HIOKI

PW9100-03
PW9100-04

AC/DC CURRENT BOX

Instruction Manual

Dec. 2015 Edition 1
Printed in Japan
PW9100A961-00 15-12H

EN

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 PW9100-03, PW9100-04 AC/DC Current Box. To obtain maximum performance from the device, please read this manual first, and keep it handy for future reference.

Verifying package contents

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

Cleaning

To clean the device, wipe it gently with a soft cloth moistened with water or mild detergent.

Calibrations

The calibration period varies depending on the status of the device or installation environment. We recommend that the calibration period be determined in accordance with the status of the device or installation environment. Please contact your Hioki distributor to have your device periodically calibrated.

Troubleshooting

If the device seems to be malfunctioning, contact your authorized Hioki distributor or reseller.When sending the device for repair, be sure to include details of the problem.

Discarding the device

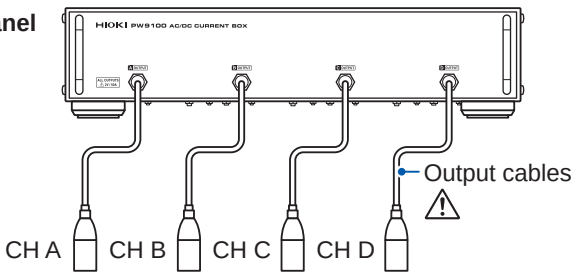
Handle and dispose of the device in accordance with local regulations.

Overview

This device measures AC and DC currents of up to 50 A with a high degree of precision. Thanks to its excellent frequency characteristics (amplitude and phase) and temperature characteristics (sensitivity and offset), it can be used not only for current measurement, but also for high-precision power measurement.

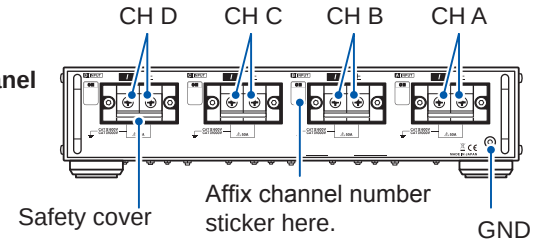
Names of Parts

Front panel



Current input terminals

Rear panel



The above figure depicts the PW9100-04 (4-channel model).

Safety Information

This device is designed to conform to IEC 61010 Safety Standards, and has been thoroughly tested for safety prior to shipment. However, using the device in a way not described in this manual may negate the provided safety features.
Before using the device, be certain to carefully read the following safety notes:

⚠ DANGER

Mishandling during use could result in injury or death, as well as damage to the device. Be certain that you understand the instructions and precautions in the manual before use.

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⚠ WARNING

With regard to the electricity supply, there are risks of electric shock, heat generation, fire, and arc flash due to short circuits. If persons unfamiliar with electricity measuring device are to use the device, another person familiar with such devices must supervise operations.

Notation

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

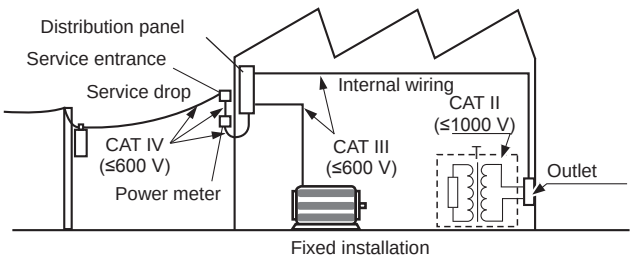
⚠ DANGER	Indicates an imminently hazardous situation that will result in death or serious injury to the operator.
⚠ WARNING	Indicates a potentially hazardous situation that may result in death or serious injury to the operator.
⊘	Indicates prohibited actions.
❗	Indicates the action which must be performed.

Symbols affixed to the device

⚠	Indicates cautions and hazards. When the symbol is printed on the device, refer to a corresponding topic in the Instruction Manual.
⏚	Indicates a grounding terminal.
	Indicates the Waste Electrical and Electronic Equipment Directive (WEEE Directive) in EU member states.
CE	Indicates that the device conforms to regulations set out by the EC Directive.

Measurement categories

This device conforms to the safety requirements for CAT II 1000 V, CAT III 600 V measuring devices.



Fixed installation

For more information, see the power meter's instruction manual.

