HIOKI

PW9100A-3
PW9100A-4

AC/DC CURRENT BOX

Instruction Manual

EN

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PW9100C961-00 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.

Troubleshooting

If the device seems to be malfunctioning, contact your authorized Hioki distributor or reseller. Attach a description of the malfunction when sending the device for repair.

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.

Introduction

Thank you for choosing the Hioki PW9100A-3, PW9100A-4 AC/DC Current Box. 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.

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.

Precautions for Use

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 analyzer’s instruction manual.

⚠ DANGER

- **To prevent an 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 to measure circuits that exceed its ratings or specifications. Damage to the device or overheating can cause bodily injury.**
- **To prevent an electric shock, do not remove the device's case. The internal components of the device carry high voltages and may become very hot during operation.**
- **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.**

- **To prevent an electric shock, use crimp contacts that cover live wires with insulation.**

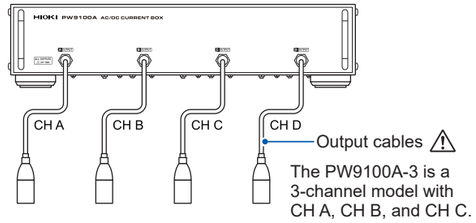
⚠ WARNING

- **To prevent an electric shock and short-circuit, 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.**

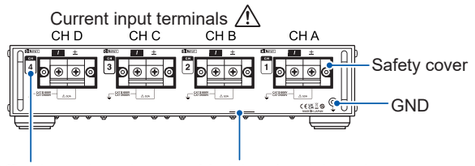
This device complies with EN 61326 Class A. This device may cause interference if used in residential areas. Such use must be avoided unless the user takes special measures to reduce electromagnetic emissions to prevent interference to the reception of radio and television broadcasts.

Part Names

Front panel PW9100A-4 (4-channel model)



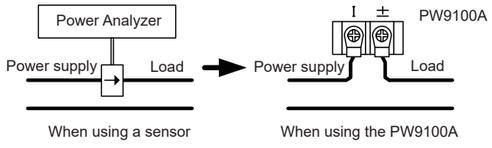
Rear panel



Making Measurements

1. **Turn off the power analyzer.**
2. **Affix the channel number stickers corresponding to the power analyzer channels.**
3. **Remove the safety covers.**
4. **Connect the output cables to the power analyzer’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.**

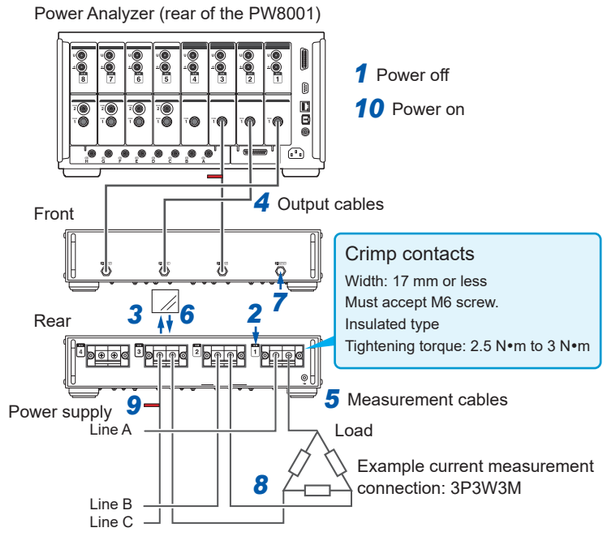
   For more information about how to connect the device, refer to the power analyzer’s instruction manual or the [Connection] screen. If referring to the wiring diagram for a current sensor or current probe, change the sensor in the wiring diagram so that the connection is as follows:



