HIOKI

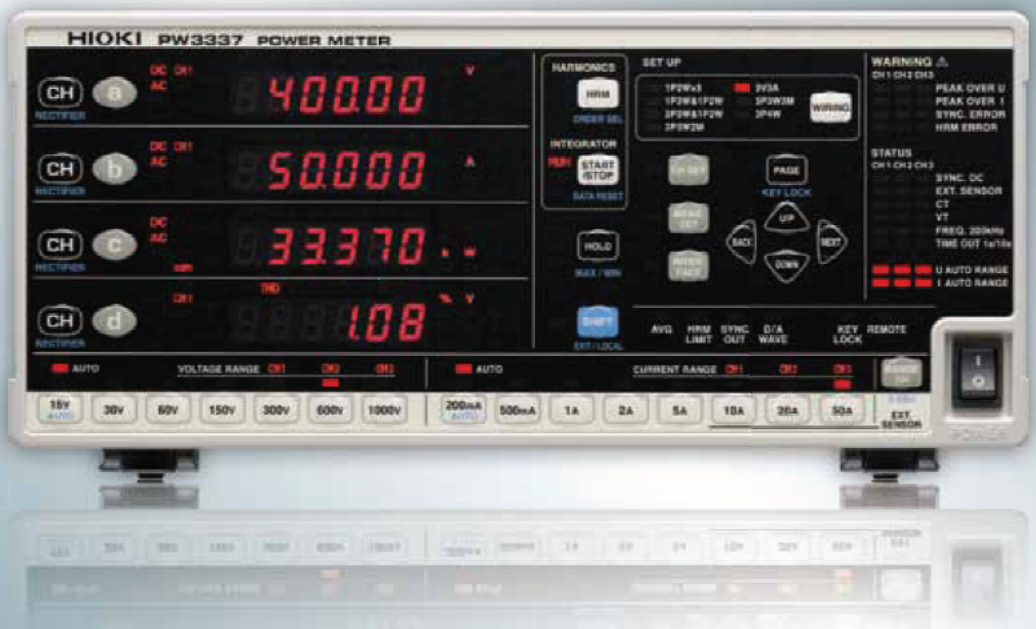
New

POWER METER PW3336/PW3337

Power Measuring Instruments

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

Accurately measure devices up to 1,000 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 : ±0.15%
- Measurement frequencies : DC, 0.1 Hz to 100 kHz
- High-current measurement : Up to 65 A, direct input
- 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 5,000 A AC : Built-in external sensor input terminals

ISO 9001 JMI-0216

ISO14001 JQA-E-90091

www.hioki.com

HIOKI company overview, new products, environmental considerations and other information are available on our website.

*3-phase 4-wire measurement: PW3337 series only

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.

Configure multiple ranges with a single instrument

3 Best-in-class accuracy of ±0.15% rdg.

HIOKI has drawn on its accumulated base of technology and experience to deliver best-in-class accuracy for the PW3336/PW3337. This rock-solid accuracy serves to support customers throughout the full range of measurement situations.

±0.15%rdg.

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

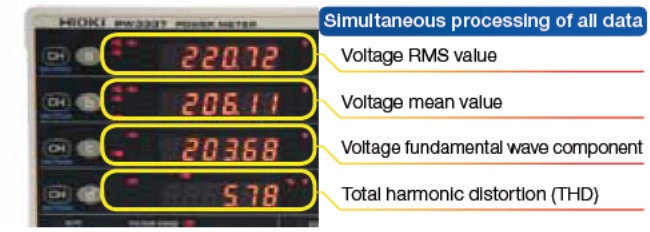
PW3337 series (3-channel models)
Measurement lines: 1P2W/1P3W/3P3W/3P4W

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.

*Available soon for free download from the HIOKI website.

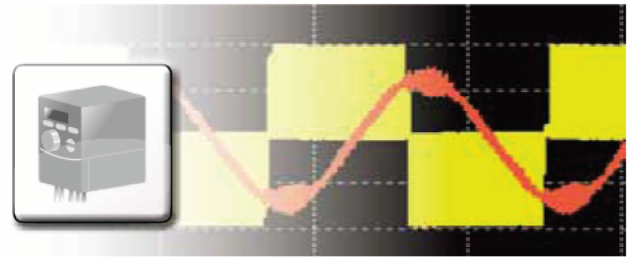


5 High-accuracy measurement, even with low-power-factor input

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.

