PW4001

HIOKI

PW4001-01
PW4001-02
PW4001-03
PW4001-04
PW4001-05

Startup Guide

POWER ANALYZER

Check for the latest edition and other language versions.

Read carefully before use.
Keep for future reference.

EN

Apr. 2026 Revised edition 1
PW4001A966-01

600681681

Contents

Introduction

Thank you for choosing the Hioki PW4001 Power Analyzer. To ensure your ability to get the most out of this instrument over the long term, please read this manual carefully and keep it available for future reference.

Information on download site

For details on the product application, the update file for the instrument, and the instruction manual, please check Hioki's website:
https://cloud.gennect.net/dl

Product registration

Register your product in order to receive important product information.
https://www.hioki.com/global/support/myhioki/registration

The instruction manuals listed below are available for the instrument. Refer to them as necessary depending on your application. Please review the separate "Operating Precautions" before using the instrument.

Name of the instruction manual	Description	Format
Operating Precautions	Includes information for using the instrument safely.	Hard copy
Startup Guide	Includes information for using the instrument safely, basic operation methods, and specifications (excerpt).	
Instruction Manual	Includes a product overview for this instrument, operation methods, function descriptions, and specifications.	PDF (download) PW4001
Communication Command Instruction Manual	Includes descriptions of communications commands for controlling this instrument.	
Modbus/TCP Communications Instruction Manual	Includes descriptions of communications commands for controlling this instrument via Modbus*1/TCP.	
MATLAB Toolkit User's Manual	Includes information about using the MATLAB*1 toolkit to load waveform binary data recorded with this instrument as MATLAB array data and controlling the instrument connected via Ethernet on MATLAB.	
CAN Editor Instruction Manual	Includes information about installing and using the PC application software to configure CAN settings for the instrument.	
PW Data Receiver Instruction Manual	Includes information about installing and using the PC applications and specifications.	
LabVIEW Driver User's Manual	Includes information about controlling the instrument and acquiring measured data using the LabVIEW driver.	
GENNECT One User's Manual	Includes information about installing and using the PC applications and specifications.	

*1. Third-party company's trademarks

Target 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).

Trademarks

- Microsoft, Microsoft Edge and Windows are trademarks of the Microsoft group of companies.
- Intel is a trademark of Intel Corporation or its subsidiaries in the United States and/or other countries.
- LABVIEW is a trademark of Nialli Inc. in the United States, Canada and other countries.

Font on the screen

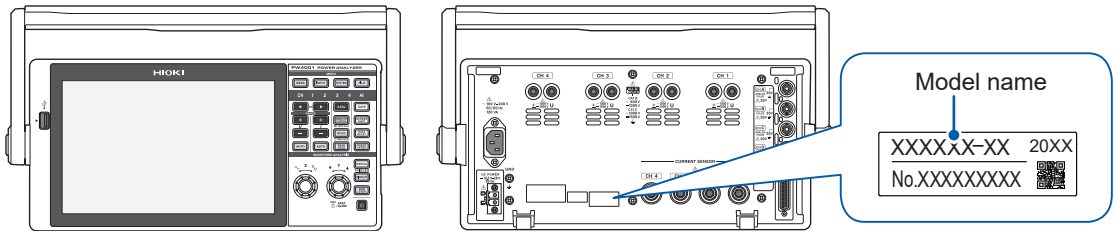
DynaFont is a registered trademark of DynaComware Taiwan Inc.

Checking Package Contents

Upon receiving the instruments, inspect them for any damage or anomalies. If you discover any damage or find that the product does not perform as indicated in the specifications, please contact your authorized Hioki retailer or reseller.

Confirm the package contents.

☐ PW4001 Power Analyzer



✓: Function available. –: Function not available.

Model name (order code)	Optional feature (additional function)		
	Waveform and D/A output	Motor analysis	DC power supply (operates on 10.5 V to 28 V DC)
PW4001-01	—	—	—
PW4001-02	✓	—	—
PW4001-03	—	✓	—
PW4001-04	—	—	✓
PW4001-05	✓	✓	✓

Accessories

- ☐ Startup Guide
- ☐ Operating Precautions (0990A903)
- ☐ Power cord
- ☐ USB cable
- ☐ D-sub 25-pin connector (PW4001-02 and PW4001-05 only)
- ☐ DC power supply connector (PW4001-04 and PW4001-05 only)

Options (Sold Separately)

The options listed below are available for the instrument. To purchase any optional equipment, please contact your authorized Hioki retailer or reseller. Please note that optional equipment offerings are subject to change without advance notice. Check Hioki's website for the latest information.

Factory default options

Optional products that can be specified with the model number (PW4001-xx)

Waveform and D/A output option
Motor analysis option
Optional DC power supply (operates on 10.5 V to 28 V DC)

Optional products for voltage measurement

Safety banana plugs (ø4 mm) can be connected to the voltage input terminals of the instrument. Prepare voltage cords appropriate for your applications.

Product name		Maximum rated voltage and current	Cable length (approximate)	Remark
L1025	Voltage Cord	CAT II 1500 V DC 1000 V AC, 1 A CAT III 1000 V, 1 A	3 m	Banana plug-banana plug (red, black ×1 each) (alligator clips included) 
L9438-50	Voltage Cord	CAT III 1000 V, 10 A CAT IV 600 V, 10 A	3 m	Banana plug-banana plug (red, black ×1 each) (alligator clips included) 
L1000	Voltage Cord	CAT III 1000 V, 10 A CAT IV 600 V, 10 A	3 m	Banana plug-banana plug (red, yellow, blue, gray ×1 each; black ×4) (alligator clips included) 
L9257	Connection Cord	CAT III 1000 V, 10 A CAT IV 600 V, 10 A	1.2 m	Banana plug-banana plug (red, black ×1 each) (alligator clips included) 
L1021-01	Patch Cord	CAT III 1000 V, 10 A CAT IV 600 V, 10 A	0.5 m	For distributing voltage input Stackable banana plug–banana plug (red ×1) 
L1021-02	Patch Cord	CAT III 1000 V, 10 A CAT IV 600 V, 10 A	0.5 m	For distributing voltage input Stackable banana plug-banana plug (black ×1) 
L9243	Grabber Clip	CAT II 1000 V, 1 A	—	Red, black ×1 each 
L4940	Connection Cable Set	CAT III 1000 V, 10 A CAT IV 600 V, 10 A	1.5 m	Banana plug-banana plug (red, black ×1 each) (no alligator clips) 
L4935	Alligator Clip Set	CAT III 1000 V, 10 A CAT IV 600 V, 10 A	—	Red, black ×1 each 
VT1005	AC/DC High Voltage Divider	5000 V, ±7100 V peak CAT III 1500 V CAT II 2000 V	—	For measuring voltages of 1000 V or more 

Optional products for current measurement

For details, refer to the instruction manual that came with the current sensor.

✓: Available –: Not available

Current sensor type	Auto-recognition function	Model name	Rated current (rms)	Frequency characteristics	Basic accuracy (amplitude) ±[(% of reading) + (% of full scale)]	Measurable conductor diameter	Number of channels Cable length (approximate)	Operating temperature range
Ultra-high accuracy, direct connection 	✓	PW9100A-3	50 A	DC to 3.5 MHz	±0.02% ±0.005%	Measurement terminals M6 screw	3 channels	0°C to 40°C
	✓	PW9100A-4					4 channels	
Ultra-high accuracy, pass-through 	✓	CT6904A	500 A	DC to 4 MHz	±0.02% ±0.007%	ø 32 mm	3 m	−10°C to 50°C
	✓	CT6904A-1*3		DC to 2 MHz			10 m	
	✓	CT6904A-2*3	800 A	DC to 4 MHz	±0.025% ±0.009%		3 m	
	✓	CT6904A-3*3		DC to 2 MHz			10 m	
High accuracy, pass-through 	—	CT6862-05	50 A	DC to 1 MHz	±0.05% ±0.01%	ø 24 mm	3 m	−30°C to 85°C
	✓	CT6872		DC to 10 MHz	±0.03% ±0.007%			−40°C to 85°C
	✓	CT6872-01					10 m	
	—	CT6863-05	200 A	DC to 500 kHz	±0.05% ±0.01%		3 m	−30°C to 85°C
	✓	CT6873		DC to 10 MHz	±0.03% ±0.007%			−40°C to 85°C
	✓	CT6873-01					10 m	
	✓	CT6875A	500 A	DC to 2 MHz	±0.04% ±0.008%	ø 36 mm	3 m	
	✓	CT6875A-1		DC to 1.5 MHz			10 m	
	✓	CT6876A	1000 A				3 m	
	✓	CT6876A-1		DC to 1.2 MHz			10 m	
	✓	CT6877A	2000 A	DC to 1 MHz		ø 80 mm	3 m	
	✓	CT6877A-1					10 m	
High accuracy clamp 	✓	CT6830	2 A	DC to 100 kHz	±0.3% ±0.05%	ø 5 mm	4.2 m	−40°C to 85°C
	✓	CT6831	20 A		±0.3% ±0.01%			
	✓	CT6841A		DC to 2 MHz	±0.2% ±0.01%	ø 20 mm	3 m	
	✓	CT6843A	200 A	DC to 700 kHz	±0.2% ±0.01%			
	✓	CT6833		DC to 50 kHz	±0.07% ±0.007%		5 m	
	✓	CT6833-01					10 m	
	✓	CT6834	500 A	DC to 50 kHz	±0.07% ±0.007%		5 m	
	✓	CT6834-01					10 m	
	✓	CT6844A		DC to 500 kHz	±0.2% ±0.01%		3 m	
	✓	CT6845A		DC to 200 kHz		ø 50 mm		
	✓	CT6846A	1000 A	DC to 100 kHz				
General purpose clamp*1 	—	9272-05	20 A 200 A	1 Hz to 100 kHz	±0.3% ±0.01%	ø 46 mm	3 m	0°C to 50°C
	—	CT7642*2	2000 A	DC to 10 kHz	±1.5% ±0.5%	ø 55 mm	2.5 m	−25°C to 60°C
	—	CT7742*2		DC to 5 kHz				
	—	CT7044*2	6000 A	10 Hz to 50 kHz	±1.5% ±0.25%	Approx. 390 mm		
	—	CT7045*2				Approx. 630 mm		
	—	CT7046*2				Approx. 870 mm		

*1. For measuring commercial power frequency bands
*2. For CT9920 conversion cable
*3. The product is manufactured on a per-order basis.

Connection cables

Product name		Cable length (approximate)	Remark
L9217	Connection Cord	1.7 m	CAT II 600 V, 0.2 A CAT III 300 V, 0.2 A For motor analysis input, insulated BNC 
9165	Connection Cord	1.5 m	For BNC synchronization Metallic BNC-to-metallic BNC 
9713-01	CAN Cable	2 m	One end not terminated 
CT9920	Conversion Cable	0.4 m	PL14 Receptacle - ME15W Plug 

Optional additional license

Licensed product that allows customers to add optional functions after purchasing the instrument

License	Optional features	
	Product name	Function overview
PW9006-01	PW9006	IEC Harmonic/Flicker Measurement Function

Other optional products

Product name		Remark
C4001	Carrying Case	Hard trunk type Equipped with casters 
Z5302	Rackmount Fittings	EIA-compliant
Z5303	Rackmount Fittings	JIS-compliant
Z5200	BNC Terminal Box	D-sub 25 pins-to-BNC (female) 20-channel conversion box 
L3000	D/A Output Cable	Cable length: 2.5 m D-sub 25 pins-to-BNC (male) 20-channel conversion cable 
CT9557	Sensor Unit	4-channel sensor power supply Includes waveform, summed waveform, and summed RMS output functions 
SP7001-95	Non-Contact CAN Sensor	For CAN/CAN FD 

Symbols and Abbreviations

Safety

This manual classifies the seriousness of risks and hazard levels as described below.

⚠ DANGER	Indicates an imminently hazardous situation that, if not avoided, will result in death or serious injury.
⚠ WARNING	Indicates a potentially hazardous situation that, if not avoided, could result in serious injury or death.
⚠ CAUTION	Indicates a potentially hazardous situation that, if not avoided, could result in minor or moderate injury or potential risks of damage to the supported product (or to other property).
IMPORTANT	Indicates information or content that is particularly important from the standpoint of operating or maintaining the instrument.
	Indicates a high-voltage hazard. Failure to verify safety or improper handling of the instrument could lead to an electric shock, burn, or death.
	Indicates prohibited actions.
	Indicates mandatory actions.

Symbols on the product

	Indicates the presence of a potential hazard. See “Precautions for Use” (p. 14) in the instruction manual and warning messages listed at the beginning of each operating instruction, as well as the accompanying document entitled “Operating Precautions”.
	Indicates the push-button switch that can turn on and off the product.
	Indicates a grounding terminal.
	Indicates direct current (DC).
	Indicates alternating current (AC).

Symbols for various standards

	Indicates that the product is covered by the Directive on Waste Electrical and Electronic Equipment (WEEE) in EU member nations. Dispose of the product in accordance with local regulations.
	Indicates that the product complies with standards imposed by EU directives.
	Indicates that the product complies with standards imposed by the country of South Korea. Declarer: HIOKI KOREA CO., LTD. https://www.rra.go.kr/selform/HKO-PW4001S

Others

Tips	Indicates useful advice concerning instrument performance and operation.
*	Indicates additional information is provided below.
(p.)	Indicates the page number to refer to.
START (Bold letters)	Indicates the names of the control keys.
[ ]	Indicates the names of user interface elements on the screen.
Windows	Unless otherwise noted, the term Windows is used generically to refer to Windows 11.
Current sensors	Sensors for measuring currents are collectively referred to as “current sensors”.
S/s	For this instrument, the number of times the analog input signal is digitized is indicated in samples per second (S/s). For example, 20 MS/s (20 megasamples per second) signifies 20×10^6 samples per second.

Accuracy labeling

The accuracy of the measuring instrument is expressed using a combination of the formats shown below:

- By defining limit values for errors using the same units as measured values.
- By defining limit values for errors as a percentage of the reading, a percentage of the full scale, a percentage of the range, and in terms of digits.

Reading (display 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 measurement range of the instrument. Limit values for range errors are expressed as a percentage of the range (% of range or % rng).
Full scale (rated current)	For this instrument, this mainly indicates the rated current of the current sensor. Limit values for full-scale errors are expressed as a percentage of the full scale (“% f.s.”).
Digit (resolution)	Indicates the minimum display unit (in other words, the smallest digit that can have a value of 1) for a digital measuring instrument. Limit values for digit errors are expressed in terms of digits.

Safety Information

This instrument has been designed in accordance with the international standard IEC 61010 and has undergone rigorous safety testing prior to shipment. However, using the instrument in a way not specified in this manual may compromise its safety features.
Please review the safety precautions below before using the instrument.

⚠ DANGER

■ **Familiarize yourself with the contents of this manual before use.**

Failure to follow this guidance will result in misuse, leading to serious bodily injury or damage to the instrument.

⚠ WARNING

■ **If you have not previously used electrical measuring instruments, ensure adequate supervision by a technician with experience in electrical measurement.**

Failure to do so could cause the operator to experience an electric shock. It could also cause serious incidents, such as heat generation, fire, or arc flash due to a short-circuit.

Measurement category

IEC 61010 defines measurement categories to facilitate safe use of measuring instruments. Test and measurement circuits designed to be connected to a main power supply circuit are classified into three categories depending on the type of main power supply circuit. A measuring instrument that does not have a measurement category cannot be used to measure a main power supply circuit.

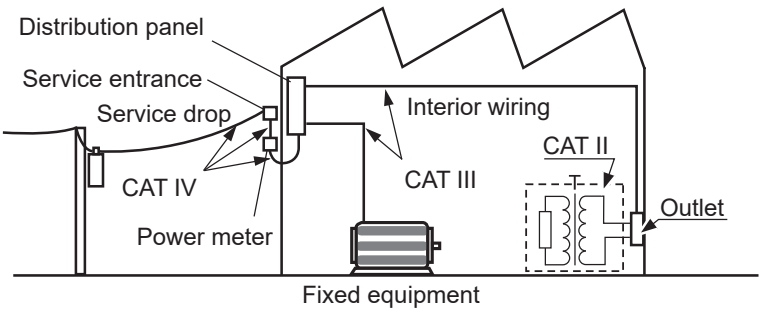
⚠ DANGER

- **Do not use a measuring instrument to measure a main power supply circuit whose category exceeds the instrument's rated measurement category.**

- **Do not use a measuring instrument that does not have a rated measurement category to measure a main power supply circuit.**

  Doing so may result in serious bodily injury or damage to the instrument or other equipment.

No measurement category (O)	Applicable to the measurement of other circuits that are not directly connected to the main power supply. Example: Measurement on the secondary-side equipment from the socket outlet of fixed equipment through a transformer, etc.
Measurement category II (CAT II)	Applicable to test and measuring circuits connected directly to utilization points (socket outlets and similar points) of a low-voltage MAINS installation. Example: Measurements on household appliances, portable tools, and similar equipment, and on the consumer side only of socket outlets in the fixed equipment.
Measurement category III (CAT III)	Applicable to test and measuring circuits connected to the distribution part of a building's low-voltage MAINS installation. Example: Measurements on distribution boards (including secondary meters), photovoltaic panels, circuit breakers, wiring, including cables, busbars, junction boxes, switches, and socket outlets in fixed equipment, as well as equipment for industrial use and some other equipment such as stationary motors with permanent connection to the fixed equipment.
Measurement category IV (CAT IV)	Applicable to test and measuring circuits connected at the source of a building's low-voltage MAINS installation. Example: Measurements on devices installed before the main fuse or circuit breaker in the building installation.



Precautions for Use

Be sure to follow the precautions listed below in order to use the instrument safely and in a manner that allows it to function effectively.
Use of the instrument should conform not only to its specifications, but also to the specifications of all accessories, options, and other equipment in use.

Installing the instrument

⚠ WARNING

■ **Do not use the instrument in locations such as the following:**

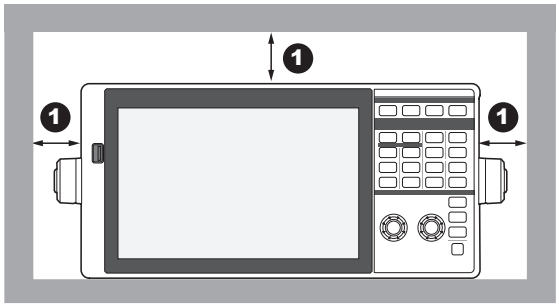
- Where it would be subject to direct sunlight or high temperatures
- Where it would be exposed to corrosive or explosive gases
- Where it would be exposed to powerful electromagnetic radiation or close to objects carrying an electric charge
- Where it would be close to an inductive heating device (such as high-frequency inductive heating devices and IH cooktops)
- Where it would be subject to a large amount of mechanical vibration
- Where it would be exposed to water, oil, chemicals, or solvents
- Where it would be exposed to high humidity or condensation
- Where it would be exposed to an excessive amount of dust
- Where it would be unstable or inclined

Doing so could damage the instrument or cause it to malfunction, resulting in bodily injury.

■ **Place the instrument, leaving enough space around it to facilitate unplugging the power cord.**

If there is not enough space left around, the power cannot be shut off immediately in an emergency. Failure to follow this guidance could result in bodily injury, fire, or damage to the instrument.

- Leave at least 50 mm of space on every surface other than the underside to keep the instrument's temperature from rising (❶).
- Place with its bottom side facing downward.
- Do not block any side vents.



Handling the instrument

⚠ WARNING

■ **If smoke, abnormal sounds, strange odor, or other abnormalities occur, immediately unplug the power cord from the outlet and remove measurement leads and sensors.**

Failure to do so could result in serious bodily injury or fire.
See “4.2 Troubleshooting” (p. 69) and “4.3 Error Messages” (p. 72) before contacting your authorized Hioki retailer or reseller.

⚠ CAUTION

■ **Do not route cords between other objects or step on them.**

■ **Do not bend or pull on cords where they connect.**

Doing so could break cables.

■ **Do not bend or pull on the cables at temperatures of 0°C or lower.**

The cables could harden in low temperatures. Bending or pulling them under these conditions could break the cable or damage the insulation, resulting in electric shock.

The instrument is classified as a Class A device under the EN 61326 standard. Use of the instrument in a residential setting such as a neighborhood could interfere with reception of radio and television broadcasts. If you encounter this issue, take steps as appropriate to address it.

Cautions for measurement

⚠ DANGER

■ **Do not use the instrument for measurements on any circuits that exceed the ratings or specifications of the instrument.**

Doing so could cause damage to the instrument or cause it to overheat, resulting in serious bodily injury.
See the “3.2 Specifications of Input, Output, and Measurement” (p. 46).

⚠ WARNING

■ **Do not touch the wires being measured.**

The wires being measured could become hot, possibly resulting in burns.

⚠ CAUTION

■ **Do not input voltage or current to the input terminal when the instrument has been turned off.**

Doing so could damage the instrument.

Cautions for transporting the instrument

⚠ CAUTION

■ **Do not subject the instrument to vibration or mechanical shock while transporting or handling it.**

Doing so could damage the instrument.