Operating Precautions

Device installation

To keep the device from becoming hot, leave at least 20 mm of space between it and any surrounding objects.
Operating environment: See the power meter instruction manuals.

⚠ DANGER

- **To prevent electrical shock and bodily injury, do not touch any input terminals on the VT (PT), CT or the device when they are in operation.**
- **Do not use the device with circuits that exceed its ratings or specifications. Doing so may damage the device or cause it to become hot, resulting in bodily injury/electric shock.**
- **To avoid electric shock, do not remove the device's case.**

- **This device should only be connected to the secondary side of a breaker. If a short circuit occurs in the secondary side, the breaker will interrupt the circuit to prevent a short-circuit current from flowing through the secondary side circuit. A large current will flow if a short-circuit occurs in the primary side, resulting in damages to the device and the installation.**
- **To prevent electric shock, use crimp contacts that cover live wires with insulation.**

⚠ WARNING

- **In order to prevent electric shock and short-circuit accidents, shut off the power to the line to be measured before connecting the device.**
- **The device's current input terminals may become hot when measuring a large current. Exercise care during measurement and when disconnecting wires.**
- **Connect measurement lines to current input terminals securely. If a terminal is loose, the contact resistance will increase, resulting in overheating, equipment burnout, or fire.**
- **To avoid damage to the device, protect it from physical shock when transporting and handling. Be especially careful to avoid physical shock from dropping.**
- **To prevent device damage or electric shock, use only the input screws (M6) or safety covers that are originally installed. If you have lost any screws or find that any screws are damaged, please contact your Hioki distributor for a replacement.**

This device may cause interference if used in residential areas. Such use must be avoided unless the user takes special measures to reduce electromagnetic emissions to prevent interference to the reception of radio and television broadcasts.

Preliminary Checks

Before using the device, verify that no damage occurred during storage or shipping. If you find any damage, contact your authorized Hioki distributor or reseller.

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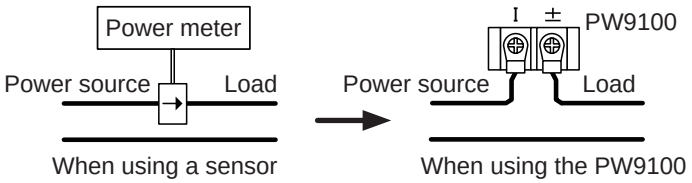
Measurement Method

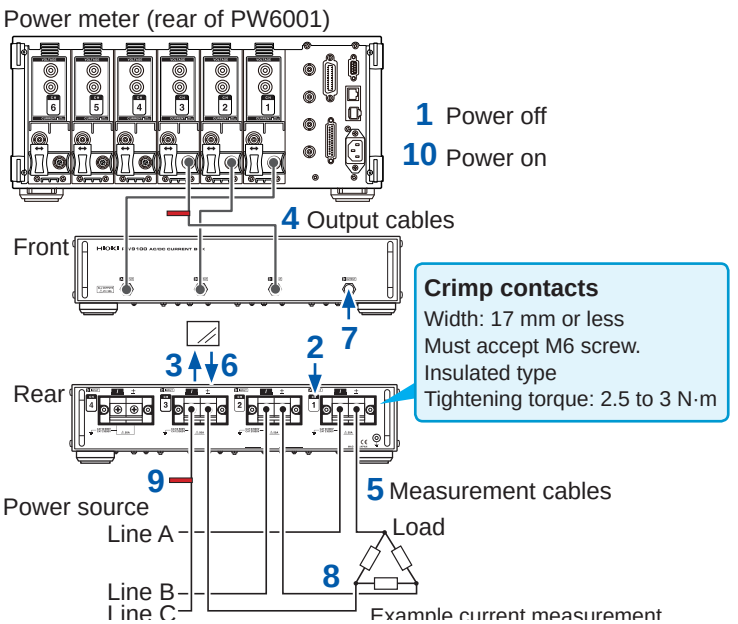
1. **Turn off the power meter.**
2. **Affix the channel number stickers corresponding to the power meter channels.**
3. **Remove the safety covers.**
4. **Connect the output cables to the power meter's current sensor input connectors.**
5. **Connect the measurement cables to the device's current input terminals.**
6. **Reattach the safety covers.**
7. **To prevent contact with the current input terminals, secure the output cables for channels not being used with a tie band.**
8. **Connect the measurement cables to the measurement lines.**

