HIOKI

CT6830
CT6831
AC/DC CURRENT PROBE

Instruction Manual

EN

Dec. 2023 Revised edition 1
CT6830A961-01

600646361

HIOKI

www.hioki.com/

All regional contact information

HIOKI E.E. CORPORATION
81 Koizumi, Ueda, Nagano 386-1192 Japan

2309 EN
Edited and published by HIOKI E.E. CORPORATION
Printed in Japan

Europe only
・EU declaration of conformity can be downloaded from our website.
・Contact in Europe: HIOKI EURPOPE GmbH
Helfmann-Park 2, 65760 Eschborn, Germany hioki@hioki.eu

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 CT6830, CT6831 AC/DC Current Probe. To ensure that you get the most out of this device over the long term, please read this manual carefully and keep it available for future reference.
Please review the separate Current Sensor Operating Precautions before using this device.
When you receive the device, inspect it to confirm that no damage occurred during shipment. If you find any damage or discover that the device does not perform as indicated in the specifications, please contact your authorized Hioki distributor or reseller.

Latest version of instruction manual

The information in this manual is subject to change for reasons such as product improvements and specification changes.
The latest version can be downloaded from Hioki's website.
https://www.hioki.com/global/support/download/

Overview

The CT6830 and CT6831 are clamp current sensors that can perform highly precise measurements of AC and DC currents of up to 2 A and 20 A, respectively. Both devices have excellent frequency (amplitude and phase) and temperature (sensitivity and offset) characteristics, and can be used for current measurement and high-precision power measurement.

Precautions

Observe the following precautions to ensure safe use of the device and effective use of its functions.

⚠ DANGER

- **Do not cause a short-circuit between the two wires in the measurement line with the metallic part of the tip of the sensor.**
Doing so may cause an arc flash, resulting in serious bodily injury or damage to the device or other equipment.
- **Do not measure any current in excess of the maximum input current.**
Doing so may cause overheating of the sensor, resulting in bodily injury, fire, or damage to the device. Maximum input current values can be confirmed from the Frequency derating curve (Fig. 1).
- **Do not use the device to measure bare conductors.**
- **Only perform measurement of insulated wires where there is sufficient insulation for the circuit voltage.**
Failure to do so can cause serious bodily injury or a short-circuit.

- **Check that the cable insulation is not damaged and that the conductors in the cables are not exposed before use.**
Use with a damaged cable may lead to serious bodily injury.
Contact your authorized Hioki distributor or reseller for repair.

⚠ WARNING

- **If you have not previously used electrical measuring instruments, ensure adequate supervision by a technician who has experience in electrical measurement.**
Failure to do so may cause the operator to experience an electric shock. It may also cause serious events such as heat generation, fire, or arc flash due to a short-circuit.

⚠ CAUTION

- **Do not step on cables or allow them to become caught between other objects.**
Doing so may damage the insulation, and cause the operator to experience an electric shock.
- **Do not touch the cores while the jaws are open.**
If the cores are subject to static electricity, the device may be damaged.
- **Do not touch the jaws during the measurement.**
Even when the jaws are closed, if static electricity is applied, it could cause the device to malfunction.
- **Do not connect or disconnect connectors while the device being connected is powered on.**
Doing so may damage this device or the connected device.
- **Do not apply current to the device while it is turned off.**
Doing so may damage the device.
- **Do not subject the device to vibration or mechanical shock while transporting or handling it.**
- **Do not drop the device.**
Doing so may damage the device.
- **Do not bend or pull on a cable at temperatures of 0°C or lower.**
Low temperature conditions can cause a cable to harden. Bending or pulling a cable under these conditions may damage the insulation or cause a wire break, resulting in an electric shock.

- **Keep the jaws locked when the device is not in use.**
Leaving the jaws unlocked may allow dust or dirt to settle on the facing core surfaces, resulting in failure of the device.
- **Check that there is no overcurrent.**
Current that significantly exceeds the maximum input current of the device may flow when the equipment being measured is turned on and off, resulting in failure of the device.

