HIOKI

POWER METER Series

# Measure Everything from AC, DC and 3-Phase Power Sources to Standby Power

## The optimal power meter lineup for all applications

POWER METER PW3337/PW3336

POWER METER PW3335




AC/DC POWER HiTESTER 3334

POWER HiTESTER 3333




CE

3 year Warranty

# Advancing the Standard for Power Measurement

The best performing instruments for power measurement
on production lines, in laboratories, and in research facilities.
Hioki delivers the optimal power testing solutions
based on use case conditions, practical application, and accuracy.

## Three-phase Power Meter

The PW3337 and PW3336 are suitable for a wide variety of connections,
such as measuring three-phase circuits and single-phase 2-wire multiple circuits.
There is little internal resistance for the current input,
and large currents up to 65 A can be measured with great accuracy.



PW3337 (3ch)



PW3336 (2ch)

## Single-phase Power Meter

The PW3335 provides highly accurate measurements for
everything from standby power to operating power.
Compliant with the IEC62301 measurement standard for standby power,
it is capable of measuring current as low as 10 μA.
Designed for power consumption testing,
the 3334 and 3333 are guaranteed for accuracy for up to 3 years.



PW3335 (1ch)

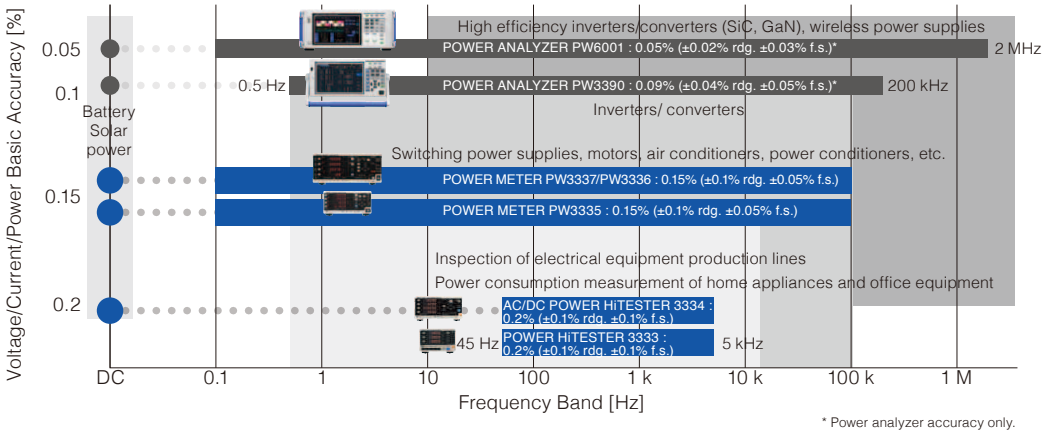


3334 (1ch)



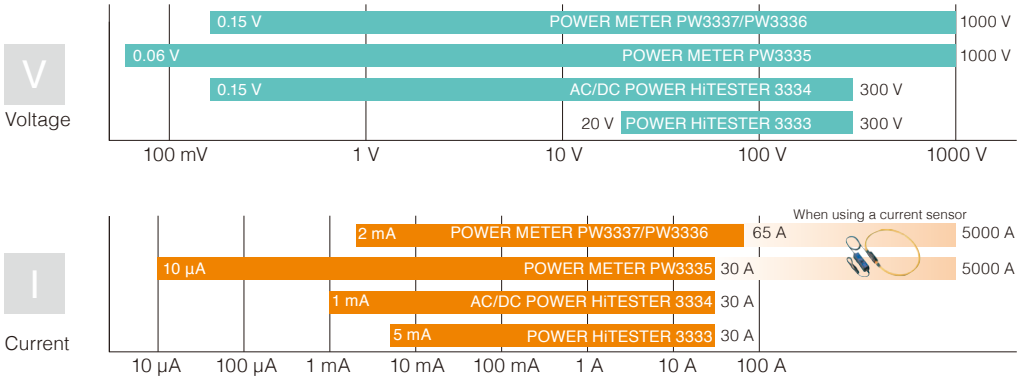
3333 (1ch)

## Basic Accuracy and Frequency Bands




* Power analyzer accuracy only.

## Effective Measurement Range



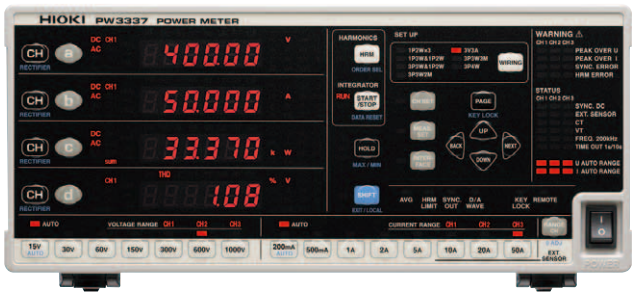

## Comparison Chart

| | | PW3337 | PW3336 | PW3335 | 3334 | 3333 |
|---|---|---|---|---|---|---|
| No. of channels | | 3 | 2 | 1 | 1 | 1 |
| Supported connections | | Three-phase, three-phase + single-phase, single-phase x 3, DC x 3 | Three-phase, single-phase x 2, DC x 2 | Single-phase, DC | Single-phase, DC | Single-phase |
| Effective measurement range, voltage | | 0.15 V to 1000 V | | 0.06 V to 1000 V | 0.15 V to 300 V | 20 V to 300 V |
| Effective measurement range, current | | 2 mA to 65 A | | 10 µA to 30 A | 1 mA to 30 A | 5 mA to 30 A |
| Frequency band | | DC, 0.1 Hz to 100 kHz | | | DC, 45 Hz to 5 kHz | 45 Hz to 5 kHz |
| Basic accuracy, AC (Voltage, current, power) | | ±0.1% rdg. ±0.05% f.s. | | | ±0.1% rdg. ±0.1% f.s. | ±0.1% rdg. ±0.2% f.s. |
| Basic accuracy, DC (Voltage, current, power) | | ±0.1% rdg. ±0.1% f.s. | | | ±0.1% rdg. ±0.2% f.s. | - |
| Integrated power measurement | | Yes | | | Yes | - |
| Harmonic measurement | | IEC61000-4-7 compliant | | | - | |
| Current sensor input | | Yes | | PW3335-03, -04 | - | |
| Interface | LAN | Yes | | | - | |
| | RS-232C | Yes | | PW3335, -02, -03, -04 | Yes | |
| | GP-IB | PW3337-01, -03 | PW3336-01, -03 | PW3335-01, -04 | 3334-01 | 3333-01 |
| | D/A output | PW3337-02, -03 | PW3336-02, -03 | PW3335-02, -04 | Yes | |

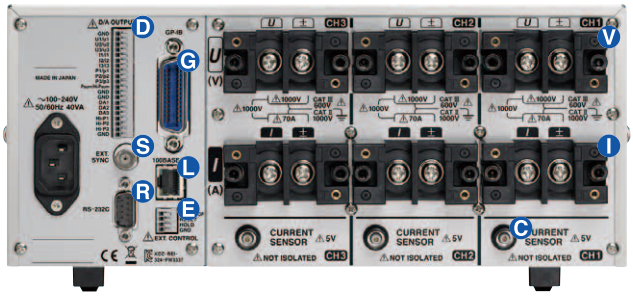
# Features

## POWER METER PW3337/PW3336

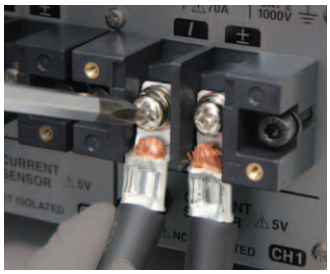
Accurate measurement of power for three-phase equipment, through direct input up to 1000 V AC/DC / 65 A.




PW3337-03 Front Panel




PW3337-03 Rear Panel



Maximum 65 A input.
Cable terminals are fixed securely
with large screws on the terminal block.

- Voltage/current/power basic accuracy of ±0.1% *
- Direct input up to 1000 V AC/DC / 65 A
- Harmonic measurement as standard feature, IEC61000-4-7 compliant
- Little instrument loss, even with large currents. DCCT input with an input resistance of 1 mΩ or less.
- Power factor effect of ±0.1% f.s. delivers highly accurate measurements even for no-load testing of transformers with a low power factor
- Measurement of multiple connections in the optimal range for each due to independent ranges for each channel
- Measure up to 5000 A AC with optional current sensor



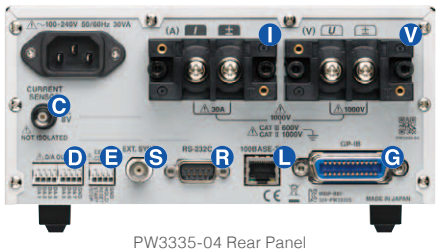
PW3336-03
Rear Panel

## POWER METER PW3335

Highly accurate AC/DC measurements from standby power to operating power




PW3335-04 Front Panel




PW3335-04 Rear Panel



Half-rack Size to Save Space



For development/production lines for
electrical equipment

- Voltage/current/power basic accuracy ±0.1% *
- Highly accurate AC/DC measurements from standby power to operating power
- Accuracy guaranteed throughout a wide range, from 10 µA to 30 A and 60 mV to 1000 V AC/DC
- Harmonic measurement as standard feature, IEC61000-4-7 compliant
- Compliant with the IEC62301 and EN50564 measurement standards for standby power
- Power factor effect of ±0.1% f.s. delivers highly accurate measurements even for no-load testing of transformers with a low power factor
- Accurate measurement of fluctuating electric power thanks to auto range integration with guaranteed accuracy for measurements while range switching
- Measure up to 5000 A AC with optional current sensor (PW3335-03, -04)

| | | | | |
|---|---|---|---|---|
| V Voltage input terminal | I Current input terminal | L LAN connector | R RS-232C connector | G GP-IB connector |
| D D/A output terminal | C Current sensor input terminal | S Synchronous control terminal | E External control terminal | |

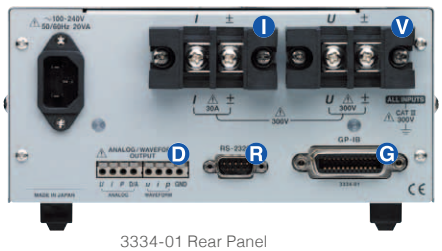
* For complete details, please refer to the specifications

## AC/DC POWER HiTESTER 3334

Measurement of power consumption and integrated power for battery-operated equipment, home appliances, and office equipment




3334-01 Front Panel




3334-01 Rear Panel

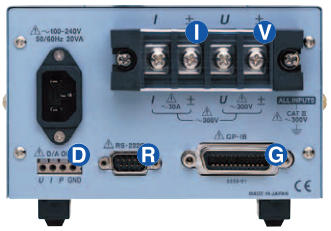
- Accuracy guaranteed up to 3 years
- Compliant with the SPECpower® server power evaluation test

## POWER HiTESTER 3333

Low-price model for measurement of power consumption on production/inspection lines




3333-01 Front Panel




3333-01 Rear Panel

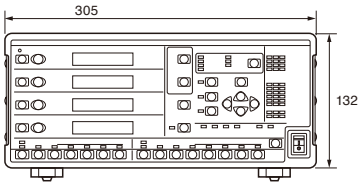
- Compact model for saving space, even when added to a system
- Accuracy guaranteed up to 3 years

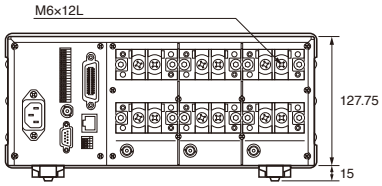
# Dimensional Drawings

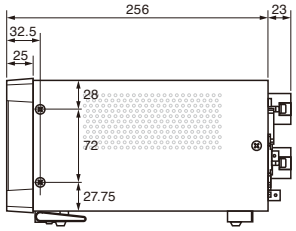
Units: mm

PW3337

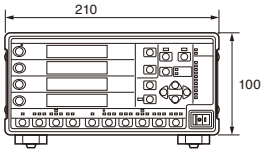
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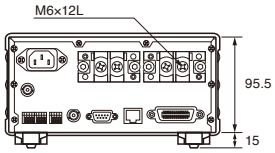


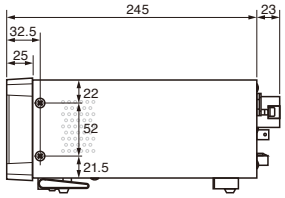



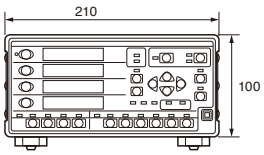

PW3335

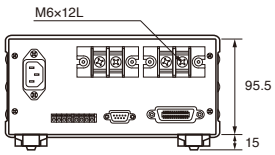


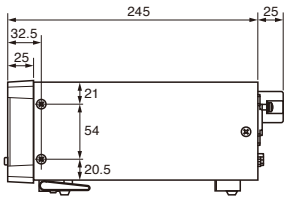



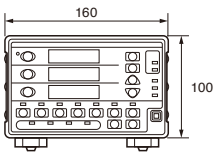

3334

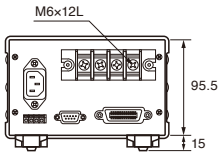


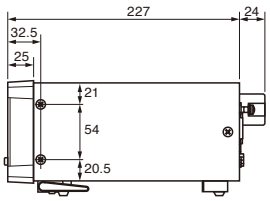




3333

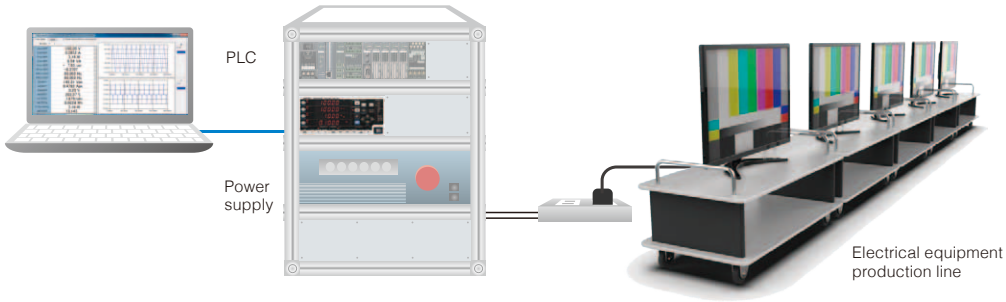


# Applications

## Inspection of Electrical Equipment Production Lines




Key features

- Best-in-class basic accuracy
- Extensive interfaces
- Long-term accuracy guarantee

### Best-in-class Accuracy ±0.1% * PW3337 PW3336 PW3335

Our lineup provides reliable accuracy for a variety of measurement scenarios. Accurately measure the power consumption of a variety of household appliances, such as liquid crystal displays, refrigerators, and air conditioners.