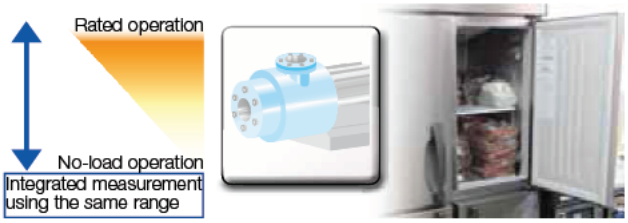
6 Wide frequency band of DC and 0.1 Hz to 100 kHz

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

*Available soon.

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

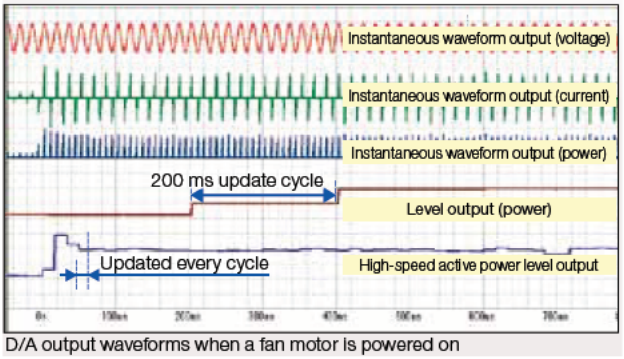
D/A output-equipped instruments can generate voltage output for measured values and integrated power with their 16-bit D/A converter. By connecting an external data logger, HIOKI Memory HiCorder, recorder, or other device, you can simultaneously record data along with temperature and other non-power 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.

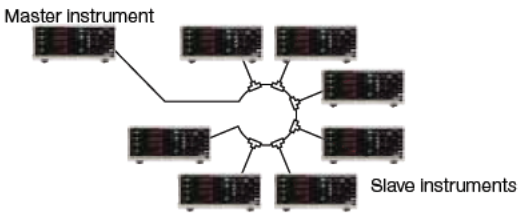


D/A output waveforms when a fan motor is powered on

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.

**Available soon for download from the HIOKI website.*



6 Current sensor connectivity

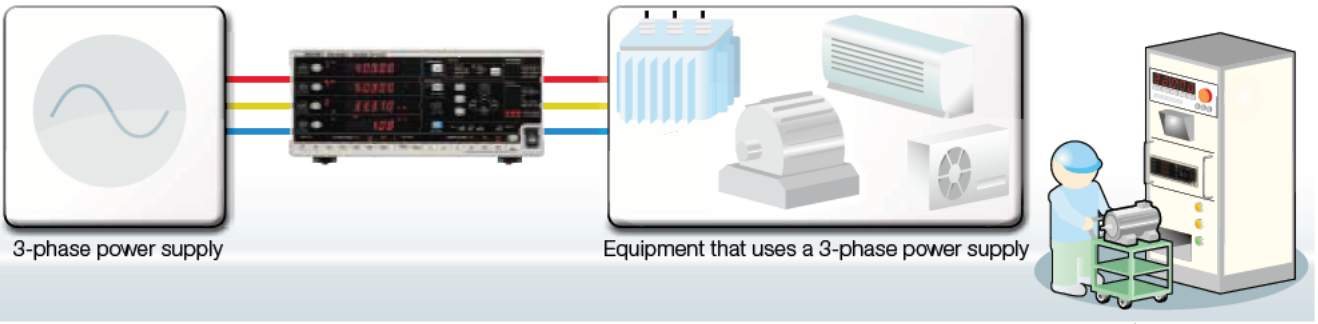
The PW3336/PW3337 can also measure devices that exceed 65 A with the use of an optional current sensor. Measurements with guaranteed accuracy can be performed for currents of up to 5,000 A AC. Choose from a range of high-accuracy, clamp or pass-through AC/DC current sensors and models specifically designed 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 ±0.15% rdg.
- ✔ 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

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.

