3273-50
3276

HIOKI

Instruction Manual

CLAMP ON PROBE

EN

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3276A981-05 20-03H

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Contents

Introduction

Thank you for purchasing the HIOKI 3273-50,3276 CLAMP ON PROBE. To obtain maximum performance from the device, please read this manual first, and keep it handy for future reference.

Inspection

When you receive the device, inspect it carefully to ensure that no damage occurred during shipping. If damage is evident, or if it fails to operate according to the specifications, contact your dealer or Hioki representative.

Supplied accessories

Instruction manual		1
3273-50	Soft case	1
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Notes on Safety

⚠ WARNING

This deviceis designed to comply with IEC 61010 Safety Standards, and has been thoroughly tested for safety prior to shipment. However, mishandling during use could result in injury or death, as well as damage to the device. Be certain that you understand the instructions and precautions in the manual before use. We disclaim any responsibility for accidents or injuries not resulting directly from device defects.

Safety Symbols

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

	The ⚠ symbol printed on the device indicates that the user should refer to a corresponding topic in the manual (marked with the ⚠ symbol) before using the relevant function. In the manual, the ⚠ symbol indicates particularly important information that the user should read before using the device.
	Indicates that only insulated conductors suited to the voltage of the circuit under test can be measured.

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

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

Notes on Use

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

Preliminary Check

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

⚠ DANGER

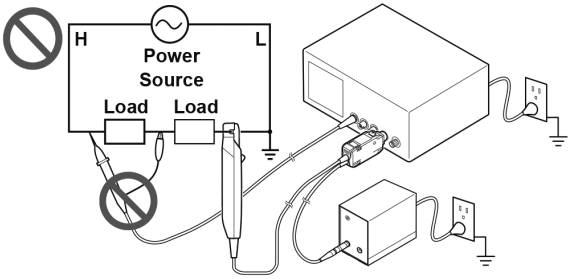
- **Do not measure around a bare conductor. Doing so may result in short-circuit or electric shock. Take measurements at a location on an insulated wire where there is sufficient insulation for the circuit voltage.**
- **Refer to the derating characteristics when measuring current that includes a highfrequency component and never measure any current that exceeds the rated current.**
- **Use with high frequencies or strong magnetic fields may cause the device to become abnormally hot, resulting in fire, equipment damage, or burns. (See "3 Specifications" (p5.))**
- **Observe the following to avoid electric shock and short circuits.**
  - **Connect the device to the 3269 or the 3272 Power Supply and waveform measurement instrument (oscilloscope or recorder) first, and then to the active lines to be measured**
  - **When the sensor is opened, do not shortcircuit the conductor being measured or other two wires with the metal part of the tip.**
  - **Be careful to avoid damaging the insulation surface while taking measurements.**

⚠ DANGER

- **Before clamping the conductor being measured,make sure that the insulation on the conductor isundamaged. Also, take care not to damage theinsulation when clamping the conductor. Any damageto the insulation could cause an electric shock.**
- **This instrument is made for use with the 3269 or 3272 POWER SUPPLY.**
- **To prevent fire or damage of the measurement target and device as well as burns, exercise caution concerning the following when measuring high-frequency currents or currents that contain high-frequency components:**
  - **Eddy current loss may cause heating of the sensor head.**
  - **Dielectric heating may cause heating of cord insulation and other materials.**
- **This device should only be connected to the secondary side of a breaker, so the breaker can prevent an accident if a short circuit occurs. Connections should never be made to the primary side of a breaker, because unrestricted current flow could cause a serious accident if a short circuit occurs.**

⚠ DANGER

- **Be sure to observe all operating precautions for the waveform monitoring instrument (oscilloscope or recorder) and other measurement instruments to which this device is connected.**
- **When using a measurement instrument that does not provide isolation between its input terminals and chassis or other input terminals, please pay attention to the following points. If a signal is applied to an input terminal other than that to which this device is connected, do not connect the ground-side terminal to any non-ground potential. Otherwise, short-circuit current will flow through the 3269,3272 or this device from the ground terminal, which could cause an electrical accident or damage.**



⚠ WARNING

- Do not allow the device to get wet, and do not take measurements with wet hands. This may cause an electric shock.
- Do not press the demagnetizing switch (DEMAG) to perform demagnetization while the conductor being measured is clamped. Doing so could damage the circuitry or cause an accident that might result in injury or death.
- Ensure that the input does not exceed the maximum rated current to avoid device damage, shortcircuiting and electric shock resulting from heat building.

