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

3year 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

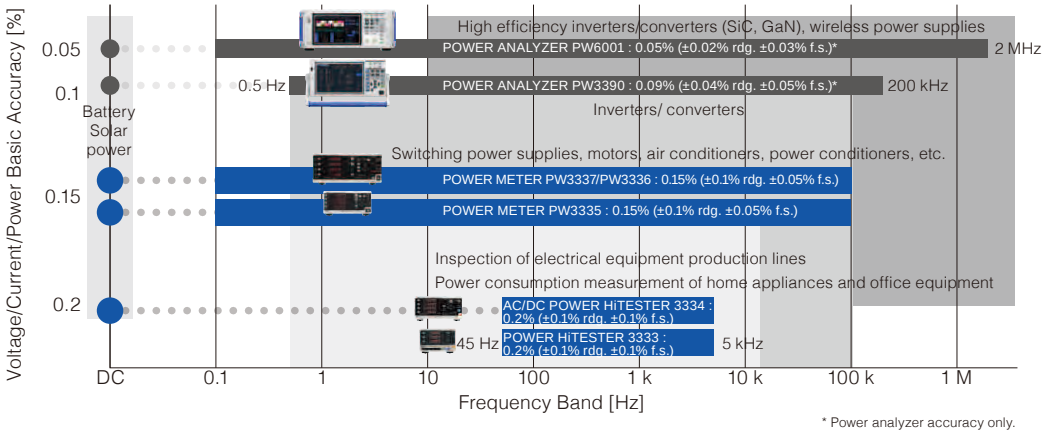
The PW3335 provides highly accurate measurements for
everything from standby power to operating power.
Compliant with the IEC62301 measurement standard for standby power,
it is capable of measuring current as low as 10 μA.
Designed for power consumption testing,
the 3334 and 3333 are guaranteed for accuracy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

PW3335 (1ch)

3334 (1ch)

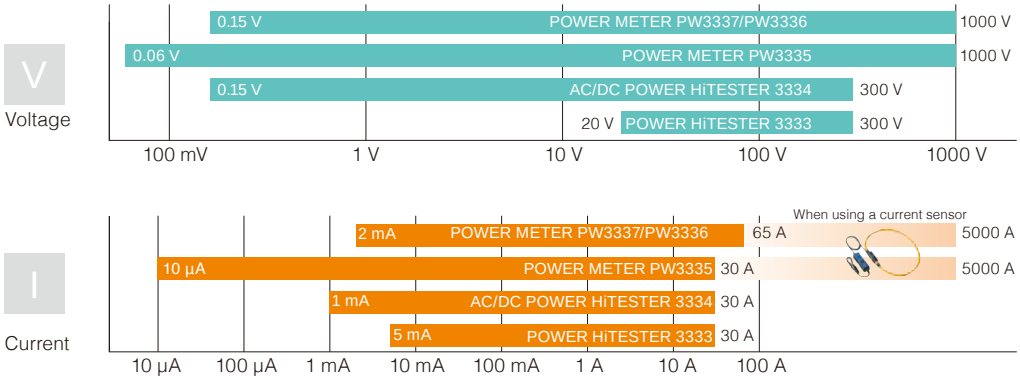
3333 (1ch)

Basic Accuracy and Frequency Bands



* Power analyzer accuracy only.

Effective Measurement Range



Comparison Chart

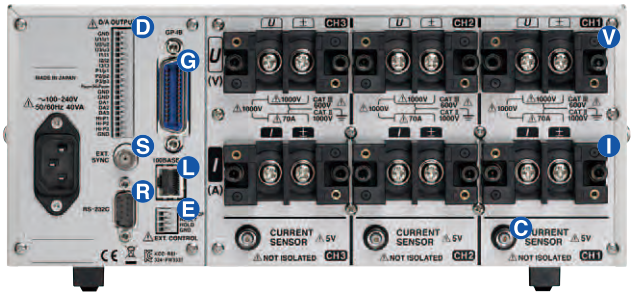
		PW3337	PW3336	PW3335	3334	3333
No. of channels		3	2	1	1	1
Supported connections		Three-phase, three-phase + single-phase, single-phase x 3, DC x 3	Three-phase, single-phase x 2, DC x 2	Single-phase, DC	Single-phase, DC	Single-phase
Effective measurement range, voltage		0.15 V to 1000 V		0.06 V to 1000 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

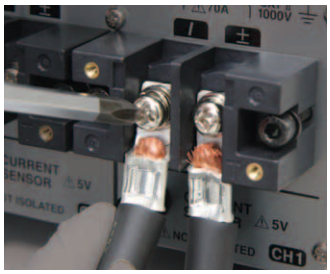
POWER METER PW3337/PW3336

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.

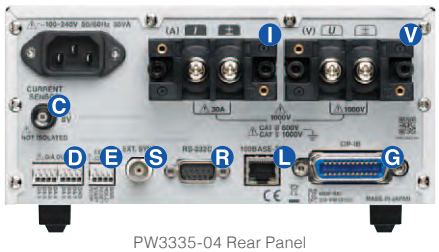
- Voltage/current/power basic accuracy of ±0.1% *
- Direct input up to 1000 V AC/DC / 65 A
- Harmonic measurement as standard feature, IEC61000-4-7 compliant
- Little instrument loss, even with large currents. DCCT input with an input resistance of 1 mΩ or less.
- Power factor effect of ±0.1% f.s. delivers 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)

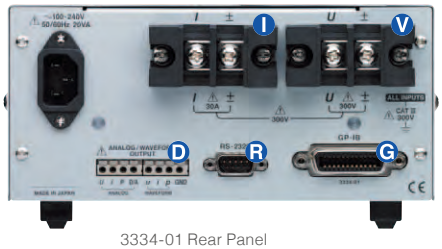
V Voltage input terminal	I Current input terminal	L LAN connector	R RS-232C connector	G GP-IB connector
D D/A output terminal	C Current sensor input terminal	S Synchronous control terminal	E External control terminal	

* 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



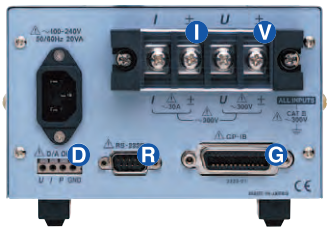
3334-01 Rear Panel

- 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

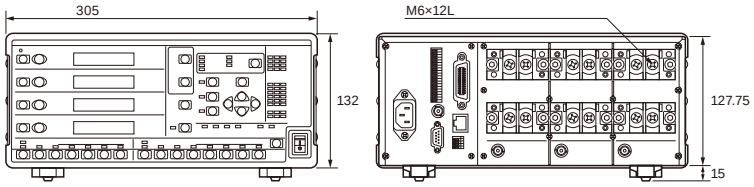
- Compact model for saving space, even when added to a system
- Accuracy guaranteed up to 3 years

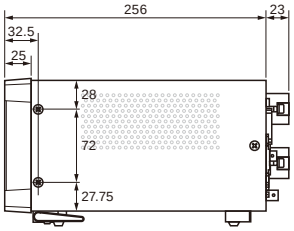
Dimensional Drawings

Units: mm

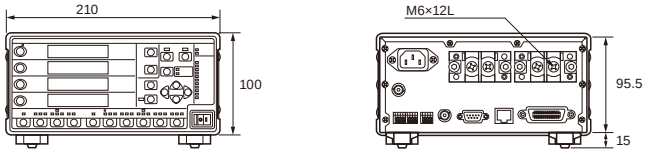
PW3337

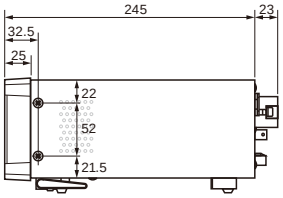
PW3336



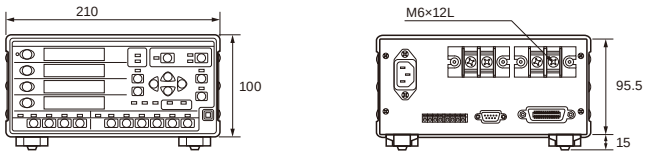


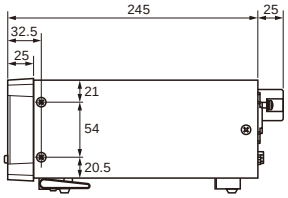
PW3335



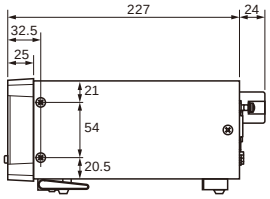


3334



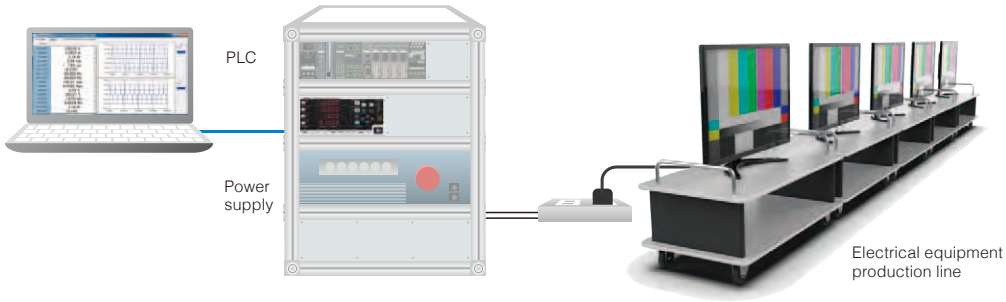


3333



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

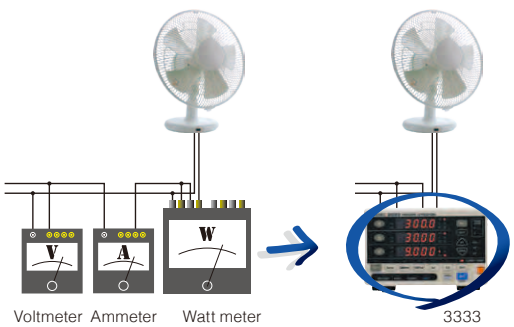
1-year guarantee of accuracy ±0.2% rdg.	3-year guarantee of accuracy ±0.3% rdg.

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.

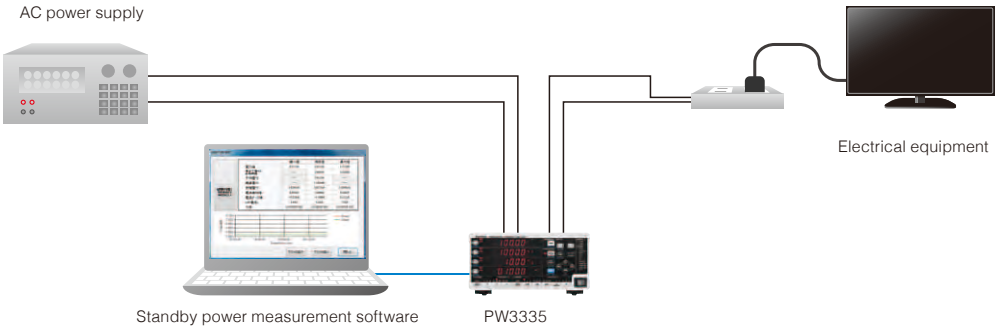
Replacement for Analog Meters PW3337 PW3336 PW3335 3334 3333

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.

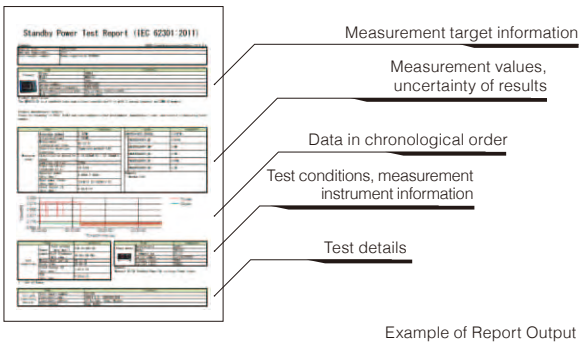
Requirements for Measurement Instruments for Standby Power Measurements (excerpt)

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

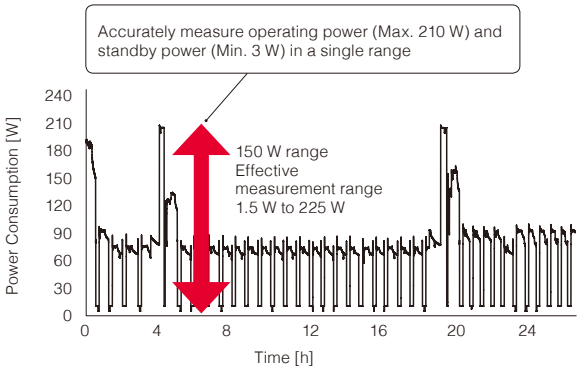
Standby power measurement software can be downloaded free of charge from the HIOKI website. Enter the required information to perform standby power measurements according to standards. Use this software to create reports of measurement results and save test data in CSV format.