   For more information about how to connect the device, refer to the power meter's instruction manual or the [Connection] screen. If referring to the wiring diagram for a current sensor or current probe, change the sensor in the wiring diagram so that the connection is as follows:

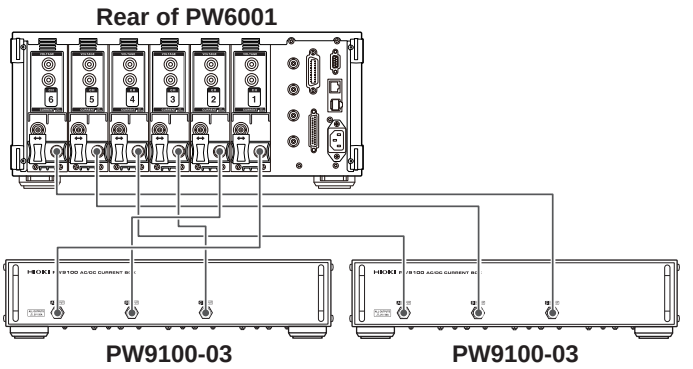


   To ensure accurate measurement, do not connect output cables and measurement cables in parallel.
9. **Apply the included color labels to the output cables and wires as necessary so that channels and connections can be identified.**
10. **Turn on the power meter and start measurement.**

    The device will be recognized as a 50 A rated current sensor at each connected power meter channel.
    The voltage must be measured in order to perform power measurement. For more information about connections and power meter settings and precautions, refer to the instruction manual for the power meter being used.



Example connections when using 6 channels



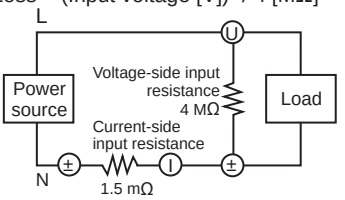
Choosing the connection method

Example: When using the device and a PW6001 with a 1P2W connection

Depending on the input level, the power meter's instrument loss may affect measured values. Choose the connection method that has the lower instrument loss at the inputs connected to the load side from the two possibilities shown below.

(1) Connecting the power meter's voltage input terminals to the load side

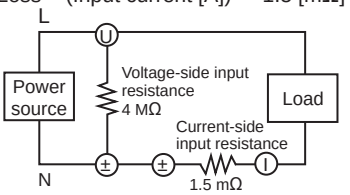
Loss = (Input voltage [V])^2 / 4 [MΩ]



Power including loss is measured by means of the voltage input terminal's input resistance.

(2) Connecting the device's current input terminals to the load side

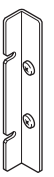
Loss = (Input current [A])^2 × 1.5 [mΩ]



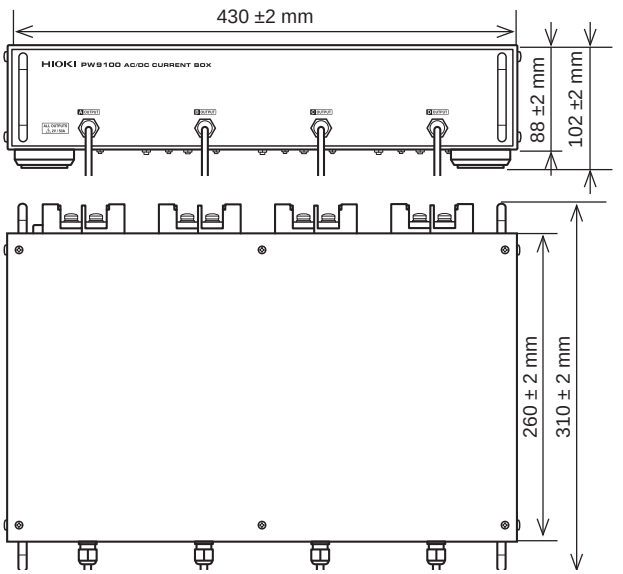
Power including loss is measured by means of the current input terminal's input resistance.

Rack Installation

You can remove the screws from the rear of the instrument and attach rack-mounting hardware.
The rack-mounting hardware shown at the right is available on a special-order basis in both EIA and JIS variants. For more information, please contact your authorized Hioki distributor or reseller.



