CT6710
CT6711

HIOKI

Instruction Manual

CURRENT PROBE

EN

Feb. 2019 Edition 1
CT6710A961-00 19-02H

* 6 0 0 5 3 8 0 2 0 *

Measurement Procedure

Be sure to familiarize yourself with the “Usage Notes” section (p.8), each instruction of use, and safety notes presented at the beginning of each instruction of use.

Inspecting the Device Before Use (p.26)

↓

Preparing for Measurement (p.28)

Provide power to the device.

Connect the termination unit to the host waveform measuring instrument.

Execute demagnetization and automatic zero-adjustment.

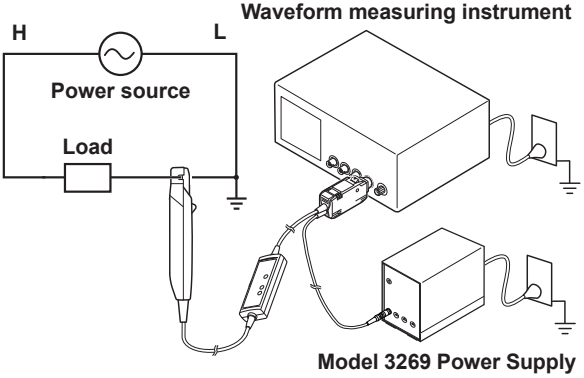
Measuring Currents (p.40)

Clamp the sensor around a conductor to be measured.

Measure a current.

Finishing Measurement (p.64)

Connection Example



See “Example of connection to the circuit to be measured” (p.48).

Contents

Introduction

Thank you for choosing the Hioki CT6710, CT6711 Current Probe. Preserve this manual carefully and keep it handy to make full use of this device for a long time.

Each model offers a different frequency band listed below:
Model CT6710: DC to 50 MHz
Model CT6711: DC to 120 MHz

Following manuals are provided along with these models. Refer to manuals relevant to your purpose.
- Current Sensor Operating Precautions
  Information on the device for safe operation
- Instruction Manual (this document)
  Basic instructions and specifications of the device

Also read the separate document “Current Sensor Operating Precautions” carefully before using this device.

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).

Notations

Safety notations

In this manual, 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 device or malfunction.
IMPORTANT	Indicates information related to the operation of the device or maintenance tasks with which operators must be fully familiar.
NOTE	Indicates advisory items related to performance or correct operation of the device.
	Indicates a high voltage hazard. If a particular safety check is not performed or the device is mishandled, the operator can suffer from a hazardous situation such as an electric shock, burn, or even fatal injury.

	Indicates prohibited actions.
	Indicates an action that must be performed.

Symbols shown on the device

	Indicates cautions and hazards. When this symbol is displayed on the device, refer to the “Usage Notes” section (p.8) and warning messages presented at the beginning of each instruction of use in the Instruction Manual, and included “Current Sensor Operating Precautions” for more information.
	Indicates that only insulated conductors appropriate to the voltage of the circuit under test can be measured.

Symbols for various 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.

Others

*	Additional information is presented below.
Bold	Keys of the device are indicated in boldface.

Accuracy

We define measurement tolerances in terms of rdg. (reading) with the following meanings:

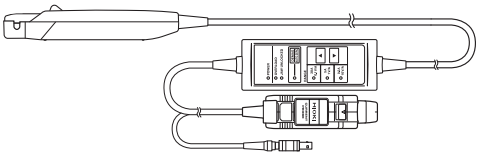
rdg.	(reading or displayed value) The value currently being measured and indicated on a measuring instrument.

Confirming Package Contents

When you open the package, inspect the device carefully to ensure that everything is in good condition, and that no damage occurred during shipping.
Check the accessories, keys, and connectors carefully. If the device 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.

☐ Model CT6710/CT6711 Current Probe



Accessories

☐ Carrying case
☐ Instruction Manual
☐ Current Sensor Operating Precautions (0990A901)

The carrying case contains the current probe, Instruction Manual, and Current Sensor Operating Precautions.

Option

The following option is available for the device. Contact your authorized Hioki distributor or reseller when ordering.

☐ **Model 3269 Power Supply**
Model 3269 can provide the power to up to two probes of Model CT6710 or Model CT6711.
(Model 3272 Power Supply cannot be used as a power supplying unit for Model CT6710/CT6711)

Precautions for transportation

- Store the packaging materials even after unpacking because you will need them when you transport the device.
- Transport the device in its carrying case.

Safety Notes

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

⚠DANGER

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

⚠WARNING

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

Usage Notes

Follow these precautions to ensure safe operation and to obtain the full benefits of the various functions.
Ensure that your use of the device falls within the specifications not only of the device itself, but also of any accessories, options and other equipment being used.

⚠DANGER

Do not use the device for measuring bare conductors. Doing so may result in a short-circuit or electric shock. Take measurements at a location on an insulated wire with sufficient insulation for the circuit voltage.

⚠DANGER

- **Do not remove any covers of the sensor, junction box, and termination unit. The internal components of the device carry high voltages and may become very hot during operation. Making contact with them could cause an electric shock and burns.**
- **Do not apply the device to the primary side of a distribution panel. If a short-circuit occurs on the primary side, an unrestricted current flow can damage the device and facilities. Even if a short-circuit occurs on the secondary side of the distribution panel, the panel will interrupt the short-circuit current.**
- **Do not use the device in strong magnetic fields. If you do, the sensor could become abnormally hot, resulting in damage to the device, a fire, or burn to the operator.**

Follow all operating precautions for a waveform measuring instrument or any other measuring instrument this device is connected to.

⚠WARNING

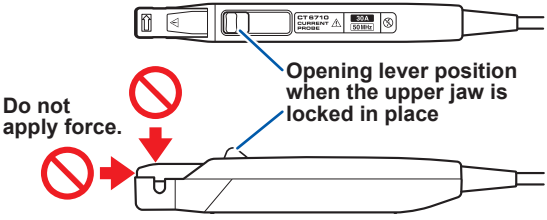
- **Do not use the device to measure circuits that exceed the ratings or specifications of the device. Damage to the device or overheating can cause bodily injury.**
- **Do not install the device in the following locations. Failure to observe this could cause a malfunction of the device, an accident, or fire.**
  - **Exposed to direct sunlight or high temperatures**
  - **Exposed to corrosive or combustible gases**
  - **Exposed to water, oil, chemicals, or solvents**
  - **Exposed to high humidity or condensation**
  - **Exposed to strong electromagnetic fields or electrostatic charges**
  - **Exposed to high concentrations of dust particles**
  - **Near induction heating systems (such as high-frequency induction heating systems and IH cooking equipment)**
  - **Susceptible to vibration**
  - **Near HF power supply units**

⚠WARNING

Confirm that the insulation on the cords is undamaged and that no bare conductors are improperly exposed before using the device. Any damage to the device leads to an electric shock. Contact your authorized Hioki distributor or reseller for repair.

⚠CAUTION

- Do not place the device on an unstable surface or an inclined place. Dropping or knocking down the device could cause bodily injury or damage to the device.
- Do not store and use the device in locations subject to abrupt temperature changes. Doing so could damage the sensor heads.
- Do not apply force in the directions shown in the figure below while the upper jaw is locked in place. Doing so may damage the retracting/ extending mechanism.



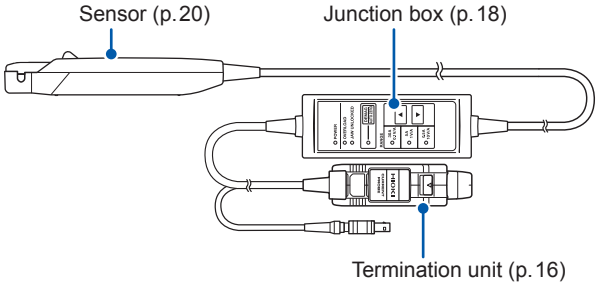
⚠CAUTION

- Keep the upper jaw locked in place when the device is not in use. Leaving the upper jaw unlocked causes dust or dirt to settle on the facing core surfaces, which can damage the device.
- Properly connect the device to a circuit to be measured and a host waveform measuring instrument. Improperly connecting them could cause an electric shock or damage to the device and instrument.

1 Overview

1.1 Product Overview

Model CT6710/CT6711 is a clamp-on current probe that features high current-detection sensitivity and broad frequency band. The probe uses three current ranges to detect current waveforms from 1 mA to 50 A.
You can directly connect the termination unit to a BNC input terminal of your waveform measuring instrument such as an oscilloscope and recorder, and then clamp the sensor around a conductor to be measured to easily observe current waveforms.



1.2 Product Features

Clamp-on sensor heads (p.21)

The clamp-on sensor heads allow current measurement without the need to make physical contact with a conductor to be measured, or to disconnect it. You can observe current waveforms while maintaining the flow of electric current.

Sliding jaw retracting/extending mechanism (p.21)

This feature lets you easily retract, extend, and lock the upper jaw in place to clamp the sensor around a conductor to be measured.

Easy-to-connect output terminal (p.17, p.37)

Insert the output terminal into a BNC input terminal on your waveform measuring instrument to connect the termination unit.

Warning LED lights (p.18)

The warning LEDs alert you to an overload (indicating that an input current value exceeds the rated current of the device) or jaw unlocked condition (indicating that the upper jaw has not been locked in place).

