HIOKI

Instruction Manual

8870-20

MEMORY HiCORDER

HIOKI E. E. CORPORATION

October 2013 Revised edition 7 8870B982-07 13-10H

Contents

Introduction

Thank you for purchasing the HIOKI "Model 8870-20 Memory HiCorder." To obtain maximum performance from the instrument, please read this manual carefully, and keep it handy for future reference.

An optional clamp-on probe is required for current measurement with the Memory HiCorder. In this manual, all models of these probes are collectively referred to as “clamp sensors.” For details, refer to the instruction manual of the particular clamp sensor to be used.

Registered trademarks

- Windows is a registered trademark of Microsoft Corporation in the United States and/or other countries.
- CompactFlash is a registered trademark of Sandisk Corporation (USA).

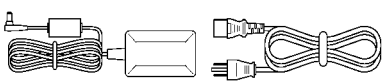
Confirming Package Contents

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

Confirm that these contents are provided.

☐ **Model 8870-20 Memory HiCorder1**

☐ **Model Z1005 AC Adapter..... 1**
with supplied power cord



(p. 26)

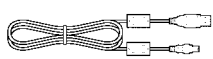
☐ **Model 9809 Protection Sheet 1**

Please stick this over the screen to protect it from any damage.

☐ **Instruction Manual**
(This document).....1

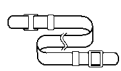
☐ **Measurement Guide 1**

☐ **USB Cable 1**



(p. 84)

☐ **Strap 1**



(p. 32)

☐ **Dedicated Wave Processor Application Program for the 8870-20 (CD).....1**

The latest version can be downloaded from our web site.

For information about options:(p. A12)

Contact your dealer or Hioki representative for details.

Safety Information

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

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

Safety Symbols

⚠	In the manual, the ⚠ symbol indicates particularly important information that the user should read before using the instrument.
	The ⚠ symbol printed on the instrument indicates that the user should refer to a corresponding topic in the manual (marked with the ⚠ symbol) before using the relevant function.
⧈	Indicates a double-insulated device.
⎓	Indicates DC (Direct Current).
⏚	Indicates a grounding terminal.
|	Indicates the ON side of the power switch.
○	Indicates the OFF side of the power switch.

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

DANGER	Indicates that incorrect operation presents an extreme hazard that could result in serious injury or death to the user.
WARNING	Indicates that incorrect operation presents a significant hazard that could result in serious injury or death to the user.
CAUTION	Indicates that incorrect operation presents a possibility of injury to the user or damage to the instrument.
NOTE	Indicates advisory items related to performance or correct operation of the instrument.

Symbols for Various Standards

CE	This symbol indicates that the product conforms to safety regulations set out by the EC Directive.
Ni-MH	This is a recycle mark established under the Resource Recycling Promotion Law (only for Japan).
	WEEE marking: This symbol indicates that the electrical and electronic appliance is put on the EU market after August 13, 2005, and producers of the Member States are required to display it on the appliance under Article 11.2 of Directive 2002/96/EC (WEEE).

Other Symbols

	Indicates the prohibited action.
(p. #)	Indicates the location of reference information.
*	Indicates that descriptive information is provided below.
[ ]	The names of setting objects and buttons on the screen are indicated by square brackets [ ].
SET (Bold characters)	Bold characters within the text indicate operating key labels.

Unless otherwise specified, "Windows" represents Windows 95, 98, Me, Widows NT4.0, Windows 2000, Windows XP, Windows Vista, Windows 7, or Windows 8

Click: Press and quickly release the left button of the mouse.
Double click: Quickly click the left button of the mouse twice.

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 scale length. In this instrument, the maximum displayable value is the range (V/div) times the number of divisions (10) on the vertical axis. Example: For the 1 V/div range, f.s. = 10 V

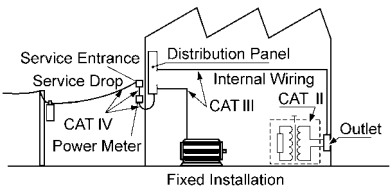
rdg. (reading or displayed value)
The value currently being measured and indicated on the measuring instrument.

dgt. (resolution)
The smallest displayable unit on a digital measuring instrument, i.e., the input value that causes the digital display to show a "1" as the least-significant digit.

Measurement categories

This instrument complies with CAT II safety requirements.
To ensure safe operation of measurement instruments, IEC 61010 establishes safety standards for various electrical environments, categorized as CAT II to CAT IV, and called measurement categories.

CAT II: Primary electrical circuits in equipment connected to an AC electrical outlet by a power cord (portable tools, household appliances, etc.) CAT II covers directly measuring electrical outlet receptacles.
CAT III: Primary electrical circuits of heavy equipment (fixed installations) connected directly to the distribution panel, and feeders from the distribution panel to outlets.



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

Using a measurement instrument in an environment designated with a higher-numbered category than that for which the instrument is rated could result in a severe accident, and must be carefully avoided.
Use of a measurement instrument that is not CAT-rated in CAT II to CAT IV measurement applications could result in a severe accident, and must be carefully avoided.

Operating Precautions

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

Before Use

- Before using the instrument 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.
- Before using the instrument, make sure that the insulation on the probes, connection cords, and clamp sensor leads is undamaged and that no bare conductors are improperly exposed. Using the instrument in such conditions could cause an electric shock, so contact your dealer or Hioki representative for replacements.

Instrument Installation

Operating temperature and humidity: 0 to 40°C at 80% RH or less (non-condensating)
Temperature and humidity range for guaranteed accuracy: 23±5°C, 80%RH or less

Avoid the following locations that could cause an accident or damage to the instrument.

Exposed to direct sunlight
Exposed to high temperature

In the presence of corrosive or explosive gases

Exposed to liquids
Exposed to high humidity or condensation

Exposed to strong electromagnetic fields
Near electromagnetic radiators

Exposed to high levels of particulate dust

Subject to vibration

⚠CAUTION The maximum operating (ambient) temperature for the 8870-20 is 40°C. Do not attempt to use in higher temperature environments.

NOTE Correct measurement may be impossible in the presence of strong magnetic fields, such as near transformers and high-current conductors, or in the presence of strong electromagnetic fields such as near radio transmitters.

Installation Precautions

- Do not install the instrument with any side except the bottom facing down.
- Leave sufficient space around the ventilation holes and install the instrument with the holes unobstructed.

Handling the Instrument

⚠WARNING
- **Do not allow the instrument to get wet, and do not take measurements with wet hands. This may cause an electric shock.**
- **Do not attempt to modify, disassemble or repair the instrument; as fire, electric shock and injury could result.**

⚠CAUTION
- To avoid damage to the instrument, protect it from physical shock when transporting and handling. Be especially careful to avoid physical shock from dropping.
- This i nstrument may cause interference if used in residential areas. Such use must be avoided unless the user takes special measures to reduce electromagnetic emissions to prevent interference to the reception of radio and television broadcasts.

Handling the Cords and Probes

⚠CAUTION
- Avoid stepping on or pinching cables, which could damage the cable insulation.
- To avoid breaking the cables and probes, do not bend or pull them.
- To avoid damaging the power cord, grasp the plug, not the cord, when unplugging it from the power outlet.
- 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.

⚠CAUTION

- To prevent an electric shock accident, confirm that the white or red portion (insulation layer) inside the cable is not exposed. If a color inside the cable is exposed, do not use the cable.

NOTE

- Use only the specified measurement cables. Using a non-specified cable may result in incorrect measurements due to poor connection or other reasons.
- Before using a clamp sensor or logic probe, read the instruction manual supplied with it.

Before Turning Power On

⚠WARNING

Using the Battery Pack

- **For battery operation, use only the HIOKI Model 9780 Battery Pack. We do not take any responsibility for accidents or damage related to the use of any other batteries.**

See: "2.1 Using the Battery Pack (Option)" (p. 22)

Using the AC Adapter

- **Use only the supplied Model Z1005 AC Adapter. AC adapter input voltage range is 100 to 240 VAC (with ±10% stability) at 50/60 Hz. To avoid electrical hazards and damage to the instrument, do not apply voltage outside of this range.**
- **Turn the instrument off before connecting the AC adapter to the instrument and to AC power.**
- **To avoid electrical accidents and to maintain the safety specifications of this instrument, connect the power cord provided only to a 3-contact (two-conductor + ground) outlet.**
- **Before turning the instrument on, make sure the supply voltage matches that indicated on its power connector. Connection to an improper supply voltage may damage the instrument and present an electrical hazard.**

⚠CAUTION

When the power is turned off, do not apply voltage or current to the BNC jacks, logic connector, or external control terminals. Doing so may damage the instrument.

NOTE

After use, always turn OFF the power.

About Inputs and Measurement

DANGER

Note the following maximum input voltage and maximum rated voltage to earth.
Maximum input voltage: 400 VDC
Maximum rated voltage to earth: 300 VAC/DC (CAT II)
The following tables list the maximum input voltage and the maximum rated voltage to earth for connection cords.
To avoid electric shock and instrument damage, do not input voltages in excess of these figures.
The lower of the instrument's and the connection cord's maximum input voltages applies.
When these voltage levels are exceeded, the instrument will be damaged. Do not make measurements as doing so may result in bodily injury.
The maximum rated voltage to earth does not change, even if you make measurements with an attenuator or other component connected to the input.
Consider your connection method and do not exceed the maximum rated voltage to earth.

Measurement cables	Maximum input voltage	Maximum rated voltage to earth
Model L9197 Model 9197	600 VAC/DC	600 VAC/DC (CAT III) 300 VAC/DC (CAT IV)
Model L9198 Model L9217	300 VAC/DC	600 VAC/DC (CAT II) 300 VAC/DC (CAT III)
Model L9790	600 VAC/DC	When using the L9790-01 Alligator clip, the 9790-03 Contact pin 600 VAC/DC (CAT II) 300 VAC/DC (CAT III) When using the L9790-01 Grabber clip 300 VAC/DC (CAT II) 150 VAC/DC (CAT III)
Model 9322 Differential Probe	2000 VDC, 1000 VAC	When using the Grabber clip 1500 VAC/DC (CAT II) 600 VAC/DC (CAT III) When using the Alligator clip 1000 VAC/DC (CAT II) 600 VAC/DC (CAT III)

For example, if the instrument is used in combination with Model L9198, the maximum input voltage is 300 VDC and the maximum rated voltage to earth is 300 VAC (CAT II).

DANGER

Connect the clamp-on sensors or measurement cables to the instrument first, and then to the active lines to be measured. Observe the following to avoid electric shock and short circuits.

- **To avoid short circuits and potentially life-threatening hazards, never attach the clamp to a circuit that operates at more than the maximum rated voltage to earth, or over bare conductors.**
- **Do not allow the connection cord clips to touch two wires at the same time. Never touch the edge of the metal clips.**
- **When the clamp sensor is opened, do not allow the metal part of the clamp to touch any exposed metal, or to short between two lines, and do not use over bare conductors.**
- **Do not leave the Memory HiCorder connected to test objects in environments where a voltage surge might exceed the dielectric withstand voltage. Doing so could result in damage to the Memory HiCorder, bodily injury or fatal accident.**

CD Handling

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 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.

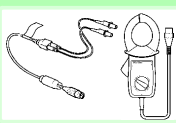
Overview Chapter 1

1.1 Product Overview and Features

The Hioki 8870-20 Memory HiCorder is a compact, lightweight, easy-to-operate waveform recorder. It can run on batteries, and can be quickly deployed when a power anomaly occurs.
Measurement data can be monitored, subjected to calculations and analyzed on a personal computer using the supplied application program.

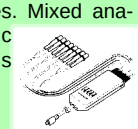
Recording various analog signals

Measurements for a wide variety of applications are available using the appropriate measurement leads or clamp sensor options.



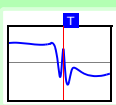
Recording logic signals

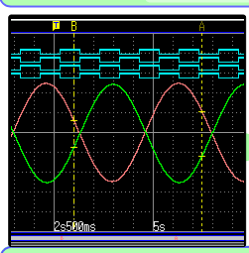
Measures using optional logic probes. Mixed analog and logic recording is possible.



Recording waveforms of abnormal events

Abnormal events can be analyzed by recording with the trigger function (p. 51).



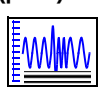


Measurement data and setting configurations are stored, read and managed as data files

Measurement data can be stored to and read from an optional CF card (p. 67).

Waveform analysis

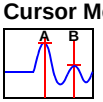
Gauge display (p. 62)



Zoom in/out (p. 60)

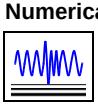
Numerical display (p. 65)

Cursor Measurements (p. 62)



Using the A/B cursors, values at cursor locations on waveforms and the time and period at trigger positions can be displayed.

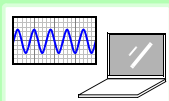
Numerical Calculations (p. 85)



Up to seven types of calculations such as RMS, maximum and average values can be applied to measurement data, and waveforms and calculation results can be displayed separately on screen.

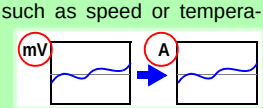
Analysis on a PC

Data stored on the CF card can be transferred for analysis to a computer using the supplied USB cable (p. 84). Measurement data can be analyzed using the supplied application program (p. A6).



Display in converted units

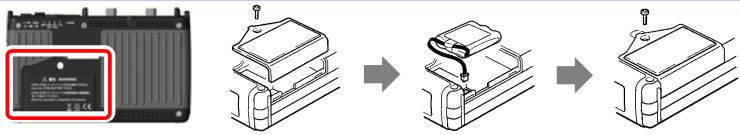
Using the scaling function, input values can be displayed in units of the actual physical quantity being measured, such as speed or temperature (p. 47).



1.2 Measurement Flow

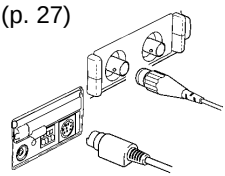
Installing, Connecting and Turning On

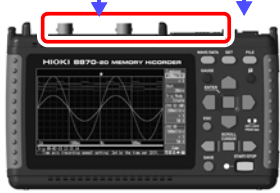
Install the battery pack (option) (p. 22)



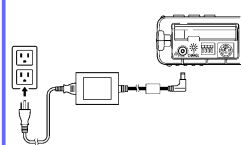
Connect to the Model 8870-20 (p. 21), and set up (p. 6)

Measurement cables connections (p. 27)

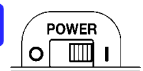




AC adapter connection (p. 26)

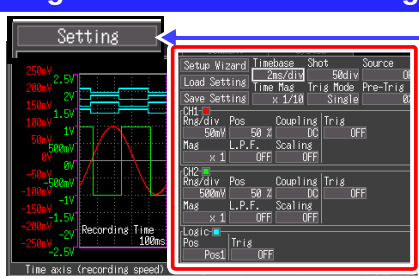


Turn the power on (p. 33)



Settings

Configure measurement settings (p. 35)



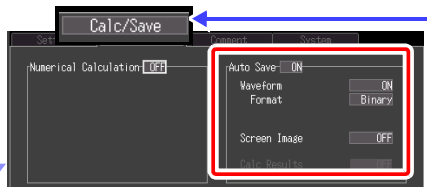
Move to a setting item — Open the setting options — Select — Apply

Select the timebase (horizontal axis), voltage range (vertical axis) and input channels.
If the measurement ranges are unknown, they can be set automatically (p. 39).

Using a previously saved setting configuration

Reload a previously stored setting configuration from Model 8870-20 memory or a CF card, and measure (p. 79).

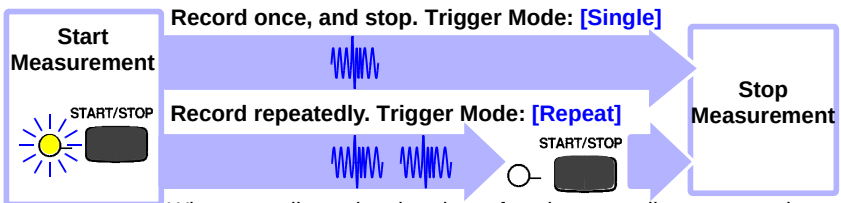
Configure Automatic Data Storage to a CF card (as needed) (p. 72)



To save (store) measured data automatically, enable Auto-Save before starting to measure. Alternatively, you can save data manually after measuring.

Starting and Stopping Measurement

Press the START/STOP key (p. 19)



When recording using the trigger function, recording occurs only when the input waveform satisfies specified trigger criteria.

Data Analysis

View Measurement Data (p. 59)

Waveforms can be zoomed and numerical values confirmed.

Save Data (p. 67)

Measurement data, waveform data, screen images and numerical calculation results can be saved.

Calculate (p. 85)

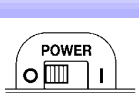
Numerical measurement data can be applied to calculations.

View on a Computer (p. 84)

To download data from the CF card in the Memory HiCorder, connect a computer with the supplied USB cable. Recorded data can be analyzed on the computer with the bundled Wave Processor program (p. A6).

When Finished

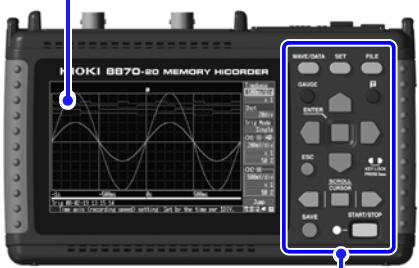
Turn the Memory HiCorder Off (p. 33)



1.3 Names and Functions of Parts

Front Panel

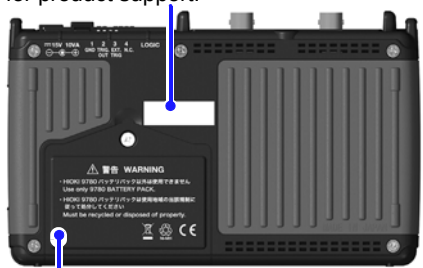
Display Screen (p. 59)
4.3-inch TFT color LCD
Screen Configurations (p. 16)



Operating Keys

Rear Panel

Manufacturer's Serial Number
Shows the serial number.
Do not remove this label, as it is required for product support.



Battery Compartment (p. 22)
The optional Model 9780 Battery Pack is installed here.

Operating Keys

Choose a screen

■ **WAVE/DATA**
Switches between Waveform and Numerical Value screens (p. 16).

■ **SET**
Displays the Settings screens, and switches among the screen tabs with each press (p. 17).

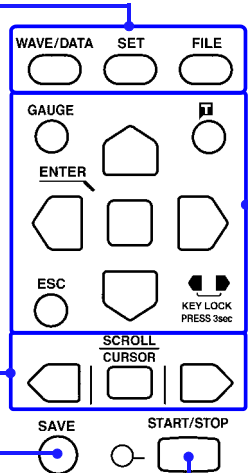
■ **FILE**
Displays file information (p. 17).

Scroll waveforms and read cursor values

Use the left and right keys to scroll waveforms or move the A/B cursors. Press the middle key to select which of these actions the left and right keys perform (p. 18).

Saving operations

Press to save data manually (p. 72).



Start and stop measurement

Start and stop measurement. The LED at the left lights green while measuring (p. 19).

Setup and display

■ **GAUGE**
Alternately displays and hides the measurement scale on the Waveform screen.

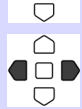
■ **T (Manual trigger)**
Press to trigger manually.

■ **ESC**
Cancels changes to settings.

■ **Cursor Keys**
Moves the position of the cursor (blinking selection) on the screen.

■ **ENTER**
Accepts displayed settings.

■ **KEY LOCK**
To lock the keys, press and hold the left and right cursor keys for three seconds. Repeat to unlock.



Top Panel

CF Card Slot
Insert an optional CF Card (p. 69).

AC Adapter Socket
Connect the supplied Model Z1005 AC Adapter (p. 26).

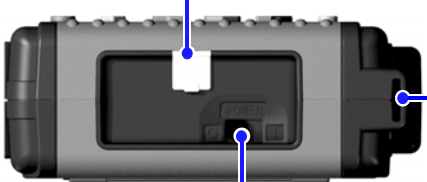
CHARGE LED
This LED lights when the battery is charging (p. 25).

BNC Jack
Connect optional measurement cables or clamp sensors (p. 27).

LOGIC Connector
Connect an optional logic probe (p. 31).

External Control Terminals
Control signals can be received from and output to external devices (p. 97).

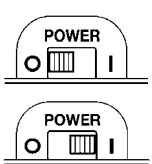
Right Side



USB Port
(USB 2.0 mini-B receptacle)
Open the dust cap and connect the USB cable (p. 84).
Connect to a computer to transfer data.

Strap Hole (p. 32)

POWER Switch
Turns the instrument on and off (p. 33).



○ Power Off

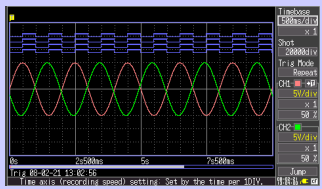
| Power On

1.4 Screen Configurations

Waveform/Numerical Screens

Press this key to switch between the screens.

Operational information is displayed along the bottom of the screen.



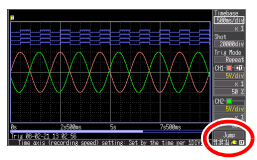
Waveform Screen

Data stored in the Memory HiCorder is displayed as waveforms (p. 59).

Numerical Screen

Displays the real-time numerical values of the measurement signals. Switch between instantaneous (peak-to-peak) and RMS values, or Display Hold. (p. 65)

About the Icons



Clock
"Setting the Date and Time" (p. 94)

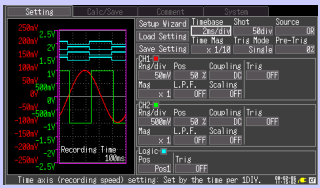
Power Source Indicator
Indicates the Memory HiCorder's power source.

	AC adapter operation
	Battery pack operation Fully charged battery pack
	Battery pack operation
	Low battery indicator during battery pack operation

CF Card
Displayed when a CF card is inserted.

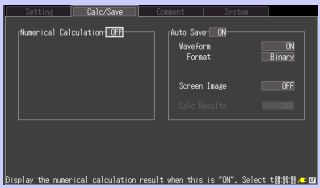
Settings Screens

Press this key to switch between the screens.
Operational information is displayed along the bottom of the screen.



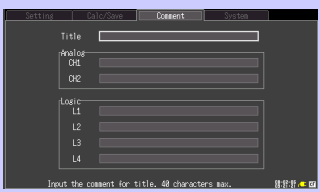
Setting Screen

Configure measurement settings (p. 41).
Set trigger criteria as needed (p. 51).



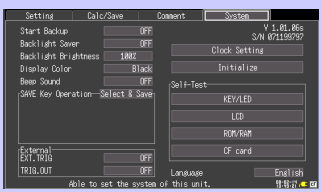
Calc/Save Screen

Configure numerical calculations (p. 85) and auto-saving (p. 73).



Comment Screen

Enter per-channel comments (p. 49).



System Screen

Configure the system environment (p. 91).

File Screen

Operational information is displayed along the bottom of the screen.

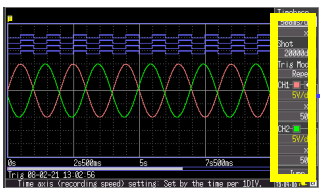
File Screen

View and manage files on the CF card (p. 67).

1.5 Basic Operation

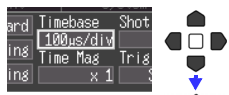
Screen Operations

Setting Screen



Waveform Screen

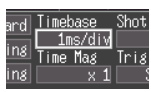
Changing screen contents



Select the item to change.

Show available setting options.

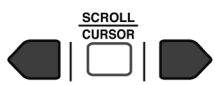
Select the desired setting.



Apply the new setting, or cancel it.

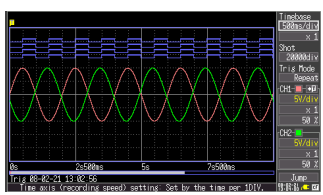
ESC

Scrolling a waveform

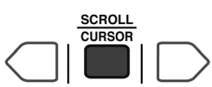


Earlier **Later**

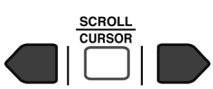
See: "Scrolling Waveforms" (p. 60)



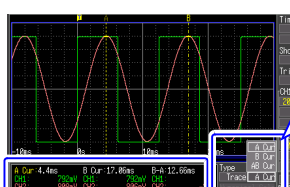
Reading values at cursors

1 

Display the A/B cursors.

2 

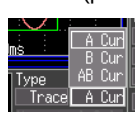
Move the A/B cursors.
Values at cursor positions can be read numerically.



A/B cursor values

Cursor type

Select the cursor type, and which cursor(s) to move (p. 62).



Starting and Stopping Recording

Acquire measurement data on the Memory HiCorder, and start recording. Recording stops according to the trigger mode (recording criteria) setting (p. 43).

Start Measurement

Press the **START/STOP** key.
The green LED lights.
When using the trigger function, the times when measurement starts and when recording (data acquisition) starts are not the same.

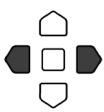
Finish Measurement

Trigger Mode: **[Repeat]** (default setting)
Pressing the START/STOP key stops recording.

Trigger Mode: **[Single]**
Recording stops when the specified recording time has elapsed.

Disabling Key Operations (Key-Lock Function)

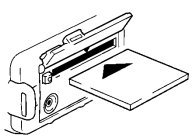
Keys can be disabled to avoid inadvertent operations.



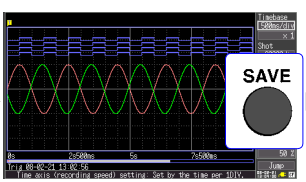
Press and hold the right and left cursor keys for three seconds to lock the other keys, and repeat to unlock.

Saving Display Images

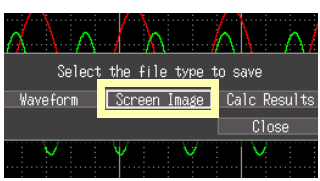
Screen images of measurement data and setting configurations can be captured and saved (p. 76).