When carrying the instrument, remove the cords and the USB flash drive and hold the handles.

Shipping Precautions

- When shipping the instrument, use the box and packaging materials in which it was originally shipped, or use the C4001 Carrying Case. However, do not use the original box and packaging materials if they are damaged. If the original box and packaging materials cannot be used, contact your Hioki retailer or reseller. You will be sent a suitable box and packaging materials.
- When packing the instrument, make sure to disconnect the cords and remove the USB flash drive.
- When transporting the product, exercise care to avoid dropping it or otherwise subjecting it to rough handling.

Motor measurement

⚠ WARNING

When connecting input terminals to Ch. A through Ch. D

■ **Do not input a signal that exceeds the rating of any connector.**

Doing so could cause damage to the instrument or cause it to overheat, resulting in serious bodily injury.

■ **Turn off the instrument and other devices being connected before making any connections, and make sure the connections are secure.**

Failure to do so could cause connectors to loosen and come into contact with other conductive parts, resulting in bodily injury and damage to the equipment.

Rackmount fittings

⚠ WARNING

■ **Use the screws included with the rackmount fittings to secure the PW4001 main unit and rackmount fittings.**

■ **When removing the rackmount fittings from the instrument and returning it to its original position, secure the handles in place with the screws attached to the instrument at the time of shipment.**

Using any other screws could damage the instrument, resulting in bodily injury.
If any screw is lost or damaged, please contact your authorized Hioki retailer or reseller.

Disposal of the instrument (how to remove the lithium battery)

⚠ WARNING

- **Do not short-circuit the battery.**
- **Do not charge the Battery Pack.**
- **Do not disassemble the Battery Pack.**
- **Do not incinerate or heat it.**

  Doing so can cause the battery to explode, resulting in bodily injury.

- **Before removing the lithium battery, turn off the instrument and remove the power cord and the measurement cables from the object under measurement.**

  Failure to do so could cause the operator to experience an electric shock.
- **Store the removed batteries out of reach of young children.**

  Failure to follow this guidance could lead to accidental ingestion of a battery by young children.

CALIFORNIA, USA ONLY
Perchlorate Material - special handling may apply.
Visit https://dtsc.ca.gov/perchlorate/.

Measurement Procedure

The basic measurement procedure with the instrument is as follows. Refer to the Instruction Manual (downloadable from the Internet) for details.

1 Inspect the instrument before use.

“2.1 Inspecting the Instrument before Use” (p. 25)

2 Prepare for measurement.

“2.2 Connecting the Voltage Cords (Voltage Input)” (p. 26)
“2.3 Connecting the Current Sensors (Current Input)” (p. 27)
“2.4 Supplying Power to the Instrument” (p. 30)
Allow the instrument to warm up for 30 minutes or more after turning on the instrument before performing the zero adjustment.

3 Set wiring modes and configure current sensor settings.

“2.5 Setting Wiring Mode and Configuring Current Sensor Settings” (p. 35)

4 Configure Simple Setup (Quick Set).

“2.6 Simple Configuration (Quick Set)” (p. 39)

5 Perform the zero adjustment.

“2.8 Zero Adjustment and Degaussing (Demagnetization)” (p. 41)
Always perform zero adjustment before connecting measurement leads and sensors.

6 Connect the sensor and leads to the lines to be measured.

“2.9 Connecting Measurement Leads and Sensors to Lines to Be Measured” (p. 42)

7 Verify proper connection.

“2.10 Checking Connections” (p. 44)

8 View the measured values and waveforms.

Instruction Manual: “3 Displaying Power Numerically”
Instruction Manual: “4 Displaying Waveforms”

Starting/stopping the integration

Displaying the waveforms

9 Save the data.

Instruction Manual: “7 Saving Data and Managing Files” (p. 20)

10 Analyze the data.

Instruction Manual: “8 Connecting External Devices”
Instruction Manual: “9.1 USB Connections and Settings”
Instruction Manual: “9.2 LAN Connections and Settings”
Instruction Manual: “9.8 GENNECT One (PC Application Software)”

11 Finish the measurement.

1 Overview

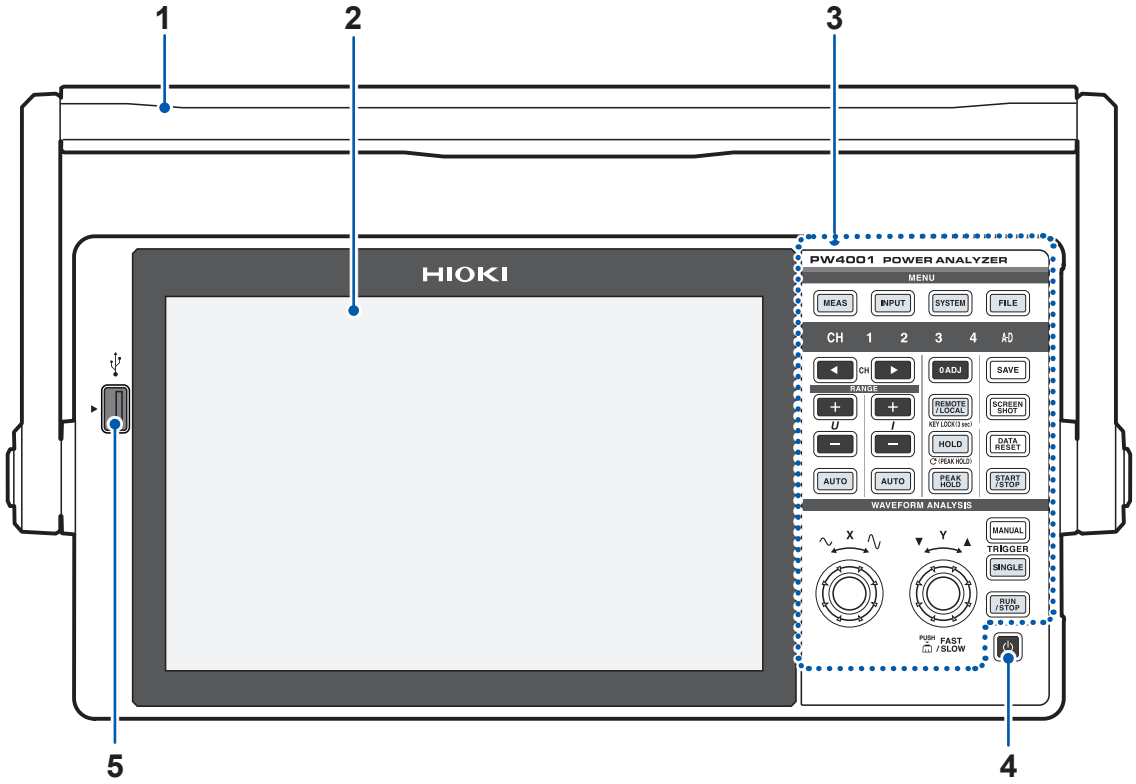
1.1 Product Overview

This instrument is a power analyzer that can analyze the power conversion efficiency by simultaneously measuring the input and output powers of an object under measurement. The instrument comes standard with four voltage inputs and four current inputs, enabling various lines to be measured according to your applications by combining wiring configurations from single-phase to three-phase four-wire configurations.

1.2 Part Names and Functions

The illustration shows PW4001-05.

Front



1	**Handle**	Use when carrying the instrument. It can also be rotated to enable use as a stand.
2	**Display area**	This is a touchscreen. Screen displays and settings can be changed just by touching it.
3	**Control area**	Make various settings using the keys and rotary knobs.
4	**Power key**	Use to turn the power on and off.
5	**USB port**	Connect a USB flash drive to save various types of data, including measured data, setting details, and screenshots. The port cannot be used with any other devices, including a mouse and a keyboard.

Handling the touchscreen

⚠ CAUTION

- **Do not press too hard on the touchscreen.**
- **Do not use hard or sharp objects to operate the touchscreen.**

Doing so could damage the instrument.

Engaging key lock

Press the **REMOTE/LOCAL** key for 3 s to lock the key operations.
Both key operation and touchscreen operation are entirely disabled while the key lock function is engaged, except key operation used to cancel the key lock state. The key lock state will persist even if the instrument is cycled.

Key operation area

MENU keys (switching screens)
Pressing a key causes the selected key to light up and the screen to switch over to the selected screen.

MEAS	Displays the Measurement screen. The Measurement screen displays measured values and waveforms.
INPUT	Displays the Input Settings screen. The Input Settings screen is used to configure settings related to input, wiring mode, measurement, and calculations.
SYSTEM	Displays the System Settings screen. The System Settings screen is used to configure settings related to time control, interfaces, and other functionality.
FILE	Displays the File Operation screen. Use this screen to manipulate data from the internal memory or USB flash drive.

Channel indicators

The display settings of the **RANGE** key and the setting indicator affect the input channels that are lit up.
The channels included in a single wiring configuration based on the wiring settings light up simultaneously.

◀ CH ▶	**Channel selection key** Selects the channel to display on the Measurement screen. The channel indicators light up linking to the channel selection key.
RANGE + + U I − − AUTO AUTO	**RANGE keys** The **+** and **−** keys of **U** can switch the voltage range, while the **+** and **−** keys of **I** can switch the current range. These affect the ranges of the channel with its channel indicator LED lit up. When the **[A-D]** channel indicator is lit up, the U keys function for Ch. A analog input, while the I keys function for Ch. C analog input. When the **AUTO** key is lit up, auto-ranging operation is canceled at the time when the range is switched.
	AUTO keys The **AUTO** key in the **U** area enables the auto-ranging function for voltage, while the **AUTO** key in the **I** area enables the auto-ranging function for current. The keys will light up. The key light turns off if pressed again, and the range will be fixed to the present setting at that time. The keys function for the channels with their channel indicators are lit up.

0 ADJ	Performs zero adjustment for the input channels.
SAVE	Saves measured data onto the USB flash drive or internal memory when the key is pressed.
SCREEN SHOT	Saves the screen image onto the USB flash drive or internal memory when the key is pressed.
REMOTE / LOCAL KEY LOCK(3sec)	**REMOTE/LOCAL key (key lock)** Lights up when updating firmware via the Remote Operation screen. Keys cannot be operated when lit up. If the key is held down for at least 3 s, the key lock is activated and the key lock icon is displayed on the screen. If the key is held down again for at least 3 s, the setting is released, and the key light turns off.

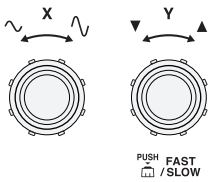
Measurement control keys

The measurement control keys function primarily to control power measurement functions. They do not affect the waveform display.

HOLD (PEAK HOLD)	Turns the hold function on and off. The key is lit up when the hold function is enabled. Pressing the **HOLD** key while the peak hold function is enabled will clear the peak hold data.	
PEAK HOLD	Turns the peak hold function on and off. The key is lit up when the hold function is enabled. Pressing the **PEAK HOLD** key while the hold function is enabled will update the hold data.	
DATA RESET	Resets integrated data. This key functions for the channels in which the integration is stopped.	
START / STOP	Controls starting and stopping of the integration and auto-save operation. The key does not light up when each wiring-configuration integration is enabled.	
	START / STOP (Lit up in green)	Integration or auto-save operation is in progress.
	START / STOP (Lit up in red)	Integration or auto-save operation is stopped. If the **DATA RESET** key is pressed, the **START/STOP** key light turns off.

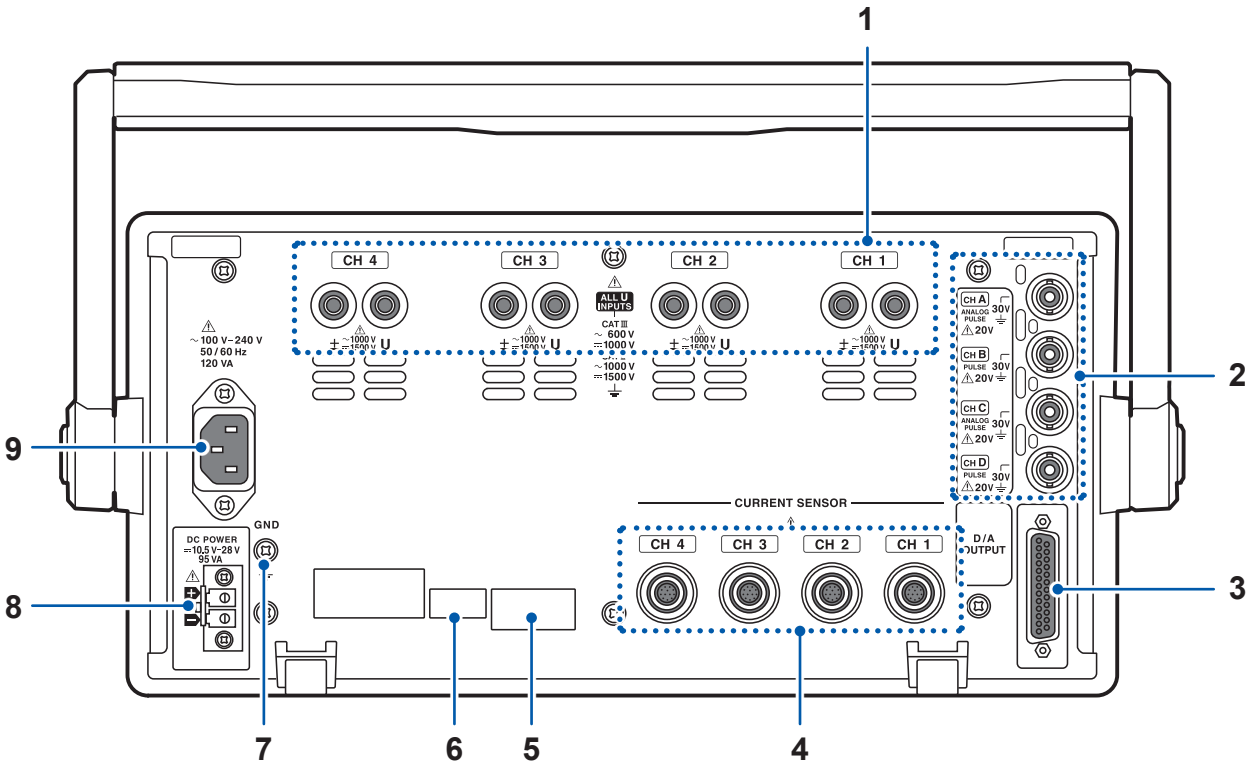
Waveform control keys (rotary knobs)

The waveform control keys function primarily to control waveform capture.

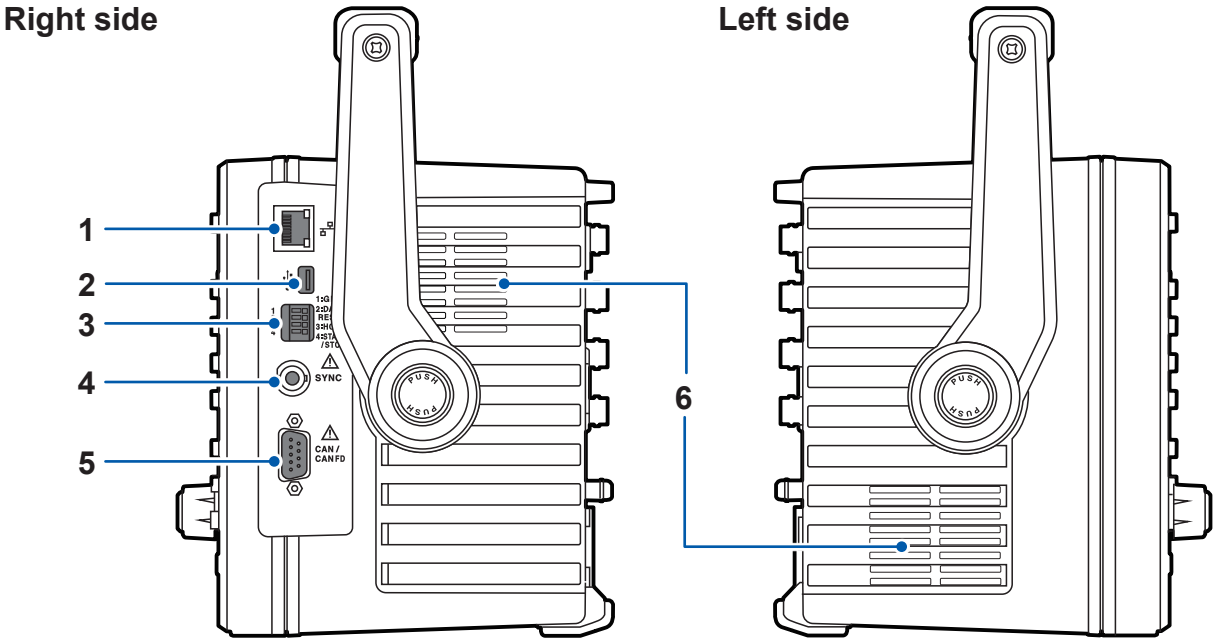
<table>
<tr><td>MANUAL
TRIGGER</td><td colspan="2">Forcibly applies a trigger while the instrument is waiting for a trigger (manual trigger).
The trigger is applied when the key is pressed, causing recording to start.</td></tr>
<tr><td rowspan="3">SINGLE</td><td colspan="2">The waveform is recorded once.</td></tr>
<tr><td>SINGLE
(Lit up in green)</td><td>If the key is pressed, the key lights up in green and the instrument enters the trigger standby state.
Recording will start when a trigger is activated.</td></tr>
<tr><td>SINGLE
(Off)
+
RUN / STOP
(Lit up in red)</td><td>Recording will stop once data has been recorded for the recording length.
Pressing the RUN/STOP key while the instrument is in the standby state will cause recording to stop.</td></tr>
<tr><td rowspan="3">RUN / STOP</td><td colspan="2">Enables waveforms to be recorded continuously.
The key lights up in green when pressed and then turns red when pressed again.</td></tr>
<tr><td>RUN / STOP
(Lit up in green)</td><td>The instrument is in the trigger standby state.
Recording will start when a trigger is activated.
The instrument will enter the trigger standby state repeatedly.</td></tr>
<tr><td>RUN / STOP
(Lit up in red)</td><td>Recording will stop.</td></tr>
<tr><td> 
</td><td colspan="2">Rotary knob
The rotary knobs function primarily to zoom waveforms in or out and to change the position or cursor.
They are also used to set the parameters whose numerical value will increase or decrease.
When you tap the button you wish to use on the screen, the corresponding rotary knob lights up.
Some items can be changed using the Y rotary knob. Pressing the Y rotary knob toggles between green and red lights, allowing you to change increments.

Tapping the original key again will turn the rotary knob light off.
When its light stays out, the knob does not work.</td></tr>
</table>

Rear



1	**Voltage input terminals**	Connect optional voltage cords.
2	**Motor analysis option (External input)**	You can input torque sensor and tachometer output to measure motor output.
3	**Waveform and D/A output option**	You can input the instrument's output into a recorder to record data over an extended period of time. You can also input this signal to an oscilloscope to observe the waveform.
4	**Current input terminal**	Connect an optional current sensor. The instrument automatically recognizes the current sensor. It also supplies power to the current sensor.
5	**Model name (top)**	This is the model name (order code). Option specifications will vary depending on the suffix.
	Serial number (bottom)	Check Hioki's website for the latest information. Do not remove this sticker because the number is required for product tracking. The serial number can be checked on the System screen.
6	**MAC address**	This is the MAC address allocated to the instrument. Do not remove this sticker because the number is required for its management.
7	**Function ground terminal**	Grounding this terminal may enhance noise resistance when measuring in noisy locations. When using the DC power supply option, make sure to ground the function ground terminal using a wire. Also, when using on a vehicle, make sure to connect with the body ground using a wire.
8	**DC power supply option (operates on 10.5 V to 28 V DC)**	Enables the instrument to be powered by a DC power supply, such as a battery.
9	**Power supply inlet**	Connect the included power cord.



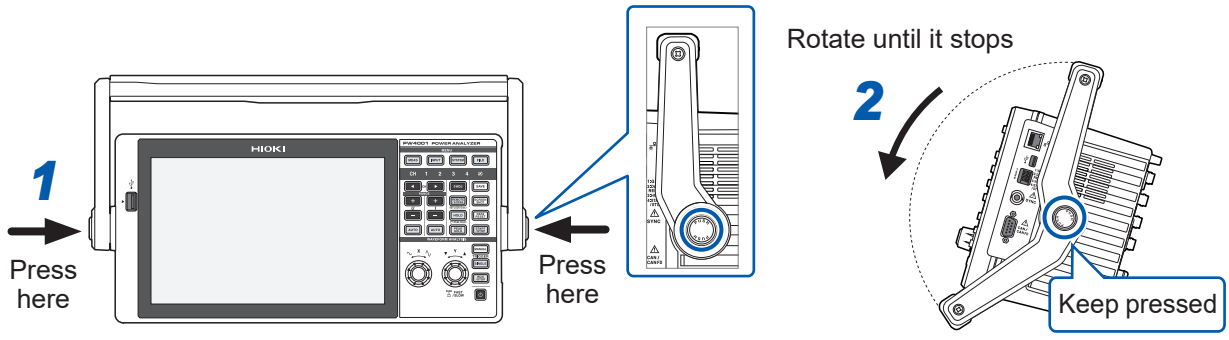
1	**RJ-45 connector (Gigabit Ethernet)**	Controls the instrument remotely over a LAN. Transfers measured data to a PC.
2	**USB port (mini-B type)**	Transfers measured data to a PC.
3	**External control terminal**	Controls starting and stopping of integration with a contact switch.
4	**BNC synchronization connector**	Connect the 9165 Connection Cable. Performs measurement using up to 8 synchronized instruments.
5	**CAN/CAN FD connector**	With the CAN output function, measured data can be output as CAN/CAN FD signals to the CAN bus in real time. With the CAN input function, CAN signals can be measured and recorded in real time.
6	**Air vent**	These ventilation holes prevent the inside of the instrument from becoming too hot. Make sure to place the instrument in a manner that prevents these holes from being blocked.