⚠ CAUTION

- To avoid damage to the device, protect it from physical shock when transporting and handling. Be especially careful to avoid physical shock from dropping.
- This device should be installed and operated indoors only, between 0 and 40℃ (32 to 104℉) and 80% RH or less.
- Do not store or use the device where it could be exposed to direct sunlight, high temperature or humidity, or condensation. Under such conditions, the device may be damaged and insulation may deteriorate so that it no longer meets specifications.
- This device is not designed to be entirely water- or dust-proof. To avoid damage, do not use it in a wet or dusty environment.
- The sensor head is a precision assembly including a molded component, a ferrite core, and a Hall effect element. It may be damaged if subjected to sudden changes in ambient temperature, or mechanical strain or shock, and therefore great care should be exercised in handling it.
- The matching surfaces of the sensor head are precisely ground, and should be treated with care. If these surfaces are scratched, performance may be impaired.
- Measurements are degraded by dirt on the mating surfaces of the sensor head, so keep the surfaces clean by gently wiping with a soft cloth.

⚠ CAUTION

- Foreign substances such as dust on the contact surfaces of the sensor head can cause acoustic resonance and degrade measurement, so it should be cleaned by gently wiping with a soft cloth. Refer to NOTE (p. 23) for resonance sound.
- To avoid damaging the cables, do not bend or pull the sensor cable and power supply cable.
- Keep the clamp jaws and core slits free from foreign objects, which could interfere with clamping action.
- Do not apply a static electricity or other source of high voltage to the sensor. Doing so may damage its internal Hall elements and circuitry
- To clean the device, wipe it gently with a soft cloth moistened with water or mild detergent. Never use solvents such as benzene, alcohol, acetone, ether, ketones, thinners or gasoline, as they can deform and discolor the case.
- When the power is on, keep the core section of the sensor closed, except when clamping them onto the conductor to be measured. The facing surface of the core section can be scratched while it is open
- .Do not short-circuit the output terminal and do not input voltage to the output terminal. The device may be damaged.

⚠ CAUTION

- Keep the cables well away from heat sources, as bare conductors could be exposed if the insulation melts.
- Keep the sensor head closed when not in use, to avoid accumulating dust or dirt on the mating core surfaces, which could interfere with clamp performance.

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

Service

When sending the device for repair, carefully to prevent damage in transit. Include cushioning material so the instrument cannot move within the package. Be sure to include details of the problem. Hioki cannot be responsible for damage that occurs during shipment.

IMPORTANT

Periodic calibration is necessary in order to ensure that the device provides correct measurement results of the specified accuracy.

Chapter 1 Overview

1.1 Product Overview

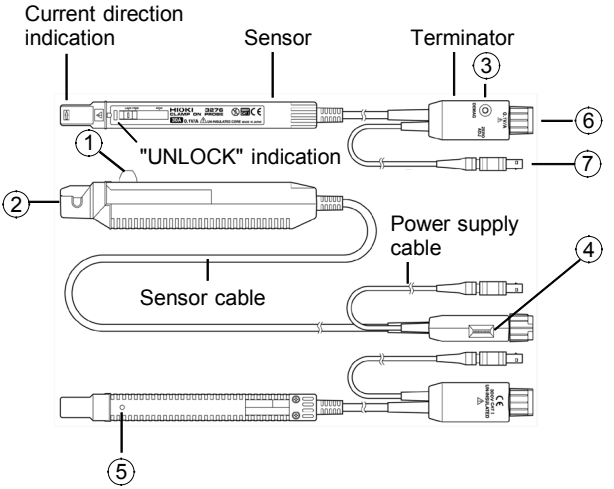
This device can be directly connected to a BNC input connector of a waveform measuring instrument such as an oscilloscope or recorder, and by clamping on a conductor to be measured, allows the current waveform to be easily captured.