Insert a CF card.



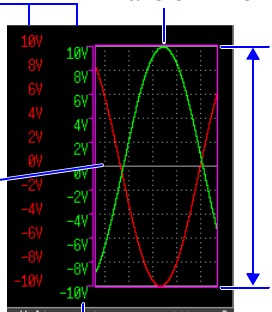
Display the screen to be saved, and press the SAVE key.



Select **[Screen Image]** in the dialog, and press the **ENTER** key to display the confirmation dialog. Select **[Yes]** and press **ENTER** again.
The image is saved as a bitmap image file (named *date_number*.BMP).

Verifying the Input Level (Level Monitor)

You can verify the input status and display range while making settings on the Setting screen. This is not available while measuring.



Gauge
Shows the selected voltage range (vertical axis) for channels 1 and 2.

Waveform monitor

Displayable waveform range

The displayable range is determined by the waveform magnification (vertical zoom) and zero-position settings.

Current Input Signal Level

Measurement Units of Input Waveform
Using the Scaling function (p. 47), measurement units can be converted as desired for display.

Measurement Preparations Chapter 2

1 **Install the 9780 Battery Pack (option) (p. 22)**

Rear View

2 **Connect measurement cables (p. 27)**

Voltage measurement:
connect connection cords

Current measurement:
connect clamp sensors

Logic signal measurement:
connect logic probe

3 **Connect the AC adapter (p. 26)**

4 **(To save data)**
Insert a CF card (option) (p. 69)

Attach the strap (p. 31)

External control signal inputs
External control signal outputs
(p. 97)

5 **Turn the power on (p. 32)**
Execute zero adjustment (p. 33)

2.1 Using the Battery Pack (Option)

If commercial power is not available when the AC adapter is connected, the 8870-20 Memory HiCorder can operate from the Model 9780 battery pack, so when using commercial power, the battery pack serves as a backup supply during power outages.
Charge the battery pack fully before using it the first time.

⚠WARNING **Be sure to observe the following precautions. Incorrect handling may result in liquid leaks, heat generation, ignition, bursting and other hazards.**

- **Do not use a battery pack other than the 9780 Battery Pack. We cannot accept responsibility for accidents or damage related to the use of any other batteries.**
- **To avoid the possibility of explosion, do not short circuit, disassemble or incinerate battery pack.**
- **When storing the instrument, make sure no objects that could short-circuit the connectors are placed near them.**
- **The battery pack contains lye, which can cause blindness if comes into contact with the eyes. Should battery liquid get into your eyes, do not rub your eyes but rinse them in plenty of water and seek the immediate attention of a physician.**

Installing and replacing the battery pack

- **To avoid electric shock, turn off the power switch and disconnect the cables before replacing the battery pack.**
- **After installing or replacing the battery pack, replace the battery compartment cover and screw.**
- **Handle and dispose of batteries in accordance with local regulations.**

⚠CAUTION **Observe the following to avoid damage to the instrument.**

- Use the battery pack in an ambient temperature range of 0 to 40°C and charge it in an ambient temperature range of 5 - 30°C to be on the safe side.
- If the battery packs fails to complete charging within the stipulated time, disconnect the AC adapter from the pack to stop charging.
- Consult your dealer or nearest service station should liquid leaks, strange odor, heat, discoloration, deformation and other abnormal conditions occur during use, charging or storage. Should these conditions occur during use or charging, turn off and disconnect the instrument immediately.
- Do not expose the instrument to water and do not use it in excessively humid locations or locations exposed to rain.
- Do not expose the instrument to strong impacts and do not throw it around.

NOTE

- The battery pack is subject to self-discharge. Be sure to charge the battery pack before initial use.
- When recharging a discharged battery pack in the Model 8870-20, allow it to charge for at least ten minutes with the Model 8870-20 turned off to maximize battery longevity.
- The battery pack is a consumable. If the battery capacity remains very low after correct recharging, the useful battery life is at an end. It can be recharged up to about 500 times.
- To prevent battery pack deterioration when the battery will not be used for 1 month or longer, remove it and store it in a dry location with an ambient temperature range of between -10 to 30°C. Be sure to discharge and charge it every two months. Long-term storage when capacity has decreased will make charging impossible and reduce performance.
- Remove the battery pack from instrument once a month and check that appearance is normal.
- As long as battery charge remains, waveform data is retained in internal memory while the Memory HiCorder is turned off, so the battery continues to gradually discharge. When the battery charge is depleted, stored waveform data is lost.

When to charge

When powering the instrument from the battery pack without the Model Z1005 AC Adapter, the low battery indicator () is displayed when the battery charge is depleted, indicating that the battery pack requires charging.
Note that if the Memory HiCorder is turned off under this situation, waveform data may fail to be backed up, and could be lost.

Approximate charging time:
About 200 minutes at 23ºC when recharged at the first appearance of the low battery indicator.

Approximate continuous battery-only operating time

(operating at 23°C)

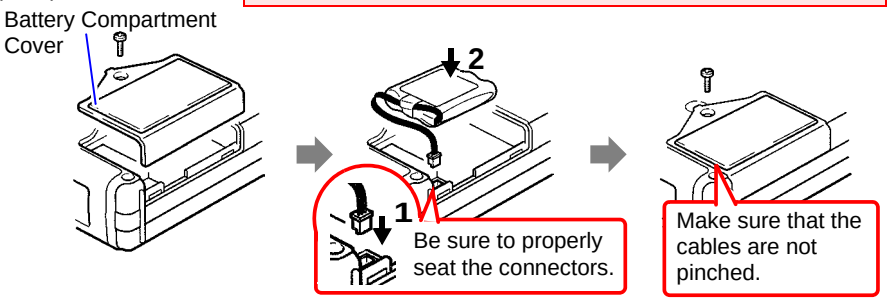
- After a full charge, with the LCD backlight always on (default setting): approximately two hours
- After a full charge, with the LCD backlight off (five minutes after last key-press): approximately 2.5 hours

See: "Enabling and Disabling the Backlight Saver" (p. 93)

Install the Battery Pack

Required tool:
One Phillips screwdriver (No.2)

Important
Disconnect the AC adapter when installing the battery pack.



1 Place the Memory HiCorder face down, and remove the battery compartment cover screw and cover.

2 Connect the plugs of the battery pack to the connectors and insert the battery pack with the label side up.

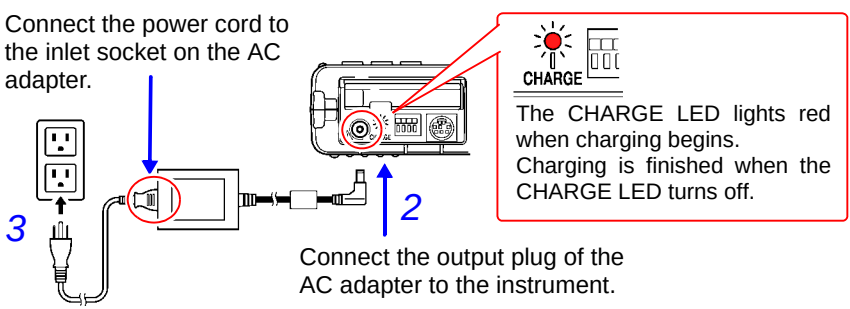
3 Replace the battery compartment cover and screw.

Pull the battery pack plug straight out to remove the battery pack.

Charge the Battery Pack

Regardless of whether the Memory HiCorder is on or off, the battery pack recharges whenever the Z1005 AC Adapter is plugged in to a power source. Therefore, charging is provided by merely keeping the battery installed in the Memory HiCorder.

1 Connect the power cord to the inlet socket on the AC adapter.



The CHARGE LED lights red when charging begins.
Charging is finished when the CHARGE LED turns off.

2 Connect the output plug of the AC adapter to the instrument.

3 Plug the power cord into the mains outlet.

Refer to "2.2 Connecting the AC Adapter" (p. 26) for details about the AC adapter.

2.2 Connecting the AC Adapter

Connect the power cord and the instrument to the supplied Model Z1005 AC Adapter, then plug the power cord into an outlet. When used with the battery pack installed, the battery serves as an operating backup supply in case of power failure, and the AC adapter otherwise has priority.

Before Connecting

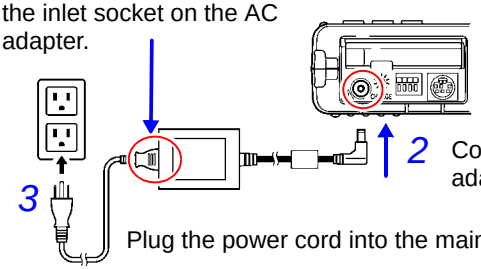
⚠WARNING

- **Use only the supplied Model Z1005 AC Adapter. AC adapter input voltage range is 100 to 240 VAC (with ±10% stability) at 50/60 Hz. To avoid electrical hazards and damage to the instrument, do not apply voltage outside of this range.**
- **Turn the instrument off before connecting the AC adapter to the instrument and to AC power.**
- **To avoid electrical accidents and to maintain the safety specifications of this instrument, connect the power cord only to a 3-contact (two-conductor + ground) outlet.**

⚠CAUTION

To avoid damaging the power cord, grasp the plug, not the cord, when unplugging it from the power outlet.

1 Connect the power cord to the inlet socket on the AC adapter.



Rated supply voltage is 100 to 240 VAC, and rated supply frequency is 50 or 60 Hz.

2 Connect the output plug of the AC adapter to the instrument.

3 Plug the power cord into the mains outlet.

2.3 Connecting Measurement Cables to the Memory HiCorder

Connect the appropriate cables for the intended recording application.
- To record voltage waveforms (p. 29)
- To record current waveforms (p. 29)
- To record logic signals (p. 30)

Be sure to read the "Operating Precautions" (p. 6) before connecting the cables.

Connecting to the BNC terminals

DANGER

Note the following maximum input voltage and maximum rated voltage to earth.
Maximum input voltage: 400 VDC
Maximum rated voltage to earth: 300 VAC/DC (CAT II)
The following tables list the maximum input voltage and the maximum rated voltage to earth for connection cords. To avoid electric shock and instrument damage, do not input voltages in excess of these figures.
The lower of the instrument's and the connection cord's maximum input voltages applies.
When these voltage levels are exceeded, the instrument will be damaged. Do not make measurements as doing so may result in bodily injury.
The maximum rated voltage to earth does not change, even if you make measurements with an attenuator or other component connected to the input.
Consider your connection method and do not exceed the maximum rated voltage to earth.

Measurement cables	Maximum input voltage	Maximum rated voltage to earth
Model L9197 Model 9197	600 VAC/DC	600 VAC/DC (CAT III) 300 VAC/DC (CAT IV)
Model L9198 Model L9217	300 VAC/DC	600 VAC/DC (CAT II) 300 VAC/DC (CAT III)
Model L9790	600 VAC/DC	When using the L9790-01 Alligator clip, the 9790-03 Contact pin 600 VAC/DC (CAT II) 300 VAC/DC (CAT III) When using the L9790-01 Grabber clip 300 VAC/DC (CAT II) 150 VAC/DC (CAT III)
Model 9322 Differential Probe	2000 VDC, 1000 VAC	When using the Grabber clip 1500 VAC/DC (CAT II), 600 VAC/DC (CAT III) When using the Alligator clip 1000 VAC/DC (CAT II) 600 VAC/DC (CAT III)

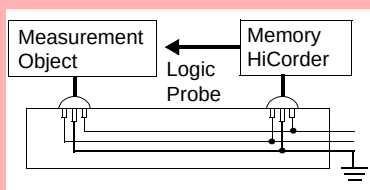
For example, if the instrument is used in combination with Model L9198, the maximum input voltage is 300 VDC and the maximum rated voltage to earth is 300 VAC (CAT II).

⚠WARNING **Do not connect a cable to the instrument while it is connected to the object to be measured. Otherwise, an electric shock accident may occur.**

⚠CAUTION To prevent damage to the instrument and sensor, never connect or disconnect a sensor while the power is on, or while the sensor is clamped around a conductor.

Connecting to the logic terminals

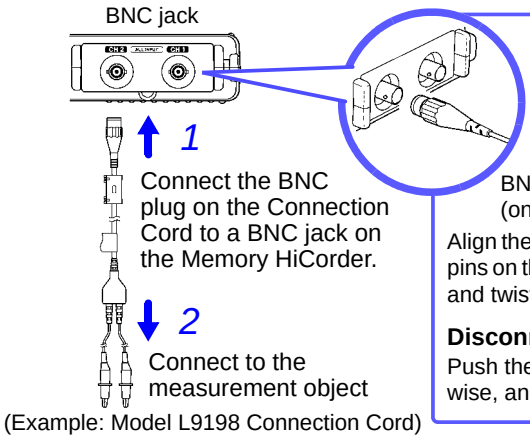
⚠DANGER **To avoid electric shock and short circuit accidents or damage to the instrument, pay attention to the following:**



- **The ground terminal for the optional logic probe is not isolated from the Memory HiCorder's ground (chassis ground). Therefore, if the measurement object connect to AC, it should have a grounded, polarized plug, and be connected to the same power outlet as the Memory HiCorder's AC adapter.**
  If the Memory HiCorder and measurement object are connected to different mains circuits, or if an ungrounded power cord is used, the potential difference between the different grounding paths may result in current flow through a logic probe that could damage the measurement object or Memory HiCorder.
- **Do not allow the metal tip of a logic probe to cause a short between conductors on the measurement object. Never touch the metal tip of a probe.**
- **Maximum logic probe input voltages are as follows.**
  Do not measure if the maximum voltage would be exceeded, as damage the instrument or personal injury may result.
  Model 9320-01 Logic Probe: +50 VDC
  Model MR9321-01 Logic Probe: 250 Vrms (HIGH range), 150 Vrms (LOW range)

Connecting Connection Cords (to record voltage waveforms)

Connect an optional Hioki Connection Cord. Use the Hioki 9322 Differential Probe if the voltage of the measurement object may exceed the Memory HiCorder's maximum input voltage.



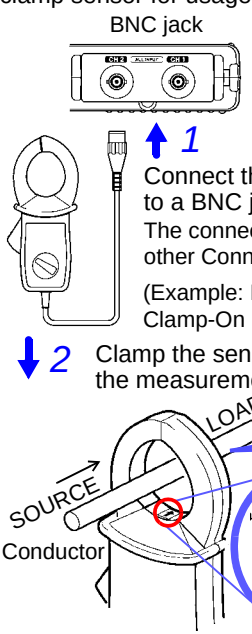
Align the slots in the BNC plug with the guide pins on the jack on the instrument, then push and twist the plug clockwise until it locks.

Disconnecting BNC connectors

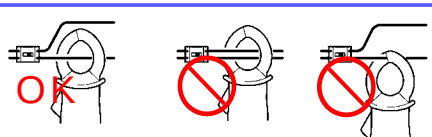
Push the BNC plug, twist it counterclockwise, and pull it out.

Connecting a Clamp Sensor (to record current waveforms)

Connect an optional Hioki clamp sensor. Refer to the instructions provided with the clamp sensor for usage instructions.



The scaling function needs to be set according to the clamp sensor model being used. Refer to "Converting Units (Scaling function)" (p. 47) for details.

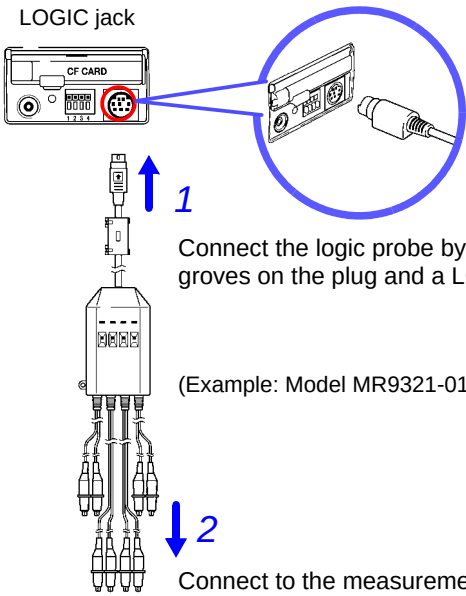


Attach the clamp around only one conductor. Single-phase (2-wire) or three-phase (3-wire) cables clamped together will not produce any reading.

The arrows on the clamp indicating the direction of current flow should point toward the load side.

Connecting the Logic Probe (to record logic signals)

Connect the optional logic probe. Refer to the instructions provided with the probe.



Connect the logic probe by aligning the groves on the plug and a LOGIC jack.

(Example: Model MR9321-01 Logic Probe)

Connect to the measurement object.

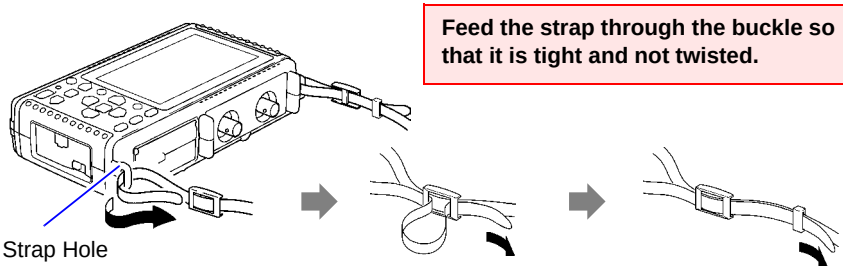
When a logic probe is not connected, the corresponding logic waveform appears at HIGH level on the waveform screen.

2.4 Attaching the Carrying Strap

Use the strap to avoid dropping the instrument while carrying, or when you need to hang it on a hook.

⚠CAUTION Attach both ends of the Strap securely to the instrument. If insecurely attached, the instrument may fall and be damaged when carrying.

Feed the strap through the buckle so that it is tight and not twisted.



1 Push the strap through one of the strap holes on the instrument.

2 Feed the strap through the buckle.

3 Put the end of the strap under the retaining loop.

4 Repeat the same procedure with the other end of the strap and the other strap hole.

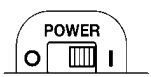
2.5 Turning the Power On and Off

⚠WARNING **Using the AC Adapter**

Before turning the instrument on, make sure the supply voltage matches that indicated on its power connector. Connection to an improper supply voltage may damage the instrument and present an electrical hazard.
Rated supply voltage is 100 to 240 VAC
(Voltage fluctuations of ±10% from the rated supply voltage are taken into account.)
Rated supply frequency is 50 or 60 Hz.

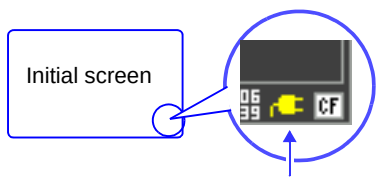
Turning Power On

Verify that the instrument and peripheral devices are correctly connected.



Turn the power switch on (|).

Right Side

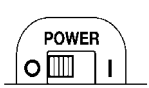


The power supply icon appears near the bottom right corner of the screen (p. 16).

If the " " indicator is not displayed, the instrument is not being powered from the AC line. In this state, the battery charge will be depleted if measuring for a long time, and measurement may be interrupted. Verify that the AC adapter is securely connected to an AC power source and to the instrument.
See: "Approximate continuous battery-only operating time" (p. 24)

Execute zero-adjust 30 minutes after turning power on. (p. 33)

Turning Power Off



Turn the power switch off (○).

The installed battery pack is charged whenever the AC adapter is plugged into a power outlet, even when the Memory HiCorder is off. In addition, providing there is some remaining battery charge, waveform data and the setting configuration are memorized whenever the Memory HiCorder is turned off, so that when the Memory HiCorder is turned back on, the same operating state is displayed.

2.6 Zero Adjustment

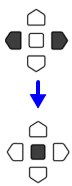
Zero adjustment corrects for voltage offset at the input terminals, so that Memory HiCorder measurements are relative to zero volts.
Repeat zero adjustment if the ambient temperature changes suddenly.

Turn on the power and wait for 30 minutes to stabilize the internal temperature of the Memory HiCorder.

1 
(simultaneously)

With the Waveform or Setting screen displayed, press and hold these keys simultaneously for one second.

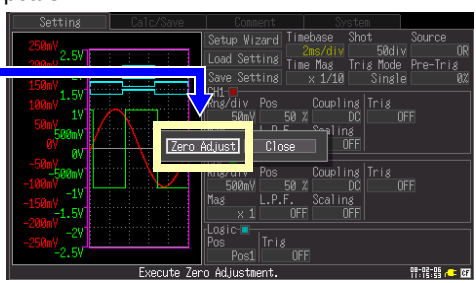
The Zero Adjust dialog appears.

2 

Select **[Zero Adjust]**.

Apply

Zero adjustment is executed.



From the Setting screen

NOTE Any zero-adjust setting is cleared upon system reset (p. 95).

Setting before Measurement Chapter 3

3.1 Pre-Operation Inspection

Before using the instrument 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 Peripheral Device Inspection

When using probes and connection cords

Is the insulation of the probe or connection cord to be used damaged, or is bare metal exposed?

- **Metal Exposed** → Do not use if damage is present as you could receive an electric shock. Replace the damaged items.
- **No Metal Exposed** → To 2

When using a clamp

Is the clamp cracked or damaged?

- **Yes** → Do not use if damage is present as you could receive an electric shock. Replace the damaged items.
- **No** → To 2

2 Instrument Inspection

Is damage to the instrument evident?

- **Yes** → If damage is evident, request repairs.
- **No** ↓

When turning power on

Does the HIOKI logo appear on the screen?

- **No** → The power cord may be damaged, or the instrument may be damaged internally. Request repairs.
- **Yes** ↓

Is the Waveform or Setting screen displayed? (When power is turned on the first time after purchase, the Setting screen should appear.)

- **Nothing appears, or the display is abnormal** → The instrument may be damaged internally. Request repairs.
- **Yes** ↓

Inspection complete

3.2 Operating Flow Overview

Connect

Connect measurement cables or a clamp sensor (p. 27).

Configure

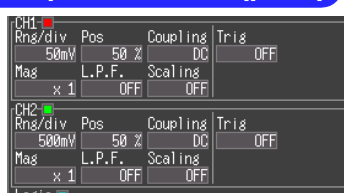
WAVE/DATA SET FILE

Display the Setting screen

Manual configuration

Manual configuration (p. 41)

Configure input channels (p. 44)

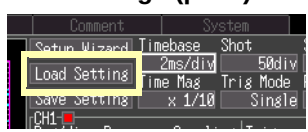


Specify recording criteria (p. 51) (to record specific phenomena)

Configure data saving (p. 73) (to save automatically)

Automatic configuration (p. 39)

Reload stored settings (p. 79)



Record

When configuration is finished, start recording (p. 19).

START/STOP

Analyze

Analyze recorded data on the Waveform screen (p. 59).
Calculations can be applied to measured data (p. 85).

Save

Select and save data (p. 67).

SAVE

Measurement Configuration (Setting Screen)

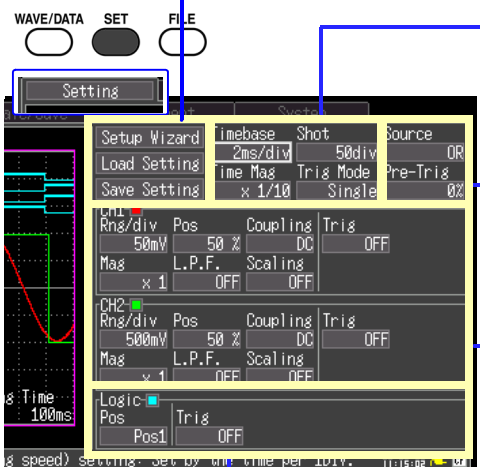
Before starting measurement, configure settings on the [Setting] screen according to the desired measurement.
To observe their effects, settings can be made while viewing input waveforms in the waveform monitor window (p. 20).
Previously stored setting configurations can also be reloaded (p. 79).

Information about the currently highlighted item is displayed along the bottom of the [Setting] screen.

Automatic Setting Configuration, Saving and Reloading

- Automatic Setting Configuration (p. 39)
- Reloading Settings (p. 79)
- Saving Settings (p. 78) *1

*1. Can be set only from the [Setting] screen.



Time Axis (Horizontal Axis) Settings

- Selecting the Timebase (p. 41)
- Setting the Recording Length (divisions) (p. 42)
- Selecting Horizontal Display Magnification (p. 42)

Setting Recording Criteria

- Selecting the Trigger Mode (p. 43)
- Trigger Settings (p. 51)

Input Channel Settings

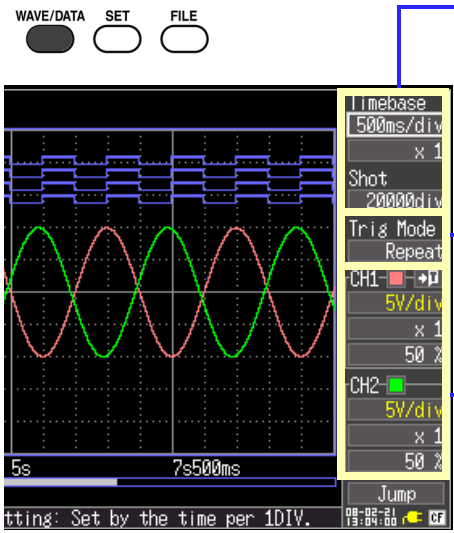
- Selecting the Voltage Axis (Vertical Axis) Range (p. 44)
- Selecting Waveform Display Colors (p. 44)
- Setting the Zero Position (p. 45)
- Selecting the Input Coupling Method (p. 45) *1
- Selecting Vertical Axis Magnification (p. 46)
- Selecting the Low-Pass Filter (p. 46) *1
- Setting Unit Conversion (Scaling) (p. 47) *1

Logic Channel Settings

- Selecting Logic Channel Waveform Colors (p. 48)
- Setting Logic Channel Waveform Display Positions (p. 48)
- Trigger Settings (p. 57)

Measurement Configuration (Waveform Screen)

Certain setting items are available on the Waveform screen. Setting details are the same as for those on the Setting screen.
Changing the range, recording length or trigger setting while measuring causes any existing measurement data to be erased as measurement restarts with the new settings (Restart).