Example of Report Output

Wide Range of Effective Measurement

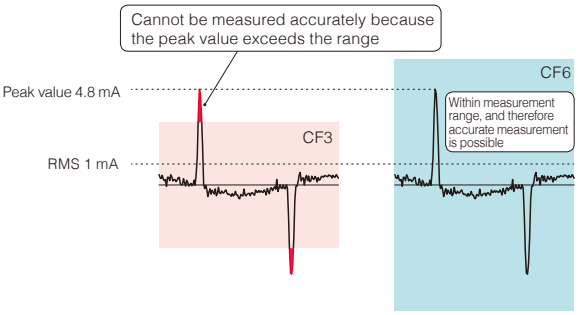
The PW3335 has an effective measurement range of 1% to 150%. Due to this wide range of effective measurement, even equipment with large load fluctuations, such as refrigerators, heaters, and pumps, can be measured accurately under all conditions from no-load to full operation.



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.

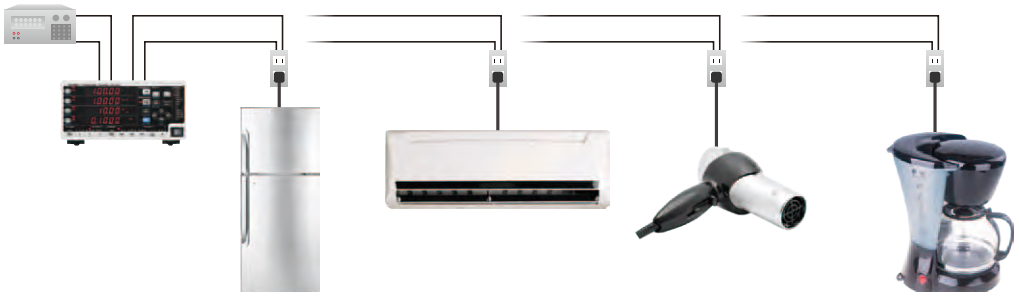


Example of Standby Current Waveform (CF = Peak Value, RMS = 4.8)

Measurement of Fluctuating Loads and Power Supply Control

Key features

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

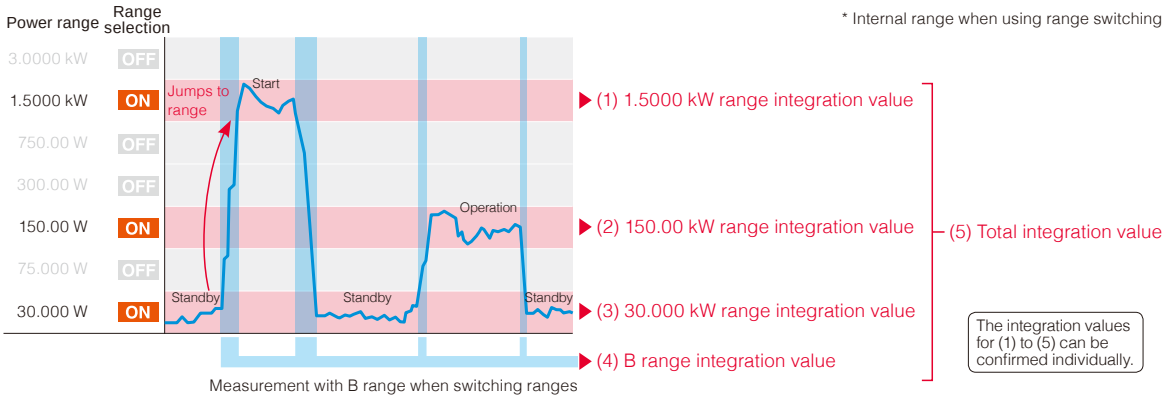


Auto Range Integration with Guaranteed Accuracy when Switching Ranges

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



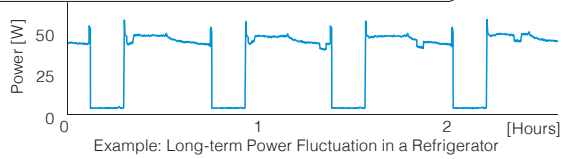
Measurement with B range when switching ranges

Intermittent Power Supply

PW3337 PW3336 PW3335

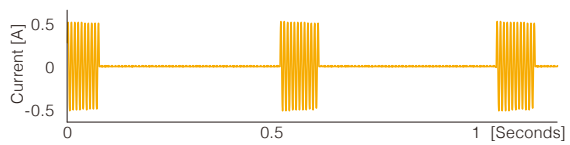
Devices that perform intermittent operation and cycle control repeat a cycle of stopped states and operating states. Therefore, with normal power measurement, it is not possible to determine a value for rated power consumption.
Time average active power (current) is a function that allows the measurement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



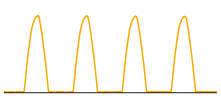
Example: Current Waveform for Heat Retention Heater

AC/DC Measurement

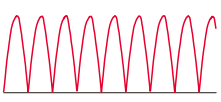
PW3337 PW3336 PW3335 3334

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.

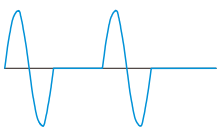
- Half-wave rectified waveforms used for dryers and fans
- Full-wave rectified waveforms used for AC adapters
- Cycle control waveforms used for voltage and temperature adjustment heaters
- DC waveforms with superimposed ripple components



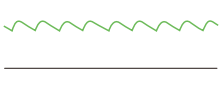
Half-wave Rectified Waveform



Full-wave Rectified Waveform



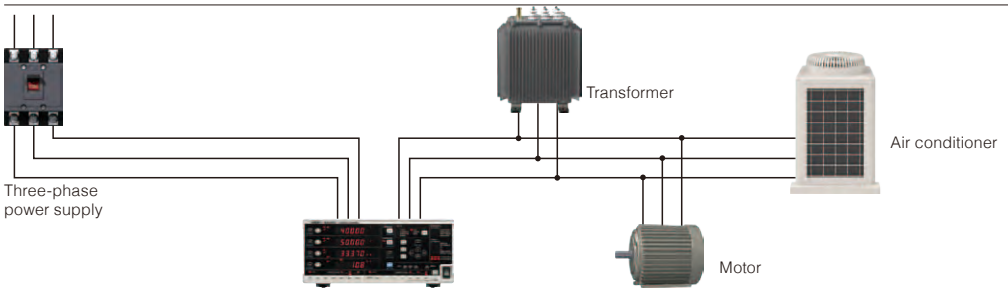
Cycle Control Waveform



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.

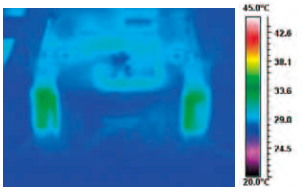
Support for Various Connections

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.

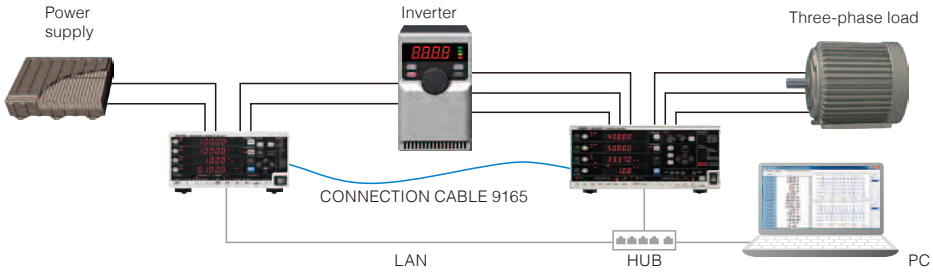
DCCT current sensor
(in the PW3337)



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

Inverter Efficiency Measurement

PW3337 7 PW3336 6 PW3335 5

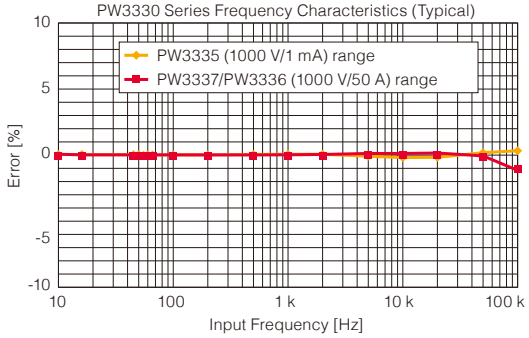


Key features

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

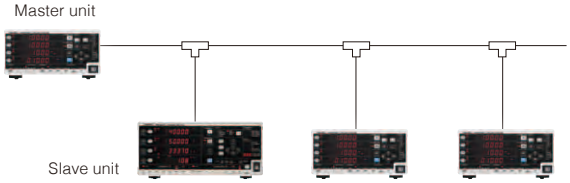
Wide Frequency Band (DC, 0.1 Hz to 100 kHz)

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

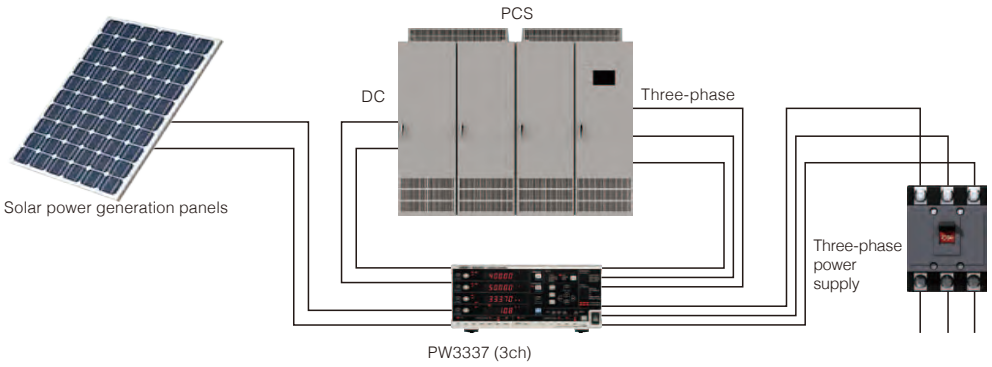
Connect 8 units for synchronous measurement of up to 24 channels. The calculation and control timing for PW3337, PW3336, and PW3335 units that are set as slaves are synchronized with the master unit. Use this feature to measure the I/O efficiency of power supply devices, compare multiple pieces of equipment, 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 7
DC 1-phase/ 2-wire PW3336

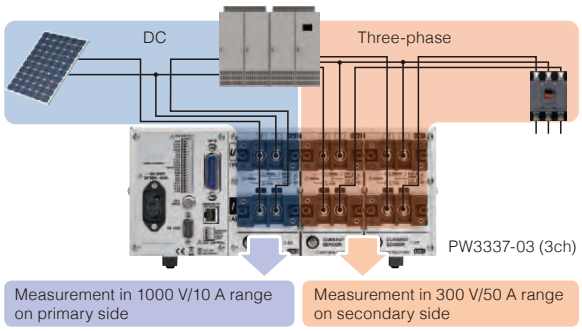


Key features

- 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

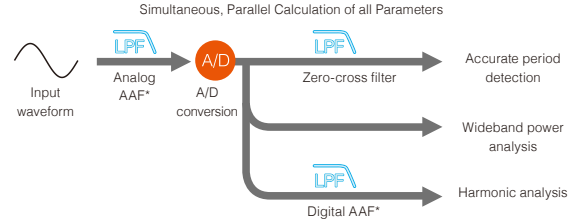
Input and output can be measured independently at the optimal ranges, and the PCS efficiency can be calculated and displayed on a single unit. PCS can be evaluated with a simple system configuration.

