

# CM3281 CM3291

## AC CLAMP METER Instruction Manual

EN

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CM3281A961-00 19-12H



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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 purchasing the Hioki CM3281, CM3291 AC Clamp Meter. To obtain maximum performance from the instrument, please read this manual first, and keep it handy for future reference. Be sure to also read the separate document "Operating Precautions" before use.

|        |  |
|--------|--|
| CM3281 | Average value measurement RMS conversion model |
| CM3291 | True RMS measurement model                     |

### Target audience

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

### Safety Notes

#### Symbols affixed to the device

|  |   |
|--|---|
|  | Precaution or hazard (See corresponding topic.)   |
|  | The instrument can be connected to or disconnected from a live conductor  |
|  | The flexible sensor can be connected to or disconnected from live conductors when appropriate protective insulation is used.<br>The clamp meter and test leads can only be connected to or disconnected from insulated conductors suited to the voltage of the conductor under measurement. |

### ! DANGER

- ⊘ To avoid electric shock, do not touch the portion beyond the protective barrier during use.

Do not subject the instrument to any voltages when the resistance measurement or continuity check function is selected. Doing so may damage the instrument and result in bodily injury. To avoid electrical accidents, turn off the circuit before measuring it.

### ! WARNING

- To avoid electric shock, short circuits and damage to the instrument, disconnect the test leads from the measurement object before switching the rotary switch.
- To prevent electric shock, when measuring the voltage of a power line use a test lead that satisfies the following criteria:
  - Conforms to safety standards IEC61010 or EN61010
  - Of measurement category III or IV
  - Its rated voltage is higher than the voltage to be measured
- The optional test leads for this instrument conform to the safety standard EN61010. Use a test lead in accordance with its defined measurement category and rated voltage.
- To prevent a short circuit accident, be sure to use the L9208 test leads with the sleeves attached when performing measurements in the CAT III measurement category. (For the measurement categories, see the "Measurement categories" section in the separate document "Operating Precautions".)
- If the sleeves are removed during measurement, stop the measurement.
- Handle and dispose of batteries in accordance with local regulations.

### ! CAUTION

- ⊘ Do not place foreign objects between the jaw tips (or flexible loop couplings) or insert foreign objects into the gaps of the jaws (or flexible loop couplings). Doing so may worsen the performances of the sensor or interfere with clamping action.

- The indicator is displayed when the remaining battery capacity is low. In this case, the accuracy of the instrument is not guaranteed. Replace the battery immediately.
- To avoid battery depletion, set the rotary switch in the [OFF] position after use. (Even when the automatic power-saving function is enabled, the instrument consumes a small amount of the battery power.)

### Inspection Before Measurement

- Before using the instrument, check it and verify that it operates properly to make sure that it suffered no damage during storage or transportation.
- If damage is suspected, check the section below before contacting your authorized Hioki distributor or reseller.

- (1) **Check the test lead for breaks.**  
If any, replace it with the new L9208 Test Lead.
- (2) **Check that the resistance measurement and continuity check operates normally.**  
If any one of them does not operate normally, send the instrument for repair to your authorized Hioki distributor or reseller. The instrument may have been subject to a voltage of greater than 600 V during resistance measurement or continuity check.
- (3) **Check that the battery weakens.**  
If it weakens, replace the battery.

### Functions

#### Automatic power-saving function

The instrument automatically turns off the LCD after it is not operated for 30 minutes.

- To enable the function
  - To restore the instrument from a non-displaying state
- 1 Set the rotary switch in the [OFF] position and then set the rotary switch in a position other than [OFF].
- To cancel automatic power-saving function
- 1 Set the rotary switch in a position other than [OFF] while holding down the HOLD key. The text [APS] and [OFF] are displayed in turn on the LCD, and the automatic power-saving function is disabled.

#### Auto-range function

The instrument automatically selects the most appropriate measurement range.

The text [AUTO] is displayed on the LCD.

#### Manual-range function

Sets the measurement range manually.

- 1 Set the rotary switch in the [OFF] position and then set the rotary switch in a position other than [OFF] while holding down the key.
- 2 Press the key to switch the measurement range. (Any ranges can be set except for the continuity check.)

#### Overflow indication

If an input exceeds the measurement range, the text [OF] or [-OF] is displayed on the LCD.

