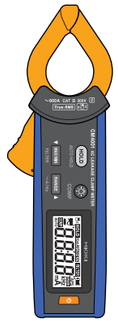
HIOKI



CM4001

AC LEAKAGE CLAMP METER

Instruction Manual

EN

May 2020 Edition 1
CM4001A961-00 20-05H

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GENNECT Cross special site

https://gennect.net/en/cross/index

HIOKI

http://www.hioki.com

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Warranty

Warranty malfunctions occurring under conditions of normal use in conformity with the Instruction Manual and Product Precautionary Markings will be repaired free of charge. This warranty is valid for a period of three (3) years from the date of purchase. Please contact the distributor from which you purchased the product for further information on warranty provisions.

Introduction

Thank you for choosing the Hioki CM4001 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. Familiarize yourself with the separate document entitled “Operating Precautions” before using the instrument.

Overview

The instrument is an AC leakage clamp meter capable of true RMS value measurement of current ranging from 0.60 mA to 600.0 A using a compact, low-profile sensor. It also provides a comparator function to facilitate instantaneous pass/fail judgments.

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).

Notations

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

⚠ DANGER	Indicates an imminently hazardous situation that will result in death of or serious injury to the operator.
⚠ WARNING	Indicates a potentially hazardous situation that may result in death of or serious injury to the operator.
⚠ CAUTION	Indicates a potentially hazardous situation that may result in minor or moderate injury to the operator or damage to the instrument or malfunction.
⃠	Indicates an action that must not be performed.
❗	Indicates an action that must be performed.
⚠	Indicates the need for caution or the presence of danger. For more information about locations where this symbol appears on instrument components, see the “Usage Notes” section, warning messages listed at the beginning of operating instructions, and accompanying the document entitled “Operating Precautions”.
⚡	Indicates that the instrument may be connected to or disconnected from a live conductor.
[ ]	The names of user interface elements on the screen are enclosed in brackets ([ ]).
Bold	Operation keys are printed in bold.

The instrument screen displays the alphanumeric characters as follows.

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z
AbCdEFGHiJKLmnoPQrStUvWXyZ

1 2 3 4 5 6 7 8 9 0
1234567890

Usage Notes

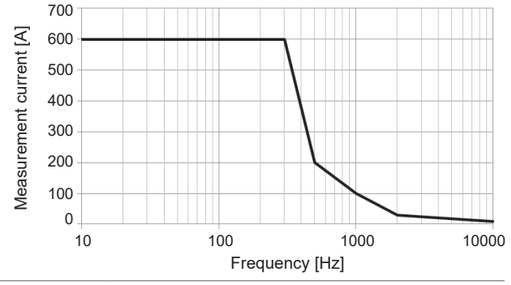
⚠ CAUTION

- Avoid dropping or jarring the instrument which could damage the jaw, adversely affecting measurement.
- ⃠ Do not place any foreign object between the jaws or insert any foreign object into the gap of the sensor head. Doing so may worsen the performance of the sensor or the opening-closing operation of the sensor head.

- Displayed values can frequently fluctuate due to induction potential even when no voltage is applied. This, however, is not a malfunction.
- The 6 A and below ranges have different sensor characteristics than the 60 A and above ranges. As a result, use of different ranges may yield different indicated values. Such differences do not represent a problem with the instrument.
- Use of the instrument should confirm not only to its specifications, but also to the specifications of all accessories, options, battery, and other equipment in use.