External dimensions



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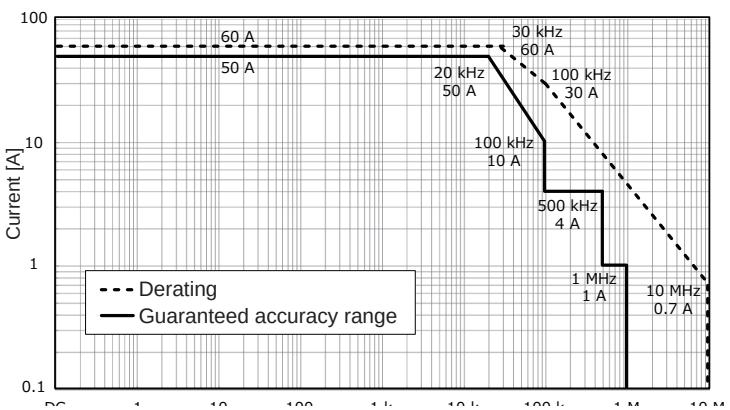
Specifications

f.s.: Indicates the measurement range, maximum display value, or device rating.
rdg.: Reading or displayed value (the value currently being measured and indicated on the measuring instrument).

Operating environment	Indoors, pollution degree 2, altitude up to 2000 m (6562 ft.)
Operating temperature and humidity	0°C to 40°C (32°F to 104°F), 80% RH or less (no condensation)
Storage temperature and humidity	-10°C to 50°C (14°F to 122°F), 80% RH or less (no condensation)
Dust-proof, water-proof	IP20 (EN 60529)
Standards	Safety: EN 61010 EMC: EN 61326 Class A
Dielectric strength	5.4 kV AC (sensed current of 1 mA), 50 Hz/60 Hz, 1 min. • Between current input terminals and output cable terminals and case • Between channels
Power supply	Supplied from PW6001, 3390, or 3390-10
Power supply rating	±11 V to ±13 V (tracking) ±400 mA per channel or less (during 50 A/55 Hz measurement with ±12 V power supply)
Interface	Dedicated interface (ME15W)
Dimensions	Approx. 430W × 88H × 260D mm (16.93"W × 3.46"H × 10.24"D)
Output cable length	Approx. 80 cm
Mass	PW9100-03: Approx. 3.7 kg (130.5 oz.) PW9100-04: Approx. 4.3 kg (151.7 oz.)
Product warranty period	1 year
Accessories	Channel number stickers, color labels, instruction manual, tie bands (PW9100-03: 3; PW9100-04: 4)
Options	CT9901 Conversion Cable (for connecting to the 3390 or 3390-10) and CT9902 Extension Cable (5 m)
Input and measurement method	Isolated input, DCCT input
Rated primary current	50 A AC/DC
Number of input channels	PW9100-03: 3 channels, PW9100-04: 4 channels
Maximum input current	Within derating region (see graph below) However, up to ±200 A peak is allowable if within 20 ms (design value).
Output voltage	2 V/50 A
Maximum output voltage	Approx. ±7 V
Maximum rated voltage to earth	1000 V (measurement category II) 600 V (measurement category III) Anticipated transient overvoltage: 6000 V
Measurement terminals	Terminal block (with safety cover): M6 screws Proper torque: 2.5 N·m to 3 N·m
Input resistance	1.5 mΩ or less (50 Hz/60 Hz)
Input capacitance	Between measurement terminals and case (secondary side), 40 pF or less, defined at 100 Hz
Output resistance	50 Ω ±2 Ω
Conditions of guaranteed accuracy	Guaranteed accuracy period: 1 year 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 Warm-up time: at least 30 min. Input waveform: sine wave Connection: measuring instrument with an input resistance of 0.9 MΩ to 1.1 MΩ Terminal-to-ground voltage: 0 V



