HIOKI

MR8740T

MR8740-50

Quick Start Manual

MEMORY HiCORDER

The latest edition of the instruction manual

Read carefully before use.
Keep for future reference.

When using the instrument for the first time

Troubleshooting

EN

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FAQs

To set the measurement range automatically

Refer to “3.7 Measuring Signals With the Auto-range Setting” (p. 82).

To change the measurement range

Refer to “Analog channel” (p. 75).

To add a comment to the data

Refer to “Analog channel” (p. 75).

To minimize influence of noise (Low-pass filter, LPF)

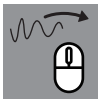
Refer to “Analog channel” (p. 75).

To change the sampling rate

Refer to “3.2 Setting Measurement Conditions” (p. 72).

To configure the trigger settings

Refer to “3.4 Configuring the Level Trigger Settings” (p. 77).

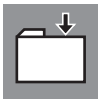


To scroll through the waveform display

Refer to “4.2 Handling Waveforms” (p. 87).

To read measured values (cursor values) with cursors

Refer to “4.1 Reading Measured Values (Trace Cursors)” (p. 85).



To save data files

Refer to “3.6 Saving Data Consisting of Items Selected” (p. 80).

To estimate file size

Refer to “13.1 Information for Reference Purposes” of Instruction Manual.

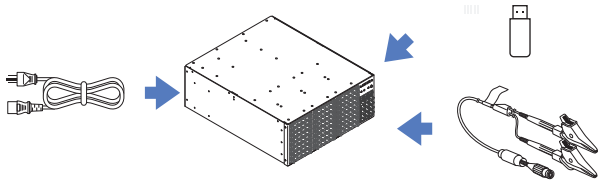
To open data files with a computer

Refer to “4.3 Loading Data With Your Computer (Wave Viewer)” (p. 88).

Measurement Procedure

The basic measurement procedure is as follows. For advanced use, refer to the Instruction Manual (PDF) in the accompanying CD.

Preparing for measurement (p. 35)



Inspecting the instrument before measurement (p. 71)

Configuring the basic settings for measurement (p. 72)

- Choose a sampling rate.
- Choose a recording length (shot).

Configuring the input channel settings (p. 74)

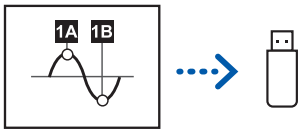
- Configure the analog channel settings.

Configuring the trigger settings (p. 77)

- Configure the trigger settings.

Starting/Stopping measurement (p. 79)

Saving measured data files (p. 80)



Analyzing waveforms (p. 85)

- Scroll through, zoom in, and zoom out waveforms.
- Read measured values (with the trace cursors).

Finishing the measurement

Contents

Introduction

Thank you for choosing the Hioki MR8740T Memory HiCorder (Model MR8740-50). Preserve this manual carefully and keep it handy to make full use of this instrument for a long time.

Following manuals are provided along with these models. Refer to manuals relevant to your purpose.

Type	Contents	Printed	PDF
Operating Precautions	Information on the instrument for safe operation	✓	–
Quick Start Manual (This document)	Basic instructions and specifications of the instrument	✓	–
Instruction Manual	Functions and instructions for the instrument	–	✓
Instruction Manual U8793, MR8790, MR8791	Functions, specifications, and instructions for the U8793, MR8790, and MR8791	–	✓

Latest instruction manual

The contents of this manual are subject to change, for example as a result of product improvements or changes to specifications.
The latest edition can be downloaded from Hioki's website.
https://www.hioki.com/global/support/download

Target audience

This manual has been written for use by individuals who use the product in question or who teach others to do so.
It is assumed that the reader possesses basic electrical knowledge (equivalent to that of someone who graduated from the electrical program at a technical high school).

Trademarks

- Microsoft and Internet Explorer are trademarks of the Microsoft group of companies.
- Other products and company names are trade names, registered trademarks, or trademarks of their respective owners.

Symbols and abbreviations

Safety notations

In this document, the risk seriousness and the hazard levels are classified as follows.

⚠ DANGER	Indicates an imminently hazardous situation that will result in death or serious injury to the operator.
⚠ WARNING	Indicates a potentially hazardous situation that may result in death or serious injury to the operator.
⚠ CAUTION	Indicates a potentially hazardous situation that may result in minor or moderate injury to the operator or damage to the instrument or malfunction.
IMPORTANT	Indicates information related to the operation of the instrument or maintenance tasks with which the operators must be fully familiar.
	Indicates a high voltage hazard. If a particular safety check is not performed or the instrument is mishandled, this may give rise to a hazardous situation; the operator may receive an electric shock, may get burnt or may even be fatally injured.
	Indicates prohibited action.
	Indicates the action which must be performed.

Symbols affixed to the instrument

	Indicates cautions and hazards. When the symbol appears on the instrument, read the corresponding topic in the Instruction Manual.
	Indicates the power button that switches the instrument between on and off states.
	Indicates a grounding terminal.
	Indicates DC (direct current).
	Indicates AC (alternating current).

Symbols for Standards

	Indicates the Waste Electrical and Electronic Equipment Directive (WEEE Directive) in EU member states.
	Indicates that the product conforms to regulations set out by the EU Directive.
	Indicates that the product complies with Korean regulations. Declarer: HIOKI KOREA CO., LTD.

Others

*	Additional information is presented below.
☑	Indicates the initial setting values of the items. Initializing the instrument restores settings to each of these values.
(p.)	Indicates the location of reference information.
START (Bold-faced)	Names and keys on the screen are indicated in boldface.
[ ]	Menus, dialog boxes, buttons in a dialog box, and other names on the screen are indicated in brackets (**[ ]**).
Windows	Unless otherwise specified, “Windows” represents Windows 7, Windows 8, and Windows 10.
Current sensor	Sensors measuring current are referred to as “current sensor.”
S/s	The number of times per second the analog input signals are digitized by the instrument is represented in “samples per second (S/s).” Example: “20 MS/s” (20 megasamples per second) indicates that the signal is digitized 20×10^6 times per second.

Notations

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

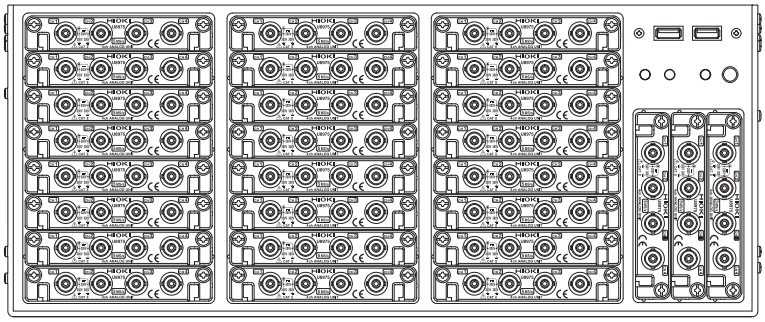
f.s.	(maximum display value or scale length) The maximum displayable value or scale length.
rdg.	(displayed value) The value currently being measured and displayed on the measuring instrument.
setting	(setting value) Indicates the value set as the output voltage, current, or other quantity.

Confirming Package Contents

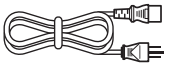
When you open the package, inspect the instrument carefully to ensure that everything is in good condition, and that no damage occurred during shipping. Carefully check the accessories, panel keys and switches, and connectors. If the instrument seems to have been damaged or does not work as specified, contact your authorized Hioki distributor or reseller.
Check that the package contents are correct.

Instrument

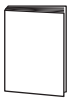
☐ Model MR8740T Memory HiCorder



Accessories

☐ Power cord  (p. 64)

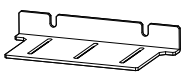
☐ Operating Precautions (0990A903) 

☐ Quick Start Manual (This document) 

☐ Instruction Manual CD*1
• Instruction Manual
MR8740C964-xx.pdf  (p. 34)

☐ Application disc*1  (p. 88)

☐ Blank panel (for slots with no module installed)  (p. 36)

☐ Rack-mount brackets  (p. 169)

*1: The latest version can be downloaded from our website.

Options (sold separately)

The options listed below are available for the instrument. To order an option, please contact your authorized Hioki distributor or reseller. Options are subject to change. Please check Hioki's website for the latest information.
For information about products, including cables, probes, and sensors, that can be connected to optional modules, see the "Options" row of each module's specifications in "5.2 Specifications of the Options" (p. 105).

Input modules

Model 8966	Analog Unit
Model 8967	Temp Unit
Model 8968	High Resolution Unit
Model U8969	Strain Unit
Model 8970	Freq Unit
Model 8971	Current Unit
Model 8972	DC/RMS Unit
Model 8973	Logic Unit
Model U8974	High Voltage Unit
Model U8975	4ch Analog Unit
Model U8977	3CH Current Unit
Model U8978	4CH Analog Unit
Model U8979	Charge Unit
Model MR8990	Digital Voltmeter Unit
Model U8991	Digital Voltmeter Unit

Output modules

Model MR8790	Waveform Generator Unit
Model MR8791	Pulse Generator Unit
Model U8793	Arbitrary Waveform Generator Unit
Model U8794	VIR Generator Unit

USB flash drive

Model Z4006	USB Drive (16 GB)

LAN cable

Model 9642	LAN Cable

Other

Model 9335	Wave Processor

Safety Information

This instrument and modules are designed to conform to IEC 61010 Safety Standards, and has been thoroughly tested for safety prior to shipment. However, using the instrument in a way not described in this manual may negate the provided safety features.
Read the following safety notes carefully before using the instrument.

⚠DANGER

Mishandling the instrument could result in bodily injury or even death, as well as damage to the instrument. Familiarize yourself with the instructions and precautions in this manual before using the instrument.

⚠WARNING

Electricity can cause potentially serious events such as an electric shock, heat generation, fire, and an arc flash due to a short-circuit. If you have not used electrical measuring instruments before, you should be supervised by a technician who has experience in electrical measurement.

Protective gear

⚠WARNING

Performing measurement using this instrument involves live-line work. To prevent an electric shock, use appropriate protective insulation and adhere to applicable laws and regulations.

Measurement categories

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

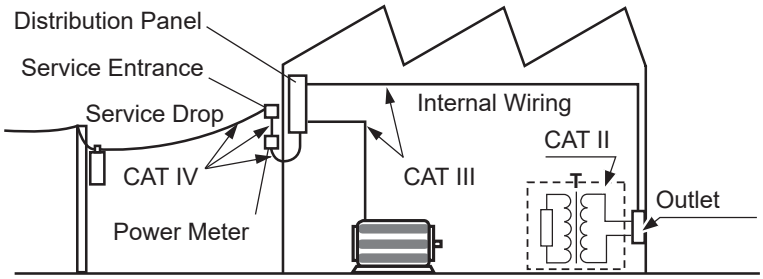
⚠ DANGER

- **Using a measuring instrument in an environment designated with a higher-numbered category than that for which the instrument is rated could result in a severe accident, and must be carefully avoided.**
- **Never use a measuring instrument that lacks category labeling in a CAT II to CAT IV measurement environment. Doing so could result in a serious accident.**

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

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

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



Fixed Installation

The applicable measurement category is determined based on the module being used.
Refer to “Handling the instrument and modules” (p. 10).

Operation Precautions

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

Checks before Use

⚠ DANGER

If the connection cords or the instrument is damaged, there is a risk of an electric shock. Perform the following inspection before using the instrument:

- **Check that the insulation of the connection cords are neither ripped nor torn and that no metal parts are exposed before using the instrument. Using the instrument under such conditions could result in an electric shock. Replace the connection cords with those specified by our company.**
- **Check if there is any damage to the instrument occurred during storage or shipping and verify that it operates normally before using the instrument. If you find any damage, contact your authorized Hioki distributor or reseller.**

Installing the instrument and modules

⚠ WARNING

Installing the instrument in inappropriate locations could cause a malfunction of the instrument an accident, or fire. Avoid the locations that are:

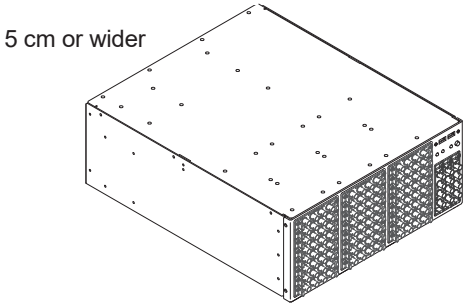
- **Exposed to direct sunlight or high temperatures**
- **Exposed to corrosive or combustible gases**
- **Exposed to strong electromagnetic fields or electrostatic charges**
- **Near induction heating systems (such as high-frequency induction heating systems and IH cooking equipment)**
- **Susceptible to vibration**
- **Exposed to water, oil, chemicals, or solvents**
- **Exposed to high humidity or condensation**
- **Exposed to high quantities of dust particles**

- **Unplugging the power cord kills power to the instrument. Be sure to provide enough unobstructed space to unplug the power cord immediately in an emergency.**
- **Use M4 × 8 mm screws to fix the rack-mount brackets on the MR8740-50.**
  Using a screw longer than 8 mm can cause damage to the inside of the instrument or an electric shock.

⚠ CAUTION

Failure to observe the following precaution may result in bodily injury.

- The instrument weighs about 14 kg (20.8 kg with modules installed in all slots). It should be moved by at least two people.
- The instrument is heavy. When transporting it, follow your company's workplace safety standards to assure safety (for example, by wearing non-slip gloves and protective footwear).



- Do not place the instrument on an unstable table.
- Do not place the instrument on an inclined surface.
- Do not stack the multiple instruments.
- Vents must not be blocked.

- To prevent overheating, be sure to leave 5 cm (2 inches) around the instrument.
- The instrument should be operated only with the bottom side downwards.

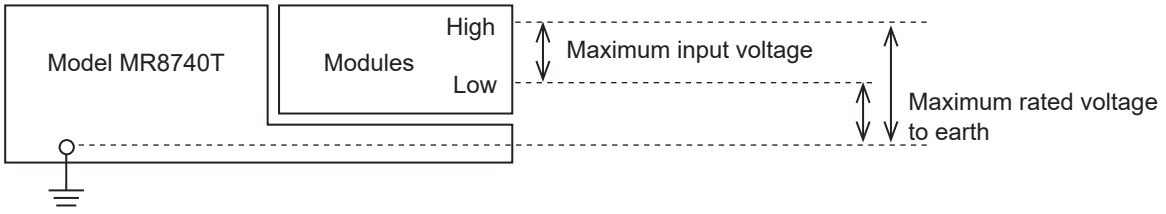
Handling the instrument and modules

⚠DANGER

- **Do not use the modules or the cables to measure circuits that exceed those ratings or specifications. Damage to the instrument or overheating can cause bodily injury.**
- **The maximum input voltage and maximum rated voltage to earth of the modules and connection cords are shown in the following table. To avoid an electric shock and damage to the instrument, ensure that input voltage never exceeds these limits. The lower maximum input voltage of the module or connection cord must be used. Measuring a voltage exceeding this value can cause damage to the instrument, resulting in bodily injury. The same applies to the maximum rated voltage to earth using an input attenuator for the measurement. Ensure that the connection does not allow the input voltage to exceed the maximum rated voltage to earth.**
  Refer to "5.2 Specifications of the Options" (p. 105).

Rating of input modules

Modules		Maximum input voltage	Maximum rated voltage to earth
Model 8966	Analog Unit	400 V DC	300 V AC/DC (CAT II)
Model 8967	Temp Unit	–	300 V AC/DC (CAT II)
Model 8968	High Resolution Unit	400 V DC	300 V AC/DC (CAT II)
Model U8969	Strain Unit	–	30 V rms / 60 V DC
Model 8970	Freq Unit	400 V DC	300 V AC/DC (CAT II)
Model 8971	Current Unit	–	Non-isolated
Model 8972	DC/RMS Unit	400 V DC	300 V AC/DC (CAT II)
Model 8973	Logic Unit	–	Non-isolated
Model U8974	High Voltage Unit	1000 V DC 700 V AC	1000 V AC/DC (CAT III) 600 V AC/DC (CAT IV)
Model U8975	4ch Analog Unit	200 V DC	300 V AC/DC (CAT II)
Model U8977	3CH Current Unit	–	Non-isolated
Model U8978	4CH Analog Unit	40 V DC (Direct input) 400 V DC (with Model 9665 10:1 Probe used)	30 V AC, 60 V DC (Direct input) 300 V AC/DC (CAT II) (with Model 9665 10:1 Probe used)
Model U8979	Charge Unit	40 V DC	30 V AC 60 V DC
Model MR8990	Digital Voltmeter Unit	500 V DC	300 V AC/DC (CAT II)
Model U8991	Digital Voltmeter Unit	100 V DC	100 V AC/DC



Rating of generator modules

You can mixedly install generator modules and measurement modules in the instrument.

Intended use	Model name	Number of channels	Maximum output frequency	Output voltage
For generating sine wave and DC	Model MR8790 Waveform Generator Unit	4	20 kHz	−10 V to 10 V
For generating pulse	Model MR8791 Pulse Generator Unit	8	20 kHz	TTL level (amplitude: 0 to 5 V) Open-collector output
For generating arbitrary waveforms	Model U8793 Arbitrary Waveform Generator Unit	2	100 kHz	−10 V to 15 V
For generating DC voltage, DC current, and resistance generation	Model U8794 VIR Generator Unit	8		Voltage: −0.1 V to 5.3 V Current: −5 mA to 5 mA Resistance: 10 Ω to 1 MΩ

Ratings of connection cords

Connection Cord	Maximum input voltage	Maximum rated voltage to earth	Maximum rated current
Model L9197 Connection Cord	600 V AC/DC	600 V AC/DC (CAT III) 300 V AC/DC (CAT IV)	1 A
Model L9198 Connection Cord (for measuring low-voltage)	300 V AC/DC	600 V AC/DC (CAT II) 300 V AC/DC (CAT III)	0.2 A
Model L9217 Connection Cord			
Model L9790 Connection Cord	600 V AC/DC	• With Model L9790-01 Alligator Clip or Model 9790-03 Contact Pin attached 600 V AC/DC (CAT II) 300 V AC/DC (CAT III) • With Model 9790-02 Grabber Clip attached 300 V AC/DC (CAT II) 150 V AC/DC (CAT III)	1 A
Model 9322 Differential Probe	2000 V DC 1000 V AC	• With grabber clips attached 1000 V AC/DC (CAT II) • With alligator clips attached 1000 V AC/DC (CAT II) 600 V AC/DC (CAT III)	–
Model L4940 Connection Cord	1000 V DC*	• With Model L4935 Alligator Clip Set or Model L4932 Test Pin Set attached 600 V AC/DC (CAT IV) 1000 V AC/DC (CAT III, CAT II)	10 A
		• With Model L9243 Grabber Clip attached 1000 V AC (CAT II)	1 A
		• With Model L4936 Bus Bar Clip Set attached 600 V AC/DC (CAT III)	5 A
		• With Model L4937 Magnetic Adapter Set attached 1000 V AC/DC (CAT III)	2 A
		• With Model L4934 Small Alligator Clip Set attached 300 V AC/DC (CAT III) 600 V AC/DC (CAT II)	3 A

*: When Model U8974 High Voltage Unit is used

Connection Cord	Maximum input voltage	Maximum rated voltage to earth	Maximum rated current
Model P9000-01 Differential Probe	1000 V AC/DC	1000 V AC/DC (CAT III)	–
Model P9000-02 Differential Probe			
Model 9166 Connection Cord	30 V AC 60 V DC	For inputting voltage into Model U8979	–
Model L9795-01 Connection Cable (for generating)	±30 V	30 V rms AC, 42.4 V peak AC, or 60 V DC	–
Model L9795-02 Connection Cable (for generating)			

⚠DANGER

It is recommended to measure the secondary side of a distribution panel with the U8974 High Voltage Unit. Do not measure the primary side of the distribution panel because an unrestricted current flow could damage the instrument and facilities if a short circuit occurs.

- **Each channel of Model U8979 Charge Unit has the BNC terminal and miniature connector terminal with the common ground. Do not connect cables with each of the terminals simultaneously to avoid a short-circuit.**

⚠WARNING

- **To avoid an electric shock and damage to the module and the instrument, confirm that the instrument is turned off and that the connection cords are disconnected before removing or replacing a module.**
- **To avoid an electric shock, install a blank panel over any slot with a module removed.**
- **To prevent the instrument damage or an electric shock, use only the screws that are originally installed for securing the module in place. If you have lost any screws or find that any screws are damaged, please contact your authorized Hioki distributor or reseller.**

⚠CAUTION

- Do not touch module connectors inserted to the instrument to avoid damaging a module.
- To avoid damage to the instrument, do not unplug the power cable from the instrument when operations are in progress. Be sure to use the power key to turn off the instrument.
- The U8794 permits a load resistance of 1 kΩ or more while outputting a voltage. Do not connect a load resistance lower than the permissible value or short-circuit an output terminal. Damage to the instrument could result.
- Do not set the OUTPUT terminal status of the U8794 to SHORT when a power supply unit connects with the OUTPUT terminal. A short-circuit current will flow, resulting in damage to the instrument or power supply device.
- Do not connect anything with the U8794 OUTPUT terminal during a general test of the self-diagnosis function and an offset measurement of the offset canceling function. When the connected target is a power supply device, the instrument and the connected target can be damaged because the OUTPUT terminals of each channel are momently short-circuited.

- The mounting screws must be firmly tightened or the module may not work as specified, or may even fail.
- When you use the U8794 resistance generation function to presume a characteristic of a connected target with an output resistance of less than 1 kΩ, a current that exceeds the specification will flow, resulting in damage to the instrument and the connected target.
- Model U8979 Charge Unit has two miniature connectors with the maximum input charge of ±500 pC (for six higher-sensitivity range) or ±50,000 pC (for six lower-sensitivity range). Inputting a charge that exceeds these value causes damage to the instrument.
- Use an acceleration sensor with a built-in pre-amplifier that conforms to the specification of Model U8979 (3.0 mA, 22 V). Using a inapplicable sensor may cause damaging itself.

IMPORTANT

- Install a blank panel over the slot with no module installed. If the measurement is performed without the blank panel installed, the instrument may not work as specified because of temperature instability within the modules.
- If any unexpected waveform is observed or a module is not recognized, send the instrument for repair.

- Disconnect all cables and remove a USB flash drive before carrying the instrument.
- Waveforms can frequently fluctuate even when no voltage is applied due to an induction voltage. This, however, is not a malfunction.
- This instrument may cause interference if used in residential areas. Such use must be avoided unless the user takes special measures to reduce electromagnetic emissions to prevent interference to the reception of radio and television broadcasts.

Precautions during shipment

⚠ CAUTION

To avoid damage to the instrument, protect it from physical shock when transporting and handling. Be especially careful to avoid physical shock due to dropping it.

- Store the packaging materials even after unpacking, because you will need them when you transport the instrument.
- To ensure safe handling, when transporting the instrument, please use the original box and packing materials,
  but do not use if the box is damaged or warped, or if the packing materials are in poor condition or incomplete.
  If you find any damage, contact your authorized Hioki distributor or reseller.
- When packing the instrument, make sure to disconnect the test leads and power supply cords from the main device.
- When transporting, avoid dropping or other excessive impact.

CD precautions

- Exercise care to keep the recorded side of discs free of dirt and scratches. When writing text on a disc's label, use a pen or marker with a soft tip.
- Keep discs inside a protective case and do not expose to direct sunlight, high temperature, or high humidity.
- Hioki is not liable for any issues your computer system experiences in the course of using this disc.

Handling storage devices

⚠ CAUTION

- Do not carry the instrument with a USB flash drive inserted. Damage could result.
- Do not subject the instrument to extreme shock or vibration. Shock can cause damage to the built-in SSD unit.
- Do not insert a storage device upside down, backward, or in the wrong direction. Doing so may damage the storage device or instrument.

Exercise care when using such products because static electricity could damage the external storage device or cause a malfunction of the instrument.

IMPORTANT

- Do not extract any external storage device or turn off the instrument while the instrument is accessing the storage device (while the green DIAG LED is lighting up). Data stored in the device could be lost.
- No compensation is available for loss of data stored on the external storage device (USB flash drive) or the built-in SSD unit of the instrument, regardless of the content or cause of damage or loss. Be sure to back up any important data stored on the device (USB flash drive) and the built-in SSD unit of the instrument.
- When the instrument is left powered off for a long period of time (about 1 year or more), the data saved to the built-in SSD may be lost. Be sure to back up the data if the instrument is to be left powered off for a long time.

- With some external storage device, the instrument may not start up if power is turned on while the device is inserted. In such a case, turn off and cycle the instrument.
- The instrument supports not all commercially available USB flash drives.
- The number of times data can be written on external storage devices (USB flash drive) and the built-in SSD unit of the instrument is limited by their flash memory. If data has been rewritten many times, data reading and writing capabilities will be degraded. In that case, replace the device.
- Model Z4006 USB Drive can be used to save data. Use the product available as Hioki's option only. (p. 5)

Built-in battery

The instrument contains a battery (sealed nickel-metal hydride battery) to shut down Windows in case power is cut (power outrage or turning off a breaker). Since the battery has a limited life expectancy, it must regularly be replaced. When replacing batteries, please contact your authorized Hioki distributor or reseller.

Expected lifetime: About 2.5 years (Operated at an ambient temperature of 30°C, when the instrument is turned off once a day)

About 3 years (Operated at an ambient temperature of 30°C, when the instrument is turned off five times a year)

⚠ CAUTION

- You have to re-charge the battery periodically even if you do not use the instrument (necessary re-charge more than four hours). When long-term storage for more six months, re-charge the battery a yearly. Failure to do so may reduce the battery life expectancy.
- Do not install the instrument in a sealed space or near a fire. Doing so may cause an explosion or fire.
- Do not use the instrument at high ambient temperature. Do not use the instrument with the end-of-life battery. Doing so may cause electrolyte leakage, resulting in a bad influence that includes a fire at a worst. Make sure that you use the instrument within the operating temperature range and inspect and replace the battery periodically.

Before connecting cords

For detailed precautions and instructions on connections, refer to the instruction manuals of your connection cords.

⚠DANGER

- **If the insulation on a connecting cable melts, the metal conductor may be exposed. Do not use any cable whose metal conductor is exposed. Doing so could result in an electric shock, burn, or other hazards.**

When measuring power line voltage

- **Only connect connection cords on the secondary side of a distribution panel. If a short-circuit occurs on the secondary side of the distribution panel, the panel will interrupt the short-circuit current. Do not connect the connection cords on the primary side of the distribution panel because an unrestricted current flow can damage the connection cords and facilities if a short-circuit occurs.**
- **To prevent an electrical shock and bodily injury, do not touch any input terminals on the VT (PT), CT or the instrument when they are in operation.**
- **Do not leave the measurement cables connected to the instrument in an environment where voltage may surge beyond the maximum input voltage. Applying voltage may result in damage to the instrument, or serious accidents.**
- **Do not cause a short-circuit between another wire and the wire to be measured with the metal tip of the connection cord. Arcs or such grave accidents are likely to occur.**
- **To avoid a short-circuit or electric shock, do not touch the metal tip of the connection cord.**

⚠WARNING

- **To prevent an electric shock, 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.**
- **Do not place a cable in contact with the lines to be measured. Any contact can cause the instrument to malfunction and lead to a short-circuit or electric shock, resulting in bodily injury.**
- **Be sure to connect the voltage input and current input terminals correctly. An incorrect connection could damage or a short-circuit.**

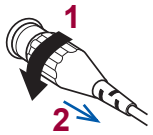
- **Use only the specified connection cords. Using a non-specified cable may result in unsafe measurements. Using a non-specified cable may also result in incorrect measurements due to poor connection or other reasons.**
- **To avoid electric shock, do not exceed the lower of the ratings shown on the modules and connection cords.**

⚠CAUTION

- To prevent cord damage, do not step on cords or pinch them between other objects. Do not bend or pull on cords at their base.

- The cable is hardened in freezing temperatures. Do not bend or pull it to avoid tearing its shield or cutting the cable.
- Do not use any cable terminated with a metal BNC connector for connecting cables to the BNC jacks on modules. If you connect a metal BNC cable to insulated BNC connector, the insulated BNC connector and instrument may be damaged.

- To prevent damage to the BNC connector, be sure to release the locking mechanism, grip the head of the connector (not the cord), and pull it out.

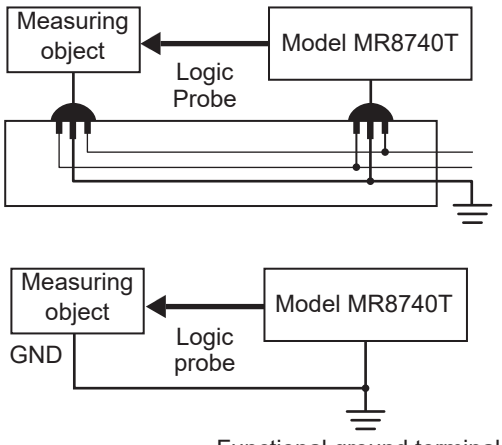


Before connecting a logic probe to a measuring object

⚠DANGER

To avoid an electric shock, a short-circuit and damage to the instrument, supply power from a single main to the instrument and a measuring object with the accompanying power cord.
The ground pin of logic terminal of Model 9320-01 Logic Probe (or Model 9327 Logic Probe) is not isolated from the instrument ground. The ground is shared. If each of the terminals are supplied with power from separate mains or power is supplied through a non-grounded power cord, the measuring object and the instrument may be damaged because a current may flow through the logic probe due to the resulting ground potential difference between the terminals. The following connection procedure is recommended to avoid this problem:

- **Connect the power cord provided to the instrument and supply power from the same outlet as the measuring object.**
- **Connect the ground of the measuring object to the GND terminal (functional earth terminal) of the instrument.**
  (Always supply power from a single main.)
  Refer to “2.6 Supplying Power to the Instrument” (p. 64).



Before turning on the instrument

⚠ WARNING

- **To prevent electrical shock and to maintain the safety specifications of this instrument, connect the accompanying power cord only to an inlet.**
- **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

Do not operate the instrument on any of the power sources (UPS or uninterruptible power supply, DC/AC inverter) that provide rectangular-wave or pseudo-sine-wave power. Doing so may damage the instrument.

Before connecting the instrument to external equipment

⚠DANGER

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

Model MR8740T

I/O terminal	Maximum input voltage
IN1	10 V DC
IN2	10 V DC
OUT1	50 V DC, 50 mA, 200 mW
OUT2	50 V DC, 50 mA, 200 mW
TRIG.OUT	50 V DC, 50 mA, 200 mW

I/O terminals	Maximum input voltage
EXT.TRIG	10 V DC
EXT.SMPL	10 V DC

Model U8793 Arbitrary Waveform Generator Unit

I/O terminal	Maximum input voltage
IN	−0.5 V to 7 V DC
OUT	30 V DC, 50 mA

⚠WARNING

To avoid an electric shock or damage to the equipment, always observe the following precautions when connecting your external equipment to external control terminals.

- **Always turn off the instrument and any equipment to be connected before making connections.**
- **Be careful to avoid exceeding the ratings of the external control terminals.**
- **The external control terminal shares the ground with the chassis. As required, isolate the devices and systems to be connected to the external control terminals from one another.**

Always turn both devices off before connecting and disconnecting an interface connector. This may cause an electric shock.

⚠CAUTION

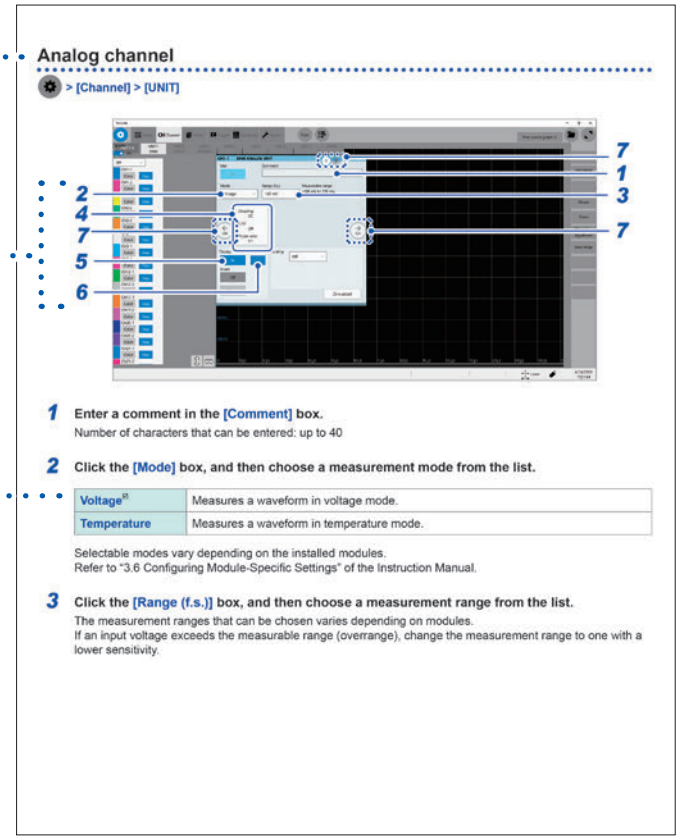
- Use a common ground to both the instrument and the connected equipment. Using different ground circuits will result in a ground potential difference between the instrument and the connected equipment. If the cable is connected while such a potential difference exists, it may result in equipment malfunction or failure.
- Before connecting or disconnecting any cable, always turn off the instrument and your device to be connected. Failure to do so could result in an equipment malfunction or damage to the equipment.
- After inserting the connector, securely tighten the screws of the connector. Failure to do so could result in an equipment malfunction or damage to the equipment.
- To prevent damage to the equipment, use the recommended type of wires to connect your external equipment to the external control terminal, or otherwise ensure that the wires have sufficient withstand voltage and current capacity.
  Refer to “2.3 Connecting the External Control Terminals” (p. 57).

How to Refer to This Document

How to open a screen
Indicates the order of clicking the screens.
The button  represents the setting key.

Procedure numbers
Numbered same as a corresponding step-by-step instruction.

Options and explanations
Describes selectable settings when an item is clicked.
The icon ☑ indicates the default setting of the item.



Analog channel

> [Channel] > [UNIT]

1 **Enter a comment in the [Comment] box.**
Number of characters that can be entered: up to 40

2 **Click the [Mode] box, and then choose a measurement mode from the list.**

Voltage☑	Measures a waveform in voltage mode.
Temperature	Measures a waveform in temperature mode.

Selectable modes vary depending on the installed modules.
Refer to "3.6 Configuring Module-Specific Settings" of the Instruction Manual.

3 **Click the [Range (f.s.)] box, and then choose a measurement range from the list.**
The measurement ranges that can be chosen varies depending on modules.
If an input voltage exceeds the measurable range (overrange), change the measurement range to one with a lower sensitivity.

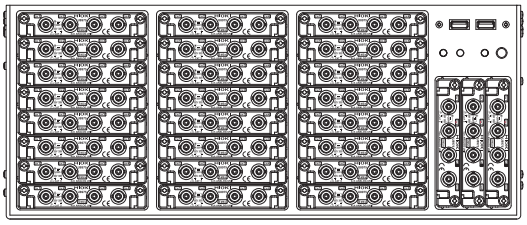
1 Overview

1.1 Product Overview and Features

This recorder allows you to observe a wide range of waveforms from low-speed signals to high-speed waveforms.
You can mainly use this instrument for analyzing test and evaluation results of various products and troubleshooting those products.

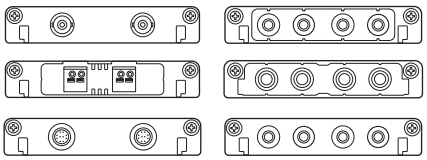
Multichannel simultaneous sampling

This instrument can simultaneously measure signals across up to 108 channels.



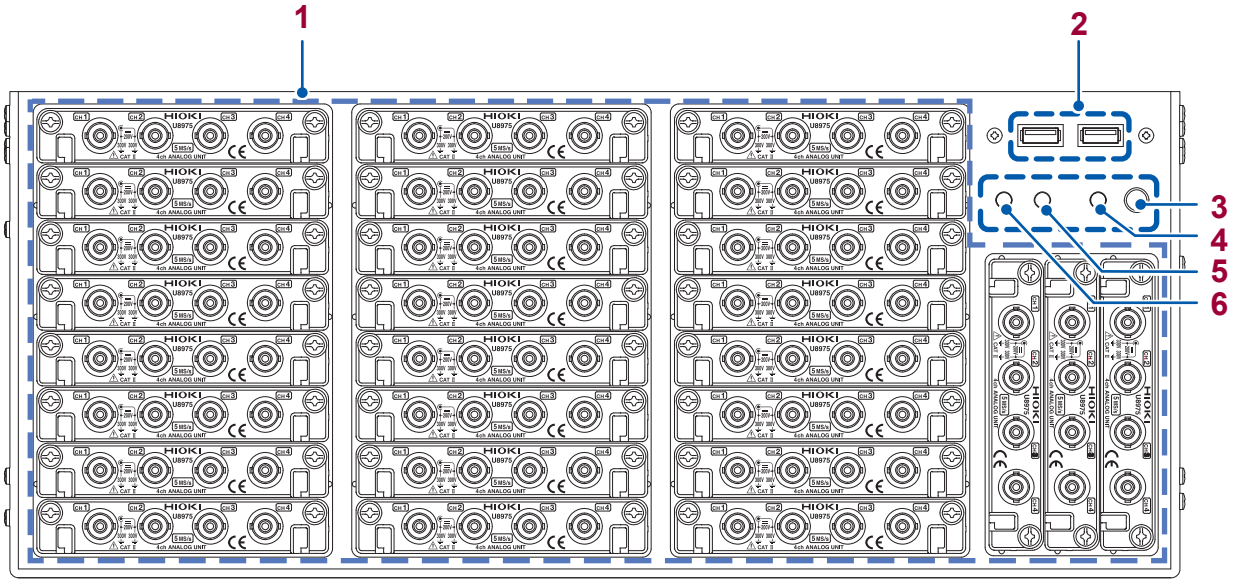
Extensive line of measurement modules

Many types of measurement modules let the instrument measure a variety of signals that include voltage, current, temperature, and frequency.



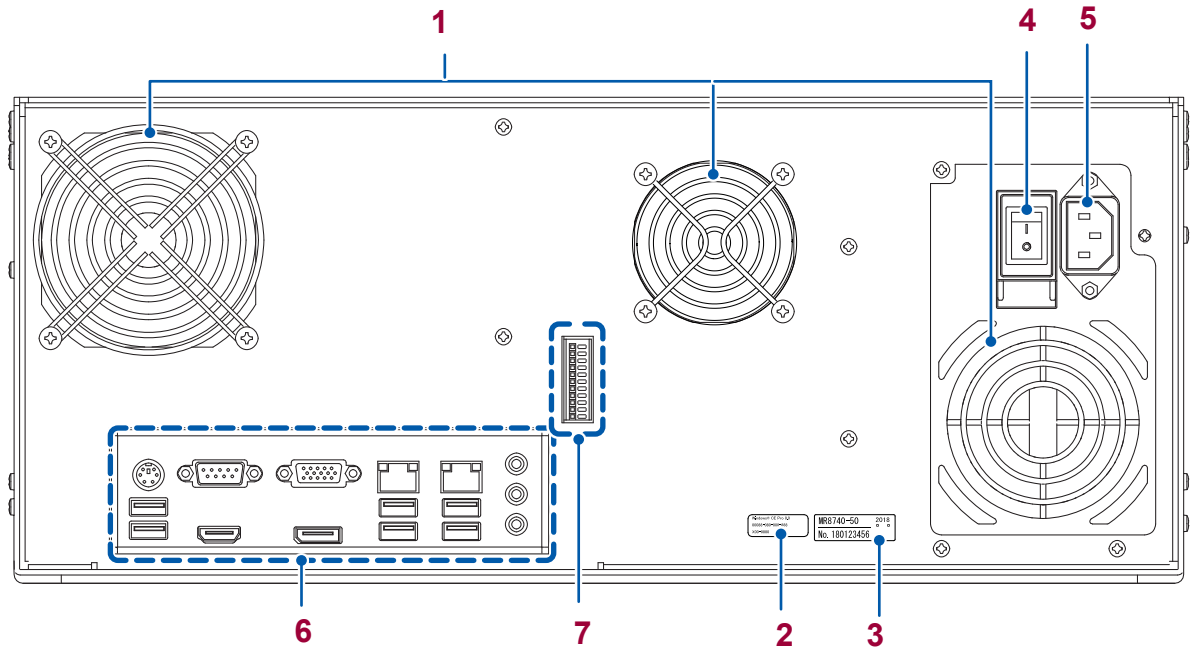
1.2 Name and Function of Each Part

Front side



No.	Name	Function	Reference page
1	**Module embedding part**	Up to 27 modules can be installed in the instrument. You can install as many modules of Model 8971 Current Unit and Model U8977 3CH Current Unit as possible in any slots unless the total number of connectable current sensors reaches nine. Model 8973 Logic Unit can be installed in slots to which UNIT 25, UNIT 26, or UNIT 27 is assigned only. Refer to an instruction manual that comes with each input module.	p. 10 p. 36
2	**USB2.0 connector**	Connect a USB flash drive, USB mouse, or USB keyboard.	p. 61
3	**Start button.**	Activates the instrument or puts it into standby when pressed.	p. 26
4	**POWER lamp**	Indicates whether the instrument is powered on or in standby mode.	
5	**DIAG lamp**	Indicates instrument status.	
6	**Command error lamp**	Lights up if a command error occurs.	