Specifications

Operating environment	Indoors, Pollution Degree 2, altitude up to 2000 m (6562 ft.)
Operating temperature and humidity range	Temperature: −10°C to 65°C (14°F to 149°F) Humidity: −10°C to 40°C (14°F to 104°F), 80% RH or less 40°C to 45°C (104°F to 113°F), 60% RH or less 45°C to 65°C (113°F to 149°F), 50% RH or less (non-condensing)
Storage temperature and humidity range	Temperature: −10°C to 65°C (14°F to 149°F) Humidity 80% RH or less (non-condensing)
Standards	Safety EN 61010 EMC EN 61326
Power supply	LR03 alkaline battery × 1 Rated power voltage: 1.5 VDC Maximum rated power: 450 mVA Rated power: 60 mVA+20% or less (supply voltage 1.5 V, ACA measurement, LCD backlight off)
Continuous operating time	• Approx. 32 hours (without Z3210) • Approx. 16 hours (with Z3210, wireless communication) • Other conditions: LCD backlight off, no input
Dimensions	Approx. 37W × 160H × 27D mm (1.46”W × 6.3”H × 1.06”D) (excluding the protruding parts, operation grip, and jaw)
Jaw dimensions	Approx. 44W × 18D mm (1.73”W × 0.71”D)
Jaw cross-sectional minimum dimension	Approx. 9.5 mm
Maximum measurable conductor diameter	ϕ24 mm
Mass	Approx. 115 g (4.1 oz.)
Product warranty period	3 years (number of jaw open/close cycles: 10000)
Accessories	LR03 Alkaline battery × 1, Carrying case, Instruction Manual, Operating Precautions (0990A909), Strap
Option	Z3210 Wireless Adapter Option is subject to change. Check Hioki’s website for the latest information.
Measurement items	AC Current (~ A), Frequency (Hz)
Maximum rated terminal-to-ground voltage	300 V AC (Measurement Category III) Anticipated transient overvoltage: 4000 V
Measurement method	True RMS value measurement
Display update rate	Measured value: 5 times/sec. (after range fixed, excluding frequency) 1 time to 2 times/sec. (frequency) Defined within the measurement range (does not include range change time)
Zero-display range	5 counts or less
Crest factor	For the 60.00 mA range/ 600.0 mA range/ 6.000 A range/ 60.00 A range/600.0 A range 4.5 (4000 counts or less) 3 (more than 4000 counts, 6000 counts or less)
Maximum input current	As per frequency derating (within 5 min.)



Accuracy Specifications

rdg.: The value currently being measured and indicated on the measuring instrument.

Accuracy guarantee conditions	Accuracy guarantee period: 1 year Accuracy guarantee period after adjustment made by Hioki: 1 year Accuracy guarantee temperature and humidity range: 23°C±5°C (73°F±9°F), 80% RH or less (non-condensing) Number of jaw open/close cycles: 10000 or less
Accuracy guarantee input conditions	Sine wave input
Effect of external magnetic field	In a magnetic field of 400 A AC/m Max. 7.0 mA (6.000 A range and below) Max. 4.0 A (60.00 A range and above)
Effects of conductor position	Within±0.1% (6.000 A range and below) Within ±5.0% (60.00 A range and above) (At any positions, based on the center of sensor)
Temperature coefficient	Add “measurement accuracy × 0.1/°C” (excluding 23°C±5°C [73°F±9°F]).

AC current RMS value measurement (ACA/ACA MAX/ACA MIN/ACA AVG)