Three current measurement ranges (p.52)

You can choose from the three ranges according to the magnitude of the current to be measured. This feature lets you observe a wide range of currents, from 1 mA to 50 A.

Broad frequency band (p.69)

Model CT6710: DC to 50 MHz
Model CT6711: DC to 120 MHz

Demagnetizing and automatic zero-adjustment functions (p.33)

You can use a single key to demagnetize the magnetic cores and correct variations in offset voltage, both of which are required before measuring.

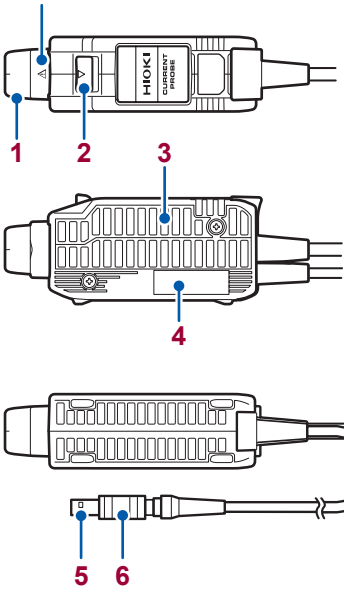
Protection mode (p.61)

The device automatically enters protection mode to prevent damaging itself when overheating.

1.3 Name and Function of Each Part

Termination unit

See p.33 and p.34.



Top view

1 Output terminal

The device converts an captured current waveform into a voltage waveform by multiplying a certain rate according to a specified current range and outputs the voltage waveform from this terminal. Connect this terminal to a BNC input terminal of your waveform measuring instrument.

2 Unlock lever

To disconnect the output terminal, pull on the termination unit while simultaneously pulling this lever.

3 Vents

The unit has the vents on the sides and bottom. Do not clog them.

4 Serial number

The serial number consists of nine digits. The first two (from the left) indicate the year of manufacture, and the next two indicate the month of manufacture.
Required for production control. Do not peel off the label.

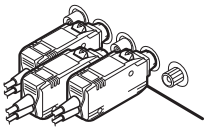
5 Power plug

Power is provided to Model CT6710/CT9711 through this plug. Connect this plug with Model 3269 Power Supply.

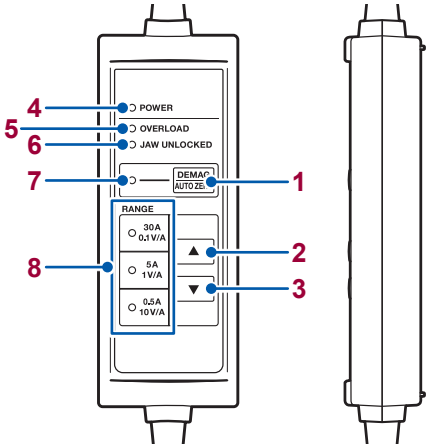
6 Shell

Pull on the power plug while simultaneously pulling this shell to disconnect the plug.

You can easily connect and disconnect the termination unit with two fingers even when multiple termination units are connected to the waveform measuring instrument.



Junction box (keys, LEDs)



Top view

1 DEMAG / AUTO ZERO key

Hold down (about 1 s)	Performs demagnetization followed by automatic zero-adjustment (p.33).
Press momentarily (less than 0.5 s)	Performs automatic zero-adjustment alone (p.39).

2 ▲ (Higher range) key (p.52)

Switch over to a next higher current range.
(Does not switch from the 30 A range to the 0.5 A range)

3 ▼ (Lower range) key (p.52)

Switch over to a next lower current range.
(Does not switch from the 0.5 A range to the 30 A range)

4 **POWER LED** (green light)

- Lights up when the power is on (p.31).
- Blinks rapidly when a checksum error has occurred (p.93).

5 **OVERLOAD LED** (red light)

- Blinks three times when demagnetizing or automatic zero-adjustment cannot be performed (p.89).
- Blinks rapidly when an overload state is detected (p.88), the device has entered protection mode (p.61), or a checksum error has occurred (p.93).

6 **JAW UNLOCKED LED** (red light)

- Lights up when the upper jaw is unlocked.
- Blinks three times when demagnetizing or automatic zero-adjustment cannot be performed (p.89).
- Blinks rapidly when the device has entered protection mode (p.61) or a checksum error has occurred (p.93).

7 **DEMAG / AUTO ZERO LED** (orange light)

- Blinks slowly when demagnetization or automatic zero-adjustment has not yet been performed (p.33).
- Lights up when demagnetization and automatic zero-adjustment are in execution (p.38).
- Goes out when demagnetization and automatic zero-adjustment has been completed (p.38).
- Blinks three times when demagnetization and automatic zero-adjustment cannot be performed (p.89).
- Blinks rapidly when the device has entered protection mode (p.61) or a checksum error has occurred (p.93).

8 **RANGE LEDs** (green lights)

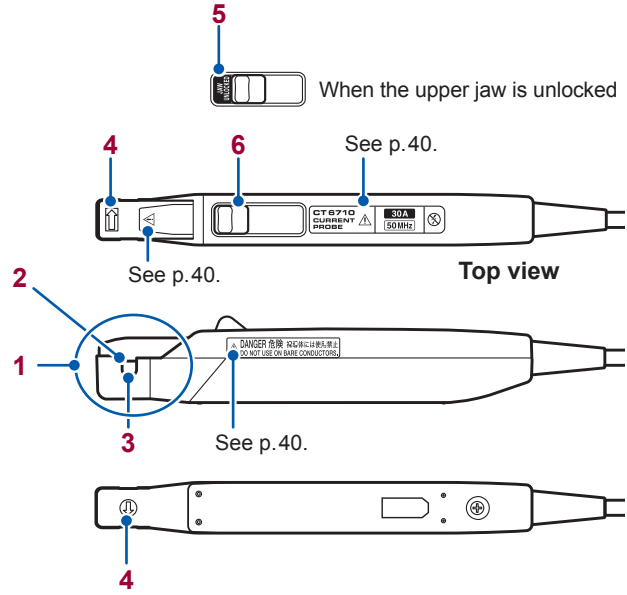
- Lights up when its current range is chosen (p.52).
- Blinks rapidly when the device has entered protection mode (p.61) or a checksum error has occurred (p.93).

Sensor

⚠CAUTION

Avoid doing the following acts. Doing so could damage to the sensor heads.

- Storing and using the device in locations subject to abrupt temperature changes
- Applying force or mechanical shock to the device
- Subjecting the device to static electricity



1 **Jaws**

Clamp this part around a conductor to be measured by operating the opening lever, which allows the upper jaw to slide (retract/extend).

2 **Sensor aperture**

A conductor to be measured must pass through this aperture.

3 **Sensor heads**

The sensor heads, which is located inside the jaws, detects currents.

4 **Current direction indicator**

Clamp the sensor around the conductor so this mark matches the current direction of a conductor to be measured.

5 **JAW UNLOCKED indicator**

If this indicator appears, the upper jaw is not locked in place.

6 **Opening lever**

To retract and extend the upper jaw, always operate this lever. This lever allows you to retract and lock the upper jaw in place.

1.4 Specifications of Lighting up / Blinking LEDs

○: Lighting up ●: Off ◔: Blinking

	Device state			LED
	Automatic zero-adjustment	Overload	Others	Green POWER
1	–	–	(On start-up)	○
2	Not performed	Not detected	(Initial state)	○
3	In execution (Incl. demag.)	–	(No range keys available)	○
4	In execution (excl. demag.)	–	(No range keys available)	○
5	Completed	Not detected	(Before use, normal state)	○
6	Completed	Exceeds prescribed level	–	○
7	Not performed	Exceeds prescribed level	–	○
8	Completed	Not detected	Upper jaw unlocked	○
9	Completed	Exceeds prescribed level	Upper jaw unlocked	○
10	Not performed	Not detected	Upper jaw unlocked	○
11	Not performed	Exceeds prescribed level	Upper jaw unlocked	○
12	–	*1	*1	○
13	–	–	Excess heat detected in junction box*2	○
14	–	–	ROM checksum error at power-on (CPU failure)	◔: Rapidly

*1. When the **DEMAG / AUTO ZERO** key is pressed under any one of the following conditions (p.89):
- The upper jaw is unlocked.
- An overload has been detected whether or not the upper jaw is locked in place.
- A current exceeding 0.5 A rms has been detected whether or not the upper jaw is locked in place.

*2. Press any key to restore the device. The ranges cannot be switched until the device is restored.
See “When the device has entered protection mode” (p.61).

○: Lighting up ●: Off ◔: Blinking

LED							
Red	Red	Orange	Green				
OVERLOAD	**JAW UNLOCKED**	**DEMAG / AUTO ZERO**	**RANGE**				
			30 A	**5 A**	**0.5 A**	
○ 1 s	○ 1 s	○ 1 s	○ 1 s	○ 1 s	○ 1 s	1
●	●	◔ Slowly*4	○	●	●	2
●	●	○	●	●	●	3
●	●	○	○ Specified range only			4
●	●	●	○ Specified range only			5
◔ Rapidly*3	●	●	○ Specified range only			6
◔ Rapidly*3	●	●*5	○ Specified range only			7
●	○	●	○ Specified range only			8
◔ Rapidly*3	○	●	○ Specified range only			9
●	○	●	○ Specified range only			10
◔ Rapidly*3	○	●*5	○ Specified range only			11
◔ Rapidly 3 times	◔ Rapidly 3 times	◔ Rapidly 3 times	○ Specified range only			12
◔ Rapidly	◔ Rapidly	◔ Rapidly	◔ Rapidly			13
◔ Rapidly	◔ Rapidly	◔ Rapidly	◔ Rapidly			14

*3. Blinks at 250-ms intervals. (duty ratio: 50%)

*4. After the device is turned on and then all LEDs light up for 1 second, the **DEMAG / AUTO ZERO** LED blinks, which indicates that demagnetization or automatic zero-adjustment has not yet been performed.

