CM4002
CM4003

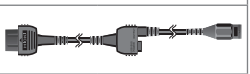
HIOKI

Instruction Manual

AC LEAKAGE CLAMP METER

Nov. 2020 Edition 1
CM4002A961-00 20-11H

Checking Package Contents

Main body	Accessories	
☐ CM4002/CM4003 AC Leakage Clamp Meter  CM4002 CM4003 (With output function)	☐ L9097 Connection Cable (Approx. 1.5 m) (CM4003 only)	
	☐ USB cable (Type-A to Type-C) (CM4003 only)	
	☐ LR6 Alkaline batteries ×2	
	☐ C0203 Carrying Case	
	☐ Instruction Manual (this manual)	
	☐ Operating Precautions (0990A907)	

Details of Intended Operations

Contents

Introduction

Thank you for choosing the Hioki CM4002/CM4003 AC Leakage Clamp Meter. To ensure your ability to get the most out of this instrument over the long term, please read this manual carefully and keep it available for future reference.
Carefully read the separate document entitled “Operating Precautions” before use.

Intended audience

This manual has been written for use by individuals who use the product or provide information about how to use the product. In explaining how to use the product, it assumes electrical knowledge (equivalent of the knowledge possessed by a graduate of an electrical program at a technical high school).

Overview

This AC leakage clamp meter allows you to measure from minute leakage current to load current.

■ Accurately measuring minute leakage current

- The 6.000 mA range is incorporated to ensure the measurement with a high resolution of 1 µA.
- High permeability magnetic material is used for the jaws.
  Effects of external electromagnetic noise are minimized to enable the measurement with high reproducibility.

■ Measuring a wide range of current from leakage current to load current

- Accuracy ranging from 0.060 mA to 200.0 A is ensured.
- Frequency band ranging from 15 Hz to 2 kHz.

Principle of leakage current measurement

The instrument is designed based on the principle of electromagnetic induction. The magnetic field corresponding to the current flowing through the conductor to be measured is detected by a current transformer that consists of a magnetic core and coil. The current transformer generates the current corresponding to the magnetic field. The detection resistor converts this current into the voltage to calculate the value of the current flowing through the conductor.

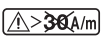
Notations

Safety notations

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

⚠ DANGER	Indicates an imminently hazardous situation that, if not avoided, will result in death or serious injury.		Indicates a high-voltage hazard. Failure to verify safety or improper handling of the instrument could lead to an electric shock, burn, or death.
⚠ WARNING	Indicates a potentially hazardous situation that, if not avoided, could result in death or serious injury.	IMPORTANT	Indicates information or content that is particularly important from the stand point of operating or maintaining the instrument.
⚠ CAUTION	Indicates a potentially hazardous situation that, if not avoided, could result in minor or moderate injury.		Indicates an action that must not be performed.
NOTICE	Indicates potential risks of damage to the supported product (or to other property).		Indicates an action that must be performed.

Symbols shown on the instrument

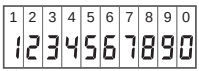
	Indicates the need for caution or the presence of danger. For more information about locations where this symbol appears on instrument components, see the “Operating Precautions” (p.7), warning messages listed at the beginning of operating instructions, and accompanying the document entitled “Operating Precautions”.
	Indicates AC (Alternating Current).
	Indicates that the instrument may be connected to or disconnected from a live conductor.
	Indicates an instrument that has been protected throughout by double insulation or reinforced insulation.
	Indicates that using the instrument in an external magnetic field of exceeding 30 A/m is prohibited.

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 required by the EU Directive.

Screen display

The instrument screen displays the alphanumeric characters as follows.



Accuracy

Hioki expresses accuracy as error limit values specified in terms of percentages of reading and of full scale.

Reading (Displayed value)	Refers to the displayed value of the measuring instrument. The limit values of reading errors are expressed in percent of reading (% of reading, % rdg).
Full scale (Maximum displayable value)	Refers to the maximum displayable value of each measurement range. The instrument has measurement ranges whose values are equal to the maximum displayable values. The limit values of full-scale errors are expressed in percent of full scale (% of full scale, % f.s.).

Other notations

Tips	Indicates useful advice concerning instrument performance and operation.
APS (bold)	The names of elements on the screen are printed in bold.
(p.)	Indicates the page number to reference.
*	Instructs the reader to see below for additional information.

Options

The options listed below are available for the instrument. To order an option, please contact your authorized Hioki distributor or reseller. Options are subject to change. Check Hioki's website for the latest information.

L9097 Connection Cable (Approx. 1.5 m)	C0203 Carrying Case
Z3210 Wireless Adapter 	Z1013 AC Adapter (power cord included) 
9704 Conversion Adapter (BNC, banana plug) 	

Operating Precautions

Be sure to follow the precautions listed below in order to use the instrument safely and in a manner that allows it to function effectively. Please review the separate “Operating Precautions” before using the instrument. Use of the instrument should conform not only to its specifications, but also to the specifications of all accessories, options, and other equipment in use.

Handling the instrument

⚠ DANGER

■ **Do not use the instrument outside its rated range or specifications.**

Doing so could cause damage to the instrument or overheating, resulting in serious bodily injury.

■ **Do not measure any current in excess of the derating curve.**

Doing so can cause overheating of the sensor, resulting in bodily injury, fire, or damage to the instrument.

See “Frequency derating characteristics” (p.51).

The maximum measurement current varies with the frequency, and the current that can be measured continuously is limited. Operating the instrument at less than this limitation is referred to as derating.

⚠ WARNING

■ **Do not approach any high voltage equipment or wiring when measuring with a ground wire for class B grounding work of the transformer.**

Otherwise, the user may receive electric shock.

■ **When the ground wire is close to a high voltage live part, change the route of the grounding wire.**

⚠ CAUTION

■ **Do not bend or pull on cables at temperatures of 0°C or lower.**
Since cables become rigid, doing so could damage the insulation or cause a wire break, resulting in electric shock.

NOTICE

■ **Keep the jaws closed when the instrument is not in use.**
Leaving the jaws open will cause dust or dirt to settle on the facing core surfaces, resulting in damage to the instrument.

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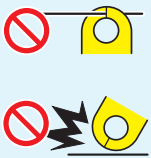
IMPORTANT



- Do not allow any foreign object to be caught between the facing core surfaces of the jaws.
- Do not scratch the facing core surfaces of the jaws.
- Do not touch the facing core surfaces of the jaws with your fingers.
- Do not insert any foreign object into the gap of the jaws.
- Do not drop the instrument.
- Do not subject the instrument to any shock.

Doing so may adversely affect the measurement accuracy and open/close operation.

- Electric circuit on which DC components are superimposed may not be measured accurately.
- Displayed values can frequently fluctuate due to induction potential even when no voltage is applied. This, however, is not a malfunction.
- When the ▮□ mark blinks, the batteries are exhausted. Replace the batteries as soon as possible. (p. 16)

Part Names

(The illustration shows the CM4003.)