Using the handle as a stand

⚠ CAUTION

■ **Do not apply excessive downward force to the device when using its handle as a stand.**

Failure to follow this guidance could damage the handle.



2 Preparing for Measurement

2.1 Inspecting the Instrument before Use

Before starting measurement, inspect the instrument, accessories, and options.

⚠ DANGER

- **Check the voltage cord for damaged insulation or exposed metal before use.**
- **Inspect the instrument and check it for proper operation before use.**

  Using a damaged voltage cord or instrument could cause serious bodily injury. If you find any damage on a product, replace it with a Hioki-specified one.

IMPORTANT
The following display languages are available for this instrument. The default language is English.
English (default setting)/Japanese/Simplified Chinese/Traditional Chinese
Select the language you would like to use.
See “6.1 Checking and Changing Settings” in the Instruction Manual.

Inspecting accessories and options

Make sure that . . .	Action
Insulation of the power cords and voltage cords is not damaged. No metal is exposed.	If you find any damage, do not use the instrument as the damage may result in an electric shock or short circuit. The instrument will not be able to perform normal measurement in its present state. Please contact your authorized Hioki retailer or reseller.
The current sensors’ clamps are not cracked or otherwise damaged.	

Inspecting the instrument

Make sure that . . .	Action
The instrument is not damaged.	If you find any damage, request repair.
The instrument displays **[PW4001 POWER ANALYZER]** after being turned on. (The self-test is started internally.)	If **[PW4001 POWER ANALYZER]** is not displayed, the power cord may have a break in it, or the instrument’s internal circuitry may be damaged. Please contact your authorized Hioki retailer or reseller.
After the self-test is complete, the instrument displays the **INPUT** key > **[WIRING]** screen or the screen shown when it was last turned off. 	If the screen is not displayed, the instrument’s internal circuitry may be damaged. Please contact your authorized Hioki retailer or reseller.
The instrument’s clock is accurate.	If it is not accurate, set the instrument’s clock to the present time. See “6.1 Checking and Changing Settings” in the Instruction Manual.

2.2 Connecting the Voltage Cords (Voltage Input)

Connect the voltage cords (optional) to the voltage input terminals. Connect as many cords as required based on the lines to be measured and the wiring configuration.

⚠ DANGER

■ **Do not cause a short circuit between the wire to be measured and another wire with the metallic parts of the tips of the voltage cord.**

Failure to follow this guidance will cause an arc flash, resulting in serious bodily injury or damage to the instrument or other equipment.

■ **Check the cables for an exposed white inner insulation layer.**

Using a cable with its inner color layer exposed will result in electric shock.

⚠ WARNING

■ **Disconnect power to the line under measurement before connecting the test leads.**

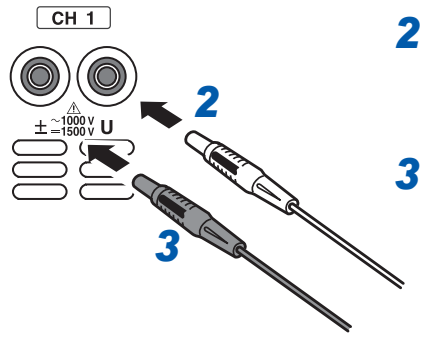
Doing so could damage the instrument, resulting in bodily injury.

■ **Use only Hioki-specified connection cords with the instrument.**

Failure to follow this guidance could result in bodily injury or a short-circuit fault. See “Optional products for voltage measurement” (p. 7).

IMPORTANT
To ensure accurate measurement, firmly insert the voltage cords completely.

Rear panel of the instrument



1 **Turn off the instrument.**

2 **Insert the red voltage cord or one with the same color as the channel indicator into the U voltage input terminal.**

3 **Insert the black voltage cord into the ± voltage input terminal.**

2.3 Connecting the Current Sensors (Current Input)

Connect the current sensor to a current input terminal.

⚠ DANGER

■ **Do not use the current sensors to measure an exposed conductor (circuit) carrying a voltage greater than the maximum rated voltage to earth*1.**

Doing so could result in serious bodily injury or a short circuit.

*1. For details about the maximum rated voltage to earth of the current sensor, refer to the instruction manual that came with the current sensor.

■ **Only connect an optional current sensor.**

Using a current sensor other than the optional current sensors could cause serious bodily injury.

⚠ WARNING

■ **Turn off all devices before connecting a pass-through-type current sensor of the through type, such as the CT6875.**

There is a risk of the operator experiencing an electric shock. A short circuit may also occur.

⚠ CAUTION

■ **Do not connect or disconnect connectors while the instrument has been turned on.**

Doing so could damage the sensor.

IMPORTANT

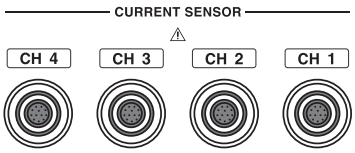
Certain current sensors have limitations on the number that can be used depending on the usage conditions. Check the specifications of the current sensor to be used and ensure it is operated within the rated current range.

Under the following usage conditions, only use a maximum of three CT6877A, CT6876A, or CT6904A series current sensors.

1. When using an AC or DC power supply (power supply voltage: 10.5 V to 20 V) and with an operating temperature of 40°C to 50°C
2. When using a DC power supply (power supply voltage: 20 V to 28 V) and with an operating temperature of 30°C to 40°C

Also, under the above usage conditions, when using a Hioki current sensor that is not a standard option for this instrument (p. 7), ensure that the total power supply capacity specified in the sensor specifications (consumption current when measuring rated current) does not exceed ±1200 mA.

Rear panel of the instrument

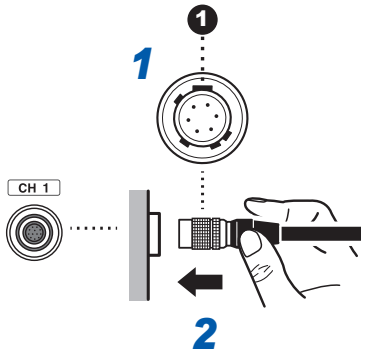


Connect an optional current sensor. The instrument automatically recognizes current sensors equipped with a memory function.
It also supplies power to the current sensor.

For detailed specifications and instructions for the current sensors being used, refer to the instruction manual that came with the current sensors.

How to connect the connector

When the connector is metallic



1 Turn the instrument off, then align the positions of the connector guides of the instrument and the current sensor.

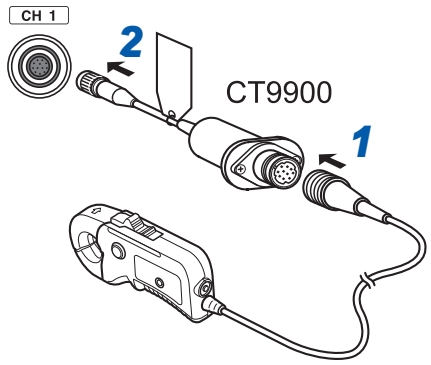
Connect the part of the connector with the large notch (❶) is facing upwards.

2 Hold the plastic part of the connector and insert it straight until it is locked.

The instrument automatically recognizes the type of the current sensor.

When the connector is plastic

The 9709, CT6860 series, and CT6840 series have current sensors with black plastic connectors. These current sensors can be connected to current input terminals using a CT9900 Conversion Cable.

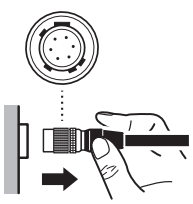


1 Turn the instrument off, then align the positions of the connector guides of the CT9900 Conversion Cable and the current sensor to connect them.

2 Insert the connector of the CT9900 straight until it is locked.

IMPORTANT
When the CT6846 or CT6865 is connected via the CT9900 Conversion Cable, the current sensor is recognized as a 500 A AC/DC sensor. Set the CT ratio to 2.00 in such a case.
See “Scaling (when using VTs [PTs] or CTs)” in the Instruction Manual.

How to disconnect the connector

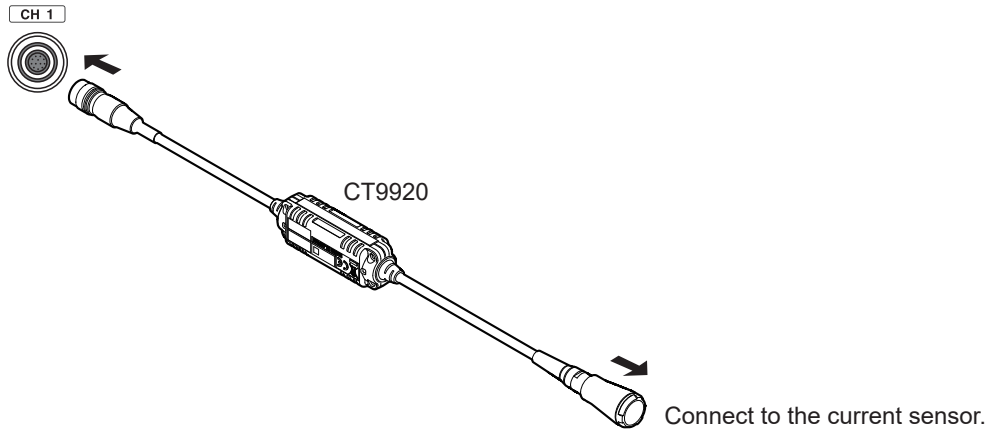


1 Hold the metallic part of the connector and slide it toward the cable side to unlock the connector.

2 Pull out the connector.

Connecting a CT7000 Series sensor

CT7642, CT7742, CT7044, CT7045, and CT7046 current sensors can be used to measure large currents of 1000 A or more. Connect these current sensors to the instrument using the CT9920 Conversion Cable.



When connecting using the CT9920 Conversion Cable, the rate must be set for the current sensor being used.
See “2.5 Setting Wiring Mode and Configuring Current Sensor Settings” (p. 35).

If the input exceeds the measurable range (using VTs and CTs)

Use instrument transformers: voltage transformers (VTs [potential transformers, PTs]) and current transformers (CTs) externally. VT ratios and CT ratios can be set on the instrument to allow primary-side input values to be read directly.
See “Scaling (when using VTs [PTs] or CTs)” in the Instruction Manual.

⚠ DANGER

■ **Do not touch VT (PT), CT, or the input terminals of the instrument when they are active.**

Doing so could result in serious bodily injury.

⚠ WARNING

■ **When using VTs (PTs) externally, do not short the secondary side.**

Applying a voltage to the primary side while in the shorted state may cause a large current to flow to the secondary side, resulting in equipment damage or fire.

■ **When using CTs externally, do not leave the secondary side open.**

If a current flows to the primary side while in the open state, a high voltage may occur on the secondary side, resulting in a risk of the operator experiencing an electric shock.

IMPORTANT
The phase difference between the external VTs (PTs) and CTs may introduce a large error component into power measurement. If you wish to make more accurate power measurement, use VTs (PTs) and CTs with a small phase error in the frequency band of the circuit being used.

2.4 Supplying Power to the Instrument

The instrument can be powered by a commercial power supply (100 V to 240 V AC) or a DC power supply such as an external battery (10.5 V to 28 V DC, using the DC power supply option).

IMPORTANT
Do not attempt to connect the instrument to both a commercial power supply and DC power supply at the same time.

When using a commercial power supply

⚠ DANGER

■ **Use only the specified power cord to provide power to the instrument.**

Using a power cord other than those specified could cause a fire, resulting in serious bodily injury.

⚠ WARNING

■ **Connect the power cord to a 3-prong grounded-type (2-pole) power outlet.**

Connecting the power cord to an ungrounded power outlet could result in electric shock.

⚠ CAUTION

■ **Do not power the instrument with a power supply that generates a rectangular or pseudo-sine wave, such as an uninterruptible power supply (UPS) or DC/AC inverter.**

Doing so could damage the instrument, resulting in bodily injury. Ensure to use a power supply system with a sine-wave output.

■ **Unplug the power cord while the instrument is not in use.**

Failure to do so could cause the operator to experience an electric shock.

■ **Before plugging the power cord into an outlet, ensure that your supply voltage falls within the supply voltage range indicated close to the power inlet of the instrument.**

Supplying a voltage outside the specified range to the instrument could damage it, causing bodily injury.

■ **Ground the ground terminals of the instrument and the equipment to be connected at the same location.**

Connecting the cable when there is a difference in ground potentials between them could cause damage or malfunction.

Connecting the power cord

1. **Confirm that the power supply voltage is within the rated range and then connect the power cord to the power inlet.**
   (100 V to 240 V AC)

2. **Connect the plug of the power cord to the outlet.**

When using a DC power supply (DC power supply option)

⚠ DANGER

■ **When using a battery, connect it in a manner that prevents short circuits.**

Failure to follow this guidance can cause arc flash, resulting in serious bodily injury or damage to the instrument or connected devices.

■ **When using a battery, use one with protective components or protection circuits.**

Failure to follow this guidance may result in conditions such as overcurrent or over-discharge that can cause bodily injury or damage to the instrument or connected devices.

⚠ WARNING

■ **Securely connect the measurement cables to the input terminals.**

Loose terminals could increase contact resistance and cause the instrument to overheat, resulting in bodily injury, instrument burnout, or fire.

⚠ CAUTION

■ **Securely connect the connection cord to the power supply connector using appropriate wire and tightening torque.**

Failure to follow this guidance may result in a malfunction or damage to the instrument or connected devices.

■ **Before connecting the instrument to a DC power supply, ensure that the supply voltage falls within the supply voltage range indicated close to the power inlet of the instrument and that the polarities (+, -) are correct.**

Failure to follow this guidance may result in damage to the instrument or connected devices.

■ **Use the function ground terminal for the instrument and the devices being connected.**

When using on a vehicle, etc., make sure to connect with the body ground.

Failure to follow this guidance may result in a malfunction or damage to the instrument or connected devices.

■ **Ensure that no force is applied to the power supply connector.**

Particularly in environments subject to vibration, secure the wires so that no stress is applied.

Failure to follow this guidance may result in a malfunction or damage to the instrument or connected devices.

■ **When disconnecting the power supply connector from the instrument, first turn off the power and then pull it out by holding the power supply connector itself.**

Failure to follow this guidance may result in damage to the connection cord or breakage of the power supply connector.

IMPORTANT

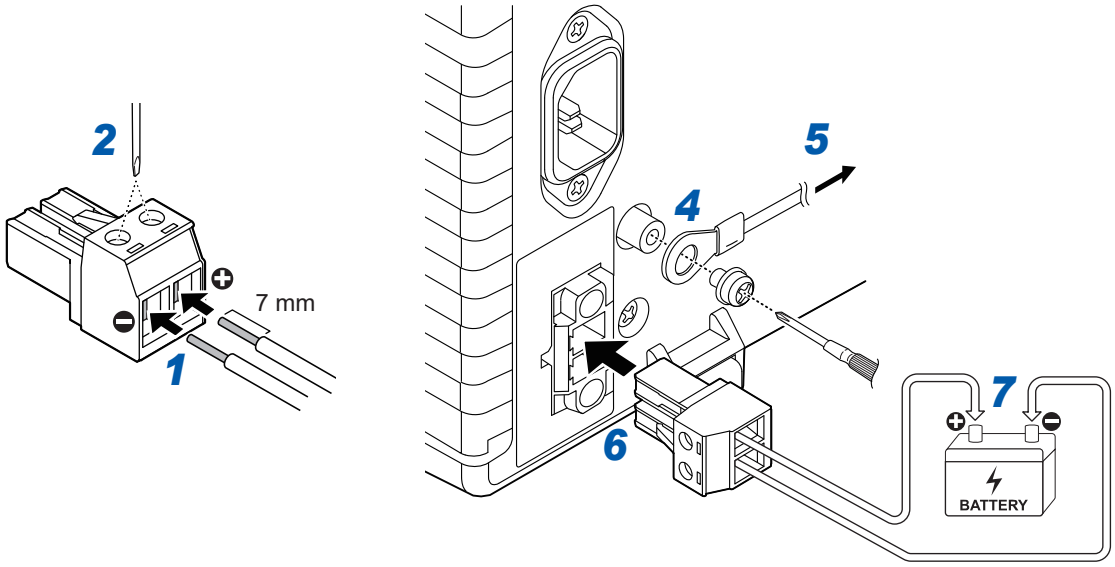
The DC power supply voltage that can be provided will vary depending on the operating temperature.

- 10.5 V to 28 V DC (Operating temperature range: -20°C to 40°C)
- 10.5 V to 20 V DC (Operating temperature range: 40°C to 50°C)

Connecting the power supply connector

Tools to be prepared

DC power supply (battery, etc.)	Power supply voltage: 10.5 V to 28 V DC (Operating temperature range: -20°C to 40°C) 10.5 V to 20 V DC (Operating temperature range: 40°C to 50°C)
Power supply connector (accessory)	Model number: PC 4/2-ST-7.62 (Phoenix Contact)
Connection cord	Single wire: 1.25 mm^2 to 4 mm^2 (AWG16 to AWG12) Stranded wire: 1.25 mm^2 to 4 mm^2 (AWG16 to AWG12) Recommended bare wire length: 7 mm
Wire (for function grounding)	Crimp terminal: M4 screw type
Phillips screwdriver (M4)	
Flat-head screwdriver (M3)	



1 **Connect the connection cord to the power supply connector.**

Fully insert the connection cord and connect it so that all core wires are inside the connector.

2 **Tighten the screws of the power supply connector with a flat-head screwdriver (M3).**

Tightening torque: 0.5 N•m to 0.6 N•m

3 **Gently pull on the connection cord to confirm that it does not become disconnected.**

IMPORTANT

- Make sure the polarities are correct when connecting.
- The screws of the power supply connector are electrically connected to the terminal. Before handling the screws, disconnect the connection cord from the DC power supply.
- Periodically retighten the screws of the power supply connector.

4 **Connect the wire to the function grounding terminal of the instrument and secure it with a Phillips screwdriver (M4).**

Tightening torque: 1.2 N•m to 1.3 N•m

5 **Connect the wire to the ground.**

Connect it to a nearby grounding point.

IMPORTANT

When using on a vehicle, make sure to connect with the body ground.

6 **Connect the power supply connector to the instrument.**

Make sure the connector orientation is correct when connecting.

7 **Connect to the DC power supply used to supply power. When using a battery, connect the positive terminal (+) to the positive wire of the connection cord, and the negative terminal (−) to the negative wire of the connection cord.**

IMPORTANT

- This instrument does not have a battery charging function.
- The instrument will automatically stop power from being supplied from the +12 V battery if the voltage falls outside the rated supply voltage range (9.0 V to 10.5 V) due to over-discharge, etc. Once stopped, it will not restart even if the power supply voltage returns to around +12 V. To restart, first stop the supply of power by means such as disconnecting connection cord from the +12 V battery before attempting to supply power again.

Turning the instrument on

1 **Connect the voltage cords, current sensors, and power cord (or power supply connector).**

2 **Press the power key.**

The instrument is turned on and starts a self-test (self-diagnosis by the instrument, approx. 10 s).
Once the self-test is finished, the Input screen's **[WIRING]** page will be displayed (default setting).
If the startup screen is set to **[LAST]**, the screen when the instrument was last turned off will be displayed.
See "2.1 Inspecting the Instrument before Use" (p. 25).

3 **Warm up for 30 minutes or longer.**

IMPORTANT

- Perform warm up in an environment of between 0°C and 50°C.
- For high-precision measurement, warm up for 60 minutes or longer.

4 **Perform the zero adjustment.**

See "2.8 Zero Adjustment and Degaussing (Demagnetization)" (p. 41).

IMPORTANT

If the instrument malfunctions, a dialog box will appear and operation will be restricted. The instrument is faulty if the dialog box appears again after power has been restarted. Perform the following procedure before contacting your authorized Hioki retailer or reseller.

1. Stop measurement, shut off power to the lines under measurement or disconnect the voltage cords and current sensors from the lines under measurement, and turn off the instrument.
2. Disconnect the power cord and all measurement leads and sensors.