*5. Even when demagnetization or automatic zero-adjustment has not yet been performed, the device that has detected an overload and that with the upper jaw unlocked leave the **DEMAG / AUTO ZERO** LED unlit.

2 Current Measurement

⚠WARNING

- **Do not clog the vents on the sides and bottom of the termination unit (p.16). Doing so can cause a breakdown or fire due to internal overheating.**
- **Do not cover the junction box (p.18) with a cloth or pile the box on another. Doing so can cause a breakdown or fire due to internal overheating.**

IMPORTANT

- Do not drop the device or subject the device to an impact. Failure to observe this could damage the facing core surfaces of the sensor heads, resulting in an adverse effect on the measurement accuracy.
- Do not place any foreign object between the facing core surfaces of the sensor heads, touch the surfaces, or insert any foreign object into the gap around the sensor heads. Failure to observe this could adversary affect the measurement accuracy and the retracting/extending mechanism.
- Do not scratch the facing core surfaces of the sensor heads. Failure to observe this could adversary affect the measurement accuracy.

2.1 Inspecting the Device Before Use

Check if any damage to the device occurred during storage or shipping and verify that it operates normally before using the device. If you find any damage or failure, contact your authorized Hioki distributor or reseller.
See “Before sending back your device for repair” (p.83).

Items to prepare

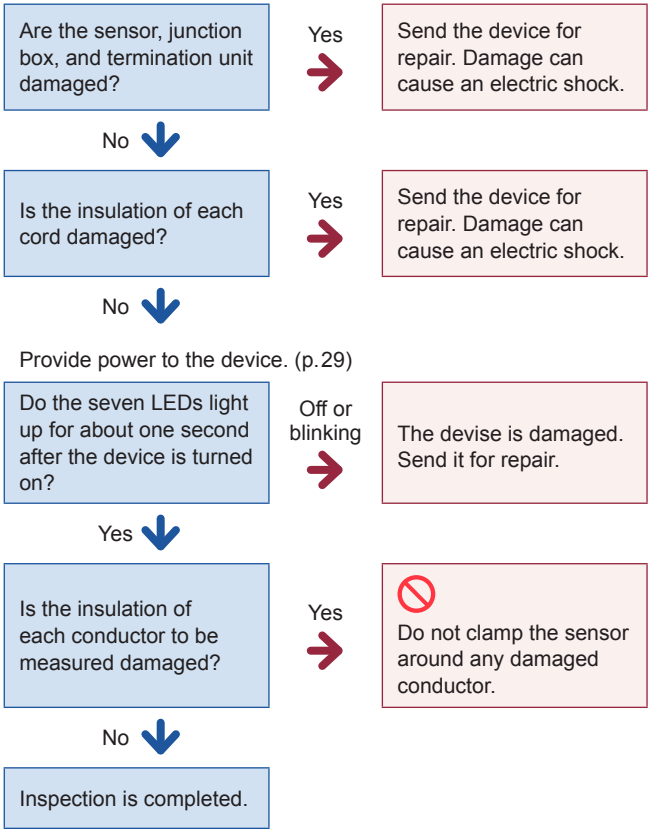
- Model CT6710/CT6711 Current Probe
- Model 3269 Power Supply (available as an option)
- Waveform measuring instrument (such as oscilloscope and recorder)

Connecting the device to a Hioki Memory HiCorder with a power supply module for current probes (option) installed allows the device to operate without Model 3269 Power Supply. For more information, contact your authorized Hioki distributor or reseller.

IMPORTANT

Use a waveform measuring instrument (such as oscilloscope and recorder) that has an input impedance of 1 MΩ or more. The output of the device is internally terminated. Accurate measurement is not possible with waveform measuring instruments that have an input resistance of 50 Ω.

Inspecting appearance and functionality of the device and condition of conductors to be measured



2.2 Preparing for Measurement

⚠WARNING

Turn off all the instrument before connecting the device. Failure to observe this can cause an electric shock and short-circuit.

⚠CAUTION

- Confirm that the supply voltage to Model 3269 Power Supply (option) matches the supply voltage indicated on the rear panel of the 3269 before connecting the power cord to the 3269. Connection to an improper supply voltage may damage the device and the 3269, and present an electrical hazard.
- Always operate the opening lever to retract, extend, and lock the upper jaw. If you retract or lock the upper jaw directly by hand, the sensor may be damaged.

Providing power to the device

IMPORTANT

Do not allow the total consumption current of the current sensors connected with the 3269 to exceed the rated output current of the 3269. The consumption current of the device depends on currents to be measured. One unit of Model 3269 can simultaneously provide power to up to two current probes (Model CT6710/CT6711) each of which measures a current with the maximum rated current value. For information about the consumption current, see “Consumption current” (p.79) in “Typical Characteristics”.

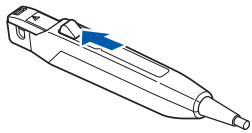
Model 3272 Power Supply, which does not have sufficient current capacity, cannot activate Model CT6710/CT6711.

How to provide the power to the device

1 **Confirm that the POWER switch of Model 3269 Power Supply is OFF.**

2 **Connect the power cord to the power inlet on the back of the 3269.**

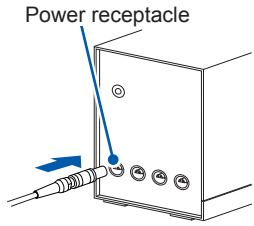
3 **Slide the opening lever of the sensor toward the lower jaw until the JAW UNLOCKED indicator is hidden.**



The upper jaw is locked in place.

Do not clamp the sensor around any conductor.

4 **Connect the power plug of the device to the power receptacle of the 3269.**



5 Set the POWER switch of Model 3269 Power Supply to the ON position.

The LEDs of the probes and power supply light up or blinks as follows:

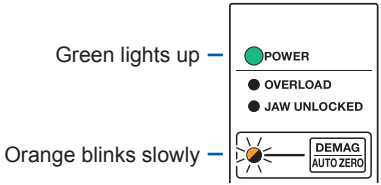
Model 3269

The **POWER** indicator lights up.

Model CT6710/CT6711

After all LEDs light up for 1 second, the device operates as follows:

- The **POWER** LED lights up.
- The **DEMAG / AUTO ZERO** LED blinks slowly.



Keep the upper jaw locked in place while the **POWER** LED lights up.

6 **Wait for 30 minutes or more.**

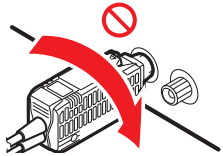
Wait at least 30 minutes after starting to supply power to the device to accurately measure a current before executing demagnetization and automatic zero-adjustment. See “Executing demagnetization and automatic zero-adjustment” (p.33).

Do not execute demagnetization and automatic zero-adjustment or measure a current immediately after starting to supply the power to the device. An offset voltage may increase due to the heat generation of the device.

Executing demagnetization and automatic zero-adjustment

⚠CAUTION

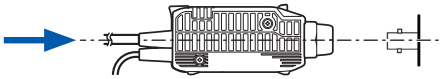
- Do not rotate the output terminal while the termination unit is connected with a waveform measuring instrument. Moreover, do not apply force to the connection. Doing so could cause damage to the output terminal on the termination unit or to the locking mechanism of the BNC input terminal on the waveform measuring instrument.



- Do not short-circuit the output terminal or deliver a voltage to the output terminal. Doing so may damage the device.

⚠CAUTION

- Align the termination unit with a BNC input terminal of your waveform measuring instrument when connecting the termination unit. Failure to do so may damage the output terminal.



- When connecting the output terminal to an input terminal that is not a BNC terminal through a conversion plug, make sure that the BNC center contact is positive and the outer conductor is ground potential (or negative). Failure to do so may damage the device and your waveform measuring instrument.

What is *demagnetization*?

The magnetic core can be magnetized, which results from turning the power on and off, inputting an excessively large current, or other factors. Executing demagnetization eliminates magnetic charges.

What is *automatic zero-adjustment*?

Automatic zero-adjustment corrects variations in the offset voltage caused by factors such as the device-specific offset voltage and variations in temperature.

When the **DEMAG / AUTO ZERO** LED blinks slowly, execute demagnetization and automatic zero-adjustment. The **DEMAG / AUTO ZERO** LED blinks slowly in the following states:

- The power supply to the device just started.
- A current exceeding the rated current was inputted to the device, but this condition was resolved.

During demagnetization (with the **DEMAG / AUTO ZERO** LED lit), the device outputs a demagnetization waveform (which attenuates over time) from its output terminal. This waveform, which appears on a waveform measuring instrument, may be asymmetric along the horizontal axis; however, this does not represent a device malfunction.