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

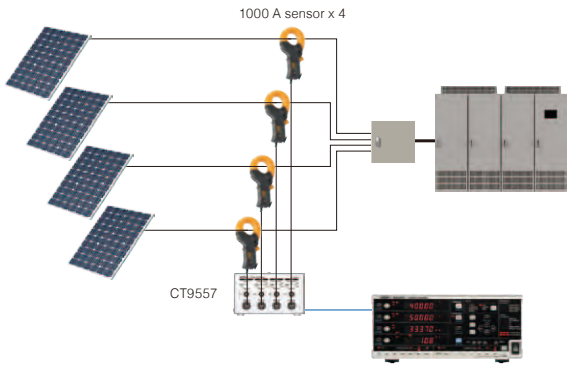
In addition to standard measurement items such as voltage, current, and power, all items related to harmonics, such as distortion and content percentage, are calculated internally in parallel at the same time. Items such as RMS value, MEAN value, DC components, AC components, and fundamental wave components 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

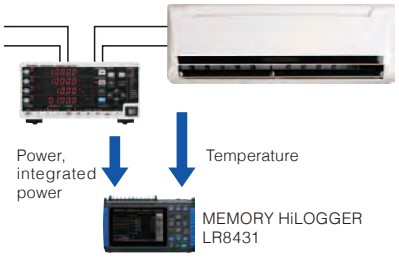
Aggregation of Output from DC Current Sensors (Up to 4000 A)

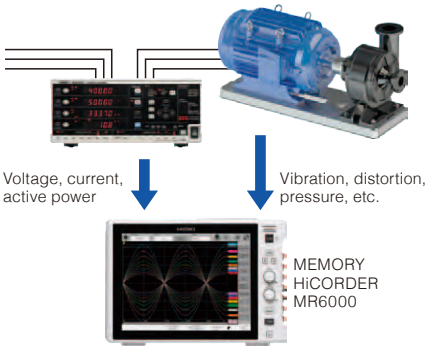
SENSOR UNIT CT9557 is a power supply for highly accurate current sensors that have a waveform output function. In addition to using it as a 4-channel power supply, it is also equipped with a sum feature for aggregating the input waveforms into a single waveform to be output.



Aggregating the Output from 4 Sensors into One Unit

Output Function Linked with Recorder





Key features

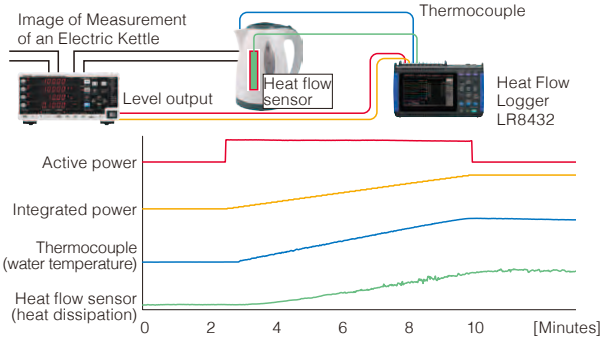
- Level output
- Waveform output
- High-speed level output
- LR8410Link

	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*.

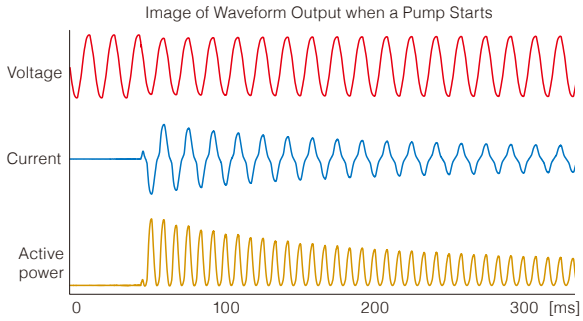


* Heat flow: Parameter for understanding the heat reception and heat dissipation of an object. Can be measured with a heat flow sensor.

Observe Waveforms with a Memory Hicorder

PW3337 PW3336 PW3335 PW3334 PW3333

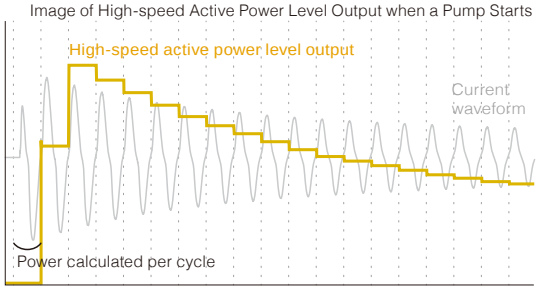
The waveform output function outputs the voltage/current waveforms captured by a power meter in the form of high-speed analog voltage. Connect to a memory recorder to check behavior when load fluctuates, such as with the inrush current of a motor.



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.

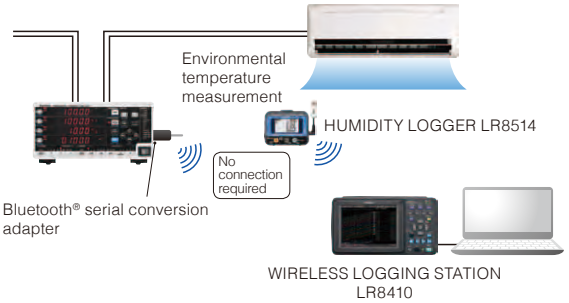


* With the PW3335, high-speed level output is also possible for 45 Hz to 66 Hz voltage and current.

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.

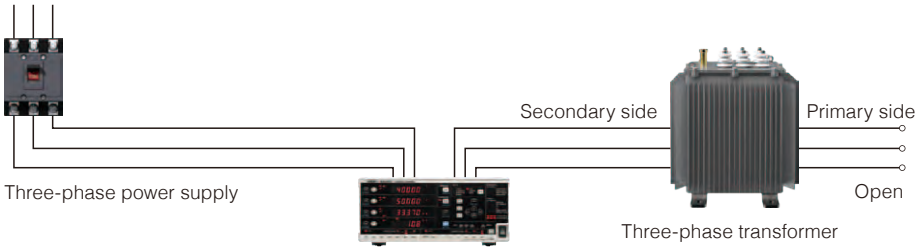


* Connection requires the serial - Bluetooth® wireless technology conversion adapter recommended by Hioki. Please inquire with your Hioki distributor.

No-load Loss Measurements for Transformers

Single-phase only

PW3337 PW3336 PW3335

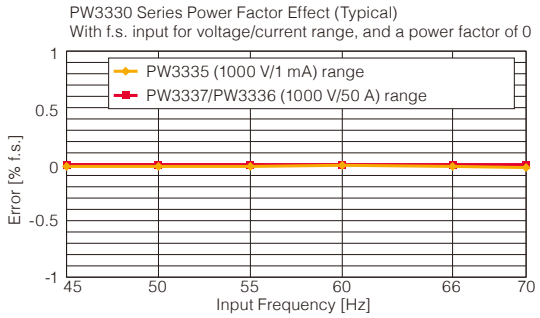


Key features

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

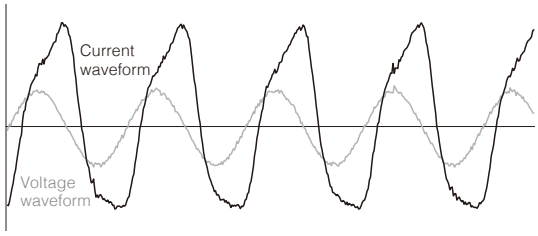
Power Factor Effect of 0.1% or Less, Even at Low Power Factors

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.



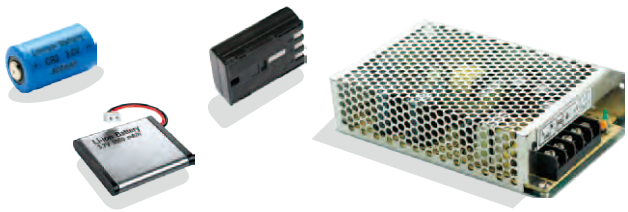
Support for Crest Factor 6

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% *

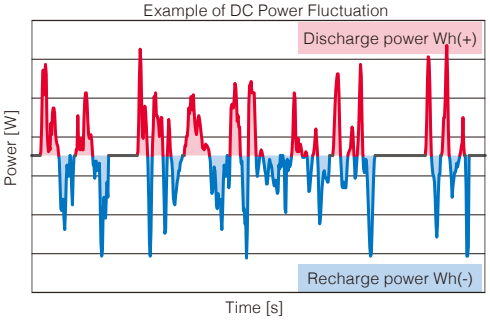
* For complete details, please refer to the specifications

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

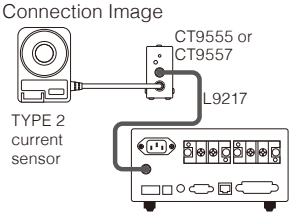
Connect this unit to the current sensor input terminal (BNC) on the PW3337/PW3336/PW3335.
SENSOR UNIT CT9555 or CT9557 and CONNECTION CABLE L9217 are required.

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

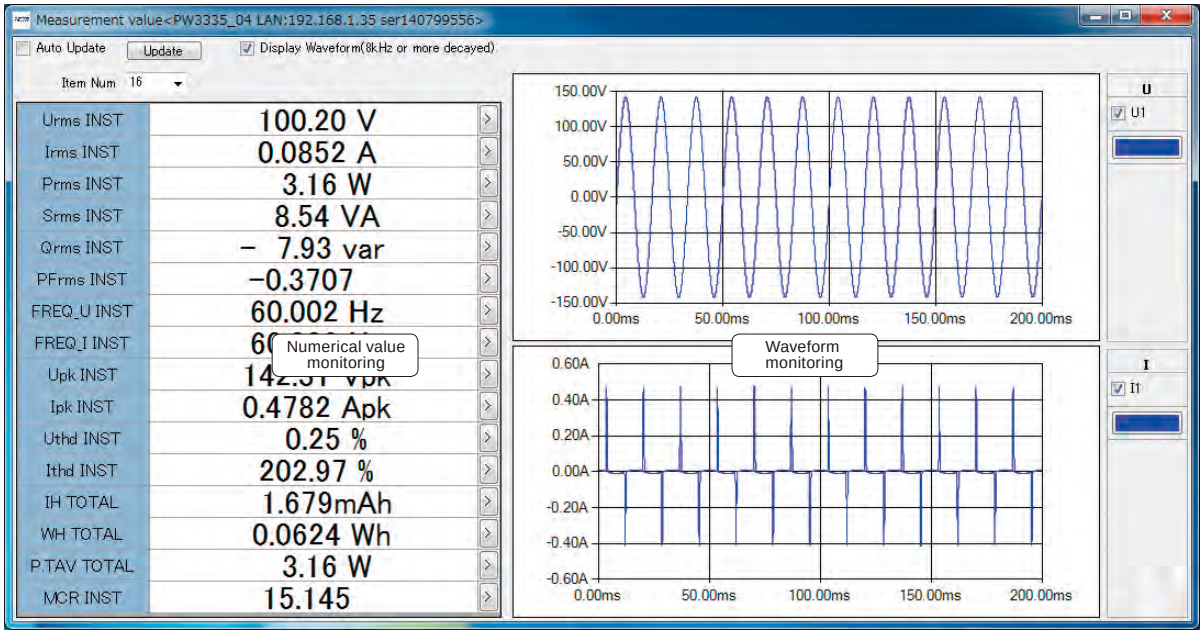
RECORDING PAPER 1196
112 mm (4.41 in) × 25 m (82.03 ft), 10-roll set

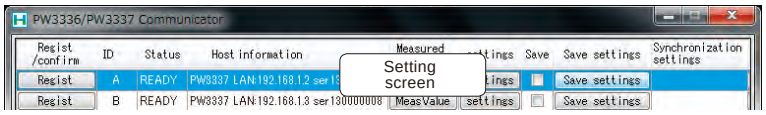
Software

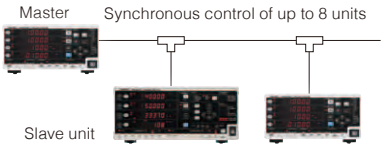
PW Communicator

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.

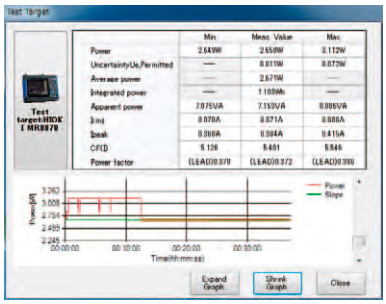
Workflow for Standby Power Test

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).

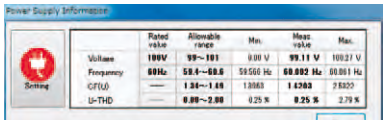
2. Configure the test target

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

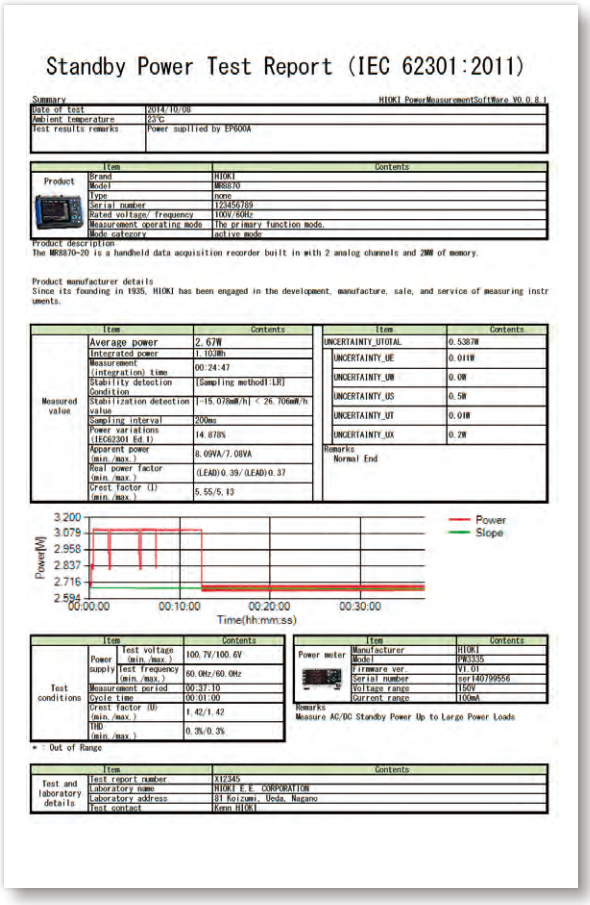
Set the current range, stop conditions, algorithm used to judge stability, cycle time, and upper limit for test time.