1	Lever
2	Power key (p.11)
3	Jaws (p.8)
4	Barrier
5	Serial number (The serial number consists of 9-digit numbers. The first two digits from the left show the year of manufacture and the next two digits show the month of manufacture.)
6	Operation keys (p.11)
7	Display panel
8	Battery cover (p.16)
9	Cable connection terminal (CM4003 only) (p.17, p.34)

Operation Keys

Key	Press.	Hold down for 1 s or longer.
⏻	Turns on the instrument. (p.20, p.41)	Turns off the instrument.
HOLD AUTO HOLD	Freezes the readouts. / Disables the hold function. (p.27)	Automatically freezes the readouts. / Disables the auto-hold function. (p.27)
MAX/MIN	Sets or switches the max., min., average, and peak values. (p.30)	Resets the max., min., average, and peak value display.
RANGE FILTER	Cycles through the range. **AUTO → 6.000 mA → 60.00 mA → 600.0 mA** **200.0 A ← 60.00 A ← 6.000 A**	Toggles the filter on or off. (p.26) (The setting is not saved to the instrument.)
COMP EVENT	Toggles the comparator function on or off. (p.32)	Displays the number of events recorded by the event recording function. (p.45)
AC INRUSH ☼ + COMP	–	Toggles the AC INRUSH on or off. (p.31)

Continued on next page →

Key	Press.	Hold down for 1 s or longer.
OUTPUT	Toggles the display backlight on or off. (p.39)	Switches the output function (OUTPUT). (CM4003 only) (p.34) **RMS (RMS value)** → **WAVE (waveform)** → **Off**
HOLD + COMP	–	Toggles the wireless communications function on or off. (The setting is saved to the instrument. This operation is enabled only when the Z3210 is installed.) (p.42)

1 Preparing for Measurement

1.1 Installing the Batteries and Wireless Adapter

When using the instrument for the first time, install two LR6 Alkaline batteries. (p. 16) In addition, check that there is adequate remaining power in the batteries before starting the measurement.

	Appears	There is adequate remaining battery power.
	Appears	When the remaining power decreases, the indicator disappears from the left.
	Appears	The batteries are exhausted. Replace the batteries as soon as possible.
	Blinks	The batteries are exhausted. Replace the batteries with new ones.

Tips The CM4003 can be used by connecting an external power supply without installing the batteries. (p. 17)

When the Z3210 Wireless Adapter (option) is installed, the wireless communications function can be used. (p. 42)

Continued on next page →

⚠ WARNING

- **Do not short-circuit the battery.**
- **Do not charge the battery.**
- **Do not disassemble the battery.**
- **Do not throw the battery into a fire or heat it up.**

Doing so can cause the battery to explode, resulting in bodily injury.

- **Before removing the battery cover, disconnect the instrument from an object under measurement and turn off the instrument.**

When the instrument is clamped around the object under measurement, the battery contacts are regarded as high-voltage parts. Removing the battery cover in this state could cause electric shock.

- **After replacing the batteries or after installing/removing the Z3210, install the battery cover and tighten the screws before use.**
- **Secure the battery cover with the screws attached to the instrument at the time of shipment.**

If the battery cover is secured with other screws, the instrument could be damaged, resulting in bodily injury. If you have lost a screw or find that the screw is damaged, please contact your authorized Hioki distributor or reseller.

NOTICE

- **Do not mix batteries of different ages or types.**
- **Do not use a battery whose recommended service life has expired.**
- **Do not reverse the battery polarity.**
- **Do not leave the exhausted batteries in the instrument.**

- **Use the specified batteries only (LR6 Alkaline batteries).**
- **Remove the batteries when the instrument is not in use for an extended period of time.**
  Failure to do so may cause the battery to leak, damaging the instrument.
- **Before connecting/disconnecting the Z3210, touch any metallic part, such as a doorknob, to eliminate static electricity on your body.**
  Failure to do so may cause static electricity to damage the Z3210.

- When the mark blinks, the batteries are exhausted. Replace the batteries as soon as possible.
- Before replacing the batteries, turn off the instrument.
- Dispose of the batteries in accordance with local regulations.

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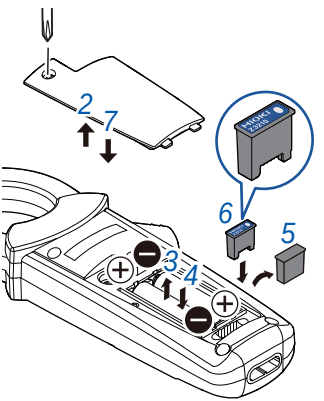
Installing (replacing) the batteries and Wireless Adapter

Start the following procedure after reading the safety precautions. (p. 13)

Rear



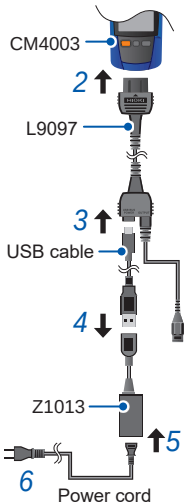
You will need:

- LR6 Alkaline batteries ×2
- Z3210 Wireless Adapter (option)
- Phillips screwdriver (No. 2)

1. **Remove the instrument from the object under measurement and turn off the instrument.**
2. **Loosen the screw and remove the battery cover.**
3. **Remove the old batteries (when replacing the batteries).**
4. **Install new batteries.**
5. **When installing the Wireless Adapter, remove the protective cap.**
6. **Carefully check the orientation, insert the Wireless Adapter all the way inside.**
7. **Install the battery cover and tighten the screw.**

1.2 Using an External Power Supply (CM4003 only)

Use an external power supply for long-term measurement.



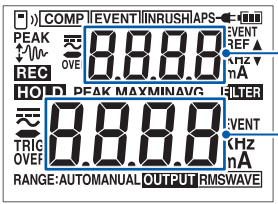
If the supplied power includes significant noise, the display may show several counts or noise may be present in the output.

You will need:

- L9097 Connection Cable (supplied with the CM4003)
- USB cable (supplied with the CM4003)
- Z1013 AC Adapter (Option, power cord included)

1. **Remove the instrument from the object under measurement and turn off the instrument.**
2. **Connect the L9097 to the cable connection terminal of the instrument.**
3. **Connect the USB cable (included) to the USB terminal (Type-C) of the L9097.**
4. **Connect the other end of the USB cable to the Z1013.**
5. **Connect the power cord to the Z1013.**
6. **Connect the power cord to an outlet.**
   When you turn on the instrument, the mark will appear.
   The auto-power save function will be disabled.

1.3 Inspection Prior to Measurement

Check	Inspection details	Remedy
☐	Check the following points visually. • The instrument is not damaged or cracked. • No internal circuit is exposed.	If the instrument is damaged, ask for repair. Otherwise, the user may receive an electric shock.
☐	No segments are missing. Pressing the ⏻ key while holding down the COMP key during a power-off condition allows all segments to appear while holding down the COMP key.  	If any segment is missing, ask for repair.
☐	The ▭ mark does not blink.	When the ▭ mark blinks, replace the batteries as soon as possible. The batteries are exhausted. (p. 13, p. 16)

2 Performing Measurement

2.1 Measuring Leakage Current

⚠ DANGER

■ **Do not touch the section beyond the barrier during operation.**

Doing so could cause electric shock.

See “Part Names” (p. 10).

■ **Inspect the instrument and verify proper operation before use.**

Use of the instrument while malfunctioning could result in serious bodily injury. If you find any damage, contact your authorized Hioki distributor or reseller.

See “1.3 Inspection Prior to Measurement” (p. 18).