Rear side



No.	Name	Function	Reference page
1	**Vents (fan motors)**	Do not block the vents.	–
2	**Windows license**	The Windows license label is affixed.	–
3	**Serial number**	For the latest information, check Hioki's website. Do not remove this sticker because the number is required for product tracking. Inform your authorized Hioki distributor or reseller of this number if required.	–
4	**Main power switch**	Turns the instrument on and off.	–
5	**Power inlet**	Connects the power cord provided.	p. 19 p. 64
6	**Interface terminals**	Connect an LCD, LAN cable, and USB cable.	p. 27
7	**External control terminals**	Connect an external device.	p. 57

⚠ CAUTION

If you set the main power switch to off while the instrument is powered on, the power from the built-in battery is lost, resulting in incorrect Windows shutdown. Be sure to use the front start button to set the instrument in the standby state, and then set the main power switch to off.

Instrument status indicator

The LEDs indicate the instrument status.

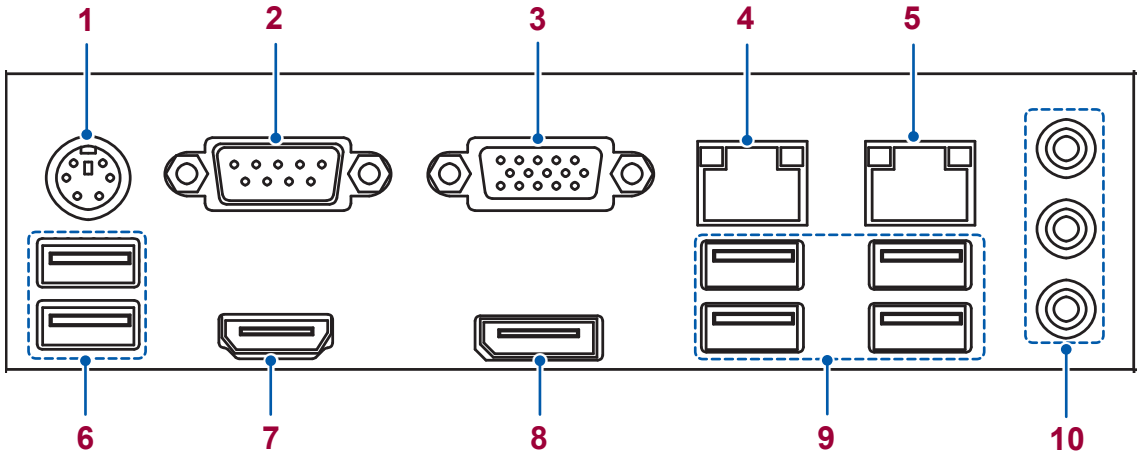
Basic LED indicator

LED name	Color	Lighting up / blinking	When lights up	How to turn off the LED
POWER STANDBY	Orange	Lighting up	Stand-by status	Set the rear switch to off.
	Green	Lighting up	Power-on status	Shut the power off.
	Green	Blinking	Power-on status (warm-up)	Shut the power off.
DIAG	Refer to the table below.	Refer to the table below.	Refer to the table below.	–
CMD ERR	Red	Lighting up	A command received contained a syntax error.	Send the `*CLS` command to turn off the LED.

Details of DIAG LED

DIAG LED mode table

Indicator priority order	Status	Color	Note
1	The inside temperature is high (ambient temperature > 35°C).	Red	–
2	The inside temperature is low (ambient temperature < 10°C).	Purple	–
3	CPU load rate ≥ 80%	Yellow	Updated every 0.5 seconds, based on average load rates calculated over the period.
4	Waiting for a trigger.	Blue	–
4	The recording is in progress.	Green	–
4	The recording is complete.	Pink	Switches to the normal operation indication when a new command is received.
5	During normal operation (under suspension)	White	–



No.	Name	Function	Reference page
1	**PS2 connector**	Not available	–
2	**COM terminal**	Not available	–
3	**VGA terminal**	Connect a display with an RGB cable. Maximum resolution: 2560 × 1600	–
4 5	**1000BASE-T connector** LINK ACT	Attach a LAN cable to connect the instrument to your network. ACT LED Blinking: Communicating data LINK LED Yellow light: 1000BASE Green light: 100BASE Off: 10BASE	p. 59
6	**USB2.0 connector**	Connect a USB flash drive, USB mouse, or USB keyboard.	p. 61
7	**HDMI terminal**	Connect a display with an HDMI cable. Maximum resolution: 3840 × 2160	–
8	**DisplayPort* terminal**	Connect a display with a DisplayPort cable. Maximum resolution: 4096 × 2160	–
9	**USB3.0 connector**	Connect a USB flash drive, USB mouse, or USB keyboard.	p. 61
10	**Audio terminal**	Not available	–

- A resolution of 1920 × 1080 dots or more is recommended. Using a display with a lower resolution can cause poor visibility of waveforms.
- Using a 4K-resolution monitor connected to the HDMI or DisplayPort terminal with the maximum resolution set may require longer time for processing command communication and displaying screens.

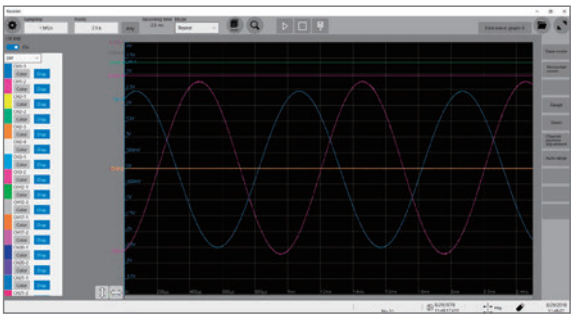
*: Trademark of another company

1.3 Screen

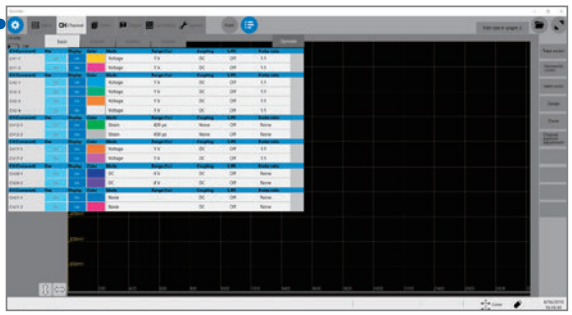
A commercially-available monitor is required to display information. Use a monitor that supports a VGA input, HDMI input, or DisplayPort input. (Full HD with a resolution of 1920 × 1080 dots is recommended)

Screen configuration

Waveform screen (p. 29)



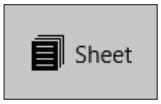
List screen



Setting screen

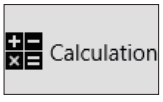
Status
This screen is used to set the measurement conditions such as the sampling rate, recording length (shot), and saving data.
Refer to “3.2 Setting Measurement Conditions” (p. 72).

Channel
This screen is used to configure the input channel settings such as the measurement range and low-pass filter.
Refer to “3.3 Configuring the Input Channel Settings” (p. 74).



Sheet screen
This screen is used to configure a display settings for each sheet.
Choose channels to be displayed on each sheet.
Refer to “1.4 Configuring the Sheet Settings” of the Instruction Manual.

Trigger
This screen is used to configure the trigger settings.
Refer to “3.4 Configuring the Level Trigger Settings” (p. 77).

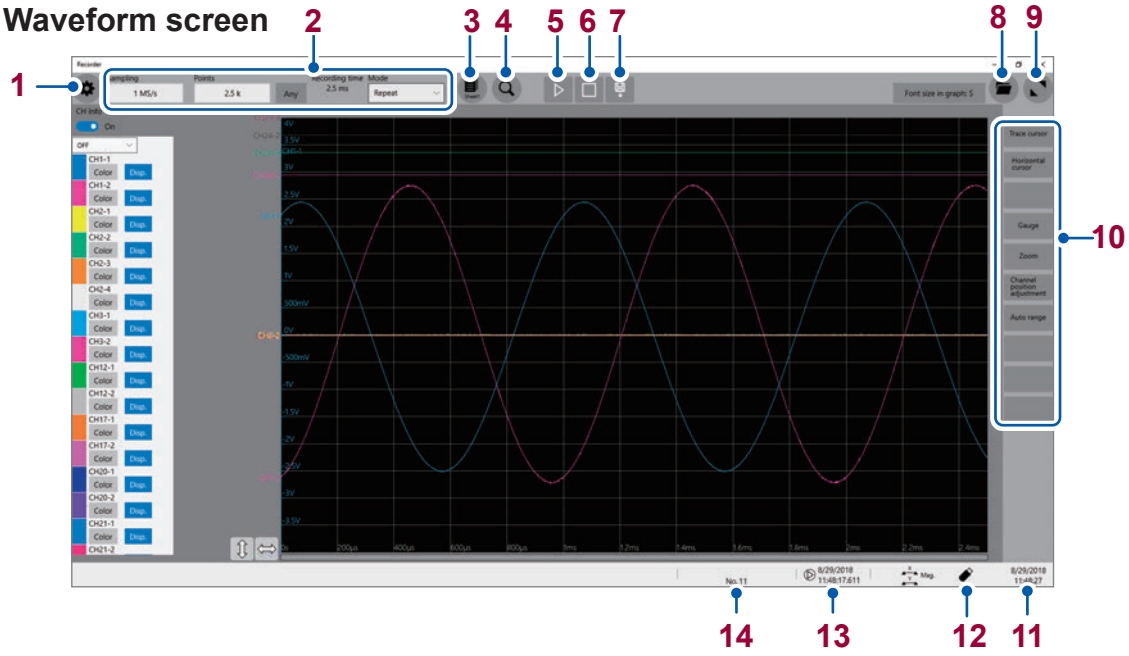


Calculation screen
This screen is used to configure the numerical and waveform calculation settings.
Refer to “7 Numerical Calculation Functions” and “8 Waveform Calculation”in Instruction Manual.

System screen
This screen is used to configure the system environment, communications, and external control terminal settings, and to initialize the instrument. You can also check the instrument configuration on this screen.
Refer to “6.2 Initializing the Instrument” (p. 155).

Explanation of each screen

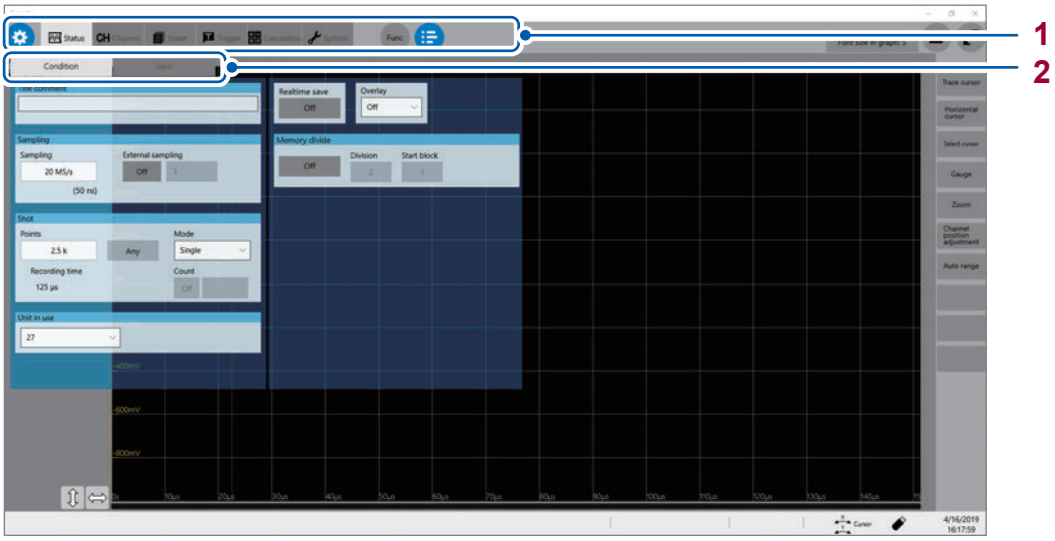
Waveform screen



No.	Item	Description	Reference page
1	⚙	Switches between the setting and waveform screens.	p. 72, p. 85
2	**Measurement condition setting**	Allows you to choose a sampling rate, recording length (the number of points and user-defined length), and recording mode (single or repeat).	p. 72
3	**Sheet selection**	Switches among preset sheets.	*1
4	**Search setting screen**	Allows you to set search conditions.	*2
5	▷ (Start icon)	Starts a measurement.	p. 79
6	□ (Stop icon)	Stops the measurement.	
7	(Save icon)	Saves data.	
8	**File screen**	Opens the file screen.	*3
9	**Waveform area zoom-in**	Zooms in the waveform area.	–
10	**Function buttons**	Allows you to choose functions available on the waveform screen.	p. 85
11	**Current date and time**	Displays the current date and time.	p. 66
12	**Eject button**	Ejects a USB flash drive.	p. 62
13	**Trigger time**	Displays the trigger time.	–
14	**Number of measurement times**	Displays the processing state of the instrument. Displays the number of measurement times.	–

*1: Refer to “1.4 Specifying the Sheet Settings” of Instruction Manual.
*2: Refer to “6 Search Function” of Instruction Manual.
*3: Refer to “4 Saving/Loading Data and Managing Files” of Instruction Manual.

Cross-screen functions

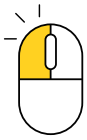


No.	Name	Description
1	**Menu tab**	Click a tab to choose a menu to open.
2	**Sub-menu tab**	Click a tab to choose a sub-menu to open.

1.4 Basic Operation

Mouse operation

Using a commercially available USB mouse enables you to operate the instrument.
Basic mouse operation for the instrument is as follows:

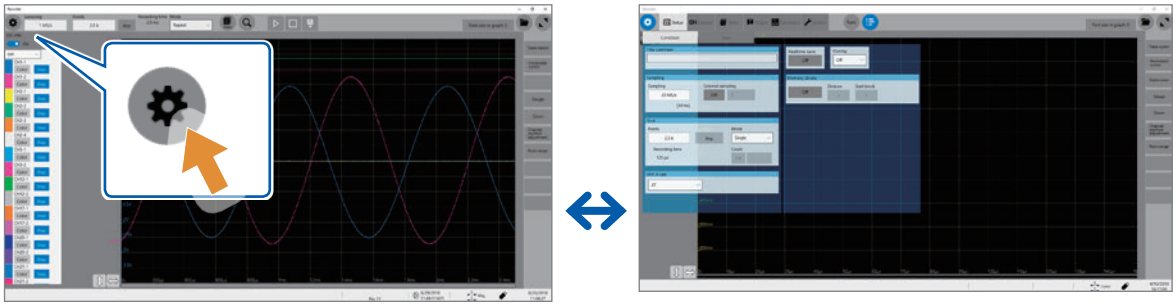
Mouse operation		Description
	**Click**	Allows you to choose a menu or execute an action.
	**Wheel button**	Changes options to be selected.
	**Up/down/left/right**	Moves the mouse cursor around.

External noise may cause the mouse to malfunction. Keep the mouse and mouse cable as far away as possible from sources of noise.
Use the mouse on an insulated table. Some commercially available mouse devices are susceptible to noise and using such a mouse on a metal table may cause the instrument to malfunction.

Changing screens and settings

Switching between the waveform and setting screens

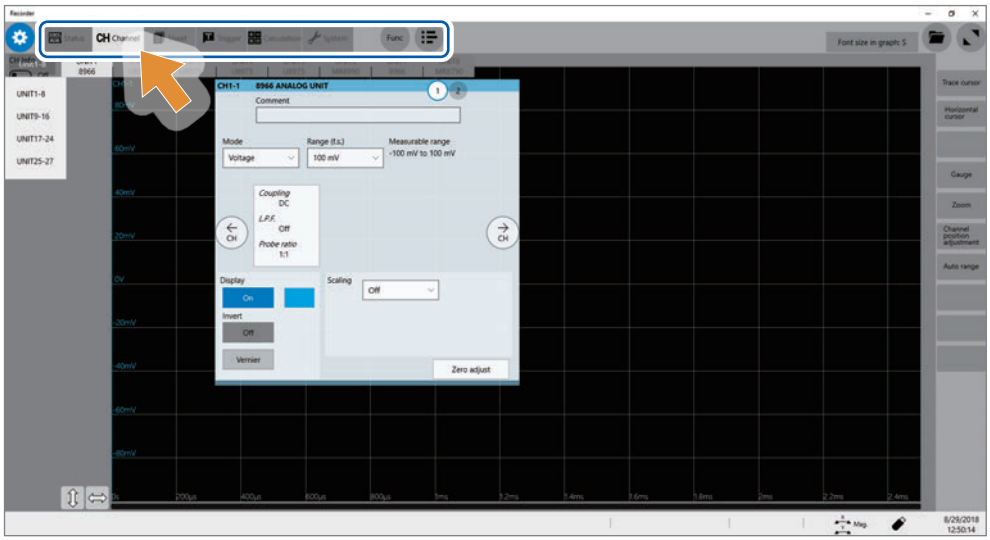
Click the button to switch between the waveform and setting screens.



Waveform screen **Setting screen**

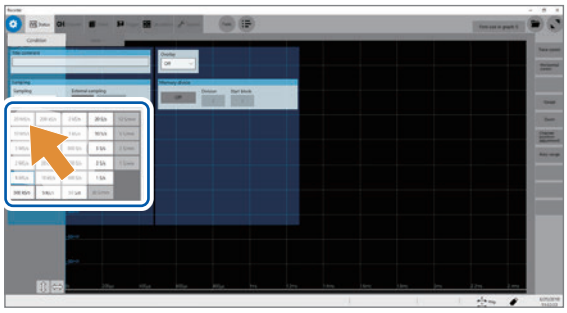
Switching the setting screens

Click a tab to switch the setting screens.



Choosing an option from a list

Example: Choosing a sampling rate

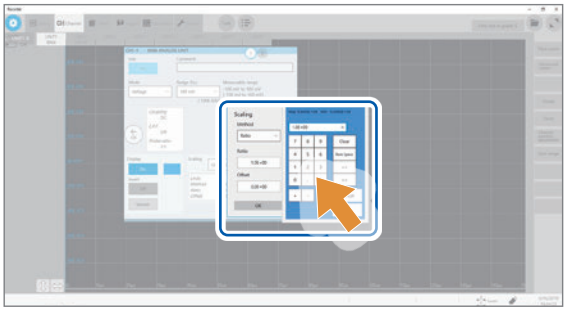


Example: Choosing a measurement range of Model 8966

Entering numerical values

Example: Entering a user-defined recording length

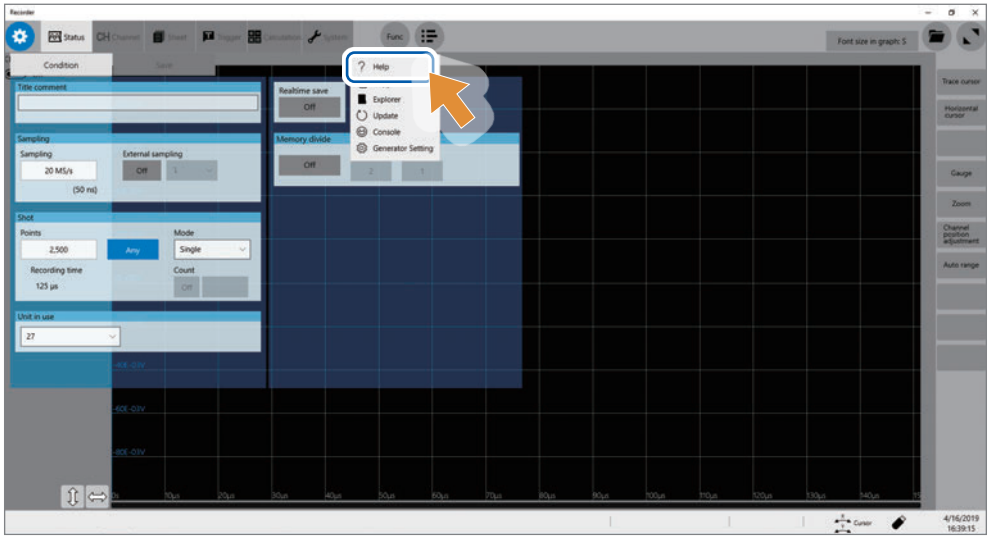
Example: Entering a scaling ratio



Help Function (Displaying Instruction Manual)

The HTML file of a selected manual appears.

> [Func] > [Help]



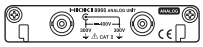
2 Preparing for Measurement

Carefully read “Operation Precautions” (p. 8) before starting preparation.

Keyboard, mouse

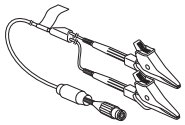
(p. 31)

Modules



(p. 36)

Connection cords

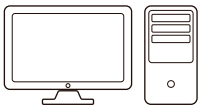


(p. 38)

External control terminals

(p. 57)

Computer



(p. 59, p. 88)

Storage devices

(p. 61)

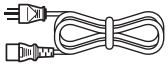
Zero-adjustment

(p. 67)

Setting the clock

(p. 66)

Power cord



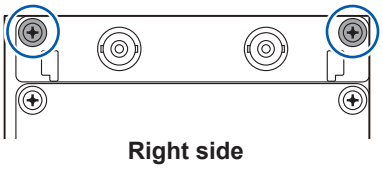
(p. 64)

2.1 Installing and Removing Modules

If you order the instrument with modules specified, the instrument will be delivered with the modules pre-installed. Follow the procedures below to install a module additionally, replace modules, or remove a module. Up to four modules of Model 8971 Current Unit and up to three modules of Model 8973 Logic Unit can be installed to the instrument.
Refer to “Handling the instrument and modules” (p. 10).

Required items: Phillips-head screwdriver (No. 2)

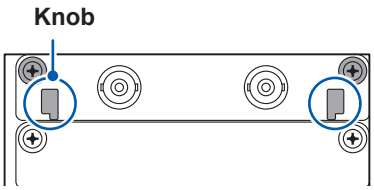
How to install a module



Right side

1. **Orient and insert the module all the way into the instrument.**
2. **Tighten the two screws with the Phillips-head screwdriver to secure the module.**

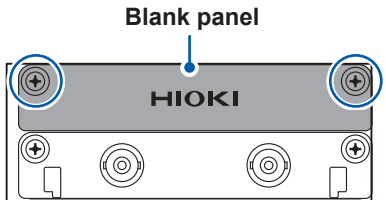
How to remove the module



1. **Loosen the two module mounting screws with the Phillips-head screwdriver.**
2. **Pinch the two knobs and pull out the module.**

When not installing any module after removal

Install a blank panel. To order additional blank panels, contact your authorized Hioki distributor or reseller.



1. **Place a blank panel.**
2. **Tighten the two screws with the Phillips screwdriver to secure the blank panel.**

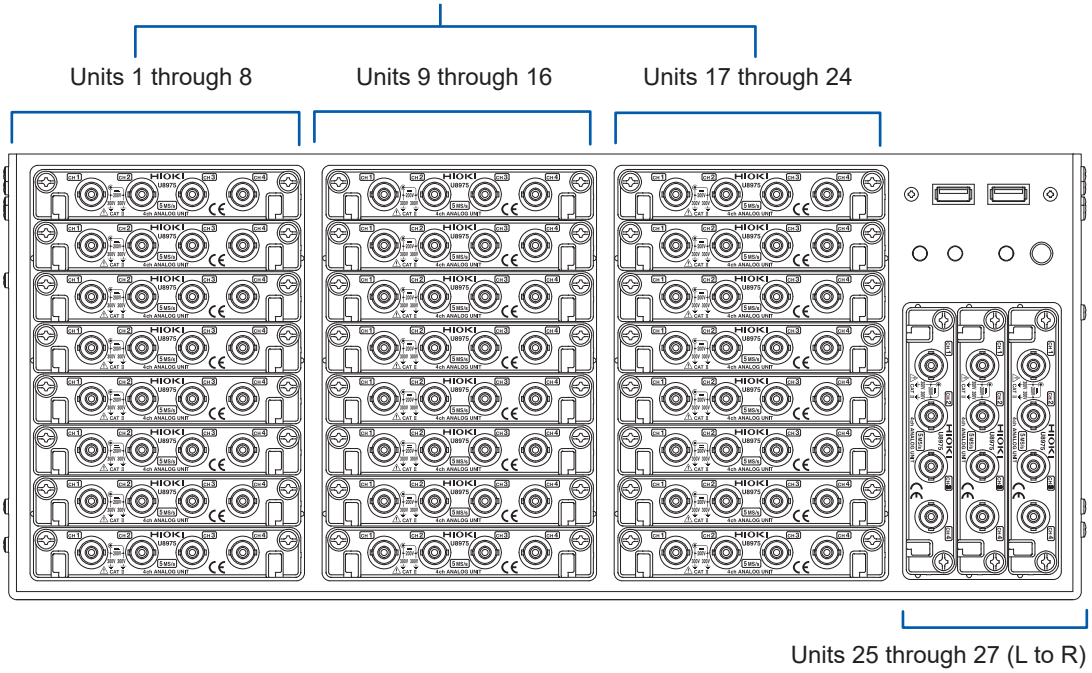
Allocation of modules and channels

Module numbers

Modules are numbered beginning at the top.

Channel numbers

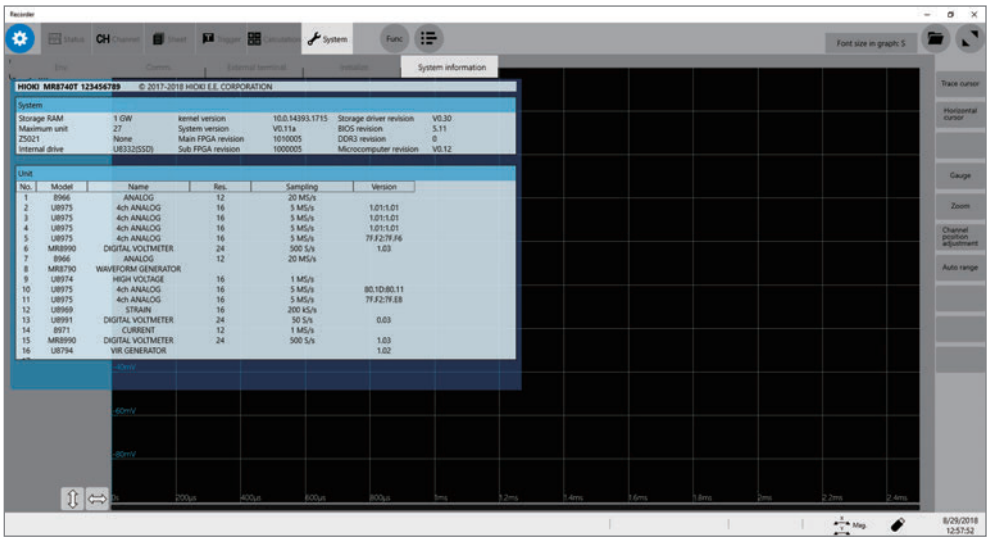
The channels are numbered beginning from the top left.



Model 8973 Logic Unit can be installed in slots to which Unit 25, 26, or 27 is assigned only.

You can find out information about the modules installed in the instrument in **[System information]**. Refer to “System configuration check” (p. 166).

> [System] > [System information]



2.2 Attaching Connection Cords

Refer to the manuals of the modules and connection cables if provided.

Measurement	Applicable module	Cable to be connected	Reference page
Voltage	Model 8966 Analog Unit Model 8968 High Resolution Unit Model 8972 DC/RMS Unit Model U8975 4ch Analog Unit Model U8978 4CH Analog Unit Model U8979 Charge Unit*	Model L9197 Connection Cord Model L9198 Connection Cord (For measuring low-voltage) Model L9217 Connection Cord Model L9790 Connection Cord Model 9665 10:1 Probe Model 9666 100:1 Probe Model 9322 Differential Probe Model P9000-01 Differential Probe Model P9000-02 Differential Probe Model 9166 Connection Cord* (For inputting voltage into Model U8979)	p. 18 p. 40
Frequency Rotation speed Count	Model 8970 Freq Unit		
Temperature	Model 8967 Temp Unit	Thermocouple	p. 42
Vibration Load Pressure Acceleration Torque Displacement	Model U8969 Strain Unit	Strain gauge transducer	p. 43
	Model U8979 Charge Unit	Acceleration sensor	p. 50
Current	Model 8971 Current Unit Model U8977 3CH Current Unit (Up to nine current sensors)	Current sensor	p. 45
Logic signal	Model 8973 Logic Unit (Up to 3 modules)	Model 9320-01 Logic Probe Model MR9321-01 Logic Probe Model 9327 Logic Probe	p. 52
Voltage (precision)	Model MR8990 Digital Voltmeter Unit	Model L2200 Test Lead	p. 52
	Model U8991 Digital Voltmeter Unit	Model L9197 Connection Cord Model L9198 Connection Cord (for measuring low-voltage) Model L9217 Connection Cord Model L9790 Connection Cord	p. 40
High voltage	Model U8974 High Voltage Unit	Model L4940 Connection Cable Set	p. 56

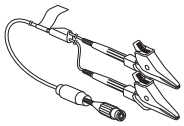
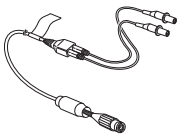
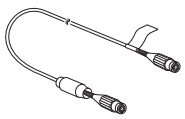
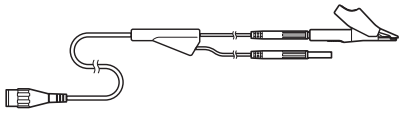
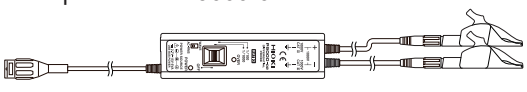
*: Model 9166 Connection Cord can be used for Model U8979 Charge Unit only.

Output	Applicable module	Cable to be connected	Reference page
Waveform	Model MR8790 Waveform Generator Unit Model U8793 Arbitrary Waveform Generator Unit	Model L9795-01 Connection Cable Model L9795-02 Connection Cable	p. 53
Pulse	Model MR8791 Pulse Generator Unit	Commercially available cable (Half-pitch 50 pins)	p. 54
DC voltage DC current Resistance (simulated)	Model U8794 VIR Generator Unit	Commercially available cable (D-sub 25 pins)	p. 55

Connection cables (For measuring voltage, frequency, or rotation speed, and obtaining accumulations)

Insert connection cords to modules. Choose an appropriate connection cord based on the maximum input voltage and tips of cables.
The maximum input voltage of the instrument or connection cord, whichever is lower, is applicable.
Refer to “Before connecting cords” (p. 17).

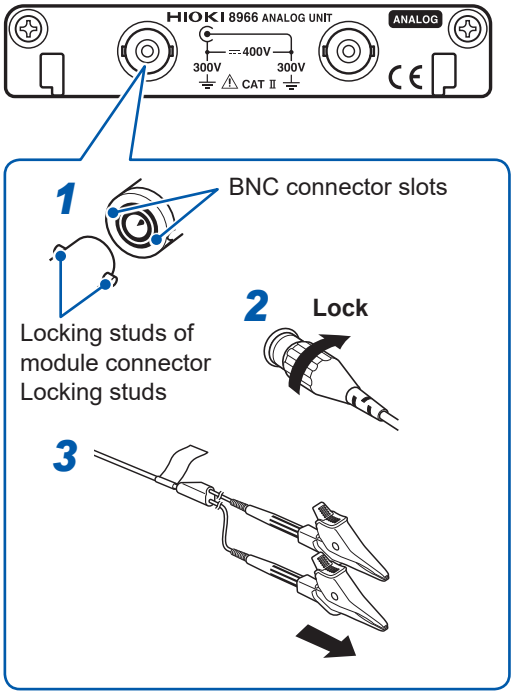
Required items: Connection cords

Connection cord	Maximum input voltage	Type
Model L9197 Connection Cord 	600 V	Large alligator clip
Model L9198 Connection Cord 	300 V	Small alligator clip
Model L9217 Connection Cord 	300 V	BNC output
Model L9790 Connection Cord Example: with the alligator clip attached. 	600 V	Alligator clip Grabber clip Contact pin
When the voltage to be measured exceeds the maximum input rating of the module being used (excluding Model U8991 Digital Voltmeter Unit) Model 9665 10:1 Probe*1 Model 9666 100:1 Probe*1 Model 9322 Differential Probe*2 Model P9000-01 Differential Probe*3 Model P9000-02 Differential Probe*3 Example: Model P9000-02 Differential Probe 		Alligator clip

*1: The maximum rated voltage to earth depends on a module to be used.
*2: An optional power cord or AC adapter is required.
*3: An optional AC adapter or a commercially available USB cable is required.

How to connect a cord

Example: Model 8966 Analog Unit



1 **Align the slots in the BNC connector of a connection cord with the locking studs of a BNC connector on the module, and insert the connector.**

2 **Turn the BNC connector of the connection cord clockwise until it locks.**

3 **Connect the connection cord clips to a measuring object.**

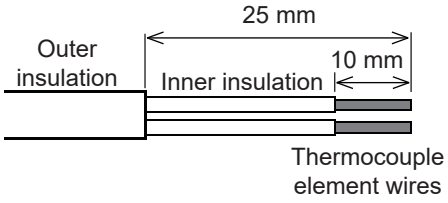
How to disconnect the cord

Turn the BNC male connector of the connection cable counterclockwise, and then pull out the connector.

Thermocouple (Temperature)

Connect thermocouples to Model 8967 Temp Unit.

Required items: Thermocouple and flat-blade screwdriver (2.6-mm-width blade)

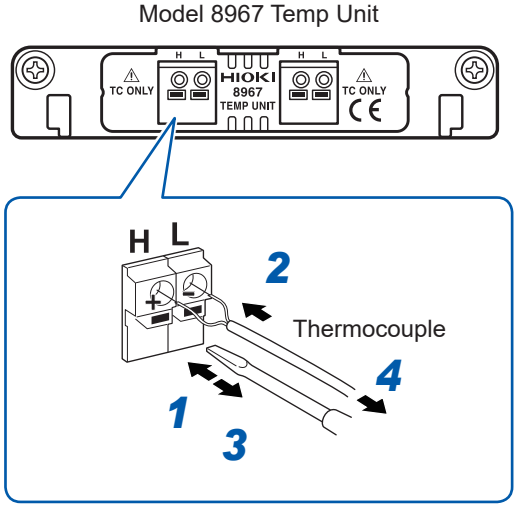


Recommended cable

Compatible wire: Thermocouple element wires with a diameter of 0.4 mm to 1.2 mm
Standard insulation stripping length: About 10 mm
Strip the insulation of the thermocouple wires as shown on the left.

How to connect the thermocouple

Model 8967 Temp Unit



1 **Depress a button on the terminal block on the module with the flat-blade screwdriver.**

2 **While depressing the button with the flat-blade screwdriver, insert each thermocouple wire into the appropriate terminal hole**

3 **Release the button.**

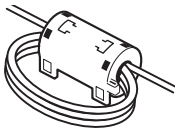
The thermocouple is connected.

4 **Attach the thermocouple on a measuring object.**

How to disconnect the thermocouple

While depressing the button, pull the thermocouple wire.

- If noise influences surrounding equipment, pass the thermocouple element wires through the center hole of the ferrite clamp-on choke (comes with Model 8967 Temp Unit) several times successively from the same end.
- If a thermocouple three meters long or longer is connected, the measurement may be influenced by the EMC environment that includes external noise.
- For K type and E type thermocouples, the physical phenomenon, short-range ordering can probably cause incorrect temperature measurement in the range of 250°C to 600°C. Contact a thermocouple manufacturer to choose proper thermocouples.



Strain gauge transducer

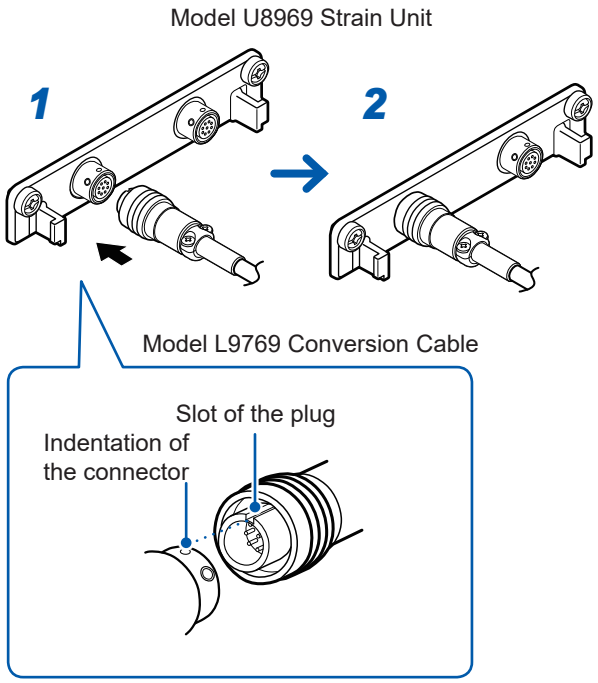
Connect a strain gauge transducer*1 to Model U8969 Strain Unit via Model L9769 Conversion Cable*2.
*1: Hioki does not offer any strain gauge transducers.
*2: Model L9769 Conversion Cable is an accessory of Model U8969 Strain Unit.

⚠ CAUTION

To prevent damage due to in a break in a conversion cable, do not excessively bend, pull, or twist the cables and joints between the cables and connectors.

Required items: Strain gauge transducer and Model L9769 Conversion Cable

How to connect the transducer



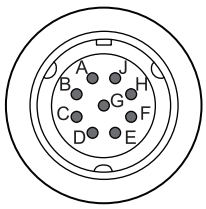
1. **Align the plug slot of Model L9769 with the outward indentation of Model U8969, and then insert the plug into the connector on Model U8969.**
2. **Insert the plug until it locks.**
3. **Connect Model L9769 to the strain gauge transducer.**
4. **Connect the strain gauge transducer to a measuring object.**

How to disconnect the conversion cable

Gently pull the collar of the plug, which releases the lock, and disconnect the cable.

Connector pin-out

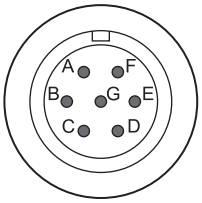
Model U8969 Strain Unit



The metal shell is connected to the GND terminal of the instrument.

Pin mark	Description
A	BRIDGE+
B	INPUT−
C	BRIDGE−
D	INPUT+
E	FLOATING COMMON
F	SENSE+
G	SENSE−
H	N.C.
J	N.C.

Model L9769 Conversion Cable
(Strain gauge converter)



Applied voltage:
A bridge voltage of 2 V

The metal shell is connected to the GND terminal of the instrument.

Pin mark	Description
A	BRIDGE+, SENSE+
B	INPUT−
C	BRIDGE−, SENSE−
D	INPUT+
E	FLOATING COMMON
F	N.C.
G	N.C.

Model L9769 connection

- Pin F of the conversion cable (module end) is connected to pin A of the conversion cable (transducer end).
- Pin G of the conversion cable (module end) is connected with pin C of the conversion cable (transducer end).

IMPORTANT

- A bridge box is required to measure strain using a strain gauge. Use a commercially available strain gauge and a bridge box.
- Some bridge boxes may be susceptible to noise. In that case, grounding the bridge box allows the box to be less susceptible to noise. For information on how to ground the bridge box, refer to the manual of your bridge box or contact its manufacturer.

You can use your Model 8969 Strain Unit with the instrument. The instrument with Model 8969 Strain Unit installed refers to Model 8969 as **[U8969]** on the display.

Current sensor

Familiarize yourself with “Operation Precautions” (p. 8) before connecting a current sensor. Refer to the instruction manual that comes with each current sensor for details on specifications and directions for use.

⚠ CAUTION

Do not connect and remove a current sensor while the instrument remains on. Doing so will cause damage to the current sensor.

