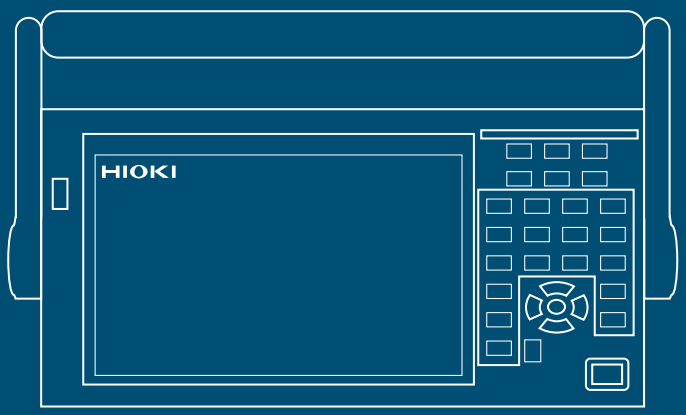
CATALOGO STRUMENTI

Ricerca & Sviluppo

MISURE PRIMARIE

WATTMETRI



TECNOLOGIA

HIOKI

asita

TECNOLOGIE DI MISURA

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STRUMENTI **R&S**

MISURE PRIMARIE
- IMPEDENZIMETRI
- PONTI LCR
- OHMETRI - MICROHMETRI - MILLIOHMETRI - MEGA-OHMETRI - SUPER-MEGA-OHMETRI
- MULTIMETRI
- VOLTMETRI
- WATTMETRI

MONITORAGGIO E CONTROLLO
- DATA LOGGER
- OSCILLOSCOPI REGISTRATORI

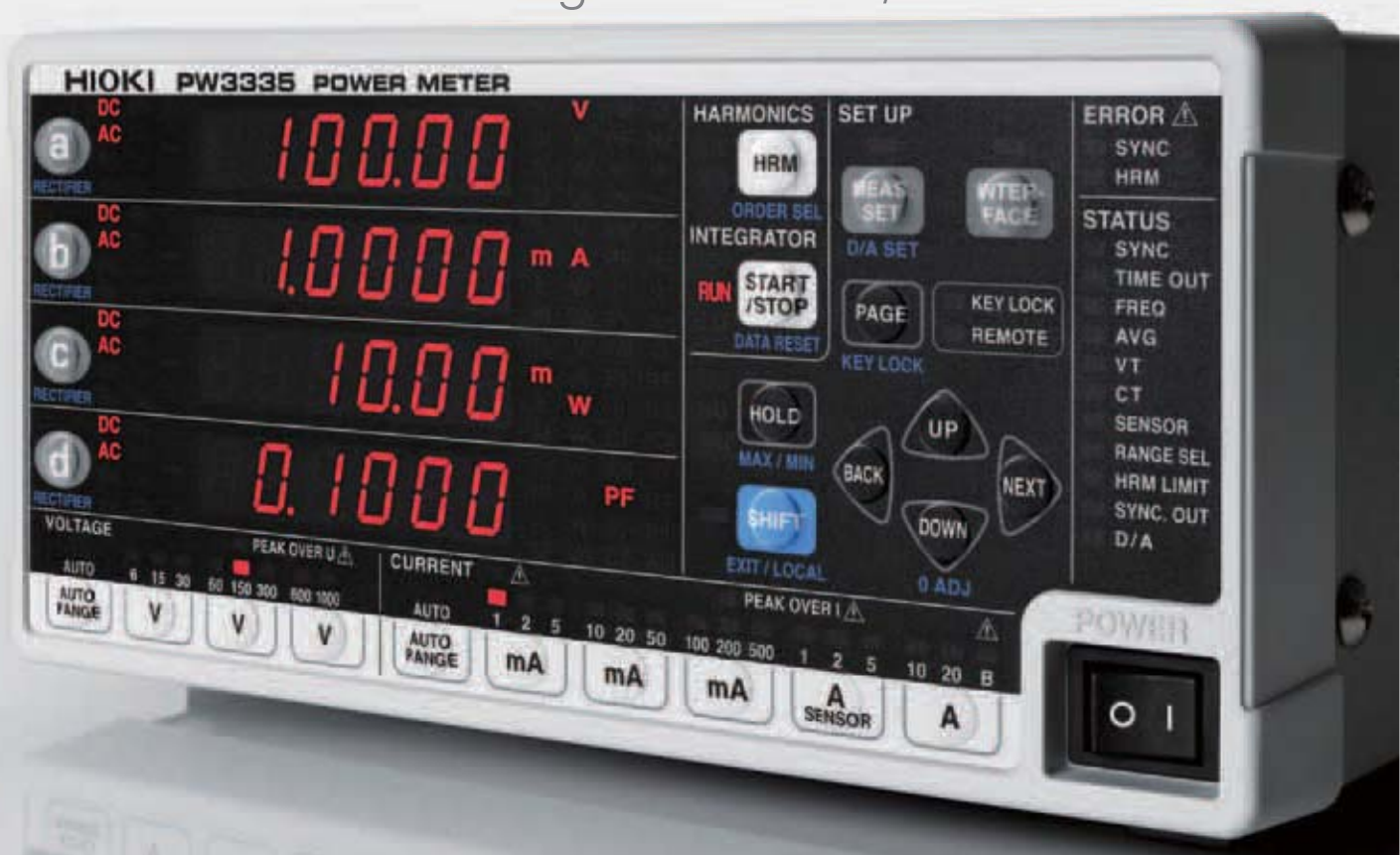
PROVE E VERIFICHE
- PROVA BATTERIA
- PROVA RIGIDITA' DIELETTRICA ED ISOLAMENTO
- PROVA ISOLAMENTO
- PROVA DI CONTINUITA'
- PROVA CORRENTE DISPERSA

SENSORI e ACCESSORI

HIOKI

POWER METER PW3335

Single-Phase AC/DC Power Meter



High-accuracy measurement of standby to operating power

- Wide measurable range : 10 µA to 30 A, 60 mV to 1000 V
- Basic accuracy for voltage, current and power : ±0.1%*
- Frequency bandwidth : DC, 0.1Hz to 100kHz
- High-accuracy measurement even for equipment with low power factors : ±0.1% f.s. power factor effect
- Standby power consumption : Built-in harmonic measurement; IEC62301-compliant
- Measure up to 5000A AC : Built-in external sensor input terminals (PW3335-03, -04)

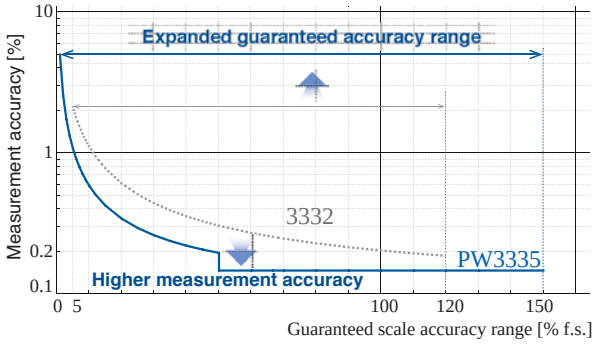
CE

* For complete details, please refer to the specifications.

Single-Phase Power Meter with All-Round Capability

High accuracy of ±0.1%*1 and guaranteed accuracy range from 1 to 150% f.s.

Measurement accuracy & guaranteed accuracy range*2
(PW3335 compared to legacy Model 3332*3)



*2 : Up to 1000 V with a voltage range of 1000 V.
*3 : For detailed specifications of Model 3332, see the comparison chart on page 6.

Power Meter PW3335: Single-phase AC/DC power meter with built-in harmonic measurement
Voltage range: 6.0000 V to 1.0000 kV
Current range: 1.0000 mA to 20.000 A (30 A maximum)

With an expanded guaranteed accuracy range, the power meter minimizes range switchings even under power fluctuations.

*1 : For complete details, please refer to the specifications.

DC, 0.1Hz to 100kHz frequency bandwidth
With built-in harmonic measurement for detailed analysis

Measure the standby power of AC adapters, both primary-side AC and secondary-side DC

Measure power supply conversion devices such as inverters and thyristors

Measures solar panels and power converters, max. 1000V range

Measured power parameters

Voltage	Current	Effective power	Apparent power
Reactive power	Power factor	Phase angle	Frequency
Integral current	Effective integral power	Waveform peak value	Crest factor
Maximum current ratio	Time-averaged current	Time-averaged effective power	Ripple rate

Harmonic measurement parameters

Harmonic effective value	Harmonic effective power	Total harmonic distortion	Fundamental wave effective value
Fundamental wave effective power	Fundamental wave apparent power	Fundamental wave reactive power	Fundamental wave power factor (displacement power factor)
Fundamental wave voltage/current phase difference	Harmonic wave content		
Harmonic voltage phase angle*	Harmonic current phase angle*	Harmonic voltage/ current phase difference*	

*: Only with PC communication

Use in the development and production of solar panels and AC adapters, secondary-side DC equipment and inverters, and power converters such as thyristors. Equipped with multiple functions for computing a wide variety of items, the PW3335 Power Meter can also be used alone for detailed analysis.

from AC/DC Standby to Operating Power

PW3335

Highest basic accuracy and DC accuracy of any instrument in its class

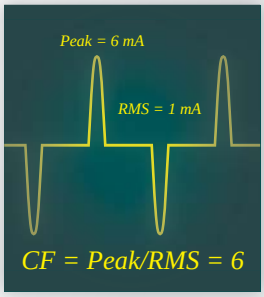
±0.1%*

Thanks to Hioki's accumulated technology and track record, the PW3336/PW3337 delivers the highest basic accuracy and DC accuracy of any instrument in its class. Reliable measurement accuracy ensures robust performance in customers' measurement applications.

* For complete details, please refer to the specifications.

Greater accuracy for standby power

The PW3335 Power Meter delivers a range configuration that lets you measure extremely low power levels with a margin to spare. Accuracy can be set from 10 µA and up for current, and 0 W and up for effective power. Perfect for measurements according to IEC62301 and other standards.

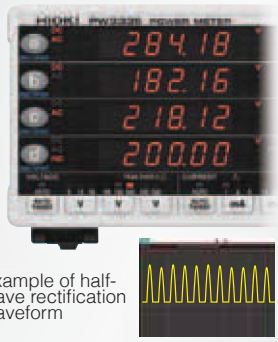


Peak value of up to 600% of the range, supporting crest factor of 6

Current waveforms in the switching power supply or at the primary-side of inverters become steep and often exceeds the fundamental range, preventing them from being accurately measured. The PW3335 resolves these issues by offering a crest factor of 6, allowing it to measure accurately even when the waveform peaks are high relative to its range.

Power factor effects of no more than ±0.1% f.s.

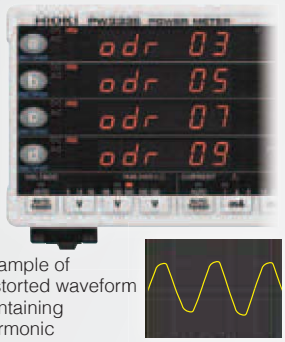
The effective power value may be affected in situations with low power factors, such as measurement of standby power or unloaded operation of transformers and motors. The PW3335 reduces the power factor effect to less than a half of that available in legacy models.



Example of half-wave rectification waveform

Power data and harmonic data — all measured simultaneously

All measurement data are internally processed in parallel simultaneously. Even when waveforms have mixed AC/DC components – half-wave rectification waveforms for example – the individual components can be measured simultaneously. The PC communication application further enables 180 or more measurement parameters to be acquired simultaneously.

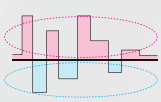


Example of distorted waveform containing harmonic component

Built-in harmonic measurement

The PW3335 measures harmonics up to the 50th order. Use it for evaluation and development of power sources for home appliances and other electrical equipment. Simultaneously display the effective voltage and total harmonic distortion (THD) on the screen. For THD computation, any maximum harmonic order can be specified.

Example of power fluctuation



Power consumption and regeneration (recharging) power integrated separately

Use for evaluating the input and output of secondary batteries in EVs, etc., and for measuring the sold power of solar panels. Power consumption and regeneration (recharging) power can each be measured separately.

MAX/MIN hold function for spotting current peaks at a glance

Capture maximum and minimum values such as inrush current waveform peak values and maximum consumed power.


"Half-rack size" – 2 units fit into 1 rack

Diverse and Powerful Functionality

Measure power in accordance with international standards

The PW3335 is engineered to comply with important international standards, including IEC62301 for electrical power consumption in standby mode and the ErP Directive or Energy Star standard. It can also be used to find the special parameters required by the standards – such as THD, CF, and MCR.

THD (total harmonic distortion)
Indicates the total harmonic components in an AC waveform.

CF (crest factor)
Also known as the peak-to-rms ratio, the ratio of the waveform's peak value to its effective value.

MCR (maximum current ratio)
Evaluation index of the current, calculated from the crest factor and the power factor.


Download free software for creating IEC62301-compliant reports from the Hioki website.

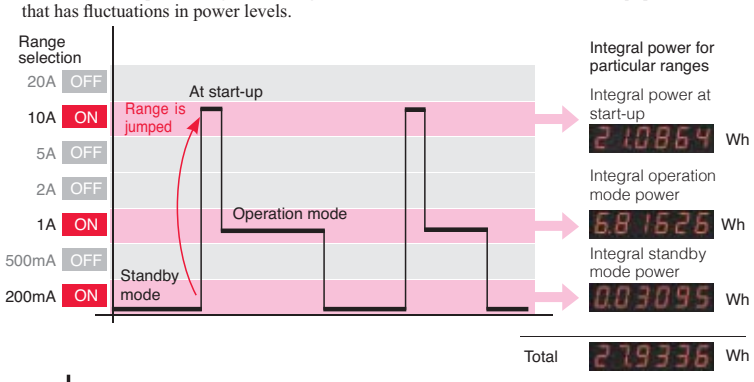
Measure integral power of equipment that operates intermittently or has a large power variation

Time-averaged effective integral power
Use this feature to measure the power of equipment that operates intermittently or is under cycle control. Average power is calculated from the integral value of the fluctuating power.

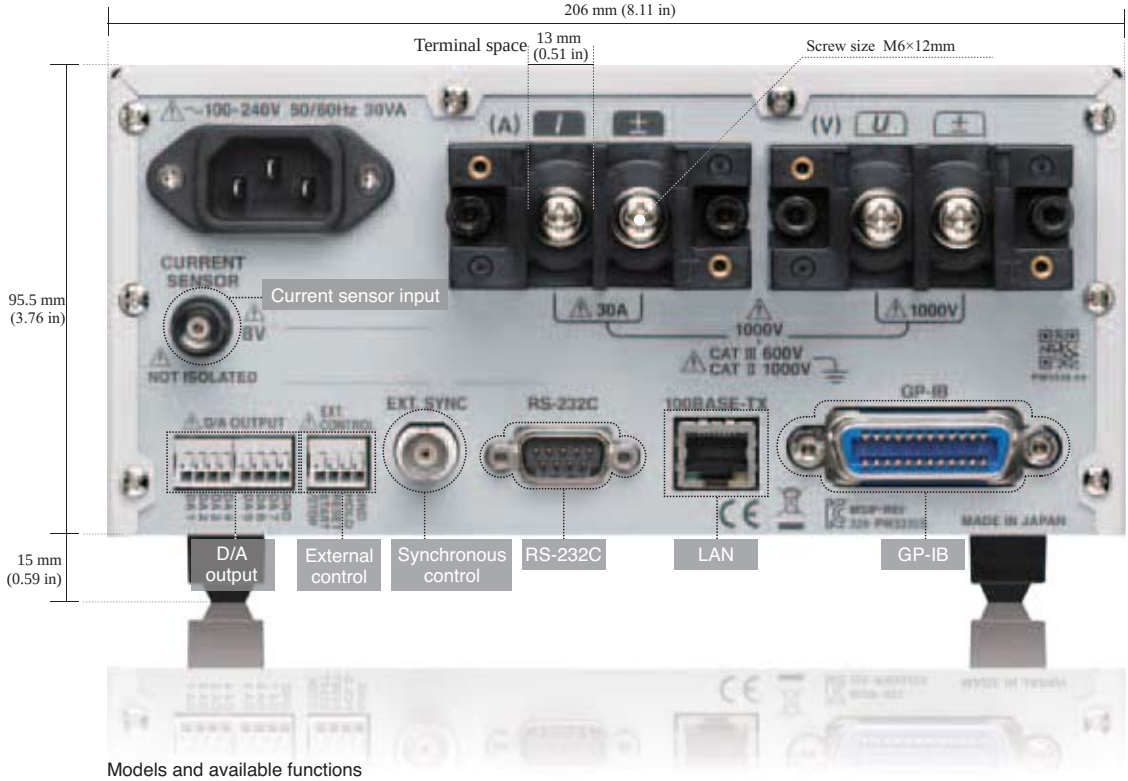

Example of intermittent operation


Example of cycle control

Auto-range integration
A function whereby the device jumps automatically to the optimal current range for the consumed current as it measures and integrates the values. Power integration can be carried out on separate ranges, enabling measurements for individual modes in equipment that has fluctuations in power levels.



Rear view of PW3335-04

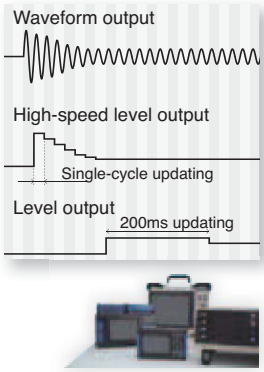


Models and available functions

Model	Harmonics measurement	Synchronous control	LAN	RS-232C	GP-IB	D/A output	Current sensor input
PW3335	✔	✔	✔	✔	—	—	—
PW3335-01	✔	✔	✔	—	✔	—	—
PW3335-02	✔	✔	✔	✔	—	✔	—
PW3335-03	✔	✔	✔	✔	—	—	✔
PW3335-04	✔	✔	✔	✔	✔	✔	✔

✔ : available
— : not available

Rich interfaces and extensibility

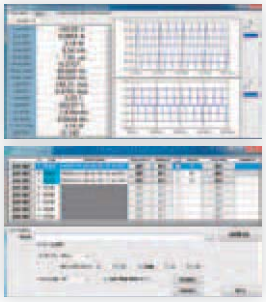


3 D/A output types

(PW3335-02, PW3335-04)

The PW3335 can output measurement values to a data logger, Hioki Memory HiCorder or similar, via voltage signals. The power meter is also built in with functions for outputting the high-speed level of each successive fundamental wave cycle*, in addition to instantaneous waveform output and level output, and provides in-depth analysis of power-consuming equipment such as cutting/grinding tool monitoring equipment.

* For voltage and current, cycle-by-cycle updating is possible only with an input of 45 to 66 Hz.



PC communication software

By using the bundled PC application, you can control the power meter from a PC without needing to code your own communication program. The software enables you to save data to the PC, display waveforms, and perform efficiency calculations*, etc.

Compatible with LAN, RS-232C, GP-IB

*Two or more PW3335s are necessary in order to carry out efficiency computation.

Synchronous control cable 9165

Up to 8 units of simultaneous control

Use the simultaneous control feature for measuring input/output efficiency of the power source equipment, for making comparisons between multiple equipment, or for simultaneous parallel testing of production lines and achieve measurement with guaranteed synchronization. Efficiency computation is also possible in conjunction with PC software. Synchronization with both the Hioki PW3336 and PW3337 Power Meters is also supported.

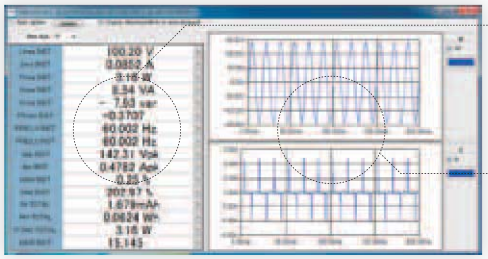
Pair with current sensors delivering a maximum accuracy of ±0.26% to measure 30 A and up

(PW3335-03, PW3335-04)

You can input up to 5000A AC with the use of an optional current sensor. Using Hioki AC/DC high-accuracy pull-through sensors will enable precise measurement with maximum accuracy of ±0.26%.

PC Communication Software – PW Communicator

PW Communicator is an application software for communicating between a PW3335 series power meter and a PC. Free download is available from the Hioki website. The application contains convenient functions for setting the PW3335, monitoring the measurement values, acquiring data via communication, computing efficiency, and many more.

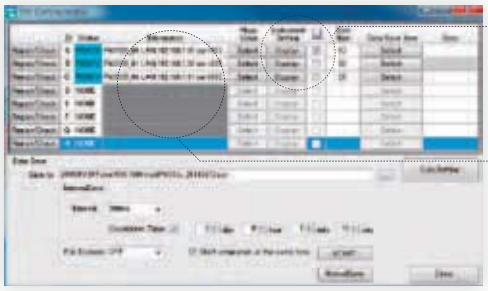


Value monitoring

The Value monitoring function displays the PW3335's measurement values on the PC screen. You can freely select up to 64 values, such as voltage, current, power, and harmonics.

Waveform monitoring

This function enables you to monitor the voltage, current, and waveforms measured by the meter right on the PC screen.

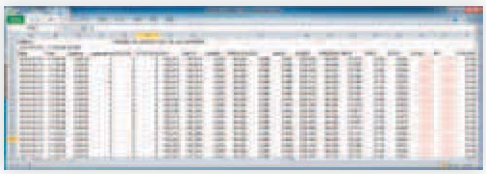


Meter setting

The application also enables you to configure the connected PW3335 from the PC screen.

Synchronous measurement

When using multiple PW3335s, computation of the input/output efficiency of a power converter and similar operations are supported. This feature can be used to synchronously control up to 8 meters – including Hioki PW3336 and PW3337 series units – connected together with synchronous control cables.



Saving data as CSV file

Record 180 or more measurement data to a CSV file at fixed intervals.
The shortest interval between recordings is 200 ms.

PW Communicator Specifications

Availability	Free download from the Hioki website
Operating environment	PC/AT-compatible
OS	Windows 8, Windows 7 (32/64-bit)
Memory	2GB or more recommended
Interface	LAN, RS-232C, GP-IB

IEC62301-compliant reporting software

Download free software for creating IEC62301-compliant reports from the Hioki website.

LabVIEW Driver

A LabVIEW driver compatible with the PW3335 will enable you to acquire data and build measurement systems.
(LabVIEW is a registered trademark of National Instruments Corporation.)

Comparison with Hioki legacy Model 3332

	PW3335 series	3332
Frequency bandwidth	DC, 0.1 Hz to 100 kHz	1 Hz to 100 kHz
Sampling	700 kHz digital sampling	Analog computation
Voltage measurement range	6 V to 1000 V	15 V to 600 V
Current measurement range	1 mA to 20 A	1 mA to 50 A
Power measurement range	Determined by combination of voltage and current ranges. 6.0000 mW and up	Determined by combination of voltage and current ranges. 15.000 mW and up
Basic accuracy (DC)	Voltage/current/power: ±0.1% rdg, ±0.1% f.s.	-
Basic accuracy (45 Hz to 66 Hz)	Voltage/current/power: ±0.1% rdg, ±0.05% f.s.	Voltage/current/power: ±0.1% rdg, ±0.1% f.s.
Effect of power factor	±0.1% f.s. with 45 Hz to 66 Hz, PF = 0	±0.23% f.s. with 45 Hz to 66 Hz, PF = 0
Communication interface	LAN RS-232C (PW3335, PW3335-02, PW3335-03, PW3335-04) GP-IB (PW3335-01, PW3335-04)	RS-232C GP-IB
Synchronous control	Up to 8 meters	-
Harmonics measurement	Available on all models Compliant with IEC61000-4-7:2002	-
Current sensor support	PW3335-03, PW3335-04	-
Auto-range integration function	Available	-
D/A output	7 channels (level output, high-speed level output and waveform output selectable)	Level output (fixed voltage, current and effective power) Waveform output (fixed voltage and current) 1-channel D/A level output
Time-averaged effective integral power	Computable	-
Maximum current ratio (MCR)	Computable	-

Specifications

Input Specifications

Measurement line type	Single-phase 2-wire(1P2W)
Input methods	Voltage Isolated input, resistive voltage divider method Current Isolated input, shunt input method
Voltage measurement ranges	AUTO/ 6 .0000 V/ 15.000 V/ 30.000 V/ 60.000 V/ 150.00 V/ 300.00 V/ 600.00 V/ 1.0000 kV
Current measurement ranges	AUTO/ 1.0000 mA/ 2.0000 mA/ 5.0000 mA/ 10.000 mA/ 20.000 mA/ 50.000 mA/ 100.00 mA/ 200.00 mA/ 500.00 mA/ 1.0000 A/ 2.0000 A/ 5.0000 A/ 10.000 A/ 20.000 A
Power ranges	Depends on the combination of voltage and current ranges; From 6.0000 mW to 20.000 kW (also applies to VA, var) The details are as below.
Input resistance	Voltage input terminal: Approx.2 MΩ Current input terminal: 1 mA to 100 mA range 520 mΩ or less 200 mA to 20 A range 15 mΩ or less

Basic Measurement Specifications

Measurement method	Simultaneous voltage and current digital sampling, zero-cross simultaneous calculation
Sampling frequency	Approx. 700 kHz
A/D converter resolution	16-bit
Frequency bandwidth	DC, 0.1 Hz to 100 kHz (Values within 0.1Hz ≤ f < 10 Hz are for reference only)
Synchronization sources	U, I, DC (fixed to 200 ms)
Measurement items	Voltage / Current / Active power Apparent power / Reactive power / Power factor Phase angle / Frequency / Current integration Active power integration / Integration time Voltage waveform peak value / Current waveform peak value Voltage crest factor / Current crest factor Maximum current ratio / Time average current Time average active power Voltage ripple rate / Current ripple rate Harmonic parameters Harmonic voltage RMS value / Harmonic current RMS value Harmonic active power / Total harmonic voltage distortion Total harmonic current distortion / Fundamental wave voltage Fundamental wave current / Fundamental wave active power Fundamental wave apparent power / Fundamental wave reactive power Fundamental wave power factor (Displacement power factor) Fundamental wave voltage current phase difference Harmonic voltage content percentage Harmonic current content percentage Harmonic active power content percentage (The following parameters can be downloaded as data via PC communication) Harmonic voltage phase angle Harmonic current phase angle Harmonic voltage current phase difference
Rectifiers	AC+DC : AC+DC measurement Display of true RMS values for both voltage and current AC+DC Umn : AC+DC measurement Display of average value rectified RMS converted values for voltage and true RMS values for current DC : DC measurement Display of simple averages for both voltage and current Display of values calculated by (voltage DC value) × (current DC value) for active power AC : AC measurement Display of values calculated by $\sqrt{(\text{AC+DC value})^2 - (\text{DC value})^2}$ for both voltage and current Display of values calculated by (AC+DC value) - (DC value) for active power FND : Extraction and display of the fundamental wave component from harmonic measurement
Zero-cross Filter	100 Hz: 0.1 Hz to 100 Hz 500 Hz: 0.1 Hz to 500 Hz 5 kHz: 0.1 Hz to 5 kHz 100 kHz: 0.1 Hz to 100 kHz

Measurement accuracy

Voltage

Frequency (f)	Input < 50%f.s.	50%f.s. ≤ Input < 100%f.s.	100%f.s. ≤ Input
DC	±0.1rdg.±0.1%f.s.	±0.1%rdg.±0.1%f.s.	±0.2%rdg.
0.1Hz≤f<16Hz	±0.1%rdg.±0.2%f.s.	±0.3%rdg.	±0.3%rdg.
16Hz≤f<45Hz	±0.1%rdg.±0.1%f.s.	±0.2%rdg.	±0.2%rdg.
45Hz≤f≤66Hz	±0.1%rdg.±0.05%f.s.	±0.15%rdg.	±0.15%rdg.
66Hz<f≤500Hz	±0.1%rdg.±0.1%f.s.	±0.2%rdg.	±0.2%rdg.
500Hz<f≤10kHz	±0.1%rdg.±0.2%f.s.	±0.3%rdg.	±0.3%rdg.
10kHz<f≤50kHz	±0.5%rdg.±0.3%f.s.	±0.8%rdg.	±0.8%rdg.
50kHz<f≤100kHz	±2.1%rdg.±0.3%f.s.	±2.4%rdg.	±2.4%rdg.

Current

Frequency (f)	Input < 50%f.s.	50%f.s. ≤ Input < 100%f.s.	100%f.s. ≤ Input
DC	±0.1%rdg.±0.1%f.s.	±0.1%rdg.±0.1%f.s.	±0.2%rdg.
0.1Hz≤f<16Hz	±0.1%rdg.±0.2%f.s.	±0.3%rdg.	±0.3%rdg.
16Hz≤f<45Hz	±0.1%rdg.±0.1%f.s.	±0.2%rdg.	±0.2%rdg.
45Hz≤f≤66Hz	±0.1%rdg.±0.05%f.s.	±0.15%rdg.	±0.15%rdg.
66Hz<f≤500Hz	±0.1%rdg.±0.1%f.s.	±0.2%rdg.	±0.2%rdg.
500Hz<f≤1kHz	±0.1%rdg.±0.2%f.s.	±0.3%rdg.	±0.3%rdg.
1kHz<f≤10kHz	±(0.03+0.07×F)%rdg. ±0.2%f.s.	±(0.23+0.07×F)%rdg.	±(0.23+0.07×F)%rdg.
10kHz<f≤100kHz	±(0.3+0.04×F)%rdg. ±0.3%f.s.	±(0.6+0.04×F)%rdg.	±(0.6+0.04×F)%rdg.

Active power

Frequency (f)	Input < 50%f.s.	50%f.s. ≤ Input < 100%f.s.	100%f.s. ≤ Input
DC	±0.1%rdg.±0.1%f.s.	±0.1%rdg.±0.1%f.s.	±0.2%rdg.
0.1Hz≤f<16Hz	±0.1%rdg.±0.2%f.s.	±0.3%rdg.	±0.3%rdg.
16Hz≤f<45Hz	±0.1%rdg.±0.1%f.s.	±0.2%rdg.	±0.2%rdg.
45Hz≤f≤66Hz	±0.1%rdg.±0.05%f.s.	±0.15%rdg.	±0.15%rdg.
66Hz<f≤500Hz	±0.1%rdg.±0.1%f.s.	±0.2%rdg.	±0.2%rdg.
500Hz<f≤1kHz	±0.1%rdg.±0.2%f.s.	±0.3%rdg.	±0.3%rdg.
1kHz<f≤10kHz	±(0.03+0.07×F)%rdg. ±0.2%f.s.	±(0.23+0.07×F)%rdg.	±(0.23+0.07×F)%rdg.
10kHz<f≤50kHz	±(0.07×F)%rdg. ±0.3%f.s.	±(0.3+0.07×F)%rdg.	±(0.3+0.07×F)%rdg.
50kHz<f≤100kHz	±(0.6+0.07×F)%rdg. ±0.3%f.s.	±(0.9+0.07×F)%rdg.	±(0.9+0.07×F)%rdg.

- Values for f.s. depend on measurement ranges.
- "F" in the tables refers to the frequency in kHz.
- When using the 1 mA/ 2 mA range:
  Add ±1 μA to 0.1 Hz to 100 kHz measurement accuracy for current.
  Add (±1 μA) × (voltage read value) to 0.1 Hz to 100 kHz measurement accuracy for active power.
- When using the 200 mA/ 500 mA/ 1 A/ 2 A/ 5 A/ 10 A/ 20 A range:
  Add ±1 mA to DC measurement accuracy for current.
  Add (±1 mA) × (voltage read value) to DC measurement accuracy for active power.
- When using the 1 mA/ 2 mA/ 5 mA/ 10 mA/ 20 mA/ 50 mA/ 100 mA range:
  Add ±10 μA to DC measurement accuracy for current.
  Add (±10 μA) × (voltage read value) to DC measurement accuracy for active power.
- When using the 200 mA/ 500 mA/ 1 A/ 2 A/ 5 A/ 10 A/ 20 A range:
  Add ±(0.02×F)% rdg. to the measurement accuracy for current and active power for which (10 kHz < f ≤ 100 kHz).
- The measurement results for following input are considered reference values:
  Values for voltage, current, and active power for which 0.1 Hz ≤ f < 10 Hz.
  Values for voltage, current, and active power in excess of 220 V or 20 A for which 10 Hz ≤ f < 16 Hz.
  Values for current and active power in excess of 20 A for which 500 Hz < f ≤ 50 kHz.
  Values for current and active power in excess of 10 A for which 50 kHz < f ≤ 100 kHz.
  Values for voltage and active power in excess of 750 V for which 30 kHz < f ≤ 100 kHz.

Effective measuring range	Voltage 1% to 150% of the range (1000 V range, up to 1000 V) Current 1% to 150% of the range Active power 0% to 225% of the range (when using 1000 V range, up to 150%) However, valid when the voltage and current fall within the effective measurement range.
Maximum effective peak voltage	±600% of each voltage range However, for 300 V, 600 V, and 1000 V ranges, ±1500 V peak
Maximum effective peak current	±600% of each current range However, for 20 A range, ±60 A peak
Guaranteed accuracy period	1 year
Post-adjustment accuracy guaranteed	6 months
Conditions of guaranteed accuracy	Temperature and humidity range: 23°C±5°C (73°F±9°F), 80% RH or less Warm-up time: 30 minutes Input: Sine wave input, power factor of 1, voltage to earth of 0 V, after zero-adjustment; within range in which the fundamental wave satisfies synchronization source conditions
Temperature coefficient	±0.03%f.s. per °C or less. However, for 1 mA range, ±0.06%f.s. per °C or less.

Range table (Power ranges)

Current/ Voltage	6.0000 V	15.000 V	30.000 V	60.000 V	150.00 V	300.00 V	600.00 V	1.0000 kV
1.0000 mA	6.0000 mW	15.000 mW	30.000 mW	60.000 mW	150.00 mW	300.00 mW	600.00 mW	1.0000 W
2.0000 mA	12.000 mW	30.000 mW	60.000 mW	120.00 mW	300.00 mW	600.00 mW	1.2000 W	2.0000 W
5.0000 mA	30.000 mW	75.000 mW	150.00 mW	300.00 mW	750.00 mW	1.5000 W	3.0000 W	5.0000 W
10.000 mA	60.000 mW	150.00 mW	300.00 mW	600.00 mW	1.5000 W	3.0000 W	6.0000 W	10.000 W
20.000 mA	120.00 mW	300.00 mW	600.00 mW	1.2000 W	3.0000 W	6.0000 W	12.000 W	20.000 W
50.000 mA	300.00 mW	750.00 mW	1.5000 W	3.0000 W	7.5000 W	15.000 W	30.000 W	50.000 W
100.00 mA	600.00 mW	1.5000 W	3.0000 W	6.0000 W	15.000 W	30.000 W	60.000 W	100.00 W
200.00 mA	1.2000 W	3.0000 W	6.0000 W	12.000 W	30.000 W	60.000 W	120.00 W	200.00 W
500.00 mA	3.0000 W	7.5000 W	15.000 W	30.000 W	75.000 W	150.00 W	300.00 W	500.00 W
1.0000 A	6.0000 W	15.000 W	30.000 W	60.000 W	150.00 W	300.00 W	600.00 W	1.0000 kW
2.0000 A	12.000 W	30.000 W	60.000 W	120.00 W	300.00 W	600.00 W	1.2000 kW	2.0000 kW
5.0000A	30.000 W	75.000 W	150.00 W	300.00 W	750.00 W	1.5000 kW	3.0000 kW	5.0000 kW
10.000 A	60.000 W	150.00 W	300.00 W	600.00 W	1.5000 kW	3.0000 kW	6.0000 kW	10.000 kW
20.000 A	120.00 W	300.00 W	600.00 W	1.2000 kW	3.0000 kW	6.0000 kW	12.000 kW	20.000 kW

Effect of power factor	±0.1%f.s. or less (45 to 66 Hz, at power factor = 0) Internal circuitry voltage/current phase difference: ±0.0573°
Effect of common mode voltage	±0.01%f.s. or less (600 V, 50 Hz/60 Hz, applied between input terminals and enclosure)
Effect of magnetic field	400 A/m, DC and 50 Hz/60 Hz magnetic field Voltage ±1.5%f.s. or less Current ±1.5%f.s. or less than or equal to the following value, whichever is greater 200 mA/ 500 mA/ 1 A/ 2 A/ 5 A/ 10 A/ 20 A range: ±20 mA 1 mA/ 2 mA/ 5 mA/ 10 mA/ 20 mA/ 50 mA/ 100 mA range: ±200 µA Active power ±3.0%f.s. or less than or equal to the following value, whichever is greater 200 mA/ 500 mA/ 1 A/ 2 A/ 5 A/ 10 A/ 20 A range: (Voltage influence quantity)×(±20 mA) 1 mA/ 2 mA/ 5 mA/ 10 mA/ 20 mA/ 50 mA/ 100 mA range: (Voltage influence quantity)×(±200 µA)
Effect of self-heating	With input of at least 15 A to current input terminals Current AC input signal ±(0.025+0.005×(I-15))%rdg. or less DC input signal 200 mA/ 500 mA/ 1 A/ 2 A/ 5 A/ 10 A/ 20 A range ±((0.025+0.005×(I-15))% rdg.+(0.5+0.1×(I-15))mA) or less 1 mA/ 2 mA/ 5 mA/ 10 mA/ 20 mA/ 50 mA/ 100 mA range ±((0.025+0.005×(I-15))% rdg.+(5+1×(I-15))µA) or less I: Current read value (A) Active power (above current influence quantity) × (voltage read value) or less The effects of self-heating will continue to manifest themselves until the input resistance temperature falls, even if the current value is low.

Voltage/ Current/ Active Power Measurement Specifications

Measurement types	Rectifiers: AC+DC, DC, AC, FND, AC+DC Umn
Effective measuring range	Voltage ±1% to ±150% of the range. However, up to ±1500 V peak value and 1000 V RMS value Current ±1% to ±150% of the range Active Power ±0% to ±225% of the range. However, valid when the voltage and current fall within the effective measurement range.
Display range	Voltage Up to ±152% of the range. However, zero-suppression when less than ±0.5% Current Up to ±152% of the range. However, zero-suppression when less than ±0.5% or less than ±9 µA. Active Power ±0% to ±231.04% of the range (no zero-suppression)
Polarity	Voltage/ Current Displayed when using DC rectifier Active Power Positive : Power consumption (no polarity display) Negative : generation or regenerated power

Frequency Measurement Specifications

Number of measurement channels	2 (Voltage, current)
Measurement method	Calculated from input waveform period (reciprocal method)
Measurement ranges	100 Hz/ 500 Hz/ 5 kHz/ 100 kHz (linked to zero-cross filter)
Measurement accuracy	±0.1% rdg. ±1 dgt. However, for 1 mA range, ±0.2% rdg. ±1 dgt.
Effective measuring range	0.1 Hz to 100 kHz For sine wave input that is at least 20% of the measurement source's measurement range Measurement lower limit frequency setting: 0.1 sec. / 1 sec. / 10 sec. (linked to synchronization timeout setting)
Display format	0.1000 Hz to 9.9999 Hz, 9.900 Hz to 99.999 Hz, 99.00 Hz to 999.99 Hz, 0.9900 kHz to 9.9999 kHz, 9.900 kHz to 99.999 kHz, 99.00 kHz to 100.00 kHz

Apparent Power/ Reactive Power/ Power Factor/ Phase Angle Measurement Specifications

Measurement types	Rectifiers Apparent Power/ Reactive Power/ Power Factor AC+DC, AC, FND, AC+DC Umn Phase Angle AC, FND
Effective measuring range	As per voltage, current, and active power effective measurement ranges
Display range	Apparent Power/ Reactive Power 0% to 231.04% of the range (no zero-suppression) Power Factor ±0.0000 to ±1.0000 Phase Angle +180.00 to -180.00
Polarity	Reactive Power/ Power Factor/ Phase Angle Polarity is assigned according to the lead/lag relationship of the voltage waveform rising edge and the current waveform rising edge. +: When current lags voltage (no polarity display) -: When current leads voltage

Power Calculation Formulas

S : Apparent power	$S = U \times I$
Q : Reactive power	$Q = si\sqrt{S^2 - P^2}$
λ : Power factor	$\lambda = si \mid P/S \mid$
ϕ : Phase angle	$\phi = si \cos^{-1} \mid \lambda \mid$ (±90° to ±180°) $\phi = si \mid 180 - \cos^{-1} \mid \lambda \mid \mid$ (0° to ±90°)

U: Voltage, *I*: Current, *P*: Active Power, *si*: Polarity symbol (acquired based on voltage waveform and current waveform lead and lag)

Voltage Waveform Peak Value/ Current Waveform Peak Value Measurement Specifications

Measurement method	Measures the voltage waveform's peak value (for both positive and negative polarity) based on sampled instantaneous voltage values.
Range configuration	Voltage

Voltage range	Voltage peak range
6.0000 V	36.000 V
15.000 V	90.000 V
30.000 V	180.00 V
60.000 V	360.00 V
150.00 V	900.00 V
300.00 V	1.8000 kV
600.00 V	3.6000 kV
1.0000 kV	6.0000 kV

Current

Current range	Current peak range
1.0000 mA	6.0000 mA
2.0000 mA	12.000 mA
5.0000 mA	30.000 mA
10.000 mA	60.000 mA
20.000 mA	120.00 mA
50.000 mA	300.00 mA
100.00 mA	600.00 mA
200.00 mA	1.2000 A
500.00 mA	3.0000 A
1.0000 A	6.0000 A
2.0000 A	12.000 A
5.0000 A	30.000 A
10.000 A	60.000 A
20.000 A	120.00 A

Measurement accuracy	±2.0%f.s. at DC and when 10 Hz ≤ f ≤ 1 kHz (f.s.: current peak range). Provided as reference value when 0.1 Hz ≤ f < 10 Hz and when 1 kHz < f. The above measurement accuracy is multiplied by 2 for the 1 mA range.
Effective measuring range	±5% to ±100% of current peak range, however, up to ±60 A
Display range	Up to ±102% of current peak range, however, the value 0 will be displayed if the current RMS value triggers the instrument's zero suppression function.

Voltage Crest Factor/Current Crest Factor Measurement Specifications

Measurement method	Calculates the ratio of the voltage waveform peak value to the voltage RMS value.
Effective measuring range	As per voltage and voltage waveform peak value, or current and current waveform peak value effective measurement ranges.
Display range	1.0000 to 612.00 (no polarity)

Voltage Ripple Rate/ Current Ripple Rate Measurement Specifications

Measurement method	Calculates the AC component (peak to peak [peak width]) as a proportion of the voltage or current DC component.
Effective measuring range	As per voltage and voltage waveform peak value, or current and current waveform peak value effective measurement ranges.
Display range	0.00 to 500.00 (No polarity)

Maximum Current Ratio Measurement Specifications (MCR)

Measurement method	Calculates the ratio of the current crest factor to the power factor. (MCR) = (Current Crest Factor) / (Power Factor)
Effective measuring range	As per power factor (voltage, current, active power) and current crest factor (current, current waveform peak value) effective measurement ranges.
Display range	1.0000 to 6.1200 M (no polarity)

Synchronized control

Functions	The timing of calculations; display updates; data updates; integration start, stop, and reset events; display hold operation; key lock operation; and zero-adjustment operation for the slave PW3335 series is synchronized with the master PW3335 series. Synchronization with the PW3336 series and PW3337 series is also supported.
Terminal	BNC terminal × 1 (non-isolated)
Terminal name	External synchronization terminal (EXT.SYNC)
I/O settings	Off Synchronized control function off (signals input to the external synchronization terminal (EXT.SYNC) are ignored) In The external synchronization terminal (EXT.SYNC) is set to input, and a dedicated synchronization signal can be input (slave). Out The external synchronization terminal (EXT.SYNC) is set to output, and a dedicated synchronization signal can be output (master).
Number of units for which synchronized control can be performed	Up to 7 slaves per master (total of 8 units including the PW3336/PW3337 series)

Functional Specifications

Auto-range (AUTO)	Automatically changes the voltage and current range according to the input. Range up: The range is increased when input exceeds 150% of the range or when the peak is exceeded. Range down: The range is decreased when input falls below 15% of the range. However, the range is not decreased when the peak is exceeded at the lower range. The input level is monitored, and the range is switched over multiple ranges. Range select can be used to disable ranges so that they are not selected.
Range select	Selects whether to enable (turn on) or disable (turn off) individual voltage and current ranges. Enabled (use): Ranges can be selected with the range keys. Range switching occurs using auto-range operation. Range switching occurs during auto-range integration. Disabled (do not use): Ranges cannot be selected with the range keys. Range switching does not occur using auto-range operation. Range switching does not occur during auto-range integration.
Zero-cross filter's threshold level	Sets the zero-cross filter's threshold level for voltage and current ranges. Set from 1% to 15% (in 1% intervals). Synchronization occurs when the percentage level set for each measurement range is exceeded.
Averaging	Averages the voltage, current, active power, apparent power, and reactive power. (Other than harmonic measurement parameters.) The power factor and phase angle are calculated from averaged data. Averaging is not performed for parameters other than those listed above. Method: Simple averaging Number of averaging iterations and display update interval

Number of averaging iterations	Display update interval
1 (OFF)	200 ms
2	400 ms
5	1 s
10	2 s
25	5 s
50	10 s
100	20 s

Scaling (VT, CT)	Applies user-defined VT and CT ratio settings to measured values. VT ratio setting range OFF (1.0), 0.001 to 1000 CT ratio setting range OFF (1.0), 0.001 to 1000
Hold	• Stops display updates for all measured values and fixes the display values at that point in time. • Measurement data acquired by communications is also fixed at that point in time. • Internal calculations (including integration and integration elapsed time) will continue. • Analog output and waveform output are not held
Maximum value/ minimum value hold (MAX/MIN HOLD)	• Detects maximum and minimum measured values (except current integration, active power integration, integration elapsed time, time average current, and time average active power values) as well as maximum and minimum values for the voltage waveform peak and current waveform peak and holds them on the display. • For data with polarity, display of the maximum value and minimum value for the data's absolute values is held (so that both positive and negative polarity values are shown). However, this does not apply to the voltage waveform peak value or the current waveform peak value. • Internal calculations (including integration and integration elapsed time) will continue. • The maximum and minimum values during integration are detected (maximum/minimum value measurement during the integration interval). • Analog output and waveform output are not held.
Zero Adjustment	Zeroes out the voltage and current input offset.
Key-lock	Disables key input in the measurement state, except for the KEY LOCK key.
Backup	Backs up settings and integration data if the instrument is turned off and if a power outage occurs.
System Reset	Initializes the instrument's settings.