1.2 Features

- Highly accurate current detection
- Easy current measurement
- Broadband frequency characteristics
  3273-50: DC～50MHz
  3276: DC～100MHz
- Compact and permits measurement of low current levels
- Easy protect function at excessive input
- Unique HIOKI development of thin film Hall effect element

1.3 Names of Parts

External view



1.4 Parts of the Sensor

① Opening lever

Operating lever for opening the sensor head. Always use this lever to open the sensor head.

② Sensor head

This clamps the conductor being measured, and carries out the actual current measurement. It is a precision assembly including a molded component, a ferrite core, and a Hall effect element. It may be damaged if subjected to sudden changes in ambient temperature, or mechanical strain or shock, and therefore great care should be exercised in handling it.

③ Demagnetizing switch (DEMAG)

This demagnetizes the core if it has been magnetized by switching the power on and off, or by an excessive input. Always carry out demagnetizing before measurement.

The demagnetizing process takes about one second. During demagnetizing, a demagnetizing waveform is output.

④ Zero adjustment dial (ZERO ADJ)

Use the zero adjustment dial to correct for the effect of a voltage offset or temperature drift on the device. When beginning measurement, after demagnetizing always carry out zero adjustment.

⑤ Coarse adjustment trimmer

Use this only when adjustment is not possible within the range of the zero adjustment dial.Use a nonconductive screwdriver (e.g. ceramic driver) for adjustment.

⑥ Output connector

The current waveform of the measured conductor is output at a constant rate (0.1 V/A).

Connect to the BNC input connector of the waveform measuring instrument.

NOTE

- The output of this device is terminated internally.
- Since the output resistance is 25 Ω, the device must be used with a waveform measurement instrument (oscilloscope,recorder, etc.) that has an input impedance of at least 1 MΩ. Accurate measurement is not possible with waveform measurement instruments that have an input resistance of 50 Ω.

NOTE

- If using BNC-banana plug adapters or similar to connect to input terminals other than BNC connectors, make sure the polarity is correct.
- Turn the collar until it clicks, and check that it is locked securely.

⑦ Power plug

Connect this to the 3269 or 3272 POWER SUPPLY receptacle to supply power to the sensor terminator.

Chapter 2 Specifications

2.1 Product Specifications

Accuracy is guaranteed at 23℃ ±5 ℃ (73℉ ±9℉) after the power has been on for 30 minutes.

Frequency range	3273-50:DC to 50 MHz (-3 dB) (Characteristics shown in Fig.1) 3276:DC to 100 MHz (-3 dB) (Characteristics shown in Fig.2)
Rise time	3273-50 :7 ns or less 3276 :3.5 ns or less
Maximum continuous input range	30 Arms (Derating according to frequency shown in Fig.3 Fig.4)
Maximum peak current value	Non-continuous 50 A peak
Output voltage rate	0.1 V/A
Amplitude accuracy	±1.0% rdg. ±1 mV ; to 30 Arms ±2.0% rdg. ; to 50 A peak (DC, and 45 to 66 Hz, input within continuous maximum input range)
Noise	Equivalent to 2.5 mArms or less (for 20 MHz band measuring instrument)
Input impedance	(Characteristics shown in Fig.5 Fig.6)

Temperature coefficient for sensitivity	±2% or less (During input of 50 Hz 30 Arms within range of 0 to 40℃(32 to 104℉))
Maximum rated power	3273-50 : 5.3 VA 3276 : 5.3VA
Rated supply voltage	±12 V ±0.5 V
Operating temperature and humidity range	0 to 40℃ (32 to 104℉), 80 % RH or less (no condensation)
Storage temperature and humidity range	-10 to 50 ℃ (14 to 122℉), 80 % RH or less (no condensation)
Location for use	Indoor, altitude up to 2000 m (6562 feet) Pollution Degree 2
Effect of external magnetic fields	3273-50:Equivalent to a maximum of 20 mA 3276:Equivalent to a maximum of 5 mA (DC and 60 Hz, Magnetic field of 400 A/m)
Diameter of measurable conductors	5 mm dia. 0.2" dia.
Measurable conductors	Insulated conductor
Guaranteed accuracy period	1 year (Opening/closing up to 10,000 times)
Cable lengths	Sensor cable Approx. 1.5 m (59.0") Power supply cable Approx. 1 m (39.4")