Turning the instrument off

⚠ CAUTION

■ **Remove the voltage cords and the current sensors from the lines to be measured before turning off the instrument.**

Failure to do so could damage the instrument.

1 **Press the power key. Or, tap [SHUTDOWN] at the lower right of the screen.**

The confirmation window is displayed.

2 **Tap [Yes] to shut down the instrument.**

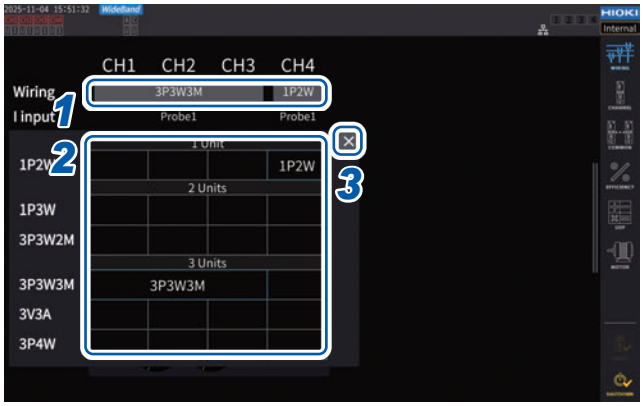
The instrument enters the following state during the shutdown process:
- The fan inside the instrument keeps rotating.
- The **MEAS**, **INPUT**, **SYSTEM**, and **FILE** keys light up simultaneously.

IMPORTANT
The following standby power will be consumed even after shutting down the instrument using the power key. When not in use, unplug the power cord and power supply connector.
Commercial power supply: Approx. 4.2 W
DC power supply: Approx. 1.0 W

2.5 Setting Wiring Mode and Configuring Current Sensor Settings

This section describes how to set wiring modes based on the number of channels with which the instrument is equipped and the lines to be measured.
For measurement on multi-phase systems, connect the same current sensors to all the channels to be combined.

Display screen **INPUT** key > **[WIRING]**



1 **Tap the button to select a wiring mode for each channel.**

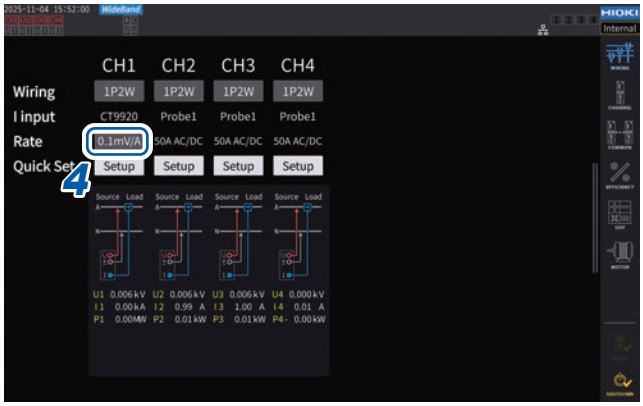
The Settings window will open.

2 **Select a wiring mode from among 1 module, 2 modules, and 3 modules.**

See “Wiring mode” (p. 36).

When different types of input modules are connected to a single wiring configuration, the circumference of the wiring button is displayed in yellow.

3 **Tap [×] to close the Settings window.**



Rates can be individually selected when using the CT9920.

4 **(When using the CT9920) Tap the rate-selection button and then select the rate of the connected current sensor.**

Select 0.1 mV/A when using the CT7642, CT7742, CT7044, CT7045 or CT7046.

IMPORTANT
When using a current sensor whose rating can be switched, match the rating of current sensors in the same line.
If a wiring pattern using multiple channels is selected, the parameters that can be set for each channel (such as the voltage range) are unified to those of the first channel.

Wiring mode

1P2W (Single-phase 2-wire)	Select this wiring mode when measuring a DC line. The current sensor can be connected to either the source or ground terminal. The wiring diagrams include examples of both. See “Wiring diagrams” (p. 43).
1P3W (Single-phase 3-wire)	—
3P3W2M (3-phase 3-wire)	Select this wiring mode when using the two-wattmeter method with two channels to measure a three-phase delta configuration. It enables accurate measurement of active power even when waveforms are distorted due to an unbalanced state. Apparent power, reactive power, and power factor values for unbalanced lines may differ from corresponding values obtained from other measuring instruments. In such a case, use 3V3A or 3P3W3M wiring mode.
3V3A (3-phase 3-wire)	Select this wiring mode when using the two-wattmeter method with three channels to measure a three-phase delta configuration, which is used when you emphasize compatibility with legacy power meters such as the Hioki 3193. It allows accurate measurement of not only active power, but also apparent and reactive power and power factor even with unbalanced lines.
3P3W3M (3-phase 3-wire)	Select this wiring mode when using the three-wattmeter method with three channels to measure a three-phase delta configuration. It allows accurate measurement even if the instrument in 3V3A wiring mode yields an error due to leakage current with large high-frequency component when measuring a PWM inverter, making it well suited to motor power measurement.
3P4W (3-phase 4-wire)	Select this wiring mode when using the three-wattmeter method with three channels to measure a three-phase Y (star) configuration.

Current sensor auto-recognition function

The instrument automatically acquires the rated current, phase compensation values, and other information of the current sensor connected to the instrument.
This function can significantly reduce the setting time before measurement, and measure the power based on accurate sensor information.
(Only current sensors with the auto-recognition function)

In the following cases, the instrument automatically acquires only the rated current of the current sensor connected to the instrument.

- When a current sensor not equipped with the auto-recognition function is connected to the instrument
- If the instrument fails to read current-sensor information, including phase compensation values

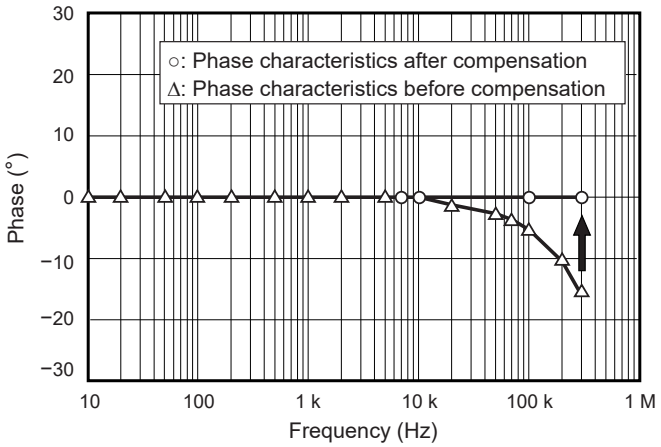
List of optional current sensors

See “Optional products for current measurement” (p. 8).

Compensating for phase errors of current sensors

Current sensors generally exhibit a tendency for phase error to increase gradually in the high-frequency region of their frequency band. By using sensor-specific phase characteristics information to correct the measured values, it is possible to reduce the error component in power measurement made in a high-frequency region.

Conceptual diagram



Tips

Phase compensation of current sensors with auto-recognition function

When using a current sensor with the auto-recognition function, the phase of the current sensor is automatically corrected. If you wish to set any phase compensation values, follow the steps listed in the following “How to enter phase compensation values” section.

How to enter phase compensation values

If using current sensors without the auto-recognition function, measure after performing phase compensation for the current sensors.

Display screen **INPUT** key > **[CHANNEL]**

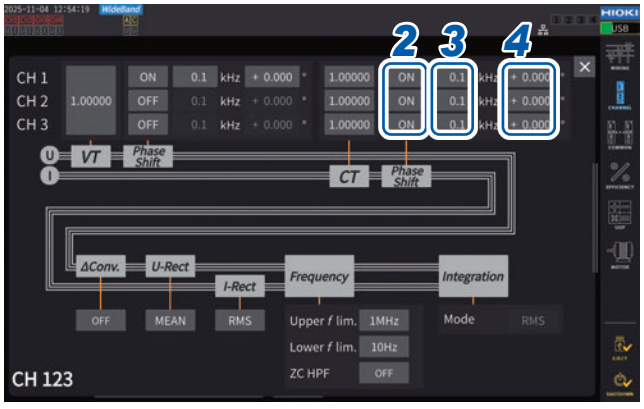
1 **Tap the detailed display area for the channel to be configured.**

2 **Tap the [Phase Shift] area box and select [ON].**

When using a current sensor equipped with the auto-recognition function, **[Auto]** is displayed as an alternative. When **[Auto]** is selected, the compensation values are entered automatically.

3 **Tap the frequency box, then enter the frequency with the numeric keypad.**

4 **Tap the phase difference box, then enter the phase difference with the numeric keypad.**



IMPORTANT

- Enter the phase compensation value accurately. Mistaken settings can cause the compensation process to increase measurement errors.
- Operation outside the frequency range within which the current sensor’s phase accuracy is specified is not defined.

Typical values of current sensors' phase characteristics

You can find typical values of current sensors' phase characteristics on Hioki's website.

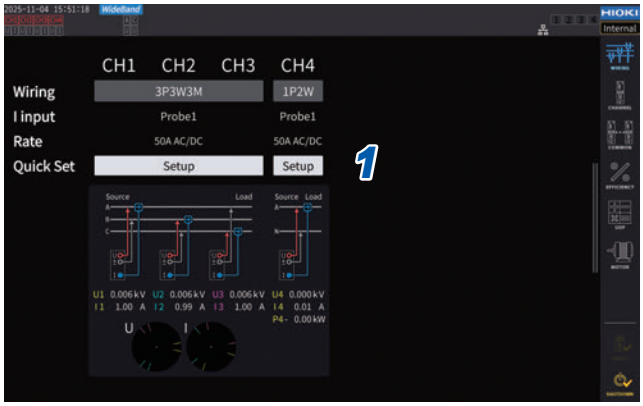
1. **Open the PW4001 product page on https://www.hioki.com.**
2. **Select [User's Guide] in [Downloads].**
3. **Check the "Typical Values of Current Sensors' Phase Characteristics".**

For the phase characteristics information when using CT9557, please contact your authorized Hioki retailer or reseller.

2.6 Simple Configuration (Quick Set)

The measurement conditions are set to the representative values according to the selected lines to be measured. This functionality is useful when you are using the instrument for the first time or when you need to measure lines that differ from those measured last.

Display screen **INPUT** key > **[WIRING]**



1 **Tap [Setup] in the [Quick Set] box.**

2 **Touch the type of the line to be measured to select it from the list.**
The confirmation window is displayed.

3 **Tap [Yes] to accept the setting.**

4 **Check the setting details via the INPUT key > [CHANNEL] screen.**

Change the settings as necessary.

2

Types of lines under measurement

50/60 Hz	Select this type to measure a commercial power line over a broad range of frequencies.
DC/WLTP	Select this type to measure DC line over a broad range of frequencies. The settings are suitable for measuring the charging/recharging cycle of a battery or a DC line, specified in the worldwide harmonized light vehicles test procedure (WLTP). When making measurement in conformity with WLTP, set the data update interval at 50 ms or less. This setting is selectable only in 1P2W wiring mode.
PWM	Select this type to measure a PWM line. A fundamental frequency of 1 Hz to 1 kHz is used so that it does not synchronize with the carrier frequency of 1 kHz or more. It is recommended to use the sensor phase compensation function to facilitate more accurate measurement.
HIGH FREQ	Select this type to measure a high-frequency source with a frequency of at least 10 kHz. It is recommended to use the sensor phase compensation function to facilitate more accurate measurement.
GENERAL	Select this type to measure lines other than the **[50/60Hz]**, **[DC/WLTP]**, **[PWM]**, or **[HIGH FREQ]** type. Also use this setting when the object under measurement is not well known. It is recommended to use the sensor phase compensation function to facilitate more accurate measurement.

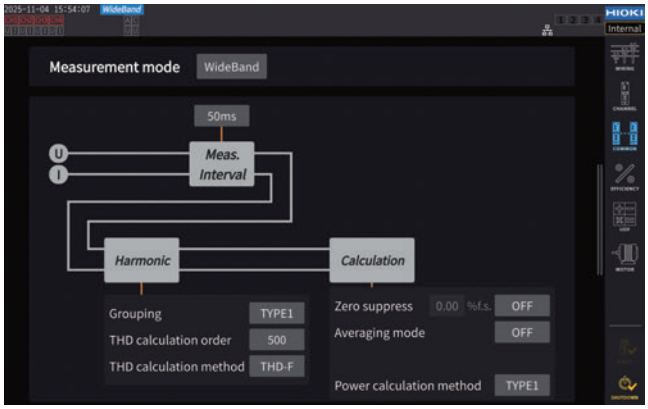
Setting details

Lines under measurement	Sync. source	Voltage range	Current range	Upper frequency limit	Lower frequency limit	Integration mode	U/I rectification method	LPF
50/60 Hz	Voltage	Auto	Auto	100 Hz	10 Hz	RMS	RMS/RMS	OFF
DC/WLTP	DC	Auto	Max. range	100 Hz	10 Hz	DC	RMS/RMS	OFF
PWM	Voltage	Auto	Auto	1 kHz	1 Hz	RMS	MEAN/RMS	OFF
HIGH FREQ	Voltage	Auto	Auto	1 MHz	1 kHz	RMS	RMS/RMS	OFF
GENERAL	Voltage	Auto	Auto	1 MHz	0.1 Hz	RMS	RMS/RMS	OFF

2.7 Measurement Mode

This section describes how to choose a measurement mode.

Display screen **INPUT** key > **[COMMON]**



1 **Tap the [Measurement mode] box and select a measurement mode.**

IEC	Select to use IEC measurement mode. This mode can only be selected when the PW9006 IEC harmonic/flicker measurement function (optional) is installed. When the measured line has a frequency of 50 Hz or 60 Hz, the instrument performs harmonic measurement that complies with the IEC 61000-4-7 standard and voltage fluctuation/flicker measurement that complies with the IEC 61000-4-15 standard. Harmonic measured values will be updated at intervals of 200 ms. Accurately measured values for harmonic measurement and voltage fluctuation/flicker measurement cannot be guaranteed if the frequency to be measured falls outside the range of 45 Hz to 66 Hz. Analysis can be performed up to the 200th order.
WideBand	Select to use wideband measurement mode. It can be used with a wide range of frequencies from 0.1 Hz to 600 kHz. The analysis order varies with the frequency being measured. When the data update interval is set at 10 ms or less, measured harmonic values will be updated at intervals of 50 ms.

- Settings cannot be switched on a wiring configuration or channel basis.
- The same synchronization source will be used for each channel's harmonic measurement. Note, however, that if **[Zph1]** is selected as the synchronization source and **[Ext1]** is selectable, either **[Ext1]** or **[Zph1]** is selectable as the synchronization source for harmonic measurement.
  See "Synchronization source" in the Instruction Manual.
- Accurate harmonic measurement is not possible if the frequency of the input signal set as the synchronization source fluctuates or if the input signal exhibits a low level relative to the range.

2.8 Zero Adjustment and Degaussing (Demagnetization)

Before connecting the instrument, perform zero adjustment while no voltage or current is inputted. Zero adjustment is performed for all ranges and for all input channels at the same time. In addition, if a current sensor that can measure both AC and DC currents is connected to the instrument, the current sensor will be degaussed (demagnetization, DMAG) at the same time.

1 **Connect the current sensors and voltage cords to the instrument.**

Adjustment of measured current values must include the current sensors.

2 **Allow the instrument to warm up for 30 minutes or more while it has been turned on.**

3 **When zero adjustment can be performed on the current sensor connected to the instrument, perform zero adjustment on the current sensor side.**

Some current sensors may have an element, such as a knob, to perform zero adjustment.
See the Instruction Manual of the current sensor. If it contains any instructions regarding connecting to equipment with a zero correction function, follow them.

4 **Set wiring modes and configure current sensor settings.**

5 **Press the MEAS key.**

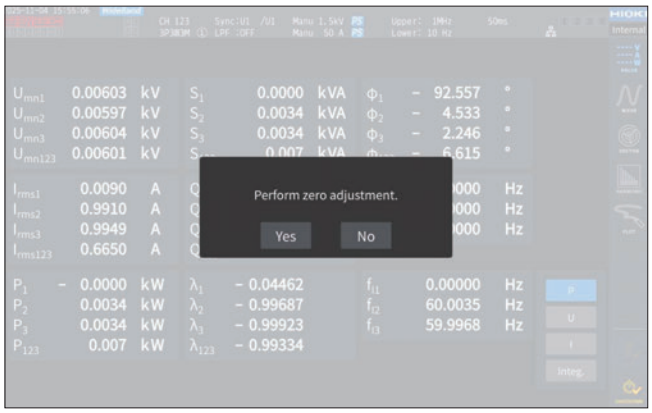
If Ch. 1 through Ch. 4 are lit up, zero adjustment will be performed for voltage and current.
(When equipped with the motor analysis option) If the **[A-D]** channel indicators are lit up, zero adjustment will be performed for the motor input channels.

6 **Press the 0ADJ key.**

A confirmation dialog box is displayed.

7 **Tap [Yes].**

The screen will display **[Performing zero adjustment...]** and the process will be completed in about 30 s.

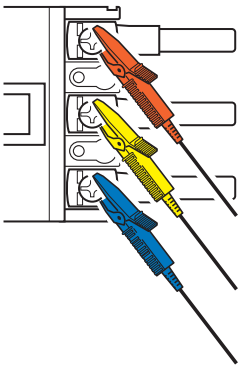


8 **Connect the sensor and leads to the lines to be measured.**

2.9 Connecting Measurement Leads and Sensors to Lines to Be Measured

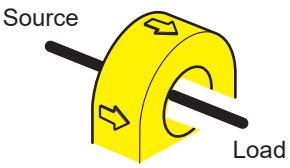
Perform zero adjustment and then connect voltage cords and current sensors to lines to be measured as indicated in the wiring diagram shown via the **INPUT** key > **[WIRING]** screen. To ensure accurate measurement, connect the instrument exactly as shown on the wiring diagram. The wiring diagram will be displayed when you select a wiring mode via the **INPUT** key > **[WIRING]** screen.
See “2.5 Setting Wiring Mode and Configuring Current Sensor Settings” (p. 35).

Voltage Cord

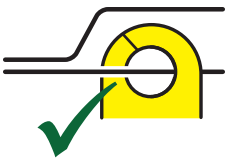


Firmly clip the voltage cords to the metallic parts on the power supply side, such as screws and bus bars.

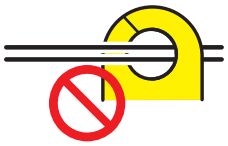
Current sensors



Clamp the current sensor around a conductor so that its current direction mark points at the load side.

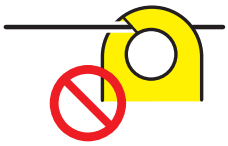


OK



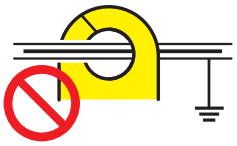
NO

Do not clamp the sensor around two or more conductors.



NO

Do not pinch the conductor.



NO

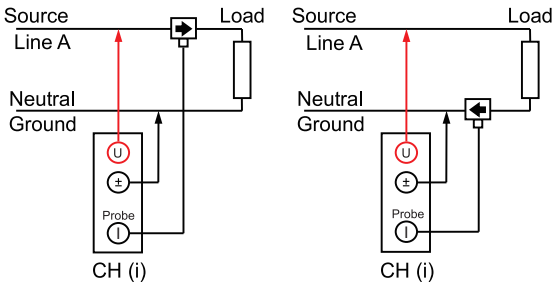
Do not clamp the sensor to a shielded wire.

IMPORTANT

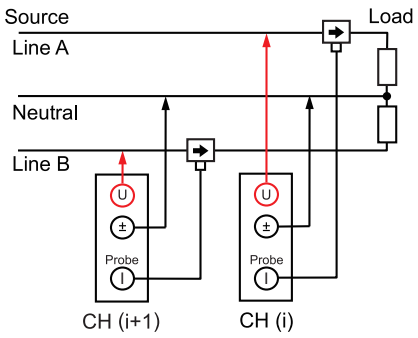
- The phases are labeled as A, B, C on the wiring diagram screen. Connect the instrument based on whatever names you are using, such as R/S/T and U/V/W, as appropriate.
- Ensure the current sensor is clamped around only one wire of the conductors. Regardless of whether it is the single-phase or three-phase, clamping the instrument around two or more wires together in a bundle will prevent accurate measurement of the current.