Waveform Screen

Time Axis (Horizontal Axis) Settings

- Selecting the Timebase (p. 41)
- Setting the Recording Length (divisions) (p. 42)
- Selecting Horizontal Display Magnification(p. 42)

Setting Recording Criteria

- Selecting the Trigger Mode (p. 43)
- Trigger Settings (p. 51)

Input Channel Settings

- Selecting the Voltage Axis (Vertical Axis) Range (p. 44)
- Selecting Waveform Display Colors (p. 44)
- Setting the Zero Position (p. 45)
- Selecting Vertical Axis Magnification (p. 46)

3.3 Automatic Configuration of Measurement Settings (Auto Range)

If the appropriate measurement range settings are unknown, Auto Range can be enabled from the Waveform or Setting screen.
Setting configurations saved to Memory HiCorder memory or to an installed CF card can be reloaded for later reuse (p. 79).

Auto Range from the Waveform Screen

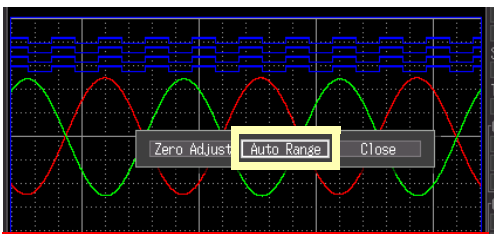
1 WAVE/DATA SET FILE

Select the Waveform Screen

Press and hold together for one second (simulta-neously)
A dialog appears.

2 Select **[Auto Range]**

Apply



If the appropriate range cannot be automatically detected, "Auto Range failed" appears. In this case, configure the range settings manually from the Setting screen while watching the waveform monitor.

Selecting Auto Range on the Setting Screen

1 WAVE/DATA SET FILE

Select the [Setting] Screen.

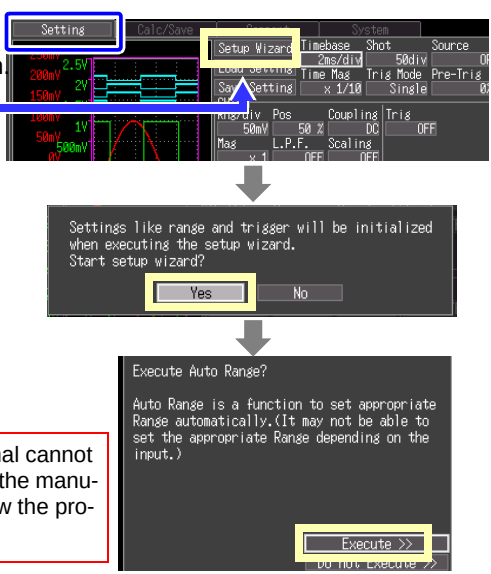
2 Select **[Setup Wizard]**.

Apply

A dialog appears.
Follow the instructions in the dialog.

Apply

Set according to the input waveform amplitude.



If appropriate settings for the input signal cannot be determined, select [Next] to display the manual range selection procedure, and follow the procedure to make the settings.

Auto Range Settings

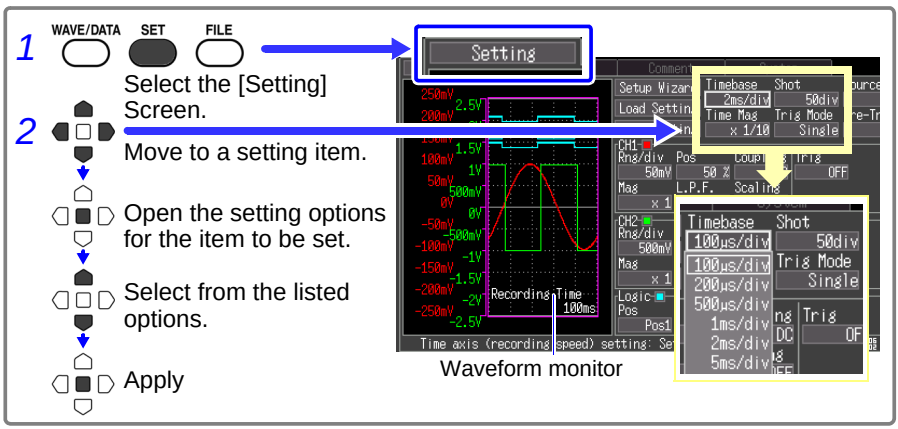
Setting Item		Settings
Timebase	[Timebase]	Auto setting value Automatically displays 1 to 2.5 cycles on the Waveform screen. When both channels are enabled for waveform display, the waveform on CH1 determines the timebase setting.
Zoom (magnification)	[Time Mag]	x1
Settings for CH1 and CH2		
Voltage-axis range	[Rng/div]	Auto setup value
Zero position	[Pos]	Auto setup value
Zoom (magnification)	[Mag]	x1
Low-pass filter	[L.P.F]	Off
Input coupling	[Coupling]	DC
Trigger Criteria		
Trigger mode	[Trig Mode]	Repeat
Trigger source AND/OR	[Source]	OR
Pre-Trigger	[Pre-Trig]	20%
Trigger	[Trig]	Level trigger CH1 only. However, if CH1 display is disabled when executing Auto Range from the Waveform screen, this setting is applied to CH2 only. This setting is also applied to CH2 when the difference between maximum and minimum values of the input signal on CH1 is two divisions or less.
Slope	[Slope]	↑ (Rising)
Level (Trigger Level)	[Level]	Auto setup value
Filter	[Filter]	Off

When Using External Control Terminals

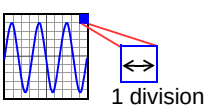
NOTE Executing Auto Range generates a trigger signal on the trigger output external control terminal. Bear this in mind when using the trigger output terminal and the Auto Range function.

3.4 Measurement Configuration 1 (Horizontal Axis Settings)

Make settings while viewing the Waveform monitor at the left side of the [Setting] screen.

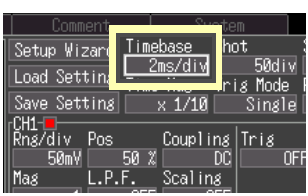


Select a Timebase

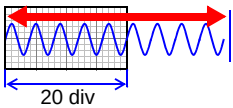


Set the amount of time to display per horizontal division.
Sampling rate = timebase (seconds/div)/100 (data samples/division), so at x1 display magnification, each division contains 100 data samples.
Decreasing the timebase increases the resolution of data available for analysis. See "Selecting a Timebase (Horizontal Axis)" (p. 10).
When the product of the timebase multiplied by the display magnification is greater than 50 ms, waveforms can be automatically scrolled on the display while measuring (the Roll Mode display function).

Select from the **[Timebase]** setting options.
Setting options:
100∗, 200, 500 µs, 1, 2, 5, 10, 20, 50, 100, 200, 500 ms, 1, 2, 5, 10, 30 s, 1, 2, 5 min [/div]
(∗ default setting)



Setting Recording Length (no. of divisions)



Set the recording length in units of display divisions.
Recording time = timebase (s/div) x recording length (div)

Select from the **[Shot]** setting options.
Setting options:
20∗, 50, 100, 200, 500, 1000, 2000, 5000, 10000, 20000 [div], Cont (continuous)
(∗ default setting)

Recording length (Cont) (continuous)

- During (Cont) recording length, it is possible to make settings whose time axis is slower than 50 ms/div.
  For example, setting the recording length (Cont) when the time axis is set to 10 ms/div will automatically set the time axis to 50 ms/div.
- Time values are not indicated during measurements.
- The trigger function (p. 51) and external trigger function (p. 99) are not available.
- The trigger mode (p. 43) is fixed at [Single].

When recording exceeds the maximum recording length (20,000 div), the following will take place

- A total of 20000 divisions worth of data remains when recording is stopped.
- Data saved on a CF card during auto save and manual save extends a total of 20000 divisions back from the end of recording.
- The time values indicated in the waveform screen indicates the time at end of recording as 0 s, a negative value.

Setting Display Zoom (as needed)

Normal Display | Magnified Display (x2)

Select display magnification of the horizontal axis as needed.

Select from the **[Time Mag]** setting options.
Setting options:
x10, x5, x2, x1∗, x1/2, x1/5, x1/10, x1/20, x1/50, x1/100, x1/200, x1/500, x1/1000
(∗ default setting)

3.5 Measurement Configuration 2 (Setting Recording Criteria)

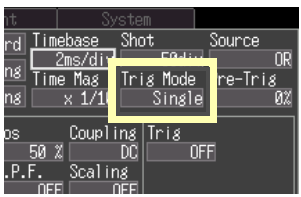
Setting the Trigger Mode

Select whether to record one recording length per trigger event, or to record continuously ([Repeat]). To specify other recording criteria, additional trigger settings are required.

See: "Chapter 4 Making Trigger Settings" (p. 51)

Select from the **[Trig Mode]** setting options.
Setting options:(∗ default setting)

Single	Records one time and stops.
Repeat∗	Records continuously until you press the START/STOP key.

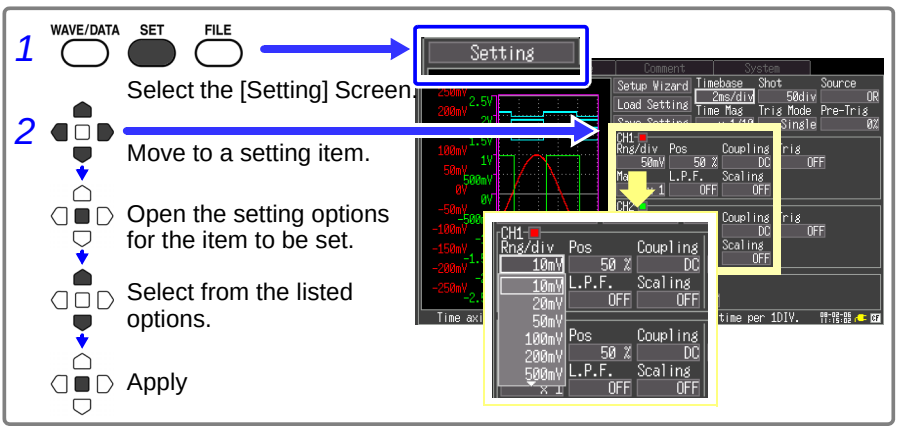


When the trigger mode is set to [Repeat], triggering is disabled during the end of recording processing (auto save, waveform display processing and calculation) before going to the next trigger standby status. Therefore, events that meet the trigger criteria during this processing period are not recognized as trigger events.

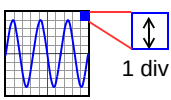
Recording length [Cont], the trigger mode is fixed at [Single].

3.6 Measurement Configuration 3 (Analog Channel Settings)

Configure the analog input channels (CH1 and CH2) from the [Setting] screen.



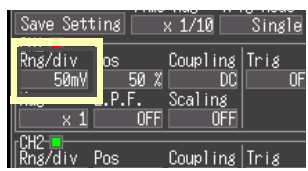
Setting the Voltage Axis (Vertical Axis) Range



Select the voltage amplitude (voltage axis range) per vertical division for each input channel.

Select from the **[Rng/div]** setting options.

Setting options:
10∗, 20, 50, 100, 200, 500 mV,
1, 2, 5, 10, 20, 50 V [/div]
(∗ default setting)



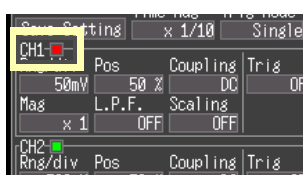
Measurable effective range is up to ±10 times of the voltage axis range (For 50 V/div, the maximum input voltage is up to 400 V DC).

Selecting Waveform Display Color (as needed)

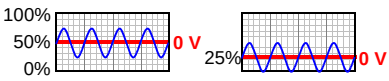
Different display colors can be selected for each input channel waveform.

Select from the waveform display color setting options.

Setting options:
OFF (x), Red (* CH1), Green (* CH2),
Blue, Yellow, Pink, Light Blue
(∗ default setting)



Setting the Zero Position (as needed)

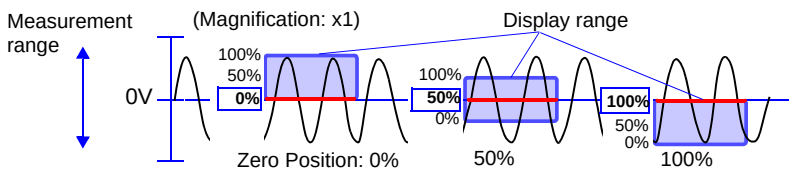


Normal Waveform(50%) Changed Zero Position(25%)

The vertical display position of each waveform can be changed.
Set the waveform zero position (in this example, zero volts) for display on the vertical axis.

Select from the **[Pos]** setting options.
Setting options:**- 50 to 150%**
(in 1% steps, when the [Mag] setting is x1),
(default setting: 50%),

Magnification and compression (p. 46) in the voltage axis direction is based on the zero position.
Although the range of voltage that can be displayed on the Waveform screen depends on the zero position and magnification/compression of the voltage axis, the measurement range is unaffected.



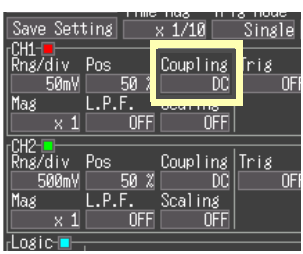
The valid setting range depends on display magnification.
With x10 magnification (maximum setting range), -950 to 1050%

Selecting the Input Coupling Method (as needed)

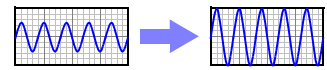
Select the coupling method for input signals.

Select from the **[Coupling]** setting options.
Setting options:(∗ default setting)

DC∗	DC Coupling Select this to acquire both DC and AC components of an input signal.
GND	The input signal is disconnected. Zero position can be confirmed.



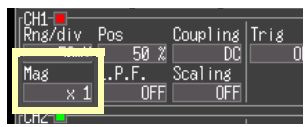
Zooming the Vertical Axis (as needed)



Normal Display　Zoomed Display (x2)

Display magnification of the vertical (voltage) axis can be selected for each input waveform. Magnification is applied relative to the waveform's zero position.

Select from the **[Mag]** setting options.
Setting options: **x10, x5, x2, x1∗, x1/2, x1/5**
(∗ default setting)

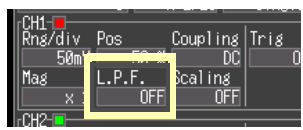


Selecting a Low-Pass Filter (L.P.F.) (as needed)

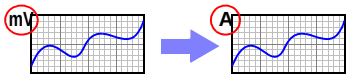
Normal Display OFF)　Cut-Off Frequency Selected

To suppress high-frequency components, select a low-pass filter.

Select from the **[L.P.F]** setting options.
Setting options: **OFF∗, 5Hz, 50Hz, 500Hz, 5kHz**
(∗ default setting)



Converting Units (Scaling function)

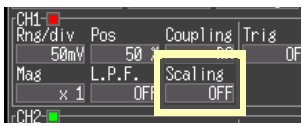


Normal Display (OFF) | Scaling Enabled

Input voltage values can be converted to physical units for display, such as by converting voltage to current. Preset scaling settings are provided for current measurement with the optional clamp sensor models.

Select from the **[Scaling]** setting options.

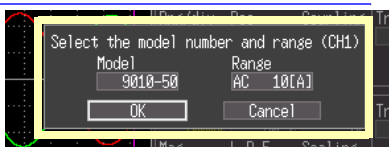
Setting options: **OFF∗, Model, Ratio, 2-Point**
(∗ default setting)



A dialog appears when selected.

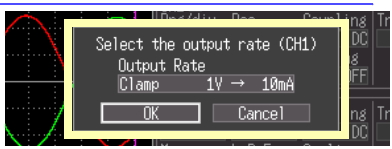
Model

Select your clamp sensor model from the Model list.
Setting options:
9010-50, 9018-50, 9132-10, 9322



Ratio

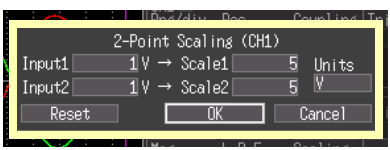
Select the output ratio (conversion ratio) of the clamp sensor, or the attenuating ratio of the attenuating probe.

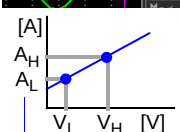


2-Point

Set the voltage values of two points of the input signal, the converted unit value of these two points and the name of the converted measurement units, so measurement values acquired as voltage are converted to the specified units.
Example:

Voltage value at 2 points	Voltage of units to convert
V_H: High value	A_H: Converted high value
V_L: Low value	A_L: Converted low value





Conversion ratio and offset value are calculated from the two points and converted

Converted unit values

Actual measurement values

$$Y = \underbrace{\frac{A_H - A_L}{V_H - V_L}}_{\text{Conversion Ratio}} \times X + \underbrace{\frac{V_H \times A_L - V_L \times A_H}{V_H - V_L}}_{\text{Offset}}$$

X: Voltage value
Y: Converted value

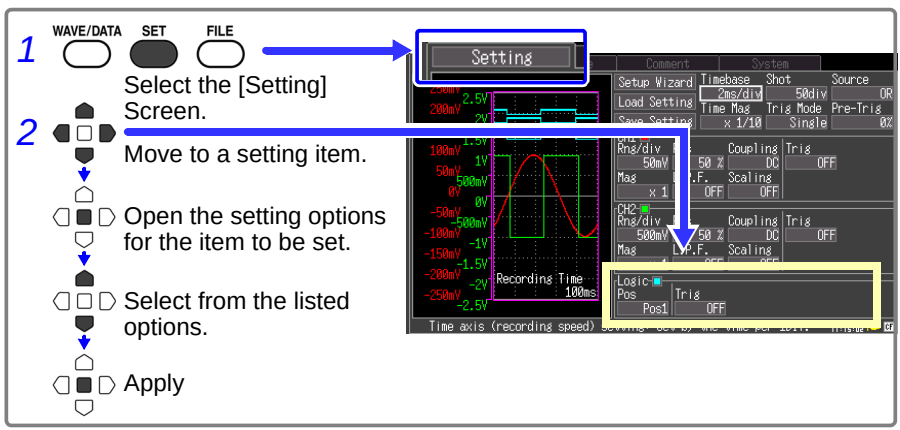
Valid setting ranges for conversion ratio and offset are as follows.
Note that the conversion ratio cannot be set to zero.
-9.9999E+9 ≤ (conversion ratio, offset) ≤ -1.0000E-9
(offset) = 0
+1.0000E-9 ≤ (conversion ratio, offset) ≤ +9.9999E+9
Values outside the above range cannot be set.
Scaled values (and cursor values when using the A/B cursors) can be verified in the waveform screen.

3.7 Measurement Configuration 4 (Logic Channel Settings)

Configure the input channels when measuring with a logic probe.

To use logic signals as a trigger source:

See: "4.3 Logic Channel Trigger Settings" (p. 57)



Setting Logic Channel Display Colors (as needed)

You can select a display color for each logic channel waveform

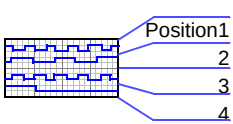
Select from the waveform display color setting options.

Setting options:

OFF*, Red, Green, Blue, Yellow, Pink, Light Blue

(* default setting)

Setting Logic Channel Display Positions

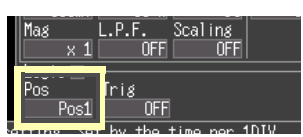


You can select the display position of each logic waveform. Waveform overlap on the display can be minimized when recording simultaneously with an analog waveform.

Select from the **[Pos]** setting options.

Setting options: **Pos1*, Pos2, Pos3, Pos4**

(* default setting)



3.8 Entering Comments

Comments of up to 40 characters can be entered as a title for the measurement data, and as a label for each input waveform.
The comments can be displayed when the data is viewed in an application program on a computer.

1 WAVE/DATA SET FILE
Select the [Comment] Screen.

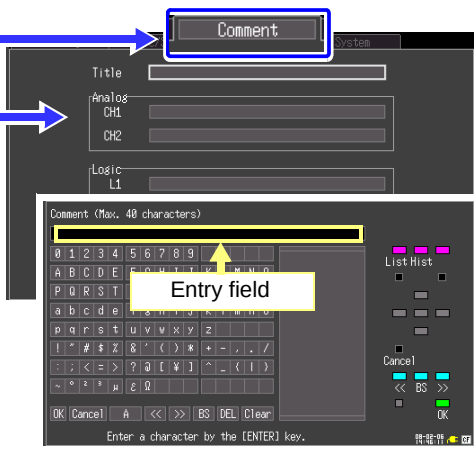
2
Select the field in which to enter the comment

Apply
The character entry screen appears.

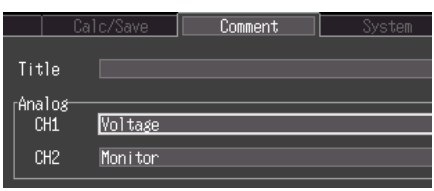
3
Select the characters to enter
To enter a space, select a blank character.

Apply
Characters appear in the entry field as you select them.

Select **[OK]**
Accepts your entry and returns to the [Comment] screen.



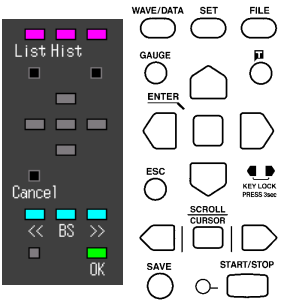
Finished with entry Navigate the entry field



The following characters are converted as follows when saved to a text file.

Entered character	²	³	μ	Ω	°	℮
Converted plain text equivalent	^2	^3	^u	~o	~c	~e

Operating Panel



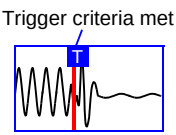
The operating panel depicts the functions of Memory Hi-Corder's operating keys.

Only the keys displayed on the operating panel are enabled.

- **List** (**WAVE/DATA** key)
  Measurement related terms are registered in the list beforehand.
- **Hist** (History, **SET** key)
  You can select previously entered terms from the pick list.
- **Char Input** (T key)
  Switches between the pick list and character selection frames.
- ↑/↓ (Cursor up/down key)
  Selects from the pick list frame.
- **Select** (**ENTER** key)
  Accepts the item selected in the pick list.
- **Cancel** (**ESC** key)
  Cancels entry.
- **<</ >>** (**SCROLL/CURSOR** left/right key)
  Move input position.
- **BS** (**SCROLL/CURSOR** middle key)
  Deletes one character.
- **OK** (**START/STOP** key)
  Accepts entry.

Making Trigger Settings Chapter 4

Triggering is the process of controlling the start and stop of recording by specific signals or conditions (criteria). When recording is started or stopped by a specific signal, we say the trigger is "applied" or "triggering occurs".
In this manual, T indicates a "trigger point", as the time at which a trigger is applied.



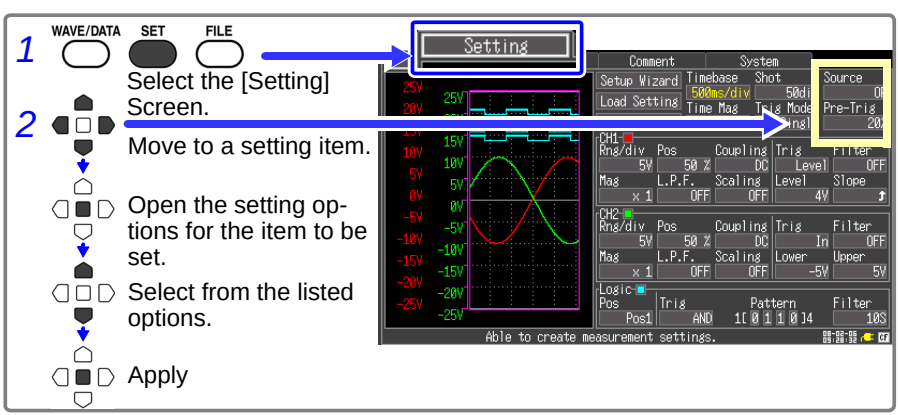
Signals that can be used for triggering (trigger sources) are as follows.

Trigger Source	Description	Ref.
Analog Trigger	Applies a trigger according to a signal input on an analog channel. (Level, In-Window, Out-of-Window, or Voltage Sag trigger)	(p. 53)
Logic Trigger	Applies a trigger according to signals input on logic channels (Ch A to Ch D).	(p. 57)
External Trigger	Applies a trigger according to an input signal at the EXT.TRIG terminal (External Trigger Input)	(p. 97)
Manual Trigger	Applies a trigger by pressing T.	(p. 58)

A trigger can be applied by combining (AND/OR) criteria from multiple trigger sources (except manual triggering). When the recording length is [Cont], the trigger function is not available.

4.1 Setting Recording Criteria

Make these settings when selecting the type of triggering to be applied to input channel (CH1 or CH2) recording.



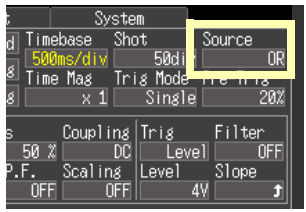
Setting Combining Logic (AND/OR) for Multiple Trigger Sources

Analog, logic, and external trigger criteria can be combined by AND/OR logic to define complex trigger criteria.

Select from the **[Source]** setting options.

Setting options:(∗ default setting)

OR∗	Triggering occurs when any one of the specified trigger source criteria is met.
AND	Triggering occurs only when all of the specified trigger source criteria are met.

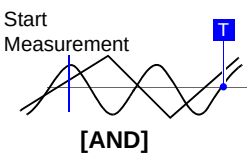


When the trigger combining logic is set to [AND]

If trigger criteria are already met when you press the START/STOP key, no triggering occurs. Triggering occurs only after all trigger sources have ceased to meet the criteria at once, and are subsequently met again.