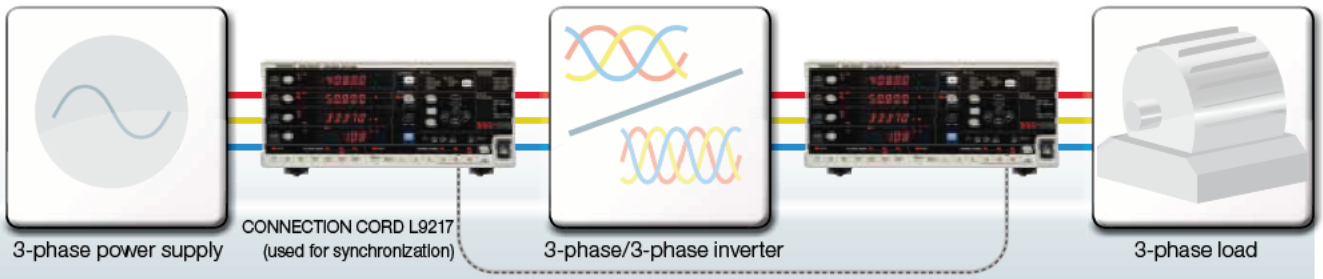
Other DC/3-phase and 1-phase/3-phase measurement applications

- ✔ 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.