Basic accuracy, AC

**±0.1%** *

* For complete details, please refer to the specifications

### Accuracy Guaranteed Up to 3 Years (Longest in the Industry) 3334 3333

The 3333 and 3334 are guaranteed for accuracy for 3 years. Even after 3 years, they maintain an accuracy of ±0.5% rdg. as required for measurements. This 3-year accuracy guarantee, the longest in the industry, helps to save on calibration expenses.

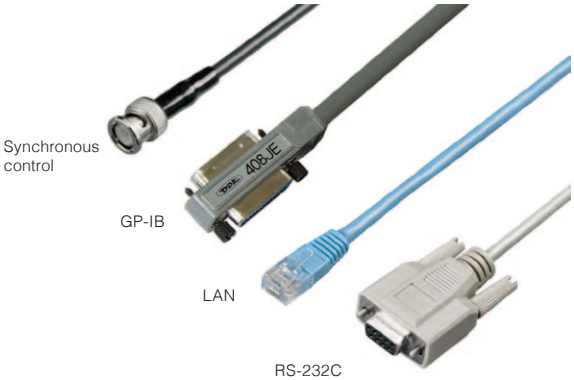



**3 years**

| 1-year guarantee of accuracy ±0.2% rdg. | 3-year guarantee of accuracy ±0.3% rdg. |
|---|---|

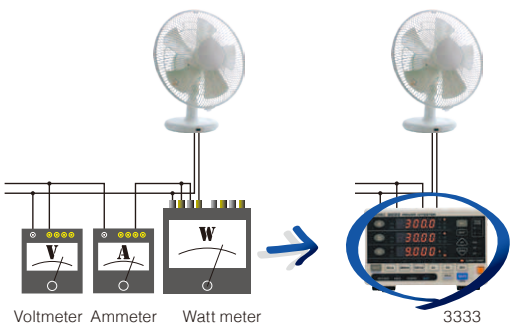
### Extensive Interfaces PW3337 PW3336 PW3335 3334 3333

The built-in interfaces are convenient for transferring data to a PC and equipping the unit on automated machines. PC communication software can be downloaded free of charge from the HIOKI website. For details about the built-in interfaces, refer to the specifications for each model.



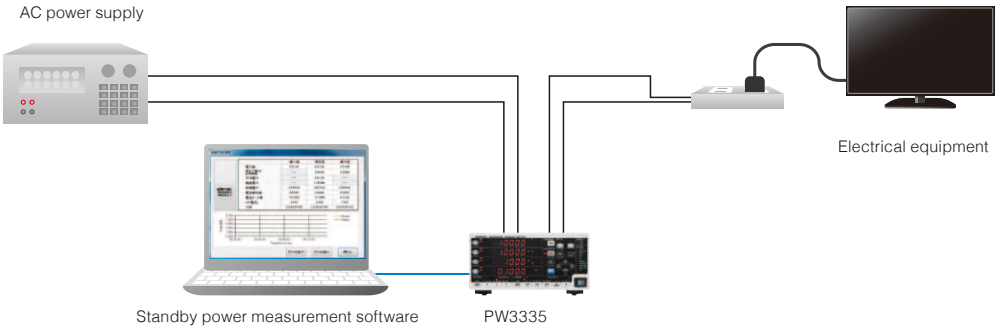

### Replacement for Analog Meters PW3337 PW3336 PW3335 3334 3333

These models can be used as replacements for analog voltmeters, ammeters, and watt meters. Up to 4 parameters such as voltage, current, and power can be displayed at the same time, allowing 3 measuring devices to be covered with a single unit. The digital display avoids issues such as parallax due to viewing angle and zero shift of the indicator.



# Standby Power Measurement

PW3335




Key features

- Compliant with standby power standards
- Wide dynamic range
- Standby power measurement software



AC adapter standby power measurement, for primary AC and secondary DC

## Compliant with IEC62301 and EN50564 Standards

The PW3335 is compliant with measurement standards for standby power, as welll as other measurement standards including the ErP Directive and Energy Star. Special parameters required by such standards including THD, CF, and MCR can also be checked with this unit.

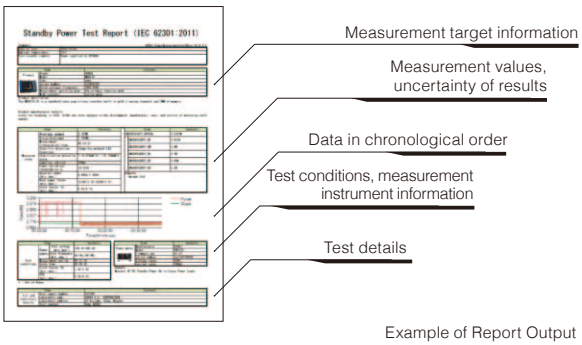
Requirements for Measurement Instruments for Standby Power Measurements (excerpt)

| Requirement | PW3335 Performance |
|---|---|
| Power resolution of 1 mW or better | ✔ Minimum resolution of 0.01 mW (in the 300 V/1 mA range) |
| Crest factor 3 support | ✔ Crest factor 6 support |
| Harmonic component measurement of up to at least 50th order | ✔ Harmonic measurement as standard feature |
| Data acquisition via interface | ✔ LAN (standard feature), RS-232C, GP-IB |

THD (Total Harmonic Distortion): Indicates to what extent harmonic components are present in an AC waveform
CF (Crest Factor): Ratio of the peak value to the effective (RMS) value of an AC waveform
MCR (Maximum Current Ratio): Current evaluation index, calculated from the crest factor and power factor

## Create Reports with Free Software

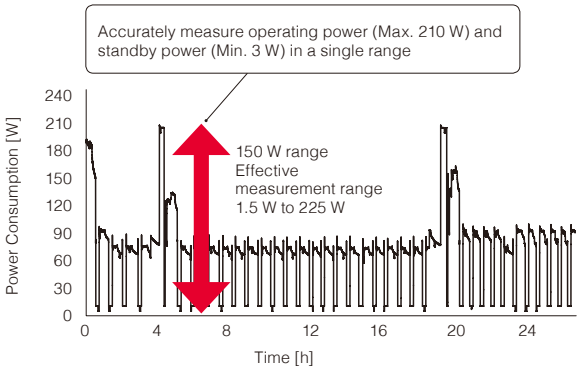
Standby power measurement software can be downloaded free of charge from the HIOKI website. Enter the required information to perform standby power measurements according to standards. Use this software to create reports of measurement results and save test data in CSV format.




Example of Report Output

## Wide Range of Effective Measurement

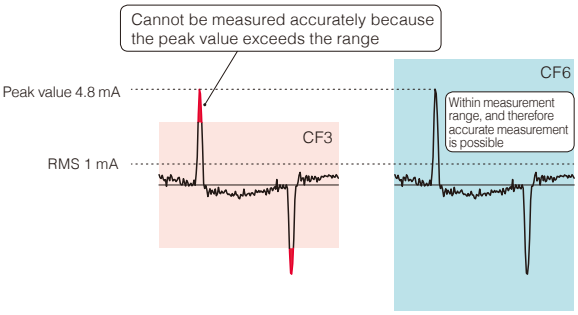
The PW3335 has an effective measurement range of 1% to 150%. Due to this wide range of effective measurement, even equipment with large load fluctuations, such as refrigerators, heaters, and pumps, can be measured accurately under all conditions from no-load to full operation.




Long-term Measurement of Refrigerator Power

## Support for CF6 (Crest Factor 6)

When an AC adapter or switching power supply operates with no load, the crest factor of the current waveform increases. The PW3335 can measure waveforms that exceed the range of watt meters that support crest factor 3.
In addition, although the power factor is low during no-load operation, the PW3335 is affected very little by power factor and can therefore achieve accurate measurements.

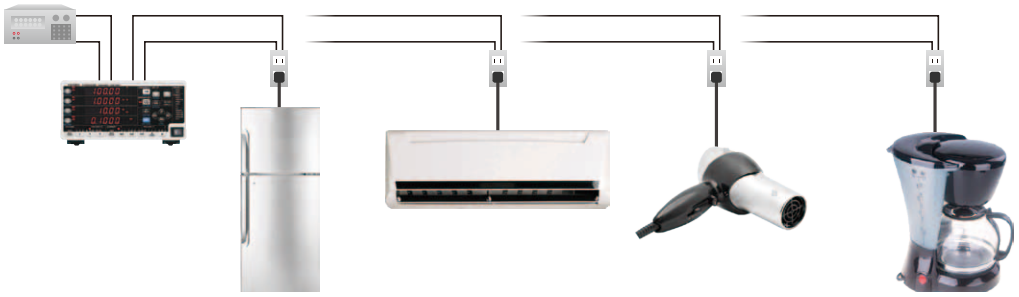



Example of Standby Current Waveform (CF = Peak Value, RMS = 4.8)

# Measurement of Fluctuating Loads and Power Supply Control

Key features

- Auto range integration
- Time average active power
- AC/DC power measurement

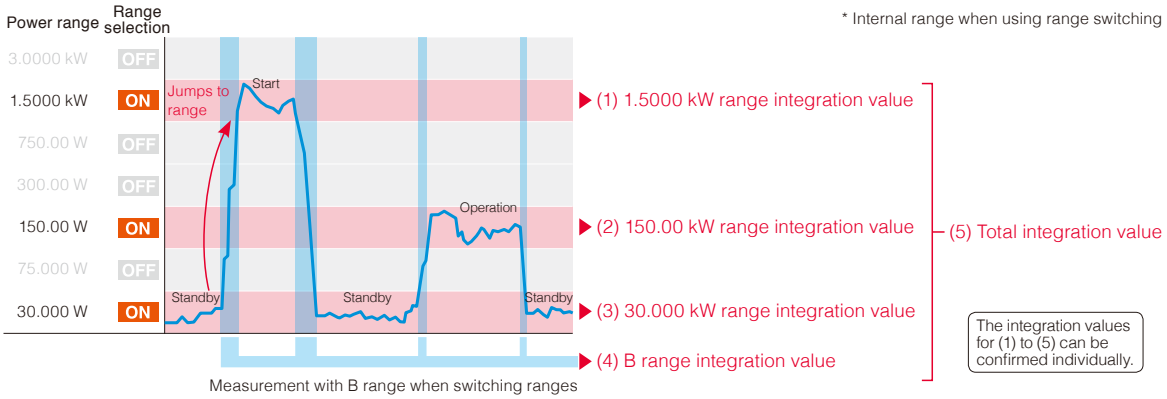


## Auto Range Integration with Guaranteed Accuracy when Switching Ranges

PW3335

These models automatically jump to the optimal power range according to current consumption when performing integration measurements. When switching ranges, power is integrated using the B range*, and therefore there is no loss of integration data. Achieve seamless power integration with guaranteed accuracy, even with loads that experience frequent and repeated fluctuations. In addition, since power integration can be performed for individual ranges, you can measure integrated power for the various conditions of devices that experience power fluctuations.

* Internal range when using range switching



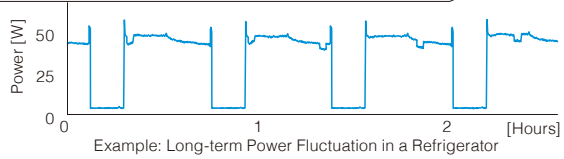

Measurement with B range when switching ranges

## Intermittent Power Supply

PW3337 PW3336 PW3335

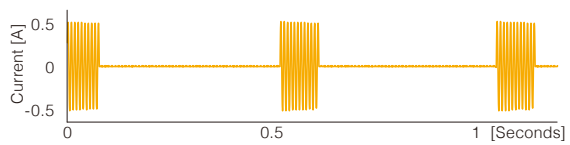
Devices that perform intermittent operation and cycle control repeat a cycle of stopped states and operating states. Therefore, with normal power measurement, it is not possible to determine a value for rated power consumption.
Time average active power (current) is a function that allows the measurement of the time average for power (current) that experiences fluctuations.

Time average power = Integration power / Integration time




Example: Long-term Power Fluctuation in a Refrigerator

Time average current = Integration current / Integration time



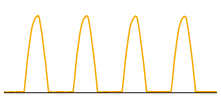

Example: Current Waveform for Heat Retention Heater

## AC/DC Measurement

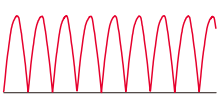
PW3337 PW3336 PW3335 3334

For equipment that uses rectifiers and control devices, it might not be possible to accurately measure voltage or current without an AC/DC power meter.