Up to nine sensors can connect to Model 8971 Current Unit and Model U8977 3CH Current Unit all together.

Current sensors that can be connected to current modules

The following current sensors can be connected to the Model U8977 3CH Current Unit and Model 8971 Current Unit. Use of conversion cables may be required depending on sensors and modules.

✓: Directly connectible

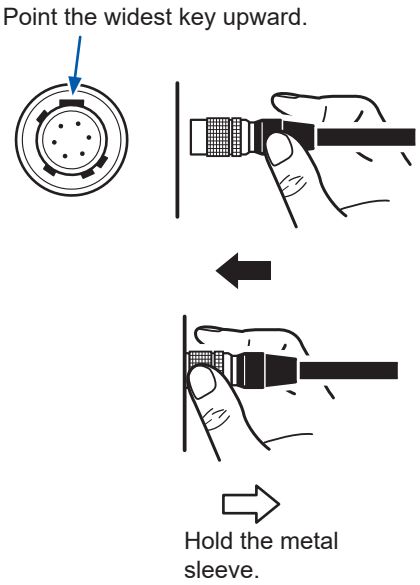
Model number	Model name	Maximum input current / Frequency	Conversion cable for U8977	Conversion cable for 8971	Connector*1
9709	AC/DC Current Sensor	500 A DC to 100 kHz	CT9900	9318	Plastic
9709-05			✓	CT9900 + 9318	Metal
9272-05	Clamp on Sensor	20 A / 200 A 1 Hz to 100 kHz	✓	CT9900 + 9318	Metal
9272-10			CT9900	9318	Plastic
CT6830	AC/DC Current Probe	2 A DC to 100 kHz	✓	Cannot connect	Metal
CT6831		20 A DC to 100 kHz			
CT6833 CT6833-01	AC/DC Current Probe	200 A DC to 50 kHz	✓	CT9901 + 9318	Metal
CT6834 CT6834-01	AC/DC Current Probe	500 A DC to 50 kHz	✓	CT9901 + 9318	Metal
CT6841	AC/DC Current Probe	20 A DC to 1 MHz	CT9900	9318	Plastic
CT6841-05 CT6841A			✓	CT9900 + 9318	Metal
CT6843	AC/DC Current Probe	200 A DC to 500 kHz	CT9900	9318	Plastic
CT6843-05 CT6843A			✓	CT9900 + 9318	Metal
CT6844	AC/DC Current Probe	500 A DC to 200 kHz	CT9900	9318	Plastic
CT6844-05 CT6844A			✓	CT9900 + 9318	Metal
CT6845	AC/DC Current Probe	500 A DC to 100 kHz	CT9900	9318	Plastic
CT6845-05 CT6845A			✓	CT9900 + 9318	Metal
CT6846	AC/DC Current Probe	1000 A DC to 20 kHz	CT9900	9318	Plastic
CT6846-05 CT6846A			✓	CT9900 + 9318	Metal
CT6862	AC/DC Current Sensor	50 A DC to 1 MHz	CT9900	9318	Plastic
CT6862-05			✓	CT9900 + 9318	Metal
CT6863	AC/DC Current Sensor	200 A DC to 500 kHz	CT9900	9318	Plastic
CT6863-05			✓	CT9900 + 9318	Metal
CT6865	AC/DC Current Sensor	1000 A DC to 20 kHz	CT9900	9318	Plastic
CT6865-05			✓	CT9900 + 9318	Metal

Model number	Model name	Maximum input current / Frequency	Conversion cable for U8977	Conversion cable for 8971	Connector*1
CT6875 CT6875A CT6875A-1	AC/DC Current Sensor	500 A DC to 2 MHz	✓	CT9900 + 9318	Metal
CT6876 CT6876A CT6876A-1	AC/DC Current Sensor	1000 A DC to 1.5 MHz	✓	CT9900 + 9318	Metal
CT6877 CT6877A CT6877A-1	AC/DC Current Sensor	2000 A DC to 1 MHz	✓	Cannot connect	Metal
CT6872 CT6872-01	AC/DC Current Sensor	50 A DC to 10 MHz	✓	CT9901 + 9318	Metal
CT6873 CT6873-01	AC/DC Current Sensor	200 A DC to 10 MHz	✓	CT9901 + 9318	Metal
CT6904A	AC/DC Current Sensor	500 A DC to 4 MHz	✓	CT9901 + 9318	Metal
CT6904A-1	AC/DC Current Sensor	500 A DC to 2 MHz	✓	CT9901 + 9318	Metal
CT6904A-2	AC/DC Current Sensor	800 A DC to 4 MHz	✓	CT9901 + 9318	Metal
CT6904A-3	AC/DC Current Sensor	800 A DC to 2 MHz	✓	CT9901 + 9318	Metal

*1: Metal connector (ME15W), plastic connector (PL23)

Connecting a current sensor with Model U8977 3CH Current Unit

You can directly connect a current sensor which has a metal connector (ME15W).



1 **Align the connector guides of the cable with those of the module connector.**

2 **Straightly insert the connector until it locks.**

Hold the part other than metal to insert the connector.

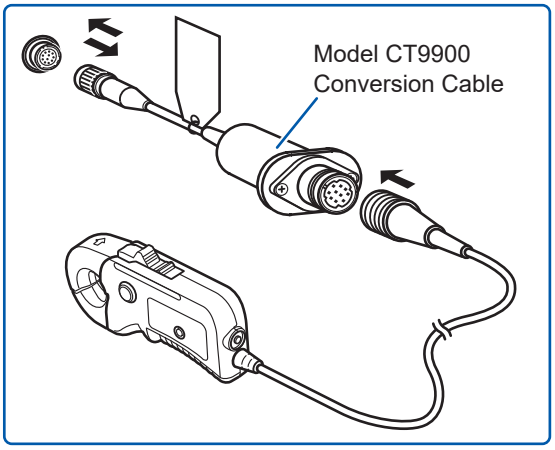
The instrument automatically recognizes the model of the current sensor.

How to disconnect the current sensor

1 **Hold and pull the metal collar, which releases the lock.**

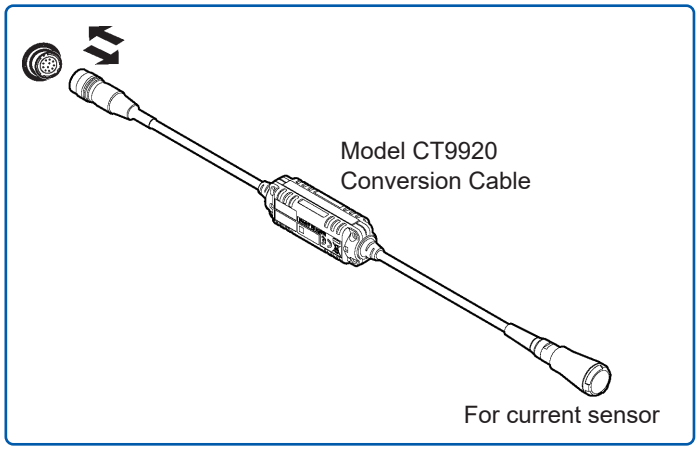
2 **Pull the connector.**

You can connect a current sensor which has a black plastic connector (PL23) to Model U8977 3CH Current Unit using optional Model CT9900 Conversion Cable.



When Model CT9900 Conversion Cable is used, the instrument recognizes Model CT6846 or CT6865 (1000 A rating) as a 500-A AC/DC sensor. Set the conversion ratio to 2.00.

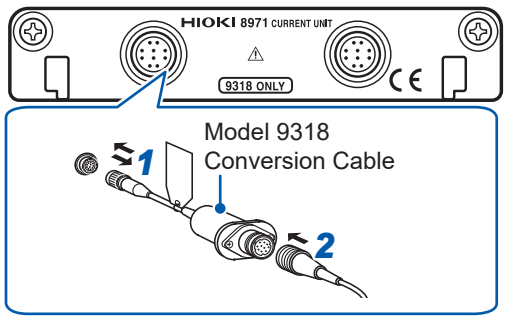
By using Model CT9920 Conversion Cable (optional), you can connect a current sensor of Model CT7000 series with Model U8977 3CH Current Unit. The instrument cannot recognize any sensor with Model CT9920 connected.
Select a mode in the setting screen.
Supported models Model CT7631, Model CT7636, Model CT7642, Model CT7731, Model CT7736, Model CT7742, Model CT7044, Model CT7045,
Model CT7046



Connecting a current sensor with Model 8971 Current Unit

You can connect Model 8971 Current Unit to a current sensor which has a black plastic connector using Model 9318* Conversion Cable.
You can connect a current sensor with metallic connector to Model 8971 Current Unit using both Conversion Cables Model 9318* and Model CT9901.
*: Model 9318 Conversion Cable is an accessory of Model 8971 Current Unit.

Model 8971 Current Unit



1 **Align the guides of the conversion cable with those of the sensor connector on the module, and straightly insert the plug until it locks.**

2 **Align the guides of the current sensor to be used with those of the conversion cable connector, and straightly insert the plug until it locks.**

The instrument automatically recognizes the model of the current sensor.

3 **Clamp the current sensor around a line of a measuring object.**

How to connect the cable and a sensor

1 **Hold and pull the plastic collar of the conversion cable, which releases the lock, and the remove the connector.**

2 **Hold and pull the plastic collar of the current sensor, which releases the lock, and the remove the connector.**

When measuring currents with a voltage module

Using Model 9018-50 Clamp on Probe, you can measure a current using a voltage measurement module such as Model 8966 Analog Unit.
Configuring the scaling settings allows measured waveforms to be displayed as current values. For the setup procedure, refer to “Converting Input Values (Scaling Function)” of the Instruction Manual.

Acceleration sensor

Connect a acceleration sensor* to Model U8979 Charge Unit
Familiarize yourself with “Operation Precautions” (p. 8) before connecting a current sensor.

*: Hioki does not offer any acceleration sensors.

Acceleration sensor connectable with Model U8979

⚠CAUTION

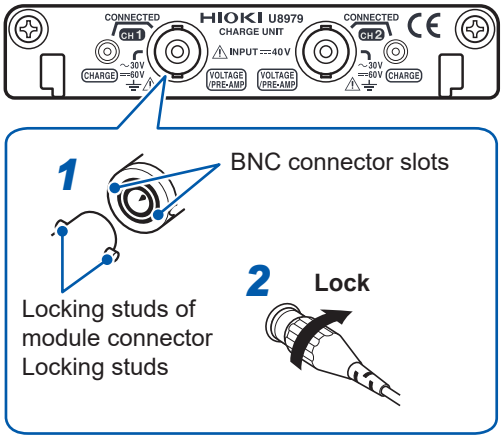
Use an acceleration sensor with a built-in pre-amplifier that conforms to the specification of Model U8979 Charge Unit. Using an inapplicable sensor may cause damaging itself.

Acceleration sensor type	Terminal the sensor is connected to	Note
With a built-in pre-amplifier	BNC connector	Drive power: 3.0 mA, 22 V
Charge output	Miniature connector (#10-32)	–

Connecting an acceleration sensor with a built-in pre-amplifier

Connecting a BNC-output acceleration sensor with a built-in pre-amplifier

U8979 Charge Unit



1 **Align the slots in the BNC connector of an acceleration sensor with the locking studs of a BNC connector on the module, and insert the connector.**

2 **Turn the BNC connector of the acceleration sensor clockwise until it locks.**

3 **Attach the acceleration sensor with the built-in pre-amplifier to a measuring object.**

How to connect the cable and a sensor

Turn the BNC connector of the acceleration sensor counter-clockwise to release the lock and remove the connector.

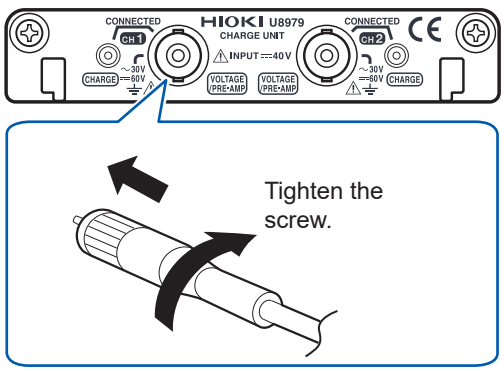
Connecting an acceleration sensor other than a sensor with a built-in pre-amplifier

Convert the output connector into the BNC connector using a commercially available conversion connector or conversion cable to connect the sensor.

Connecting a charge-output acceleration sensor

Connecting a charge-output acceleration sensor equipped with the miniature connector (#10-32)

Model U8979 Charge Unit



1 **Align the screw of the miniature connector, and turn the connector clockwise to tighten it.**

2 **Attach the charge-output acceleration sensor to a measuring object.**

How to disconnect the current sensor

Turn the miniature connector counterclockwise, and then pull out the connector.

Connecting an charge-output acceleration sensor equipped with a connector other than a miniature connector (#10-32)

Convert the output connector into the miniature connector (#10-32) using a commercially available conversion connector or conversion cable to connect the sensor.

Logic probe (Measuring logic signals)

Connect logic probes to Model 8973 Logic Unit.

Refer to “Before connecting a logic probe to a measuring object” (p. 18).

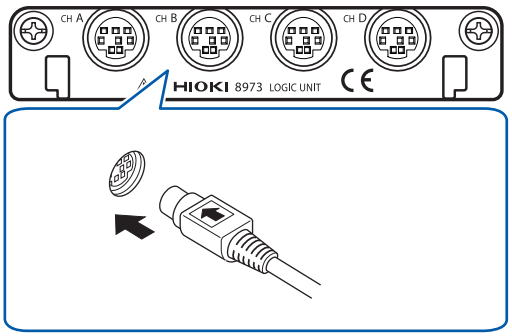
Refer to an instruction manual of each logic probe.

Required item: Logic probe (Model 9320-01, Model MR9321-01, or Model 9327)

How to connect a logic probe

Example: Connecting Model 9327 Logic Probe

Model 8973 Logic Unit



1 **Align the plug slots of the logic probe with a logic terminal, and insert the logic-probe plug.**

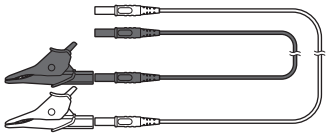
2 **Connect the logic probe to a measuring object.**

> Only slots to which UNIT 25, UNIT 26, or UNIT 27 is assigned are available.

Connection cable (For precisely measuring voltage)

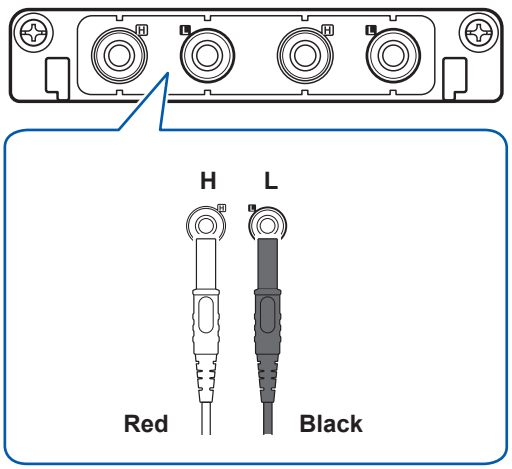
Connect Model L2200 Test Lead to a module.

Required item: Model L2200 Test Lead (maximum input voltage: 1000 V)



How to connect a logic probe

Model MR8990 Digital Voltmeter Unit



1 **Connect the test leads to the banana jacks on the module.**

Connect the black lead to the L jack; and the red lead to the H jack. Make sure the test leads are fully inserted into the jacks.

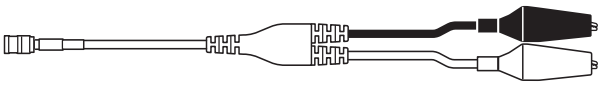
2 **Connect the test leads to a measuring object.**

Outputting waveforms

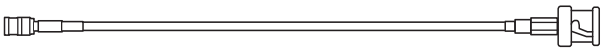
Connect the connection cable to an SMB terminal of Model MR8790 or Model U8793.

Required item: Model L9795-01/L9795-02 Connection Cable

• Model L9795-01 Connection Cable (mini-alligator clip type)

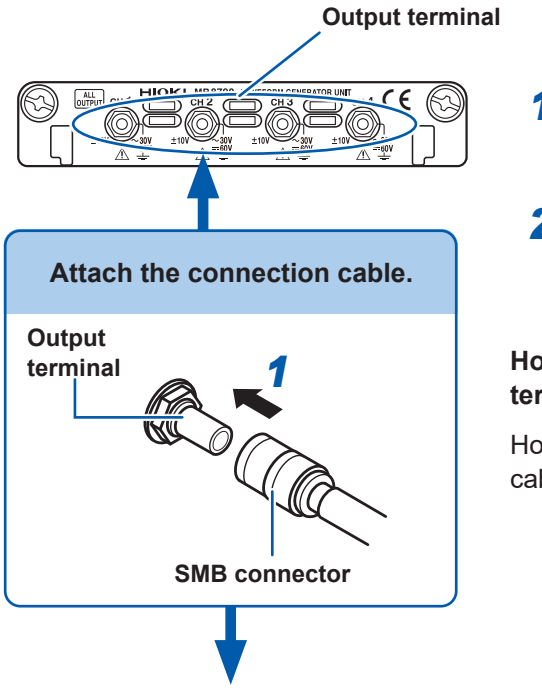


• Model L9795-02 Connection Cable (BNC output type)



How to connect the cable to an output terminal

Example: Model MR8790 Waveform Generator Unit



1 **Insert the SMB connector of the connection cable to an output terminal until the connector clicks.**

2 **Attach the clips of the connection cable to a target.**

How to disconnect the cable from the output terminal

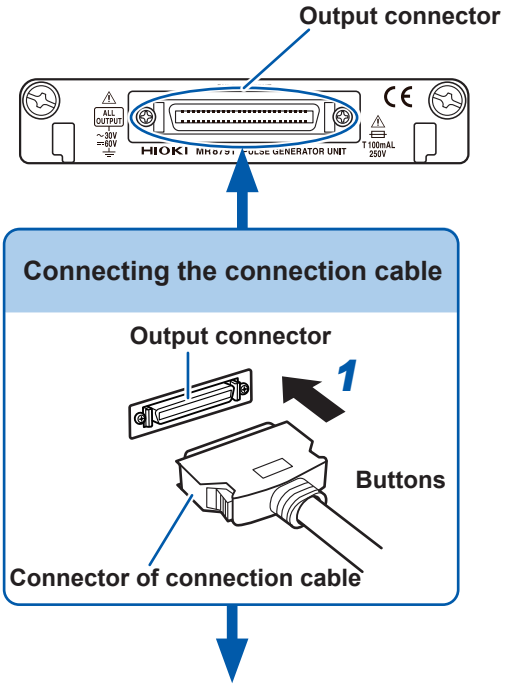
Hold the head of the SMB connector (other than the cable) and pull it out.

Outputting pulse waveforms

Connect the connection cable to Model MR8791 Pulse Generator Unit.

Required item: Commercially available cable (Half-pitch 50 pins)

How to connect the cable to the output connector



1 **Attach the connector of the connection cable to an output connector of the module.**

2 **Attach the connection cable to a target.**

How to disconnect the cable from the output terminal

While holding down the buttons, pull our the connector.

Output connector

10250-52A2PL: 3M (SCSI-2 connector, Centronics half-pitch, 50 pins, female)
Refer to “Model MR8791 Pulse Generator Unit” (p. 138).

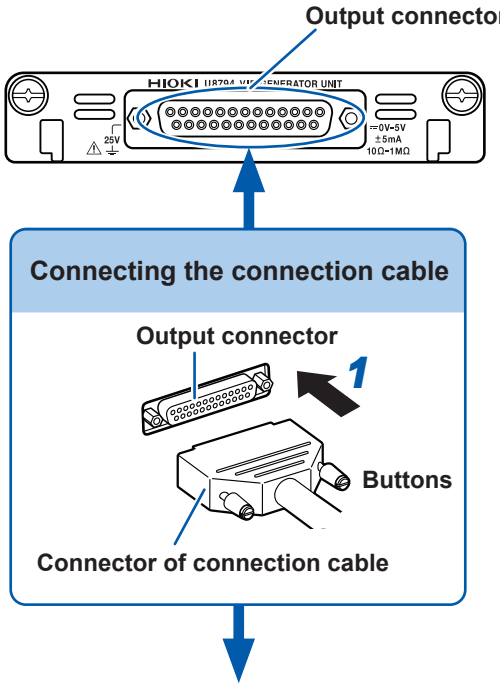
- The metal shell of the 10250-52A2PL connector is equipotential to the chassis ground (frame ground).
- Use a lock-type connector to attach a harness to the connector of the module.

Outputting voltage, current, and resistance

Attach the connection cable to Model U8794 VIR Generator Unit.

Required item: commercially available cable (D-sub 25 pins)

How to connect the cable to the output connector



1 **Attach the connector of the connection cable to the output connector of the module and tighten the screws.**

2 **Attach the connection cable to a target.**

How to disconnect the cable from the output terminal

Loosen the screws of the output terminals.

Output connector

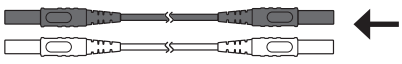
09663527617, Harting (D-sub 25 pins, female)
Refer to “Specifications of the output connector” (p. 140).

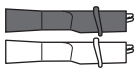
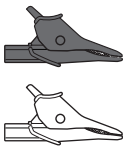
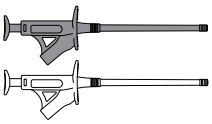
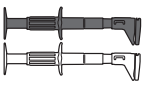
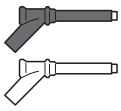
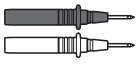
The metal shell of the 09663527617 connector is equipotential to the chassis ground (frame ground).

Connection cable (high voltage)

Connect Model L4940 Connection Cable Set to Model U8974 High Voltage Unit. Choose appropriate connection cord tips based on the maximum input voltage and terminal type.

Required item: Model L4940 Connection Cable Set

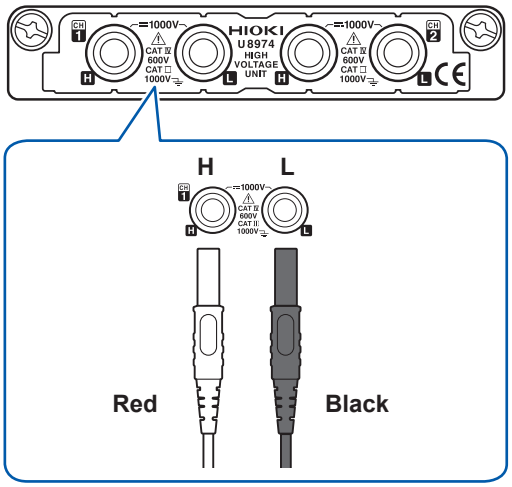


	**Model L4934* Small Alligator Clip Set**	CAT III 300 V CAT II 600 V
	**Model L4935 Alligator Clip Set**	CAT III 1000 V CAT IV 600 V
	**Model L9243 Grabber Clip**	CAT II 1000 V
	**Model L4936 Bus Bar Clip Set**	CAT III 600 V
	**Model L4937 Magnetic Adapter Set**	CAT III 1000 V
	**Model L4932 Test Pin Set**	CAT II 1000 V CAT III 1000 V CAT IV 600 V

* Using Model L4934 requires Model L4932.

How to connect the thermocouple

Model U8974 High Voltage Unit



1 **Connect the plugs of the connection cord to the banana jacks on the module.**

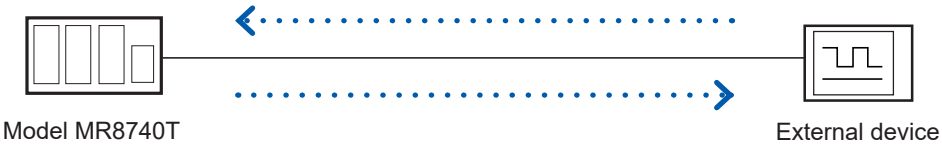
Connect the plugs to the banana jacks of their respective colors.

2 **Insert the accessory clips into the clip ends of the connection cord.**

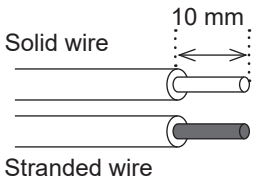
3 **Connect the connection cord clips to a measuring object.**

2.3 Connecting the External Control Terminals

This section describes the procedure and the external control terminal function to externally control the instrument. Connecting the external control terminals with external devices allows the instrument to start and stop measurement.
The term “external control terminals” is used to refer to all of these terminals collectively.
Refer to “Before connecting the instrument to external equipment” (p. 20).

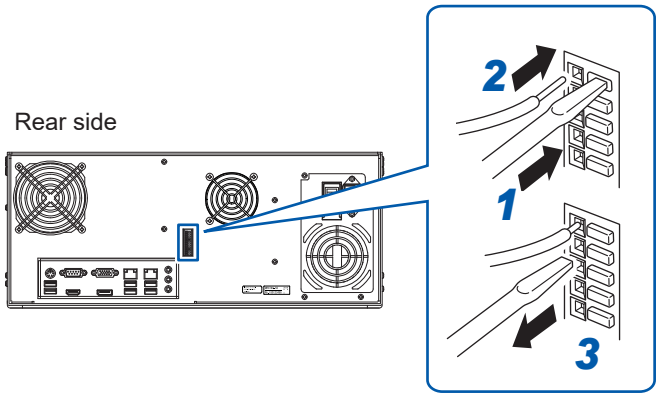


Wires to be connected



Recommended wire	Solid wire: 0.65 mm in diameter (AWG22) Stranded wire: 0.32 mm^2 (AWG22)
Acceptable wire	Solid wire: 0.32 mm to 0.65 mm in diameter (AWG28 to AWG22) Stranded wire: 0.08 mm^2 to 0.32 mm^2 (AWG28 to AWG22) Strand diameter: 0.12 mm or more (per wire)
Stripped length	9 mm to 10 mm
Button pressing tool	Flat-blade screwdriver (shaft diameter: 3 mm, tip width: 2.6 mm)

How to connect wires



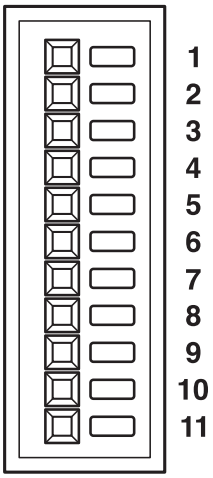
1 **Depress the terminal button using a tool, such as a flat-blade screwdriver.**

2 **Insert the wire into the wire connection hole while depressing the button.**

3 **Release the button.**
The wire is locked.

The external control terminal shares the ground with the chassis.

Terminal block

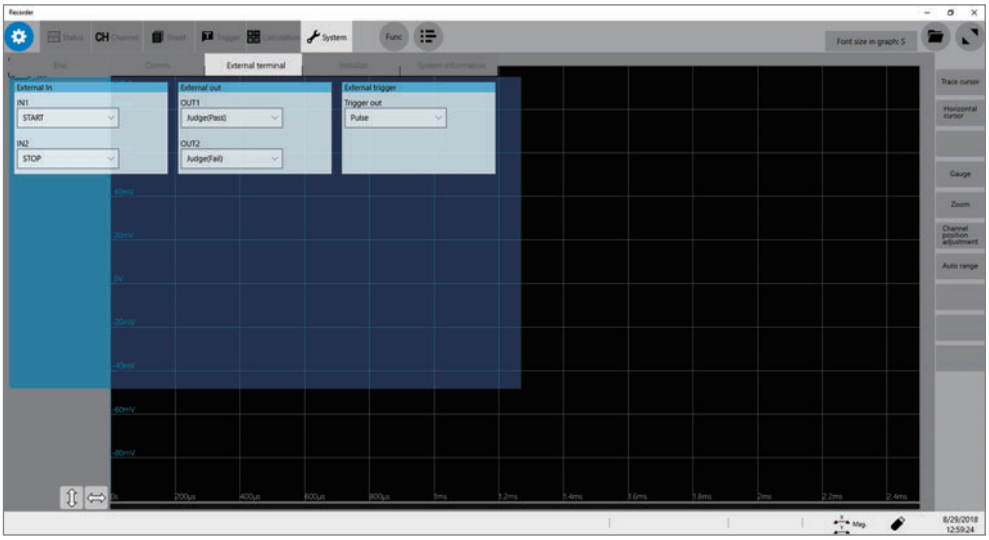


No.	Pin name	Operation
1	GND	Ground (shared with the chassis)
2	IN1	Starts/stops measurement, saves data files, aborts measurement, enters events
3	IN2	
4	GND	Ground (shared with the chassis)
5	OUT1	Outputs signals indicating judgments and status (error, busy, waiting for a trigger)
6	OUT2	
7	GND	Ground (shared with the chassis)
8	EXT.TRIG	The instrument is triggered when an external signal is inputted as a trigger source.
9	TRIG.OUT	Outputs a signal when the instrument is triggered.
10	GND	Ground (shared with the chassis)
11	EXT.SMPL	Input a external sampling signal.

How to configure the external control terminal settings

On the **[External terminal]** screen, you can configure the following terminal: the external input (IN1, IN2), external output (OUT1, OUT2), and trigger output (TRIG.OUT). Use the **[Trigger]** screen to configure the external trigger (EXT.TRIG) setting.

> [System] > [External terminal]



2.4 Connecting the Instrument with computers

Connecting the instruments with computers via a LAN cable allows computers to control and monitor the instrument. Connect LAN cables to the 1000BASE-T connector of computers and instrument.

⚠ CAUTION

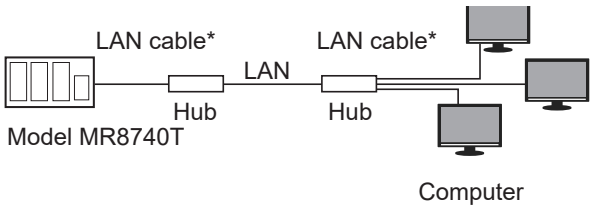
When connecting the instrument to your LAN using a LAN cable of more than 30 m or with a cable laid outdoors, take appropriate countermeasures that include installing a surge protector for LANs. Such signal wiring is susceptible to induced lighting, which can cause damage to the instrument.

The procedures for connecting the cables (2 ways) are as follows.

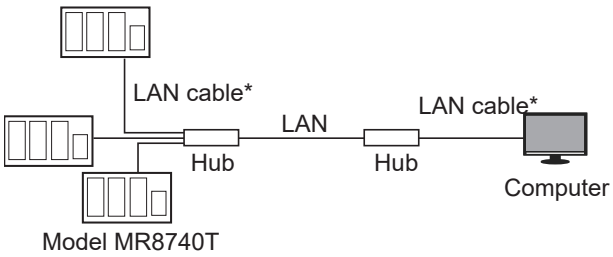
(1) Connecting the instrument to the existing network

Connecting the instruments with a hub via LAN cables allows computers to control and monitor the instruments.

Connecting one instrument to multiple PCs



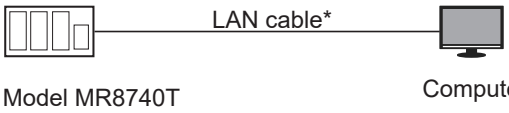
Connecting multiple instruments to one computer



*: Use one of the following cables:
- 1000BASE-T straight-through cable (commercially available)
- Model 9642 LAN Cable (optional)

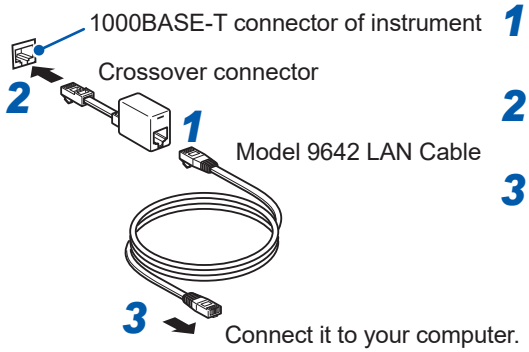
(2) One-to-one connection of the instrument and a computer

Connecting the instruments with computers via a LAN cable allows computers to control and monitor the instrument.



*: Use one of the following cables:
- 1000BASE-T compatible crossover cable
- 1000BASE-T straight-through cable and crossover connector
- Model 9642 LAN Cable (optional, coming with crossover connector)

When connecting the instrument and the computer using Model 9642 LAN Cable and the accompanying crossover connector



1 **Connect Model 9642 LAN Cable to the accompanying crossover connector.**

2 **Connect the crossover connector to the 1000BASE-T connector of the instrument.**

3 **Connect Model 9642 LAN Cable to the 1000BASE-T connector of your computer.**

2.5 Preparing Storage Devices (Recording Media)

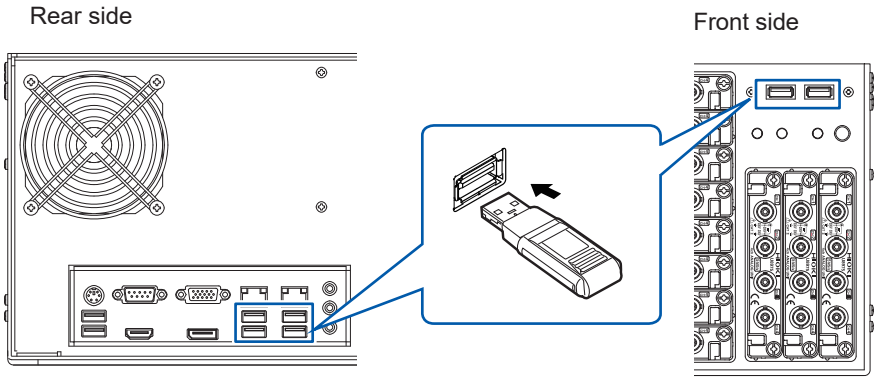
The storage device that can be used with the instrument are USB flash drives and a built-in drive.
Refer to “Handling storage devices” (p. 15).

USB flash drive

The instrument supports not all commercially available USB flash drives. You have to configure the USB flash drive setting on the instrument to use USB flash drives.
Refer to “Formatting storage devices” (p. 63).

How to insert a USB flash drive

Align the USB flash drive with the connector, and fully insert it.



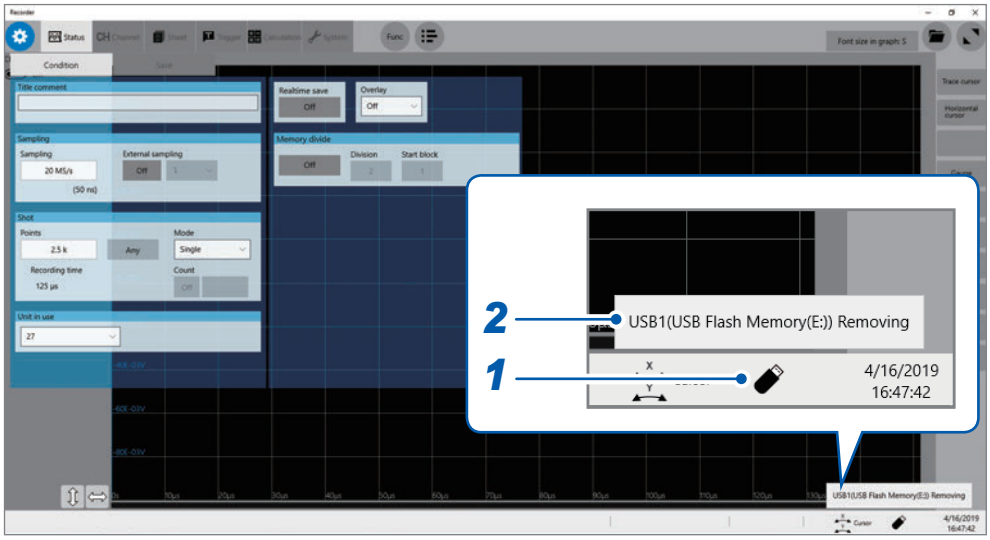
Built-in drive

The built-in drive is factory-formatted.
Built-in SSD (capacity: 480 GB*)
*: Once the SSD has been formatted, the actually available capacity decreases.

You cannot remove the built-in drive.

Removing storage devices

Take the following procedure to remove the USB flash drive.



1 **Click the remove button.**

2 **Click a storage device to be removed.**

3 **Remove the storage device according to the message.**

This device can be removed.	Remove the storage device.
This device cannot be removed.	Check whether the storage device is being accessed.

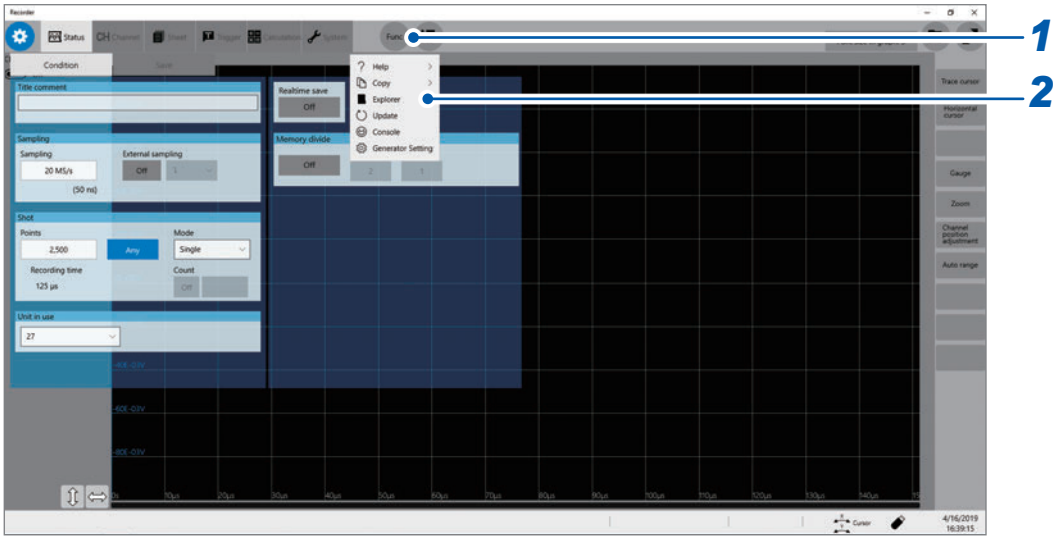
Be sure to use the remove button to remove any storage device. Do not use Windows® Explorer or an icon on the Windows® taskbar to remove the storage device.

Formatting storage devices

The instrument can format USB flash drives and the built-in drive. Once they are formatted, the “HIOKI_MR8740T” folder is created.

IMPORTANT
Note that formatting a storage device deletes all the information stored on the storage device and information deleted cannot be recovered.

> [Func] > [Explorer]



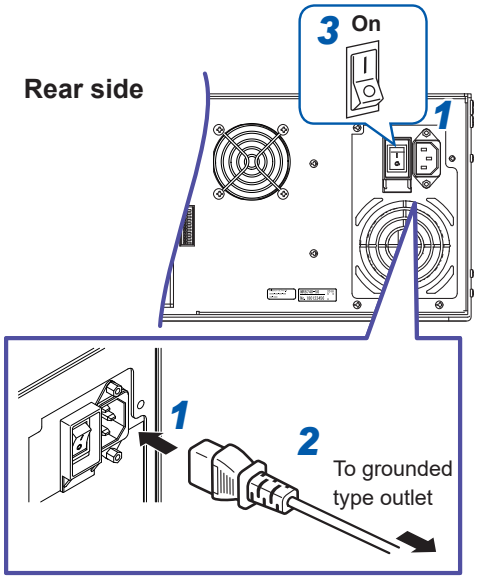
1. **Click [Func].**
2. **Choose [Explorer].**

   Explorer appears.
3. **Right-click a storage device to be formatted.**
4. **Click [Format] on the shortcut menu.**

2.6 Supplying Power to the Instrument

Refer to “Before turning on the instrument” (p. 19).

Turning on the instrument



1 **Connect the power cord to the power inlet on the instrument.**

2 **Connect the plug to a grounded type outlet.**

3 **Set the main power switch on the back side of the instrument to on.**

The POWER orange LED lights up.

4 **Press the start button to turn on the instrument.**

The splash screen appears followed by the waveform screen.

5 **Warm up the instrument for about 30 minutes.**

This warm-up stabilizes the temperature in the modules, yielding accurate measurement.

6 **Execute zero-adjustment.**

Refer to “2 Regulating the Zero Position (Zero-Adjustment)” (p. 67).

7 **Start a measurement.**

Refer to “3.5 Starting/Stopping Measurement” (p. 79).

Turning off the instrument

IMPORTANT
When the instrument is turned off, data recorded in the internal memory is deleted. To retain the recorded data, save the data to an external storage device before turning off the instrument.
Refer to “3.6 Saving Data Consisting of Items Selected” (p. 80).