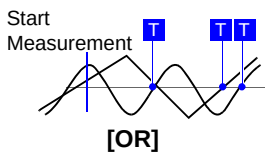
To apply a trigger when the upslope (↑) of the waveform crosses zero volts

Trigger..... Level
Filter..... Off
Level .....0 V
Slope..... ↑



[AND]

One waveform has crossed above 0V as the other crosses on the upslope

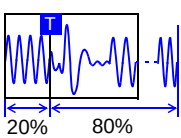


[OR]

Either waveform crosses 0V on the upslope

When the recording length is [Cont], the trigger source setting is disabled.

Setting the Trigger Start Point (Pre-Trigger)



Make this setting to specify a portion of the waveform to be recorded prior to a trigger event, as a percentage of the overall specified recording length.

Select from the **[Pre-Trig]** setting options.

Setting options:
0∗, 5, 10, 20, 30, 40, 50, 60, 70, 80, 90, 95, 100%
(∗ default setting)

Difference between [Waiting for pre-trigger] and [Waiting for trigger]

When measurement is started, the specified pre-trigger length is recorded. This period is indicated as the [Waiting for pre-trigger].

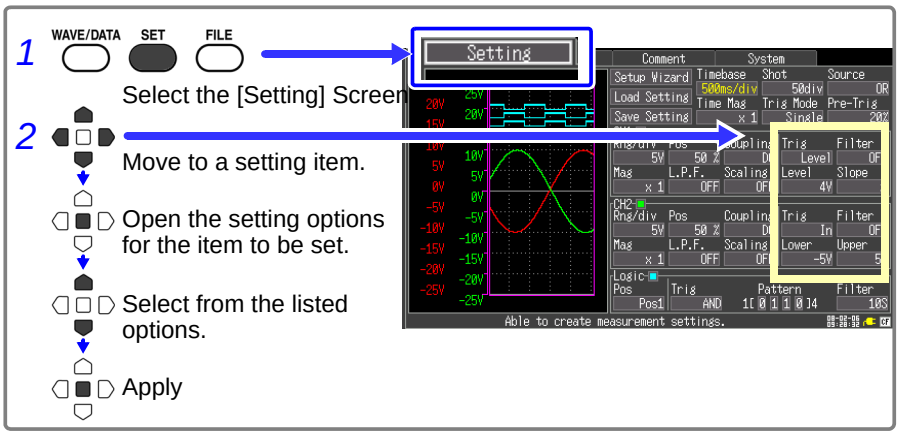
After the specified pre-trigger length has been recorded, the period indicated as [Waiting for trigger] continues until a trigger occurs.

During the [Waiting for pre-trigger] period, trigger events are not recognized even when the trigger criteria are met.

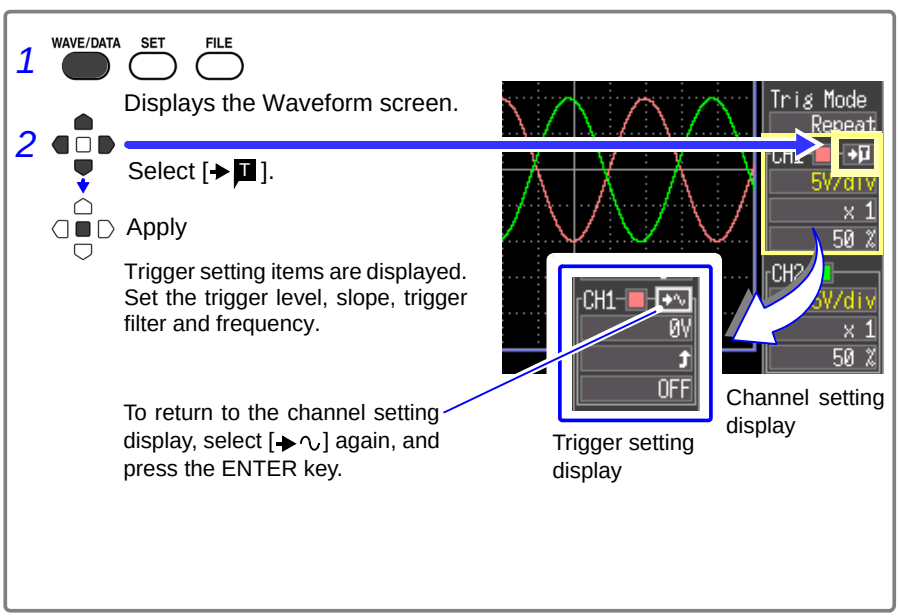
When the recording length is [Cont], the pre-trigger setting is disabled.

4.2 Triggering by Analog Signals

Make this setting to define trigger criteria according to input signal characteristics on CH1 or CH2.



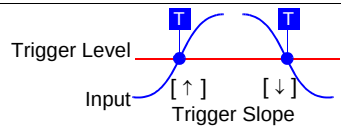
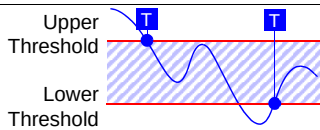
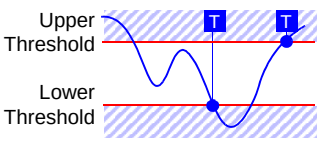
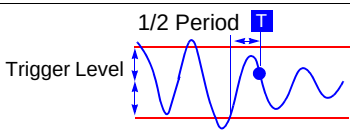
Settings can also be made on the Waveform screen.



Selecting an Analog Trigger Type

Select the appropriate trigger type. Setting options differ by trigger type.

Select from the **[Trig]** setting options.
Setting options: **OFF∗, Level, In, Out, Drop**
(∗ default setting)

Type of Analog Trigger	Trigger Example	Description
Level Trigger [Level]		A trigger is applied when an input signal crosses the specified trigger level (threshold voltage).
In-Window Trigger [In]		A trigger is applied when the input signal enters a range defined by upper and lower thresholds.
Out-of-Window Trigger [Out]		A trigger is applied when the input signal exits a range defined by upper and lower thresholds.
Voltage dip Trigger [Drop]		A trigger is applied when the amplitude of the input signal (at commercial mains frequency) dips below the specified trigger level.

Setting Example

Apply a trigger when the input signal exceeds 200 mV

Trigger ..... Level (Level Trigger)
Level..... 200 mV
Slope .....↑ (rising)

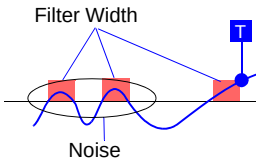
Apply a trigger when the input signal is outside of the range ±1 V

Trigger ..... Out (Out-Window Trigger)
Upper..... 1 V
Lower..... -1 V

Apply a trigger if a 50-Hz mains frequency input signal, nominally about 220 Vrms (311 Vpeak), drops below 198 Vrms (280 Vpeak)

Trigger..... Drop
Level..... 280 V
Freq..... 50 Hz

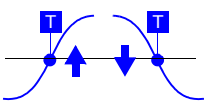
Selecting a Trigger Filter



Sets the filter width (trigger filter) for triggering. Suppresses triggering from noise.
The filter width setting is defined according to the number of samples* of acquired data.
* Number of samples: 1 division = 100 samples (with x1 display magnification)

Select from the **[Filter]** setting options.
Setting options: **OFF∗, 10, 20, 50, 100S**
(∗ default setting)

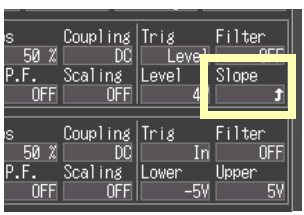
Selecting Rising or Falling (Slope) of the Input Signal



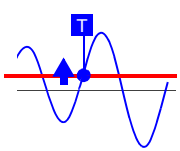
Set the slope (rising (↑) or falling (↓) edge) of the input signal on which to trigger.

Select from the **[Slope]** setting options.
Setting options: (∗ default setting)

↑∗	A trigger occurs when the signal crosses the threshold on the upslope (rising edge ↑).
↓	A trigger occurs when the signal crosses the threshold on the downslope (falling edge ↓).

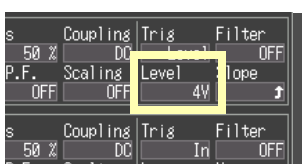


Setting the Signal Threshold Level (Trigger Level)



Set the signal threshold level (voltage value) at which the triggering is to occur. The trigger level setting value is an instantaneous value (*not* RMS). The setting value can be verified in the waveform monitor or on the Waveform screen. When scaling is enabled, the scaled trigger level value can be verified in the waveform monitor.

Select from the **[Level]** setting options.
Setting options: One twentieth of the voltage range [Rng/div] (Default setting: Zero volts for Level Trigger mode, and one division above the zero position for Voltage Sag trigger mode.)

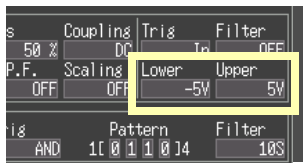


Setting Lower and Upper Trigger Thresholds

Set the upper and lower thresholds for a trigger window. Upper and lower thresholds can be verified in the waveform monitor or on the Waveform screen. When scaling is enabled, the scaled threshold values are displayed.

Select from the **[Lower]**/**[Upper]** setting options.

Setting options: One twentieth of the voltage range [Rng/div] (Default setting: One division below the lower limit zero position, and one division above the upper limit zero position.)



Selecting Measurement Frequency

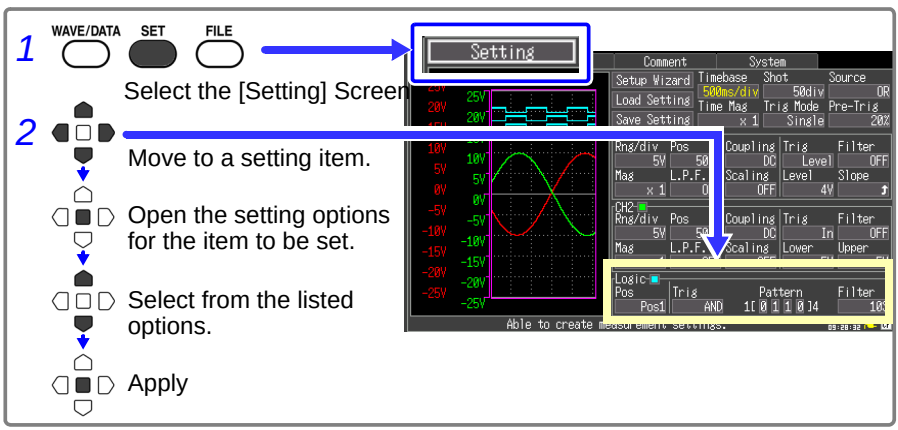
Select the frequency of the commercial mains power to be measured.

Select from the **[Freq]** setting options.

Setting options: **50Hz**∗**, 60Hz** (∗ default setting)

4.3 Logic Channel Trigger Settings

Make these settings to utilize logic channel input signals for triggering.
A trigger event occurs when the logic signal pattern matches the specified logical AND/OR trigger criteria. You can enable a trigger filter to specify a minimum interval (the filter width) during which trigger criteria must be met before triggering occurs.

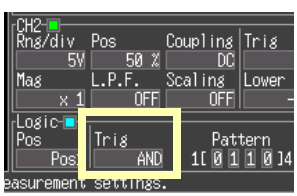


Configuring Logical (AND/OR) Trigger Criteria

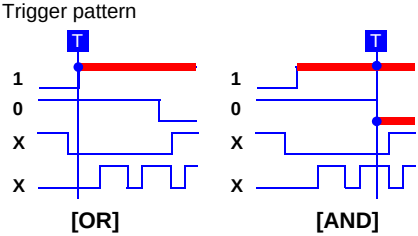
Specify a logical pattern of logic inputs to serve as trigger criteria.

Select from the **[Trig]** setting options.
Setting options:(∗ default setting)

OFF∗	Logic triggering is disabled.
OR	Triggering occurs when input signal logic matches any setting in the trigger pattern.
AND	Triggering occurs only when input signal logic matches all settings in the trigger pattern.



Trigger pattern



When the trigger combining logic is set to [AND]

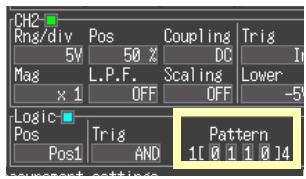
If trigger criteria are already met when starting measurement, no triggering occurs. Instead, triggering occurs once as soon as the criteria are no longer met, and again when the criteria are subsequently met.

Setting a Trigger Pattern

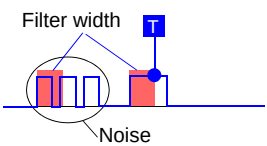
Specify the state of each input signal required for triggering.

Select from the **[Pattern]** setting options.
Setting options:(∗ default setting)

X∗	Ignore signal
0	Triggering occurs when the signal transitions from HIGH to LOW.
1	Triggering occurs when the signal transitions from LOW to HIGH.

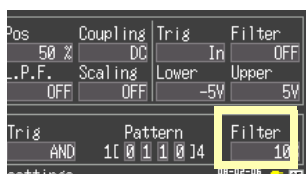


Setting a Trigger Filter



To enable trigger filtering, just specify a filter width (trigger filter). The filter can prevent false triggering due to noise. The filter width setting is defined according to the number of samples* of acquired data.
* Number of samples: 1 division = 100 samples (with x1 display magnification)

Select from the **[Filter]** setting options.
Setting options: **OFF**∗**, 10, 20, 50, 100 S**
(∗ default setting)



4.4 Triggering Manually (Manual Trigger)

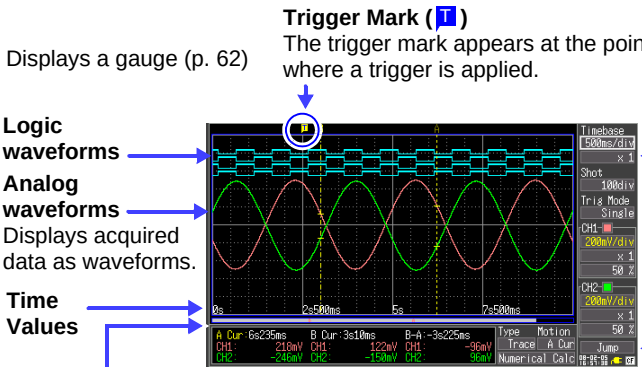
Triggers can be applied manually. Manual triggering takes priority over all other trigger sources, regardless of settings.

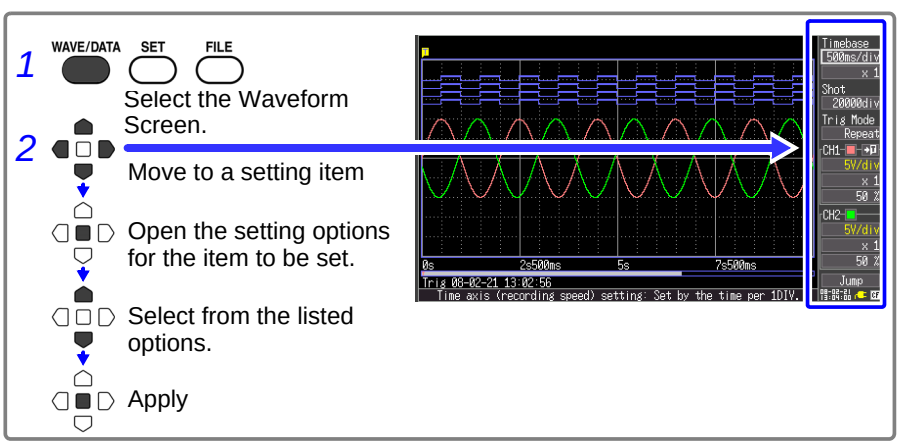
At any time after starting measurement (by pressing the START/STOP key), you can press the T key to apply a manual trigger. However, manual triggering is disabled when the input channel trigger setting is OFF. After setting trigger criteria and starting measurement, the [Waiting for trigger] mode is active, during which a trigger can be generated by pressing the T key.

Waveform Analysis Chapter 5

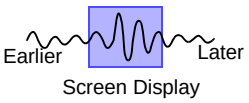
5.1 Viewing Waveforms

Waveform Screen

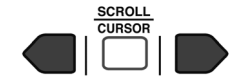


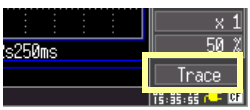


Scrolling Waveforms



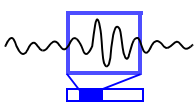
Screen Display



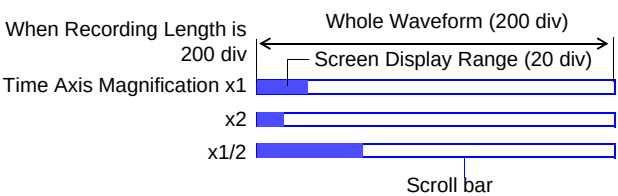


When measuring or displaying an existing waveform, use the SCROLL/CURSOR keys to scroll.
During Roll Mode display,* manually scrolling a waveform terminates the Roll Mode, so you can freely view any part of the measured waveform.
To return to Roll Mode, move the cursor to **[Trace]** near the bottom right corner of the display, and press the ENTER key. Alternatively, just scroll to the right end of the waveform to resume Roll Mode.
* About the Roll Mode display:
When the product of the timebase multiplied by the display magnification is greater than 50 ms, the screen scrolls automatically so that the newest part of the waveform is always displayed.
To jump to the start or end of a waveform (or between trigger events), hold the ESC key while pressing the right or left SCROLL/CURSOR key.

Verifying Waveform Display Position

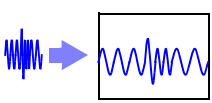


From the scroll bar you can verify the relative position and size of the displayed portion of a waveform within the overall recorded waveform. Trigger time, trigger position and A/B cursor positions (when using vertical or trace cursors) are also displayed.



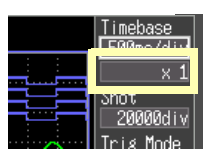
Even for identical recording lengths, the width of the screen display range indication in the scroll bar depends on the specified magnification/compression of the time axis.

Magnifying and Compressing Horizontally (Time Axis)

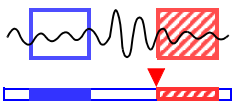


Data details can be observed by magnifying the waveform along the time axis. Also, by compressing the time axis, overall waveform fluctuations can be readily seen. Time axis magnification can be changed while measuring, and when the A/B cursors are displayed, magnification can be set according to cursor position (but only when finished measuring).

Select from the [x1](display magnification) setting options.
Setting options:
x10, x5, x2, x1∗, x1/2, x1/5, x1/10, x1/20, x1/50, x1/100, x1/200, x1/500, x1/1000 (∗ default setting)



Viewing Any Waveform Location (Jump Function)



When the recording length of a waveform is long, you can specify the portion to be displayed immediately.

1 WAVE/DATA SET FILE

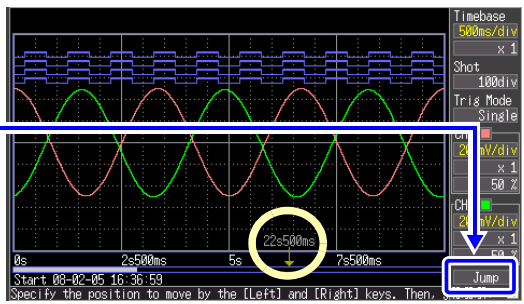
Select the Waveform Screen.

2

Select **[Jump]**.

Apply

The location of the currently displayed portion of the overall waveform is indicated by the ▼ mark on the scroll bar.



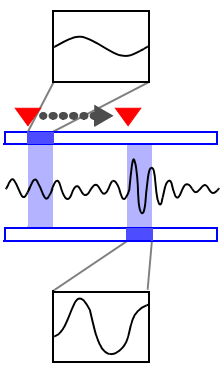
3

Move the ▼ mark to display a different portion of the waveform.

4

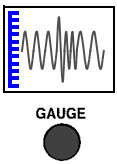
Apply

The portion of the waveform at the ▼ mark is displayed.



5.2 Viewing Measurement Values

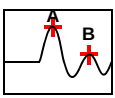
Displaying Gauges



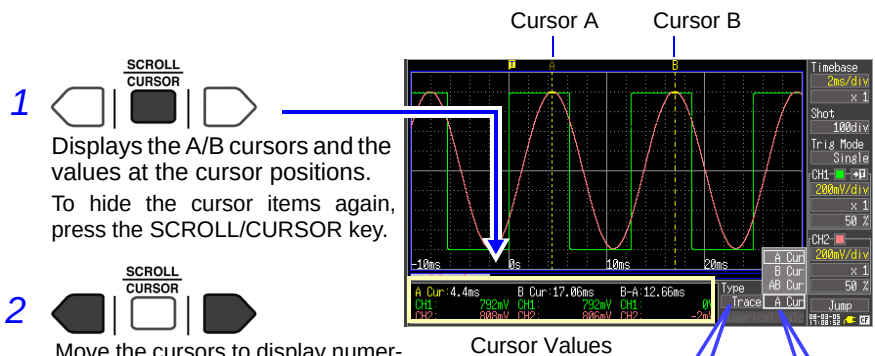
Press the GAUGE key to display gauges at the left side of the screen corresponding to the measurement range of each channel. Measurement values can be confirmed on the gauges. The color of each gauge matches the color of its waveform.

Press the GAUGE key again to hide the gauges.

Displaying Cursor Values



Time difference, frequency and potential difference (and when scaling is enabled, scaling values) can be read as numerical values using the A/B cursors.
See "About Cursor Values" (p. 63)



[Type]
Trace∗
Vert (Vertical)
Horz (Horizontal)
(∗ default setting)

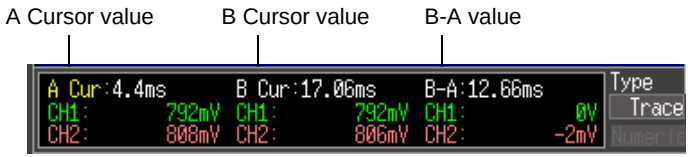
[Motion]
A Cur∗
B Cur
AB Cur
(∗ default setting)

The current [Motion] selection can be changed directly, by holding the ESC key while pressing the central SCROLL/CURSOR key.

Changing Cursor Type

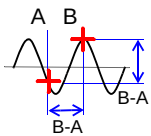
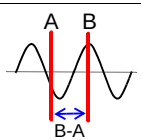
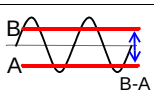
To select which cursor(s) to move
Select from the [Motion] setting options.

To select the type of cursor values to display
Select from the [Type] setting options.



Trace Cursor case

About Cursor Values

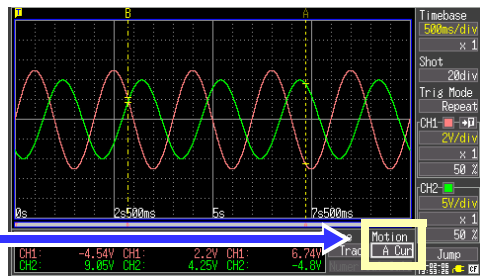
Cursor Type	Example	Cursor Value
Trace Cursors		Displays the time and measurement values at the A/B cursors, or the time and measurement differences between the A/B cursors. Displays the intersections (trace points) of cursors and waveforms. (the intersections of waveform traces of selected channels) (Time and Measurement Values) Time Values A Cursor value, B Cursor value: Time from trigger point or recording start B-A value: Time difference between A/B cursors Measurement Values A Cursor value, B Cursor value: Measurement value B-A value: Difference between measured values at A/B cursors
Vertical Cursors		Displays the time and frequency values at the A/B cursors, or the time and frequency differences between the A/B cursors. (Time Value and Frequency) Time Values (t): Time from trigger point or recording start Frequency (f): Frequency having period t B–A value: Time difference between A/B cursors
Horizontal Cursors		Displays the measurement values at the A and B cursors for the selected channel(s), or the difference between A/B cursor values. (Measurement Values) A Cursor value, B Cursor value: Measured value of channel B–A value: Difference between values at A/B cursors

Specifying a Waveform Time Span

Specify a waveform time span when saving a partial waveform or applying numerical calculations (Trace cursors or Vertical cursors).

1 SCROLL CURSOR

The A/B cursors and cursor values are displayed.



2

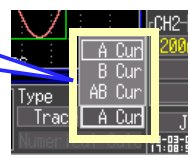
Select **[Motion]**.

Open the setting options for the item to be set.

Select which cursor(s) to move.

Apply

[Motion]
A Cur
B Cur
AB Cur



3 SCROLL CURSOR

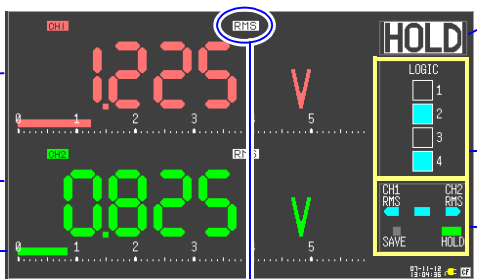
Move the A/B cursors to specify the time span.

Viewing Input Signals as Numerical Values (Numerical Value Display Function)

AC voltage measured at commercial mains frequencies (50/60 Hz) or DC voltage can be displayed as a numerical value. Either instantaneous or RMS numerical value can be displayed.
Instantaneous value: the input voltage
RMS value: the root-mean-square of the actual input voltage (p. 89)
Note that the RMS value is only displayed correctly for commercial mains frequencies (50/60 Hz) and DC signals.

Select the Numerical Screen.

Normal Display



CH1 Numerical Value

CH2 Numerical Value

Gauge
Maximum count is 5500

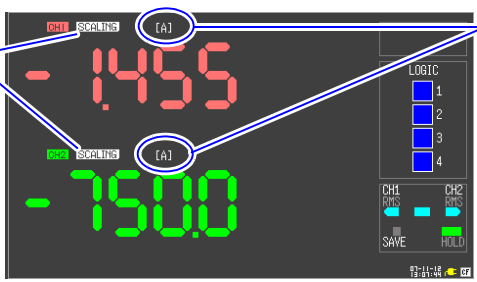
Display Hold
The displayed value is held constant.