Range (Display range)	Resolution (Accuracy guarantee range)	Accuracy guarantee frequency range	Measurement accuracy	
			Filter off	Filter on
60.00 mA (0.00 mA to 60.00 mA)	0.01 mA (0.60 mA rms to 60.00 mA rms)	45 Hz ≤ f ≤ 66 Hz	±1.5% rdg ±0.05 mA	±1.5% rdg ±0.05 mA
		40 Hz ≤ f < 45 Hz 66 Hz < f ≤ 1 kHz	±2.5% rdg ±0.05 mA	–
600.0 mA (0.0 mA to 600.0 mA)	0.1 mA (6.0 mA rms to 600.0 mA rms)	45 Hz ≤ f ≤ 66 Hz	±1.5% rdg ±0.5 mA	±1.5% rdg ±0.5 mA
		40 Hz ≤ f < 45 Hz 66 Hz < f ≤ 1 kHz	±2.5% rdg ±0.5 mA	–
6.000 A (0.000 A to 6.000 A)	0.001 A (0.060 A rms to 6.000 A rms)	45 Hz ≤ f ≤ 66 Hz	±1.5% rdg ±0.005 A	±1.5% rdg ±0.005 A
		40 Hz ≤ f < 45 Hz 66 Hz < f ≤ 1 kHz	±2.5% rdg ±0.005 A	–
60.00 A (0.00 A to 60.00 A)	0.01 A (0.60 A rms to 60.00 A rms)	45 Hz ≤ f ≤ 66 Hz	±2.5% rdg ±0.05 A	±2.5% rdg ±0.05 A
		40 Hz ≤ f < 45 Hz 66 Hz < f ≤ 1 kHz	±5.0% rdg ±0.05 A	–
600.0 A (0.0 A to 600.0 A)	0.1 A (6.0 A rms to 600.0 A rms)	45 Hz ≤ f ≤ 66 Hz	±2.5% rdg ±0.5 A	±2.5% rdg ±0.5 A
		40 Hz ≤ f < 45 Hz 66 Hz < f ≤ 1 kHz	±5.0% rdg ±0.5 A	–

AC current peak measurement (ACA PEAK MAX/ACA PEAK MIN)

PEAK detection time width: 2 ms or more (Filter off)

Range (Display range)	Resolution (Accuracy guarantee range)	Accuracy guarantee frequency range	Measurement accuracy	
			Filter off	Filter on
60.00 mA (0.0 mA to ±180.0 mA)	0.1 mA (±1.8 mA to ±180.0 mA)	45 Hz ≤ f ≤ 66 Hz	±2.5% rdg ±0.7 mA	±2.5% rdg ±0.7 mA
		40 Hz ≤ f < 45 Hz 66 Hz < f ≤ 1 kHz	±3.5% rdg ±0.7 mA	–
600.0 mA (0 mA to ±1800 mA)	1 mA (±18 mA to ±1800 mA)	45 Hz ≤ f ≤ 66 Hz	±2.0% rdg ±7 mA	±2.0% rdg ±7 mA
		40 Hz ≤ f < 45 Hz 66 Hz < f ≤ 1k Hz	±3.0% rdg ±7 mA	–
6.000 A (0.00 A to ±18.00 A)	0.01 A (±0.18 A to ±18.00 A)	45 Hz ≤ f ≤ 66 Hz	±2.0% rdg ±0.07 A	±2.0% rdg ±0.07 A
		40 Hz ≤ f < 45 Hz 66 Hz < f ≤ 1 kHz	±3.0% rdg ±0.07 A	–
60.00 A (0.0 A to ±180.0 A)	0.1 A (±1.8 A to ±180.0 A)	45 Hz ≤ f ≤ 66 Hz	±3.0% rdg ±0.7 A	±3.0% rdg ±0.7 A
		40 Hz ≤ f < 45 Hz 66 Hz < f ≤ 1 kHz	±6.0% rdg ±0.7 A	–
600.0 A (0 A to ±1800 A)	1 A (±18 A to ±1800 A)	45 Hz ≤ f ≤ 66 Hz	±3.0% rdg ±7 A	±3.0% rdg ±7 A
		40 Hz ≤ f < 45 Hz 66 Hz < f ≤ 1 kHz	±6.0% rdg ±7 A	–

AC inrush current measurement (ACA INRUSH)