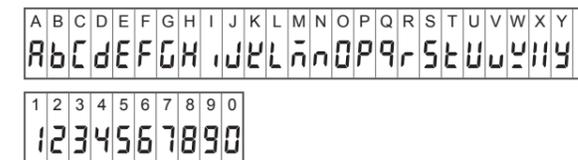
### Parts Names

#### LCD (with all segments turned on)

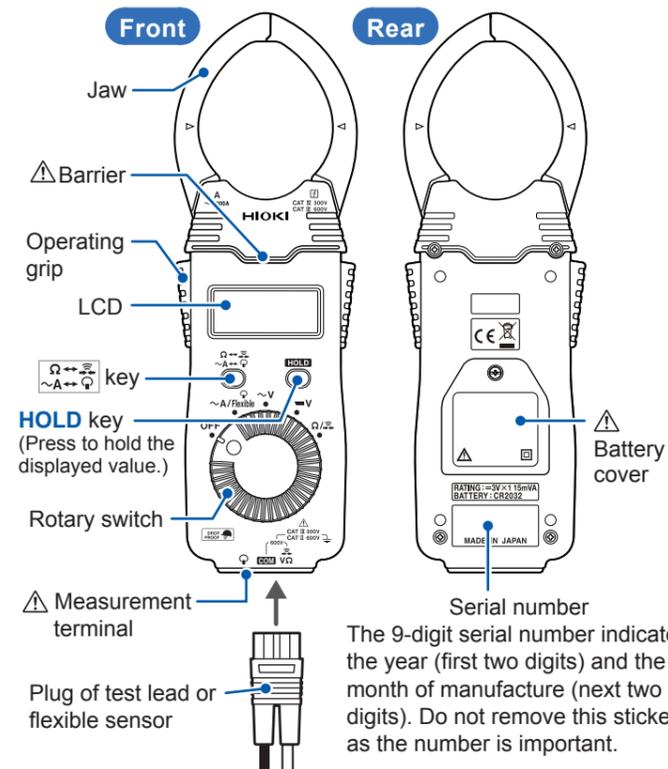


- [FILTER] : Not used
- [HOLD] : Holds measured value
- [AUTO] : Auto-range function
- : Low battery warning
- : Connection of flexible loop
- : Continuity check

The instrument screen displays the alphanumeric characters as follows.

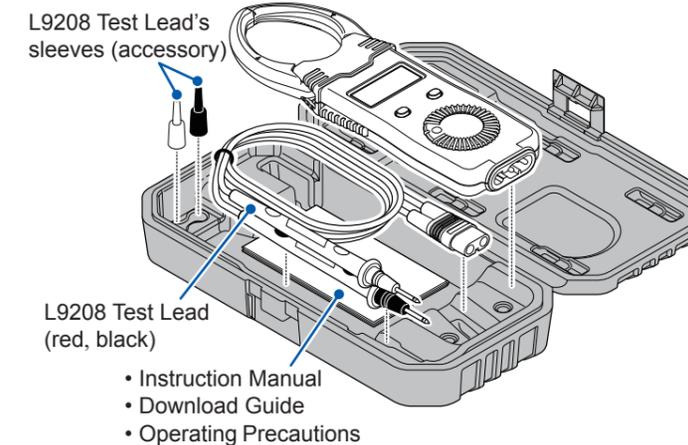


### AC Clamp Meter

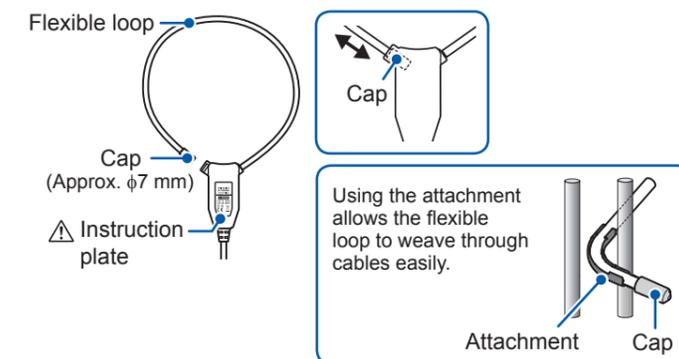


The 9-digit serial number indicates the year (first two digits) and the month of manufacture (next two digits). Do not remove this sticker as the number is important.