Instantaneous logic values (☐: 0, ■: 1)

These depict operating key functions

RMS display mode indicator (Indicates the current mode: RMS or instantaneous (P-P))

Scaling Indicators



Scaling Unit Indicators
Appears only when scaling is enabled for that channel (p. 47).

Units displayed after conversion by scaling settings

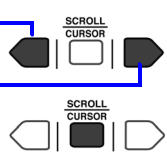
Switching between instantaneous and RMS values

Press these keys to toggle the selection

Toggles only CH1

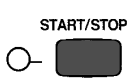
Toggles only CH2

Toggles both CH1 and CH2



Holding and releasing display values

Press these keys to toggle the selection



Saving & Loading Data Chapter 6

Measurement data acquired by the Memory HiCorder can be saved to a CF card.

See: "6.2 Using a CF Card" (p. 69)

Methods available for saving data consist of Auto Save, for saving data automatically while measuring; and Select & Save and Quick Save for saving data after measurement is finished. Refer to "6.3 Saving Data" (p. 72) for details.

6.1 About Saving and Loading Data

When saving data, a folder named HIOKI8870 is created, and files are stored in the folder as follows. Up to 1,000 files can be saved in one folder.

O = Available, X = Not available

File Type	File Format	Folder Name	File Name (Auto-numbered from 1)	Save		Load	PC-Readable
				Auto	Manual		
Settings Data	Binary	CONFIG	CONFIG0001.SET	X	O	O	X
Settings List	Binary	CONFIG	LIST0001.BDL	X	O	O	X
Waveform Data*1	Binary	Date of saving (e.g. 08-05-01) *3,*5	WAVE0001.MEM	O	O	O	O
	Text		WAVE0001.CSV	O	O	X	O
Numerical Calculation Results	Text		MEAS0001.CSV	O	O	X	O
Captured Screen Image	BMP *2		SCR0001.BMP*4	O	O	O	O

*1. To reload data into the instrument or load it into the Wave Processor program: Save it in binary format. Waveforms and some of the measurement settings are saved. To save a waveform partially, specify a period by using A/B cursors (p. 64).

*2. BMP Format: This is a standard Windows graphics format. These files can be handled by many graphics programs.

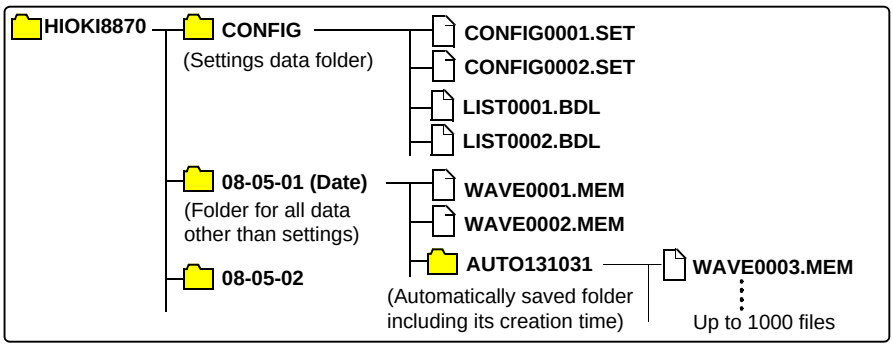
*3. When auto-saving, a folder named AUTO*hhmmss* is created under a folder named with the date of saving, where *hhmmss* is the measurement starting time. (Example: The file AUTO131031 is created at the time 13:10:31)

*4. Also when auto-saving, screen images are saved in the file named [WAVE0001.BMP].

*5. When the retrieved waveform is re-saved as waveform or display image data, it is saved under the date (year-month-date) folder where the retrieved waveform file is saved.

See: "Appendix 2 File Naming" (p. A5)

Directory Structure for Saved Data



Model 8870 waveform data size list

Recording length(div)	Binary	Text
20	12.8 KB	82.5 KB
50	27.4 KB	205.6 KB
100	51.8 KB	410.6 KB
200	100.7 KB	820.8 KB
500	247.1 KB	2.0 MB
1,000	491.3 KB	4.0 MB
2,000	979.6 KB	8.0 MB
5,000	2.4 MB	20.0 MB
10,000	4.8 MB	40.1 MB
20,000	9.5 MB	80.1 MB

In binary saving, all channels will be saved, regardless of whether the display is ON or OFF.
When saving as text, only the channel that is displayed will be saved.
The save column in the chart above is an example of the case of displaying and saving all channels.
For example, when using the 9729 PC Card (1GB), approximately 100 binary data of record length 20,000div files can be saved.

6.2 Using a CF Card

The following options are available for saving and loading measurement data with the Memory HiCorder.

Hioki options PC cards (includes adapter)
- Model 9726 PC Card 128M
- Model 9727 PC Card 256M
- Model 9728 PC Card 512M
- Model 9729 PC Card 1G
- Model 9830 PC Card 2G

Important

Use only CF cards sold by Hioki. Compatibility and performance are not guaranteed for CF cards made by other manufacturers. You may be unable to read from or save data to such cards.

This Memory HiCorder does not require a CF (CompactFlash) adapter.
See "6.5 Data Management" (p. 81) for details about managing data storage in the card.

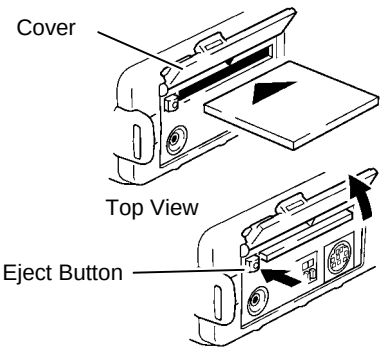
⚠CAUTION

- Format new CF cards before use.
  To format with this instrument: (p. 71)
- Inserting a CF card upside down, backwards or in the wrong direction may damage the CF card or instrument.
- Never eject a CF card while it is being accessed by the instrument. Data on the CF card could be lost.
- During battery-only operation, data may fail to be stored properly if battery charge is exhausted while saving. In the worst case, the CF card could be damaged, so pay appropriate attention to the discharge state of the battery pack.
- If the Eject button is in the released position, press it in first before inserting the CF card all the way in. Inserting the CF card when the Eject button is released may damage the instrument. If the CF card does not go all the way in, do not force it in. Press the Eject button once to release it, then press it again and insert the CF card all the way in.
- As the CF card is sensitive to static electricity, damage to the CF card or wrong operations by the this instrument may occur due to static electricity. Please be careful when handling it.

NOTE

- The Flash memory in a CF card has a limited operating life. After long-term usage, data storage and retrieval become difficult. In this case, replace the CF card with a new one.
- We cannot provide compensation for data loss in a CF card, regardless of content or cause of the damage. Always maintain a backup of important data stored on a CF card.

CF Card Insertion & Removal



Inserting a CF card

1. Open the CF card slot cover.
2. Press the Eject button in if it is in the released position.
3. Face the CF card with the arrow mark (▲) on top, and insert it in the direction of the arrow all the way in the slot.

Removing a CF card

1. Open the CF card slot cover.
2. Press the Eject button (to release it).
3. Press the Eject button again and pull the card out.

Formatting a CF Card

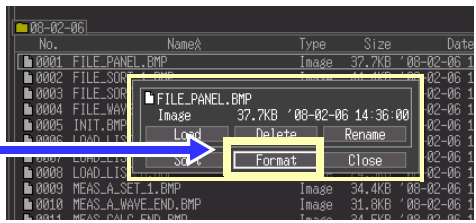
CF Cards are formatted from the Memory HiCorder's File screen.

1 WAVE/DATA SET FILE

Select the File Screen.

2 Open the Control Dialog box

Select **[Format]**.



Apply

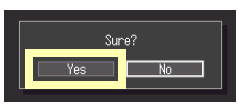
The Format Confirmation dialog appears.

Select **[Yes]**.

Apply

The Format Confirmation dialog appears again.

Select **[Yes]**.

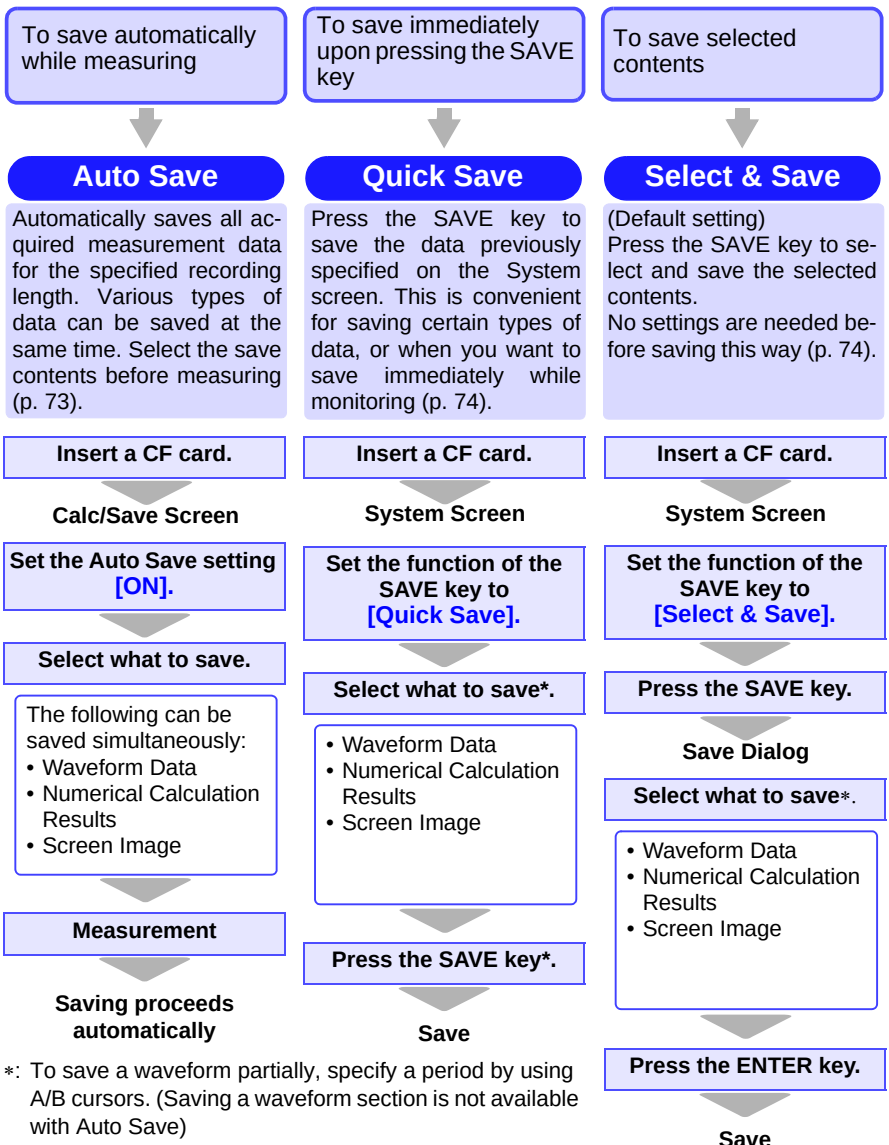


Apply

NOTE Formatting irretrievably erases all data on the CF card. Always backup important data from the CF card before formatting.

6.3 Saving Data

Basically, three methods are available for saving.



*: To save a waveform partially, specify a period by using A/B cursors. (Saving a waveform section is not available with Auto Save)
To save a screen image, display the desired screen before saving.

Automatic Saving

Before measuring, configure saving on the [Calc/Save] screen.
Waveform data, screen images and numerical calculation results can be saved at the same time.
Before starting to measure, confirm that Auto Save is configured correctly, and that the CF card is properly installed.

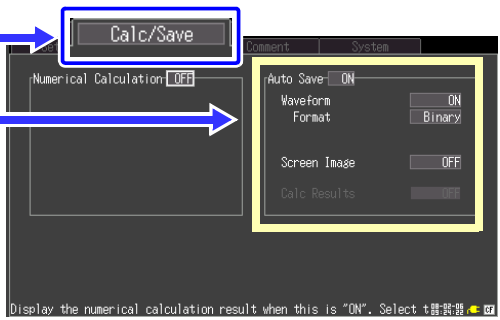
1 WAVE/DATA SET FILE
Select the [Calc/Save] Screen.

2 Move to a setting item.

Open the setting options for the item to be set.

Select from the listed options.

Apply



Set **[Auto Save]** to **[ON]**, and select the item(s) to save.

To Save Waveform Data

Set **[Waveform]** to **[ON]**.

From the **[Format]** options, select the data saving format.

Binary Select this format to be able to reload the saved data into the instrument, or so that it can be loaded into the Wave Processor program.

Text Select this format to save the data as a text file.

(When [Text] format is selected)
From the **[Thinning]** options, select the amount of data thinning desired.
1/2, 1/5, 1/10, 1/20, 1/50, 1/100, 1/200, 1/500, 1/1000, OFF∗ (* default setting)
1/2: Saves every other data point (• x• x• x...)
1/5: 5Saves one of every five data points (•xxxx•xxxx•xxxx...)

Saving Screen Images

Set **[Screen Image]** to **[ON]**.

[Format] **BMP** (fixed)

This is selected automatically when setting [Screen Image] to [ON].

To Save Numerical Calculation Results

Set **[Calc Results]** to **[ON]**.

Numerical calculation settings are necessary (p. 85).

3 After making any other necessary settings, press the START/STOP key.

Data is automatically saved to the CF card when measurement finishes.
"Directory Structure for Saved Data" (p. 68)

Selecting the Manual Saving Method [Quick Save]/[Select & Save]

Two manual saving methods are available: [Quick Save] and [Select & Save], both of which offer the same setting options. When saving waveforms, a folder (named with the date of saving) is created for data on the CF card, and saved files are automatically numbered (p. 67).

1 WAVE/DATA SET FILE

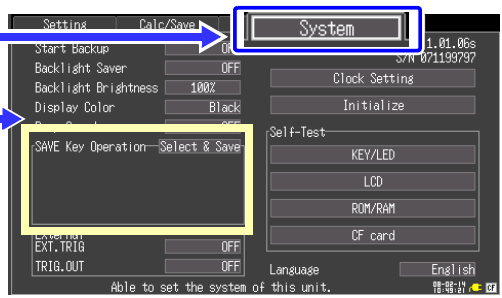
Select the [System] Screen.

2 Move to a setting item.

Open the setting options for the item to be set.

Select from the listed options.

Apply



Selecting **[SAVE Key Operation]** setting options.

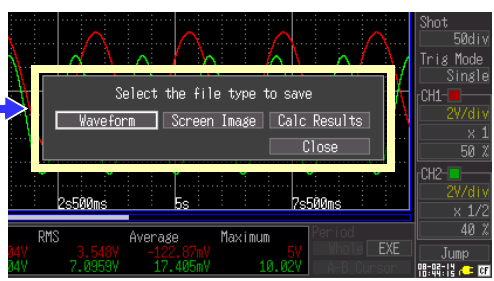
Setting options:(∗ default setting)

Select & Save∗	Pressing the SAVE key displays the setting options for saving.
Quick Save	Select the setting options for saving on the [Calc/Save] screen before pressing the SAVE key.

[Select & Save]

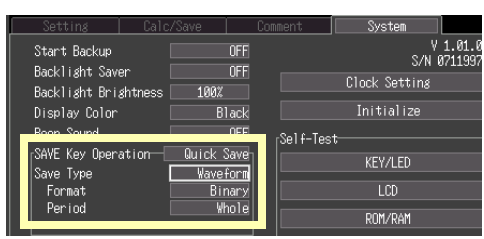
SAVE

The Save dialog appears.
Select from the saving options in this dialog.
Save Waveforms (p. 75)
Save Screen Image (p. 76)
Save Numerical Calculation Results (p. 77)



[Quick Save]

Setting items are displayed.
Select your saving options.

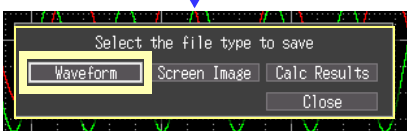


Saving Waveform Data (with the SAVE Key)

When saving waveform data, created files are automatically named WAVE*nnnn*.MEM (or .CSV) in a folder automatically named HIOKI8870-*date*, where *nnnn* is an automatically generated serial number starting from 0001 and *date* is the saving date (p. 67).
To save a partial waveform, specify the time span to save beforehand (p. 64).

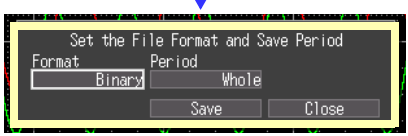
Select & Save

SAVE

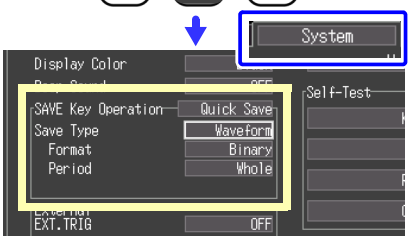


(Select from the dialog that appears when you press the SAVE key)

Select **[Waveform]**, and press the ENTER key.



Quick Save



(Before pressing the SAVE key, make settings on the System screen)

Select **[Waveform]** as the **[Save Type]**.

1 For the **[Format]** setting, select the data saving format. (* default setting)

Binary * Select this format to be able to reload the saved data into the instrument, or so that it can be loaded into the Wave Processor program.

Text Select this format to save the data as a text file.

2 **(When [Text] format is selected)**
From the **[Thinning]** options, select the amount of data thinning desired.
1/2, 1/5, 1/10, 1/20, 1/50, 1/100, 1/200, 1/500, 1/1000, OFF *
1/2: Saves every other data point (• x• x• x...)
1/5: Saves one of every five data points (•xxxx•xxxx•xxxx...)

3 From the **[Period]** setting options, select the portion of the data to save.
Whole *, A-B, Start-A, Start-B, A-End, B-End
(Whole = all acquired waveforms, A = Cursor A, B = Cursor B,
Start = start of acquired waveforms, End = end of acquired waveforms)

Select **[Save]** and press the **ENTER** key.

Select **[Yes]** in the confirmation dialog, and press the **ENTER** key.

SAVE

Capturing a Screen Image (With the SAVE Key)

Captured screen image files are automatically named SCR*nnnn*.BMP in a folder named [HIOKI8870]-[*save date*] (p. 67).

Select & Save

SAVE

Display the screen to capture, and press the SAVE key.

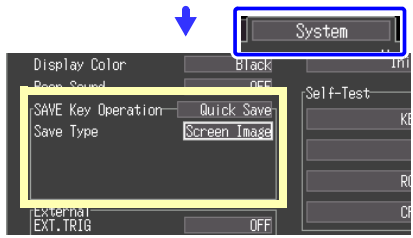
(Select from the dialog that appears when you press the SAVE key)

Select **[Screen Image]**, and press the ENTER key.

Select **[Yes]** in the confirmation dialog, and press the ENTER key.

Quick Save

WAVE/DATA SET FILE



(Before pressing the SAVE key, make settings on the System screen)

Select **[Screen Image]** as the **[Save Type]**.

Display the screen to capture

SAVE

Saving Numerical Calculation Results (With the SAVE Key)

Numerical calculation settings are necessary before saving results (p. 85).
Numerical calculation result files are automatically named MEAS*nnnn*.CSV in a folder named [HIOKI8870]-[*save date*] (p. 67).

Select & Save

SAVE

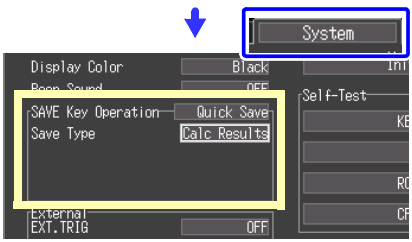
(Select from the dialog that appears when you press the SAVE key)

Select **[Calc Results]**, and press the ENTER key (p. 85).

Select **[Yes]** in the confirmation dialog, and press the ENTER key.

Quick Save

WAVE/DATA SET FILE



(Before pressing the SAVE key, make settings on the System screen)

Select **[Calc Results]** as the **[Save Type]**.

Display the numerical calculation results to be saved.

SAVE

By specifying a particular time span for numerical calculation, only the results for that time span are saved.

Saving Setting Configurations

Setting configurations can be saved as data files and later reloaded into the Memory HiCorder when you need to make more measurements with the same settings.
Up to ten setting configurations can be saved to internal memory, and more can be stored on a CF card.

1 WAVE/DATA SET FILE

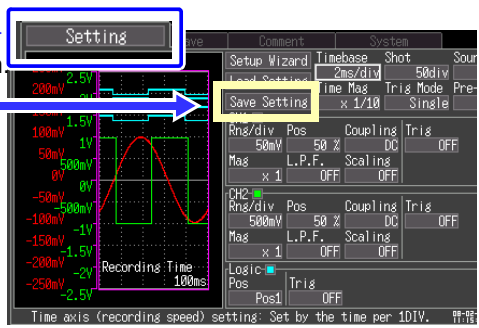
Select the [Setting] Screen.

2

Select **[Save Setting]**.

Apply

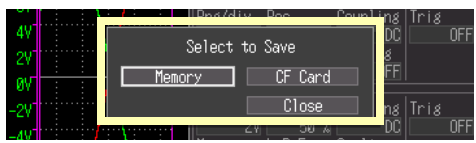
The Save dialog appears.



3

Select whether to save to the 8870-20's memory or to a CF card.

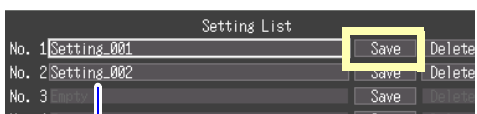
Apply



4 **(When [Memory] is selected)**

Select **[Save]** for the configuration instance (No.) to save.
Enter a comment as needed.

Apply



Comments entered on the [Comment] screen are displayed here.

When [Export] is selected, all the setting configurations saved in the internal memory can be saved as one file in the CF card.
Saved under the file name [LIST + Automatic No. (0001).BDL] inside the [HIOKI8870]-[CONFIG] folder.
When reading the setting list file (LISTxxxx.BDL) saved in the CF card on this instrument, all the 10 settings inside the internal memory will be overwritten.

(When [CF Card] is selected)

Setting configuration files are automatically named CONFIG*nnnn*.SET in a folder named [HIOKI8870]-[CONFIG] (p. 67).

To reload a setting configuration, see p. 79.

6.4 Loading Data on the Memory HiCorder

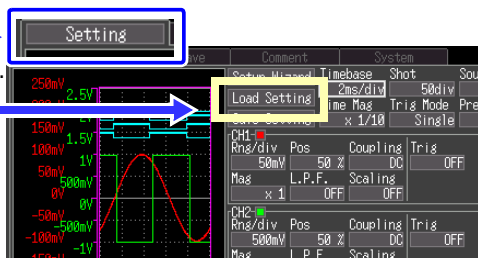
Previously stored binary waveform data, captured screen images, saved setting configurations and setting list can be reloaded into the Memory HiCorder (p. 67). Data stored on a CF card can also be transferred to a computer using the supplied USB cable (p. 84).

Loading a Setting Configuration

Setting configurations saved in the Memory HiCorder's memory or on a CF card can be reloaded.
How to save a setting configuration: p. 78

1 WAVE/DATA SET FILE

Select the [Setting] Screen.



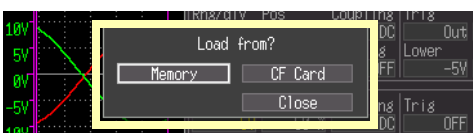
2 Select **[Load Setting]**.

Apply

The loading dialog appears.

3 Select whether to load a setting configuration from 8870-20's memory or CF card

Apply



4 **(If you selected [Memory])**

Select **[Load]** for the configuration you want to load

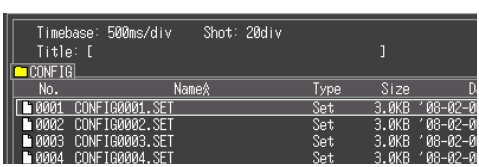
Apply

When Loading from Memory HiCorder Memory
The list of configurations stored in Memory HiCorder memory is displayed.

(If you selected [CF Card])

Select the configuration file to load. (CONFIG*nnnn*.SET)

Apply



When Loading from CF card
Configuration files stored in the [HIOKI8870]-[CONFIG] folder on the CF card are displayed.

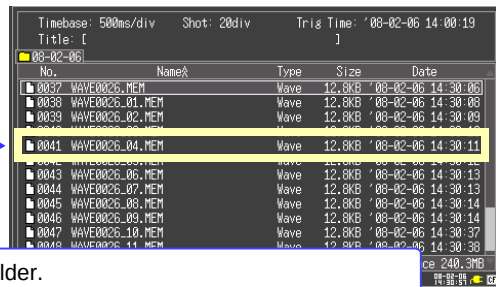
Memory HiCorder settings are reconfigured to those in the loaded configuration file.

Loading Waveform Data and Screen Images

Waveform data saved in binary format, or captured screen images, can be reloaded into the Memory HiCorder.

1 WAVE/DATA SET FILE

Select the File Screen.
The contents of the CF card are displayed.



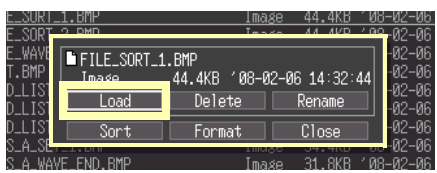
2 Select a file to load.

Displays the parent folder.

Displays the child folder.
After selecting a folder by pressing the ENTER key, select **[Change folder]** in the displayed control dialog box.

Apply

The control dialog box appears.



3 Select **[Load]**.

Apply

The selected file content is displayed on the waveform screen.

When binary format waveform data and screen images have been automatically saved together, you can switch the display between the two.