1 **Save the acquired data if needed.**

2 **Press the start button.**

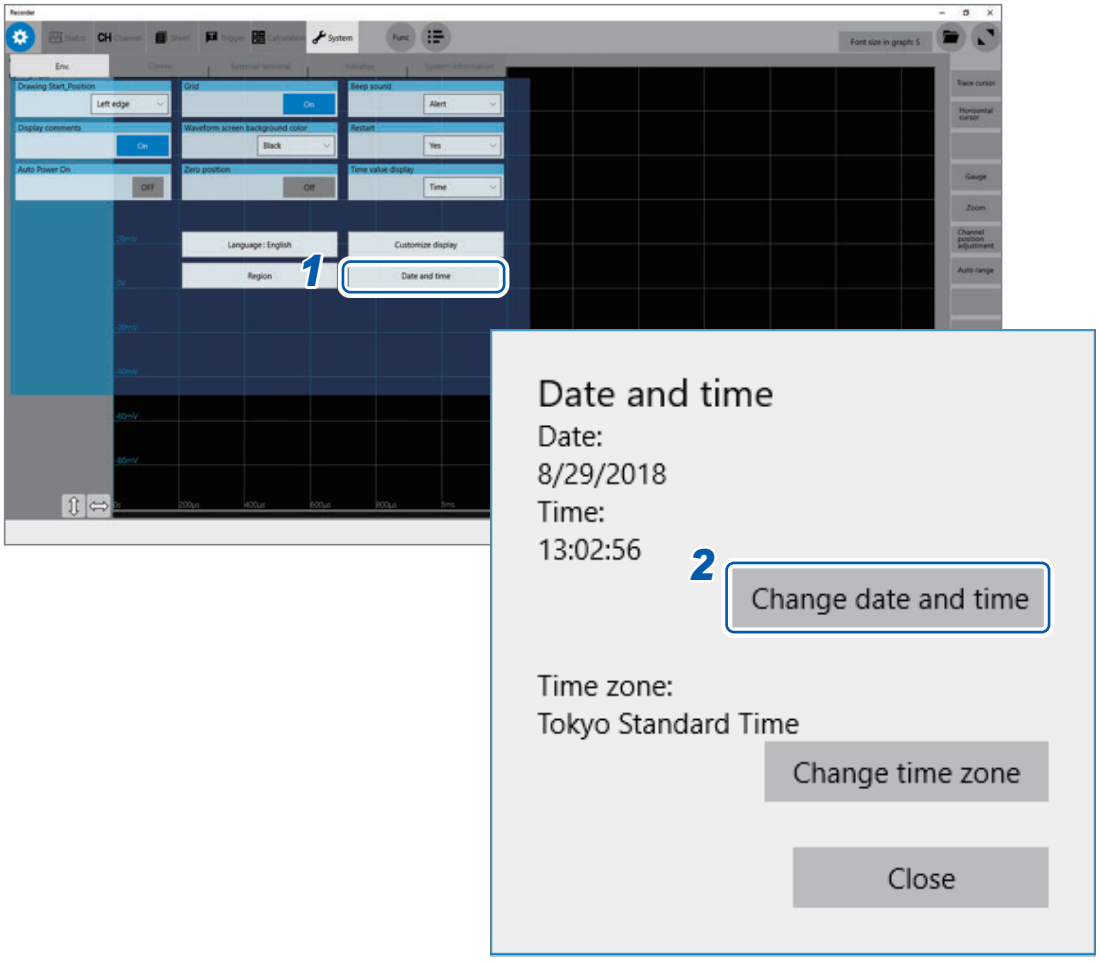
Click **[OK]** to turn off the instrument according to the message.
Alternatively, pressing the start button again turns off the instrument. After the instrument has been turned on again, the settings configured before the instrument was turned off are loaded.
Confirm that the instrument is turned off before setting the main power switch to off.

IMPORTANT
Do not set the main power switch on the rear to off while Windows® is running. Doing so may cause the instrument to start properly.

2.7 Setting the Clock

Set the date, time, and time zone. The instrument has the automatic calendar with leap year correction and 24-hour clock.
Measurement start times (trigger times) and times when files were stored are recorded using the absolute time set in the instrument. Make sure that the clock shows correct day and time before using the instrument.

> [System] > [Env.]



1 **Click [Date and time].**
The [Date and time] dialog box will appear.

2 **Click [Change date and time].**

3 **Set the date and time and then click [OK].**

IMPORTANT
Do not change any Windows® setting unless otherwise indicated in this document.
Doing so may cause unstable behavior of the system.

The instrument regulates the clock internally. Always select **> [System] > [Env.]**, and then click **[Date and time]** to set the clock. In any another way, the clock could not be set.

2.8 Regulating the Zero Position (Zero-Adjustment)

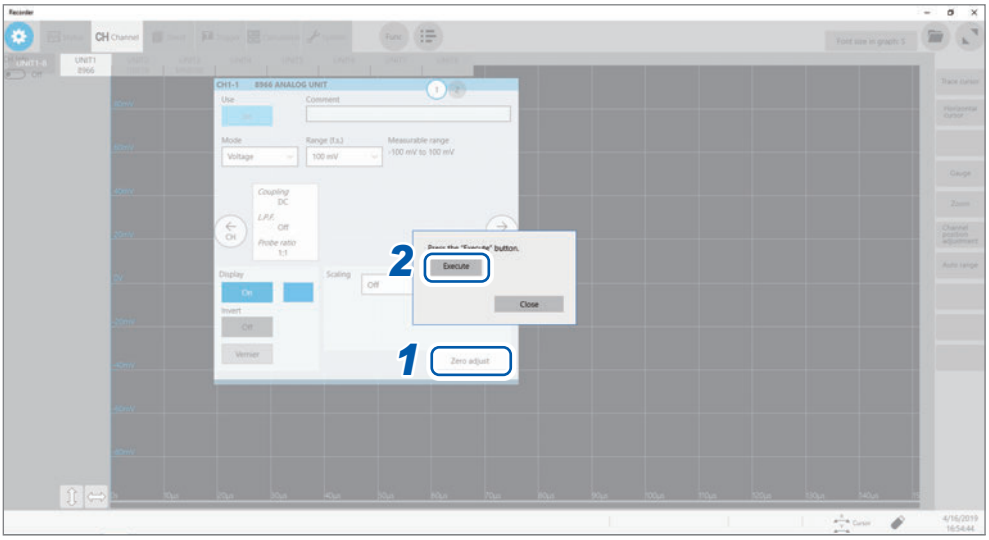
Executing zero-adjustment regulates the zero positions of all channels in each module on the reference potential of the instrument. Zero-adjustment involves all ranges of all channels.

Before executing zero-adjustment

- Warm up the instrument for about 30 minutes after the power-on to stabilize the internal temperature of the modules, and then execute zero-adjustment.
- Execute zero-adjustment with no signals inputted. Zero-adjustment may not correctly be executed with a signal inputted.
- Note that you cannot execute zero-adjustment during measurement.
- No key operation is acceptable during zero-adjustment.
- The time required for the zero-adjustment varies depending on types and the number of modules installed in the instrument (in some cases, it takes more than 10 seconds).

To execute zero-adjustment

> [Channel] > each module (UNIT)



1 **Click [Zero adjust].**

2 **Click [Execute].**

The instrument performs zero-adjustment.
The instrument also calibrates Model MR8990 Digital Voltmeter Unit.
Zero-adjustment is invalid for Model U8969 Strain Unit. Regulate the zero position using the auto-balance.
Refer to “Model U8969 Strain Unit” (p. 111).
Refer to “Settings of the Model U8969 Strain Unit” in “3.6 Configuring Module-Specific Settings” of the Instruction Manual.

Re-execute zero-adjustment in the following cases:

- After replacing any modules
- After cycling the instrument
- After initializing the instrument
- After switching between DC mode and RMS mode on Model 8971 Current Unit, Model 8972 DC/RMS Unit, or Model U8974 High Voltage Unit.
- When the ambient temperature has significantly changed
  The zero position may drift*.

*: Drift:
A phenomenon where a shift in the operating point of an operational amplifier causes a false output. Drift can result from a change in temperature and component aging over a period of use.

2.9 Executing Calibration (For the Instrument With Model MR8990 Installed)

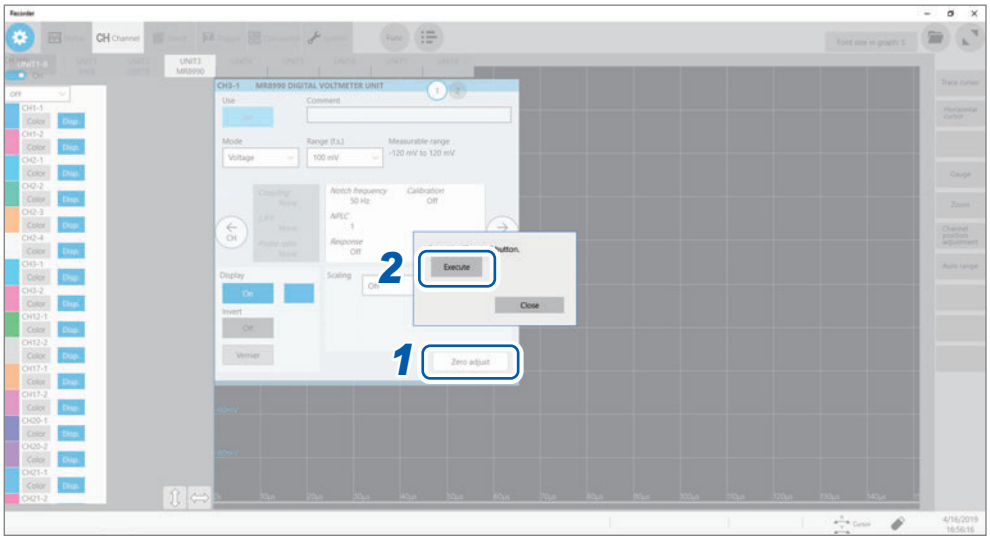
Executing calibration regulates the zero position of each channel in Model MR8990 Digital Voltmeter Unit on the reference potential of the instrument. Calibration involves all ranges of all channels.

Before executing calibration

- Warm up the instrument for about 30 minutes after the power-on to stabilize the internal temperature of the modules before executing calibration.
- You cannot execute calibration during measurement. However, the instrument performs calibration at the start of measurement with the calibration setting set to on.
- No key operation is acceptable during calibration.
- The time required for calibration varies depending on the type and number of modules installed in the instrument (it may take several seconds).

Executing calibration

> [Channel] > [MR8990]



1 Click [Zero adjust].

2 Click [Execute].

The instrument starts to calibrate Model MR8990.

Execute calibration again in the following cases:

- After replacing any modules
- After cycling the instrument
- After initializing the instrument
- When the ambient temperature has significantly changed
  The zero position may drift.

3 Measurement Method

3.1 Inspection Before Measurement

Check if there is any damage to the instrument occurred during storage or shipping and verify that it operates normally before using the instrument. If you find any damage, contact your authorized Hioki distributor or reseller.

Inspecting peripheral devices

When using probes and connecting cords

Is the insulation of each probe of each cord damaged?
Is the metal part exposed?

Yes → Do not use them because it may cause an electric shock. Send instrument for repair.

No ↓

When using a current sensor

Does the current sensor (jaw) have a crack or damage?

Yes → Do not use them because it may cause an electric shock. Send instrument for repair.

No ↓

Inspecting the instrument and modules

Are the instrument and modules damaged?

Yes → Send instrument for repair.

No ↓

When turning on the instrument

Does Windows® splash screen appear on the screen?

No → • The power cord may have a brake or the internal circuit of the instrument may have failed. Send the instrument for repair.
• Make sure that the monitor is turned on and the connection cable is correctly attached. If using another monitor and cable cannot solve the problem, the instrument may fail. Send the instrument for repair.

Yes ↓

Does the screen display waveforms?

Nothing appears. An incorrect screen appears. → The internal circuit of the instrument may fail. Send the instrument for repair.

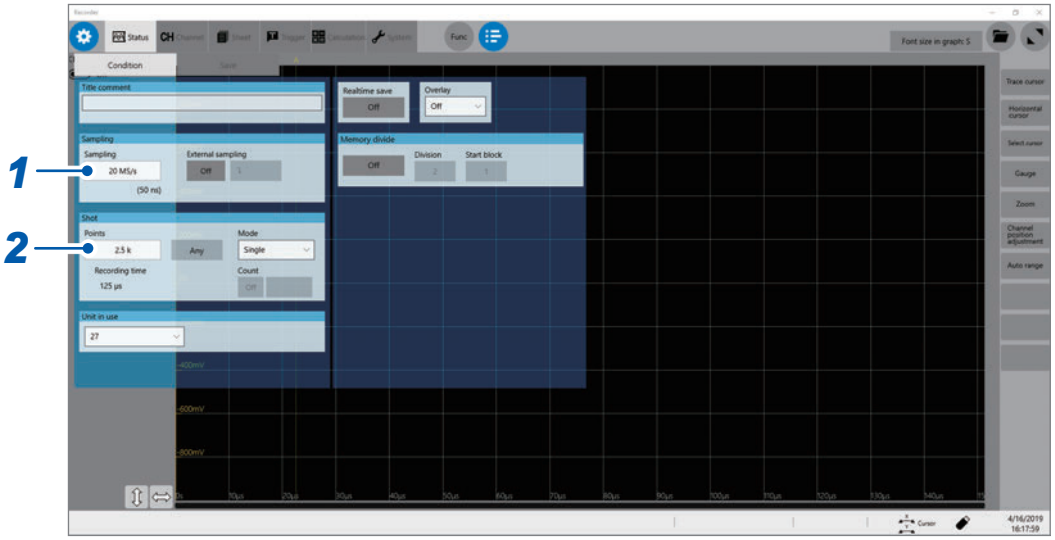
Yes ↓

The inspection is completed.

3.2 Setting Measurement Conditions

Set conditions required for measurement, such as the sampling rate and recording length.

> [Status] > [Condition]



1 Click the [Sampling] box, and then choose a sampling rate from the list.

Refer to “Sampling rate setting guideline” (p. 73).

20 MS/s, 10 MS/s, 5 MS/s, 2 MS/s, 1 MS/s
500 kS/s, 200 kS/s, 100 kS/s, 50 kS/s, 20 kS/s, 10 kS/s, 5 kS/s, 2 kS/s, 1 kS/s,
500 S/s, 200 S/s, 100 S/s, 50 S/s, 20 S/s, 10 S/s, 5 S/s, 2 S/s, 1 S/s

2 Click the [Points] box, and then choose an option for the number of points to be measured from the list.

2.5 k☑, 5 k, 10 k, 20 k, 50 k, 100 k, 200 k, 500 k, 1 M, 2 M, 5 M, 10 M, 20 M, 50 M, 100 M

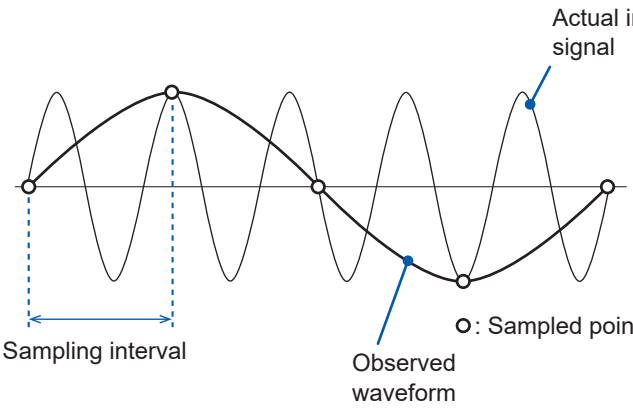
Sampling rate setting guideline

Choose a sampling rate using the following table as a guideline.

Maximum display frequency	Sampling rate	Maximum display frequency	Sampling rate
800 kHz	20 MS/s	80 Hz	2 kS/s
400 kHz	10 MS/s	40 Hz	1 kS/s
200 kHz	5 MS/s	20 Hz	500 S/s
80 kHz	2 MS/s	8 Hz	200 S/s
40 kHz	1 MS/s	4 Hz	100 S/s
20 kHz	500 kS/s	2 Hz	50 S/s
8 kHz	200 kS/s	0.8 Hz	20 S/s
4 kHz	100 kS/s	0.4 Hz	10 S/s
2 kHz	50 kS/s	0.2 Hz	5 S/s
800 Hz	20 kS/s	0.08 Hz	2 S/s
400 Hz	10 kS/s	0.04 Hz	1 S/s
200 Hz	5 kS/s		

If the instrument plots false waveforms (aliasing)

If a measured signal oscillates at a higher frequency compared to the sampling rate, you chose the instrument may plot a false waveform oscillating at a frequency lower than that of the actual signal once the signal frequency reaches a certain level. This phenomenon is called aliasing.



A sampling interval longer than the cycle of the input signal causes aliasing.

To plot a sign wave that allows you to observe the peaks without any aliasing, the instrument needs to sample the waveform at a minimum of 25 points per cycle.

To set the sampling rate automatically

Refer to “3.7 Measuring Signals With the Auto-range Setting” (p. 82).

3.3 Configuring the Input Channel Settings

Configure the analog channel settings.

Channel setting procedure

This section describes how to configure the analog channel (CH1-1 through CH27-4) settings. For details of analog channels such as a setting of each module, refer to "1.3 Specifying Input Channel Settings" of the Instruction Manual.

Configuring the input settings

- **Choose a measurement mode.**
- **Choose a measurement range for each measuring object.**
- **Choose an input coupling method.**
- **Choose a low-pass filter cutoff frequency (if noise is present).**
- **Configure each module settings (as required).**

Configuring the display settings

- **Select waveform colors.**
- **Choose a display position and magnification ratio (as required).**
- **Fine-adjust waveform amplitude (vernier function).**
- **Convert input values. (scaling function)**

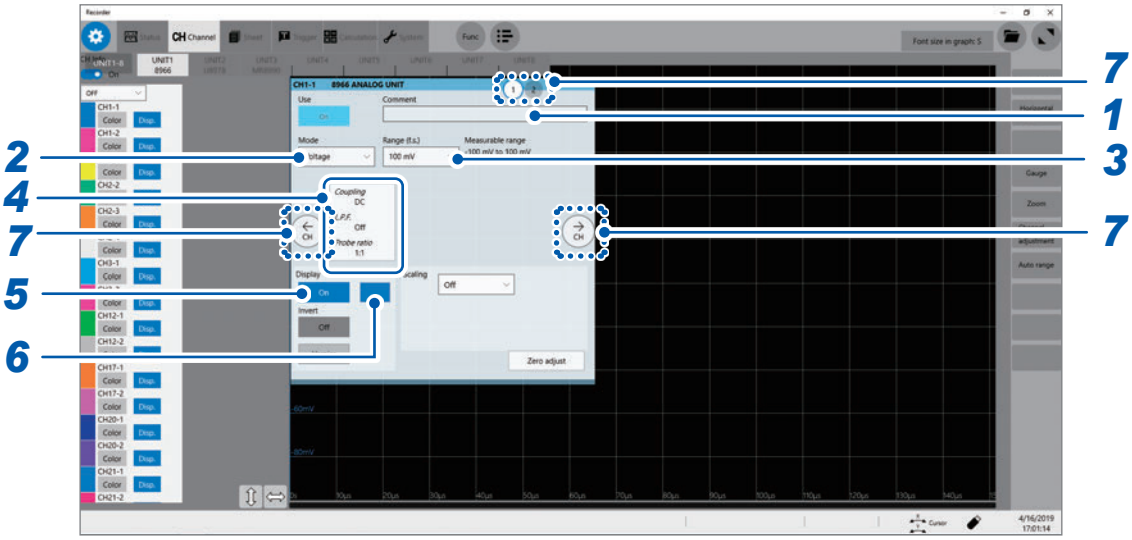
Configuring the trigger settings (as required)

- **Configure the level trigger settings.**

- When the input coupling method is set to GND, the instrument measures the ground potential in the module; thus, it does not measure any input waveforms.
- An influence of the filter attenuation may prevent the instrument from setting an appropriate range.

Analog channel

> [Channel] > [UNIT]



1 **Enter a comment in the [Comment] box.**

Number of characters that can be entered: up to 40

2 **Click the [Mode] box, and then choose a measurement mode from the list.**

Voltage☑	Measures a waveform in voltage mode.
Temperature	Measures a waveform in temperature mode.

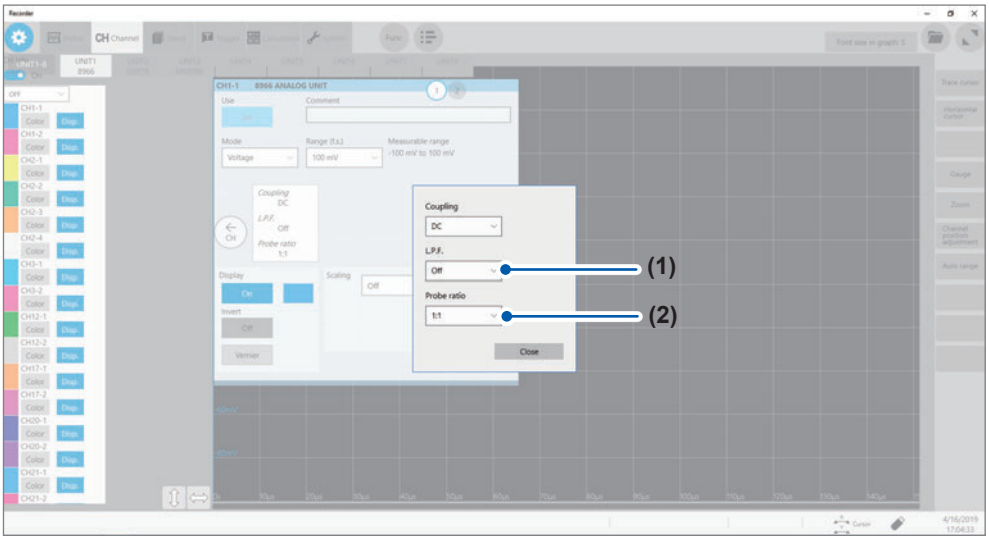
Selectable modes vary depending on the installed modules.
Refer to “3.6 Configuring Module-Specific Settings” of the Instruction Manual.

3 **Click the [Range (f.s.)] box, and then choose a measurement range from the list.**

The measurement ranges that can be chosen varies depending on modules.
If an input voltage exceeds the measurable range (overrange), change the measurement range to one with a lower sensitivity.

4 Select a cutoff frequency of the low-pass filter and a probe ratio in [L.P.F] and [Probe ratio], respectively.

Click the area that includes **[L.P.F]** and **[Probe ratio]** allows the setting dialog box to appear.



(1) Click the [L.P.F] box, and then choose a cutoff frequency of the low-pass filter from the list.

Enabling the low-pass filter in the module eliminates excessive harmonic components.
Available cutoff frequencies of the low-pass filter vary depending on the module type. Choose an adequate cutoff frequency depending on the characteristics of an input signal.
Example: Model 8966 Analog Unit

Off☑, **5 Hz, 50 Hz, 500 Hz, 5 kHz, 50 kHz, 500 kHz**

(2) Click the [Probe ratio] box, and then choose a probe ratio from the list.

Configure this setting when you perform measurement using the instrument with connection cords or probes connected.

1:1☑	Choose this option when using any of the following cords: • Model L9197 Connection Cord • Model L9790 Connection Cord • Model L9198 Connection Cord (for low voltage) • Model L9217 Connection Cord
1:10	Choose this ratio when using Model 9665 10:1 Probe.
1:100	Choose this ratio when using Model 9666 100:1 Probe, Model P9000-01 Differential Probe, or Model P9000-02 Differential Probe.
1:1000	Choose this option when using Model 9322, Model P9000-01, or Model P9000-02 Differential Probe.

5 Click the [Display] button to set it to [On] or [Off].

On☑	Displays the waveform on the waveform screen.
Off	Does not display any waveform.

6 When the [Display] button has been set to [On], click the box next to [On] on the right, and choose a display color from the color pallet.

You can also choose the same color as lines acquired across other channels.

7 Switch the channels.

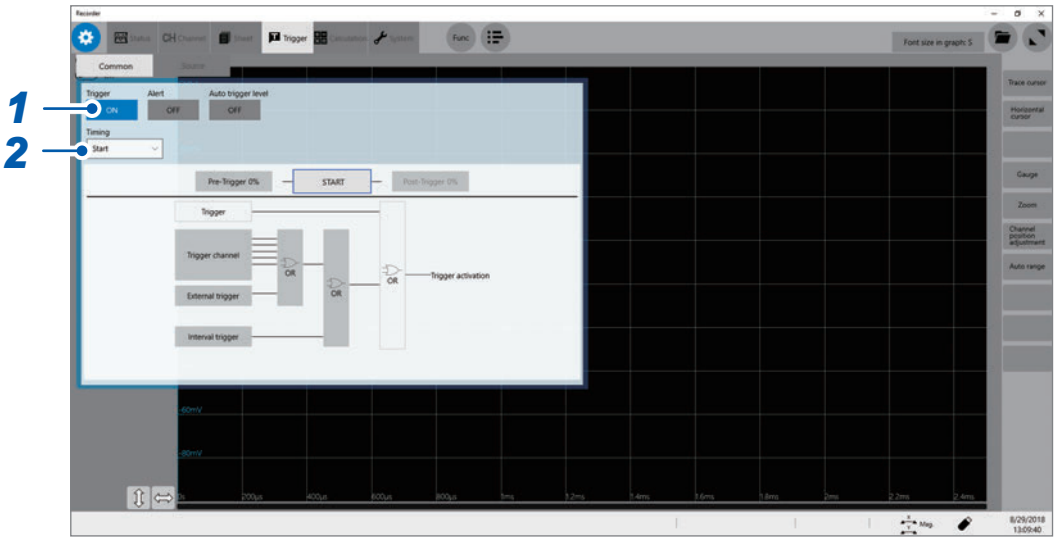
Switch the channels by clicking the corresponding point on the display.

3.4 Configuring the Level Trigger Settings

The trigger function allows you to start and stop measurements using specific signals. When recording is started by specific signals, it is called “The instrument is triggered.” The trigger function is useful to find trends in unexpected events. This section explains “level trigger,” which triggers the instrument at a specified value. For details about triggers other than the level trigger, refer to “5 Specifying the Trigger Settings” of the Instruction Manual.

Cross-trigger settings

> [Trigger] > [Common]



1 **Click the [Trigger] button to set it to [On] or [Off].**

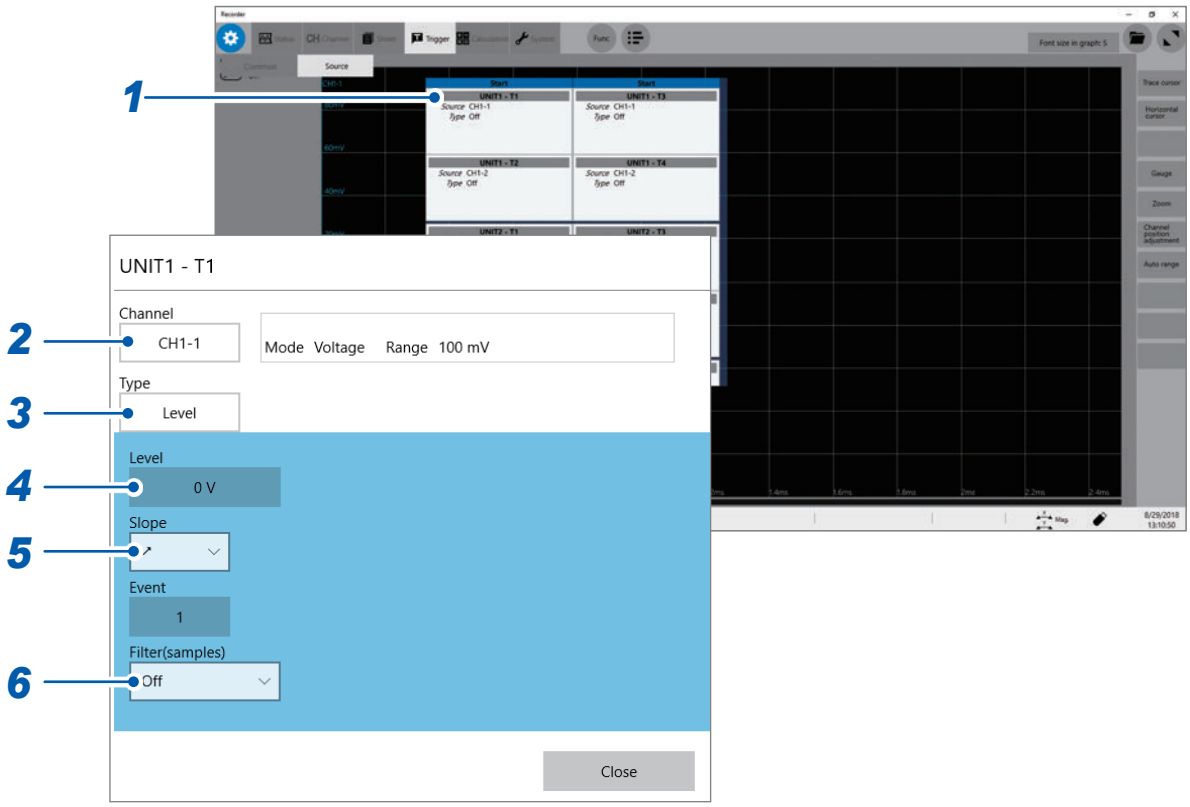
Off☑	Disables the trigger function.
On	Enables the trigger function.

2 **Click the [Timing] box, and then choose a trigger recording method from the list.**

Start☑	Starts recording when the instrument is triggered, and stops the recording after the instrument has acquired the recording-length waveforms.

Configuring the trigger source settings

> [Trigger] > [Source]



1 Click a trigger source you want to specify.

The setting dialog box will appear.
You can set four triggers per module.

2 Click the [Channel] box, and then choose a channel to be used for the level trigger from the list.

3 Click the [Type] box, and then choose [Level] from the list.

4 In the [Level] box, enter a threshold value the level trigger condition is satisfied at.

5 Click the [Slope] box, and then choose a signal direction that allows the level trigger condition to be satisfied from the list.

Choose a direction used to trigger the instrument when the signal crosses the threshold value specified in [Level].

↗☑	The level-trigger condition is satisfied when a signal crosses the threshold value in the positive direction.
↘	The level-trigger condition is satisfied when a signal crosses the threshold value in the negative direction.

6 Click the [Filter] box, and then choose a sampling count of the filter from the list.

Only after the level-trigger condition is continuously satisfied during the specified period, an analog trigger is generated. This is useful to prevent the instrument from triggering due to noise.

3.5 Starting/Stopping Measurement

Starting a measurement

When you click the start icon, the instrument starts a measurement.
Waveform data shown on the screen is cleared once the measurement starts.

Stopping the measurement

Clicking the stop icon causes the setting dialog box to open.
Leave the instrument performing the measurement. Once the instrument has acquired the waveforms with the specified recording length, it stops the measurement.
Clicking **[OK]** stops the measurement immediately.

Initializing the instrument (Restoring the basic settings)

Select > **[System]** > **[Initialize]** to restore the instrument settings to the factory default. The setting after the initialization is suitable for simple measurement. If any unexpected or complicated behavior is observed, initialize the instrument.
Refer to “6.2 Initializing the Instrument” (p. 155).

To configuring measurement settings automatically

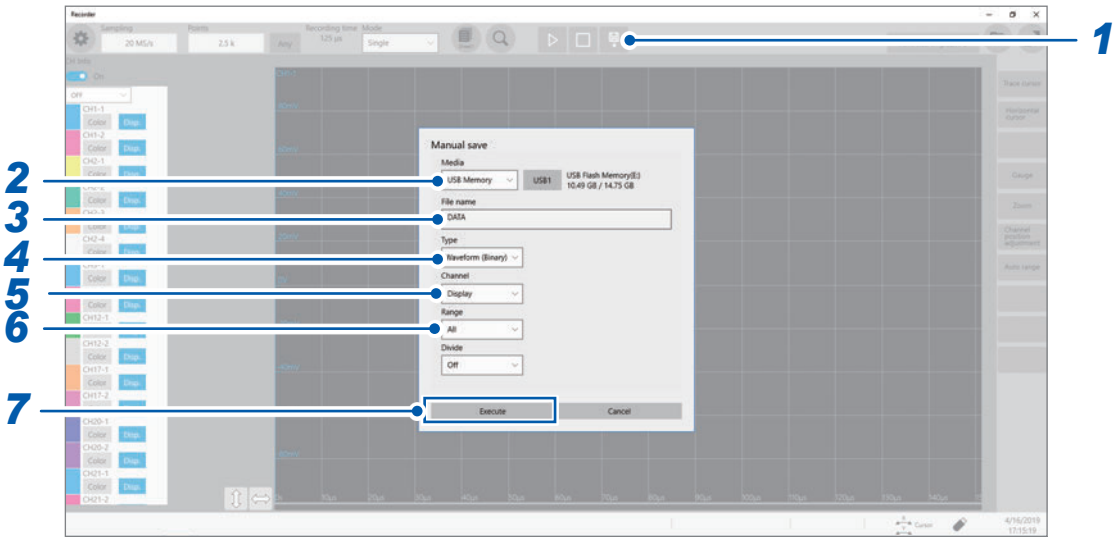
Clicking **[Auto range]** on the waveform screen automatically specifies the sampling rate, measurement range, and zero position of the input waveform and start a measurement.
Refer to “3.7 Measuring Signals With the Auto-range Setting” (p. 82).

3.6 Saving Data Consisting of Items Selected

Clicking the save icon allows you to select any of the following items and save them:

- Waveform data
- Screenshot
- Numerical calculation result
- Setting

Refer to “4 Saving/Loading Data and Managing Files” of the Instruction Manual.



1 **Click the save icon.**

2 **Click the [Media] box, and then choose a destination to save from the list.**

SSD/HDD☑	Saves data on the built-in SSD.
USB Memory	Saves data on the USB flash drive.
E-mail transmission	Sends emails with waveform data attached to computers in the network or to a remote computer. Refer to “11.4 Sending E-mails” of the Instruction Manual.
FTP transfer	Sends waveform data to a computer connected to a network. Refer to “11.3 Sending Data to a Computer With the FTP Client Function” of the Instruction Manual.

3 **Enter the file name in the [File name] box.**

Number of characters for a file name: Up to 100 characters
The maximum length of a file name that includes its path: Up to 255 characters
Some characters or symbols are not accepted due to the file system restrictions.

4 **Click the [Type] box, and then choose a save format of waveform data or save target from the list.**

Waveform (Binary)☑	Saves waveform data in binary format. Choose this option to reload the waveforms into the instrument.
Waveform (Text)	Saves waveform data in text format. Choose this option to load the waveform data into a computer. The instrument cannot read this type of files.
Waveform (Float)	Saves waveform data in binary format (32-bit floating point). Choose this option to load the waveform data into MATLAB. The instrument cannot read this type of files.
Screen image	Saves image data on the screen in BMP, PNG or JPEG format. You can display the data saved on a computer with image viewing software.
Calc. Result	Saves numerical calculation results.
Setting	Saves the present measurement conditions.

When [Type] is set to [Waveform (Binary)] or [Waveform (Text)]

5 **Tap the [Channel] box, and then choose an option for channels to be saved.**

All	Saves measured data of all channels. The instrument also saves data acquired across channels with the waveform display set to **[Off]**.
Display☑	Saves the data acquired across the channels of all sheets with the waveform display preferences set to **[On]**.

6 **Click the [Range] box, and then choose an option for save range from the list.**

All☑	Saves all data written in the memory.
A_B	Saves the data in the section between trace cursors **[A]** and **[B]**.
C_D	Saves the data in the section between trace cursors **[C]** and **[D]**.

7 **Click [Execute].**

3.7 Measuring Signals With the Auto-range Setting

The auto-range function is available only for signals inputted to analog measuring modules.

1. **Input signals to an analog measuring module.**
2. **Click [Auto range] on the waveform screen.**
3. **Click [Execute].**

The instrument specifies the sampling rate, measurement range, and zero position for each input waveform automatically and starts a measurement.

The sampling rate is specified according to the lowest numbered channel of the channels with **[Display]** button set to **[On]**. In addition, it is automatically specified so that waveforms have a length of between 1 cycle and 2.5 cycles while 2500 points are recorded.

The auto-range function changes the following items:

Module conditions (for all channels)	
Range (f.s.)	Automatically specified value
Zero position	
L.P.F	Off
Input coupling	DC

Triggering condition (for one channel only)	
Selecting the trigger logical operation (AND or OR operation) among trigger sources	OR
Pre-trigger	20%
Internal trigger	Detects trigger levels beginning from the channel lowest-numbered among the channels with the **[Display]** button set to **[On]**.
Trigger type	Level trigger (Slope: ↗, Level: Automatically specified value, Filter: 10 samples)

Measurement conditions	
Sampling rate	Automatically set value
Points	2.5 k
Mode	Repeat

- Be careful when performing auto-range measurement while using the TRIG OUT signals. Starting a measurement with the auto-range setting outputs a trigger signal from the TRIG.OUT terminal.
- Input signals (waveforms) before starting a measurement with the auto-range setting. The auto-range function changes the setting depending on a signal inputted on the start of execution.
- When an input signal acquired across the channel lowest-numbered among the channels with the **[Display]** button set to **[On]** has an extremely small level, the sampling rate is specified depending on the input signal of the next lowest-numbered channel.
- If the range setting fails for every channel with the **[Display]** button set to **[On]**, the instrument displays a warning message and cancels the measurement.
- When the auto-save is set to on, the instrument saves the data after specifying the setting value of the auto-range.
- The instrument cannot choose an adequate automatic range for a signal with a frequency of lower than 10 Hz. Manually choose a measurement range.
- The auto-range function is not available for the following modules:

Model 8967	Temp Unit
Model U8969	Strain Unit
Model 8970	Freq Unit
Model MR8990	Digital Voltmeter Unit
Model U8991	Digital Voltmeter Unit
Model 8973	Logic Unit

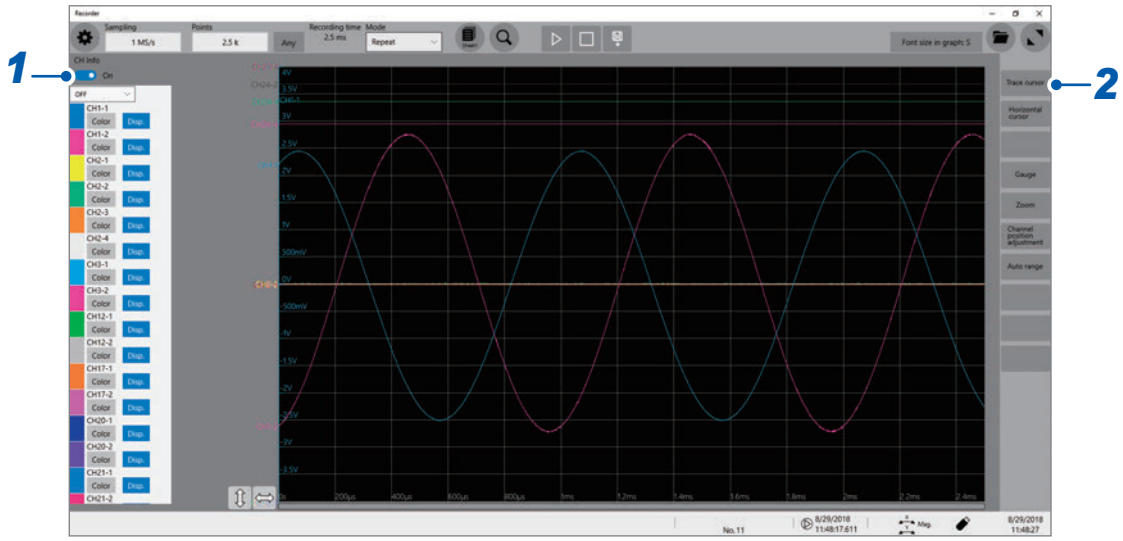
4 Analysis Method

4.1 Reading Measured Values (Trace Cursors)

You can read measured values (scaled values when the scaling is used) using trace cursors on the waveform screen. The instrument can simultaneously display up to eight trace cursors. You can read differences in times and measured values between any two cursors you choose from among all cursors.
For information about other types of cursors than the trace cursor, refer to “2 Operating the Waveform Screen and Analyzing Data” in Instruction Manual.