Integration Measurement Specifications

Integration operation modes	Switchable between fixed-range integration and auto-range integration. Fixed-range integration Integration can be performed for all voltage and current ranges. The voltage and current ranges are fixed once integration starts. Auto-range integration Integration can be performed for all voltage ranges. The current is set to auto-range operation using ranges from 200 mA to 20 A. The integrated value for each range can be displayed by switching the current range (200 mA to 20 A) while integration is stopped.
Measurement items and display	Simultaneous integration of the following 6 parameters: Positive current integrated value (Ah+) Negative current integrated value (Ah-) Sum of current integrated values (Ah) Positive active power integrated value (Wh+) Negative active power integrated value (Wh-) Sum of active power integrated values (Wh)
Measurement types	Rectifiers: AC+DC, AC+DC Umn Current: Displays the result of integrating current RMS value data (display values) once every display update interval as an integrated value. Active power: Displays the result of integrating active power values by polarity calculated once every cycle for the selected synchronization source as integrated values. Rectifier: DC Displays the result of integrating instantaneous data obtained by sampling both current and active power by polarity as integrated values (these values are not integrated values for the DC component when active power contains both DC and AC components)
Integration time	1 min. to 10000 hr., settable in 1 min. blocks
Integration time accuracy	±0.01% rdg. ±1 dgt.
Integration measurement accuracy	(Current or active power measurement accuracy) + (±0.01% rdg. ±1 dgt.)
Effective measuring range	Until PEAK OVER U lamp or PEAK OVER I lamp lights up.
Display resolution	999999 (6 digits + decimal point)
Functions	• Stopping integration based on integration time setting (timer) • Stopping/starting integration and resetting integrated values based on external control • Displaying the integration elapsed time (displayed as TIME on panel display) • Additional integration by repeatedly starting/stopping integration • Backing up integrated values and the integration elapsed time during power outages • Stopping integration when power returns

Time Average Current/ Time Average Active Power Measurement Specifications

Measurement method	Calculates the average by dividing the current or active power integrated value by the integration time.
Measurement accuracy	(Current or Active power measurement accuracy) + (±0.01% rdg. ±1 dgt.)
Effective measuring range	As per the current or active power integration effective measurement range.
Display range	Time Average Current ±0% to ±612% of the range (Has polarity when using the DC rectifier.) Time Average Active Power ±0% to ±3745.4% of the range (Has polarity)

Harmonic Measurement Specifications

Measurement method	Zero-cross simultaneous calculation method Uniform thinning between zero-cross events after processing with a digital antialiasing filter Interpolation calculations (Lagrange interpolation) When the synchronization frequency falls within the 45 Hz to 66 Hz range: IEC 61000-4-7:2002 compliant Gaps and overlaps may occur if the measurement frequency is not 50 Hz or 60 Hz. When the synchronization frequency falls outside the 45 Hz to 66 Hz range: No gaps or overlap will occur.
Synchronization source	Conforms to synchronization source (SYNC) for the basic measurement specifications.
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 active power content percentage Harmonic voltage current phase difference Total harmonic voltage distortion / Total harmonic current distortion Fundamental wave voltage / Fundamental wave current Fundamental wave active power / Fundamental wave apparent power Fundamental wave reactive power / Fundamental wave power factor Fundamental wave voltage current phase difference (The following parameters can be downloaded as data with communications) Harmonic voltage phase angle / Harmonic current phase angle Harmonic voltage current phase difference
FFT processing	FFT processing word length : 32 bits Number of FFT points : 4096 points
Window function	Rectangular
Analysis window width	45 Hz ≤ f < 56 Hz : 178.57 ms to 222.22 ms (10 cycles) 56 Hz ≤ f < 66 Hz : 181.82 ms to 214.29 ms (12 cycles) Frequencies other than the above : 185.92 ms to 214.08 ms
Data update rate	Depends on window width.
Maximum analysis order	Synchronization frequency (f) range — Analysis order 10 Hz ≤ f < 45 Hz — 50th 45 Hz ≤ f < 56 Hz — 50th 56 Hz ≤ f ≤ 66 Hz — 50th 66 Hz < f ≤ 100 Hz — 50th 100 Hz < f ≤ 200 Hz — 40th 200 Hz < f ≤ 300 Hz — 25th 300 Hz < f ≤ 500 Hz — 15th 500 Hz < f ≤ 640 Hz — 11th
Analysis order upper limit setting	2nd to 50th
Measurement accuracy	f.s.: Measurement range

Frequency (f)	Voltage, Current, Active power
DC	±0.4% rdg. ±0.2%f.s.
10 Hz ≤ f < 30 Hz	±0.4% rdg. ±0.2%f.s.
30 Hz ≤ f ≤ 400 Hz	±0.3% rdg. ±0.1%f.s.
400 Hz < f ≤ 1 kHz	±0.4% rdg. ±0.2%f.s.
1 kHz < f ≤ 5 kHz	±1.0% rdg. ±0.5%f.s.
5 kHz < f ≤ 8 kHz	±4.0% rdg. ±1.0%f.s.

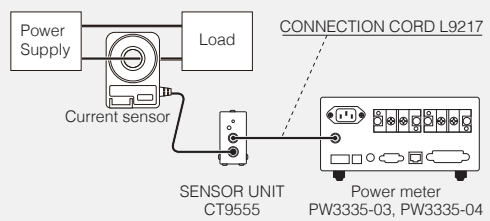
- When using the 1 mA/ 2 mA range:
  Add ±1 µA to 10 Hz to 8 kHz measurement accuracy for current.
  Add (±1 µA) × (voltage read value) to 10 Hz to 8 kHz measurement accuracy for active power.
- When using the 200 mA/ 500 mA/ 1 A/ 2 A/ 5 A/ 10 A/ 20 A range:
  Add ±1 mA to DC measurement accuracy for current.
  Add (±1 mA) × (voltage read value) to DC measurement accuracy for active power.
- When using the 1 mA/ 2 mA/ 5 mA/ 10 mA/ 20 mA/ 50 mA/ 100 mA range:
  Add ±10 µA to DC measurement accuracy for current.
  Add (±10 µA) × (voltage read value) to DC measurement accuracy for active power.

Display Specifications

Display	7-segment LED
Number of display parameters	4 (display area a, b, c, and d)
Display resolution	Other than integrated values: 99999 count (5 digits) Integrated values: 999999 count (6 digits)
Display update rate	200 ms ±50 ms (approx. 5 updates per sec.) to 20 s (varies with number of averaging iterations setting)

External Current Sensor Input Specifications (PW3335-03 and PW3335-04)

Terminal	Isolated BNC terminals
Current sensor type switching	Off / TYPE.1 / TYPE.2 When set to off, input from the external current sensor input terminal is ignored.
Current sensor options	Supported current sensors TYPE.1 (Can be directly connected) 9660 CLAMP ON SENSOR (100 A AC) 9661 CLAMP ON SENSOR (500 A AC) 9669 CLAMP ON SENSOR (1000 A AC) CT9667-01/ -02/ -03 AC FLEXIBLE CURRENT SENSOR (500A/ 5000 A AC) TYPE.2 (Requires Sensor Unit CT9555 and Connection Cable L9217) CT6862-05 AC/DC CURRENT SENSOR (50 A AC/DC) CT6863-05 AC/DC CURRENT SENSOR (200 A AC/DC) 9709-05 AC/DC CURRENT SENSOR (500 A AC/DC) CT6865-05 AC/DC CURRENT SENSOR (1000 A AC/DC) CT6841-05 AC/DC CURRENT PROBE (20 A AC/DC) CT6843-05 AC/DC CURRENT PROBE (200 A AC/DC) CT6844-05 AC/DC CURRENT PROBE (500 A AC/DC) CT6845-05 AC/DC CURRENT PROBE (500 A AC/DC) CT6846-05 AC/DC CURRENT PROBE (1000 A AC/DC) 9272-05 CLAMP ON SENSOR (20 A/ 200 A AC)



TYPE2 Current sensor connection diagram

Current measurement range	Auto/ 1 A/ 2 A/ 5 A (range noted on panel) Can be read directly by manually setting the CT ratio.
Constraints	Auto-range integration not supported.
Power range configuration	Depends on the combination of voltage and current ranges; from 24.000 W to 5.0000 MW (also applies to VA, var)
Measurement accuracy	

Current/ Active Power

Frequency (f)	Input < 50%f.s.	50%f.s. ≤ Input < 100%f.s.	100%f.s. ≤ Input
DC	±0.1%rdg.±0.2%f.s.	±0.1%rdg.±0.2%f.s.	±0.3%rdg.
0.1Hz≤f<16Hz	±0.1%rdg.±0.2%f.s.	±0.3%rdg.	±0.3%rdg.
16Hz≤f<45Hz	±0.1%rdg.±0.2%f.s.	±0.3%rdg.	±0.3%rdg.
45Hz≤f≤66Hz	±0.1%rdg.±0.1%f.s.	±0.2%rdg.	±0.2%rdg.
66Hz<f≤500Hz	±0.1%rdg.±0.2%f.s.	±0.3%rdg.	±0.3%rdg.
500Hz<f≤1kHz	±0.1%rdg.±0.2%f.s.	±0.3%rdg.	±0.3%rdg.

Current

Frequency (f)	Input < 50%f.s.	50%f.s. ≤ Input < 100%f.s.	100%f.s. ≤ Input
1kHz<f≤10kHz	±(0.03+0.07×F)%rdg. ±0.2%f.s.	±(0.23+0.07×F)%rdg.	±(0.23+0.07×F)%rdg.
10kHz<f≤100kHz	±(0.3+0.04×F)%rdg. ±0.3%f.s.	±(0.6+0.04×F)%rdg.	±(0.6+0.04×F)%rdg.

Active Power

Frequency (f)	Input < 50%f.s.	50%f.s. ≤ Input < 100%f.s.	100%f.s. ≤ Input
1kHz<f≤10kHz	±(0.03+0.07×F)%rdg. ±0.2%f.s.	±(0.23+0.07×F)%rdg.	±(0.23+0.07×F)%rdg.
10kHz<f≤50kHz	±(0.07×F)%rdg. ±0.3%f.s.	±(0.3+0.07×F)%rdg.	±(0.3+0.07×F)%rdg.
50kHz<f≤100kHz	±(0.6+0.07×F)%rdg. ±0.3%f.s.	±(0.9+0.07×F)%rdg.	±(0.9+0.07×F)%rdg.

- Values for f.s. depend on measurement ranges.
- "F" in the tables refers to the frequency in kHz.
- To obtain the current or active power accuracy, add the current sensor's accuracy to the above current and active power accuracy figures.
- The effective measurement range and frequency characteristics conform to the current sensor's specifications.
- The following input are considered reference values:
  Values for voltage, current, and active power for which 0.1 Hz ≤ f < 10 Hz.
  Values for voltage and active power in excess of 220 V for which 10 Hz ≤ f < 16 Hz.
  Values for voltage and active power in excess of 750 V for which 30 kHz < f ≤ 100 kHz.
- When using the CT684x-05 series, add ±2 mV to the CT684x-05 series accuracy after performing CT684x-05 series zero adjustment using the 1 A range noted on the panel.

Temperature coefficient	Current, active power: ±0.08%f.s./°C or less (instrument temperature coefficient; f.s. : instrument measurement range) Add current sensor temperature coefficient to above.
Effect of power factor	Instrument: ±0.15%f.s. or less (45 to 66 Hz with power factor = 0) Internal circuit voltage/current phase difference: ±0.0859° Add the current sensor phase accuracy to the internal circuit voltage/ current phase difference noted above.
Current waveform peak value measurement specifications	±2.0% at DC or 10 Hz ≤ f ≤ 1 kHz (f.s.: current peak range) Add the current sensor accuracy to the above.
Harmonic measurement accuracy	External current sensor input instrument measurement accuracy only Frequency (f) / Voltage, Current, Active power DC: ±0.4% rdg.±0.2%f.s. 10 Hz ≤ f < 30 Hz: ±0.4% rdg.±0.2%f.s. 30 Hz ≤ f ≤ 400 Hz: ±0.3% rdg.±0.1%f.s. 400 Hz < f ≤ 1 kHz: ±0.4% rdg.±0.2%f.s. 1 kHz < f ≤ 5 kHz: ±1.0% rdg.±0.5%f.s. 5 kHz < f ≤ 8 kHz: ±4.0% rdg.±1.0%f.s. • Values for f.s. depend on measurement ranges. • To obtain the current or active power accuracy, add the current sensor's accuracy to the above current and active power accuracy figures. • When using the CT684x-05 series, add ±2 mV to the CT684x-05 series accuracy after performing CT684x-05 series zero adjustment using the 1 A range noted on the panel.

D/A Output Specifications (PW3335-02 and PW3335-04)

Number of output channels	7 channels
Configuration	16-bit D/A converter (polarity + 15 bits)
Output voltage	The output level, output speed, and waveform output can be selected. Level output 2 Vf.s. or 5 Vf.s., linked to display updates High-speed level output 2 Vf.s. or 5 Vf.s., linked to synchronization interval Waveform output 1 Vf.s., linked to sampling
Output parameters	Output parameters for all channels Available selections vary with the output parameter. Level output/ High-speed level output/ Waveform output Voltage, current, active power Only Level output Apparent power, reactive power, power factor, phase angle, total harmonic voltage distortion, total harmonic current distortion, voltage ripple rate, current ripple rate, voltage crest factor, current crest factor, time average current, time average active power, maximum current ratio Only Level output 5 Vf.s. Frequency, current integration, active power integration The rectifier can be selected. Harmonic-order output is not supported.
Output accuracy	f.s.: Relative to the output voltage rated value for each output parameter Level output (Output parameter measurement accuracy) + (±0.2%f.s.) High-speed level output (Output parameter measurement accuracy) + (±0.2%f.s.) Waveform output (Output parameter measurement accuracy) + (±1.0%f.s.)
Output frequency band	Waveform output, high-speed level output At DC or 10 Hz to 30 kHz, accuracy is as defined above.
Maximum output voltage	Approx. ±12 V DC
Output update rate	Level output Same as the data update period. High-speed level output AC Updated once every cycle for the input waveform set as the synchronization source. However, voltage and current are only updated once every cycle for input signals from 45 to 66 Hz. Waveform output Approx. 1.43 µs (approx. 700 kHz)
Response time	Level output 0.6 sec. or less High-speed level output 2 ms or less Waveform output 0.2 ms or less
Temperature coefficient	±0.05%f.s./°C or less
Output resistance	Approx. 100 Ω

External control

Functions	Integration start/stop, integration reset and hold via external control
Input signal level	0 to 5 V (high-speed CMOS level) or shorted [Lo]/ open [Hi]

GP-IB interface (PW3335-01 and PW3335-04)

Method	Compliant with IEEE488.1 1987, in reference to IEEE488.2 1987 Interface functions SH1, AH1, T6, L4, SR1, RL1, PP0, DC1, DT1, C0
Address	00 to 30

RS-232C interface (PW3335, PW3335-02, PW3335-03, and PW3335-04)

Connector	D-sub 9-pin connector × 1
Communication method	Full duplex, Start-stop synchronization Stop bits: 1 (fixed) Data length: 8 (fixed) Parity: None
Communication speed	9600 bps/ 38400 bps

LAN interface

Connector	RJ-45 connector × 1
Electrical specifications	Compliant with IEEE802.3
Transmission method	10Base-T/ 100Base-TX (automatic detection)
Protocol	TCP/ IP
Functions	HTTP server (remote operation, firmware updates) Dedicated ports (command control, data transfer) Remote control by controller

General Specifications

Product warranty period	1 year
Operating environment	Indoors, altitude up to 2000 m (6562 ft.), pollution degree 2
Operating temperature and humidity	0°C to 40°C (32°F to 104°F), 80% RH or less (no condensation)
Storage temperature and humidity	-10°C to 50°C (14°F to 122°F), 80% RH or less (no condensation)
Dielectric strength	4290 V rms AC (current sensitivity: 1 mA) Between the voltage input terminals and a connection consisting of chassis, interfaces, and output terminals Between the current input terminals and a connection consisting of chassis, interfaces, and output terminals Between the voltage input terminals and current input terminals
Maximum rated voltage to earth	Voltage input terminal, Current input terminal Measurement category III 600 V (anticipated transient overvoltage: 6000 V) Measurement category II 1000 V (anticipated transient overvoltage: 6000 V)
Maximum input voltage	Between the voltage input terminals U and ± 1000 V, ±1500 V peak
Maximum input current	Between the current input terminals I and ± 200 mA to 20 A range 30 A, ±100 A peak 1 mA to 100 mA range 20 A, ±30 A peak
Applicable Standards	Safety EN61010 EMC EN61326 Class A EN61000-3-2 EN61000-3-3
Rated supply voltage	100 V AC to 240 V AC 50 Hz/60 Hz
Maximum rated power	30 VA or less
Dimensions	Approx. 210W × 100H × 245D mm (8.27"W × 3.94"H × 9.65"D) (excluding protrusions)
Mass	Approx. 3 kg (105.8 oz.)
Accessories	Instruction manual ×1 Power cord ×1 Voltage and current input terminal safety cover ×2

Model : POWER METER PW3335

Model (Order Cord)	Harmonics measurement	Synchronous control	LAN	RS-232C	GP-IB	D/A output	Current sensor input
PW3335	✔	✔	✔	✔	—	—	—
PW3335-01	✔	✔	✔	—	✔	—	—
PW3335-02	✔	✔	✔	✔	—	✔	—
PW3335-03	✔	✔	✔	✔	—	—	✔
PW3335-04	✔	✔	✔	✔	✔	✔	✔

Accessories : Instruction manual ×1, Power cord ×1, Voltage and current input terminal safety cover ×2

✔ : available
— : not available

Options

Current measurement options [Type 1] Can be directly connected to the current sensor input terminals on the PW3335-03/ PW3335-04

CLAMP ON SENSOR 9660
100 A AC, φ15 mm(0.59”), 40 Hz to 5 kHz
±0.3%rdg.±0.02%f.s. (Amplitude accuracy 45 Hz to 66 Hz)
±1° or less (Phase accuracy 45 Hz to 66 Hz)

CLAMP ON SENSOR 9661
500 A AC, φ46 mm(1.81”), 40 Hz to 5 kHz
±0.3%rdg.±0.01%f.s. (Amplitude accuracy 45 Hz to 66 Hz)
±0.5° or less (Phase accuracy 45 Hz to 66 Hz)

CLAMP ON SENSOR 9669
1000 A AC, φ55mm(02.17”), 80 × 20 mm (3.15” × 0.79”) busbar, 40 Hz to 5 kHz
±1.0%rdg.±0.01%f.s. (Amplitude accuracy 45 Hz to 66 Hz)
±1° or less (Phase accuracy 45 Hz to 66 Hz)

CLAMP ON SENSOR CT9667-01, CT9667-02, CT9667-03
500 A /5000 A AC Switchable, φ100mm to φ254 mm (3.94” to 10”), 10 Hz to 20 kHz
±2.0%rdg.±0.3%f.s. (Amplitude accuracy 45 Hz to 66 Hz)
±1° or less (Phase accuracy 45 Hz to 66 Hz)
Power supply : LR6 alkaline battery ×2, or AC Adapter (option)
Option : AC ADAPTER 9445-02 (universal 100 V to 240 VAC /for USA)
AC ADAPTER 9445-03 (universal 100 V to 240 VAC /for Europe)

Current measurement options [Type 2] Requires Sensor Unit CT9555 and Connection Cable L9217 to be connected to the current sensor input terminals on the PW3335-03/ PW3335-04

200 A or lower

AC/DC CURRENT SENSOR CT6862-05
50 A AC/DC, pass-through type, φ24 mm(0.94”), DC to 1 MHz
±0.05%rdg.±0.01%f.s. (Amplitude accuracy 16 Hz to 400 Hz)
±0.2° or less (Phase accuracy 16 Hz to 400 Hz)
Power supply : SENSOR UNIT CT9555 (option)

AC/DC CURRENT SENSOR CT6863-05
200 A AC/DC, pass-through type, φ24 mm(0.94”), DC to 500 kHz
±0.05%rdg.±0.01%f.s. (Amplitude accuracy 16 Hz to 400 Hz)
±0.2° or less (Phase accuracy 16 Hz to 400 Hz)
Power supply : SENSOR UNIT CT9555 (option)

AC/DC CURRENT PROBE CT6841-05
20 A AC/DC, clamp-on type, φ20 mm(0.79”), DC to 1 MHz
±0.3%rdg.±0.01%f.s. (Amplitude accuracy DC < f ≤ 100 Hz)
±0.1° or less (Phase accuracy DC < f ≤ 100 Hz)
Power supply : SENSOR UNIT CT9555 (option)

AC/DC CURRENT PROBE CT6843-05
200 A AC/DC, clamp-on type, φ20 mm(0.79”), DC to 500 kHz
±0.3%rdg.±0.01%f.s. (Amplitude accuracy DC < f ≤ 100 Hz)
±0.1° or less (Phase accuracy DC < f ≤ 100 Hz)
Power supply : SENSOR UNIT CT9555 (option)

CLAMP ON SENSOR 9272-05 (Scheduled for release in 2017)
20 A/ 200 A AC Switchable, clamp-on type, φ46 mm(1.81”),
1 Hz to 100 kHz
±0.3%rdg.±0.01%f.s. (Amplitude accuracy 45 Hz to 66 Hz)
±0.2° or less (Phase accuracy 45 Hz to 66 Hz)
Power supply : SENSOR UNIT CT9555 (option)

500 A or lower

AC/DC CURRENT SENSOR 9709-05
500 A AC/DC, pass-through type, φ36 mm(1.42”), DC to 100 kHz
±0.05%rdg.±0.01%f.s. (Amplitude accuracy 45 Hz to 66 Hz)
±0.2° or less (Phase accuracy 45 Hz to 66 Hz)
Power supply : SENSOR UNIT CT9555 (option)

AC/DC CURRENT PROBE CT6844-05
500 A AC/DC, clamp-on type, φ20 mm(0.79”), DC to 200 kHz
±0.3%rdg.±0.01%f.s. (Amplitude accuracy DC < f ≤ 100 Hz)
±0.1° or less (Phase accuracy DC < f ≤ 100 Hz)
Power supply : SENSOR UNIT CT9555 (option)

AC/DC CURRENT PROBE CT6845-05
500 A AC/DC, clamp-on type, φ50 mm(1.97”), DC to 100 kHz
±0.3%rdg.±0.01%f.s. (Amplitude accuracy DC < f ≤ 100 Hz)
±0.1° or less (Phase accuracy DC < f ≤ 100 Hz)
Power supply : SENSOR UNIT CT9555 (option)

1000 A or lower

AC/DC CURRENT SENSOR CT6865-05
1000 A AC/DC, pass-through type, φ36 mm(1.42”), DC to 20 kHz
±0.05%rdg.±0.01%f.s. (Amplitude accuracy 16 Hz to 66 Hz)
±0.2° or less (Phase accuracy 16 Hz to 66 Hz)
Power supply : SENSOR UNIT CT9555 (option)

AC/DC CURRENT PROBE CT6846-05
1000 A AC/DC, clamp-on type, φ50 mm(1.97”), DC to 20 kHz
±0.3%rdg.±0.01%f.s. (Amplitude accuracy DC < f ≤ 100 Hz)
±0.1° or less (Phase accuracy DC < f ≤ 100 Hz)
Power supply : SENSOR UNIT CT9555 (option)

Type 2 Current sensor options

SENSOR UNIT CT9555
POWER SUPPLY 100 V to 240 V AC (50Hz/ 60Hz)

CONNECTION CORD L9217
For sensor output, Isolated BNC to isolated BNC
Cord length: 1.6 m (5.25 ft) length

Communications and control options

RS-232C CABLE 9637
Cable length: 1.8 m (5.91 ft)
9pin to 9pin

RS-232C CABLE 9638
Cable length: 1.8 m (5.91 ft)
9pin to 25pin

GP-IB CONNECTOR CABLE 9151-02
Cable length: 2 m (6.56 ft)

LAN CABLE 9642
Cable length: 5 m (16.41 ft)
supplied with straight to cross conversion cable

CONNECTION CORD 9165
For synchronized control
Cable length: 1.5 m (4.92 ft),
metal BNC to metal BNC

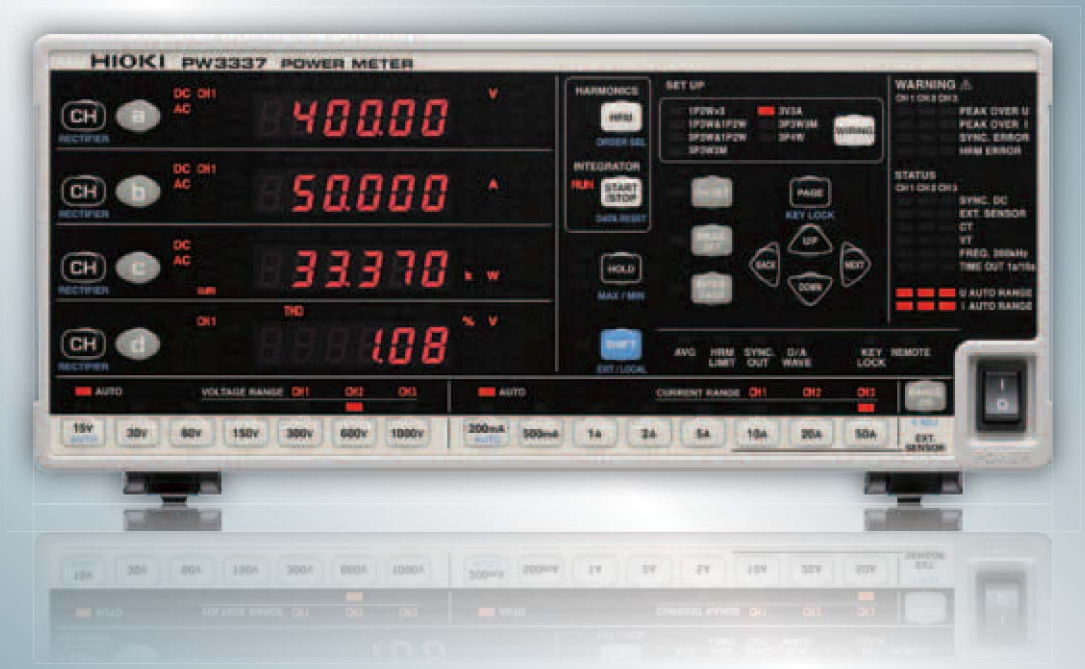
HIOKI
HIOKI E.E. CORPORATION

HIOKI

POWER METER PW3336, PW3337

High-precision, 3-channel power meter with built-in harmonic measurement

Accurately measure devices up to 1000 V/65 A AC/DC with direct input



The PW3336 (2-channel) and PW3337 (3-channel) can measure DC and a variety of power connections ranging from single-phase 2-wire to 3-phase 4-wire*.

- For development and production of motors, inverters, power conditioners, power supplies, and other devices
- Assess and verify the energy-saving performance of industrial equipment such as heavy machinery, air-conditioners as well as household appliances

• Voltage, current, and power basic accuracy	: ±0.1% **
• Measurement frequency bands	: DC, 0.1 Hz to 100 kHz
• High-current measurement	: Up to 65 A, direct input
• Low-loss current input	: Input resistance of 1mΩ or less
• Harmonic measurement up to the 50th order	: IEC 61000-4-7 compliant
• High-accuracy measurement, even with a low power factor	: Ideal for no-load testing of transformers and motors
• Measure up to 5000 A AC	: Built-in external sensor input terminals

CE

* 3-phase 4-wire measurement: PW3337 series only
** For complete details, please refer to the specifications.

High-accuracy
High-current
Harmonic measurement

Support for development and production of motors, transformers, air-conditioners, and other industrial equipment

The PW3336 series (2-channel) and PW3337 series (3-channel) are easy-to-use, high-accuracy power meters that deliver current measurement of up to 65 A with direct input as well as built-in harmonic analysis functionality, all with accuracy that exceeds that of previous HIOKI power meters.

World class performance

Measure up to 65 A with direct input

1 Measurement accuracy that remains unchanged for high-current measurement

Accuracy is guaranteed for currents of up to 65 A with direct input. The power meters can also measure high currents in excess of 65 A with optional current sensors. Direct-input power meters typically exhibit degraded accuracy when inputting high currents due to shunt resistor self-heating. However, the PW3336 and PW3337 reduce input resistance with a DCCT design that virtually eliminates this type of accuracy degradation.

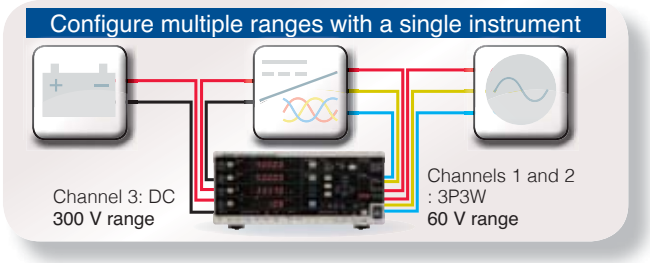
2mA — **65A** — 5000A

Direct input | Sensor input

2 A 3-channel power meter

Enabling you to select the optimal range for each connection

The advanced engineering of the PW3336 and PW3337 enables you to measure an inverter's primary-side DC power supply and its secondary-side 3-phase output at the same time. The power meters make a tremendous contribution in applications that need to measure the input/output efficiency of inverters, uninterruptible power supplies, and other power supply equipment.



3 Best-in-class accuracy of ±0.1% *

Highest basic accuracy and DC accuracy of any instrument in its class

Thanks to Hioki's accumulated technology and track record, the PW3336/PW3337 delivers the highest basic accuracy and DC accuracy of any instrument in its class. Reliable measurement accuracy ensures robust performance in customers' measurement applications.

±0.1%*

* For complete details, please refer to the specifications.

Simultaneously measure power consumption and all harmonic parameters, from single-phase 2-wire to 3-phase 4-wire measurement lines

2ch

PW3336 series (2-channel models)
Measurement lines: 1P2W/1P3W/3P3W

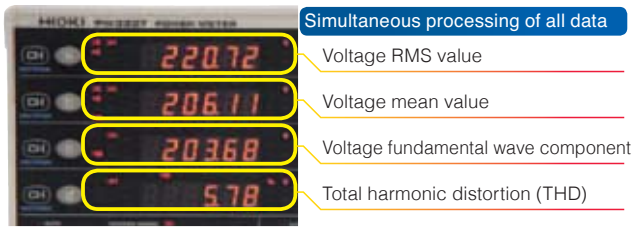
3ch

PW3337 series (3-channel models)
Measurement lines: 1P2W/1P3W/3P3W/3P4W

World class performance

4 Simultaneous processing of power data and all harmonic data

All data, including RMS values, mean values, DC components, AC components, fundamental wave components, harmonic measurement, and integration measurement, is processed in parallel internally. There is no need to switch modes depending on whether you wish to acquire power data or harmonic data-- simply switch the display to obtain measured values with true simultaneity. Additionally, PC communications software can be used to capture measurement data, including from multiple synchronized instruments.

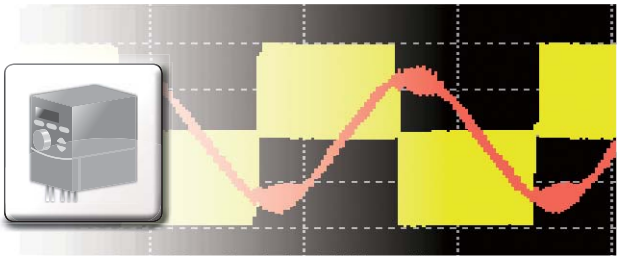


5 High-accuracy measurement, even with low-power-factor input

Because power factor has little impact at just ±0.1% f.s., the PW3336/PW3337 can measure active power of low-power-factor input at a high level of accuracy, for example during no-load-loss testing, a technique that is used to evaluate energy-saving performance of transformers.
Even though the high current waveform crest factor that typically accompanies no-load operation causes the power factor to deteriorate, measurements taken with the PW3336/PW3337 series remain accurate under these conditions.

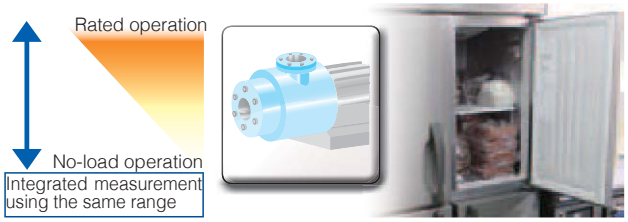
6 Wide frequency band of DC and 0.1 Hz to 100 kHz

Thanks to a wide-band capability extending from DC and 0.1 Hz to 100 kHz, the PW3336/PW3337 can cover not only inverters' fundamental frequency band, but also the carrier frequency band.



7 Integrating fluctuating power values

The power consumption of equipment subject to a fluctuating load, for example refrigerators, heaters, and pumps, varies considerably between rated operation and no-load operation. Thanks to its broad dynamic range, the PW3336/PW3337 can perform integrated power measurement with guaranteed accuracy using a single range, even if the power fluctuates dramatically during integration. Measurements can accommodate waveform peaks of up to 600% of the range rating.



Advanced functions

1 Extensive built-in features including harmonic measurement, current sensor input, synchronized control, and a wide selection of interfaces

The PW3336/PW3337 ships standard with all the functionality you need for measurement. Choose from a total of eight models depending on whether your application requires support for GP-IB communications and D/A output.

Standard functionality by model ●: Built-in function —: Function not available

Model	No. of channels	Harmonic measurement	Current sensor input	Synchronized control	LAN	RS-232C	GP-IB	D/A output
PW3336	2	●	●	●	●	●	—	—
PW3336-01		●	●	●	●	●	●	—
PW3336-02		●	●	●	●	●	—	●
PW3336-03		●	●	●	●	●	●	●
PW3337	3	●	●	●	●	●	—	—
PW3337-01		●	●	●	●	●	●	—
PW3337-02		●	●	●	●	●	—	●
PW3337-03		●	●	●	●	●	●	●

2 IEC61000-4-7 compliant harmonic measurement

The PW3336/PW3337 supports measurement that complies with IEC 61000-4-7:2002, the international standard governing harmonic measurement.
The power meters can measure voltage, current, and power harmonics up to the 50th order depending on the fundamental frequency, including total harmonic distortion (THD), fundamental wave component, harmonic level, phase difference, content percentage, and other parameters for each order. Since you can cap the number of orders for which harmonic analysis is performed to any order from the 2nd to the 50th, you can make standard-compliant calculations, even if the standard defines an upper limit order for THD calculations.

About IEC 61000-4-7

IEC 61000-4-7 is an international standard governing the measurement of harmonic current and harmonic voltage in power supply systems as well as harmonic current emitted from devices. It defines the performance of standard instruments used to make such measurements.

3 Large selection of interfaces

The PW3336/PW3337's interfaces can be used to control the instrument and to capture its data - simply download the free PC application from the HIOKI website. Functionality supported via LAN connections includes power meter configuration, measured value monitoring, waveform monitoring, display of time-series recordings, and capturing data at intervals.

GP-IB (-01, -03)
RS-232C
LAN

PW3336-03
PW3337-03

4 16-channel D/A output (-02, -03)

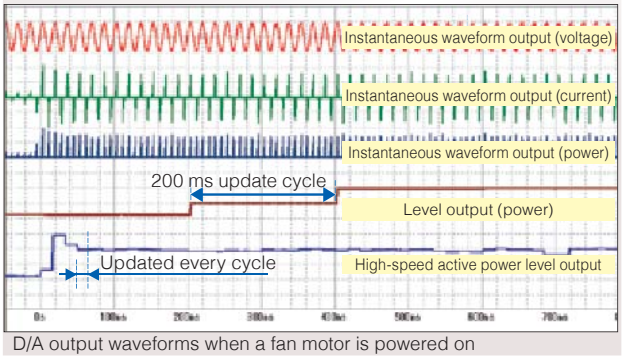
D/A output-equipped instruments can generate voltage output for measured values and integrated power with their 16-bit D/A converter. By connecting an external data logger, HIOKI Memory HiCorder, recorder, or other device, you can simultaneously record data along with temperature and other non-power signals. The PW3336/PW3337 also offers the first active power level output on a cycle-by-cycle basis of any instrument in its class.

Three types of D/A output (switchable)

Instantaneous waveform output
Output voltage, current, or power instantaneous waveforms. (Sampling speed: Approx. 87.5 kHz)

Level output
Output voltage, current, power, and other selected parameters with an update cycle of approximately 200 ms.

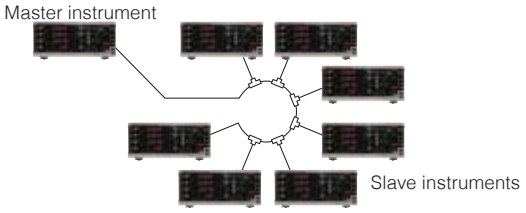
High-speed active power level output
Generate level output for the active power for each cycle of the measurement waveform.



D/A output waveforms when a fan motor is powered on

5 Synchronized control using up to 8 instruments

Eight units of PW3336/PW3337 can be connected and their measurements fully synchronized. That means you can have up to 24 channels of simultaneous calculations, display updates, data updates, integration control, display hold timing, and zero-adjustment. In addition, the master-slave configuration allows you to key lock all slave devices with the master unit, mirroring the master unit's operations and modes on all of the other power meters. The free PC application can be used to calculate efficiency values across multiple units.



6 Current sensor connectivity

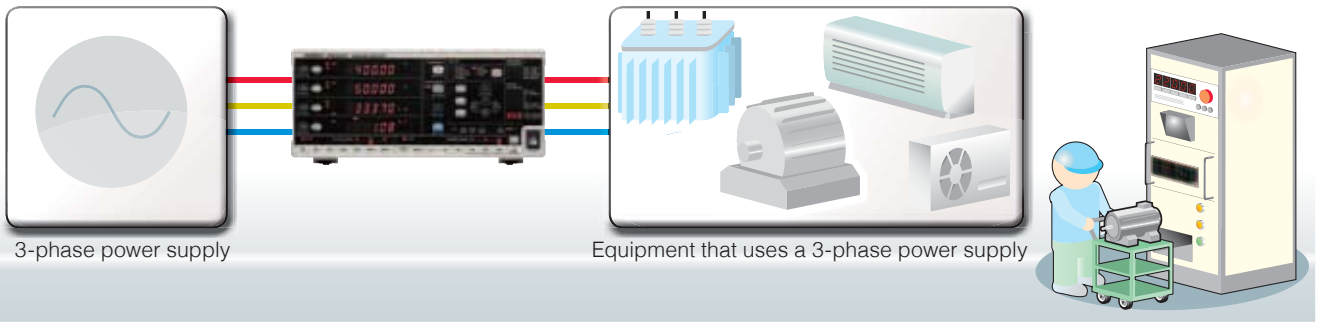
The PW3336/PW3337 can also measure devices that exceed 65 A with the use of an optional current sensor. Measurements with guaranteed accuracy can be performed for currents of up to 5000 A AC. Choose from a range of high-accuracy, clamp or pass-through AC/DC current sensors and models specifically designed for 50/60 Hz measurement.

Applications

1 Research, development, and testing of equipment with 3-phase power supplies such as transformers, motors, air-conditioners, and heavy machinery

Key advantages

- ✔ Measure 3-phase 3-wire and 3-phase 4-wire* lines with a basic measurement accuracy of ±0.1%**
- ✔ Perform high-current measurement of 65 A with direct input without accuracy degradation caused by shunt resistor self-heating.
- ✔ Built-in IEC 61000-4-7 compliant harmonic measurement functionality as well as current sensor input terminals and a LAN interface.
- ✔ Accuracy is guaranteed for active power measurement from 0 W, as well as for measurement of integrated power for loads with large fluctuations.
- ✔ Measure active power at a high level of accuracy even with low power factors, for example during no-load operation testing of transformers.

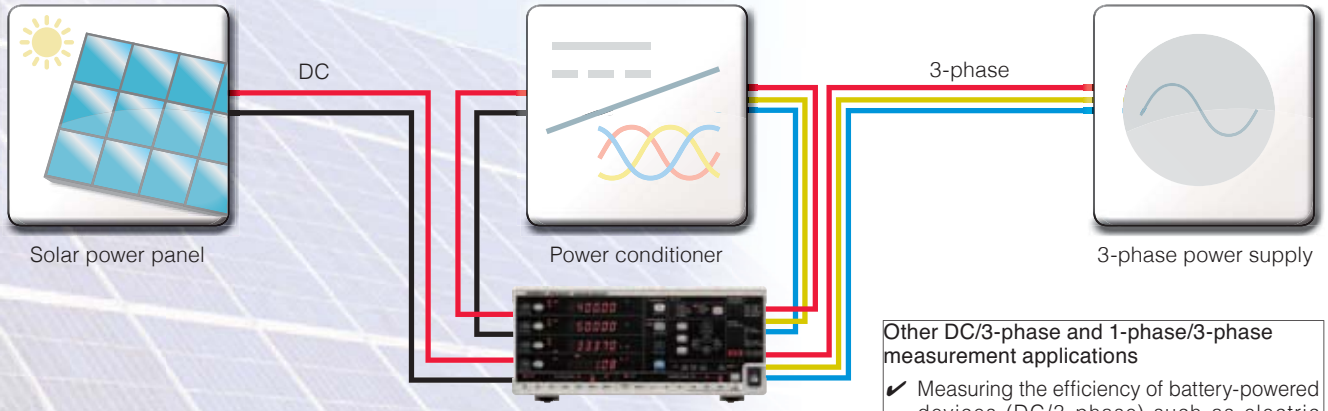


*3-phase 4-wire measurement: PW3337 series only ** For complete details, please refer to the specifications.

2 Measuring the efficiency of power conditioners used in solar power installations

Key advantages

- ✔ Measure primary-side DC and secondary-side 3-phase output with a single PW3337, using the optimal range for each.
- ✔ Calculate efficiency: Perform output/input calculations and easily identify the resulting efficiency on the power meter's screen.
- ✔ Ripple rate calculation: Display the ratio of the AC component that is superposed on a DC line.
- ✔ Built-in current sensor input terminals: Measure currents exceeding 65 A with an optional current sensor.
- ✔ Harmonic measurement: Test for harmonic components such as voltage THD, which can be a concern with grid-linked systems.



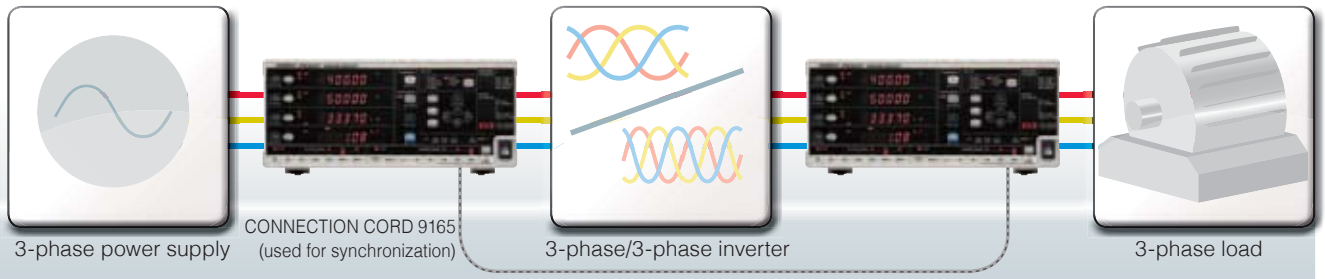
Other DC/3-phase and 1-phase/3-phase measurement applications

- ✔ Measuring the efficiency of battery-powered devices (DC/3-phase) such as electric vehicles
- ✔ Measuring the efficiency of rapid chargers for electric vehicles (3-phase/DC)

3 Measuring power supply devices such as 3-phase/3-phase inverters

Key advantages

- ✔ Connect multiple instruments to synchronize their operation, including display updates, data updates, and start of integration.
- ✔ Measure all data with simultaneous parallel processing, including RMS values, mean values, fundamental wave components, THD, and harmonic components.
- ✔ Wide frequency band from DC and 0.1 Hz to 100 kHz: Enjoy coverage for the inverter secondary-side frequency band.
- ✔ Built-in current sensor input terminals: Measure currents exceeding 65 A with an optional current sensor.

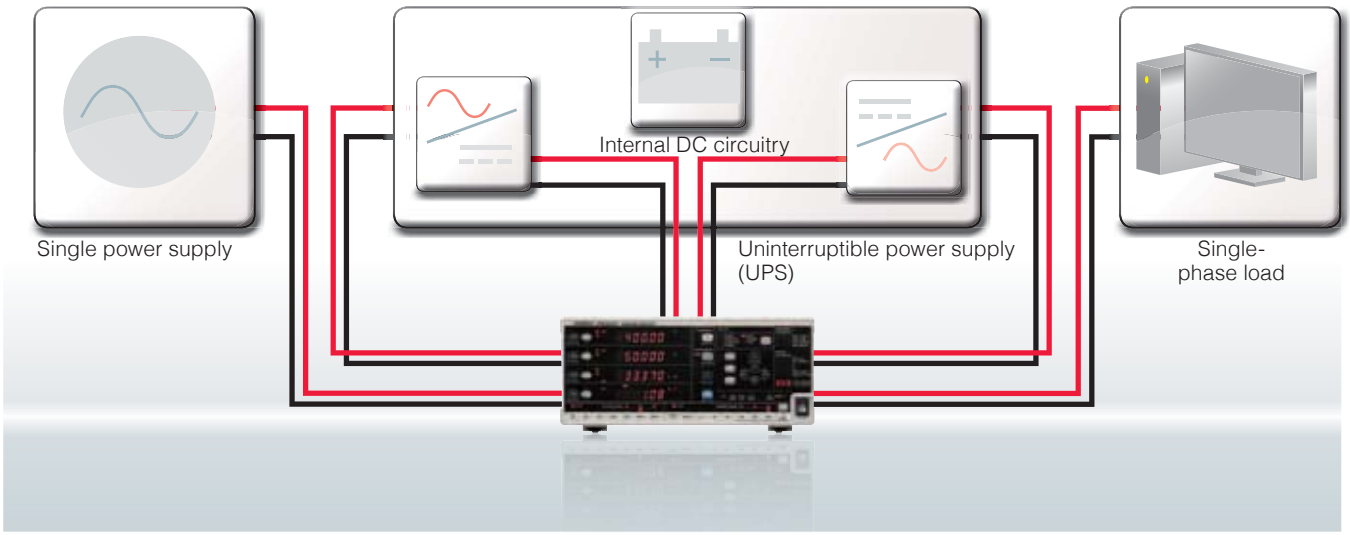


Applications

4 Measuring the primary-side, internal circuitry, and secondary-side power consumption in uninterruptible power supplies (UPS)

Key advantages

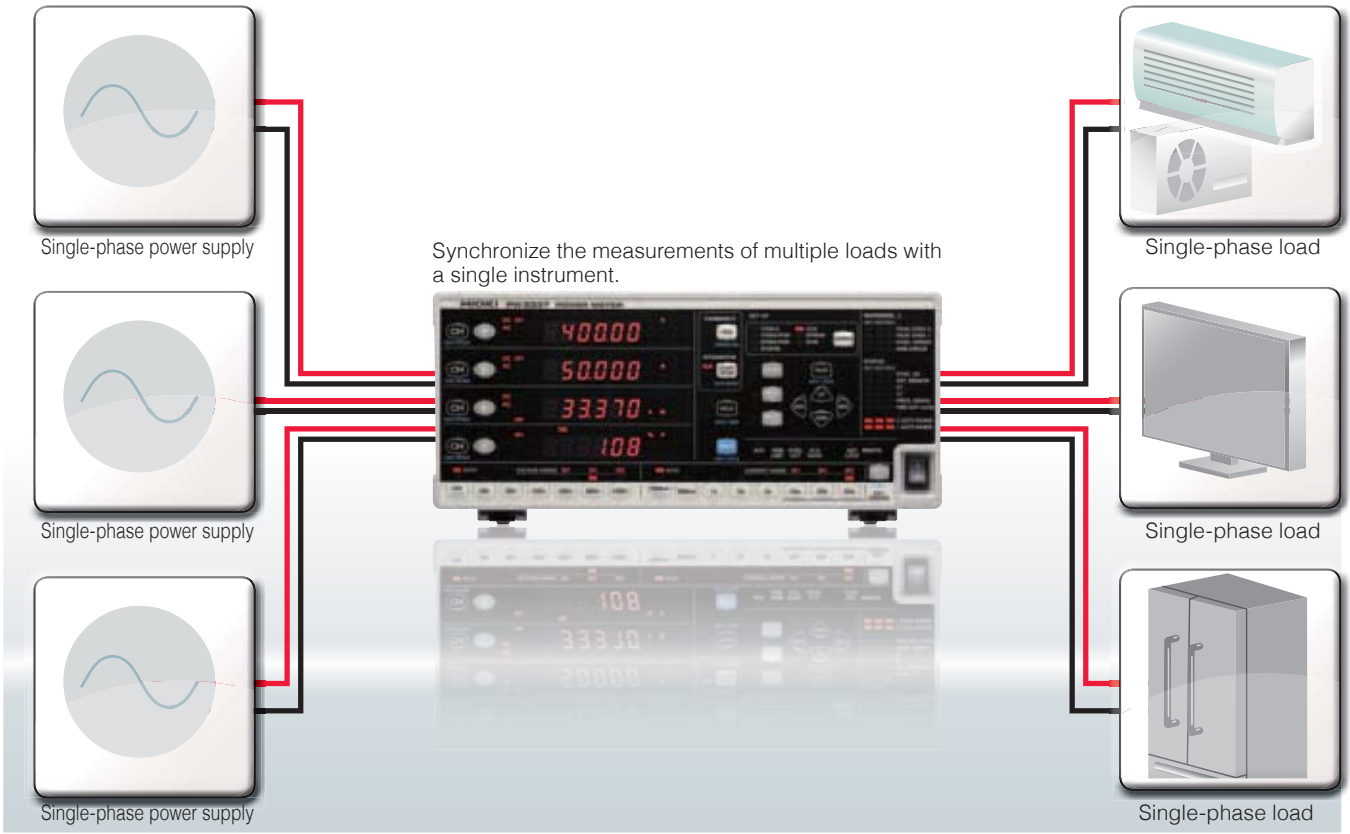
- ✔ Set individual ranges and measurement types for each channel. Measure power consumption at each stage of the UPS.
- ✔ Hold waveform peak values and measured value maximum and minimum values.
- ✔ Measure all data with simultaneous parallel processing, including RMS values, mean values, fundamental wave components, THD, and harmonic components.