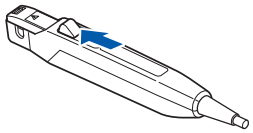
How to execute demagnetizing and automatic zero-adjustment

IMPORTANT

Do not move the sensor during demagnetization or automatic zero-adjustment. Disturbance (such as external magnetic fields and temperature changes) may prevent demagnetization or automatic zero-adjustment from being completed normally.

---

1 **Slide the opening lever of the sensor toward the lower jaw until the JAW UNLOCKED indicator is hidden.**



The upper jaw is locked in place and the **JAW UNLOCKED** LED goes out.

Do not clamp the sensor around any conductor.

---

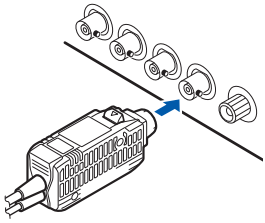
2 **Set the input coupling of the host waveform measuring instrument to GND, then adjust the zero position of the display.**

---

3 **Set the input coupling of the waveform measuring instrument to DC.**

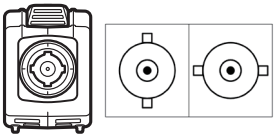
---

4 Connect the output terminal of the termination unit to BNC input terminal of the waveform measuring instrument.

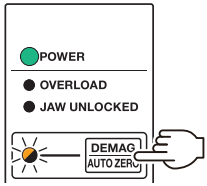


Insert the output terminal until it clicks so that it is securely locked in position.

The connection can be established with the unlock lever of the termination unit pointing up, regardless of whether the pair of the locking studs in the BNC input terminal on the waveform measuring instrument are fixed in the horizontal or vertical orientation.



5 Hold down the DEMAG / AUTO ZERO key on the junction box for about 1 second.

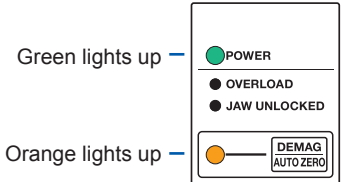


Hold down

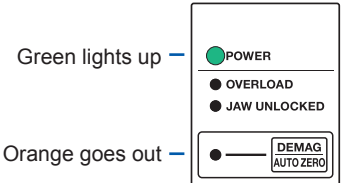
The **DEMAG / AUTO ZERO** LED lights up, and demagnetization and automatic zero-adjustment start.

After the completion, the **DEMAG / AUTO ZERO** LED goes out.

Demagnetizing and automatic zero-adjustment are in execution.



Demagnetizing and automatic zero-adjustment have been completed.



If the **DEMAG / AUTO ZERO** LED continuously blinks three times, the devise cannot perform demagnetization or automatic zero-adjustment. Implement the remedy described in the following page.
See “Demagnetizing / automatic zero-adjustment unavailable” (p. 90).

To halt demagnetization or automatic zero-adjustment on the middle of its execution

Pull the unlock lever toward you to unlock the upper jaw. When you halt demagnetization or automatic zero-adjustment, re-execute demagnetization and automatic zero-adjustment before taking a measurement.

To execute automatic zero-adjustment alone (without executing demagnetization)

Press the **DEMAG / AUTO ZERO** key momentarily (do not hold down the key). (p. 18)

2.3 Measuring Currents

Be sure to read the following sections and perform the steps described there before taking measurements:
“2.1 Inspecting the Device Before Use” (p.26)
“2.2 Preparing for Measurement” (p.28)

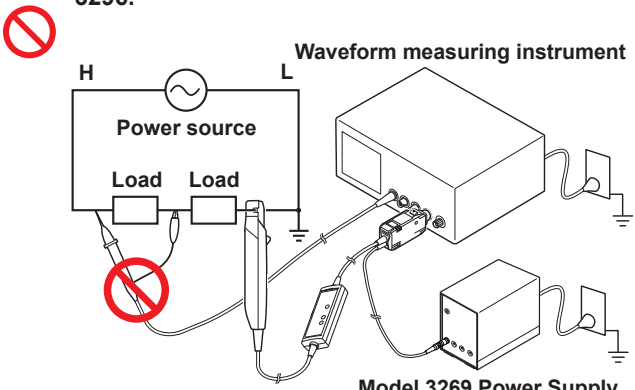
Follow all operating precautions for the host waveform measuring instrument or any other measuring instrument.

⚠DANGER

- **Do not cause a short-circuit between another wire and the wire to be measured with the metallic parts of the tips of the sensor. Arcs or such grave accidents are likely to occur.**
- **Do not measure any current in excess of the derating curve. Damage to the device or overheating can malfunction, a fire, or burn. See “Frequency derating curve” (p.76). The maximum measurement current varies with the frequency, and the current that can be measured continuously is limited. Operating the device at less than this limitation is referred to as derating.**

⚠DANGER

When you use a waveform measuring instrument that do not provide electrical insulation between its input terminals and chassis or among its input terminals, do not apply a different potential to the ground side of other input terminals. If you do, a short-circuit current will flow through Model 3269 Power Supply and the device from the ground terminal, causing an electrical accident that may cause bodily injury or damage to the device and the 3296.



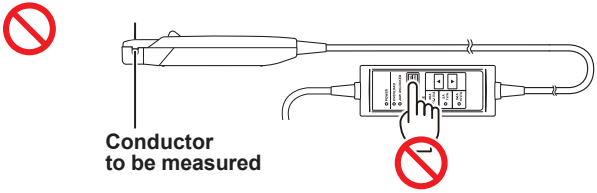
See the figure in “Example of connection to the circuit to be measured” (p.48) for a proper connection.

⚠DANGER

- **Confirm that the insulation on a conductor is not worn or damaged before clamping the sensor around the conductor to be measured. Also, take care not to damage the insulation when clamping the sensor around the conductor. Damage to the conductor insulation can cause an electric shock.**
- **Connect the device to Model 3269 Power Supply and a waveform measuring instrument (oscilloscope or recorder) before clamping the device around a live line to be measured. Failure to do so may cause a short-circuit or electric shock.**

⚠WARNING

Do not hold down the DEMAG / AUTO ZERO key when the sensor is clamped around a conductor to be measured. Starting magnetization can cause damage to the circuit being measured, which can lead to bodily injury.



Do not hold down the key.

Observe the following points when you measure a high-frequency current or a current that includes high-frequency components. Failure to do so could fire or damage to the measurement target and device, as well as burns.

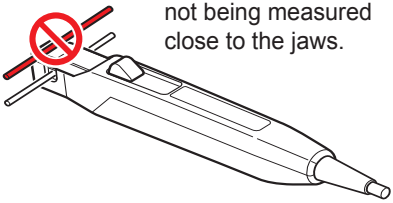
- **Keep hands and other body parts away from the jaws. Eddy current loss may cause heating of the sensor heads.**
- **Keep away any cords and other parts, which include the cords of the device, from the conductor to be measured. Dielectric heating may cause heating of cords and other parts.**

⚠CAUTION

- Do not apply high voltage, including static electricity, to the sensor. Doing so may damage its internal Hall element and circuitry.
- Do not pass a current through a conductor to be measured when Model 3269 Power Supply or a host waveform measuring instrument is off. Doing so may damage the device and instrument.

⚠CAUTION

Do not place any conductor carrying a current with a frequency of 10 kHz or more close to the jaws even when the sensor is not clamped around a conductor. A current flowing through conductors near the sensor may heat up the sensor heads, leading to damage to the device. As shown in the figure, when the device is clamped around one of the go-and-return conductors and the other conductor is close to the jaws, self-heating of both currents will synergistically heat up the sensor heads even if the electric current is lower than the maximum rated current, thereby leading to damage to the device.



Do not place conductors not being measured close to the jaws.

⚠CAUTION

- Do not prevent heat radiation from the device. Never input a current that exceeds the maximum rated current value*. The maximum rated current is affected by a temperature increase caused by self-heating during measurement. An temperature increase in the device cause damage to the device, a short-circuit, or electric shock.
- Never input a current that exceeds ±50 A even momentarily. Doing so can damage the device. See “Maximum peak current” (p. 70).
- Be sure not to exceed the maximum rated current, regardless of the flashing of **OVERLOAD** LED. Doing so can damage the device. Overload warnings are detectable in a frequency band of DC and 45 Hz to 66 Hz (sine wave). When measuring a current with a frequency outside the detection frequency band, the overload warning function may not work properly. See “Frequency characteristics” (p. 75).

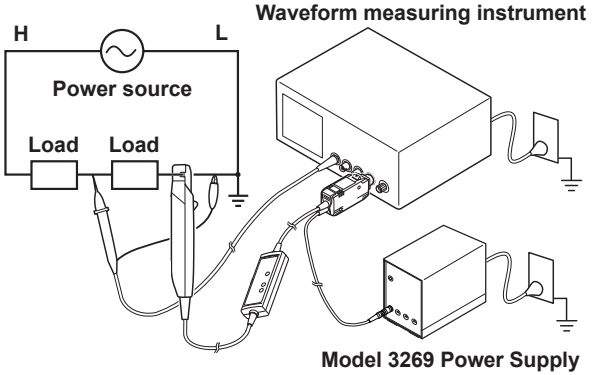
* The maximum rated current varies depending on the frequency of the current to be measured. See the figures below in “Frequency derating curve” (p. 76).”