### Carrying case storage



### CT6280 AC Flexible Current Sensor (optional)

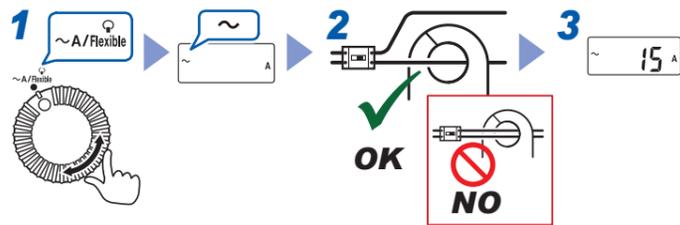


Using the attachment allows the flexible loop to weave through cables easily.

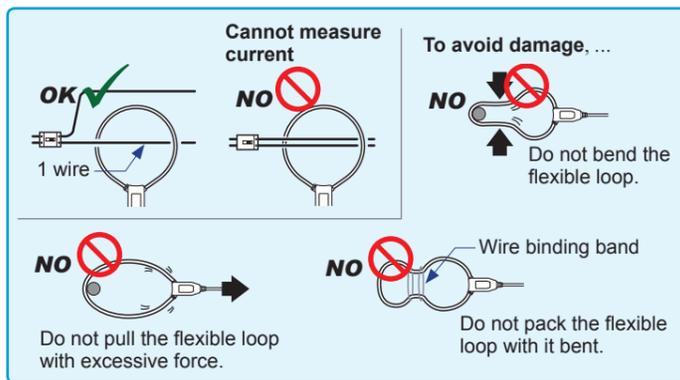
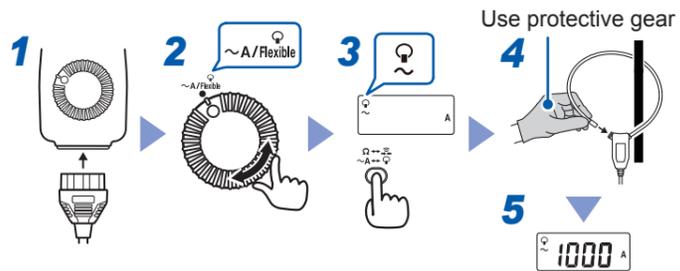
## Measuring Methods

### AC Current Measurement [~A/Flexible]

#### Measuring current with the instrument

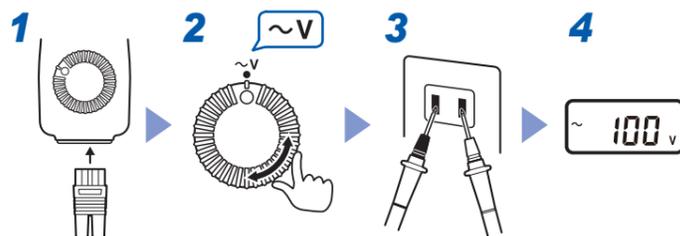


#### Measuring current with Model CT6280 AC Flexible Current Sensor (optional)

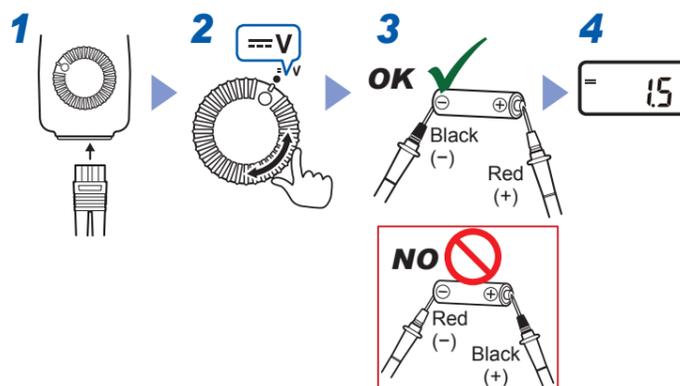


## Voltage Measurement

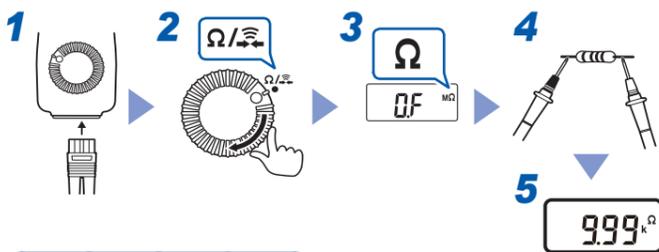
### AC Voltage Measurement [~V]