1 Set [CH Info] toggle switch to [On].

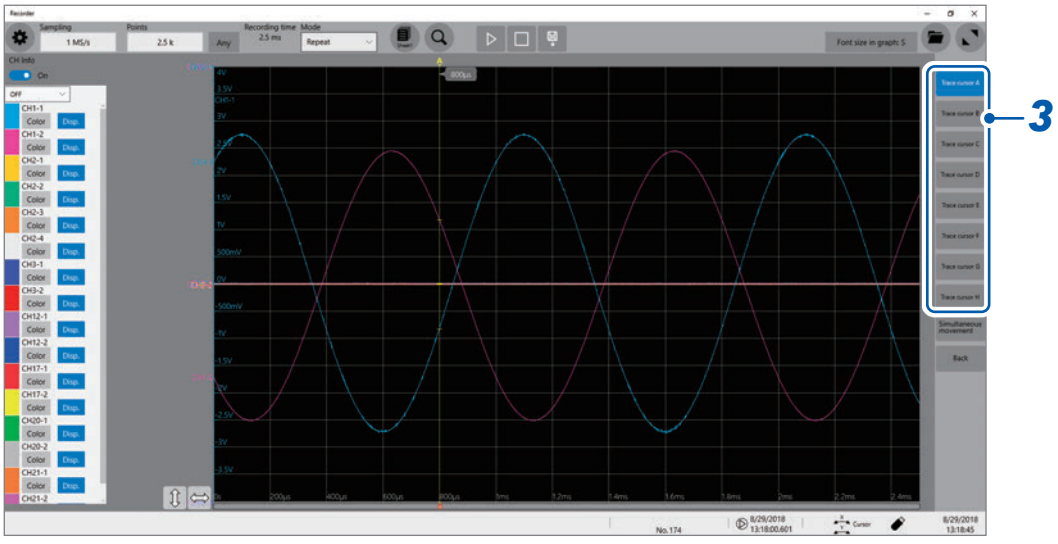
Click **[CH Info]** toggle switch to switch between **[On]** and **[Off]** for the information display setting of each channel.



2 Click [Trace cursor].

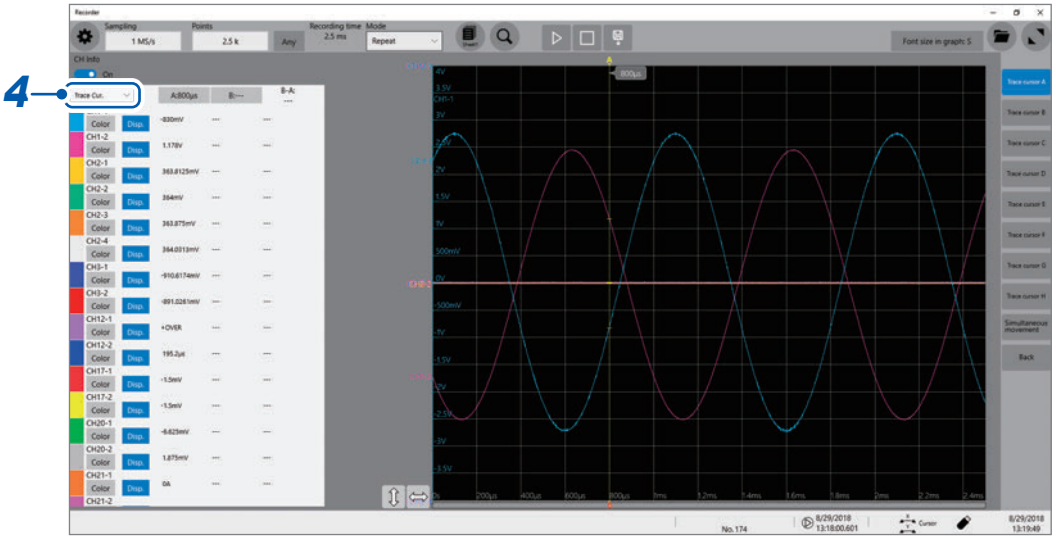
3 Choose one or more cursors to be displayed from among [Trace cursor A] through [Trace cursor H] by tapping them.

The chosen trace cursors are displayed on the waveform screen.
Drag the trace cursors on the waveform screen to move them.



4 Reading measured values

Click **[ ]**, and then choose **[Trace Cur.]** from the drop-down list.

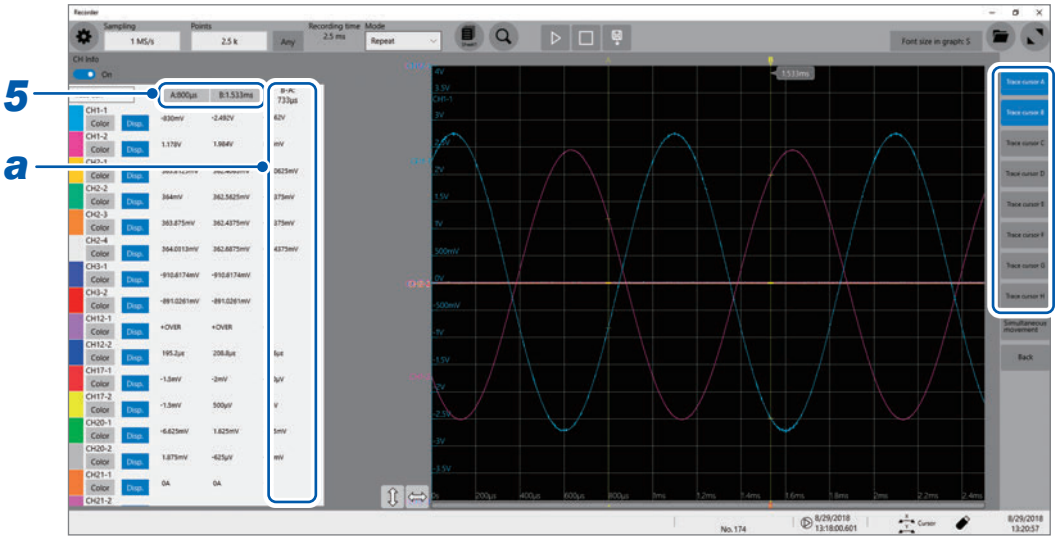


5 Choose two cursors to be displayed from among [Trace cursor A] through [Trace cursor H] by tapping them.

(Default setting: **[Trace cursor A]**, **[Trace cursor B]**)

In column **a**, the instrument displays differences between cursors you choose.

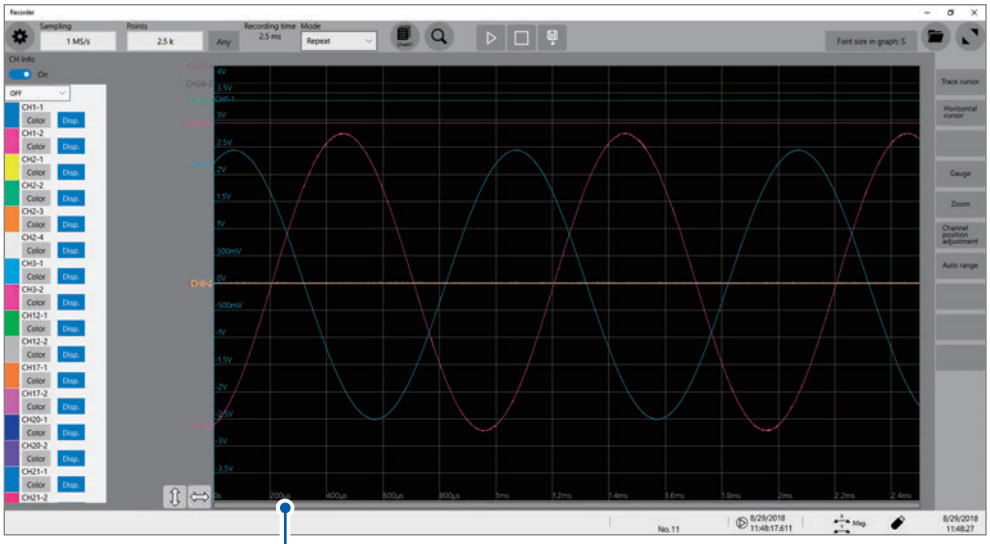
If you select a trace cursor other than the one selected in step **3**, the instrument displays the strings **[---]** in the difference field.



4.2 Handling Waveforms

Scrolling through waveforms

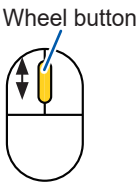
You can use the scroll bar to check the position of waveforms presently displayed on the waveform. Drag the scroll bar to scroll through the waveforms.



Zooming in and out waveforms

Point to a specified point and rotate the wheel button to zoom in or out waveforms.

Vertical axis	Point to a vertical scale (gauge) and rotate the wheel button.
Horizontal axis	Point to a time axis value and rotate the wheel button.
Vertical axis	Rotate the wheel button while holding down the Shift key.
Time axis	Rotate the wheel button while holding down the Ctrl key.



4.3 Loading Data With Your Computer (Wave Viewer)

You can load waveform data saved in CSV format into spreadsheets. This section explains how to install, uninstall, start, and exit the Wave Viewer.

Supported computer: Computers running on Windows 7, or Windows 8, or Windows 10

Installing Wave viewer (for computers running on Windows 7)

1 **Insert the accompanying application disc into the CD-ROM drive.**

The top page appears automatically.
If the top page does not appear, open the “index.htm” file with your web browser.

2 **Choose a display language (Click the [English] icon to display the installation program in English).**

3 **Click the [Wave viewer (Wv)] icon.**

The specifications and revision history of Waveform viewer (Wv) appear.

4 **Click the [Install] icon at the top right of the page.**

The **[File Download]** dialog box appears.

5 **Click [Open].**

The confirmation dialog box appears to check whether to continue the installation.

6 **Click [Next].**

The window for selecting the installation folder opens.
Click **[Browse]** to change the installation folder.

7 **Click [Next].**

The installation starts.

Starting Wave viewer

Before using Wave viewer, read the “READ ME.txt.”

Click the Start button of Windows®, select [Program] > [HIOKI] > [Wv].

Waveform Viewer starts.

Exiting Wave viewer

On the [File] menu of Wave viewer, click [Exit].

Alternatively, you can click the **[Close]** button at the top right of the screen to exit Wave viewer.

Uninstalling Wave viewer

1 **Click the Start button to display the Windows® start menu, and then click [Control Panel] > [Uninstall a program].**

When you use Windows 10, click the Start button and select **[Settings]** > **[Apps]**.

1 **Select [HIOKI Wave Viewer (Wv)] to uninstall.**

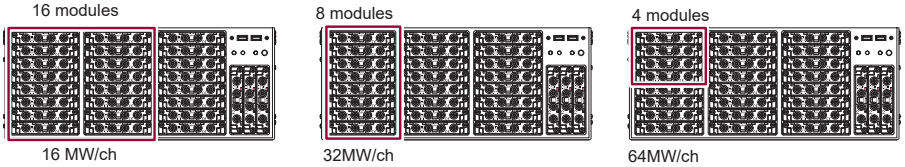
Wave viewer is uninstalled.
When updating Wave viewer to the latest version, uninstall the earlier version before installing the latest version.

5 Specifications

5.1 Specifications of Model MR8740T

General specifications

1. Basic specifications

Recording method	Normal (memory recording)
Number of channels	Analog: Up to 54 channels (when Model 8966 Analog Unit is used) With logic modules installed: Up to 48 channels for analog and up to 48 channels for logic (when Model 8973 Logic Unit is used) Analog: Up to 108 channels (when Model U8975 4ch Analog Unit, Model U8978 4CH Analog Unit, or Model U8991 Digital Volt Meter unit is used) With logic modules installed: Up to 96 channels for analog and up to 48 channels for logic (when Model 8973 Logic Unit is used*) However, logic modules can be installed in slots 25 through 27 only. *: The ground of the logic probe input connectors is equipotential to the GND terminal of Model MR8740T.
Maximum sampling rate	20 MS/s (when Model 8966 Analog Unit is used) Simultaneously samples values across all channels. 10 MS/s for external sampling
Memory capacity	1 gigaword
Number of available modules	Recording length per channel can be extended by limiting the number of available modules. 27 modules: Uses all slots. 16 modules: Uses slot 1 through 16. 8 modules: Uses slot 1 through 8. 4 modules: Uses slot 1 through 4.  * Memory length is applicable when Model U8975 is installed. * Modules installed in slots except for the above are invalid for measurement.
Built-in storage device	SSD with a storage capacity of 480 GB
Operating environment	Indoors, Pollution Degree 2, Operating altitude: up to 2000 m (6562 ft.)
Operating temperature and humidity	0°C to 40°C (32°F to 104°F), 80% RH or less (no condensation)
Storage temperature and humidity	−10°C to 50°C (14°F to 122°F), 80% RH or less (no condensation)
Standards	Safety: EN61010 EMC: EN61326 Class A
Power supply	Rated supply voltage: 100 V to 240 V AC (Voltage fluctuations of up to ±10% centered on the rated supply voltage are allowed.) Rated supply frequency: 50 Hz / 60 Hz Anticipated transient overvoltage: 2500 V

Maximum rated power	400 VA
Clock	Automatic calendar, automatic leap year adjustment, 24-hour clock
Backup battery life	About 10 years (at 23°C, for reference) Backup for the clock and setting conditions
Built-in battery life	About 2.5 years (when discharged once a day, at 30°C); * for reference, about 3 years when discharged 5 times a year
Dimensions	Approx. 426W × 177H × 505D mm (1cv 6.77″W × 6.97″H × 19.88″D) (excluding protrusions)
Mass	Approx. 13.3 kg (29.3 lb.) (Model MR8740T Memory HiCorder only) Approx. 20.0 kg (44.1 lb.) (with Model 8966 Analog Unit installed)
Product warranty period	3 years
Accessories	p. 4
Options	p. 5

2. Specifications for accuracy

Conditions of guaranteed accuracy	Guaranteed accuracy period: 1 year Temperature and humidity for guaranteed accuracy: 23°C±5°C (73°F±9°F), 80% RH or less
Time axis accuracy	±0.001%
Clock accuracy	±0.001%

3. Specifications of the system

CPU	Intel Core i5 or equivalent
Main memory	DDR4 with a storage capacity of 8 GB
Operating system	Windows 10
Startup disk	SSD with a storage capacity of 120 GB

4. Specifications of the interfaces

(1) LAN interface

Standards	IEEE802.3 Ethernet 1000BASE-T, 100BASE-TX, 10BASE-T
Number of ports	2
Functions	DHCP, DNS, FTP, HTTP, email transmission
Connector	RJ-45

(2) USB interface

Standards	USB 3.0 compliant ×4, USB 2.0 compliant ×4
Number of ports	Front side: 2 (USB 2.0) Rear side: 6 (USB 3.0 ×4, USB 2.0 ×2)
Host	Connector: Series-A receptacle Peripheral devices: keyboard, mouse, USB flash drive

(3) Monitor output

Output format	VGA	Resolution: 2560 × 1600 dots (maximum)
	HDMI	Resolution: 3840 × 2160 dots (maximum)
	DisplayPort	Resolution: 4096 × 2304 dots (maximum)
	A resolution of 1920 × 1080 dots or more is recommended.	

(4) Others

Incompatible interface	Audio (Line-in/out, Mic-in) RS-232C
Interface	PS2 (keyboard, mouse)

5. External control terminals

Terminal block	Push-button type	
External input	Maximum input voltage	10 V DC
	Input voltage	High level: between 2.5 V and 10 V Low level: between 0 V and 0.8 V
	Acceptable pulse width	High-level period: 50 ms or longer Low-level period: 50 ms or longer
	Pulse interval	200 ms or more
	Number of terminals	2
	Functions	START, STOP, START/STOP, SAVE, ABORT, EVENT
External output	Output format	Open-drain output (equipped with a 5-volt voltage output, active-low)
	Output voltage	High level: between 4.0 V and 5.0 V Low level: between 0 V and 0.5 V
	Maximum input voltage	50 V DC, 50 mA, 200 mW
	Number of terminals	2
	Functions	Judgment (pass), judgment (fail), occurrence of an error, busy, waiting for a trigger
External trigger	Maximum input voltage	10 V DC
	External trigger filter	On/Off
	Acceptable pulse width	When the external trigger filter is off High-level period: 1 ms or longer Low-level period: 2 µs or longer When the external trigger filter is on High-level period: 2.5 ms or longer Low-level period: 2.5 ms or longer
	Functions	The edge to be used can be chosen between rising and falling. Rising: Triggered when a pulse rises from the low level (between 0 V and 0.8 V) to the high level (between 2.5 V and 10 V). Falling: Triggered when a pulse falls from the high level (between 2.5 V and 10 V) to the low level (between 0 V and 0.8 V), or when the terminals are connected with each other.
Trigger output	Output format	Open-drain output (equipped with a 5-volt voltage output, active-low)
	Output voltage	High level: between 4.0 V and 5.0 V Low level: between 0 V and 0.5 V
	Maximum input voltage	50 V DC, 50 mA, 200 mW
	Output pulse width	The pulse width to be used can be chosen between level and pulse. Level: [(sampling interval) × (number of data sets after trigger)] or more Pulse: 2 ms ±1 ms

External sampling input	Maximum input voltage	10 V DC
	Input voltage	High level: between 2.5 V and 10 V, low level: between 0 V and 0.8 V
	Acceptable pulse width	High-level period: 50 ns or longer, low-level period: 50 ns or longer
	Maximum input frequency	10 MHz
	Functions	External sampling clock input The edge to be used can be chosen between rising and falling.

Trigger

Trigger method	Digital comparison method	
Trigger conditions	Logical AND or OR operation among each trigger source and the interval trigger	
Trigger source	Analog, logic • Up to 108 channels (Up to four analog triggers are available for one analog channel.) (Up to four logic triggers are available for one logic probe.) External trigger The instrument immediately starts a measurement (freely running) when all trigger sources are set to off.	
Analog trigger	Level trigger:	The instrument is triggered when an input signal voltage exceeds (or falls below) a user-defined voltage level.
	Voltage drop trigger:	The instrument is triggered when the peak voltage of an input signal falls below a user-defined voltage. (Dedicated to 50 Hz / 60 Hz commercial power) (Not available when Model MR8990 Digital Voltmeter Unit, Model U8991 Digital Voltmeter Unit, or Model 8970 Freq Unit is used.)
	Window trigger:	A range, which is defined by an upper level and lower level, shall previously be specified. The instrument is triggered when an input signal voltage falls within (IN) or outside (OUT) the user-defined range.
	Period trigger*:	A period-measuring level and a period range shall previously be specified. The instrument measures periods by acquiring moments when a voltage exceeds (or falls below) a user-defined level and is triggered when a period falls outside or within the user-defined range. (Not available when Model MR8990 Digital Voltmeter Unit, Model U8991 Digital Voltmeter Unit, or Model 8970 Freq Unit is used.)
	Glitch trigger*:	A voltage level and a pulse width (glitch width) shall be previously specified. The instrument measures pulse widths by acquiring moments when rising edges (or falling edges) cross the user-defined level and is triggered when a signal pulse width becomes narrower than the user-defined pulse width. (Not available when Model MR8990 Digital Voltmeter Unit or U8991 Digital Voltmeter Unit is used.)
	Event designation:	The number of events shall previously be specified (1 to 4000). The instrument counts the number of times the trigger condition of each trigger source is met and is triggered when the number of events exceeds the user-defined number. (Not available when the trigger condition is set to AND operation.)
Logic trigger	Pattern trigger defined by 1, 0, or disregard (×)	
Forcible trigger	Available (A forcible trigger can trigger the instrument in priority to any trigger sources.)	
Interval trigger	Data can be recorded at a user-defined measuring interval (in hours, minutes, and seconds). The instrument is triggered at the start of a measurement and then repeatedly triggered at a user-defined measurement interval.	
Trigger filter	Off, 10, 20, 50, 100, 150, 200, 250, 500, 1000, 2000, 5000, 10000 (samples)	
Trigger level resolution	1 LSB (12-/16-bits unit) 256 LSB for Model MR8990 Digital Voltmeter Unit and Model U8991 Digital Voltmeter Unit (Uses only higher 16 bits of an A/D resolution of 24 bits.)	
Pre-trigger	0% to 100% (freely settable in one percentage point increments) The instrument displays waveforms acquired during the pre-trigger period.	
Trigger priority	On/Off	

Trigger mark	Trigger marks, which indicate the positions of trigger events, can be displayed.
Trigger timing	Start
Alert function	The alert function and trigger function other than the analog trigger setting are mutually exclusive. Available sampling rate: 100 kS/s or less When the trigger conditions are satisfied Displays and stores channel numbers and measured values, puts marks, and beeps When the trigger conditions are not satisfied Displays and stores channel numbers and measured values, puts marks, and turns off a buzzer sound.
Auto-trigger level	On/Off (for the trigger and alert functions) Acquires the specified number of values and specifies the average value of them as the reference of the window-out trigger. Choose a number of samples from among 100, 200, 300, 400, and 500.

Waveform screen

Display format	Time-domain waveform representation:	1, 2, 4, 8, 16 screens (Up to 64 channels can be displayed on each sheet.) (Every channel can be set to be displayed on multiple sheets.)
Sheet function	Up to 16 sheets A display format can be chosen for each sheet.	
Zoomed display	On/Off Displays time-domain waveforms on the upper waveform screen and zoomed waveforms on the lower screen.	
Full-screen display	Maximizes the waveform screen to full screen.	
Waveform display	Waveform color: Interpolation: Variable display: Vernier: Grid: Logic width: Inverted waveform:	Fixed colors (32 colors) Line Always on Amplitudes of inputted waveforms can be adjusted. (Adjustable range: 50% to 200% of input) Off/On Wide, standard, narrow Polarity-reversed waveforms can be displayed. (Not available for Model 8967 Temp Unit, Model 8970 Freq Unit, or Model 8973 Logic Unit)
Zoom in/out	Waveforms can be displayed at a preferred magnification.	
Waveform scrolling	The operator can scroll through waveforms horizontally by dragging the display. Scrolling through waveforms backward is available during a measurement.	
Rolling display	Latest data is always displayed following the measurement. The drawing starting position can be chosen between the left edge and right edge. (The rolling display is not available when the overlay setting is used.)	
Level monitor function	Numeric value representation	
Overlaying waveforms	Overlaying setting can be selected from off, automatic, manual. (The rolling display is not available when the overlay setting is used.)	
Cursor	Trace cursor: Horizontal cursor: Gauge: Section designation: Jump:	Up to 8 cursors can be displayed. (Displays potential, time from trigger, time lag between cursors, and potential difference between cursors.) Up to 8 cursors can be displayed. (Displays potential and potential difference between cursors.) Up to 8 cursors can be displayed. A_B or C_D (Specifies calculation range, save range, and search area.) Jumps to the position specified by clicking the screen.
Event mark	Event marks can be put during measurement (up to 10,000 marks) by clicking the start icon or inputting an external signal.	

Setting screen

Sampling rate	Real-time sampling	20 M, 10 M, 5 M, 2 M, 1 M 500 k, 200 k, 100 k, 50 k, 20 k, 10 k, 5 k, 2 k, 1 k 500, 200, 100, 50, 20, 10, 5, 2, 1 [S/s] **For the external sampling setting:** Depends on a signal input to the external sampling terminal. Up to 10 MHz
	For the real-time save setting	Available maximum sampling rate **When the destination to save data is set to buit-in SSD:** 500 kS/s (65 channels or more*) 1 MS/s (33 to 64 channels*) 2 MS/s (13 to 32 channels*) 5 MS/s (12 channels or less*) **When the destination to save data is set to Model Z4006 USB Drive:** 100 kS/s (65 channels or more*) 200 kS/s (25 to 64 channels*) 500 kS/s (13 to 24 channels*) 1 MS/s (12 channels or less*) Only when a drive connects to a USB 3.0 connector **When the destination to save data is set to FTP transmission:** 20 kS/s (65 channels or more*) 50 kS/s (25 to 64 channels*) 100 kS/s (13 to 24 channels*) 200 kS/s (12 channels or less*) *: When Model U8991 is installed, the number of all channels increases two times.

Maximum recording length	Real-time sampling	**For the fixed recording length setting:** When 27 modules are used 2 M (with Model U8991 installed) 5 M (with Model U8975, U8977, U8978, or MR8990 installed) 10 M (54 channels, in points*) When 16 modules are used 5 M (with Model U8991 installed) 10 M (with Model U8975, U8977, U8978, or MR8990 installed) 20 M (32 channels, in points*) When 8 modules are used 10 M (with Model U8991 installed) 20 M (with Model U8975, U8977, U8978, or MR8990 installed) 50 M (16 channels, in points*) When 4 modules are used 20 M (with Model U8991 installed) 50 M (with Model U8975, U8977, U8978, or MR8990 installed) 100 M (8 channels, in points*)
		For freely-specified recording length setting: When 27 modules are used 4194300 (with Model U8991 installed) 8388600 (with Model U8975, U8977, U8978, or MR8990 installed) 16777200 (54 channels, in points*) When 16 modules are used 8388600 (with Model U8991 installed) 16777200 (with Model U8975, U8977, U8978, or MR8990 installed) 33554400 (32 channels, in points*) When 8 modules are used 16777200 (with Model U8991 installed) 33554400 (with Model U8975, U8977, U8978, or MR8990 installed) 67108800 (16 channels, in points*) When 4 modules are used 33554400 (with Model U8991 installed) 67108800 (with Model U8975, U8977, U8978, or MR8990 installed) 134217600 (8 channels, in points*) * Can be set in 100 points increments
	For the real-time save setting	The maximum recording length is defined depending on a free space of a destination, file systems, and the number of measuring channels.
Repeat measurements	Single, repeat, count	
Scaling	Ratio and offset, 2-point, model name, output rate, decibel, rating Model name: The scaling is automatically specified by selecting a connected model. The combination use of auto-recognition and auto-scaling is supported when a current measuring module is used.	
Comment	Title comment, channel comment The instrument displays both of channel numbers and channel comments on the setting and waveform screens.	
Help	The instrument displays the instruction manuals.	

File

1. Data saving

Destination to save	SSD: USB flash drive: FTP transfer: Email transmission:	Built-in SSD (storage capacity: 480 GB) Model Z4006 USB Drive (16 GB) Computer connected via LAN The instrument sends email messages with a file attached to user-defined destination.
File format	FAT, FAT32, NTFS, exFAT	
File name	Alphanumeric file names can be entered.	
Handling of same-name files	Prefixes a sequential number to the file name and saves the file. (For FTP transmission, suffixes data and time)	
Auto-save	On/Off * Automatically saves the acquired data with a recording length after each measurement. * No setting files are supported. * Not available when the real-time save is selected.	
Real-time save	On/Off * Directly saves waveform data (binary) acquired during measurement to the save destination. * Auto-save setting is unavailable. File division: Automatically divides files into those with a size of about 512 MB.	
Older-file overwriting	If a free space of a destination is insufficient, the existing files are overwritten beginning with the oldest. (Available with the auto-save and real-time save settings)	
Saving format	Setting data: Measured data: Index: Screenshot: Numerical calculation result: Startup: Arbitrary waveform data: Generation program data:	.SET Binary (.MEM, .FLT), text (.CSV) Division save (.IDX) .BMP, .PNG, .JPG .CSV STARTUP.SET .WFG (when the U8793 is installed) .FGP (when the U8793 is installed)
Channels to be saved	When the saving format is set to the measured data, the channels to be saved can be selected between all channels and displayed channels.	
Data decimation save	With the saving format set to measured data (in text format), data is decimated by retaining one out of the specified decimation number (2 to 1000) and the remaining data is saved.	
File division	See table below	
File designation	New file or existing file (Enabled when the saving format is set to the numerical calculation result) (Before starting a measurement, select whether a new file is created or data is appended to the existing file)	
Save operation	Quick save: Saving range:	The save icon is used to save data based on a preset destination, file name, and saving setting. All or a specified segment range can be selected. (Available only for saving data started by click the save icon)

Saving format	Division content
Binary format	Off, every 16 MB, every 32 MB, every 64 MB
Text format	Off, every 60,000 data points, every 1,000,000 data points
Numerical calculation result	Off, by calculation number

2. Data loading

Drive from which data is loaded	SSD:	Built-in SSD (storage capacity: 480 GB)
	USB flash drive:	Model Z4006 USB Drive (16 GB)
Loadable data formats	Setting data:	.SET
	Measured data:	Binary format (.MEM)
	Index:	Division save (.IDX)
	Startup:	STARTUP.SET
	Arbitrary waveform data:	.WFG (when the U8793 is installed)
	Generation program data:	.FGP (when the U8793 is installed)
	Pattern data:	.PLS (when the MR8791 is installed)

Performing calculation

1. Numerical calculation

Maximum number of calculations	(108 items) × (the number of measuring channels)
Calculation range	All or a specified segment
Statistical functions	Start, average, maximum, minimum
Calculation items	P-P, maximum, minimum, high level, low level, average, RMS, standard deviation, rise time*, fall time*, frequency*, period*, duty ratio*, pulse count, area, X-Y area, time lag*, phase contrast*, time to maximum, time to minimum, time to level, level at time, pulse width*, four arithmetic operations, intermediate, amplitude, accumulation, burst width*, angle of XY waveform, overshoot, undershoot, +Width*, −Width* *: Statistical functions (start, average, maximum, minimum) available
Numerical judgment	Target waveform: Analog, logic, and waveform calculation channels Judge setting: On/Off Stopping condition: PASS, FAIL, PASS & FAIL

2. Waveform calculation

Maximum number of calculations	16 expressions
Calculation range	All or a specified segment
Maximum recording length	2,000,000 points
Standard operators	+, −, ×, ÷
Calculation items	Absolute value, square root, cubic root, logarithm, exponent, sine, arc sine, cosine, arc cosine, tangent, arc tangent, derivative, 2nd-order derivative, integral, 2nd-order integral, moving average, slide, PLCS

Memory division

Maximum division number	1024 blocks
Block search	The instrument can search data stored in divided memory blocks.
Representation	Displays blocks specified.

Waveform search

Search method	Trigger	Level, window-in, window-out Logic trigger points can be searched for when the target channel is set to the logic channels.
	Peak	Maximum, minimum, maximal, minimal
	Concierge	Histogram or standard deviation (For each of them, a target for comparison can be chosen between the fundamental waveform and the previously observed waveform.)
	Jump	Event mark, cursor, time (specified by an absolute time, a relative time, or the number of points), trigger point, search mark.
Search range	All:	Whole data stored in the internal memory
	Section designation:	Either one of the areas between cursors A and B and between cursors C and D is chosen.
Number of points to be searched for	Up to 10,000 points	
Continuous search	When the scope of search is found to include retrieved data points more than the specified number after the search, the instrument can continuously search waveform data points after the last retrieved data point.	
Display method	Displays the search result specified as a search position.	

Others

Auto-range	Available The instrument automatically selects a sampling rate and measurement range appropriate for an input waveforms. (Not available when the external sampling is used.)
Beep sound	Three levels are available: • Off • Alert • Alert+Action
Email transmission	Email transmission function using SMTP Transmission timing: When data is automatically saved; when data is saved by clicking the SAVE icon Contents of email: The text entered in the Body box is included and a file in the format specified in the Type box is attached.
Initialization	Discarding the existing waveform data, restoring the settings to the initial values, initializing the instrument
Self-check	Memory check, LAN check, media check
Language	English, Japanese, Chinese
Error indication **Warning indication**	The instrument displays details of an error or warning.

Time value display	Time, time in sexagesimal, date, the number of data points	
Zero position display	On/Off	
Waveform screen background color	Black or white	
Restart permission	Permitted or prohibited Permitted: When a setting is changed during a measurement, another measurement starts. Prohibited: Changing any settings are prohibited during measurement.	
Auto Power on	On/Off *On: Supplying the power can start the instrument.	
Time setting	A date and time can be set.	
Number of current sensors to be connected	Up to nine sensors can connect to Model 8971 Current Unit and Model U8977 3CH Current Unit in total.	
Limitation of the number of modules	Model 8971 Current Unit Model U8977 3CH Current Unit Model 8973 Logic Unit	Up to four slots Up to three slots Up to three slots Slots in which the module can be installed (slots 25, 26, and 27)
POWER LED indication	Green light	Power-on state
	Green blinking light	During aging (30 minutes or less since powered on)
	Orange light	Stand-by state (the rear main-power switch is set to on)
	Off	The power is shut off (the rear main-power switch is set to off).
CMD ERR LED indication	Red light	A command received contains a syntax error. Send the `*CLS` command to turn the LED off. A warning is issued.
	Off	No error or warning is found.
DIAG LED indication	Red light	An ambient temperature is too high. (> 35°C)
	Purple light	An ambient temperature is too low. (< 10°C)
	Yellow light	The CPU load rate stands at 80% or more (Updated every 0.5 seconds, based on average load rates calculated over the period).
	Blue light	Waiting for a trigger.
	Green light	The recording is in progress.
	Pink light	The recording is complete. Switches to the normal operation indication when a new command is received.
	White light	During normal operation (under suspension)

5.2 Specifications of the Options

Model 8966 Analog Unit

Conditions of guaranteed accuracy
Specified under the following conditions: installed in a Memory HiCorder and operated at 23°C ±5°C (73°F ±9°F) in the humidity range of 20% to 80% RH after a half-hour (at least) warm-up and execution of zero-adjustment.

Product warranty period	3 years
Guaranteed accuracy period	1 year
Number of input channels	2 channels
Measurement range	100, 200, 400 mV f.s., 1, 2, 4, 10, 20, 40, 100, 200, 400 V f.s.
Measurement accuracy	±0.5% f.s. (with the filter set at 5 Hz)
Temperature characteristics	±0.06% f.s./°C
Frequency characteristics	DC to 5 MHz −3 dB (DC-coupled) 7 Hz to 5 MHz −3 dB (AC-coupled, lower cut-off frequency: 7 Hz±50%)
Noise	1.5 mV p-p (typ.), 2 mV p-p (max.); with the highest sensitivity range and the terminals of each input connector connected with each other
Common mode rejection ratio	80 dB or more (at 50 Hz / 60 Hz, a signal source resistance of 100 Ω or less)
Low-pass filter	Off, 5±50%, 50±50%, 500±50%, 5 k±50%, 50 k±50%, 500 k±50% (Hz); −3 dB
Input type	Unbalanced input (floating)
Input coupling	AC/DC/GND
Input resistance	1 MΩ ±1%
Input capacitance	30 pF ±10 pF (at 100 kHz)
A/D resolution	12 bits
Maximum sampling rate	20 MS/s
Input terminals	Insulated BNC terminal
Maximum input voltage	400 V DC
Maximum rated voltage to earth	300 V AC, DC (between each input channel and the enclosure, between any two of input channels) Measurement category II, anticipated transient overvoltage: 2500 V
Operating temperature and humidity	Consistent with the specifications of the Memory HiCorder in which Model 8966 is installed.
Operating environment	Consistent with the specifications of the Memory HiCorder in which Model 8966 is installed.
Storage temperature and humidity	−10°C to 50°C (14°F to 122°F), 80% RH or less (no condensation)
Dimensions	Approx. 106W × 19.8H × 196.5D mm (4.17″W × 0.78″H × 7.74″D)
Mass	Approx. 250 g (8.8 oz.)

Effect of radiated radio-frequency electromagnetic field	±15% f.s. (max.) at 3 V/m
Effect of conducted radio-frequency electromagnetic field	±45% f.s. (max.) at 3 V (in the 2 V f.s. range, with 1 V DC applied)
Standards	Safety: EN61010 EMC: EN61326 Class A
Options	Model L9197 Connection Cord (300 V CAT IV, 600 V CAT III, 1 A) Model L9198 Connection Cord (300 V CAT III, 600 V CAT II, 0.2 A) Model L9217 Connection Cord (300 V CAT III, 600 V CAT II, 0.2 A) Model L9790 Connection Cord (With Model L9790-01 or Model 9790-03 attached: 300 V CAT III, 600 V CAT II, 1 A) (With Model 9790-02 attached: 150 V CAT III, 300 V CAT II, 1 A) Model 9322 Differential Probe (With grabber clips attached: 1000 V CAT II) (With alligator clips attached: 600 V CAT III, 1000 V CAT II) Model P9000-01 Differential Probe (1000 V CAT III) Model P9000-02 Differential Probe (1000 V CAT III) Model 9665 10:1 Probe (300 V CAT II) Model 9666 100:1 Probe (300 V CAT II)

Model 8967 Temp Unit

Conditions of guaranteed accuracy
Specified under the following conditions: installed in a Memory HiCorder and operated at 23°C ±5°C (73°F ±9°F) in the humidity range of 20% to 80% RH after a half-hour (at least) warm-up and execution of zero-adjustment.

Product warranty period	3 years
Guaranteed accuracy period	1 year
Number of input channels	2 channels
Input terminals	Push-button type terminal block (2 terminals/channel)
Measuring target	Thermocouple (K, J, E, T, N, R, S, B, W)
Reference junction compensation accuracy	±1.5°C (When the reference junction compensation is set to internal, add this value to the accuracy of thermocouple measurement.)
Reference junction compensation	Switchable between internal or external (for temperature measurement with thermocouples)
Temperature characteristics	Add [(measurement accuracy) × 0.1]/°C to the measurement accuracy.
Data refresh	The data refresh rate can be switched. Fast: Approx. 1.2 ms Normal: Approx. 100 ms Slow: Approx. 500 ms
Wire break detection	Switchable between on and off
Input resistance	5 MΩ or more (regardless of the wire break detection setting)
Common-mode rejection ratio	80 dB or more (at 50 Hz / 60 Hz, for a signal source resistance of 100 Ω or less, with the data refresh set to Fast) 100 dB or more (at 50 Hz / 60 Hz, for a signal source resistance or 100 Ω or less, with the data refresh set to Normal)
Input type	Unbalanced input (floating)
Maximum rated voltage to earth	300 V AC, DC (between each input channel and the enclosure, between any two of input channels) Measurement category II, anticipated transient overvoltage: 2500 V
Operating temperature and humidity	Consistent with the specifications of the Memory HiCorder in which Model 8967 is installed.
Storage temperature and humidity	−20°C to 50°C (−4°F to 122°F), 90% RH or less (no condensation)
Operating environment	Consistent with the specifications of the Memory HiCorder in which Model 8967 is installed.
Dimensions	Approx. 106W × 19.8H × 204.5D mm (4.17″W × 0.78″H × 8.05″D)
Mass	Approx. 240 g (8.5 oz.)
Effect of radiated radio-frequency electromagnetic field	±2% f.s. (max.) at 3 V/m
Effect of conducted radio-frequency electromagnetic field	±2% f.s. (max.) at 3 V

Standards	Safety: EN61010 EMC: EN61326 Class A
Accessories	Ferrite clamp-on choke ×2
Options	Model 9810 Thermocouple (K)

Table: Measurable ranges, resolutions, and measurement accuracy of each thermocouple type and measurement range

Measurement target	Measurement range		Measurable range	Resolution	Measurement accuracy
Thermocouple*1	K*2	200°C f.s.	−100°C to 200°C	0.01°C	±0.1% f.s. ±1°C (0°C or higher) ±0.1% f.s. ±2°C (−200°C or higher but lower than 0°C)
		1000°C f.s.	−200°C to 1000°C	0.05°C	
		2000°C f.s.	−200°C to 1350°C	0.1°C	
	J*2	200°C f.s.	−100°C to 200°C	0.01°C	
		1000°C f.s.	−200°C to 1000°C	0.05°C	
		2000°C f.s.	−200°C to 1100°C	0.1°C	
	E*2	200°C f.s.	−100°C to 200°C	0.01°C	
		1000°C f.s.	−200°C to 800°C	0.05°C	
		2000°C f.s.	−200°C to 800°C	0.1°C	
	T*2	200°C f.s.	−100°C to 200°C	0.01°C	
		1000°C f.s.	−200°C to 400°C	0.05°C	
		2000°C f.s.	−200°C to 400°C	0.1°C	
	N*2	200°C f.s.	−100°C to 200°C	0.01°C	
		1000°C f.s.	−200°C to 1000°C	0.05°C	
		2000°C f.s.	−200°C to 1300°C	0.1°C	
	R*2	200°C f.s.	0°C to 200°C	0.01°C	±0.1% f.s. ±3.5°C (0°C or higher but lower than 400°C) (For Type B, accuracy is not guaranteed below 400°C.) ±0.1% f.s.±3°C (400°C or higher)
		1000°C f.s.	0°C to 1000°C	0.05°C	
		2000°C f.s.	0°C to 1700°C	0.1°C	
	S*2	200°C f.s.	0°C to 200°C	0.01°C	
		1000°C f.s.	0°C to 1000°C	0.05°C	
		2000°C f.s.	0°C to 1700°C	0.1°C	
	B*2	1000°C f.s.	400°C to 1000°C	0.05°C	
		2000°C f.s.	400°C to 1800°C	0.1°C	
	W*3 (WRe5-26)	200°C f.s.	0°C to 200°C	0.01°C	
		1000°C f.s.	0°C to 1000°C	0.05°C	
		2000°C f.s.	0°C to 2000°C	0.1°C	

*1: Not including reference junction compensation accuracy
*2: JIS C 1602-1995
*3: ASTM E-988-96

Model 8968 High Resolution Unit

Conditions of guaranteed accuracy
Specified under the following conditions: installed in a Memory HiCorder and operated at 23°C ±5°C (73°F ±9°F) in the humidity range of 20% to 80% RH after a half-hour (at least) warm-up and execution of zero-adjustment.