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	ser140799556					
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	SAE	
Stop Factor	Pass[Condition(LR)]					
Valid Period	0	180				
Time(Sec)	Test voltage(V)	Test frequency(Hz)	U-THD(%)	Crest Factor U	Crest Factor I	F
14.8	99.48	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
Single-phase 2-wire (1P2W), Single-phase 3-wire (1P3W), Three-phase 3-wire (3P3W, 3P3W2M)

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

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

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

Input methods	Voltage Isolated input, resistance voltage division method Current Isolated input, DCCT method Isolated input from current sensors
Voltage measurement ranges	AUTO/ 15.000 V/ 30.000 V/ 60.000 V/ 150.00 V/ 300.00 V/ 600.00 V/ 1000.0 V (set for each wiring mode)
Current measurement ranges	AUTO/ 200.00 mA/ 500.00 mA/ 1.0000 A/ 2.0000 A/ 5.0000 A/ 10.000 A/ 20.000 A/ 50.000 A (set for each wiring mode) For more information about external current sensor input, see the external current sensor input specifications
Power ranges	Depends on the combination of voltage and current ranges; PW3336: from 3.0000W to 100.00kW (also applies to VA, var) PW3337: from 3.0000W to 150.00kW (also applies to VA, var)
Input resistance (50/60 Hz)	Voltage input terminal : 2 MΩ 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) Can be set separately for each wiring mode.
Measurement items	· Voltage · Current · Active power · Apparent power · Reactive power · Power factor · Phase angle · Frequency · Efficiency · Current integration · Active power integration · Integrated time · Voltage waveform peak value · Current waveform peak value · Voltage crest factor · Current crest factor · Time average current · Time average active power · Voltage ripple factor · Current ripple factor Harmonic parameters: · Harmonic voltage RMS value · Harmonic current RMS value · Harmonic active power · Total harmonic voltage distortion · Total harmonic current distortion · Voltage fundamental waveform · Current fundamental waveform · Active power fundamental waveform · Apparent power fundamental waveform · Reactive power fundamental waveform · Power factor fundamental waveform (displacement power factor) · Voltage current phase difference fundamental waveform · Interchannel voltage fundamental wave phase difference · Interchannel current fundamental wave phase difference · Harmonic voltage content % · Harmonic current content % · Harmonic active power content % The following parameters can be downloaded as data during PC communication but not displayed: · Harmonic voltage phase angle · Harmonic current phase angle · Harmonic voltage current phase difference
Rectifiers	AC+DC: AC+DC measurement Display of true RMS values for both voltage and current AC+DC Umn: AC+DC measurement Display of average value rectified RMS converted values for voltage and true RMS values for current DC: DC measurement Display of simple averages for both voltage and current Display of values calculated by (voltage DC value)× (current DC value) for active power AC: AC measurement Display of values calculated by for both voltage and current Display of values calculated by $\sqrt{(\text{AC+DC value})^2 - (\text{DC value})^2}$ for active power FND Extraction and display of the fundamental wave component from harmonic measurement
Zero-Crossing Filter	500 Hz/200 kHz 500 Hz: 0.1 Hz to 500 Hz, 200 kHz: 0.1 Hz to 200 kHz

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 However, for 300 V, 600 V, and 1000 V ranges, ±1500 Vpeak
Maximum effective peak current	±600% of each current range However, for 20 A range and 50 A range, ±100 Apeak
Conditions of guaranteed accuracy	Temperature and humidity: 23°C ±5°C, 80% RH or less Warm-up time: 30 minutes Input: Sine wave input, power factor of 1, terminal-to-ground voltage of 0V, after zero adjustment; within range in which the fundamental wave satisfies synchronization source conditions
Temperature characteristic	±0.03% f.s. per °C or less
Power factor effects	±0.1% f.s. or less (45 to 66 Hz, at power factor = 0) Internal circuitry voltage/current phase difference: ±0.0573°
Effect of common mode voltage	±0.02% f.s. or less (600 V, 50/60 Hz, applied between input terminals and enclosure)
Effect of external magnetic field interference	400 A/m, DC and 50/60 Hz magnetic field Voltage :±1.5% f.s. or less Current :±1.5% f.s. or ±10 mA, whichever is greater, or less Active power :±3.0% f.s. or (voltage influence quantity) × (±10 mA), whichever is greater, or less
Magnetization effect	±10 mA equivalent or less (after inputting 100 A DC to the current direct input terminals)
Adjacent channel input effect	±10 mA equivalent or less (when inputting 50 A to adjacent channel)

Voltage/ Current/ Active Power Measurement Specifications

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

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

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

(i): Measurement channel

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

Power channel and sum value calculation formulas

Wiring		S : Apparent power	Q : Reactive power
All channels	1P2W	$S_{(i)} = U_{(i)} \times I_{(i)}$	$Q_{(i)} = si_{(i)}\sqrt{S_{(i)}^2 - P_{(i)}^2}$
Sum values	1P3W	$S_{sum} = S_{(1)} + S_{(2)}$	$Q_{sum} = Q_{(1)} + Q_{(2)}$
	3P3W	$S_{sum} = \frac{\sqrt{3}}{2}(S_{(1)} + S_{(2)})$	
	3P3W2M		
	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		λ : Power factor	ϕ : Phase angle
All channels	1P2W	$\lambda_{(i)} = si_{(i)}\left\lvert\frac{P_{(i)}}{S_{(i)}}\right\rvert$	$\phi_{(i)} = si_{(i)}\ cos^{-1}\lvert\lambda_{(i)}\rvert$
Sum values	1P3W 3P3W 3P3W2M 3V3A 3P3W3M 3P4W	$\lambda_{sum} = si_{sum}\left\lvert\frac{P_{sum}}{S_{sum}}\right\rvert$	*When* $P_{sum} \geq 0$ $\phi_{sum} = si_{sum}\ cos^{-1}\lvert\lambda_{sum}\rvert$ *(0º to ±90º)* *When* $P_{sum} \geq 0$ $\phi_{sum} = si_{sum}\ \lvert 180 - cos^{-1}\lvert\lambda_{sum}\rvert\rvert$ *(±90º to ±180º)*

(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 For sine wave input that is at least 20% of the measurement source's measurement range. Measurement lower limit frequency setting: 0.1 sec. / 1 sec. / 10 sec.
Display format	0.1000 Hz to 9.9999 Hz, 9.900 Hz to 99.999 Hz, 99.00 Hz to 999.99 Hz, 9900 kHz to 9.9999 kHz, 9.900 kHz to 99.999 kHz, 99.00 kHz to 220.00 kHz

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 PW3336

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

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Wiring	CH1	CH2	CH3	Calculation formulas
1P2W × 3	1P2W	1P2W	1P2W	η1=100×|P3| / |P1| η2=100×|P1| / |P3|
1P3W & 1P2W	1P3W		1P2W	η1=100×|P3| / |Psum|
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 Range up: The range is increased when input exceeds 130% of the range or when the peak is exceeded. Range down: The range is decreased when input falls below 15% of the range. However, the range is not decreased when the peak is exceeded at the lower range.
Averaging (AVG)	· Averages the voltage, current, active power, apparent power, and reactive power. · The power factor and phase angle are calculated from averaged data. · Measured values other than peak values, power factor, frequency, integrated values, T.AV, crest factor, ripple rate, total harmonic distortion, and harmonics are averaged. Method : Simple averaging Number of averaging iterations and display update interval

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

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

Integration Measurement Specifications

Measurement items	Simultaneous integration of the following 6 parameters for each channel (total of 18 parameters): Sum of current integrated values (displayed as Ah on panel display) Positive current integrated value (displayed as Ah+ on panel display) Negative current integrated value (displayed as Ah- on panel display) Sum of active power integrated values (displayed as Wh on panel display) Positive active power integrated value (displayed as Wh+ on panel display) Negative active power integrated value (displayed as Wh- on panel display)
Measurement types	Rectifiers: AC+DC, AC+DC Umn Current: Displays the result of integrating current RMS value data (display values) once every display update interval (approx. 200 ms) as an integrated value. Active power: Displays the result of integrating active power values by polarity calculated once every cycle for the selected synchronization source as integrated values. Rectifier: DC Displays the result of integrating instantaneous data obtained by sampling both current and active power by polarity as integrated values (When the active power contains both AC and DC, the DC component will not be integrated)
Integration time	1 min. to 10000 hr., settable in 1 min. blocks
Integration time accuracy	±100 ppm ±1 dgt. (0°C to 40°C)
Integration measurement accuracy	(Current or active power measurement accuracy) + (±0.01% rdg. ±1 dgt.)
Effective measuring range	Until PEAK OVER U or PEAK OVER I occurs
Display resolution	999999 (6 digits + decimal point)
Functions	· Stopping integration based on integration time setting (timer) · Displaying the integration elapsed time (displayed as TIME on panel display) · Additional integration by repeatedly starting/stopping integration · Backing up integrated values and the integration elapsed time during power outages · Stopping integration when power returns
External control	Stopping/starting integration and resetting integrated values based on external control
Measuring range	Corresponds to the range set for START integretation

Harmonic Measurement Specifications (built-in function)

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

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

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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 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 In : The EXT SYNC terminal is set to input, and a dedicated synchronization signal can be input (slave). Out: The EXT SYNC terminal is set to output, and a dedicated synchronization signal can be output (master).
Number of units for which synchronized control can be performed	1 master unit and 7 slave units (total 8 units)

External Current Sensor Input Specifications (built-in feature)

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

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

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

Temperature characteristics	Current, active power: ±0.08% f.s./°C (instrument temperature coefficient; f.s.: instrument measurement range) Add current sensor temperature coefficient to above.
Power factor effects	· Instrument: ±0.15% f.s. or less (45 Hz to 66 Hz with power factor = 0) · Internal circuit voltage/current phase difference: ±0.086° · Add the current sensor phase accuracy to the internal circuit voltage/current phase difference noted above.
Current peak value measurement accuracy	· (External current sensor input instrument accuracy) + (±2.0% f.s.) (f.s.:current peak range) · Add the current sensor accuracy to the above.
Harmonic measurement accuracy	Frequency / Voltage / Current, Active power DC: ±0.4%rdg. ±0.2%f.s. / ±0.6%rdg. ±0.8%f.s. 10Hz≤ f < 30Hz: ±0.4%rdg. ±0.2%f.s. / ±0.6%rdg. ±0.4%f.s. 30Hz≤ f ≤ 400Hz: ±0.3%rdg. ±0.1%f.s. / ±0.5%rdg. ±0.3%f.s. 400Hz < f ≤ 1kHz: ±0.4%rdg. ±0.2%f.s. / ±0.6%rdg. ±0.5%f.s. 1kHz < f ≤ 5kHz: ±1.0%rdg. ±0.5%f.s. / ±1.0%rdg. ±5.5%f.s. 5kHz < f ≤ 8kHz: ±4.0%rdg. ±1.0%f.s. / ±2.0%rdg. ±6.0%f.s. f.s.: Each measurement range •To obtain the current or active power accuracy, add the current sensor's accuracy to the above current and active power accuracy figures.