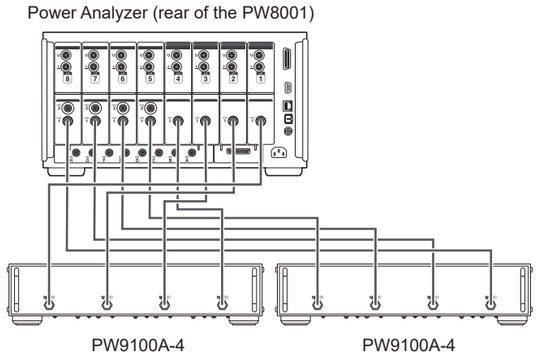
   To ensure accurate measurement, do not connect output cables and measurement cables in parallel.
9. **Apply the included color labels to the output cables and wires as necessary so that channels and connections can be identified.**
10. **Turn on the power analyzer and start measurement.**

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

Connection diagram



Example connections when using 8 channels

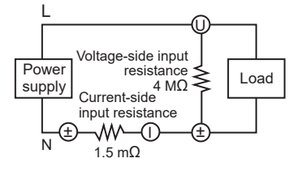


Choosing the connection method

Example: When using the device and PW8001 (U7005) with a 1P2W connection
Depending on the input level, the power analyzer’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 analyzer’s voltage input terminals to the load side

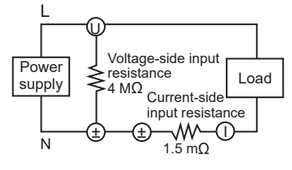
Loss = (Input voltage [V])^2 / 4 [MΩ]



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.

Specifications

Accuracy

Reading (displayed value): Indicates the value displayed by the instrument. Limit values for reading errors are expressed in percent 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.
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	0°C to 40°C (32°F to 104°F) 80% RH or less (non-condensing)
Storage temperature and humidity range	−10°C to 50°C (14°F to 122°F) 80% RH or less (non-condensing)
Dust resistance and water resistance	IP20 (EN 60529)
Standards	Safety: EN 61010 EMC: EN 61326 Class A
Power supply	Supplied from PW8001, PW6001, PW3390, CT9555, CT9556 or CT9557 Rated supply voltage: ±11 V to ±13 V (Tracking) Maximum rated current: ±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
Weight	PW9100A-3: Approx. 3.7 kg (130.5 oz.) PW9100A-4: Approx. 4.3 kg (151.7 oz.)
Product warranty duration	3 years
Accessories	Channel number stickers, colored labels (for channel identification), Instruction Manual, and Operating Precautions (0990A907)
Options	CT9901 Conversion Cable CT9902 Extension Cable (5 m)
Memory function	Sensor information can be read for products with memory function support. Applicable product: PW8001
Input and measurement method	Isolated input, DCCT input
Rated primary current	50 A AC/DC
Number of input channels	PW9100A-3: 3 channels, PW9100A-4: 4 channels
Maximum input current	Not exceeding derating curve (See Figure 1.) However, a current of up to ±200 A peak (design value) is allowable for up to 20 ms.
Output voltage	2 V/50 A
Maximum output voltage	Approx. ±12 V
Maximum rated line-to-ground voltage	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 (50 Hz/60 Hz)	1.5 mΩ or less
Input capacitance	Between measurement terminals and case (secondary side), 40 pF or less, defined at 100 kHz
Output resistance	50 Ω ±2 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 an input resistance of 0.9 MΩ to 1.1 MΩ line-to-ground voltage: 0 V

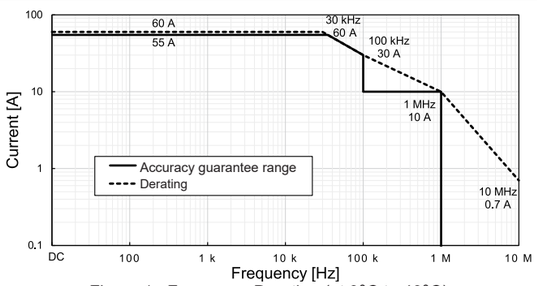


Figure 1. Frequency Derating (at 0°C to 40°C)