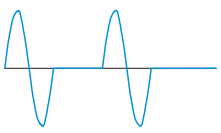
- Half-wave rectified waveforms used for dryers and fans
- Full-wave rectified waveforms used for AC adapters
- Cycle control waveforms used for voltage and temperature adjustment heaters
- DC waveforms with superimposed ripple components



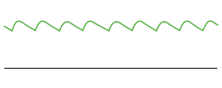
Half-wave Rectified Waveform



Full-wave Rectified Waveform



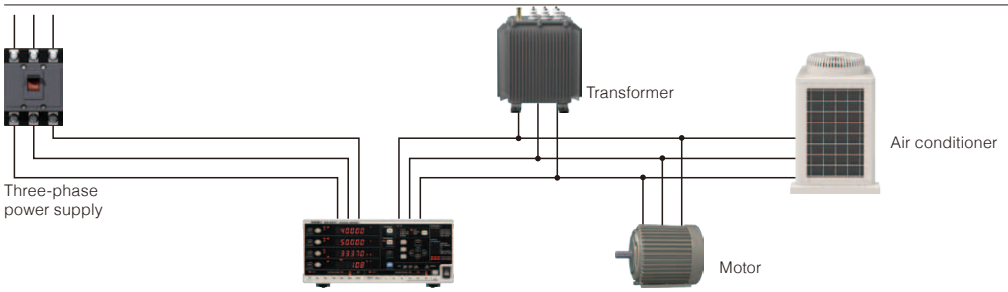
Cycle Control Waveform



DC Waveform with Superimposed Ripple

# Research, Development, and Inspection of Three-Phase Equipment

PW3337 7 PW3336 6




Key features

- Extensive connection settings
- Max. 65 A direct input
- Harmonic measurement function
- Current sensor input

## Compliant with IEC61000-4-7 Harmonic Measurement Standards

These models are compliant with the IEC61000-4-7 international standard for harmonic measurements. Conduct harmonic analysis up to the 50th order. The upper limit for harmonic analysis can be set from 2nd to 50th, according to the standard used.

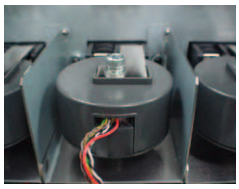
IEC61000-4-7 is an international standard for the measurement of harmonic current and harmonic voltage in power supply systems, and the harmonic current emitted from devices. It specifies the performance of standard measurement instruments. Among the series of standards that include specifications for power measurements, it is used as a reference standard for harmonic measurements.

## Support for Various Connections

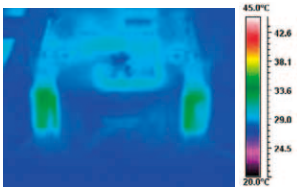
The PW3337 supports not only 3V3A, but also a variety of three-phase connections such as 3P4W, 3P3W2M, and 3P3W3M.

## Accuracy Guaranteed for Currents Up to 65 A

Because DCCT allows a current with an input resistance of 1 mΩ or less, accuracy is guaranteed up to 65 A. No heat is generated even with the input of large currents, so there is no loss of accuracy due to self heating. Even if the current exceeds 65 A, an optional current sensor allows measurements up to 5000 A.



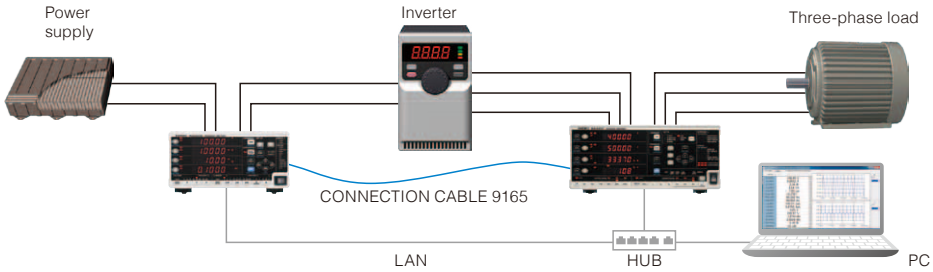
DCCT current sensor
(in the PW3337)




Temperature distribution image at
30 A DC/10-minute input

# Inverter Efficiency Measurement

PW3337 7 PW3336 6 PW3335 5

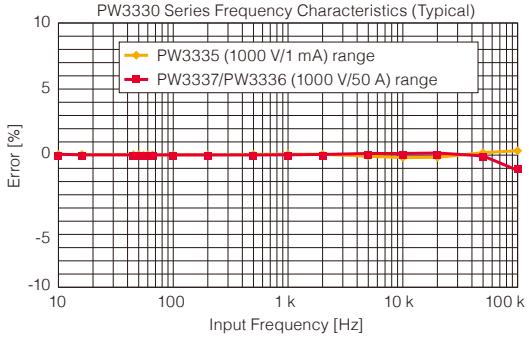



Key features

- Max. 24-channel power meter
- Wideband DC, 0.1 Hz to 100 kHz
- PW Communicator

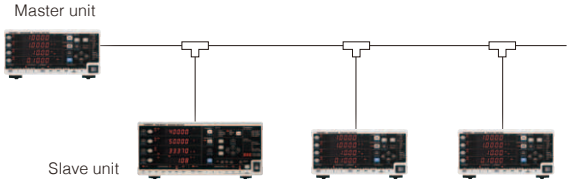
## Wide Frequency Band (DC, 0.1 Hz to 100 kHz)

These models cover not only the fundamental frequency bands for inverters, but also carrier frequency bands, in a wide range that includes DC and frequencies from 0.1 Hz to 100 kHz.




## 24-channel Power Meter with Synchronous Control for up to 8 Units

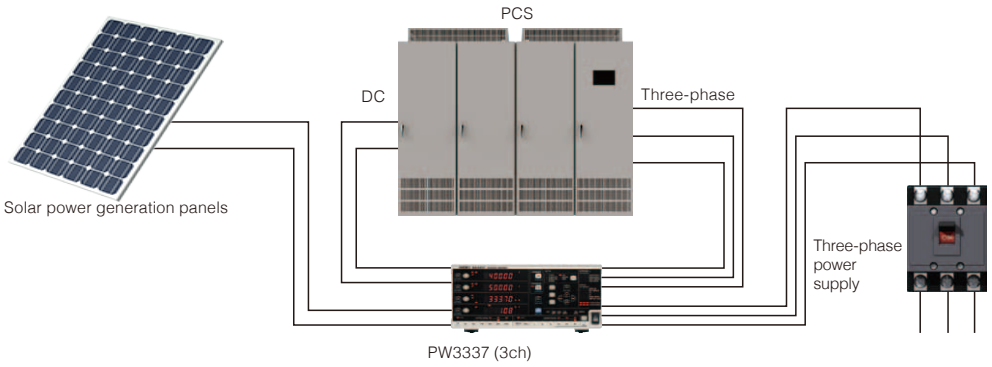
Connect 8 units for synchronous measurement of up to 24 channels. The calculation and control timing for PW3337, PW3336, and PW3335 units that are set as slaves are synchronized with the master unit. Use this feature to measure the I/O efficiency of power supply devices, compare multiple pieces of equipment, or to perform simultaneous parallel testing of production lines. Use the free PW COMMUNICATOR* software to calculate the efficiency between multiple units and to acquire data simultaneously from multiple units.




* This software can be downloaded from the HIOKI website.

# PV Power Conditioner (PCS) Efficiency Measurements

DC - 3-phase/ 3-wire PW3337 | DC 1-phase/ 2-wire PW3336

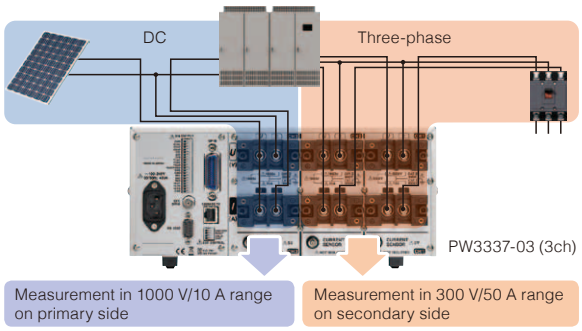



Key features

- Independent range per channel
- Extensive calculation functions
- Harmonic measurement function

## Independent Ranges Per Channel for Highly Accurate Measurements

Independent channels allow the selection of the optimal range for each connection. One example is the simultaneous measurement of the primary side (DC) and secondary side (three-phase) of a PCS using a single unit. Selecting the optimal range for each target to be measured enables highly accurate measurements.




Setting Optimal Range According to Target to be Measured

## I/O Efficiency Calculation with a Single Unit

Input and output can be measured independently at the optimal ranges, and the PCS efficiency can be calculated and displayed on a single unit. PCS can be evaluated with a simple system configuration.

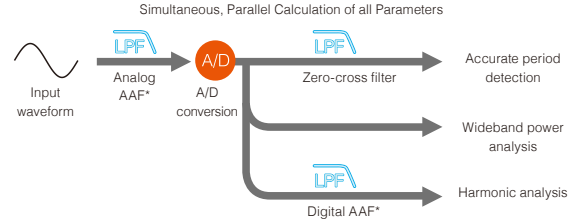
## 1000 V Range for Evaluation of Large Power Conditioners

These models support the measurement of large voltages, which is required in order to measure power conditioners for solar power generation. Measure up to 1000 Vrms and 1500 Vpeak.



## Simultaneous Measurement of Power Data and Harmonics

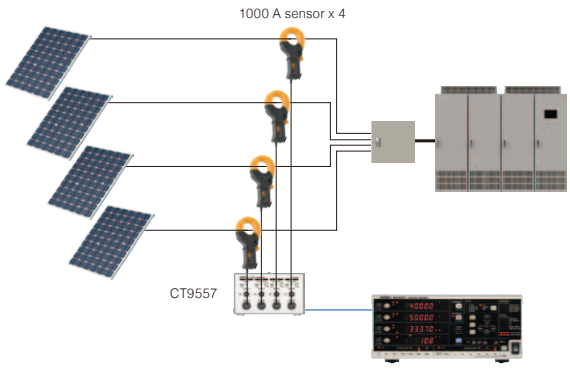
In addition to standard measurement items such as voltage, current, and power, all items related to harmonics, such as distortion and content percentage, are calculated internally in parallel at the same time. Items such as RMS value, MEAN value, DC components, AC components, and fundamental wave components can all be confirmed simply by switching the display. Even for DC waveforms with superimposed ripple components, the AC/DC components can be measured separately.
In addition, when using PC software, more than 180 measurement items can be acquired at the same time.




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

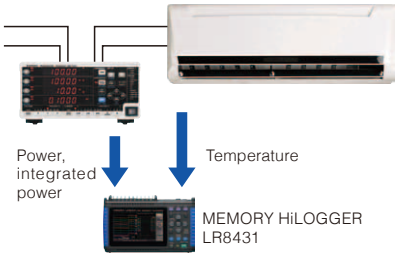
## Aggregation of Output from DC Current Sensors (Up to 4000 A)

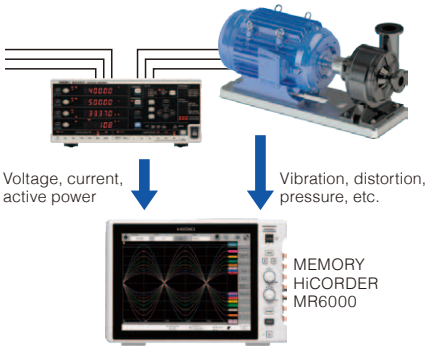
SENSOR UNIT CT9557 is a power supply for highly accurate current sensors that have a waveform output function. In addition to using it as a 4-channel power supply, it is also equipped with a sum feature for aggregating the input waveforms into a single waveform to be output.




Aggregating the Output from 4 Sensors into One Unit

# Output Function Linked with Recorder




Key features

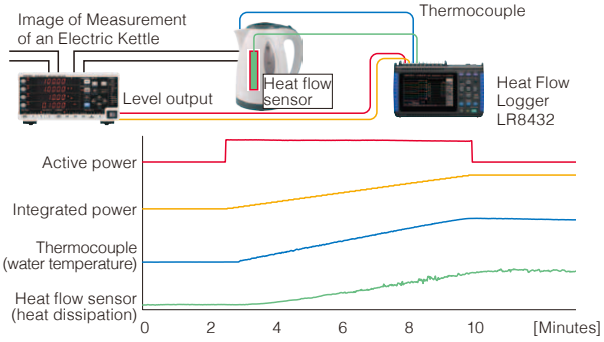
- Level output
- Waveform output
- High-speed level output
- LR8410Link

| | PW3337-02 PW3337-03 | PW3336-02 PW3336-03 | PW3335-02 PW3335-04 | 3334 3334-01 | 3333 3333-01 |
|---|---|---|---|---|---|
| Level output (Analog output) | Yes | | Yes | Yes | Yes |
| Waveform output | Yes | | Yes | Yes | - |
| High-speed level output | Active power only | | Voltage, current, active power | - | - |

## Display Trends with a Data Logger

PW3337 PW3336 PW3335 PW3334 PW3333

The level output (analog output) function delivers measured values that are displayed on the power meter with an analog voltage that is updated every 200 ms. Connect the unit to a data logger to check trends through synchronization with data such as temperature and heat flow*.

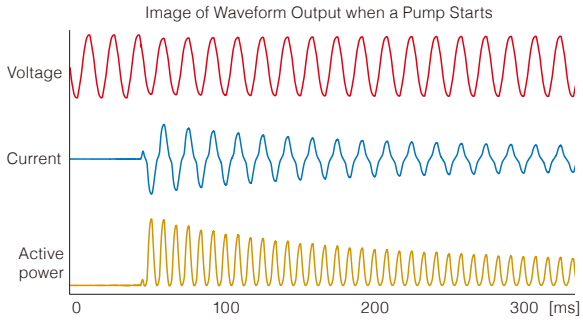



* Heat flow: Parameter for understanding the heat reception and heat dissipation of an object. Can be measured with a heat flow sensor.