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

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

External control (built-in feature)

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

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

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

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

RS-232C interface (built-in feature)

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

LAN interface (built-in feature)

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

General Specifications (product guaranteed for 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) Between voltage input terminals and (case, interface, and output terminals) Between current direct input terminals and (case, interface, and output terminals) Between voltage input terminals and current direct input terminals
Maximum rated voltage to earth	Voltage input terminal, Current direct input terminal Measurement category III 600 V (anticipated transient overvoltage 6000 V) Measurement category II 1000 V (anticipated transient overvoltage 6000 V)
Maximum input voltage	Between voltage input terminals U: 1000 V, ±1500 Vpeak
Maximum input current	Between +/- current direct input terminals I: ±70 A, ±100 Apeak
Applicable Standards	Safety : EN61010, EMC : EN61326 Class A/ EN61000-3-2/ EN61000-3-3
Rated supply voltage	100 VAC to 240 VAC, Rated power supply frequency : 50/60 Hz
Maximum rated power	40 VA or less
Dimensions	Approx. 305W(12.01") × 132H(5.20") × 256D(10.08") mm (excluding protrusions)
Mass	PW3336 series Approx. 5.2 kg (183.4 oz.) PW3337 series Approx. 5.6 kg (197.5 oz.)
Accessories	Instruction manual × 1, Measurement guide × 1, Power cord × 1

PW3335 Specifications

Input Specifications

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

Basic Measurement Specifications

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

Measurement accuracy

Voltage

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

Current

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

Active power

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

- Values for f.s. depend on measurement ranges.
- "F" in the tables refers to the frequency in kHz.
- When using the 1 mA/ 2 mA range:
  Add ±1 µA to 0.1 Hz to 100 kHz measurement accuracy for current.
  Add (±1 µA) × (voltage read value) to 0.1 Hz to 100 kHz measurement accuracy for active power.
- When using the 200 mA/ 500 mA/ 1 A/ 2 A/ 5 A/ 10 A/ 20 A range:
  Add ±1 mA to DC measurement accuracy for current.
  Add (±1 mA) 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) Current 1% to 150% of the range Active power 0% to 225% of the range (when using 1000 V range, up to 150%) However, valid when the voltage and current fall within the effective measurement range.
Maximum effective peak voltage	±600% of each voltage range However, for 300 V, 600 V, and 1000 V ranges, ±1500 V peak
Maximum effective peak current	±600% of each current range However, for 20 A range, ±60 A peak
Guaranteed accuracy period	1 year
Post-adjustment accuracy guaranteed	6 months
Conditions of guaranteed accuracy	Temperature and humidity range: 23°C±5°C (73°F±9°F), 80% RH or less Warm-up time: 30 minutes Input: Sine wave input, power factor of 1, voltage to earth of 0 V, after zero-adjustment; within range in which the fundamental wave satisfies synchronization source conditions
Temperature coefficient	±0.03%f.s. per °C or less. However, for 1 mA range, ±0.06%f.s. per °C or less.
Effect of power factor	±0.1%f.s. or less (45 to 66 Hz, at power factor = 0) Internal circuitry voltage/current phase difference: ±0.0573°
Effect of common mode voltage	±0.01%f.s. or less (600 V, 50 Hz/60 Hz, applied between input terminals and enclosure)
Effect of magnetic field	400 A/m, DC and 50 Hz/60 Hz magnetic field Voltage ±1.5%f.s. or less Current ±1.5%f.s. or less than or equal to the following value, whichever is greater 200 mA/ 500 mA/ 1 A/ 2 A/ 5 A/ 10 A/ 20 A range: ±20 mA 1 mA/ 2 mA/ 5 mA/ 10 mA/ 20 mA/ 50 mA/ 100 mA range: ±200 µA Active power ±3.0%f.s. or less than or equal to the following value, whichever is greater 200 mA/ 500 mA/ 1 A/ 2 A/ 5 A/ 10 A/ 20 A range: (Voltage influence quantity)×(±20 mA) 1 mA/ 2 mA/ 5 mA/ 10 mA/ 20 mA/ 50 mA/ 100 mA range: (Voltage influence quantity)×(±200 µA)
Effect of self-heating	With input of at least 15 A to current input terminals Current AC input signal ±(0.025+0.005×(I-15))%rdg. or less DC input signal 200 mA/ 500 mA/ 1 A/ 2 A/ 5 A/ 10 A/ 20 A range ±((0.025+0.005×(I-15))% rdg.+(0.5+0.1×(I-15))mA) or less 1 mA/ 2 mA/ 5 mA/ 10 mA/ 20 mA/ 50 mA/ 100 mA range ±((0.025+0.005×(I-15))% rdg.+(5+1×(I-15))µA) or less I: Current read value (A) Active power (above current influence quantity) × (voltage read value) or less The effects of self-heating will continue to manifest themselves until the input resistance temperature falls, even if the current value is low.

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

PW3335

Voltage/ Current/ Active Power Measurement Specifications

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

Voltage Waveform Peak Value/ Current Waveform Peak Value Measurement Specifications

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

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

Current

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

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

Voltage Crest Factor/Current Crest Factor Measurement Specifications

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

Voltage Ripple Rate/ Current Ripple Rate Measurement Specifications

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

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

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

Power Calculation Formulas

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

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 For sine wave input that is at least 20% of the measurement source's measurement range Measurement lower limit frequency setting: 0.1 sec. / 1 sec. / 10 sec. (linked to synchronization timeout setting)
Display format	0.1000 Hz to 9.9999 Hz, 9.900 Hz to 99.999 Hz, 99.00 Hz to 999.99 Hz, 0.9900 kHz to 9.9999 kHz, 9.900 kHz to 99.999 kHz, 99.00 kHz to 100.00 kHz

Maximum Current Ratio Measurement Specifications (MCR)

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

Time Average Current/ Time Average Active Power Measurement Specifications

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

Functional Specifications

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

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

Scaling (VT, CT)	Applies user-defined VT and CT ratio settings to measured values. VT ratio setting range OFF (1.0), 0.001 to 1000 CT ratio setting range OFF (1.0), 0.001 to 1000
Hold	• Stops display updates for all measured values and fixes the display values at that point in time. • Measurement data acquired by communications is also fixed at that point in time. • Internal calculations (including integration and integration elapsed time) will continue. • Analog output and waveform output are not held

Maximum value/ minimum value hold (MAX/MIN HOLD)	• Detects maximum and minimum measured values (except current integration, active power integration, integration elapsed time, time average current, and time average active power values) as well as maximum and minimum values for the voltage waveform peak and current waveform peak and holds them on the display. • For data with polarity, display of the maximum value and minimum value for the data's absolute values is held (so that both positive and negative polarity values are shown). However, this does not apply to the voltage waveform peak value or the current waveform peak value. • Internal calculations (including integration and integration elapsed time) will continue. • The maximum and minimum values during integration are detected (maximum/minimum value measurement during the integration interval). • Analog output and waveform output are not held.
Zero Adjustment	Zeroes out the voltage and current input offset.
Key-lock	Disables key input in the measurement state, except for the KEY LOCK key.
Backup	Backs up settings and integration data if the instrument is turned off and if a power outage occurs.
System Reset	Initializes the instrument's settings.

Integration Measurement Specifications

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

Harmonic Measurement Specifications

Measurement method	Zero-cross simultaneous calculation method Uniform thinning between zero-cross events after processing with a digital antialiasing filter Interpolation calculations (Lagrange interpolation) When the synchronization frequency falls within the 45 Hz to 66 Hz range: IEC 61000-4-7:2002 compliant Gaps and overlaps may occur if the measurement frequency is not 50 Hz or 60 Hz. When the synchronization frequency falls outside the 45 Hz to 66 Hz range: No gaps or overlap will occur.
Synchronization source	Conforms to synchronization source (SYNC) for the basic measurement specifications.
Measurement items	Harmonic voltage RMS value / Harmonic voltage content percentage Harmonic voltage phase angle / Harmonic current RMS value Harmonic current content percentage / Harmonic current phase angle Harmonic active power Harmonic active power content percentage Harmonic voltage current phase difference Total harmonic voltage distortion / Total harmonic current distortion Fundamental wave voltage / Fundamental wave current Fundamental wave active power / Fundamental wave apparent power Fundamental wave reactive power / Fundamental wave power factor Fundamental wave voltage current phase difference (The following parameters can be downloaded as data with communications) Harmonic voltage phase angle / Harmonic current phase angle Harmonic voltage current phase difference
FFT processing	FFT processing word length : 32 bits Number of FFT points : 4096 points
Window function	Rectangular
Analysis window width	45 Hz ≤ f < 56 Hz : 178.57 ms to 222.22 ms (10 cycles) 56 Hz ≤ f < 66 Hz : 181.82 ms to 214.29 ms (12 cycles) Frequencies other than the above : 185.92 ms to 214.08 ms
Data update rate	Depends on window width.
Maximum analysis order	Synchronization frequency (f) range / Analysis order 10 Hz ≤ f < 45 Hz : 50th 45 Hz ≤ f < 56 Hz : 50th 56 Hz ≤ f ≤ 66 Hz : 50th 66 Hz < f ≤ 100 Hz : 50th 100 Hz < f ≤ 200 Hz : 40th 200 Hz < f ≤ 300 Hz : 25th 300 Hz < f ≤ 500 Hz : 15th 500 Hz < f ≤ 640 Hz : 11th
Analysis order upper limit setting	2nd to 50th
Measurement accuracy	f.s.: Measurement range Frequency (f) / Voltage, Current, Active power DC : ±0.4% rdg. ±0.2%f.s. 10 Hz ≤ f < 30 Hz : ±0.4% rdg. ±0.2%f.s. 30 Hz ≤ f ≤ 400 Hz : ±0.3% rdg. ±0.1%f.s. 400 Hz < f ≤ 1 kHz : ±0.4% rdg. ±0.2%f.s. 1 kHz < f ≤ 5 kHz : ±1.0% rdg. ±0.5%f.s. 5 kHz < f ≤ 8 kHz : ±4.0% rdg. ±1.0%f.s. • When using the 1 mA/ 2 mA range: Add ±1 µA to 10 Hz to 8 kHz measurement accuracy for current. Add (±1 µA) × (voltage read value) to 10 Hz to 8 kHz measurement accuracy for active power. • When using the 200 mA/ 500 mA/ 1 A/ 2 A/ 5 A/ 10 A/ 20 A range: Add ±1 mA to DC measurement accuracy for current. Add (±1 mA) × (voltage read value) to DC measurement accuracy for active power. • When using the 1 mA/ 2 mA/ 5 mA/ 10 mA/ 20 mA/ 50 mA/ 100 mA range: Add ±10 µA to DC measurement accuracy for current. Add (±10 µA) × (voltage read value) to DC measurement accuracy for active power.

Display Specifications

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

Synchronized control

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

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

Terminal	Isolated BNC terminals
Current sensor type switching	Off / TYPE.1 / TYPE.2 When set to off, input from the external current sensor input terminal is ignored.
Current sensor options	TYPE1 (100 A to 5000 A sensors) 9660, 9661, 9669, CT9667-01/-02/-03 TYPE2 (20 A to 1000 A sensors, Power supply is required to use) CT6862-05, CT6863-05, 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) Can be read directly by manually setting the CT ratio.
Constraints	Auto-range integration not supported.

PW3335-5

Power range configuration	Depends on the combination of voltage and current ranges; from 24.000 W to 5.0000 MW (also applies to VA, var)
Measurement accuracy	

Current/ Active Power

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

Current

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

Active Power

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

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

Temperature coefficient	Current, active power: ±0.08%f.s./°C or less (instrument temperature coefficient; f.s. : instrument measurement range) Add current sensor temperature coefficient to above.
Effect of power factor	Instrument: ±0.15%f.s. or less (45 to 66 Hz with power factor = 0) Internal circuit voltage/current phase difference: ±0.0859° Add the current sensor phase accuracy to the internal circuit voltage/current phase difference noted above.
Current waveform peak value measurement specifications	±2.0% at DC or 10 Hz ≤ f ≤ 1 kHz (f.s.: current peak range) Add the current sensor accuracy to the above.
Harmonic measurement accuracy	External current sensor input instrument measurement accuracy only

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

- Values for f.s. depend on measurement ranges.
- To obtain the current or active power accuracy, add the current sensor's accuracy to the above current and active power accuracy figures.
- When using the CT684x-05 series, add ±2 mV to the CT684x-05 series accuracy after performing CT684x-05 series zero adjustment using the 1 A range noted on the panel.