5 Simultaneous measurement of multiple loads

Key advantages

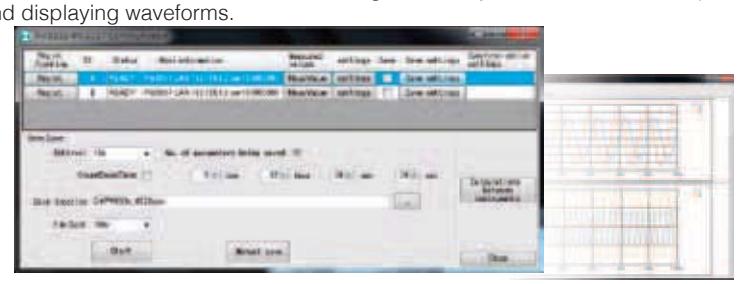
- ✔ Set individual ranges and measurement types for each channel. Measure power consumption at each stage of an uninterruptible power supply.
- ✔ Perform integrated measurement of widely fluctuating power signals without changing the range - useful during long-term integrated power evaluation tests.
- ✔ Use the synchronized control function to sync measurement timing and start/stop integration across a maximum of 8 power meters.



Software

PW3336/PW3337 Communicator

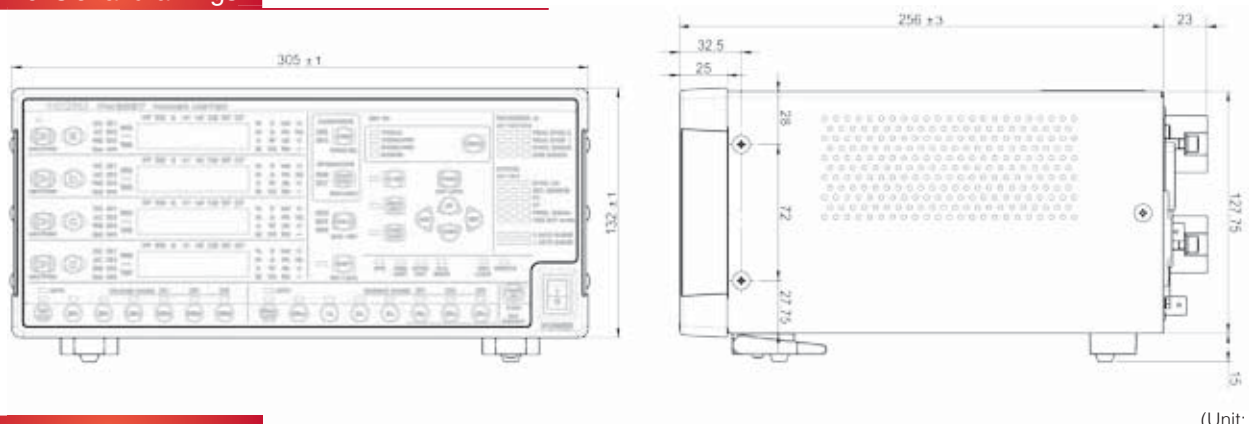
The PW3336/PW3337 Communicator connects with the power meters via the LAN, RS-232C, or GP-IB (-01, -03) interface, and is available for free download from the HIOKI website. Functionality includes configuring instruments, capturing interval data, performing numerical calculations based on measurement data, calculating efficiency values across multiple units, displaying 10 or more measurement parameters, and displaying waveforms.



LabVIEW Driver

Use LabVIEW* to collect data and integrate the power meter into existing systems.
*LabVIEW is a trademark of National Instruments Corporation.

Dimensional drawings



(Unit: mm)

Specifications

Input Specifications

Measurement line type	PW3336 series Single-phase 2-wire (1P2W), Single-phase 3-wire (1P3W), Three-phase 3-wire (3P3W, 3P3W2M)

Wiring	CH1	CH2
1P2W×2	1P2W	1P2W
1P3W	1P3W	
3P3W	3P3W	
3P3W2M	3P3W2M	

PW3337 series
Single-phase 2-wire (1P2W),
Single-phase 3-wire (1P3W),
Three-phase 3-wire (3P3W, 3P3W2M, 3V3A, 3P3W3M),
Three-phase 4-wire (3P4W)

Wiring	CH1	CH2	CH3
1P2W×3	1P2W	1P2W	1P2W
1P3W&1P2W	1P3W		1P2W
3P3W&1P2W	3P3W		1P2W
3P3W2M	3P3W2M		
3V3A	3V3A		
3P3W3M	3P3W3M		
3P4W	3P4W		

Input methods	Voltage Isolated input, resistance voltage division method Current Isolated input, DCCT method Isolated input from current sensors
Voltage measurement ranges	AUTO/ 15.000 V/ 30.000 V/ 60.000 V/ 150.00 V/ 300.00 V/ 600.00 V/ 1000.0 V (set for each wiring mode)
Current measurement ranges	AUTO/ 200.00 mA/ 500.00 mA/ 1.0000 A/ 2.0000 A/ 5.0000 A / 10.000 A/ 20.000 A/ 50.000 A (set for each wiring mode) For more information about external current sensor input, see the external current sensor input specifications
Power ranges	Depends on the combination of voltage and current ranges; PW3336: from 3.0000W to 100.00kW (also applies to VA, var) PW3337: from 3.0000W to 150.00kW (also applies to VA, var)
Input resistance (50/60 Hz)	Voltage input terminal : 2 MΩ±0.04 MΩ Current direct input terminal : 1 mΩ or less

Basic Measurement Specifications

Measurement method	Simultaneous voltage and current digital sampling, zero-cross simultaneous calculation
Sampling frequency	Approx. 700 kHz
A/D converter resolution	16-bit
Frequency bands	DC, 0.1 Hz to 100 kHz
Synchronization sources	U1, U2, U3, I1, I2, I3, DC (fixed at 200 ms) Can be set separately for each wiring mode.
Measurement items	· Voltage · Current · Active power · Apparent power · Reactive power · Power factor · Phase angle · Frequency · Efficiency · Current integration · Active power integration · Integrated time · Voltage waveform peak value · Current waveform peak value · Voltage crest factor · Current crest factor · Time average current · Time average active power · Voltage ripple factor · Current ripple factor Harmonic parameters: · Harmonic voltage RMS value · Harmonic current RMS value · Harmonic active power · Total harmonic voltage distortion · Total harmonic current distortion · Voltage fundamental waveform · Current fundamental waveform · Active power fundamental waveform · Apparent power fundamental waveform · Reactive power fundamental waveform · Power factor fundamental waveform (displacement power factor) · Voltage current phase difference fundamental waveform · Interchannel voltage fundamental wave phase difference · Interchannel current fundamental wave phase difference · Harmonic voltage content % · Harmonic current content % · Harmonic active power content % The following parameters can be downloaded as data during PC communication but not displayed: · Harmonic voltage phase angle · Harmonic current phase angle · Harmonic voltage current phase difference
Rectifiers	AC+DC : AC+DC measurement Display of true RMS values for both voltage and current AC+DC Umn : AC+DC measurement Display of average value rectified RMS converted values for voltage and true RMS values for current DC : DC measurement Display of simple averages for both voltage and current Display of values calculated by (voltage DC value)× (current DC value) for active power AC : AC measurement Display of values calculated by for both voltage and current Display of values calculated by $\sqrt{(AC+DC\ value)^2 - (DC\ value)^2}$ for active power FND Extraction and display of the fundamental wave component from harmonic measurement
Zero-Crossing Filter	500 Hz/200 kHz 500 Hz: 0.1 Hz to 500 Hz, 200 kHz: 0.1 Hz to 200 kHz
Maximum effective peak voltage	±600% of each voltage range However, for 300 V, 600 V, and 1000 V ranges, ±1500 Vpeak
Maximum effective peak current	±600% of each current range However, for 20 A range and 50 A range, ±100 Apeak

Measurement accuracy

Voltage

Frequency (f)	Input < 50% f.s.	50%f.s. ≤ Input < 100%f.s.	100%f.s. ≤ Input
DC	±0.1%rdg. ±0.1%f.s.	±0.1%rdg. ±0.1%f.s.	±0.2%rdg.
0.1Hz ≤ f < 16Hz	±0.1%rdg. ±0.2%f.s.	±0.3%rdg.	±0.3%rdg.
16Hz ≤ f < 45Hz	±0.1%rdg. ±0.1%f.s.	±0.2%rdg.	±0.2%rdg.
45Hz ≤ f ≤ 66Hz	±0.1%rdg. ±0.05%f.s.	±0.15%rdg.	±0.15%rdg.
66Hz < f ≤ 500Hz	±0.1%rdg. ±0.1%f.s.	±0.2%rdg.	±0.2%rdg.
500Hz < f ≤ 10kHz	±0.1%rdg. ±0.2%f.s.	±0.3%rdg.	±0.3%rdg.
10kHz < f ≤ 50kHz	±0.5%rdg. ±0.3%f.s.	±0.8%rdg.	±0.8%rdg.
50kHz < f ≤ 100kHz	±2.1%rdg. ±0.3%f.s.	±2.4%rdg.	±2.4%rdg.

Current (direct input)

Frequency (f)	Input < 50% f.s.	50%f.s. ≤ Input < 100%f.s.	100%f.s. ≤ Input
DC	±0.1%rdg. ±0.1%f.s.	±0.1%rdg. ±0.1%f.s.	±0.2%rdg.
0.1Hz ≤ f < 16Hz	±0.1%rdg. ±0.2%f.s.	±0.3%rdg.	±0.3%rdg.
16Hz ≤ f < 45Hz	±0.1%rdg. ±0.1%f.s.	±0.2%rdg.	±0.2%rdg.
45Hz ≤ f ≤ 66Hz	±0.1%rdg. ±0.05%f.s.	±0.15%rdg.	±0.15%rdg.
66Hz < f ≤ 500Hz	±0.1%rdg. ±0.1%f.s.	±0.2%rdg.	±0.2%rdg.
500Hz < f ≤ 1kHz	±0.1%rdg. ±0.2%f.s.	±0.3%rdg.	±0.3%rdg.
1kHz < f ≤ 10kHz	±(0.03+0.07×F)%rdg. ±0.2%f.s.	±(0.23+0.07×F)%rdg.	±(0.23+0.07×F)%rdg.
10kHz < f ≤ 100kHz	±(0.3+0.04×F)%rdg. ±0.3%f.s.	±(0.6+0.04×F)%rdg.	±(0.6+0.04×F)%rdg.

Active power

Frequency (f)	Input < 50% f.s.	50%f.s. ≤ Input < 100%f.s.	100%f.s. ≤ Input
DC	±0.1%rdg. ±0.1%f.s.	±0.1%rdg. ±0.1%f.s.	±0.2%rdg.
0.1Hz ≤ f < 16Hz	±0.1%rdg. ±0.2%f.s.	±0.3%rdg.	±0.3%rdg.
16Hz ≤ f < 45Hz	±0.1%rdg. ±0.1%f.s.	±0.2%rdg.	±0.2%rdg.
45Hz ≤ f ≤ 66Hz	±0.1%rdg. ±0.05%f.s.	±0.15%rdg.	±0.15%rdg.
66Hz < f ≤ 500Hz	±0.1%rdg. ±0.1%f.s.	±0.2%rdg.	±0.2%rdg.
500Hz < f ≤ 1kHz	±0.1%rdg. ±0.2%f.s.	±0.3%rdg.	±0.3%rdg.
1kHz < f ≤ 10kHz	±(0.03+0.07×F)%rdg. ±0.2%f.s.	±(0.23+0.07×F)%rdg.	±(0.23+0.07×F)%rdg.
10kHz < f ≤ 50kHz	±(0.07×F)%rdg. ±0.3%f.s.	±(0.3+0.07×F)%rdg.	±(0.3+0.07×F)%rdg.
50kHz < f ≤ 100kHz	±(0.6+0.07×F)%rdg. ±0.3%f.s.	±(0.9+0.07×F)%rdg.	±(0.9+0.07×F)%rdg.

- Values for f.s. depend on measurement ranges.
- "F" in the tables refers to the frequency in kHz.
- Add ±1mA to DC measurement accuracy for current.
- Add (±1mA) x (voltage read value) to DC measurement accuracy for active power.
- When using the 200mA or 500mA range, add ±0.1% rdg. to current and active power for which 1kHz < f ≤ 10kHz.
- Values for voltage, current, and active power for which 0.1Hz ≤ f < 10Hz are for reference only.
- Values for voltage, current, and active power in excess of 220V or 20A for which 10Hz ≤ f < 16Hz are for reference only.
- Values for current and active power in excess of 20A for which 500Hz < f ≤ 50kHz are for reference only.
- Values for current and active power in excess of 15A for which 50kHz < f ≤ 100kHz are for reference only.
- Values for voltage and active power in excess of 750V for which 30kHz < f ≤ 100kHz are for reference only.

Guaranteed accuracy period	1 year
Post-adjustment accuracy guaranteed	6 months
Conditions of guaranteed accuracy	Temperature and humidity : 23°C ±5°C, 80% RH or less Warm-up time : 30 minutes Input : Sine wave input, power factor of 1, terminal-to-ground voltage of 0V, after zero adjustment; within range in which the fundamental wave satisfies synchronization source conditions
Temperature characteristic	±0.03% f.s. per °C or less
Power factor effects	±0.1% f.s. or less (45 to 66 Hz, at power factor = 0) Internal circuitry voltage/current phase difference: ±0.0573°
Effect of common mode voltage	±0.02% f.s. or less (600 V, 50/60 Hz, applied between input terminals and enclosure)
Effect of external magnetic field interference	400 A/m, DC and 50/60 Hz magnetic field Voltage :±1.5% f.s. or less Current :±1.5% f.s. or ±10 mA, whichever is greater, or less Active power :±3.0% f.s. or (voltage influence quantity) × (±10 mA), whichever is greater, or less
Magnetization effect	±10 mA equivalent or less (after inputting 100 A DC to the current direct input terminals)
Adjacent channel input effect	±10 mA equivalent or less (when inputting 50 A to adjacent channel)

Voltage/ Current/ Active Power Measurement Specifications

Measurement types	Rectifiers: AC+DC, DC, AC, FND, AC+DC Umn
Effective measuring range	Voltage : 1% to 130% of range (however, up to ±1500 V peak value and 1000 V RMS value) Current : 1% to 130% of range Active power : 0% to 169% of the range (However, defined when the voltage and current fall within the effective measurement range.)
Display range	Voltage/ Current : 0.5% to 140% of range (zero-suppression when less than 0.5%) Active power : 0% to 196% of the range (no zero-suppression)
Polarity	Voltage/ Current : Displayed when using DC rectifier Active power +: Positive: Power consumption (no polarity display) –: generation or regenerated power

Voltage/ Current/ Active power channel and sum value calculation formulas

Wiring		X: U (Voltage) or I (Current)	P (Active power)
All channels	1P2W	$X_{(i)}$	$P_{(i)}$
Sum values	1P3W	$X_{sum} = \frac{1}{2}(X_{(1)} + X_{(2)})$	$P_{sum} = (P_{(1)} + P_{(2)})$
	3P3W		
	3P3W2M	$X_{sum} = \frac{1}{3}(X_{(1)} + X_{(2)} + X_{(3)})$	$P_{sum} = (P_{(1)} + P_{(2)} + P_{(3)})$
	3V3A		
	3P3W3M		
	3P4W		

(i): Measurement channel

Frequency Measurement Specifications

Number of measurement channels	3
Measurement source	Select from U (VHz) or I (AHz) by channel
Measurement method	Calculated from input waveform period (reciprocal method)
Measurement range	500 Hz/200 kHz (linked to zero-cross filter)
Measurement accuracy	±0.1% rdg. ±1 dgt. (0°C to 40°C)
Effective measuring range	0.1 Hz to 100 kHz For sine wave input that is at least 20% of the measurement source's measurement range. Measurement lower limit frequency setting: 0.1 sec. / 1 sec. / 10 sec.
Display format	0.1000 Hz to 9.9999 Hz, 9.900 Hz to 99.999 Hz, 99.00 Hz to 999.99 Hz, 9900 kHz to 9.9999 kHz, 9.900 kHz to 99.999 kHz, 99.00 kHz to 220.00 kHz

Apparent Power/ Reactive Power/ Power Factor/ Phase Angle Measurement Specifications

Measurement types	Rectifiers Apparent Power/ Reactive Power/ Power Factor: AC+DC, AC, FND, AC+DC Umn Phase Angle : AC, FND
Effective measuring range	As per voltage, current, and active power effective measurement ranges.
Display range	Apparent Power/ Reactive Power : 0% to 196% of the range (no zero-suppression) Power Factor : ±0.0000 to ±1.0000 Phase Angle : +180.00 to -180.00
Polarity	Reactive Power/ Power Factor/ Phase Angle Polarity is assigned according to the lead/lag relationship of the voltage waveform rising edge and the current waveform rising edge. + : When current lags voltage (no polarity display) - : When current leads voltage

Power channel and sum value calculation formulas

Wiring		S : Apparent power	Q : Reactive power
All channels	1P2W	$S_{(i)} = U_{(i)} \times I_{(i)}$	$Q_{(i)} = si_{(i)}\sqrt{S_{(i)}^2 - P_{(i)}^2}$
Sum values	1P3W	$S_{sum} = S_{(1)} + S_{(2)}$	$Q_{sum} = Q_{(1)} + Q_{(2)}$
	3P3W	$S_{sum} = \frac{\sqrt{3}}{2}(S_{(1)} + S_{(2)})$	
	3P3W2M	$S_{sum} = \frac{\sqrt{3}}{3}(S_{(1)} + S_{(2)} + S_{(3)})$	
	3V3A		
	3P3W3M	$S_{sum} = S_{(1)} + S_{(2)} + S_{(3)}$	$Q_{sum} = Q_{(1)} + Q_{(2)} + Q_{(3)}$
	3P4W		

(i): Measurement channel

Wiring		λ : Power factor	ϕ : Phase angle
All channels	1P2W	$\lambda_{(i)} = si_{(i)}\left\lvert\frac{P_{(i)}}{S_{(i)}}\right\rvert$	$\phi_{(i)} = si_{(i)}\ cos^{-1}\lvert\lambda_{(i)}\rvert$
Sum values	1P3W 3P3W 3P3W2M 3V3A 3P3W3M 3P4W	$\lambda_{sum} = si_{sum}\left\lvert\frac{P_{sum}}{S_{sum}}\right\rvert$	When $P_{sum} \geq 0$ $\phi_{sum} = si_{sum}\ cos^{-1}\lvert\lambda_{sum}\rvert$ (0° to ±90°) When $P_{sum} \geq 0$ $\phi_{sum} = si_{sum}\lvert 180 - cos^{-1}\lvert\lambda_{sum}\rvert\rvert$ (±90° to ±180°)

(i): Measurement channel ; The polarity symbol si_{sum} is acquired from the Q_{sum} symbol.

Voltage Waveform Peak Value / Current Waveform Peak Value Measurement Specifications

Measurement method	Measures the waveform's peak value (for both positive and negative polarity) based on sampled instantaneous voltage values.
Sampling frequency	Approx. 700 kHz
Range configuration	

Voltage peak range

Voltage range	15V	30V	60V	150V	300V	600V	1000V
Voltage peak range	90.000V	180.00V	360.00V	900.00V	1.8000kV	3.6000kV	6.0000kV

Current peak range

Current range	200mA	500mA	1A	2A	5A	10A	20A	50A
Current peak range	1.2000A	3.0000A	6.0000A	12.000A	30.000A	60.000A	120.00A	300.00A

Measurement accuracy	Same as the voltage or current measurement accuracy at DC and when 10 Hz ≤ f ≤ 1 kHz (f.s.: voltage peak range or current peak range). Provided as reference value when 0.1 Hz ≤ f < 10 Hz and when in excess of 1 kHz.
Effective measuring range	±5% to ±100% of voltage peak range (up to ±1500 V) or ±5% to ±100% of current peak range (up to ±100 A)
Display range	±0.3% to ±102% of voltage peak range or current peak range (values less than ±0.3% are subject to zero-suppression)

Voltage Crest Factor/ Current Crest Factor Measurement Specifications

Measurement method	Calculates values from display values once each display update interval for voltage and voltage waveform peak values or current and current waveform peak values.
Effective measuring range	As per voltage and voltage waveform peak value or current and current waveform peak value effective measurement ranges.
Display range	1.0000 to 612.00 (no polarity)

Synchronized Control

Functions	Timing of calculations, display updates, data updates, integration start/stop/reset events, display hold operation, key lock operation, and zero-adjustment operation for the slave PW3336/PW3337 are synchronized with the master PW3336/PW3337.
Terminal	BNC terminal × 1 (non-isolated)
Terminal name	EXT SYNC
I/O settings	Off: Synchronized control function off In : The EXT SYNC terminal is set to input, and a dedicated synchronization signal can be input (slave). Out: The EXT SYNC terminal is set to output, and a dedicated synchronization signal can be output (master).
Number of units for which synchronized control can be performed	1 master unit and 7 slave units (total 8 units)

Voltage Ripple Rate / Current Ripple Factor Measurement Specifications

Measurement method	Calculates the AC component (peak to peak [peak width]) as a proportion of the voltage or current DC component
Effective measuring range	As per voltage and voltage waveform peak value or current and current waveform peak value effective measurement ranges
Display range	0.00[%] to 500.00[%]
Polarity	None

Efficiency Measurement Specifications

Measurement method	Calculates the efficiency η [%] from the ratio of active power values for channels and wires
Wiring modes and calculation equations	Calculated based on the AC+DC rectifier active power

PW3336 series

Wiring (WIRING)	CH1	CH2	Calculation formulas
1P2W × 2	1P2W	1P2W	η1=100×|P2| / |P1| η2=100×|P1| / |P2|
1P3W	1P3W		
3P3W	3P3W		
3P3W2M	3P3W2M		

PW3337 series

Wiring (WIRING)	CH1	CH2	CH3	Calculation formulas
1P2W × 3	1P2W	1P2W	1P2W	η1=100×|P3| / |P1| η2=100×|P1| / |P3|
1P3W & 1P2W	1P3W		1P2W	η1=100×|P3| / |Psum| η2=100×|Psum| / |P3|
3P3W & 1P2W	3P3W		1P2W	
3P3W2M	3P3W2M			
3V3A	3V3A			
3P3W3M	3P3W3M			
3P4W	3P4W			

Effective measuring range	As per the active power effective measurement range.
Display range	0.00[%] to 200.00[%]

Functional Specifications

Auto-range (AUTO)	Automatically changes the voltage and current range for each wiring mode according to the input Range up : The range is increased when input exceeds 130% of the range or when the peak is exceeded. Range down : The range is decreased when input falls below 15% of the range. However, the range is not decreased when the peak is exceeded at the lower range.
Averaging (AVG)	· Averages the voltage, current, active power, apparent power, and reactive power. · The power factor and phase angle are calculated from averaged data. · Measured values other than peak values, power factor, frequency, integrated values, T.AV, crest factor, ripple rate, total harmonic distortion, and harmonics are averaged. Method : Simple averaging Number of averaging iterations and display update interval

Number of averaging iterations	1 (OFF)	2	5	10	25	50	100
Display update interval	200ms	400ms	1s	2s	5s	10s	20s

Scaling (VT, CT)	Applies user-defined VT and CT ratio settings to measured values. These settings can be configured separately for each wiring mode. VT ratio setting range : OFF (1.0), 0.1 to 1000 (setting: 0000) CT ratio setting range : OFF (1.0), 0.001 to 1000 (setting: 0000)
HOLD (HOLD)	· Stops display updates for all measured values and fixes the display values at that point in time. · Measurement data acquired by communications is also fixed at that point in time. · Internal calculations (including integration and integration elapsed time) will continue. · Analog output and waveform output are not held.
Maximum value/ minimum value hold (MAX/MIN HOLD)	· Detects maximum and minimum measured values as well as maximum and minimum values for the voltage and current waveform peak and holds them on the display. · For data with polarity, display of the maximum value and minimum value for the data's absolute values is held (so that both positive and negative polarity values are shown). · Internal calculations (including integration and integration elapsed time) will continue. · Analog output and waveform output are not held.
Zero Adjustment (0 ADJ)	Degausses the current input unit DCCT and then zeroes out the current input offset.
Key-lock (KEY LOCK)	Disables key input in the measurement state, except for the SHIFT key and KEY LOCK key.
Backup	Backs up settings and integration data if the instrument is turned off and if a power outage occurs.
System Reset	· Initializes the instrument's settings. · Communications-related settings (communications speed, address, and LAN-related settings) are not initialized.

Integration Measurement Specifications

Measurement types	Rectifiers: AC+DC, AC+DC Umn Current: Displays the result of integrating current RMS value data (display values) once every display update interval (approx. 200 ms) as an integrated value. Active power: Displays the result of integrating active power values by polarity calculated once every cycle for the selected synchronization source as integrated values. Rectifier: DC Displays the result of integrating instantaneous data obtained by sampling both current and active power by polarity as integrated values (When the active power contains both AC and DC, the DC component will not be integrated)

Integration Measurement Specifications

Measurement items	Simultaneous integration of the following 6 parameters for each channel (total of 18 parameters): Sum of current integrated values (displayed as Ah on panel display) Positive current integrated value (displayed as Ah+ on panel display) Negative current integrated value (displayed as Ah- on panel display) Sum of active power integrated values (displayed as Wh on panel display) Positive active power integrated value (displayed as Wh+ on panel display) Negative active power integrated value (displayed as Wh- on panel display)
Integration time	1 min. to 10000 hr., settable in 1 min. blocks
Integration time accuracy	±100 ppm ±1 dgt. (0°C to 40°C)
Integration measurement accuracy	(Current or active power measurement accuracy) + (±0.01% rdg. ±1 dgt.)
Effective measuring range	Until PEAK OVER U or PEAK OVER I occurs
Display resolution	999999 (6 digits + decimal point)
Functions	· Stopping integration based on integration time setting (timer) · Displaying the integration elapsed time (displayed as TIME on panel display) · Additional integration by repeatedly starting/stopping integration · Backing up integrated values and the integration elapsed time during power outages · Stopping integration when power returns
External control	Stopping/starting integration and resetting integrated values based on external control
Measuring range	Corresponds to the range set for START integretation

Time Average Current / Time Average Active Power Measurement Specifications (T.AV)

Measurement method	Calculates the average by dividing the integrated value by the integration time
Measurement accuracy	±(Current or active power measurement accuracy) ±(±0.01%rdg. ±1dgt.)
Effective measuring range	As per the current or active power effective measurement range

Harmonic Measurement Specifications (built-in function)

Measurement method	· Zero-cross simultaneous calculation method (separate windows by channel according to the wiring mode) · Uniform thinning between zero-cross events after processing with a digital antialiasing filter · Interpolation calculations (Lagrange interpolation) · When the synchronization frequency falls within the 45 Hz to 66 Hz range » IEC 61000-4-7:2002 compliant » Gaps and overlaps may occur if the measurement frequency is not 50 Hz or 60 Hz · When the synchronization frequency falls outside the 45 Hz to 66 Hz range » No gaps or overlap will occur
Synchronization source	Conforms to synchronization source (SYNC) for the basic measurement specifications
Measurement channels	3
Measurement items	·Harmonic voltage RMS value ·Harmonic voltage content % ·Harmonic voltage phase angle ·Harmonic current RMS value ·Harmonic current content % ·Harmonic current phase angle ·Harmonic active power ·Harmonic active power content % ·Harmonic voltage current phase difference ·Total harmonic voltage distortion ·Total harmonic current distortion ·Voltage fundamental waveform ·Current fundamental waveform · Active power fundamental waveform ·Apparent power fundamental waveform · Reactive power fundamental waveform ·Power factor fundamental waveform ·Voltage current phase difference fundamental waveform ·Interchannel voltage fundamental wave phase difference ·Interchannel current fundamental wave phase difference The following parameters can be downloaded as data during PC communication but not displayed: · Harmonic voltage phase angle · Harmonic current phase angle · Harmonic voltage current phase difference
FFT processing word length	32 bits
Number of FFT points	4096
Window function	Rectangular
Analysis window width	45 Hz ≤ f < 56 Hz 178.57 ms to 222.22 ms (10 cycles) 56 Hz ≤ f < 66 Hz 181.82 ms to 214.29 ms (12 cycles) Frequencies other than the above 185.92 ms to 214.08 ms
Data update rate	Depends on window width
Synchronization frequency range	10 Hz to 640 Hz
Maximum analysis order	

Synchronization frequency (f) range	Analysis order
10 Hz ≤ f < 45 Hz	50th
45 Hz ≤ f < 56 Hz	50th
56 Hz ≤ f ≤ 66 Hz	50th
66 Hz < f ≤ 100 Hz	50th
100 Hz < f ≤ 200 Hz	40th
200 Hz < f ≤ 300 Hz	25th
300 Hz < f ≤ 500 Hz	15th
500 Hz < f ≤ 640 Hz	11th

Analysis order upper limit setting	2nd to 50th
Measurement accuracy	f.s.: Measurement range

Frequency (f)	Voltage, Current, Active power
DC	±0.4%rdg.±0.2%f.s.
10 Hz ≤ f < 30 Hz	±0.4%rdg.±0.2%f.s.
30 Hz ≤ f ≤ 400 Hz	±0.3%rdg.±0.1%f.s.
400 Hz < f ≤ 1 kHz	±0.4%rdg.±0.2%f.s.
1 kHz < f ≤ 5 kHz	±1.0%rdg.±0.5%f.s.
5 kHz < f ≤ 8 kHz	±4.0%rdg.±1.0%f.s.

For DC, add ±1 mA to current and (±1 mA) × (voltage read value) to active power.

Display Specifications

Display	7-segment LED
Number of display parameters	4
Display resolution	Other than integrated values: 99999 count Integrated values: 999999 count
Display update rate	200 ms ±50 ms (approx. 5 updates per sec.) to 20 s (varies with number of averaging iterations setting)

External Current Sensor Input Specifications (built-in feature)

Terminal	Isolated BNC terminals, 1 for each channel
Current sensor type switching	Off / Type 1 / Type 2 When set to off, input from the external current sensor input terminal is ignored.
Current sensor options	TYPE1 (100 A to 5000 A sensors) 9660, 9661, 9669, CT9667-01/-02/-03 TYPE2 (20 A to 1000 A sensors, Power supply is required to use) CT6862-05, CT6863-05, 9709-05, CT6865-05, 9272-05, CT6841-05, CT6843-05, CT6844-05, CT6845-05, CT6846-05
Current measurement range	Auto / 10 A / 20 A / 50 A (range noted on panel) User-selectable for each wiring mode. Can be read directly by manually setting the CT ratio.
Power range configuration	Depends on the combination of voltage and current ranges; from 60.000W to 15.000MW (also applies to VA, var)
Measurement accuracy	

Current, Active power

Frequency	Input < 50%f.s.	50%f.s. ≤ Input < 100%f.s.	100%f.s. ≤ Input
DC	±0.2%rdg. ±0.6%f.s.	±0.2%rdg. ±0.6%f.s.	±0.8%rdg.
0.1Hz≤ f <16Hz	±0.2%rdg. ±0.2%f.s.	±0.4%rdg.	±0.4%rdg.
16Hz≤ f < 45Hz	±0.2%rdg. ±0.2%f.s.	±0.4%rdg.	±0.4%rdg.
45Hz ≤ f ≤ 66Hz	±0.2%rdg. ±0.1%f.s.	±0.3%rdg.	±0.3%rdg.
66Hz < f ≤ 500Hz	±0.2%rdg. ±0.2%f.s.	±0.4%rdg.	±0.4%rdg.
500Hz < f ≤ 1kHz	±0.2%rdg. ±0.3%f.s.	±0.5%rdg.	±0.5%rdg.
1kHz < f ≤ 10kHz	±5.0%rdg.	±5.0%rdg.	±5.0%rdg.
10kHz < f ≤ 50kHz			
50kHz < f ≤ 100kHz			

f.s. : Each measurement range
- To obtain the current or active power accuracy, add the current sensor's accuracy to the above current and active power accuracy figures.
- The effective measurement range and frequency characteristics conform to the current sensor's specifications.
- Values for current, and active power for which 0.1 Hz ≤ f < 10 Hz are for reference only.
- Values for voltage in excess of 220 V active power for which 10 Hz ≤ f < 16 Hz are for reference only.

Temperature characteristics	Current, active power : ±0.08% f.s./°C (instrument temperature coefficient; f.s.: instrument measurement range) Add current sensor temperature coefficient to above.
Power factor effects	· Instrument: ±0.15% f.s. or less (45 Hz to 66 Hz with power factor = 0) · Internal circuit voltage/current phase difference: ±0.086° · Add the current sensor phase accuracy to the internal circuit voltage/current phase difference noted above.
Current peak value measurement accuracy	· (External current sensor input instrument accuracy) + (±2.0% f.s.) (f.s.:current peak range) · Add the current sensor accuracy to the above.
Harmonic measurement accuracy	

Frequency	Voltage	Current, Active power
DC	±0.4%rdg. ±0.2%f.s.	±0.6%rdg. ±0.8%f.s.
10Hz≤ f < 30Hz	±0.4%rdg. ±0.2%f.s.	±0.6%rdg. ±0.4%f.s.
30Hz≤ f ≤ 400Hz	±0.3%rdg. ±0.1%f.s.	±0.5%rdg. ±0.3%f.s.
400Hz < f ≤ 1kHz	±0.4%rdg. ±0.2%f.s.	±0.6%rdg. ±0.5%f.s.
1kHz < f ≤ 5kHz	±1.0%rdg. ±0.5%f.s.	±1.0%rdg. ±5.5%f.s.
5kHz < f ≤ 8kHz	±4.0%rdg. ±1.0%f.s.	±2.0%rdg. ±6.0%f.s.

f.s.: Each measurement range
- To obtain the current or active power accuracy, add the current sensor's accuracy to the above current and active power accuracy figures.

D/A Output Specifications (PW3336-02/-03 and PW3337-02/-03)

Number of output channels	16
Configuration	16-bit D/A converter (polarity + 15 bits)
Output parameters	U1 to U3 (voltage level) or u1 to u3 (instantaneous voltage waveform) (switchable) I1 to I3 (current level) or i1 to i3 (instantaneous current waveform) (switchable) P1 to P3 (active power level) or p1 to p3 (instantaneous power waveform) (switchable) Psum (active power level) or Hi-Psum (high-speed active power level) (switchable) Psum and Hi-Psum output is not available (0 V) when using the 1P2W wiring mode.P12 is output when using 1P3W, 3P3W, or 3P3W2M, and P123 is output when using 3V3A, 3P3W3M, or 3P4W. D/A1 to D/A3 : Select any 3 from channel or sum value for voltage, current, active power, apparent power, reactive power, power factor, phase angle, total harmonic voltage/current distortion, inter-channel voltage/current fundamental wave phase difference, voltage/current crest factor, time average current/active power, voltage/current ripple rate, frequency, efficiency, current integration, active power integration (harmonic output is not available for individual orders). Hi-P1 to Hi-P3 and Hi-Psum (high-speed active power level): Fixed to AC+DC For other level output, select AC+DC, AC+DC Umn, DC, AC, or fnd.
Output accuracy	f.s.: Relative to the output voltage rated value for each output parameter Level output : (Output parameter measurement accuracy) + (±0.2% f.s.) High-speed active power level output : (Output parameter measurement accuracy) + (±0.2% f.s.) Instantaneous waveform output : (Output parameter measurement accuracy) + (±1.0% f.s.) Instantaneous voltage, instantaneous current: RMS value level Instantaneous power: Average value level
Output frequency band	Instantaneous waveform output, high-speed active power level output At DC or 10 Hz to 5 kHz, accuracy is as defined above.
Output voltage	Level output Voltage, current, active power, apparent power, reactive power, time average current/active power : ±2 V DC for ±100% of range Power factor : ±2 V DC at ±0.0000, 0 V DC at ±1.0000 Phase angle : 0 V DC at 0.00°, ±2 V DC at ±180.00° Voltage/current ripple rate, total harmonic voltage/current distortion : + 2 V DC at 100.00% Voltage/current crest factor : +2 V DC at 10.000 Frequency : Varies with measured value. +2 V DC per 100 Hz from 0.1000 Hz to 300.00 Hz +2 V DC per 10 kHz from 300.01 Hz to 30.000 kHz +2 V DC per 100 kHz from 30.001 kHz to 220.00 kHz Efficiency : +2 V DC at 200.00% Current integration, active power integration : ±5 V DC at (range) × (integration set time) Waveform output : 1 V f.s. relative to 100% of range
Maximum output voltage	Approx. ±12 V DC
Output update rate	Level output : Fixed at 200 ms ±50 ms (approx. 5 times per sec.) Update rate is unrelated to number of averaging iterations setting and display hold operation. Waveform output : Approx. 11.4 µs (approx. 87.5 kHz) High-speed P level : Updated once every cycle for the input waveform set as the synchronization source.
Response time	Level output : 0.6 sec. or less (when the input changes abruptly from 0% to 90%, or from 100% to 10%, the time required in order to satisfy the accuracy range) Waveform output : 0.2 ms or less High-speed active power level output : 1 cycle
Temperature characteristic	±0.05% f.s./°C or less
Output resistance	100 Ω ±5 Ω

External control (built-in feature)

Functions	Integration start/stop, integration reset and hold via external control
External control	Input signal level: 0 to 5 V (high-speed CMOS level or shorted [Lo]/open [Hi])

Functions	External control signal	External control terminal
Start	Hi → Lo	START/STOP
Stop	Lo → Hi	
Reset	Lo interval of at least 200 ms	RESET
Hold on	Hi → Lo	HOLD
Hold off	Lo → Hi	

GP-IB interface (PW3336-01/-03, PW3337-01/-03)

Method	IEEE488.1 1978 compliant; see IEEE488.2 1987 Interface functions: SH1, AH1, T6, L4, SR1, RL1, PP0, DC1, DT1, C0 Remote control by controller
Address	00 to 30

RS-232C interface (built-in feature)

Connector	D-sub 9-pin connector × 1
Communication method	Full duplex, Start-stop synchronization, Stop bits: 1 (fixed), Data bits: 8 (fixed), Parity: None Remote control by controller
Communication Speed	9600bps/ 38400bps

LAN interface (built-in feature)

Connector	RJ-45 connector × 1
Electrical Specifications	IEEE802.3 compliant
Transmission Method	10BASE-T/100BASE-TX (automatic detection)
Protocol	TCP/IP
Functions	HTTP server (remote operation, firmware updates) Dedicated ports (command control, data transfer) Remote control by controller (REMOTE lamp will light up.)

General Specifications (product guaranteed for one year)

Operating environment	Indoors, altitude up to 2000 m (6562-ft.), pollution degree 2
Operating temperature and humidity	0 to 40°C (32 to 104°F), 80% RH or less (non-condensating)
Storage temperature and humidity	-10 to 50°C (14 to 122°F) 80% RH or less (non-condensating)
Dielectric strength	4290 Vrms AC (sensed current: 1 mA) Between voltage input terminals and (case, interface, and output terminals) Between current direct input terminals and (case, interface, and output terminals) Between voltage input terminals and current direct input terminals
Maximum rated voltage to earth	Voltage input terminal, Current direct input terminal Measurement category III 600 V (anticipated transient overvoltage 6000 V) Measurement category II 1000 V (anticipated transient overvoltage 6000 V)
Maximum input voltage	Between voltage input terminals U: 1000 V, ±1500 Vpeak
Maximum input current	Between +/- current direct input terminals I: ±70 A, ±100 Apeak
Applicable Standards	Safety : EN61010, EMC : EN61326 Class A/ EN61000-3-2/ EN61000-3-3
Rated supply voltage	100 VAC to 240 VAC, Rated power supply frequency : 50/60 Hz
Maximum rated power	40 VA or less
Dimensions	Approx. 305W(12.01") × 132H(5.20") × 256D(10.08") mm (excluding protrusions)
Mass	PW3336 series Approx. 5.2 kg (183.4 oz.) PW3337 series Approx. 5.6 kg (197.5 oz.)
Accessories	Instruction manual × 1, Measurement guide × 1, Power cord × 1

Current Measurement Options [Type 1] Specifications (Can be connected to the current sensor input terminals on the PW3336/PW3337 series.)

Model	CLAMP ON SENSOR 9660	CLAMP ON SENSOR 9661	CLAMP ON SENSOR 9669	FLEXIBLE CLAMP ON SENSOR CT9667-01	FLEXIBLE CLAMP ON SENSOR CT9667-02	FLEXIBLE CLAMP ON SENSOR CT9667-03
Appearance						
Primary current rating	100A AC	500A AC	1000 A AC	500A/ 5000A AC		
Measurable conductor diameter	Max.ϕ15mm (0.59")	Max.ϕ46mm (1.81")	Max. ϕ55 mm(2.17"), 80 (3.15")×20(0.79") mm busbar	Max. ϕ100mm (3.94")	Max. ϕ180mm (7.09")	Max. ϕ254mm(10.0")
Basic accuracy	±0.3%rdg.±0.02%f.s. (amplitude) ±1° or less (phase) (At 45 Hz to 66 Hz)	±0.3%rdg.±0.01%f.s. (amplitude) ±0.5° or less (phase) (At 45 Hz to 66 Hz)	±1.0%rdg.±0.01%f.s. (amplitude) ±1° or less (phase) (At 45 Hz to 66 Hz)	±2.0%rdg.±0.3%f.s. (amplitude) ±1° or less (At 45 Hz to 66 Hz)		
Frequency characteristics	±1.0% or less (At 40Hz to 5kHz)		±2% or less (At 40Hz to 5kHz)	±3dB or less (At 10 Hz to 20kHz)		
Operating Temperature	0 to 50°C (32 to 122°F),			-25 to 65°C (-13 to 149°F)		-10 to 50°C (14 to 122°F)
Effect of conductor position	Within ±0.5% (deviation from center)		Within ±1.5% (deviation from center)	Within ±3% (deviation from center)		
Effect of external electromagnetic field	0.1A equivalent or lower (400A/m,55Hz)		1A equivalent or lower (400A/m, 55Hz)	1.5% f.s. or lower (400A/m, 55Hz)		
Maximum rated voltage to earth	CAT III 300Vrms		CATIII 600Vrms	CATIII 1000 Vrms, CATIV 600 Vrms		
Dimensions	46W(1.81")×135H(5.31") ×21D(0.83")mm Cable length: 3 m (9.84 ft)	78W(3.07")×152H(5.98") ×42D(1.65")mm Cable length: 3 m (9.84 ft)	99.5W (3.92") × 188H (7.40") × 42D (1.65") mm Cable length: 3 m (9.84 ft)	Circuit box: 35W (1.38") × 120.5H (4.74") × 34D (1.34") mm, Cable length: 2m (between flexible loop and circuit box), 1m (output cable)		
Mass	230g(8.1oz.)	380g(13.4oz.)	590g (20.8 oz.)	280 g (9.9oz.)	280 g (9.9oz.)	470 g (4.9 oz.)
Power supply	—	—	—	LR6 alkaline battery x2, or AC Adapter 9445-02/ 9445-03 (sold separately)		

Current Measurement Options [Type 2] Specifications (Requires Sensor Unit CT9555 or CT9557, and Connection Cable L9217.)