## Observe Waveforms with a Memory Hicorder

PW3337 PW3336 PW3335 PW3334

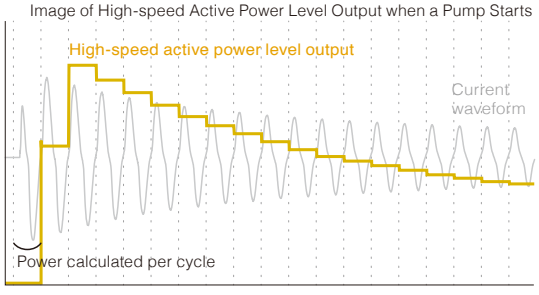
The waveform output function outputs the voltage/current waveforms captured by a power meter in the form of high-speed analog voltage. Connect to a memory recorder to check behavior when load fluctuates, such as with the inrush current of a motor.




## Observe Power for Each Cycle

PW3337 PW3336 PW3335

The PW3337, PW3336, and PW3335 feature built-in, high-speed active power level output. Level is output for power per cycle. When used in combination with a memory hicorder, fluctuations in power can be observed in real time. This feature is also useful for analyzing equipment that uses power, such as monitoring cutting and grinding tools.

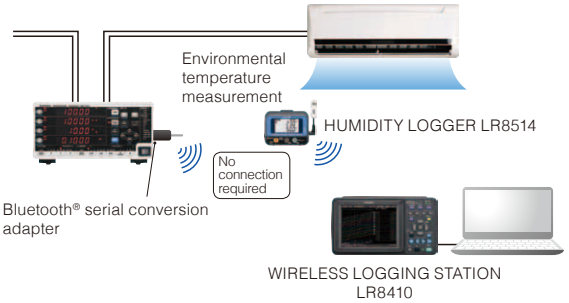



* With the PW3335, high-speed level output is also possible for 45 Hz to 66 Hz voltage and current.

## Transfer Information to Data Logger Wirelessly (LR8410Link)

PW3335

Connect the PW3335 (excluding model -01) and a data logger (with support for LR8410 Link) via Bluetooth® wireless technology* to wirelessly transmit 8 measurement parameters from the power meter to the data logger. In addition to the voltage and temperature measured by the multichannel data logger, you can also integrate current and power and observe and record them in real time.

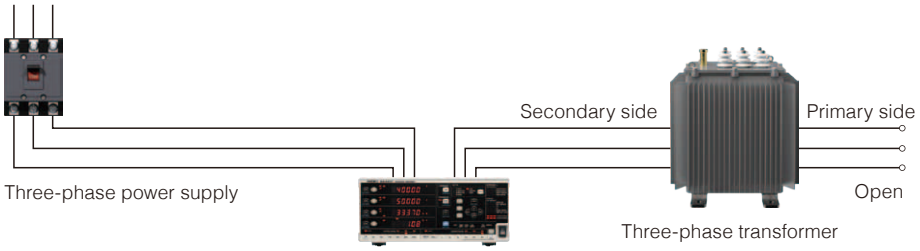



* Connection requires the serial - Bluetooth® wireless technology conversion adapter recommended by Hioki. Please inquire with your Hioki distributor.

# No-load Loss Measurements for Transformers

Single-phase only

PW3337 PW3336 PW3335

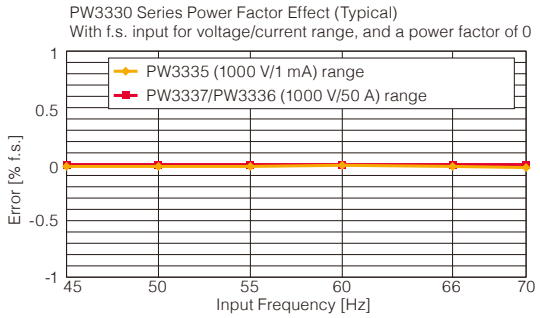



Key features

- Power factor effect ±0.1% f.s. or less
- Crest factor 6

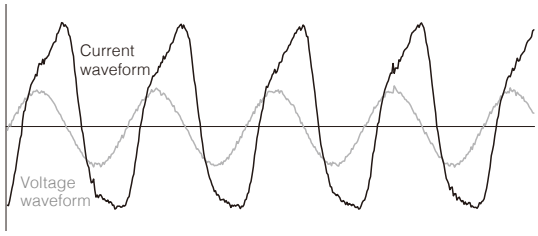
## Power Factor Effect of 0.1% or Less, Even at Low Power Factors

A no-load loss test is one indicator for evaluating energy conservation for transformers and motors. The PW3337 and PW3336 are affected very little by power factor, at ±0.1% f.s. or less, allowing active power to be measured with a high level of accuracy at low power factors.



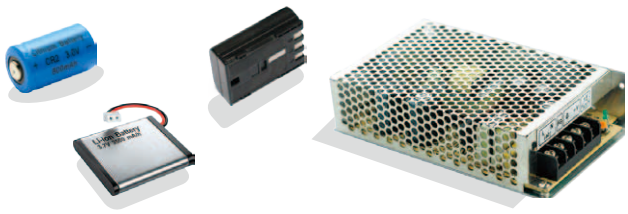

## Support for Crest Factor 6

The crest factor of a current waveform increases during no-load operation. The PW3337, PW3336, and PW3335 support a crest factor 6. Therefore, even if the waveform peak value is large relative to the range, accurate measurements are possible without exceeding the range.




Example of Transformer Current Waveform during No-load Operation

# DC Power Measurement for Batteries and Power Supplies





Key features

- DC power accuracy ±0.2% rdg.
- Power integration function by polarity

## Best-in-class DC Power Accuracy

PW3337 PW3336 PW3335

These models are best for measuring battery power consumption and output from switching power supplies. Make accurate measurements of DC power, which is an important factor in improving efficiency and saving energy.



PW3337/PW3336



PW3335

DC power accuracy

**±0.1%** *

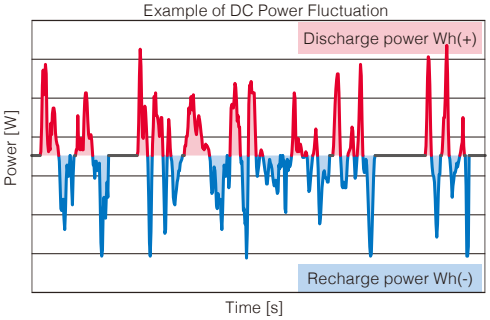
* For complete details, please refer to the specifications

## Current and Power Integration Function by Polarity

PW3337 PW3336 PW3335 PW3334

For integrated measurements, recharging power and discharging power are integrated by polarity every 200 ms. The amount of power in the positive direction, the amount of power in the negative direction, and the sum of the amounts of power in the positive and negative direction during the integration period are measured. Accurate measurement of recharging power and discharging power is possible even if there is rapid repetition of battery recharging/discharging.

Example of DC Power Fluctuation



# Options

## TYPE 1 Current Sensor (General Current Measurements)

PW3337 PW3336 PW3335

Connect this unit to the current sensor input terminal (BNC) on the PW3337/PW3336/PW3335. It can be used with a direct connection.

| Wiring method | External appearance | Product name/ model no. | Rated current | Frequency band | Diameter of measurable conductors | Basic accuracy (amplitude) Basic accuracy (phase) | Cord lengths | Power supply |
|---|---|---|---|---|---|---|---|---|
| Clamp method |  | CLAMP ON SENSOR 9660 | 100 A | 40 Hz to 5 kHz | ⌀ 15 mm (0.59 in) | ±0.3% rdg. ±0.02% f.s. Within ±1° | 3 m (9.84 ft) | Not used |
| |  | CLAMP ON SENSOR 9661 | 500 A | 40 Hz to 5 kHz | ⌀ 46 mm (1.81 in) | ±0.3% rdg. ±0.01% f.s. Within ±0.5° | | |
| |  | CLAMP ON SENSOR 9669 | 1000 A | 40 Hz to 5 kHz | ⌀ 55 mm (2.17 in), 80 mm (3.15 in) × 20 mm (0.79 in) BUS BAR | ±1.0% rdg. ±0.01% f.s. Within ±1° | | |
| |  | FLEXIBLE CLAMP ON SENSOR CT9667-01 | 500 A/ 5000 A | 10 Hz to 20 kHz | ⌀ 100 mm (3.94 in) | ±2.0% rdg. ±0.3% f.s. Within ±1° | | AA (LR6) Alkaline Batteries x 2 (approx. 7 days) or AC ADAPTER 9445-02 (optional) |
| |  | FLEXIBLE CLAMP ON SENSOR CT9667-02 | | | ⌀ 180 mm (7.09 in) | | | |
| |  | FLEXIBLE CLAMP ON SENSOR CT9667-03 | | | ⌀ 254 mm (10.00 in) | | | |

Options for CT9667-01/-02/-03

| External appearance | Product name/ model no. | Functions | Power supply |
|---|---|---|---|
|  | AC ADAPTER 9445-02 | For supplying power to CT9667-01/-02/-03 | 100 to 240 V AC |

## TYPE 2 Current Sensor (Highly Accurate Current Measurements)

PW3337 PW3336 PW3335

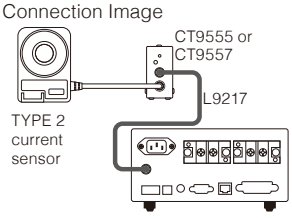
Connect this unit to the current sensor input terminal (BNC) on the PW3337/PW3336/PW3335.
**SENSOR UNIT CT9555 or CT9557 and CONNECTION CABLE L9217 are required.**

| Wiring method | External appearance | Product name/ model no. | Rated current | Frequency band | Diameter of measurable conductors | Basic accuracy (amplitude) Basic accuracy (phase) | Cord lengths | Power supply |
|---|---|---|---|---|---|---|---|---|
| Through method |  | CT6862-05 | 50 A | DC to 1 MHz | ⌀ 24 mm (0.94 in) | ±0.05% rdg. ±0.01% f.s. Within ±0.2° | 3 m (9.84 ft) | CT9555 or CT9557 |
| |  | CT6863-05 | 200 A | DC to 500 kHz | ⌀ 24 mm (0.94 in) | | | |
| |  | CT6875 | 500 A | DC to 2 MHz | ⌀ 36 mm (1.42 in) | ±0.04% rdg. ±0.008% f.s. Within ±0.1° | | |
| |  | CT6876 | 1000 A | DC to 1.5 MHz | ⌀ 36 mm (1.42 in) | | | |
| |  | CT6877 | 2000 A | DC to 1 MHz | ⌀ 80 mm (3.15 in) | | | |
| Clamp method |  | CT6841-05 | 20 A | DC to 1 MHz | ⌀ 20 mm (0.79 in) | ±0.3% rdg. ±0.01% f.s. Within ±0.1° | | |
| |  | CT6843-05 | 200 A | DC to 500 kHz | ⌀ 20 mm (0.79 in) | | | |
| |  | CT6844-05 | 500 A | DC to 200 kHz | ⌀ 20 mm (0.79 in) | | | |
| |  | CT6845-05 | 500 A | DC to 100 kHz | ⌀ 50 mm (1.97 in) | | | |
| |  | CT6846-05 | 1000 A | DC to 20 kHz | ⌀ 50 mm (1.97 in) | | | |
| |  | 9272-05 | 20 A/ 200 A | 1 Hz to 100 kHz | ⌀ 46 mm (1.81 in) | ±0.3% rdg. ±0.01% f.s. Within ±0.2° | | |

Options for Current Sensor TYPE 2

| External appearance | Product name/ model no. | Max. no. of sensors | Functions | Power supply | Cord lengths |
|---|---|---|---|---|---|
|  | SENSOR UNIT CT9555 | 1 | For supplying power to the TYPE 2 current sensor | 100 V to 240 V AC | - |
|  | SENSOR UNIT CT9557 | 4 | For supplying power to the TYPE 2 current sensor With addition output function | 100 V to 240 V AC | - |
|  | CONNECTION CORD L9217 | - | For connecting CT9555/CT9557 and PW3330 series units | - | 1.6 m (5.25 ft) |

Connection Image




## Rack Mount Hardware

HIOKI can also manufacture rack mount hardware (EIA, JIS). Please contact your Hioki distributor or subsidiary for more information.

## Printing with a Printer

3333

Connect the 3333 to PRINTER 9442* to print out values.