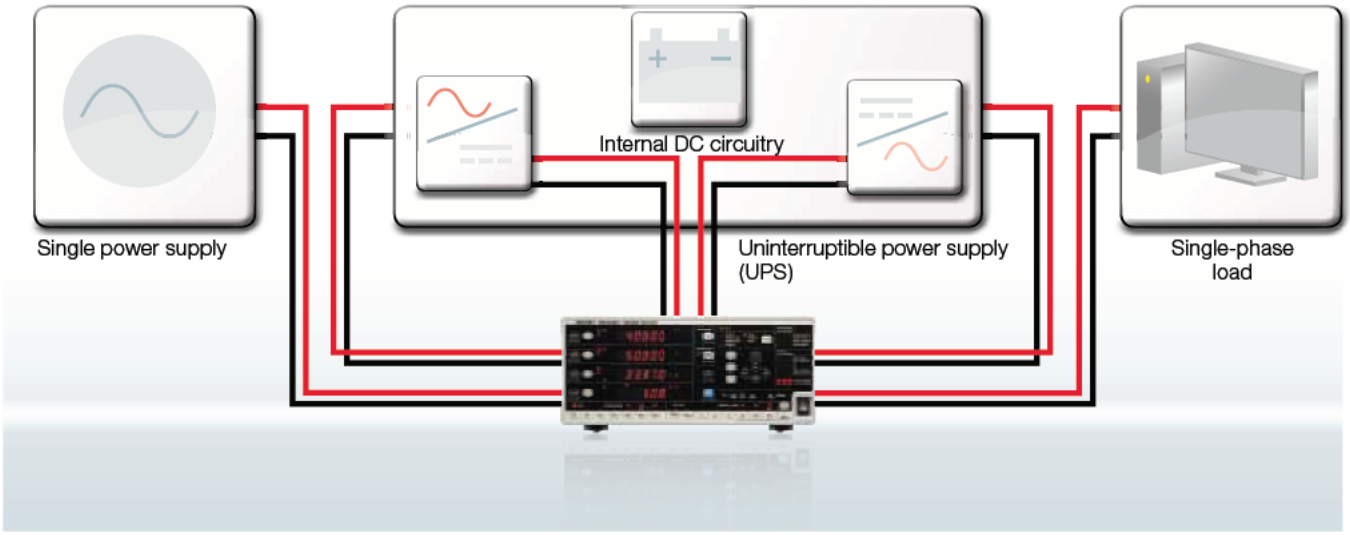


Applications

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

Key advantages

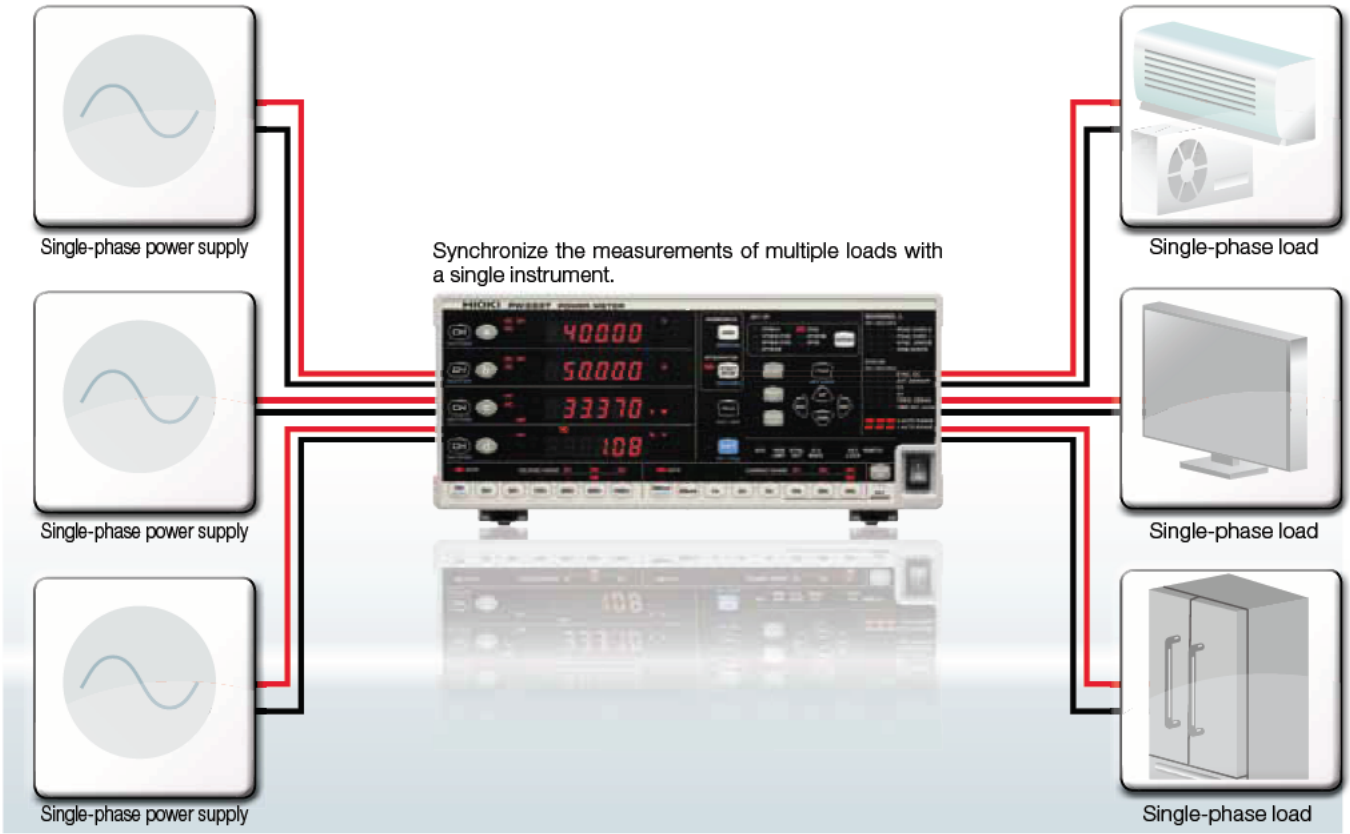
- ✔ Set individual ranges and measurement types for each channel. Measure power consumption at each stage of the UPS.
- ✔ Hold waveform peak values and measured value maximum and minimum values.
- ✔ Measure all data with simultaneous parallel processing, including RMS values, mean values, fundamental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