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

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

External control

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

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

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

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

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

LAN interface

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

General Specifications

Product warranty period	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) Between the voltage input terminals and a connection consisting of chassis, interfaces, and output terminals Between the current input terminals and a connection consisting of chassis, interfaces, and output terminals Between the voltage input terminals and current input terminals
Maximum rated voltage to earth	Voltage input terminal, Current input terminal Measurement category III 600 V (anticipated transient overvoltage: 6000 V) Measurement category II 1000 V (anticipated transient overvoltage: 6000 V)
Maximum input voltage	Between the voltage input terminals U and ± 1000 V, ±1500 V peak
Maximum input current	Between the current input terminals I and ± 200 mA to 20 A range 30 A, ±100 A peak 1 mA to 100 mA range 20 A, ±30 A peak
Applicable Standards	Safety EN61010 EMC EN61326 Class A EN61000-3-2 EN61000-3-3
Rated supply voltage	100 V AC to 240 V AC 50 Hz/60 Hz
Maximum rated power	30 VA or less
Dimensions	Approx. 210W × 100H × 245D mm (8.27"W × 3.94"H × 9.65"D) (excluding protrusions)
Mass	Approx. 3 kg (105.8 oz.)
Accessories	Instruction manual ×1 Power cord ×1 Voltage and current input terminal safety cover ×2

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%) 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 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 Current Integration: From 0.00000mAh, Polarity-independent integration and Sum value Active power Integration: From 0.00000mWh, Polarity-independent integration and Sum value Integration time: 1 min to 10000 h 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) 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: Voltage, Current and Active power (3 simultaneous channels) D/A select an item from Current integration, Active power integration, Apparent power, power factor Voltage output: ±2 VDC f.s. for each range Output accuracy: ±0.5% f.s. + individual measurement accuracy
Waveform output	Parameter output representation: Voltage, Current and Active power (3 simultaneous channels) Voltage output: 1 VDC f.s. for each range 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 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 Asynchronous communication method: full-duplex; Baud rate: 9600 bps (fixed) GP-IB interface (Model 3334-01 only) 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, 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 (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% 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 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: voltage, current and active power (3 simultaneous channels) Voltage output: +2 VDC f.s. for each range 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 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 Asynchronous communication method: full-duplex; Baud rate: 9600 bps (fixed) GP-IB interface (Model 3333-01 only) 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, 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 (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

HIOKI
HIOKI E.E. CORPORATION

HEADQUARTERS
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Ueda, Nagano 386-1192 Japan
https://www.hioki.com/

Our regional contact information

HIOKI

ASM®

LEISTUNGSMESSGERÄTE
3336/3337(PW)

Leistungsmessgeräte

Hochpräzise 2-/3-Kanal-Leistungsmessgeräte
mit Oberschwingungsmessung

Genaue Messungen bis zu 1.000 V/65 A AC/DC mit Direkteingang

Die Leistungsmessgeräte 3336(PW) (2-Kanal) und 3337(PW) (3-Kanal) messen DC und eine Vielfalt an Netzsystemen von 1-Phasen-2-Leiter- bis 3-Phasen-4-Leiter*.

- Für Entwicklung und Herstellung von Motoren, Invertern, Stromversorgungen und ähnlichen Anlagen
- Beurteilung und Prüfung des Energiesparverhaltens von industriellen Anlagen, wie z.B. Schwermaschinen, Klimaanlagen oder Haushaltsgeräten

- Grundgenauigkeit für Spannung, Strom und Leistung: ±0,15%
- Messfrequenzen : DC, 0,1 Hz bis 100 kHz
- Hochstrommessung : Bis zu 65 A, Direkteingang
- Oberschwingungsmessung bis zu 50. Ordnung : Normenkonform mit IEC 61000-4-7
- Hochgenaue Messung, auch mit niedrigem Leistungsfaktor : Ideal für lastfreie Prüfung von Transformatoren und Motoren
- Messung bis zu 5.000 A AC : eingebaute Eingänge für externe Stromzangen

ISO 9001 JMI-0216
ISO14001 JQA-E-90091

CE

*3-Phasen-4-Leiter-Messung: nur die 3337(PW)-Serie

Hochgenaue Strom- und Oberschwingungsmessung

Für die Entwicklung und Produktion von Motoren, Transformatoren, Klimaanlagen, und Industriegeräten

Die Messgeräte der 3336(PW)-Serie (2-Kanäle) und der 3337(PW)-Serie (3-Kanäle) sind benutzerfreundlich und hochgenau und ermöglichen Strommessungen von bis zu 65 A mit einem Direkteingang, wie auch Oberschwingungsmessungen, mit einer besseren Genauigkeit - im Vergleich zu Vorgängermodellen.

Erstklassige Leistung

Direkteingang-Messung bis zu 65 A

1 Unveränderte Messgenauigkeit für Hochstrom-Messungen

Die stabile Messgenauigkeit für Hochstrom-Messungen bis zu 65 A mit einem Direkteingang wird garantiert. Die Leistungsmessgeräte können hohe Ströme über 65 A ebenfalls mit Hilfe der optionalen Stromzangen messen. Üblicherweise weisen andere Leistungsmessgeräte* bei Messungen von hohen Strömen verminderte Genauigkeit auf - dies geschieht aufgrund der Selbsterhitzung der Widerstände. Nicht so die 3336(PW)- und 3337(PW)-Geräte: sie reduzieren den Eingangswiderstand dank dem DCCT-Design, das diese Genauigkeitsminderung virtuell eliminiert.

2mA **65A** 5000A

***mit Direkteingang** | Stromzangen-eingang

2 Ein 3-Kanal-Leistungsmessgerät

Optimale Messbereiche können für jedes Messsystem gewählt werden. Die hochentwickelten Messgeräte 3336(PW) und 3337(PW) ermöglichen gleichzeitige Messungen an der Primärsite eines DC-gespeisten Inverters und an seiner Sekundärseite mit dem 3-Phasen-Ausgang. Diese Leistungsmessgeräte eignen sich hervorragend für Applikationen mit Messungen der Eingangs-/Ausgangs-Effizienz von Invertern, unterbrechungsfreier Stromversorgungen und anderen Netzversorgungsanlagen.

3 Hervorragende Genauigkeit von ±0,15% rdg.

Die hervorragende Genauigkeit der HIOKI Messgeräte 3336/3337(PW) - das Ergebnis jahrelanger Erfahrung und Forschung - beträgt ±0,15% rdg. und deckt eine breite Palette an Messsituationen und -anwendungen.

±0,15%rdg.

Gleichzeitige Messung des Leistungsverbrauchs und sämtlicher Oberschwingungsparameter, von 1-Phasen-2-Leiter- bis 3-Phasen-4-Leiter-Systeme

2ch

3336(PW)-Serie (2-Kanäle)
Messsysteme: 1P2W/1P3W/3P3W

3ch

3337(PW)-Serie (3-Kanäle)
Messsysteme: 1P2W/1P3W/3P3W/3P4W

Erstklassige Performance

4 Gleichzeitige Verarbeitung von Leistungsdaten und allen Oberschwingungsdaten

Sämtliche Daten, inklusive Effektivwerte (RMS), Durchschnittswerte, DC- und AC-Komponenten, Grundschwingungs-Komponenten, Oberschwingungsmessung und Integrationsmessung werden intern gleichzeitig verarbeitet. Ob Sie Leistungsdaten oder Oberschwingungsdaten anzeigen möchten - es reicht, wenn Sie nur die Anzeige, und nicht den Messmodus, umschalten. Mit der PC-Kommunikations-Software* können zusätzlich Messdaten erfasst werden - von einem oder von mehreren synchronisierten Messgeräten.

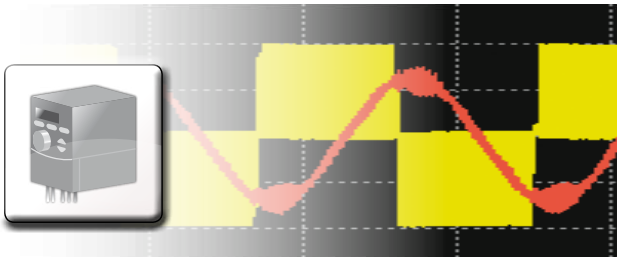
*in Kürze als kostenfreie Download auf der HIOKI-Website verfügbar.

5 Hochgenaue Messungen, sogar bei einem niedrigen Leistungsfaktor-Eingang

Da der Leistungsfaktor bei ±0,1% f.s. nur wenig Einfluss auf die Messung hat, können die 3336/3337(PW)-Messgeräte Wirkleistung bei einem niedrigen Leistungsfaktor-Eingang mit hoher Genauigkeit messen, z.B. während einer Leerlaufverlust-Prüfung - einer Methode, die für die Auswertung des Energiesparverhaltens von Transformatoren verwendet wird.
In Messsituationen, wenn der Scheitelfaktor des Hochstrom-Signals, der normalerweise die lastfreien Operationen begleitet, den Leistungsfaktor abschwächt, sind die Messungen mit den 3336/3337(PW)-Messgeräten auch unter diesen Bedingungen sehr genau.

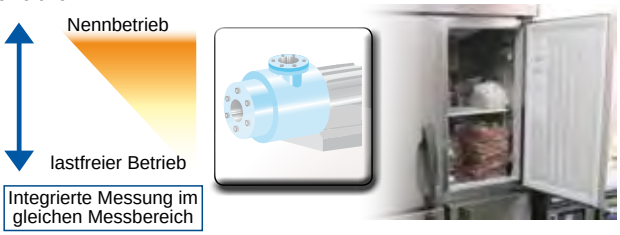
6 Weites Frequenzband von DC und 0,1 Hz bis 100 kHz

Mit einem weiten Frequenzband von DC und 0,1 Hz bis 100 kHz decken die 3336/3337(PW)-Messgeräte nicht nur das Grund-Frequenzband von Invertern, sondern auch das Trägerfrequenzband ab.



7 Integration schwankender Leistungswerte

Der Leistungsverbrauch der Geräte unterliegt Lastschwankungen. Bei Kühlschränken, Heizungen und Pumpen, beispielsweise, treten deutliche Unterschiede zwischen dem Nennbetrieb und einem lastfreien Betrieb auf. Mit ihrem breiten dynamischen Messbereich können die 3336/3337(PW)-Messgeräte integrierte Leistungsmessung mit garantierter Genauigkeit innerhalb eines einzelnen Messbereichs durchführen, und dies auch bei hohen Wertschwankungen während der Integration. Signalspitzenwerte können bis zu 600% des Messbereichs erreichen.



Erweiterte Funktionen

1 Umfasssende eingebaute Funktionen beinhalten Oberschwingungsmessung, Stromzangeneingang, synchronisierte Steuerung und eine breite Auswahl an Schnittstellen

Die 3336/3337(PW) Leistungsmessgeräte verfügen über alle erforderlichen und nützlichen Funktionen für Ihre Messung. Zur Auswahl stehen dem Anwender 8 Messgeräte, inklusive GP-IB Schnittstelle und D/A-Ausgang, je nach Modell und Anwendung.

Standard-Funktionalität nach Modell

● : interne Funktion — : nicht möglich

Modell	Anzahl der Kanäle	Oberschwingungs-messung	Stromzangen-eingang	Synchronisierte Steuerung	LAN	RS-232C	GP-IB	D/A-Ausgnag
3336(PW)	2	●	●	●	●	●	—	—
3336-01(PW)		●	●	●	●	●	●	—
3336-02(PW)		●	●	●	●	●	—	●
3336-03(PW)		●	●	●	●	●	●	●
3337(PW)	3	●	●	●	●	●	—	—
3337-01(PW)		●	●	●	●	●	●	—
3337-02(PW)		●	●	●	●	●	—	●
3337-03(PW)		●	●	●	●	●	●	●

2 Oberschwingungsmessung nach IEC61000-4-7

Die 3336/3337(PW) sind normgerecht mit der internationalen Norm für Oberschwingungsmessungen IEC 61000-4-7:2002.
Diese Leistungsmessgeräte können Oberschwingungen von Spannung, Strom und Leistung bis zu 50. Ordnung messen, abhängig von der Grundfrequenz, inklusive Gesamtverzerrung (THD), Grundschwingungs-Komponenten, harmonischen Pegels, Phasendifferenz, Prozentualanteil und weiteren Parameter für jede Ordnung. Da die Anzahl der Ordnungen für die Oberschwingungsanalyse beliebig von der 2. bis 50. Ordnung gesetzt werden kann, werden normgerechte Berechnungen durchgeführt, auch wenn die Norm Ordnungsbegrenzugen für die THD-Berechnungen vorsieht.

Über IEC 61000-4-7

IEC 61000-4-7 ist eine internationale Norm für Messungen an harmonischem Strom und harmonischer Spannung in Netzversorgungssystemen, wie auch an harmonischem Strom aus Geräten. Sie definiert die Anforderungen an Standard-Messgeräte für diese Messungen.

3 Breite Auswahl an Schnittstellen

Die Schnittstellen der 3336/3337(PW)-Messgeräte werden für die Steuerung und Datenerfasssung verwendet - laden Sie dazu die kostenlose PC-Anwendung von der HIOKI-Website* herunter. Über die LAN-Anbindung können die Einstellungen der Leistungsmessgeräte vorgenommen, gemessene Werte und Signale beobachtet, Logger-Aufzeichnungen angezeigt und Daten mit Intervallen aufgezeichnet werden.