Model	AC/DC CURRENT PROBE CT6841-05	AC/DC CURRENT PROBE CT6843-05	AC/DC CURRENT PROBE CT6844-05	AC/DC CURRENT PROBE CT6845-05	AC/DC CURRENT PROBE CT6846-05
Appearance					
Rated primary current	20 A AC/DC	200 A AC/DC	500 A AC/DC	500 A AC/DC	1000 A AC/DC
Frequency band	DC to 1 MHz	DC to 500 kHz	DC to 200 kHz	DC to 100 kHz	DC to 20 kHz
Diameter of measurable conductors	Max.φ 20 mm (0.79") (insulated conductor)	Max.φ 20 mm (0.79") (insulated conductor)	Max.φ 20 mm (0.79") (insulated conductor)	Max.φ 50 mm (1.97") (insulated conductor)	Max.φ 50 mm (1.97") (insulated conductor)
Basic accuracy (At DC)	±0.3% rdg. ±0.05% f.s. (amplitude)	±0.3% rdg. ±0.02% f.s.(amplitude)	±0.3% rdg. ±0.02% f.s. (amplitude)	±0.3% rdg. ±0.02% f.s. (amplitude)	±0.3% rdg. ±0.02% f.s. (amplitude)
Basic accuracy (At DC < f ≤ 100 Hz)	±0.3% rdg. ±0.01% f.s. (amplitude) ±0.1° (phase)	±0.3% rdg. ±0.01% f.s. (amplitude) ±0.1° (phase)	±0.3% rdg. ±0.01% f.s. (amplitude) ±0.1° (phase)	±0.3% rdg. ±0.01% f.s. (amplitude) ±0.1° (phase)	±0.3% rdg. ±0.01% f.s. (amplitude) ±0.1° (phase)
Frequency characteristics (Amplitude)	to 500 Hz: ±0.3% rdg. ±0.02% f.s. to 1 kHz: ±0.5% rdg. ±0.02% f.s. to 10 kHz: ±1.5% rdg. ±0.02% f.s. to 100 kHz: ±5.0% rdg. ±0.05% f.s. to 1 MHz: ±30% rdg. ±0.05% f.s. (Includes derating characteristics)	to 500 Hz: ±0.3% rdg. ±0.02% f.s. to 1 kHz: ±0.5% rdg. ±0.02% f.s. to 10 kHz: ±1.5% rdg. ±0.02% f.s. to 50 kHz: ±5.0% rdg. ±0.02% f.s. to 500 kHz: ±30% rdg. ±0.05% f.s. (Includes derating characteristics)	to 500 Hz: ±0.3% rdg. ±0.02% f.s. to 1 kHz: ±0.5% rdg. ±0.02% f.s. to 10 kHz: ±1.5% rdg. ±0.02% f.s. to 50 kHz: ±5.0% rdg. ±0.02% f.s. to 200 kHz: ±30% rdg. ±0.05% f.s. (Includes derating characteristics)	to 500 Hz: ±0.3% rdg. ±0.02% f.s. to 1 kHz: ±0.5% rdg. ±0.02% f.s. to 10 kHz: ±1.5% rdg. ±0.02% f.s. to 20 kHz: ±5.0% rdg. ±0.02% f.s. to 100 kHz: ±30% rdg. ±0.05% f.s. (Includes derating characteristics)	to 500 Hz: ±0.5% rdg. ±0.02% f.s. to 1 kHz: ±1.0% rdg. ±0.02% f.s. to 5 kHz: ±2.0% rdg. ±0.02% f.s. to 10 kHz: ±5.0% rdg. ±0.05% f.s. to 20 kHz: ±30% rdg. ±0.10% f.s. (Includes derating characteristics)
Operating Temperature	-40°C to 85°C (-40°F to 185°F)	-40°C to 85°C (-40°F to 185°F)	-40°C to 85°C (-40°F to 185°F)	-40°C to 85°C (-40°F to 185°F)	-40°C to 85°C (-40°F to 185°F)
Effect of conductor position	Within ±0.1% rdg. (DC to 100 Hz)	Within ±0.1% rdg. (DC to 100 Hz)	Within ±0.1% rdg. (DC to 100 Hz)	Within ±0.2% rdg. (DC to 100 Hz)	Within ±0.2% rdg. (50/ 60 Hz)
Effect of external magnetic fields	50 mA equivalent or lower (400 A/m, 60 Hz and DC)	50 mA equivalent or lower (400 A/m, 60 Hz and DC)	100 mA equivalent or lower (400 A/m, 60 Hz and DC)	150 mA equivalent or lower (400 A/m, 60 Hz and DC)	150 mA equivalent or lower (400 A/m, 60 Hz and DC)
Dimensions	153W (6.02") × 67H (2.64") × 25D (0.98") mm Cable length: 3 m (9.84 ft)	153W (6.02") × 67H (2.64") × 25D (0.98") mm Cable length: 3 m (9.84 ft)	153 (6.02") W × 67 (2.64") H × 25 (0.98") D mm Cable length: 3 m (9.84 ft)	238 (9.37") W × 116 (4.57") H × 35 (1.38") D mm Cable length: 3 m (9.84 ft)	238 (9.37") W × 116 (4.57") H × 35 (1.38") D mm Cable length: 3 m (9.84 ft)
Mass	350 g (12.3 oz)	370 g (13.1 oz)	400 g (14.1 oz)	860 g (30.3 oz)	990 g (34.9)
Power supply	SENSOR UNIT CT9555 or CT9557	SENSOR UNIT CT9555 or CT9557	SENSOR UNIT CT9555 or CT9557	SENSOR UNIT CT9555 or CT9557	SENSOR UNIT CT9555 or CT9557

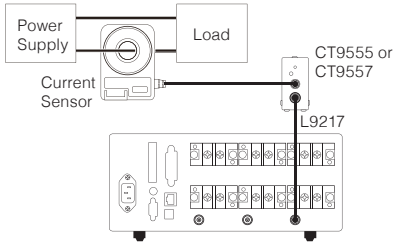
Model	AC/DC CURRENT SENSOR CT6862-05	AC/DC CURRENT SENSOR CT6863-05	AC/DC CURRENT SENSOR 9709-05	AC/DC CURRENT SENSOR CT6865-05	CLAMP ON SENSOR 9272-05
Appearance					
Rated primary current	50 A AC/DC	200 A AC/DC	500 A AC/DC	1000 A AC/DC	20A/200A AC
Frequency band	DC to 1 MHz	DC to 500 kHz	DC to 100 kHz	DC to 20 kHz	1 Hz to 100 kHz
Diameter of measurable conductors	Max.φ 24mm (0.94")	Max.φ 24 mm (0.94")	Max.φ 36 mm (1.42")	Max.φ 36 mm (1.42")	Max.ϕ 46mm (1.81")
Basic accuracy	±0.05 % rdg.±0.01 % f.s. (amplitude) ±0.2° (phase, not defined for DC) (At DC and 16 Hz to 400 Hz)	±0.05 % rdg.±0.01 % f.s. (amplitude) ±0.2° (phase, not defined for DC) (At DC and 16 Hz to 400 Hz)	±0.05 % rdg.±0.01 % f.s. (amplitude) ±0.2° (phase, not defined for DC) (At DC and 45 Hz to 66 Hz)	±0.05 % rdg.±0.01 % f.s. (amplitude) ±0.2° (phase, not defined for DC) (At DC and 16 Hz to 66 Hz)	±0.3 % rdg.±0.01 % f.s. (amplitude) ±0.2° (phase) (At 45 Hz to 66 Hz)
Frequency characteristics (Amplitude)	to 16 Hz: ±0.1% rdg. ±0.02% f.s. 400Hz to 1kHz: ±0.2% rdg. ±0.02% f.s. to 50 kHz: ±1.0% rdg. ±0.02% f.s. to 100 kHz: ±2.0% rdg. ±0.05% f.s. to 1 MHz: ±30% rdg. ±0.05% f.s. (Includes derating characteristics)	to 16 Hz: ±0.1% rdg. ±0.02% f.s. 400Hz to 1kHz: ±0.2% rdg. ±0.02% f.s. to 10 kHz: ±1.0% rdg. ±0.02% f.s. to 100 kHz: ±5.0% rdg. ±0.05% f.s. to 500 kHz: ±30% rdg. ±0.05% f.s. (Includes derating characteristics)	to 45 Hz: ±0.2% rdg. ±0.02% f.s. 66 Hz to 500 Hz:±0.2% rdg. ±0.02% f.s. to 5 kHz: ±0.5% rdg. ±0.05% f.s. to 10 kHz: ±5.0% rdg. ±0.10% f.s. to 100 kHz: ±30% rdg. ±0.10% f.s. (Includes derating characteristics)	to 16 Hz: ±0.1% rdg. ±0.02% f.s. 66 Hz to 100 Hz:±0.5% rdg. ±0.02% f.s. to 500 Hz: ±1.0% rdg. ±0.02% f.s. to 5 kHz: ±5.0% rdg. ±0.05% f.s. to 20 kHz: ±30% rdg. ±0.1% f.s. (Includes derating characteristics)	1 Hz to 10Hz: ±2.0% rdg. ±0.10% f.s. to 45Hz: ±0.5% rdg. ±0.02% f.s. 66Hz to 5kHz: ±1.0% rdg. ±0.05% f.s. to 50kHz: ±5.0% rdg. ±0.10% f.s. to 100kHz: ±30% rdg. ±0.10% f.s. (Includes derating characteristics)
Operating Temperature	-30°C to 85°C (-22°F to 185°F)	-30°C to 85°C (-22°F to 185°F)	0°C to 50°C (32°F to 122°F)	-30°C to 85°C (-22°F to 185°F)	0°C to 50°C (-32°F to 122°F)
Effect of conductor position	Within ±0.01% rdg. (DC to 100 Hz)	Within ±0.01% rdg. (DC to 100 Hz)	Within ±0.05% rdg. (DC)	Within ±0.05% rdg. (50/60 Hz)	Within ±0.2%rdg. (55Hz)
Effect of external magnetic fields	10 mA equivalent or lower (400 A/m, 60 Hz and DC)	50 mA equivalent or lower (400 A/m, 60 Hz and DC)	50 mA equivalent or lower (400 A/m, 60 Hz and DC)	200 mA equivalent or lower (400 A/m, 60 Hz and DC)	100 mA equivalent or lower (400 A/m, 60 Hz)
Dimensions	70W (2.76") × 100H (3.94") × 53D (2.09") mm Cable length: 3 m (9.84 ft)		160W (6.30") × 112H (4.41") × 50D (1.97") mm Cable length: 3 m (9.84 ft)		78W(3.07")×188H(7.40")×35D(1.38")mm Cable length: 3 m (9.84 ft)
Mass	340 g (12.0 oz.)	350 g (12.3 oz.)	850 g (30.0 oz.)	980 g (35.3 oz)	430g (15.2 oz.)
Power supply	SENSOR UNIT CT9555 or CT9557	SENSOR UNIT CT9555 or CT9557	SENSOR UNIT CT9555 or CT9557	SENSOR UNIT CT9555 or CT9557	SENSOR UNIT CT9555 or CT9557

Type 2 Current Sensor Options

	SENSOR UNIT CT9555	SENSOR UNIT CT9557
Appearance		 With additive output function
Number of available sensors	1	4
Compatible current sensors	CT6862-05, CT6863-05, 9709-05, CT6865-05, 9272-05, CT6841-05, CT6843-05, CT6844-05, CT6845-05, CT6846-05	
Power supply	100 to 240 V AC	

	Connection Cord L9217
Appearance	
Cord length	1.6 m (5.25 ft) length
Terminals	Isolated BNC to isolated BNC

Type 2 Current Sensor Connection Diagram



Model : POWER METER PW3336

LAN RS-232C GP-IB -01/-03 Model CE True RMS

Model No. (Order Code)	(Note)
PW3336	(2ch)
PW3336-01	(2ch, with GP-IB)
PW3336-02	(2ch, with D/A output)
PW3336-03	(2ch, with GP-IB, D/A output)

Accessories: Instruction manual ×1, Measurement guide ×1, Power cord ×1

Model : POWER METER PW3337

LAN RS-232C GP-IB -01/-03 Model CE True RMS

Model No. (Order Code)	(Note)
PW3337	(3ch)
PW3337-01	(3ch, with GP-IB)
PW3337-02	(3ch, with D/A output)
PW3337-03	(3ch, with GP-IB, D/A output)

Accessories: Instruction manual ×1, Measurement guide ×1, Power cord ×1

Options

Current measurement options [Type 1] Can be directly connected to the current sensor input terminals on the PW3336/ PW3337 series

CLAMP ON SENSOR 9660
100 A AC, φ15 mm(0.59”), 40 Hz to 5 kHz
±0.3%rdg.±0.02%f.s. (Amplitude accuracy 45 Hz to 66 Hz)
±1° or less (Phase accuracy 45 Hz to 66 Hz)

CLAMP ON SENSOR 9661
500 A AC, φ46 mm(1.81”), 40 Hz to 5 kHz
±0.3%rdg.±0.01%f.s. (Amplitude accuracy 45 Hz to 66 Hz)
±0.5° or less (Phase accuracy 45 Hz to 66 Hz)

CLAMP ON SENSOR 9669
1000 A AC, φ55mm(02.17”), 80 × 20 mm (3.15” × 0.79”) busbar, 40 Hz to 5 kHz
±1.0%rdg.±0.01%f.s. (Amplitude accuracy 45 Hz to 66 Hz)
±1° or less (Phase accuracy 45 Hz to 66 Hz)

CLAMP ON SENSOR CT9667-01, CT9667-02, CT9667-03
500 A /5000 A AC Switchable, φ100mm to φ254 mm (3.94” to 10”), 10 Hz to 20 kHz
±2.0%rdg.±0.3%f.s. (Amplitude accuracy 45 Hz to 66 Hz)
±1° or less (Phase accuracy 45 Hz to 66 Hz)
Power supply : LR6 alkaline battery ×2, or AC Adapter (option)
Option : AC ADAPTER 9445-02 (universal 100 V to 240 VAC /for USA)
AC ADAPTER 9445-03 (universal 100 V to 240 VAC /for Europe)

Current measurement options [Type 2] Requires SENSOR UNIT CT9555 or CT9557, and CONNECTION CORD L9217 to be connected to the current sensor input terminals on the PW3336/ PW3337 series

200 A or lower

AC/DC CURRENT SENSOR CT6862-05
50 A AC/DC, pass-through type, φ24 mm(0.94”), DC to 1 MHz
±0.05%rdg.±0.01%f.s. (Amplitude accuracy 16 Hz to 400 Hz)
±0.2° or less (Phase accuracy 16 Hz to 400 Hz)
Power supply : SENSOR UNIT CT9555 or CT9557 (option)

AC/DC CURRENT SENSOR CT6863-05
200 A AC/DC, pass-through type, φ24 mm(0.94”), DC to 500 kHz
±0.05%rdg.±0.01%f.s. (Amplitude accuracy 16 Hz to 400 Hz)
±0.2° or less (Phase accuracy 16 Hz to 400 Hz)
Power supply : SENSOR UNIT CT9555 or CT9557 (option)

AC/DC CURRENT PROBE CT6841-05
20 A AC/DC, clamp-on type, φ20 mm(0.79”), DC to 1 MHz
±0.3%rdg.±0.01%f.s. (Amplitude accuracy DC < f ≤ 100 Hz)
±0.1° or less (Phase accuracy DC < f ≤ 100 Hz)
Power supply : SENSOR UNIT CT9555 or CT9557 (option)

AC/DC CURRENT PROBE CT6843-05
200 A AC/DC, clamp-on type, φ20 mm(0.79”), DC to 500 kHz
±0.3%rdg.±0.01%f.s. (Amplitude accuracy DC < f ≤ 100 Hz)
±0.1° or less (Phase accuracy DC < f ≤ 100 Hz)
Power supply : SENSOR UNIT CT9555 or CT9557 (option)

CLAMP ON SENSOR 9272-05 (Scheduled for release in 2017)
20 A/ 200 A AC Switchable, clamp-on type, φ46 mm(1.81”),
1 Hz to 100 kHz
±0.3%rdg.±0.01%f.s. (Amplitude accuracy 45 Hz to 66 Hz)
±0.2° or less (Phase accuracy 45 Hz to 66 Hz)
Power supply : SENSOR UNIT CT9555 or CT9557 (option)

500 A or lower

AC/DC CURRENT SENSOR 9709-05
500 A AC/DC, pass-through type, φ36 mm(1.42”), DC to 100 kHz
±0.05%rdg.±0.01%f.s. (Amplitude accuracy 45 Hz to 66 Hz)
±0.2° or less (Phase accuracy 45 Hz to 66 Hz)
Power supply : SENSOR UNIT CT9555 or CT9557 (option)

AC/DC CURRENT PROBE CT6844-05
500 A AC/DC, clamp-on type, φ20 mm(0.79”), DC to 200 kHz
±0.3%rdg.±0.01%f.s. (Amplitude accuracy DC < f ≤ 100 Hz)
±0.1° or less (Phase accuracy DC < f ≤ 100 Hz)
Power supply : SENSOR UNIT CT9555 or CT9557 (option)

AC/DC CURRENT PROBE CT6845-05
500 A AC/DC, clamp-on type, φ50 mm(1.97”), DC to 100 kHz
±0.3%rdg.±0.01%f.s. (Amplitude accuracy DC < f ≤ 100 Hz)
±0.1° or less (Phase accuracy DC < f ≤ 100 Hz)
Power supply : SENSOR UNIT CT9555 or CT9557 (option)

1000 A or lower

AC/DC CURRENT SENSOR CT6865-05
1000 A AC/DC, pass-through type, φ36 mm(1.42”), DC to 20 kHz
±0.05%rdg.±0.01%f.s. (Amplitude accuracy 16 Hz to 66 Hz)
±0.2° or less (Phase accuracy 16 Hz to 66 Hz)
Power supply : SENSOR UNIT CT9555 or CT9557 (option)

AC/DC CURRENT PROBE CT6846-05
1000 A AC/DC, clamp-on type, φ50 mm(1.97”), DC to 20 kHz
±0.3%rdg.±0.01%f.s. (Amplitude accuracy DC < f ≤ 100 Hz)
±0.1° or less (Phase accuracy DC < f ≤ 100 Hz)
Power supply : SENSOR UNIT CT9555 or CT9557 (option)

Type 2 Current sensor options

SENSOR UNIT CT9555
Power supply :
100 V to 240 V AC (50Hz/ 60Hz)

SENSOR UNIT CT9557
Four Sensors can be used.
With additive output function
Power supply: 100 V to 240 V AC (50Hz/ 60Hz)

CONNECTION CORD L9217
For sensor output,
Isolated BNC to isolated BNC
Cord length: 1.6 m (5.25 ft) length

Communications and control options

RS-232C CABLE
9637
Cable length: 1.8 m (5.91 ft)
9pin to 9pin

RS-232C CABLE
9638
Cable length: 1.8 m (5.91 ft)
9pin to 25pin

GP-IB CONNECTOR CABLE 9151-02
Cable length: 2 m (6.56 ft)

LAN CABLE
9642
Cable length: 5 m (16.41 ft)
supplied with straight to
cross conversion cable

CONNECTION CORD
9165
For synchronized control
Cable length: 1.5 m (4.92 ft),
metal BNC to metal BNC

HIOKI
HIOKI E.E. CORPORATION

HIOKI

POWER ANALYZER PW6001

Improve Power Conversion Efficiency

World-class accuracy in measurement and analysis of DC to high-frequency signals with a single device. The next-generation POWER ANALYZER.

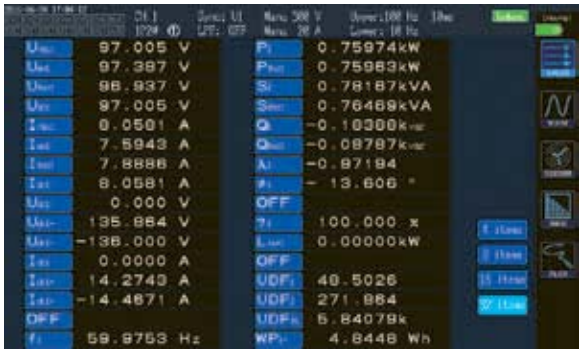
Ver. 3.00
Newly Added Functions

CE

Achieving true power analysis

DC, 0.1Hz to 2 MHz frequency bandwidth

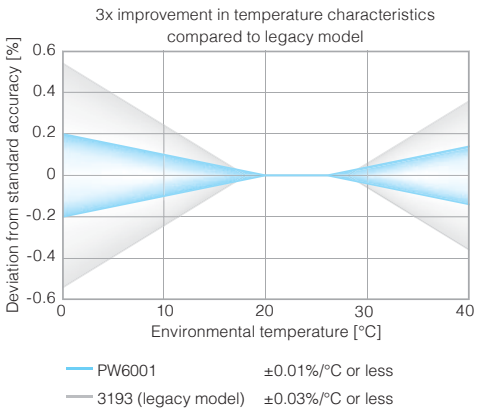
A wide frequency range is required for power measurement due to the acceleration of switching devices, especially SiC. High accuracy, broadband, and high stability. The PW6001's world-class technology-based fundamental performance makes in-depth power analysis a reality.



±0.02%* basic accuracy for power
Strengthened resistance to noise and temperature fluctuations in the absolute pursuit of measurement stability

The custom-shaped solid shield made completely of finely finished metal and optical isolation devices used to maintain sufficient creepage distance from the input terminals dramatically improve noise resistance, provide optimal stability, and achieve a CMRR performance of 80 dB/100 kHz. Add the superior temperature characteristics of ±0.01%/°C and you now have access to a power analyzer that delivers top-of-the-line measurement stability.

*Device accuracy only



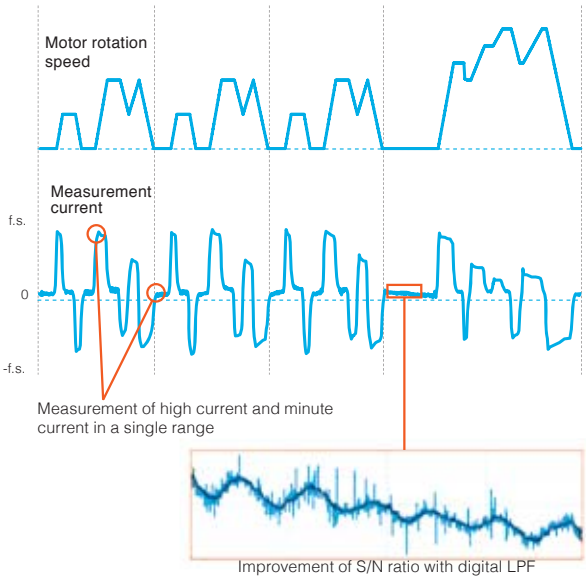
18-bit resolution, 5 MS/s sampling

Measurements based on sampling theorem are required to perform an accurate power analysis of PWM waveforms. The Hioki PW6001 features direct sampling of input signals at 5 MS/s, resulting in a measurement band of 2 MHz. This enables analysis without aliasing error.

TrueHD 18-bit converter* measures widely fluctuating loads with extreme accuracy

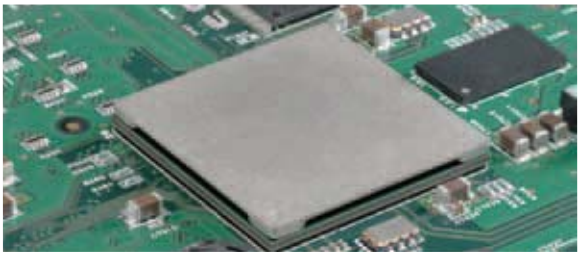
A built-in 18-bit A/D converter provides a broad dynamic range. Even loads with large fluctuations can be shown accurately down to tiny power levels without switching the range. Further, a digital LPF is used to remove unnecessary high-frequency noise, for accurate power analysis.

Conversion efficiency measurement during mode measurement without switching ranges

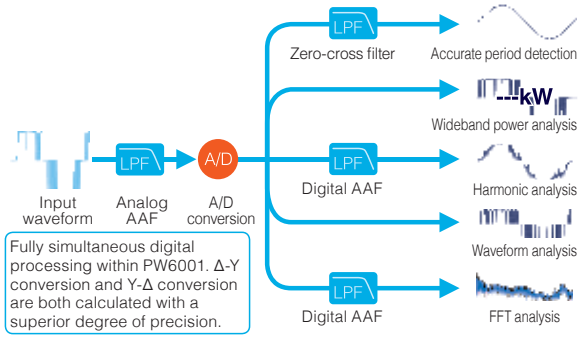


*True HD : True High Definition

Achieve lightning fast calculations for 5 independent signal paths at the same time with the Power Analysis Engine II



Calculations for up to five independent signal paths (period detection/broadband power analysis/harmonic analysis/waveform analysis/FFT analysis) are independently and digitally processed, eliminating any effects one may have on another. Achieve a 10 ms data update speed while maintaining full accuracy through high-speed processing.



* AAF (Anti-aliasing filter): This filter prevents aliasing errors during sampling.

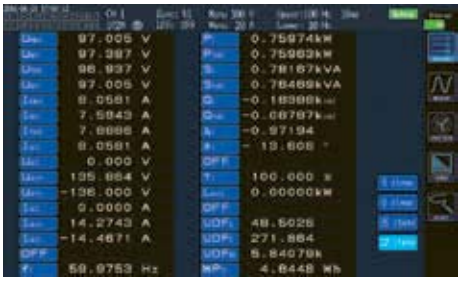
Functions and Characteristics

Newly Added Functions Ver.3.00

Ver. 3.00 If you already have the PW6001, these functions will be added with the firmware version update (free of charge).

Max Speed 10 ms, Maximum 12 ch* High Accuracy Power Calculation

Data updates in 10 ms to 200 ms. Make high speed calculations while maintaining high accuracy. Achieve measurement stability with original digital filter technology, and measure power after automatically tracking frequency fluctuations from 0.1 Hz.



* Two 6-channel model devices, during synchronized function usage

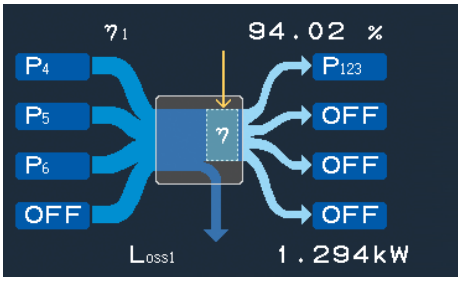
Extensive Current Sensor Lineup Achieve a Combined Basic Accuracy of ±0.04%

Choose the best sensor for your application: the pull-through type for highly accurate and high current measurements up to 1000 A, the clamp type for quick and easy wire connection, or the direct input type for high accuracy and broadband. Connect a sensor for oscilloscopes for even more options.
PW6001 comes equipped with a sensor power line built-in. Automated recognition functions make setup a cinch.

*±0.075% = accuracy in combination with PW9100

Simple, high-precision efficiency and loss calculations

When measuring DC/AC converter efficiency, accuracy is required not only for AC but also DC. The basic DC measurement accuracy of the PW6001 is ±0.02%, enabling you to make accurate and stable efficiency measurements.

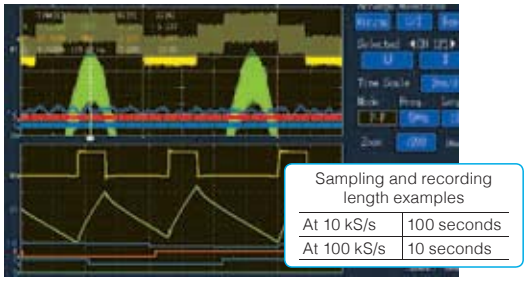


Setting up efficiency calculation formulas for power conditioners and similar equipment is simple on the dedicated screen. Simultaneously display loss and efficiency calculations for a maximum of four systems.

*Device accuracy

Ver. 3.00 Large-capacity waveform storage for oscilloscope/ PQA-level waveform analysis

Waveform Storage of 1 MWord × (voltage-current 6 ch + Motor Analysis 4 ch). The torque sensor and encoder signals are displayed along with the voltage and current waveforms.



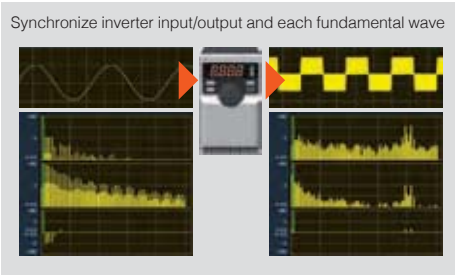
Sampling and recording length examples

At 10 kS/s	100 seconds
At 100 kS/s	10 seconds

In addition to level triggers, Ver. 3.00 now includes event trigger functions triggered by RMS value and frequency fluctuations. Cursor measurement and waveform zoom functions also render oscilloscopes unnecessary for waveform analysis.

Independent harmonic analysis for a maximum of 6 systems (wideband/IEC)

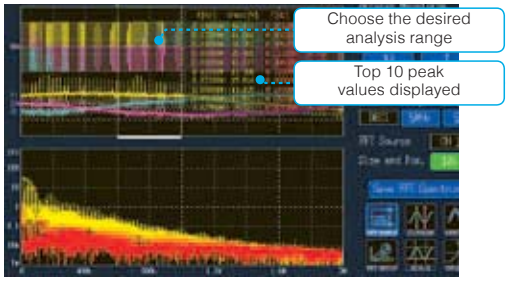
0.1 Hz to 300 kHz fundamental frequency, 1.5 MHz analyzable bandwidth. Comes equipped with IEC61000-4-7-compliant harmonic analysis and up to 100th order wideband harmonic analysis.



Applications
- Motor fundamental wave analysis
- Wireless power transmission waveforms
- Measuring distortion ratio of power conditioner output waveforms

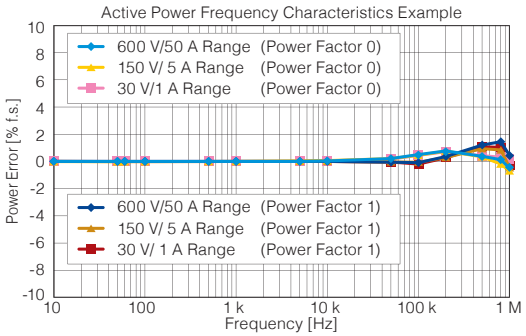
FFT analysis of target waveforms

Analyze frequencies up to 2 MHz across 2 channels. Specify any waveform analysis range you like and view the 10 highest peak values and frequencies. Observe frequency components that do not show up in harmonics and save the measured results.



Flat Frequency Characteristics

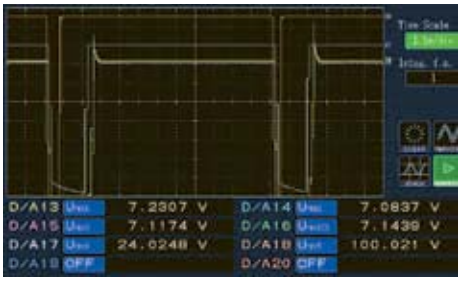
Frequency characteristics are flat up to 1 MHz even when the power factor is zero. Use together with the Current Sensor Phase Shift Function to make highly accurate low power factor measurements of high-frequency waves. Also ideal for loss assessment of high-frequency transformers and reactors.



* Options to further improve high-frequency wave phase characteristics available. Contact us for more information.

D/A Monitor

View up to 8 channels of progressive fluctuations in measured values. Voltage, current, power, frequency and other parameters are updated at the fastest rate of 10 ms, allowing you to observe even the tiniest variations.

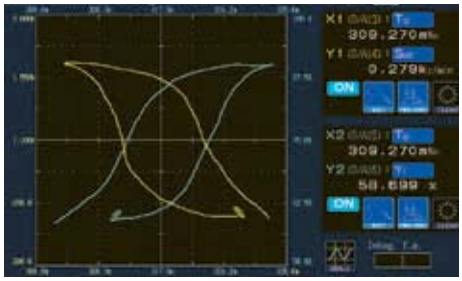


Applications
- Power conditioner FRT Analysis
- Motor Transient State Power Analysis

FRT (Fault Ride Through) :
Ability to continue operation despite system disturbance in the power conditioner or similar systems

X-Y Plot

Easily check correlations in measured values for up to two systems simultaneously. Plot physical quantities other than measured values as well by using it together with the user defined calculation function.



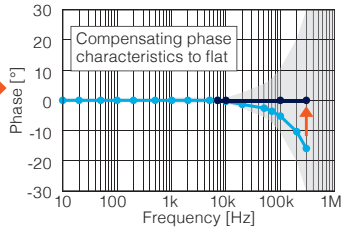
Applications
- Motor characteristics analysis
- Transformer characteristics analysis
- Power conditioner MPPT Analysis

MPPT: Maximum Power Point Tracker

Current Sensor Phase Shift Function

Our original virtual oversampling technology, evolved. Make phase compensation equivalent to 2 GS/s oscilloscopes a reality while maintaining 5 MS/s 18-bit high resolution. Perform current sensor phase compensation with a 0.01° resolution, and measure power more accurately (Ver. 2.00 and later). With the Current Sensor Phase Shift Function, you can now achieve even more accurate high frequency, low power factor power measurements.

Enter current sensor phase characteristic representative value as phase compensation value (please refer to instruction manual version 03 or later)



Virtual Oversampling: Technology where deskewing processing is performed virtually within the device at a much higher sampling frequency than the actual sampling frequency.

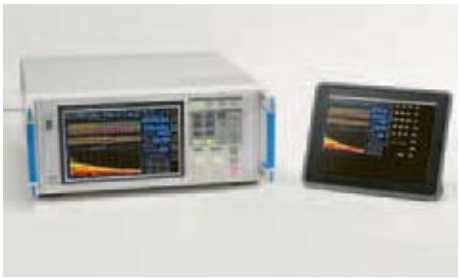
Complex calculation formulas settable on the device

Set equations to compute measurement values any way you want. Enter up to 16 calculation formulas, including functions like sin and log. Calculation results can be used as parameters for other calculation formulas, enabling complex analysis.

Applications
- Calculate multisystem efficiency and loss with solar power modules and similar equipment
- Calculate Ld.Lq for motor vector control
- Calculate transformer current B and H utilizing Epstein's Method

Supports various power analysis systems

Improved connectivity to PCs over LAN. Remotely operate the PW6001 using a browser from any PC, tablet, or smartphone via the HTTP server function. Acquire files through the network with the FTP server function. LabVIEW driver and MATLAB Toolkit are also available.



* LabVIEW is a registered trademark of NATIONAL INSTRUMENTS
*MATLAB is a registered trademark of Mathworks, Inc.

Specially designed for current sensors to achieve highly precise measurement

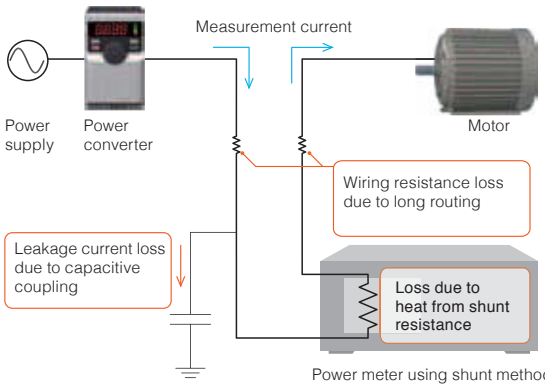
With direct wire connection method

The wiring of the measurement target is routed for connecting to the current input terminal. However, this results in an increase in the effects of wiring resistance and capacitive coupling, and meter loss occurs due to shunt resistance, all of which lead to larger accuracy uncertainty.

Advantages of current sensor method

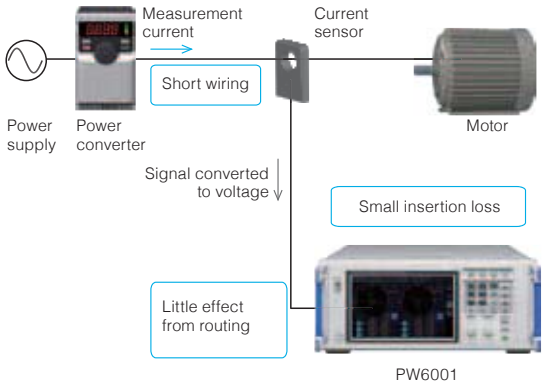
A current sensor is connected to the wiring on the measurement target. This reduces the effects of wiring and meter loss, allowing measurements with wiring conditions that are close to the actual operating environment for a highly efficient system.

Measurement example using the direct wire connection method



Power meter using shunt method

Measurement example using the current sensor method



PW6001

Compared to the direct wire connection method, measurement with conditions closer to the actual operation environment of a power converter is achieved.

Ver. 3.00 Seamless operability

Simple settings and intuitive operating interface. From Ver. 3.00, a low power factor measurement (LOW PF) mode is included.

9-inch touch screen with soft keypad

Quick Configuration screen*

Enter handwritten memos on the screen, or use the onscreen keypad

Wiring confirmation function, to avoid wiring mistakes

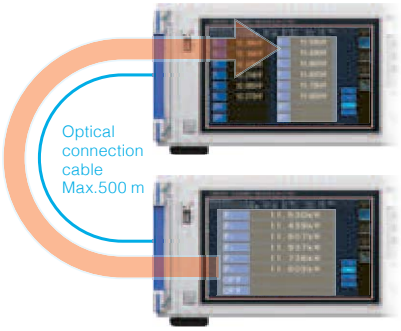
Dual knobs for vertical/horizontal manipulation of waveforms

One-touch data saving with dedicated key

* A low power factor measurement (LOW PF) mode for easily setting reactor and transformer loss measurement has been added.

Build a 12-channel power meter using “numerical synchronization”

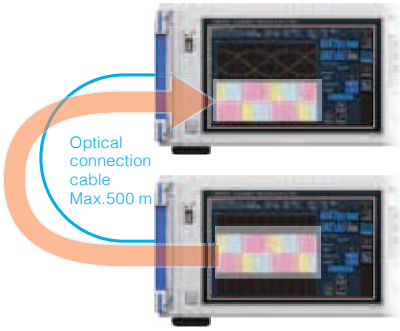
For multi-point measurements, use the numerical synchronization function to transfer power parameters from the slave device to aggregate at the master in real-time, essentially enabling you to build a 12-channel power analysis system



- Real-time display of slave instrument measurement values on master instrument screen
- Real-time efficiency calculations between master/slave
- Save data for 2 units on recording media in master instrument
- Use the slave’s measured values on the master’s user-defined calculations

Simply transfer waveforms with “waveform synchronization”

Achieve real-time* transfer of 5 MS/s 18-bit sampling data. Measurement waveforms on the slave instrument are displayed without modification on the master unit, paving the way for new applications for power analyzers, such as measurement of the voltage phase difference between two separate devices.



- Real-time display of slave instrument waveforms on master instrument screen
- Harmonic analysis and fundamental wave analysis for master instrument and slave instrument
- Simultaneously measure waveforms on master device while using the slave to trigger

* For both master instruments and slave instrument, waveform synchronization operates only when there are 3 or more channels. Max. ±5 sampling error.

Wide range of Motor Analysis functions

(Motor Analysis and D/A output model)

Enter signals from torque meters and speed meters to measure motor power. In addition to motor parameters such as motor power and electrical angle, output signals from insolation meters and wind speed meters can also be measured.

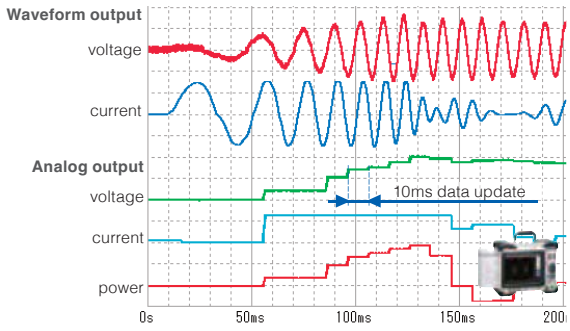
Operating mode		Single	Dual	Independent input
	ch A	Torque	Torque	Voltage/ Pulse
	ch B	Encoder A phase signal	Torque	Voltage/ Pulse
	ch C	Encoder B phase signal	RPM	Pulse
	ch D	Encoder Z phase signal	RPM	Pulse
Measurement targets		Motor x 1	Motor x 2, Motors, transmissions, etc.	Pyranometer/ anemometer and other output signals
Measurement parameters		Electric angle Rotation direction Motor power RPM Torque Slip	Motor power x 2 RPM x 2 Torque x 2 Slip x 2	Voltage x 2 & Pulse x 2 or Pulse x 4

Analog Output and 1 MS/s Waveform Output

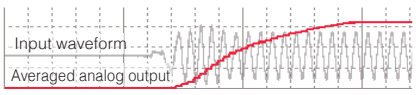
(Motor Analysis and D/A output model)

Output analog measurement data at update rates of up to 10ms. Combine with a data logger to record long-term fluctuations, and use the built-in waveform output function to output voltage and current at 1 MS/s*.

Analog output	Analog output x 20 channels
Waveform output	Waveform output x max. 12 channels* & analog output x 8 channels



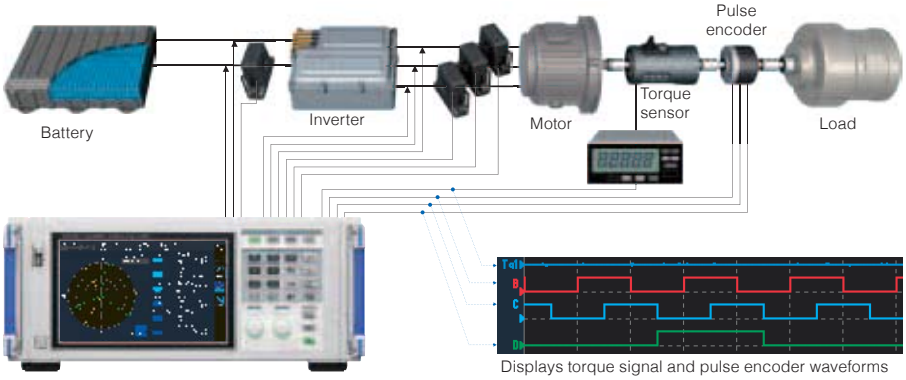
Averaging processing reproduces output responses similar to the Hioki legacy Model 3193



*During waveform output, accurate reproduction is possible at an output of 1 MS/s and with a sine wave up to 50 kHz.

Applications

EV/HEV inverter and motor analysis



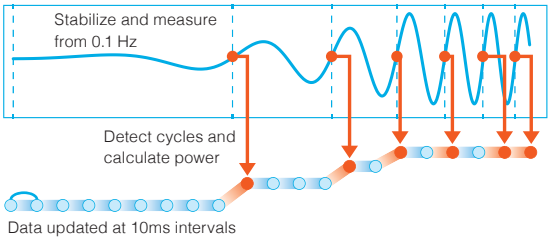
Displays torque signal and pulse encoder waveforms

Key features

Accuracy guaranteed @ 10ms data update	5MS/s high-speed sampling
±0.02% DC accuracy	Wideband mode harmonic analysis
Flexible efficiency calculation	Noise resistance
TrueHD 18-bit resolution	User-defined calculations
Current sensor phase shift function	Z phase synchronization

Ver. 3.00 Calculate transient state power with 10 ms high accuracy and high speed

Measure power transient states, including motor operations such as starting and accelerating, at 10ms update rates. Automatically measure and keep up with power with fluctuating frequencies, from a minimum of 0.1 Hz. Ver. 3.00 increases the stability of efficiency calculations further by delivering a function to calculate the electric power for one motor cycle.



Even during frequency fluctuations from low to high, the fundamental waveform is automatically pursued. Comes equipped with Δ-Y and Y-Δ conversion while calculating with a high degree of accuracy.

Advanced electrical angle measurement function

Comes equipped with electrical angle measurement necessary for vector control analysis via dq coordination systems as well as high efficiency synchronous motor parameter measurements. Measure voltage and current fundamental wave components based on encoder pulses in real time. In addition, analyze 4 quadrants of torque and rotation through detecting the forward/reverse from A-phasic and B-phasic pulses.

Calculation of the d, and q-axis inductances

$$Ld = \frac{vq - Ke \cdot \omega - R \cdot iq}{\omega \cdot id}$$

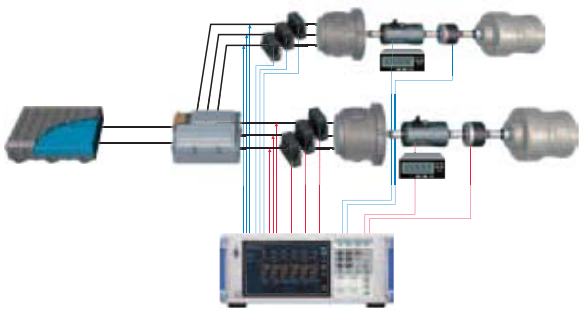
$$Lq = \frac{R \cdot id - vd}{\omega \cdot iq}$$

Calculate the Ld and Lq values with user-defined operation

* For more information about electrical angle measurements, please refer to "Technical Notes: HIOKI Power Analyzer PW6001's PMSM Parameter Identification Methodology" available on the HIOKI website.

Simultaneous measurement of 2 motor powers

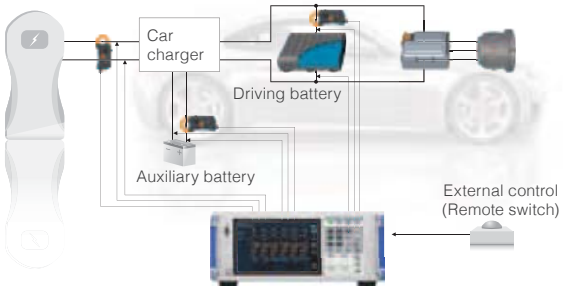
The PW6001 is engineered with the industry's first built-in dual mode motor analysis function that delivers the simultaneous analysis of 2 motors. Simultaneous measurement of the motor power for HEV driving and power generation is now possible.



Example of 2 motor measurement

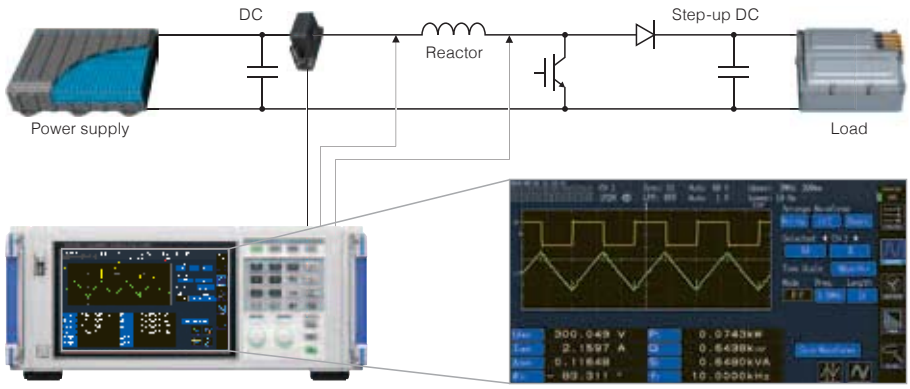
Evaluate WLTC Mode Performance - A New Fuel Economy Standard

Taking fuel economy measurements that comply with WLTP international standards requires the precise measurement of current integration and power integration for the recharging/discharging of each battery in the system. High accuracy clamp current sensors, the excellent DC accuracy of the PW6001, and the ability to integrate current and power at 10 ms intervals work together in unison to effectively meet this application.



* WLTC (Worldwide harmonized Light duty driving Test Cycle)
WLTP (Worldwide harmonized Light duty driving Test Procedure)

Chopper circuit reactor loss measurement

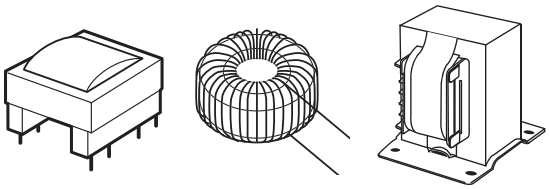


Key features

- TrueHD 18-bit resolution
- CMRR 80dB/100 kHz
- 5MS/s high-speed sampling
- Current sensor phase shift function
- Wideband mode harmonic analysis
- Noise resistance
- User-defined calculations

Ver. 3.00 High-frequency and low power factor device evaluation

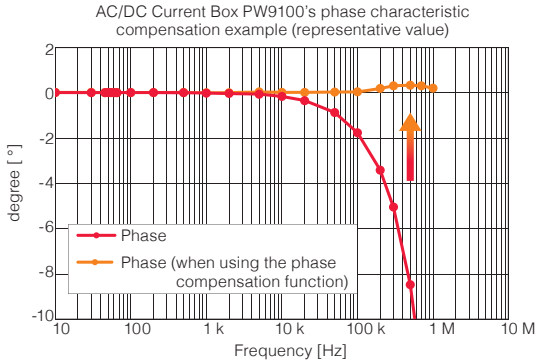
Reactors are used for high harmonic current suppression as well as the voltage step up/down of chopper circuits. The PW6001's outstanding high frequency characteristics, high-speed sampling, and noise-suppressing performance are extremely effective in evaluating high-frequency, low power factor devices (reactors, transformers, etc.).
With the addition of a low power factor measurement (LOW PF) mode to the Quick Configuration menu in Ver. 3.00, measurements can now be performed even more quickly.



* For more information about reactor loss measurements, please refer to "Technical Notes: High-Frequency Reactor Loss Measurement" available on the HIOKI website.

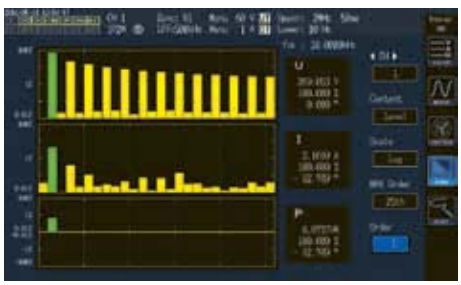
Current Sensor Phase Shift Function

In addition to the PW6001's flat, broad frequency characteristics, sensor phase error compensation allows highly accurate high-frequency and low power factor device analysis.



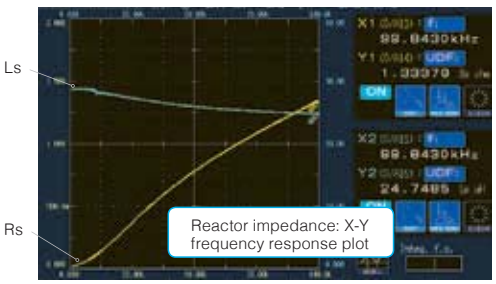
Harmonic analysis synchronized with switching frequencies

With the PW6001 you can perform harmonic analysis of fundamental waves up to 300 kHz with a band frequency of 1.5 MHz. For reactors used by chopper circuits, measure phase angles and RMS values for the current and voltage of each harmonic order through harmonic analysis synchronized with the switching frequency.



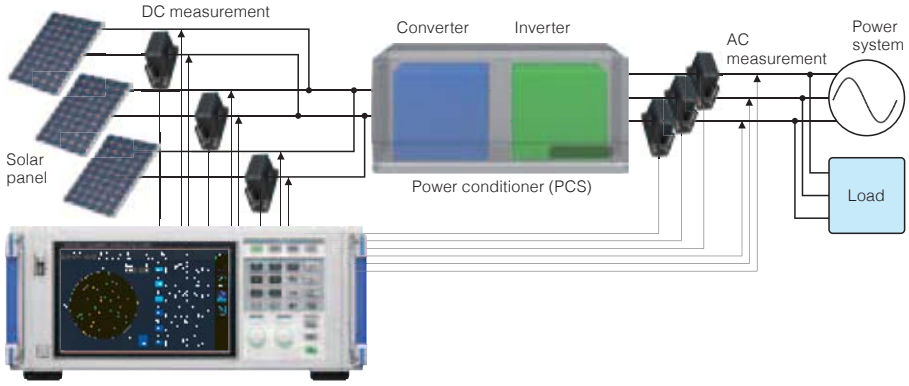
Circuit impedance analysis

Calculate circuit impedance, resistance, and inductance by using harmonic analysis results and user defined calculations. X-Y plot functions are especially effective for impedance analysis.



- Impedance Z [Ω]
  = fundamental frequency voltage / fundamental frequency current
- Serial resistance RS [Ω]
  = Z × cos (voltage phase angle - current phase angle)
- Serial inductance Ls [H]
  = Z × sin (voltage phase angle - current phase angle) / (2 × π × frequency)

PV Power Conditioner (PCS) Efficiency Measurement



Key features

- ±0.02% DC accuracy
- Frequency accuracy ±0.01 Hz
- Various measurement parameters
- Event triggers
- Independent input for Motor Analysis
- IEC mode harmonic analysis
- Integration of purchased electricity

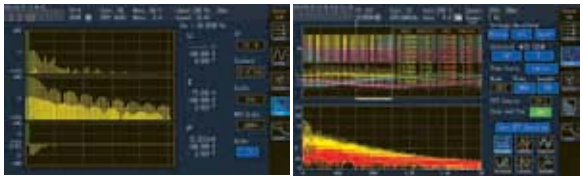
Supports PCS-specific measurements

Simultaneously display the necessary parameters for PCS such as efficiency, loss, fundamental wave reactive power Qfnd, DC ripple ratio, three-phrase unbalanced factor, etc. Easily check the required measured items for improved test efficiency. In addition, by setting the DC power sync source to the output AC power channel, you can perform DC output and stable efficiency measurements perfectly synchronized with the output AC.