External dimensions	Sensor Approx. 175W × 18H × 40Dmm Approx. 6.89"W × 0.71"H × 1.58"D (excluding protrusions) Terminator Approx. 27H × 55W × 18D mm Approx. 1.06"W × 2.17"H × 0.71"D
Mass	3273-50 Approx. 230g Approx. 8.1 oz. 3276 Approx. 240g Approx. 8.5 oz.
Accessories	3273-50 Instruction manual, Soft case 3276 Instruction manual, Carrying case
Product warranty period	1 year

2.2 Standards Applying

Safety	EN61010
EMC	EN61326

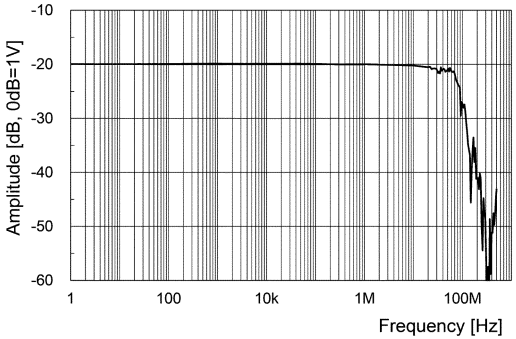


Fig.1 Frequency characteristics
(Typical characteristics of 3273-50)

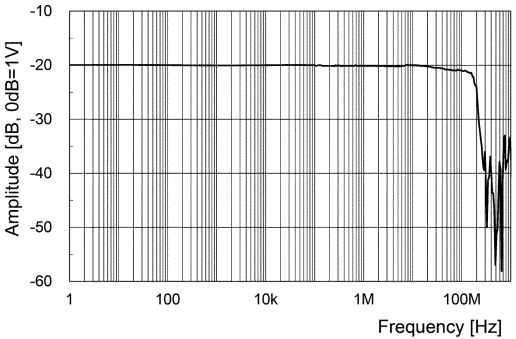


Fig.2 Frequency characteristics
(Typical characteristics of 3276)

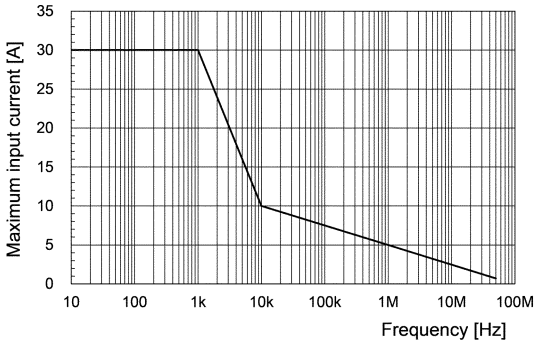


Fig.3Derating according to frequency(3273-50)

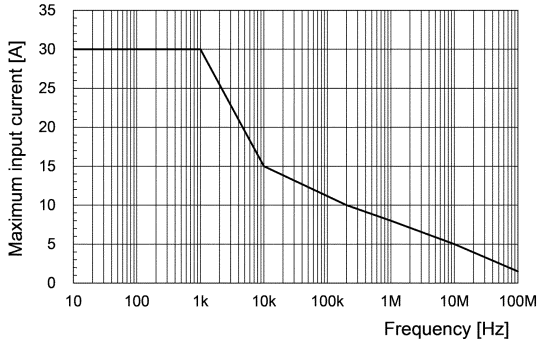


Fig.4 Derating according to frequency(3276)

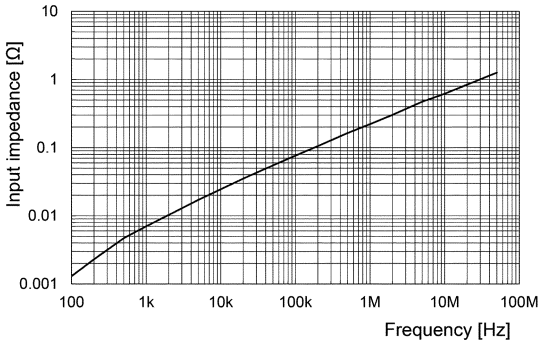


Fig.5 Input impedance
(Typical characteristics of 3273-50)