Product warranty period	3 years
Guaranteed accuracy period	1 year
Number of input channels	2 channels
Measurement range	100, 200, 400 mV f.s., 1, 2, 4, 10, 20, 40, 100, 200, 400 V f.s.
Measurement accuracy	±0.3% f.s. (with the filter setting set at 5 Hz, operated after zero-adjustment)
Temperature characteristics	±0.045% f.s./°C
Frequency characteristics	DC to 100 kHz −3 dB (DC-coupled) 7 Hz to 100 kHz −3 dB (AC-coupled, lower cut-off frequency: 7 Hz±50%)
Noise	500 µV p-p (typ., 1 mV p-p (max.) with the highest sensitivity range and the terminals of each input connector connected with each other
Common-mode rejection ratio	80 dB or more (at 50 Hz / 60 Hz, a signal source resistance of 100 Ω or less)
Low-pass filter	Off, 5 ±50%, 50 ±50%, 500 ±50%, 5 k ±50%, 50 k ±50% (Hz); −3 dB
Anti-aliasing filters	Cutoff frequency (fc): 20, 40, 80, 200, 400, 800, 2 k, 4 k, 8 k, 20 k, 40 k (Hz) (Automatically set when the anti-aliasing filter is on.) Attenuation property: −66 dB or higher at a frequency of 1.5 fc
Input type	Unbalanced input (floating)
Input coupling	AC/DC/GND
Input resistance	1 MΩ ±1%
Input capacitance	30 pF ±10 pF (at 100 kHz)
A/D resolution	16 bits
Maximum sampling rate	1 MS/s
Input terminals	Insulated BNC terminal
Maximum input voltage	400 V DC
Maximum rated voltage to earth	300 V AC, DC (between each input channel and the enclosure, between any two of input channels) Measurement category II, anticipated transient overvoltage: 2500 V
Operating temperature and humidity	Consistent with the specifications of the Memory HiCorder in which Model 8968 is installed.
Operating environment	Consistent with the specifications of the Memory HiCorder in which Model 8968 is installed.
Storage temperature and humidity	−10°C to 50°C (14°F to 122°F), 80% RH or less (no condensation)
Dimensions	Approx. 106W × 19.8H × 196.5D mm (4.17″W × 0.78″H × 7.74″D)
Mass	Approx. 250 g (8.8 oz.)

Effect of radiated radio-frequency electromagnetic field	±15% f.s. (max.) at 3 V/m
Effect of conducted radio-frequency electromagnetic field	±20% f.s. (max.) at 3 V (in the 2 V f.s. range, with 1 V DC applied)
Standards	Safety: EN61010 EMC: EN61326 Class A
Options	Model L9197 Connection Cord (300 V CAT IV, 600 V CAT III, 1 A) Model L9198 Connection Cord (300 V CAT III, 600 V CAT II, 0.2 A) Model L9217 Connection Cord (300 V CAT III, 600 V CAT II, 0.2 A) Model L9790 Connection Cord (With Model L9790-01 or Model 9790-03 attached: 300 V CAT III, 600 V CAT II, 1 A) (With Model 9790-02 attached: 150 V CAT III, 300 V CAT II, 1 A) Model 9322 Differential Probe (With grabber clips attached: 1000 V CAT II) (With alligator clips attached: 600 V CAT III, 1000 V CAT II) Model P9000-01 Differential Probe (1000 V CAT III) Model P9000-02 Differential Probe (1000 V CAT III) Model 9665 10:1 Probe (300 V CAT II) Model 9666 100:1 Probe (300 V CAT II)

Model U8969 Strain Unit

Conditions of guaranteed accuracy
Specified under the following conditions: installed in a Memory HiCorder and operated at 23°C±5°C (73°F±9°F) and 80% RH or less after a half-hour (at least) warm-up and execution of the auto-balance.

Operating environment	Indoors, Pollution Degree 2, Operating altitude: up to 2000 m (6562 ft.)
Operating temperature and humidity	−10°C to 40°C (14°F to 104°F), 80% RH or less (no condensation)
Storage temperature and humidity	−20°C to 50°C (−4°F to 122°F), 90% RH or less (no condensation)
Standards	Safety: EN 61010 EMC: EN 61326 Class A
Dimensions	Approx. 106W × 19.8H × 196.5D mm (4.17″W × 0.78″H × 7.74″D)
Mass	Approx. 245 g (8.6 oz.)
Product warranty period	3 years
Guaranteed accuracy period	1 year
Accessories	Model L9769 Conversion Cable ×2 (Compatible connector: NDIS connector PRC03-12A10-7M10.5)
Number of input channels	2 channels
Input terminals	NDIS connector EPRC07-R9FNDIS
Measuring object	Strain gauge transducer
Gauge ratio	2.0
Bridge voltage	2 V ±0.05 V
Bridge resistor	120 Ω to 1 kΩ
Balance adjustment range	±10000 με or lower
Balancing method	Electronic auto-balancing
Measurement range	400, 1000, 2000, 4000, 10000, 20000 με f.s.
Frequency characteristics	DC to 20 kHz, +1/−3 dB
A/D resolution	16 bits (± f.s. = ±25000 data points)
Maximum sampling rate	200 kS/s
Maximum rated voltage to earth	30 V rms AC or 60 V DC (between each input channel and enclosure, between any two of input channels) Anticipated transient overvoltage: 330 V
Measurement accuracy	±0.5% f.s. ±4 με (with the filter set at 5 Hz)
Temperature characteristics	Gain: ±0.05% f.s./°C Zero-position: ±2.5 με/°C
Effect of radiated radio-frequency electromagnetic field	±10% f.s. (max.) at 3 V/m (with the filter set at 5 Hz)

Effect of conducted radio-frequency electromagnetic field	±10% f.s. (max.) at 3 V (with the filter set at 5 Hz)
Low-pass filter	Off, 5 ±30%, 10 ±30%, 100 ±30%, 1 k ±30% (Hz); −3 dB

Model 8970 Freq Unit

Conditions of guaranteed accuracy
Specified under the following conditions: installed in a Memory HiCorder and operated at 23°C±5°C (73°F±9°F) in the humidity range of 20% to 80% RH after a half-hour (at least) warm-up.

Product warranty period	3 years
Guaranteed accuracy period	1 year
Measurement functions	The following types of measurement based on voltage input: frequency, rotation speed, power frequency, count, pulse duty ratio, and pulse width
Input terminals	Insulated BNC terminal
Input resistance	1 MΩ ±1%
Input capacitance	30 pF ±10 pF
Maximum input voltage	400 V DC
Maximum rated voltage to earth	300 V AC, DC (Measurement category II) Anticipated transient overvoltage: 2500 V (between each input channel and the enclosure, between any two of input channels)
Input type	Unbalanced input (floating)
Frequency mode	Measurement range: 20, 100, 200 Hz, 1, 2, 10, 20, 100 kHz f.s. Measurement accuracy: ±0.1% f.s. (except for the 100 kHz range) ±0.7% f.s. (the 100 kHz range) Measurable range: DC to 100 kHz (minimum pulse width: 2 µs)
Rotation speed mode	Measurement range: 2 k, 10 k, 20 k, 100 k, 200 k, 1 M, 2 Mr/min f.s. Measurement accuracy: ±0.1% f.s. (except for the 2 Mr/min range) ±0.7% f.s. (the 2 Mr/min range) Measurable range: 0 Mr/min to 2 Mr/min (minimum pulse width: 2 µs)
Power frequency mode	Measurement range: 50 Hz (40 Hz to 60 Hz), 60 Hz (50 Hz to 70 Hz), 400 Hz (390 Hz to 410 Hz) Measurement accuracy: ±0.03 Hz (50 Hz, 60 Hz), ±0.1 Hz (400 Hz)
Accumulation mode	Measurement range: 40 k, 200 k, 400 k, 2 M, 4 M, 20 M counts f.s. Measurement accuracy: 0.0025% f.s. Measurable range: DC to 100 kHz (minimum pulse width: 2 µs)
Duty ratio mode	Measurement range: 100% f.s. Measurement accuracy: ±1% (10 Hz to 10 kHz) ±4% (10 kHz to 100 kHz) Measurable range: 10 Hz to 100 kHz (minimum pulse width: 2 µs)
Pulse width mode	Measurement range: 10 ms, 20 ms, 100 ms, 200 ms, 1 s, 2 s f.s. Measurement accuracy: ±0.1% f.s. Measurable range: 2 µs to 2 s
Measurement resolution	0.0025% f.s. (accumulation mode) 0.01% f.s. (except for accumulation mode or power frequency mode) 0.01 Hz (power frequency mode)
Response time	Within the sum of 40 µs and the sampling interval of the instrument in which the module is installed
Input voltage range	±10 V, ±20 V, ±50 V, ±100 V, ±200 V, ±400 V

Threshold value	±10 V range: Variable in the range of −10 V to +10 V (in 0.1 V increments) ±20 V range: Variable in the range of −20 V to +20 V (in 0.2 V increments) ±50 V range: Variable in the range of −50 V to +50 V (in 0.5 V increments) ±100 V range: Variable in the range of −100 V to +100 V (in 1 V increments) ±200 V range: Variable in the range of −200 V to +200 V (in 2 V increments) ±400 V range: Variable in the range of −400 V to +400 V (in 5 V increments)
Slope	Rising, falling (frequency mode, rotation speed mode, power frequency mode, accumulation mode)
Level	High, low (duty ratio mode, pulse width mode)
Hold	Frequency mode, rotation speed mode: On, Off (1 Hz, 0.5 Hz, 0.2 Hz, 0.1 Hz) Operation with Off: When the instrument cannot determine a subsequent measured value while the waiting time (period) elapses, the instrument calculates a frequency and rotation speed based on the time interval between the time it previously determines measured value and the time it sampled the data, and records these calculated values. When these calculated values are less than user-defined values, then the values will be assumed to be zero.
Smoothing	Off, On (frequency mode, rotation speed mode) The permissible smoothing frequency is up to 10 kHz.
Low-pass filter	Off, 5, 50, 500, 5 k, 50 k (Hz)
Input coupling	DC, AC (Lower cutoff frequency in AC-coupled mode: 7 Hz)
Frequency dividing function	Setting range: 1 to 4096, in one increments (frequency mode, rotation speed mode, accumulation mode)
Accumulation start timing	Start, trigger (accumulation mode)
Process performed when accumulation overflows	Hold, back (accumulation mode)
Operating temperature and humidity	Consistent with the specifications of the Memory HiCorder in which Model 8970 is installed.
Operating environment	Consistent with the specifications of the Memory HiCorder in which Model 8970 is installed.
Storage temperature and humidity	Consistent with the specifications of the Memory HiCorder in which Model 8970 is installed.
Standards	Safety: EN61010 EMC: EN61326 Class A
Dimensions	Approx. 106W × 19.8H × 196.5D mm (4.17″W × 0.78″H × 7.74″D)
Mass	Approx. 250 g (8.8 oz.)
Options	Model L9197 Connection Cord (300 V CAT IV, 600 V CAT III, 1 A) Model L9198 Connection Cord (300 V CAT III, 600 V CAT II, 0.2 A) Model L9217 Connection Cord (300 V CAT III, 600 V CAT II, 0.2 A) Model L9790 Connection Cord (With Model L9790-01 or Model 9790-03 attached: 300 V CAT III, 600 V CAT II, 1 A) (With Model 9790-02 attached: 150 V CAT III, 300 V CAT II, 1 A) Model 9322 Differential Probe (With grabber clips attached: 1000 V CAT II) (With alligator clips attached: 600 V CAT III, 1000 V CAT II) Model P9000-01 Differential Probe (1000 V CAT III) Model P9000-02 Differential Probe (1000 V CAT III) Model 9665 10:1 Probe (300 V CAT II) Model 9666 100:1 Probe (300 V CAT II)

Model 8971 Current Unit

Conditions of guaranteed accuracy
Specified under the following conditions: installed in a Memory HiCorder and operated at 23°C ±5°C (73°F ±9°F) in the humidity range of 20% to 80% RH after a half-hour (at least) warm-up and execution of zero-adjustment.

Product warranty period	3 years
Guaranteed accuracy period	1 year
Number of input channels	2 channels
Supported current sensors	• Connect a sensor with Model 8971 using Model 9318 Conversion Cable Models 9272-10, 9277, 9278, 9279, 9709, CT6862, CT6863, CT6865*2, CT6841,CT6843, CT6844, CT6845, or CT6846*2 • Connect a sensor with Model 8971 using Model 9318 Conversion Cable and Model CT9901 Conversion Cable Models 9272-05, 9709-05, CT6862-05, CT6863-05, CT6865-05*2, CT6841-05, CT6843-05, CT6844-05, CT6845-05,CT6846-05*2, CT6875, CT6876*2,CA6841A, CT6843A, CT6844A, CT6845A, CT6846A, , CT6872, CT6872-01, CT6873, CT6873-01, CT6875A, CT6875A-1, CT6876A*2, CT6876A-1*2, CT6833, CT6833-01, CT6834, or CT6834-01
Measurement range	• When Model 9272-10 (20 A), 9272-05 (20 A), 9277, CT6841, CT6841-05 or CT6841A is used: 100 m, 200 m, 500 m, 1, 2, 5 A/div • When Model CT6862, CT6862-05, CT6872, or CT6872-01 is used 200 m, 500 m, 1, 2, 5, 10 A/div • When Model 9272-10 (200 A), 9272-05 (200 A), 9278, CT6863, CT6863-05, CT6843, CT6843-05, CT6873, CT6873-01, CT6843A, CT6833, or CT6833-01 is used: 1, 2, 5, 10, 20, 50 A/div • When Model 9279, 9709, 9709-05, CT6865*2, CT6865-05*2, CT6844, CT6844-05, CT6845, CT6845-05, CT6846*2, CT6846-05*2, CT6875, CT6876*2, CT6844A, CT6845A, CT6846A*2, CT6875A, CT6875A-1, CT6876A*2, CT6876A-1*2, CT6834, or CT6834-01 is used: • 2, 5, 10, 20, 50, 100 A/div
Measurement accuracy*1	±0.65% f.s. (with the filter set at 5 Hz) ±0.85% f.s. (with the filter set at 5 Hz) when Model 9278 or Model 9279 is used.
RMS accuracy*1	±1% f.s. (DC, 30 Hz to 1 kHz) ±3% f.s. (1 kHz to 10 kHz) (Sine wave input, with the filter set at 5 Hz, crest factor: 2)
Response time*1	100 ms (rising from 0% of f.s. to 90% of f.s.)
Temperature characteristics*1	±0.075% f.s./°C
Frequency characteristics*1	DC to 100 kHz ±3 dB (DC-coupled) 7 Hz to 100 kHz ±3 dB (AC-coupled, at the lower cutoff frequency of 7 Hz ±50%)
Noise*1	10 mA p-p (max.), with the highest sensitivity range and the terminals of each input connector connected with each other (for 20 A/2 V range)
Low-pass filter	Off, 5 ±50%, 50 ±50%, 500 ±50%, 5 k ±50%, 50 k ±50% (Hz); −3 dB
Input type	Unbalanced input (Not isolated)
Input coupling	AC/DC/GND
Input resistance	1 MΩ ±1%
A/D resolution	12 bits

*1: For current measurement, add accuracy and characteristics of a current sensor used.
*2: When these sensors are connected to Model 8791, the conversion ration is recognized as 2 V/500 A; thus, set the conversion ratio to two using the scaling function to double measurement values.

Maximum sampling rate	1 MS/s
Input terminals	Sensor connector HR10A-10R-S (Hirose)
Operating temperature and humidity	Consistent with the specifications of the Memory HiCorder in which Model 8971 is installed.
Operating environment	Consistent with the specifications of the Memory HiCorder in which Model 8971 is installed.
Storage temperature and humidity	−10°C to 50°C (14°F to 122°F), 80% RH or less (no condensation)
Dimensions	Approx. 106W × 19.8H × 196.5D mm (4.17″W × 0.78″H × 7.74″D)
Mass	Approx. 250 g (8.8 oz.)
Standards	Safety: EN61010 EMC: EN61326 Class A
Accessories	Model 9318 Conversion Cable ×2 (for connecting current sensors)
Options	Model 9318 Conversion Cable Model CT9901 Conversion Cable
Number of installable modules	Up to four modules

Model 8972 DC/RMS Unit

Conditions of guaranteed accuracy
Specified under the following conditions: installed in a Memory HiCorder and operated at 23°C ±5°C (73°F ±9°F) in the humidity range of 20% to 80% RH after a half-hour (at least) warm-up and execution of zero-adjustment.

Product warranty period	3 years
Guaranteed accuracy period	1 year
Number of input channels	2 channels
Measurement range	100, 200, 400 mV f.s. 1, 2, 4, 10, 20, 40, 100, 200, 400 V f.s.
Measurement accuracy	±0.5% f.s. (with the filter set at 5 Hz)
RMS accuracy*1	±1% f.s. (DC, 30 Hz to 1 kHz) ±3% f.s. (1 kHz to 100 kHz, sine wave, response time setting: Slow)
Response time	Slow: 5 s (rising from 0% of f.s. to 90% of f.s.) Normal: 800 ms (rising from 0% of f.s. to 90% of f.s.) Fast: 100 ms (rising from 0% of f.s. to 90% of f.s.)
Crest factor	2
Temperature characteristics	±0.045% f.s./°C
Frequency characteristics	DC to 400 kHz −3 dB (DC-coupled) 7 Hz to 400 kHz −3 dB (AC-coupled, at the lower cutoff frequency of 7 Hz ±50%)
Noise	500 µV p-p (typ.), 750 µV p-p (max.), with the highest sensitivity range and the terminals of each input connector connected with each other
Common-mode rejection ratio	80 dB or more (at 50 Hz / 60 Hz, a signal source resistance of 100 Ω or less)
Low-pass filter	Off, 5 ±50%, 50 ±50%, 500 ±50%, 5 k ±50%, 50 k ±50% (Hz); −3 dB
Input type	Unbalanced input (floating)
Input coupling	AC/DC/GND
Input resistance	1 MΩ ±1%
Input capacitance	30 pF ±10 pF (at 100 kHz)
A/D resolution	12 bits
Maximum sampling rate	1 MS/s
Input terminals	Insulated BNC terminal
Maximum input voltage	400 V DC
Maximum rated voltage to earth	300 V AC, DC (between each input channel and the enclosure, between any two of input channels) Measurement category II, anticipated transient overvoltage: 2500 V
Operating temperature and humidity	Consistent with the specifications of the Memory HiCorder in which Model 8972 is installed
Operating environment	Consistent with the specifications of the Memory HiCorder in which Model 8972 is installed
Storage temperature and humidity	−10°C to 50°C (14°F to 122°F), 80% RH or less (no condensation)

Dimensions	Approx. 106W × 19.8H × 196.5D mm (4.17″W × 0.78″H × 7.74″D)
Mass	Approx. 250 g (8.8 oz.)
Effect of radiated radio-frequency electromagnetic field	±15% f.s. (max.) at 3 V/m
Effect of conducted radio-frequency electromagnetic field	±20% f.s. (max.) at 3 V (in the 2 V f.s. range, with 1 V DC inputted)
Standards	Safety: EN61010 EMC: EN61326 Class A
Options	Model L9197 Connection Cord (300 V CAT IV, 600 V CAT III, 1 A) Model L9198 Connection Cord (300 V CAT III, 600 V CAT II, 0.2 A) Model L9217 Connection Cord (300 V CAT III, 600 V CAT II, 0.2 A) Model L9790 Connection Cord (With Model L9790-01 or Model 9790-03 attached: 300 V CAT III, 600 V CAT II, 1 A) (With Model 9790-02 attached: 150 V CAT III, 300 V CAT II, 1 A) Model 9322 Differential Probe (With grabber clips attached: 1000 V CAT II) (With alligator clips attached: 600 V CAT III, 1000 V CAT II) Model P9000-01 Differential Probe (1000 V CAT III) Model P9000-02 Differential Probe (1000 V CAT III) Model 9665 10:1 Probe (300 V CAT II) Model 9666 100:1 Probe (300 V CAT II)

Model 8973 Logic Unit

Product warranty period	3 years
Number of input channels	4 probes (16 channels)
Input terminals	Mini DIN
Supported probes	Model 9320-01 Logic Probe, Model MR9321-01 Logic Probe, Model 9327 Logic Probe
Operating temperature and humidity	Consistent with the specifications of the Memory HiCorder in which Model 8973 is installed.
Operating environment	Consistent with the specifications of the Memory HiCorder in which Model 8973 is installed.
Storage temperature and humidity	−20°C to 50°C (−4°F to 122°F), 80% RH or less (no condensation)
Dimensions	Approx. 106W × 19.8H × 196.5D mm (4.17″W × 0.78″H × 7.74″D)
Mass	Approx. 190 g (6.7 oz.)
Standards	Safety: EN61010 EMC: EN61326 Class A

Model MR8990 Digital Voltmeter Unit

Conditions of guaranteed accuracy
Specified under the following conditions: installed in a Memory HiCorder and operated at 23°C ±5°C (73°F ±9°F) in the humidity range of 20% to 80% RH after a half-hour (at least) warm-up and execution of calibration.

Product warranty period

3 years

Guaranteed accuracy period

1 year

Number of input channels

2 channels

Measurement item

DC voltage

Measurement range

Measurement range	Effective input range*	Maximum resolution	Input resistance
100 mV f.s.	−120 mV to 120 mV	0.1 µV	100 MΩ or more
1 V f.s.	−1200 mV to 1200 mV	1 µV	
10 V f.s.	−12 V to 12 V	10 µV	
100 V f.s.	−120 V to 120 V	100 µV	10 MΩ ±5%
1000 V f.s.	−500 V to 500 V	1 mV	

*: Guaranteed range of measurement accuracy

Measurement accuracy

Measurement range	NPLC: Less than 1	NPLC: 1 or more
100 mV f.s.	±0.01% rdg. ±0.015% f.s.	±0.01% rdg. ±0.01% f.s.
1 V f.s.	±0.01% rdg. ±0.0025% f.s.	
10 V f.s.		
100 V f.s.	±0.025% rdg. ±0.0025% f.s.	
1000 V f.s.		

Temperature characteristics

±(0.002% rdg. + 0.00025% f.s.)/°C

A/D conversion measurement method

Delta-sigma modulation method

Integration time

Power frequency	Integration time
50 Hz	20 ms × NPLC
60 Hz	16.67 ms × NPLC

NPLC: Settable from 0.1 to 0.9 (in 0.1 increments), 1 to 9 (in one increments), and 10 to 100 (in 10 increments)

Response time

Within [2 ms + 2 × (integration time)] (rising from − f.s. to +f.s., and falling from +f.s. to −f.s.)

High-speed response

On/Off

Common-mode rejection ratio

100 dB or more (at 50 Hz / 60 Hz, a signal source resistance of 100 Ω or less)

Input type

Unbalanced input (floating)

Input terminals

Banana jacks

Maximum input voltage

500 V DC

Maximum rated voltage to earth	300 V AC, DC (between each input channel and the enclosure, between any two of input channels) Measurement category II, anticipated transient overvoltage: 2500 V
Operating temperature and humidity	Consistent with the specifications of Memory HiCorder in which Model MR8990 is installed.
Operating environment	Consistent with the specifications of Memory HiCorder in which Model MR8990 is installed.
Storage temperature and humidity	−10°C to 50°C (14°F to 122°F), 80% RH or less (no condensation)
Dimensions	Approx. 106W × 19.8H × 196.5D mm (4.17″W × 0.78″H × 7.74″D)
Mass	Approx. 260 g (9.2 oz.)
Effect of radiated radio-frequency electromagnetic field	±0.1% f.s. (max.) at 3 V/m (with the 100 mV f.s. range)
Standards	Safety: EN61010 EMC: EN61326 Class A
Option	Model L2200 Test Lead (600 V CAT IV, 1000 V CAT III, 10 A)

Model U8974 High Voltage Unit

Conditions of guaranteed accuracy
Specified under the following conditions: installed in a Memory HiCorder and operated at 23°C ±5°C (73°F ±9°F) in the humidity range of 20% to 80% RH after a half-hour (at least) warm-up and execution of zero-adjustment.

Product warranty period	3 years
Guaranteed accuracy period	1 year
Number of input channels	2 channels
Measurement functions	Instantaneous value, RMS value (Each channel can have a different setting.)
Measurement range	4, 10, 20, 40, 100, 200, 400, 1000 V f.s. (DC mode) 10, 20, 40, 100, 200, 400, 1000 V f.s. (RMS mode)
Measurement accuracy	±0.25% f.s. (with the filter set at 5 Hz)
RMS measurement accuracy	±1.5% f.s. (DC, 30 Hz or higher but lower than 1 kHz, sine wave, response time setting: Slow) ±3% f.s. (1 kHz to 10 kHz, sine wave) Crest factor: 2 (sine wave, a peak voltage of up to 1000 V)
RMS measurement response time	Fast: 150 ms (rising from 0% of f.s. to 90% of f.s.) Normal: 500 ms (rising from 0% of f.s. to 90% of f.s.) Slow: 2.5 s (rising from 0% of f.s. to 90% of f.s.)
Temperature characteristics	±0.05% f.s./°C
Frequency characteristics	DC to 100 kHz, −3 dB
Noise	30 mV p-p (typ.), 50 mV p-p (max.); with the highest sensitivity range and the terminals of each input connector connected with each other
Common mode rejection ratio	80 dB or more (at 50 Hz / 60 Hz, with input terminals connected with each other)
Low-pass filter	Off, 5 ±50%, 50 ±50%, 500 ±50%, 5 k ±50%, 50 k ±50% (Hz); −3 dB
Input type	Balanced input (floating)
Input coupling	DC/GND
Input resistance	4 MΩ ±1%
Input capacitance	5 pF or less (at 100 kHz)
A/D resolution	16 bits
Maximum sampling rate	1 MS/s
Input terminals	Banana jacks
Maximum input voltage	1000 V DC, 700 V AC
Maximum rated voltage to earth	1000 V AC, DC, Measurement category III; 600 V AC, DC, Measurement category IV (between each input channel and the enclosure, between any two of input channels) Anticipated transient overvoltage: 8000 V
Operating temperature and humidity	Consistent with the specifications of Memory HiCorder in which Model U8974 is installed.
Operating environment	Consistent with the specifications of Memory HiCorder in which Model U8974 is installed.

Storage temperature and humidity	−20°C to 50°C (−4°F to 122°F) For −20°C or higher but lower than 40°C (−4°F or higher but lower than 104°F), 80% RH or less (no condensation) For 40°C or higher but lower than 45°C (104°F or higher but lower than 113°F), 60% RH or less (no condensation) For 45°C to 50°C (113°F to 122°F), 50% RH or less (no condensation)
Dimensions	Approx. 106W × 19.8H × 196.5D mm (4.17″W × 0.78″H × 7.74″D)
Mass	Approx. 230 g (8.1 oz.)
Effect of radiated radio-frequency electromagnetic field	±5% f.s. (max.) at 3 V/m
Effect of conducted radio-frequency electromagnetic field	±5% f.s. (max.) at 3 V (in the 10 V f.s. range, with 1 V DC inputted)
Standards	Safety: EN61010 EMC: EN61326 Class A
Options	Model L4940 Connection Cable Set (1.5 m) Model L4935 Alligator Clip Set (attached to the tips of Model L4940, 600 V CAT IV, 1000 V CAT III, 10 A) Model L9243 Grabber Clip (attached to the tips of Model L4940, 1000 V CAT II, 1 A) Model L4936 Bus Bar Clip Set (attached to the tips of Model L4940, 600 V CAT III, 5 A) Model L4937 Magnetic Adapter Set (attached to the tips of Model L4940, 1000 V CAT III, 2 A) Model L4931 Extension Cable Set (to extend the length of Model L4940, 1.5 m, 600 V CAT IV, 1000 V CAT III, 10 A) Model L4932 Test Pin Set (attached to the tips of Model L4940, 600 V CAT IV, 1000 V CAT III, 10 A) Model L4934* Small Alligator Clip Set (300 V CAT III, 600 V CAT II, 3 A) *: Model L4932 is required when Model L4934 is used.

Model U8975 4ch Analog Unit

Conditions of guaranteed accuracy
Specified under the following conditions: installed in a Memory HiCorder and operated at 23°C ±5°C (73°F ±9°F) and 80% RH or less after a half-hour (at least) warm-up and execution of zero-adjustment.

Operating environment	Indoors, Pollution Degree 2, Operating altitude: up to 2000 m (6562 ft.)
Operating temperature and humidity	0°C to 40°C (32°F to 104°F), 80% RH or less (no condensation)
Storage temperature and humidity	−10°C to 50°C (14°F to 122°F) For −10°C or higher but lower than 40°C (14°F or higher but lower than 104°F), 80% RH or less (no condensation) For 40°C or higher but lower than 45°C (104°F or higher but lower than 113°F), 60% RH or less (no condensation) For 45°C to 50°C (113°F to 122°F), 50% RH or less (no condensation)
Standards	Safety: EN61010 EMC: EN61326 Class A
Dimensions	Approx. 106W × 19.8H × 196.5D mm (4.17″W × 0.78″H × 7.74″D)
Mass	Approx. 250 g (8.8 oz.)
Product warranty period	3 years
Measurement range	4, 10, 20, 40, 100, 200 V f.s.
Maximum input voltage	200 V DC
Maximum rated voltage to earth	300 V AC, DC, Measurement category II (between each input channel and the enclosure, between any two of input channels) Anticipated transient overvoltage: 2500 V
Measurement terminal	Insulated BNC terminal
Number of channels	4 channels
Frequency characteristics	DC to 2 MHz, −3 dB
Noise	5 mV p-p (typ., 10 mV p-p (max.) (with the highest sensitivity range with input terminals connected with each other)
Input type	Unbalanced input (floating)
Input coupling	DC/GND
Input resistance	1 MΩ ±1%
Input capacitance	30 pF ±10 pF (at 100 kHz)
A/D resolution	16 bits (± f.s. = ±32000 data points)
Maximum sampling rate	5 MS/s
Guaranteed accuracy period	1 year
Measurement accuracy	±0.1% f.s. (with the filter set at 5 Hz)
Temperature characteristics	±0.02% f.s./°C
Effect of radiated radio-frequency electromagnetic field	±5% f.s. (max.) at 3 V/m (with the filter set at 5 Hz)

Effect of conducted radio-frequency electromagnetic field	±5% f.s. (max.) at 3 V (in the 10 V f.s. range, with the filter set at 5 Hz and 1 V DC inputted)
Common-mode rejection ratio	80 dB or more (at 50 Hz / 60 Hz, a signal source resistance of 100 Ω)
Low-pass filter	Off, 5 ±50%, 500 ±50%, 5 k ±50%, 200 k ±50% (Hz); −3 dB
Options	Model L9197 Connection Cord (300 V CAT IV, 600 V CAT III, 1 A) Model L9198 Connection Cord (300 V CAT III, 600 V CAT II, 0.2 A) Model L9217 Connection Cord (300 V CAT III, 600 V CAT II, 0.2 A) Model L9790 Connection Cord (With Model L9790-01 or Model 9790-03 attached: 300 V CAT III, 600 V CAT II, 1 A) (With Model 9790-02 attached: 150 V CAT III, 300 V CAT II, 1 A) Model 9322 Differential Probe (With grabber clips attached: 1000 V CAT II) (With alligator clips attached: 600 V CAT III, 1000 V CAT II) Model P9000-01 Differential Probe (1000 V CAT III) Model P9000-02 Differential Probe (1000 V CAT III) Model 9665 10:1 Probe (300 V CAT II) Model 9666 100:1 Probe (300 V CAT II)

Model U8977 3CH Current Unit

Conditions of guaranteed accuracy
Specified under the following conditions: installed in a Memory HiCorder and operated at 23°C ±5°C (73°F ±9°F) and 80% RH or less after a half-hour (at least) warm-up and execution of zero-adjustment.

Operating environment	Indoors, Pollution Degree 2, Operating altitude: up to 2000 m (6562 ft.)
Operating temperature and humidity	0°C to 40°C (32°F to 104°F), 80% RH or less (no condensation)
Storage temperature and humidity	−10°C to 50°C (14°F to 122°F) For −10°C or higher but lower than 40°C (14°F or higher but lower than 104°F), 80% RH or less (no condensation) For 40°C or higher but lower than 45°C (104°F or higher but lower than 113°F), 60% RH or less (no condensation) For 45°C to 50°C (113°F to 122°F), 50% RH or less (no condensation)
Standards	Safety: EN61010 EMC: EN61326 Class A
Dimensions	Approx. 106W × 19.8H × 196.5D mm (4.17″W × 0.78″H × 7.74″D)
Mass	Approx. 250 g (8.8 oz.)
Product warranty period	3 years
Options	Model CT9900 Conversion Cable (PL23 receptacle–ME15W plug) Model CT9920 Conversion Cable (PL14 receptacle–ME15W plug)
Number of input channels	3 channels

Supported current sensors	• Directly connectable current sensors Model 9272-05 Clamp on Sensor (20 A/200 A AC) Model CT6841-05 AC/DC Current Probe (20 A) Model CT6843-05 AC/DC Current Probe (200 A) Model CT6844-05 AC/DC Current Probe (500 A, ϕ20 mm) Model CT6845-05 AC/DC Current Probe (500 A, ϕ50 mm) Model CT6846-05 AC/DC Current Probe (1000 A) Model CT6862-05 AC/DC Current Sensor (50 A) Model CT6863-05 AC/DC Current Sensor (200 A) Model 9709-05 AC/DC Current Sensor (500 A) Model CT6904 AC/DC Current Sensor (500 A) Model CT6865-05 AC/DC Current Sensor (1000 A) Model CT6875 AC/DC Current Sensor (500 A) Model CT6876 AC/DC Current Sensor (1000 A) Model CT6877 AC/DC Current Sensor (2000 A) Model CT6830 AC/DC Current Probe (2 A) Model CT6831 AC/DC Current Probe (20 A) Model CT6833 AC/DC Current Probe (200 A, cord length 5 m) Model CT6833-01 AC/DC Current Probe (200 A, cord length 10 m) Model CT6834 AC/DC Current Probe (500 A, cord length 5 m) Model CT6834-01 AC/DC Current Probe (500 A, cord length 10 m) Model CT6841A AC/DC Current Probe (20 A) Model CT6843A AC/DC Current Probe (200 A) Model CT6844A AC/DC Current Probe (500 A, ϕ20 mm) Model CT6845A AC/DC Current Probe (500 A, ϕ50 mm) Model CT6846A AC/DC Current Probe (1000 A) Model CT6872 AC/DC Current Sensor (50 A) Model CT6872-01 AC/DC Current Sensor (50 A, cord length 10 m) Model CT6873 AC/DC Current Sensor (200 A) Model CT6873-01 AC/DC Current Sensor (200 A, cord length 10 m) Model CT6875A AC/DC Current Sensor (500 A) Model CT6875A-1 AC/DC Current Sensor (500 A, cord length 10 m) Model CT6876A AC/DC Current Sensor (1000 A) Model CT6876A-1 AC/DC Current Sensor (1000 A, cord length 10 m) Model CT6877A AC/DC Current Sensor (2000 A) Model CT6877A-1 AC/DC Current Sensor (2000 A, cord length 10 m) Model CT6904A AC/DC Current Sensor (500 A) • Current sensors that require Model CT9920 for connection Model CT7631 AC/DC Current Sensor (100 A) Model CT7636 AC/DC Current Sensor (600 A) Model CT7642 AC/DC Current Sensor (2000 A) Model CT7731 AC/DC Auto-Zero Current Sensor (100 A) Model CT7736 AC/DC Auto-Zero Current Sensor (600 A) Model CT7742 AC/DC Auto-Zero Current Sensor (2000 A) Model CT7044 AC Flexible Current Sensor (6000 A, ϕ100 mm) Model CT7045 AC Flexible Current Sensor (6000 A, ϕ180 mm) Model CT7046 AC Flexible Current Sensor (6000 A, ϕ254 mm)

Measurement range	• For the directly connectable current sensors, the instrument automatically recognizes the rating of the current sensor. 2 A, 4 A, 10 A, 20 A, 40 A, 100 A (rating: 20 A) 4 A, 10 A, 20 A, 40 A, 100 A, 200 A (rating: 50 A) 20 A, 40 A, 100 A, 200 A, 400 A, 1000 A (rating: 200 A) 40 A, 100 A, 200 A, 400 A, 1000 A, 2000 A (rating: 500 A) 100 A, 200 A, 400 A, 1000 A, 2000 A, 4000 A (rating: 1000 A) 200 A, 400 A, 1000 A, 2000 A, 4000 A, 10000 A (rating: 2000 A) • For the current sensors that require Model CT9920 for connection, choose a conversion rate or a model number. 200 A (Model CT7631, Model CT7731) 200 A, 400 A, 1000 A (Model CT7636, Model CT7736) 2000 A, 4000 A (Model CT7642, Model CT7742) 2000 A, 4000 A, 10000 A (Model CT7044, Model CT7045, Model CT7046) 2000 A, 4000 A, 10000 A, 20000 A, 40000 A, 100000 A (0.1 mV/A) 200 A, 400 A, 1000 A, 2000 A, 4000 A, 10000 A (1 mV/A) 20 A, 40 A, 100 A, 200 A, 400 A, 1000 A (10 mV/A) 2 A, 4 A, 10 A, 20 A, 40 A, 100 A (100 mV/A) 0.2 A, 0.4 A, 1 A, 2 A, 4 A, 10 A (1000 mV/A)
Frequency characteristics	DC to 2 MHz (±3 dB)
Noise	10 mA p-p (max.) (using the 20 A sensor, with the 2 A f.s. range, with input terminals connected with each other)
Low-pass filter	Off, 5 Hz, 500 Hz, 5 kHz, 200 kHz ±50%; −3 dB
Input type	Current sensor
Measurement terminal	Dedicated connector (ME15W)
Input coupling	DC/GND
Input resistance	1 MΩ ±1%
Maximum input current	Depends on a sensor.
Maximum rated voltage to earth	Non-isolated
Maximum sampling rate	5 MS/s
A/D resolution	16 bits
Guaranteed accuracy period	1 year
Measurement accuracy	±0.3% f.s. + (accuracy of current sensor)
Temperature characteristics	±0.045% f.s./°C
Effect of radiated radio-frequency electromagnetic field	±5% f.s. (max.) at 3 V/m (with the filter set at 5 Hz)
Effect of conducted radio-frequency electromagnetic field	±5% f.s. (max.) at 3 V (using the 20 A sensor, with the 20 A f.s. range, with the filter set at 5 Hz, with a current of 2 A DC inputted)

Model U8978 4CH Analog Unit

Conditions of guaranteed accuracy
Specified under the following conditions: installed in a Memory HiCorder and operated at 23°C±5°C (73°F±9°F) and 80% RH or less after a half-hour (at least) warm-up and execution of zero-adjustment.