P4: DC power (panel output)
P123: 3-phase power (power conditioner output)
η1: Conversion efficiency
Urf4: Ripple rate
f1: Frequency
Uthd1: Voltage total harmonic distortion
Uunb123: Unbalance rate
Qfnd123: Fundamental wave reactive power

Harmonic analysis and higher order harmonic analysis (noise analysis)

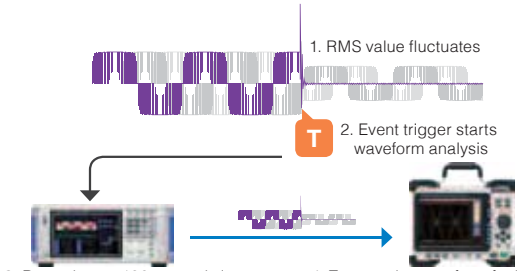
Equipped with IEC standard mode supporting IEC61000-4-7. Arbitrarily set THD calculated upper limit orders also based on the standard's requirements. In addition, measure 2 kHz – 150 kHz high-order harmonics (noise that is not synchronized with the power frequency) through FFT analysis.
General CTs are not defined for accuracy beyond 60Hz. On the other hand, Hioki current sensors are guaranteed for accuracy even for harmonic measurements.



Measure output harmonics and noise through input waveform FFT analysis

Ver. 3.00 Use event triggers to analyze waveforms

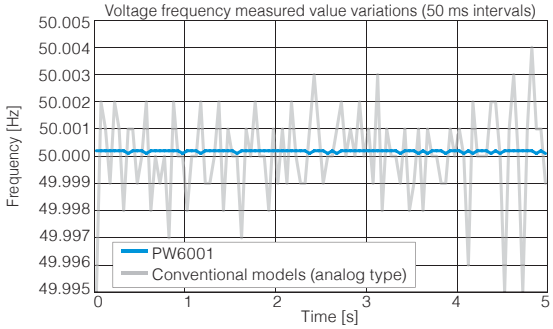
An event trigger function is now available with Ver.3.00. Set triggers for up to four measurement items, such as RMS value and frequency, and record waveforms during an event for up to 100 seconds. If you need to record waveforms for more than 100 seconds, use the D/A output function (Motor Analysis & D/A output option) to observe and record waveforms with a recorder, simplifying the evaluation system. (It is not necessary to connect a differential probe or current probe to the recorder.)



3. Record up to 100 seconds in the PW6001 internal memory
4. To record a waveform for longer than 100 seconds, use a recorder to record the D/A output waveform

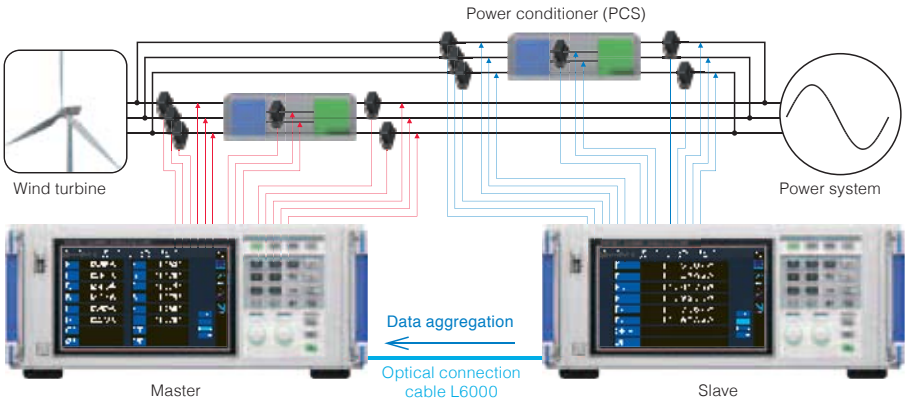
Voltage frequency measurement fundamental accuracy of ± 0.01 Hz*

Perform frequency measurements required for each PCS test with world-class accuracy and stability. Achieve highly accurate frequency measurement values for a maximum of 6 ch (12 ch when there are two devices) while measuring each parameter at the same time.



* ±0.01 Hz fundamental accuracy is defined for cases where the data update is over 50 ms. Please contact us for even more precise frequency measurement.

Power conversion for wind power generation



Key features

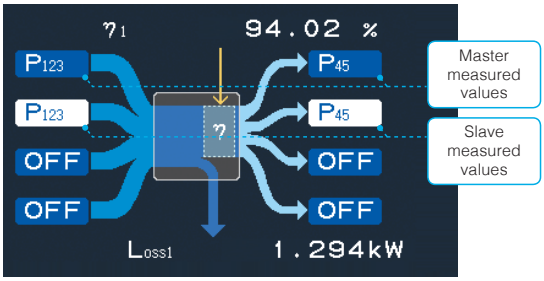
- Zero-cross filter
- Event triggers
- Numerical synchronization Max. 12 channels
- Flexible efficiency calculation
- 2-system vector display
- IEC mode harmonic analysis

Simultaneous analysis of system and power generation

With the dual vector display, you can see the 3-phase balancing conditions for both the system and power generation at a glance.

PCS efficiency measurements

Perfectly synchronize and measure a two-system PCS by using the numerical synchronization function.



All power parameters can be aggregated on the master instrument, and the efficiency for each or the overall efficiency can be calculated and displayed.

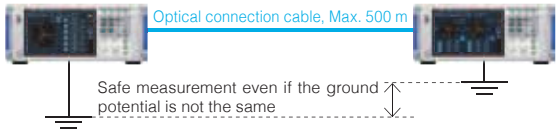
Test and evaluate substations, plants and railroads

Key features

- Waveform synchronization
- Event triggers
- Waveform synchronization

Measure phase difference between 2 separate points

Use the waveform synchronization function to measure the phase relationship between 2 points separated by a maximum distance of 500 m. Due to insulation with an optical connection cable, measurement can be performed safely even if the ground potential between the 2 points is not the same.



D/A output waveforms captured 500m away

Transfer voltage/current waveforms taken by the slave instrument located as far as 500m away and output the signals from the master device. When combined with a Hioki MEMORY HiCORDER, timing tests and simultaneous analysis of multiple channels for 3-phase power are possible.

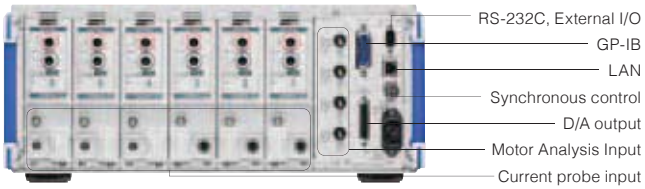
Max. analog 32 channels + logic 32 channels
MEMORY HiCORDER MR8827

* The waveform that is output has a delay of 7 µs to 12 µs, depending on the distance.

Interfaces

Download the communication command manual from the HIOKI website at www.hioki.com

Names of parts



GP-IB	Data viewable through dedicated application Command control
RS-232C	Data viewable through dedicated application Command control Bluetooth® logger connection Send the D/A output of values measured with the PW6001 (maximum of 8 items) wirelessly to the Hioki Wireless Logging Station LR8410 using the dedicated cable and Bluetooth® serial conversion adapter. (Approx. 30m* line of sight)The observable output resolution is dependent on the LR8410's resolution. * The presence of obstructions (walls, metal, etc.) may shorten the communication range or destabilize the signal. * Bluetooth® is a trademark of Bluetooth SIG, Inc. and licensed for use by HIOKI E.E. CORPORATION.
External I/O	START/ STOP/ DATA RESET control Terminals shared with RS-232C, ±5 V/200 mA power supply possible
LAN	Gbit LAN supported Command control View data in free dedicated application

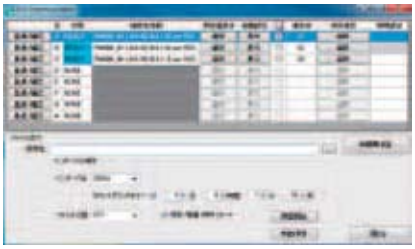
Synchronous control	Optical connection cable connector, Duplex-LC (2-core)
D/A output (PW6001-11 to 16 only)	Switching for 20 channels of analog output or maximum 12 channels of waveform + 8 channels of analog output
Current probe input component	Power can also be supplied from the PW6001 to Probe1 or Probe2 by using the sliding cover.
Motor Analysis input component	Input signals from torque meters or rotation meters to measure motor power. Measure motor signals including electric angle and motor power from instruments such as actinometers and anemometers.
USB flash drive	Save waveform data/measured data (csv) Save screen copy (bmp) Save interval data (csv) in real time at the fastest interval of 10 ms
64 MB internal memory	Save interval data and send it to a USB flash drive later

Software

Download the software and drivers below from the HIOKI website at www.hioki.com

PC Communication Software PW Communicator

PW Communicator is a dedicated application software for communicating between a PW6001 power meter and a PC. Free download is available from the Hioki website. The application contains convenient functions for setting the PW6001, monitoring the measurement values, acquiring data via communication, computing efficiency, and much more.



Value monitoring	Display the PW6001's measurement values on the PC screen. Freely select up to 64 values, such as voltage, current, power, and harmonics.
Waveform monitoring	Monitor the voltage, current, and waveforms measured by the meter right on the PC screen.
Meter setting	Configure the connected PW6001 from the PC screen.
Measure with multiple units	Compute the input/output efficiency of a power converter and similar operations when using multiple units of PW6001. In addition to the PW6001, you can also batch control other Hioki power meters, such as the PW3335, PW3336, and PW3337.
Save in CSV format	Record 180 or more measurement data to a CSV file at fixed intervals.The shortest interval between recordings is 200 ms.

Operating environment	PC/AT-compatible
OS	Windows 10/Windows 8/Windows 7 (32 bit/64 bit) *Windows is a registered trademark of Microsoft Corporation.
Memory	2GB or more recommended
Interface	LAN, RS-232C, GP-IB

LabVIEW driver

Obtain data and configure measurement systems with the LabVIEW driver.
*LabVIEW is a registered trademark of NATIONAL INSTRUMENTS.

MATLAB Toolkit

Control the PW6001 with MATLAB through an Ethernet connection and read the PW6001's waveform binary data.
*MATLAB is a registered trademark of Mathworks, Inc.

Specifications

Power measurement

Measurement lines	1-phase/2-wire (1P2W), 1-phase/3-wire (1P3W), 3-phase/3-wire (3P3W2M, 3V3A, 3P3W3M), 3-phase/4-wire (3P4W)

	CH1	CH2	CH3	CH4	CH5	CH6
Pattern 1	1P2W	1P2W	1P2W	1P2W	1P2W	1P2W
Pattern 2	1P3W / 3P3W2M		1P2W	1P2W	1P2W	1P2W
Pattern 3	1P3W / 3P3W2M		1P2W	1P3W / 3P3W2M		1P2W
Pattern 4	1P3W / 3P3W2M		1P3W / 3P3W2M		1P3W / 3P3W2M	
Pattern 5	3P3W3M / 3V3A / 3P4W			1P2W	1P2W	1P2W
Pattern 6	3P3W3M / 3V3A / 3P4W			1P3W / 3P3W2M		1P2W
Pattern 7	3P3W3M / 3V3A / 3P4W			3P3W3M / 3V3A / 3P4W		

For 2-channel combinations, select 1P3W or 3P3W2M.
For 3-channel combinations, select 3P3W3M, 3V3A, or 3P4W.

Number of channels	1	2	3	4	5	6
Pattern 1	✓	✓	✓	✓	✓	✓
Pattern 2	–	✓	✓	✓	✓	✓
Pattern 3	–	–	–	–	–	✓
Pattern 4	–	–	–	✓	–	✓
Pattern 5	–	–	✓	✓	✓	✓
Pattern 6	–	–	–	–	✓	✓
Pattern 7	–	–	–	–	–	✓

Connection patterns that can be selected based on the number of channels:
[✓] Can be selected, [–] Cannot be selected

Number of input channels	Max. 6 channels; each input unit provides 1 channel for simultaneous voltage and current input
Input terminal profile	Voltage: Plug-in terminals (safety terminals) Probe 1: Dedicated connector (ME15W) Probe 2: BNC (metal) + power supply terminal
Probe 2 power supply	+12 V ±0.5 V, -12 V ±0.5 V, max. 600 mA, up to a max. of 700 mA for up to 3 channels
Input method	Voltage measurement unit: Photoisolated input, resistance voltage divider Current measurement unit: Isolated input from current sensor (voltage output)
Voltage range	6 V / 15 V / 30 V / 60 V / 150 V / 300 V / 600 V / 1500 V
Current range (Probe 1)	400 mA / 800 mA / 2 A / 4 A / 8 A / 20 A (with 20 A sensor) 4 A / 8 A / 20 A / 40 A / 80 A / 200 A (with 200 A sensor) 1 A / 2 A / 5 A / 10 A / 20 A / 50 A (with 50 A sensor) 10 A / 20 A / 50 A / 100 A / 200 A / 500 A (with 500 A sensor) 20 A / 40 A / 100 A / 200 A / 400 A / 1 kA (with 1000 A sensor)
(Probe 2)	1 kA / 2 kA / 5 kA / 10 kA / 20 kA / 50 kA (with 0.1 mV/A sensor) 100 A / 200 A / 500 A / 1 kA / 2 kA / 5 kA (with 1 mV/A sensor) 10 A / 20 A / 50 A / 100 A / 200 A / 500 A (with 10 mV/A sensor; with 3274 or 3275) 1 A / 2 A / 5 A / 10 A / 20 A / 50 A (with 100 mV/A sensor; with 3273 or 3276) 100 mA / 200 mA / 500 mA / 1 A / 2 A / 5 A (with 1 V/A sensor; with CT6700 or CT6701) (0.1 V / 0.2 V / 0.5 V / 1.0 V / 2.0 V / 5.0 V range)
Power range	2.40000 W to 4.50000 MW (depending on voltage and current combinations)
Crest factor	3 (relative to voltage/current range rating); however, 1.33 for 1500 V range, 1.5 for 5 V Probe 2 range 300 (relative to minimum valid voltage and current input); however, 133 for 1500 V range, 150 for 5 V Probe 2 range
Input resistance (50 Hz / 60 Hz)	Voltage inputs: 4 MΩ ±40 kΩ Probe 1 inputs: 1 MΩ ±50 kΩ Probe 2 inputs: 1 MΩ ±50 kΩ
Maximum input voltage	Voltage inputs: 1000 V, ±2000 Vpeak (10 ms or less) Input voltage frequency of 250 kHz to 1 MHz, (1250 - f) V Input voltage frequency of 1 MHz to 5 MHz, 50 V Unit for f above: kHz Probe 1 inputs: 5 V, ±12 Vpeak (10 ms or less) Probe 2 inputs: 8 V, ±15 Vpeak (10 ms or less)
Maximum rated voltage to earth	Voltage input terminal (50 Hz/60 Hz) CATIII 600V; anticipated transient overvoltage: 6000V CATII 1000V; anticipated transient overvoltage: 6000V
Measurement method	Voltage/current simultaneous digital sampling with zero-cross synchronized calculation
Sampling	5 MHz / 18 bits
Frequency band	DC, 0.1 Hz to 2 MHz
Synchronization frequency range	0.1 Hz to 2 MHz
Synchronization source	U1 to U6, I1 to I6, DC (fixed at data update rate), Ext1 to Ext2, Zph, CH C, CH D The zero-cross point of the waveform after passing through the zero-cross filter is used as the standard for U or I selection.
Data update rate	10 ms / 50 ms / 200 ms When using simple averaging, the data update rate varies based on the number of averaging iterations.
LPF	500 Hz / 1 kHz / 5 kHz / 10 kHz / 50 kHz / 100 kHz / 500 kHz / OFF Approx. 500 kHz analog LPF + digital IIR filter (Butterworth characteristics equivalent) Except when off, add ±0.1% rdg. to the accuracy. Defined for frequencies that are less than or equal to 1/10 of the set frequency.
Polarity detection voltage	Current zero-cross timing comparison
Measurement parameters	Voltage (U), current (I), active power (P), apparent power (S), reactive power (Q), power factor (λ), phase angle (φ), frequency (f), efficiency (η), loss (Loss), voltage ripple factor (Urf), current ripple factor (Irf), current integration (Ih), power integration (WP), voltage peak (Upk), current peak (Ipk)
Effective measurement range	Voltage, current, power: 1% to 110% of range
Zero-suppression range	Select from OFF / 0.1% f.s. / 0.5% f.s. When set to OFF, a value may be displayed even when receiving zero input.
Zero-adjustment	Zero-adjustment of input offsets that are less than ±10% f.s. for voltage and ±10% f.s. ±4 mV for current

Accuracy	Sine wave input with a power factor of 1 or DC input, terminal-to-ground voltage of 0 V, after zero-adjustment Within the effective measurement range

	Voltage (U)	Current (I)
DC	±0.02% rdg. ±0.03% f.s.	±0.02% rdg. ±0.03% f.s.
0.1 Hz ≤ f < 30 Hz	±0.1% rdg. ±0.2% f.s.	±0.1% rdg. ±0.2% f.s.
30 Hz ≤ f < 45 Hz	±0.03% rdg. ±0.05% f.s.	±0.03% rdg. ±0.05% f.s.
45 Hz ≤ f ≤ 66 Hz	±0.02% rdg. ±0.02% f.s.	±0.02% rdg. ±0.02% f.s.
66 Hz < f ≤ 1 kHz	±0.03% rdg. ±0.04% f.s.	±0.03% rdg. ±0.04% f.s.
1 kHz < f ≤ 50 kHz	±0.1% rdg. ±0.05% f.s.	±0.1% rdg. ±0.05% f.s.
50 kHz < f ≤ 100 kHz	±0.01×f% rdg. ±0.2% f.s.	±0.01×f% rdg. ±0.2% f.s.
100 kHz < f ≤ 500 kHz	±0.008×f% rdg. ±0.5% f.s.	±0.008×f% rdg. ±0.5% f.s.
500 kHz < f ≤ 1 MHz	±(0.021×f-7)% rdg. ±1% f.s.	±(0.021×f-7)% rdg. ±1% f.s.
Frequency band	2 MHz (-3 dB, typical)	2 MHz (-3 dB, typical)

	Active power (P)	Phase difference
DC	±0.02% rdg. ±0.05% f.s.	–
0.1 Hz ≤ f < 30 Hz	±0.1% rdg. ±0.2% f.s.	±0.1°
30 Hz ≤ f < 45 Hz	±0.03% rdg. ±0.05% f.s.	±0.05°
45 Hz ≤ f ≤ 66 Hz	±0.02% rdg. ±0.03% f.s.	±0.05°
66 Hz < f ≤ 1 kHz	±0.04% rdg. ±0.05% f.s.	±0.05°
1 kHz < f ≤ 10 kHz	±0.15% rdg. ±0.1% f.s.	±0.4°
10 kHz < f ≤ 50 kHz	±0.15% rdg. ±0.1% f.s.	±(0.040×f)°
50 kHz < f ≤ 100 kHz	±0.012×f% rdg. ±0.2% f.s.	±(0.050×f)°
100 kHz < f ≤ 500 kHz	±0.009×f% rdg. ±0.5% f.s.	±(0.055×f)°
500 kHz < f ≤ 1 MHz	±(0.047×f-19)% rdg. ±2% f.s.	±(0.055×f)°

- Unit for f in accuracy calculations as mentioned in the table above: kHz
- Voltage and current DC values are defined for Udc and Idc, while frequencies other than DC are defined for Urms and Irms.
- When U or I is selected as the synchronization source, accuracy is defined for source input of at least 5% f.s.
- The phase difference is defined for a power factor of zero during f.s. input.
- Add the current sensor accuracy to the above accuracy figures for current, active power, and phase difference.
- For the 6 V range, add ±0.05% f.s. for voltage and active power.
- Add ±20 µV to the DC accuracy for current and active power when using Probe 1 (however, 2 V f.s.).
- Add ±0.05% rdg. ±0.2% f.s. for current and active power when using Probe 2, and add ±0.2° to the phase at or above 10 kHz.
- The accuracy figures for voltage, current, active power, and phase difference for 0.1 Hz to 10 Hz are reference values.
- The accuracy figures for voltage, active power, and phase difference in excess of 220 V from 10 Hz to 16 Hz are reference values.
- The accuracy figures for voltage, active power, and phase difference in excess of 750 V for values of f such that 30 kHz < f ≤ 100 kHz are reference values.
- The accuracy figures for voltage, active power, and phase difference in excess of (22000/f [kHz]) V for values of f such that 100 kHz < f ≤ 1 MHz are reference values.
- Add ±0.02% rdg. for voltage and active power at or above 1000 V (however, figures are reference values).
  Even for input voltages that are less than 1000 V, the effect will persist until the input resistance temperature falls.
- For voltages in excess of 600 V, add the following to the phase difference accuracy:
  - 500 Hz < f ≤ 5 kHz: ±0.3°
  - 5 kHz < f ≤ 20 kHz: ±0.5°
  - 20 Hz < f ≤ 200 kHz: ±1°

Measurement parameters	Accuracy
Apparent power	Voltage accuracy + current accuracy ±10 dgt.
Reactive power	Apparent power accuracy + $(\sqrt{2.69 \times 10^{-4} \times f + 1.0022} - \lambda^2 - \sqrt{1-\lambda^2}) \times 100\%$ f.s.
Power factor	φ of other than ±90°: $\pm\left(1-\frac{\cos(\phi + \text{phase difference accuracy})}{\cos(\phi)}\right) \times 100\%$rdg. ± 50dgt. φ of ±90°: ±cos (φ + phase difference accuracy) × 100% f.s. ±50 dgt.
Waveform peak	Voltage/current RMS accuracy ±1% f.s. (f.s.: apply 300% of range)

f: kHz; φ: Display value for voltage/current phase difference;
λ: Display value for power factor

Effects of temperature and humidity	Add the following to the voltage, current, and active power accuracy within the range of 0°C to 20°C or 26°C to 40°C: ±0.01% rdg./°C (add 0.01% f.s./°C for DC measured values) For current and active power when using Probe 2, ±0.02% rdg./°C (add 0.05% f.s./°C for DC measured values) Under conditions of 60% RH or greater: Add ±0.0006 × humidity [%RH] × f [kHz]% rdg. to the voltage and active power accuracy. Add ±0.0006 × humidity [%RH] × f [kHz]° for the phase difference.
Effects of common-mode voltage	50 Hz/60 Hz : 100 dB or greater (when applied between the voltage inputterminals and the enclosure) 100 kHz : 80 dB or greater (reference value) Defined for CMRR when the maximum input voltage is applied for all measurement ranges.
Effects of external magnetic fields	±1% f.s. or less (in a magnetic field of 400 A/m, DC or 50 Hz/ 60 Hz)
Effects of power factor	φ of other than ±90°: $\pm\left(1-\frac{\cos(\phi + \text{phase difference accuracy})}{\cos(\phi)}\right) \times 100\%$rdg. φ of ±90°: ±cos (φ + phase difference accuracy) × 100% f.s.

Frequency measurement

Number of measurement channels	Max. 6 channels (f1 to f6), based on the number of input channels
Measurement source	Select from U/I for each connection.
Measurement method	Reciprocal method + zero-cross sampling value correction Calculated from the zero-cross point of waveforms after application of the zero-cross filter.
Measurement range	0.1 Hz to 2 MHz (Display shows 0.00000 Hz or ----- Hz if measurement is not possible.)
Accuracy	±0.01Hz (Only when measuring 45-66 Hz with a minimum measurement interval of 50 ms and sine input of at least 50% relative to the voltage range when measuring the voltage frequency.) ±0.05% rdg ± 1 dgt. (other than the conditions mentioned above, when the sine wave is at least 30% relative to the measurement source's measurement range)
Display format	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, 0.99000 MHz to 2.00000 MHz

Integration measurement

Measurement modes	Select RMS or DC for each connection (DC mode can only be selected when using an AC/DC sensor with a 1P2W connection).
Measurement parameters	Current integration (Ih+, Ih-, Ih), active power integration (WP+, WP-, WP) Ih+ and Ih- are measured only in DC mode. Only Ih is measured in RMS mode.
Measurement method	Digital calculation based on current and active power values DC mode: Every sampling interval, current values and instantaneous power values are integrated separately for each polarity. RMS mode: The current RMS value and active power value are integrated for each measurement interval. Only active power is integrated separately for each polarity.
Display resolution	999999 (6 digits + decimal point), starting from the resolution at which 1% of each range is f.s.
Measurement range	0 to ±9999.99 TAh/TWh
Integration time	10 sec. to 9999 hr. 59 min. 59 sec.
Integration time accuracy	±0.02% rdg. (0°C to 40°C)
Integration accuracy	±(current or active power accuracy) ±integration time accuracy
Backup function	None

Harmonics measurement

Number of measurement channels	Max. 6 channels, based on the number of built-in channels
Synchronization source	Based on the synchronization source setting for each connection.
Measurement modes	Select from IEC standard mode or wideband mode (setting applies to all channels).
Measurement parameters	Harmonic voltage RMS value, harmonic voltage content ratio, harmonic voltage phase angle, harmonic current RMS value, harmonic current content ratio, harmonic current phase angle, harmonic active power, harmonic power content ratio, harmonic voltage/current phase difference, total voltage harmonic distortion, total current harmonic distortion, voltage unbalance ratio, current unbalance ratio
FFT processing word length	32 bits
Antialiasing	Digital filter (automatically configured based on synchronization frequency)
Window function	Rectangular
Grouping	OFF / Type 1 (harmonic sub-group) / Type 2 (harmonic group)
THD calculation method	THD_F / THD_R (Setting applies to all connections.) Select calculation order from 2nd order to 100th order (however, limited to the maximum analysis order for each mode).

(1) IEC standard mode

Measurement method	Zero-cross synchronization calculation method (same window for each synchronization source) Fixed sampling interpolation calculation method with average thinning in window IEC 61000-4-7:2002 compliant with gap overlap
Synchronization frequency range	45 Hz to 66 Hz
Data update rate	Fixed at 200 ms.
Analysis orders	0th to 50th
Window wave number	When less than 56 Hz, 10 waves; when 56 Hz or greater, 12 waves
Number of FFT points	4096 points

Accuracy

Frequency	Harmonic voltage and current	Harmonic power	Phase difference
DC (0th order)	±0.1% rdg. ±0.1% f.s.	±0.1% rdg. ±0.2% f.s.	--
45 Hz ≤ f ≤ 66 Hz	±0.2% rdg. ±0.04% f.s.	±0.4% rdg. ±0.05% f.s.	±0.08°
66 Hz < f ≤ 440 Hz	±0.5% rdg. ±0.05% f.s.	±1.0% rdg. ±0.05% f.s.	±0.08°
440 Hz < f ≤ 1 kHz	±0.8% rdg. ±0.05% f.s.	±1.5% rdg. ±0.05% f.s.	±0.4°
1 kHz < f ≤ 2.5 kHz	±2.4% rdg. ±0.05% f.s.	±4% rdg. ±0.05% f.s.	±0.4°
2.5 kHz < f ≤ 3.3 kHz	±6% rdg. ±0.05% f.s.	±10% rdg. ±0.05% f.s.	±0.8°

Unit for f in accuracy calculations as mentioned in the table above: kHz
Power is defined for a power factor of 1.
Accuracy specifications are defined for fundamental wave input that is greater than or equal to 50% of the range.
Add the current sensor accuracy to the above accuracy figures for current, active power, and phase difference.
Add ±0.02% rdg. for voltage and active power at or above 1000 V (however, figures are reference values).
Even for input voltages that are less than 1000 V, the effect will persist until the input resistance temperature falls.

(2) Wideband mode

Measurement method	Zero-cross synchronization calculation method (same window for each synchronization source) with gaps Fixed sampling interpolation calculation method
Synchronization frequency range	0.1 Hz to 300 kHz
Data update rate	Fixed at 50 ms.

Maximum analysis order and Window wave number

Frequency	Window wave number	Maximum analysis order
0.1 Hz ≤ f < 80 Hz	1	100th
80 Hz ≤ f < 160 Hz	2	100th
160 Hz ≤ f < 320 Hz	4	60th
320 Hz ≤ f < 640 Hz	2	60th
640 Hz ≤ f < 6 kHz	4	50th
6 kHz ≤ f < 12 kHz	2	50th
12 kHz ≤ f < 25 kHz	4	50th
25 kHz ≤ f < 50 kHz	8	30th
50 kHz ≤ f < 101 kHz	16	15th
101 kHz ≤ f < 201 kHz	32	7th
201 kHz ≤ f ≤ 300 kHz	64	5th

Phase zero-adjustment	The instrument provides phase zero-adjustment functionality using keys or communications commands (only available when the synchronization source is set to Ext).

Accuracy

Add the following to the accuracy figures for voltage (U), current (I), active power (P), and phase difference. (Unit for f in following table: kHz)

Frequency	Harmonic voltage and current	Harmonic power	Phase difference
DC	±0.1% f.s.	±0.2% f.s.	-
0.1 Hz ≤ f < 30 Hz	±0.05% f.s.	±0.05% f.s.	±0.1°
30 Hz ≤ f < 45 Hz	±0.1% f.s.	±0.2% f.s.	±0.1°
45 Hz ≤ f ≤ 66 Hz	±0.05% f.s.	±0.1% f.s.	±0.1°
66 Hz < f ≤ 1 kHz	±0.05% f.s.	±0.1% f.s.	±0.1°
1 kHz < f ≤ 10 kHz	±0.05% f.s.	±0.1% f.s.	±0.6°
10 kHz < f ≤ 50 kHz	±0.2% f.s.	±0.4% f.s.	±(0.020×f)° ±0.5°
50 kHz < f ≤ 100 kHz	±0.4% f.s.	±0.5% f.s.	±(0.020×f)° ±1°
100 kHz < f ≤ 500 kHz	±1% f.s.	±2% f.s.	±(0.030×f)° ±1.5°
500 kHz < f ≤ 900 kHz	±4% f.s.	±5% f.s.	±(0.030×f)° ±2°

Unit for f in accuracy calculations as mentioned in the table above: kHz
The figures for voltage, current, power, and phase difference for frequencies in excess of 300 kHz are reference values.
When the fundamental wave is 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 reference values.
When the fundamental wave is within the range of 16 Hz to 850 Hz, the figures for voltage, current, power, and phase difference in excess of 6 kHz are reference values.
Accuracy values for phase difference are defined for input for which the voltage and current for the same order are at least 10% f.s.

Waveform recording

Number of measurement channels	Voltage and current waveforms: Max. 6 channels (based on the number of installed channels) Motor waveforms *: Max. 2 analog DC channels + max. 4 pulse channels
Recording capacity	1 Mword × ((voltage + current) × max. 6 channels + motor waveforms) Fixed to 1 Mword when the number of channels is low. Motor waveforms: Motor analysis and D/A-equipped models only No memory allocation function
Waveform resolution	16 bits (Voltage and current waveforms use the upper 16 bits of the 18-bit A/D.)
Sampling speed	Voltage and current waveforms: Always 5 MS/s Motor waveforms *: Always 50 kS/s (analog DC) Motor pulse *: Always 5 MS/s
Compression ratio	1/1, 1/2, 1/5, 1/10, 1/20, 1/50, 1/100, 1/200, 1/500 (5 MS/s, 2.5 MS/s, 1 MS/s, 500 kS/s, 250 kS/s, 100 kS/s, 50 kS/s, 25 kS/s, 10 kS/s) However, motor waveforms* are only compressed at 50 kS/s or less.
Recording length	1 kWord / 5 kWord / 10 kWord / 50 kWord / 100 kWord / 500 kWord / 1 Mword
Storage mode	Peak-to-peak compression or simple thinning
Trigger mode	SINGLE or NORMAL (with forcible trigger setting) When FFT analysis is enabled in NORMAL mode, the instrument enters trigger standby and waits for FFT calculations to complete.
Pre-trigger	0% to 100% of the recording length, in 10% steps
Trigger source	Voltage and current waveform, waveform after voltage and current zero-cross filter, manual, motor waveform*, motor pulse*
Trigger slope	Rising edge, falling edge
Trigger level	±300% of the range for the waveform, in 0.1% steps
Trigger detection method	Level trigger / Event trigger (1) Level trigger Detects the trigger based on fluctuations in the level of the storage waveform. Trigger source: Voltage and current waveform, waveform after voltage and current zero-cross filter, manual, motor waveform, motor pulse (motor waveform and motor pulse: Motor analysis and D/A-equipped models only) Trigger slope: Rising edge, falling edge Trigger level: ±300% of the range for the waveform, in 0.1% steps (2) Event trigger Detects the trigger based on fluctuations in the value of the measurement parameter selected for D/A output. Specifically, trigger detection conditions are set using OR and AND operations performed on the four events defined below. Note that the AND operator has precedence over the OR operator. Event: These condition definitions consist of a D/A output measurement parameter (D/A13 to D/A20), an inequality sign (< or >), and a value (0.00000 to 999999T). EVm : D/An □ X.XXXXX y (m: 1 to 4, n: 13 to 20, □: Inequality sign, X.XXXXX: 6-digit constant, y: SI prefix)

*Motor waveform and motor pulse: Motor Analysis and D/A-equipped models only

FFT analysis

Measurement channel	Voltage-Current Waveform - 1 channel (selected from input channels) Motor Waveform - Analog DC Analysis performed only when FFT screen is displayed
Calculation type	RMS spectrum
Number of FFT points	1,000, 5,000, 10,000 or 50,000 points
FFT processing word length	32 bits
Analysis position	Any desired position among the waveform record data
Antialiasing	Automatic Digital Filter (during simple thinning mode) None (During Peak-Peak compression mode, use the Max value and perform FFT)
Window function	Rectangular/Hanning/Flat-top
Max. analysis frequency	Linked with compression ratio of waveform records. 2 MHz, 1 MHz, 400 kHz, 200 kHz, 100 kHz, 40 kHz, 20 kHz, 10 kHz or 4 kHz / 20 kHz, 10 kHz, or 4kHz during analog DC input (Mentioned above frequency - frequency resolution) becomes the maximum analysis frequency
FFT peak value display	Compute 10 frequencies and voltage-current peak value levels (local maximum value) each starting from the top, ordered by level / For FFT calculation results, recognize as the peak value when the data on both sides is lower than the original data

Motor Analysis (PW6001-11 to -16 only)

Number of input channels	4 channels: CH A: Analog DC input / Frequency input / Pulse input CH B: Analog DC input / Frequency input / Pulse input CH C: Pulse input CH D: Pulse input
Operating mode	Single, dual, or independent input
Input terminal profile	Isolated BNC connectors
Input resistance (DC)	1 MΩ ±50 kΩ
Input method	Function-isolated input and single-end input
Measurement parameters	Voltage, torque, rpm, frequency, slip, motor power
Maximum input voltage	±20 V (analog DC and pulse operation)
Additional conditions for guaranteed accuracy	Input: Terminal-to-ground voltage of 0 V, after zero-adjustment

(1) Analog DC input (CH A/CH B)

Measurement range	±1 V / ±5 V / ±10 V
Effective input range	1% to 110% f.s.
Sampling	50 kHz, 16 bits
Response speed	0.2 ms (when LPF is OFF)
Measurement method	Simultaneous digital sampling, zero-cross synchronization calculation method (averaging between zero-crosses)
Measurement accuracy	±0.05% rdg. ±0.05% f.s.
Temperature coefficient	±0.03% f.s./°C
Effects of common-mode voltage	±0.01% f.s. or less with 50 V applied between the input terminals and the enclosure (DC / 50 Hz / 60 Hz)
LPF	OFF (20 kHz) / ON (1 kHz)
Display range	From the range's zero-suppression range setting to ±150%
Zero-adjustment	Voltage ±10% f.s., zero-correction of input offsets that are less

(2) Frequency input (CH A/CH B)

Detection level	Low: 0.5 V or less; high: 2.0 V or more
Measurement frequency band	0.1 Hz to 1 MHz (at 50% duty ratio)
Minimum detection width	0.5 μs or more
Measurement accuracy	±0.05% rdg. ±3 dgt.
Display range	1.000 kHz to 500.000 kHz

(3) Pulse input (CH A / CH B / CH C / CH D)

Detection level	Low: 0.5 V or less; high: 2.0 V or more
Measurement frequency band	0.1 Hz to 1 MHz (at 50% duty ratio)
Minimum detection width	0.5 μs or more
Pulse filter	OFF / Weak / Strong (When using the weak setting, positive and negative pulses of less than 0.5 μs are ignored. When using the strong setting, positive and negative pulses of 5 μs are ignored.)
Measurement accuracy	±0.05% rdg. ±3 dgt.
Display range	0.1 Hz to 800.000 kHz
Unit	Hz / r/min.
Frequency division setting range	1~60000
Rotation direction detection	Can be set in single mode (detected based on lead/lag of CH B and CH C).
Mechanical angle origin detection	Can be set in single mode (CH B frequency division cleared at CH D rising edge).

D/A output (PW6001-11 to -16 only)

Number of output channels	20 channels
Output terminal profile	D-sub 25-pin connector × 1
Output details	- Switchable between waveform output and analog output (select from basic measurement parameters). - Waveform output is fixed to CH1 to CH12.
D/A conversion resolution	16 bits (polarity + 15 bits)
Output refresh rate	Analog output 10 ms / 50 ms / 200 ms (based on data update rate for the selected parameter) Waveform output 1 MHz
Output voltage	Analog output ±5 V DC f.s. (max. approx. ±12 V DC) Waveform output Switchable between ±2 V f.s. and ±1 V f.s., crest factor of 2.5 or greater. Setting applies to all channels.
Output resistance	100 Ω ±5 Ω
Output accuracy	Analog output Output measurement parameter measurement accuracy ±0.2% f.s. (DC level) Waveform output Measurement accuracy ±0.5% f.s. (at ±2 V f.s.) or ±1.0% f.s. (at ±1 V f.s.) (RMS value level, up to 50 kHz)
Temperature coefficient	±0.05% f.s./°C

Display section

Display characters	English, Japanese, Chinese (simplified)
Display	9" WVGA TFT color LCD (800 × 480 dots) with an LED backlight and analog resistive touch panel
Display value resolution	999999 count (including integration values)
Display refresh rate	Measured values Approx. 200 ms (independent of internal data update rate) When using simple averaging, the data update rate varies based on the number of averaging iterations. Waveforms Based on display settings

External interface

(1) USB flash drive interface

Connector	USB Type A connector × 1
Electrical specifications	USB 2.0 (high-speed)
Power supplied	Max. 500 mA
Supported USB flash drives	USB Mass Storage Class compatible
Recorded data	- Save/load settings files - Save measured values/automatic recorded data (CSV format) - Copy measured values/recorded data (from internal memory) - Save waveform data, save screenshots (compressed BMP format)

(2) LAN interface

Connector	RJ-45 connector × 1
Electrical specifications	IEEE 802.3 compliant
Transmission method	10Base-T / 100Base-TX / 1000Base-T (automatic detection)
Protocol	TCP/IP (with DHCP function)
Functions	HTTP server (remote operations) Dedicated port (data transferring, command control) FTP server (file transferring)

(3) GP-IB interface

Communication method	IEEE 488.1 1987 compliant developed with reference to IEEE 488.2 1987 Interface functions: SH1, AH1, T6, L4, SR1, RL1, PP0, DC1, DT1, C0
Addresses	00 to 30
Functions	Command control

(4) RS-232C interface

Connector	D-sub 9-pin connector × 1, 9-pin power supply compatible, also used for external control
Communication method	RS-232C, EIA RS-232D, CCITT V.24, and JIS X5101 compliant Full duplex, start stop synchronization, data length of 8, no parity, 1 stop bit
Flow control	Hardware flow control ON/OFF
Communications speed	9,600 bps / 19,200 bps / 38,400 bps / 57,600 bps / 115,200 bps / 230,400 bps
Functions	Command control LR8410 Link supported (dedicated connector is required) Used through exclusive switching with external control interface

(5) External control interface

Connector	D-sub 9-pin connector × 1, 9-pin power supply compatible, also used for RS-232C
Power supplied	OFF/ON (voltage of +5 V, max. 200 mA)
Electrical specifications	0/5 V (2.5 V to 5 V) logic signals or contact signal with terminal shorted or open
Functions	Same operation as the [START/STOP] key or the [DATA RESET] key on the control panel Used through exclusive switching with RS-232C

(6) Two-instrument synchronization interface

Connector	SFP optical transceiver, Duplex-LC (2-wire LC)
Optical signal	850 nm VCSEL, 1 Gbps
Laser class	Class 1
Fiber used	50/125 μm multi-mode fiber equivalent, up to 500 m
Functions	Sends data from the connected slave instrument to the master instrument, which performs calculations and displays the results.

Auto-range function

Functions	The voltage and current ranges for each connection are automatically changed in response to the input.
Operating mode	OFF/ON (selectable for each connection)
Auto-range breadth	Broad/ narrow (applies to all channels) Broad The range is increased by one if the peak value is exceeded for the connection or if there is an RMS value that is greater than or equal to 110% f.s. The range is lowered by two if all RMS values for the connection are less than or equal to 10% f.s. Narrow The range is increased by one if the peak value is exceeded for the connection or if there is an RMS value that is greater than or equal to 105% f.s. The range is lowered by one if all RMS values for the connection are less than or equal to 40% f.s. Voltage range changes when Δ-Y conversion is enabled are determined by multiplying the range by [$\frac{1}{\sqrt{3}}$]

Time control function

Timer control	OFF, 10 sec. to 9999 hr. 59 min. 59 sec. (in 1 sec. steps)
Actual time control	OFF, start time/stop time (in 1 min. steps)
Intervals	OFF / 10 ms / 50 ms / 200 ms / 500 ms / 1 sec. / 5 sec. / 10 sec. / 15 sec. / 30 sec. 1 min. / 5 min. / 10 min. / 15 min. / 30 min. / 60 min.

Hold functionality

Hold	Stops updating the display with all measured values and holds the value currently being displayed. Used exclusively with the peak hold function.
Peak hold	Updates the measured value display each time a new maximum value is set. Used exclusively with the hold function.

Calculation functionality

(1) Rectifier

Functions	Selects the voltage and current values used to calculate apparent and reactive power and power factor.
Operating mode	RMS/mean (Can be selected for each connection's voltage and current.)

(2) Scaling

VT (PT) ratio	OFF/ 0.00001 to 9999.99
CT ratio	OFF/ 0.01 to 9999.99

(3) Averaging (AVG)

Functions	All instantaneous measured values, including harmonics, are averaged.
Operating mode	OFF / Simple averaging / Exponential averaging
Operation	Simple averaging Averaging is performed for the number of simple averaging iterations for each data update cycle, and the output data is updated. The data update rate is lengthened by the number of averaging iterations. Exponential averaging Data is exponentially averaged using a time constant defined by the data update rate and the exponential averaging response rate. During averaging operation, averaged data is used for all analog output and save data.

Number of simple averaging iterations

Number of averaging iterations		5	10	20	50	100
Data update rate	10 ms	50 ms	100 ms	200 ms	500 ms	1 sec.
	50 ms	250 ms	500 ms	1 sec.	2.5 sec.	5 sec.
	200 ms	1 sec.	2 sec.	4 sec.	10 sec.	20 sec.

Exponential averaging response rate

Setting		FAST	MID	SLOW
Data update rate	10 ms	0.1 sec.	0.8 sec.	5 sec.
	50 ms	0.5 sec.	4 sec.	25 sec.
	200 ms	2.0 sec.	16 sec.	100 sec.

These values indicate the time required for the final stabilized value to converge on ±1% when the input changes from 0% f.s. to 90% f.s.

(4) User-defined calculations

Functions	User-specified basic measurement parameters are calculated using the specified calculation formulas.
Calculated items	Four basic measured items or constants with a maximum of 6-digits; operators are four-arithmetic operators. UDFn = ITEM1 □ ITEM2 □ ITEM3 □ ITEM4 ITEMn : basic measured item, or constant of up to 6 digits □ : any one of +, -, *, or / UDFn can also be selected for ITEMn, with calculations performed in the order of n. The functions that can be selected and calculated in regards to each ITEMn are as follows: neg, sin, cos, tan, sqrt, abs, log10 (common logarithm), log (logarithm), exp, asin, acos, atan, sinh, cosh, tanh When a UDFn with an n higher than the current UDF is encounted, previously calculated values are used
Number of allowed calculations	16 formulas (UDF1 to UDF16)
Maximum value setting	Set for each UDFn in the range 1.000 μ to 100.0 T / Functions as a UDFn range
Unit	Up to 6 characters in ASCII for each UDFn

(5) Efficiency and loss calculations

Calculated items	Active power value (P), fundamental wave active power (Pfnd), and motor power (Pm) (Motor Analysis and D/A-equipped models only) for each channel and connection
Number of calculations that can be performed	Four each for efficiency and loss
Formula	Calculated items are specified for Pin(n) and Pout(n) in the following format: Pin = Pin1 + Pin2 + Pin3 + Pin4, Pout = Pout1 + Pout2 + Pout3 + Pout4 $\eta = 100 \times \frac{\lvert Pout \rvert}{\lvert Pin \rvert}$, Loss = |Pin| - |Pout|

(6) Power formula selection

Functions	Selects the reactive power, power factor, and power phase angle formulas.
Formula	TYPE1 / TYPE2 / TYPE3 TYPE1 Compatible with TYPE1 as used by the Hioki 3193 and 3390. TYPE2 Compatible with TYPE2 as used by the Hioki 3192 and 3193. TYPE3 The sign of the TYPE1 power factor and power phase angle are used as the active power signs.

(7) Delta conversion

Functions	Δ-Y When using a 3P3W3M or 3V3A connection, converts the line voltage waveform to a phase voltage waveform using a virtual neutral point. Y-Δ When using a 3P4W connection, converts the phase voltage waveform to a line voltage waveform. Voltage RMS values and all voltage parameters, including harmonics, are calculated using the post-conversion voltage.

(8) Current sensor phase shift calculation

Functions	Compensates the current sensor's harmonic phase characteristics using calculations.
Compensation value settings	Compensation points are set using the frequency and phase difference. Frequency 0.1 kHz to 999.9 kHz (in 0.1 kHz steps) Phase difference 0.00° to ±90.00° (in 0.01° intervals) However, the difference in time calculated from the frequency phase difference can be up to 98 μs in 0.5ns intervals

Display functionality

(1) Connection confirmation screen

Functions	Displays a connection diagram and voltage and current vectors based on the selected measurement lines. The ranges for a correct connection are displayed on the vector display so that the connection can be checked.
Mode at startup	User can select to display the connection confirmation screen at startup (startup screen setting).
Simple settings	Commercial power supply / Commercial power supply high-resolution HD / DC / DC high-resolution HD / PWM / High-frequency / Other

(2) Vector display screen

Functions	Displays a connection-specific vector graph along with associated level values and phase angles.

(3) Numerical display screen

Functions	Displays power measured values and motor measured values for up to six instrument channels.
Display patterns	Basic by connection Displays measured values for the measurement lines and motors combined in the connection. There are four measurement line patterns: U, I, P, and Integ. Selection display Creates a numerical display for the measurement parameters that the user has selected from all basic measurement parameters in the location selected by the user. There are 4-, 8-, 16-, and 32-display patterns.

(4) Harmonic display screen

Functions	Displays harmonic measured values on the instrument's screen.
Display patterns	Display bar graph: Displays harmonic measurement parameters for user-specified channels as a bar graph. Display list: Displays numerical values for user-specified parameters and user-specified channels.