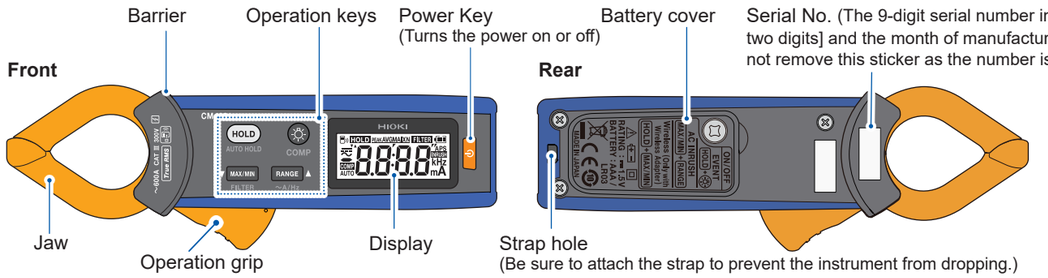
Range (Display range)	Resolution (Accuracy guarantee range)	Accuracy guarantee frequency range	Trigger threshold value (PEAK value)	Measurement accuracy
				Filter off
600.0 mA (0.0 mA to 600.0 mA)	0.1 mA (60.0 mA rms to 600.0 mA rms)	40 Hz ≤ f ≤ 1 kHz	+60.0 mA or more or −60.0 mA or less	±6.0% rdg ±1.0 mA
6.000 A (0.000 A to 6.000 A)	0.001 A (0.600 A rms to 6.000 A rms)	40 Hz ≤ f ≤ 1 kHz	+0.600 A or more or −0.600 A or less	±6.0% rdg ±0.010 A
60.00 A (0.00 A to 60.00 A)	0.01 A (6.00 A rms to 60.00 A rms)	40 Hz ≤ f ≤ 1 kHz	+2.00 A or more or −2.00 A or less	±10.0% rdg ±0.10 A
600.0 A (0.0 A to 600.0 A)	0.1 A (60.0 A rms to 600.0 A rms)	40 Hz ≤ f ≤ 1 kHz	+20.0 A or more or −20.0 A or less	±10.0% rdg ±1.0 A

Frequency measurement (Current)

Minimum current sensitivity: 1.80 mA

Range (Display range)	Resolution (Accuracy guarantee range)	Measurement accuracy
999.9 Hz (40.0 Hz to 999.9 Hz)	0.1 Hz (40.0 Hz to 999.9 Hz)	±1.5% rdg ±0.1 Hz

Names and Function of Parts



Operation keys

Key	Press once	Press for 1 sec. or more
HOLD AUTO HOLD	Retains measured value (**HOLD** lights up) (Cancel: Press the **HOLD** key), saves measured value when using the GENNECT Cross.	Turns the auto hold function on or off. (**HOLD** flashes)
COMP	Turns the display backlight on and off. Automatically deactivates the backlight when the instrument is not in use for 40 sec.	Turns the comparator function on or off. (**COMP** lights up)
MAX/MIN FILTER	Switches among the maximum value, minimum value, average value, maximum peak value, minimum peak value, and current value. MAX ▶ MIN ▶ AVG ▶ PEAK MAX ▶ PEAK MIN ▶ ——— Cancel: Press the **MAX/MIN** key for 1 sec. or more.	Turns the filter function on or off. (**FILTER** lights up)
RANGE ~A/Hz	Switches among the auto range, 60.00 mA range, 600.0 mA range, 6.000 A range, 60.00 A range, and 600.0 A range.	Switches frequency measurement and current measurement.

Power-on Option

(Turns the power on while pressing operation keys)

Key	Function	Default value	Setting retained?
HOLD + ⏻	Cancels the auto power save function (**APS**) off.	On	No
COMP + ⏻	Automatic backlight deactivation (on or off)	On	Yes
MAX/MIN + ⏻	Turns the filter function on or off when the instrument is powered on.	Off	Yes
RANGE + ⏻	Beep (on or off)	On	Yes
HOLD + MAX/MIN + ⏻	Displays Serial No.	–	–
MAX/MIN + RANGE + ⏻	Displays model number, version of software, and all indicators.	–	–

Making Measurements

To ensure that the instrument is properly operating, conduct an inspection and check instrument operation before using instrument to ensure that no damage has occurred during storage or transport. Verify that the tips of the jaws are free of damage and cracking. If there is any damage to the instrument, contact your authorized Hioki distributor or reseller for repair.

