

CT6590

SENSOR UNIT

Instruction Manual

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HIOKI

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The Declaration of Conformity for instruments that comply to CE mark requirements may be downloaded from the HIOKI website.

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 one (1) year 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 Model CT6590 Sensor Unit. To obtain maximum performance from the device, please read this manual first, and keep it handy for future reference.

Initial Inspection

When you receive the device, inspect it carefully to ensure that no damage occurred during shipping. In particular, check the accessories, panel switches, and connectors. If damage is evident, or if it fails to operate according to the specifications, contact your authorized Hioki distributor or reseller.

Safety

This manual contains information and warnings essential for safe operation of the device and for maintaining it in safe operating condition. Before using it, be sure to carefully read the following safety precautions.

⚠ WARNING

This device is designed to comply with IEC 61010 Safety Standards, and has been thoroughly tested for safety prior to shipment. However, mishandling during use could result in injury or death, as well as damage to the device. Using the device in a way not described in this manual may negate the provided safety features. Be certain that you understand the instructions and precautions in the manual before use. We disclaim any responsibility for accidents or injuries not resulting directly from device defects.

Safety Symbols

	In the manual, the symbol indicates particularly important information that the user should read before using the device. The symbol printed on the device indicates that the user should refer to a corresponding topic in the manual (marked with the symbol) before using the relevant function.
	Indicates DC (Direct Current).

The following symbols in this manual indicate the relative importance of cautions and warnings.

	Indicates that incorrect operation presents an extreme hazard that could result in serious injury or death to the user.
	Indicates that incorrect operation presents a significant hazard that could result in serious injury or death to the user.
	Indicates that incorrect operation presents a possibility of injury to the user or damage to the device.
	Indicates advisory items related to performance or correct operation of the device.

Symbols for Various Standards

	WEEE marking: This symbol indicates that the electrical and electronic appliance is put on the EU market after August 13, 2005, and producers of the Member States are required to display it on the appliance under Article 11.2 of Directive 2002/96/EC (WEEE).
	This symbol indicates that the product conforms to safety regulations set out by the EC Directive.

Accuracy

We define measurement tolerances in terms of f.s. (full scale) and rdg. (reading) values, with the following meanings:

rdg. (reading or displayed value)	The value currently being measured and indicated on the measuring device.
f.s. (maximum display value or scale length)	The maximum displayable value or scale length. This is usually the name of the currently selected range.

Operating Precautions



Follow these precautions to ensure safe operation and to obtain the full benefits of the various functions.

Installation Environment

Avoid the following locations that could cause an accident or damage to the instrument.

	Exposed to direct sunlight Exposed to high temperature		In the presence of corrosive or explosive gases
	Exposed to water, oil, other chemicals, or solvents Exposed to high humidity or condensation		Near induction heating systems (e.g., high-frequency induction heating systems and IH cooking utensils)
	Exposed to strong electromagnetic fields Near electromagnetic radiators		Operating temperature and humidity range: See specifications. Storage temperature and humidity range: See specifications.

⚠ DANGER

To prevent electric shock, do not allow sensor outputs or the sensor case to come into contact with high voltages.

⚠ CAUTION

To avoid damage to the device, protect it from physical shock when transporting and handling. Be especially careful to avoid physical shock from dropping.

Preliminary Checks

Before using the device for the first time, verify that it operates normally to ensure that no damage occurred during storage or shipping. If you find any damage, contact your authorized Hioki distributor or reseller.