Load the screen image (WAVE*nnnn*.BMP)

SCROLL CURSOR

Switch to the screen image files in the same folder.

SCROLL CURSOR

Loads the waveform data corresponding to the screen image file with the same name.

The loading dialog appears

Select **[Yes]** and press the ENTER key to display the waveform data.

6.5 Data Management

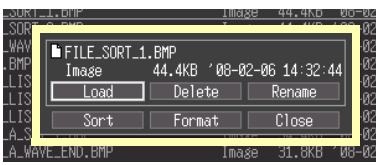
You can manage data stored on a CF card in the Memory HiCorder.

- Load a file (when the file is selected) (p. 79)
- Move displayed folders (when the folder is selected) (p. 81)
- Delete data (p. 82)
- Rename files and folders (p. 82)
- Sort files (p. 83)
- Format a CF card (p. 71)

The following operations can be performed from the control dialog box displayed by pressing the ENTER key from the File screen.

1 WAVE/DATA SET FILE
Select the File Screen.

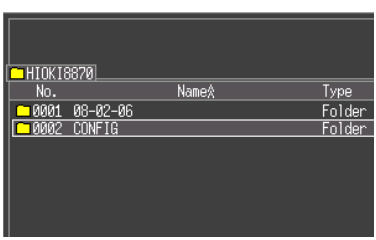
2 Opens the control dialog box.



Viewing Folder Contents and the Parent Folder

1 WAVE/DATA SET FILE
Select the File Screen.

The contents of the card are displayed.



2 Select a folder to view.

View child folder (view contents of the currently highlighted folder) (press the ENTER key and select **[Folder]** in the displayed control dialog box)

Displays the parent folder.

Deleting Data

Folder and files on the CF card can be deleted.

1 WAVE/DATA SET FILE

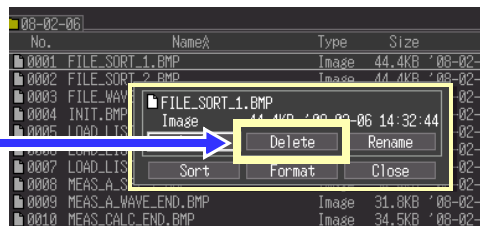
Select the File Screen.
The contents of the CF card are displayed.

2 Select a file to delete.

Apply

3 Select **[Delete]**.

Apply



A confirmation dialog appears.
Select **[Yes]** and press the ENTER key to delete.

Renaming Files and Folders

Folders and files on a CF card can be renamed. File names may consist of up to 26 regular characters.

1 WAVE/DATA SET FILE

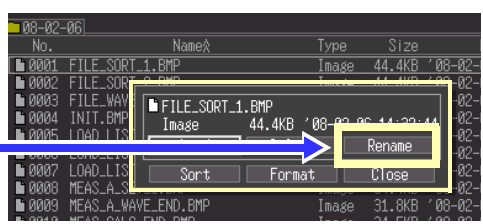
Select the File Screen.
The contents of the CF card are displayed.

2 Select the file or folder to rename.

Apply

3 Select **[Rename].**

Apply



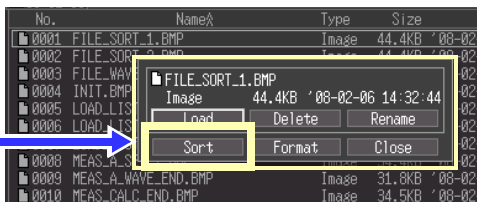
The character entry dialog appears.
Enter the new file name (the same way as when entering a comment) (p. 49)
A confirmation dialog appears.
Select **[Yes]** and press the ENTER key to apply the new name.

Sorting Files

Files can be sorted in ascending or descending order according to a selected sort key.

1 WAVE/DATA SET FILE
Select the File Screen.

2 Apply
The control dialog box appears.

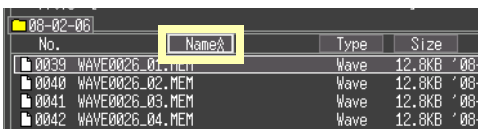


3 Select **[Sort]**.

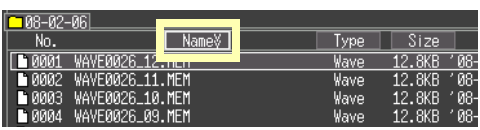
Apply

4 Select the key on which to sort.

Apply



5 Select the desired sort order.
(Ascending or Descending)
Files are displayed in the new sort order



6 ESC
Finish

6.6 Transferring Data to a Computer

Using the supplied USB cable, data stored on a CF card in the Memory HiCorder can be transferred to a computer. To analyze the data using an application program, refer to the instructions for the program.

See: "Appendix 3 Wave Processor Application Program" (p. A6)

Computer Requirements

A personal computer running Windows 2000, XP, Vista, 7, or 8

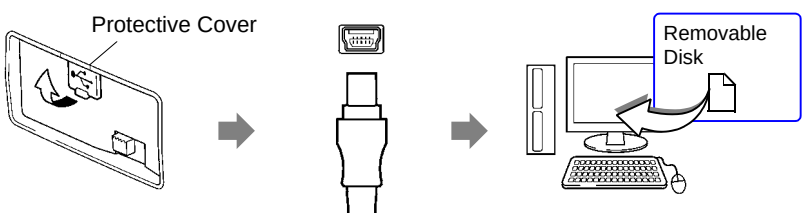
⚠CAUTION

- Do not eject the CF card or pull out the USB cable during data transfer. Doing so would prevent proper data transfer.
- The Memory HiCorder and computer should be connected to the same earth ground. If grounded separately, potential difference between the ground points can cause malfunctions or damage when connecting the USB cable.

Connecting the USB Cable

Connection Precautions

Connecting the cable while measuring or with the File screen displayed will prevent the computer from recognizing the Memory HiCorder. Also, the Memory HiCorder cannot be operated during the connection process.



1 Open the protective cover over the USB connector.

2 Orient the USB cable plug properly, and insert it into the receptacle.

3 Connect the other end of the cable to a USB port on the computer.

The computer should recognize the Memory HiCorder as a removable disk when the cable is connected. Only data in the CF card inserted in this Memory HiCorder can be accessed from the computer. Data not saved in the CF card cannot be accessed.

USB Disconnection Procedure

Before unplugging the USB cable connected to the Memory HiCorder, select the “Safely Remove Hardware” icon in the Windows notification area, and click the mass storage device corresponding to the Memory HiCorder to remove.

Numerical Calculations Chapter 7

7.1 Calculation Methods

Calculations can be applied to measured data. Seven types of numerical calculation are available, four of which can be applied at the same time. Refer to "7.2 Numerical Value Calculation Expressions" (p. 89) for details of the calculation methods. You can specify the measurement time span over which calculations are to be applied (p. 88).

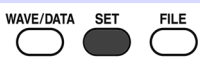
Types of calculations

• Average value	Average value of waveform data
• RMS value	RMS value of waveform data
• Peak-to-Peak (P-P) value	Peak-to-peak value of waveform data
• Maximum value	Maximum value of waveform data
• Minimum value	Minimum value of waveform data
• Period	Period of signal waveform
• Frequency	Frequency of signal waveform

Two methods are available for applying calculations, as follows.

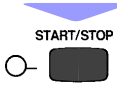
Auto Calculation

Configure numerical calculations before starting measurement. Calculations are performed automatically after measurement (p. 86).



(Calc/Save Screen)
Set Numerical Calculation to [ON], and select the calculation types

To save calculation results automatically
(Calc/Save Screen)
Enable Auto Save (p. 73)



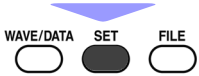
Start and finish measuring

Analyze (p. 59)

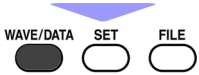
Calculating After Measuring

Configure numerical calculations after measurement (p. 87).

End of Measurement



(Calc/Save Screen)
Set Numerical Calculation to [ON], and select the calculation types.



(Waveform Screen)
Execute Calculations

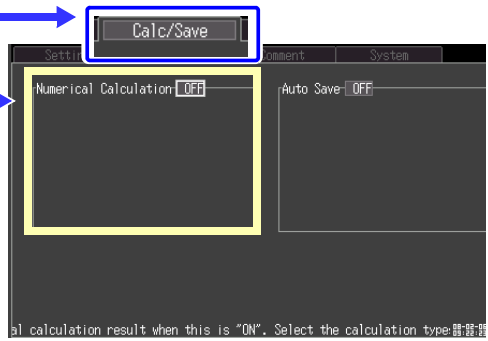
Analyze (p. 59)

Auto Calculation

Numerical calculations are performed automatically after measurement.

1 WAVE/DATA SET FILE

Select the [Calc/Save] Screen.



2

Select **[Numerical Calculation]**.

Open the setting options for the item to be set.

Select **[ON]**.

Apply

3

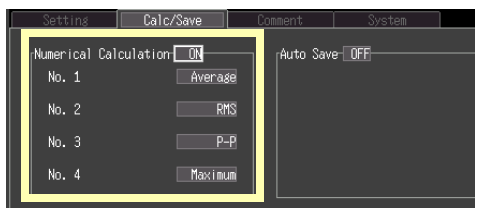
Select any of No. 1 to No. 4.

Open the setting options for the item to be set.

Select the calculation type.

Calculation types:
Average, RMS Value, P-P Value, Maximum, Minimum, Period, Frequency (or **OFF**, the default)

Apply



4 Enable Auto Save (if automatic saving is needed)
"Automatic Saving" (p. 73)

5 START/STOP

Start and finish measuring

6 Analyze (p. 59)

The results of numerical calculations are displayed on the Waveform screen.

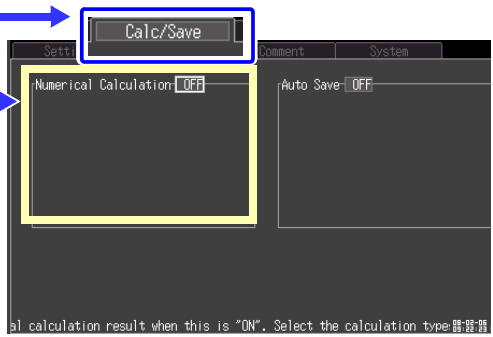
Manual Calculation

1 START/STOP

Start and finish measuring

2 WAVE/DATA SET FILE

Select the [Calc/Save] Screen.



3

Select **[Numerical Calculation]**.

Open the setting options for the item to be set.

Select **[ON]**.

Apply

4

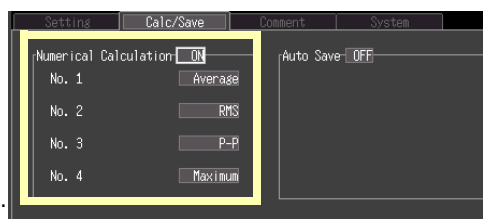
Select any of No. 1 to No. 4.

Open the setting options for the item to be set.

Select the calculation type.

Calculation types:
Average, RMS Value, P-P Value, Maximum, Minimum, Period, Frequency (or **OFF**, the default)

Apply



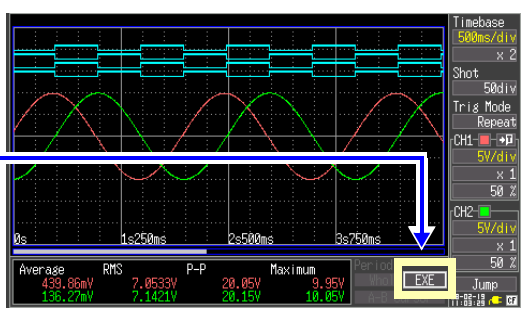
5 WAVE/DATA SET FILE

Select the Waveform Screen.

6

Select **[EXE]**.

Apply



7 Analyze (p. 59)

The results of numerical calculations are displayed on the Waveform screen. If needed, you can change calculation types and recalculate.

Apply Calculations to a Specific Time Span (Manual Calculation Only)

After measuring, calculation can be applied to a specified time span.
Make any other calculation settings before specifying the calculation time span (p. 87).

1 SCROLL CURSOR

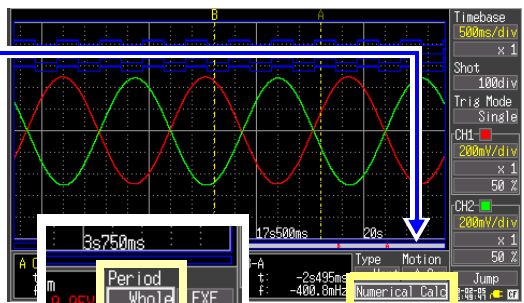
Display A/B Cursors.

SCROLL CURSOR

Position the A/B cursors to define the calculation time span.
To select which cursor to move: p. 64

2 Select **[Numerical Calc]**.

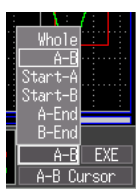
Apply



3 Select **[Period]**.

Open the setting options for the item to be set.

Select the calculation time span
Whole, A-B, Start-A, Start-B, A-End, B-End



Apply

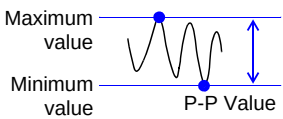
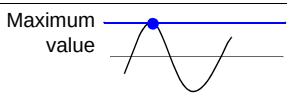
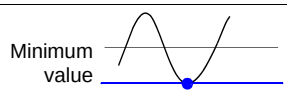
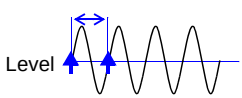
- **Whole**: the entire acquired waveform
- **A-B**: the time span between cursors A and B
- **Start-A**:From the start of the acquired waveform to cursor A
- **Start-B**:From the start of the acquired waveform to cursor B
- **A-End**: From cursor A to the end of the acquired waveform
- **B-End**: From cursor B to the end of the acquired waveform

4 Select **[EXE]**.

Apply

The results of calculations are displayed.

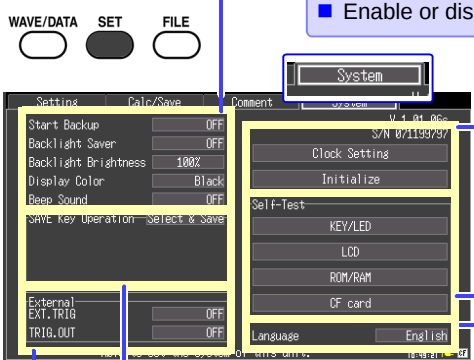
7.2 Numerical Value Calculation Expressions

Average	$AVE = \frac{1}{n}\sum_{i=1}^{n} di$	Obtains the average value of waveform data. *AVE* : Average value *n* : Data count *di* : Data on channel number i
RMS (Root-Mean-Square) Value	$RMS = \sqrt{\frac{1}{n}\sum_{i=1}^{n} di^2}$	Obtains the RMS value of waveform data. If Scaling is enabled, calculations are applied to the waveform after scaling. *RMS* : RMS value *n* : Data count *di* : Data on channel number i
Peak-to-Peak (P-P) Value		Obtains the value of the difference (peak-to-peak value) between maximum and minimum values of waveform data.
Maximum Value		Obtains the maximum value of waveform data.
Minimum Value		Obtains the minimum value of waveform data.
Period and Frequency		Displays the period (in seconds) and frequency (Hz) of the signal waveform. Calculations are based on the interval between successive rising or falling transitions of the signal waveform through its amplitude mid-point in the same direction.

System Environment Settings

Chapter 8

Settings affecting the clock, SAVE key operation and self testing are made from the System screen.



Screen and Key Operation Settings

- Specify operating behavior when recovering from power outages (Start Backup) (p. 92)
- Set backlight power saving (p. 93)
- Set backlight brightness (p. 92)
- Select black or white screen background (p. 93)
- Enable or disable the beeper (p. 93)

System-Related Settings

- Set the clock (p. 94)
- Reinitialize the Memory HiCorder (p. 95)
- Select display language (p. 95)

Self Testing

- KEY/LED test (p. 96)
- LCD test (p. 96)
- ROM/RAM test (p. 96)
- CF card test (p. 96)

Save (Storage) Settings (SAVE key)

- Select the saving method for the SAVE key (p. 74)

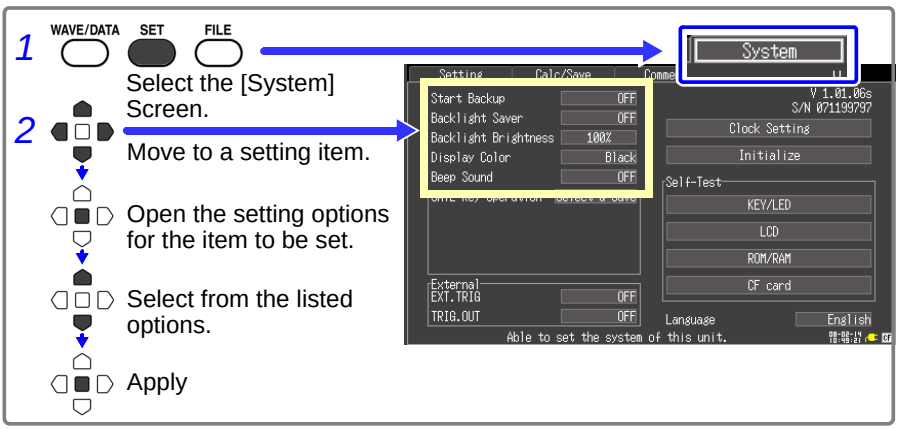
(for [Quick Save])

- Select the type of data to save (p. 75)
- Select the saving format (p. 75)
- Select the time span to save (p. 75)
- Select the amount of data thinning (p. 75)

External Control Terminals

- Select external triggering (EXT.TRIG) (p. 99)
- Enable trigger output (TRIG.OUT) (p. 100)

8.1 Screen and Key Operation Settings



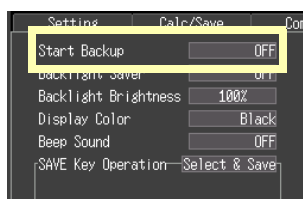
Using the Auto-Resume Function (Resume After Power Restoration)

If a power outage or other power loss causes an interruption in recording (while the LED on the left side of the START/STOP key is lit), you can automatically resume recording when the power is restored. If you are using triggers, the triggers are restored to the [Waiting for trigger] state.

Select from the **[Start Backup]** setting options.

Setting options:(∗ default setting)

ON	Use the Auto-Resume Function.
OFF∗	Do not use the Auto-Resume Function.

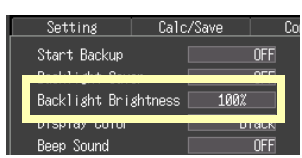


Adjust backlight brightness

Backlight brightness can be selected from four levels. Lower brightness settings provide longer battery operating time.

When the [Backlight Brightness] setting is selected, pressing the ENTER key repeated cycles through the four brightness levels.

Setting options: **100%**∗, **70%, 40%, 25%** (four-step brightness setting) (∗ default setting)

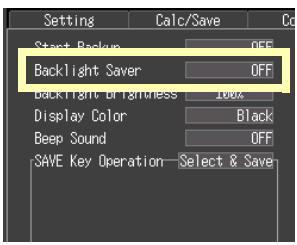


Enabling and Disabling the Backlight Saver

A backlight saver can be activated after a specified number of minutes during which no operation key is pressed. The backlight saver turns off the backlight of the LCD, prolonging the lifetime of the backlight by turning it off when not needed.
To deactivate the backlight saver, press any key. The operating screen appears again.
While the backlight saver is active, the Memory HiCorder's measuring state is still indicated by the LED (lights green when measuring, and blinks when not measuring).

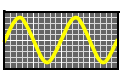
Select from the **[Backlight Saver]** setting options.
Setting options:(∗ default setting)

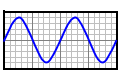
OFF∗	Disables the backlight saver function. The operating screen is always displayed.
1min, 2min, 3min, 4min, 5min	The backlight saver is activated if the specified time is exceeded.



Be aware that power is still consumed even when the backlight is off, so be sure to turn the Memory HiCorder power switch off when not in use.

Selecting Black or White Screen Background

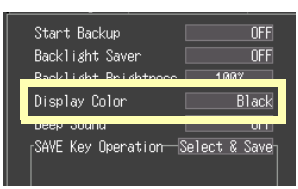

Black Background


White Background

The screen background can be set to black or white.

Select from the **[Display Color]** setting options.
Setting options:(∗ default setting)

Black*	Make background black
White	Make background white.

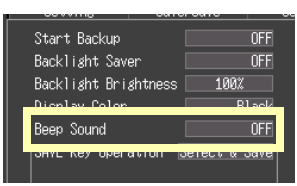


Enabling or Disabling the Beeper

The beeper can be set to sound when an error occurs.

Select from the **[Beep Sound]** setting options.
Setting options:(∗ default setting)

OFF	Do not emit beep sound.
ON∗	Emit a beep sound on error messages (error and warning displays).



8.2 Making System Settings

Setting the Date and Time

The 8870-20 is equipped with an auto-calendar, automatic leap year detection, and a 24-hour clock.
If the clock is not set to the correct time, measurement start time (trigger time) and file date information will be incorrect. If this occurs, reset the clock.

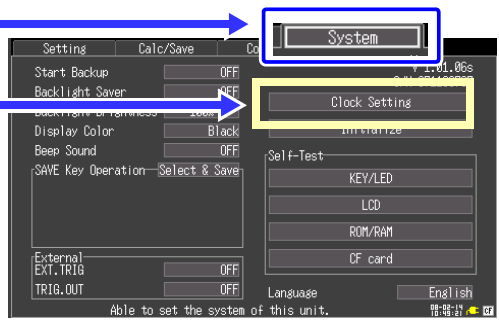
1 WAVE/DATA SET FILE

Select the [System] Screen.

2

Select **[Clock Setting]**.

Apply
The setting dialog appears.



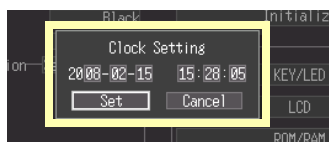
3

Select an item to change. (year, month, day, hour, minute or second)

Apply

Adjust the setting.

Apply



Change 1's digit

Change 10's digit

4

Select **[Set]**.

Apply

The clock is reset.

Initializing the Memory HiCorder (System Reset)

This procedure resets all settings to their factory defaults.
The system is reset by pressing and holding the START/STOP key while turning the Memory HiCorder POWER switch on.
For details about the factory default settings, see "Appendix 4 List of Default Settings" (p. A9).

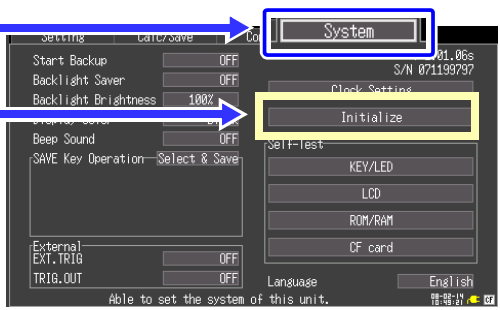
1 WAVE/DATA SET FILE

Select the [System] Screen.

2

Select **[Initialize]**.

Apply
A confirmation dialog appears.

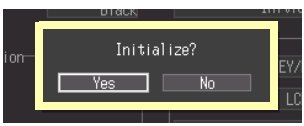


3

Select **[Yes]**.

Apply

Initialization proceeds.



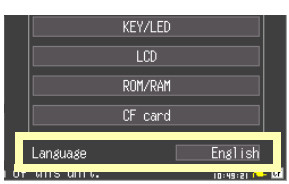
Setting configurations stored in Memory HiCorder memory are not affected.
To delete stored setting configurations, press and hold both the SAVE and START/STOP keys simultaneously.
When the power is switched on, the language selection screen will display for you to choose the language you wish to use.

Selecting the Display Language

Select the display language.

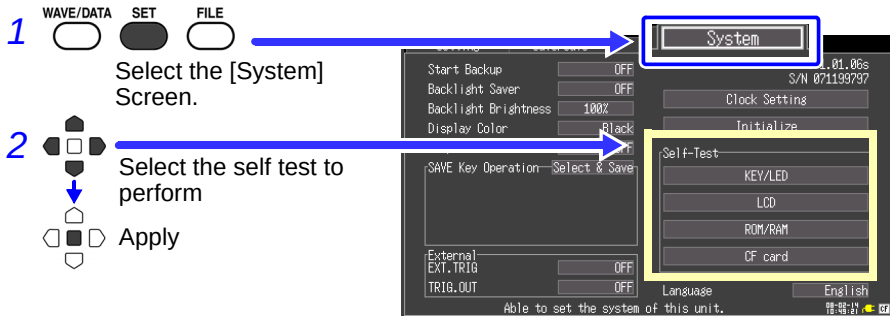
Select from the **[Language]** setting options.
Setting options:(* default setting)

English*	Display in English.
Japanese	Display in Japanese.



Self-Test

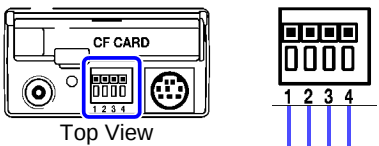
The following self tests are available. Results are displayed on the screen.
If any faults are found, have the Memory HiCorder repaired. Contact your dealer or Hioki representative.



Self-Test	Details
KEY/LED	Tests the keys and LEDs for correct operation. After every key has been pressed, the KEY/LED check finishes. Pressing the START/STOP key also tests whether the LED lights. If you notice a malfunction, press the SAVE and START/STOP keys simultaneously to abort the test.
LCD	Tests the screen display (color test, gradation test, character test) The screen changes each time you press an operation key. If the display screen seems abnormal, request repairs.
ROM/RAM	Tests the instrument's internal memory (ROM and RAM) If "NG" appears, request repairs.
CF card	Tests whether the Memory HiCorder recognizes the inserted CF card. The CF card is formatted (p. 71)

External Control ⚠ Chapter 9

The external control terminals on the Memory HiCorder support trigger signal input and output.