Operating environment	Indoors, Pollution Degree 2, Operating altitude: up to 2000 m (6562 ft.)
Operating temperature and humidity	0°C to 40°C (32°F to 104°F), 80% RH or less (no condensation)
Storage temperature and humidity	−10°C to 50°C (14°F to 122°F) For −10°C or higher but lower than 40°C (14°F or higher but lower than 104°F), 80% RH or less (no condensation) For 40°C or higher but lower than 45°C (104°F or higher but lower than 113°F), 60% RH or less (no condensation) For 45°C to 50°C (113°F to 122°F), 50% RH or less (no condensation)
Standards	Safety: Model EN61010 EMC: EN61326 Class A
Dimensions	Approx. 106W × 19.8H × 196.5D mm (4.17″W × 0.78″H × 7.74″D)
Mass	Approx. 250 g (8.8 oz.)
Product warranty period	3 years
Measurement range	100, 200, 400 mV f.s., 1, 2, 4, 10, 20, 40 V f.s.
Maximum input voltage	(Direct input) 40 V DC (In combination with Model 9665) 400 V DC
Maximum rated voltage to earth	(Direct input) 30 V AC, 60 V DC (between each input channel and the enclosure, between any two of input channels) (In combination with Model 9665) 300 V AC, DC, Measurement category II (between each input channel and the enclosure, between any two of input channels)
Measurement terminal	Insulated BNC terminal
Number of channels	4 channels
Frequency characteristics	DC to 2 MHz, −3 dB
Noise	500 µV p-p (typ.), 1 mV p-p (max.) (with the highest sensitivity range and the terminals of each input connector connected with each other)
Input type	Unbalanced input (floating)
Input coupling	DC/GND
Input resistance	1 MΩ ±1%
Input capacitance	30 pF ±10 pF (at 100 kHz)
A/D resolution	16 bits (± f.s. = ±32000 data points)
Maximum sampling rate	5 MS/s
Guaranteed accuracy period	1 year
Measurement accuracy	±0.3% f.s. (with the filter set at 5 Hz)
Temperature characteristics	±0.045% f.s./°C

Effect of radiated radio-frequency electromagnetic field	±5% f.s. (max.) at 3 V/m (with the filter set at 5 Hz)
Effect of conducted radio-frequency electromagnetic field	±5% f.s. (max.) at 3 V (in the 10 V range, with the filter set at 5 Hz and 1 V DC inputted)
Common-mode rejection ratio	80 dB or more (at 50 Hz / 60 Hz, a signal source resistance of 100 Ω)
Low-pass filter	Off, 5 ±50%, 500 ±50%, 5 k ±50%, 200 k ±50% (Hz); −3 dB
Options	Model L9197 Connection Cord (300 V CAT IV, 600 V CAT III, 1 A) Model L9198 Connection Cord (300 V CAT III, 600 V CAT II, 0.2 A) Model L9217 Connection Cord (300 V CAT III, 600 V CAT II, 0.2 A) Model L9790 Connection Cord (With Model L9790-01 or Model 9790-03 attached: 300 V CAT III, 600 V CAT II, 1 A) (With Model 9790-02 attached: 150 V CAT III, 300 V CAT II, 1 A) Model 9322 Differential Probe (With grabber clips attached: 1000 V CAT II) (With alligator clips attached: 600 V CAT III, 1000 V CAT II) Model P9000-01 Differential Probe (1000 V CAT III) Model P9000-02 Differential Probe (1000 V CAT III) Model 9665 10:1 Probe (300 V CAT II) Model 9666 100:1 Probe (300 V CAT II)

Model U8979 Charge Unit

1. General specifications

Operating environment	Indoors, Pollution Degree 2, Operating altitude: up to 2000 m (6562 ft.)
Operating temperature and humidity	0°C to 40°C (32°F to 104°F), 80% RH or less (no condensation)
Storage temperature and humidity	−10°C to 50°C (14°F to 122°F) For −10°C or higher but lower than 40°C (14°F or higher but lower than 104°F), 80% RH or less (no condensation) For 40°C or higher but lower than 45°C (104°F or higher but lower than 113°F), 60% RH or less (no condensation) For 45°C to 50°C (113°F to 122°F), 50% RH or less (no condensation)
Standards	Safety: EN61010 EMC: EN61326 Class A
Dimensions	Approx. 106W × 19.8H × 196.5D mm (4.17″W × 0.78″H × 7.74″D)
Mass	Approx. 250 g (8.8 oz.)
Product warranty period	3 years
Guaranteed accuracy period	1 year
Option	Model 9166 Connection Cord (for voltage measurement)

2. Specifications of input, output, and measurement

-1. Common specifications

Number of channels	2 channels
Measurement mode	Charge, pre-amplifier, voltage (selectable for each channel)
Input type	Unbalanced input (floating) In each channel, the voltage input terminal has the same-potential ground as the charge input terminal.
Common-mode rejection ratio	80 dB or more (at 50 Hz / 60 Hz, a signal source resistance of 100 Ω)
Anti-aliasing filters	Cutoff frequency (fc) 20, 40, 80, 200, 400, 800, 2 k, 4 k, 8 k, 20 k, 40 k (Hz) Switchable between on and off; the instrument automatically chooses a cutoff frequency along with the sampling rate. Attenuation property: −66 dB or higher at a cutoff frequency of 1.5 × fc
Maximum sampling rate	200 kS/s
A/D resolution	16 bits (± f.s. = ±25,000 data points)
Maximum rated voltage to earth	30 V AC, 60 V DC (between each input channel and the enclosure, between any two of input channels) Anticipated transient overvoltage: 330 V

-2. Voltage input

Measurement range	10, 20, 40, 100, 200, 400 mV f.s., 1, 2, 4, 10, 20, 40 V f.s.
Maximum input voltage	40 V DC

Frequency characteristics	DC to 50 kHz −3 dB (DC-coupled) 1 Hz to 50 kHz −3 dB (AC-coupled, at the lower cutoff frequency of 1 Hz ±50%)
Noise	80 µV p-p (typ.), 120 µV p-p (max.), with the highest sensitivity range and the terminals of each input connector connected with each other
Input resistance	1 MΩ ±1%
Input capacitance	200 pF or less (at 100 kHz)
Input coupling	AC/DC/GND
Input terminals	Insulated BNC terminal

-3. Charge input

Supported detector	Charge-output acceleration detector
Measurement sensitivity	0.1 pC/(m/s^2) to 10 pC/(m/s^2)
Measurement range	40, 100, 200, 400, 1 k, 2 k, 4 k, 10 k, 20 k, 40 k, 100 k, 200 k m/s^2 f.s. Measurement sensitivity: 0.1 pC/(m/s^2) to 0.25 pC/(m/s^2) 20, 40, 100, 200, 400, 1 k, 2 k, 4 k, 10 k, 20 k, 40 k, 100 k m/s^2 f.s. Measurement sensitivity: 0.251 pC/(m/s^2) to 0.5 pC/(m/s^2) 10, 20, 40, 100, 200, 400, 1 k, 2 k, 4 k, 10 k, 20 k, 40 k m/s^2 f.s. Measurement sensitivity: 0.501 pC/(m/s^2) to 1.0 pC/(m/s^2) 4, 10, 20, 40, 100, 200, 400, 1 k, 2 k, 4 k, 10 k, 20 k m/s^2 f.s. Measurement sensitivity: 1.001 pC/(m/s^2) to 2.5 pC/(m/s^2) 2, 4, 10, 20, 40, 100, 200, 400, 1 k, 2 k, 4 k, 10 k m/s^2 f.s. Measurement sensitivity: 2.501 pC/(m/s^2) to 5.0 pC/(m/s^2) 1, 2, 4, 10, 20, 40, 100, 200, 400, 1 k, 2 k, 4 k m/s^2 f.s. Measurement sensitivity: 5.001 pC/(m/s^2) to 10.0 pC/(m/s^2)
Frequency characteristics	1.5 Hz to 50 kHz, −3 dB
Maximum input charge	±500 pC (when one of the higher six ranges is chosen) ±50,000 pC (when one of the lower six ranges is chosen)
Input coupling	AC/GND
Input terminals	Miniature connector (#10-32UNF)

-4. Input from acceleration sensor with the built-in pre-amplifier

Supported detector	Acceleration detector with built-in pre-amplifier
Measurement sensitivity	0.1 mV/(m/s^2) to 10 mV/(m/s^2)
Measurement range	40, 100, 200, 400, 1 k, 2 k, 4 k, 10 k, 20 k, 40 k, 100 k, 200 k m/s^2 f.s. Measurement sensitivity: 0.1 mV/(m/s^2) to 0.25 mV/(m/s^2) 20, 40, 100, 200, 400, 1 k, 2 k, 4 k, 10 k, 20 k, 40 k, 100 k m/s^2 f.s. Measurement sensitivity: 0.251 mV/(m/s^2) to 0.5 mV/(m/s^2) 10, 20, 40, 100, 200, 400, 1 k, 2 k, 4 k, 10 k, 20 k, 40 k m/s^2 f.s. Measurement sensitivity: 0.501 mV/(m/s^2) to 1.0 mV/(m/s^2) 4, 10, 20, 40, 100, 200, 400, 1 k, 2 k, 4 k, 10 k, 20 k m/s^2 f.s. Measurement sensitivity: 1.001 mV/(m/s^2) to 2.5 mV/(m/s^2) 2, 4, 10, 20, 40, 100, 200, 400, 1 k, 2 k, 4 k, 10 k m/s^2 f.s. Measurement sensitivity: 2.501 mV/(m/s^2) to 5.0 mV/(m/s^2) 1, 2, 4, 10, 20, 40, 100, 200, 400, 1 k, 2 k, 4 k m/s^2 f.s. Measurement sensitivity: 5.001 mV/(m/s^2) to 10.0 mV/(m/s^2)
Frequency characteristics	1 Hz to 50 kHz, −3 dB

Power supply for detector	3.0 mA ±20%, 22 V ±5%
Input coupling	AC/GND
Input terminals	Metallic BNC terminal

-5. Specifications for accuracy

Conditions of guaranteed accuracy	Guaranteed accuracy period: 1 year Temperature and humidity for guaranteed accuracy: 23°C ±5°C (73°F ±9°F), 80% RH or less Warm-up time: 30 minutes or more Specified after execution of zero-adjustment
Accuracy of voltage measurement	±0.5% f.s. (with the filter set at 5 Hz)
Temperature characteristic of voltage measurement	±0.05% f.s./°C
Accuracy of amplitude with charge inputted	±2% f.s.
Temperature characteristic with charge inputted	±0.2% f.s./°C (1 kHz)
Accuracy of amplitude inputted from acceleration detector with built-in pre-amplifier	±2% f.s.
Temperature characteristics of input from acceleration sensor with the built-in pre-amplifier	±0.2% f.s./°C (1 kHz)
Effect of radiated radio-frequency electromagnetic field	±10% f.s. (max.) at 3 V/m (with the filter set at 5 Hz)
Effect of conducted radio-frequency electromagnetic field	±10% f.s. (max.) at 3 V (with the filter set at 5 Hz)

3. Specifications of functions

Low-pass filter	Off, 5 ±50% (voltage input only), 500 ±50%, 5k ±50% (Hz); −3 dB
TEDS	IEEE1451.4 Class 1 compliant The instrument reads out sensor information to automatically configure the sensitivity setting.

Model U8991 Digital Voltmeter Unit

Conditions of guaranteed accuracy	Specified under the following conditions: operated at 23°C±5°C (73°F±9°F) and 80% RH or less after a half-hour (at least) warm-up (when installed in a Memory HiCorder)
Operating environment	Indoors, Pollution Degree 2, Operating altitude: up to 2000 m (6562 ft.)
Operating temperature and humidity	Temperature: 0°C to 40°C (32°F to 104°F) Humidity: 80% RH or less (no condensation)
Storage temperature and humidity	Temperature: −10°C to 50°C (14°F to 122°F) Humidity: 80% RH or less (no condensation)
Standards	Safety: EN 61010 EMC: EN 61326 Class A
Dimensions	Approx. 106W ×19.8H × 196.5D mm (4.17″W × 0.78″H × 7.74″D)
Mass	Approx. 250 g (8.8 oz.)
Product warranty period	3 years
Measurement item	DC voltage
Measurement range	<table><tr><td>Measurement range</td><td>Effective input range*</td><td>Resolution</td><td>Input resistance</td></tr><tr><td>1 V f.s.</td><td>−1.2 V to 1.2 V</td><td>1 µV</td><td rowspan="2">100 MΩ or more</td></tr><tr><td>10 V f.s.</td><td>−12 V to 12 V</td><td>10 µV</td></tr><tr><td>100 V f.s.</td><td>−100 V to 100 V</td><td>100 µV</td><td>10 MΩ ±1%</td></tr></table>*: Guaranteed range of measurement accuracy
Maximum input voltage	100 V DC
Maximum rated voltage to earth	100 V AC, DC (between each input channel and enclosure, between any two of input channels) Without a measurement category rating, anticipated transient overvoltage: 500 V
Measurement method	Delta-sigma modulation method
Measurement terminal	Insulated BNC terminal
Number of channels	4 channels
Input type	Unbalanced input (floating)
Integration time	20 ms × NPLC (power frequency: 50 Hz), 16.67 ms × NPLC (power frequency: 60 Hz) (NPLC can be chosen from among 1, 10, and 100)
High-speed response	The high-speed response can be switched between on and off.
Guaranteed accuracy period	1 year
Measurement accuracy	±0.02% rdg. ±0.0025% f.s.
Temperature characteristics	(±0.002% rdg.±0.00025% f.s.)/°C
Effect of radiated radio-frequency electromagnetic field	±0.1% f.s. (max.) at 3 V/m (in the 1 V f.s. range)
Effect of conducted radio-frequency electromagnetic field	±0.1% f.s. (max.) at 3 V (in the 1 V f.s. range)

Common-mode rejection ratio	100 dB or more (at 50 Hz / 60 Hz, a signal source resistance of 100 Ω)
Options	Model L9197 Connection Cord (300 V CAT IV, 600 V CAT III, 1 A) Model L9198 Connection Cord (300 V CAT III, 600 V CAT II, 0.2 A) Model L9217 Connection Cord (300 V CAT III, 600 V CAT II, 0.2 A) Model L9790 Connection Cord (With Model L9790-01 or Model 9790-03 attached: 300 V CAT III, 600 V CAT II, 1 A) (With Model 9790-02 attached: 150 V CAT III, 300 V CAT II, 1 A)

Model MR8790 Waveform Generator Unit

Conditions of guaranteed accuracy	Specified under the following conditions: operated at 23°C±5°C (73°F±9°F) and 80% RH or less after a half-hour (at least) warm-up (when installed in a Memory HiCorder)
Product warranty period	3 years
Guaranteed accuracy period	1 year
Number of output channels	4 channels (isolated between enclosure and output, and between every channel)
Self-diagnosis function	Available (with the voltage and current monitors)
Switchable between the voltage and current monitors	Resolution: 5 µA (current monitor), 10 mV (voltage monitor) Monitor accuracy: ±3.0% f.s. (f.s. = 10 V: voltage monitor, f.s. = 5 mA: current monitor)
Maximum output current	±5 mA
Allowable load resistance	2 kΩ or more
Output terminal	SMB terminal
Output configuration	Waveform output / open / short-circuit
Output relay switching time	5 ms or less
Output protection	The output current is limited to 40 mA (when the output terminals are are connected with each other)
Maximum rated voltage to earth	30 V rms AC or 60 V DC (between each output channel and enclosure, between any two of output channels) Anticipated transient overvoltage: 330 V
Withstanding voltage	350 V AC (sensitivity current: 1 mA) (between each output channel and enclosure, between any two of output channels)
Operating temperature and humidity	Consistent with the specifications of Memory HiCorder in which Model MR8790 is installed.
Operating environment	Consistent with the specifications of Memory HiCorder in which Model MR8790 is installed.
Storage temperature and humidity	−20°C to 50°C (−4°F to 122°F), 90% RH or less (no condensation)
Dimensions	Approx. 106W × 19.8H × 196.5D mm (4.17″W × 0.78″H × 7.74″D) (excluding protrusions)
Mass	Approx. 230 g (8.1 oz.)
Standards	Safety: EN61010 EMC: EN61326 Class A
Effect of radiated radio-frequency electromagnetic field	±3% f.s. (max.) at 3 V/m (f.s. = 10 V)
Effect of conducted radio-frequency electromagnetic field	±1% f.s. (max.) at 3 V (f.s. = 10 V)
Options	Model L9795-01 Connection Cable (terminal type: SMB terminal - alligator clip) Model L9795-02 Connection Cable (terminal type: SMB terminal - BNC terminal)
Maximum output voltage	±10 V

Resolution	16 bits
Output frequency	Output frequency: DC, 0 Hz to 20 kHz (sine wave) Setting resolution: 1 Hz Frequency accuracy: ±0.01% of setting
Amplitude	Measurable range: 0 V p-p to 20 V p-p Setting resolution: 1 mV Amplitude accuracy: ±0.25% of setting ±2 mV p-p (1 Hz to 10 kHz), ±0.6% of setting ±2 mV p-p (more than 10 kHz to 20 kHz)
DC offset	Setting range: −10 V to 10 V (The peak value, which is the total of amplitude and DC offset, is limited to ±10 V) Setting resolution: 1 mV, offset accuracy: ±3 mV
DC output	Output accuracy: ±0.6 mV

Model MR8791 Pulse Generator Unit

General specifications

Temperature and humidity for guaranteed accuracy	23°C±5°C (73°F±9°F), 80% RH or less (no condensation) (when installed in a Memory HiCorder)
Guaranteed accuracy period	1 year
Product warranty period	3 years
Operating temperature and humidity	Consistent with the specifications of Memory HiCorder in which Model MR8791 is installed.
Operating environment	Consistent with the specifications of Memory HiCorder in which Model MR8791 is installed.
Storage temperature and humidity	−20°C to 50°C (−4°F to 122°F), 90% RH or less (no condensation)
Maximum rated voltage to earth	30 V rms AC or 60 V DC (between each output channel and enclosure) Anticipated transient overvoltage: 330 V
Withstanding voltage	350 V AC (sensitivity current: 1 mA) (between each output channel and enclosure, between any two of output modules)
Dimensions	Approx. 106W × 19.8H × 196.5D mm (4.17″W × 0.78″H × 7.74″D) (excluding protrusions)
Mass	Approx. 230 g (8.1 oz.)
Number of output channels	8 channels (isolated between each output channel and enclosure, and between any two of input channels; not isolated between any two of output channels [cross-channel GND terminal]; not isolated between output connector frame and instrument's GND terminal)
Output mode 1	Pattern output / pulse output (8 channels are commonly switched)
Output mode 2 **Logic output:** **Open-collector output:**	Logic output / open-collector output (configurable for 8 channels individually) Output voltage level: 0 V to 5 V (High level: 3.8 V or more, low level: 0.8 V or less) Rated current: ±5 mA Absolute maximum rated voltage between collector and emitter: 50 V Overcurrent protection: 100 mA
Output mode 3	Output / open (for self-diagnosis) (8 channels are commonly switched)
Open-collector output specification (rising time from 10% to 90%)	5 µs (max.) (load capacity: 1000 pF, pull-up resistor: 1 kΩ)
Self-diagnosis function	Detection voltage High level: 3.4 V or more, low level: 1.6 V or less
Relay switching time	5 ms or less (switching between logic and open-collector, between output and open [self-diagnosis])
Standards	Safety: EN 61010 EMC: EN 61326 Class A

Specifications of the pulse outputting

Output frequency	Setting range: 0 Hz to 20 kHz (configurable for 8 channels individually) Setting resolution: 0.1 Hz Frequency accuracy: Consistent with the time-axis accuracy of Memory HiCorder in which Model MR8791 is installed.
Duty ratio	Setting range: 0.1% to 99.9%, 0, 100% (DC) Setting resolution: 0.1% Duty ratio accuracy: Consistent with the time-axis accuracy of Memory HiCorder in which Model MR8791 is installed.
Minimum pulse width	1 µs

Specifications of the pattern outputting

Clock frequency	Range: 0 Hz to 120 kHz (common for 8 channels) Setting resolution: 10 Hz Frequency accuracy: Consistent with the time-axis accuracy of Memory HiCorder in which Model MR8791 is installed.
Memory (pattern)	2,048 words (16,384 bits = 2,048 words × 8 bits/word)

Specifications of the output connector

10250-52A2PL: 3M brand (SCSI-2 connector, Centronics half-pitch, 50 pins, female)

Pin	Signal name	Pin	Signal name
1	I_GND:	26	I_GND:
2	CH1	27	I_GND:
3	CH2	28	I_GND:
4	CH3	29	I_GND:
5	CH4	30	I_GND:
6	I_GND:	31	I_GND:
7	CH5	32	I_GND:
8	CH6	33	I_GND:
9	CH7	34	I_GND:
10	CH8	35	I_GND:
11	I_GND:	36	I_GND:
12	NC	37	I_GND:
13	NC	38	I_GND:
14	NC	39	I_GND:
15	NC	40	I_GND:
16	I_GND:	41	I_GND:
17	NC	42	I_GND:
18	NC	43	I_GND:
19	NC	44	I_GND:
20	NC	45	I_GND:
21	I_GND:	46	I_GND:
22	TEST2 (DIN03)	47	I_GND:
23	TEST3 (DIN02)	48	I_GND:
24	NC	49	I_GND:
25	NC	50	I_GND:
Frame	F_GND:		

CH1 through CH8:	Pulse output
I_GND:	Isolated ground
F_GND:	Non-isolated ground (frame ground)
NC:	Not connected
TESTn:	Do not connect a test pin.

Recommended connection cable: Model KB-SHH2K Sanwa Supply brand (SCSI-2 connector, Centronics half-pitch, 50 pins, male)

Model U8793 Arbitrary Waveform Generator Unit

1. General specifications

Operating environment	Consistent with the specifications of the Memory HiCorder in which Model U8793 is installed.
Operating temperature and humidity range	Consistent with the specifications of the Memory HiCorder in which Model U8793 is installed.
Storage temperature and humidity range	Temperature: −20°C to 50°C (−4°F to 122°F) Humidity: 80% RH or less (no condensation)
Standards	Safety: EN61010 EMC: EN61326 Class A
Dimensions	Appx. 106W × 19.8H × 196.5D mm (4.17″W × 0.78″H × 7.74″D) (excluding protrusions)
Weight	Approx. 250 g (8.8 oz.)
Product warranty period	3 years
Options	Model L9795-01 Connection Cable (terminal type: SMB terminal-mini alligator clip) Model L9795-02 Connection Cable (terminal type: SMB terminal-BNC terminal)

2. Output specifications

(1) Basic specifications (common between the function generator function and arbitrary waveform generator function)

Accuracy guarantee conditions	Accuracy guarantee period: 1 year Accuracy guarantee period after adjustment made by Hioki: 1 year Accuracy guarantee temperature and humidity range: 23°C ±5°C (73°F ±9°F), 80% RH or less Warm-up time: 30 minutes or more Power frequency range of Memory HiCorder in which Model U8793 is installed: 50 Hz/60 Hz ±2 Hz
Number of output channels	2 channels
Output terminals	SMB terminals
Output type	Unbalanced (floating)
Maximum rated terminal-to-ground voltage	30 V rms AC or 60 V DC (between each output channel and the enclosure, between each output channel and the external I/O terminal, between any two of output channels) Anticipated transient overvoltage: 330 V
Maximum output voltage	−10 V to 15 V
Amplitude setting range	0 V p-p to 20 V p-p (setting resolution: 1 mV)
DC offset setting range	−10 V to 15 V (setting resolution: 1 mV)
Output impedance	1 Ω or less
Maximum output current	±10 mA (per channel)
Allowable load resistance	1.5 kΩ or more
Output type	Waveform output, open-circuit, short-circuit

(2) Specifications of function generator function

Output waveforms	Sine wave, rectangular wave, pulse wave (duty cycle adjustable), triangular wave, lamp wave, DC
Output frequency range	0 Hz to 100 kHz (setting resolution: 10 mHz)
Output frequency accuracy	±0.015% of setting
DC output accuracy	±0.05% of setting ±10 mV
Temperature characteristics of DC output	(±0.005% of setting ±1 mV)/°C
Amplitude accuracy	±0.5% of setting ±10 mV p-p (more than or equal to 10 mHz but less than or equal to 10 kHz) ±0.8% of setting ±10 mV p-p (more than 10 kHz but less than or equal to 50 kHz) ±1.0% of setting ±10 mV p-p (more than 50 kHz but less than or equal to 100 kHz)
Temperature characteristics of amplitude	(±0.05% of setting ±1 mV p-p)/°C
DC offset accuracy	±0.5% of setting ±10 mV
Temperature characteristics of DC offset	(±0.05% of setting ±1 mV)/°C
Phase difference setting range	−360° to 360° (setting resolution: 0.1°)
Jitter	Within 50 ns p-p (rectangular wave, pulse wave, triangular wave, lamp wave)
Setting range of pulse-wave duty cycle	0.1% to 99.9% (setting resolution: 0.1 percent point) Effective for a pulse width of 500 ns or more in length
Accuracy of pulse-wave duty cycle	±0.1% of period (more than or equal to 10 mHz but less than or equal to 5 kHz) ±0.5% of period (more than 5 kHz but less than or equal to 20 kHz) ±1.0% of period (more than 20 kHz but less than or equal to 100 kHz)

(3) Specification of arbitrary waveform generator function

Output waveforms	Waveforms measured with the following Memory HiCorders: Model 8847, Model MR8847, Model MR8847A, Model MR8827, Model MR8740, Model MR8740T, Model MR8741, and Model MR6000 (Logic waveforms not supported) Waveforms measured with Model PW3198 Power Quality Analyzer (via Model SF8000) Waveforms saved with Model 7075 Waveform Generator (via Model SF8000) Waveforms saved as CSV files (via Model SF8000) Waveforms created with Model SF8000 Waveform Maker
Resolution of voltage axis	16 bits
Waveform memory capacity	256 kW/channel × 8 blocks
Low-pass filter	2nd-order LPF, 50 Hz to 1 MHz (1-2-5 series, 14 levels)
D/A refresh rate	Up to 2 MHz (setting resolution: 10 mHz)
Clock frequency accuracy	±150 ppm
Clock-frequency jitter	Within 50 ns p-p
Delay	−250,000 to 250,000 (settable in increments of one data point)
Number of looping times	1 to 50,000 times or infinity

(4) Specifications of sweep function

Swept waveforms	Function generator waveforms and arbitrary waveforms (except DC)
Sweeping form	Linear
Sweeping target parameters	Function generator waveforms: Frequency, amplitude, offset, duty cycle (for pulse wave only) (Frequency, amplitude, and offset can be swept simultaneously) Arbitrary waveforms: Clock frequency, amplitude, offset (Clock frequency, amplitude, and offset can be swept simultaneously)
Sweeping-time setting range	10 µs to 1000 s (setting resolution: 10 µs)

3. Specifications of program function

Sequence length	Outputs 128 steps with pieced together.
Step control	Individual steps can be set to output a function generator waveform, a swept waveform, or an arbitrary waveform. The number of looping times (swept waveforms) or the output length in time (function generator waveforms and arbitrary waveforms) can be set for individual steps.
Holding setting	Can be enabled/disabled for individual steps.
Output time setting range	10 µs to 1000 s (function generator waveforms, arbitrary waveforms)
Setting range of the number of sweeping times	1 to 1000 times (swept waveforms)
Setting range of the number of whole looping times	1 to 50,000 times or infinity

Monitor function	The running step number, the number of sweeping times, and the iteration count for the whole loop can be displayed.

4. Other specifications

Synchronization of all channels with one another	Phase settings between channels of individual modules and phase settings between modules can be configured.
Self-diagnosis function	Output voltages can be monitored. Monitor resolution: 10 mV Accuracy of monitor: ±3.0% f.s. (f.s. = 15 V)
Start/stop of output	Available with the operation of the Memory HiCorder and input of signals to the instrument's external control terminal.
External input	When a low-level signal is externally input during the use of the program function, the instrument can exit hold mode and proceed to the subsequent step. Control voltage level: 3.5 V to 5.0 V (high level), 0 V to 0.8 V (low level) Responsive pulse width: 100 µs or more (low level)
External output	A signal is output at the time of waveform output. Output type: Open-drain output (equipped with a 5-volt voltage output, active-low) Output voltage level: 4.0 V to 5.0 V (high level), 0 V to 0.5 V (low level) Maximum switching capacity: 5 V to 30 V DC, 50 mA
External I/O terminal	Push-button type terminal block
Waveform output indication	A red indicator goes on if waveforms are output; goes off if not.

Model U8794 VIR Generator Unit

Operating environment	Indoors, Pollution Degree 2, Operating altitude: up to 2000 m (6562 ft.)				
Operating temperature and humidity	0°C to 40°C (32°F to 104°F), 80% RH or less (no condensation)				
Storage temperature and humidity	−10°C to 50°C (14°F to 122°F), 80% RH or less (no condensation)				
Standards	Safety: EN 61010 EMC: EN 61326 Class A				
Dimensions	Approx. 106W × 19.8H × 196.5D mm (4.17″W × 0.78″H × 7.74″D) (excluding protrusions)				
Mass	Approx. 280 g (9.9 oz.)				
Product warranty period	3 years				
Output item	DC voltage, DC current, resistance (simulated output), AC voltage (sine wave) Default setting: DC voltage				
Output range	DC voltage	5 V range	−0.100 0 V to +5.300 0 V Output current: −5 mA to +5 mA Setting resolution: 0.1 V		
	DC current		Current	Output voltage	Open terminal voltage
		5 mA range	−5.000 0 mA to +5.000 0 mA Setting resolution: 0.1 µA	−0.1 V to +5.3 V	9 V max.
		1 mA range	−1.000 00 mA to +1.000 00 mA Setting resolution: 0.01 µA		
		250 µA range	−250. 00 µA to +250.00 µA Setting resolution: 0.01 µA		
		50 µA range	−50. 000 µA to +50. 000 µA Setting resolution: 0.001 µA		
	Resistance	10 Ω to 1 MΩ Setting resolution: 6 digits			
	DC voltage	Amplitude	5.0 V p-p Setting resolution: 0.1 V		
		DC offset	0.0 V to 2.5 V Setting resolution: 0.1 V		
		Frequency	10 Hz, 20 Hz, 50 Hz, 100 Hz		
Measurement item	DC voltage, DC current, AC current				

Measurable range	DC voltage	5 V range	−0.200 00 V to +5.500 00 V
		0.5 V range (for resistance output function only)	−0.200 000 V to +0.500 000 V
	DC current	5 mA range	−5.500 00 mA to +5.500 00 mA (Fixed at 5 mA range for voltage output function)
		1 mA range	−1.000 000 mA to +1.000 000 mA
		250 μA range	−250.000. 00 μA to +250.000 μA
		50 μA range	−50.000. 0 μA to +50.000. 0 μA
	AC voltage	5.500 0 mA p-p (fixed at 5 mA range)	
Measurement method	Delta-sigma method		
Integration time of voltage measurement and current measurement	1 PLC (20 ms for a power frequency of 50 Hz, 16.67 ms for a power frequency of 60 Hz)		
Number of channels	8 channels (isolated between any two of channels)		
Output terminal	D-sub 25 pin		
Maximum rated voltage to earth	25 V Anticipated transient overvoltage: 25 V		
Conditions of guaranteed accuracy	Guaranteed accuracy period: 1 year Temperature and humidity for guaranteed accuracy: 23°C ±5°C (73°F ±9°F), 80% RH or less Warm-up time: 30 minutes or more *When outputting a resistance • The product of the set resistance value and output current is 30 mV or more. • The response coefficient of the resistance generation stands at 0.0002.		

Output accuracy

DC voltage	5 V range	±0.035% of setting ± 800 µV	
	Temperature coefficient	Add the following value when operating the instrument in temperature ranges of 0°C to 18°C and of 28°C to 40°C. [0.1 × (output accuracy)] /°C	
	Output resistance	100 mΩ or less	
	Overshoot	When an output changes from 0% to 100% of a setting value Less than 5% (reference value with resistance load)	
	Output settling time	Time an output signal takes to settle within 0.1% of the range value when the signal changes from 0% to 100% of the range 5 ms (reference value with no load)	
DC current	5 mA range	±0.050% of setting ± 4.0 µA	
		Temperature coefficient	Add the following value when operating the instrument in temperature ranges of 0°C to 18°C and of 28°C to 40°C. [0.1 × (output accuracy)] /°C
	1 mA range	±0.050% of setting ± 800 nA	
		Temperature coefficient	Add the following value when operating the instrument in temperature ranges of 0°C to 18°C and of 28°C to 40°C. [0.1 × (output accuracy)] /°C
	250 µA range	±0.050% of setting ± 200 nA	
		Temperature coefficient	Add the following value when operating the instrument in temperature ranges of 0°C to 18°C and of 28°C to 40°C. [0.1 × (output accuracy)] /°C
	50 µA range	±0.050% of setting ± 40 nA	
		Temperature coefficient	Add the following value when operating the instrument in temperature ranges of 0°C to 18°C and of 28°C to 40°C. [0.1 × (output accuracy)] /°C
	Overshoot	When an output changes from 0% to 100% of a setting value Less than 5% (reference value with resistance load)	
	Output settling time	Time an output signal takes to settle within 0.1% of the range value when the signal changes from 0% to 100% of the range 5 ms (reference value with short-circuited load)	

Resistance	Current generation range	Voltage measurement 0.5 V range		Voltage measurement 5 V range	
		Percent of output	Floor [Ω]	Percent of output	Floor [Ω]
	5 mA range	0.09 + 0.4000 / *I*	0.10 / *I* + 0.1	0.09 + 0.0040 / *I*	0.70 / *I* + 0.1
	1 mA range	0.09 + 0.0800 / *I*	0.10 / *I* + 0.1	0.09 + 0.0800 / *I*	0.70 / *I*
	250 µA range	0.09 + 0.0200 / *I*	0.10 / *I*	0.09 + 0.0200 / *I*	0.70 / *I*
	50 µA range	0.09 + 0.0040 / *I*	0.10 / *I*	0.09 + 0.0040 / *I*	0.70 / *I*
	Current values *I* are represented in milliamperes.				
	Output settling time	Time an output signal takes to settle within 200% of the accuracy specification centered on the final value (A setting resistance and an output resistance of a connected object are in a ratio 1:1, with no capacitive load) When connected-object presumption is not performed: 1.5 s or less (response coefficient of resistance generation: 0.0002) When connected-object presumption is performed: 100 ms or less			

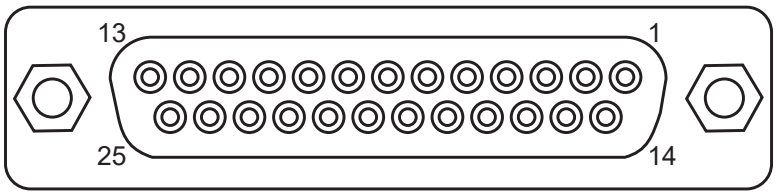
Measurement accuracy	DC voltage	5 V range	±0.030 % of rdg. ± 700 µV	
			Temperature coefficient	Add the following value when operating the instrument in temperature ranges of 0°C to 18°C and of 28°C to 40°C [0.05 × (measurement accuracy)] /°C
		5 V range (for resistance output function only)	±0.030 % of rdg. ± 100 µV	
			Temperature coefficient	Add the following value when operating the instrument in temperature ranges of 0°C to 18°C and of 28°C to 40°C [0.05 × (measurement accuracy)] /°C
	DC current	5 mA range	±0.040 % of rdg. ± 900 nA	
			Temperature coefficient	Add the following value when operating the instrument in temperature ranges of 0°C to 18°C and of 28°C to 40°C [0.05 × (measurement accuracy)] /°C
		1 mA range	±0.040 % of rdg. ± 180 nA	
			Temperature coefficient	Add the following value when operating the instrument in temperature ranges of 0°C to 18°C and of 28°C to 40°C [0.05 × (measurement accuracy)] /°C
		250 µA range	±0.040 % of rdg. ± 45 nA	
			Temperature coefficient	Add the following value when operating the instrument in temperature ranges of 0°C to 18°C and of 28°C to 40°C [0.05 × (measurement accuracy)] /°C
		50 µA range	±0.040 % of rdg. ± 10 nA	
			Temperature coefficient	Add the following value when operating the instrument in temperature ranges of 0°C to 18°C and of 28°C to 40°C [0.05 × (measurement accuracy)] /°C
Effect of radiated radio-frequency electromagnetic field	1% f.s. (Max.) at 3 V/m (for DC voltage output function)			
Effect of conducted radio-frequency electromagnetic field	1% f.s. (Max.) at 3 V (for DC voltage output function)			

No accuracy is specified for AC voltage output and AC current measurement.

Self-diagnosis	Operation	comprehensive test	The instrument outputs the following signals with the voltage and current functions, measuring them using the internal measurement circuit. If a measured value differs from the corresponding output setting value by more than the threshold value, the instrument gives itself a fail judgment. The instrument returns a judgment result, output setting value, and measured value in response to a query. The threshold value of 0% causes the instrument to fail to judge.		
			Voltage function		0 V, .0.5 V, 5 V
			Current function		0 µA, 50 µA, 55 µA, 250 µA, 275 µA, 1 mA, 1.1 mA, 5 mA
			Threshold value	Setting range	0% to 10% Setting resolution: 1%
				Default setting	0%
		Simple test	Using the internal measurement circuit, the instrument measures an signal outputted when a command is sent. The instrument returns an output setting value and measured value in response to a query.		
Switching OUTPUT terminals **Relay switching time**	Operation	OPEN: SHORT: NORMAL:	Opens the circuit of the OUTPUT terminal. Connects the OUTPUT terminal to ground. (10 Ω or less with a load current of 5 mA) Outputs the specified signal across the OUTPUT terminal.		
	Default setting	OPEN			
Connected-object presumption	Operation	With the resistance generation function, the instrument presumes an output resistance value of the connected object, capacitance value between the OUTPUT and GND terminals, and voltage value across them. Optimizes a resistance-generation response coefficient based on the presumption. When the time constant based on an output resistance value and inter-terminal capacitance value is less than 10 ms, the inter-capacitance is determined to be 0 pF.			
	Calculation time	1.6 seconds (max.)			
Offset cancel	Operation	Measures an output-circuit offset with the measurement circuit and outputs a signal with the offset subtracted.			
	Default setting	Off			

Specifications of output connector

Connector used: 25 pins,female, locking-block screws #4-40



Connector pin-out

Pin	Signal name	Pin	Signal name
1	NC	14	CH8_GND
2	CH8_RESERVE	15	CH8_OUTPUT
3	CH7_GND	16	CH7_RESERVE
4	CH7_OUTPUT	17	CH6_GND
5	CH6_RESERVE	18	CH6_OUTPUT
6	CH5_GND	19	CH5_RESERVE
7	CH5_OUTPUT	20	CH4_GND
8	CH4_RESERVE	21	CH4_OUTPUT
9	CH3_GND	22	CH3_RESERVE
10	CH3_OUTPUT	23	CH2_GND
11	CH2_RESERVE	24	CH2_OUTPUT
12	CH1_GND	25	CH1_RESERVE
13	CH1_OUTPUT		

6 Maintenance and Service

⚠WARNING

Touching any of the high-voltage points inside the instrument is very dangerous. Do not attempt to modify, disassemble, or repair the instrument. Doing so may cause a fire, electric shock, or injury.

Calibration

The calibration period varies depending on the state of the instrument and installation environment. We recommend that the calibration period be determined in accordance with the state of the instrument and installation environment. Please contact your authorized Hioki distributor or reseller to have your instrument periodically calibrated.

Backing up the data

The instrument may be initialized (returned to the factory default settings) when it is repaired or calibrated.
Before you ask for repair or calibration, it is recommended to back up (save or record) the measurement conditions and measured data.

Precautions during shipment

Be sure to observe the following precautions:

- To avoid damage to the instrument, remove any accessories and optional equipment from the instrument. Use the original packing materials the instrument was shipped in. Damage that occurs during transportation is not covered by the warranty.
- When sending the instrument for repair, be sure to include a memo that describes the problem in detail.

Replaceable parts and operating lifetimes

The characteristics of some of the parts used in the instrument may deteriorate with extended use. To ensure the instrument can be used over the long term, it is recommended to replace these parts on a periodic basis. When replacing batteries, please contact your authorized Hioki distributor or reseller.
The service life of parts varies with the operating environment and frequency of use. Parts are not guaranteed to operate throughout the recommended replacement cycle.

Part name	Recommended replacement cycle	Remarks/conditions
Fan motor	About 5 years	–
SSD	About 1,400 hours (When the instrument writes data continuously)	At an ambient temperature of 25°C Total bytes written (TBW): About 300 TB Data retention period: About 1 year (When the instrument is turned off) Data backup at regular intervals is recommended.
Electrolytic capacitors	About 10 years	Deteriorates in about 10 years when the instrument is used in a severe environment (at an ambient temperature of 40°C).
Lithium battery	About 10 years	The instrument contains built-in backup lithium batteries, which offer a service life of about 10 years. If the date and time deviate substantially at power-on, it is the time to replace that battery. Contact your authorized Hioki distributor or reseller.
Built-in battery	About 2.5 years	The instrument contains a built-in battery. Regularly replacing the batteries is required because a powerless battery can prevent Windows® from shutting down and thus correctly restarting. When recommended replacing period has passed, contact your authorized Hioki distributor or reseller.

The fuse is housed in the power unit of the instrument. If the instrument is not powered on, the fuse may be blown. Customers cannot replace the fuse or repair the instrument. Please contact your authorized Hioki distributor or reseller.