Measurement accuracy

Frequency	Amplitude	Phase
DC	±0.02% rdg. ±0.007% f.s.	–
DC < f < 30 Hz	±0.1% rdg. ±0.02% f.s.	±0.3 deg.
30 Hz ≤ f < 45 Hz	±0.1% rdg. ±0.02% f.s.	±0.1 deg.
45 Hz ≤ f ≤ 65 Hz	±0.02% rdg. ±0.005% f.s.	±0.1 deg.
65 Hz < f ≤ 500 Hz	±0.1% rdg. ±0.01% f.s.	±0.12 deg.
500 Hz < f ≤ 1 kHz	±0.1% rdg. ±0.01% f.s.	±0.5 deg.
1 kHz < f ≤ 5 kHz	±0.5% rdg. ±0.02% f.s.	±0.5 deg.
5 kHz < f ≤ 20 kHz	±1% rdg. ±0.02% f.s.	±1 deg.
20 kHz < f ≤ 50 kHz	±1% rdg. ±0.02% f.s.	±(0.05 × f) deg.
50 kHz < f ≤ 100 kHz	±2% rdg. ±0.05% f.s.	±(0.06 × f) deg.
100 kHz < f ≤ 300 kHz	±5% rdg. ±0.05% f.s.	±(0.06 × f) deg.
300 kHz < f ≤ 700 kHz	±5% rdg. ±0.05% f.s.	±(0.07 × f) deg.
700 kHz < f ≤ 1 MHz	±10% rdg. ±0.05% f.s.	±(0.07 × f) deg.
Frequency band	3.5 MHz (-3 dB typical)	

- Unit for f in accuracy calculations: kHz
- Amplitude accuracy and phase accuracy are defined within the accuracy guarantee range shown in the derating figure. However, the design value is DC < f < 10 Hz.
- When using the CT9902 Extension Cable (5 m), add the accuracy shown in the table below. Measurement bandwidth: 2 MHz (±3 dB typical)
- Accuracy is not defined when 2 or more CT9902 are connected together.

Frequency	Amplitude	Phase
DC ≤ f ≤ 10 kHz	±0.015% rdg.	None added
10 kHz < f ≤ 50 kHz	±0.015% rdg.	±(0.02 × f) deg.
50 kHz < f ≤ 300 kHz	±0.015% rdg.	±(0.03 × f) deg.
300 kHz < f ≤ 700 kHz	±2% rdg.	±(0.03 × f) deg.
700 kHz < f ≤ 1 MHz	±4% rdg.	±(0.03 × f) deg.

Output noise	300 µV rms or less (≤1 MHz)
Effects of temperature	Within the range of 0°C to 18°C or 28°C to 40°C Amplitude accuracy: ±0.005% rdg./°C Offset voltage: ±0.005% f.s./°C Phase: ±0.01 deg./°C
Effects of magnetization	5 mA or less (input conversion value, after input of ±50 A)
Effects of common-mode voltage (Defined for CMRR)	50 Hz/60 Hz: 120 dB or greater 100 kHz: 120 dB or greater (Effect/common-mode voltage on output voltage)
Effects of radiated radio frequency electromagnetic field	0.5% f.s. or less at 10 V/m
Effects of external magnetic field	±10 mA or less (for a magnetic field of 400 A/m at DC or 50 Hz/60 Hz)
Connectable products	PW6001 Power Analyzer 3390, 3390-10 Power Analyzer (using the CT9901 Conversion Cable)

PW6001 Power Analyzer combined accuracy

Frequency	Current	Power
DC	±0.04% rdg. ±0.037% f.s. (f.s.: PW6001 range)	±0.04% rdg. ±0.057% f.s. (f.s.: PW6001 range)
45 Hz ≤ f ≤ 65 Hz	±0.04% rdg. ±0.025% f.s. (f.s.: PW6001 range)	±0.04% rdg. ±0.035% f.s. (f.s.: PW6001 range)
DC, band other than 45 Hz ≤ f ≤ 65 Hz	PW6001 accuracy + PW9100 accuracy (Consider sensor rating when calculating f.s. error.)	PW6001 accuracy + PW9100 accuracy (Consider sensor rating when calculating f.s. error.)

- To calculate the phase accuracy, add the PW6001 accuracy and the PW9100 accuracy.
- For other measurement parameters, add the PW6001 accuracy and the PW9100 accuracy (and consider the sensor rating when calculating the f.s. error).
- When using the 1 A range or the 2 A range, add ±0.12% f.s. (f.s.: PW6001 range).
- Accuracy additions defined by conditions in the PW6001 and PW9100 specifications also apply.
- To use the PW6001's sensor phase correction function when using the CT9902, it is necessary to obtain calibration data for the combination of the device and the CT9902.

3390, 3390-10 Power Analyzer combined accuracy

- Add the power analyzer accuracy and the PW9100 accuracy (and consider the sensor rating when calculating f.s. error).
- Accuracy additions defined by the power analyzer and PW9100 specifications

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