IMPORTANT

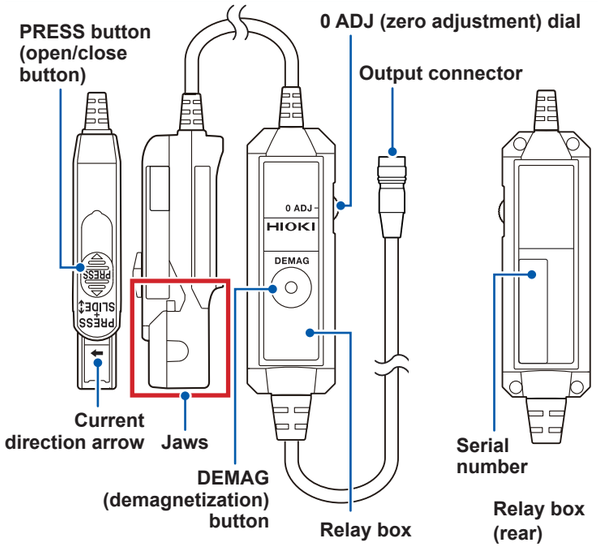
- Do not place any foreign object between the jaw tips or insert any foreign object into the gap of the jaws. Failure to do so may cause the sensor characteristics to worsen or lead to problems with clamp opening/closing operation.
- Do not drop the device or subject it to mechanical shock. Doing so could damage the facing core surfaces of the jaws, and adversely affect measurement.

The device is classified as a Class A product under the EN 61326 standard. Use of the device in a residential setting may interfere with reception of radio and television broadcasts. If this occurs, take appropriate steps to counteract the issue.

Symbols on equipment

Indicates that the device can only be used at a location on an insulated wire with sufficient insulation for the circuit voltage.

Part Names



Option

The optional equipment listed below is available for the device. To purchase optional equipment, please contact your authorized Hioki distributor or reseller. Option is subject to change. Check Hioki's website for the latest information.

CT9902 Extension Cable (up to two cables can be connected together)

Phase Compensation Values

For phase compensation of the PW6001 or PW3390, enter the following compensation values (typical):

	Frequency	Phase compensation value
CT6830	10 kHz	−6.9°
CT6831	10 kHz	−4.4°

The PW8001 automatically sets the phase compensation value, so it does not need to be entered manually.

Maintenance and Service

If the device malfunctions, contact your authorized Hioki distributor or reseller.

⚠ CAUTION

Observe the following when shipping the device.
- **Remove optional equipment from the device.**
- **When requesting repair, include a description of the malfunction.**
- **Double-pack the device.**
Failure to do so could cause damage during shipment.

Cleaning

⚠ CAUTION

- **If the device becomes dirty, wipe it clean with a soft cloth moistened with water or a neutral detergent.**
Never use solvents such as benzene, alcohol, acetone, ether, ketone, thinners, or gasoline, and do not wipe with excessive force. Doing so could cause deformation or discoloration of the device.

Calibration

The appropriate schedule for calibration depends on factors such as the operating conditions and environment. Determine the appropriate calibration interval based on your operating conditions and environment and have Hioki calibrate it accordingly.

Measuring Current

Inspecting the device before use

Before use, check the device for malfunctions or damage and check its operation. If you find any malfunction or damage, contact your authorized Hioki distributor or reseller.

Inspection item	Solution
Damage to cable insulation	If there is any damage to the cable insulation, request repair and do not use the device. Doing so could cause an electric shock.
Jaw crack or damage	

⚠ CAUTION

- **Do not place any conductor that can carry a current with a frequency of 10 kHz or higher near the jaws.**
Even if the device is not clamped around a conductor, a nearby conductor carrying a high frequency current may cause the temperature of the jaws to rise and damage the device due to self-heating.

The signal output circuit of the device includes protective resistance (output resistance). Use a measuring instrument, such as a digital multimeter, with high input resistance to monitor the output signal. (1 MΩ or more is recommended.)