⚠CAUTION

- Use the device for measuring currents much lower than the maximum rated current value if an ambient temperature is relatively high or a current to be measured can contain frequency components other than the fundamental. Self-heating could damage the device even if the current being measured is lower than the maximum rated current. The maximum rated current is defined as a recommended value for when a sine-wave current is inputted to the device at the temperatures and humidity specified for the guaranteed accuracy.
  See “Frequency derating curve” (p. 76).
- Keep the upper jaw locked in place except when clamping the sensor around a conductor to be measured or removing the sensor from the conductor. Leaving the upper jaw unlocked can damage the device.
- Connect the device and other probes properly to a circuit to be measured and a host waveform measuring instrument. Improperly connecting them could cause an electric shock or damage to the device, other probes, and instrument.

Example of connection to the circuit to be measured

The figure below illustrates a connection between the device and a measuring instrument with non-isolated input terminals equipped, such as a general oscilloscope.



Model 3269 can provide the power to up to two probes of Model CT6710/CT6711.

Connecting the device to a Hioki Memory HiCorder with a power supply module for current probes (option) installed allows the device to operate without Model 3269 Power Supply. For more information, contact your authorized Hioki distributor or reseller.

How to measure a current

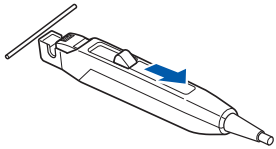
IMPORTANT

Do not perform the following actions. Changes in ambient temperature and an impact on the sensor head can cause fluctuations in the offset voltage, resulting in adverse effect on the measurement accuracy.

- Placing the sensor close to a heat source
- Roughly operating the opening lever to lock the upper jaw
- Subjecting the jaws and opening lever to force
- Allowing a conductor being measured to apply force to the sensor aperture while the sensor is being clamped around the conductor

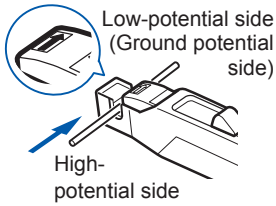
Be sure to execute demagnetization and automatic zero-adjustment before taking measurements.
See “Executing demagnetization and automatic zero-adjustment” (p.33).

1 **Pull the opening lever of the sensor toward you to retract the upper jaw.**



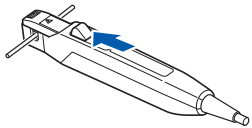
2 **Clamp the sensor around a conductor to be measured.**

- Align the sensor so that the current direction indicator matches the direction of the current to be measured.
- Place the conductor at the center of the sensor aperture.



3 **Slide the opening lever toward the lower jaw until the JAW UNLOCKED indicator is hidden.**

The upper jaw is locked in place and the **JAW UNLOCKED** LED goes out.



4 Confirm the LEDs on the junction box.

POWER LED and one of RANGE LEDs light up.

There is no error.

▷ Go to step **5**.

OVERLOAD LED blinks rapidly.

The device has detected a measurement current in excess of the level defined for the current range.

See “Overload” (p.88).

▷ When you use the 30 A range, immediately remove the sensor from the conductor being measured.

▷ When you use the 0.5 A range or 5 A range, switch a higher current range.

IMPORTANT

- The instrument may be unable to properly detect overload states immediately after the current range has changed.
- The currents for which an overload state can be detected are DC and sine waves with frequencies of 45 Hz to 66 Hz. The device is unable to detect the currents listed below as an overload state.
  - Currents that exceed the defined level on a momentary basis
  - High-frequency currents that exceed the defined level

Any other LEDs lights up or blinks.

A different error is occurring. See “4.2 Errors” (p.86) to identify a reason and take necessary measures.

5 Press the ▲ (higher range) key and ▲ (lower range) key to choose a current range.

- Choose a current range with a maximum peak current higher than the peak value of a current to be measured. See “Maximum peak current” (p.70).
  If the peak value of the current being measured exceeds the maximum peak current of the chosen current range, the output waveform will be saturated or distorted, preventing you from correctly observing the current waveform.

- You have to choose a current range according to the level of the current to be measured to minimize an adverse effect of noise on observation of the current waveform. The following table shows the recommended current ranges for each of the levels of currents to be measured.

Electric current level	Recommended current range (Output rate)
±5 A to ±50 A	30 A (0.1 V/A)
±0.5 A to ±5 A	5 A (1 V/A)
±1 mA to ±0.5 A	0.5 A (10 V/A)

6 Convert a voltage sensitivity of the waveform measuring instrument into a current sensitivity.

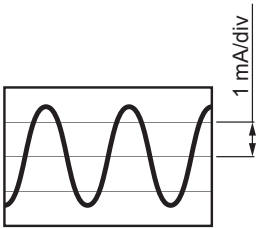
Using the following formula converts a voltage sensitivity (unit: V/div) specified on the waveform measuring instrument into a current sensitivity (unit: A/div).

$$S_I = S_V / R_O$$

S_I: Current sensitivity (A/div)
S_V: Voltage sensitivity (V/div)
R_O: Output rate (V/A)

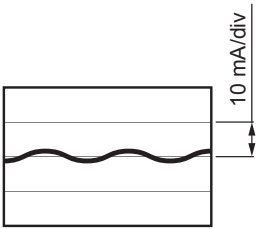
Example

When a host waveform measuring instrument with its voltage sensitivity set at 10 mV/div measures a current that has a RMS value of 1 mA



0.5 A range (10 V/A)

$S_I = (10 \times 10^{-3}) / 10$
$= 1 \times 10^{-3}$ (A/div)



5 A range (1 V/A)

$S_I = (10 \times 10^{-3}) / 1$
$= 10 \times 10^{-3}$ (A/div)

IMPORTANT

After you measured a current that exceeds the maximum rated current value of each current range, the sensor heads have been magnetized, causing incorrect current measurements. Re-execute the demagnetization and automatic zero-adjustment.
See “Executing demagnetization and automatic zero-adjustment” (p.33).

IMPORTANT

When you measure high-frequency currents, the position of the conductor being measured in the sensor aperture may vary the magnitude of load applied to the circuit to be measured, adversely affecting the measurement accuracy.
See “Input impedance” (p.78).

The following methods can minimize the adverse effect:

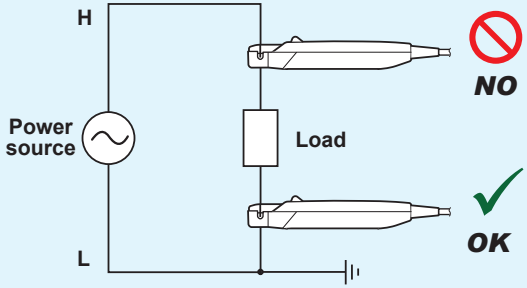
- Straighten the conductor to be measured as long as possible.
- Clamp the sensor at the center of the straight portion of the conductor as close as possible.
- Arrange the conductor at the center of the sensor aperture as close as possible.
- Do not wind the conductor around a jaw.

IMPORTANT

When you measure high-frequency currents, Clamping the sensor around the high-potential side of a circuit may cause common-mode noise to affect the measurement accuracy adversely.

See “Influence of common-mode voltage” (p.80).

As needed, reduce the frequency band of the waveform measuring instrument, or clamp the sensor around the low-potential side conductor.



The displayed value may fluctuate due to common-mode noise with no current inputted; this, however, does not represent a device malfunction.

NOTE

- Depending on the amplitude and frequency of a current to be measured, the sensor heads may emit a resonant sound. Such a sound may also be emitted during demagnetization. This, however, does not represent a device malfunction.

- If foreign matter adheres to the facing core surfaces on the sensor heads and thus creates a slight gap between the upper and lower sensor heads, the sensor heads may emit a resonant sound. Remove any foreign matter by following the cleaning method.
  See “4.3 Cleaning” (p.94).

- An increase in the resonant sound while the device is in use may indicate that the gap between the upper and lower heads has widened. You should calibrate the device because the gap may adversary affect the measurement accuracy.
  See “Maintenance and Service” (p.81).

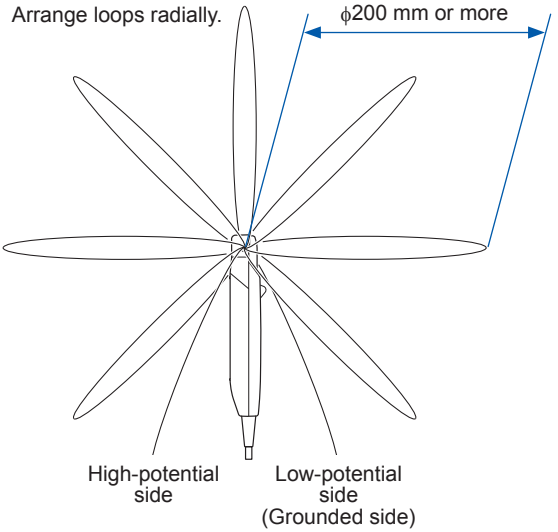
To measure a low current

When measuring low DC or low-frequency low AC, you can increase the current-detection sensitivity of the device in the following way.

How to measure a low current

1. **Coil a single conductor to be measured into several loops with a diameter of 200 mm or more.**
2. **Clamp the sensor around the loops in a bundle so the conductor passes through the sensor aperture one time more than the loop count consecutively in one direction.**
3. **Arrange the loops radially as shown in the following page.**
4. **Measure the current.**

As shown in the figure below, clamping the sensor around the seven loops in a bundle allows the conductor to pass through the sensor aperture eight times, which increases the voltage of the output signal by a factor of eight.