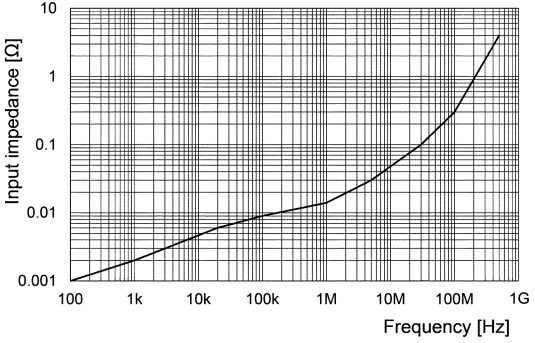


Fig.6 Input impedance
(Typical characteristics of 3276)

Chapter 3 Measurement Procedure

3.1 Notes on Use

Before using the instrument, make sure to refer to Notes on Use" (p. iii to xi)

3.2 Preparations for Measurement

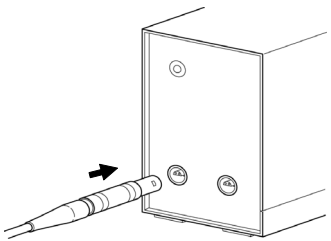
(1) Have the 3269,3272 POWER SUPPLY, and oscilloscope or recorder for waveform measurement ready.

⚠ CAUTION

Before turning on the power, make sure that the voltage of the power supply being used matches the supply voltage indicated on the rear panel of the 3269,3272.

(2) Turn the power switch off and connect the power cord.

(3) Connect the power plug of the 3273-50,3276 to the power receptacle of the 3269,3272.

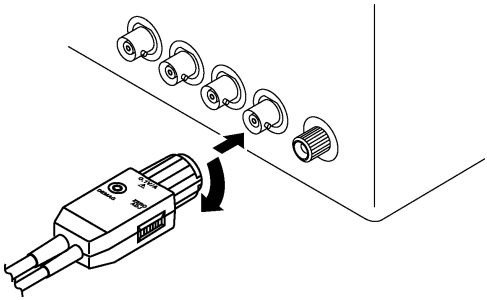


(4) Turn the 3269,3272 power switch on, and check that the front panel power indicator lights.

3.3 Demagnetizing and Zero Adjustment

(1) With the waveform measurement instrument input at ground, adjust the trace to the zero position.
(2) Set the input coupling of the waveform measurement instrument to DC.

(3) Connect the output connector of the 3273-50,3276 to the input connector of the waveform measurement instrument. Turn the collar until it clicks, and check that it is locked securely.

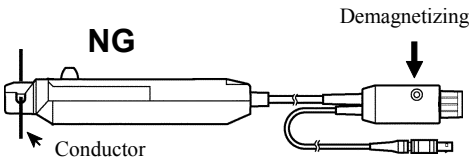


⚠ CAUTION

- When disconnecting the output connector, be sure to release the lock before pulling off the connector. Forcibly pulling the connector without releasing the lock, or pulling on the cable, can damage the terminator.
- If using BNC-banana plug adapters or similar to connect to input terminals other than BNC connectors, make sure the polarity is correct.

⚠ CAUTION

- Do not demagnetize while the 3273-50,3276 is clamping a conductor to be measured. Demagnetizing causes current to flow into the conductor, which may damage parts in the circuit to be measured.



- Check that the conductor being measured is not clamped when supplying power to the 3273-50,3276 for the same reason. Demagnetized waveforms are generated when supplying electric power.

(4) Without clamping the conductor to be measured, press the opening lever until the "UNLOCK" indication disappears, and check that the sensor head is properly closed.
(5) Press the demagnetizing switch (DEMAG) on the terminator.
(6) Turn the zero adjustment dial on the terminator, to adjust the trace to the zero position.

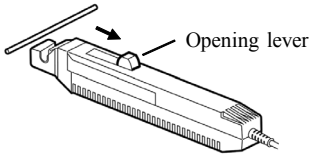
NOTE • If zero adjustment is not possible in step 6, turn the coarse adjustment trimmer to bring the trace within the range of adjustment by the zero adjustment dial.

NOTE

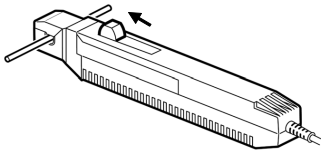
- Turning the coarse adjustment trimmer, do not subject it to a thrust. Doing so may cause the trimmer to come off. To turn the trimmer, use a screwdriver with the following flat blade made of a non-conductive material including ceramic: 0.4 mm in thickness, 1.8 mm in width,and 10 mm in length or longer.