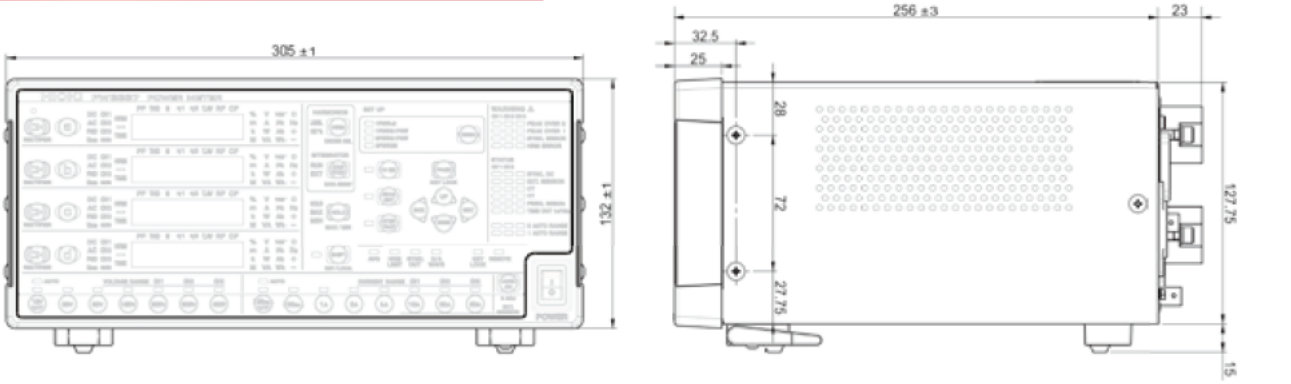
The PW3336/PW3337 Communicator connects with the power meters via the LAN, RS-232C, or GP-IB (-01, -03) interface, and is available for free download from the HIOKI website*. Functionality includes configuring instruments, capturing interval data, performing numerical calculations based on measurement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

*Available soon.

LabVIEW Driver

Use LabVIEW* to collect data and integrate the power meter into existing systems. (Available soon)
*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 V/ 30 V/ 60 V/ 150 V/ 300 V/ 600 V/ 1,000 V (set for each wiring mode)
Current measurement ranges	AUTO/ 200 mA/ 500 mA/ 1 A/ 2 A/ 5 A/ 10 A/ 20 A/ 50 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; 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 $\sqrt{(\text{AC+DC value})^2 - (\text{DC value})^2}$ 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 1,000 V ranges, ±1,500 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) × (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 200V 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
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 ±1,500 V peak value and 1,000 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 3P3W	$X_{sum} = \frac{1}{2}(X_{(1)} + X_{(2)})$	$P_{sum} = (P_{(1)} + P_{(2)})$
	3P3W2M 3V3A 3P3W3M 3P4W	$X_{sum} = \frac{1}{3}(X_{(1)} + X_{(2)} + X_{(3)})$	$P_{sum} = (P_{(1)} + P_{(2)} + P_{(3)})$

(i): Measurement channel

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 3V3A	$S_{sum} = \frac{\sqrt{3}}{3}(S_{(1)} + S_{(2)} + S_{(3)})$	
	3P3W3M 3P4W	$S_{sum} = S_{(1)} + S_{(2)} + S_{(3)}$	$Q_{sum} = Q_{(1)} + Q_{(2)} + Q_{(3)}$

(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.

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, 9.900 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

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 ±1,500 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×IP2I / IP1I η2=100×IP1I / IP2I
1P3W	1P3W		
3P3W	3P3W		
3P3W2M	3P3W2M		