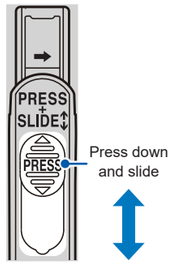
Procedure

1. **Connect the device to a measuring instrument that is powered off.**
2. **Turn on the measuring instrument.**
3. **If required, perform demagnetization (DEMAG) and zero adjustment (0 ADJ).**

   See “Demagnetization (DEMAG) and zero adjustment (0 ADJ).”
4. **Open the jaws.**

   Press down and slide the PRESS button.
5. **Close the jaws.**

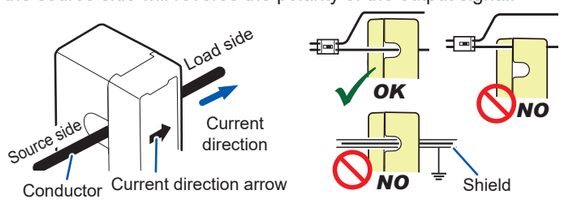
   Clamp the device around one conductor only, then press down and slide the PRESS button to close the jaws.



IMPORTANT

Clamp the device around only one conductor. Clamping the device around two or more conductors in a bundle prevents the device from measuring current, regardless of whether the measurement target is a single-phase or three-phase circuit.

Clamping the device with the current direction arrow pointing to the source side will reverse the polarity of the output signal.



6. **Start measurement.**
7. **Remove the device from the conductor after measurement has finished.**
8. **Turn the measuring instrument off and disconnect the device from the measuring instrument.**

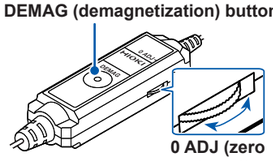
Demagnetization (DEMAG) and zero adjustment (0 ADJ)

Immediately after the device is turned on or if a current exceeding the rated current is input, the device will output an offset. The offset will cause an error in DC current measurement, so perform demagnetization and zero adjustment as follows:

1. **Close the jaws with no input and press the DEMAG (demagnetization) button.**

   Wait at least 1 second.
2. **Open and close the jaws several times, and then close them.**
3. **Check the offset output displayed on the measuring instrument and turn the 0 ADJ (zero adjustment) dial on the device to perform zero adjustment.**

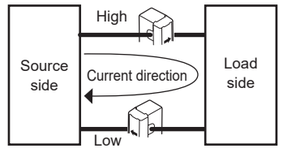
DEMAG (demagnetization) button



0 ADJ (zero adjustment) dial

- Zero adjustment cannot be performed while a current is being input.
- The offset output varies depending on the ambient temperature and surrounding environment, such as terrestrial magnetism and equipment that generates magnetic fields. Perform zero adjustment at the location where you will measure current.
- If the connected measuring instrument has a zero-correction function, perform zero correction on the connected instrument. In such cases, set the 0 ADJ dial on the device so that the value is roughly in the middle of the values displayed when the dial is fully turned to the maximum and minimum positions.

- Mechanical shocks such as dropping the device may cause the offset to shift.
- If zero adjustment is unsuccessful, perform demagnetization (DEMAG) several times with the jaws closed.
- When measuring a DC or low-frequency (1 kHz or less) small current, the sensitivity of the device can be increased by wrapping the conductor around the jaws several times. If the conductor is wrapped around the jaws 10 times, the device will output a signal that is 10 times the measured current.
- Measurement of high-frequency current is susceptible to common-mode noise if the device is clamped to the high-potential side of a circuit. If common-mode noise occurs, clamp the device to the low-potential side of the circuit.



- When measuring a high-frequency (1 kHz or more) large current, the conductor position may increase measurement errors or distort the waveform. Place the conductor to be measured as close as possible to the center of aperture of the jaws. Nearby conductors other than the one around which the device is clamped that are carrying high-frequency (1 kHz or more) large currents may increase measurement errors or distort the waveform. Keep the device as far away as possible from other conductors during measurement.
- Do not use the device to measure conductors with surface temperatures that exceed 85°C.