Wiring diagrams

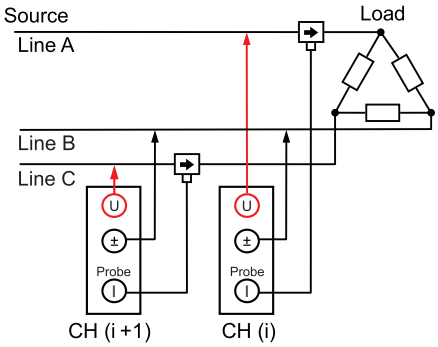
Single-phase 2-wire (1P2W)



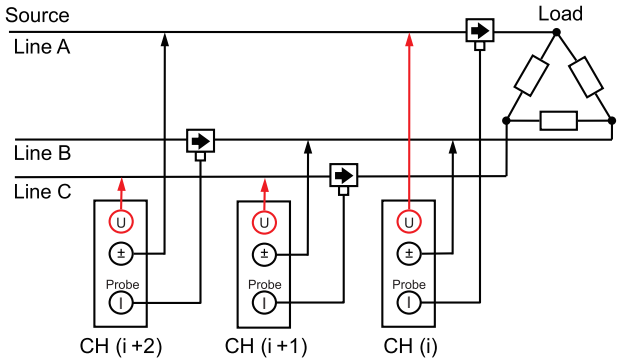
Single-phase 3-wire (1P3W)



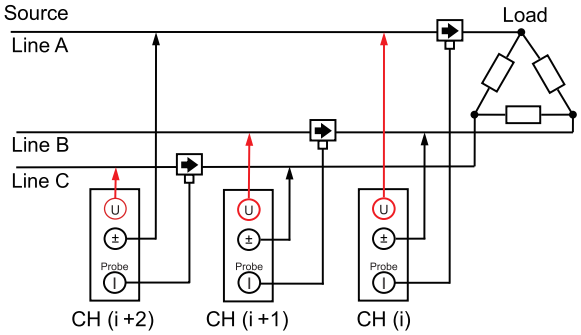
3-phase 3-wire (3P3W2M)



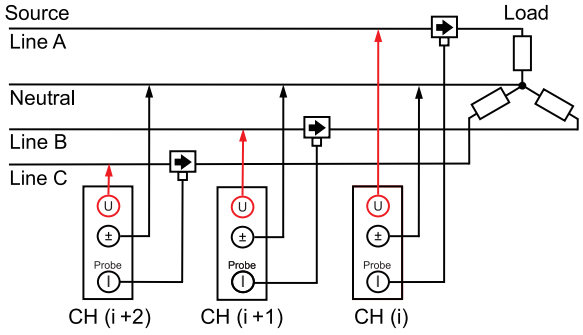
3-phase 3-wire (3V3A)



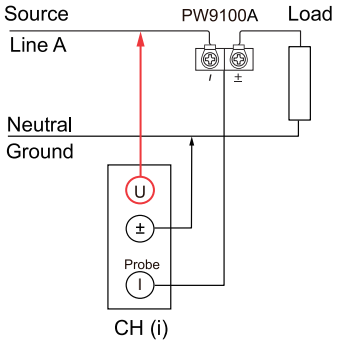
3-phase 3-wire (3P3W3M)



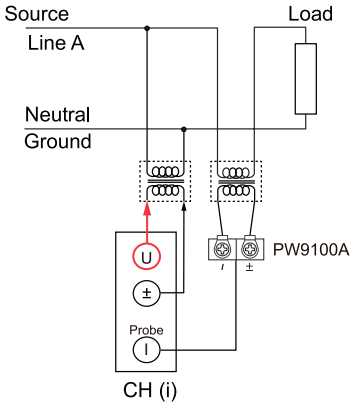
3-phase 4-wire (3P4W)



Normal connection when using the PW9100A



When the PW9100A and either PT or CT are used



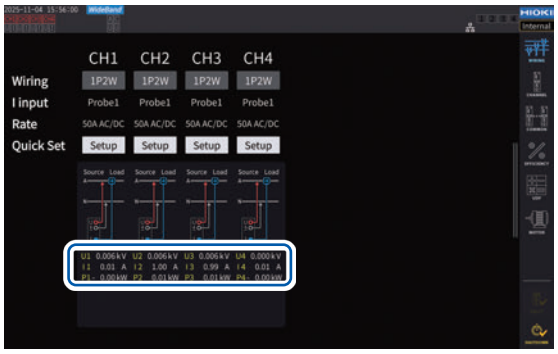
2.10 Checking Connections

Based on the measured values and vectors on the screen, you can check whether the voltage cords and the current sensors are connected properly.

Display screen **INPUT** key > **[WIRING]**

1P2W mode

When the cords and sensors are properly connected, the measured values are displayed.



Wiring mode other than 1P2W mode

The measured values and vector lines are displayed. When the cords and sensors are properly connected, the vector lines indicates the proper range.

- The vector lines are shown in the same colors as those of measured values' items.
- The indication range used in vector diagrams assumes an inductive load (such as a motor).
- Vectors may exit the range when the power factor approaches zero or when a capacitive load is measured.
- The measured value of active power P for individual channels may be negative for 3P3W2M and 3V3A lines.

Issue	Cause
The measured voltage value is too high. **The measured voltage value is too low.**	• The voltage cord connectors have insufficiently been inserted into the instrument's voltage input terminals. • The voltage cords have improperly been connected to the lines under measurement.
The measured current value is not appropriate.	• The current sensor connectors have insufficiently been inserted into the instrument's current sensor input terminals. • The current sensors have improperly been connected to the lines under measurement.
The measured active power value is negative.	• The voltage cords have improperly been connected to the lines under measurement. • The current sensors' current direction mark (arrow) have not pointed at the load side but the source side.
The instrument does not display an active power but zero.	• The zero suppress setting is not set to off.
The vector arrow is too short or the vector lengths differ.	**For voltage vectors** • The voltage cords have improperly been connected to the lines under measurement.
	For current vectors • The current sensors have improperly been connected to the lines under measurement. • The connected current sensors are inappropriate for currents flowing through the line under measurement. • The **[Sync. source]** setting has been set improperly.
The vector direction (phase) and color differ.	• The voltage cords and current sensors have been connected to the inappropriate terminals.

See "2.2 Connecting the Voltage Cords (Voltage Input)" (p. 26)
"2.3 Connecting the Current Sensors (Current Input)" (p. 27)
"2.9 Connecting Measurement Leads and Sensors to Lines to Be Measured" (p. 42).

3 Specifications (Excerpt)

3.1 General Specifications

Operating environment	Indoor use, pollution level 2, altitude up to 2000 m (6562 ft.)
Operating temperature and humidity range	-20°C to 50°C (−4°F to 122°F), 80% RH or less (non-condensing) When using below 0°C (32 °F), pre-warm the device in an environment between 0°C and 50°C (32 °F to 122 °F) beforehand.
Storage temperature and humidity range	-20°C to 50°C (−4°F to 122°F), 80% RH or less (non-condensing)
Conforming standards	Safety EN 61010 EMC EN 61326 Class A
Complying standards (PW9006 option)	The instrument in IEC measurement mode complies with IEC 61000-4-7:2002 (Ed. 2.0). The instrument in IEC measurement mode complies with IEC 61000-4-15:2010 (Ed. 2.0).
Vibration resistance	JIS D 1601:1995 5.3 (1) Type 1: Passenger cars, Condition: Equivalent to Type A Vibration acceleration: 45 m/s^2 (4.6 G) for 4 h in the X direction and 2 h in the Y and Z directions
Power supply	• Commercial power supply Rated supply voltage: 100 V to 240 V AC (Assuming voltage fluctuation of ±10%) Rated power-supply frequency: 50 Hz, 60 Hz Anticipated transient overvoltage: 2500 V Maximum rated power: 120 VA Typical power consumption (reference value): 47 W (Conditions: Power supply voltage of 100 V/60 Hz. Voltage of 800 V DC and current of 200 A DC (CT6834) measured on all channels.) • DC power supply (optional) Rated supply voltage:10.5 V to 28 V DC (Operating temperature range: −20°C to 40°C (−4°F to 104°F)) 10.5 V to 20 V DC (Operating temperature range: 40°C to 50°C (104°F to 122°F)) Maximum rated power: 95 VA
Backup battery life	Lithium battery About 10 years (Reference value at 23°C) For backing up clock and setting conditions
Dimensions	Approx. 361W × 176H × 135D mm (14.2″W × 6.9″H × 5.3″D) (excluding protruding parts)
Weight	Approx. 4.6 kg (10.1 lb.) (for PW4001-05)
Product warranty duration	3 years
Accuracy guarantee conditions	Accuracy guarantee duration: 12 months The accuracy guarantee period for voltage, current, power, and the voltage accuracy of the Motor Analysis Option is 6 months. For 12-month accuracy, multiply the reading error of each accuracy specification by 1.5. Accuracy guarantee temperature and humidity range: 23°C ±3°C (73°F ±5°F), 80% RH or less Warm-up time: 30 minutes or longer Other conditions: Within the effective measurement ranges, sine waveforms or DC input, a line-to-earth voltage of 0 V After zero adjustment has been performed and a change in ambient temperature does not exceed ±1°C after zero adjustment.
Accessories	See p. 6.
Options	See p. 7.

3.2 Specifications of Input, Output, and Measurement

Basic specifications

(1) Specifications common to voltage, current, and power measurement

Number of input channels	Voltage 4 channels (U1 to U4) Current 4 channels (I1 to I4)
Wiring configuration to be measured	Single-phase 2-wire (1P2W), single-phase 3-wire (1P3W), 3-phase 3-wire (3P3W2M, 3V3A, 3P3W3M), 3-phase 4-wire (3P4W)
Wiring configuration	Input channels can be assigned to any wiring channels. (However, only adjacent channels can be used in the same wiring configuration.) Different types of current sensors cannot coexist in the same wiring configuration.
Measurement method	Voltage/current simultaneous digital sampling with zero-crossing synchronized calculation
Sampling frequency, sampling bit rate	2.5 MHz, 16-bit
Frequency flatness	±0.1% amplitude band: 50 kHz (typical) ±0.1° phase band: 100 kHz (typical)
Effective measurement range	Voltage, current, and active power For DC: 0% to 110% of the range For AC: 1% to 110% of the range
Effects of conducted radio-frequency electromagnetic field	For current and active power measurement, 6% of full scale or less at 10 V Current full scale means the sensor's rated current Active power full scale means the voltage range × current sensor rating
Effects of radiated radio-frequency electromagnetic field	For current and active power measurement, 6% of full scale or less at 10 V/m Current full scale means the current sensor rating Active power full scale means the voltage range × current sensor rating
Display range	See "10.4 Detailed Specifications of Measurement Parameters" in the Instruction Manual.
Measurement mode	• Wideband measurement mode • IEC measurement mode (PW9006 option)
Data update interval	1 ms, 10 ms, 50 ms, 200 ms The harmonic data update interval is specified separately. Average and user-defined operations are unavailable when the data update interval is set to 1 ms. In IEC measurement mode, the data update interval is fixed at approx. 200 ms (10 waves for 50 Hz measurement-frequency setting and 12 waves for 60 Hz).
LPF	Cutoff frequency fc 500 Hz, 1 kHz, 5 kHz, 10 kHz, 50 kHz, 100 kHz, off Digital LPF Add ±0.05% of the reading to the accuracy except if the LPF is set to off. The accuracy specifications are specified for frequencies less than or equal to one tenth the set cutoff frequency. The peak value is based on the LPF-processed values, whereas the peak-over judgment uses not-digital-LPF processed values.

Synchronization source	U1 to U4, I1 to I4, DC (fixed at the data update interval for DC only) Models equipped with the motor analysis option Ext1 to Ext2: When the input settings of the following channels are set to Speed (pulse input) and the remainder left over when the pulse count is divided by half the number of poles is zero. Ext1: Ch. B, Ext2: Ch. D Zph1: When the Ch. D input setting is set to Origin (pulse input) Ch. B, Ch. D: When the corresponding channel enters **[Individual input]** operating mode • Can be selected for each wiring configuration. (U and I of the same channel are measured in sync with the same synchronization source.) • The zero-crossing point of the waveform after passing through the zero-cross filter is used as the reference when U or I is selected. • In IEC measurement mode, only U or I can be selected.
Effective frequency range of synchronization source	DC, 0.1 Hz to 200 kHz
Effective input range of synchronization source	1% to 110% of the range
Zero-cross filter	Used in zero-crossing detection for voltage and current waveforms. Does not affect measured waveforms. Consists of a digital LPF and HPF filters. Cutoff frequencies are automatically determined based on the settings of the measurement upper and lower frequency limits as well as measurement frequencies. HPF is selectable between on and off (fixed to off in IEC measurement mode).
Lower measurement frequency limit	Choose from the following frequency values for each wiring configuration: 0.1 Hz, 1 Hz, 10 Hz, 100 Hz, 1 kHz, 10 kHz, 100 kHz The frequency is fixed (not selectable) in IEC measurement mode.
Upper measurement frequency limit	Choose from the following frequency values for each wiring configuration: 100 Hz, 500 Hz, 1 kHz, 5 kHz, 10 kHz, 50 kHz, 100 kHz, 500 kHz, 1 MHz The frequency is fixed (not selectable) in IEC measurement mode.
Polarity detection	Voltage/current zero-crossing timing comparison method
Measurement items	Voltage (U), current (I), active power (P), apparent power (S), reactive power (Q), power factor (λ), phase angle (ϕ), voltage frequency (fU), current frequency (fI), efficiency (η), loss (Loss), voltage ripple factor (Urf), current ripple factor (Irf), current integration (Ih), power integration (WP), voltage peak (Upk), current peak (Ipk) See “10.4 Detailed Specifications of Measurement Parameters” in the Instruction Manual.

(2) Specifications for voltage measurement

Input terminal profile	Plug-in terminal (safety terminal)
Input method	Isolated input, resistance voltage division
Range	6 V, 15 V, 30 V, 60 V, 150 V, 300 V, 600 V, 1500 V
Crest factor	3 relative to voltage range rating (however, 1.35 for 1500 V range)
Input resistance, input capacity	3 MΩ ±30 kΩ, 1 pF typical
Maximum input voltage	1000 V AC, 1500 V DC or ±2000 V peak
Maximum rated voltage to earth	600 V AC, 1000 V DC in measurement category III Anticipated transient overvoltage: 8000 V 1000 V AC, 1500 V DC in measurement category II Anticipated transient overvoltage: 8000 V

(3) Specifications for current measurement

Input terminal profile	Dedicated connector (ME15W)
Input method	Current sensor input method

Range	• Probe 1: Automatically recognizes the sensor's rated current	
	40 mA, 80 mA, 200 mA, 400 mA, 800 mA, 2 A	with a 2 A sensor
	400 mA, 800 mA, 2 A, 4 A, 8 A, 20 A	with a 20 A sensor
	4 A, 8 A, 20 A, 40 A, 80 A, 200 A	with a 200 A sensor
	40 A, 80 A, 200 A, 400 A, 800 A, 2 kA	with a 2000 A sensor
	100 mA, 200 mA, 500 mA, 1 A, 2 A, 5 A	with a 5 A sensor
	1 A, 2 A, 5 A, 10 A, 20 A, 50 A	with a 50 A sensor
	10 A, 20 A, 50 A, 100 A, 200 A, 500 A	with a 500 A sensor
	100 A, 200 A, 500 A, 1 kA, 2 kA, 5 kA	with a 5000 A sensor
	20 A, 40 A, 100 A, 200 A, 400 A, 1 kA	with a 1000 A sensor
	• CT9920: The sensor output rate can be selected	
	40 mA, 80 mA, 200 mA, 400 mA, 800 mA, 2 A	1 V/A
	400 mA, 800 mA, 2 A, 4 A, 8 A, 20 A	100 mV/A
	4 A, 8 A, 20 A, 40 A, 80 A, 200 A	10 mV/A
	40 A, 80 A, 200 A, 400 A, 800 A, 2 kA	1 mV/A
	400 A, 800 A, 2 kA, 4 kA, 8 kA, 20 kA	0.1 mV/A
	Selectable for each wiring (Only when the same sensors are used for all channels of the same wiring configuration)	
Crest factor	3 relative to voltage range rating	
Input resistance	1 MΩ ±50 kΩ	
Maximum input	8 V, ±12 V peak (10 ms or less)	
Maximum number of connected channels	Up to 4 Up to three CT6877A, CT6876A, or CT6904A series current sensors can be connected when using an AC or DC power supply (power supply voltage: 10.5 V to 20 V) and with an operating temperature of 40˚C to 50˚C. Up to three CT6877A, CT6876A, or CT6904A series current sensors can be connected when using a DC power supply (power supply voltage: 20 V to 28 V) and with an operating temperature of 30˚C to 40˚C.	

(4) Voltage, current, power accuracy specifications

Measurement accuracy for active voltage, current, power, and power phase angle

Accuracy	±[(% of the reading) + (% of the range)]	
	Voltage (U)	Current (I)
DC	0.03% + 0.01%	0.03% + 0.01%
0.1 Hz ≤ f < 30 Hz	0.10% + 0.20%	0.10% + 0.20%
30 Hz ≤ f < 45 Hz	0.10% + 0.10%	0.10% + 0.10%
45 Hz ≤ f ≤ 440 Hz	0.03% + 0.01%	0.03% + 0.01%
440 Hz < f ≤ 1 kHz	0.05% + 0.05%	0.05% + 0.05%
1 kHz < f ≤ 10 kHz	0.20% + 0.05%	0.20% + 0.05%
10 kHz < f ≤ 50 kHz	0.40% + 0.10%	0.40% + 0.10%
50 kHz < f ≤ 100 kHz	0.01 × f% + 0.2%	0.01 × f% + 0.2%
100 kHz < f ≤ 200 kHz	0.025 × f% + 0.3%	0.025 × f% + 0.3%
Frequency band	600 kHz (−3 dB typical)	600 kHz (−3 dB typical)

Accuracy	±[(% of the reading) + (% of the range)]	Degrees
	Active power (P)	Power phase angle (ϕ) (Phase difference)
DC	0.03% + 0.01%	—
0.1 Hz ≤ f < 30 Hz	0.10% + 0.20%	±0.05°
30 Hz ≤ f < 45 Hz	0.10% + 0.10%	±0.05°
45 Hz ≤ f ≤ 440 Hz	0.03% + 0.01%	±0.05°
440 Hz < f ≤ 1 kHz	0.05% + 0.05%	±0.05°
1 kHz < f ≤ 10 kHz	0.20% + 0.05%	±0.20°
10 kHz < f ≤ 50 kHz	0.40% + 0.10%	±(0.02 × f) degrees
50 kHz < f ≤ 100 kHz	0.01 × f% + 0.2%	±(0.02 × f) degrees
100 kHz < f ≤ 200 kHz	0.025 × f% + 0.3%	±(0.02 × f) degrees

- In the expressions listed above, the unit “f” is kilohertz.
- DC values of voltage and current are specified by Udc and Idc.
  Frequencies other than DC are specified by U rms and I rms.
- When U or I is selected as the synchronization source, accuracy is specified for a source input of at least 5% of the range.
- The power phase angle is specified for a power factor of zero during 100% input.
- For current, active power, and power phase angle, add the current sensor accuracy to the accuracy figures listed above.
- When 0.1 Hz ≤ f < 10 Hz, the accuracy figures for voltage, current, active power, and power phase angle are values for reference purposes.
- When 10 Hz ≤ f < 16 Hz, the accuracy figures for voltage, active power, and power phase angle over 220 V are values for reference purposes.
- When 16 Hz < f ≤ 30 kHz, the accuracy figures for voltage, active power, and power phase angle over 1000 V are reference values.
- When 30 kHz < f ≤ 100 kHz, the accuracy figures for voltage, active power, and power phase angle over 750 V are reference values.
- When 100 kHz < f ≤ 200 kHz, the accuracy figures for voltage, active power, and power phase angle over (22000 / f [kilohertz]) volts are values for reference purposes.
- For the 6 V range, add ±0.02% of the range to the accuracy of voltage and active power.
- For the 15 V range, add ±0.005% of the range to the accuracy of voltage and active power.
- Add ±0.02% of the range to the accuracy of the current and active power for the 1/25 and 1/50 range of the current sensor rating.
- Add ±0.01% of the range to the accuracy of the current and active power for the 1/10 range of the current sensor rating.
- The effective measurement range of the current sensor (9272-05, CT7642, CT7742, CT7044, CT7045, CT7046) is between 0.5% of full scale and 100% of full scale.
- If a voltage is over 1000 V DC, add 0.05% of the reading to the DC accuracy for voltage and active power.
- When the input magnitude is between 100% of the range (exclusive) and 110% of the range (inclusive), multiply the range error by 1.1.
- If a voltage is over 600 V, add the following values to the power phase angle accuracy:
  0.1 Hz < f ≤ 500 Hz: ±0.1°
  500 Hz < f ≤ 5 kHz: ±0.3°
  5 kHz < f ≤ 20 kHz: ±0.5°
  20 kHz < f ≤ 200 kHz: ±1°
- Add the following value to the accuracy figures for voltage and active power if a voltage of 600 V or more is measured.
  ±(0.003 × V^2)% of the reading ±(1× V^2) mV (V is input voltage [kV])
  Even when the voltage input value decreases, the effect of self-heating persists until the input resistance temperature drops. If the input voltage is over 900 V, other measurement channels (up to 600 V) will also have half the influence.
- If zero adjustment is performed with a warm-up time of less than 60 minutes, add ±0.02% of the range to the voltage, current, and active power accuracy.
- When the data update interval is 1 ms, add ±0.1% of the range to the voltage, current, and active power accuracy.
- Also see “Effects of temperature” in the Instruction Manual.