Measurement procedure

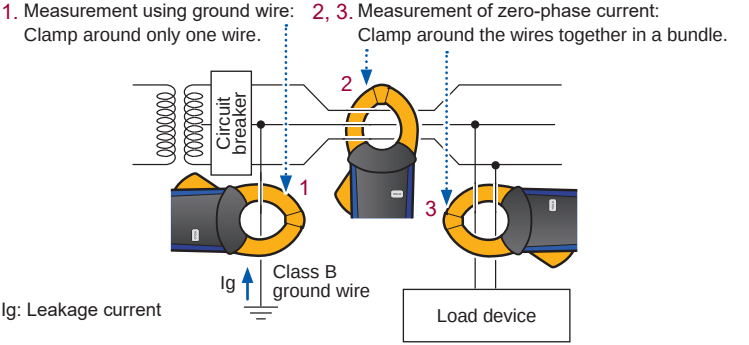
1 **Turn on the instrument.** The default setting of the range is **AUTO**. Change the range as required. (p.11)

2 **Clamp the instrument around the object under measurement.**

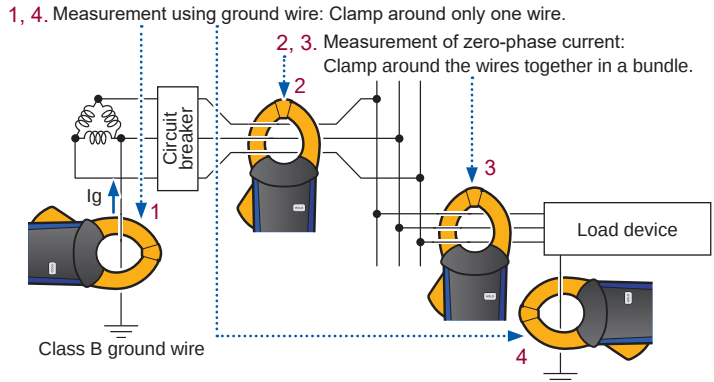
Wear appropriate protective gear such as gloves.

Clamp the instrument so that the object under measurement is located at the center of the jaws.

Single-phase 3-wire circuit



Three-phase 3-wire circuit



Ig: Leakage current

Other circuit

- Clamp around two wires together in a bundle in the single-phase 2-wire circuit.
- Clamp around four wires together in a bundle in the three-phase 4-wire circuit. When the instrument cannot be clamped, you can measure leakage current using the ground wire of the equipment instead.

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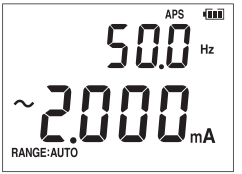
3 **Read the current value and frequency.**



The RMS value (RMS) and frequency of the leakage current will appear on the display panel.

IMPORTANT

In the following cases, the accurate measurement may not be performed.

- A large current (approx. 100 A) flows through adjacent wires.
- A special waveform such as the secondary side of an inverter is measured.
- The jaws are not closed completely.
  In particular, if the external dimension of the object under measurement is large, such as when three-phase wires are clamped together in a bundle, make sure that the jaws are closed completely. If the jaws are even slightly open, errors occur in the measured value and the accuracy cannot be ensured.
- The leakage current measurement at zero phase is affected by the load current. For the degree of influence of the load current, see E12 on p.60.

Locating an insulation failure

By measuring leakage current of the entire circuit using the ground wire of the transformer (location 1 in the figure on the next page), you can determine the presence or absence of an earth leakage in accordance with changes in leakage current.
When you find an earth leakage, perform the bundled measurement of all the wires from the power supply side toward the load side to locate an insulation failure.

Tips

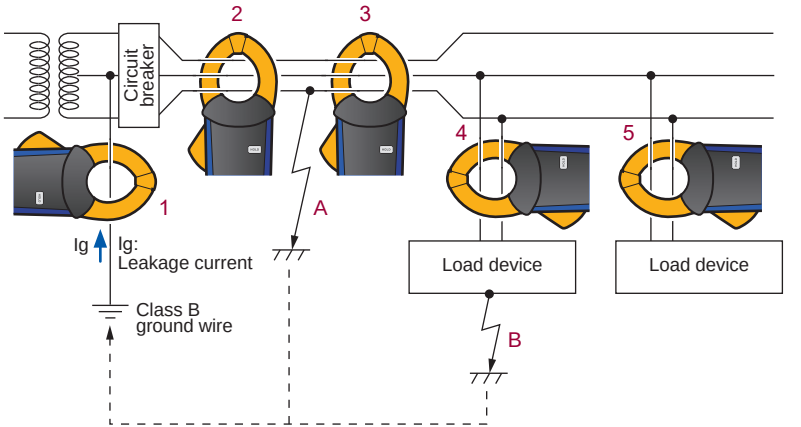
To investigate an intermittent earth leakage, the following functions are convenient.

1. Event recording function (p.45)
   When the measured value exceeds the set threshold value, the event data (event occurrence time, event stop time, and maximum value) can be recorded.
   To use this function, the Z3210 (option) and GENNECT Cross (free application software) are needed.
2. Output function (CM4003 only)
   You can record the output value with a recorder. (p.34)

Continued on next page →

Single-phase 3-wire circuit

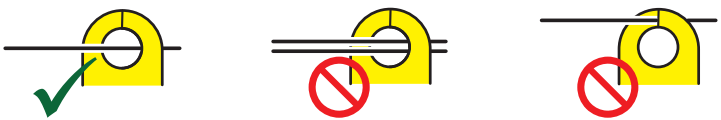
- If the insulation on the wire has deteriorated at location A in the figure, you can detect the leakage current through the measurement by clamping around bundled wires, not at location 3 but location 2.
- If the insulation on the load device has deteriorated at location B in the figure, you can detect the leakage current through the measurement by clamping around the bundled wires, not at location 5 but location 4.



Precautions for measuring the load current

IMPORTANT

Be sure to clamp the instrument around only one wire of the conductor. Regardless of the single-phase and three-phase, when clamping around two or more wires together in a bundle, the load current cannot be measured.



Tips

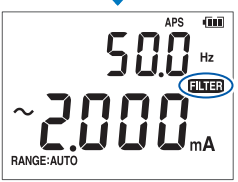
- A special waveform such as the secondary side of the inverter may not be measured.
- In accordance with the magnitude of the input current, a sound may be generated from the jaws due to resonance, but it does not affect the measurement.
- When the magnitude of the input current is unknown, disable the filter function and start the measurement using the auto-range or 200.0 A range.

2.2 Filter Function (FILTER)

When a switching power supply or an inverter is connected to the same system as the object under measurement, high frequency components may be superimposed on the leakage current waveform. Unnecessary high frequency components can be eliminated using the filter function.

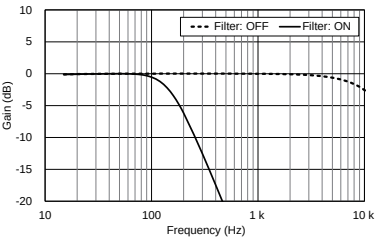
Enable the filter function.

Hold down the key for 1 s or longer.
(Holding down the key for 1 s or longer again disables the function.)



FILTER will appear.

You can also set the filter function on or off when turning on the instrument. (p.41)



Frequency characteristic example
6 mA range

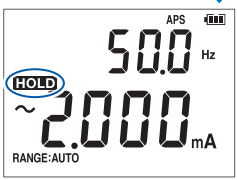
Tips When the filter function is enabled, the frequency band is limited to approx. 180 Hz (−3 dB), which is equivalent to the frequency band of the general earth leakage circuit breaker.
To analyze the operation of the earth leakage circuit breaker, it is recommended that you use the filter function.