Specifications

Accuracy notations

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

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

Operating environment	Indoor use, pollution degree 2, altitude up to 2000 m (6562 ft.)
Operating temperature and humidity range	Sensor: −40°C to 85°C (−40°F to 185°F), 80% RH or less (non-condensing) Relay box: −25°C to 50°C (−13°F to 122°F), 80% RH or less (non-condensing)
Storage temperature and humidity range	−25°C to 50°C (−13°F to 122°F), 80% RH or less (non-condensing) (Sensor + relay box)
Standards	Safety: EN 61010 EMC: EN 61326 Class A
Power supply	Power supplied from Hioki instruments with a ME15W connector (see “Function specifications”) Rated supply voltage: ±11 V to ±15 V (tracking) Maximum rated current: (Approx. 100 mA peak when demagnetized for approx. 1 second) CT6830: ±30 mA (during measurement of 2 A current with 55 Hz, when ±12 V power is supplied) CT6831: ±70 mA (during measurement of 20 A current with 55 Hz, when ±12 V power is supplied) Maximum rated power: CT6830: 0.5 VA or less (during measurement of 2 A current with 55 Hz, when ±12 V power is supplied) CT6831: 1 VA or less (during measurement of 20 A current with 55 Hz, when ±12 V power is supplied) Normal power consumption (reference, with approx. 50% input): CT6830: 0.24 VA, CT6831: 0.42 VA
Memory function	Instruments with a memory function can load the sensor information of the device. Compatible model: PW8001
Interface	Dedicated interface (ME15W)
Dimensions	Sensor: Approx. 76.5W × 23.4H × 14.2D mm (3.0W × 0.9H × 0.6D in.) Relay box: Approx. 80W × 20H × 26.5D mm (3.2W × 0.8H × 1.0D in.) (excluding protrusions and cable)
Dimensions of jaws	Approx. 18.2H × 11.5D mm
Output cable length	Approx. 4 m (between sensor and relay box) Approx. 0.2 m (between relay box and output connector)
Weight	Approx. 160 g (5.6 oz.)
Product warranty duration	3 years (excluding the jaws and cable)
Included accessories	Color labels (for channel identification), carrying case, Instruction Manual, Current Sensor Operating Precautions (0990A901)
Option	See “Option”.
Rated current	CT6830: 2 A AC/DC, CT6831: 20 A AC/DC
Maximum input current	CT6830: 3 A rms continuous (±4.3 Ap) CT6831: 30 A rms continuous (±43 Ap) Not exceeding frequency derating curve shown in Figure 1
Output voltage	CT6830: 1 V/A, CT6831: 0.1 V/A
Measurement method	Flux-gate-type zero-flux current sensor
Output resistance	50 Ω ±10 Ω
Measurable conductor diameter	ϕ5 mm (0.2 in.) or less
0 ADJ dial range	CT6830: ±8 mV typ. (±8 mA typ. when converted to input current) CT6831: ±0.8 mV typ. (±8 mA typ. when converted to input current)
DEMAG function	Operation time approx. 1 second
Accuracy guarantee conditions	Accuracy guarantee duration: 1 year or 10000 cycles of opening and closing, whichever comes first Accuracy guarantee temperature and humidity range: 0°C to 40°C (32°F to 104°F), 80% RH or less No warmup required. Input: sine wave or DC; connected to a measuring instrument with an input resistance of 1 MΩ ±10%; line-to-ground voltage: 0 V; no external magnetic field; a conductor located at the aperture center

Measurement accuracy

Frequency	Amplitude ± [(% of reading) + (% of full scale)]		Phase
	CT6830	CT6831	
DC	0.3% + 0.10%	0.3% + 0.10%	—
DC < f ≤ 66 Hz	0.3% + 0.05%	0.3% + 0.01%	±0.1°
66 Hz < f ≤ 500 Hz	0.3% + 0.05%	0.3% + 0.02%	±0.7°
500 Hz < f ≤ 1 kHz	0.5% + 0.05%	0.5% + 0.05%	±2.0°
1 kHz < f ≤ 5 kHz	1.0% + 0.10%	1.0% + 0.10%	±7.0°
5 kHz < f ≤ 10 kHz	5.0% + 0.10%	5.0% + 0.10%	±15.0°
10 kHz < f ≤ 100 kHz	30.0% + 0.10%	30.0% + 0.10%	—

- DC accuracy is defined after the offset voltage has been regulated at ±0.5 mV or less and after zero adjustment has been performed on the measuring instrument.
- The amplitude and phase accuracy are defined for an input current not more than a current of 110% of full scale and within the derating range (Fig. 1). However, the design value is defined for the frequency range of DC < f < 10 Hz.
- An offset voltage of ±0.005% of the full scale per degree Celsius is added from the ambient temperature during zero adjustment (CT6830 only)