3.4 Measurement Procedure

(1) Check that the system is safe, and that the preparations described in the preceding section have been carried out.
(2) Pull the sensor opening lever, so that the sensor head opens.



(3) Align the sensor so that the current direction indication corresponds to the direction of current flow through the conductor to be measured, and clamp so that the conductor is in the center of the sensor aperture.
(4) Press the opening lever on the sensor head until the "UNLOCK" indication disappears, and check that the opening lever is firmly locked and the sensor head securely closed.



(5) It is now possible to monitor the current waveform. The output rate of the 3273-50,3276 is 0.1 V/A. The current sensitivity can be derived from the voltage sensitivity of the waveform measurement instrument. For example, if the voltage sensitivity is 10 mV/division, the current sensitivity is 100 mA/division.

NOTE

- When using the 3273-50,3276, note that two clamp-on probes may not be used simultaneously with the 3269or3272 POWER SUPPLY, depending on the current to be measured.
- The current consumption of clamp-on probes depends on the current to be measured. Confirm that the total current consumption of the clamp-on probes does not exceed the rated output current of the 3269or3272. See Fig. 7,8.

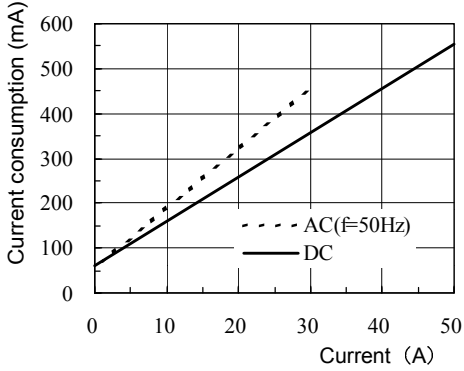


Fig.7 Current consumption* vs. current to be measured
(typical of 3273-50)

*The sum total of a positive and negative current consumption

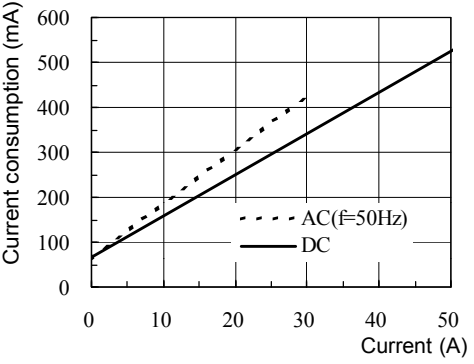


Fig.7 Current consumption* vs. current to be measured
(typical of 3276)

*The sum total of a positive and negative current consumption

⚠ CAUTION

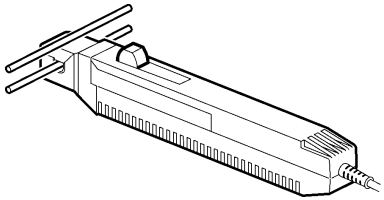
- **The maximum continuous input range is based on heat that is internally generated during measurement. Never input current in excess of this level. Exceeding the rated level may result in damage to the probe.**
- **The device may sustain damage from self-heating even at current levels that are lower than the maximum current value defined by the maximum rated current.The maximum rated current is a recommended value that assumes sine-wave input under standard conditions. Self-heating may increase if the ambient temperature increases or the measurement current waveform contains other frequency components. Refer to the derating characteristics in the product specifications.**
- **Current measurement exceeding approx. 1kHz may result in temperature rise on the sensor-head. This is attributed to excitation loss that cannot be prevented due to natural physical principles. Be careful to avoid injury, electric shock due to short-circuits, or damage to the device that may be caused by the increased temperature.**
- **If excess current is input, generated heat activates a built-in safety function that blocks normal output. If this happens, remove the input immediately (remove the sensor from the conductor being measured, or reduce the input current to zero). Wait until the sensor has had sufficient time to cool before resuming operation.**