2.3 Hold Function (HOLD)

Manual hold

The display refresh is stopped at a desired timing.

Press.
(Pressing the key again disables the function.)



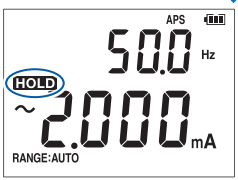
HOLD will appear.

HOLD will be lit .

Auto-hold

When the measured value is stable, the display refresh is stopped automatically.

Hold down the key for 1 s or longer.
(Pressing the key again resets the function.)



Before auto-hold

HOLD will blink.

After auto-hold

HOLD will appear.

HOLD will be lit.

Buzzer sound

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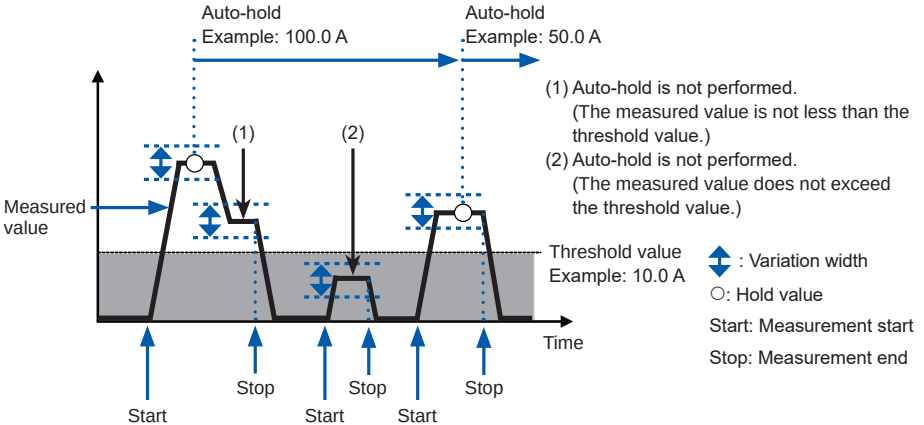
Auto-hold conditions

When both the following conditions are satisfied, the instrument will freeze the readouts.

- The measured value does not fluctuate beyond the variation range (the next page) for a certain period of time.
- The measured value exceeds the threshold value (the next page).

The measured value is held until the auto-hold conditions are satisfied again.



The variation range and threshold value may vary depending on the range.

Measurement function	Range	Variation width	Threshold value
AC current	6.000 mA	200 counts or less	300 counts
	60.00 mA	100 counts or less	100 counts
	600.0 mA		
	6.000 A		
	60.00 A		
	200.0 A		

2.4 Max., Min., Average, and Peak Values (MAX/MIN)

The maximum, minimum, average, or peak values of the measured data can be displayed.
The auto-power save function is disabled. (p.38)

1 **Clamp the instrument around the object under measurement.**

2 **Set the range. (p.11)**

RANGE The current range is fixed in the auto-range.

3 **Use the MAX/MIN key to switch the display.**

MAX/MIN **MAX ⇒ MIN ⇒ AVG ⇒ PEAK MAX ⇒ PEAK MIN**

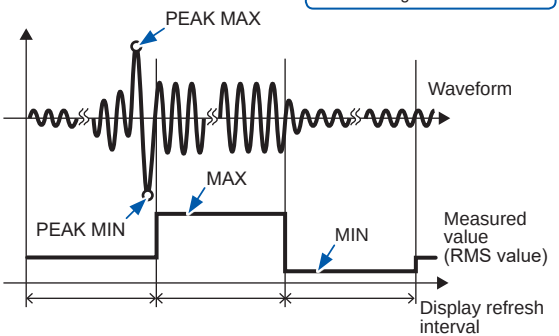
MAX/MIN 1 s
Hold down the key for 1 s or longer. ⇒ Reset.

4 HOLD ▶ Holds the measured value.

Main readout:
Max., min., average, and peak values

Sub-readout:
Present measured value

The instrument measures the RMS value.
"AVG" means the average value of all measured values.



2.5 AC INRUSH (Inrush Current)

The AC inrush current can be measured.

1 **Set the range. (p. 11)**

RANGE

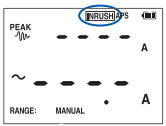
The inrush measurement range is set as follows in accordance with the range when the current is measured.

Range when the current is measured	INRUSH measurement range
AUTO	200.0 A range
6.000 mA, 60.00 mA	600.0 mA range
600.0 mA, 6.000 A, 60.00 A, 200.0 A	Range when the current is measured

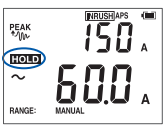
2 **Turn on the AC INRUSH.**

AC INRUSH + COMP

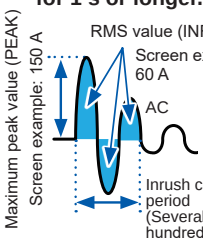
Hold down the key for 1 s or longer.



(Inrush current occurs.)



Auto-hold of measured value



Trigger level

±60 mA peak	(600.0 mA range)
±0.6 A peak	(6.000 A range)
±2 A peak	(60.00 A range)
±10 A peak	(200.0 A range)

An inrush current including DC components cannot be measured accurately.

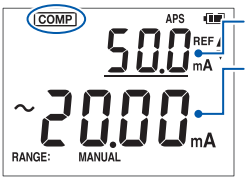
2.6 Comparator Function (COMP)

When a measured value exceeds the threshold value, a buzzer will sound and the warning backlight (p.40) will light up. The buzzer sound can also be disabled. (p.41)

1 Enable the comparator function.

Press.
(Pressing the key again disables the function.)

COMP will appear.



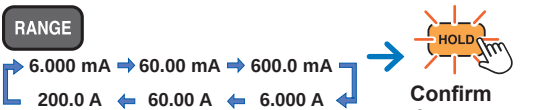
Threshold value

Present measured value

The range is displayed here during the range setting.

How to change the threshold value

2 Set the range. (Main readout)



Confirm the range.

3 Set the threshold value. (Sub-readout)

▲ **MAX/MIN** Increases the value.

REF

▼ **RANGE** Decreases the value.

Holding down the key increases or decreases the value continuously.

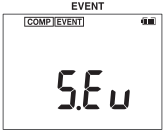
Confirm the threshold value.

2.7 Simple Event Recording Function (EVENT)

The blinking red backlight will warn you that the maximum value exceeds the set threshold value.

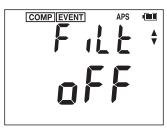
1 Start the simple event recording function.

MAX/MIN + COMP → ⏻
EVENT



2 Set the range and threshold value. (p.32)

3 Set the filter.



▲ MAX/MIN
▼ RANGE
Switches between on and off.

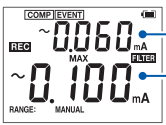
HOLD
Confirm

4 Start recording.

▲ MAX/MIN or ▼ RANGE → Step *2* (Returns to the range and threshold setting)

HOLD → Start recorcing

5 During recording.



The instrument may not accurately measure an event of less than 400 ms in length, resulting in detection failure.

Present measured value

Maximum value from the recording start

When the maximum value exceeds the threshold value, the backlight will blink in red.

6 Stop recording.

MAX/MIN, RANGE, or COMP

HOLD → Returns to step *4* “Start recording”.

When the instrument sits idle for about 4 s, the operation will return to step *5* “During recording.”

