HIOKI

CT6872
CT6872-01

AC/DC CURRENT SENSOR

Instruction Manual

EN

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CT6872A961-00 21-12H

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HIOKI

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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 CT6872, CT6872-01 AC/DC Current Sensor. To ensure your ability to get the most out of this device 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).

Troubleshooting

- If the device seems to be malfunctioning, contact your authorized Hioki distributor or reseller.
- Store the device packaging material after opening the device. When shipping the device, use the box and packaging materials in which it was originally shipped.

Safety Information

⚠ DANGER

- **If the cable melts, metal parts could be exposed, posing a hazard. Keep the cable away from sources of heat.**
- **Connect the device to the secondary side of a distribution panel. If a short-circuit occurs on the secondary side of the distribution panel, the panel will interrupt the short-circuit current. Do not connect the device to the primary side of the distribution panel because an unrestricted current flow can damage the device and facilities if a short-circuit occurs.**

Do not use the device to measure bare conductors to which a voltage that exceeds the maximum rated line-to-ground voltage is being applied. Doing so could damage the device and cause bodily injury. If the voltage exceeds the maximum rated line to- ground voltage, measure it using an insulated wire with the appropriate level of insulation for the voltage in question.

⚠ WARNING

Do not place the cable in contact with the measured line. Any contact can cause the device to malfunction and lead to a short-circuit or electric shock.

⚠ CAUTION

- To prevent cable damage, do not step on cables or pinch them between other objects. Do not bend or pull on cables at their base.
- Do not place the device on an unstable table or uneven surface. Doing so could cause the device to fall or turn over, causing bodily injury or damage to the device.

- The cable is hardened in freezing temperatures. Do not bend or pull it to avoid tearing its shield or causing a break.
- When the power to lines to be measured is turned on or off, a current flowing through the lines can exceed considerably the maximum allowable current of the device. This could result in damage to the device. Make sure that there is not any over-current.
- Do not apply current to the lines to be measured while the device turned off. This could result in damage to the device.

Overview

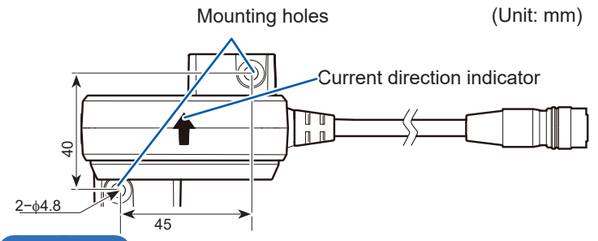
This pull-through current sensor has excellent frequency characteristics (amplitude, phase) and temperature characteristics (sensitivity, offset), which enables high-precision power measurement as well as current measurement.

Use with Other Hioki Products

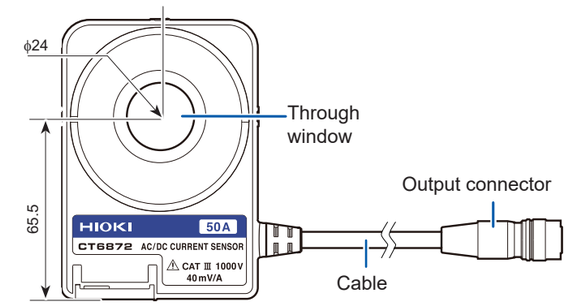
This device is used in connection with a dedicated instrument (Hioki product). Refer to combined accuracy and conditions specified in the specifications for details.

Name of Each Part

Top view



Front view



Measurement Procedure

For correct measurement, connect the device to a measuring instrument with an input impedance of 1 MΩ ±10%.

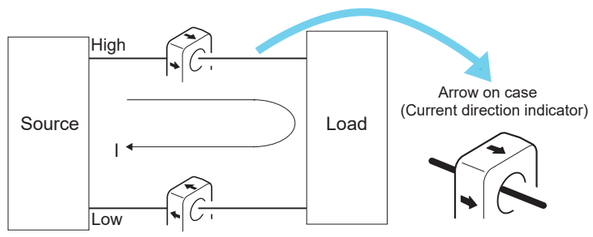
Inspection Before Use

Check the device for any damage that may have occurred during storage or shipping before use. If you find any damage to the device, please contact your authorized Hioki distributor or reseller for repair.

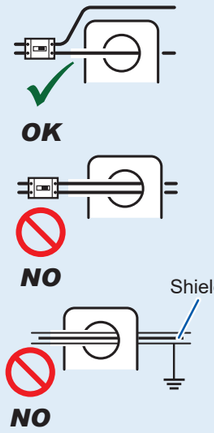
Check Items	Remedy
Is the device cracked or damaged?	If there is any damage, electric shock may result. Discontinue use and contact your authorized Hioki distributor or reseller.
Is the cable insulation torn?	
Is the cable broken at the base (of the connector or the sensor)?	Broken connections will make proper measurement impossible. Discontinue use and contact your authorized Hioki distributor or reseller.