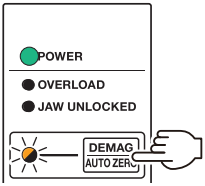
To measure a current accurately

Retracting and extending the upper jaw can cause an offset voltage of several millivolts. Perform the steps described below before measuring a current to accurately measure it.

How to measure a current accurately

1 **Hold down the DEMAG / AUTO ZERO key on the junction box for about 1 second.**

The **DEMAG / AUTO ZERO** LED lights up, and demagnetization and automatic zero-adjustment start. After the completion, the **DEMAG / AUTO ZERO** LED goes out.



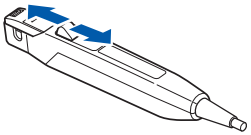
Hold down

Before execution, orange blinks or goes out.

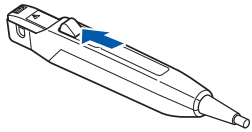
2 **Wait for about 5 minutes.**

The fluctuation in the offset voltage stabilizes.

3 **Operate the opening lever of the sensor back and forth to retract and extend the upper jaw 4 or 5 times.**



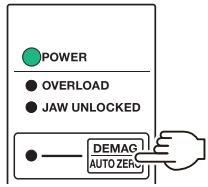
4 **Slide the opening lever toward the lower jaw until the JAW UNLOCKED indicator is hidden.**



The upper jaw is locked with the upper and lower sensor heads arranged in position relative to each other.

The **JAW UNLOCKED** LED goes out.

5 **Momentarily press the DEMAG / AUTO ZERO key on the junction box. (Do not hold down the key.)**



Press (Do not hold down)

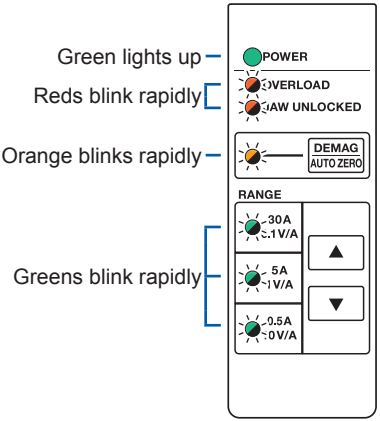
The **DEMAG / AUTO ZERO** LED lights up, and automatic zero-adjustment is performed alone. After the completion, the **DEMAG / AUTO ZERO** LED goes out.

6 **Measure a current.**

See “How to measure a current” (p. 49).

When the device has entered protection mode

To protect the device against self-generated heat, it enters protection mode when the temperature of the junction box exceeds a specified level.

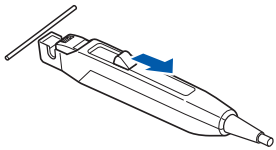


In protection mode, the device cannot correctly measure any current. Moreover, you cannot switch the current ranges. When the device has entered protection mode, follow the procedure presented in the following pages to restore it to normal operation.

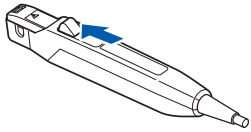
If the device has entered protection mode, re-calibrate it because internal components may have been subjected to thermal stress.

How to restore the device

1 **Pull the opening lever of the sensor toward you to retract the upper jaw, and remove the sensor from the conductor being measured.**



2 **Slide the opening lever toward the lower jaw until the JAW UNLOCKED indicator is hidden.**



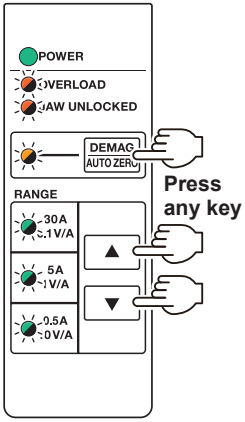
The upper jaw is locked in place.

3 **Wait for a while to let the junction box cool down to a normal temperature.**

4 Press any key.

One of the **RANGE** LEDs (of the range used before the device entered protection mode) lights up and the device gets back to normal.

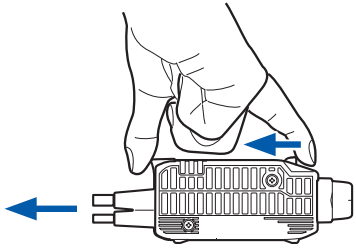
The **DEMAG / AUTO ZERO** LED blinks slowly, which indicates demagnetization and automatic zero-adjustment are required.
See “Executing demagnetization and automatic zero-adjustment” (p.33).



2.4 Finishing Measurement

⚠CAUTION

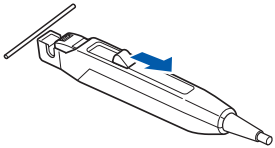
- To prevent a cable breaking, always hold the termination unit and disconnect the output terminal while pulling the unlock lever toward you. Do not pull the cord to unplug the output terminal. Doing so can damage the cord and output terminal.



- To disconnect the power plug of the device, follow the instructions below. Failure to observe these could damage to the cord and the power receptacle of Model 3269 Power Supply.
  - While holding the shell (p.17), pull the power plug out (pulling the shell lets the plug be unlocked, so you can disconnect the plug from the power receptacle).
  - Do not pull the cord or twist the power plug.

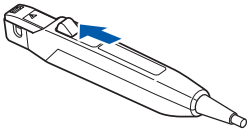
How to finish measurement

1 **Pull the opening lever of the sensor toward you to retract the upper jaw, and remove the sensor from the conductor being measured.**



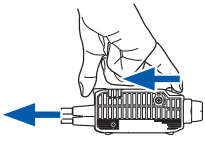
2 **Slide the opening lever toward the lower jaw until the JAW UNLOCKED indicator is hidden.**

The upper jaw is locked in place and the **JAW UNLOCKED** LED goes out.



3 **Disconnect the termination unit from the BNC input terminal on the waveform measuring instrument.**

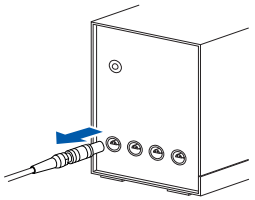
While pulling the unlock lever, pull out the termination unit straight.



4 **Set the POWER switch of the 3269 in the OFF position.**

5 **Disconnect the power plug of the device from the 3269.**

Hold the shell (p. 17) of the power plug when you disconnect it.



Do not pull the cord or twist the power plug.

6 **Unplug the power cord of the 3269 from the outlet.**

3 Specifications

Unless otherwise specified, each specification item is applied to both Model CT6710 and Model CT6711.
Items with a model number, “(Model CT6710)” or “(Model CT6711),” indicated are applicable to each model.
Each item is specified for the device operated at 23°C±5°C (73°F±9°F) and 80% RH (no condensation), 30 minutes elapses after the device is turned on before use.

3.1 General Specifications

Operating environment	Indoor, 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 range	−10°C to 50°C (14°F to 122°F), 80% RH or less (no condensation)
Standards	Safety: EN61010 EMC: EN61326
Measurable conductors	Insulated conductors
Measurable diameter of conductors	5 mm or less in diameter

Power supply	External power supply (Model 3269) Rated supply voltage: ±12 V DC ±0.5 V Maximum rated power: 7.8 VA (For current probe only, when measuring 30 A rms continuously)
Consumption current	See “Consumption current” (p.79) in “3.4 Typical Characteristics.”
Dimensions	• Sensor Approx. 155W × 18H × 26D mm (6.10″W × 0.71″H × 1.02″D) • Junction box Approx. 45W × 120H × 25D mm (1.77″W × 4.72″H × 0.98″D) • Termination unit Approx. 29W × 83H × 40D mm (1.14″W × 3.27″H × 1.57″D) Excluding BNC connector or protrusions
Mass	Approx. 370 g (13.1 oz.)
Cord lengths	• Between sensor and junction box Approx. 1500 mm (59.06″) • Between junction box and termination unit Approx. 150 mm (5.91″) • Power cord Approx. 1000 mm (39.37″)
Product warranty period	1 year
Accessories Option	See “Accessories” (p.5) and “Option” (p.6).

3.2 Specifications of Input, Output, and Measurement

Basic specifications

Frequency band	DC to 50 MHz (−3 dB) (Model CT6710) DC to 120 MHz (−3 dB) (Model CT6711) See “Frequency characteristics” (p.75) in “3.4 Typical Characteristics.”
Rise time (10% to 90%)	7.0 ns or less (Model CT6710) 2.9 ns or less (Model CT6711)
Delay time (the time lag between the input signal with a rise time of 1 ns and the output signal)	30 A range: 12 ns (typical) 5 A range: 12 ns (typical) 0.5 A range: 13 ns (typical)
Current range (output rate)	30 A range (Rate: 0.1 V/A) 5 A range (Rate: 1 V/A) 0.5 A range (Rate: 10 V/A)

Maximum rated current*1	30 A range: 30 A rms 5 A range: 5 A rms 0.5 A range: 0.5 A rms Derating is needed as input frequency increases. See “Frequency derating curve” (p.76) in “3.4 Typical characteristics.” Specified for currents of DC and sine wave
Maximum peak current	30 A range: ±50 A peak (maximum duration of input: 2 s*2) 5 A range: ±7.5 A peak 0.5 A range: ±0.75 A peak (less that 10 MHz) ±0.3 A peak (10 MHz or more)
Noise	75 µA rms or less (Typical: 60 µA rms) (For only the probe with the 0.5 A range, connected with a measuring instrument that has a frequency band of 20 MHz)
Input impedance	See “Input impedance” (p.78) in “3.4 Typical characteristics.”.