Specifications

General Specifications

Compatible sensors	CT9691, CT9692, CT9693 Clamp on AC/DC Sensor and the 9691, 9692, 9693 Clamp On AC/DC Sensor (Model 9691, 9692, 9693: no phase definition)
Clamp sensor output ranges	Switchable between 2 ranges (see table)
Accuracy guarantee for temperature and humidity	23°C ± 5°C (73°F ± 9°F), 80%RH or less (no condensation)
Guaranteed accuracy period:	1 year
Amplitude accuracy	± 0.5% rdg. ± 0.5 mV (DC ≤ f ≤ 1kHz, (DC < f < 5 Hz is design value))
Phase accuracy	± 0.2 deg. (f ≤ 66 Hz, (DC < f < 10 Hz is design value))
Operating temperature and humidity range	-10°C to 40°C (14°F to 104°F), 80%RH or less (no condensation) 40°C to 45°C (104°F to 113°F), 60%RH or less (no condensation) 45°C to 50°C (113°F to 122°F), 50%RH or less (no condensation) (When using batteries, depends on battery specifications.)
Storage temperature range	-20°C to 60°C (-4°F to 140°F), 80%RH or less (no condensation), excluding batteries
Location for use	Indoor, pollution degree 2, altitude up to 2000 m (6566 feet)
Power supply	Two LR06 alkaline batteries, optional AC adapter, or 5 V to 15 VDC external power
Rated power supply voltage	When using batteries: 1.5 V DC × 2 When using AC adapter or external DC power supply: 5 V to 15 V DC (Voltage fluctuations of ±10% from the rated supply voltage are taken into account.)
Maximum rated power	When using batteries: 1 VA When using AC adapter or external DC power supply: 1.5 VA
Continuous operating time (Battery)	Approx. 25 hours (23°C, continuous use while connected to CT9691 to CT9693)
Output Impedance	50 Ω (±5%)
Output cable length	Approx. 1000 mm (39.37")
Dimensions	Approx. 36W×120H×34D mm Approx. 1.42"W×4.72"H×1.34"D (excluding protruding parts)
Mass	Approx. 165 g (5.8 oz.) (including batteries)
Accessories	• Two LR06 alkaline batteries • Instruction manuals (Japanese/English/Chinese) one each • Connector cover
Options	9445-02 AC Adapter 9445-03 AC Adapter
Applying standards	Safety EN61010 EMC EN61326, EN61326-2-2, EN61000-3-2, EN61000-3-3

Clamp Sensor Combination Specifications

Refer to "Specifications" in the clamp sensor instruction manual.

Output rates and ranges

	CT9691 sensor	CT9692 sensor	CT9693 sensor
H	Range (f.s.)	100 A	200 A
	Output rate	1 mV/A	1 mV/A
L	Range (f.s.)	10 A	20 A
	Output rate	10 mV/A	10 mV/A
Output (f.s.)	100 mV	200 mV	200 mV

CT9691 sensor combination accuracy

Frequency	DC	DC < f ≤ 66 (Hz)	66 < f ≤ 500 (Hz)
Continuous input	I ≤ 80 (A)	±1.5%rdg. ±1%f.s.	±1.5%rdg. ±1%f.s.
	80 < I ≤ 100 (A)	±1.5%rdg. ±0.5%f.s.	±1.5%rdg. ±0.5%f.s.
Phase	-	±2deg.	Not defined.

CT9692 sensor combination accuracy

Frequency	DC	DC < f ≤ 66 (Hz)	66 < f ≤ 1k (Hz)
Continuous input	I ≤ 200 (A)	±1.5%rdg. ±0.5%f.s.	±1.5%rdg. ±0.5%f.s.
	-	±2deg.	Not defined.

CT9693 sensor combination accuracy

Frequency	DC	45 ≤ f ≤ 66 (Hz)	DC < f < 45, 66 < f ≤ 1k (Hz)
Continuous input	I ≤ 1800 (A)	±2.0%rdg. ±0.5%f.s.	±1.5%rdg. ±0.5%f.s.
	1800 < I ≤ 2000 (A)	±2.5%rdg. ±0.5%f.s.	±2.5%rdg. ±0.5%f.s.
Phase	-	±2deg.	DC < f < 45 Hz: ±2deg. 66 < f ≤ 1k (Hz): Not defined.

Measuring instrument with an input resistance of 1 MΩ or higher with sine wave input measured with the conductor centered and input less than or equal to the rated value and within the derating range DC < f < 5 Hz is design value for amplitude accuracy. DC < f < 10 Hz is design value for phase accuracy.

Display

POWER LED display LED green: Power on
LED red: Low battery (when using battery power)

Maintenance and Service

Cleaning

To clean the device, wipe it gently with a soft cloth moistened with water or mild detergent. Never use solvents such as benzene, alcohol, acetone, ether, ketones, thinners or gasoline, as they can deform and discolor the case.

Troubleshooting

If the unit seems to be malfunctioning, check the following table before taking it to your dealer.