2.8 Output Function (OUTPUT) (CM4003 only)

The voltage corresponding to the measured value is output. (Procedure: p.36)

RMS (RMS value output)	Outputs the DC voltage proportional to the RMS value of the measured current. Recording the voltage with a recorder (such as Hioki's Memory HiCoder) allows you to check changes in measured current value visually.
WAVE (Waveform output)	Outputs the AC voltage proportional to the measured current. Observing the voltage with a recorder (such as Hioki's Memory HiCoder, etc.) allows you to check the current waveform visually.

Use an external power supply to record the measured value for an extended period of time. (p.17)

- When using the scaling function of a recorder (such as Hioki's Memory HiCorder), the voltage value can be converted into the current value on the recorder.
- For the investigation of the intermittent earth leakage (occasional earth leakage), the RMS output is recorded with the recorder to check the time variation of the leakage current value.

Output rate (A-to-V conversion ratio)

Range	Output rate	Output accuracy		Crest factor
		RMS (RMS value)	WAVE (waveform)	
6.000 mA	600.0 mV / 6.000 mA	±1.0% rdg ±5 mV (For the display count)	±3.0% rdg ±10 mV (45 Hz to 400 Hz) ±5.0% rdg ±10 mV (15 Hz to 45 Hz, 400 Hz to 2 kHz)	3
60.00 mA	600.0 mV / 60.00 mA			
600.0 mA	600.0 mV / 600.0 mA			
6.000 A	600.0 mV / 6.000 A			
60.00 A	600.0 mV / 60.00 A			
200.0 A	200.0 mV / 200.0 A			
200.0 A	200.0 mV / 200.0 A			1.5

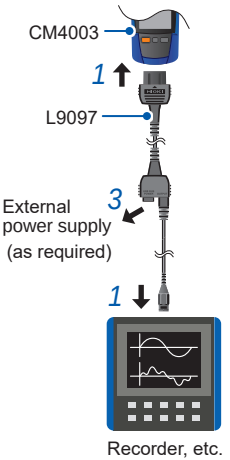
A voltage of 600.0 mV, corresponding to the full scale count of “6000” for the current range, is outputted.
In addition, a voltage of 200.0 mV AC/DC, corresponding to the full scale count of “2000”, is outputted in the 200.0 A range.
Example: A voltage of 300.0 mV, corresponding to 300.0 mA, is outputted in the 600.0 mA range.

Output response

RMS (RMS value)	Refresh rate: 5 times/s
WAVE (waveform)	Frequency band: 15 Hz to 15 kHz (within ±3 dB)

Continued on next page →

Using the output function (RMS/WAVE)



You will need:

- L9097 Connection Cable (supplied with the CM4003)
- External power supply (as required)
- Recorder, etc.

1 **Connect the instrument and a device such as a recorder using the L9097.**

2 **Set the range. (p.11)**

RANGE

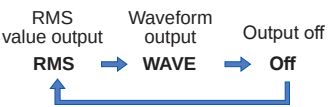
The auto-range cannot be used when the output function is enabled.

3 **Connect an external power supply as required. (p.17)**

4 **Set the output function.**

OUTPUT

Hold down the key for 1 s or longer.



Precautions for using the output function

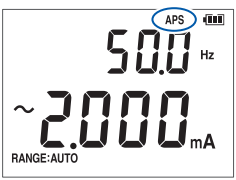
- If the output function is enabled when the auto-range (AUTO) is selected, the auto-range is reset and the range that is selected at this time is fixed.
- The measured frequency value cannot be output.
- Even when you press the HOLD key, the output voltage is not held.
- Use an instrument (for example, recorder) with a high input-impedance to record the output. (An instrument with an input impedance of 100 kΩ or more is recommended.)
- When the output function is enabled, the auto-power save function (APS) is disabled.

Tips Using the filter function can eliminate unnecessary high-frequency components. (p.26)

2.9 Auto-Power Save Function (APS)

Using the auto-power save function can reduce the battery consumption.
When you turn on the instrument, the auto-power save function is enabled automatically. When using the instrument continuously for an extended period of time, disable the auto-power save function.

Enabled (The APS icon will appear.)
(Default setting)



→ Idle for about 15 min.

[APS]
↓
[P.oFF]
↓
Shutdown

Disabling the APS function
In the power-off state
HOLD → ⏻ ➡ **The APS icon will hide.**

Enabling the APS function again
Cycle the instrument.
➡ **The APS icon will appear.**

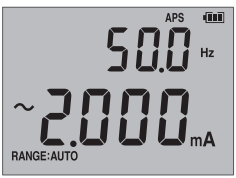
2.10 Backlight

Display backlight

When the backlight is lit, the display panel can be seen easily even in a dark place.

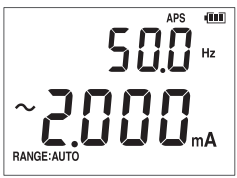
Not lit

(Default setting)



Otherwise, no operation for about 40 s will turns off the backlight automatically.*

Lit (in white)



* You can disable the automatic backlight shutoff. (p.41)

Warning backlight

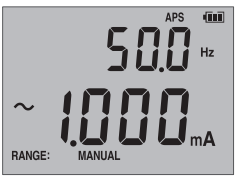
When any of the following occurs, the backlight will light up or blink in red to warn you.

- Excessive input

  When the measured current exceeds the measurement range, the full scale value on the main readout or sub-readout and **OVER** will blink.

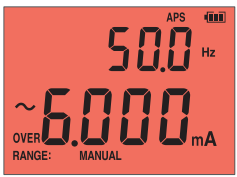
- When the comparator function detects that the measured value exceeds the threshold value (p.32)

Not lit



Auto

Lit/Blinking (in red)



The warning backlight operates only for the present measured value. The warning backlight does not operate for the hold value and recorded values of the MAX, MIN, AVG, PEAK MAX, and PEAK MIN display functions.

2.11 Power-On Option

Turn off the instrument, and then turn it on again while holding down operation keys.

Settings	How to turn on the instrument	At shipment from factory	Saving of setting
Auto-power save (APS) function (disabled) (p. 38)	HOLD → ⏻	Enabled	Not saved
Model number, firmware version number, and all segments display (p. 18)	COMP → ⏻	–	–
Filter function (Enabled/disabled at startup, p. 26)	RANGE → ⏻	Disabled at startup	Saved
Buzzer sound (Enabled/disabled)	MAX/MIN → ⏻	Enabled	Saved
Automatic deactivation of the display backlight (Enabled/disabled, p. 39)	☼ → ⏻	Enabled	Saved
Serial number display	☼ + COMP → ⏻	–	–
Simple event recording function (p. 33)	MAX/MIN + COMP → ⏻	–	Range Threshold

2.12 Wireless communications Function

Using the GENNECT Cross

The wireless communications function allows you to check and record the measured data of the instrument, and create the measurement report using your mobile communications device. For details, see the operation guide for the GENNECT Cross app (free of charge).

GENNECT Cross special site
https://gennect.net/en/cross/index

- The communication distance is about 10 m with a clear line of sight. The communicable distance may vary greatly depending on the presence of an obstruction (wall or metallic shielding object) and the distance between the floor (ground) and instrument. To ensure the stable communication, make sure that the radio wave intensity is sufficient.
- The GENNECT Cross is free of charge. However, the customer is responsible for the cost to download the application software and connect to the Internet when using the software.
- The GENNECT Cross may not operate properly depending on the mobile communications device.
- The Z3210 uses the 2.4 GHz band wireless technology.
  When there is a device that uses the same frequency band such as a wireless LAN (IEEE802.11.b/g/n) near your mobile communications device, the communication may not be established.