*1. Depending on the ambient temperature and measurement conditions, internal overheating can result in an overload condition, limiting the maximum rated current lower than those specified here.
*2. The device requires to cool down for 10 times of the length of time the current was inputted.

Specifications of accuracy

Accuracy warranty conditions	• Accuracy warranty period 1 year (until the upper jaw has been retracted and locked up to 10,000 cycles) • Guaranteed accuracy period after adjustment made by Hioki 0.5 year • Temperature and humidity for guaranteed accuracy 23°C±5°C (73°F±9°F), 80% RH or less • Warm-up time At least 30 minutes • Power voltage range ±12 V DC ±0.5 V
Amplitude accuracy*3	30 A range: ±3.0% rdg. ±1 mV (Typical: ±1.0% rdg. ±1 mV [for 10 A rms or less]) 5 A range: ±3.0% rdg. ±1 mV (Typical: ±1.0% rdg. ±1 mV) 0.5 A range: ±3.0% rdg. ±10 mV (Typical: ±1.0% rdg. ±10 mV) For a DC current and a sine-wave current with frequencies of 45 Hz to 66 Hz within the maximum peak current value of each current range

*3. Unless there is any change in the state of the facing core surfaces, which includes scratches, adhesion of foreign objects, or any change in the operating environment.

Temperature characteristics of sensitivity *3, *4	±2.0% rdg. or less After automatic zero-adjustment was executed, in the temperature range except 23°C±5°C, under the following input conditions: 30 A range: AC with 50 Hz, 30 A 5 A range: AC with 50 Hz, 5 A 0.5 A range: AC with 50 Hz, 0.5 A
Effect of radiated radio-frequency electro-magnetic field	±10 mA or less at 3 V/m
Effect of conducted radio-frequency electro-magnetic field	±10 mA or less at 3 V
Effect of external magnetic field	20 mA or less (Model CT6710) (DC and 60 Hz, in a magnetic field of 400 A/m) 5 mA or less (Model CT6711) (DC and 60 Hz, in a magnetic field of 400 A/m)

*3. Unless there is any change in the state of the facing core surfaces, which includes scratches, adhesion of foreign objects, or any change in the operating environment.

*4. The values of the temperature characteristics of sensitivity are added to the amplitude accuracy.

3.3 Specifications of Functionality

Demagnetizing and automatic zero-adjustment functions	When the upper jaw is not locked in place, an overload is detected, or an inputted current exceeds the values listed below, the functions are not available. 0.50 ±0.25 A rms (DC and sine wave with frequencies of 45 Hz to 66 Hz) • Demagnetizing and automatic zero-adjustment Operation: Executes demagnetization and automatic zero-adjustment. Means: Hold down the **DEMAG / AUTO ZERO** key (1 s). • Automatic zero-adjustment Operation: Executes automatic zero-adjustment alone. Means: Press the **DEMAG / AUTO ZERO** key.
Jaws unlocked detection	When the upper jaw is not locked in place, the **JAW UNLOCKED** LED lights up.

Overload detection	• Typical sampling frequency: 7.8125 kHz • Typical checking cycle: 500 ms Breakdown Typical sampling period: 400 ms Typical computing-and-judging period: 100 ms (1) Excess of rated current level When the input current exceeds the following level, the **OVERLOAD** LED blinks rapidly. 30 A range: 32.5 ±2.5 A rms 5 A range: 5.25 ±0.25 A rms 0.5 A range: 0.525 ±0.025 A rms (For all the ranges, the target currents are of DC and sine wave with frequencies of 45 Hz to 66 Hz) (2) Excess of specified temperature Detects an internal temperature anomaly and issues an alert by blinking all of the LEDs except the **POWER** LED. Typical specified temperature: 80°C Typical hysteresis: 10°C Recovery means: Press any key. Then, the device requires demagnetization and automatic zero-adjustment.
Specifications of lighting up / blinking LEDs	See “1.4 Specifications of Lighting up / Blinking LEDs” (p.22).

3.4 Typical Characteristics

All of the characteristics shown in this section are typical.

Frequency characteristics

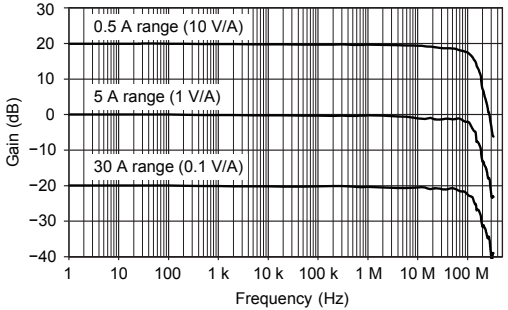


Fig. 1 Frequency characteristics (Model CT6710)

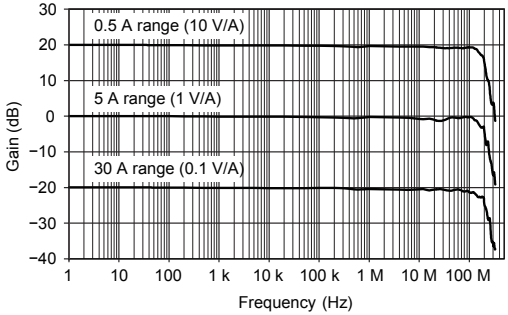


Fig. 2 Frequency characteristics (Model CT6711)

Frequency derating curve

Figures 3 and 4 show the derating curves with a sine-wave current inputted in the temperature and humidity range for the guaranteed accuracy. If the ambient temperature (T_A) rises or the current being measured contains high-frequency components, the device temperature will rise, and thus its continuously inputtable current value and frequency will lower.

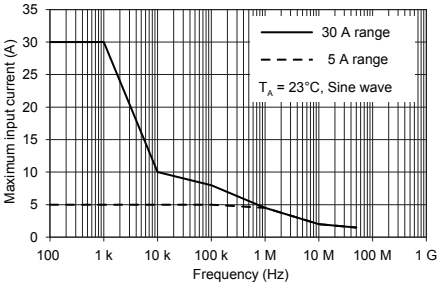


Fig. 3 Derating curve according to frequency (Model CT6710)

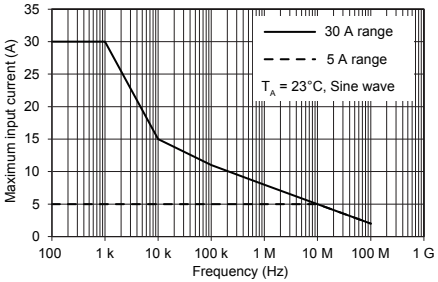


Fig. 4 Derating curve according to frequency (Model CT6711)

Input impedance

The location where the sensor is clamped will exhibit impedance as shown in Figs. 5 and 6, which inserts a load in a circuit to be measured. In particular, take this characteristic into account when measuring a high-frequency current.

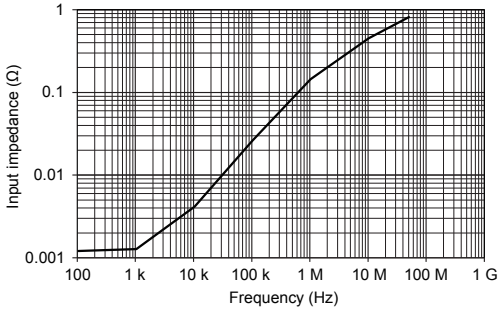


Fig. 5 Input impedance (Model CT6710)

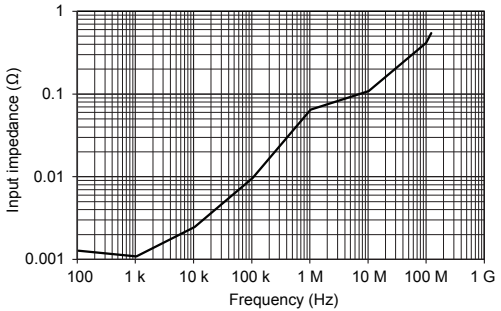


Fig. 6 Input impedance (Model CT6711)

Consumption current

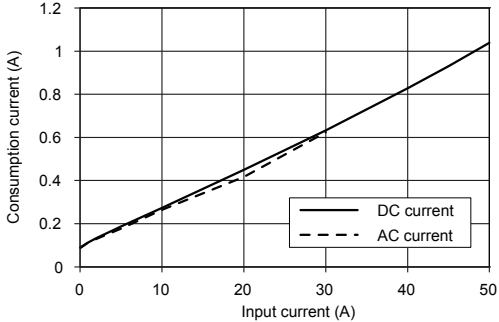
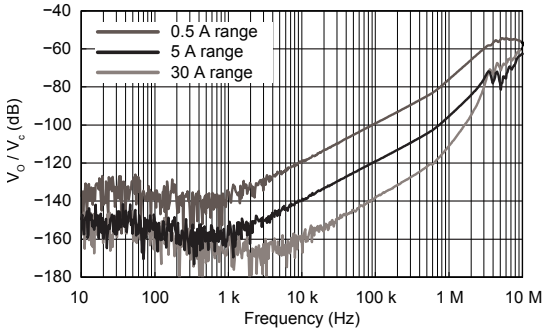


Fig. 7 Consumption current (with the 30 A range specified)

Influence of common-mode voltage

The figure below indicates the ratio of common-mode voltage (external noise voltage) applied to a conductor being measured positioned in the sensor aperture and the resulting output voltage.