Wiring

Make sure the direction of the arrow on the case matches the direction of the current flow, as shown in the figure below. If they are oriented incorrectly, the output signal from the sensor will be reversed. When using the device in combination with a power meter, conform to the power meter’s wiring method.



IMPORTANT



Pass only one conductor through the device.

Passing two or more of conductors in a bundle prevents the device from measuring any current regardless of whether the measurement target is a single-phase or three-phase circuit.

Ground-shielded conductors cannot be accurately measured.

- Arrange the conductor as close to the center of the through window as possible. For a current to be measured of frequency 1 kHz or more, the conductor position could cause increase in measured value error or distortion of output-signal waveforms.
- If a conductor not being measured carries a current of frequency 1 kHz or more, keep such conductor at least 100 mm away from the device. Failure to observe this could cause increase in measured value error or distortion of output signal waveforms.
- Use the device with its surface temperature of 105°C or less.

Options

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

CT9901 Conversion Cable

Connecting the CT9901 enables the device to connect to an instrument that does not support direct connection with the device (No accuracy is affected).

CT9902 Extension Cable

- Connecting a CT9902 enables the device cable to be extended by 5 m (max. 10 m).
- Up to two of the Extension Cable available (If three or more extension cables are connected to the device, its performance is not guaranteed.)
- Add the following to the sensor accuracy for each cable used:
  Amplitude accuracy: ± 0.1% of reading (DC ≤ f* ≤ 1 kHz)
  : ±(0.1 + 0.01 × f*)% of reading (1 kHz < f*)
  Phase accuracy: ±(0.03 × f*)° (1 kHz < f*)
  *: frequency

Phase Compensation Values

Enter the following compensation values (representative values) when performing phase compensation on the PW6001 or PW3390.
CT6872: 100 kHz, −1.28°
CT6872-01: 100 kHz, −2.63°

Specifications

Accuracy

Reading (displayed value):
Indicates the value displayed by the instrument. Limit values for reading errors are expressed as a percentage of the reading (“% of reading” or “% rdg”).

Range:
Indicates the instrument’s range. Limit values for range errors are expressed as a percentage of the range ("% of range" or "% rng").

Full scale (rated current):
Indicates the rated current. Limit values for full-scale errors are expressed as a percentage of full scale (“% of full scale” or “% f.s.”).

Operating environment	Indoor use, pollution degree 2, altitude up to 2000 m (6562 ft.)
Operating temperature and humidity range	−40°C to 85°C (−40°F to 185.0°F) 80% RH or less (non-condensing)
Storage temperature and humidity range	−40°C to 85°C (−40°F to 185.0°F) 80% RH or less (non-condensing)
Standards	Safety: EN 61010 EMC: EN 61326
Withstand voltage	7.4 kV AC (sensed current: 1 mA) 50 Hz/60 Hz for 1 minute, between through window and cable output terminal
Protection against mechanical impacts	IK07 (energy level: 2 J, test height defined in EN 61010 Safety requirements: 400 mm)
Power supply	Supplied from PW8001, PW6001, PW3390, CT9555, CT9556, CT9557, U8977, or external DC power supply Rated supply voltage: ±11.5 V to ±15 V (Tracking) Maximum rated current: ±150 mA (50 A/55 Hz measurement, ±12 V power supply)
Maximum rated power	4 VA (50 A/55 Hz measurement, ±12 V power supply)
Interface	Dedicated interface (ME15W)
Dimensions	Approx. 70W × 100H × 53D mm (2.76″W × 3.94″H × 2.09″D) (excluding protrusions and the cable)
Output cable length	CT6872: Approx. 3 m CT6872-01: Approx.10 m
Mounting hole diameter	ϕ4.8mm (M4 screw, recommended tightening torque: 1.2 N•m to 1.5 N•m)
Weight	CT6872: Approx. 370 g (13.1 oz.) CT6872-01: Approx. 690 g (24.3 oz.)
Product warranty duration	3 years
Accessories	Mark band ×6 Instruction Manual Operating Precautions (0990A907)
Options	CT9901 Conversion Cable CT9902 Extension Cable
Memory function	Sensor information can be read for products with memory function support. Applicable product: PW8001
Rated current	50 A AC/DC
Measurable conductor diameter	ϕ24 mm or less
Maximum input current	Not exceeding derating curve shown in Figure 1 However, a current of up to ±150 A peak (design value) is allowable for up to 20 ms at 40°C or less.
Output voltage	4 mV/A
Maximum rated line-to-ground voltage	1000 V (Measurement category III) Anticipated transient overvoltage: 8000 V
Output resistance	50 Ω ±10 Ω
Accuracy guarantee conditions	Accuracy guarantee duration: 1 year Accuracy guarantee duration 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 Warm-up time: at least 30 min Sine wave inputted, connected with measuring instrument with input resistance 1 MΩ ±10%, line-to-ground voltage: 0 V, no external magnetic field, conductor arranged at center of window