PW3337 series

Wiring (WIRING)	CH1	CH2	CH3	Calculation formulas
1P2W × 3	1P2W	1P2W	1P2W	η1=100×IP3I / IP1I η2=100×IP1I / IP3I
1P3W & 1P2W	1P3W		1P2W	η1=100×IP3I / IPsumI η2=100×IPsumI / IP3I
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 1,000 (setting: 0000) CT ratio setting range : OFF (1.0), 0.001 to 1,000 (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 10,000 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	999,999 (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	4,096
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: 99,999 count Integrated values: 999,999 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	Type 1 9661 (500 A AC) 9669 (1,000 A AC) 9660 (100 A AC) CT9667 (500 A / 5,000 A AC) Type 2 (9555-10 and L9217 is required; sold separately) 9272-10 (20 A/200 A AC) 9277 (20 A AC/DC) 9278 (200 A AC/DC) 9279* (500 A AC/DC) 9709 (500 A AC/DC) CT6862 (50 A AC/DC) CT6863 (200 A AC/DC) CT6865 (1,000 A AC/DC) * 9279 is not CE marked
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 200 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	4,290 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: 1,000 V, ±1,500 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 kg (176.4 oz.) PW3337 series Approx. 6 kg (211.6 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
Appearance				
Primary current rating	100A AC	500A AC	1000 A AC	500A AC, 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. ϕ254mm (10")
Amplitude accuracy *	±0.3%rdg.±0.02%f.s. *	±0.3%rdg.±0.01%f.s. *	±1.0%rdg.±0.01%f.s. *	±2.0%rdg.±0.3%f.s. *
Phase accuracy *	±1° or less *	±0.5° or less *	±1° or less *	±1° or less *
Frequency characteristics	±1.0% or less for 66Hz to 5kHz (deviation from specified accuracy)		Within ±2% at 40Hz to 5kHz (deviation from accuracy)	±3dB or less for 10 Hz to 20kHz (within ±3dB)
Operating Temperature & Humidity (non-condensating)	0 to 50°C (32-122°F), 80%RH or lower			0 to 40°C (32-104°F), 80%RH or lower, 40 to 50°C (104-122°F), 50%RH or lower
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, Mass	46W(1.81")×135H(5.31")×21D(0.83")mm, 230g(8.1oz.)	78W(3.07")×152H(5.98")×42D(1.65")mm, 380g(13.4oz.)	99.5W (3.92") × 188H (7.40") × 42D (1.65") mm, 590g (20.8 oz.)	Circuit box: 35W (1.38") × 120.5H (4.74") × 34D (1.34") mm, 140 g (4.9 oz.)
Power supply	—	—	—	LR6 alkaline battery x2, or AC Adapter (option)
Options (sold separately)	—	—	—	**AC ADAPTER 9445-02** (universal 100 to 240VAC /for USA) **AC ADAPTER 9445-03** (universal 100 to 240VAC /for Europe)

*: 45 to 66Hz

Current Measurement Options [Type 2] Specifications (Requires Sensor Unit 9555-10 and Connection Cable L9217.)

Model	CLAMP ON SENSOR 9272-10	UNIVERSAL CLAMP ON CT 9277	UNIVERSAL CLAMP ON CT 9278	UNIVERSAL CLAMP ON CT 9279
Appearance				 Not CE-marked
Primary current rating	20A/200A AC	20A AC/DC	200A AC/DC	500A AC/DC
Measurable conductor diameter	Max.ϕ 46mm (1.81")	Max.ϕ 20mm (0.79")		Max.ϕ 40mm (1.57")
Amplitude accuracy *	±0.3%rdg.±0.01%f.s. *	±0.5%rdg.±0.05%f.s. (30 minutes after power is turned on and after magnetization) *		
Phase accuracy *	±0.2° or less	±0.2° (30 minutes after power is turned on and after magnetization) *		
Frequency characteristics** (typical)	1Hz to 5Hz: ±2%rdg.±0.1%f.s. 1kHz to 5kHz: ±1%rdg.±0.05%f.s. (±1.0°) 10kHz to 50kHz: ±5%rdg.±0.1%f.s.	DC to 1kHz: ±1.0% (±0.5°) 1 k to 50 kHz: ±2.5 % (±2.5°) 50 k to 100 kHz: ±5.0 % (±5.0°)		DC to 1kHz: ±1.0% (±0.5°) 1 k to 10 kHz: ±2.5 % (±2.5°) 10 k to 20 kHz: ±5.0 % (±5.0°)
Operating Temperature & Humidity (non-condensating)	0°C to 50°C (-32°F to 122°F) 80%RH or lower	0°C to 40°C (-32°F to 104°F) 80%RH or lower		
Effect of conductor position	Within ±0.2%rdg. (deviation from center)	Within ±0.2%rdg. (deviation from center)	Within ±1.5%rdg.(deviation from center)	Within ±1.5%rdg. (deviation from center)
Effect of external electromagnetic field	0.1A equivalent or lower (400A/m, 55Hz)	0.2A equivalent or lower (400A/m, 55Hz and DC)	1A equivalent or lower (400A/m, 55Hz and DC)	2A equivalent or lower (400A/m, 55Hz and DC)
Maximum rated voltage to earth	CAT III 600Vrms	CAT III 300Vrms	CAT III 300Vrms	Not CE-marked 600 V insulated conductor
Dimensions, Mass	78W(3.07")×188H(7.40")×35D(1.38")mm, 430g(15.2 oz.)	176W(6.93")×69H(2.72")×27D(1.06")mm 470g(16.6 oz.)		220W(8.66")×103H(4.06")×43.5D(1.71")mm, 470g(16.6 oz.)
Power supply	Sensor Unit 9555-10			
Options (sold separately)	Sensor Unit 9555-10, Connection Cable L9217			