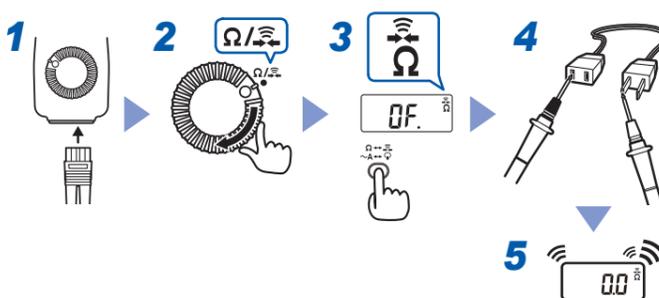
### DC Voltage Measurement [≡V]



## Resistance Measurement [Ω]



## Continuity Check [Ω]

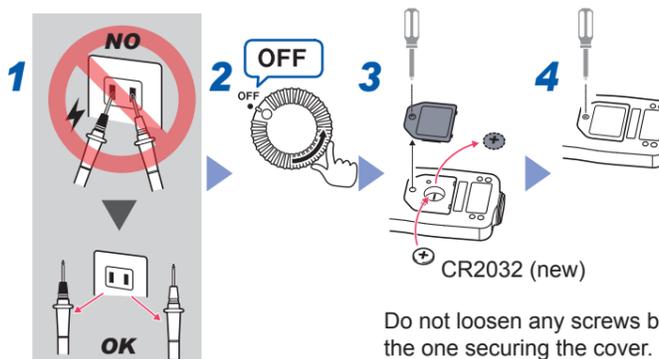


## Cleaning

- Measurements are degraded by dirt on the mating surfaces of the jaw (or flexible loop coupling), so keep the surfaces clean by gently wiping with a soft, dry cloth.
- To clean the instrument, wipe it gently with a soft cloth moistened with water or mild detergent.
- Wipe the LCD gently with a soft, dry cloth.

## Replacing Battery

Necessary items: Phillips screwdriver (No.1) and Coin cell lithium battery (CR2032)



Do not turn any one of the 3 screws inside the battery case. Doing so will cause the instrument to report abnormal measured values.

### CALIFORNIA, USA ONLY

This product contains a CR Coin Lithium Battery which contains Perchlorate Material - special handling may apply. See [www.dtsc.ca.gov/hazardouswaste/perchlorate](http://www.dtsc.ca.gov/hazardouswaste/perchlorate)

## Specifications

### Function Specifications

|                                   |  |
|-----------------------------------|--|
| Display                           | Maximum count: 4199 counts   |
| Battery indicator warning voltage | The mark <b>B</b> is displayed at a battery voltage of 2.3 V±0.15 V or less. |

### General Specifications

|                                    |  |
|------------------------------------|--|
| Operating environment              | Indoors, pollution degree 2, altitude up to 2000 m (6562 ft.)                            |
| Operating temperature and humidity | Temperature: -25°C to 65°C (-13°F to 149°F)<br>(For the 40 MΩ range: up to 40°C [104°F]) |

|                            |  |
|----------------------------|--|
| Humidity (no condensation) | Less than 40°C (104°F): 80% RH or less<br>At least 40°C (104°F) but less than 45°C (113°F): 60% RH or less<br>At least 45°C (113°F) but less than 50°C (122°F): 50% RH or less<br>At least 50°C (122°F) but less than 55°C (131°F): 40% RH or less<br>At least 55°C (131°F) but less than 60°C (140°F): 30% RH or less<br>At least 60°C (140°F) but less than 65°C (149°F): 25% RH or less |
|----------------------------|--|

|                                  |  |
|----------------------------------|--|
| Storage temperature and humidity | -25°C to 65°C (-13°F to 149°F), 80% RH or less (no condensation)   |
| Drop-proof                       | Operate after a drop from 1 m on concrete  |
| Standards                        | Safety: EN61010<br>EMC: EN61326  |
| Power supply                     | Coin cell lithium battery CR2032 ×1<br>Rated power voltage: 3 V DC<br>Maximum rated power: 15 mVA  |
| Continuous operating time        | CM3281: Approx. 120 hours<br>CM3291: Approx. 70 hours<br>(AC current measurement mode, continuous, unloaded, under conditions of temperature and humidity for guaranteed accuracy)   |
| Dimensions                       | • CM3281, CM3291: Approx. 57W×198H×16D mm (2.24"W × 7.80"H × 0.63"D)<br>• CT6280: Approx. 42W×65H×18D mm (1.65"W × 2.56"H × 0.71"D)<br>(excluding the flexible loop and output cable)  |
| Dimensions (Jaw)                 | Approx. 65W×13D mm (2.56"W × 0.51"D)   |
| Mass                             | • CM3281, CM3291: Approx. 103 g (3.6 oz.) (including battery)<br>• CT6280: Approx. 71 g (2.5 oz.)  |
| Product warranty period          | CM3281, CM3291, CT6280: 3 years  |
| Accessories                      | • Carrying Case<br>• L9208 Test lead<br>• Coin cell lithium battery CR2032 (Installed in the instrument, for LCD)<br>• Instruction Manual (This document)<br>• Download Guide<br>• Operating Precautions (0990A909)  |
| Options                          | The following options are available for the instrument. To purchase an option, please contact your authorized Hioki distributor or reseller. Options are subject to change. Please check Hioki's website for the latest information. <ul style="list-style-type: none"> <li>• CT6280 AC Flexible Current Sensor (Attachment and C0205 Carrying Case are included)</li> <li>• L4933 Contact Pin Set (Can be connected to the tip of the L9208, which comes with the instrument.)</li> <li>• L4934 Small Alligator Clip Set (Can be connected to the tip of the L9208, which comes with the instrument.)</li> <li>• L9208 Test Lead</li> </ul> |