Printing example

```
STATUS,000000.U,+0200.0E+0,I,+014.82E+0.
P,+02.727E+3,S,+02.964E+3,PF,+00.920E+0
```



PRINTER 9442
Thermal serial dot method, 112 mm (4.41 in) paper width
Power supply: AC ADAPTER 9443-02, or the included nickel hydride batteries
Dimensions, mass: 160 mm W × 67 mm H × 170 mm D (6.30 in W × 2.64 in H × 6.69 in D), 580 g (20.5 oz)



CONNECTION CABLE 9444
9-pin - 9-pin, straight, 1.5 m (4.92 ft)



AC ADAPTER 9443-02
For printer, 9442, EU type



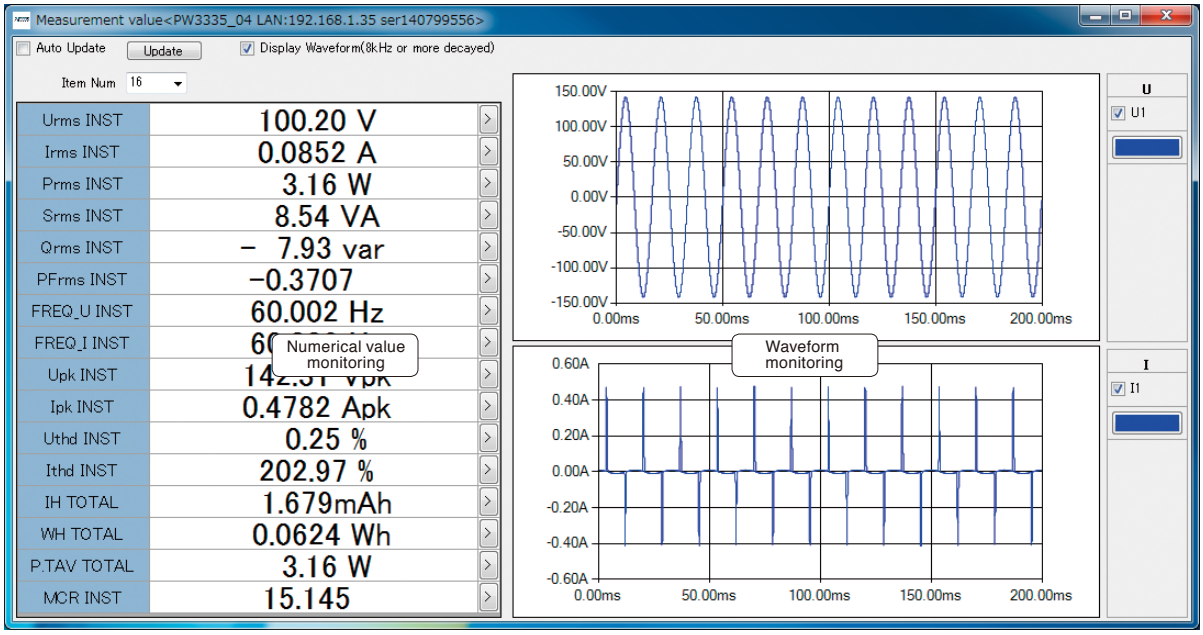
RECORDING PAPER 1196
112 mm (4.41 in) × 25 m (82.03 ft), 10-roll set

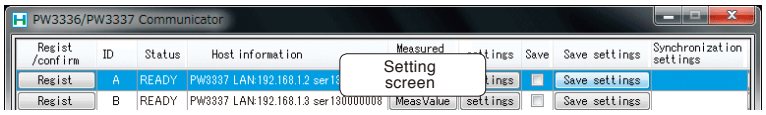
# Software

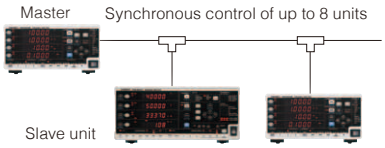
## PW Communicator

PW3337 PW3336 PW3335

PW Communicator is an application for communicating between a PW3337/PW3336/PW3335 and a PC. This software can be downloaded free of charge from the HIOKI website. Use this software to configure the power meter, acquire interval data with a PC, perform numerical calculations for measurement data, calculate efficiency between multiple units, display 10 or more measurement items, and display waveforms.




| | |
|---|---|
| Numerical value monitoring | Display the PW3337/PW3336/PW3335 measurement values on the PC screen. You can freely select up to 64 values, such as voltage, current, power, and harmonics. |
| Waveform monitoring | The voltage, current, and waveforms measured by the unit can be monitored on the PC screen. |
| Meter setting | The configuration of the connected power meter can be changed on the PC screen. |
| Synchronous measurement | Efficiency calculations, such as input/output of the power supply conversion device, are possible between multiple power meters. Use a sync cable to connect and synchronize the control of up to 8 units. |
| Save in chronological order | More than 180 pieces of measured data can be recorded to a file in CSV format at regular time intervals. The minimum time interval for recording is 200 ms. |

## LabVIEW Driver

PW3337 PW3336 PW3335

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

## Sample Software

3334 3333

Sample software for loading data (via RS-232C) can be downloaded from the HIOKI website.

- The 3333/3334 front panel is displayed on the PC screen. Operate the power meter or change settings directly on the PC.
- The measured values for the 3333/3334 are displayed in real time on the PC screen. Save data as a CSV file.

# Standby Power Measurement Software

PW3335 5

"Standby Power Measurement Software" is an application software exclusively designed for the Power Meter PW3335. This software lets you to view PW3335 measurement data and also save them as reports or in CSV format via a LAN, GP-IB, or RS-232C. Measure standby power consumption in accordance with IEC62301. Download the software free of charge from the HIOKI website.

## Workflow for Standby Power Test

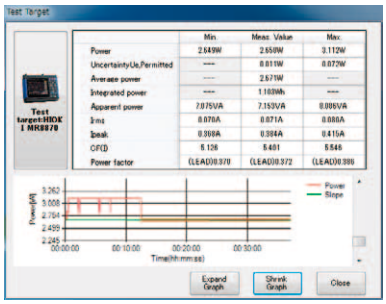
### 1. Connect to power meter

Configure the settings for communication with a power meter. Connect the PC to a power meter, and enter the settings required for the interface used (LAN/RS-232C/GP-IB).



### 2. Configure the test target

Enter the information of the device under test. The information to be entered includes manufacturer name, model name, serial number, and operation mode. You can also register an image of the test target.




### 3. Configure the test power supply

Enter the information of the test power supply. Information to be entered includes rating and frequency. Also, enter the values of uncertainty due to the connection method, wiring, power supply, and temperature.




### 4. Configure the test conditions

Set the current range, stop conditions, algorithm used to judge stability, cycle time, and upper limit for test time.



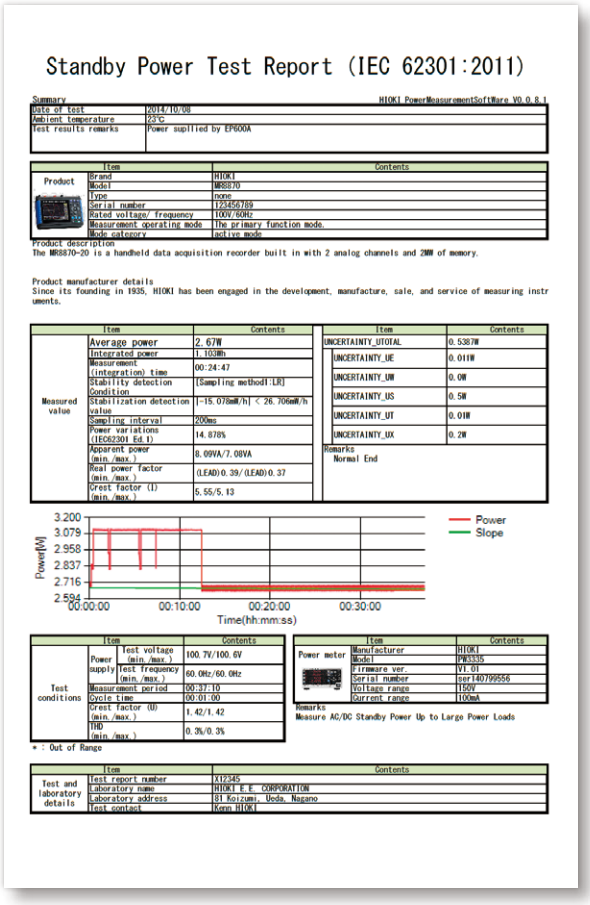

### 5. Run test

The consumed power is measured according to the configured settings.




### 6. Create report

Create a report of the test results. Output either a PDF report or CSV file.




Example of report output

| Model | PW3335 | | | | | |
|---|---|---|---|---|---|---|
| Serial Number | serl 40799556 | | | | | |
| Firmware Ver | V0.07 | | | | | |
| Start Time | 2014 | 7 | 28 | 14 | 32 | |
| Voltage Range | 150V | | | | | |
| Current Range | 200mA | | | | | |
| Update Rate | 200ms | | | | | |
| Algorithm | LR | CA | SP1 | SP2 | SAF | |
| Stop Factor | Pass[Condition1(LR)] | | | | | |
| Valid Period | 0 | 180 | | | | |
| Time(Sec) | Test voltage(V) | Test frequency(Hz) | U-THD(%) | Crest Factor U | Crest Factor I | F |
| 14.0 | 99.49 | 60.002 | 0.26 | 1.4202 | 5.6212 | |
| 15 | 99.49 | 60.002 | 0.27 | 1.4199 | 5.6585 | |
| 15.2 | 99.49 | 60.002 | 0.25 | 1.4198 | 5.6606 | |
| 15.4 | 99.49 | 60.002 | 0.26 | 1.4198 | 5.6834 | |
| 15.6 | 99.49 | 60.002 | 0.26 | 1.4198 | 5.6652 | |
| 15.8 | 99.49 | 60.002 | 0.26 | 1.4198 | 5.6668 | |
| 16 | 99.49 | 60.002 | 0.26 | 1.4199 | 5.6484 | |
| 16.2 | 99.49 | 60.002 | 0.26 | 1.4198 | 5.6675 | |

CSV output example

# PW3337 7 PW3336 6 and PW3337 and PW3336 Specifications

## Input Specifications

| | |
|---|---|
| Measurement line type | PW3336 series<br>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<br>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)<br>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;<br>PW3336: from 3.0000W to 100.00kW (also applies to VA, var)<br>PW3337: from 3.0000W to 150.00kW (also applies to VA, var) |
| Input resistance (50/60 Hz) | Voltage input terminal : 2 MΩ<br>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 | 16-bit resolution |
| Frequency bands | DC, 0.1 Hz to 100 kHz |
| Synchronization sources | U1, U2, U3, I1, I2, I3, DC (fixed at 200 ms)<br>Can be set separately for each wiring mode. |
| Measurement items | · Voltage · Current · Active power · Apparent power<br>· Reactive power · Power factor · Phase angle · Frequency<br>· Efficiency · Current integration<br>· Active power integration · Integrated time<br>· Voltage waveform peak value · Current waveform peak value<br>· Voltage crest factor · Current crest factor<br>· Time average current · Time average active power<br>· Voltage ripple factor · Current ripple factor<br>Harmonic parameters:<br>· Harmonic voltage RMS value · Harmonic current RMS value<br>· Harmonic active power · Total harmonic voltage distortion<br>· Total harmonic current distortion · Voltage fundamental waveform<br>· Current fundamental waveform · Active power fundamental waveform<br>· Apparent power fundamental waveform · Reactive power fundamental waveform<br>· Power factor fundamental waveform (displacement power factor)<br>· Voltage current phase difference fundamental waveform<br>· Interchannel voltage fundamental wave phase difference<br>· Interchannel current fundamental wave phase difference<br>· Harmonic voltage content % · Harmonic current content %<br>· Harmonic active power content %<br>The following parameters can be downloaded as data during PC communication but not displayed:<br>· Harmonic voltage phase angle · Harmonic current phase angle<br>· Harmonic voltage current phase difference |
| Rectifiers | AC+DC: AC+DC measurement<br>Display of true RMS values for both voltage and current<br>AC+DC Umn: AC+DC measurement<br>Display of average value rectified RMS converted values for voltage and true RMS values for current<br>DC: DC measurement<br>Display of simple averages for both voltage and current<br>Display of values calculated by (voltage DC value)× (current DC value) for active power<br>AC: AC measurement<br>Display of values calculated by for both voltage and current<br>Display of values calculated by $\sqrt{(\text{AC+DC value})^2 - (\text{DC value})^2}$ for active power<br>FND<br>Extraction and display of the fundamental wave component from harmonic measurement |
| Zero-Crossing Filter | 500 Hz/200 kHz<br>500 Hz: 0.1 Hz to 500 Hz, 200 kHz: 0.1 Hz to 200 kHz |

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 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 |
| Maximum effective peak voltage | ±600% of each voltage range<br>However, for 300 V, 600 V, and 1000 V ranges, ±1500 Vpeak |
| Maximum effective peak current | ±600% of each current range<br>However, for 20 A range and 50 A range, ±100 Apeak |
| Conditions of guaranteed accuracy | Temperature and humidity: 23°C ±5°C, 80% RH or less<br>Warm-up time: 30 minutes<br>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)<br>Internal circuitry voltage/current phase difference: ±0.0573° |
| Effect of common mode voltage | ±0.02% f.s. or less<br>(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<br>Voltage :±1.5% f.s. or less<br>Current :±1.5% f.s. or ±10 mA, whichever is greater, or less<br>Active power :±3.0% f.s. or (voltage influence quantity) × (±10 mA), whichever is greater, or less |
| Magnetization effect | ±10 mA equivalent or less<br>(after inputting 100 A DC to the current direct input terminals) |
| Adjacent channel input effect | ±10 mA equivalent or less<br>(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<br>(However, up to ±1500 V peak value and 1000 V RMS value)<br>Current: 1% to 130% of range<br>Active power: 0% to 169% of the range<br>(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%)<br>Active power: 0% to 196% of the range (no zero-suppression) |
| Polarity | Voltage/ Current: Displayed when using DC rectifier<br>Active power: +: Positive: Power consumption (no polarity display)<br>–: 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<br>3P3W | $X_{sum} = \frac{1}{2}(X_{(1)} + X_{(2)})$ | $P_{sum} = (P_{(1)} + P_{(2)})$ |
| | 3P3W2M<br>3V3A<br>3P3W3M<br>3P4W | $X_{sum} = \frac{1}{3}(X_{(1)} + X_{(2)} + X_{(3)})$ | $P_{sum} = (P_{(1)} + P_{(2)} + P_{(3)})$ |

( i ): Measurement channel

## 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 |

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<br>±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) |

## 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 |

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

| | |
|---|---|
| Measurement types | Rectifiers<br>Apparent Power/ Reactive Power/ Power Factor : AC+DC, AC, FND, AC+DC Umn<br>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)<br>Power Factor : ±0.0000 to ±1.0000<br>Phase Angle : +180.00 to -180.00 |
| Polarity | Reactive Power/ Power Factor/ Phase Angle<br>Polarity is assigned according to the lead/lag relationship of the voltage waveform rising edge and the current waveform rising edge.<br>+ : When current lags voltage (no polarity display)<br>- : 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 | | |
| | 3V3A | $S_{sum} = \frac{\sqrt{3}}{3}(S_{(1)} + S_{(2)} + S_{(3)})$ | |
| | 3P3W3M | $S_{sum} = S_{(1)} + S_{(2)} + S_{(3)}$ | $Q_{sum} = Q_{(1)} + Q_{(2)} + Q_{(3)}$ |
| | 3P4W | | |

( i ): Measurement channel

| Wiring | | $\lambda$ : Power factor | $\phi$ : 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<br>3P3W<br>3P3W2M<br>3V3A<br>3P3W3M<br>3P4W | $\lambda_{sum} = si_{sum}\left\lvert\frac{P_{sum}}{S_{sum}}\right\rvert$ | When $P_{sum} \geq 0$<br>$\phi_{sum} = si_{sum}\ cos^{-1}\lvert\lambda_{sum}\rvert$ (0° to ±90°)<br>When $P_{sum} \geq 0$<br>$\phi_{sum} = si_{sum}\lvert 180 - cos^{-1}\lvert\lambda_{sum}\rvert\rvert$ (±90° to ±180°) |

( i ): Measurement channel ; The polarity symbol sisum is acquired from the Qsum symbol.