Issue	Items to check /issue cause	Solution
The POWER LED does not turn green when the toggle switch is set to a position other than "OFF."	• If the LED does not light up, there is no battery power remaining. • If the LED turns red, there is only a little battery power remaining.	• Replace the batteries. • Replace the batteries soon.
The measuring instrument is not displaying a current value.	Is the BNC connector securely connected to the instrument?	If the instrument does not display the value even when the sensor unit is properly connected, have the sensor unit and clamp sensor repaired.
The measuring instrument is displaying a value even though nothing is being measured.	Has zero-adjustment been performed for the unit?	If the instrument fails to display a value close to 0 A even after zero-adjustment is performed, have the sensor unit and clamp sensor repaired.

Repair

⚠ WARNING

Do not attempt to modify, disassemble or repair the device; as fire, electric shock and injury could result.

Transporting Precautions

When sending the device for repair, remove the batteries and pack carefully to prevent damage in transit. Include cushioning material so the device cannot move within the package. Be sure to include details of the problem. Hioki cannot be responsible for damage that occurs during shipment.

Storage

⚠ CAUTION

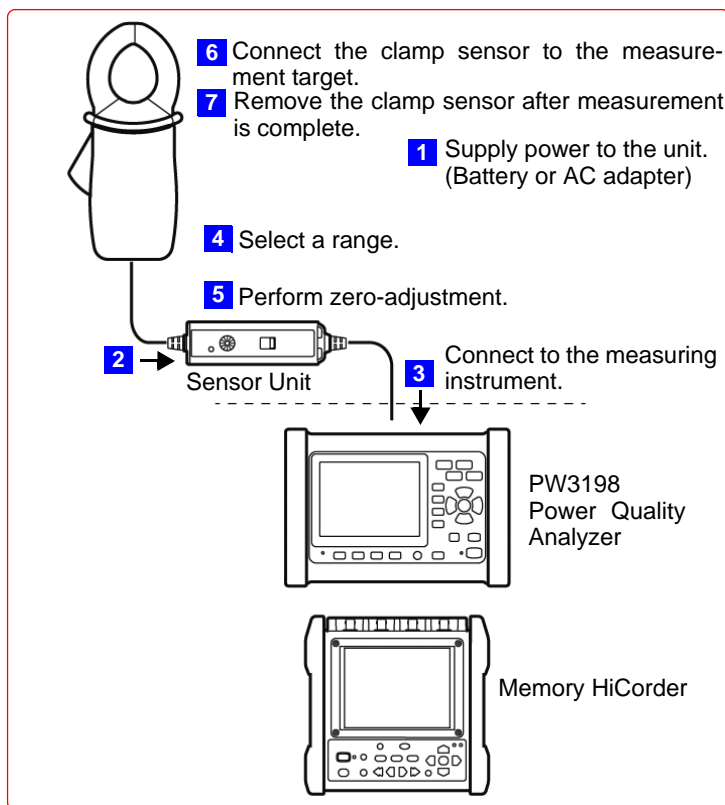
To avoid corrosion and damage to this device from battery leakage, remove the batteries from the device if it is to be stored for a long time (1 week or more).

Disposal

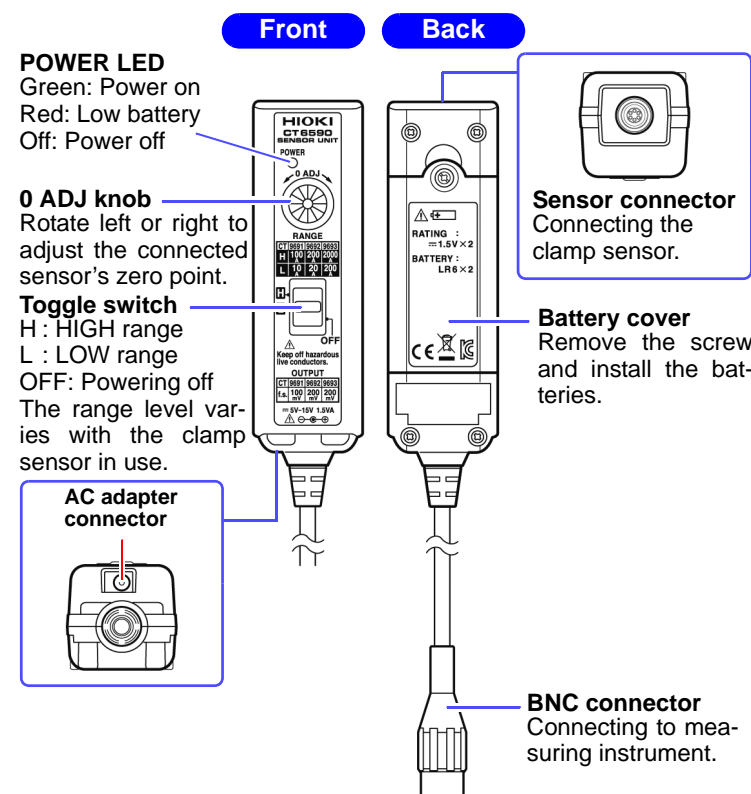
When disposing of the unit, do so in accordance with all applicable local regulations.