Tips When the instrument is placed on the floor or ground, the communication distance becomes short. It is recommended that you move the instrument from the floor or ground and place it on a desk or table or hold it by hand.

Using the wireless communications function

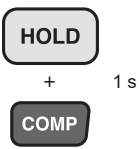
1 **Connect the Z3210 Wireless Adapter (option) into the instrument. (p.16)**

2 **Install the GENNECT Cross on your mobile communications device.**

3 **Turn on the instrument, and then enable the wireless communications function.**

Off
(Default setting)

Hold down both keys for 1 s or longer.



The icon will appear.
(Wireless communications function is enabled.)

Hidden: Wireless communications function is disabled.
Blinking: Communicating with your mobile device.

Continued on next page →

4 Start the GENNECT Cross and register the connection of the instrument.

Tap [Other]. **Tap [Instrument Settings].** **Choose the instrument you wish to connect.**

- When the GENNECT Cross is started for the first time (when there is no registered instrument), the Instrument Settings screen appears.
- When the instrument is placed near your mobile communications device, its connection is registered automatically on the Instrument Settings screen of the GENNECT Cross (up to eight instruments).
- Wait for 5 to 30 s until the connection of the instrument is registered after turning on the instrument. If the connection of the instrument is not registered after 1 minute has elapsed, restart the GENNECT Cross and the instrument.

5 **Select the measurement function (general measurement, waveform display, event, etc.), and then start the measurement.**

Event recording function

The event recording function logs the data when measured values exceed a desired threshold value, which can be set with the GENNECT Cross. For details, see the Help function in the GENNECT Cross. The number of recorded events can be checked using the instrument.

Hold down the key for 1 s or longer.

Displays the number of events.

An event with a duration time of less than 200 ms may not be accurately measured, failing to detect the event.

Useful functionality of the Z3210

For detail information, please visit the Z3210's website.
https://z3210.gennect.net

3 Specifications

3.1 General Specifications

Operating environment	Indoors, pollution degree 2, altitude up to 2000 m (6562 ft.)
Operating temperature and humidity range	−10°C to 40°C (14°F to 104°F), 80% RH or less (non-condensing) 40°C to 45°C (104°F to 113°F), 60% RH or less (non-condensing) 45°C to 65°C (113°F to 149°F), 50% RH or less (non-condensing)
Storage temperature and humidity range	−30°C to 70°C (−22°F to 158°F), 80% RH or less (non-condensing)
Dustproofness, waterproofness	IP40 (with the jaws closed) (EN 60529) The protection rating for the enclosure of this instrument is *IP40. *IP40: This indicates the degree of protection provided by the enclosure of the device for use in hazardous locations, entry of solid foreign objects, and the ingress of water. “4”: Protected against access to hazardous parts with wire measuring 1.0 mm in diameter. The equipment inside the enclosure is protected against entry by solid foreign objects larger than 1.0 mm in diameter. “0”: The equipment inside the enclosure is not protected against the harmful effects of water.

Standards	Safety EN 61010 EMC EN 61326	
Applicable standard	IEC/EN 61557-13:2011 Class 2, ≤ 30 A/m	
Power supply	CM4002	• LR6 Alkaline batteries ×2 Rated supply voltage: 1.5 V DC × 2 Maximum rated power: 800 mVA
	CM4003	• LR6 Alkaline batteries ×2 Rated supply voltage: 1.5 V DC × 2 Maximum rated power: 800 mVA • External power supply (USB power) Rated supply voltage: 5 V DC Maximum rated power: 1000 mVA
Continuous operating time	Approx. 48 hours (with the Z3210 not installed) Approx. 30 hours (with the Z3210 installed and while wirelessly communicating) With the backlight shut off and no signal input Values used for reference purposes at an ambient temperature of 23°C	
Maximum diameter of measurable conductor	ϕ40 mm	
Dimensions	Approx. 64W × 233H × 37D mm (2.52″W × 9.17″H × 1.46″D) (Excluding those of protrusions, lever, and jaws)	
Jaw dimensions	Approx. 75W × 20D (2.95″W × 0.79″D)	
Mass	Approx. 400 g (14.1 oz.) (Excluding batteries)	

Product warranty period	3 years or 10,000 cycles of jaws opening/closing operations, whichever is shorter
Accessories	See p.i.
Options	See p.6.

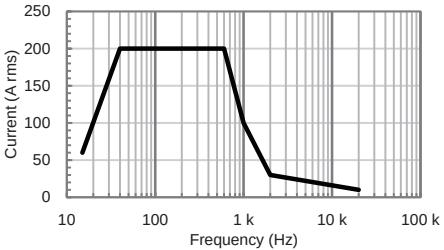
3.2 Input, Output, and Measurement Specifications

Basic specifications

Measurement parameters	AC current	~A
	Power frequency	Hz
Measurable range	See “Accuracy list” (p.54).	
Maximum input current	In accordance with the frequency derating characteristics (p.51)	
Maximum rated terminal-to-ground voltage	CM4002	300 V AC (Measurement category IV) 600 V AC (Measurement category III) Anticipated transient overvoltage 6000 V
	CM4003	300 V AC (Measurement category III) Anticipated transient overvoltage 4000 V
Measurement method	True RMS method	

Measurement specifications

Display refresh rate	AC current Frequency	5 times/s 1 to 2 times/s
	The switching time between ranges is not included.	
Response time	AC current	2.5 s or less
Zero display range	5 counts or less	

Frequency derating characteristics		
Crest factor	3 (other than 200.0 A range), 1.5 (200.0 A range)	
Peak detection time width	2 ms or more (with filter disabled)	
Frequency detection input level	5% or more of f.s. in each range	
Inrush trigger level	600.0 mA range	Not less than +60.0 mA (peak) or not exceeding −60.0 mA (peak)
	6.000 A range	Not less than +0.600 A (peak) or not exceeding −0.600 A (peak)
	60.00 A range	Not less than +2.00 A (peak) or not exceeding −2.00 A (peak)
	200.0 A range	Not less than +10.0 A (peak) or not exceeding −10.0 A (peak)

Accuracy specifications

Accuracy guarantee conditions	Accuracy guarantee period	1 year
	Accuracy guarantee period after adjustment made by Hioki	1 year
	Accuracy guarantee temperature and humidity range	23°C ±5°C (73° ±9°F) 80% RH or less (non-condensing)
Accuracy guarantee input conditions	Sine wave input Not exceeding the rated current and the derating curve	
Measurement accuracy	See “Accuracy list” (p.54).	
Effect of external magnetic field	4 mA or less (In an external magnetic field of 400 A/m AC with 50 Hz/60 Hz)	
Effect of conductor position	Within ±0.1% rdg (less than 100 A) Within ±0.5% rdg (100 A or more) (At any position based on the center of the jaws)	
Effect of radiated radio-frequency electro-magnetic field	Add ±2 mA to the measurement accuracy. (In a radiated radio-frequency electro-magnetic field of 10 V/m)	