## Basic Specifications

|                                 |   |
|---------------------------------|---|
| Maximum input current           | • CM3281, CM3291 (Jaw): 2000 A AC, continuous (45 Hz to 66 Hz)<br>• CT6280 (Flexible loop): 4200 A AC, continuous (50 Hz to 60 Hz)  |
| Maximum input voltage           | 600 V AC/DC and 3×10 <sup>6</sup> V·Hz or less (ACV, DCV)   |
| Overload protection             | 600 V AC/DC (ACV, DCV, Ω, continuity)   |
| Maximum rated voltage to earth  | CM3281, CM3291 (jaw)/CT6280: 600 V AC (Measurement category III), 300 V AC (Measurement category IV) (Anticipated transient overvoltage: 6000 V)<br>Voltage measurement terminal: 600 V AC (Measurement category II), 300 V AC (Measurement category III) (Anticipated transient overvoltage: 4000 V) |
| AC measurement method           | CM3281: Average value measurement RMS conversion model<br>CM3291: True RMS measurement model  |
| Display update rate             | 400 ms±25 ms  |
| Noise rejection characteristics | NMRR DCV: -40 dB or more (50 Hz/60 Hz)<br>CMRR DCV: -100 dB or more (50 Hz/60 Hz, 1 kΩ unbalance)<br>ACV: -60 dB or more (50 Hz/60 Hz, 1 kΩ unbalance)<br>But, -45 dB or more for 600 V range.  |
| Crest factor                    | CM3291: For 2500 counts or less, 2.5<br>Reduces linearly to 1.5 or less at 4200 counts<br>But, 1.5 or less for 2000 A ACA range   |
| Zero-display range              | 5 counts (AC current measured with jaw or flexible loop)  |

|                                       |  |
|---------------------------------------|--|
| Effects of conductor position         | • CM3281, CM3291: within ±5.0% (Specified with a 11-mm-diameter [22 mm <sup>2</sup> ] cable)<br>• CT6280: within ±5.0% (At any positions, based on the center of sensor) |
| Maximum measurable conductor diameter | • CM3281, CM3291: φ46 mm or less<br>• CT6280: φ130 mm or less  |
| Model CT6280                          | Cross-section diameter of sensor cable: Approx. φ5.0 mm<br>Sensor-tip cap diameter: Approx. φ7.0 mm<br>Output cable length: Approx. 800 mm                               |

## Accuracy Specifications

**rdg** (reading or displayed value): The value currently being measured and indicated on the measuring instrument.  
**dgt** (resolution): The smallest displayable unit on a digital measuring instrument, i.e., the input value that causes the digital display to show a "1" as the least-significant digit.

### Conditions of guaranteed accuracy

- Guaranteed accuracy period: 1 year (Number of jaw and flexible loop open/close cycles: 10,000 or less)
- Guaranteed accuracy period after adjustment made by Hioki: 1 year
- Temperature and humidity for guaranteed accuracy: 23°C±5°C (73°F±9°F), 80% RH or less
- Supply voltage for guaranteed accuracy: The mark **B** is not displayed.
- Temperature characteristic: Measurement accuracy × 0.1%/°C is added (excluding 23°C±5°C)
- AC waveform: sine wave