Apparent power (S) measurement accuracy	(voltage accuracy) + (current accuracy) ±10 digits
Reactive power (Q) measurement accuracy	For any condition except if ϕ = 0° or ±180° (Apparent power accuracy) ± {1−sin[ϕ + (Power phase angle accuracy)] / sin ϕ} × (100% of the reading) ±[√(1.001 − λ^2) − √(1 − λ^2)] × (100% of the range) For ϕ = 0° and ±180° (Apparent power accuracy) ± [sin(Power phase angle accuracy)] × (100% of the range) ± (3.16% of the range) The symbol λ designates the display value of the power factor.

Power factor (λ) measurement accuracy	For any condition except if ϕ = ±90° ±{1 − cos[ϕ + (Power phase angle accuracy)] / cos ϕ} × (100% of the reading) ±50 digits For ϕ = ±90° ±cos[ϕ + (Power phase angle accuracy)] × (100% of the range) ±50 digits The symbol ϕ designates the display value of the power phase angle. Both of the above are specified at voltage/current range rating input.
Waveform peak measurement accuracy	Voltage and current RMS value accuracy ±1% of the range (300% of the range is applied as a peak range)
Effects of temperature	Add ±0.005% of the reading/°C to the voltage, current, and active power accuracy within the range of −20°C to 20°C (−4°F to 68°F) or 26°C to 50°C (79°F to 122°F). Add ±0.005% of the range/°C to DC accuracy of the voltage, current, and active power if a change in operating temperature range reaches or exceeds ±1°C after zero adjustment. For the 6 V range, add another ±0.005% of the reading/°C to the DC accuracy of the voltage and active power.
Common-mode voltage rejection ratio (Effects of common-mode voltage)	50 Hz/60 Hz: 80 dB or more Specified for CMRR when the maximum input voltage is applied between the voltage input terminals and the enclosure for all measurement ranges.
Effects of external magnetic fields	±1% of the range or less (in a magnetic field of 400 A/m, DC or 50 Hz/60 Hz)
Effects of the power factor on the active power	For any condition except if ϕ = ±90° ±{1 − cos[ϕ + (Phase accuracy)] / cos ϕ} × (100% of the reading) For ϕ = ±90° ±cos[ϕ + (Phase accuracy)] × (100% of VA)

Specially specified combinatorial accuracy with optional products for current measurement

For the following optional products for current measurement, the combinatorial accuracy with the PW4001 is specified specially.
For details, see “10.6 Specially Specified Combinatorial Accuracy With Optional Products for Current Measurement” in the Instruction Manual and specifications of optional products for current measurement.

Outline of the special combinatorial accuracy

Reading accuracy	Simple addition of the reading accuracy of the PW4001 and that of optional products for current measurement
Range accuracy	Simple addition of the range accuracy of the PW4001 and full-scale accuracy of optional products for current measurement (Regardless of the PW4001 range setting)

However, the above-listed combinational accuracy is specified only for DC and a frequency of between 45 Hz and 66 Hz (for some optional products for current measurement, 45 Hz and 65 Hz).

High accuracy, clamp

CT6841A	AC/DC Current Probe (20 A)
CT6843A	AC/DC Current Probe (200 A)
CT6833	AC/DC Current Probe (200 A)
CT6833-01	AC/DC Current Probe (200 A)
CT6834	AC/DC Current Probe (500 A)
CT6834-01	AC/DC Current Probe (500 A)
CT6844A	AC/DC Current Probe (500 A)
CT6845A	AC/DC Current Probe (500 A)
CT6846A	AC/DC Current Probe (1000 A)

High accuracy, pass-through

CT6872	AC/DC Current Sensor (50 A)
CT6872-01	AC/DC Current Sensor (50 A)
CT6873	AC/DC Current Sensor (200 A)
CT6873-01	AC/DC Current Sensor (200 A)
CT6904A	AC/DC Current Sensor (500 A)
CT6904A-1	AC/DC Current Sensor (500 A, manufactured on a per-order basis)
CT6875A	AC/DC Current Sensor (500 A)
CT6875A-1	AC/DC Current Sensor (500 A)
CT6904A-2	AC/DC Current Sensor (800 A, manufactured on a per-order basis)
CT6904A-3	AC/DC Current Sensor (800 A, manufactured on a per-order basis)
CT6876A	AC/DC Current Sensor (1000 A)
CT6876A-1	AC/DC Current Sensor (1000 A)
CT6877A	AC/DC Current Sensor (2000 A)
CT6877A-1	AC/DC Current Sensor (2000 A)

High accuracy, direct wiring

PW9100A-3	AC/DC Current Box (50 A)
PW9100A-4	AC/DC Current Box (50 A)

(5) Frequency measurement specifications

Number of measurement channels	Up to 4 channels (fU1 to fU4, fI1 to fI4)
Measurement method	Reciprocal method The waveforms processed with the zero-cross filter are measured.
Measurable range	0.1 Hz to 500 kHz (The display shows 0.00000 Hz or – – – – – – Hz if measurement was not possible.) The range is limited by the measurement lower frequency limit setting.
Measurement accuracy	±0.005 Hz Assuming all the following conditions are met: • Measurement parameter: voltage frequency • Data update interval: 50 ms or more • Voltage range: 15 V range or higher • Inputted waveform: a sine wave with a magnitude of at least 50% of the range • Frequency range: 45 Hz to 66 Hz Under conditions other than listed above: ±0.05% of the reading (With a sine wave at least 30% of the measurement range of the measurement source. However, add ±0.05 % of the reading for the data update interval of 1 ms.)
Display resolution	0.10000 Hz to 9.99999 Hz, 9.9000 Hz to 99.9999 Hz, 99.000 Hz to 999.999 Hz, 0.99000 kHz to 9.99999 kHz, 9.9000 kHz to 99.9999 kHz, 99.000 kHz to 999.999 kHz

(6) Integration measurement specifications

Measurement mode	Can be chosen between RMS and DC for each wiring. (The DC mode is selectable for the 1P2W wiring configuration only.)
Measurement items	Current integration (Ih+, Ih−, Ih), Active power integration (WP+, WP−, WP) The instrument measures Ih+ and Ih− only in DC mode; Ih only in RMS mode.

Measurement method	Digital calculation based on current and active power. (Calculations are performed using not-averaged values during averaging.) In DC mode: Integrates current values and instantaneous power values for each polarity at every sampling point. In RMS mode: Integrates current RMS values and active power values at the measurement intervals. Only the active power is integrated by polarity. (Active power is integrated by polarity at every period of the synchronization source.) (The sum of integrated active power values of a polyphase wiring configuration is the sum of effective power values by polarity at the measurement intervals.)
Measurement interval	Same as the data update interval
Display resolution	999999 (6 digits + decimal point), Starts from the resolution assuming 1% of each range to be 100% of the range.
Measurable range	0 Ah/Wh to ±99.9999 PAh/PWh
Integration time	0 s to 9999 h 59 min. 59 s Integration stops if the integration time exceeds the range.
Integration time accuracy	±0.02% of the reading (−20˚C to 50˚C)
Integration accuracy	±(Current or active power) ±(Integration time accuracy)
Backup function	None If a power outage occurs during integration, the integration stops after power is restored and the integration data is reset.
Integration control	All-channel synchronized integration: • Manual (keys, communications commands, external) control: Start, stop, data reset • Real time control: Start, stop • Timer control: Stop after a lapse of the set time. Configuration-specific independent integration: (No data will be saved.) (Unavailable in IEC measurement mode and during BNC synchronization) • Manual (keys, communications commands, external) control: Start, stop, and data reset by the wiring configuration • Real time control: Start and stops by the wiring configuration • Timer control: Stop by the wiring configuration after a specified time Cumulative integration available (Restarting after integration stop is available. Integration resumes, adding values to the previous integrated values.) Unavailable in IEC measurement mode (restart not possible)

(7) Specifications common to harmonic measurement

Number of measurement channels	Up to 4
Synchronization source	Same as those specified in the basic measurement specifications. Based on the synchronization source setting of the voltage, current, and power measurement selected for each wiring configuration. However, for the wiring configuration with Zph1 respectively selected as the synchronization source of the voltage, current, and power measurement, you can choose whether harmonic measurement is in sync with Ext1 or in sync with Zph1.
Measurement mode	Selectable between Wideband measurement mode (PW9006 option) and IEC measurement mode (setting common to all channels)

Measurement items	Harmonic voltage RMS value, harmonic voltage content percentage, harmonic voltage phase angle, harmonic current RMS value, harmonic current content percentage, harmonic current phase angle, harmonic active power, harmonic power content percentage, harmonic voltage-vs.-current phase difference, total harmonic voltage distortion, total harmonic current distortion, voltage unbalance rate, current unbalance rate (Only in IEC measurement mode) Inter-harmonic voltage RMS value, inter-harmonic current RMS value
FFT processing word length	32 bits
Anti-aliasing	Digital filter (automatically set based on synchronization frequency)
Window function	Rectangular
Grouping	Off, Type 1 (harmonic sub-group), Type 2 (harmonic group) (Setting common to all channels)
THD calculation method	THD_F, THD_R Select the calculation order from between 2nd and 500th. (However, limited to the maximum analysis order of each mode.) (Setting common to all channels)

(8) Specifications of IEC-compliant harmonic measurement in IEC measurement mode (PW9006 option)

Measurement method	Compliant with IEC 61000-4-7:2002 (Ed. 2.0), without gaps or overlaps
Measurement frequency setting	50 Hz/60 Hz
Synchronization frequency range	For 50 Hz setting: 45 Hz to 55 Hz For 60 Hz setting: 56 Hz to 66 Hz
Data update interval	Fixed at approx. 200 ms (10 waves for 50 Hz measurement-frequency setting; 12 waves for 60 Hz)
Analysis order	Harmonics: 0th to 200th orders Inter-harmonic: 0.5th to 200.5th orders
Window wave number	10 waves for 50 Hz measurement-frequency setting; 12 waves for 60 Hz
Number of FFT points	8192 points
Measurement accuracy	Add ±0.04% of the range to the following measurement accuracy within the synchronous frequency range of each frequency setting: voltage, current, and power. For a frequency of 10 kHz or more, add another ±0.04% of the range.

(9) Specifications of wideband harmonic measurement in wideband measurement mode

Measurement method	Zero-crossing sync calculation method (the same window for each synchronization source), with gaps Fixed sampling interpolation calculation method
Synchronization frequency range	0.1 Hz to 600 kHz
Data update interval	Fixed at 50 ms. When it is set to 10 ms, only harmonic data is updated at 50 ms intervals. When it is set to 200 ms, values are obtained by averaging four sets of 50 ms data.

Maximum analysis order and the window wave number

Fundamental wave frequency	Window wave number	Maximum analysis order
0.1 Hz ≤ f ≤ 2 kHz	1	500th
2 kHz < f ≤ 5 kHz	1	300th
5 kHz < f ≤ 10 kHz	2	150th
10 kHz < f ≤ 20 kHz	4	75th
20 kHz < f ≤ 50 kHz	8	30th
50 kHz < f ≤ 100 kHz	16	15th
100 kHz < f ≤ 200 kHz	32	7th
200 kHz < f ≤ 300 kHz	64	5th
300 kHz < f ≤ 500 kHz	128	3rd
500 kHz < f ≤ 600 kHz	256	1st

Phase zero-adjustment function

Phase zero-adjustment can be started by using keys or communications commands. (Only available when the synchronization source is set to Ext)
Phase zero-adjustment values can be set automatically or manually.
Valid setting range of the phase zero-adjustment: 0.000° to ±180.000° (in 0.001° increments)

Number of FFT points

Automatically selected from among 2048, 4096, and 8192 points.

Measurement accuracy

Add the following values to the voltage, current, power, and phase difference accuracy.
When the fundamental frequency is 100 Hz or more, add another ±0.1% of the range to the following voltage, current, and power accuracies, and add ±0.1° to the phase difference accuracy.
When the fundamental frequency is 2 kHz or more, add another ±0.05% of the reading and ±0.1% of the range to the following voltage, current, and power accuracies, and add ±0.1° to the phase difference accuracy.

Frequency	Voltage, current, power ±(% of the reading)	Phase difference ±(degree)
DC	0.05%	—
0.1 Hz ≤ f ≤ 100 Hz	0.01%	0.1°
100 Hz < f ≤ 1 kHz	0.03%	0.1°
1 kHz < f ≤ 10 kHz	0.08%	0.6°
10 kHz < f ≤ 50 kHz	0.15%	(0.020 × f) ±0.5°
50 kHz < f ≤ 200 kHz	0.20%	(0.030 × f) ±2.0°

- In the expressions listed above, the unit of frequency (f) is kilohertz (kHz).
- The figures for voltage, current, power, and phase difference for frequencies over 200 kHz are values for reference purposes.
- When the fundamental wave has a frequency within the range of 16 Hz to 850 Hz, the figures for voltage, current, power, and phase difference over 6 kHz are values for reference purposes.
- When the fundamental wave has a frequency outside the range of 16 Hz to 850 Hz, the figures for voltage, current, power, and phase difference for frequencies other than the fundamental wave are values for reference purposes.
- Accuracy values for phase difference are specified for input with the voltage and current of the same order that have an amplitude of at least 10% of the range.

Specifications of waveform recording

Measurement channels	Voltage and current waveforms: Up to 4 channels (up to 12 waveforms can be displayed) Motor waveform: Up to 2 analog DC channels + up to 4 pulse channels
Recording capacity	(5 megawords) × [(Number of measured items, including voltage and current) × (Number of channels, up to 4) + (Number of motor waveforms)] No memory segmentation function
Waveform resolution	16-bit
Sampling speed	• Voltage and current waveform • Motor waveform (analog DC) (1 MS/s is interpolated with 0th held when 2.5 MS/s of data is sampled.) • Motor waveform (pulse) 2.5 MS/s, 1.0 MS/s, 500 kS/s, 250 kS/s, 100 kS/s, 50 kS/s, 25 kS/s, 10 kS/s
Recording length	1 kiloword, 5 kilowords, 10 kilowords, 50 kilowords, 100 kilowords, 500 kilowords, 1 megaword, 5 megawords
Storage mode	Peak-to-peak compression
Trigger mode	Single, normal (auto-trigger setting available)
Pre-trigger	0% to 100% of the recording length, in 10 percent increments
Trigger detection method	• Level trigger (detects triggers based on fluctuations in the level of storage waveforms) Trigger source: Voltage and current waveforms, voltage and current waveforms processed by the zero-cross filter, manual trigger, motor waveform, motor pulse Trigger slope: Rising edge, falling edge Trigger level: ±300% of the range for waveforms in 0.1 percent increments • Event trigger Triggers are detected based on fluctuations in the values of basic measurement items. The trigger-detecting conditions are determined based on the logical OR and AND of the following four events. The logical AND takes precedence over the logical OR. Events: Composed of basic measurement items, inequality signs (<, >), and numerical values (0 to ±99999.9T). Ev n: Item ☐ X.XXXXX y n: 1 to 4 Item: basic measurement item ☐: inequality signs X.XXXXX: six-digit constant y: SI prefix

Specifications of flicker measurement (PW9006 option)

Measurement channels	Up to 4
Measurement method	Compliant with IEC 61000-4-15:2010 (Ed. 2.0) Flickermeter Class F1
Measurement items	Short-term flicker (Pst) Maximum short-term flicker value (PstMax) Long-term flicker value (Plt) Maximum instantaneous flicker value (PinstMax) Minimum instantaneous flicker value (PinstMin) Relative steady-state voltage change (dc) Maximum relative voltage change (dmax) Period during which the relative voltage change exceeds the threshold (Tmax)
Measurement frequency	50 Hz, 60 Hz (measurable in IEC measurement mode only)
Measurement range	Pst, Plt: 0.0001 P.U. to 6400 P.U. (logarithmic 1400-way split)
Flicker filter	230 V lamp, 120 V lamp
Measurement accuracy	dc, dmax: ±4% (at a dmax of 4%) Pst: ±5% (Pst = 0.2 to 5)

Specifications of motor analysis (optional)

(1) Specifications common to analog DC input, frequency input, and pulse input

Number of input channels

4 channels

Channel	Input parameter
Ch. A, Ch. C	Analog DC, frequency, pulse
Ch. B, Ch. D	Frequency, pulse

Operating mode

• Motor analysis mode

	Measurement or detection item (input type)	Maximum number of analysis parameters
Pattern 1	Torque (analog/frequency), speed (pulse)	2 motors
Pattern 2	Torque (analog/frequency), speed (pulse), direction, origin (pulse)	1 motor
Pattern 3	Torque (analog/frequency), speed (pulse), direction	1 motor
Pattern 4	Torque (analog/frequency), speed (pulse), origin (pulse)	1 motor
Pattern 5	Torque (analog/frequency), speed (analog)	1 motor

• Individual input mode
Ch. A, Ch. C: DC voltage measurement, frequency measurement
Ch. B, Ch. D: Frequency measurement

Input terminal profile	Isolated BNC connector
Input method	Function-isolated input and single-end input Between-channels function isolation
Input resistance (DC)	1 MΩ ±50 kΩ
Maximum input voltage	20 V
Maximum rated line-to-ground voltage	30 V (50 Hz/60 Hz)

Measurement items	Voltage, torque, RPM, frequency, slip, motor power
Synchronization source	Same as those specified in the basic measurement specifications (The effective frequency range and effective input range are also the same.) (However, there are no restrictions in IEC measurement mode.) • In motor analysis mode Pattern 1: Two types, for Ch. A and Ch. B as well as Ch. C and Ch. D, can be set in **[A-D]**. Pattern 2 to Pattern 5: One type can be set in each of **[A-D]**. • In individual input mode Two types, for Ch. A and Ch. B as well as Ch. C and Ch. D, can be set in **[A-D]**.
Lower measurement frequency limit	Select from among the following frequency values for each motor synchronization source: 0.1 Hz, 1 Hz, 10 Hz, 100 Hz
Upper measurement frequency limit	Select from among the following frequency values for each motor synchronization source: 100 Hz, 500 Hz, 1 kHz, 5 kHz, 10 kHz, 50 kHz, 100 kHz, 500 kHz, 1 MHz, 2 MHz
Input frequency source	Selectable between fU1 to fU4 and fI1 to fI4. The frequency for slip calculation can be set.
Number of motor poles	2 to 254
Z-phase pulse detection reference	The reference for detecting Zph of the synchronization source can be set in operating mode 2 or 4. Rising edge, falling edge

(2) Analog DC input specifications (Ch. A, Ch. C)

Measurement range	1 V, 5 V, 10 V
Crest factor	1.5
Effective input range	1% to 110% of the range
Sampling frequency, sampling bit rate	1 MHz, 16-bit
LPF	1 kHz, off (20 kHz)
Response speed	0.2 ms (when the LPF is disabled)
Measurement method	Simultaneous digital sampling, zero-crossing synchronization calculation method (Between-zero-crossing averaging)
Measurement accuracy	±0.03% of the reading ±0.03% of the range
Effects of temperature	Add ±0.005% of the reading/°C within the range of -20°C to 20°C or 26°C to 50°C. Also, add ±0.005% of the range/°C for temperature changes of ±1°C or more after zero adjustment.
Effects of common-mode voltage	±0.01% of the range or less When a voltage of 30 V (DC, 50 Hz/60 Hz) is applied between the input terminals and the enclosure
Effects of external magnetic fields	±0.1% of the range or less (in a magnetic field of 400 A/m, DC or 50 Hz/60 Hz)
Display range	See “(4) Motor analysis measurement items (only when the motor analysis option is installed)” of the Instruction Manual “10.4 Detailed Specifications of Measurement Parameters”.
Scaling	For torque: ±0.01 to 9999.99 For RPM: ±0.00001 to 99999.9
Zero adjustment	Scaled input offsets less than or equal to ±10% of the range are compensated for to zero. When the torque meter correction is enabled, input offsets are compensated to zero after adding the calibration values.

Torque meter correction	Off/on (selectable by motor) • Nonlinearity correction Torque values are corrected using an 11-point (at a maximum) correction table of torque calibration points (N·m) vs. torque calibration values (N·m). • Friction correction Torque values are corrected using an 11-point (at a maximum) correction table of RPM values (r/min.) with consideration of rotation directions vs. torque calibration values (N·m). Each interval between torque calibration values is linearly interpolated. The unit for the correction table depends on the setting. Enter a 6-digit calibration value. The signs of torque calculation are used for detecting rotation directions: forward (plus sign) and backward (minus sign).
Torque calculation and correction	When disabled: (Torque value) = S × [X − (Zero-correction value)] When enabled: (Torque value) = S × [X − (Zero-correction value)] − At − Bt S: Scaling X: Input signal-to-torque converted value At: Nonlinearity correction value Bt: Friction correction value

(3) Frequency input specifications (Ch. A, Ch. B, Ch. C, Ch. D)

Detection level	Low: approx. 0.8 V or less; High: approx. 2.0 V or more
Measurement frequency band	0.1 Hz to 2 MHz (when the duty ratio is set at 50%)
Minimum detection width	0.25 µs or more
Measurement range	The zero-point frequency fc and frequency fd at rated torque in fc ±fd (Hz) can be set. Set fc and fd using 7-digit figures in the range of 1 kHz to 500 kHz. However, values must be set so that both the inequalities (fc + fd) ≤ 500 kHz and (fc − fd) ≥ 1 kHz are met.
Measurement accuracy	±0.01% of the reading When the data update interval is set to 1 ms, add ±0.01% of the reading to the measuring accuracy.
Display range	1.000 kHz to 500.000 kHz
Scaling	±0.01 to 9999.99
Zero adjustment	Offsets of input within the range of fc ±1 kHz can be compensated to zero. When the torque meter correction is enabled, calibration values are added to compensate for offsets to zero.
Unit	mN·m, N·m, kN·m
Torque meter correction	Off/on • Nonlinearity correction Torque values are corrected using an 11-point (at a maximum) correction table of torque calibration points (N·m) vs. torque calibration values (N·m). • Friction correction Torque values are corrected using the 11-point (at a maximum) correction table of RPM values (r/min.) with consideration of rotation directions vs. torque calibration values (N·m). Each interval between torque calibration values is linearly interpolated. The unit for the correction table depends on the setting. Enter a 6-digit calibration value. The signs of torque calculation are used for detecting rotation directions: forward (plus sign) and backward (minus sign).