Effect of conducted radio-frequency electro-magnetic field	Add ±2 mA to the measurement accuracy. (In a conducted radio-frequency electro-magnetic field of 10 V)
Temperature coefficient	Add (Measurement accuracy × 0.05)/°C to the measurement accuracy. (Specified outside a range of 23°C ±5°C)

Accuracy list

(1) AC current

1. RMS value measurement (Measured value, maximum, minimum, and average)

Range (Auto-range threshold value: Switch over to higher/lower range)	Accuracy guarantee range (Resolution)	Accuracy guarantee frequency range	Measurement accuracy	
			Filter disabled	Filter enabled
6.000 mA (over 6000 counts)	0.060 mA to 6.000 mA (0.001 mA)	15 Hz ≤ f < 45 Hz	±2.0% rdg ±0.005 mA	±3.0% rdg ±0.005 mA
		45 Hz ≤ f ≤ 66 Hz	±1.0% rdg ±0.005 mA	±1.0% rdg ±0.005 mA
		66 Hz < f ≤ 400 Hz		–
		400 Hz < f ≤ 2 kHz	±2.0% rdg ±0.005 mA	–
60.00 mA (over 6000 counts / less than 540 counts)	0.60 mA to 60.00 mA (0.01 mA)	15 Hz ≤ f < 45 Hz	±2.0% rdg ±0.05 mA	±3.0% rdg ±0.05 mA
		45 Hz ≤ f ≤ 66 Hz	±1.0% rdg ±0.05 mA	±1.0% rdg ±0.05 mA
		66 Hz < f ≤ 400 Hz		–
		400 Hz < f ≤ 2 kHz	±2.0% rdg ±0.05 mA	–
600.0 mA (over 6000 counts / less than 540 counts)	6.0 mA to 600.0 mA (0.1 mA)	15 Hz ≤ f < 45 Hz	±2.0% rdg ±0.5 mA	±3.0% rdg ±0.5 mA
		45 Hz ≤ f ≤ 66 Hz	±1.0% rdg ±0.5 mA	±1.0% rdg ±0.5 mA
		66 Hz < f ≤ 400 Hz		–
		400 Hz < f ≤ 2 kHz	±2.0% rdg ±0.5 mA	–

Range (Auto-range threshold value: Switch over to higher/lower range)	Accuracy guarantee range (Resolution)	Accuracy guarantee frequency range	Measurement accuracy	
			Filter disabled	Filter enabled
6.000 A (over 6000 counts / less than 540 counts)	0.060 A to 6.000 A (0.001 A)	15 Hz ≤ f < 45 Hz	±2.0% rdg ±0.005 A	±3.0% rdg ±0.005 A
		45 Hz ≤ f ≤ 66 Hz	±1.0% rdg ±0.005 A	±1.0% rdg ±0.005 A
		66 Hz < f ≤ 400 Hz		–
		400 Hz < f ≤ 2 kHz	±2.0% rdg ±0.005 A	–
60.00 A (over 6000 counts / less than 540 counts)	0.60 A to 60.00 A (0.01 A)	15 Hz ≤ f < 45 Hz	±2.0% rdg ±0.05 A	±3.0% rdg ±0.05 A
		45 Hz ≤ f ≤ 66 Hz	±1.5% rdg ±0.05 A	±1.5% rdg ±0.05 A
		66 Hz < f ≤ 400 Hz		–
		400 Hz < f ≤ 2 kHz	±2.0% rdg ±0.05 A	–
200.0 A (less than 540 counts)	6.0 A to 200.0 A (0.1 A)	15 Hz ≤ f < 45 Hz	±2.0% rdg ±0.5 A	±3.0% rdg ±0.5 A
		45 Hz ≤ f ≤ 66 Hz	±1.5% rdg ±0.5 A	±1.5% rdg ±0.5 A
		66 Hz < f ≤ 400 Hz		–
		400 Hz < f ≤ 2 kHz	±2.0% rdg ±0.5 A	–

2. Peak value measurement (PEAK MAX / PEAK MIN)

Range	Accuracy guarantee range (Resolution)	Accuracy guarantee frequency range	Measurement accuracy	
			Filter disabled	Filter enabled
6.000 mA	±0.9 mA to ±18.00 mA (0.01 mA)	15 Hz ≤ f < 45 Hz	±3.0% rdg ±0.05 mA	±4.0% rdg ±0.05 mA
		45 Hz ≤ f ≤ 66 Hz	±2.0% rdg ±0.05 mA	±2.0% rdg ±0.05 mA
		66 Hz < f ≤ 400 Hz		–
		400 Hz < f ≤ 2 kHz	±3.0% rdg ±0.05 mA	–
60.00 mA	±1.8 mA to ±180.0 mA (0.1 mA)	15 Hz ≤ f < 45 Hz	±3.0% rdg ±0.5 mA	±4.0% rdg ±0.5 mA
		45 Hz ≤ f ≤ 66 Hz	±2.0% rdg ±0.5 mA	±2.0% rdg ±0.5 mA
		66 Hz < f ≤ 400 Hz		–
		400 Hz < f ≤ 2 kHz	±3.0% rdg ±0.5 mA	–
600.0 mA	±18 mA to ±1800 mA (1 mA)	15 Hz ≤ f < 45 Hz	±3.0% rdg ±5 mA	±4.0% rdg ±5 mA
		45 Hz ≤ f ≤ 66 Hz	±2.0% rdg ±5 mA	±2.0% rdg ±5 mA
		66 Hz < f ≤ 400 Hz		–
		400 Hz < f ≤ 2 kHz	±3.0% rdg ±5 mA	–

Range	Accuracy guarantee range (Resolution)	Accuracy guarantee frequency range	Measurement accuracy	
			Filter disabled	Filter enabled
6.000 A	±0.18 A to ±18.00 A (0.01 A)	15 Hz ≤ f < 45 Hz	±3.0% rdg ±0.05 A	±4.0% rdg ±0.05 A
		45 Hz ≤ f ≤ 66 Hz	±2.0% rdg ±0.05 A	±2.0% rdg ±0.05 A
		66 Hz < f ≤ 400 Hz		–
		400 Hz < f ≤ 2 kHz	±3.0% rdg ±0.05 A	–
60.00 A	±1.8 A to ±180.0 A (0.1 A)	15 Hz ≤ f < 45 Hz	±5.0% rdg ±0.5 A	±5.0% rdg ±0.5 A
		45 Hz ≤ f ≤ 66 Hz	±3.0% rdg ±0.5 A	±3.0% rdg ±0.5 A
		66 Hz < f ≤ 400 Hz		–
		400 Hz < f ≤ 2 kHz	±5.0% rdg ±0.5 A	–
200.0 A	±18 A to ±300 A (1 A)	15 Hz ≤ f < 45 Hz	±5.0% rdg ±5 A	±5.0% rdg ±5 A
		45 Hz ≤ f ≤ 66 Hz	±3.0% rdg ±5 A	±3.0% rdg ±5 A
		66 Hz < f ≤ 400 Hz		–
		400 Hz < f ≤ 2 kHz	±5.0% rdg ±5 A	–

(2) AC INRUSH (Inrush current)