GP-IB
RS-232C
LAN

3336-03(PW)
3337-03(PW)

*in Kürze erhältlich

4 16-Kanal-D/A-Ausgang (-02, -03)

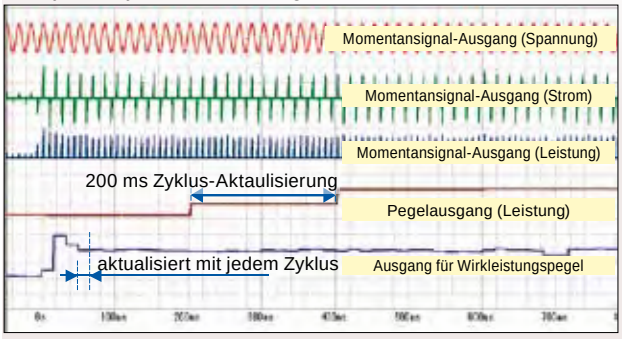
Messgeräte mit dem D/A-Ausgang können den Spannungs-ausgang für Messwerte und integrierte Leistung mit 16 Bit-Auflösung erzeugen. Durch den Anschluss eines externen Datenlogger, Recorders oder ähnl. Geräts können Temperaturdaten und weitere nicht-leistungsrelevante Daten gleichzeitig aufgezeichnet werden. Die 3336/3337(PW) bieten, als erste Geräte in ihrer Klasse, den Wirkleistungs-Pegelausgang auf der Zyklus-zu-Zyklus-Basis an.

3 Typen des D/A-Ausgangs (umschaltbar)

Momentansignal-Ausgang
Ausgang von Momentan-signalen der Spannung, des Stroms und der Leistung.
(Abtastgeschwindigkeit: ca. 87,5 kHz)

Pegel-Ausgang
Ausgang von Spannung, Strom, Leistung und weitere gewählter Parameter mit Aktualisierung von ca. 200 ms.

High-Speed-Pegelausgang der Wirkleistung
Generierung des Pegelausgangs für Wirkleistung für jeden Zyklus des Messsignals.

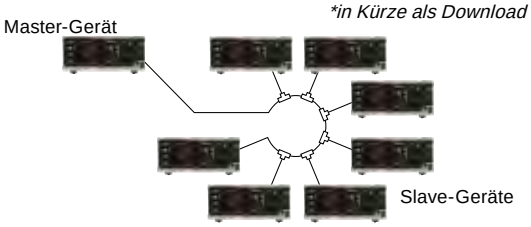


D/A-Ausgangssignale beim Einschalten eines Ventilator-Motors

5 Synchronisierte Steuerung von bis zu 8 Geräten

Bis zu 8 Messgeräte der 3336/3337(PW)-Serie können für eine synchronisierte Messung miteinenander verbunden werden. Damit werden bis zu 24 Kanäle für gleichzeitige Berechnungen, Anzeige und Aktualisierung, Integrationssteuerung, Halten der Anzeige und Nullpunktabgleich verwendet. Zusätzlich ermöglicht die Master-Slave-Konfiguration eine Tastensperre für alle Slave-Geräte, so dass nur die Operationen des Master-Geräts an den anderen Leistungsmessgeräten wiederspiegelt werden. Mit der kostenlosen PC-Anwendung* können Effizienzwerte aller angeschlossenen Geräte berechnet werden.

in Kürze als Download erhältlich



6 Stromzangen-Anschluss

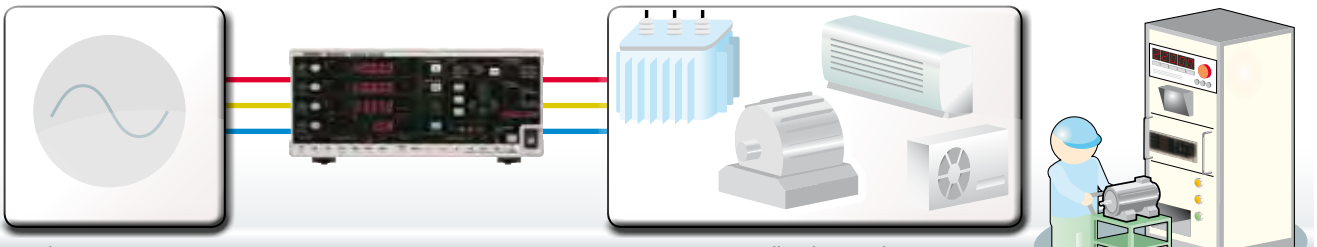
Die 3336/3337(PW) können Ströme über 65 A mit einer optionalen Stromzange messen. Messungen mit garantierter Genauigkeit können für Ströme bis zu 5.000 A AC durchgeführt werden. Eine breite Auswahl an Stromzangen, AC/DC Stromzangen und speziellen Modellen für 50/60 Hz-Messungen stehen dem Anwender zur Verfügung.

Anwendungen

1 Forschung, Entwicklung und Prüfung von Anlagen mit 3-Phasen-Stromversorgungen, wie z.B. Transformatoren, Motoren, Klimaanlagen und Schwermaschinen

Vorteile

- ✓ Messung von 3-Phasen-3-Leiter- und 3-Phasen-4-Leiter-Systemen* mit einer Grundgenauigkeit von ±0,15% rdg.
- ✓ Hochstrom-Messungen von 65 A mit einem Direkteingang ohne Genaugkeitsverlust aufgrund der Verwendung der Shunt-Widerstände und aufgrund der Selbsterhitzung von Widerständen.
- ✓ Normgerecht mit IEC 61000-4-7-Norm für Oberschwingungsmessungen und ausgestattet mit Stromzangen-Eingängen und einer LAN-Schnittstelle.
- ✓ Garantierte Genauigkeit für Wirkleistungsmessung von 0 W, und für integrierte Leistungsmessung von Lasten mit großen Schwankungen.
- ✓ Hochgenaue Wirkleistungsmessung auch mit niedrigem Leistungsfaktor, z.B. während einer Leerlaufverlust-Prüfung eines Transformators.



3-Phasen-Stromversorgung

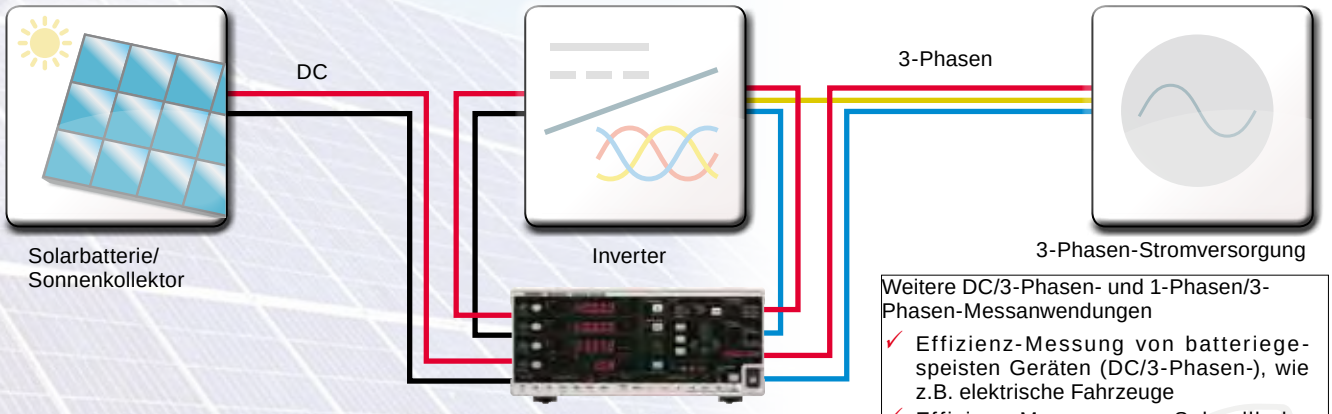
Geräte, die eine 3-Phasen-Stromversorgung benötigen

*3-Phasen-4-Leiter-Messung: nur die 3337(PW)-Serie

2 Effizienz-Messung von Invertern in Solarkraftwerken

Vorteile

- ✓ Messung des DC-Stroms an der Primärseite und der 3-Phasen-Leistung an der Sekundärseite mit einem einzelnen Messgerät 3337(PW), mit der Einstellung des optimalen Messbreichs für jede Messung.
- ✓ Effizienz-Berechnung: Eingangs-/Ausgangs-Berechnungen und Anzeige der resultierenden Effizienz auf dem Bildschirm des Leistungsmessgeräts.
- ✓ Berechnung des Brummfaktors: Verhältnis-Anzeige der AC-Komponenten, überlagert an der DC-Leitung.
- ✓ Eingebaute Stromzangen-Eingänge: Strommessungen über 65 A mit einer optionalen Stromzange.
- ✓ Oberschwingungsmessung: Prüfung der Oberschwingungskomponenten, wie Spannungs-THD, die sich bei Netzgekoppelten Systemen negativ auswirken kann.



Solarbatterie/ Sonnenkollektor

Inverter

3-Phasen-Stromversorgung

Weitere DC/3-Phasen- und 1-Phasen/3-Phasen-Messanwendungen

- ✓ Effizienz-Messung von batteriegespeisten Geräten (DC/3-Phasen-), wie z.B. elektrische Fahrzeuge
- ✓ Effizienz-Messung von Schnellladegeräten für elektrische Fahrzeuge (3-Phasen-/DC)

3 Messungen an Stromversorgungsgeräten, wie 3-Phasen-/3-Phasen-Inverter

Vorteile

- ✓ Synchronisierter Betrieb mit mehreren Messgeräten; synchronisierte Aktualisierung der Anzeige und der Daten und Integrationsstart.
- ✓ Gleichzeitige Messung sämtlicher Datenparameter, inkl. Effektivwerte, Durchschn. werte, Grundschwingungs-Komponenten, THD und Oberchwingungs-Komponenten.
- ✓ Weites Frequenzband von DC und 0,1 Hz bis 100 kHz: deckt das Frequenzband bei Inverter-Messungen an der Sekundärseite ab.
- ✓ Eingebaute Stromzangen-Eingänge: Strommessungen über 65 A mit einer optionalen Stromzange.

3-Phasen-Versorgung

ANSCHLUSSLEITUNG 9217(L) (für Synchronisierung)

3-Phasen-/3-Phasen-Inverter

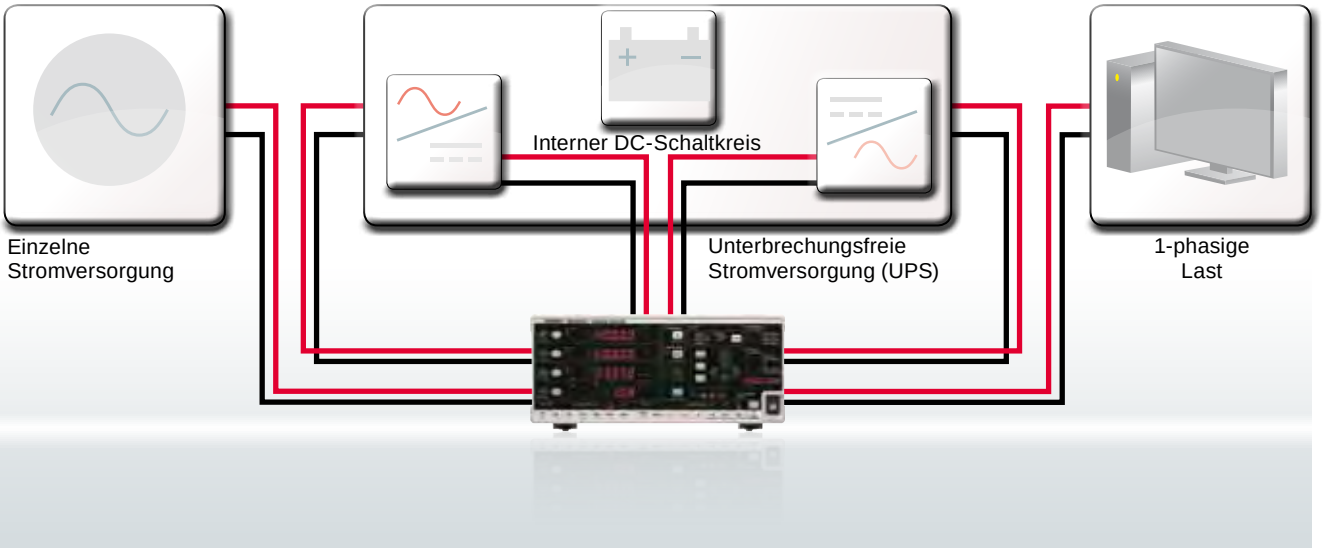
3-Phasen-Last

Anwendungen

4 Messungen des Leistungsverbrauchs an der Primärseite, am internen Schaltkreis und an der Sekundärseite einer unterbrechungsfreien Stromversorgung (UPS)