⚠ CAUTION

- **Even if the input current does not exceed the rated continuous maximum, continuous input for an extended period of time may result in activation of the safety circuit to prevent damage resulting from heating of the sensor.**
- **At high ambient temperatures, the built-in safety circuit may activate at current input levels below the rated continuous maximum.**
- **Continuous input of current exceeding the rated maximum or repeated safety circuit activation will degrade performance of the safety circuit, possibly resulting in damage to the device.**
- **The maximum input range is indicated by the continuous maximum input range. It is also indicated by another product specification Maximum peak current: Noncontinuous 50 A peak. This means that the upper limit of the waveform response is 50 A peak. Make sure that the input does not exceed the continuous maximum input range in rms.**

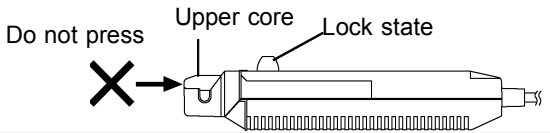
⚠ CAUTION

- **Do not place any unclamped conductor with an electric current of a frequency of 10 kHz or more near the sensor head. Current flowing in the conductor nearby may heat up the sensor head and cause its temperature to rise, leading to damage to the sensor. For example, when one side of a go-and-return conductor is clamped and the other side is also placed near the sensor head as shown in the diagram, even if the electric current is lower than the consecutive maximum current, electric currents in both sides will heat up the wires and raise the temperature, thereby causing damage to the sensor.**



⚠ CAUTION

- **When opening the sensor head of the probe, be sure to operate with the opening lever. If an upper core is forced to open, when the sensor head is locked, the open-close mechanism can be damaged.**



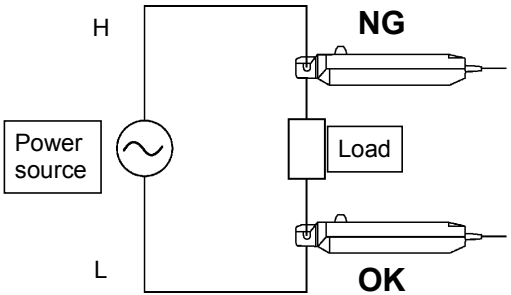
NOTE

- Immediately after powering on, this device may be subject to an appreciable offset drift due to the effect of self-heating. To counteract this, allow the device to warm up for about 30 minutes before carrying out measurement.
- When performing continuous measurements, it is necessary to be aware that the offset voltage drifts, depending on factors such as the ambient temperature.
- Under certain circumstances, oscillation may occur if the probe is connected to the 3269 or 3272 POWER SUPPLY while the power supply is on. This does not indicate a malfunction. Oscillation can be stopped and operation restored to normal by opening and closing the sensor head.

NOTE

- A resonant sound may be emitted depending on the amplitude and frequency of the current being measured. Such a sound may also be emitted dur demagnetization. Measurement is not affected
- Depending on the amplitude and frequency of the current being measured, the sensor head may emit a resonant sound. This sound may also occur during demagnetizing operation, but it does not represent a malfunction (device failure).
- If foreign matter becomes adhered to the facing surfaces on the sensor head so that a slight gap exists between the upper and lower sensors, the sensor head may emit a resonant sound. Any foreign matter should be removed using the cleaning method described in this manual (see “4.3 Cleaning” (p. 63)).
- An increase in the volume of the resonant sound during use may indicate that the gap between the upper and lower sensors has increased in size. Since the sensor characteristics may change, it is recommended to calibrate the device (see “4 Maintenance and Service” (p. 57)).
- Pressing the demagnetizing switch (DEMAG) will cause a demagnetized waveform to be output from the instrument. Although it may be asymmetry with respect to the zero-volt line, the instrument has no malfunction.
- The measurement may be affected by the position within the clamp aperture of the conductor being measured. The conductor should be in the center of the clamp aperture.
- When carrying out measurement, press the opening lever until the "UNLOCK" indication disappears, and check that the sensor head is properly closed. If the sensor head is not properly closed, accurate measurement will not be possible.

- At high frequencies, common mode noise may affect measurements taken on the high voltage side of circuits. If this occurs, reduce the frequency range of the waveform measuring instrument, or clamp onto the low-voltage side of the circuit, as appropriate.



- Accurate measurement may be impossible in locations subject to strong external magnetic fields, such as transformers and high-current conductors, or in locations subject to strong external electric fields, such as radio transmission equipment.

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.

HIOKI E.E. CORPORATION
http://www.hioki.com 18-07 EN-1

HIOKI

www.hioki.com/

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