Measurement accuracy

Frequency	Amplitude ±(% of reading + % of full scale)	Phase
DC	0.03% + 0.002%	–
DC < f < 16 Hz	0.1% + 0.01%	±0.1°
16 Hz ≤ f < 45 Hz	0.05% + 0.01%	±0.08°
45 Hz ≤ f ≤ 66 Hz	0.03% + 0.007%	±0.05°
66 Hz < f ≤ 100 Hz	0.04% + 0.01%	±0.1°
100 Hz < f ≤ 500 Hz	0.06% + 0.01%	±0.15°
500 Hz < f ≤ 1 kHz	0.1% + 0.01%	±0.4°
1 kHz < f ≤ 5 kHz	0.15% + 0.02%	±0.4°
5 kHz < f ≤ 10 kHz	0.15% + 0.02%	±0.5°
10 kHz < f ≤ 1 MHz	(0.012 × f)% + 0.05%	± (0.04 × f) ±0.1°
Frequency range	10 MHz (±3 dB Typical)	–

- The variable f in accuracy equations is expressed in kHz.
- Accuracy of amplitude and phase is specified with 110% of full scale input or less and not exceeding derating curve in Figure 1.
  Accuracy in range of DC < f < 10 Hz are design value.
- Add ±0.01% of reading to amplitude accuracy when input is 100% of full scale to 110% of full scale.
- For Model CT6872-01, add the following values to accuracy in the range of 1 kHz < f ≤ 1 MHz.
  Phase accuracy: ±(0.015 × f)°

Linearity error[*1 *2]	±2 ppm Typical (23°C)
Offset voltage[*2]	±5 ppm Typical (23°C, no input)
Amplitude error[*3]	DC: ±7 ppm Typical 10 Hz to 100 Hz: ±0.005% Typical 100 Hz to 1 kHz: ±0.01% Typical 1 kHz to 50 kHz: ±0.1% Typical 50 kHz to 100 kHz: ±0.3% Typical 100 kHz to 300 kHz: ±1% Typical 300 kHz to 1 MHz: ±3% Typical

*1: Measuring the output voltage while cycling the input current (DC) from +50 A → 0 A→ −50 A → 0 A → +50 A at an interval of 10 A.
Defined as the difference between the regression line calculated from the above measurements and the measurement points.
*2: Defined as a percentage of the rated current.
*3: DC error is defined as (linearity error + offset voltage).
AC error is defined as deviation from the 55 Hz measurement point.

Output noise	300 µV rms or less (≤ 1 MHz)
Effects of temperature	Within the range of −40°C to 18°C or 28°C to 85°C Amplitude sensitivity: ±20 ppm of reading/°C Offset voltage: ±0.2 ppm of full scale/°C
Effects of magnetization	0.5 mA or less (input equivalent, after 50 A DC is inputted)
Common mode rejection ratio (CMRR)	150 dB or more (DC to 1 kHz) 140 dB or more (1 kHz to 10 kHz) 120 dB or more (10 kHz to 100 kHz) 100 dB or more (100 kHz to 1 MHz) (Effect on output voltage / common-mode voltage)
Effects of conductor position	DC: ±0.004% of reading or less (input current: 50 A) 50 Hz/60 Hz: ±0.005% of reading or less (input current: 50 A) 1 kHz: ±0.04% of reading or less (input current: 50 A) 10 kHz: ±0.04% of reading or less (input current: 50 A) 100 kHz: ±0.8% of reading or less (input current: 10 A) When wire of outer diameter 10 mm is used
Effects of radiated radio-frequency electromagnetic field	0.5% of full scale or less at 10 V/m
Effects of conducted radio-frequency electromagnetic field	0.1% of full scale or less at 10 V
Effects of external magnetic field	2 mA or less (input equivalent, under a magnetic field of 400 A/m, DC) 25 mA or less (input equivalent, under a magnetic field of 400 A/m DC or 400 A/m with 60 Hz)

Connectable products

1. PW8001 Power Analyzer

-1. U7001 Combined accuracy

Frequency	Current ±(% of reading + % of range)	Power ±(% of reading + % of range)	Phase
DC	0.05% + 0.052%	0.05% + 0.052%	U7001 accuracy + sensor accuracy
45 Hz ≤ f ≤ 66 Hz	0.05% + 0.057%	0.05% + 0.057%	
Bands other than DC and 45 Hz ≤ f ≤ 66 Hz	U7001 accuracy + sensor accuracy (Consider sensor rating for full scale error.)		