Measurement accuracy

Frequency	Amplitude ±(% of reading +% of full scale)	Phase
DC	0.02% + 0.007%	–
DC < f < 30 Hz	0.1% + 0.02%	±0.3°
30 Hz ≤ f < 45 Hz	0.1% + 0.02%	±0.1°
45 Hz ≤ f ≤ 65 Hz	0.02% + 0.005%	±0.1°
65 Hz < f ≤ 500 Hz	0.1% + 0.01%	±0.12°
500 Hz < f ≤ 1 kHz	0.1% + 0.01%	±0.5°
1 kHz < f ≤ 5 kHz	0.5% + 0.02%	±0.5°
5 kHz < f ≤ 20 kHz	1% + 0.02%	±1°
20 kHz < f ≤ 50 kHz	1% + 0.02%	±(0.05 × f)°
50 kHz < f ≤ 100 kHz	2% + 0.05%	±(0.06 × f)°
100 kHz < f ≤ 300 kHz	5% + 0.05%	±(0.06 × f)°
300 kHz < f ≤ 700 kHz	5% + 0.05%	±(0.07 × f)°
700 kHz < f ≤ 1 MHz	10% + 0.05%	±(0.07 × f)°
Frequency band	3.5 MHz (−3 dB Typical)	–

- The variable f in accuracy equations is expressed in kHz.
- Amplitude accuracy and phase accuracy are defined within the accuracy guarantee range shown in Figure 1, “Frequency Derating.” However, design values are given for DC < f < 10 Hz.
- Add ±0.01% of reading to amplitude accuracy when input is 100% of full scale to 110% of full scale.
- 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 ±(% of reading)	Phase
DC ≤ f ≤ 10 kHz	0.015%	None added
10 kHz < f ≤ 50 kHz	0.015%	±(0.02 × f) °
50 kHz < f ≤ 300 kHz	0.015%	±(0.03 × f) °
300 kHz < f ≤ 700 kHz	2%	±(0.03 × f) °
700 kHz < f ≤ 1 MHz	4%	±(0.03 × f) °

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 sensitivity: ±20 ppm of reading/°C Offset voltage: ±1 ppm of full scale/°C Phase: ±0.01°/°C
Effects of magnetization	5 mA or less (input equivalent, after ±50 A is input)
Common mode rejection ratio (CMRR)	50 Hz/60 Hz: 120 dB or more 100 kHz: 120 dB or more (Effect on output voltage / common-mode voltage)
Effects of radiated radio-frequency electromagnetic field	0.5% of full scale or less at 10 V/m
Effects of external magnetic field	±10 mA or less (under a magnetic field of 400 A/m DC or 400 A/m with 50 Hz/60 Hz)

Connectable products

1. PW8001 Power Analyzer

U7001 Combined accuracy

U7001 accuracy + sensor accuracy (consider sensor rating for full scale error).
Additional components should be added to the accuracy depending on the power analyzer and sensor specifications.

U7005 Combined accuracy

Frequency	Current	Power	Phase
	±(% of reading + % of range)		
DC	0.04% + 0.037%	0.04% + 0.037%	U7005 accuracy + PW9100A accuracy
45 Hz ≤ f ≤ 65 Hz	0.03% + 0.025%	0.03% + 0.025%	
Bands other than DC and 45 Hz ≤ f ≤ 65 Hz	U7005 accuracy + PW9100A accuracy (Consider sensor rating for full scale error.)		

- For other measurement parameters, U7005 accuracy + PW9100A accuracy (consider sensor rating for full scale error).
- For the 1 A range or the 2 A range, add ±0.12% of full scale of the measurement range set on the U7005.
- Additional components should be added to the accuracy depending on the power analyzer and sensor specifications.