Model	AC/DC CURRENT SENSOR CT6862	AC/DC CURRENT SENSOR CT6863	AC/DC CURRENT SENSOR 9709	AC/DC CURRENT SENSOR CT6865
Appearance				
Primary current rating	50A AC/DC	200A AC/DC	500A AC/DC	1000A AC/DC
Measurable conductor diameter	Max.ϕ 24mm (0.94")		Max.ϕ 36mm (1.42")	
Amplitude accuracy *	±0.05 %rdg.±0.01 % f.s. , ±0.2° (Right after power is turned on at DC and 16Hz to 400Hz)		±0.05 %rdg.±0.01 % f.s. , ±0.2° (10 minutes after power is turned on)	±0.05 %rdg.±0.01 % f.s. , ±0.2°
Phase accuracy *	±0.05 %rdg.±0.01 % f.s. , ±0.2° (Right after power is turned on at DC and 16Hz to 400Hz)		±0.05 %rdg.±0.01 % f.s. , ±0.2° (10 minutes after power is turned on)	±0.05 %rdg.±0.01 % f.s. , ±0.2°
Frequency characteristics** (typical)	DC to 16 Hz: ±0.1%rdg.±0.02%f.s.(±0.3°) 5kHz to 10kHz: ±1%rdg.±0.02%f.s. (±1.0°) 500kHz to 1M Hz: ±30%rdg.±0.05%f.s. ***	DC to 16 Hz: ±0.1%rdg.±0.02%f.s.(±0.3°) 5kHz to 10kHz: ±1%rdg.±0.02%f.s. (±1.0°) 300kHz to 500k Hz: ±30%rdg.±0.05%f.s.***	DC to 45Hz: ±0.2%rdg.±0.02%f.s.(±0.3°) 5kHz to 10kHz: ±2%rdg.±0.1%f.s. (±2.0°) 20kHz to 100kHz: ±30%rdg.±0.1%f.s. (±30°)	DC to 16Hz: ±0.1%rdg.±0.02%f.s.(±0.3°) 500Hz to 10kHz: ±5%rdg.±0.05%f.s. 10kHz to 20kHz: ±30%rdg.±0.1%f.s.
Operating Temperature & Humidity (non-condensating)	-30°C to 85°C (-22°F to 185°F) 80%RH or less		9709: 0°C to 50°C (-32°F to 122°F) 80%RH or less	-30°C to 85°C (-22°F to 185°F), 80%RH or less
Effect of conductor position	Within ±0.01%rdg. (deviation from center)	Within ±0.01%rdg. (deviation from center)	Within ±0.05%rdg. (deviation from center)	Within ±0.05%rdg. (deviation from center)
Effect of external electromagnetic field	10mA equivalent or lower (400A/m, 60Hz and DC)	50mA equivalent or lower (400A/m, 60Hz and DC)	50mA equivalent or lower (400A/m, 60Hz and DC)	200mA equivalent or lower (400A/m, 60Hz and DC)
Maximum rated voltage to earth	CAT III 1000Vrms	CAT III 1000Vrms	CAT III 1000Vrms	CAT III 1000Vrms
Dimensions, Mass	70W(2.76")×100H(3.94")×53D(2.09")mm, CT6862: 340g(12.0 oz.), CT6863: 350g(12.3oz.)		160W(6.30")×112H(4.41")×50D(1.97")mm, 9709: 850g(30.0oz.) CT9895: 1000g(35.3oz)	
Power supply	Sensor Unit 9555-10			
Options (sold separately)	Sensor Unit 9555-10, Connection Cable L9217			