Overview

- The CT6590 Sensor Unit is used to connect a CT9691, CT9692, or CT9693 Clamp-on AC/DC Sensor to a measuring instrument, which may be a PW3198 Power Quality Analyzer, Memory HiCorder, oscilloscope, or other device.
- Current is measured with the clamp sensor, which converts the reading and outputs it as a voltage signal.
- To perform measurements, connect the sensor unit to the instrument and correct any output deviation with the unit's zero-adjustment knob.



Names of Parts



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Pre-Operation Inspection

Perform the following inspection before starting measurement:

No.	Inspection step (Continue inspection if OK.)	Corrective action (Perform when unit fails inspection.)
1	Is there any wiring break in the unit or clamp sensor connectors or at the base of the connectors on the sensor side?	
2	Is there any damage to insulation on unit or clamp sensor cables? Is any metal exposed?	You will not be able to perform proper measurement. Cease use and contact your dealer.
3	Is there any damage to the unit or clamp sensor?	
4	(When using the AC adapter) Is there any damage to the AC adapter?	
5	Does the POWER LED turn green when the toggle switch is set to a position other than "OFF"?	If the LED turns red, there is little battery power remaining. Replace the batteries soon. If the LED does not turn on at all, there is no battery power remaining. Replace the batteries.

Measurement Procedures

1 Supply power to the unit.

The unit can be powered using batteries (which are included) or an AC adapter (option). Use the AC adapter when operating the unit continuously for an extended period of time.

Installing (or Replacing) the batteries

WARNING

- After replacing the batteries, replace the battery cover and screws before using the device.
- Battery may explode if mistreated. Do not short-circuit, recharge, disassemble or dispose of in fire.
- Handle and dispose of batteries in accordance with local regulations.

CAUTION

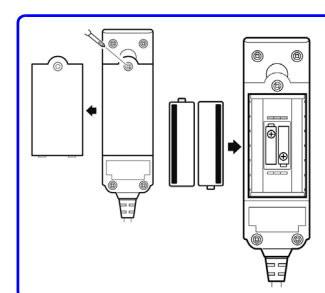
- Do not mix old and new batteries, or different types of batteries. Also, be careful to observe battery polarity during installation. Otherwise, poor performance or damage from battery leakage could result.
- Replace batteries only with the specified type.

NOTE

- When the POWER LED turns red, there is little battery power remaining. Replace the batteries soon.
- When using the AC adapter and batteries at the same time, the AC adapter takes precedence. Switching between the AC adapter and battery power during measurement may cause interference in the output.

Install the batteries using the following procedure:

(Required items: two LR6 alkaline batteries, One Phillips head screwdriver)



- Place the toggle switch in the "OFF" position.
- Using a Phillips head screwdriver, remove the battery cover screw and remove the battery cover.
- Insert the batteries, exercising care to orient them properly.
- Reattach the battery cover and tighten the screw with the screwdriver.

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Connecting the AC adapter

WARNING

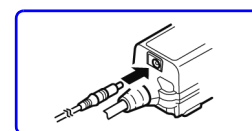
Before turning the device on, make sure the supply voltage matches that indicated on the AC adapter. Connection to an improper supply voltage may damage the device or AC adapter and present an electrical hazard.

CAUTION

Avoid using an uninterruptible power supply (UPS) or DC/AC inverter with rectangular wave or pseudo-sine-wave output to power the instrument. Doing so may damage the instrument.

Connect the AC adapter using the following procedure:

Use either the specified HIOKI AC adapter.



- Insert the AC adapter plug into the unit's AC adapter jack.
- Plug the AC adapter into an outlet.