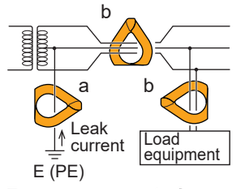
⚠ DANGER

- **To prevent an electric shock, do not touch any areas beyond the barrier while the instrument is in use.**
- **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. Do not measure currents in excess of the derating curve. Damage to the instrument or overheating can malfunction, a fire, or burn.**

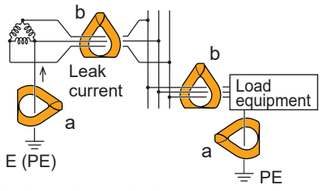
Affix around the wire and check the measured value.

Leakage current measurement

Single-phase 3-wire circuit

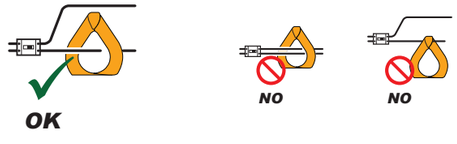


3-phase 3-wire circuit



- For measurement of grounded wires, clamp the instrument on one wire only (see a in the figure).
- For overall measurement, clamp the instrument on the entire circuit's wires bundled together (see b in the figure).
- To measure a single-phase 2-wire circuit, clamp both of the circuit's wires together.
- To measure a 3-phase 4-wire circuit, clamp all 4 of the circuit's wires bundled together. If this is not possible, carry out the measurement on the equipment's ground wire.
- Measurement may not be accurate in the cases below.
  (1) If there is large current flowing through a nearby electric line.
  (2) If you use the instrument to measure the waveforms on the secondary side of an inverter, or other special waveforms.
- Note that a large display count may appear momently when opening or closing the jaws. This is not an error. It may take some time for the display to return to zero. However, starting measurement before the display returns to zero will not affect measurement.

AC current measurement, frequency measurement



- Clamp the instrument on one wire only.
- Put the conductor perpendicular to the sensor.
- Correct measurement may be impossible for the case of rush current or significantly fluctuating current.
- At a low temperature, there are cases when the reading may not be around zero without any input signal. But it does not affect measurement.
- Press **RANGE** key for 1 sec. or more to switch frequency measurement and current measurement.

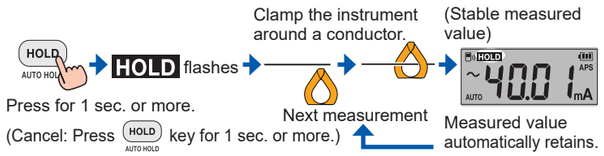
Over-input warning (Red backlight or flashing red backlight + beep)

The measured value is beyond the measurable range of current measurement. Halt measurement as the instrument is in an over-input state.
The backlight will also turn red if the comparator or event function threshold is exceeded.

Useful Functionality

Auto hold function

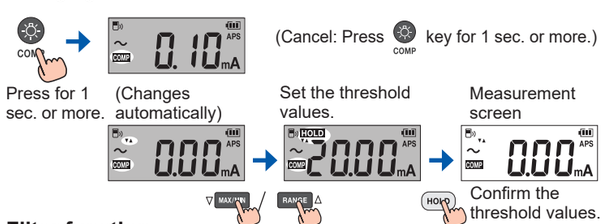
When the measured value stabilizes, the value automatically retains.



Comparator function

If the present threshold value is exceeded, the instrument will sound an intermittent beep, and the display will turn red.

Changing the threshold values

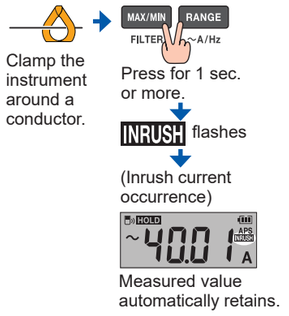


Filter function

The effects of noise can be reduced by the low-pass filter.
The passband is −3 dB at 180 Hz ±30 Hz. Turn off the filter function when performing measurement of current frequencies in excess of 180 Hz. When the filter function is enabled, the indicated value may be lower than the actual value.