Output noise	CT6830: 5 mV rms or less (5 mA rms or less when converted to input current), ≤ 100 kHz CT6831: 5 mV rms or less (50 mA rms or less when converted to input current), ≤ 100 kHz
Effects of temperature	The following values are added to the measurement accuracy if operating temperatures are outside the guaranteed accuracy temperature range. Sensor: Ambient temperature −40°C to 0°C or 40°C to 85°C Relay box: Ambient temperature −25°C to 0°C or 40°C to 50°C Amplitude: ±0.01% of reading per degree Celsius Offset: CT6830: ±0.05% of full scale per degree Celsius CT6831: ±0.01% of full scale per degree Celsius
Effects of magnetization	CT6830: 1 mV or less (1 mA or less when converted to input current, after input of 2 A DC) CT6831: 0.2 mV or less (2 mA or less when converted to input current, after input of 20 A DC)
Common-mode voltage rejection ratio (CMRR)	DC to 100 Hz: 140 dB or more 100 Hz to 1 kHz: 130 dB or more
Effects of conductor position	DC to 100 Hz: ±0.1% of reading or less (CT6830: 2 A input, CT6831: 20 A input) For a conductor 2 mm in diameter
Effects of external magnetic fields	CT6830: 20 mV or less (20 mA or less when converted to input current, DC or 60 Hz magnetic field of 400 A/m) CT6831: 2 mV or less (20 mA or less when converted to input current, DC or 60 Hz magnetic field of 400 A/m)
Effects of radiated radio-frequency electromagnetic field	30% of full scale at 10 V/m
Effects of conducted radio-frequency electromagnetic field	30% of full scale at 10 V/m

Function specifications

	Combined accuracy and conditions
Options	CT9902 Extension Cable • Up to two cables can be connected together. Accuracy is not guaranteed if additional cables are connected. • Add the following accuracy per cable. Amplitude accuracy: ±0.1% of reading (DC ≤ f ≤ 1 kHz) ±0.5% of reading (1 kHz < 10 kHz) Phase accuracy: ±(0.1 × f kHz) ° (1 kHz < 10 kHz) f = frequency
Compatible instrument	PW8001 Power Analyzer Combined accuracy (I, P, θ) = PW8001 (U7001/U7005) accuracy + sensor accuracy CT6830: 40 mA, 80 mA, 200 mA, 400 mA, 800 mA, 2 A (range) CT6831: 400 mA, 800 mA, 2 A, 4 A, 8 A, 20 A (range) Full-scale error calculated based on sensor rating. Defined after zero adjustment. Phase compensation function with memory function is available.
	PW6001 Power Analyzer Combined accuracy (I, P, θ) = PW6001 accuracy + sensor accuracy CT6830: 40 mA, 80 mA, 200 mA, 400 mA, 800 mA, 2 A (range) CT6831: 400 mA, 800 mA, 2 A, 4 A, 8 A, 20 A (range) Full-scale error calculated based on sensor rating. Defined after zero adjustment. Upgrade to V3.04 or later is required when using CT6830.
	PW3390 Power Analyzer Combined accuracy (I, P, θ) = PW3390 accuracy + sensor accuracy CT6830: 40 mA, 80 mA, 200 mA, 400 mA, 800 mA, 2 A (range) CT6831: 400 mA, 800 mA, 2 A, 4 A, 8 A, 20 A (range) Full-scale error calculated based on sensor rating. Defined after zero adjustment. Upgrade to V2.10 or later is required when using CT6830.
	CT9555, CT9556, CT9557 Sensor Unit Combined accuracy (wave output) = sensor accuracy Add the sensor accuracy to the accuracy of sensor unit when RMS or total output is used. The accuracy addition under each condition as defined in the specifications of the measuring instrument and the sensor will also apply.
	U8977 3CH Current Unit Combined accuracy = U8977 accuracy + sensor accuracy No wave output or additional accuracy The accuracy addition under each condition as defined in the specifications of the Memory HiCorder and sensor will also apply. Recorder must be CT6830-compatible.

Fig. 1. Frequency derating curve.

T_A : Ambient temperature