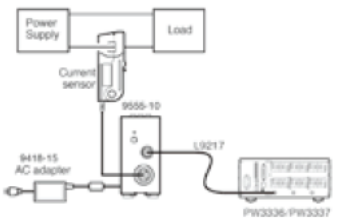
*: 45 to 66 Hz, DC: DC compatible sensor **: Includes derating characteristics ***: No phase precision regulations

Type 2 Current Sensor Options

	Sensor Unit 9555-10
Appearance	
Compatible current sensors	9272-10, 9277, 9728, 9279, CT6862, CT6863, 9709, CT6865
Output terminals	BNC terminals
Power supply	AC Adapter 9418-15 (100 to 240 V AC)
Accessories	Instruction manual, AC Adapter 9418-15

	Connection Cord L9217
Appearance	
Cord length	3 m
Terminals	Isolated BNC to isolated BNC

Type 2 Current Sensor Connection Diagram



Instrument

Power Meter **PW3336** (2-channel)
PW3336-01 (2-channel, with GP-IB terminal)
PW3336-02 (2-channel, with D/A output terminal)
PW3336-03 (2-channel, with GP-IB terminal and D/A output terminal)

Power Meter **PW3337** (3-channel)
PW3337-01 (3-channel, with GP-IB terminal)
PW3337-02 (3-channel, with D/A output terminal)
PW3337-03 (3-channel, with GP-IB terminal and D/A output terminal)

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

Current measurement options: Type 1 (For more information, see page 11.)

Can be connected to the current sensor input terminals on the PW3336/PW3337 series.

For 50/60Hz commercial power lines

CLAMP ON SENSOR
9660
100A AC
ϕ15mm(0.59")

CLAMP ON SENSOR
9661
500A AC
ϕ46mm(1.81")

CLAMP ON SENSOR
9669
1000A AC
ϕ55mm(2.17"),
80(3.15")×20(0.79")mm busbar

FLEXIBLE CLAMP ON SENSOR
CT9667
500A AC/ 5000A AC (selectable),
ϕ254mm (10"),
Power supply: LR06 alkaline battery
or **AC ADAPTER 9445-02/03** (sold separately)

Current measurement options: Type 2

(For more information, see page 11.)

Requires SENSOR UNIT 9555-10 and CONNECTION CORD L9217

CLAMP ON SENSOR
9272-10
20A/ 200A AC
ϕ46mm(1.81")
POWER SUPPLY: 9555-10

UNIVERSAL CLAMP ON CT
9277
20A AC/DC
ϕ20mm(0.79")
POWER SUPPLY: 9555-10

UNIVERSAL CLAMP ON CT
9278
200A AC/DC
ϕ20mm(0.79")
POWER SUPPLY: 9555-10

UNIVERSAL CLAMP ON CT
9279 (no CE mark)
500A AC/DC
ϕ40mm(1.57")
POWER SUPPLY: 9555-10

SENSOR UNIT
9555-10
POWER SUPPLY:
100V to 240V AC (50/60Hz)

AC/DC CURRENT SENSOR
CT6862
50A AC/DC
ϕ24mm(0.94")
POWER SUPPLY: 9555-10

AC/DC CURRENT SENSOR
CT6863
200A AC/DC
ϕ24mm(0.94")
POWER SUPPLY: 9555-10

AC/DC CURRENT SENSOR
9709
500A AC/DC
ϕ36mm(1.42")
POWER SUPPLY: 9555-10

AC/DC CURRENT SENSOR
CT6865
1000A AC/DC
ϕ36mm(1.42")
POWER SUPPLY: 9555-10

CONNECTION CORD
L9217
For sensor output
Cord length: 3m
Isolated BNC to Isolated BNC

Communications and control options

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

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

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

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

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

HIOKI

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