Torque calculation and correction	When disabled: (Torque value) = S × [X − (Zero-correction value)] When enabled: (Torque value) = S × [X − (Zero-correction value)] − At − Bt S: Scaling X: Input signal-to-torque converted value At: Nonlinearity correction value Bt: Friction correction value

(4) Pulse input specifications (Ch. A, Ch. B, Ch. C, Ch. D)

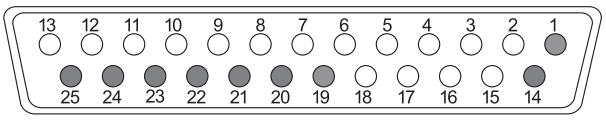
Detection level	Low: approx. 0.8 V or less; High: approx. 2.0 V or more
Measurement frequency band	0.1 Hz to 2 MHz (when the duty ratio is set at 50%)
Minimum detection width	0.25 µs or more
Pulse-noise filter (PNF)	Off, weak, strong (positive/negative pulses of less than 0.25 µs are ignored with the weak setting, as are those less than 5 µs with the strong setting)
Measurement range	2 MHz
Measurement accuracy	±0.01% of the reading When the data update interval is set to 1 ms, add ±0.01% of the reading to the measuring accuracy.
Display range	0.1 Hz to 2.00000 MHz
Unit	Hertz (Hz), revolutions per minute (r/min.)
Frequency division setting range	±1 to 60000
Rotation direction detection	Individually settable in **[A-D]** Pattern 2 to Pattern 5 of motor analysis mode Detects direction based on lead/lag of Ch. B and Ch. C in **[A-D]**.
Mechanical angle origin detection	Individually settable in **[A-D]** Pattern 2 to Pattern 5 of motor analysis mode Ch. B frequency division is cleared at the Ch. D rising or falling edge in **[A-D]**.

Specifications of waveform and D/A output (optional)

Number of output channels	16 channels
Output terminal profile	D-sub 25-pin connector ×1
Output details	Switchable between waveform output and analog output (selectable from basic measurement items excluding flicker measurement items)
D/A conversion resolution	16-bit (polarity + 15 bits)
Output update interval	Waveform output: 1 MHz Analog output: 1 ms, 10 ms, 50 ms, 200 ms (depending on data update intervals of selected items, with an error of ±1 ms)
Output voltage	Waveform output: Switchable between ±2 V f.s. and ±1 V f.s., crest factor: 2.5 or more The settings affect all channels. Analog output: ±5 V DC f.s. (approx. up to ±12 V DC)
Maximum output voltage	Approx. ±12 V
Output resistance	100 Ω ± 5 Ω
Output accuracy	Waveform output: Add ±0.5% f.s. to measurement accuracy with the ±2 V f.s. setting. Add ±1.0% f.s. to measurement accuracy at the ±1 V f.s. setting. Specified assuming DC to 50 kHz output. Analog output: Add ±0.2% f.s. to the measurement accuracy of output measurement items (DC level).
Temperature coefficient	±0.05% f.s./°C

Pin assignment

Pin No.	Output	Pin No.	Output
1	GND	14	GND
2	D/A1	15	D/A13
3	D/A2	16	D/A14
4	D/A3	17	D/A15
5	D/A4	18	D/A16
6	D/A5	19	GND
7	D/A6	20	GND
8	D/A7	21	GND
9	D/A8	22	GND
10	D/A9	23	GND
11	D/A10	24	GND
12	D/A11	25	GND
13	D/A12		



Display specifications

Display language	Japanese, English, Simplified Chinese, Traditional Chinese
Display	10.1″ WXGA TFT color LCD (1280 × 800 dots)
Dot pitch	0.1695 (V) mm × 0.1695 (H) mm
Display value resolution	999999 count (including integrated values)
Display update interval	Measured values: Approx. 200 ms (independent of internal data update interval) Waveforms: Based on waveform recording settings
Screen	Measurement screen, Input Settings screen, System Settings screen, File Operation screen
Warning display	When an input-channel voltage or current peak-over condition is detected, when no synchronization source is detected. Warning icons for all channels will be displayed on any page of the screen.

Specifications of operating parts

Control device	Power button ×1, rubber keys ×23, rotary knobs ×2, touchscreen
Touchscreen	Analog resistive film
Rotary knob	30 notches, 15 pulses, lamp-equipped
Keys	Mechanical switch type, lamp-equipped ×12, no-lamp-equipped ×12 • Lamp-equipped Green: **MEAS**, **INPUT**, **SYSTEM**, **FILE**, **AUTO** ×2, **SINGLE** Red: **HOLD**, **PEAK HOLD**, **REMOTE/LOCAL** Red/green: **START/STOP**, **RUN/STOP** • No-lamp-equipped: Pages (left and right), **SAVE**, **SCREEN SHOT**, U-UP, U-DOWN, I-UP, I-DOWN, **0 ADJ**, **DATA RESET**, **MANUAL**, POWER
Key lock	Holding down the **REMOTE / LOCAL** key for 3 s can turn the key lock on/off. While the key lock is engaged, the key lock icon is displayed on the screen.
System reset	The instrument setting is reset to the initial state. However, the language and communications settings are not reset.
Boot-key reset	The instrument's settings are reverted to their factory defaults if the instrument is turned on while the **SYSTEM** key is held down. All settings, including the language and communications settings, are reverted to their factory defaults.
File operation	Displaying data list stored on a USB flash drive, formatting a USB flash drive, creating new folders, renaming folders/files, copying/deleting files, updating the firmware, displaying screenshots, creating/loading settings files

External interface specifications

(1) USB flash drive

Connector	USB Type A receptacle connector ×1
Standard/method	USB 3.0 (Super Speed)
Device to be connected	USB flash drive
Data to be recorded on USB flash drives	Saving/loading settings files Saving measured values and automatically recorded data Saving waveform data and screenshots

(2) LAN

Connector	RJ-45 connector ×1
Standard/method	IEEE 802.3 compliant
Transmission method	100Base-TX, 1000Base-T (automatic detection)
Protocol	TCP/IP (with DHCP function)
Function	HTTP server (remote operation) Dedicated port (data transfer, command control) FTP server (file transfer) FTP client Modbus/TCP server XCP on Ethernet (compliant with ASAM e.V.MCD-1 v 1.5.0)
Recommended cable	Category 6A or higher STP cable, maximum cable length: 5 m

(3) USB (function)

Connector	Series Mini B receptacle × 1
Electrical specifications	USB2.0 (Full Speed / High Speed)
Class	Proprietary (USB488h)
Connected device	Computer (Windows 10 (32-bit, 64-bit) / Windows 11 (64-bit)
Function	Data transfer, command control, USB mass storage LAN cannot be used simultaneously. If connected simultaneously, the USB connection will take priority. Operation and communication are not possible during USB mass storage

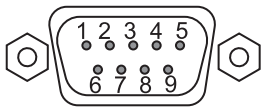
(4) External control

Connector	4-terminal screwless terminal block × 1
Pin assignment	No. 1 pin: Ground No. 2 pin: Data reset No. 3 pin: Hold No. 4 pin: Start/stop
Electrical specifications	Logic signal of 0 / 5 V (2.5 V to 5 V) or contact signals by shorting/opening the terminal
Maximum input voltage	5.5 V
Function	Same operation as the **START/STOP** key, **DATA RESET** key, or **HOLD** key on the control panel

(5) BNC synchronization

Connector	BNC
Number of instruments that can be synchronized	8 (one primary and seven secondary)
Function	Primary instrument Transmitting control signals to secondary instruments
	Secondary instruments Synchronizing the following functions and operations with those of the primary instrument • Timing of internal calculations and data updating • Starting and stopping integration and resetting integration data • Freezing displays (**HOLD**/**PEAK HOLD**) and updating data during the display freeze • Zero adjustment • Operating the instrument using the **SAVE** and **SCREEN SHOT** keys • Present time (Synchronizable items cannot be controlled; their settings cannot be change during synchronization) The primary and secondary instruments can synchronize only when they have the same settings of the measurement mode and data update interval; those with a data update interval of 10 ms or less cannot.

(6) CAN/CAN FD

Protocol	CAN (classical) CAN FD (in conformity with ISO 11898-1:2015) CAN FD (not in conformity with ISO)
Function	Data output Data input
CAN port	1 port
Number of installed modules	1
CAN transceiver	MCP2544 FD
Communication connector	D-sub 9-pin connector (male) Locking screw (hexagonal pillar): Inch screw #4-40 UNC Pin assignment 

Pin	Assignment	I/O	Function
1	N.C.	—	Unused
2	CAN_L	OUT	CAN_Low communication line
3	GND	—	GND
4	N.C.	—	Unused
5	Shield	—	Shield (internally connected to GND)
6	N.C.	—	Unused
7	CAN_H	OUT	CAN_High communication line
8	N.C.	—	Unused
9	N.C.	—	Unused

Common data I/O settings			
Baud rate	CAN: CAN FD: (The baud rate options are common to the following two CAN FD protocols: ISO-compliant and ISO-non-compliant.)		125 k, 250 k, 500 k, 1 Mbps Arbitration area: 500 k, 1 Mbps Data area: 500 k, 1 M, 2 M, 4 Mbps
Sample point setting	0.0% to 99.9%		
Terminal resistance	On/off Resistance value: 120 Ω ±10 Ω		
ISO15765-2	On/off		
CAN communication	On/off		
Data output settings			
Data frame output	Continuous		
Continuous	Output interval:	1 ms, 10 ms, 50 ms, 100 ms, 200 ms, 500 ms, 1 s, 5 s, 10 s, 15 s, 30 s, 1 min, 5 min, 10 min, 15 min, 30 min, 60 min With an error of ±1 ms from each data update interval setting However, the interval cannot be set to less than the data update interval. The output interval of 500 ms is unavailable with the data update interval of 200 ms. In IEC measurement mode, the output intervals of 100 ms and 500 ms are available with the data update interval of 200 ms.	
	Repeated output count:	0 to 10000 (0: infinite)	
Format	Standard, extended		
Setting ID	Standard format: 0x000 to 0x7FF Extended format: 0x00000000 to 0x1FFFFFFF		
Output parameters	See the “Output parameters” subsection under the “External interface specifications” section in the Instruction Manual."		
Data conversion	Measured data: Output count, output time:	Floating-point type (IEEE Float: 4 bytes) Unsigned integer	
Byte order (Endianness)	Intel (little-endian)		
Data input settings			
Number of receiving channels	Up to 20		
Receiving channel definition	Format:	Standard / extended	
	ID:	Standard format: 0x000 to 0x7FF Extended format: 0x00000000 to 0x1FFFFFFF	
	Name		
	Unit		
	Factor / offset		
	Start bit:	0 to 5119 (bit)	
	Bit length:	1 to 64 (bits)	
	Data type:	Unsigned integer/signed integer/single-precision floating-point/ double-precision floating-point	
	Byte order:	Motorola (big)/Intel (little)	
No. of transmitted arbitrary frames	Up to 20		

Arbitrary frame transmission definition	Cyclic transmission:	On/off	
	Cyclic transmission interval:	10 ms, 50 ms, 200 ms, START, STOP	
	Format:	Standard / extended	
	ID:	Standard format Extended format	0x000 to 0x7FF 0x00000000 to 0x1FFFFFFF
	DLC (when ISO15765-2 is turned off):	CAN CAN FD (The baud rate options are common to the following two CAN FD protocols: ISO-compliant and ISO-non-compliant.)	0 to 8 bytes 0 to 8 bytes 12, 16, 20, 24, 32, 48, 64 bytes
	Data length (when ISO15765-2 is turned on):	0 to 41 bytes	
	Transmitted data:	Entered in hexadecimal	

DIAG measurement setup settings			
Number of configurable channels	Up to 6		
Common settings	Measurement types	OBD II / OBD on UDS	
	Measurement interval	50 ms / 200 ms	
Individual settings for each channel			
CAN ID settings	PW4001 → ECU direction		
	Format	Standard, extended	
	ID	Standard format:	0x000 to 0x7FF ECU→PW4001 direction When auto setting is ON 0x000 to 0x7F7
		Extended format:	0x00000000 to 0x1FFFFFFF
	ECU → PW4001 direction auto setting		ON/OFF
	ECU → PW4001 direction		
	Format	Standard, extended	
	ID	Standard format:	0x000 to 0x7FF
		Extended format:	0x00000000 to 0x1FFFFFFF
Measurement item settings	Preset	Partially quoted from those defined in SAE J1979 / J1979-2	
	PID*1	0x00 to 0xFF	
	DID*2	0x0000 to 0xFFFF	
	Name		
	Unit		
	Byte order	Motorola (big)/Intel (little)	
	Data type	Unsigned integer/signed integer/single-precision floating-point/double-precision floating-point	
	Number of response bytes*1, *2	1 to 64 bytes	
	Start position of used bytes*1, *2	0 to 63 bytes	
	End position of used bytes*1, *2	0 to 63 bytes	
	Factor / offset		

*1. Configurable when measurement type is set to OBD II
*2. Configurable when measurement type is set to OBD on UDS

Output parameters

Selected output parameter	Notation	Selected output parameter	Notation
Voltage RMS value	Urms	Reactive power	Q
Voltage mean value rectification RMS equivalent	Umn	Fundamental wave reactive power	Qfnd
Voltage AC component	Uac	Power factor	λ
Voltage simple average	Udc	Fundamental wave power factor	λfnd
Voltage fundamental wave component	Ufnd	Voltage phase angle	θU
Voltage waveform peak (+)	Upk+	Current phase angle	θI
Voltage waveform peak (−)	Upk−	Power phase angle	Φ
Total voltage harmonic distortion	Uthd	Voltage frequency	fU
Voltage ripple factor	Urf	Current frequency	fI
Voltage unbalance rate	Uunb	Integrated positive current value	Ih+
Current RMS value	Irms	Integrated negative current value	Ih−
Current mean value rectification RMS equivalent	Imn	Sum of positive and negative current values	Ih
Current AC component	Iac	Integrated positive power value	WP+
Current simple average	Idc	Integrated negative power value	WP−
Current fundamental wave component	Ifnd	Sum of integrated positive and negative power values	WP
Current waveform peak (+)	Ipk+	Efficiency	η
Current waveform peak (−)	Ipk−	Loss value	Loss
Total harmonic current distortion	Ithd	Torque	Tq
Current ripple factor	Irf	RPM	Spd
Current unbalance rate	Iunb	Motor power	Pm
Active power	P	Slip	Slip
Fundamental wave active power	Pfnd	Output count	Count
Apparent power	S	Output time	Time
Fundamental wave apparent power	Sfnd	User-defined formula	UDF
		CAN input value	CAN

4 Maintenance and Service

4.1 Repair, Inspection, and Cleaning

⚠ WARNING

■ **Do not attempt to modify, disassemble, or repair the instrument yourself.**

The internal components of the instrument may carry high voltages. Failure to follow this guidance could cause bodily injury or fire.

⚠ CAUTION

■ **If the protective function of the instrument is damaged, arrange for immediate repair or dispose of it.**

■ **If storage is unavoidable, label it as damaged.**

Failure to do so could result in bodily injury.

IMPORTANT

Halt use in the event of the following conditions.

- If the instrument is clearly damaged
- If the instrument is not capable of measurement
- If the instrument has been stored for an extended period of time in an undesirable environment, for example under conditions of high temperature and humidity
- If the instrument has been subjected to stress due to shipment under harsh conditions
- If the instrument is wet or soiled with a large amount of oil or dust (If the instrument gets wet or oil and dust get inside it, internal insulation may deteriorate, posing a significant risk of electric shock or fire.)
- If the instrument is unable to save measurement conditions

Calibration

The calibration interval depends on factors such as the operating conditions and environment. Please determine the appropriate calibration interval based on your operating conditions and environment and have Hioki calibrate the instrument accordingly on a regular basis.

Backing up data

When repairing or calibrating the instrument, we may initialize it. It is recommended to back up (save/write) data such as the settings and measured data before requesting service.

Replaceable parts and service life

Some parts used in the instrument are characterized by performance that degrades over years of use.
It is recommended to replace these parts regularly to ensure instrument functionality over the long term.
To order replacements, please contact your authorized Hioki retailer or reseller.
The service life of parts varies with the operating environment and frequency of use. These parts are not guaranteed to operate throughout the period defined by the recommended replacement interval.

Parts	Service life	Remarks and conditions
Electrolytic capacitor	About 10 years	Requires replacement of the printed circuit boards on which such parts are mounted.
Liquid crystal backlight (half life period of brightness)	About 50,000 hours	At an ambient temperature of 25°C
Fan motor	About 10 years	At an ambient temperature of 23°C
Backup battery	About 10 years	At an ambient temperature of 23°C Requires replacement if the time and date are significantly deviated when the instrument is turned on.

Replacing fuses

The instrument's power supply has a built-in fuse. If the instrument cannot be turned on, the fuse may have blown. Fuses cannot be repaired or replaced by the customer. Please contact your authorized Hioki retailer or reseller.

Cleaning

PW4001 main body

⚠ CAUTION

- **Periodically clean the vents.**

  When the vents become clogged, the internal cooling effect of the instrument is hampered, and this can lead to damage to the instrument.

- **To clean the instrument, wipe it using a soft cloth moistened with water or a neutral detergent.**

  Using solvent-containing detergents, such as benzine, alcohol, acetone, ether, ketone, thinner, and gasoline, or wiping the product with excessive force could cause deformation or discoloration.

- **Gently wipe the touchscreen with a dry, soft cloth or a soft cloth soaked in ethanol. Do not use hard cloths, organic solvents, acids or alkalis.**

  Doing so may cause the panel to become scratched, deformed, or discolored, causing it to not function properly.

4.2 Troubleshooting

If damage is suspected, refer to “Before returning for repair” (p. 69) and “4.3 Error Messages” (p. 72) to address the issues. If the issue cannot be resolved, please contact your authorized Hioki retailer or reseller.

Before returning for repair

Check the following items.

Issue	Cause	Solution and where to find additional information
The time and date significantly deviated after the instrument was turned on.	The backup battery needs replacing. A backup lithium battery is installed in the instrument. The service life of the backup battery is about 10 years.	If the battery requires replacement, the battery cannot be replaced by the customer. Please contact your authorized Hioki retailer or reseller.
Nothing is shown on the screen when the power is turned on.	The power cord is not connected to the instrument. The power cord is improperly connected.	Verify that the power cord is connected properly. See “2.4 Supplying Power to the Instrument” (p. 30).
The keys are not functioning.	The instrument is in the key-lock state.	Press and hold the **REMOTE/LOCAL** key for at least 3 s to cancel the key-lock state.
The screen does not react even when you use the touchscreen.	The instrument is in the key-lock state. Foreign material, such as dust, settles on the touchscreen. The touch panel position has shifted.	• Press and hold the **REMOTE/LOCAL** key for at least 3 s to cancel the key-lock state. • Remove the dust or other foreign material. See “Replaceable parts and service life” (p. 68). See “Touch panel calibration” in the Instruction Manual.
The instrument’s settings cannot be changed.	The instrument is performing integration or stopped performing integration.	Perform an integrated value reset (data reset). See “3.3 Integration Measurement” in the Instruction Manual.
The instrument cannot display any measured voltage or current values.	The voltage cords and current sensors are improperly connected.	Check the connections. See “2 Preparing for Measurement” (p. 25).
	The input channel and display channel do not match with each other. (For example, this issue will arise if the input channel has been set to **Ch. 1** while a page other than the CH1 page has been displayed.)	Use the **◀CH▶** keys for channel selection to display the page for the input channel. See “3.2 Measuring Power” in the Instruction Manual.
The active power is not displayed.	The voltage and current range settings are improperly configured.	Set the voltage and current ranges properly. See “Voltage range and current range” in the Instruction Manual.