Top View

GND
(common with instrument ground)

TRIG.OUT (Trigger output)
Output a signal when a trigger event occurs.

N.C.
Do not connect to this terminal.

EXT.TRIG (External trigger input)
Input external signals.

9.1 Connecting to the External Control Terminals

⚠DANGER **To avoid electrical hazards and damage to the instrument, do not apply voltage exceeding the rated maximum to the external control terminals.**

	I/O terminals	Maximum input voltage
Input	EXT.TRIG	-2 to 7 V DC
Output	TRIG.OUT	-20 to 30 V DC 5 mA max, 200 mW max

⚠WARNING **To prevent electric shock accidents and damage to the equipment, always observe the following precautions when making connections to external terminal blocks and external connectors.**

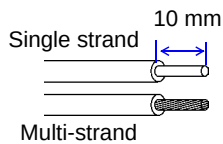
- **Before making connections, turn off the power on the instrument and the equipment to connect.**
- **Do not exceed the specified signal levels for signals supplied to external terminal blocks.**
- **Ensure that devices and systems to be connected to the external control terminals are properly isolated.**

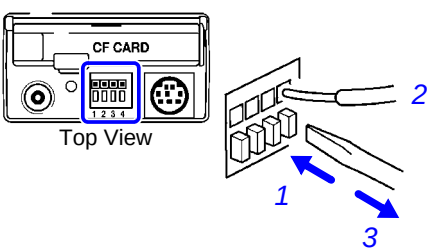
⚠CAUTION

- The external control ground terminal is not isolated from the Memory HiCorder's chassis ground. Make certain that there will be no potential difference between the external control ground terminal and the ground of any connected device. Otherwise, the Memory HiCorder or device could be damaged.
- To avoid electric shock, use the recommended wire type to connect to the external control terminals, or otherwise ensure that the wire used has adequate current-handling capacity and insulation.

Terminal Connections

- Recommended cables:
  single strand diameter 0.65 mm (AWG22),
  multi-strand 0.32 mm^2 (AWG22)
- Usable cables:
  Single strand diameter 0.32 to 0.65 mm (AWG28 to 22),
  Multi-strand 0.08 to 0.32 mm^2 (AWG28 to 22)
  Strand diameter 0.12 mm or greater (per wire)
- Standard insulation stripping length: 9 to 10 mm
- Button operation specified tool: Flat-blade screwdriver (tip width 2.6 mm)





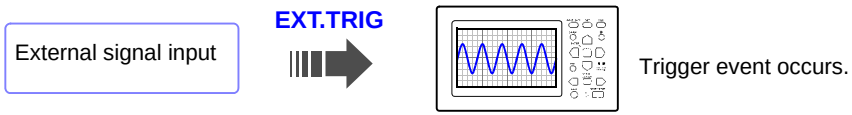
1 Push in the button on the connector with a flat-blade screwdriver or other tool.

2 With the button held in, insert the cable into the cable connection hole.

3 Release the button.
The cable is locked.

9.2 External Trigger Input

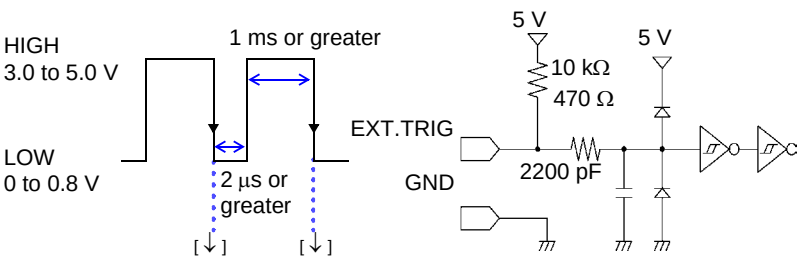
Triggering can be controlled by applying a signal from an external trigger source. This allows synchronous operation of multiple Memory HiCorders by parallel triggering (p. 101).



When the recording length is [Cont], the external trigger is disabled.

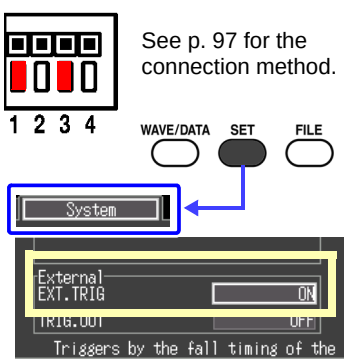
Trigger Input Signals

Voltage range	HIGH level: 3.0 to 5.0 V, LOW level: 0 to 0.8 V
Pulse width	HIGH level: 1 ms or greater, LOW level: 2 μs or greater
Maximum input voltage	-2 to 7 V



Signal Input Procedure

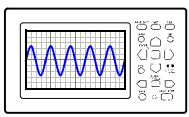
1. Connect the cables for the corresponding external input signals to the EXT.TRIG and GND terminals.
2. Press the SET key to open the [System] screen.
3. Set **[EXT.TRIG]** to **[ON]**.
4. Short-circuit the EXT.TRIG terminal and GND, or leave the terminals open-circuited, and input a HIGH level (3.0 to 5.0 V) or LOW level (0 to 0.8 V) pulse wave or rectangular wave to the EXT.TRIG terminal.
   A trigger event occurs on the falling edge of the input waveform.



See p. 97 for the connection method.

9.3 External Signal Output (Trigger Output)

You can output a signal when a trigger event occurs.
This allows synchronous operation of multiple Memory HiCorders by parallel triggering (p. 101).



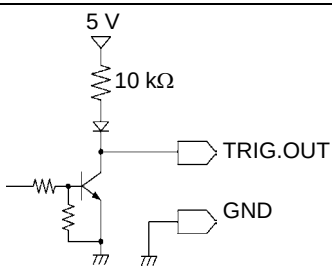
TRIG.OUT

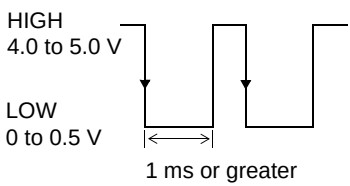
Trigger event occurs

Pulse wave is output.

Trigger Output Signals

Output signal	Open collector output (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: 1 ms or greater
Maximum input voltage	-20 to +30 V 50 mA max 200 mW max

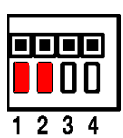




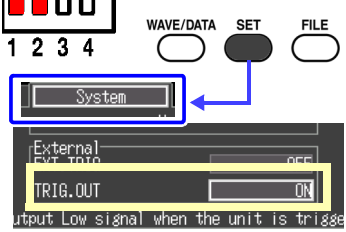
NOTE When triggering is not otherwise used, a trigger signal is output during measurement.
A trigger signal is also output when the Auto Range function is used, so be careful when using both Auto Range and the trigger output signal for triggering other devices.

Signal Output Procedure

1. Connect the cables for the corresponding external output signals to the TRIG.OUT and GND terminals.
2. Press the SET key to open the [System] screen.
3. Set **[TRIG.OUT]** to **[ON]**.
   When a trigger event occurs, a pulse wave changing from the HIGH level (4.0 to 5.0 V) to the LOW level (0 to 0.5 V) is output from the TRIG.OUT terminal.
   The signal will remain at the LOW level until the measurement is stopped.



See p. 97 for the connection method.



9.4 Synchronous Measurements with Multiple Instruments

Multiple instruments can be synchronized using the external control terminals. Two methods are available.

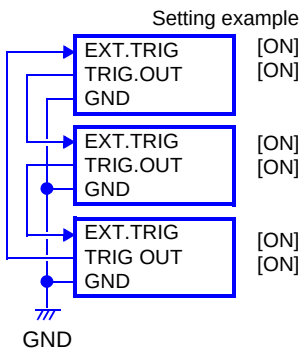
Daisy chain configuration

Set all instruments to master.

Set external trigger to [ON] for all instruments.

When a trigger event occurs on any of the connected instruments, it also occurs on the others. As more instruments are connected, the difference between trigger timing on different instruments becomes larger.

Connection example



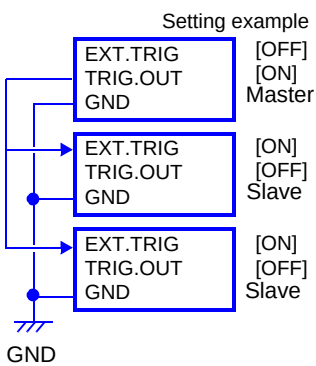
Parallel synchronization

Set one instrument to master, and set the others to slave.

Set external trigger to [ON] for the slave instruments only.

When using the master instrument as the trigger source, the other instruments start measuring simultaneously when a trigger event occurs. This gives the least difference in trigger timing between instruments.

Connection example



Specifications Chapter 10

(1) General Specifications

Basic Specifications

Measurement functions	Memory Recorder
No. of channels (max.)	2 analog channels + 4 logic channels (Logic ground is common with chassis ground)
Memory capacity	12-bit × 2M Words/Ch
Maximum sampling rate	1 MS/s (All channels simultaneously)
Timebase accuracy	±0.01% (Relative grid timing error)
External terminals	External Trigger Input, Trigger Output and GND
Clock functions	Auto calendar, auto leap year judgment, 24-hour timer Accuracy: ±50ppm (0°C to 40°C), Nominal value: ±10ppm (25°C)
Backup battery life	Approx. five years for clock and settings (@25°C, 77°F)
Conditions of guaranteed accuracy	After 30 minutes warm-up
Operating temperature and humidity	0 to 40°C (32 to 104°F), 80% RH (non-condensating)
Temperature and humidity range for guaranteed accuracy	23±5°C (73±9°F), 80% RH or less (non-condensating)
Storage temperature and humidity	-10 to 50°C (14 to 122°F), 80% RH or less (non-condensating)
Period of guaranteed accuracy	1 year
Operating environment	Indoors, Pollution degree 2, up to 2000 m (6562-ft.) ASL
Dielectric strength	3.0 kVAC for 1 minute (2 mA sense current) (between each input channel and chassis, and between input channels)

Basic Specifications

Power source	• Model Z1005 AC Adapter Rated supply voltage 100 to 240 VAC (Voltage fluctuations of ±10% from the rated supply voltage are taken into account) Rated supply frequency 50/60 Hz Anticipated transient overvoltage 2500 V • Model 9780 Battery Pack 3.6 V (Note) The AC Adapter has priority when connected • 12 V Battery (10 to 16 VDC, ±10% tolerance) (Note) Wiring from battery to instrument should be no more than 3m long
Maximum rated power	30 VA (When using the AC Adapter to charge the 9780 Battery Pack in the Memory HiCorder) 10 VA (When using 12 VDC to charge the 9780 Battery Pack in the Memory HiCorder) 3VA (When using a 9780 Battery Pack)
Continuous operating time	When using Model 9780 Battery Pack, approx. 2 hours (“Waiting for Trigger” state @25°C)
Charging function	With the 9780 Battery Pack installed and the AC Adapter connected Charging time: Approx. 200 minutes (@25°C) Note 1. Actual charging time depends on battery condition Note 2. Charging temperature range: 5 to 30°C
Dimensions	Approx. 176W × 101H × 41D mm (sans protrusions) (6.93"W × 3.98"H × 1.61"D)
Mass	Approx. 600 g (21.2 oz.) (With Model 9780 Battery Pack installed)
Effect of radiated radio-frequency electromagnetic field	±2.5%f.s. at 3 V/m
Effect of conducted radio-frequency electromagnetic field	±5.0%f.s. at 3 V
Applicable Standards	Safety EN61010 EMC EN61326 Class A EN61000-3-2 EN61000-3-3

Display Section

Display character	English/ Japanese selectable
Display type	4.3-in TFT Color LCD (480 × 272 dots)
Display resolution	Waveform: 20 div (time axis) × 10 div (voltage axis) (1div = 20 dot (time axis) × 20 dot (voltage axis)
Dot pitch	0.198 × 0.198 mm
Backlight	On, Off
Backlight lifespan	Approx. 10,000 hours (continuously on)
Backlight saver function	Selectable from on, or auto-off after selectable interval
Backlight brightness	Selectable from four levels (100%, 70%, 40%, 25%)

External Interfaces

USB standard	USB2.0 compliant High Speed
Connector	Series-mini B receptacle
Connecting devices	PC
Function	Transfer files between an installed CF card and connected PC (Mass Storage device mode)

External Storage

Slot	One CompactFlash compliant slot CF card Type I accepted
Card type	Flash ATA card
Card capacities	9726 (128MB), 9727 (256MB), 9728 (512MB), 9729 (1GB) , 9830 (2GB)
Data formats	FAT and FAT32 supported
Storage contents	• Setting configurations • Measurement data (binary and text) (data between A-B cursors can be saved) • Screen images (compressed bitmap format) • Calculation results • Thinned storage (text: simple thinning)

Measurement Input Section

Measurement ranges	10, 20, 50, 100, 200, 500 mV/div 1, 2, 5, 10, 20, 50 V/div
Measurement accuracy	±0.5%f.s. (after zero adjustment, guaranteed within measurement range) (f.s. = 10 div)
Temperature characteristic	±0.05%f.s./°C (after zero adjustment) (f.s. = 10 div)

Measurement Input Section

Frequency characteristic	DC to 50 kHz -3dB
Common mode rejection ratio	80dB minimum (at 50/60 Hz and with signal source resistance 100 Ω maximum)
Low-pass filter	OFF, 5, 50, 500 Hz, 5 kHz ±50% -3dB
Noise	2 mVp-p typ. 4 mVp-p max. (sensitivity range, with input shorted)
Input type	Unbalanced (input isolated from output)
Input resistance	1 MΩ±1%
Input capacitance	7 pF±3 pF (at 50 kHz)
A/D resolution	12 bits
Voltage axis resolution	1/100th of measurement range
Measurement range	±10 times the V/div (range) setting (in 50 V/div range, max. input is 400 VDC)
Maximum sampling rate	1 MS/s
Input coupling	DC/GND
Input terminals	Insulated BNC terminal
Maximum input voltage	400 VDC (per input channel)
Maximum rated voltage to earth	300 VAC/DC (between each input channel and chassis, and between input channels) Measurement category II (anticipated transient overvoltage 2500 V)

(2) Measurement Functions

Basic Specifications

Timebase	100, 200, 500 μs/div 1, 2, 5, 10, 20, 50, 100, 200, 500 ms/div 1, 2, 5, 10, 30 s/div 1, 2, 5 min/div
Time axis resolution	100 points/div
Sampling period	1/100th of timebase
Recording length	20, 50, 100, 200, 500, 1000, 2000, 5000, 10000, 20000 div, Cont Note 1: There are restrictions on the time axis setting for recording length [Cont]. Note 2: When recording length exceeds 20,000 div, only the latest 20,000 div worth of data will be saved.
Screen settings	On one screen
Recording line distinction	6 colors

Basic Specifications

Waveform compression and magnification	• Time axis ×10, ×5, ×2, ×1, ×1/2, ×1/5, ×1/10, ×1/20, ×1/50, ×1/100, ×1/200, ×1/500, ×1/1000 • Voltage axis ×10, ×5, ×2, ×1, ×1/2, ×1/5
Waveform scrolling	Horizontal scrolling (incl. while measuring)
Roll Mode display	Waveforms automatically scroll when one division on the waveform screen is 50 ms or more

Trigger Section

Trigger method	Digital comparison
Trigger modes	Single or Repeat
Trigger source	Two analog input channels Four logic input channels External trigger • Each source can be enabled/disabled (ON/OFF) • Free-run operation occurs when all trigger types are off. Trigger criteria can be set for each channel External triggering occurs when terminal voltage is pulled below 2.5 V, or by shorting terminals.
Manual trigger	Yes
Trigger criteria	AND or OR of each trigger source
Trigger types (analog)	• Level Trigger Set digitally as a voltage value below full-scale Triggering occurs when the signal rises (or falls) through a specified value. • Voltage Drop Trigger Triggering occurs when peak voltage falls below the specified level (for commercial power). • Window Trigger Upper and lower trigger threshold levels are specified Triggering occurs when the signal enters or exits the defined threshold range.
Trigger types (logic)	Pattern (mask) trigger by 1, 0, or X (X: don't care))
Trigger filter	Set by number of samples (0, 10, 20, 50 or 100)
Trigger level resolution	0.5%f.s. (f.s. = 10 div)
Pre-trigger	0, 5, 10, 20, 30, 40, 50, 60, 70, 80, 90, 95, 100%
Trigger timing	Start
Trigger output	Open-collector output (with 5 V output, Active Low) Pulse Width: at least 1 ms

Trigger Section

Trigger input and output terminals	Terminal Block

(3) Miscellaneous

Numerical calculations	Four calculations are available at the same time (common to all channels) Calculation results can be saved to CF card. Calculations: Average value, P-P value, Maximum value, Minimum value, RMS value, Period, Frequency Calculation time span: Can be specified by A/B cursors, or whole waveform
Cursor measurement functions	Trace, vertical or horizontal Potential at each cursor, time from trigger Time difference between A/B cursors, potential difference, frequency
Scaling functions	Available for each channel independently OFF, Model (Clamp sensor or Hioki 9322 Differential Probe), Output ratio (conversion ratio, attenuating ratio), or calculated from two data points
Comment entry	Title comment, per-channel (incl. logic) comments
Screen image capture function	Provided (compressed bitmap format)
Gauge	Gauges can be displayed (or not) for two channels on the Waveform screen
Retain start condition function	Provided
Auto save function	Provided
Auto setup function	Provided (automatically selects the appropriate timebase and voltage range for an input waveform)
Scroll bar	Indicates the relative position of the displayed waveform within the overall waveform (includes function to jump to a specified position)
Error and warning displays	Yes
Key-lock	Provided
SAVE key settings	Settings are provided to select save format and saving area by pressing the SAVE key. [Quick Save]/[Select & Save] selectable
Waveform monitor function	Settings can be changed on the Setting screen while viewing input waveforms. Changes to settings take effect immediately in the Waveform monitor.

Logic display	Each of four bits can be either on or off Four display locations are provided, one for each of the four bits A comment can be entered for each bit
Zero-position adjustment	The zero position of each channel can be set independently
Waveform backup time function	Memory is retained (backed up) while the Memory HiCorder is turned off when a charged 9780 Battery Pack is present or with the AC Adapter connected
Waveform backup time	100 hours with a 9780 Battery Pack after full charge
Numerical display function	Displays measured voltages as numerical values on the screen Pressing the WAVE/DATA key toggles between numerical and waveform display modes (not available while measuring)

Numerical Display Function

Refresh rate	0.5 s
Display contents	Instantaneous or RMS display only (DC or auto-selected 50/60 Hz AC only)
Sampling rate	10 kS/s
Resolution	Four digits (the last digit is 0 for values 0 to 4, and 5 for values 5 to 9)
Voltage ranges	10 m, 50 m, 100 m, 500 m, 1, 5, 10, 50 V/div (Autoranging)
Accuracy	±2.5%rdg.±5dgt.

(4) Accessories

- Instruction Manual (This document)..... 1
- Measurement Guide..... 1
- Model Z1005 AC Adapter..... 1
  (with supplied power cord)
- Strap..... 1
- USB cable 1
- Wave Processor Application
  Program for the 8870-20 (CD) 1
- Model 9809 Protection Sheet..... 1

(5) Options (p. A12)

AC adapter	• Model Z1005 AC Adapter (The same as supplied AC adapter)
Battery pack	• Model 9780 Battery Pack (Ni-MH, 3.6 V, 1500 mAh)
Carrying case	• Model 9782 Carrying Case • Model 9812 Soft Case
Protection sheet	• Model 9809 Protection Sheet
CF card	• Model 9726 PC Card (128MB) • Model 9727 PC Card (256MB) • Model 9728 PC Card (512MB) • Model 9729 PC Card (1GB) • Model 9830 PC Card (2GB)
For voltage measurement	• Model L9197 Connection Cord (Maximum input voltage 600 V AC/DC) • Model 9197 Connection Cord (Maximum input voltage 600 V AC/DC) • Model L9198 Connection Cord (Maximum input voltage 300 V AC/DC) • Model L9217 Connection Cord (Maximum input voltage 300 V AC/DC, Isolated BNC-BNC) • Model L9790 Connection Cord (Maximum input voltage 600 V AC/DC) • Model L9790-01 Alligator Clip (for Model L9790) • Model 9790-02 Grabber Clip (for Model L9790) • Model 9790-03 Contact Pin (for Model L9790) • Model 9322 Differential Probe • Model 9418-15 AC Adapter (for Model 9322)
For logic signal input	• Model 9320-01 Logic Probe (Four channels, for detecting voltage and closed/open contact points) • Model MR9321-01 Logic Probe (Four isolated channels, for detecting AC/DC voltage on/off)
For current measurement	• Model 9018-50 Clamp-On Probe (10 to 500 A: 40 Hz to 3 kHz) • Model 9132-10 Clamp-On Probe (20 to 1000 A: 40 Hz to 1 kHz)
PC application program	Model 9335 Wave Processor

(6) Wave Processor Program for the 8870-20 (Bundled CD)

General Specifications

PC Compatibility Requirements	A PC running Windows 2000, XP (32-bit version) , Vista (32-bit version), 7 (32-bit/ 64-bit version) ,or 8 (32-bit/ 64-bit version) with at least a 500-MHz Pentium III CPU and 256 MB RAM The display should support at least 1024 × 768 resolution and 256 color mode. At least 6 MB of hard disk space should also be available. A CD-ROM drive is required.
OS	Microsoft Windows 2000, XP (32-bit version) , Vista (32-bit version), 7 (32-bit/ 64-bit version) ,or 8 (32-bit/ 64-bit version)

General Specifications

Compatible measurement instruments	HIOKI 8870-20 Memory HiCorder

Functions

■ File Loading

Loadable data formats	Waveform data stored on this instrument. (Binary format, ".mem" extension)
File load limit	Equivalent to the maximum file storage capacity of the instrument (may be further constrained by the PC environment)
Overwriting saved data	Scaling values, and title and channel comments can be overwritten. The scaling value (specified conversion ratio) can be derived from entering two data points on the Memory HiCorder.
Slideshow display function	Waveform files in the same folder can be displayed sequentially.
Waveform synthesis function	Up to 8 waveform files can be synthesized and display it.

■ Conversion to Text

Data conversion formats	Selectable from comma- (CSV), tab- or space-separated values
Convertible data	Overall waveform or cursor-delineated time span
Data thinning	Specific thinning intervals can be selected
Conversion methods	Analog waveform data is converted to voltage values Logic data is converted to zero and one
Conversion channel	Selectable
Output file header contents	Title, trigger date, timebase, comments and settings for each channel
Batch conversion	Multiple files can be specified for batch conversion

■ Display

Display characters	English or Japanese Selectable during installation
Waveform display	Displays waveform data graphically The waveform can be scrolled and zoomed on its time axis Vertical zero position and zoom can be set for each channel independently Variable vertical zoom setting is available for each channel
Digital value display	Waveform data is displayed as digital values

Display

Cursor functions	Two cursors (A and B) can be positioned independently Time and voltage values at cursor positions are displayed
Maximum displayable channels	Analog: 2 channels Logic: 4 channels
Gauge display	Time gauge (selectable from absolute or relative time, seconds or data point no.) Voltage axis gauge (show/hide selectable for each channel)
Annotations	Annotations may be placed at any position Text boxes, straight lines, arrows, ellipses and rectangles
Clipboard copy	Waveform screens (Bitmap or uncompressed meta format) Cursor values, digital values, file information, calculation results (text format)
Screen image capture	Uncompressed meta format or bitmap format
Search function	Search by date/time, maximum, minimum, specified level or window transition
Template function	Save and reload waveform file display configurations

Printing

Compatible printers	Printers supported by the PC's operating system Color and monochrome printing are supported
Print range	All data, displayed time span or user-specified time span
Print formats	Undivided or divided into 2, 4, 8, with 2, 4, 8 or 16 traces, or XY1, XY2, XY4 screen Gauges, channel and zero-position comments and A/B cursor values can be printed.
Print preview	Supported
Waveform screen hard copy function	Provided
Logging print function	Provided

Miscellaneous

Tool function	Register any executable file for execution
Help function	Included

Maintenance and Service Chapter 11

11.1 Troubleshooting

Inspection and Repair

⚠CAUTION Do not attempt to modify, disassemble or repair the instrument; as fire, electric shock and injury could result.

NOTE If damage is suspected, check the "Before Returning for Repair" (p. 114) section before contacting your dealer or Hioki representative.

Transporting

- Use the original packing materials when transporting the instrument, if possible.
- Pack the instrument so that it will not sustain damage during shipping, and include a description of existing damage. We cannot accept responsibility for damage incurred during shipping.

Replaceable Parts and Operating Lifetimes

Useful life depends on the operating environment and frequency of use. Operation cannot be guaranteed beyond the following periods.
For replacement parts, contact your dealer or Hioki representative.

Part	Life
LCD (to half brightness)	Approx. 10,000 hours
Battery pack	60% of initial battery capacity can be expected to remain after 500 complete charge/discharge cycles.
Battery pack connectors	Disconnection/connection times: 30 (the number of times that provides stable connection)
Electrolytic Capacitors	Approx. 10 years
Lithium Battery	Approx. 5 years The instrument contains a built-in backup lithium battery. If the date and time deviate substantially when the instrument is switched on, it is the time to replace that battery. Contact your dealer or Hioki representative.

The fuse is housed in the power unit of the instrument. If the power does not turn on, the fuse may be blown. If this occurs, a replacement or repair cannot be performed by customers. Please contact your dealer or Hioki representative.

Before Returning for Repair

If abnormal operation occurs, check the following items.