AC Inrush function (Inrush current measurement)

The measured value (RMS value) is retained when an inrush current is detected.



Repeat measurement by pressing the **HOLD** key.
Revert to normal measurement by pressing and holding the **MAX/MIN** key and **RANGE** key at the same time for 1 sec. or more.
The inrush range is fixed at the range during current measurement. Specifically, the inrush range is fixed to the 600.0 A range when using the auto range for current measurement and to the 600.0 mA range when using the 60 mA range for current measurement.

Auto power save (APS) function

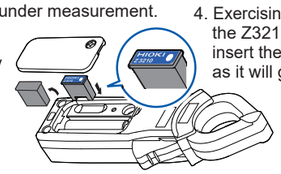
The instrument will turn off if there is no input and no operation for about 10 min.

Wireless function (GENNECT Cross)

When the wireless function is enabled, you can review measurement data and create measurement reports on mobile devices. For more information about this functionality, see the **Help** function in the GENNECT Cross (application software, free of charge).

1 Connect the Z3210 Wireless Adapter (option) to the instrument.

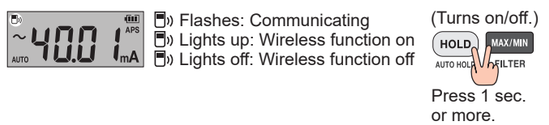
1. Turn off the power switch and disconnect the clamp from the object under measurement.
2. Remove the battery cover by turning screws.
3. Remove the protective cap.



4. Exercising care to orient the Z3210 correctly, insert the Z3210 as far as it will go.
5. Replace the battery cover and secure in place with the screw.

2 Install the GENNECT Cross on your mobile device.

3 Turn on the power switch and confirm that the wireless function is enabled.



4 Launch the GENNECT Cross and pair it with the instrument.

5 Select the measurement function (such as General Measurement and Waveform Graph function) and start measurement.

- The communication distance is approx. 10 m (line of sight). The distance over which data can be sent and received varies greatly depending on whether there are any obstructions between the paired instruments (for example, walls, metal barriers, etc.) and on the distance between the instrument and the floor (or ground). To ensure stable measurement, verify adequate signal strength.
- Although this application software is provided free of charge, downloading or using the application software may incur internet connection charges. Such charges are the sole responsibility of the user.
- This application software is not guaranteed to operate on all mobile devices.

Event function

By using GENNECT Cross, you can set a threshold value as desired and record data if it is exceeded. The instrument displays the number of events recorded. For more information, see the **Help** function in the GENNECT Cross.

Repairs, Inspections, and Cleaning

If the instrument seems to be malfunctioning, confirm that the battery is not discharged before contacting your authorized Hioki distributor or reseller.
During shipment of the instrument, handle it carefully so that it is not damaged due to a vibration or shock.

Cleaning

If the instrument becomes dirty, wipe the instrument clean with a soft cloth slightly moistened with water or a neutral detergent.

Error display

When an error is displayed on the LCD screen, repair is necessary. Please contact your authorized Hioki distributor or reseller.

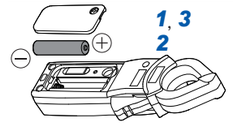
- **[Err 1]** ROM error (program)
- **[Err 2]** ROM error (adjustment data)
- **[Err 4]** Memory error
- **[Err 8]** Z3210 communication error (bad connection, malfunction of Z3210 or hardware)

Replace battery

⚠ WARNING

To avoid electric shock, turn off the power switch and disconnect the clamp from the object under measurement before replacing the battery.

	Fully charged.
	As the battery charge diminishes, black charge bars disappear, one by one, from the left of the battery indicator.
	The battery voltage is low. Replace the battery as soon as possible.
	(Flashes) The battery is exhausted. Replace the battery.



1 Remove the battery cover by turning screws.
2 Replace the battery.
3 Replace the battery cover and secure in place with the screw.