Issue	Cause	Solution and where to find additional information
Frequency cannot be measured, or measured values are unstable.	The input frequency is set outside the range of 0.1 Hz to 500 kHz.	Check the frequency by viewing the input waveform. See “4.1 Waveform Display Method” in the Instruction Manual.
	The input frequency is lower than the set frequency.	Set the measurement lower frequency limit setting. See “Measurement upper frequency limit and lower frequency limit (configuring frequency measuring range)” in the Instruction Manual.
	The synchronization source input is incorrect. The synchronization source input range is too large.	Check the synchronization source setting. See “Synchronization source” and “Voltage range and current range” in the Instruction Manual.
	A severely distorted waveform, such as a PWM waveform, is measured.	Set the zero-cross filter to **[ON]**. See “ZCF (Zero-cross filter)” subsection under the “Configuring the trigger settings”section in the Instruction Manual.”
Three-phase voltage measurement results are low.	Phase voltages are measured with the Δ-Y conversion function.	Turn off the Δ-Y conversion function. See “Δ–Y conversion” in the Instruction Manual.
Measured power values are anomalous.	The instrument is incorrectly connected.	Check the instrument’s connection. See “2.10 Checking Connections” (p. 44).
	The rectifier and LPF settings is improperly configured.	Set the rectifier properly. If the LPF is enabled, set it to **[OFF]**. See “Rectification method” and “Low-pass filter (LPF)” in the Instruction Manual.
The current reading never falls to zero even when receiving zero-input.	A Universal Clamp On CT is used with a lower current range. The current sensor’s high-frequency noise may be affecting the current reading.	Perform zero adjustment after setting the LPF to 100 kHz. See “Low-pass filter (LPF)” and “2.9 Connecting Measurement Leads and Sensors to Lines to Be Measured” (p. 42) in the Instruction Manual.
The apparent power, reactive power, and power factor readings on the secondary-side of an inverter differ from measurements obtained using other instruments. **Voltage values are higher than expected.**	The rectifier settings are not the same as those on the other instruments.	Use the same rectifier setting as with the other instruments. See “Rectification method” in the Instruction Manual.
	The calculation methods differ.	Use the same calculation methods as with the other instruments. See “5.6 Power Calculation Method” in the Instruction Manual.
Motor RPM cannot be measured.	The pulse output is set to other than voltage output. The instrument cannot detect open collector pulse output.	Set the device to voltage output to match the Ch. B pulse input setting.
	The pulse output contains noise.	Check the cable routing. Ground the encoder that generate the pulse output. Specify the pulse-noise filter (PNF). See the “Pulse-noise filter (PNF)” subsection under the “Configuring the motor input settings”section in the Instruction Manual.”

Issue	Cause	Solution and where to find additional information
A large value exceeding the display range was recorded in the saved data.	An overload condition occurs.	Set an appropriate range. See “4.1 Waveform Display Method” and “7.10 Measured Value Save Data Format” in the Instruction Manual.
A large value exceeding the display range was recorded in the saved data. **Large values such as [1.00E+104] or [7.78E+103] are included in the stored data.**	The string **[-------]** is displayed because overload or peak overload has occurred, the range has been changed, or the measured value is invalid.	Set an appropriate range. See “4.1 Waveform Display Method” and “7.10 Measured Value Save Data Format” in the Instruction Manual. Do not change the range while saving data. Alternatively, treat it as invalid data.
The instrument cannot detect a USB flash drive.	The USB flash drive is damaged.	Press the reload button () on the **[FILE]** screen. Cycle the instrument.

If the cause of your problem remains unclear

If you are unsure of the cause, try a system reset.
All settings will be returned to their factory defaults.
See “6 System Settings” in the Instruction Manual.

4.3 Error Messages

- If damage is suspected, refer to “Before returning for repair” (p. 69) and “4.3 Error Messages” (p. 72) to address the issues. If the issue cannot be resolved, please contact your authorized Hioki retailer or reseller.
- When an error is displayed, the instrument needs repair. Please contact your authorized Hioki retailer or reseller.
- Turning on the instrument while the lines to be measured are live may damage the instrument or cause an error to be displayed. Always turn the instrument on first and then activate power to the lines to be measured once you have verified that no error is being displayed by the instrument.

Message	Remedy
The option calibration data is corrupted.	The instrument is in need of repair. Please contact your authorized Hioki retailer or reseller.
The option configuration has changed.	
The unit calibration data is corrupted.	
The unit ID setting is incorrect.	
The instrument’s settings have been initialized.	If this message appears frequently, the instrument may be in need of repair. Please contact your authorized Hioki retailer or reseller.
The fan is broken. **The system will shut down after 3 minutes due to a risk of overheating or malfunction.**	The instrument is in need of repair. Please contact your authorized Hioki retailer or reseller.
Communication part of the Unit is broken.	
The internal memory cannot be recognized. **It may be damaged.**	If restarting the device does not improve the situation, it is in need of repair. Please contact your authorized Hioki retailer or reseller.

4.4 Warning Messages

Message	Remedy	Reference
The current sensor and wiring settings have changed. Settings can be restored by switching back to the current sensor below and pressing the Restore button. Caution: The restore will fail if the current sensor is different from the following.	If the current sensor was changed intentionally, tap the **[OK]** box to close the message.	—
Holding values...	While the hold function is activated, settings that affect measured values cannot be changed. If you wish to change settings, disable the hold function.	Instruction Manual “5.3 Hold Function”
Holding peak values...	While the peak hold function is activated, settings that affect measured values cannot be changed. If you wish to change settings, disable the peak hold function.	Instruction Manual “5.4 Peak hold function”
Integration is ongoing, the instrument is standing by for integration, or integration is stopped.	If you want to reset integration while the instrument is integrating or standing by for integration, stop the integration, then press the **DATA RESET** key. During the integration, settings that affect other measured values cannot be changed.	Instruction Manual “3.3 Integration Measurement” Instruction Manual “Integration measurement while using the time control function”
	If you want to reset integration while integration has been stopped, press the **DATA RESET** key.	
The entered value is out of range. Please check the setting range and enter the value again.	Check the setting range and enter the value again.	—
Unable to switch wiring. The wiring includes one or more different current sensors.	Check the current sensor connection.	“2.5 Setting Wiring Mode and Configuring Current Sensor Settings” (p. 35)
The number of parameters that can be saved has been exceeded. Check the setting.	Set the data save interval to longer than the present setting or reduce the number of items to be saved.	—
Cannot perform zero adjustment.	Zero adjustment cannot be performed during hold, peak hold, or integration. To perform zero adjustment, cancel hold and peak hold, and reset the integration.	—
Out of the input range.	Check the setting range and enter the value again.	—
The integration start time is in the past.	Check the integration start time of real time control.	Instruction Manual “5.1 Time Control Function”
Unable to switch I input. The wiring includes one or more different current sensors.	Check the current sensor connection.	“2.5 Setting Wiring Mode and Configuring Current Sensor Settings” (p. 35)
Failed to delete.	Try again.	—
Failed to load the upgrade file.	The version-up file may be corrupt. Copy the version-file again and execute it.	—

Message	Remedy	Reference
There is not enough space on the media.	Delete any unnecessary files or change the media.	Instruction Manual “7.3 Data save destination” Instruction Manual “7.9 File and Folder Operation”
Unable to automatically generate the filename.	Either specify a different destination folder or create a new folder and save the file in it. Otherwise, delete unnecessary files or replace the USB flash drive with another one.	Instruction Manual “7.9 File and Folder Operation”
The name is already being used by a different file or folder.	Use another name for the file or folder.	Instruction Manual “Renaming a file or folder”
Unable to find the media.	Confirm that the media to be saved to is recognized.	Instruction Manual “7.3 Data save destination”
Unable to switch to the wiring described in the settings file due to differences in the sensor configuration.	The instrument cannot load a configuration file if the combination of options differs from the actual combination.	Instruction Manual “7.8 Saving and Loading the Settings Data”
Unable to load the settings data. The option configuration is different.		—
Unable to load the settings data. The unit configuration is different.		—
The instrument’s firmware version differs from the version for which the settings data was created.		—
Unable to load the settings file.	Put the instrument into an integration reset state, and a hold canceled state, and disable the synchronous control.	—
Failed to write data.	Try again.	—
Failed to load data.		—
Unable to create file.		—
Unable to create folder.		—
This USB flash drive is not supported and cannot be used with this instrument.	If the USB flash drive is formatted with a non-FAT file system, reformat it with FAT32.	Instruction Manual “7.2 USB flash drive”
Unable to access the USB drive.	The instrument may not support the USB flash drive. Check that the instrument is compatible with the USB flash drive. Even if the instrument should support your USB flash drive, format it when it is not accessible.	Instruction Manual “USB flash drive requirements for this instrument” Instruction Manual “Formatting a USB flash drive or the internal memory”
No files were found for automatic FTP upload.	Check if there is a file to be sent.	—
Failed to copy data.	Try again.	—
The file on the device is being accessed.	If the instrument is automatically saving data, stop it. If the FTP server function is in use, disconnect the connection.	—
Auto-save operation has not completed. Reset the instrument.	Stop the auto-save operation.	—

Message	Remedy	Reference
Failed to rename.	You cannot rename a file the same as other files or leave the filename box blank. Enter a different name.	—
Failed to format.	Try again.	—
Cannot execute consecutive FILE screen operations during Auto-save operation. Please wait.	Wait a moment.	—
Unable to execute screenshot while Auto-save operation.	Set the data save interval to 1 s or more. Alternatively, stop the auto-save operation.	—
Unable to save measured data manually while Auto-save operation.	Stop the auto-save operation.	—
Unable to save waveform data while Auto-save operation.		
Unable to save settings data while Auto-save operation.		
Unable to execute media operation while Auto-save operation.		
Unable to make DBC file while Auto-save operation.		
Unable to make UDF settings file while Auto-save operation.		
Unable to make A2L file while Auto-save operation.		
Unable to mount FTP server while Auto-save operation.		
Failed to send the FTP file. It will be resent after a certain period of time.	Make sure that the FTP server is running. Otherwise, check the FTP client settings.	Instruction Manual “9.5 Sending Data Using the FTP Client Function”
Failed to resend the FTP file.		—
Unable to send file. Too many unsent files.	Wait while files are sent.	—
Saved in a file. **Wait a moment.**	Wait a moment.	—
Unable to save data while storing waveform.	Record the waveforms with the **SINGLE** key and then save them.	Instruction Manual “4.3 Recording Waveforms”
The waveform and settings are inconsistent. Please update with the SINGLE key and try again.		
Operating in the IEC measurement mode.	Unavailable in IEC measurement mode. Set the measurement mode to wideband measurement mode.	“2.7 Measurement Mode” (p. 40)
Operating in or waiting for the BNC synchronization mode.	Unavailable during BNC synchronization mode or in the connection-ready state. Turn the BNC-sync setting off or restore the BNC synchronization.	Instruction Manual “(5) BNC synchronization” in “External interface specifications”
Operating in the BNC synchronization secondary mode.	Unavailable during the BNC-sync secondary operation. Turn the BNC-sync setting off.	

Message	Remedy	Reference
If conditions prevent UDF from being calculated, it will also not be possible to calculate efficiency and loss. In such a case, revise the UDF settings.	Confirm that the specified UDF can be calculated.	Instruction Manual “3.5 Measuring Efficiency and Loss”
The specified efficiency or loss item cannot be calculated because the calculation settings include UDF.	Do not include UDF in the calculation settings for the specified efficiency or loss item.	
Unable to load because it is not a PW4001 configuration file.	Recreate the UDF configuration file.	Instruction Manual “Loading user-defined formula (UDF) setting data”
Unable to load some settings.		
Cannot set because of the invalid combination.	Set **[Data speed]** to be equal to or higher than **[Arbitration speed]**.	Instruction Manual “Setting CAN output”
Cannot set because the number of items has exceeded the limit.	Reduce the number of items selected.	
Unable to output arbitrary frames because the data update interval is 1ms.	Set the data update interval to a value other than 1 ms.	Instruction Manual “Data update interval”
Unable to output arbitrary frames because all settings for using arbitrary frames are turned off.	Turn ON **[✓]** the **[Use]** setting for at least one setting for arbitrary frame output.	Instruction Manual “8.5 Arbitrary Frame Output Function”
A PID with a different number of response bytes is included. Make sure that the number of response bytes is the same for each PID type.	Specify the same number of response bytes for each PID type.	Instruction Manual “Diagnostic measurement setup procedure”
The measurement ECU’s ID specification is out of range.	Specify a valid ID value.	
The factor or offset value is outside the valid input range.	Specify a value in the range of 999.999T to −999.999T.	
Unexpected license key file format. Please check the filename and format.	Check the file name and file format.	“4.5 Adding Optional Functions” (p. 77)
This additional feature is not supported by this product or the current version. Please try again after upgrading.	Try again after performing the version upgrade.	
The authentication information did not match. Please check the serial number and expiration date.	Check the serial number and expiration date. If the message is still displayed even if they match, please contact your authorized Hioki retailer or reseller..	

4.5 Adding Optional Functions

By purchasing additional optional licenses, the PW4001's functions can be expanded as follows.

Model name	Function overview	Supported versions
PW9006	IEC harmonics/flicker measurement function	V1.10 and later

Once expanded, optional functions will not be deleted even by a system reset or boot key reset.

Issuing a license key (performed on a computer)

1 Access the download site.

See "Information on download site" (p. 5).

2 Log into the download site.

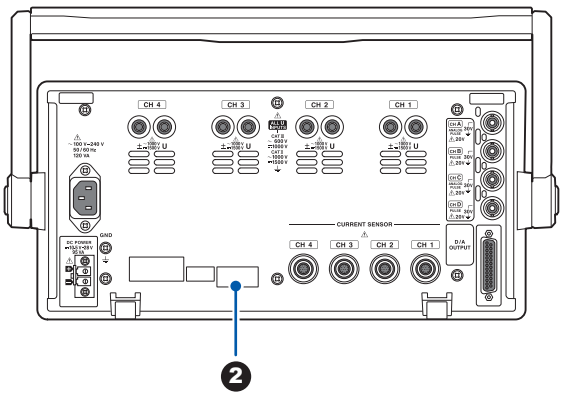
You must log in to issue a license key. If you don't have an account, please create a new account.

3 Search for the model name of the optional function and click on it.

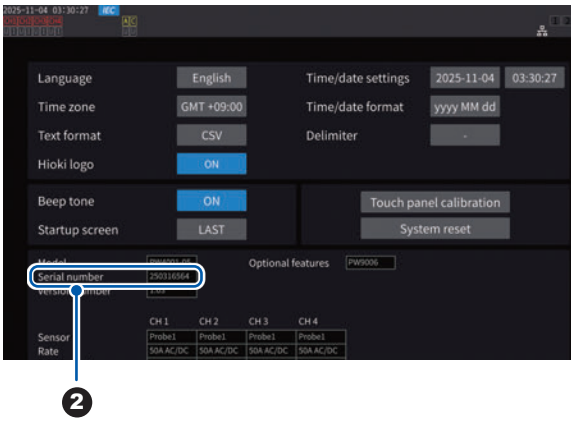
4 Input the registration code (❶) printed on your license card to issue the license key.

For instructions on issuing a license key, refer to the Help section of the download site.
To issue a license key, you will need the serial number (❷) of the PW4001 to which the optional function will be added. Make sure to confirm that in advance.

PW4001 rear



Display screen **SYSTEM** key > **[CONFIG]**

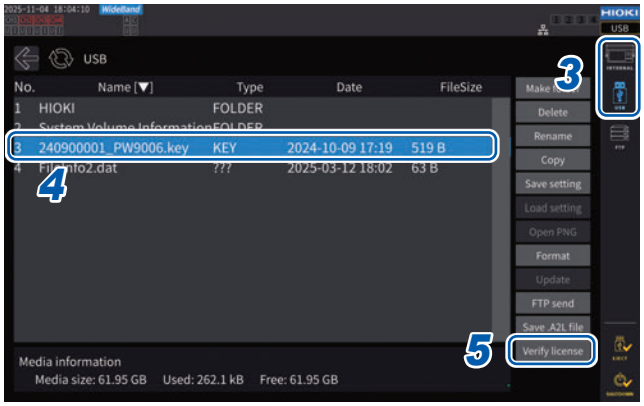


5 Save the license key to the media (USB flash drive or internal memory).

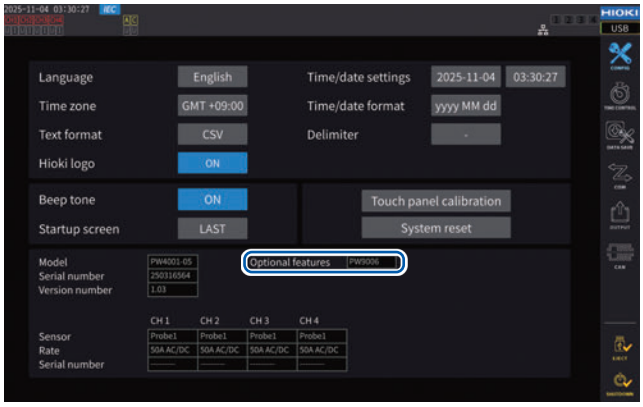
Do not change the filename. Changing it could prevent the PW4001 from authenticating the license key.

Authenticating the license key (performed on the PW4001)

Display screen **FILE** key



Display screen **SYSTEM** key > **[CONFIG]**



1 **Upgrade to the latest version.**

See the Instruction Manual “11.11 Updating the Firmware”.

2 **Import the media into the PW4001.**

3 **Press the FILE key and tap on the media icon.**

4 **Select the license key.**

The license key filename has the following format

“Serial number_Model name of the optional function.key”

Confirm that the serial number in the filename matches that of the PW4001 before proceeding to the next step.

5 **Tap [Verify license].**

If successful, a message stating that authentication is complete will appear and the model name of the optional function can be viewed via the **SYSTEM** key > **[CONFIG]** screen.
If an error is displayed, carefully check the serial number and the compatible products for the optional function before starting over from step ***1***.
If the error message is displayed even though the serial number and compatible product match, please contact your authorized Hioki retailer or reseller.

Warranty Certificate

HIOKI

Model	Serial number	Warranty period Three (3) years from date of purchase (___ / ___)

Customer name: _____

Customer address: _____

Important

- Please retain this warranty certificate. Duplicates cannot be reissued.
- Complete the certificate with the model number, serial number, and date of purchase, along with your name and address. The personal information you provide on this form will only be used to provide repair service and information about Hioki products and services.

This document certifies that the product has been inspected and verified to conform to Hioki's standards.
Please contact the place of purchase in the event of a malfunction and provide this document, in which case Hioki will repair or replace the product subject to the warranty terms described below.

Warranty terms

1. The product is guaranteed to operate properly during the warranty period (three [3] years from the date of purchase). If the date of purchase is unknown, the warranty period is defined as three (3) years from the date (month and year) of manufacture (as indicated by the first four digits of the serial number in YYMM format).
2. If the product came with an AC adapter, the adapter is warrantied for one (1) year from the date of purchase.
3. The accuracy of measured values and other data generated by the product is guaranteed as described in the product specifications.
4. In the event that the product or AC adapter malfunctions during its respective warranty period due to a defect of workmanship or materials, Hioki will repair or replace the product or AC adapter free of charge.
5. The following malfunctions and issues are not covered by the warranty and as such are not subject to free repair or replacement:
   -1. Malfunctions or damage of consumables, parts with a defined service life, etc.
   -2. Malfunctions or damage of connectors, cables, etc.
   -3. Malfunctions or damage caused by shipment, dropping, relocation, etc., after purchase of the product
   -4. Malfunctions or damage caused by inappropriate handling that violates information found in the instruction manual or on precautionary labeling on the product itself
   -5. Malfunctions or damage caused by a failure to perform maintenance or inspections as required by law or recommended in the instruction manual
   -6. Malfunctions or damage caused by fire, storms or flooding, earthquakes, lightning, power anomalies (involving voltage, frequency, etc.), war or unrest, contamination with radiation, or other acts of God
   -7. Damage that is limited to the product's appearance (cosmetic blemishes, deformation of enclosure shape, fading of color, etc.)
   -8. Other malfunctions or damage for which Hioki is not responsible
   -9. After disassembly, such as opening the product, has been performed by the customer without permission by Hioki
6. The warranty will be considered invalidated in the following circumstances, in which case Hioki will be unable to perform service such as repair or calibration:
   -1. If the product has been repaired or modified by a company, entity, or individual other than Hioki
   -2. If the product has been embedded in another piece of equipment for use in a special application (aerospace, nuclear power, medical use, vehicle control, etc.) without Hioki's having received prior notice
7. If you experience a loss caused by use of the product and Hioki determines that it is responsible for the underlying issue, Hioki will provide compensation in an amount not to exceed the purchase price, with the following exceptions:
   -1. Secondary damage arising from damage to a measured device or component that was caused by use of the product
   -2. Damage arising from measurement results provided by the product
   -3. Damage to a device other than the product that was sustained when connecting the device to the product (including via network connections)
8. Hioki reserves the right to decline to perform repair, calibration, or other service for products for which a certain amount of time has passed since their manufacture, products whose parts have been discontinued, and products that cannot be repaired due to unforeseen circumstances.

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HIOKI

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