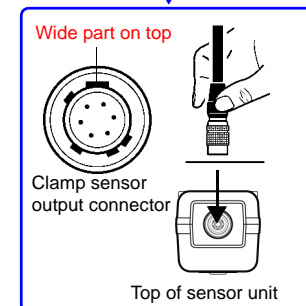
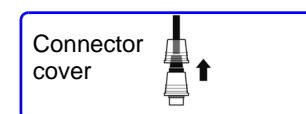
2 Connect a clamp sensor to the sensor unit.

CAUTION

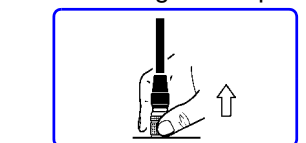
To avoid damaging the output cable, grasp the connector, not the cable, when unplugging the cable.

NOTE

Use only the specified clamp sensors. Using a non-specified instrument may result in damage to the instrument or the unit.



Removing the output connector



- If the included connector cover is attached to the clamp sensor's output connector, slide it up the cable.
- Gripping the **black part of the connector**, insert it into the jack. Orient the connector so the wide part is facing up and insert it until you hear it click into place.
- Return the connector cover.

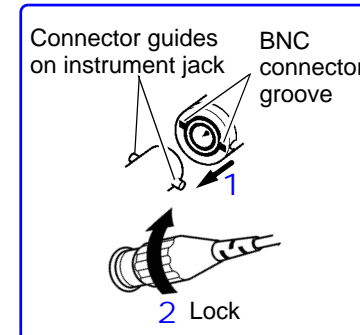
3 Connect the sensor unit to the measuring instrument.

CAUTION

- When disconnecting the BNC connector, be sure to release the lock before pulling off the connector. Forcibly pulling the connector without releasing the lock, or pulling on the cable, can damage the connector.
- To avoid damage to the device, do not short-circuit the connector and do not input voltage to the connector.

Connect the sensor unit's BNC connector to the clamp sensor connector on the measuring instrument.

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- Align the groove on the unit's BNC connector with the connector guides on the instrument's jack and insert the connector.
- Turn the connector clockwise to lock it in place. (To disconnect the connector, turn it counterclockwise to unlock it and then pull.)

4 Select a range with the toggle switch.

Instruments that allow the clamp sensor to be selected by model number (PW3198, some Memory HiCorders, etc.)

- Select the clamp sensor model number and range on the instrument's setting screen. Version 1.05 and older PW3198 models will not display the unit's model number. Check Hioki's website for instructions on how to upgrade your instrument.
- Select the unit's range so that it matches the instrument's settings.

Instruments that do not allow the clamp sensor to be selected by model number

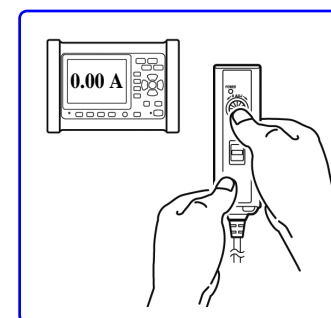
Referring to the "Output rates and ranges" table, select the best range for the instrument. Voltage will be output relative to the input current. For example, if you select the L range for the CT9691, 100 mV will be output for 10 A of current.

Output rates and ranges

		CT9691 sensor	CT9692 sensor	CT9693 sensor
H	Range (f.s.)	100 A	200 A	2000 A
	Output rate	1 mV/A	1 mV/A	0.1 mV/A
L	Range (f.s.)	10 A	20 A	200 A
	Output rate	10 mV/A	10 mV/A	1 mV/A
Output (f.s.)		100 mV	200 mV	200 mV

5 Perform zero-adjustment.

Before starting measurement, correct any output deviations with the unit's zero-adjustment knob. If the instrument fails to display a value close to 0 A even after zero-adjustment is performed, have the sensor unit and clamp sensor repaired.



- Ensure that the connected clamp sensor has not been placed around a conductor.
- Holding the unit in one hand, rotate the zero-adjustment knob with your other hand until the measured value on the instrument's display indicates a value near 0 A. The zero-adjustment knob is designed to be difficult to turn so that you do not inadvertently operate it after performing zero-adjustment.

6 Connect the clamp sensor to the measurement target. Refer to the clamp sensor's instruction manual.

7 Remove the sensor after measurement is complete.

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