(5) Waveform display screen

Functions	Displays the voltage and current waveforms and motor waveform.
Display patterns	All-waveform display, waveform + numerical display Cursor measurement supported

Simplified Graph Function

(1) D/A Monitor Graph

Functions	Graph measured values chosen as D/A output items in chronological order Illustrated waveforms are Peak-Peak compressed by setting time axis to data at data update rate, and data is not recorded.
Operations	Start and stop drawing with the RUN/STOP button Illustrate the displayed value during hold and peak hold Illustrated data is cleared when Clear button is pressed during changes in settings related to measured values of range and D/A output items
Number of illustrated items	Maximum of 8 items
Illustrated items	Operates simultaneously with D/A output items from CH13 to CH20 settings
Time axis	10 ms/dot to 48 min/dot (Cannot be selected below the data update rate)
Vertical axis	Autoscaling (operates to fit data on screen within screen display range with time axis) Manual (user sets displayed maximum value and minimum value)

(2) X-Y Plot

Functions	Select horizontal and vertical axis items from fundamental measurement items and display X-Y graph Dot illustrations are done at data update rate, and data is not recorded Illustration data can be cleared / a total of two combinations of graphs can be displayed: X1-Y1 or X2-Y2 Gauge display, displayed max value and min value settings are allowed X1, Y1, X2, and Y2 operate in synchronization with D/A output item settings for CH13, 14, 15, and 16 respectively

Automatic save function

Functions	Saves the specified measured values in effect for each interval.
Save destination	OFF / Internal memory / USB flash drive
Saved parameters	User-selected from all measured values, including harmonic measured values
Maximum amount of saved data	Internal memory 64 MB (data for approx. 1800 measurements) USB flash drive Approx. 100 MB per file (automatically segmented) × 20 files
Data format	CSV file format

Manual save function

(1) Measurement data

Functions	The [SAVE] key saves specified measured values at the time it is pressed. Comment text can be entered for each saved data point, up to a maximum of 20 alphanumeric characters. *The manual save function for measurement data cannot be used while automatic save is in progress.
Save destination	USB flash drive
Saved parameters	User-selected from all measured values, including harmonic measured values
Data format	CSV file format

(2) Waveform data

Functions	(Within touch panel) Use Save Waveforms Button to save waveform data during that session Input comments for each set of saved data *Cannot be operated when waveform data is invalid during storage and automatic saving
Save destination	USB flash drive - Assign destinations for saved data
Comment entry	OFF/ON - up to 40 letters/symbols
Data format	CSV file format (read-only attribute included), binary file format (BIN format)

(3) Screenshots

Functions	The [COPY] key saves a screenshot to the save destination. *This function can be used at an interval of 1 sec or more while automatic saving is in progress.
Save destination	USB flash drive
Comment entry	OFF / Text / Handwritten When set to [Text], up to 40 alphanumeric characters When set to [Handwritten], hand-drawn images are pasted to the screen.
Data format	Compressed BMP

(4) Settings data

Functions	Saves settings information to the save destination as a settings file via functionality provided on the File screen. In addition, previously saved settings files can be loaded and their settings restored on the File screen. However, language and communications settings are not saved.
Save destination	USB flash drive

(5) FFT data

Functions	(Within touch panel) Use Save FFT Spectrum button to save waveform data during that session Input comments for each set of saved data *Cannot be operated when waveform data is invalid during storage and automatic saving
Save destination	USB flash drive - Assign destinations for saved data
Comment entry	OFF/ON - up to 40 letters/symbols
Data format	CSV file format (with read-only attribute set)

Two-instrument synchronization function

Functions	Sends data from the connected slave instrument to the master instrument, which performs calculations and displays the results. In numerical synchronization mode, the master instrument operates as a power meter with up to 12 channels. In waveform synchronization mode, the master instrument operates while synchronizing up to three channels from the slave instrument at the waveform level.	
Operating mode	OFF / Numerical synchronization / Waveform synchronization Numerical synchronization cannot be selected when the data update rate is 10 ms. Waveform synchronization operates only when master device has more than 3 channels	
Synchronized items	Numerical synchronization mode	Data update timing, start/stop/data reset
	Waveform synchronization mode	Voltage/current sampling timing
Synchronization delay	Numerical synchronization mode	Max. 20 μs
	Waveform synchronization mode	Up to 5 samples
Transfer items	Numerical synchronization mode	Basic measurement parameters for up to six channels (including motor data)
	Waveform synchronization mode	Voltage/current sampling waveforms for up to three channels (not including motor data). However, the maximum number of channels is limited to a total of six, including the master instrument's channels.

Basic formula

Parameter \ Wiring	1P2W	1P3W	3P3W2M	3V3A	3P3W3M	3P4W
Voltage, current RMS value (True RMS)	$Xrms(i)=\sqrt{\frac{1}{M}\sum_{s=0}^{M-1}(X(i)s)^2}$	$Xrms(i)(i+1)=\frac{1}{2}(Xrms(i)+Xrms(i+1))$		$Xrms123=\frac{1}{3}(Xrms1+Xrms2+Xrms3)$ $Xrms456=\frac{1}{3}(Xrms4+Xrms5+Xrms6)$		
Voltage, current average value rectification RMS equivalent	$Xmn(i)=\frac{\pi}{2\sqrt{2}}\frac{1}{M}\sum_{s=0}^{M-1}\lvert X(i)s\rvert$	$Xmn(i)(i+1)=\frac{1}{2}(Xmn(i)+Xmn(i+1))$		$Xmn123=\frac{1}{3}(Xmn1+Xmn2+Xmn3)$ $Xmn456=\frac{1}{3}(Xmn4+Xmn5+Xmn6)$		
Voltage, current AC component	$Xac(i)=\sqrt{(X_{rms(i)})^2-(X_{dc(i)})^2}$					
Voltage, current Average value	$Xdc(i)=\frac{1}{M}\sum_{s=0}^{M-1}X(i)s$					
Voltage, current Fundamental wave component	*X1(i) for harmonic voltage and current in the harmonic formula*					
Voltage, current peak values	$Xpk+(i)=X(i)s$ Max. value for M items $Xpk-(i)=X(i)s$ Min. value for M items					
Active power	$P(i)=\frac{1}{M}\sum_{s=0}^{M-1}(U(i)s\times I(i)s)$	$P(i)(i+1)=P(i)+P(i+1)$		$P123=P1+P2$ $P456=P4+P5$	$P123=P1+P2+P3$ $P456=P4+P5+P6$	
	- When connecting 3P3W3M and 3P4W, use phase voltage for voltage waveform *u(i)s*. 3P3WM: $u1s=(U1s-U3s)/3$, $u2s=(U2s-U1s)/3$, $u3s=(U3s-U2s)/3$ - When connecting 3V3A, use line-to-line voltage for voltage *U(i)*. (The same formula is used for 3P3W2M and 3V3A.) - The polarity sign for active power *P* indicates the direction of current during power consumption (+*P*) and power regeneration (-*P*).					
Apparent power	$S(i)=U(i)\times I(i)$	$S(i)(i+1)=S(i)+S(i+1)$	$S(i)(i+1)=\frac{\sqrt{3}}{2}(S(i)+S(i+1))$	$S123=\frac{\sqrt{3}}{3}(S1+S2+S3)$ $S456=\frac{\sqrt{3}}{3}(S4+S5+S6)$	$S123=S1+S2+S3$ $S456=S4+S5+S6$	
	Select rms / mn for *U(i)* and *I(i)*. When connecting 3P3W3M and 3P4W, use phase voltage for voltage *U(i)*. When connecting 3V3A, use line-to-line voltage for voltage *U(i)*.					
Reactive power	When selecting formula type 1 and type 3					
	$Q(i)=si(i)\sqrt{S(i)^2-P(i)^2}$	$Q(i)(i+1)=Q(i)+Q(i+1)$		$Q123=Q1+Q2$ $Q456=Q4+Q5$	$Q123=Q1+Q2+Q3$ $Q456=Q4+Q5+Q6$	
	When selecting formula type 2					
	$Q(i)=\sqrt{S(i)^2-P(i)^2}$	$Q(i)(i+1)=\sqrt{S(i)(i+1)^2-P(i)(i+1)^2}$		$Q123=\sqrt{S123^2-P123^2}$, $Q456=\sqrt{S456^2-P456^2}$		
	- The polarity sign *si* for reactive power *Q* for formula type 1 and type 3 indicates leading and lagging polarity, [None] indicates lagging polarity (LAG), and [-] indicates leading polarity (LEAD). - For polarity sign *si(i)*, lead and lag for voltage waveform *U(i)s* and current waveform *I(i)s* are acquired for each measurement channel (i). - When connecting 3P3W3M and 3P4W, use phase voltage for voltage waveform *U(i)s*. 3P3WM: $u1s=(U1s-U3s)/3$, $u2s=(U2s-U1s)/3$, $u3s=(U3s-U2s)/3$ - There is no polarity sign when formula type 2 is selected.					
Power factor	When selecting formula type 1					
	$\lambda(i)=si(i)\left\lvert\frac{P(i)}{S(i)}\right\rvert$	$\lambda(i)(i+1)=si(i)(i+1)\left\lvert\frac{P(i)(i+1)}{S(i)(i+1)}\right\rvert$		$\lambda123=si123\left\lvert\frac{P123}{S123}\right\rvert$, $\lambda456=si456\left\lvert\frac{P456}{S456}\right\rvert$		
	When selecting formula type 2					
	$\lambda(i)=\left\lvert\frac{P(i)}{S(i)}\right\rvert$	$\lambda(i)(i+1)=\left\lvert\frac{P(i)(i+1)}{S(i)(i+1)}\right\rvert$		$\lambda123=\left\lvert\frac{P123}{S123}\right\rvert$, $\lambda456=\left\lvert\frac{P456}{S456}\right\rvert$		
	When selecting formula type 3					
	$\lambda(i)=\frac{P(i)}{S(i)}$	$\lambda(i)(i+1)=\frac{P(i)(i+1)}{S(i)(i+1)}$		$\lambda123=\frac{P123}{S123}$, $\lambda456=\frac{P456}{S456}$		
	- The polarity sign *si* for power factor λ for formula type 1 indicates leading and lagging polarity, [None] indicates lagging polarity (LAG), and [-] indicates leading polarity (LEAD). - For polarity sign *si(i)*, lead and lag for voltage waveform *U(i)s* and current waveform *I(i)s* are acquired for each measurement channel *(i)*. *si12*, *si34*, and *si123* are acquired from the signs for *Q12*, *Q34*, and *Q123*. - For formula type 3, the polarity sign for active power *P* is used.					
Power phase angle	When selecting formula type 1					
	$\phi(i)=si(i)\cos^{-1}\lvert\lambda(i)\rvert$	$\phi(i)(i+1)=si(i)(i+1)\cos^{-1}\lvert\lambda(i)(i+1)\rvert$		$\phi123=si123\cos^{-1}\lvert\lambda123\rvert$, $\phi456=si456\cos^{-1}\lvert\lambda456\rvert$		
	When selecting formula type 2					
	$\phi(i)=\cos^{-1}\lvert\lambda(i)\rvert$	$\phi(i)(i+1)=\cos^{-1}\lvert\lambda(i)(i+1)\rvert$		$\phi123=\cos^{-1}\lvert\lambda123\rvert$ $\phi456=\cos^{-1}\lvert\lambda456\rvert$		
	When selecting formula type 3					
	$\phi(i)=\cos^{-1}\lambda(i)$	$\phi(i)(i+1)=\cos^{-1}\lambda(i)(i+1)$		$\phi123=\cos^{-1}\lambda123$, $\phi456=\cos^{-1}\lambda456$		
	- For formula type 1, the polarity sign *si* indicates leading and lagging polarity, [None] indicates lagging polarity (LAG), and [-] indicates leading polarity (LEAD). - For polarity sign *si(i)*, lead and lag for voltage waveform *U(i)s* and current waveform *I(i)s* are acquired for each measurement channel *(i)*. *si12*, *si34*, and *si123* are acquired from the signs for *Q12*, *Q34*, and *Q123*. - For formula type 3, the polarity sign for active power *P* is used. - When calculating formula type 1 and type2, *cos-1λ(i)* is used when P ≥ 0; *π180-cos-1λ* is used when P < 0.					
Voltage and current ripple factor	$\frac{(X_{pk+(i)}-X_{pk-(i)})}{2\times\lvert X_{dc(i)}\rvert}\times100$					

X: Voltage *U* or Current *I*,
(i): Measurement channel, *M*: Number of samples during synchronized timing period, *s*: Sample point number

Motor analysis formulae

Measurement parameters	Setting	Formula
Voltage	Analog DC	$\frac{1}{M}\sum_{s=0}^{M-1}As$ *M*: Number of samples during synchronized timing period; *s*: Sample point number
Pulse frequency	Pulse	Pulse frequency
Torque	Analog DC	$\frac{1}{M}\sum_{s=0}^{M-1}As\times$ *scaling setting* *M*: Number of samples during synchronized timing period; *s*: Sample point number
	Frequency	$\frac{(Measurement\ frequency - fc\ setting)\times rated\ torque\ value}{fd\ setting}$
RPM	Analog DC	$\frac{1}{M}\sum_{s=0}^{M-1}As\times$ *scaling setting* *M*: Number of samples during synchronized timing period; *s*: Sample point number
	Pulse	$si\ \frac{60\times pulse\ frequency}{Pulse\ count\ setting}$ The polarity sign *si* is acquired based on the A-phase pulse rising/falling edge and the B-phase pulse logic level (high/low) when direction of rotation detection is enabled in single mode.
Motor power		$Torque\times\frac{2\times\pi\times RPM}{60}\times$ *unit coefficient* The unit coefficient is 1 if the torque unit is N·m, 1/1000 if mN·m, and 1000 if kN·m.
Slip		$100\times\frac{2\times60\times input\ frequency-\lvert RPM\rvert\times pole\ number\ setting}{2\times60\times input\ frequency}$ The input frequency is selected from f1 to f6.

General Specifications

Operating environment	Indoors at an elevation of up to 2000 m in a Pollution Level 2 environment
Storage temperature and humidity	-10°C to 50°C, 80% RH or less (no condensation)
Operating temperature and humidity	0°C to 40°C, 80% RH or less (no condensation)
Dielectric strength	50 Hz/60 Hz 5.4 kV rms AC for 1 min. (sensed current of 1 mA) Between voltage input terminals and instrument enclosure, and between current sensor input terminals and interfaces 1 kV rms AC for 1 min. (sensed current of 3 mA) Between motor input terminals (Ch. A, Ch. B, Ch. C, and Ch. D) and the instrument enclosure
Standards	Safety EN61010 EMC EN61326 Class A
Rated supply voltage	100 V AC to 240 V AC, 50 Hz/ 60 Hz
Maximum rated power	200 VA
External dimensions	Approx. 430 mm (16.93 in)W x 177 mm (6.97 in)H x 450 mm (17.72 in)D (excluding protruding parts)
Mass	Approx. 14 kg (49.4 oz) (PW6001-16)
Backup battery life	Approx. 10 years (reference value at 23°C) (lithium battery that stores time and setting conditions)
Product warranty period	1 year
Guaranteed accuracy period	6 months (1-year accuracy = 6-month accuracy × 1.5)
Post-adjustment accuracy guaranteed period	6 months
Accuracy guarantee conditions	Accuracy guarantee temperature and humidity range: 23°C ±3°C, 80% RH or less Warm-up time: 30 min. or more
Accessories	Instruction manual x 1, power cord x 1, D-sub 25-pin connector × 1 (PW6001-1x only)

Other functions

Clock function	Auto-calendar, automatic leap year detection, 24-hour clock
Actual time accuracy	When the instrument is on, ±100 ppm; when the instrument is off, within ±3 sec./day (25°C)
Sensor identification	Current sensors connected to Probe1 are automatically detected.
Zero-adjustment function	After the AC/DC current sensor's DEMAG signal is sent, zero-correction of the voltage and current input offsets is performed.
Touch screen correction	Position calibration is performed for the touch screen.
Key lock	While the key lock is engaged, the key lock icon is displayed on the screen.

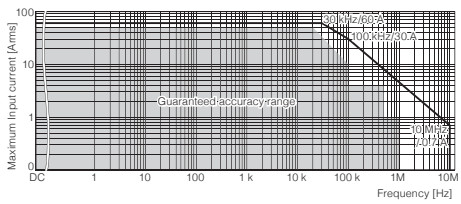
Rack mount support

Full rack size ideal for incorporation into test benches and product inspection lines

Current sensors

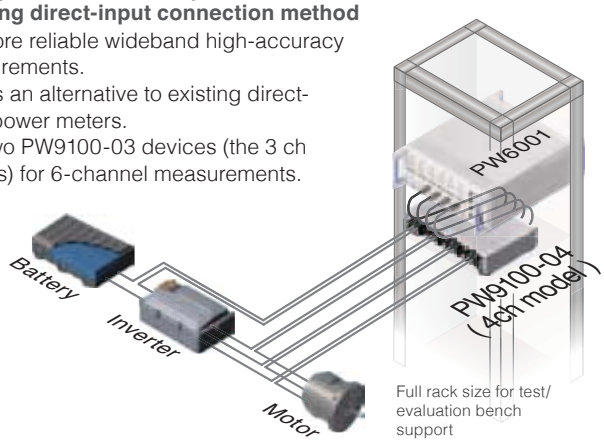
High-accuracy sensors: direct connection type (connect to Probe1 input terminal)

The newly developed DCCT method provides world-leading measurement bands and accuracy at a 50 A rating. Delivering a direct-coupled type current testing tool that brings out the PW6001 POWER ANALYZER's maximum potential. (A 5 A-rated version is also available. Contact us for more information.)

	AC/DC CURRENT BOX PW9100-03	AC/DC CURRENT BOX PW9100-04
External Appearance		
Number of input channels	3ch	4 ch
Rated primary current	50 A AC/DC	
Frequency band	DC to 3.5 MHz (-3 dB)	
Measurement terminals	Terminal block (with safety cover), M6 screws	
Basic accuracy	±0.02% rdg. ±0.005% f.s. (amplitude), ±0.1 ° (phase) (At 45 ≤ f ≤ 65 Hz) ±0.02% rdg. ±0.007% f.s. (amplitude) (At DC)	
Frequency response (Amplitude)	to 45 Hz: ±0.1% rdg. ±0.02% f.s. to 1 kHz: ±0.1% rdg. ±0.01% f.s. to 50 kHz: ±1% rdg. ±0.02% f.s. to 100 kHz: ±2% rdg. ±0.05% f.s. to 1 MHz: ±10% rdg. ±0.05% f.s. 3.5 MHz: -3 dB Typical	
Input resistance	1.5 mΩ or less (50 Hz/60 Hz)	
Operating temperature range	Temperature: 0°C to 40°C (32°F to 104°F), Humidity: 80% R.H. or less (no condensation)	
Effects of common-mode voltage (CMRR)	50 Hz/60 Hz: 120 dB or greater, 100 kHz: 120 dB or greater (Effect on output voltage/common-mode voltage)	
Maximum voltage to ground	1000 V (measurement category II), 600 V (measurement category III), anticipated transient overvoltage: 6000 V	
Dimensions	430 mm (16.93 in) W × 88 mm (3.46 in) H × 260 mm (10.24 in) D, Cable length: 0.8 m (2.62 ft)	
Mass	3.7 kg (130.5 oz)	4.3 kg (151.7 oz)
Derating Characteristics		

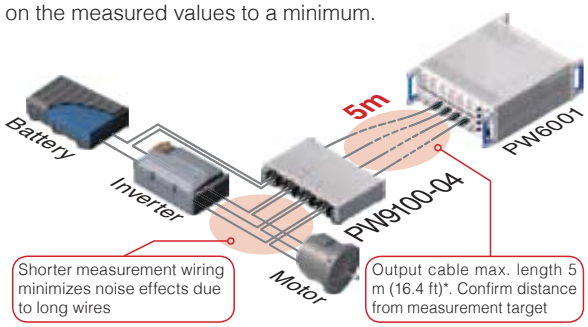
Wiring connection example 1 – Existing direct-input connection method

For more reliable wideband high-accuracy measurements.
Use as an alternative to existing direct-input power meters.
Use two PW9100-03 devices (the 3 ch models) for 6-channel measurements.



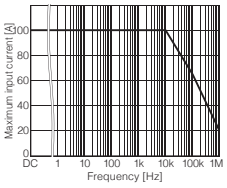
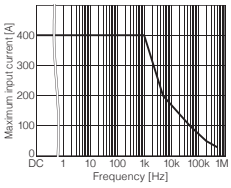
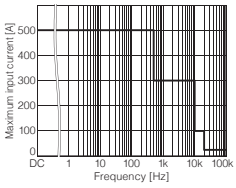
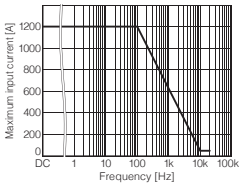
Wiring connection example 2 – Introducing a new and innovative measuring method

Shorten the wiring for current measurement by installing the PW9100 close to the measurement target. This will also keep the effects of wiring resistance, capacity coupling and other objective factors on the measured values to a minimum.



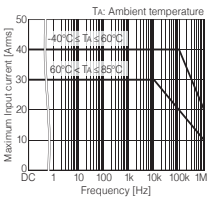
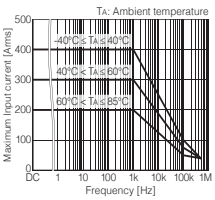
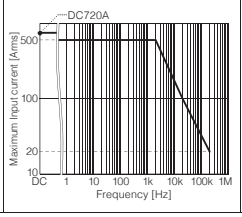
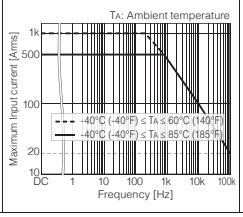
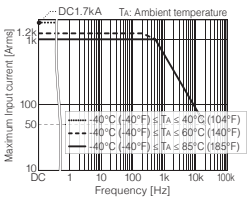
*Requires CT9902 EXTENSION CABLE

High-accuracy sensors: pull-through type (connect to Probe1 input terminal)

Model	AC/DC CURRENT SENSOR CT6862-05	AC/DC CURRENT SENSOR CT6863-05	AC/DC CURRENT SENSOR 9709-05	AC/DC CURRENT SENSOR CT6865-05
Appearance				
Rated primary current	50 A AC/DC	200 A AC/DC	500 A AC/DC	1000 A AC/DC
Frequency band	DC to 1 MHz	DC to 500 kHz	DC to 100 kHz	DC to 20 kHz
Diameter of measurable conductors	Max.φ 24mm (0.94")	Max.φ 24 mm (0.94")	Max.φ 36 mm (1.42")	Max.φ 36 mm (1.42")
Basic accuracy	±0.05 % rdg.±0.01 % f.s. (amplitude) ±0.2° (phase, not defined for DC) (At DC and 16 Hz to 400 Hz)	±0.05 % rdg.±0.01 % f.s. (amplitude) ±0.2° (phase, not defined for DC) (At DC and 16 Hz to 400 Hz)	±0.05 % rdg.±0.01 % f.s. (amplitude) ±0.2° (phase, not defined for DC) (At DC and 45 Hz to 66 Hz)	±0.05 % rdg.±0.01 % f.s. (amplitude) ±0.2° (phase, not defined for DC) (At DC and 16 Hz to 66 Hz)
Frequency characteristics (Amplitude)	to 16 Hz: ±0.1% rdg. ±0.02% f.s. 400Hz to 1kHz: ±0.2% rdg. ±0.02% f.s. to 50 kHz: ±1.0% rdg. ±0.02% f.s. to 100 kHz: ±2.0% rdg. ±0.05% f.s. to 1 MHz: ±30% rdg. ±0.05% f.s.	to 16 Hz: ±0.1% rdg. ±0.02% f.s. 400Hz to 1kHz: ±0.2% rdg. ±0.02% f.s. to 10 kHz: ±1.0% rdg. ±0.02% f.s. to 100 kHz: ±5.0% rdg. ±0.05% f.s. to 500 kHz: ±30% rdg. ±0.05% f.s.	to 45 Hz: ±0.2% rdg. ±0.02% f.s. 66 Hz to 500 Hz: ±0.2% rdg. ±0.02% f.s. to 5 kHz: ±0.5% rdg. ±0.05% f.s. to 10 kHz: ±5.0% rdg. ±0.10% f.s. to 100 kHz: ±30% rdg. ±0.10% f.s.	to 16 Hz: ±0.1% rdg. ±0.02% f.s. 66 Hz to 100 Hz: ±0.5% rdg. ±0.02% f.s. to 500 Hz: ±1.0% rdg. ±0.02% f.s. to 5 kHz: ±5.0% rdg. ±0.05% f.s. to 20 kHz: ±30% rdg. ±0.1% f.s.
Operating Temperature	-30°C to 85°C (-22°F to 185°F)	-30°C to 85°C (-22°F to 185°F)	0°C to 50°C (32°F to 122°F)	-30°C to 85°C (-22°F to 185°F)
Effect of conductor position	Within ±0.01% rdg. (50 A, DC to 100 Hz)	Within ±0.01% rdg. (100 A, DC to 100 Hz)	Within ±0.05% rdg. (DC 100 A)	Within ±0.05% rdg. (1000 A, 50/ 60 Hz)
Effect of external magnetic fields	10 mA equivalent or lower (400 A/m, 60 Hz and DC)	50 mA equivalent or lower (400 A/m, 60 Hz and DC)	50 mA equivalent or lower (400 A/m, 60 Hz and DC)	200 mA equivalent or lower (400 A/m, 60 Hz and DC)
Maximum rated voltage to earth	CAT III 1000 V rms	CAT III 1000 V rms	CAT III 1000 V rms	CAT III 1000 V rms
Dimensions	70W (2.76") × 100H (3.94") × 53D (2.09") mm Cable length: 3 m (9.84 ft)	70W (2.76") × 100H (3.94") × 53D (2.09") mm Cable length: 3 m (9.84 ft)	160W (6.30") × 112H (4.41") × 50D (1.97") mm Cable length: 3 m (9.84 ft)	160W (6.30") × 112H (4.41") × 50D (1.97") mm Cable length: 3 m (9.84 ft)
Mass	340 g (12.0 oz.)	350 g (12.3 oz.)	850 g (30.0 oz.)	980 g (35.3 oz)
Derating properties				

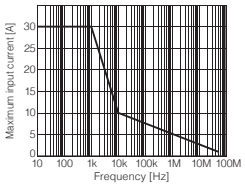
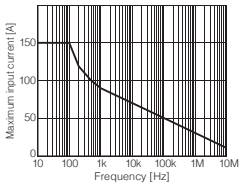
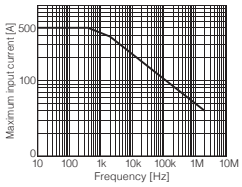
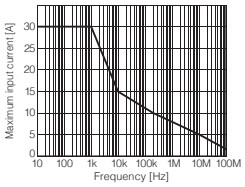
Custom cable lengths also available. Please inquire with your Hioki distributor.

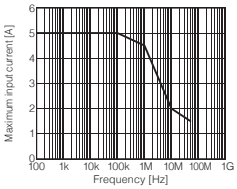
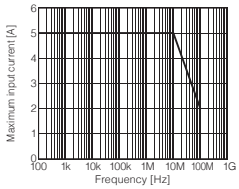
High-accuracy sensors: clamp type (connect to Probe1 input terminal)

Model	AC/DC CURRENT PROBE CT6841-05	AC/DC CURRENT PROBE CT6843-05	AC/DC CURRENT PROBE CT6844-05	AC/DC CURRENT PROBE CT6845-05	AC/DC CURRENT PROBE CT6846-05
Appearance					
Rated primary current	20 A AC/DC	200 A AC/DC	500 A AC/DC	500 A AC/DC	1,000 A AC/DC
Frequency band	DC to 1 MHz	DC to 500 kHz	DC to 200 kHz	DC to 100 kHz	DC to 20 kHz
Diameter of measurable conductors	Max.φ 20 mm (0.79") (insulated conductor)	Max.φ 20 mm (0.79") (insulated conductor)	Max.φ 20 mm (0.79") (insulated conductor)	Max.φ 50 mm (1.97") (insulated conductor)	Max.φ 50 mm (1.97") (insulated conductor)
Basic accuracy	±0.3% rdg. ±0.01% f.s. (amplitude) ±0.1° (phase) (At DC < f ≤ 100 Hz) ±0.3% rdg. ±0.05% f.s. (amplitude) (At DC)	±0.3% rdg. ±0.01% f.s. (amplitude) ±0.1° (phase) (At DC < f ≤ 100 Hz) ±0.3% rdg. ±0.02% f.s.(amplitude) (At DC)	±0.3% rdg. ±0.01% f.s. (amplitude) ±0.1° (phase) (At DC < f ≤ 100 Hz) ±0.3% rdg. ±0.02% f.s. (amplitude) (At DC)	±0.3% rdg. ±0.01% f.s. (amplitude) ±0.1° (phase) (At DC < f ≤ 100 Hz) ±0.3% rdg. ±0.02% f.s. (amplitude) (At DC)	±0.3% rdg. ±0.01% f.s. (amplitude) ±0.1° (phase) (At DC < f ≤ 100 Hz) ±0.3% rdg. ±0.02% f.s. (amplitude) (At DC)
Frequency characteristics (Amplitude)	to 500 Hz: ±0.3% rdg. ±0.02% f.s. to 1 kHz: ±0.5% rdg. ±0.02% f.s. to 10 kHz: ±1.5% rdg. ±0.02% f.s. to 100 kHz: ±5.0% rdg. ±0.05% f.s. to 1 MHz: ±30% rdg. ±0.05% f.s.	to 500 Hz: ±0.3% rdg. ±0.02% f.s. to 1 kHz: ±0.5% rdg. ±0.02% f.s. to 10 kHz: ±1.5% rdg. ±0.02% f.s. to 50 kHz: ±5.0% rdg. ±0.02% f.s. to 500 kHz: ±30% rdg. ±0.05% f.s.	to 500 Hz: ±0.3% rdg. ±0.02% f.s. to 1 kHz: ±0.5% rdg. ±0.02% f.s. to 10 kHz: ±1.5% rdg. ±0.02% f.s. to 50 kHz: ±5.0% rdg. ±0.02% f.s. to 200 kHz: ±30% rdg. ±0.05% f.s.	to 500 Hz: ±0.3% rdg. ±0.02% f.s. to 1 kHz: ±0.5% rdg. ±0.02% f.s. to 10 kHz: ±1.5% rdg. ±0.02% f.s. to 20 kHz: ±5.0% rdg. ±0.02% f.s. to 100 kHz: ±30% rdg. ±0.05% f.s.	to 500 Hz: ±0.5% rdg. ±0.02% f.s. to 1 kHz: ±1.0% rdg. ±0.02% f.s. to 5 kHz: ±2.0% rdg. ±0.02% f.s. to 10 kHz: ±5.0% rdg. ±0.05% f.s. to 20 kHz: ±30% rdg. ±0.10% f.s.
Operating Temperature	-40°C to 85°C (-40°F to 185°F)	-40°C to 85°C (-40°F to 185°F)	-40°C to 85°C (-40°F to 185°F)	-40°C to 85°C (-40°F to 185°F)	-40°C to 85°C (-40°F to 185°F)
Effect of conductor position	Within ±0.1% rdg. (At 20 A, DC to 100 Hz input)	Within ±0.1% rdg. (At 100 A, DC to 100 Hz input)	Within ±0.1% rdg. (At 100 A, DC to 100 Hz input)	Within ±0.2% rdg. (At 100 A, DC to 100 Hz input)	Within ±0.2% rdg. (At 1000A, 50/ 60 Hz input)
Effect of external magnetic fields	50 mA equivalent or lower (400 A/m, 60 Hz and DC)	50 mA equivalent or lower (400 A/m, 60 Hz and DC)	100 mA equivalent or lower (400 A/m, 60 Hz and DC)	150 mA equivalent or lower (400 A/m, 60 Hz and DC)	150 mA equivalent or lower (400 A/m, 60 Hz and DC)
Dimensions	153W (6.02") × 67H (2.64") × 25D (0.98") mm Cable length: 3 m (9.84 ft)	153W (6.02") × 67H (2.64") × 25D (0.98") mm Cable length: 3 m (9.84 ft)	153 (6.02") W × 67 (2.64") H × 25 (0.98") D mm Cable length: 3 m (9.84 ft)	238 (9.37") W × 116 (4.57") H × 35 (1.38") D mm Cable length: 3 m (9.84 ft)	238 (9.37") W × 116 (4.57") H × 35 (1.38") D mm Cable length: 3 m (9.84 ft)
Mass	350 g (12.3 oz)	370 g (13.1 oz)	400 g (14.1 oz)	860 g (30.3 oz)	990 g (34.9)
Derating properties					

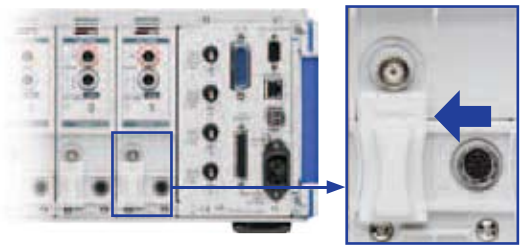
Custom cable lengths also available. Please inquire with your Hioki distributor.

Wide-band probes (connect to Probe2 input terminal)

Model	CLAMP ON PROBE 3273-50	CLAMP ON PROBE 3274	CLAMP ON PROBE 3275	CLAMP ON PROBE 3276
Appearance				
Rated primary current	30 A AC/DC	150 A AC/DC	500 A AC/DC	30 A AC/DC
Frequency band	DC to 50 MHz (-3 dB)	DC to 10 MHz (-3 dB)	DC to 2 MHz (-3 dB)	DC to 100 MHz (-3 dB)
Diameter of measurable conductors	Max.φ 5 mm (0.20") (insulated conductors)	Max.φ 20 mm (0.79") (insulated conductors)	Max.φ 20 mm (0.79") (insulated conductors)	Max.φ 5 mm (0.20") (insulated conductors)
Basic accuracy	0 to 30 A rms ±1.0% rdg. ±1 mV 30 A rms to 50 A peak ±2.0% rdg. (At DC and 45 to 66 Hz)	0 to 150 A rms ±1.0% rdg. ±1 mV 150 A rms to 300 A peak ±2.0% rdg. (At DC and 45 to 66 Hz)	0 to 500 A rms ±1.0% rdg. ±5 mV 500 A rms to 700 A peak ±2.0% rdg. (At DC and 45 to 66 Hz)	0 to 30 A rms ±1.0% rdg. ±1 mV 30 A rms to 50 A peak ±2.0% rdg. (At DC and 45 to 66 Hz)
Operating temperature	0°C to 40°C (32°F to 104°F)	0°C to 40°C (32°F to 104°F)	0°C to 40°C (32°F to 104°F)	0°C to 40°C (32°F to 104°F)
Effect of external magnetic fields	20 mA equivalent or lower (400 A/m, 60 Hz and DC)	150 mA equivalent or lower (400 A/m, 60 Hz and DC)	400 mA equivalent or lower (400 A/m, 60 Hz and DC)	400 mA equivalent or lower (400 A/m, 60 Hz and DC)
Dimensions	175W (6.89") x 18H(0.71") x 40D (1.57") mm Cable length: 1.5 m	176W (6.93") x 69H (2.72") x 27D(1.06") mm Cable length: 2 m	176W (6.93") x 69H (2.72") x 27D(1.06") mm Cable length: 2 m	175W (6.89") x 18H(0.71") x 40D (1.57") mm Cable length: 1.5 m
Mass	230 g (8.1 oz)	500 g (17.6 oz)	520 g (18.3 oz)	240 g (8.5 oz)
Derating properties				

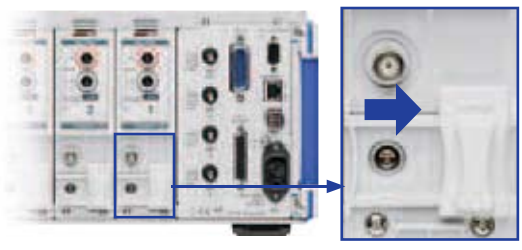
Model	CURRENT PROBE CT6700	CURRENT PROBE CT6701
Appearance		
Rated primary current	5 Arms AC/DC	5 Arms AC/DC
Frequency band	DC to 50 MHz (-3 dB)	DC to 120 MHz (-3 dB)
Diameter of measurable conductors	Max.φ 5 mm (0.20") (insulated conductors)	Max.φ 5 mm (0.20") (insulated conductors)
Basic accuracy	typical ±1.0% rdg. ±1 mV ±3.0% rdg. ±1 mV (At DC and 45 to 66 Hz)	typical ±1.0% rdg. ±1 mV ±3.0% rdg. ±1 mV (At DC and 45 to 66 Hz)
Operating temperature	0°C to 40°C (32°F to 104°F)	0°C to 40°C (32°F to 104°F)
Effects of external magnetic fields	20 mA equivalent or lower (400 A/m, 60 Hz and DC)	5 mA equivalent or lower (400 A/m, 60 Hz and DC)
Dimensions	155W (6.10") x 18H(0.71") x 26D (1.02") mm Cable length: 1.5 m	155W (6.10") x 18H(0.71") x 26D (1.02") mm Cable length: 1.5 m
Mass	250 g (8.8 oz)	250 g (8.8 oz)
Derating properties		

Sensor switching method



High accuracy sensor terminal: Slide the cover to the left.

When connecting
CT6862-05, CT6863-05, 9709-05, CT6865-05, CT6841-05, CT6843-05, CT6844-05, CT6845-05, CT6846-05, PW9100-03, PW9100-04



Wideband probe terminal: Slide the cover to the right.

When connecting
3273-50, 3274, 3275, 3276, CT6700 or CT6701

Model: POWER ANALYZER PW6001

Model No. (Order Code)	Number of built-in channels	Motor Analysis & D/A Output
PW6001-01	1ch	—
PW6001-02	2ch	—
PW6001-03	3ch	—
PW6001-04	4ch	—
PW6001-05	5ch	—
PW6001-06	6ch	—
PW6001-11	1ch	✓
PW6001-12	2ch	✓
PW6001-13	3ch	✓
PW6001-14	4ch	✓
PW6001-15	5ch	✓
PW6001-16	6ch	✓

Accessories: Instruction manual × 1, power cord × 1, D-sub 25-pin connector (PW6001-11 to -16 only) × 1

PW6001-16 (with 6 channels and Motor Analysis & D/A Output

- The optional voltage cord and current sensor are required for taking measurements.
- Specify the number of built-in channels and inclusion of Motor Analysis & D/A Output upon order for factory installation. These options cannot be changed or added at a later date.

Current measurement options

Model	Model No. (Order Code)	Note
AC/DC CURRENT SENSOR	CT6862-05	(50A)
AC/DC CURRENT SENSOR	CT6863-05	(200A)
AC/DC CURRENT SENSOR	9709-05	(500A)
AC/DC CURRENT SENSOR	CT6865-05	(1000A)
AC/DC CURRENT PROBE	CT6841-05	(20A)
AC/DC CURRENT PROBE	CT6843-05	(200A)
AC/DC CURRENT PROBE	CT6844-05	(500 A, ϕ20 mm)
AC/DC CURRENT PROBE	CT6845-05	(500 A, ϕ50 mm)
AC/DC CURRENT PROBE	CT6846-05	(1000 A)
AC/DC CURRENT BOX	PW9100-03	(50 A, 3 ch)
AC/DC CURRENT BOX	PW9100-04	(50 A, 4 ch)

Model	Model No. (Order Code)	Note
CLAMP ON PROBE	3273-50	(30A)
CLAMP ON PROBE	3274	(150A)
CLAMP ON PROBE	3275	(500A)
CLAMP ON PROBE	3276	(30A)
CURRENT PROBE	CT6700	(5A)
CURRENT PROBE	CT6701	(5A)

CONVERSION CABLE CT9900
HIOKI PL23 (10 pin) to HIOKI ME15W (12 pin) connector
For use with CT6862, CT6863, 9709, CT6865, CT6841, CT6843. When using a sensor without "-05" in the model name, Conversion Cable CT9900 must be used to make the connection.

SENSOR UNIT CT9557
Merges up to four current sensor output waveforms on a single channel, for output to PW6001.

Voltage measurement options

VOLTAGE CORD L9438-50

1000 V specifications, Black/ Red, 3 m (9.84 ft) length, Alligator clip ×2

VOLTAGE CORD L1000

1000 V specifications, Red/ Yellow/ Blue/ Gray each 1, Black 4, Alligator clip ×8, 3m (9.84ft) length

GRABBER CLIP 9243

Attaches to the tip of the banana plug cable, Red/ Black: 1 each, 196 mm (7.72 in) length, CAT III 1000 V

Connection options

CONNECTION CORD L9217

For motor signal input, cord has insulated BNC connectors at both ends, 1.6 m (5.25 ft) length

LAN CABLE 9642

Straight Ethernet cable, supplied with straight to cross conversion adapter, 5 m (16.41 ft) length

RS-232C CABLE 9637

For the PC, 9 pins - 9 pins, cross, 1.8m (5.91 ft) length

GP-IB CONNECTOR CABLE 9151-02

2m (6.56 ft) length

CONNECTION CABLE 9444

For external control interface, 9 pin - 9 pin straight, 1.5 m (4.92 ft) length

OPTICAL CONNECTION CABLE L6000

For synchronized control, 50/125 µm wavelength multimode fiber, 10 m (32.81 ft) length

Other

The following made-to-order items are also available. Please contact your Hioki distributor or subsidiary for more information.

- Carrying case (hard trunk, with casters)
- D/A output cable, D-sub 25-pin-BNC (male), 20 ch conversion
- Bluetooth® serial converter adapter cable 1 m (3.28 ft)
- Rackmount fittings (EIA, JIS)
- Optical connection cable, Max. 500 m (1640.55 ft) length
- PW9100 5 A rating version
- 2000A pull-through type sensor (DC to 5 kHz, ϕ80 mm)

2000A pull-through type sensor

Carrying case

HIOKI
HIOKI E.E. CORPORATION

HIOKI

POWER ANALYZER PW3390

NEW

High Accuracy Power Analysis.

Anywhere, Anytime.

CE

High Accuracy and Mobility.
A New Value for Power Analysis.

The original HIOKI POWER ANALYZER 3390, released 8 years ago,
featured the latest measurement technology built into a compact casing.

Pair with Hioki current sensors and take them anywhere
to immediately make highly accurate measurements.

This was the unique value of the 3390.

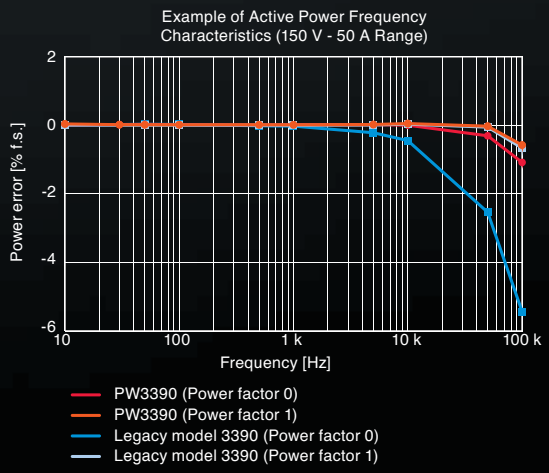
Now, Hioki has enhanced this value while refining the measurement technology even further.

Proper accuracy and bandwidth to precisely measure inverter output.
Phase shift function for the exact measurement of high frequency, low power factor power.
A broad current sensor lineup that expands the range of measurement possibilities.

Refinements that empower you to conduct precise power analysis in any situation.

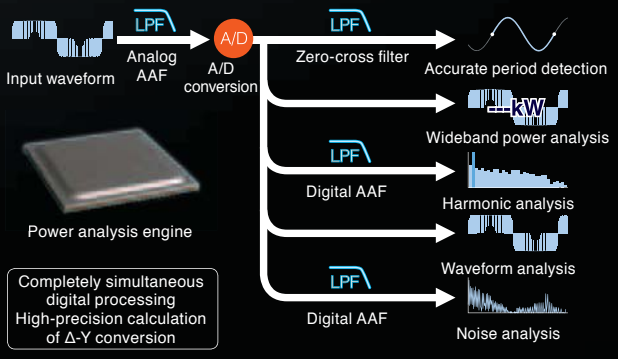
Complete Pursuit of Measurement Accuracy and High Frequency Characteristics

The PW3390 delivers 4 input channels and ±0.04% basic accuracy for power - the top instrument in its class. Achieve more precise measurements of the power and efficiency of high efficiency equipment used in power electronics. Further, a 200 kHz measurement band and flat amplitude and phase characteristics up to high frequencies enable the precise measurement of power at top frequency levels and low power factor.



Power Analysis Engine That Achieves High-Speed Simultaneous Calculation on 5 Systems

Precisely capture input waveforms with 500 kS/s high-speed sampling and a high resolution 16-bit A/D converter. The power analysis engine performs independent digital processing for 5 systems: period detection, wideband power analysis, harmonic analysis, waveform analysis, and noise analysis. High-speed simultaneous calculation processing enables both precise measurements and a 50 ms data refresh rate.



* AAF (Anti-aliasing filter):
Filter that prevents aliasing errors during sampling

Current Sensors for the Thorough Pursuit of High Accuracy. Achieve Superior Accuracy for High-Frequency, Low Power Factor Power.

High Accuracy Sensor Pass-Through Type

Pass-through type with high accuracy and a wide measurement range. Conduct extremely accurate measurements of large currents to a maximum of 1000 A over a wide operating temperature range.

High Accuracy Sensor Clamp Type

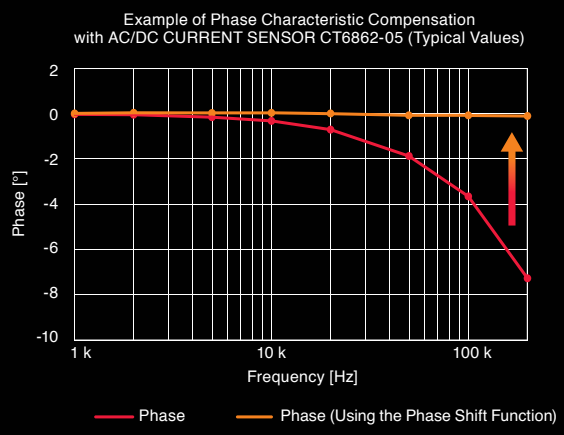
Clamp for quick and easy connections. Conduct extremely accurate measurements of large currents to a maximum of 1000 A over a wide operating temperature range.

High Accuracy Sensor Direct Wire Type

Newly developed DCCT method delivers expansive measurement range and superior measurement accuracy at a rating of 50 A.

Built-in Current Sensor Phase Shift Function

Equipped with new virtual oversampling technology. Achieve phase shift equivalent to 200 MS/s while maintaining a high speed of 500 kS/s, as well as a high resolution of 16 bits. Set and correct the phase error of the current sensor at a resolution of 0.01°. Use of the phase shift function results in a dramatic reduction of measurement error. This allows the measurement of high-frequency, low-power factor power included in the switching frequency of inverter output, which is difficult to measure with conventional equipment.



* Virtual oversampling:
Technology that uses a sampling frequency several hundred times higher than the actual sampling frequency to perform virtual deskewing

In the Laboratory or in the Field

Take Highly Accurate Measurements Even in Tough Temperature Conditions

Severe temperature environments, such as engine rooms with intense temperature changes and constant temperature rooms, can hinder high accuracy measurements. The extremely accurate pass-through and clamp type sensors both feature excellent temperature characteristics and a wide operation temperature range to help address these challenges.

Achieve High Accuracy Measurement Even in the Field

Dramatically compact and light-weight form factor achieved by concentrating the calculation functions in the power analysis engine. Highly accurate measurements normally achieved in the laboratory are now also possible in the field.

Max. 6000 A Measurement on 50 Hz/60 Hz Lines

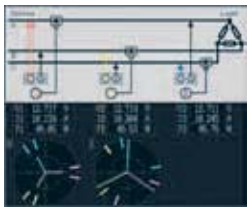
The CT7040 AC FLEXIBLE CURRENT SENSOR series can measure commercial power lines up to 6000 A, including solar power conditioner output. Even thick cables can be wired easily among crowded wiring or in narrow locations.

External Power Supply Not Needed for Sensor Connections

Power can be supplied to the current sensor from the main unit, so there is no need to provide a separate external power supply for the current sensor. Connected sensors are recognized automatically, for reliable and quick measurements.

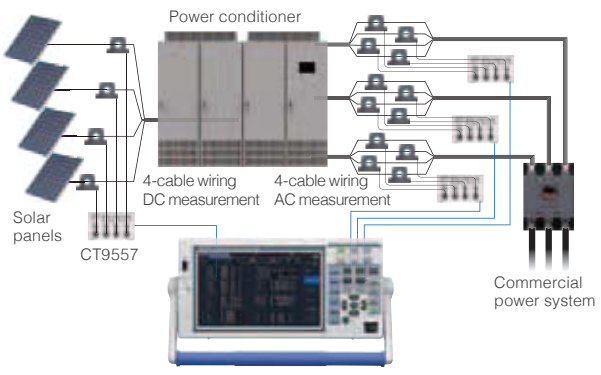
Wiring Displays and Quick Setup Lets You Begin Measuring Immediately

Perform wiring while checking wiring diagrams and vectors on the screen. Optimum settings are performed automatically simply by selecting a connection and using the quick setup function.