1. AC INRUSH measured value

Range	Accuracy guarantee range (Resolution)	Accuracy guarantee frequency range	Measurement accuracy
600.0 mA	60.0 mA to 600.0 mA (0.1 mA)	40 Hz ≤ f ≤ 1 kHz	±5.0% rdg ±1.0 mA
6.000 A	±0.600 A to ±6.000 A (0.001 A)	40 Hz ≤ f ≤ 1 kHz	±5.0% rdg ±0.010 A
60.00 A	±1.00 A to ±60.00 A (0.01 A)	40 Hz ≤ f ≤ 1 kHz	±5.0% rdg ±0.10 A
200.0 A	±10.0 A to ±200.0 A (0.1 A)	40 Hz ≤ f ≤ 1 kHz	±5.0% rdg ±1.0 A

2. AC INRUSH PEAK value

Range	Accuracy guarantee range (Resolution)	Accuracy guarantee frequency range	Measurement accuracy
600.0 mA	60 mA to 1800 mA (1 mA)	40 Hz ≤ f ≤ 1 kHz	±6.0% rdg ±10 mA
6.000 A	±0.60 A to ±18.00 A (0.01 A)	40 Hz ≤ f ≤ 1 kHz	±6.0% rdg ±0.10 A
60.00 A	±1.0 A to ±180.0 A (0.1 A)	40 Hz ≤ f ≤ 1 kHz	±6.0% rdg ±1.5 A
200.0 A	±10 A to ±300 A (1 A)	40 Hz ≤ f ≤ 1 kHz	±6.0% rdg ±15 A

(3) Frequency measurement

Range (Auto-range threshold value)	Accuracy guarantee range (Resolution)	Measurement accuracy
999.9 Hz (over 9999 counts)	15.0 Hz to 999.9 Hz (0.1 Hz)	±0.1% rdg ±0.1 Hz
2000 Hz (less than 900 counts)	900 Hz to 2000 Hz (1 Hz)	±0.1% rdg ±1 Hz

Output specifications (CM4003 only)

Output item	RMS (RMS value output)	
	WAVE (waveform output)	
Output level (Output rate: p.35)	RMS:	600 mV DC/f.s. (other than 200.0 A range) 200 mV DC/f.s. (200.0 A range) (outputs a voltage of 1 V when the f.s. of the range is exceeded.)
	WAVE:	600 mV AC/f.s. (other than 200.0 A range) 200 mV AC/f.s. (200.0 A range)
Output accuracy	RMS:	±1.0% rdg ±5 mV (for the display count)
	WAVE:	±3.0% rdg ±10 mV (45 Hz to 400 Hz) ±5.0% rdg ±10 mV (15 Hz to 45 Hz, 400 Hz to 2 kHz)
Output response	RMS:	Refresh rate: 5 times/s
	WAVE:	Frequency band: 15 Hz to 15 kHz (Within ±3 dB)
Output impedance	100 Ω or less	

3.3 Compatibility with IEC/EN 61557-13

Specified input range	6 mA to 60 A, 40 Hz to 1 kHz
Intrinsic uncertainty (A)	See “Accuracy list” (p.54).
Effects of position (E1)	Add ±0.1% rdg ±1 dgt.
Effects of operation voltage (E2)	Add ±0.1% rdg ±1 dgt.
Effects of temperature (E3)	Add ±0.05 × (specified accuracy)/°C. < 18°C, > 25°C
Effects of distortion waveform (E9)	Add ±1% rdg.
Effects of external magnetic field (E11) **15 Hz to 400 Hz**	Class 3 10 A/m: Add ±0.22 mA. Class 2 30 A/m: Add ±0.65 mA.
Effects of load current (E12)	Add ±10 µA per load current.
Effects of common mode voltage (E13)	Add ±0.5% rdg.
Effects of frequency (E14)	Add ±1.0% rdg.
Reproducibility (E15)	Add ±0.5% rdg.
Percentage operation uncertainty (B)	Class3 10 A/m: Below 15% (measurement current: 6 mA to 10 mA) Below 10% (measurement current: 10 mA or more) Class2 30 A/m: Below 20% (measurement current: 6 mA to 10 mA) Below 12.5% (measurement current: 10 mA or more)

4 Maintenance and Service

Calibration

The calibration interval depends on factors such as operating conditions and environment. Please determine the appropriate calibration interval based on your operating conditions and environment and have Hioki calibrate it accordingly on a regular basis.

Cleaning

- If the instrument becomes dirty, moisten a soft cloth with water or a neutral detergent and gently wipe it clean.
- 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.
- Wipe the display panel gently with a soft, dry cloth.

Disposing of the Instrument

Dispose of the instrument in accordance with local regulations.

4.1 Troubleshooting

If damage is suspected, read the "Troubleshooting" section to remedy the problem. If this does not help you, contacting your authorized Hioki distributor or reseller.

Before sending the instrument to be repaired

Problem	Cause	Corrective action (Reference)
The instrument cannot be turned on. The instrument shuts off during operation. The instrument shuts off immediately after it has been turned on.	The batteries are exhausted.	Replace the batteries with new ones. (p. 16)
	The instrument has sat idle for about 15 minutes with the auto-power save function (APS) enabled.	Check the settings. (p. 38)
The  mark blinks. **[bAtt]** → **[P.oFF]** → shutdown	The batteries are exhausted.	Replace the batteries with new ones. (p. 16)
The range cannot be changed.	The MAX / MIN / AVG / PEAK MAX / PEAK MIN display function is used.	Hold down the MAX/MIN key for 1 s or longer to reset the function, and then change the range. (p. 30)

Problem	Cause	Corrective action (Reference)
The output rate differs from the specifications. The output is small.	The 200.0 A range is used.	Check the current range. The 200.0 A has an output rate of 200 mV/f.s. This rate differs from the other ranges' rates .
	The equipment that receives the output has a low input impedance.	Check the input impedance of the equipment that receives the output. An input impedance of 100 kΩ or more is recommended.
	The frequency of the object under measurement is outside the output accuracy (15 Hz to 2 kHz) range.	The frequency band (15 Hz to 15 kHz) shows a band where the output attenuation is ±3 dB or less. (p. 59)
The measured value is incorrect.	Displayed values can frequently fluctuate due to induction potential even when no voltage is applied. This, however, is not a malfunction.	–
	The tip of the jaws is open.	Close the jaws.
	The jaws are damaged. When a jaw is damaged or cracked, the current cannot be measured accurately.	Have the instrument repaired.

Problem	Cause	Corrective action (Reference)
The measured value does not change.	The display is held.	Disable the hold function. (p.27)
The jaws generate a sound (vibration) during measurement.	When a large magnitude of load current or a high-frequency current is measured, resonance sounds may be generated on rare occasions. There are individual differences in loudness of the sound, but it does not affect the measurement.	–
The wireless communications cannot be established.	The Z3210 is not installed.	Install the Z3210. (p.16)
	The wireless communications function is disabled.	Enable the wireless communications function. (p.43)
	The settings of the GENNECT Cross are incorrect.	Check the settings of the GENNECT Cross and your mobile communications device (GPS, etc.). (See the operation guide for the GENNECT Cross.)
An error is displayed.	See p.65.	Have the instrument repaired.

4.2 Error Displays

Error display	Description	Corrective action
Err 001	ROM error (Program)	When an error is displayed on the display panel, repair is required. Please contact your authorized Hioki distributor or reseller.
Err 002	ROM error (Adjustment data)	
Err 004	Memory error	
Err 008	Z3210 communication error (Connection failure, the Z3210 or hardware malfunction)	

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Warranty Certificate

HIOKI

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

Customer name: _____

Customer address: _____

Important

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

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

Warranty terms

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

HIOKI E.E. CORPORATION
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