Symptom	Check Items	
The display does not appear when you turn the power on.	• Is the power cord disconnected? • Are connections made correctly? • Is the battery pack installed correctly?	Verify that the power cord is connected properly. (p. 26) Verify that the battery pack is correctly installed (p. 22).
Keys do not work.	• Is any key being held down? • Is the key-lock state active? (A message appears when a key is pressed while key-lock is active.)	Verify key operation. Cancel key-lock: (Hold the ◁ ▷ cursor keys for three seconds)
Power does not turn on.	• A power protection component may be damaged.	Customers should not attempt to perform parts replacement and repair. Contact your dealer or Hioki representative for service.
A waveform does not appear when you press the START/STOP key.	• Is the "Waiting for pre-trigger" message displayed? • Is the "Waiting for trigger" message displayed?	When pre-triggering is enabled, triggering is ignored until the pre-trigger portion of the waveform has been acquired. Recording starts when a trigger occurs.
No changes occur in the displayed waveform.	• Is the clamp sensor or connection cable connected correctly? • Is the measurement range set properly? • Is the low-pass filter enabled?	Verify that the clamp sensor or connection cable is connected correctly (p. 27).
Data cannot be saved to the CF card.	• Is the storage media inserted properly? • Is the storage media formatted? • Is the remaining capacity of the storage media too low?	See "6.2 Using a CF Card" (p. 69)
If the cause is unknown	• Try performing a system reset. (p. 95) • All settings are returned to their factory defaults. "Appendix 4 List of Default Settings" (p. A9)	

Symptom	Check Items	
battery pack cannot be charged (Charging LED is not lit).	• Please confirm that the surrounding temperature is within 5 - 30°C\ range.	The temperature allowed for charging on the this instrument is surrounding temperature of 5 -30°C. (p. 22)
	• Is the this instrument stored for a long time in a plugged condition?	The battery pack may have deteriorated and the battery life may be expiring soon. (p. 113) Please purchase a new battery pack. Please contact your dealer or the nearest HIOKI representative. If the this instrument is not used for more than a month, please remove the battery pack for storage. (p. 23)
Time that can be used with the battery pack has become shorter.	• Possibility of capacity decrease due to the deterioration of the battery pack.	The battery pack may have deteriorated and the battery life may be expiring soon. (p. 113) Please purchase a new battery pack. Please contact your dealer or the nearest HIOKI representative.

11.2 Cleaning

NOTE

Cleaning the Instrument

- To clean the instrument, 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.

Cleaning a Clamp Sensor (option)

- Measurements are degraded by dirt on the mating surfaces of the clamp-on sensor, so keep the surfaces clean by gently wiping with a soft cloth.

11.3 Disposing of the Instrument

The instrument contains a lithium battery for memory backup.
When disposing of this instrument, remove the lithium battery and dispose of battery and instrument in accordance with local regulations.

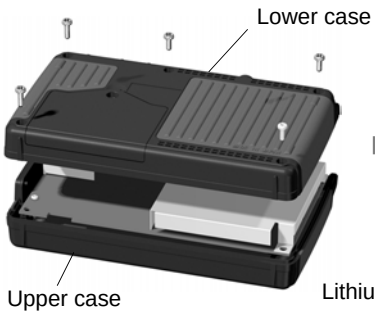
Removing the Lithium Battery

WARNING **To avoid electrocution, turn off the power switch and disconnect the power cord and cables before removing the lithium battery.**

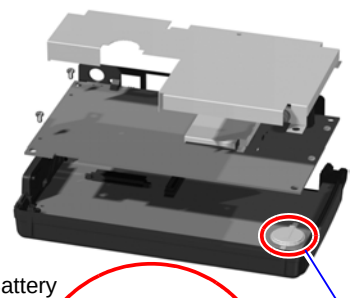
Required tools:
- One Phillips screwdriver (No.1)
- One wire cutter (to remove the lithium battery)

1 Verify that the power is off, and remove the connection cables and power cord.

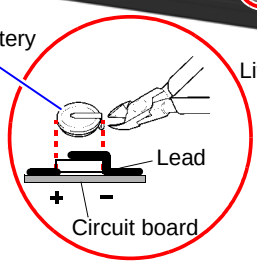
2 Turn the Memory HiCorder over and remove the five screws affixing the lower case.



3 Remove the lower case. Then remove the two screws affixing the circuit board, and remove it.



4 Pull the lithium battery up from the circuit board, and cut the two leads with a wire cutter.



CALIFORNIA, USA ONLY
This product contains a CR Coin Lithium Battery which contains Perchlorate Material - special handling may apply.
See www.dtsc.ca.gov/hazardouswaste/perchlorate

Appendix

Appendix 1 Error Messages and Remedial Actions

Error messages consist of either "Error" or "Warning" displays.
A screen message appears whenever an error occurs. In either case, take the remedial action indicated.

Error Messages

Press ENTER to clear error messages.

Message		Remedial Action
001	**Failed to back up the waveform (power off or not enough battery capacity).**	(with no battery pack) Bear in mind that no power backup is provided when operating with only the AC adapter. (with battery pack) If the AC adapter is not providing power, no backup is available when the battery charge get low. Recharge the battery pack.
004	**Battery low.**	Low battery charge: recharge or replace with a fresh battery pack.
005	**FPGA error**	Incompatible FPGA firmware version. Try updating the firmware, and if the error persists, submit the Memory HiCorder for repair.

Warning Messages

Disappears within a few seconds. Also disappears when any key is pressed.

Message		Remedial Action
101	**Invalid key. (measuring)**	Keys are disabled while measuring. Try operating again when measurement is finished.
102	**Cannot start measurement.**	The START/STOP key is disabled when the current screen is displayed. Switch to the Waveform screen before starting measurement.
201	**Exceeding the setting range.**	The entered numerical value is out of the valid range. Enter a valid value.

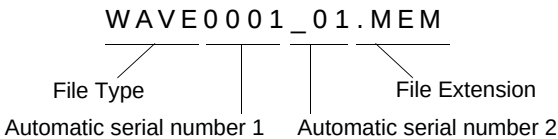
Message		Remedial Action
203	**Voltage drop trigger will be disabled.**	Voltage sag triggering is disabled when the time-base is outside of the range 100 µs to 50 ms/div. Change the timebase so that it is with this range.
301	**No waveform data**	No waveform data is preset, so data saving and calculations cannot be performed. Press the START/STOP key to start acquiring measurement data.
302	**Confirm the A-B cursor position.**	The A/B cursor positions are invalid (out of waveform range). Check the cursor positions.
303	**No numeric calculation data**	Execute numerical calculation (p. 85).
401	**File processing error**	An unexpected fault occurred while processing a file on the CF card. Turn the Memory HiCorder off and back on.
402	**Cannot load this file.**	The format of the file is incompatible with the Memory HiCorder, or the file is corrupt. Refer to "6.1 About Saving and Loading Data" (p. 67) for loadable file formats.
403	**Insert a CF card.**	CF card not found. Insert a CF card.
404	**Directory full**	No more files can be created because the directory is full. Check or perform the following: 1. System reset (p. 95) 2. Verify that the CF card is specified by Hioki (p. 69) 3. Reformat the CF card (p. 71) If the message persists after performing the above, either the CF card or Memory HiCorder may be damaged. Contact your dealer or Hioki representative.
405	**Not enough capacity**	The CF card as insufficient space to save the file. Delete files to increase free space, or replace the CF card.

Message		Remedial Action
501	**File system error (I/O error)**	An I/O error occurred while accessing the CF card. Reformat the CF card. If the error persists, try a different CF Card. If this error occurs while using a good CF card, the Memory HiCorder may be damaged, in which case contact your dealer or Hioki representative.
502	**File system error (Incorrect file handle)**	Turn the Memory HiCorder off and back on. If the fault persists, perform system reset (p. 95).
503	**File system error (system configuration)**	
504	**File system error (not enough memory)**	
505	**File system error (incomplete information)**	The CF card could not be recognized. Reformat the CF Card on a computer. If the error persists, try a different CF Card. If this error occurs while using a good CF card, the Memory HiCorder may be damaged, in which case contact your dealer or Hioki representative.
506	**File system error (incorrect device)**	Turn the Memory HiCorder off and back on. If the fault persists, perform system reset (p. 95).
507	**File system error (file protected)**	The requested write process (including deletion) could not be performed because the file attribute is read-only. Use a computer to cancel the read-only setting.
508	**File system error (failed to recognize the format)**	The CF card could not be recognized. Reformat the CF Card on a computer. If the error persists, try a different CF Card. If this error occurs while using a good CF card, the Memory HiCorder may be damaged, in which case contact your dealer or Hioki representative.
509	**File system error (limit of the number of files)**	The number of files to be processed exceeds the limit, so processing cannot be performed. Delete files to increase free space, or try another CF card.
510	**File system error (same name file)**	An attempt was made to create a file with the same name as an existing file. Change the name of the file to be created (p. 82).
511	**File system error (system busy)**	Processing could not be performed because files are in use by another executing process. Wait for the current process to finish. If there is no other executing process, turn the Memory HiCorder off and back on.
512	**File system error (too long path name)**	The specified name of a file or folder is too long. Enter a shorter name.

Message		Remedial Action
513	**File system error (no file)**	Turn the Memory HiCorder off and back on. If the fault persists, perform system reset (p. 95).
514	**File system error (mode error)**	
515	**File system error (invalid file handle)**	
516	**File system error (file offset error)**	
517	**File system error (not enough capacity)**	Insufficient free space is available on the CF card for the process to execute. Delete files to increase free space, or try another CF card.
518	**File system error (invalid file name)**	The file name contains an invalid character. Rename the file (p. 82).
519	**File system error (directory error)**	Turn the Memory HiCorder off and back on. If the fault persists, perform system reset (p. 95).
520	**File system error (invalid file type)**	
521	**File system error (file rename error)**	
522	**File system error (internal parameter error)**	
523	**File system error (block size error)**	
524	**File system error (semaphore error)**	
525	**File system error (not supported action)**	

Appendix 2 File Naming

File names are constructed as follows.



File Type		Automatic serial number 1	Automatic serial number 2	File Extension
Settings Data	CONFIG	0001, ...	None	.SET
Settings List	LIST	0001, ...	None	.BDL
Waveform Data	WAVE *1	0001, ... *2	_01, ... *3	.MEM (Binary)
				.CSV (Text)
Numerical Calculation Results	MEAS	0001, ...	None	.CSV
Captured Screen Image	SCR (Manual Save) *4	0001, ... *2	_01, ... *3	.BMP
	WAVE *1 (Auto Save)			

*1. During auto-saving of waveforms and screen images (WAVE), when the automatic serial number exceeds 9999, the file type prefix is truncated to avoid file names (prefix + serial number) exceeding eight characters.
(Example: WAVE9999.MEM, WAV10000.MEM, ...).

*2. Increments for each measurement until the date changes, at which time the serial number is reset to 0001.

*3. When auto-numbering would result in duplicate names of waveform data files, this number is appended and incremented from _01.
(Example: WAVE0001.MEM, WAVE0001_01.MEM, WAVE0001_02.MEM, ...)

*4. When turning power on the first time after the date has changed, and saving before starting measurement, the saved file is named SCR0000.BMP.

Appendix 3 Wave Processor Application Program

This section describes the installation procedure for the Wave Processor program for the 8870-20, and preparations for launching. The program can be installed from the bundled CD, or the latest version can be downloaded from our web site.
For help with program operation, see the Help screens in the program.

Wave Processor program for the 8870-20 operating environment:

See: "Chapter 10 Specifications" - "(6) Wave Processor Program for the 8870-20 (Bundled CD)" (p. 110)

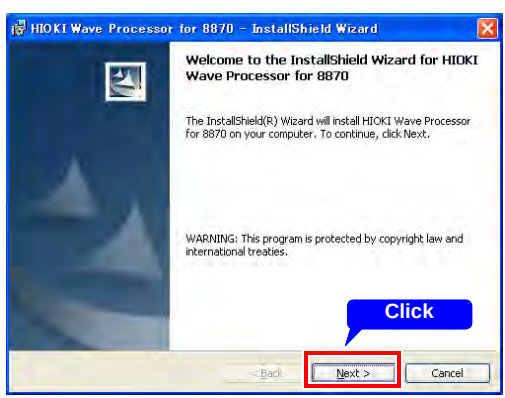
To transfer measurement data from the Memory HiCorder to a computer:

See: "6.6 Transferring Data to a Computer" (p. 84)

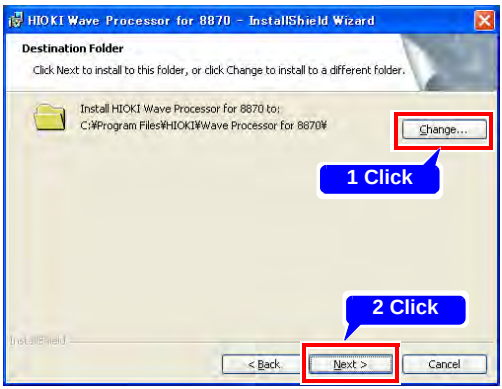
Program Installation

This description uses a PC running Windows XP as an example.

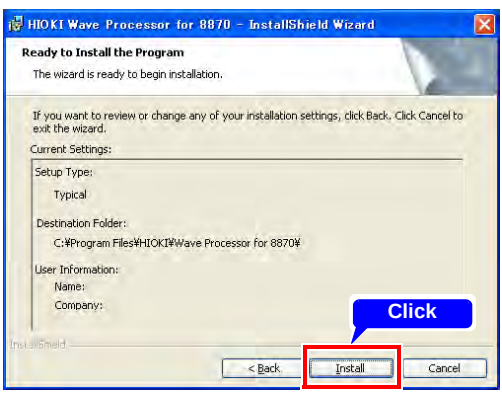
1. Turn on the computer.
   If the computer's operating system is Windows 2000 or XP Professional, log on as an "administrator" user.
   Before starting the installer, close all currently running applications.
2. Insert the bundled CD in the computer, or download and save the compressed file.
   If using a downloaded file, uncompress it.
3. Double click the file **\8870Application\English\setup.exe** to execute it.
   When setup.exe executes, follow the screen instructions to complete the installation.
4. Click **[Next]**.



5 To change the installation destination, click **[Change]** and select the destination. Then click **[Next]**.



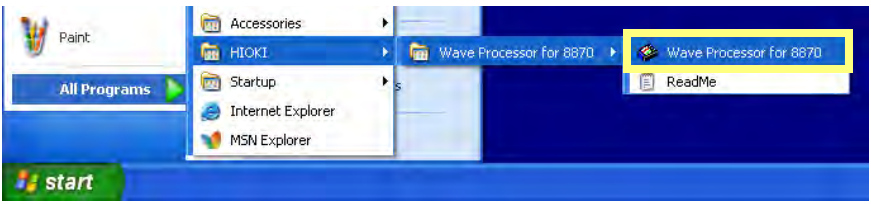
6 Click **[Install]**.



7 Click **[Finish]** to complete the installation.

Running the Application Programs

From the Windows **[Start]** menu, select **[Program] - [HIOKI] - [Wave Processor for 8870] - [Wave Processor for 8870]** to start the program.



Uninstall Procedure

To uninstall, open **[Add or Remove Programs]** in the Windows **[Control Panel]**, and select **[HIOKI Wave Processor for 8870]**.

Appendix 4 List of Default Settings

When shipped from the factory or initialized to factory defaults, the settings are as follows.

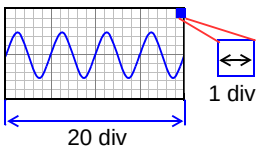
Screen	Setting Item		Default Setting
Setting	Timebase		100µs/div
	Shot		20div
	Source		OR
	Time Mag		x1
	Trig Mode		Repeat
	Pre-Trig		0%
	CH1 / CH2		CH1: red CH2: green
	Rng/div		10mV/div
	Pos		50%
	Coupling		DC
	Mag		x1
	L.P.F.		OFF
	Scaling		OFF
	Trig		OFF
		Filter	OFF
		Level	Level trigger: 0 V Drop trigger: 10 mV
		Slope	↑
		Lower	-10 mV
		Upper	10 mV
		Freq	50Hz
	Logic		OFF
	Pos		Pos1
	Trig		OFF
	Pattern		X
	Filter		OFF

Screen	Setting Item		Default Setting
Calc/ Save	Numerical Calculation		OFF
		No.1	OFF
		No.2	OFF
		No.3	OFF
		No.4	OFF
	Auto Save		OFF
		Waveform	OFF
		Screen Image	OFF
		Calc Results	OFF
System	Start Backup		OFF
	Backlight Brightness		100%
	Backlight Saver		OFF
	Display Color		Black
	SAVE Key Operation		Select & Save
	External Control Terminal	EXT.TRIG	OFF
		TRIG.OUT	OFF
	Beep Sound		ON
Zero-Adjust			Not executed

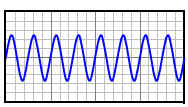
Appendix 5 Supplemental Technical Information

Selecting a Timebase (Horizontal Axis)

Timebase: with 1 div = 5 ms



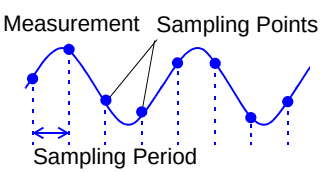
Timebase: with 1 div = 10 ms



The input signal acquisition rate corresponds to time per division on the horizontal axis.
Determining the timebase: Calculate from the frequency and period.
f [Hz] = 1/t [s] (f: frequency, t: period)
Example: If the measurement frequency is 50 Hz:
50 [Hz] = 1/t [s]
t = 1/50 [s] = 0.02 [s] = 20 [ms]
So to display five cycles on the screen (20 divisions horizontally), 20 [ms] x 5/20 [div] = 5 ms/div
Select 5 ms/div for the timebase, which is the closest available setting to the calculated value.

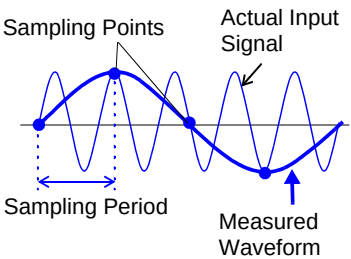
To measure phenomena with relatively fast signals such as instantaneous waveforms, we suggest setting a small value (if the frequency is 50 Hz, the timebase should be set faster than 5 ms/div).
During and after measurement, waveforms can be expanded and compressed along the time axis.

Timebase and Sampling



This instrument converts analog input signals into digital values which are then processed internally as digital (numerical) values. This A/D conversion process is called sampling. Sampling repeatedly measures the size of the input signal at a specific interval (the sampling period).
The rate of measurement is called the sampling rate.
Sampling units are [S/s] (read as samples-per-second)
This is the number of samples taken each second, and is the inverse of the sampling period. (1/T)

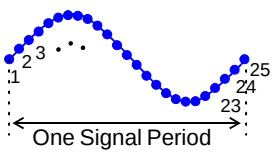
Aliasing



Aliasing occurs when the sampling period is longer than half of the input signal period.

If the signal to be measured changes too fast relative to the sampling period, beginning at a certain frequency, non-existent slow signal fluctuations are recorded. This phenomenon is aliasing.
With the Memory function, the sampling period can be significantly affected by the timebase setting, so care is necessary to avoid aliasing when selecting the timebase.
Because the timebase determines the measurement frequency limit, the fastest possible timebase setting should be used.
When the signal can be recorded repeatedly, the auto-ranging function (p. 39) may be used to select the optimum timebase.

Measurement Frequency Limit



Displaying waveforms by their sampled values with adequate resolution of characteristics such as sine wave peaks requires a minimum of about 25 samples per waveform period.
The measurement frequency limit is determined by the timebase.

Timebase	Sampling period	Measurement limit frequency	Timebase	Sampling period	Measurement limit frequency	Timebase	Sampling period	Measurement limit frequency
100 µs/div	1 µs	40 kHz	10 ms/div	100 µs	400 Hz	1 s/div	10 ms	4 Hz
200 µs/div	2 µs	20 kHz	20 ms/div	200 µs	200 Hz	2 s/div	20 ms	2 Hz
500 µs/div	5 µs	8 kHz	50 ms/div	500 µs	80 Hz	5 s/div	50 ms	0.8 Hz
1 ms/div	10 µs	4 kHz	100 ms/div	1 ms	40 Hz	10 s/div	100 ms	0.4 Hz
2 ms/div	20 µs	2 kHz	200 ms/div	2 ms	20 Hz	30 s/div	300 ms	0.13 Hz
5 ms/div	50 µs	800 Hz	500 ms/div	5 ms	8 Hz	1 min/div	600 ms	0.067 Hz
						2 min/div	1.2 s	0.033 Hz
						5 min/div	3 s	0.013 Hz

Appendix 6 Options

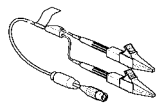
For the details, contact your supplier or Hioki representative for details.

Input cables for voltage measure-ment*

L9197 Connection Cord

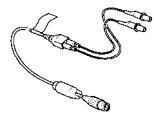
Maximum input voltage
600 V AC/DC

9197 Connection Cord



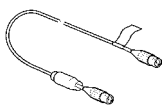
Maximum input voltage
600 V AC/DC

L9198 Connection Cord



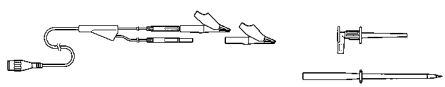
Maximum input voltage
300 V AC/DC

L9217 Connection Cord



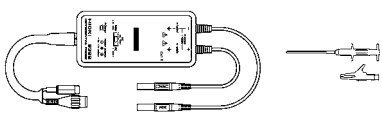
Maximum input voltage
300 V AC/DC (for BNC output)

L9790 Connection Cord



Maximum input voltage 600 V AC/DC
(Select the end clip separately.)
Model L9790-01 Alligator Clip
Model 9790-02 Grabber Clip
Model 9790-03 Contact Pin

9322 Differential Probe

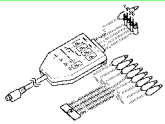


Requires the 9418-15 AC Adapter
For high voltage, maximum input voltage: (CAT II):
2000 VDC, 1000 VAC, (CAT III): 600 VAC/DC

* When used in combination with the instrument, pay attention to the input voltage.
For details, refer to "2.3 Connecting Measurement Cables to the Memory HiCorder" (p. 27).

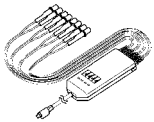
Logic Signal Measurement Logic Probes

9320-01 Logic Probe



Measures digital signals and on/off switching of non-voltage contacts.

MR9321-01 Logic Probe

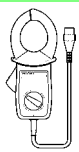


Detects the presence of AC and DC voltages. Measures activation timing of relay sequencing circuits.
Maximum input voltage: 250 Vrms (HIGH range)

For users of the following legacy products:
Models 9306, 9307, 9320, 9321, MR9321 Logic Probes
Usable with this instrument by connecting the Model 9323 Conversion Cable.

Clamp-On Probes

9018-50



10 to 500 A,
40 Hz to 3 kHz

9132-10

20 to 1000 A,
40 Hz to 1 kHz

Outputs 0.2 V AC waveform of commercial power line current.

For users of the following legacy products:
Model 9018 or 9132 Clamp-On Probe
Usable with this instrument by connecting the Model 9199 Conversion Adapter.

Software

☐ **Model 9335 Wave Processor (PC application programs)**
Provides analysis of measurement data on a computer.

Power Sources

☐ **Model 9780 Battery Pack**
☐ **Model Z1005 AC Adapter**

PC Cards

☐ **Model 9726 PC Card (128MB)**
☐ **Model 9727 PC Card (256MB)**
☐ **Model 9728 PC Card (512MB)**
☐ **Model 9729 PC Card (1GB)**
☐ **Model 9830 PC Card (2GB)**

Others

☐ **Model 9782 Carrying Case**
☐ **Model 9812 Soft Case**
☐ **Model 9809 Protection Sheet**

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Warranty Certificate

Model	Serial No.	Warranty period One (1) year from date of purchase (___ / ___)

This product passed a rigorous inspection process at Hioki before being shipped.

In the unlikely event that you experience an issue during use, please contact the distributor from which you purchased the product, which will be repaired free of charge subject to the provisions of this Warranty Certificate. This warranty is valid for a period of one (1) year from the date of purchase. If the date of purchase is unknown, the warranty is considered valid for a period of one (1) year from the product's date of manufacture. Please present this Warranty Certificate when contacting the distributor.
Accuracy is guaranteed for the duration of the separately indicated guaranteed accuracy period.

1. Malfunctions occurring during the warranty period under conditions of normal use in conformity with the Instruction Manual, product labeling (including stamped markings), and other precautionary information will be repaired free of charge, up to the original purchase price. Hioki reserves the right to decline to offer repair, calibration, and other services for reasons that include, but are not limited to, passage of time since the product's manufacture, discontinuation of production of parts, or unforeseen circumstances.
2. Malfunctions that are determined by Hioki to have occurred under one or more of the following conditions are considered to be outside the scope of warranty coverage, even if the event in question occurs during the warranty period:
   a. Damage to objects under measurement or other secondary or tertiary damage caused by use of the product or its measurement results
   b. Malfunctions caused by improper handling or use of the product in a manner that does not conform with the provisions of the Instruction Manual
   c. Malfunctions or damage caused by repair, adjustment, or modification of the product by a company, organization, or individual not approved by Hioki
   d. Consumption of product parts, including as described in the Instruction Manual
   e. Malfunctions or damage caused by transport, dropping, or other handling of the product after purchase
   f. Changes in the product's appearance (scratches on its enclosure, etc.)
   g. Malfunctions or damage caused by fire, wind or flood damage, earthquakes, lightning, power supply anomalies (including voltage, frequency, etc.), war or civil disturbances, radioactive contamination, or other acts of God
   h. Damage caused by connecting the product to a network
   i. Failure to present this Warranty Certificate
   j. Failure to notify Hioki in advance if used in special embedded applications (space equipment, aviation equipment, nuclear power equipment, life-critical medical equipment or vehicle control equipment, etc.)
   k. Other malfunctions for which Hioki is not deemed to be responsible

*Requests
- Hioki is not able to reissue this Warranty Certificate, so please store it carefully.
- Please fill in the model, serial number, and date of purchase on this form.

13-09

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