2. PW6001 Power Analyzer

Combined accuracy

Frequency	Current	Power	Phase
	±(% of reading + % of full scale) (full scale = PW6001 Range)		
DC	0.04% + 0.037%	0.04% + 0.057%	PW6001 accuracy + PW9100A accuracy
45 Hz ≤ f ≤ 65 Hz	0.04% + 0.025%	0.04% + 0.035%	
Bands other than DC and 45 Hz ≤ f ≤ 65 Hz	PW6001 accuracy + PW9100A accuracy (Consider sensor rating for full scale error.)		

- For other measurement parameters, PW6001 accuracy + PW9100A accuracy (consider sensor rating for full scale error).
- For the 1 A range or the 2 A range, add ±0.12% of full scale of the measurement range set on the PW6001.
- Additional components should be added to the accuracy depending on the power analyzer and sensor specifications.

3. PW3390 Power Analyzer

Combined accuracy

Frequency	Current	Power	Phase
	±(% of reading + % of full scale) (full scale = PW3390 Range)		
DC	0.07% + 0.077%	0.07% + 0.077%	PW3390 accuracy + PW9100A accuracy
45 Hz ≤ f ≤ 65 Hz	0.06% + 0.055%	0.06% + 0.055%	
Bands other than DC and 45 Hz ≤ f ≤ 65 Hz	PW3390 accuracy + PW9100A accuracy (Consider sensor rating for full scale error.)		

- For other measurement parameters, PW3390 accuracy + PW9100A accuracy (consider sensor rating for full scale error).
- For the 1 A range or the 2 A range, add ±0.12% of full scale of the measurement range set on the PW3390.
- Additional components should be added to the accuracy depending on the power analyzer and sensor specifications.

4. CT9555, CT9556, or CT9557 Sensor Unit

Combined accuracy

- For the CT9555, use the sensor accuracy. For the CT9556/CT9557, add ±0.01% of reading to the sensor accuracy (when the output coaxial cable is 1.6 m or less in length).
- Additional components should be added to the accuracy depending on the connected device and sensor specifications.

Phase Compensation Values

Enter the following compensation values (characteristic values) when performing phase compensation on the PW6001 or PW3390.

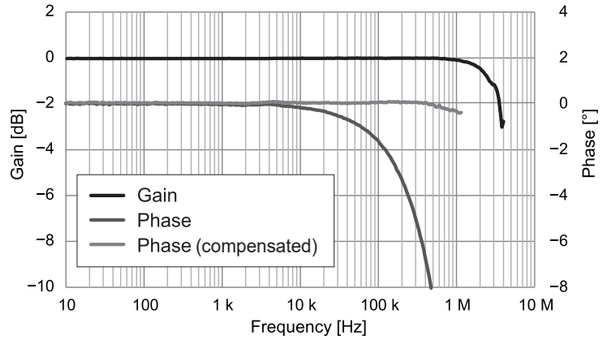
300 kHz, −2.80° (PW9100A-3, PW9100A-4 common)

The 300 kHz phase measured value noted in the test report can be used as the phase compensation value. In theory, using this value will allow more accurate measurement than is possible when using the representative value.
There’s no need to enter compensation values for the PW8001 as that instrument reads sensor information from memory and performs compensation automatically.

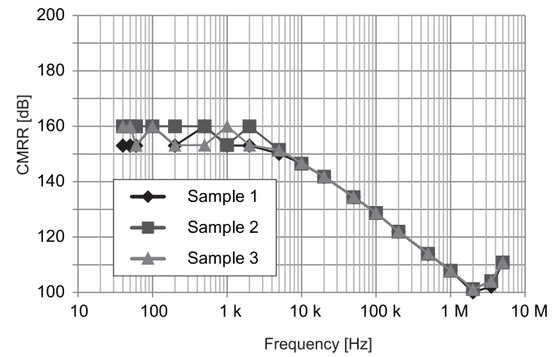
To use the phase compensation function when using the CT9902, it is necessary to obtain calibration data for the combination of the device and the CT9902.

Characteristics

Frequency characteristics (Typical)

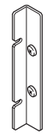


CMRR (Typical)



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