V_O: Output voltage (V)
V_C: Common-mode voltage (V)

Fig. 8 Influence of common-mode voltage

4 Maintenance and Service

⚠WARNING

Do not modify, disassemble, or attempt to repair the device. Doing so may cause a fire, electric shock, or injury.

Calibration

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

4.1 Troubleshooting

If damage is suspected, read “Before sending back your device for repair” (p.83) before contacting your authorized Hioki distributor or reseller.

When transporting the device, be sure to observe the following precautions:

- Remove any optional equipment from the device. Use the original packing materials the device was shipped in, and be sure to pack it in a double carton. Damage that occurs during transportation is not covered by the warranty.
- Be sure to include a memo that describes the problem in detail when sending the device for repair.

Before sending back your device for repair

Symptom / Cause, remedy
No waveform is displayed on the host waveform measuring instrument. ▷ Re-execute demagnetization and automatic zero-adjustment. (p.33) ▷ Make sure that the input coupling of the waveform measuring instrument is set to DC. (p.36) If the issue has not been resolved, the device may be malfunctioning. ▷ Send back the device for repair.
A resonant sound is emitted from the sensor heads. The sensor head may emit a resonant sound depending on the amplitude and frequency of the current being measured. Such a sound may also be emitted during demagnetization. This, however, does not affect the measurement accuracy.
The resonant sound emitted from the sensor heads becomes louder. The gap between the upper and lower sensor heads may have increased. You should calibrate the device because the gap may adversary affect the measurement accuracy.

Symptom / Cause, remedy
Demagnetization and automatic zero-adjustment cannot be performed. **Demagnetization or automatic zero-adjustment has not been completed normally.** Under the following conditions, demagnetizing and automatic zero-adjustment cannot be performed. Alternatively, demagnetization or automatic zero-adjustment has not been completed normally. • The upper jaw is unlocked. • An overload has been detected whether or not the upper jaw is locked. • A current exceeding 0.5 A rms has been detected whether or not the upper jaw is locked. ▷ Implement the remedy described in the following pages: See “Demagnetizing / automatic zero-adjustment unavailable” (p.90). Then, re-execute demagnetization and automatic zero-adjustment. See “Executing demagnetization and automatic zero-adjustment” (p.33). When demagnetization or automatic zero-adjustment has not been normally completed even with the sensor not clamped around any conductor and the upper jaw locked in place, the device can be damaged. ▷ Send the device for repair.

Symptom / Cause, remedy
The waveform outputted during the demagnetization is asymmetric along the horizontal axis. This does not represent a device malfunction. ▷ After demagnetization and automatic zero-adjustment are completed, make sure that the zero position on the waveform measuring instrument is appropriate.

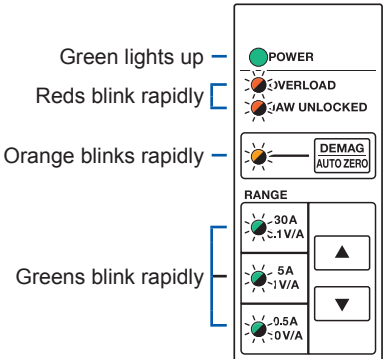
4.2 Errors

If an error occurs, the LEDs on the junction box lights up or blinks.
See “1.4 Specifications of Lighting up / Blinking LEDs” (p.22).
When an error occurs, remedy the error according to measures described in the following pages. If the device needs to be repaired, contact your authorized Hioki distributor or reseller.

Types of errors

You can identify the type of an error with the LED indicators displayed on the junction box.

Protection mode

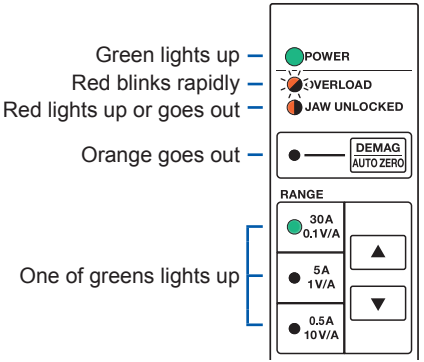


The abnormal internal temperature was detected in the junction box, and thus the device has entered protection mode.

▷Follow the procedure in the following page.
“When the device has entered protection mode” (p.61)

Since internal components may have been subject to thermal stress, it is recommended to calibrate the device.

Overload



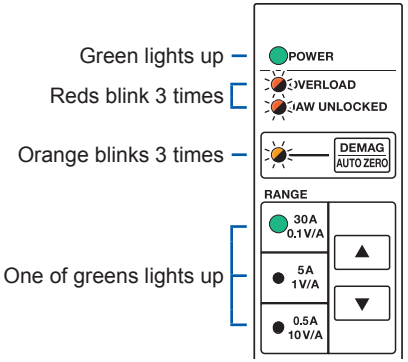
The input current exceeding the specified level of each current range is detected.

▷ When you use the 30 A range, immediately remove the sensor from the conductor being measured.
▷ When you use the 0.5 A range or 5 A range, switch a higher current range.

IMPORTANT

- The instrument may be unable to properly detect overload states immediately after the current range has changed.
- The currents for which an overload state can be detected are DC and sine waves with frequencies of 45 Hz to 66 Hz. The device is unable to detect the currents listed below as an overload state.
  - Currents that exceed the defined level on a momentary basis
  - High-frequency currents that exceed the defined level
- Although external magnetic fields may cause the **OVERLOAD** LED to blink while the upper jaw is retracted, this does not indicate an issue with the device.

Demagnetizing / automatic zero-adjustment unavailable

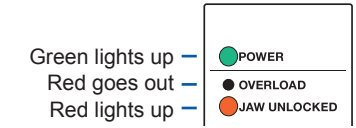


Demagnetizing and automatic zero-adjustment cannot be performed; otherwise, demagnetization or automatic zero-adjustment has not been completed normally.
The device must be in the following conditions:

- The upper jaw is unlocked.
- An overload has been detected whether or not the upper jaw is locked.
- A current exceeding 0.5 A rms has been detected whether or not the upper jaw is locked.

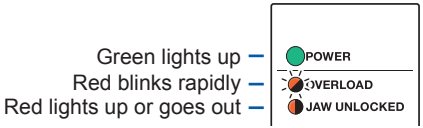
▷ Depending on the LED status exhibited after the three blinks, implement the remedy described in the following pages. After that, re-execute demagnetization and automatic zero-adjustment (p.33).

LED status after three flashes



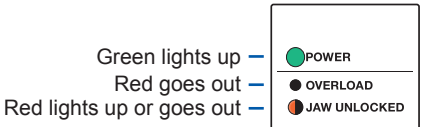
The upper jaw is unlocked.

▷ Slide the opening lever of the sensor toward the lower jaw until the **JAW UNLOCKED** indicator is hidden to lock the upper jaw in place.



An overload is detected.

▷ Remove the sensor from the conductor to be measured.
Then, slide the opening lever of the sensor toward the lower jaw until the **JAW UNLOCKED** indicator is hidden to lock the upper jaw in place.

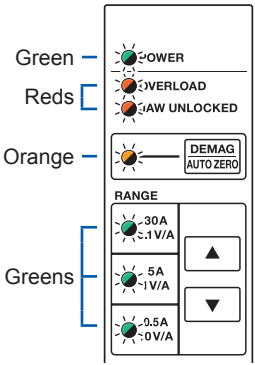


A current exceeding 0.5 A rms has been detected.

▷ Remove the sensor form the conductor to be measured.
Then, slide the opening lever of the sensor toward the lower jaw until the **JAW UNLOCKED** indicator is hidden to lock the upper jaw in place.

Checksum error

All LEDs blink rapidly.

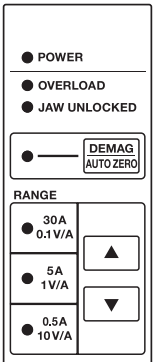


An internal CPU error (checksum error) has occurred.

▷ Send back the device for repair.

Malfunction

No LEDs light up.



The device is malfunctioning.

▷ Send back the device for repair.

4.3 Cleaning

⚠CAUTION

Do not wipe the facing core surfaces of the sensor heads and metallic parts of the connectors with a soft cloth moistened with any liquid. Doing so damage the device.

- Discharge any static electricity on your body before cleaning the facing core surfaces of the sensor heads and the metallic parts of the connectors. Subjecting the device to high voltage may damage the internal Hall elements and circuitry.
- Periodically clean the vents to avoid blockage. When the vents get clogged, the internal cooling effect of the device is hampered, and this can lead to damage to the device.

IMPORTANT

Keep the surfaces clean by gently wiping them with a soft dry cloth. Dirt on the facing core surfaces of the sensor heads can adversely affect the measurement accuracy.

To clean the exterior components of the device, gently wipe it with a soft cloth moistened with water or mild detergent.

4.4 Disposal

Dispose of the device in accordance with local regulations.

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Warranty Certificate

HIOKI

Model	Serial number	Warranty period One (1) year 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 (one [1] year from the date of purchase). If the date of purchase is unknown, the warranty period is defined as one (1) year 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-1

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