## Frequency Measurement Specifications

| | |
|---|---|
| Number of measurement channels | 3 ch |
| 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<br>For sine wave input that is at least 20% of the measurement source's measurement range.<br>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,<br>9900 kHz to 9.9999 kHz, 9.900 kHz to 99.999 kHz, 99.00 kHz to 220.00 kHz |

## Efficiency Measurement Specifications

| | |
|---|---|
| Measurement method | Calculates the efficiency h [%] 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<br>PW3336 |

| Wiring | CH1 | CH2 | Calculation formulas |
|---|---|---|---|
| 1P2W × 2 | 1P2W | 1P2W | η1=100×\|P2\| / \|P1\|<br>η2=100×\|P1\| / \|P2\| |
| 1P3W | 1P3W | | |
| 3P3W | 3P3W | | |
| 3P3W2M | 3P3W2M | | |

PW3337

| Wiring | CH1 | CH2 | CH3 | Calculation formulas |
|---|---|---|---|---|
| 1P2W × 3 | 1P2W | 1P2W | 1P2W | η1=100×\|P3\| / \|P1\|<br>η2=100×\|P1\| / \|P3\| |
| 1P3W & 1P2W | 1P3W | | 1P2W | η1=100×\|P3\| / \|Psum\| |
| 3P3W & 1P2W | 3P3W | | 1P2W | η2=100×\|Psum\| / \|P3\| |
| 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[%] |

## 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 |

## Functional Specifications

| | |
|---|---|
| Auto-range (AUTO) | Automatically changes the voltage and current range for each wiring mode according to the input<br>Range up:<br>The range is increased when input exceeds 130% of the range or when the peak is exceeded.<br>Range down:<br>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.<br>· The power factor and phase angle are calculated from averaged data.<br>· Measured values other than peak values, power factor, frequency, integrated values, T.AV, crest factor, ripple rate, total harmonic distortion, and harmonics are averaged.<br>Method : Simple averaging<br>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.<br>VT ratio setting range : OFF (1.0), 0.1 to 1000 (setting: 0000)<br>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.<br>· Measurement data acquired by communications is also fixed at that point in time.<br>· Internal calculations (including integration and integration elapsed time) will continue.<br>· 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.<br>· 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).<br>· Internal calculations (including integration and integration elapsed time) will continue.<br>· 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 items | Simultaneous integration of the following 6 parameters for each channel (total of 18 parameters):<br>Sum of current integrated values (displayed as Ah on panel display)<br>Positive current integrated value (displayed as Ah+ on panel display)<br>Negative current integrated value (displayed as Ah- on panel display)<br>Sum of active power integrated values (displayed as Wh on panel display)<br>Positive active power integrated value (displayed as Wh+ on panel display)<br>Negative active power integrated value (displayed as Wh- on panel display) |
| Measurement types | Rectifiers: AC+DC, AC+DC Umn<br>Current:<br>Displays the result of integrating current RMS value data (display values) once every display update interval (approx. 200 ms) as an integrated value.<br>Active power:<br>Displays the result of integrating active power values by polarity calculated once every cycle for the selected synchronization source as integrated values.<br>Rectifier: DC<br>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 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)<br>· Displaying the integration elapsed time (displayed as TIME on panel display)<br>· Additional integration by repeatedly starting/stopping integration<br>· Backing up integrated values and the integration elapsed time during power outages<br>· 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 |

## Harmonic Measurement Specifications (built-in function)

| | |
|---|---|
| Measurement method | · Zero-cross simultaneous calculation method (separate windows by channel according to the wiring mode)<br>· Uniform thinning between zero-cross events after processing with a digital antialiasing filter<br>· Interpolation calculations (Lagrange interpolation)<br>· When the synchronization frequency falls within the 45 Hz to 66 Hz range<br>» IEC 61000-4-7:2002 compliant<br>» Gaps and overlaps may occur if the measurement frequency is not 50 Hz or 60 Hz<br>· When the synchronization frequency falls outside the 45 Hz to 66 Hz range<br>» 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 %<br>·Harmonic voltage phase angle ·Harmonic current RMS value<br>·Harmonic current content % ·Harmonic current phase angle<br>·Harmonic active power ·Harmonic active power content %<br>·Harmonic voltage current phase difference ·Total harmonic voltage distortion<br>·Total harmonic current distortion ·Voltage fundamental waveform<br>·Current fundamental waveform · Active power fundamental waveform<br>·Apparent power fundamental waveform · Reactive power fundamental waveform<br>·Power factor fundamental waveform<br>·Voltage current phase difference fundamental waveform<br>·Interchannel voltage fundamental wave phase difference<br>·Interchannel current fundamental wave phase difference<br>The following parameters can be downloaded as data during PC communication but not displayed:<br>· Harmonic voltage phase angle · Harmonic current phase angle<br>· 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)<br>56 Hz ≤ f < 66 Hz: 181.82 ms to 214.29 ms (12 cycles)<br>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 |

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| | |
|---|---|
| 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) x (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<br>Integrated values: 999999 count |
| Display update rate | 200 ms to 20 s (varies with number of averaging iterations setting) |

## 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<br>In : The EXT SYNC terminal is set to input, and a dedicated synchronization signal can be input (slave).<br>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) |

## 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<br>When set to off, input from the external current sensor input terminal is ignored. |
| Current sensor options | TYPE1 (100 A to 5000 A sensors)<br>9660, 9661, 9669, CT9667-01/-02/-03<br>TYPE2 (20 A to 1000 A sensors, Power supply is required to use)<br>CT6862-05, CT6863-05, CT6875, CT6876, CT6877, 9272-05, CT6841-05, CT6843-05, CT6844-05, CT6845-05, CT6846-05, etc. |
| Current measurement range | Auto / 10 A / 20 A / 50 A (range noted on panel)<br>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<br>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:<br>±0.08% f.s./°C (instrument temperature coefficient;<br>f.s.: instrument measurement range)<br>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)<br>· Internal circuit voltage/current phase difference: ±0.086°<br>· 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.)<br>(f.s.:current peak range)<br>· 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)<br>I1 to I3 (current level) or i1 to i3 (instantaneous current waveform) (switchable)<br>P1 to P3 (active power level) or p1 to p3 (instantaneous power waveform) (switchable)<br>Psum (active power level) or Hi-Psum (high-speed active power level) (switchable)<br>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.<br>D/A1 to D/A3<br>: 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<br>(Harmonic output is not available for individual orders).<br>Hi-P1 to Hi-P3 and Hi-Psum (high-speed active power level): Fixed to AC+DC<br>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<br>Level output<br>: (Output parameter measurement accuracy) + (±0.2% f.s.)<br>High-speed active power level output<br>: (Output parameter measurement accuracy) + (±0.2% f.s.)<br>Instantaneous waveform output<br>: (Output parameter measurement accuracy) + (±1.0% f.s.)<br>Instantaneous voltage, instantaneous current: RMS value level<br>Instantaneous power: Average value level |
| Output frequency band | Instantaneous waveform output, high-speed active power level output<br>At DC or 10 Hz to 5 kHz, accuracy is as defined above. |
| Output voltage | Level output<br>Voltage, Current, Active power, Apparent power,<br>Reactive power, Time average current/active power<br>: ±2 V DC for ±100% of range<br>Power factor<br>: ±2 V DC at ±0.0000, 0 V DC at ±1.0000<br>Phase angle<br>: 0 V DC at 0.00°, ±2 V DC at ±180.00°<br>Voltage/current ripple rate, total harmonic voltage/current distortion<br>: + 2 V DC at 100.00%<br>Voltage/current crest factor<br>: +2 V DC at 10.000<br>Frequency<br>: Varies with measured value.<br>+2 V DC per 100 Hz from 0.1000 Hz to 300.00 Hz<br>+2 V DC per 10 kHz from 300.01 Hz to 30.000 kHz<br>+2 V DC per 100 kHz from 30.001 kHz to 220.00 kHz<br>Efficiency<br>: +2 V DC at 200.00%<br>Current integration, active power integration<br>: ±5 V DC at (range) × (integration set time)<br>Waveform output<br>: 1 V f.s. relative to 100% of range |
| Maximum output voltage | Approx. ±12 V DC |
| Output update rate | Level output<br>: Fixed at 200 ms ±50 ms (approx. 5 times per sec.)<br>Update rate is unrelated to number of averaging iterations setting and display hold operation.<br>Waveform output<br>: Approx. 11.4 µs (approx. 87.5 kHz)<br>High-speed P level<br>: Updated once every cycle for the input waveform set as the synchronization source. |
| Response time | Level output<br>: 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)<br>Waveform output<br>: 0.2 ms or less<br>High-speed active power level output<br>: 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<br>Interface functions: SH1, AH1, T6, L4, SR1, RL1, PP0, DC1, DT1, C0<br>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),<br>Data bits: 8 (fixed), Parity: None<br>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)<br>Dedicated ports (command control, data transfer)<br>Remote control by controller (REMOTE lamp will light up.) |

## General Specifications (product guaranteed for 3 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)<br>Between voltage input terminals and (case, interface, and output terminals)<br>Between current direct input terminals and (case, interface, and output terminals)<br>Between voltage input terminals and current direct input terminals |
| Maximum rated voltage to earth | Voltage input terminal, Current direct input terminal<br>Measurement category III 600 V (anticipated transient overvoltage 6000 V)<br>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<br>(excluding protrusions) |
| Mass | PW3336 series Approx. 5.2 kg (183.4 oz.)<br>PW3337 series Approx. 5.6 kg (197.5 oz.) |
| Accessories | Instruction manual × 1, Measurement guide × 1, Power cord × 1 |

# PW3335 Specifications

## Input Specifications

| | |
|---|---|
| Measurement line type | Single-phase 2-wire(1P2W) |
| Input methods | Voltage Isolated input, resistive voltage divider method<br>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;<br>From 6.0000 mW to 20.000 kW (also applies to VA, var)<br>The details are as below. |
| Input resistance | Voltage input terminal: 2 MΩ<br>Current input terminal: 1 mA to 100 mA range 520 mΩ or less<br>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<br>Apparent power / Reactive power / Power factor<br>Phase angle / Frequency / Current integration<br>Active power integration / Integration time<br>Voltage waveform peak value / Current waveform peak value<br>Voltage crest factor / Current crest factor<br>Maximum current ratio / Time average current<br>Time average active power<br>Voltage ripple rate / Current ripple rate<br>Harmonic parameters<br>Harmonic voltage RMS value / Harmonic current RMS value<br>Harmonic active power / Total harmonic voltage distortion<br>Total harmonic current distortion / Funda,mental wave voltage<br>Fundamental wave current / Fundamental wave active power<br>Fundamental wave apparent power / Fundamental wave reactive power<br>Fundamental wave power factor (Displacement power factor)<br>Fundamental wave voltage current phase difference<br>Harmonic voltage content percentage<br>Harmonic current content percentage<br>Harmonic active power content percentage<br>(The following parameters can be downloaded as data via PC communication)<br>Harmonic voltage phase angle<br>Harmonic current phase angle<br>Harmonic voltage current phase difference |
| Rectifiers | AC+DC : AC+DC measurement<br>Display of true RMS values for both voltage and current<br>AC+DC Umn : AC+DC measurement<br>Display of average value rectified RMS converted values for voltage and true RMS values for current<br>DC : DC measurement<br>Display of simple averages for both voltage and current<br>Display of values calculated by (voltage DC value) x (current DC value) for active power<br>AC : AC measurement<br>Display of values calculated by<br>$\sqrt{(\text{AC+DC value})^2 - (\text{DC value})^2}$ for both voltage and current<br>Display of values calculated by<br>(AC+DC value) - (DC value) for active power<br>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<br>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) x (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) x (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)<br>Current 1% to 150% of the range<br>Active power 0% to 225% of the range (when using 1000 V range, up to 150%)<br>However, valid when the voltage and current fall within the effective measurement range. |
| Maximum effective peak voltage | ±600% of each voltage range<br>However, for 300 V, 600 V, and 1000 V ranges, ±1500 V peak |
| Maximum effective peak current | ±600% of each current range<br>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<br>Warm-up time: 30 minutes<br>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.<br>However, for 1 mA range, ±0.06%f.s. per °C or less. |
| Effect of power factor | ±0.1%f.s. or less (45 to 66 Hz, at power factor = 0)<br>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<br>Voltage<br>±1.5%f.s. or less<br>Current<br>±1.5%f.s. or less than or equal to the following value, whichever is greater<br>200 mA/ 500 mA/ 1 A/ 2 A/ 5 A/ 10 A/ 20 A range: ±20 mA<br>1 mA/ 2 mA/ 5 mA/ 10 mA/ 20 mA/ 50 mA/ 100 mA range: ±200 µA<br>Active power<br>±3.0%f.s. or less than or equal to the following value, whichever is greater<br>200 mA/ 500 mA/ 1 A/ 2 A/ 5 A/ 10 A/ 20 A range: (Voltage influence quantity)×(±20 mA)<br>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<br>Current<br>AC input signal<br>±(0.025+0.005×(I-15))%rdg. or less<br>DC input signal<br>200 mA/ 500 mA/ 1 A/ 2 A/ 5 A/ 10 A/ 20 A range<br>±((0.025+0.005×(I-15))% rdg.+(0.5+0.1×(I-15))mA) or less<br>1 mA/ 2 mA/ 5 mA/ 10 mA/ 20 mA/ 50 mA/ 100 mA range<br>±((0.025+0.005×(I-15))% rdg.+(5+1×(I-15))µA) or less<br>I: Current read value (A)<br>Active power<br>(above current influence quantity) × (voltage read value) or less<br>The effects of self-heating will continue to manifest themselves until the input resistance temperature falls, even if the current value is low. |