### AC Current Measured With Jaw (CM3281)

| Range   | Accuracy range    | Accuracy          |
|---------|-------------------|-------------------|
| 42.00 A | 4.00 A to 41.99 A | 50 Hz ≤ f ≤ 60 Hz |
| 420.0 A | 40.0 A to 419.9 A | ±1.5% rdg ±5 dgt  |
| 2000 A  | 100 A to 1999 A   |                   |

### AC Current Measured With Jaw (CM3291)

| Range   | Accuracy range    | Accuracy          |
|---------|-------------------|-------------------|
| 42.00 A | 4.00 A to 41.99 A | 40 Hz ≤ f < 45 Hz |
| 420.0 A | 40.0 A to 419.9 A | 45 Hz ≤ f ≤ 66 Hz |
| 2000 A  | 100 A to 1999 A   | 66 Hz < f ≤ 1 kHz |

Accuracy is not defined for currents of 3×10<sup>5</sup> A·Hz or more.

### AC Current Measured With Flexible loop (CM3281)

| Range   | Accuracy range    | Accuracy           |
|---------|-------------------|--------------------|
| 420.0 A | 40.0 A to 419.9 A | 50 Hz ≤ f ≤ 60 Hz  |
| 4200 A  | 400 A to 4199 A   | ±3.0% rdg ±5 dgt*1 |

### AC Current Measured With Flexible loop (CM3291)

| Range   | Accuracy range    | Accuracy          |
|---------|-------------------|-------------------|
| 420.0 A | 40.0 A to 419.9 A | 40 Hz ≤ f < 45 Hz |
| 4200 A  | 400 A to 4199 A   | 45 Hz ≤ f ≤ 66 Hz |
|         |                   | 66 Hz < f ≤ 1 kHz |

## AC Voltage

| Range   | Accuracy range     | Accuracy           | Input impedance |
|---------|--------------------|--------------------|-----------------|
| 4.200 V | 0.400 V to 4.199 V | 45 Hz ≤ f ≤ 66 Hz  | 11 MΩ ±5%       |
| 42.00 V | 4.00 V to 41.99 V  | 66 Hz < f ≤ 500 Hz |                 |
| 420.0 V | 40.0 V to 419.9 V  | ±1.8% rdg ±7 dgt   | 10 MΩ ±5%       |
| 600 V   | 400 V to 600 V     | ±5 dgt*1,*2        | 10 MΩ ±5%       |

## DC Voltage

| Range    | Accuracy range      | Accuracy          | Input impedance |
|----------|---------------------|-------------------|-----------------|
| 420.0 mV | 40.0 mV to 419.9 mV | ±2.5% rdg ±5 dgt  | 100 MΩ or more  |
| 4.200 V  | 0.400 V to 4.199 V  | ±1.0% rdg ±3 dgt  | 11 MΩ ±5%       |
| 42.00 V  | 4.00 V to 41.99 V   |                   | 10 MΩ ±5%       |
| 420.0 V  | 40.0 V to 419.9 V   | ±3 dgt            | 10 MΩ ±5%       |
| 600 V    | 400 V to 600 V      | ±10.0% rdg ±4 dgt | 10 MΩ ±5%       |

## Resistance

| Range    | Accuracy range       | Accuracy          | Open-circuit voltage |
|----------|----------------------|-------------------|----------------------|
| 420.0 Ω  | 40.0 Ω to 419.9 Ω    | ±2.0% rdg ±4 dgt  | 3.4 V or less        |
| 4.200 kΩ | 0.400 kΩ to 4.199 kΩ |                   |                      |
| 42.00 kΩ | 4.00 kΩ to 41.99 kΩ  | ±5.0% rdg ±4 dgt  | 3.4 V or less        |
| 420.0 kΩ | 40.0 kΩ to 419.9 kΩ  |                   |                      |
| 4.200 MΩ | 0.400 MΩ to 4.199 MΩ | ±10.0% rdg ±4 dgt | 3.4 V or less        |
| 42.00 MΩ | 4.00 MΩ to 41.99 MΩ  |                   |                      |

## Continuity Check

| Range   | Accuracy         | Threshold for buzzer sound | Open-circuit voltage |
|---------|------------------|----------------------------|----------------------|
| 420.0 Ω | ±2.0% rdg ±4 dgt | 50 Ω±40 Ω or less          | 3.4 V or less        |

\*1: Includes accuracy of CT6280 AC Flexible Current Sensor, ±1.0% rdg

\*2: Accuracy is not defined for a current of 1000 A or more or that of 5×10<sup>5</sup> A·Hz or more.