New Method for Measuring Large Current over Multi-Cable Wiring

Highly accurate measurement of current in multi-cable wiring with large currents has been difficult-until now. The CT9557 adds the output waveforms from the high accuracy sensors connected to each branch line of the multi-cable wiring, for the highly accurate measurement of large currents.



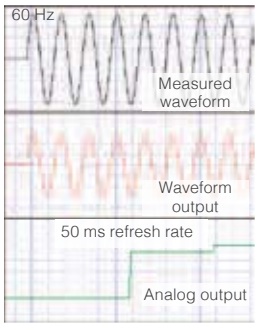
Extensive Interface for Linking with External Devices

Wide variety of built-in interfaces, including LAN, USB (communication, memory), CF cards, RS-232C, synchronization control, and external control.
D/A output* delivers analog output at 50 ms for up to 16 parameters. The voltage and current waveform** for each channel can also be output.

Interface unit

D/A
output
terminal

Example of D/A Output



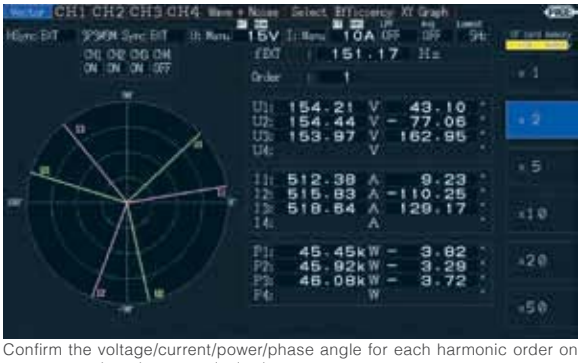
* Built-in for PW3390-02 and PW3390-03
** During waveform output, accurate reproduction is possible at an output of 500 kS/s and with a sine wave up to 20 kHz.

Switch Screens with a Single Touch, Accessing a Variety of Power Analysis Methods

The power analysis engine allows the simultaneous, parallel calculation of all parameters. Access a variety of analysis methods simply by pressing the page keys to switch screens.

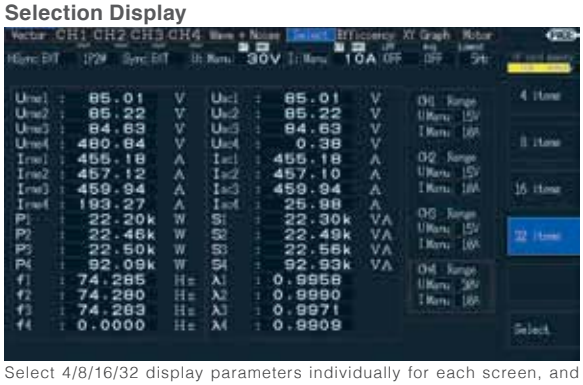
Page Keys

Vector



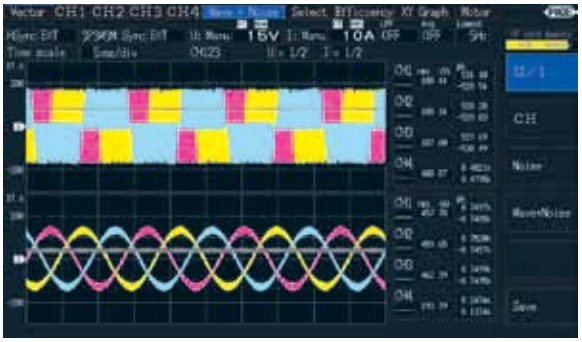
Confirm the voltage/current/power/phase angle for each harmonic order on a vector graph and as numerical values.

Selection Display



Select 4/8/16/32 display parameters individually for each screen, and summarize them on a single screen.

Waveform

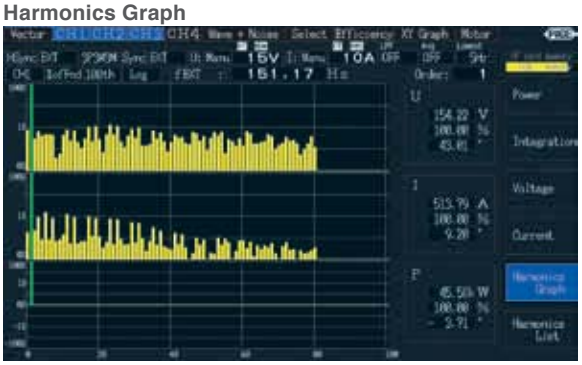


Display voltage/current waveforms for 4 channels at a high speed of 500 kS/s or a maximum length of 5 seconds. Waveform data can be saved.

Noise

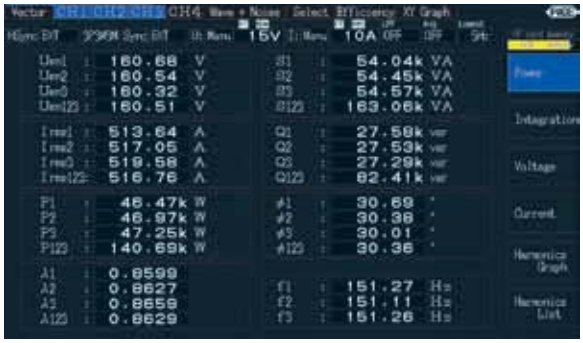
Display FFT results for voltage and current as graphs and numerical values, up to a maximum of 100 kHz. This is perfect for the frequency analysis of inverter noise.

Harmonics Graph



Display harmonics up to the 100th order for voltage/current/power in bar graphs. Confirm the numerical data for the selected order at the same time.

Power

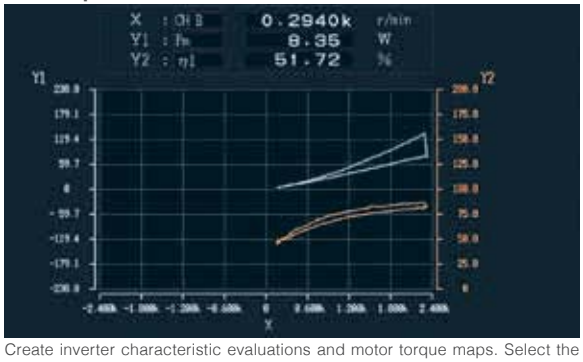


On the basic measurement screen, display voltage/current/power/power factor/frequency and other parameters in a list for each connection.

Efficiency and Loss

Using active power values and motor power values, confirm efficiency η [%] and loss [W] and total efficiency for each inverter/motor on a single unit at the same time.

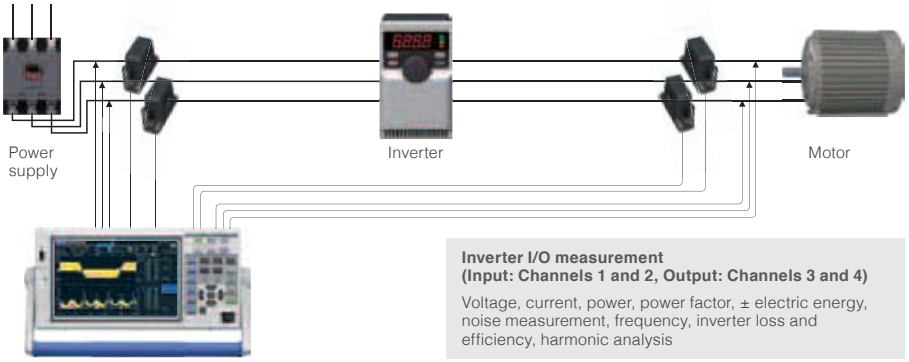
X-Y Graph



Create inverter characteristic evaluations and motor torque maps. Select the desired parameter to display an X-Y plot graph.

Applications

Measure the Power Conversion Efficiency of Inverters



Inverter I/O measurement
(Input: Channels 1 and 2, Output: Channels 3 and 4)

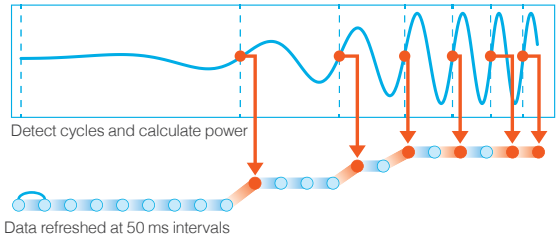
Voltage, current, power, power factor, ± electric energy, noise measurement, frequency, inverter loss and efficiency, harmonic analysis

Key features

1. Isolated input of voltage and current on each of 4 channels for simultaneous measurement of the primary and secondary power of inverters
2. Simultaneous measurement of all important parameters for secondary analysis of inverters, such as RMS value, MEAN value, and fundamental components
3. Easy wiring with current sensors. Reliable confirmation of wiring with vector diagrams
4. Current sensors reduce effects of common mode noise from inverters during power measurement
5. Simultaneous measurement of noise components, in addition to the harmonic analysis required for the measurement of inverter control

Highly Accurate and Fast 50 ms Calculation of Power in Transient State

Measure power transient states, including motor operations such as starting and accelerating, at 50 ms refresh rates. Automatically measure and keep up with power with fluctuating frequencies, from a minimum of 0.5 Hz.

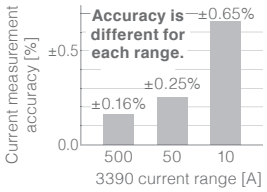


Automatic detection of fundamental wave even if the frequency fluctuates, from low to high frequencies

Combined Accuracy of Current Sensors Applicable throughout Entire Range

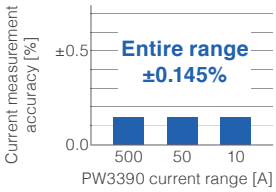
Combined accuracy throughout the entire range is provided through the use of a built-to-order high accuracy pass-through type current sensor. Obtain highly accurate measurements regardless of range, from large to minute currents, even for loads that fluctuate greatly.

Legacy Model 3390



Combination of 3390 and 9709 (500 A rating)
Total Accuracy when measuring currency of 45 to 66 Hz and f.s. for each range

Model PW3390

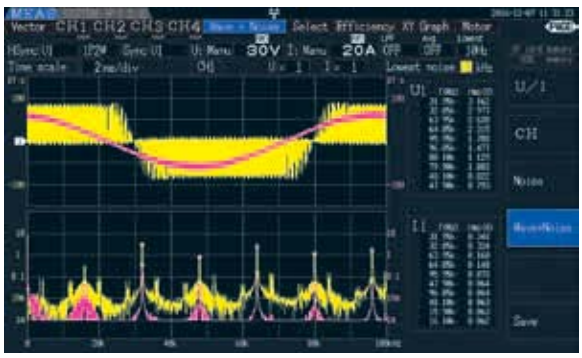


Combination of PW3390 and the high accuracy 9709-05* (500 A rating, built-to-order)
Total accuracy when measuring currency of 45 to 66 Hz and f.s. for each range

* High-accuracy specifications are not defined for the built-to-order high accuracy current sensor when used alone.

Measure High-Frequency Noise in Inverters

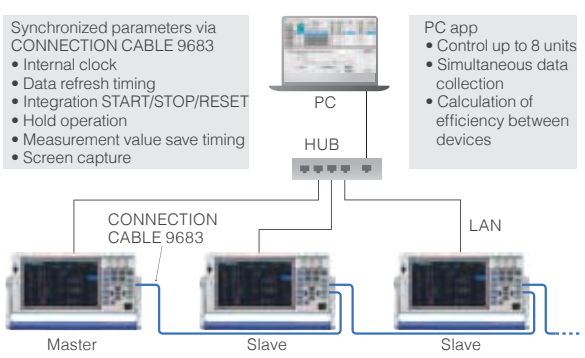
Power supply problems caused by high switching inverter frequencies are unrelated to the fundamental frequency, making it difficult to conduct proper harmonic analysis. The noise analysis function performs a frequency analysis of noise components up to 100 kHz, and displays the frequency, and voltage and current levels for the top 10 points. This is effective for measuring high-frequency noise in inverters.



Acquire Data from up to 8 Synchronized Units (32 Channels)

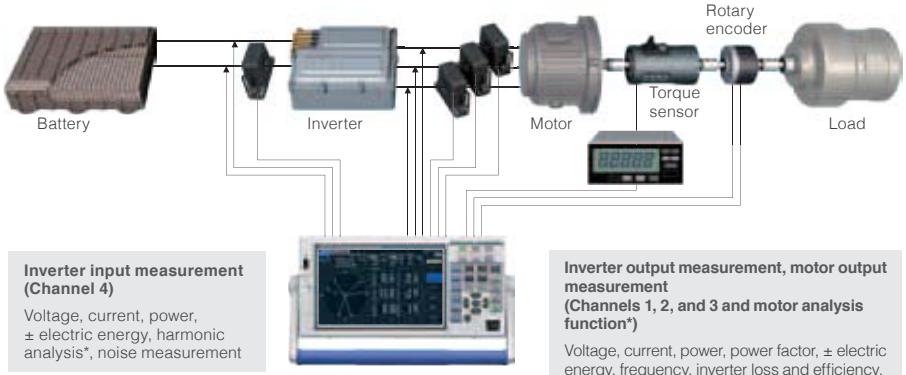
When you connect CONNECTION CABLE 9683 to multiple PW3390 units, the control signals and internal clocks synchronize. From the master unit, you can control the measurement timing on the PW3390 units that are set as slaves. With interval measurement, you can save synchronized measurement data to a CF card or a PC to achieve simultaneous measurements across a larger number of systems.

Synchronized parameters via CONNECTION CABLE 9683
- Internal clock
- Data refresh timing
- Integration START/STOP/RESET
- Hold operation
- Measurement value save timing
- Screen capture



PC app
- Control up to 8 units
- Simultaneous data collection
- Calculation of efficiency between devices

Analyze and Measure EV/HEV Inverter Motors



Inverter input measurement (Channel 4)

Voltage, current, power, ± electric energy, harmonic analysis*, noise measurement

* Can synchronize with secondary side to analyze harmonic components that overlap with DC.

Inverter output measurement, motor output measurement (Channels 1, 2, and 3 and motor analysis function*)

Voltage, current, power, power factor, ± electric energy, frequency, inverter loss and efficiency, harmonic analysis, noise measurement, rotation rate, torque, slip, motor power

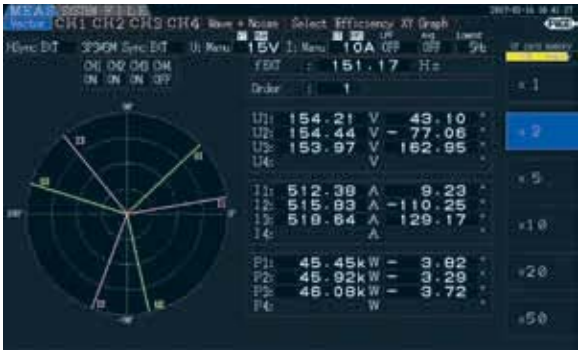
* PW3390-03 is required for motor analysis. The user must provide a torque sensor and rotation sensor.

Key features

1. Easy wiring and highly accurate measurements with the use of a pass-through type current sensor
2. Simultaneous measurement of all important parameters for secondary analysis of inverters, such as RMS value, MEAN value, and fundamental components
3. 0.5 Hz to 5 kHz harmonic analysis without external clock
4. Total measurement of inverter motors with built-in motor analysis function
5. Measurement of the voltage, torque, rotation rate, frequency, slip, and motor power required for motor analysis with a single unit
6. More precise measurements of electrical angle with incremental type encoders

Electric Angle Measurement of Motors (PW3390-03 only)

The PW3390-03 features a built-in electric angle measurement function required for vector control via dq coordinate systems in high-efficiency synchronized motors. Make real-time measurements of phase angles for voltage and current fundamental wave components based on encoder pulses. Further, zero-adjustment of the phase angle when induced voltage occurs allows electric angle measurement based on the inductive voltage phase. Electric angle can also be used as an Ld and Lq calculation parameter for synchronized motors.

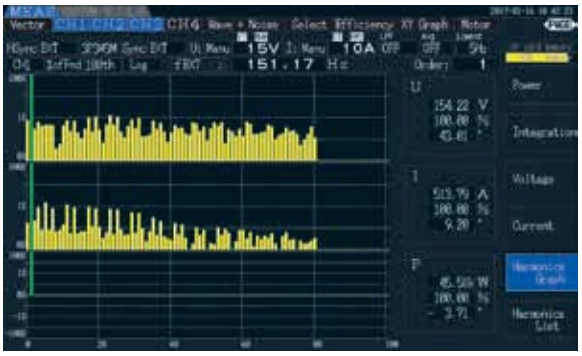


Display motor electric angles on the vector screen

Motor analysis screen (Torque, rotation rate, motor power, slip)
For CH B, enter the Z-phase pulse of the encoder to measure electric angle, and enter the B-phase pulse to measure rotation direction.

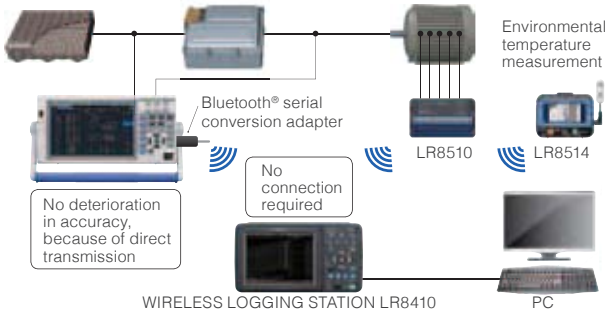
Measure Harmonics with Consideration for PWM Waveform Characteristics

The zero-crossing filter automatically matches the input frequency in the range of 0.5 Hz to 5 kHz to reliably detect the fundamental frequency. Further, harmonic analysis that is based on the fundamental frequency automatically prevents aliasing error using a digital AAF, which allows both precision and measurement reproducibility at a high level.



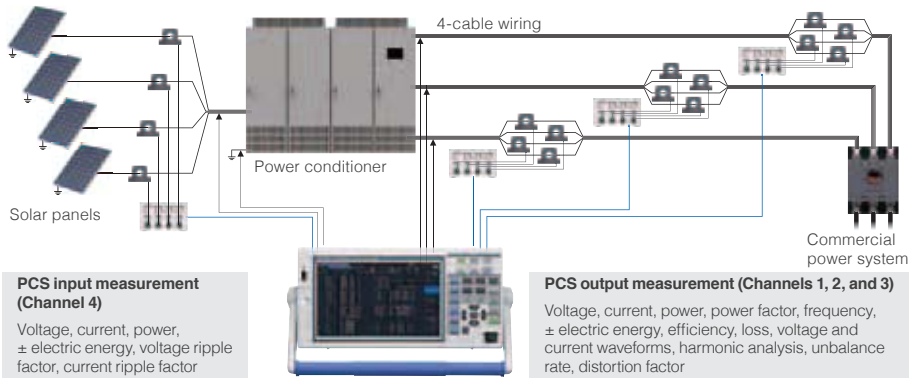
Transfer to Data Logger via Bluetooth® wireless technology

Connect the PW3390 and a data logger (with support of LR8410 Link) via Bluetooth® wireless technology to wirelessly transmit 8 parameters of measurement values from the PW3390 to the data logger. In addition to the voltage, temperature, humidity, and other parameters measured by the multichannel data logger, you can also integrate the measurement values of the PW3390 and observe and record them in real time.



* Connection requires the serial - (Bluetooth® wireless technology) conversion adapter and power supply adapter recommended by Hioki. Please inquire with your Hioki distributor.

Measure the Efficiency of PV Power Conditioners (PCS)



PCS input measurement (Channel 4)

Voltage, current, power, ± electric energy, voltage ripple factor, current ripple factor

PCS output measurement (Channels 1, 2, and 3)

Voltage, current, power, power factor, frequency, ± electric energy, efficiency, loss, voltage and current waveforms, harmonic analysis, unbalance rate, distortion factor

Key features

1. 4 built-in channels, standard. Simultaneously measure the I/O characteristics of power conditioners.
2. Current sensors can measure even large currents with high accuracy. Reliable confirmation of wiring with vector diagrams.
3. Measure the amount of power sold/purchased from power conditioner output on interconnected systems with a single unit.
4. DC mode integration function, which responds quickly to input fluctuations such as with solar power, built in.
5. Measure ripple factor, efficiency, loss, and all other parameters that are required for the measurement of power conditioners for solar power with a single unit.

HIOKI's Current Measurement Solutions for Large Currents of 1000 A or More

Introducing a lineup of sensors taking measurements up to 6000 A for 50 Hz/60 Hz, and up to 2000 A for direct current. The CT9557 SENSOR UNIT lets you add the output waveforms from multiple high accuracy sensors. Use multi-cable wiring lines to take highly accurate measurements of up to 4000 A.

Blue: High accuracy sensor Black: Normal sensors

Recommended current sensor by measurement target		DC power	System power 50 Hz/60 Hz	Inverter secondary power
1000 A or less		CT6865-05 or CT6846-05		
2000 A or less	1-cable wiring	CT7742	CT7642	-
	2-cable wiring	CT9557 + CT6865-05 x 2 or CT9557 + CT6846-05 x 2		
4000 A or less	Less than 4-cable wiring	-	CT7044/CT7045/CT7046	-
	4-cable wiring	CT9557 + CT6865-05 x 4 or CT9557 + CT6846-05 x 4		
6000 A or less		-	CT7044/CT7045/CT7046	-


CT6865-05 (AC/DC 1000 A)
Pass-through type; Wideband, high accuracy


CT6846-05 (AC/DC 1000 A)
Easy-connect clamp type


CT9557
Add waveforms from multiple current sensors

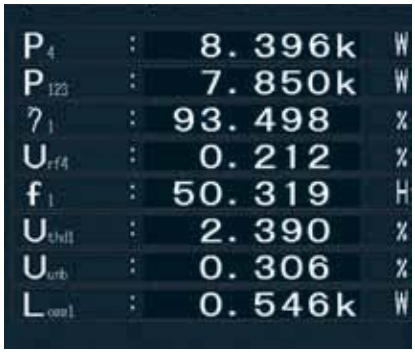

CT7742 (AC/DC 2000 A)
Stable measurement of DC without zero offset


CT7642 (AC/DC 2000 A)
Wider frequency characteristics than the CT7742


CT7044/ CT7045/ CT7046 (AC 6000 A)
Flexible, for easy connections even in narrow gaps

Support for PCS Parameters

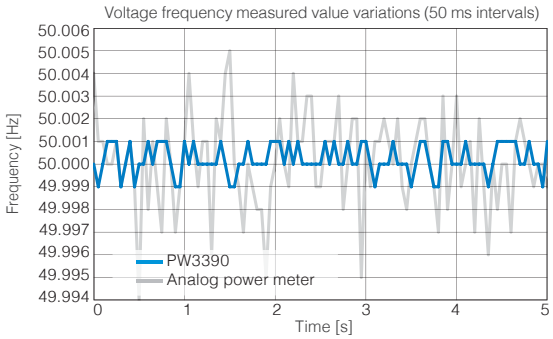
Simultaneously display the parameters required for PCS, such as efficiency, loss, DC ripple factor, and 3-phase unbalance rate. Easily check the required measured items for improved test efficiency. By matching the measurement synchronization source for both input and output, you can perform DC power measurements that are synchronized with the output AC as well as stable efficiency measurements.



DC power (panel output)
3-phase power (PCS output)
Conversion efficiency
Ripple factor
Frequency
Voltage total harmonic distortion
Unbalance rate
Loss

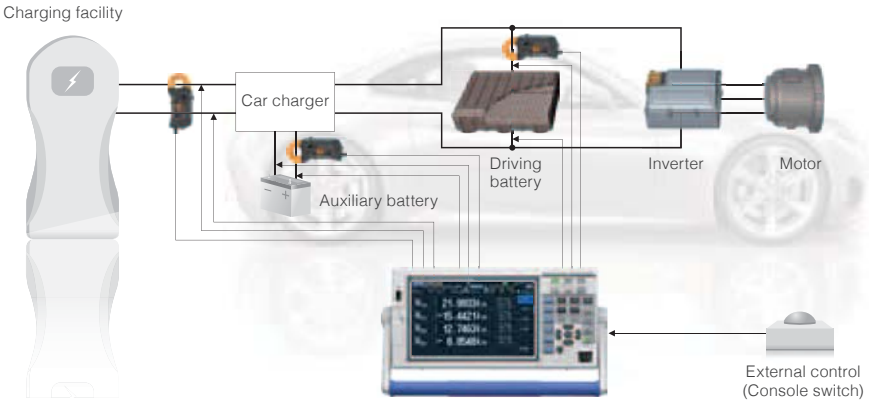
±0.01 Hz* Basic Accuracy for Voltage Frequency Measurements

Perform the frequency measurements that are required for various PCS tests with industry-leading accuracy and stability. Take highly accurate frequency measurements on up to 4 channels simultaneously, while also measuring other parameters at the same time.



* If you require even higher accuracy for frequency, please inquire with your local Hioki distributor.

Test Automobile Fuel Economy

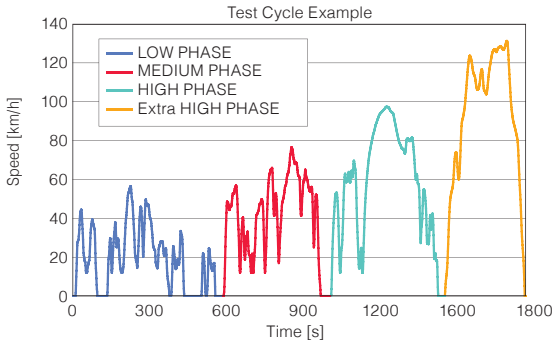


Key features

1. Accurately measure recharge and discharge power with excellent basic accuracy and DC accuracy.
2. 4 built-in channels, standard. Support for multiple recharge and discharge measurements, including auxiliary batteries.
3. Easily achieve highly accurate measurements with clamp sensors, which can be used in a wide range of operating temperatures.
4. Easily link with other measuring instruments through integration control with an external control interface.

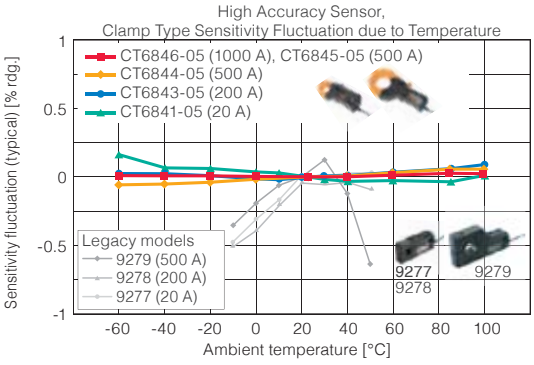
Evaluate WLTC Mode Performance - A New Fuel Economy Standard

Taking fuel economy measurements that comply with WLTP international standards requires the precise measurement of current integration and power integration for the recharging/discharging of each battery in the system. High accuracy clamp current sensors, the excellent DC accuracy of the PW3390, and the ability to integrate current and power at 50 ms intervals are extremely effective in meeting this application.



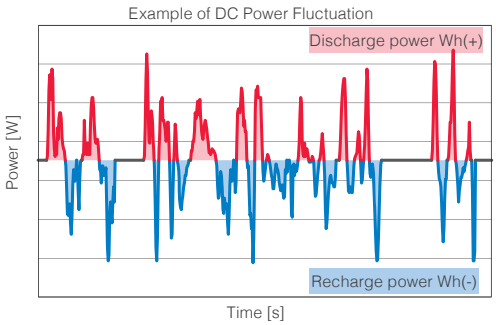
Optimal Current Sensors for Automotive Testing

Easily connect high accuracy clamp-type sensors without cutting the cables. Sensors operate over a temperature range of -40°C to 85°C (-40°F to 185°F), characteristics that enable highly accurate measurements even inside the engine room of a car.



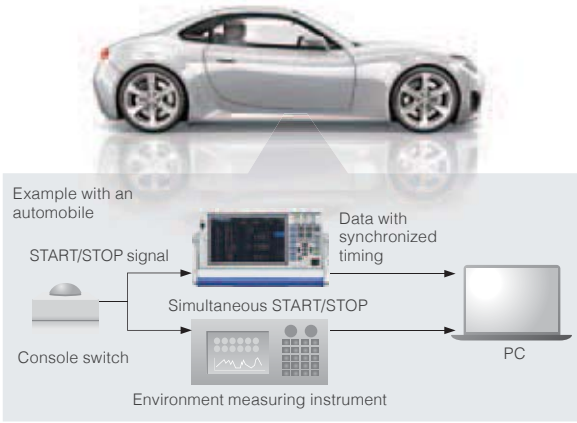
Current and Power Integration Function by Polarity

DC integration measurement integrates the recharging power and discharging power by polarity for every sample at 500 kS/s, and measures positive-direction power magnitude, negative-direction power magnitude, and the sum of positive- and negative-direction power magnitude during the integration period. Accurate measurement of recharging power and discharging power is possible even if there is rapid repetition of battery recharging/discharging.

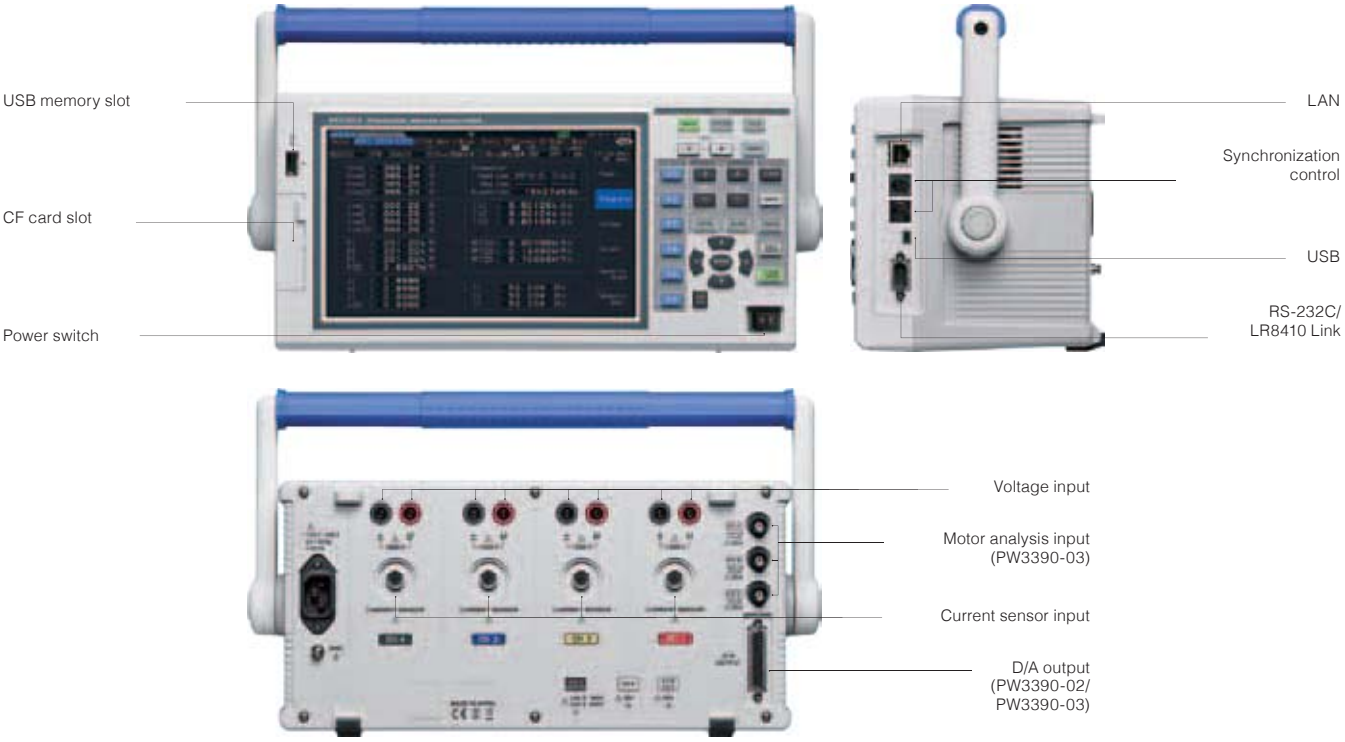


Link to Peripheral Devices via External Control

Use external control terminals to START/STOP integration and capture screen shots. This makes it easy to control operations from console switches and link to the timing of other instruments when measuring the performance of an actual automobile.



External Appearance

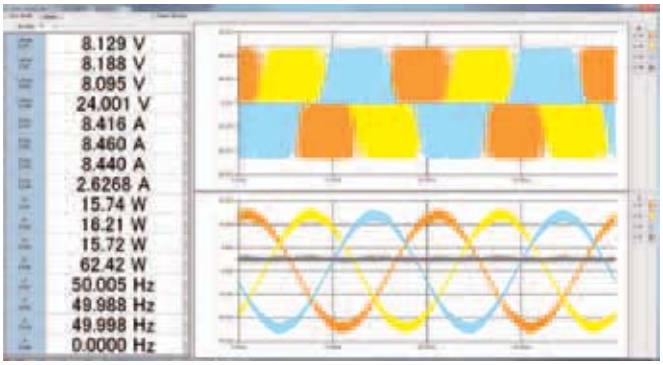


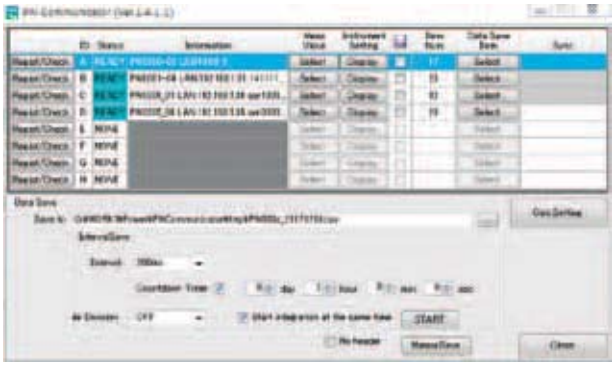
Software

Download software, drivers, and the Communications Command Instruction Manual from the Hioki website. https://www.hioki.com

"PW Communicator" PC Communication Software

PW Communicator is an application program for communicating between a PW3390 series power analyzer and a PC. It includes many useful functions, such as configuring PW3390 settings, monitoring measurement values, saving CSV data, and calculating efficiency.





Numerical value monitoring	Display the PW3390's measurement values on the PC screen. You can freely select up to 32 values, such as voltage, current, power, and harmonics.
Waveform monitoring	Monitor the measured voltage, current, and waveforms on the PC screen.
Meter setting	Change the settings of the connected PW3390 from the PC screen.
Measure with multiple units	In addition to the PW3390, it is also possible to perform batch control of up to 8 devices from the HIOKI PW6001 Power Analyzer and the PW3335, PW3336, and PW3337 Power Meter series. You can also simultaneously record measured data to the PC, and perform efficiency calculations for measuring instruments.
Record in CSV format	Record measured data to a CSV file at regular time intervals. The minimum recording interval is 50 ms.

Operating environment	PC/AT-compatible computer
OS	Windows 10 Windows 8 Windows 7 (32bit/64bit) * Windows is a registered trademark of Microsoft Corporation in the United States and/or other countries.
Memory	2 GB or more recommended
Interface	LAN/RS-232C/USB

LabVIEW Driver

Obtain data and configure measurement systems with the LabVIEW driver.

* LabVIEW is a registered trademark of NATIONAL INSTRUMENTS.

Specifications

Basic Specifications

Accuracy guaranteed for 6 months (and 1.25 times specified accuracy for one year)
Post-adjustment accuracy guaranteed for: 6 months

-1. Power Measurement Input Specifications

Measurement line type	Single-phase 2-wire (1P2W), Single-phase 3-wire (1P3W), 3-phase 3-wire (3P3W2M, 3P3W3M), 3-phase 4-wire (3P4W)

	CH1	CH2	CH3	CH4
Pattern 1	1P2W	1P2W	1P2W	1P2W
Pattern 2	1P3W		1P2W	1P2W
Pattern 3	3P3W2M		1P2W	1P2W
Pattern 4	1P3W		1P3W	
Pattern 5	3P3W2M		1P3W	
Pattern 6	3P3W2M		3P3W2M	
Pattern 7	3P3W3M			1P2W
Pattern 8	3P4W			1P2W

Number of input channels	Voltage: 4 channels U1 to U4 Current: 4 channels I1 to I4
Measurement input terminal type	Voltage: Plug-in jacks (safety jacks) Current: Dedicated custom connectors (ME15W)
Input methods	Voltage: Isolated inputs, resistive dividers Current: Insulated current sensors (voltage output)
Voltage range	15 V/30 V/60 V/150 V/300 V/600 V/1500 V (Selectable for each measured wiring system. AUTO range available.)
Current range ( ): Sensor used	2 A/4 A/8 A/20 A (with the 9272-05, 20 A) 0.4 A/0.8 A/2 A/4 A/8 A/20 A (with the CT6841-05) 4 A/8 A/20 A/40 A/80 A/200 A (200 A sensor) 40 A/80 A/200 A/400 A/800 A/2 kA (2000 A sensor) 0.1 A/0.2 A/0.5 A/1 A/2 A/5 A (5 A sensor) 1 A/2 A/5 A/10 A/20 A/50 A (50 A sensor) 10 A/20 A/50 A/100 A/200 A/500 A (500 A sensor) 20 A/40 A/100 A/200 A/400 A/1 kA (1000 A sensor) 400 A/800 A/2 kA (CT7642 and CT7742) 400 A/800 A/2 kA/4 kA/8 kA (CT7044, CT7045, and CT7046) 400 A/800 A/2 kA/4 kA/8 kA/20 kA (100 uV/A sensor) 40 A/80 A/200 A/400 A/800 A/2 kA (1 mV/A sensor) 4 A/8 A/20 A/40 A/80 A/200 A (10 mV/A sensor) 0.4 A/0.8 A/2 A/4 A/8 A/20 A (100 mV/A sensor) (Selectable for each measured wiring system. AUTO range available.)
Power range	Determined automatically by the combination of voltage range, current range, and measurement line. 1.5000 W to 90.00 MW
Crest factor	300 (relative to minimum effective voltage/current input) (for 1500 V range: 133) 3 (relative to voltage/current range rating) (for 1500 V range: 1.33)
Input resistance (50 Hz/60 Hz)	Voltage input section : 2 MΩ ±40 kΩ (differential input and insulated input) Current sensor input section : 1 MΩ ±50 kΩ
Maximum input voltage	Voltage input section : 1500 V, ±2000 Vpeak Current sensor input section : 5 V, ±10 Vpeak
Maximum rated voltage to earth	Voltage input terminal 1000 V (50 Hz/60 Hz) Measurement categories III 600 V (anticipated transient overvoltage 6000 V) Measurement categories II 1000 V (anticipated transient overvoltage 6000 V)
Measurement method	Simultaneous digital sampling of voltage and current, simultaneous zero-crossing calculation method
Sampling	500 kHz/16 bit
Measurement frequency range	DC, 0.5 Hz to 200 kHz
Synchronization frequency range	0.5 Hz to 5 kHz Selectable lower limit measurement frequency (0.5 Hz/1 Hz/2 Hz/5 Hz/10 Hz/20 Hz)
Synchronization source	U1 to U4, I1 to I4, Ext (with the motor evaluation installed model and CH B set for pulse input), DC (50 ms or 100 ms fixed) Selectable for each measurement channel (U/I for each channel measured using the same synchronization source) The zero-crossing filter automatically matches the digital LPF when U or I is selected. Two filter levels (strong or mild) Operation and accuracy are undetermined when the zero-crossing filter is disabled (off). Operation and accuracy are determined when U or I is selected and measured input is 30% f.s. or above.
Data update interval	50 ms
LPF	OFF/500 Hz/5 kHz/100 kHz (selectable for each wiring system) 500 Hz: Accuracy defined at 60 Hz or below (Add ±0.1% f.s.) 5 kHz: Accuracy defined at 500 Hz or below 100 kHz: Accuracy defined at 20 kHz or below (Add 1% rdg. at or above 10 kHz)
Zero-crossing filter	Off, mild or strong
Polarity discrimination	Voltage/current zero-crossing timing comparison method Zero-crossing filter provided by digital LPF
Basic measurement parameters	Frequency, RMS voltage, voltage mean value rectification RMS equivalent, voltage AC component, voltage simple average, voltage fundamental wave component, voltage waveform peak +, voltage waveform peak -, voltage total harmonic distortion, voltage ripple factor, voltage unbalance factor, RMS current, current mean value rectification RMS equivalent, current AC component, current simple average, current fundamental wave component, current waveform peak +, current waveform peak -, current total harmonic distortion, current ripple factor, current unbalance factor, active power, apparent power, reactive power, power factor, voltage phase angle current phase angle, power phase angle, positive-direction current magnitude, negative-direction current magnitude, sum of positive- and negative-direction current magnitude, positive-direction power magnitude, negative-direction power magnitude, sum of positive- and negative-direction power magnitude, efficiency, loss (PW3390-03) Motor torque, rpm, motor power, slip
Voltage/current rectification method	Select which voltage and current values to use for calculating apparent and reactive power, and power factor RMS/MEAN (voltage and current in each phase system)
Display resolution	99,999 counts (other than the integrated value) 999,999 counts (Integrated value)

Accuracy			
		Voltage (U)	Current (I)
	DC	±0.05% rdg. ±0.07% f.s.	±0.05% rdg. ±0.07% f.s.
	0.5 Hz ≤ f < 30 Hz	±0.05% rdg. ±0.1% f.s.	±0.05% rdg. ±0.1% f.s.
	30 Hz ≤ f < 45 Hz	±0.05% rdg. ±0.1% f.s.	±0.05% rdg. ±0.1% f.s.
	45 Hz ≤ f ≤ 66 Hz	±0.04% rdg. ±0.05% f.s.	±0.04% rdg. ±0.05% f.s.
	66 Hz < f ≤ 1 kHz	±0.1% rdg. ±0.1% f.s.	±0.1% rdg. ±0.1% f.s.
	1 kHz < f ≤ 10 kHz	±0.2% rdg. ±0.1% f.s.	±0.2% rdg. ±0.1% f.s.
	10 kHz < f ≤ 50 kHz	±0.3% rdg. ±0.2% f.s.	±0.3% rdg. ±0.2% f.s.
	50 kHz < f ≤ 100 kHz	±1.0% rdg. ±0.3% f.s.	±1.0% rdg. ±0.3% f.s.
	100 kHz < f ≤ 200 kHz	±20% f.s.	±20% f.s.
		Active power (P)	Phase difference
	DC	±0.05% rdg. ±0.07% f.s.	-
	0.5 Hz ≤ f < 30 Hz	±0.05% rdg. ±0.1% f.s.	±0.08°
	30 Hz ≤ f < 45 Hz	±0.05% rdg. ±0.1% f.s.	±0.08°
	45 Hz ≤ f ≤ 66 Hz	±0.04% rdg. ±0.05% f.s.	±0.08°
	66 Hz < f ≤ 1 kHz	±0.1% rdg. ±0.1% f.s.	±0.08°
	1 kHz < f ≤ 10 kHz	±0.2% rdg. ±0.1% f.s.	±(0.06*f+0.02)°
	10 kHz < f ≤ 50 kHz	±0.4% rdg. ±0.3% f.s.	±0.62°
	50 kHz < f ≤ 100 kHz	±1.5% rdg. ±0.5% f.s.	±(0.005*f+0.4)°
	100 kHz < f ≤ 200 kHz	±20% f.s.	±(0.022*f-1.3)°

Values of f in above tables are given in kHz.
Accuracy figures for DC voltage and current are defined for Udc and Idc, while accuracy figures for frequencies other than DC are defined for Urms and Irms.
Accuracy figures for phase difference values are defined for full-scale input with a power factor of zero and the LPF disabled.
Accuracy figures for voltage, current, and active power values in the frequency range of 0.5 Hz to 10 Hz are provided as reference values.
Accuracy figures for voltage and active power values in excess of 220 V in the frequency range of 10 Hz to 16 Hz are provided as reference values.
Accuracy figures for voltage and active power values in excess of 750 V in the frequency range of 30 kHz to 100 kHz are provided as reference values.
Accuracy figures for voltage and active power values in excess of (22,000/f [kHz]) V in the frequency range of 100 kHz to 200 kHz are provided as reference values.
Accuracy figures for voltage and active power values in excess of 1000 V are provided as reference values.
Accuracy figures for phase difference values outside the frequency range of 45 Hz to 66 Hz are provided as reference values.
For voltages in excess of 600 V, add the following to the phase difference accuracy:
500 Hz < f ≤ 5 kHz:±0.3°
5 kHz < f ≤ 20 kHz:±0.5°
20 kHz < f ≤ 200 kHz:±1°
Add ±20 µV to the DC current and active power accuracy (at 2 V f.s.)

Add the current sensor accuracy to the above accuracy figures for current, active power, and phase difference.
However, the combined accuracy is defined separately for the current measurement options listed below.

When used with current measurement options PW9100-03 or PW9100-04, combined accuracy is defined as follows (with PW3390 range as f.s.):

	Current (I)	Active power (P)
DC	±0.07% rdg. ±0.077% f.s.	±0.07% rdg. ±0.077% f.s.
45 Hz ≤ f ≤ 66 Hz	±0.06% rdg. ±0.055% f.s.	±0.06% rdg. ±0.055% f.s.

Add ±0.12% f.s. (f.s. = PW3390 range) when using 1 A or 2 A range.

When used with any of the following current measurement options: special-order high-accuracy 9709-05, high-accuracy CT6862-05, or high-accuracy CT6863-05, combined accuracy is defined as follows (with PW3390 range as f.s.):

	Current (I)	Active power (P)
DC	±0.095% rdg. ±0.08% f.s.	±0.095% rdg. ±0.08% f.s.
45 Hz ≤ f ≤ 66 Hz	±0.085% rdg. ±0.06% f.s.	±0.085% rdg. ±0.06% f.s.

Apply LPF accuracy definitions to the above accuracy figures when using the LPF.

Conditions of guaranteed accuracy	Temperature and humidity for guaranteed accuracy: 23°C ±3°C (73°F ±5°F), 80% R.H. or less Warm-up time: 30 min. or more Input: Within the specified ranges when the fundamental wave is synchronized with the sync source, for sine wave input, power factor of one, or DC input, zero ground voltage, within effective measurement range after zero-adjustment and within the range in which the fundamental wave satisfies the synchronization source conditions
Temperature coefficient	±0.01% f.s./°C (for DC, add ±0.01% f.s./°C)
Effect of common mode voltage	±0.01% f.s. or less (with 1000 V @50 Hz/60 Hz applied between voltage measurement jacks and chassis)
Magnetic field interference	±1% f.s. or less (in 400 A/m magnetic field, DC and 50 Hz/60 Hz)
Power factor influence	Other than φ = ±90°: ±(1-cos (φ+Phase difference accuracy)/cos(φ)) ×100% rdg. When φ = ±90°: ±cos (φ+Phase difference accuracy) ×100% f.s.
Susceptibility to conducted electromagnetic field	@3 V, current and active power not more than ±6% f.s., where f.s. current is the rated primary-side current of the current sensor f.s. active power equals the voltage range × the rated primary-side current of the current sensor
Susceptibility to radiated electromagnetic field	@10 V/m, current and active power not more than ±6% f.s., where f.s. current is the rated primary-side current of the current sensor f.s. active power equals the voltage range × the rated primary-side current of the current sensor
Effective measuring range	Voltage, Current, Power: 1% to 110% of the range
Total display area	Voltage, Current, Power: from zero-suppression range setting to 120%
Zero-suppression ranges	Selectable OFF, 0.1 or 0.5% f.s. When OFF, non-zero values may be displayed even with no measurement input
Zero adjustment	Voltage: Zero-adjustment compensation of internal offset at or below ±10% f.s. Current: Zero-adjustment compensation of input offset at or below ±10% f.s. ±4 mV
Waveform peak measurement range	Within ±300% of each voltage and current range
Waveform peak measurement accuracy	Within ±2% f.s. of voltage and current display accuracy

-2. Frequency Measurement Specifications

Measurement channels	Four (f1 to f4)
Measurement source	Select U/I for each measurement channel
Measurement method	Reciprocal method + zero-crossing sample value correction
Measuring range	Synchronous range from 0.5 Hz to 5 kHz (with "0.0000 Hz" or "----- Hz" unmeasurable time)
Lower limit measurement frequency	0.5 Hz/1 Hz/2 Hz/5 Hz/10 Hz/20 Hz
Data update interval	50 ms (measurement-frequency-dependent at 45 Hz and below)
Accuracy	±0.01 Hz (during voltage frequency measurement within the range of 45 Hz to 66 Hz) ±0.05% rdg., ±1 dgt. (under other conditions) With sine wave of at least 30% of the measurement source's measurement range
Numerical display format	0.5000 Hz to 9.9999 Hz, 9.900 Hz to 99.999 Hz, 99.00 Hz to 999.99 Hz, 0.9900 kHz to 5.0000 kHz

-3. Integration Measurement Specifications

Measurement mode	Selectable between RMS or DC for each wiring mode
Measurement items	Current integration (Ih+, Ih-, and Ih), active power integration (WP+, WP-, and WP) Ih+ and Ih- only for DC mode measurements, and Ih only for RMS mode measurements
Measurement method	Digital calculation from each current and active power phase (when averaging, calculates with previous average value) In DC mode: calculates current value at every sample, and integrates instantaneous power independent of polarity In RMS mode: Integrates current effective values between measurement intervals, and polarity-independent active power value
Measurement interval	50 ms data update interval
Measuring range	Integration value: 0 Ah/Wh to ±9999.99 TAh/TWh Integration time: No greater than 9999h59m
Integration time accuracy	±50 ppm ±1 dgt. (0°C to 40°C (32°F to 104°F))
Integration accuracy	± (current and active power accuracy) ± integration time accuracy
Backup function	Integration automatically resumes after power outages.