6.1 Troubleshooting

If damage is suspected, read the “Before having the instrument repaired” section before contacting your authorized Hioki distributor or reseller.

Before sending the instrument for repair

If the start button does not work correctly

Problem	Check item or cause	Remedy	Reference page
Nothing appears on the screen even if you press the power key.	• Is the power cord connected? • Is the power cord connected correctly?	Check that the power cord is properly connected.	p. 64

If the display or behavior shows an abnormality

Condition	Check item or cause	Remedy	Reference page
No waveforms are displayed even when the start icon is clicked.	• Is the message “Waiting for Pre-Trigger” displayed? • Is the message “Waiting for Trigger” displayed?	When the pre-trigger setting is enabled, the instrument is not triggered while it is writing data in the pre-trigger memory. Recording starts when the instrument is triggered.	p. 77
The displayed waveforms do not change.	• Are current sensors or connection cords connected correctly?	Check the current sensors and connection cords for disconnection.	p. 38
	• Is the measurement range suitable for the measuring object? • Is the low-pass filter setting configured to be used?	Check the settings of the input channels.	p. 74
During measurement, the instrument displays waveforms with much lower frequencies than the actual.	• Aliasing may be exhibited.	Use a faster sampling rate.	p. 73
		Use **[Auto range]** to automatically set the measurement range.	p. 82
The entire screen is filled with blue.	• Are not two monitor output cables connected? (For example, VGA and HDMI)	Remove either one of them.	–

If the instrument cannot save any data

Condition	Check item or cause	Remedy	Reference page
No data can be saved on a storage device that includes a USB flash drive.	• Does the storage device have sufficient free space? • Has the number of files in the folder reached 5000?	Format or replace the storage device.	p. 63
		Up to 5000 files can be saved in a folder. If you would like to create more files, adjust the quantity.	*
	• Is the storage device properly inserted?	Properly insert the storage device.	–
	• Formatting a storage device is required before first use.	Format the storage device.	p. 63

*: “4.4 Managing Files” of Instruction Manual

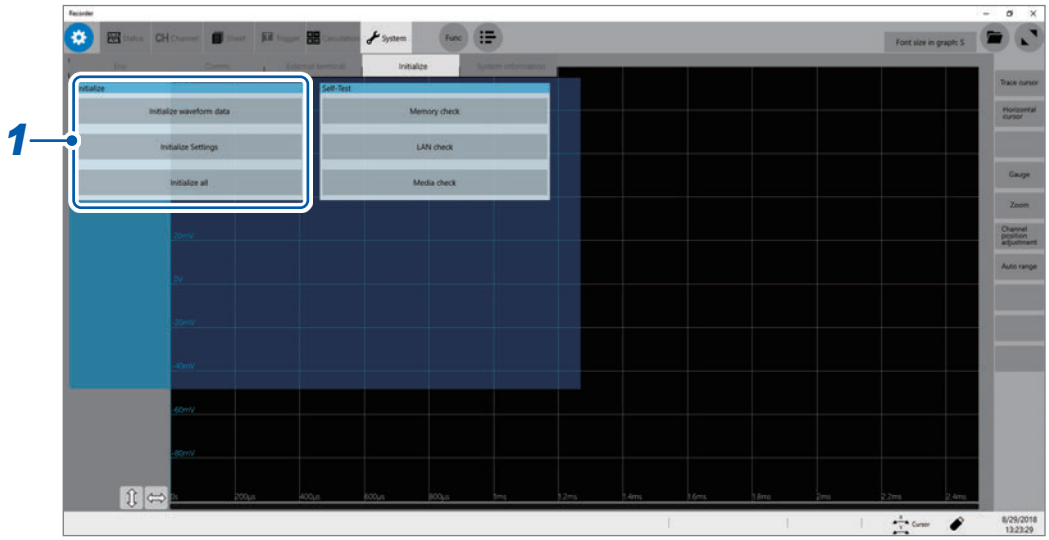
If the cause cannot be revealed

Initialize the instrument. All settings are restored to the factory default.
Refer to “6.2 Initializing the Instrument” (p. 155).

6.2 Initializing the Instrument

Choose settings configured on the instrument and restore them to the factory default.
Arbitrary waveform data and programs of Model U8793, which are stored in the module's ROM, will not be deleted even when you initialize the instrument.

> [System] > [Initialize]



1 **Choose an item to be restored.**

Initialize waveform data	Discards the waveform data saved in the internal memory.
Initialize Settings	Restores the settings for measurement, channels, sheets, triggers, and calculation tabs.
Initialize all	Restores all the settings to the factory default. However, the following settings are not restored: • Clock setting (> [System] > [Date and time]) • Computer setting (> [Comm.] > [Open PC settings])

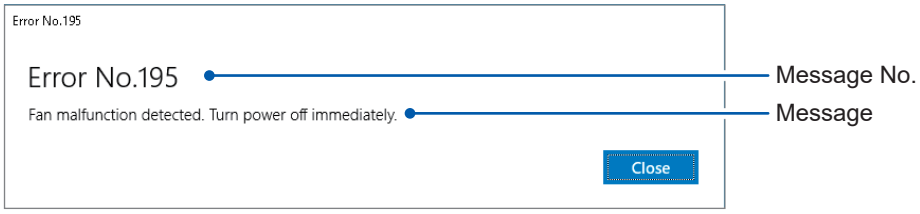
2 **Click [OK].**

6.3 Message

If any problem is found, the screen will display an error message or a warning message. It also displays an information message with advice for usage.

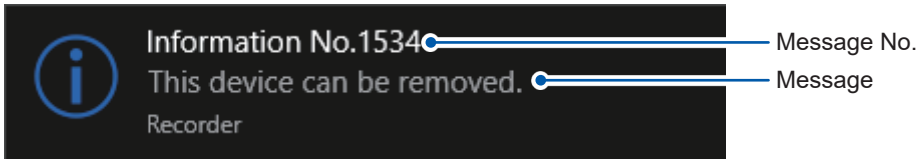
Action that should be taken after a message

If a message remains



If an error or warning message is not cleared, check the details and click **[Close]**.

If a message disappears in several seconds



Some of the warning and information messages disappear in a few seconds. Check the details while the screen is displaying the message.

To inform of a message with a beep

Select **[System] > [Env.]**, and set **[Beep sound]** to **[Alert]** or **[Alert+Action]**.

Refer to “10 Specifying the System Environment Settings” of Instruction Manual.

Error messages

The list of error messages is as follows. Check the solution.
If an error is displayed on the screen at power-on, the instrument is necessary to be repaired. Contact your authorized Hioki distributor or reseller.

No.	Message	Solution	Reference page
176	Internal temperature is abnormal. Please turn the power off.	Check the operating temperature environment and the fan rotation. Send the instrument for repair if needed.	–
195	Fan malfunction detected. Power off immediately.	High internal temperature may damage the instrument. Immediately turn off the instrument and send the instrument for repair.	–
196	Change the input unit setup so that the total number of channels of Model 8971 does not exceed 8.	Up to four modules of Model 8971 Current Unit can be installed in the instrument. Turn off the instrument and change the module configuration.	“2.1 Installing and Removing Modules” (p. 36)
639	Hardware error	A hardware error is detected. Immediately turn off the instrument and send the instrument for repair.	–
643	Hardware error		
644	Hardware error		
645	Hardware error	A hardware error is detected. Immediately turn off the instrument and send the instrument with the modules for repair.	–
646	Hardware error		
647	Hardware error		
648	Hardware error		
649	Unit X ROM checksum error		
651	System power supply error. Power off immediately.	A system power supply malfunction detected. Immediately turn off the instrument and send the instrument for repair.	–
652	Hardware error	A hardware error is detected. Immediately turn off the instrument and send the instrument for repair.	–
653	Processing could not be successfully completed.	An error occurred during an internal process of the instrument. Click **[Shutdown]** to turn off the instrument and cycle the instrument. Replace the storage device with another or cycle the instrument. Measurement can be continued by clicking **[Continue]**, but it is recommended to turn off the instrument once.	–

Warning messages

The list of warning messages is as follows. Check the solution.

No.	Message	Solution	Reference page
10	Please insert media.	Insert a USB flash drive.	“2.5 Preparing Storage Devices (Recording Media)” (p. 61)
13	Disk full.	The instrument cannot save any files because of insufficient free space on the storage device. Delete unnecessary files to free up enough space or use a new storage device.	“2.5 Preparing Storage Devices (Recording Media)” (p. 61) “4.4 Managing Files” of Instruction Manual
14	Cannot load this file.	The chosen file cannot be loaded.	“4.3 Loading Data” of Instruction Manual
15	Unable to access file.	Check that the storage device is properly inserted.	“2.5 Preparing Storage Devices (Recording Media)” (p. 61)
22	No waveform data to save.	Perform another measurement or load a file.	“4.3 Loading Data” of Instruction Manual
25	This device cannot be removed.	The instrument is accessing the device. Eject the device when the DIAG LED lights up in other than green.	“1.2 Name and Function of Each Part” (p. 24)
30	Auto-ranging failed.	Check the input signals.	“3.7 Measuring Signals With the Auto-range Setting” (p. 82)
31	Invalid section cursor position.	Section cursors are placed at improper positions (outside the waveform range). Check the section cursor positions.	“2.3 Scrolling Through Waveforms” of Instruction Manual
44	No event mark.	Put an event mark.	“12.1 External Input and Output” of Instruction Manual
45	Out of range.	–	–
60	No waveform data.	Acquire Measures waveform data.	–
70	Voltage sag triggering is disabled (valid time base range: 2 kS/s to 100 MS/s).	The voltage drop trigger setting can be used only in the sampling rate range from 2 kS/s to 20 MS/s.	“5.6 Triggering the Instrument Using Analog Signals” of Instruction Manual
74	Auto balance failed.	Make sure that the strain gauge transducer is not loaded, and it is correctly connected to a measuring target.	“Strain gauge transducer” (p. 43)
78	Recording length is too long.	To perform waveform calculation, set the recording length at 2 M points or less.	“8 Waveform Calculation Function” of Instruction Manual
83	No channel selected for use.	Set the **[Use]** buttons on one or more of the channels to **[On]**.	“Analog channels” in 1.3 of Instruction Manual
85	Invalid search condition.	Check the search criteria setting.	“6 Search Function” of Instruction Manual
112	Aborted.	–	–

No.	Message	Solution	Reference page
113	Save processing was interrupted.	Check the upper limit value of the sampling rate for real-time save. Some storage devices may have a slow writing speed, causing real-time writing to fail. Use another USB flash drive. Connect a drive to a USB 3.0 connector.	“1.2 Configuring Measurement Conditions” of Instruction Manual
123	No data matching the search criteria has not been found.	Check the search criteria setting.	“6 Search Function” of Instruction Manual
124	No waveform, or recording length is not long enough.	Acquire measured waveform data. Otherwise, specify a correct recording length.	“3.2 Setting Measurement Conditions” (p. 72) “1.2 Configuring Measurement Conditions” of Instruction Manual
208	Server communication error.	Communications may be unstable, or the instrument may not support the email or FTP servers running on the server. The connection may be established by enabling PASV for the FTP or changing the server security setting.	“11 Connecting the Instrument to Computers” of Instruction Manual
209	LAN disconnected.	Check the network environment.	“11 Connecting the Instrument to Computers” of Instruction Manual
210	LAN timed out.	Check the network environment.	“11 Connecting the Instrument to Computers” of Instruction Manual
211	LAN authentication required.	The email or FTP server authentication is required. Enable the authentication.	“11 Connecting the Instrument to Computers” of Instruction Manual
212	LAN authentication failed.	Logging in the email or FTP server failed. The user name or password may be incorrect.	“11 Connecting the Instrument to Computers” of Instruction Manual
213	Authentication setup invalid.	The user name or password for email authentication has not been set.	“11 Connecting the Instrument to Computers” of Instruction Manual
214	Encryption password not set.	Encryption is enabled, but a password has not been set.	“11 Connecting the Instrument to Computers” of Instruction Manual
215	Invalid server address.	Check the address setting.	“11 Connecting the Instrument to Computers” of Instruction Manual
216	POP3 Server not found.	Check the POP3 server address.	“11 Connecting the Instrument to Computers” of Instruction Manual
217	Cannot connect to POP3 Server.	Check the POP3 server address. POP3 may not be running on the specified server.	“11 Connecting the Instrument to Computers” of Instruction Manual
218	E-mail ‘to’ or ‘from’ settings invalid.	Check the recipient’s and sender’s addresses of the email setting.	“11 Connecting the Instrument to Computers” of Instruction Manual

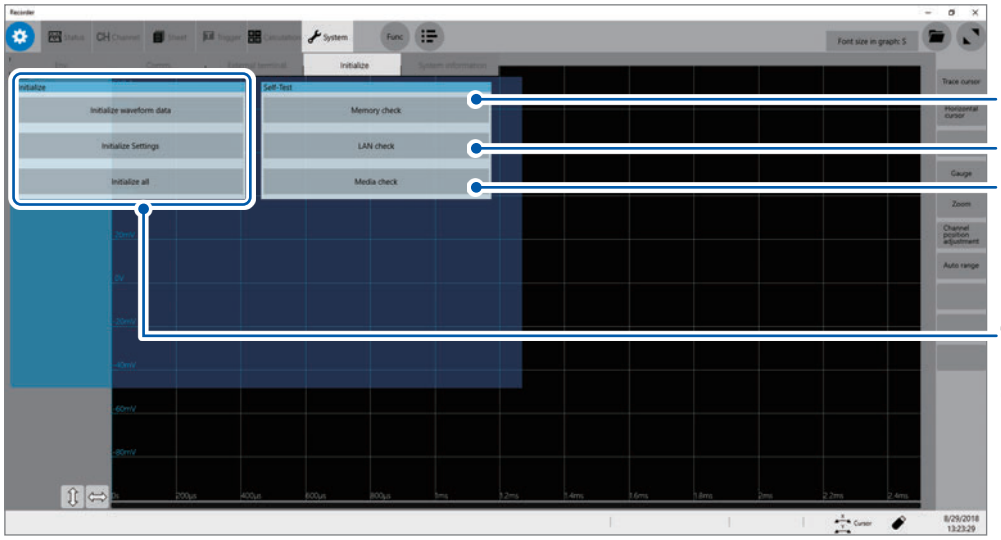
No.	Message	Solution	Reference page
219	E-mail recipient error.	The server has refused to send the email message to the recipient. Check addresses in the “to” field. Check the recipient’s address.	“11 Connecting the Instrument to Computers” of Instruction Manual
221	The sent e-mail size exceeds the limit.	The email size exceeds limits. Reduce the recording length or increase the size setting.	“11 Connecting the Instrument to Computers” of Instruction Manual
222	E-mail size exceeds server limits.	The sent email size exceeds the email server limit. Reduce the recording length or change the attachment contents.	“11 Connecting the Instrument to Computers” of Instruction Manual
223	FTP transfer failed.	Check the network environment. The FTP server may have rejected the file. Check the FTP server setting. For example, creating a directory (DIR) or file is prohibited, or the server is full.	“11 Connecting the Instrument to Computers” of Instruction Manual
224	E-mail transfer failed.	Check the network environment. The email server may have rejected the email message. Check the transmission condition of the email server. For example, the size or the number of emails reaches the limit of the server.	“11 Connecting the Instrument to Computers” of Instruction Manual
225	Data send aborted.	The transmission is aborted. Incomplete data may have been transmitted via FTP or e-mail. Check the transmitted data.	“11 Connecting the Instrument to Computers” of Instruction Manual
226	Network error.	A network error occurred during communication. Check the network environment.	“11 Connecting the Instrument to Computers” of Instruction Manual
232	File processing could not be successfully completed.	An unexpected error occurred while a file in the USB flash drive is being processed. Replace the storage device with another or cycle the instrument.	“2.5 Preparing Storage Devices (Recording Media)” (p. 61)
235	Real-time save could not be completed within available time.	Check the upper limit value of the sampling rate for real-time save. Some storage devices may have a slow writing speed, causing real-time writing to fail. Use another USB flash drive. Connect a drive to the USB 3.0 connector.	“1.2 Configuring Measurement Conditions” of Instruction Manual
241	File processing error.	An unexpected error occurred while a file in the USB flash drive is being processed. Replace the storage device with another or cycle the instrument.	“2.5 Preparing Storage Devices (Recording Media)” (p. 61)
601	Zero-adjustment required.	Execute zero-adjustment.	“2.8 Regulating the Zero Position (Zero-Adjustment)” (p. 67)
606	Current sensor recognized.	–	–

No.	Message	Solution	Reference page
607	Current sensor removed.	Check the connection of the current sensors.	–
616	Search target channel has no data.	Start another measurement or load a file.	“4.3 Loading Data” of Instruction Manual
640	Number of search results exceeded 10,000. Search has been canceled.	The instrument can display up to 10,000 search results.	“6 Search Function” of Instruction Manual
641	Insufficient data to perform search.	Check the scope of search.	“6 Search Function” of Instruction Manual
642	Unable to capture a stable fundamental wave.	Check the setting for the fundamental wave.	“6 Search Function” of Instruction Manual
650	Cannot set numerical value. Check the setting of upper and lower limits.	–	–

6.4 Self-check

Executing the self-check function checks the instrument for malfunctions. The self-check consists of the following checks:

> [System] > [Initialize]



Memory check

Storage memory, backup memory (SRAM memory)

IMPORTANT

- Save measured data in a storage device before performing the memory check. Any measured data will be deleted after the memory check.
- Do not turn off the instrument during the memory check.

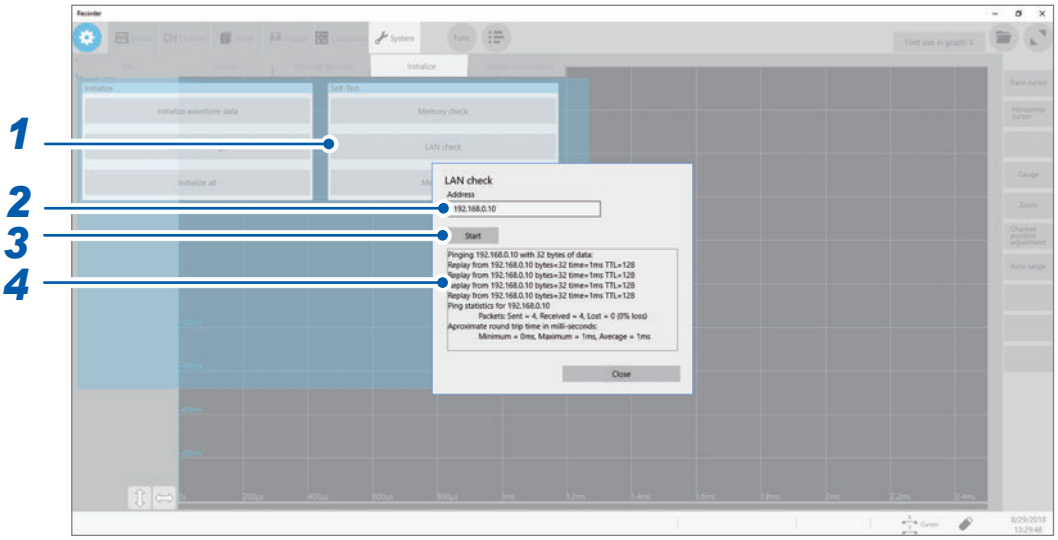
1 **Click [Memory check].**

2 **Click [Execute].**

The memory check starts.
The memory check will finish in about 30 seconds.

LAN check

This check tests the LAN cable for a break or other malfunctions.



1 Click **[Memory check]**.

2 Enter an IP address used for connecting to LAN in the **[Address]** box.

3 Click **[Open]**.

4 Check the results of transmission and reception on the screen.

When the transmission or reception results in an error

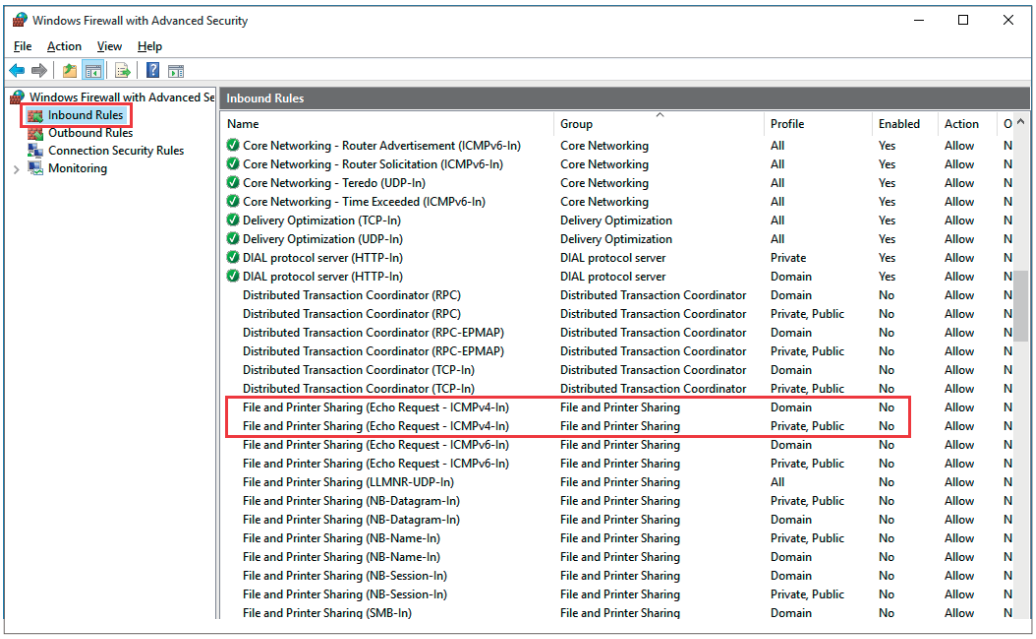
The Windows® firewall of the computer designated as a destination may cause an error. Check the Windows® firewall setting as follows:

1 **Select [System and Security] > [Windows firewall] on [Control Panel].**

2 **Select [Advanced settings] on the right of the screen.**

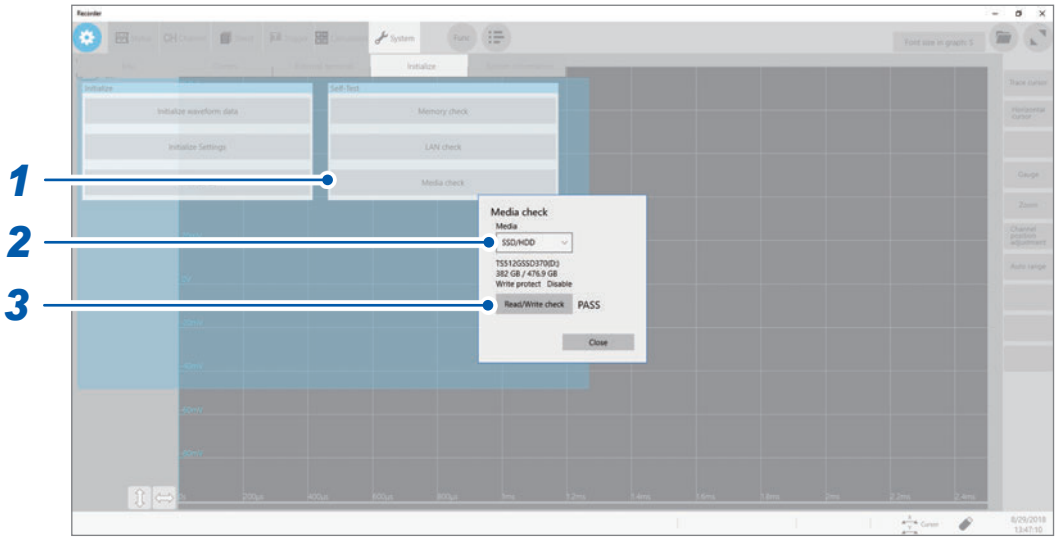
3 **After selecting [Inbound Rules], check that [Yes] is displayed in the [Enabled] column of [File and Printer Sharing (Echo Request - ICMPv4-In)].**

If [No] is displayed in the [Enabled] column, an error will occur during the LAN check. Right-click the row and select [Enable Rule].



Media check

This check tests the storage devices for malfunction.



1 **Click [Memory check].**

2 **Click the [Media] box and choose a storage device from the list.**

The screen displays the information of the chosen storage device.

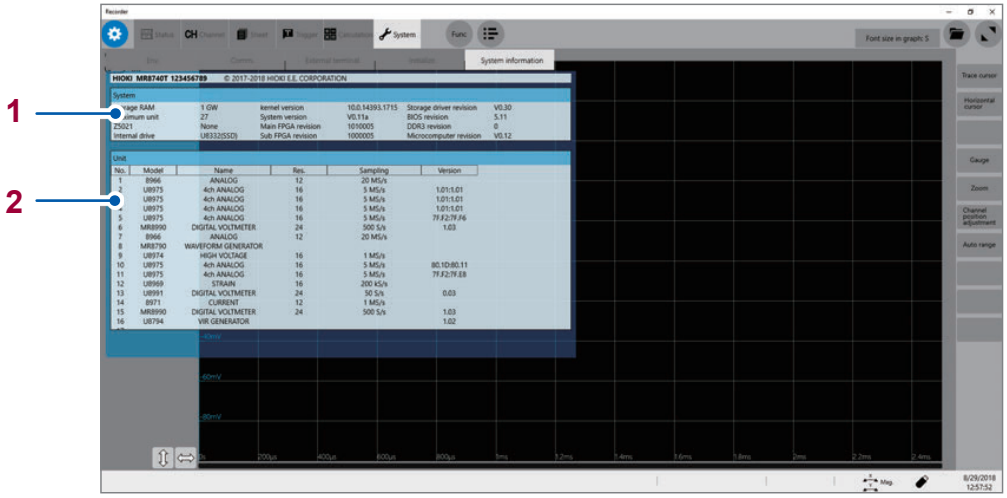
3 **Click [Read/Write check].**

The read/write check starts.

System configuration check

You can check the functions and devices installed in the instrument in a list.

> [System] > [System information]



No.	Item	Description
1	System configuration	You can check the system configuration, software version numbers, and board versions of the instrument.
2	Module configuration	You can check the model number, name, resolution, sampling rate, and firmware version number of each module (unit) installed in the instrument.

6.5 Cleaning the Instrument

To clean the instrument and modules, wipe it gently with a soft cloth moistened with water or mild detergent.

⚠CAUTION

Clean the vents periodically to avoid blockage.
When the vents get clogged, the instrument's internal cooling effect is hampered, and this can lead to damage to the instrument.

IMPORTANT
Never use solvents such as benzene, alcohol, acetone, ether, ketone, thinners or gasoline. Doing so could deform and discolor the instrument.

6.6 Disposing of the Instrument (Removing the lithium battery)

When disposing of this instrument, remove the battery and lithium battery and dispose of the battery and instrument in accordance with local regulations.

⚠WARNING

To avoid an electric shock, turn off the instrument and disconnect any connection cords from the instrument before removing the battery and lithium battery.

Do not short-circuit, recharge, disassemble or dispose of them in fire. The battery may explode if mistreated.

Keep batteries away from children to prevent accidentally swallowing.

- The instrument contains a battery (sealed nickel-metal hydride battery) to shut down the OS correctly. The battery offers a service life of about 2.5 years. If the OS does not correctly shut down, it is the time to replace that battery.
  The instrument contains built-in backup lithium batteries, which offer a service life of about 10 years.
  If the date and time deviate substantially at power-on, it is the time to replace that battery.
  Contact your authorized Hioki distributor or reseller.
- The battery is subject to self-discharge. Be sure to charge the battery before initial use. If the OS does not correctly shut down even after the battery is recharged, it is the time to replace that battery.

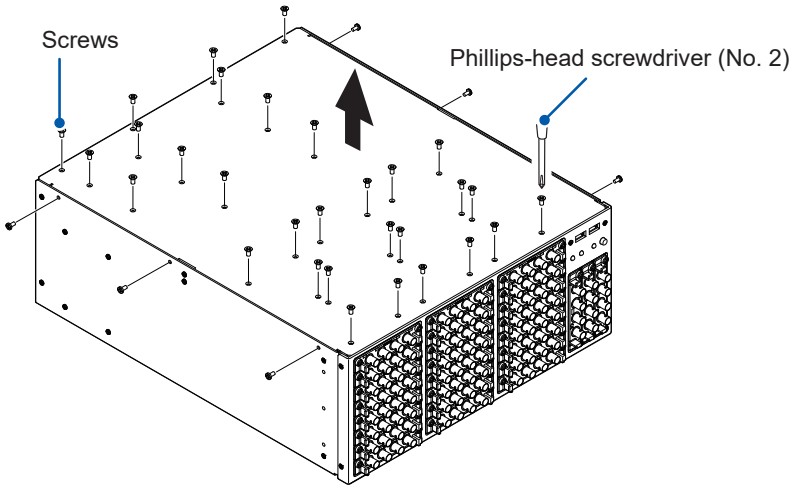
CALIFORNIA, USA ONLY
Perchlorate Material - special handling may apply.
See https://dtsc.ca.gov/perchlorate/

Removing the battery and lithium batteries

Required tools: Phillips-head screwdriver (No. 2) ×1, nippers ×1

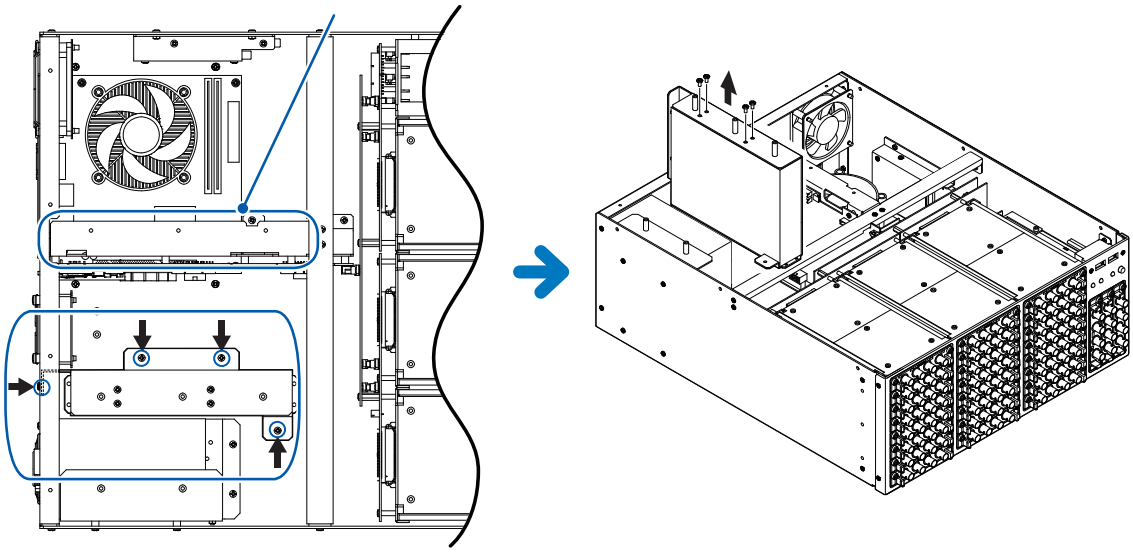
1 **Turn off the instrument and remove any cords.**

2 **Remove the upper panel.**



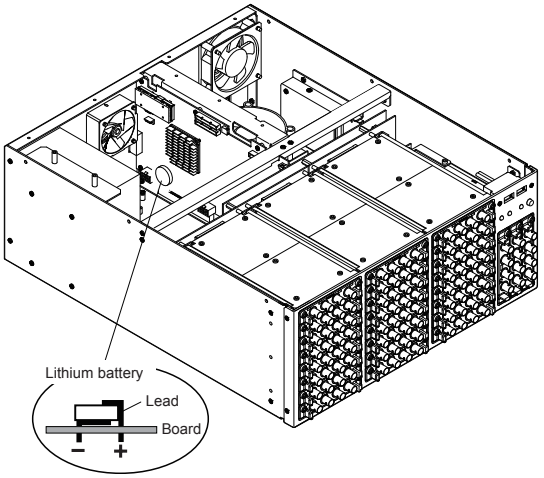
3 **Remove the four screws that secure the battery and remove the battery**

You can find the lithium battery on the CPU board here.



4 **Remove the two lithium batteries from the boards.**

Pull the lithium battery up from the circuit board, and cut the positive and negative leads with the nippers.
Put the lithium battery up out of the CPU board, and cut the leads with the nippers.



7 Appendix

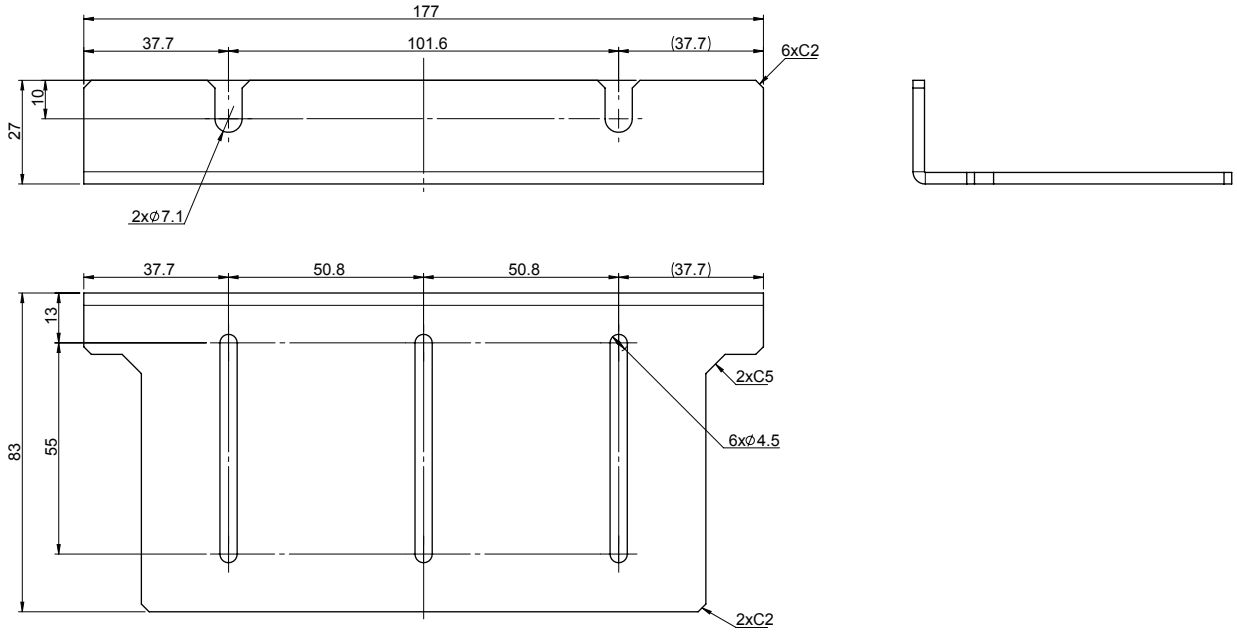
7.1 Mounting the instrument in a rack

The instrument can be installed in a rack using rack-mount brackets.

Rack-mount brackets

EIA standard

Material: EN AW-5052 (EN), 5052 (ASTM)
Thickness: 3



(Unit: mm)

How to secure the rack-mount brackets

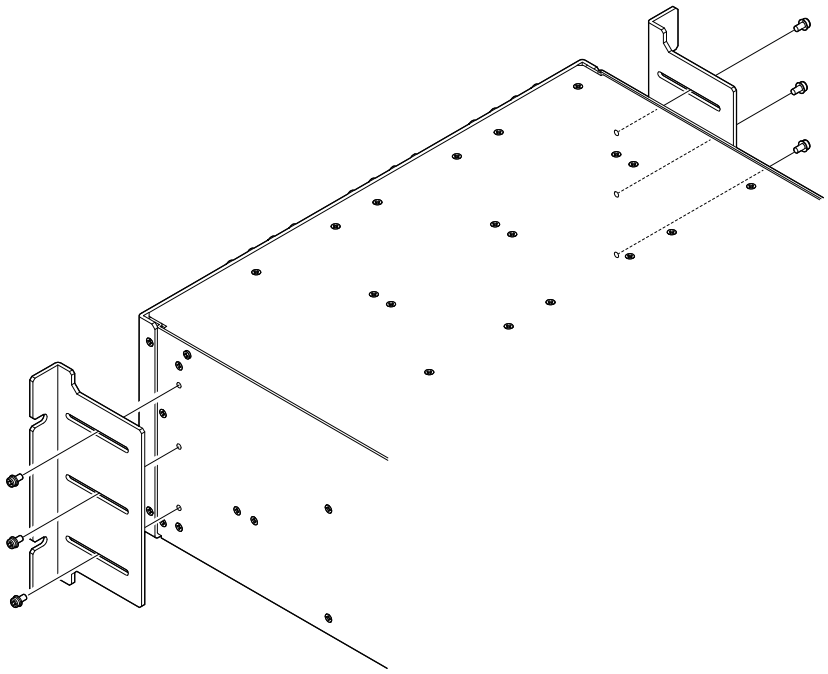
- Support the instrument by installing commercially-available support angles in the rack because the instrument is heavy.
- Leave 20 mm or more from the bottom side and the sides that have the vents (upper, right, left, and bottom sides).
- If you need the screws (M4 × 8 mm), please contact your authorized Hioki distributor or reseller.

EIA

1 **Check that the instrument is turned off and remove any cables and the power cord.**

2 **Secure each rack-mount bracket using three screws (M4 × 8 mm).**

Do not use any screws longer than 8 mm.



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W

Z

Warranty Certificate

HIOKI

Model	Serial number	Warranty period Three (3) years from date of purchase (___ / ___)

Customer name: _____

Customer address: _____

Important

- Please retain this warranty certificate. Duplicates cannot be reissued.
- Complete the certificate with the model number, serial number, and date of purchase, along with your name and address. The personal information you provide on this form will only be used to provide repair service and information about Hioki products and services.

This document certifies that the product has been inspected and verified to conform to Hioki's standards.
Please contact the place of purchase in the event of a malfunction and provide this document, in which case Hioki will repair or replace the product subject to the warranty terms described below.

Warranty terms

1. The product is guaranteed to operate properly during the warranty period (three [3] years from the date of purchase). If the date of purchase is unknown, the warranty period is defined as three (3) years from the date (month and year) of manufacture (as indicated by the first four digits of the serial number in YYMM format).
2. If the product came with an AC adapter, the adapter is warrantied for one (1) year from the date of purchase.
3. The accuracy of measured values and other data generated by the product is guaranteed as described in the product specifications.
4. In the event that the product or AC adapter malfunctions during its respective warranty period due to a defect of workmanship or materials, Hioki will repair or replace the product or AC adapter free of charge.
5. The following malfunctions and issues are not covered by the warranty and as such are not subject to free repair or replacement:
   -1. Malfunctions or damage of consumables, parts with a defined service life, etc.
   -2. Malfunctions or damage of connectors, cables, etc.
   -3. Malfunctions or damage caused by shipment, dropping, relocation, etc., after purchase of the product
   -4. Malfunctions or damage caused by inappropriate handling that violates information found in the instruction manual or on precautionary labeling on the product itself
   -5. Malfunctions or damage caused by a failure to perform maintenance or inspections as required by law or recommended in the instruction manual
   -6. Malfunctions or damage caused by fire, storms or flooding, earthquakes, lightning, power anomalies (involving voltage, frequency, etc.), war or unrest, contamination with radiation, or other acts of God
   -7. Damage that is limited to the product's appearance (cosmetic blemishes, deformation of enclosure shape, fading of color, etc.)
   -8. Other malfunctions or damage for which Hioki is not responsible
6. The warranty will be considered invalidated in the following circumstances, in which case Hioki will be unable to perform service such as repair or calibration:
   -1. If the product has been repaired or modified by a company, entity, or individual other than Hioki
   -2. If the product has been embedded in another piece of equipment for use in a special application (aerospace, nuclear power, medical use, vehicle control, etc.) without Hioki's having received prior notice
7. If you experience a loss caused by use of the product and Hioki determines that it is responsible for the underlying issue, Hioki will provide compensation in an amount not to exceed the purchase price, with the following exceptions:
   -1. Secondary damage arising from damage to a measured device or component that was caused by use of the product
   -2. Damage arising from measurement results provided by the product
   -3. Damage to a device other than the product that was sustained when connecting the device to the product (including via network connections)
8. Hioki reserves the right to decline to perform repair, calibration, or other service for products for which a certain amount of time has passed since their manufacture, products whose parts have been discontinued, and products that cannot be repaired due to unforeseen circumstances.

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18-07 EN-3

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