## Range table (Power ranges)

| Voltage \ Current | 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 |

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## Voltage/ Current/ Active Power Measurement Specifications

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

## 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).<br>Provided as reference value when 0.1 Hz ≤ f < 10 Hz and when 1 kHz < f.<br>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) |

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

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

## Power Calculation Formulas

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

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

## 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<br>For sine wave input that is at least 20% of the measurement source's measurement range<br>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,<br>99.00 Hz to 999.99 Hz, 0.9900 kHz to 9.9999 kHz,<br>9.900 kHz to 99.999 kHz, 99.00 kHz to 100.00 kHz |

## Maximum Current Ratio Measurement Specifications (MCR)

| | |
|---|---|
| Measurement method | Calculates the ratio of the current crest factor to the power factor.<br>(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) |

## 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<br>±0% to ±612% of the range (Has polarity when using the DC rectifier.)<br><br>Time Average Active Power<br>±0% to ±3745.4% of the range (Has polarity) |

## Functional Specifications

| | |
|---|---|
| Auto-range (AUTO) | Automatically changes the voltage and current range according to the input.<br>Range up:<br>The range is increased when input exceeds 150% of the range or when the peak is exceeded.<br><br>Range down:<br>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.<br><br>The input level is monitored, and the range is switched over multiple ranges.<br>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.<br>Enabled (use):<br>Ranges can be selected with the range keys.<br>Range switching occurs using auto-range operation.<br>Range switching occurs during auto-range integration.<br><br>Disabled (do not use):<br>Ranges cannot be selected with the range keys.<br>Range switching does not occur using auto-range operation.<br>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.<br>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.)<br>The power factor and phase angle are calculated from averaged data.<br>Averaging is not performed for parameters other than those listed above.<br>Method: Simple averaging<br>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.<br>VT ratio setting range OFF (1.0), 0.001 to 1000<br>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.<br>• Measurement data acquired by communications is also fixed at that point in time.<br>• Internal calculations (including integration and integration elapsed time) will continue.<br>• 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.<br>• 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.<br>• Internal calculations (including integration and integration elapsed time) will continue.<br>• The maximum and minimum values during integration are detected (maximum/minimum value measurement during the integration interval).<br>• 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.<br>Fixed-range integration<br>Integration can be performed for all voltage and current ranges.<br>The voltage and current ranges are fixed once integration starts.<br><br>Auto-range integration<br>Integration can be performed for all voltage ranges.<br>The current is set to auto-range operation using ranges from 200 mA to 20 A.<br>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:<br>Positive current integrated value (Ah+)<br>Negative current integrated value (Ah-)<br>Sum of current integrated values (Ah)<br>Positive active power integrated value (Wh+)<br>Negative active power integrated value (Wh-)<br>Sum of active power integrated values (Wh) |
| Measurement types | Rectifiers: AC+DC, AC+DC Umn<br>Current:<br>Displays the result of integrating current RMS value data (display values) once every display update interval as an integrated value.<br><br>Active power:<br>Displays the result of integrating active power values by polarity calculated once every cycle for the selected synchronization source as integrated values.<br><br>Rectifier: DC<br>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)<br>• Stopping/starting integration and resetting integrated values based on external control<br>• Displaying the integration elapsed time (displayed as TIME on panel display)<br>• Additional integration by repeatedly starting/stopping integration<br>• Backing up integrated values and the integration elapsed time during power outages<br>• Stopping integration when power returns |

## Harmonic Measurement Specifications

| | |
|---|---|
| Measurement method | Zero-cross simultaneous calculation method<br>Uniform thinning between zero-cross events after processing with a digital antialiasing filter<br>Interpolation calculations (Lagrange interpolation)<br>When the synchronization frequency falls within the 45 Hz to 66 Hz range:<br>IEC 61000-4-7:2002 compliant<br>Gaps and overlaps may occur if the measurement frequency is not 50 Hz or 60 Hz.<br>When the synchronization frequency falls outside the 45 Hz to 66 Hz range:<br>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<br>Harmonic voltage phase angle / Harmonic current RMS value<br>Harmonic current content percentage / Harmonic current phase angle<br>Harmonic active power<br>Harmonic active power content percentage<br>Harmonic voltage current phase difference<br>Total harmonic voltage distortion / Total harmonic current distortion<br>Fundamental wave voltage / Fundamental wave current<br>Fundamental wave active power / Fundamental wave apparent power<br>Fundamental wave reactive power / Fundamental wave power factor<br>Fundamental wave voltage current phase difference<br><br>(The following parameters can be downloaded as data with communications)<br>Harmonic voltage phase angle / Harmonic current phase angle<br>Harmonic voltage current phase difference |
| FFT processing | FFT processing word length : 32 bits<br>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)<br>56 Hz ≤ f < 66 Hz : 181.82 ms to 214.29 ms (12 cycles)<br>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<br>10 Hz ≤ f < 45 Hz : 50th<br>45 Hz ≤ f < 56 Hz : 50th<br>56 Hz ≤ f ≤ 66 Hz : 50th<br>66 Hz < f ≤ 100 Hz : 50th<br>100 Hz < f ≤ 200 Hz : 40th<br>200 Hz < f ≤ 300 Hz : 25th<br>300 Hz < f ≤ 500 Hz : 15th<br>500 Hz < f ≤ 640 Hz : 11th |
| Analysis order upper limit setting | 2nd to 50th |
| Measurement accuracy | f.s.: Measurement range<br>Frequency (f) / Voltage, Current, Active power<br>DC : ±0.4% rdg. ±0.2%f.s.<br>10 Hz ≤ f < 30 Hz : ±0.4% rdg. ±0.2%f.s.<br>30 Hz ≤ f ≤ 400 Hz : ±0.3% rdg. ±0.1%f.s.<br>400 Hz < f ≤ 1 kHz : ±0.4% rdg. ±0.2%f.s.<br>1 kHz < f ≤ 5 kHz : ±1.0% rdg. ±0.5%f.s.<br>5 kHz < f ≤ 8 kHz : ±4.0% rdg. ±1.0%f.s.<br>• When using the 1 mA/ 2 mA range:<br>Add ±1 µA to 10 Hz to 8 kHz measurement accuracy for current.<br>Add (±1 µA) × (voltage read value) to 10 Hz to 8 kHz measurement accuracy for active power.<br><br>• When using the 200 mA/ 500 mA/ 1 A/ 2 A/ 5 A/ 10 A/ 20 A range:<br>Add ±1 mA to DC measurement accuracy for current.<br>Add (±1 mA) × (voltage read value) to DC measurement accuracy for active power.<br><br>• When using the 1 mA/ 2 mA/ 5 mA/ 10 mA/ 20 mA/ 50 mA/ 100 mA range:<br>Add ±10 µA to DC measurement accuracy for current.<br>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)<br>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) |

## 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<br>Synchronized control function off (signals input to the external synchronization terminal (EXT.SYNC) are ignored)<br><br>In<br>The external synchronization terminal (EXT.SYNC) is set to input, and a dedicated synchronization signal can be input (slave).<br><br>Out<br>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<br>(total of 8 units including the PW3336/PW3337 series) |

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

| | |
|---|---|
| Terminal | Isolated BNC terminals |
| Current sensor type switching | Off / TYPE.1 / TYPE.2<br>When set to off, input from the external current sensor input terminal is ignored. |
| Current sensor options | TYPE1 (100 A to 5000 A sensors)<br>9660, 9661, 9669, CT9667-01/-02/-03<br><br>TYPE2 (20 A to 1000 A sensors, Power supply is required to use)<br>CT6862-05, CT6863-05, CT6875, CT6876, CT6877, 9272-05, CT6841-05, CT6843-05, CT6844-05, CT6845-05, CT6846-05, etc. |
| Current measurement range | Auto/ 1 A/ 2 A/ 5 A (range noted on panel)<br>Can be read directly by manually setting the CT ratio. |
| Constraints | Auto-range integration not supported. |

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| | |
|---|---|
| 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)<br>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)<br>Internal circuit voltage/current phase difference: ±0.0859°<br>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)<br>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.<br>Level output<br>2 Vf.s. or 5 Vf.s., linked to display updates<br>High-speed level output<br>2 Vf.s. or 5 Vf.s., linked to synchronization interval<br>Waveform output<br>1 Vf.s., linked to sampling |
| Output parameters | Output parameters for all channels<br>Available selections vary with the output parameter.<br><br>Level output/ High-speed level output/ Waveform output<br>Voltage, current, active power<br>Only Level output<br>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<br>Only Level output 5 Vf.s.<br>Frequency, current integration, active power integration<br><br>The rectifier can be selected.<br>Harmonic-order output is not supported. |
| Output accuracy | f.s.: Relative to the output voltage rated value for each output parameter<br>Level output<br>(Output parameter measurement accuracy) + (±0.2%f.s.)<br>High-speed level output<br>(Output parameter measurement accuracy) + (±0.2%f.s.)<br>Waveform output<br>(Output parameter measurement accuracy) + (±1.0%f.s.) |
| Output frequency band | Waveform output, high-speed level output<br>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<br>Same as the data update period.<br>High-speed level output<br>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.<br>Waveform output<br>Approx. 1.43 µs (approx. 700 kHz) |
| Response time | Level output<br>0.6 sec. or less<br>High-speed level output<br>2 ms or less<br>Waveform output<br>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<br>Interface functions<br>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<br>Stop bits: 1 (fixed)<br>Data length: 8 (fixed)<br>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)<br>Dedicated ports (command control, data transfer)<br>Remote control by controller |

## General Specifications

| | |
|---|---|
| Product warranty period | 3 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)<br>Between the voltage input terminals and a connection consisting of chassis, interfaces, and output terminals<br>Between the current input terminals and a connection consisting of chassis, interfaces, and output terminals<br>Between the voltage input terminals and current input terminals |
| Maximum rated voltage to earth | Voltage input terminal, Current input terminal<br>Measurement category III 600 V (anticipated transient overvoltage: 6000 V)<br>Measurement category II 1000 V (anticipated transient overvoltage: 6000 V) |
| Maximum input voltage | Between the voltage input terminals U and ±<br>1000 V, ±1500 V peak |
| Maximum input current | Between the current input terminals I and ±<br>200 mA to 20 A range 30 A, ±100 A peak<br>1 mA to 100 mA range 20 A, ±30 A peak |
| Applicable Standards | Safety EN61010<br>EMC EN61326 Class A<br>EN61000-3-2<br>EN61000-3-3 |
| Rated supply voltage | 100 V AC to 240 V AC<br>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<br>Power cord ×1<br>Voltage and current input terminal safety cover ×2 |