-4. Harmonic Measurement Specifications

Number of measurement channels	4 channels Harmonic measurements not available for multiple systems with different frequencies.
Measurement items	Harmonic rms voltage, harmonic voltage percentage, harmonic voltage phase angle, harmonic rms current, harmonic current percentage, harmonic current phase angle, harmonic active power, harmonic power percentage, harmonic voltage-current phase difference, total harmonic voltage distortion, total harmonic current distortion, voltage unbalance factor, current unbalance factor
Measurement method	Zero-crossing synchronous calculation (all channels in same window), with gap Fixed 500 kS/s sampling, after digital anti-aliasing filter Equal thinning between zero crossings (with interpolation calculation)
Harmonic sync source	U1 to U4, I1 to I4, External (with motor analysis and CH B set for pulse input), DC selectable (50 ms or 100 ms)
FFT calculation word length	32 bits
Anti-aliasing filter	Digital filter (automatically set based on synchronization frequency)
Windows	Rectangular
Synchronization frequency range	As specified for power measurements
Data update interval	50 ms (measurement-frequency-dependent at 45 Hz and below)
Phase zero adjustment	Provided by key operation or external control command (only with external sync source)
THD calculation	THD-F/THD-R
Highest order analysis and window waveforms	See table below
Accuracy	See table below

Synchronization frequency range	Window waveforms	Analysis order
0.5 Hz ≤ f < 40 Hz	1	100th
40 Hz ≤ f < 80 Hz	1	100th
80 Hz ≤ f < 160 Hz	2	80th
160 Hz ≤ f < 320 Hz	4	40th
320 Hz ≤ f < 640 Hz	8	20th
640 Hz ≤ f < 1.2 kHz	16	10th
1.2 kHz ≤ f < 2.5 kHz	32	5th
2.5 kHz ≤ f < 5.0 kHz	64	3th

Frequency	Voltage(U), Current(I), Active Power(P)
0.5 Hz ≤ f < 30 Hz	±0.4% rdg. ±0.2% f.s.
30 Hz ≤ f ≤ 400 Hz	±0.3% rdg. ±0.1% f.s.
400 Hz < f ≤ 1 kHz	±0.4% rdg. ±0.2% f.s.
1 kHz < f ≤ 5 kHz	±1.0% rdg. ±0.5% f.s.
5 kHz < f ≤ 10 kHz	±2.0% rdg. ±1.0% f.s.
10 kHz < f ≤ 13 kHz	±5.0% rdg. ±1.0% f.s.

Not specified for sync frequencies of 4.3 kHz and higher
Add the LPF accuracy to the above when using LPF.

-5. Noise Measurement Specifications

Calculation channels	1 (Select one from CH1 to CH4)
Calculation items	Voltage noise/Current noise
Calculation type	RMS spectrum
Calculation method	Fixed 500 kS/s sampling, thinning after digital anti-aliasing filter
FFT calculation word length	32 bits
FFT data points	1000/5000/10,000/50,000 (according to displayed waveform recording length)
Anti-aliasing filter	Automatic digital filter (varies with maximum analysis frequency)
Windows	Rectangular/Hanning/flat-top
Data update interval	Determined by FFT points within approx. 400 ms, 1 s, 2 s, or 15 s, with gap
Highest analysis frequency	100 kHz/50 kHz/20 kHz/10 kHz/5 kHz/2 kHz
Frequency resolution	0.2 Hz to 500 Hz (Determined by FFT points and maximum analysis frequency)
Noise amplitude measurement	Calculates the ten highest level and frequency voltage and current FFT peak values (local maxima).
Lower limit noise frequency	0 kHz to 10 kHz

-6. Motor Analysis Specifications (Model PW3390-03)

Number of input channels	3 channels CH A: Analog DC input/Frequency input (selectable) CH B: Analog DC input/Pulse input (selectable) CH Z: Pulse input
Measurement input terminal type	Insulated BNC jacks
Input impedance (DC)	1 MΩ ±100 kΩ
Input methods	Isolated and differential inputs (not isolated between channels B and Z)
Measurement items	Voltage, torque, rotation rate, frequency, slip, and motor power
Synchronization source	U1 to U4, I1 to I4, Ext (with CH B set for pulse input), DC (50 ms/100 ms) Common to channels A and B
Measurement frequency source	f1 to f4 (for slip calculations)
Maximum input voltage	±20 V (during analog, frequency, and pulse input)
Maximum rated voltage to earth	50 V (50 Hz/60 Hz)

(1). Analog DC Input (CH A/CH B)

Measurement range	±1 V, ±5 V, ±10 V (when inputting analog DC)
Valid input range	1% to 110% f.s.
Sampling	10 kHz/16 bits
Response time	1 ms (measuring zero to full scale, with LPF off)
Measurement method	Simultaneous digital sampling and zero-crossing synchronous calculation system (cumulative average of intervals between zero crossings)
Measurement accuracy	±0.08% rdg. ±0.1% f.s.
Temperature coefficient	±0.03% f.s./°C
Effect of common mode voltage	Not more than ±0.01% f.s. (with 50 V [DC or 50 Hz/60 Hz] between measurement jacks and PW3390 chassis)
Effect of external magnetic field	Not more than ±0.1% f.s. (at 400 A/m DC and 50 Hz/60 Hz magnetic fields)
LPF	OFF/ON (OFF: 4 kHz, ON: 1 kHz)
Total display area	Zero-suppression range setting ±120%
Zero adjustment	Zero-corrected input offset of voltage ±10% f.s. or less
Scaling	0.01 ~ 9999.99
Unit	CH A: V, N• m, mN• m, kN• m CH B: V, Hz, r/min

(2). Frequency Input (CH A only)

Valid amplitude range	±5 V peak (5 V symmetrical, equivalent to RS-422 complementary signal)
Max. measurement frequency	100 kHz
Measurement range	1 kHz to 100 kHz
Data output interval	According to synchronization source
Measurement accuracy	±0.05% rdg., ±3 dgt.
Total display area	1.000 kHz to 99.999 kHz
Frequency range	Select fc and fd for frequency range fc ± fd [Hz] (frequency measurement only) 1 kHz to 98 kHz in 1 kHz units, where fc + fd < 100 kHz and fc – fd > 1 kHz
Rated torque	1 ~ 999
Unit	Hz, N• m, mN• m, kN• m

(3). Pulse Input (CH B only)

Detection level	Low: 0.5 V or less; High: 2.0 V or more
Measurement range	1 Hz to 200 kHz (at 50% duty)
Division setting range	1 ~ 60000
Measurement frequency range	0.5 Hz to 5.0 kHz (limited to measured pulse frequency divided by selected no. of divisions)
Minimum detectable pulse width	2.5 μs or more
Measurement accuracy	±0.05% rdg., ±3 dgt.
Motor poles	2 ~ 98
Max. measurement frequency	100 Hz, 500 Hz, 1 kHz, 5 kHz
Pulse count	Integer multiple of half the number of motor poles, from 1 to 60,000
Unit	Hz, r/min

(4). Pulse Input (CH Z only)

Detection level	Low: 0.5 V or less; High: 2.0 V or more
Measurement range	0.1 Hz to 200 kHz (at 50% duty)
Minimum detectable pulse width	2.5 μs or more
Settings	OFF/Z Phase/B Phase (clear counts of CHB in rising edge during Z Phase, detect polar code for number of rotations during B Phase)

-7. D/A Output Option Specifications (Models PW3390-02 and PW3390-03)

Number of output channels	16 channels
Output contents	CH1 to CH8: Selectable analog/waveform outputs CH9 to CH16: Analog output
Output items	Analog output: Select a basic measurement item for each output channel. Waveform output: Output voltage or current measured waveforms.
Output connector	One 25-pin female D-sub
D/A conversion resolution	16 bits (polarity + 15 bits)
Output accuracy	Analog output: Measurement accuracy ±0.2% f.s. (DC level) Waveform output: Measurement accuracy ±0.5% f.s. (at ±2 V f.s.), ±1.0% f.s. (at ±1 V f.s.) (rms level within synchronous frequency range)
Output update interval	Analog output: 50 ms (according to input data update interval of selected parameter) Waveform output: 500 kHz
Output voltage	Analog output: ±5 V DC nom. (approx. ±12 V DC max.) Waveform output: ±2 V/±1 V switchable, crest factor of 2.5 or greater Setting applies to all channels.
Output impedance	100 Ω ±5 Ω
Temperature coefficient	±0.05% f.s./°C

-8. Display Specifications

Display type	9-inch TFT color LCD (800×480 dots)
Display refresh interval	Measurement values: 200 ms (independent of internal data update interval) Waveforms, FFT: screen-dependent

-9. External Interface Specifications

(1). USB Interface (Functions)

Connector	Mini-B receptacle ×1
Compliance standard	USB2.0 (Full Speed/High Speed)
Class	Individual (USB488h)
Connection destination	Computer (Windows10/Windows8/Windows7, 32bit/64bit)
Function	Data transfer and command control

(2). USB Memory Interface

Connector	USB type A connector ×1
Compliance standard	USB2.0
USB power supply	500 mA maximum
USB storage device support	USB Mass Storage Class
Function	Save and load settings files, Save waveform data Save displayed measurement values (CSV format) Copy measurement values and recorded data (from CF card) Save screen captures

(3). LAN Interface

Connector	RJ-45 connector × 1
Compliance standard	IEEE 802.3 compliant
Transmission method	10BASE-T/100BASE-TX Auto detected
Protocol	TCP/IP
Function	HTTP server (remote operation), Dedicated port (data transfer and command control)

(4). CF Card Interface

Slot	One Type 1
Compatible card	CompactFlash memory card (32 MB or higher)
Supported memory capacity	Up to 2 GB
Data format	MS-DOS format (FAT16/FAT32)
Recordable content	Save and load settings files, Save waveform data Save displayed measurement values and auto-recorded data (CSV format) Copy measurements/recorded data (from USB storage) Save screen captures

(5). RS-232C Interface

Method	RS-232C, [EIA RS-232D], [CCITT V.24], [JIS X5101] compliant Full duplex, start-stop synchronization, 8-bit data, no parity, one stop bit Hardware flow control, CR+LF delimiter
Connector	D-sub9 pin connector ×1
Communication speeds	9600 bps, 19,200 bps, 38,400 bps
Function	Command control, Bluetooth® logger connectivity (simultaneous use not supported)

(6). Synchronization Control Interface

Signal contents	One-second clock, integration START/STOP, DATA RESET, EVENT
Connector types	IN: One 9-pin female mini-DIN jack, OUT: One 8-pin female mini-DIN jack
Signal	5 V CMOS
Max. input	±20 V
Max. signal delay	2 µs (rising edge)

(7). External Control Interface

Connector types	9-pin round connector ×1; also used as synchronization control interface
Electrical specifications	Logic signal of 0 V/5 V (2.5 V to 5 V), or contact signal (shorted/open)
Function	Integration start, integration stop, data reset, event (the event set as the synchronization control function) Cannot be used at the same time as synchronization control.

Function Specifications

-1. Control Functions

AUTO range function	Automatically selects voltage and current ranges according to measured amplitude on each phase. Operating states: Selectable on or off for each phase system Auto-ranging span: Wide/Narrow (common to all wiring systems)
Timing control function	Interval OFF/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 Setting determines the maximum data-saving capacity Timing controls OFF/Timer/RTC Timer : 10 s to 9999:59:59 [h:m:s] (in seconds) Real-time clock : Start and stop times (in minutes)
Hold function	Stops all updating of displayed measurement values and waveforms, and holds display. Internal calculations such as integration and averaging, clock, and peak-over display continue to be updated.
Peak hold function	All measurement values are updated to display the maximum value for each measurement. Displayed waveforms and integration values continue to be updated with instantaneous values.

-2. Calculation Functions

Scaling calculation	VT(PT) ratio and CT ratio: OFF/0.01 to 9999.99
Average calculation	OFF/FAST/MID/SLOW/SLOW2/SLOW3 Exponentially averages all instantaneous measurement values including harmonics (but not peak, integration, or FFT noise values). Applied to displayed values and saved data. Response speed (time remains within specified accuracy when input changes from 0 to 100% f.s.) FAST: 0.2 s, MID: 1.0 s, SLOW: 5 s, SLOW2: 25 s, SLOW3: 100 s
Efficiency and loss calculations	Efficiency η [%] and Loss [W] are calculated from active power values measured on each phase and system. For PW3390-03, motor power (Pm) is also applied as a calculation item. Maximum no. of simultaneous calculations: Efficiency and loss, by three formulas (Parameters are specified for Pin and Pout) Calculation method: Efficiency η = 100 × IPoutI/IPinI Loss = IPinI - IPoutI
Δ-Y calculation	For 3P3W3M systems, converts between line-to-line voltage and phase voltage waveforms using a virtual center point. All voltage parameters including harmonics such as true rms voltage are calculated as phase voltage waveforms. U1s = (U1s-U3s)/3, U2s = (U2s-U1s)/3, U3s =(U3s-U2s)/3
Selecting the calculation method	TYPE1/TYPE2 (only valid when wiring is 3P3W3M) Select the calculation method used to calculate the apparent power and reactive power during 3P3W3M wiring. Only affect measurement values S123, Q123, φ123, λ123
Current sensor phase correction calculations	Compensation by calculating the current sensor's harmonic phase characteristics Correction points are set using frequency and phase difference (set separately for each wiring mode). Frequency: 0.001 kHz to 999.999 kHz (in 0.001 kHz increments) Phase difference: 0.00 deg. to ±90.00 deg. (in 0.01 deg. increments) However, the time difference calculated from the frequency phase difference is limited to a maximum of 200 us in 5 ns increments.

-3. Display Functions

Wiring Check screen	The wiring diagram and voltage/current vectors are displayed for the selected wiring system(s). The correct range for the wiring system is shown on the vector display, to confirm proper measurement cable connections.
Independent wiring system display mode	Displays power and harmonic measurement values for channels 1 to 4. A composite measurement line pattern is displayed for each system. Basic, voltage, current, and power measurement parameter, harmonic bar graph, harmonic list, and harmonic vector screens
Display Selections screen	Select to display any 4, 8, 16, or 32 of the basic measurement parameters. Display layout: 4, 8, 16, or 32 parameters (4 patterns)
Efficiency and Loss screen	The efficiency and loss obtained by the specified calculation formulas are displayed numerically. Three efficiency and three loss values.
Waveform & Noise screen	Voltage and current waveforms sampled at 500 kHz and noise measurements are displayed compressed on one screen. Trigger: Synchronized with the harmonic sync source Recording length: 1000/5000/10,000/50,000 × All voltage and current channels Compression ratio: 1/1, 1/2, 1/5, 1/10, 1/20, 1/50 (peak-to-peak compression) Recording time:

Recording speed/ Recording length	1000	5000	10,000	50,000
500 kS/s	2 ms	10 ms	20 ms	100 ms
250 kS/s	4 ms	20 ms	40 ms	200 ms
100 kS/s	10 ms	50 ms	100 ms	500 ms
50 kS/s	20 ms	100 ms	200 ms	1000 ms
25 kS/s	40 ms	200 ms	400 ms	2000 ms
10 kS/s	100 ms	500 ms	1000 ms	5000 ms

X-Y Plot screen	Select horizontal and vertical axes from the basic measurement items to display on the X-Y graphs. Dots are plotted at the data update interval, and are not saved. Drawing data can be cleared. Horizontal: 1 data item (gauge display available), Vertical: 2 data items (gauge display available)

-4. Saving Functions

Auto-save function	As the items to be saved, select any measured values including harmonics and noise value data of the FFT function. The selected items are stored to CF card during every measurement interval. (Storage to USB memory is not available.) Can be controlled by timer or real-time clock. Max. no. of saved items: Interval-setting-dependent Data format: CSV format
Manual saving function	Save destinations: USB memory/CF card • Measurement data As the items to be saved, select any measured values including harmonics and noise value data of the FFT function. Pressing the SAVE key saves each measurement value at that moment to the save destination. File format: CSV format • Screen capture The COPY key captures and saves a bitmap image of the display to the save destination. *This function can be used at an interval of 5 sec or more while automatic saving is in progress. File format: Compressed BMP format • Settings data Settings information can be saved/loaded as a settings file. File format: SET format (for PW3390 only) • Waveform data Saves the waveform being displayed by means of [Wave/Noise] display. File format: CSV format

-5. Synchronous Control Function

Function	Synchronous measurements are available by using sync cables to connect Model PW3390 (master/slave). When internal settings match, auto-save is available while synchronized.
Synchronized items	Clock, data update interval (except for FFT calculations), integration start/stop, data reset, certain events
Event items	Hold, manual save, screen capture
Synchronization timing	• Clock, data update interval Within 10 s after power-on by a slave PW3390 • Start/stop, data reset, event Upon key-press and communications operations on the master PW3390
Synchronization delay	Maximum 5 µs per connection. Maximum synchronization delay of an event is +50 ms

-6. Bluetooth® Logger Connectivity

Function	Sends measured values wirelessly to logger by using a Bluetooth® serial conversion adapter.
Supported devices	Hioki LR8410 Link-compatible loggers (LR8410, LR8416)
Sent data	Measured values assigned to the D/A CH9 to CH16 analog output parameters

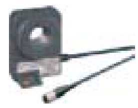
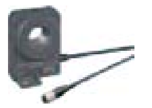
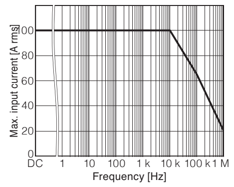
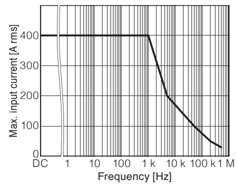
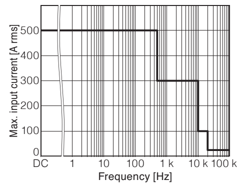
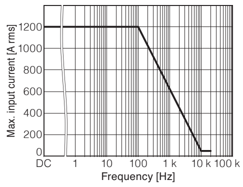
-7. Other Functions

Display language selection	Japanese, English, Chinese
Beep sound	OFF/ON
Screen color schemes	COLOR1 (black)/2 (blue-green)/3 (blue)/4 (gray)/5 (navy blue)
Start-up screen selection	Wiring or Last-displayed screen (Measurement screens only)
LCD backlight	ON/1 min/5 min/10 min/30 min/60 min
CSV file format	CSV/SSV
Real-time clock function	Auto-calendar, leap-year correcting 24-hour clock
RTC accuracy	±3 s per day @25°C (77°F)
Sensor recognition	Current sensors are automatically recognized when connected (Excluding the CT7000 series sensors)
Warning indicators	When peak over occurs on voltage and current measurement channels, When no sync source is detected Warning indicators for all channels are displayed on all pages of the MEAS screen.
Key-lock	Toggles on/off by holding the ESC key for three seconds.
System reset	Returns all settings to factory defaults
Power-on reset	Returns all settings including language and communications settings, to factory defaults.
File operations	Media content list display, format media, create folders, delete files and folders, copy between storage media

General Specifications

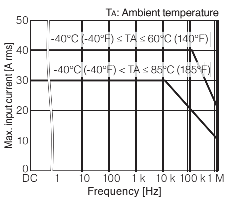
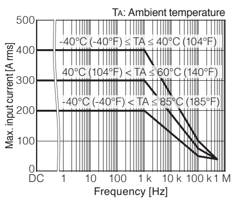
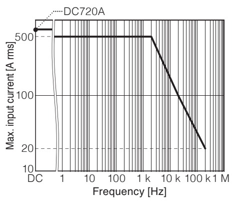
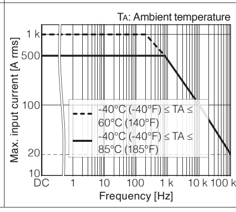
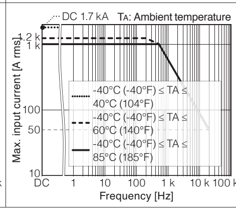
Operating environment	Indoors, Pollution Degree 2, altitude up to 2000 m (6562.20 ft)
Operating temperature and humidity	Temperature: 0°C to 40°C (32°F to 104°F), Humidity: 80% RH or less (no condensation)
Storage temperature and humidity	-10°C to 50°C (14°F to 122°F), 80% RH or less (no condensation)
Dustproof and waterproof	IP30 (EN 60529) (With CF card cover open: IP20)
Applicable standards	Safety EN 61010 EMC EN 61326 Class A
Power supply	100 V to 240 V AC, 50 Hz/60 Hz, Maximum rated power: 140 VA Anticipated transient overvoltage: 2500 V
Backup battery life	Clock, settings and integration values (Lithium battery), Approx. 10 years, @23°C (73°F)
Dimensions	340 mm (13.39 in) W × 170 mm (6.69 in) H × 156 mm (6.14 in) D (excluding protrusions)
Mass	4.6 kg (162.3 oz) with PW3390-03
Product warranty period	1 year
Accessories	Instruction Manual ×1, Measurement Guide ×1, Power cord ×1, USB cable (0.9 m (2.95 ft)) ×1, Input cord label ×2, D-sub connector ×1 (PW3390-02, PW3390-03)

High Accuracy Sensor, Pass-Through Type

	AC/DC CURRENT SENSOR CT6862-05	AC/DC CURRENT SENSOR CT6863-05	AC/DC CURRENT SENSOR 9709-05	AC/DC CURRENT SENSOR CT6865-05
External Appearance				
Rated primary current	AC/DC 50 A rms	AC/DC 200 A rms	AC/DC 500 A rms	AC/DC 1000 A rms
Frequency band	DC to 1 MHz	DC to 500 kHz	DC to 100 kHz	DC to 20 kHz
Diameter of measurable conductors	ϕ 24 mm (0.94 in) or less	ϕ 24 mm (0.94 in) or less	ϕ 36 mm (1.42 in) or less	ϕ 36 mm (1.42 in) or less
Basic accuracy	For DC, 16 Hz to 400 Hz Amplitude: ±0.05% rdg. ±0.01% f.s. Phase: ±0.2° * No DC specifications	For DC, 16 Hz to 400 Hz Amplitude: ±0.05% rdg. ±0.01% f.s. Phase: ±0.2° * No DC specifications	For DC, 45 Hz to 66 Hz Amplitude: ±0.05% rdg. ±0.01% f.s. Phase: ±0.2° * No DC specifications	For DC, 16 Hz to 66 Hz Amplitude: ±0.05% rdg. ±0.01% f.s. Phase: ±0.2° * No DC specifications
Frequency characteristics (Amplitude)	to 16 Hz: ±0.1% rdg. ±0.02% f.s. 400 Hz to 1 kHz: ±0.2% rdg. ±0.02% f.s. to 50 kHz: ±1.0% rdg. ±0.02% f.s. to 100 kHz: ±2.0% rdg. ±0.05% f.s. to 1 MHz: ±30% rdg. ±0.05% f.s.	to 16 Hz: ±0.1% rdg. ±0.02% f.s. 400 Hz to 1 kHz: ±0.2% rdg. ±0.02% f.s. to 10 kHz: ±1.0% rdg. ±0.02% f.s. to 100 kHz: ±5.0% rdg. ±0.05% f.s. to 500 kHz: ±30% rdg. ±0.05% f.s.	to 45 Hz: ±0.2% rdg. ±0.02% f.s. 66 Hz to 500 Hz: ±0.2% rdg. ±0.02% f.s. to 5 kHz: ±0.5% rdg. ±0.05% f.s. to 10 kHz: ±2.0% rdg. ±0.10% f.s. to 100 kHz: ±30% rdg. ±0.10% f.s.	to 16 Hz: ±0.1% rdg. ±0.02% f.s. 66 Hz to 100 Hz: ±0.5% rdg. ±0.02% f.s. to 500 Hz: ±1.0% rdg. ±0.02% f.s. to 5 kHz: ±5.0% rdg. ±0.05% f.s. to 20 kHz: ±30% rdg. ±0.1% f.s.
Operating temperature range	-30°C to 85°C (-22°F to 185°F)	-30°C to 85°C (-22°F to 185°F)	0°C to 50°C (32°F to 122°F)	-30°C to 85°C (-22°F to 185°F)
Effect of conductor position	±0.01% rdg. or less (DC to 100 Hz)	±0.01% rdg. or less (DC to 100 Hz)	±0.05% rdg. or less (DC)	±0.05% rdg. or less (50/60 Hz)
Effects of external magnetic fields	In 400 A/m magnetic field (DC and 60 Hz) 10 mA or less	In 400 A/m magnetic field (DC and 60 Hz) 50 mA or less	In 400 A/m magnetic field (DC and 60 Hz) 50 mA or less	In 400 A/m magnetic field (DC and 60 Hz) 200 mA or less
Maximum rated voltage to ground	CAT III 1000 V	CAT III 1000 V	CAT III 1000 V	CAT III 1000 V
Output connector	HIOKI ME15W	HIOKI ME15W	HIOKI ME15W	HIOKI ME15W
Dimensions	70 mm (2.76 in) W x 100 mm (3.94 in) H x 53 mm (2.09 in) D, Cable length: 3 m (9.84 ft)	70 mm (2.76 in) W x 100 mm (3.94 in) H x 53 mm (2.09 in) D, Cable length: 3 m (9.84 ft)	160 mm (6.30 in) W x 112 mm (4.41 in) H x 50 mm (1.97 in) D, Cable length: 3 m (9.84 ft)	160 mm (6.30 in) W x 112 mm (4.41 in) H x 50 mm (1.97 in) D, Cable length: 3 m (9.84 ft)
Mass	Approx. 340 g (12.0 oz)	Approx. 350 g (12.3 oz)	Approx. 850 g (30.0 oz)	Approx. 980 g (34.6 oz)
Derating Characteristics				

Custom cable lengths also available. Please inquire with your Hioki distributor.

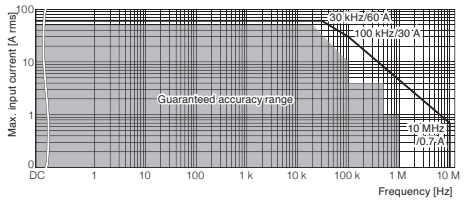
High Accuracy Sensor, Clamp Type

	AC/DC CURRENT PROBE CT6841-05	AC/DC CURRENT PROBE CT6843-05	AC/DC CURRENT PROBE CT6844-05	AC/DC CURRENT PROBE CT6845-05	AC/DC CURRENT PROBE CT6846-05
External Appearance					
Rated primary current	AC/DC 20 A rms	AC/DC 200 A rms	AC/DC 500 A rms	AC/DC 500 A rms	AC/DC 1000 A rms
Frequency band	DC to 1 MHz	DC to 500 kHz	DC to 200 kHz	DC to 100 kHz	DC to 20 kHz
Diameter of measurable conductors	ϕ 20 mm (0.79 in) or less (insulated conductor)	ϕ 20 mm (0.79 in) or less (insulated conductor)	ϕ 20 mm (0.79 in) or less (insulated conductor)	ϕ 50 mm (1.97 in) or less (insulated conductor)	ϕ 50 mm (1.97 in) or less (insulated conductor)
Basic accuracy	For DC < f ≤ 100 Hz Amplitude: ±0.3% rdg. ±0.01% f.s. Phase:±0.1° For DC Amplitude: ±0.3% rdg. ±0.05% f.s.	For DC < f ≤ 100 Hz Amplitude: ±0.3% rdg. ±0.01% f.s. Phase:±0.1° For DC Amplitude: ±0.3% rdg. ±0.02% f.s.	For DC < f ≤ 100 Hz Amplitude: ±0.3% rdg. ±0.01% f.s. Phase:±0.1° For DC Amplitude: ±0.3% rdg. ±0.02% f.s.	For DC < f ≤ 100 Hz Amplitude: ±0.3% rdg. ±0.01% f.s. Phase:±0.1° For DC Amplitude: ±0.3% rdg. ±0.02% f.s.	For DC < f ≤ 100 Hz Amplitude: ±0.3% rdg. ±0.01% f.s. Phase:±0.1° For DC Amplitude: ±0.3% rdg. ±0.02% f.s.
Frequency characteristics (Amplitude)	to 500 Hz: ±0.3% rdg. ±0.02% f.s. to 1 kHz: ±0.5% rdg. ±0.02% f.s. to 10 kHz: ±1.5% rdg. ±0.02% f.s. to 100 kHz: ±5.0% rdg. ±0.05% f.s. to 1 MHz: ±30% rdg. ±0.05% f.s.	to 500 Hz: ±0.3% rdg. ±0.02% f.s. to 1 kHz: ±0.5% rdg. ±0.02% f.s. to 10 kHz: ±1.5% rdg. ±0.02% f.s. to 50 kHz: ±5.0% rdg. ±0.02% f.s. to 500 kHz: ±30% rdg. ±0.05% f.s.	to 500 Hz: ±0.3% rdg. ±0.02% f.s. to 1 kHz: ±0.5% rdg. ±0.02% f.s. to 10 kHz: ±1.5% rdg. ±0.02% f.s. to 50 kHz: ±5.0% rdg. ±0.02% f.s. to 200 kHz: ±30% rdg. ±0.05% f.s.	to 500 Hz: ±0.3% rdg. ±0.02% f.s. to 1 kHz: ±0.5% rdg. ±0.02% f.s. to 10 kHz: ±1.5% rdg. ±0.02% f.s. to 20 kHz: ±5.0% rdg. ±0.02% f.s. to 100 kHz: ±30% rdg. ±0.05% f.s.	to 500 Hz: ±0.5% rdg. ±0.02% f.s. to 1 kHz: ±1.0% rdg. ±0.02% f.s. to 5 kHz: ±2.0% rdg. ±0.02% f.s. to 10 kHz: ±5.0% rdg. ±0.05% f.s. to 20 kHz: ±30% rdg. ±0.10% f.s.
Operating temperature range	-40°C to 85°C (-40°F to 185°F)	-40°C to 85°C (-40°F to 185°F)	-40°C to 85°C (-40°F to 185°F)	-40°C to 85°C (-40°F to 185°F)	-40°C to 85°C (-40°F to 185°F)
Effect of conductor position	±0.1% rdg. or less (DC to 100 Hz)	±0.1% rdg. or less (DC to 100 Hz)	±0.1% rdg. or less (DC to 100 Hz)	±0.2% rdg. or less (DC to 100 Hz)	±0.2% rdg. or less (50 Hz/60 Hz)
Effects of external magnetic fields	In 400 A/m magnetic field (DC and 60 Hz) under 50 mA	In 400 A/m magnetic field (DC and 60 Hz) under 50 mA	In 400 A/m magnetic field (DC and 60 Hz) under 100 mA	In 400 A/m magnetic field (DC and 60 Hz) under 150 mA	In 400 A/m magnetic field (DC and 60 Hz) under 150 mA
Output connector	HIOKI ME15W	HIOKI ME15W	HIOKI ME15W	HIOKI ME15W	HIOKI ME15W
Dimensions	153 mm (6.02 in) W x 67 mm (2.64 in) H x 25 mm (0.98 in) D Cable length: 3 m (9.84 ft)	153 mm (6.02 in) W x 67 mm (2.64 in) H x 25 mm (0.98 in) D Cable length: 3 m (9.84 ft)	153 mm (6.02 in) W x 67 mm (2.64 in) H x 25 mm (0.98 in) D Cable length: 3 m (9.84 ft)	238 mm (9.37 in) W x 116 mm (4.57 in) H x 35 mm (1.38 in) D Cable length: 3 m (9.84 ft)	238 mm (9.37 in) W x 116 mm (4.57 in) H x 35 mm (1.38 in) D Cable length: 3 m (9.84 ft)
Mass	350 g (12.3 oz)	370 g (13.1 oz)	400 g (14.1 oz)	860 g (30.3 oz)	990 g (34.9 oz)
Derating Characteristics					

Custom cable lengths also available. Please inquire with your Hioki distributor.

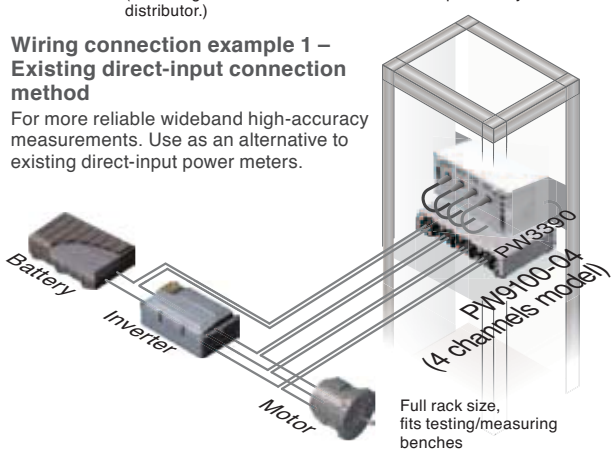
High Accuracy Sensor, Direct Wire Type

Newly developed DCCT method allows world-class measurement range and measurement accuracy at a rating of 50 A.
(5 A rating version also available. Please inquire with your Hioki distributor.)

	AC/DC CURRENT BOX PW9100-03	AC/DC CURRENT BOX PW9100-04
External Appearance		
Number of input channels	3ch	4ch
Rated primary current	AC/DC 50 A rms	
Frequency band	DC to 3.5 MHz (-3 dB)	
Measurement terminals	Terminal block (with safety cover), M6 screws	
Basic accuracy	For 45 Hz to 65 Hz Amplitude: ±0.02% rdg. ±0.005% f.s. Phase: ±0.1 ° For DC Amplitude: ±0.02% rdg. ±0.007% f.s.	
Frequency characteristics (Amplitude)	to 45 Hz: ±0.1% rdg. ±0.02% f.s. to 1 kHz: ±0.1% rdg. ±0.01% f.s. to 50 kHz: ±1% rdg. ±0.02% f.s. to 100 kHz: ±2% rdg. ±0.05% f.s. to 1 MHz: ±10% rdg. ±0.05% f.s. 3.5 MHz: -3 dB Typical	
Input resistance	1.5 mΩ or less (50 Hz/60 Hz)	
Operating temperature range	0°C to 40°C (32°F to 104°F)	
Effects of common-mode voltage (CMRR)	50 Hz/60 Hz 120 dB or greater 100 kHz 120 dB or greater (Effect on output voltage/common-mode voltage)	
Maximum rated voltage to ground	1000 V (Measurement category II), 600 V (Measurement category III), Anticipated transient overvoltage 6000 V	
Output connector	HIOKI ME15W	
Dimensions	430 mm (16.93 in) W x 88 mm (3.46 in) H x 260 mm (10.24 in) D, Cable length: 0.8 m (2.62 ft)	
Mass	3.7 kg (130.5 oz)	4.3 kg (151.7 oz)
Derating Characteristics		

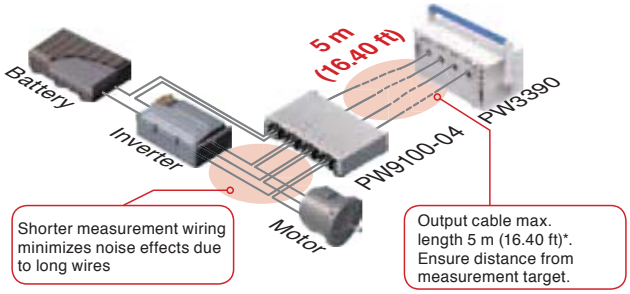
Wiring connection example 1 – Existing direct-input connection method

For more reliable wideband high-accuracy measurements. Use as an alternative to existing direct-input power meters.



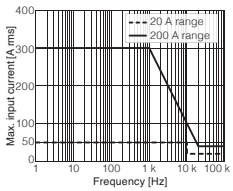
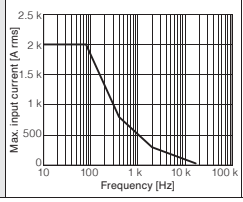
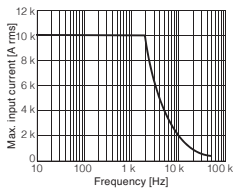
Wiring connection example 2 – Introducing a new and innovative measuring method

Shorten the wiring for current measurement by installing the PW9100 close to the measurement target. This will also keep the effects of wiring resistance, capacity coupling and other objective factors on the measured values to a minimum.



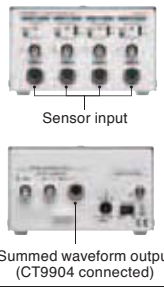
* Requires EXTENSION CABLE CT9902

Standard Sensor

	CLAMP ON SENSOR 9272-05	AC/DC CURRENT SENSOR CT7642 AC/DC AUTO ZERO CURRENT SENSOR CT7742	AC FLEXIBLE CURRENT SENSOR CT7044, CT7045, CT7046
External Appearance			
Rated primary current	AC 200 A rms/20 A rms switching	AC/DC 2000 A rms	AC 6000 A rms
Frequency band	1 kHz to 100 kHz	CT7642: DC to 10 kHz CT7742: DC to 5 kHz	10 Hz to 50 kHz (±3 dB)
Diameter of measurable conductors	ϕ 46 mm (1.81 in) or less	ϕ 55 mm (2.17 in) or less	CT7044: ϕ 100 mm (3.94 in) or less CT7045: ϕ 180 mm (7.09 in) or less CT7046: ϕ 254 mm (10.00 in) or less
Basic accuracy	For 45 Hz to 66 Hz Amplitude: ±0.3% rdg. ±0.01% f.s. Phase:±0.2 °	For DC, 45 Hz to 66 Hz Amplitude: ±1.5% rdg. ±0.5% f.s. For up to 66 Hz Phase:±2.3 °	For 45 to 66 Hz, with flexible cable core Amplitude: ±1.5% rdg. ±0.25% f.s. Phase:±1.0 °
Frequency characteristics (Amplitude)	to 10 Hz: ±2.0% rdg. ±0.10% f.s. to 45 Hz: ±0.5% rdg. ±0.02% f.s. 66 to 10 kHz: ±2.5% rdg. ±0.02% f.s. to 50 kHz: ±5% rdg. ±0.1% f.s. to 100 kHz: ±30% rdg. ±0.1% f.s.	66 kHz to 1 kHz ±2.5% rdg. ±1.0% f.s.	-
Operating temperature range	0°C to 50°C (32°F to 122°F)	-25°C to 65°C (-13°F to 149°F)	-25°C to 65°C (-13°F to 149°F)
Effect of conductor position	±0.2% rdg. or less (60 Hz)	±1.0% rdg. or less	±3.0% or less
Effects of external magnetic fields	In 400 A/m magnetic field (60 Hz) under 100 mA	In 400 A/m magnetic field (DC) 0.2% f.s. or less	In 400 A/m magnetic field (50 Hz/60 Hz) CT7044, CT7045: 1.25% f.s. or less CT7046: 1.5% f.s. or less
Output connector	HIOKI ME15W	HIOKI PL14*	HIOKI PL14*
Dimensions	78 mm (3.07 in) W x 188 mm (7.40 in) H x 35 mm (1.38 in) D Cable length: 3 m (9.84 ft)	64 mm (2.52 in) W x 195 mm (7.68 in) H x 34 mm (1.34 in) D Cable length: 2.5 m (8.20 ft)	Circuit box: 25 mm (0.98 in) W x 72 mm (2.83 in) H x 20 mm (0.79 in) D Cable length: 2.5 m (8.20 ft)
Mass	450 g (15.9 oz)	510 g (18.0 oz)	CT7044: 160 g (5.6 oz) CT7045: 174 g (6.1 oz) CT7046: 186 g (6.6 oz)
Derating Characteristics			

* CT9920 (sold separately) is required to connect PW3390 to the sensor with HIOKI PL14 on the output connector.

Current Summing

	SENSOR UNIT CT9557
External Appearance	 FRONT Sensor input REAR Summed waveform output (CT9904 connected)
Connectable current sensor	Current sensor with HIOKI ME15W (male) on the output connector
Summed waveform output accuracy	DC: ±0.06% rdg. ±0.03% f.s. to 1 kHz: ±0.06% rdg. ±0.03% f.s. to 10 kHz: ±0.10% rdg. ±0.03% f.s. to 100 kHz: ±0.20% rdg. ±0.10% f.s. to 300 kHz: ±1.0% rdg. ±0.20% f.s. to 700 kHz: ±5.0% rdg. ±0.20% f.s. to 1 MHz: ±10.0% rdg. ±0.50% f.s.
Operating temperature range	-10°C to 50°C (14°F to 122°F)
Power supply	AC ADAPTER Z1002 (100 to 240 V AC, 50/60 Hz, Max. rated power when in combination with other units: 155 VA) External power supply (10 to 30 V DC, Max. rated power: 60 VA)
Output connector	HIOKI ME15W (male)*
External dimensions	116 mm (4.57 in) W x 67 mm (2.64 in) H x 132 mm (5.20 in) D
Mass	420 g (14.8 oz)
Accessories	AC ADAPTER Z1002, Power cord, Instruction Manual

* CT9904 (sold separately) is required to connect to PW3390.

Model : POWER ANALYZER PW3390

Model No. (Order Code)	D/A output	Motor analysis
PW3390-01	—	—
PW3390-02	○	—
PW3390-03	○	○

Accessories: Instruction Manual ×1, Measurement Guide ×1, Power cord ×1, USB cable ×1, Input cord label ×2, D-sub 25-pin connector ×1 (PW3390-02, PW3390-03)

- The optional voltage cord and current sensor are required for taking measurements.
- Motor analysis and D/A output cannot be changed or added after delivery.

Current Measurement Options

Name (Note)	Model No. (Order Code)
AC/DC CURRENT SENSOR (50 A)	**CT6862-05**
AC/DC CURRENT SENSOR (200 A)	**CT6863-05**
AC/DC CURRENT SENSOR (500 A)	**9709-05**
AC/DC CURRENT SENSOR (1000 A)	**CT6865-05**
AC/DC CURRENT PROBE (20 A)	**CT6841-05**
AC/DC CURRENT PROBE (200 A)	**CT6843-05**
AC/DC CURRENT PROBE (500 A, ϕ 20 mm (0.79 in))	**CT6844-05**
AC/DC CURRENT PROBE (500 A, ϕ 50 mm (1.97 in))	**CT6845-05**
AC/DC CURRENT PROBE (1000 A)	**CT6846-05**
CLAMP ON SENSOR (AC 20 A/200 A)	**9272-05**
AC/DC CURRENT BOX (50 A, 3 ch)	**PW9100-03**
AC/DC CURRENT BOX (50 A, 4 ch)	**PW9100-04**
AC/DC AUTO ZERO CURRENT SENSOR (2000 A)	**CT7742** *
AC/DC CURRENT SENSOR (2000 A)	**CT7642** *
AC FLEXIBLE CURRENT SENSOR (6000 A, ϕ 100 mm (3.94 in))	**CT7044** *
AC FLEXIBLE CURRENT SENSOR (6000 A, ϕ 180 mm (7.09 in))	**CT7045** *
AC FLEXIBLE CURRENT SENSOR (6000 A, ϕ 254 mm (10.00 in))	**CT7046** *
SENSOR UNIT (Sensor power supply with 4 channel summing function)	**CT9557** **

* CONVERSION CABLE CT9920 is required to connect to PW3390.
** CONNECTION CABLE CT9904 is required to connect to PW3390.

CONVERSION CABLE CT9900

Required to connect PW3390 to the current sensor with HIOKI PL23 on the output connector.

[Applicable products]
CT6841, CT6843, CT6844, CT6845, CT6846, CT6862, CT6863, 9709, CT6865, 9272-10

CONVERSION CABLE CT9920

Required to connect PW3390 to the current sensor with HIOKI PL14 on the output connector.

[Applicable products]
CT7742, CT7642, CT7044, CT7045, CT7046

CONNECTION CABLE CT9904

Cable length: 1 m (3.28 ft) Required to connect the summing waveform output terminal of CT9557 to PW3390.

[Applicable products]
CT9557

Built-To-Order (Current Measurement)

PW9100 5A-rated model
9709-05 high-accuracy model
CT6862-05 high-accuracy model
CT6863-05 high-accuracy model
AC/DC 2000 A high accuracy sensor, pass-through type

Please contact your Hioki distributor or subsidiary for more information.

Voltage Measurement Options

VOLTAGE CORD L9438-50

Red, black: 1 each,
1000 V specification, Cord length: 3 m (9.84 ft)
CAT IV 600 V, CAT III 1000 V

EXTENSION CABLE SET L4931

Red, black: 1 each,
With connector, Cable length: 1.5 m (4.92 ft)
For extension of L9438-50 or L1000
CAT IV 600 V, CAT III 1000 V

VOLTAGE CORD L1000

Red, yellow, blue, gray: 1 each; Black: 4
1000 V specification, Cord length: 3 m (9.84 ft)
CAT IV 600 V, CAT III 1000 V

GRABBER CLIP 9243

Red, black: 1 each
Change the tip of the voltage cord to use
CAT III 1000 V

WIRING ADAPTER PW9000

When making a 3-phase 3-wire (3P3W3M) connection, this product allows you to reduce the number of voltage cords from 6 to 3.

WIRING ADAPTER PW9001

When making a 3-phase 4-wire (3P4W) connection, this product allows you to reduce the number of voltage cords from 6 to 4.

Other Options

PC CARD 512 MB 9728
PC CARD 1 GB 9729
PC CARD 2 GB 9830

Use only PC Cards sold by HIOKI. Compatibility and performance are not guaranteed for PC cards made by other manufacturers. You may be unable to read from or save data to such cards.

CARRYING CASE 9794

Carrying Case for PW3390 and 3390
448 mm (17.64 in) W x 618 mm (24.33 in) H x 295 mm (11.61 in) D

Connection Options

CONNECTION CORD L9217

BNC-BNC,
For motor analysis input
Cable length: 1.6 m (5.25 ft)

LAN CABLE 9642

Supplied with straight to cross conversion connector, Cable length: 5 m (16.41 ft)

CONNECTION CABLE 9683

For synchronous measurement,
Cable length: 1.5 m (4.92 ft)

RS-232C CABLE 9637

9pin-9pin cross
Cable length: 1.8 m (5.91 ft)

Built-To-Order (Other)

D/A output cable

D-sub 25-pin - BNC (male)
16 ch conversion, Cord length: 2.5 m (8.20 ft)

Rackmount fittings

For EIA or JIS

Please contact your Hioki distributor or subsidiary for more information.

HIOKI
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TECNOLOGIA

HIOKI

Le tecnologie di misura Hioki sono ampiamente e globalmente utilizzate per manutenzione, controllo qualità, ricerca e sviluppo, in ambito industriale, aziendale e delle infrastrutture, contribuendo alla sicurezza ed alla protezione del nostro vivere quotidiano.
L'azienda supporta inoltre lo sviluppo delle tecnologie di nuova generazione nei settori automotive ed energie rinnovabili, favorendo la diffusione di prodotti di elevata qualità a prezzi competittivi.
La mission di Hioki è di pordurre e divulgare tecnologie di misura volte a proteggere la sicurezza delle persone e consentire, attraverso il supporto alla ricerca, il progresso della scienza e della tecnica.

I numeri:

10% del fatturato investito in R&S
250 ingegneri impiegati nella ricerca
30 nuovi prodotti all'anno
100 brevetti depositati all'anno
1200 prodotti a catalogo
800.000 pezzi venduti all'anno
50 ppm (pezzi per milione) indice di difettosità
10.000 prove di apertura e chiusura per testare la durata dei toroidi
1 metro di caduta per testare la resistenza degli strumenti

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