- For other measurement parameters, U7001 accuracy + sensor accuracy (consider sensor rating for full scale error).
- For the 1 A range or the 2 A range, add ±0.15% of range.
- Add accuracy according to each condition in specifications of the power analyzer and sensor.
- Defined after zero adjustment has been performed.

-2. U7005 Combined accuracy

Frequency	Current ±(% of reading + % of range)	Power ±(% of reading + % of range)	Phase
DC	0.05% + 0.032%	0.05% + 0.032%	U7005 accuracy + sensor accuracy
45 Hz ≤ f ≤ 66 Hz	0.04% + 0.027%	0.04% + 0.027%	
Bands other than DC and 45 Hz ≤ f ≤ 66 Hz	U7005 accuracy + sensor accuracy (Consider sensor rating for full scale error.)		

- For other measurement parameters, U7005 accuracy + sensor accuracy (consider sensor rating for full scale error).
- For the 1 A range or the 2 A range, add ±0.15% of range.
- Add accuracy according to each condition in specifications of the power analyzer and sensor.
- Defined after zero adjustment has been performed.

2. PW6001 Power Analyzer

Combined accuracy

Frequency	Current ±(% of reading + % of range)	Power ±(% of reading + % of range)	Phase
DC	0.05% + 0.032%	0.05% + 0.052%	PW6001 accuracy + sensor accuracy
45 Hz ≤ f ≤ 66 Hz	0.05% + 0.027%	0.05% + 0.037%	
Bands other than DC and 45 Hz ≤ f ≤ 66 Hz	PW6001 accuracy + sensor accuracy (Consider sensor rating for full scale error.)		

- For other measurement parameters, add PW6001 accuracy + sensor (consider sensor rating for full scale error).
- For the 1 A range or the 2 A range, add ±0.15% of range.
- Add accuracy according to each condition in specifications of the power analyzer and sensor.
- Defined after zero adjustment has been performed.

3. PW3390 Power Analyzer

Combined accuracy

Frequency	Current ±(% of reading + % of range)	Power ±(% of reading + % of range)	Phase
DC	0.08% + 0.072%	0.08% + 0.072%	PW3390 accuracy + sensor accuracy
45 Hz ≤ f ≤ 66 Hz	0.07% + 0.057%	0.07% + 0.057%	
Bands other than DC and 45 Hz ≤ f ≤ 66 Hz	PW3390 accuracy + sensor accuracy (Consider sensor rating for full scale error.)		

- For other measurement parameters, PW3390 accuracy + sensor accuracy (consider sensor rating for full scale error).
- For the 1 A range or the 2 A range, add ±0.15% of range.
- Add accuracy according to each condition in specifications of the power analyzer and sensor.
- Defined after zero adjustment has been performed.

4. CT9555, CT9556, CT9557 Sensor Unit

Combined accuracy
- Sensor accuracy is applicable (with output coaxial cable of length 1.6 m or less).
- Add sensor unit accuracy when RMS output or total output is used.
- Add accuracy according to each condition in specifications of the products to be connected and sensor.

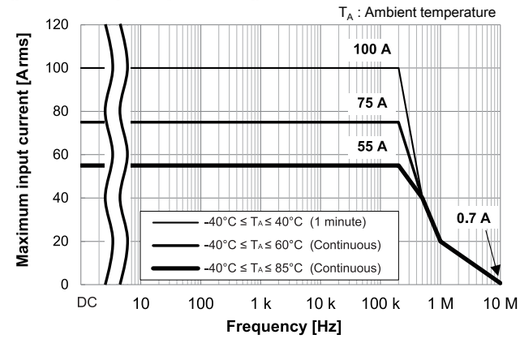
5. U8977 3CH Current Unit

Combined accuracy
- (U8977 accuracy) + (sensor accuracy)
- Add accuracy according to each condition in specifications of Memory HiCorder to be connected and sensor.
- Defined after zero adjustment has been performed.

6. 8971 Current Unit

Combined accuracy
- (8971 accuracy) + (sensor accuracy)
- Add accuracy according to each condition in specifications of Memory HiCorder to be connected and sensor.
- The 9318 Conversion Cable (accessory of 8971) and CT9901 are required.
- Defined after zero adjustment has been performed.

Figure 1. Frequency Derating Curve



Characteristics

Frequency characteristics (Typical)

CMRR (Typical)

Linearity error (Typical)