# 3334 Specifications

## Basic Specifications

| | |
|---|---|
| Measurable lines | Single-phase, 2-wire (AC/DC) |
| Measurement parameters | Voltage, current, active power, apparent power, power factor, frequency, integrated current and active power, waveform peak (voltage and current) |
| Measurement method | Simultaneous digital sampling of voltage and current, True RMS |
| Sampling Frequency | Approx. 74.4kHz |
| Measurement Ranges | |

| Voltage \ Currnet | 100.00 mA | 300.0 mA | 1.0000 A | 3.000 A | 10.000 A | 30.00 A |
|---|---|---|---|---|---|---|
| 15.000 V | 1.5000 W | 4.500 W | 15.000 W | 45.00 W | 150.00 W | 450.0 W |
| 30.00 V | 3.000 W | 9.000 W | 30.00 W | 90.00 W | 300.0 W | 900.0 W |
| 150.00 V | 15.000 W | 45.00 W | 150.00 W | 450.0 W | 1.5000 kW | 4.500 kW |
| 300.0 V | 30.00 W | 90.00 W | 300.0 W | 900.0 W | 3.000 kW | 9.000 kW |

| | |
|---|---|
| Frequency bandwidth | DC, 45Hz to 5kHz |

## Measurement accuracy

(Guaranteed at 23°C±5, max. 80%rh, sine wave input, power factor=1, in-phase voltage =0V, accuracy specifications differ depending on usage period of 1 or 3 years)

| | |
|---|---|
| Warm-up time | 3 minutes |
| Period of guaranteed accuracy | 3 years (better accuracy specifications available for 1-year period) |
| Post-adjustment accuracy guarantee | 1 year (accuracy specifications available for 1-year period) |
| Effective measurement range | Voltage, current:1% to 100% (Power: 0% to 100%)<br>Measurements below 0.5% of the voltage or current range will be zero suppressed. |
| Effect of power factor (at pf=0.5) | Maximum ±0.4%±rdg. (45 to 66Hz) |
| Temperature Coefficient | Maximum ±0.03%f.s./°C |

| Frequency | Guaranteed Period | Voltage, current and active power (at less than 50% of input range) | Current and active power (at 50% to 100% of input range) |
|---|---|---|---|
| DC * | 1 year | ±0.1 %rdg. ±0.2 %f.s. | |
| | 3 years | ±0.1 %rdg. ±0.35 %f.s. | |
| 45 Hz ≤ f ≤ 66 Hz | 1 year | ±0.1 %rdg. ±0.1 %f.s. | ±0.2 %rdg. |
| | 3 years | ±0.1 %rdg. ±0.2 %f.s. | ±0.3 %rdg. |
| 66 Hz < f ≤ 1 kHz ** | 1 year | ±0.1 %rdg. ±0.2 %f.s. | ±0.3 %rdg. |
| | 3 years | ±0.1 %rdg. ±0.35 %f.s. | ±0.45 %rdg. |
| 1 kHz < f ≤ 5 kHz ** | 1 year | ±3.0 %f.s. | ±3.0 %rdg. |
| | 3 years | ±4.5 %f.s. | ±4.5 %rdg. |

*Add ±50μA to the accuracy when measuring DC current
Add (±50μA x voltage value) to the accuracy when measuring DC active power
** Accuracy not defined for current input exceeding 20A

## Input Specifications

| | |
|---|---|
| Input impedance | 2.4 MΩ for voltage, 10 mΩ or better (50/ 60 Hz) for current |
| Maximum input voltage | 300 V, ±425 Vpeak |
| Maximum input current | 30 A, ±54.0 Apeak |
| Maximum effective peak voltage | ±300% of each voltage range, Within ±425 Vpeak |
| Maximum effective peak current | ±300% of each current range, Within ±54.0 Apeak *1 |
| Max. rated voltage to earth | 300 V (DC, 50/ 60 Hz) |

## Display Specifications

| | |
|---|---|
| Display indication range | Voltage and current: 0.5% to 105% of range<br>Active power: 0% to 110.25% of range |
| Displacement power factor | 0.000 to 1.000 (no polarity display) |
| Display refresh rate | approx. 5 times per second |
| Response time | within 0.5 s (Time to rated accuracy after abrupt change in input [0 to 90% or 100 to 10% of range]) |

## Functional Specifications

| | |
|---|---|
| Integration measurement | No.of displayed digits: Six digits<br>Current Integration: From 0.00000mAh, Polarity-independent integration and Sum value<br>Active power Integration: From 0.00000mWh, Polarity-independent integration and Sum value<br>Integration time: 1 min to 10000 h<br>Measurement accuracy: Measurement accuracy of active power ±1dgt. |
| Wave peak measurement | Maximum value of positive and negative waveform of voltage/ current (up to 300% of full scale range)<br>Measurement accuracy: ±1.2%f.s. ("f.s." is 300% of each range) |
| Rectification method | Switchable between AC+DC(True RMS), DC(simple average display) and AC(True RMS) |
| Analog output (D/A output) | Parameter output representation:<br>Voltage, Current and Active power (3 simultaneous channels)<br>D/A select an item from Current integration, Active power integration, Apparent power, power factor<br>Voltage output: ±2 VDC f.s. for each range<br>Output accuracy: ±0.5% f.s. + individual measurement accuracy |
| Waveform output | Parameter output representation:<br>Voltage, Current and Active power (3 simultaneous channels)<br>Voltage output: 1 VDC f.s. for each range<br>Output accuracy: ±1.0% f.s. + individual measurement accuracy |
| Average function | Simple averaging of specified number of samples: 1, 2, 5, 10, 25, 50 or 100 |
| VT or CT ratio | VT ratios: 1, 2, 4, 10, 20, 30, 60, 100<br>CT ratios: 1, 2, 3, 4, 5, 6, 8, 10, 12, 15, 16, 20, 24, 25, 30, 40, 50, 60, 75, 80, 100, 200, 300, 500, 1000, 2000, 3000, 5000, 10000 |
| External Interfaces | RS-232C interface: Included as standard<br>Asynchronous communication method:<br>full-duplex; Baud rate: 9600 bps (fixed)<br>GP-IB interface (Model 3334-01 only)<br>IEEE-488.1 1987 compliant, IEEE-488.2 1987 reference |
| Miscellaneous | Display hold, Maximum value hold, Peak value hold, Key lock, Backup function (preserves settings, integration data) |

## General Specifications

| | |
|---|---|
| Safety | EN61010 Pollution Factor 2,<br>Measurement Category III (4000 V anticipated overvoltage) |
| EMC | EN61326, EN61000-3-2, EN61000-3-3 |
| Operating environment | 0 to 40 °C, 80% RH or less, non-condensating |
| Storage environment | -10 to 50 °C, 80% RH or less, non-condensating |
| Rated supply voltage | 100 to 240 VAC, 50/60 Hz |
| Maximum rated power | 20 VA |
| Dimensions and mass | 210 mm (8.27 in)W × 100 mm (3.94 in)H × 245 mm (9.65 in)D<br>(excluding feet and projections), 2.5 kg (88.2 oz) |

# 3333 Specifications

## Basic specifications

| | |
|---|---|
| Measurable lines | Single-phase, 2-wire (AC) |
| Measurement parameters | Voltage, Current, Active power, Apparent power, Power factor |
| Measurement method | Simultaneous digital sampling of voltage and current, True RMS |
| Sampling frequency | Approx. 48kHz |
| Measurement ranges | |

| Voltage \ Currnet | 50.00 mA | 200.0 mA | 500.0 mA | 2.000 A | 5.000 A | 20.00 A |
|---|---|---|---|---|---|---|
| 200.0 V | 10.000 W | 40.00 W | 100.00 W | 400.0 W | 1.0000 kW | 4.000 kW |

| | |
|---|---|
| Frequency bandwidth | 45Hz to 5kHz |

## Measurement accuracy

(Guaranteed at 23°C±5, max. 80%rh, sine wave input, power factor=1, in-phase voltage =0V, accuracy specifications differ depending on usage period of 1 or 3 years)

| | |
|---|---|
| Warm-up time | 10 minutes |
| Period of guaranteed accuracy | 3 years (better accuracy specifications available for 1-year period) |
| Post-adjustment accuracy guarantee | 1 year (accuracy specifications available for 1-year period) |
| Effective measurement range | Voltage, current, power: 10% to 150%<br>Measurements below 1% of the voltage or current range will be zero suppressed. |
| Effect of power factor (at pf=0.5) | Maximum ±0.4%±rdg. (45 to 66Hz) |
| Temperature Coefficient | Maximum ±0.03%f.s./°C |

| Frequency | Guaranteed Period | Voltage, current and active power |
|---|---|---|
| 45 Hz ≤ f ≤ 66 Hz | 1 year | ±0.1 %rdg. ±0.1 %f.s. |
| | 3 years | ±0.1 %rdg. ±0.2 %f.s. |
| 66 Hz < f ≤ 1 kHz * | 1 year | ±0.1 %rdg. ±0.2 %f.s. |
| | 3 years | ±0.1 %rdg. ±0.35 %f.s. |
| 1 kHz < f ≤ 5 kHz * | 1 year | ±3.0 %f.s. |
| | 3 years | ±4.5 %f.s. |

* Accuracy not defined for current input exceeding 20A

## Input specifications

| | |
|---|---|
| Input impedance | 2.4 MΩ for voltage, 7 mΩ or better (50/60 Hz) for current |
| Maximum input voltage | 300 Vrms, 425 Vpeak |
| Maximum input current | 30 Arms, 42.5 Apeak |
| Maximum effective peak voltage | Within 425Vpeak |
| Maximum effective peak current | ±300% of each current range, Within ±42.5Apeak |
| Max. rated voltage to earth | 300V (50/60Hz) |

## Display specifications

| | |
|---|---|
| Display indication range | voltage and current: 1% to 152% of range<br>active power: 0% to 231.04% of range |
| Displacement power factor | 0.000 to 1.000 (no polarity display) |
| Display refresh rate | approx. 5 times per second |
| Response time | within 0.5 s (Time to rated accuracy after abrupt change in input [0 to 90% or 100 to 10% of range]) |

## Functional Specifications

| | |
|---|---|
| Rectification method | AC(True RMS) |
| Analog output (D/A output) | Parameter output representation:<br>voltage, current and active power (3 simultaneous channels)<br>Voltage output: +2 VDC f.s. for each range<br>Output accuracy: ±0.5% f.s. + individual measurement accuracy |
| Average function | Simple averaging of specified number of samples: 1, 2, 5, 10, 25, 50 or 100 |
| VT or CT ratio | VT ratios: 1, 2, 4, 10, 20, 30, 60, 100<br>CT ratios: 1, 2, 3, 4, 5, 6, 8, 10, 12, 15, 16, 20, 24, 25, 30, 40, 50, 60, 75, 80, 100 |
| External Interfaces | RS-232C interface: Included as standard<br>Asynchronous communication method:<br>full-duplex; Baud rate: 9600 bps (fixed)<br>GP-IB interface (Model 3333-01 only)<br>IEEE-488.1 1987 compliant, IEEE-488.2 1987 reference |
| Miscellaneous | Display hold, Key lock, Settings backup (preserves settings) |

## General Specifications

| | |
|---|---|
| Safety | EN61010 Pollution Factor 2,<br>Measurement Category III (4000 V anticipated overvoltage) |
| EMC | EN61326, EN61000-3-2, EN61000-3-3 |
| Operating environment | 0 to 40 °C, 80% RH or less, non-condensating |
| Storage environment | -10 to 50 °C, 80% RH or less, non-condensating |
| Rated supply voltage | 100 to 240 VAC, 50/60 Hz |
| Maximum rated power | 20 VA |
| Dimensions and mass | 160 mm (6.30 in)W × 100 mm (3.94 in)H × 227 mm (8.94 in)D<br>(excluding feet and projections), 1.9 kg (67.0 oz) |

## Calculation formulas (3333 & 3334)

| Measurement Parameters | Formula |
|---|---|
| Apparent Power (S) | $S = U \times I$ |
| Power Factor (λ) | $\lambda = I P / S I$ |
| Integrated Current* | *(Sum of I from start of integration)/ (Number of 1 hour data)* |
| Integrated Active Power * | *(Sum of P from start of integration)/ (Number of 1 hour data)* |

* Current and active power integration available only on Model 3334.

# 3-phase Power Meter

| Model & Appearance | Model No. (Order Code) | Number of Channels | AC/ DC | Harmonic Measurement | LAN | RS-232C | GP-IB | D/A output | Current Sensor Input | Synchronized Control |
|---|---|---|---|---|---|---|---|---|---|---|
| POWER METER PW3337  | PW3337 | 3 | AC/ DC | ✔ | ✔ | ✔ | × | × | ✔ | ✔ |
| | PW3337-01 | 3 | AC/ DC | ✔ | ✔ | ✔ | ✔ | × | ✔ | ✔ |
| | PW3337-02 | 3 | AC/ DC | ✔ | ✔ | ✔ | × | ✔ | ✔ | ✔ |
| | PW3337-03 | 3 | AC/ DC | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ |
| POWER METER PW3336  | PW3336 | 2 | AC/ DC | ✔ | ✔ | ✔ | × | × | ✔ | ✔ |
| | PW3336-01 | 2 | AC/ DC | ✔ | ✔ | ✔ | ✔ | × | ✔ | ✔ |
| | PW3336-02 | 2 | AC/ DC | ✔ | ✔ | ✔ | × | ✔ | ✔ | ✔ |
| | PW3336-03 | 2 | AC/ DC | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ |

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

# Single-phase Power Meter

| Model & Appearance | Model No. (Order Code) | Number of Channels | AC/ DC | Harmonic Measurement | LAN | RS-232C | GP-IB | D/A output | Current Sensor Input | Synchronized Control |
|---|---|---|---|---|---|---|---|---|---|---|
| POWER METER PW3335  | PW3335 | 1 | AC/ DC | ✔ | ✔ | ✔ | × | × | × | ✔ |
| | PW3335-01 | 1 | AC/ DC | ✔ | ✔ | × | ✔ | × | ✔ | ✔ |
| | PW3335-02 | 1 | AC/ DC | ✔ | ✔ | ✔ | × | ✔ | × | ✔ |
| | PW3335-03 | 1 | AC/ DC | ✔ | ✔ | ✔ | × | × | ✔ | ✔ |
| | PW3335-04 | 1 | AC/ DC | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ |
| AC/ DC POWER HiTESTER 3334  | 3334 | 1 | AC/ DC | × | × | ✔ | × | ✔ | × | × |
| | 3334-01 | 1 | AC/ DC | × | × | ✔ | ✔ | ✔ | × | × |
| POWER HiTESTER 3333  | 3333 | 1 | AC | × | × | ✔ | × | ✔ | × | × |
| | 3333-01 | 1 | AC | × | × | ✔ | ✔ | ✔ | × | × |

Accessories : Instruction manual ×1, Power cord ×1

## Communications and control options



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



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

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