Vorteile

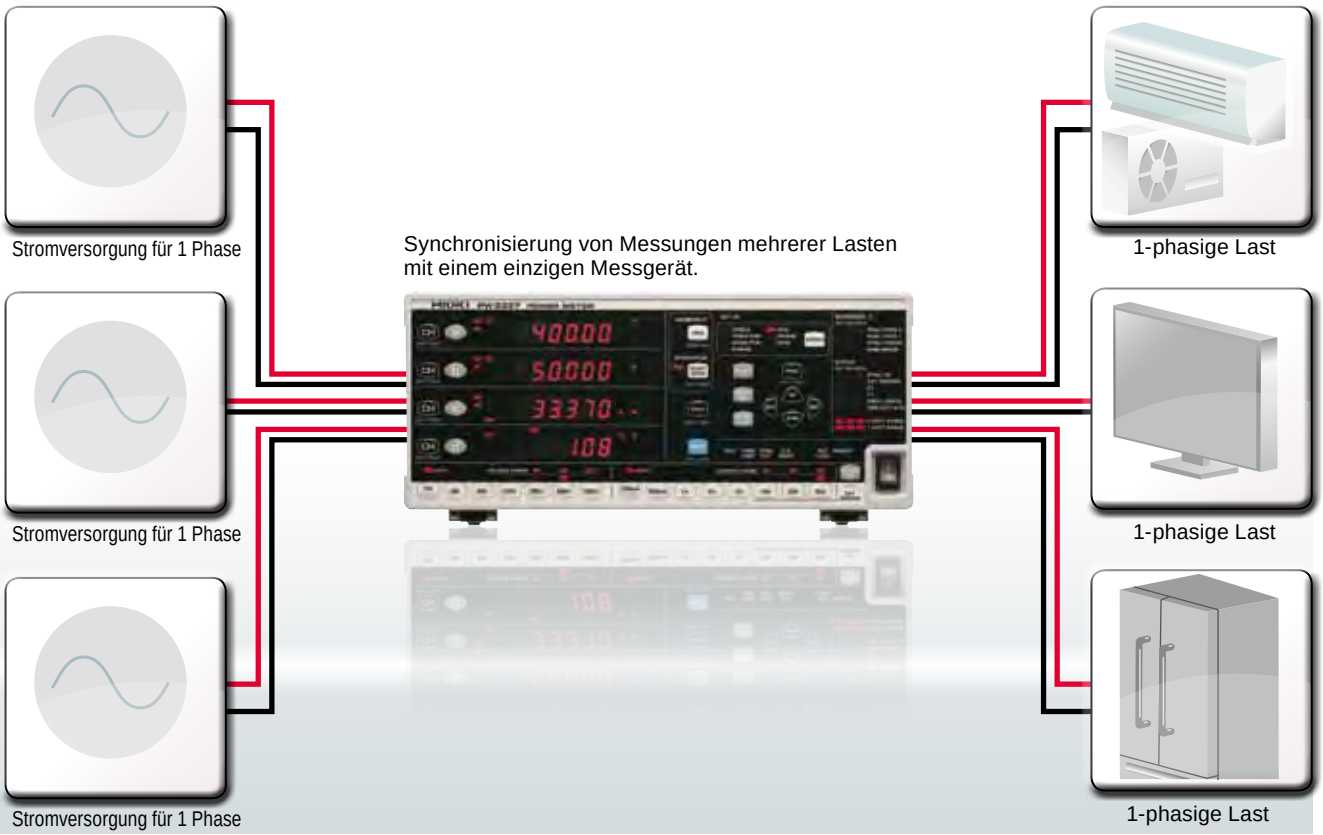
- ✓ Einstellung individueller Messbereiche und Messarten für jeden Kanal. Messung des Leistungsverbrauchs in jedem Stadium an unterbrechungsfreien Stromversorgungen.
- ✓ Haltefunktion für gemessene Spitzenwerte, Maximal- und Minimalwerte.
- ✓ Gleichzeitige Messung aller Parameter, inklusive Effektivwerte (RMS), Durchschnittswerte, Grundschwingungs-Komponenten, THD und Oberschwingungs-Komponenten.



5 Gleichzeitige Messung mehrerer Lasten

Vorteile

- ✓ Einstellung individueller Messbereiche und Messarten für jeden Kanal. Messung des Leistungsverbrauchs in jedem Stadium der unterbrechungsfreien Stromversorgung.
- ✓ Integrationsmessung schwankender Leistungssignale ohne Änderung des Messbereichs - nützlich für langfristige Auswertungs-Prüfungen integrierter Leistung.
- ✓ Synchronisierte Zeit-Steuerung für Messungen und Start-/Stopp-Integration für maximal 8 Leistungsmessgeräte.



Software

3336/3337(PW) Kommunikator

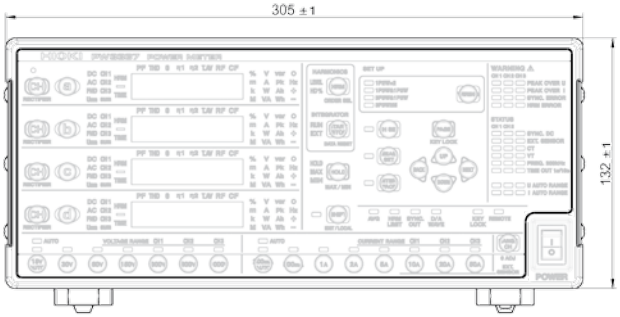
Für die Benutzung des 3336/3337(PW) Kommunikators wird ein PC mit den Leistungsmessgeräten über LAN, RS-232C oder GP-IB (Modell -01, -03)-Schnittstellen verbunden. Das Programm kann von der HIOKI-Website* kostenlos heruntergeladen werden. Die Funktionen beinhalten u. a. die Einstellung der Messgeräte, Erfassung der Intervaldaten, numerische Berechnungen von Messdaten, Berechnung von Effizienzwerten mehrere Messgeräte, Anzeige von mehr als 10 Messparameter und Anzeige von Signalverläufen.

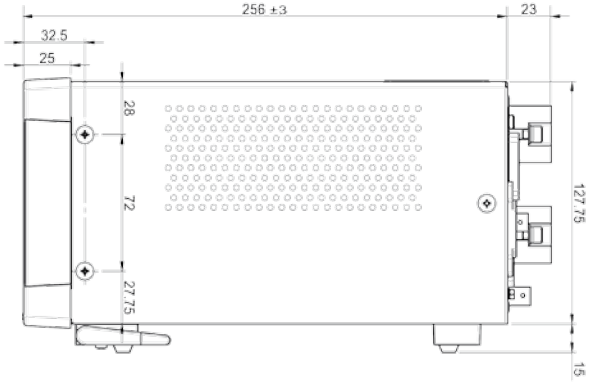
*verfügbar in Kürze

LabVIEW-Driver

Der LabVIEW* wird für die Datenerfassung und die Integration der Leistungsmessgeräte in existierende Systeme benutzt. (verfügbar in Kürze). *LabVIEW ist ein eingetragenes Markenzeichen der National Instruments Corporation.

Zeichnungen der Abmaße





(Einheit: mm)

Technische Daten

Eingangsdaten

Messsystem	3336(PW)-Serie 1-Phasen- 2-Leiter (1P2W), 1-Phasen-3-Leiter (1P3W), 3-Phasen-3-Leiter (3P3W, 3P3W2M)

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

3337(PW)-Serie
1-Phasen- 2-Leiter (1P2W),
1-Phasen-3-Leiter (1P3W),
3-Phasen-3-Leiter (3P3W, 3P3W2M, 3V3A, 3P3W3M),
3-Phasen-4-Leiter (3P4W)

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

Eingangsmethode	Spannung: isolierter Eingang, Widerstand-Spannung Divisionsmethode Strom: isolierter Eingang, DCCT-Methode isolierter Eingang bei Strom zangen
Spannungs-messbereiche	AUTO/ 15 V/ 30 V/ 60 V/ 150 V/ 300 V/ 600 V/ 1,000 V (Einstellbar für jedes System)
Strom-messbereiche	AUTO/ 200 mA/ 500 mA/ 1 A/ 2 A/ 5 A/ 10 A/ 20 A/ 50 A (Einstellbar für jedes System) Weitere information über den externen Stromzangen-Eingang, siehe Eingangsdaten der jeweiligen Stromzange
Leistungsbereiche	Abhängig von der Kombination der Spannungs- und Strommess-bereiche; von 3,0000W bis 150,00kW (auch für VA, var)
Eingangswiderstand (50/60 Hz)	Spannungseingang : 2 MΩ±0.04 MΩ Strom-Direkteingang : bis 1 mΩ

Grundlegende Messdaten

Messmethode	Gleichzeitige digitale Abtastung von Spannung und Strom, gleichzei-tige Berechnung des Nullübergangs
Abtatsfrequenz	ca. 700 kHz
A/D-Wandler-Auflösung	16 Bit

Frequenband	DC, 0,1 Hz bis 100 kHz
Synchronisations-quellen	U1, U2, U3, I1, I2, I3, DC (fest auf 200 ms) Separate Einstellung für jedes System.
Messparameter	· Spannung · Strom · Wirkleistung · Scheinleistung · Blindleistung · Leistungsfaktor · Phasenwinkel · Frequenz · Effizienz · Stromintegration · Wirkleistungs-integration · Integrationszeit · Spannungsspitzenwert · Stromspitzenwert · Scheitelfaktor Spannung · Scheitelfaktor Strom · Zeitdurchschn. Strom · Zeitdurchschn. Wirkleistung · Spannung-Brummfaktor · Strom-Brummfaktor Oberschwingungsparameter (Harmonische): · Effektivwet der harm. Spannung · Effektivwet des harm Stroms · Harm. Wirkleistung · Gesamtverzerrung harm. Spannung · Gesamtverzerrung harm. Strom · Grundschwingung Spannung · Grundschwingung Strom · Grundschwingung Wirkleistung · Grundschwingung Scheinleistung · Grundschwingung Blindleistung · Leistungsfaktor der Grundschwingung (Verschiebungsfaktor) · Phasendifferenz Spannung/Strom der Grundschwingung · Phasendifferenz der Grundschwingung für zwischenkanalige Spannung · Phasendifferenz der Grundschwingung für zwischenkanaligen Strom · Oberschwingungsanteil Spannung % · Oberschwingungsanteil Strom % · Oberschwingungsanteil Wirkleistung % Folgende Parameter können als Daten während der PC-Kommunikation heruntergeladen, jedoch nicht angezeigt werden: · Phasenwinkel der harm. Spannung · Phasenwinkel des harm. Stroms · Phasendifferenz der harm. Spannung / des harm. Stroms
Gleichrichter	AC+DC : AC+DC-Messung Anzeige von TRMS-Werte für Spannung und Strom AC+DC Umn : AC+DC-Messung Anzeige von Durchschnittswerts des gleichgerichteten Effektivwert (RMS) umgewandelter Werte für Spannung und TRMS-Werte für Strom DC : DC-Messung Anzeige einfacher Durchschnittswerte für Spannung und Strom Anzeige der berechneten Werte (Spannung DC-Wert)× (Strom DC-Wert) für Wirkleistung AC : AC-Messung Anzeige der berechneten Werte for Spannung und Strom Anzeige der berechneten Werte $\sqrt{(AC+DC\text{-}Wert)^2 - (DC\text{-}Wert)^2}$ für Wirkleistung FND Erfassung und Anzeige des Grundschwingungs-Komponenten der Oberschwingungsmessung
Nullübergangs-Filter	500 Hz/200 kHz 500 Hz: 0.1 Hz to 500 Hz, 200 kHz: 0.1 Hz to 200 kHz
Max. effektive Spitzenspannung	±600% von jedem Spannungsmessbereich Jedoch: für 300 V-, 600 V- und 1.000 V-Bereiche, ±1,500 V_{Spitze}
Max. effektiver Spitzenstrom	±600% von jedem Strommessbereich Jedoch: für 20 A- und 50 A-Bereiche, ±100 A_{Spitze}

Messgenauigkeit

Spannung

Frequenz (f)	Eingang < 50% f.s.	50%f.s. ≤ Eingang < 100%f.s.	100%f.s. ≤ Eingang
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.

Strom (Direkteingang)

Frequenz (f)	Eingang < 50% f.s.	50%f.s. ≤ Eingang < 100%f.s.	100%f.s. ≤ Eingang
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.

Wirkleistung

Frequenz (f)	Eingang < 50% f.s.	50%f.s. ≤ Eingang < 100%f.s.	100%f.s. ≤ Eingang
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.

- Werte für den vollen Messbereich f.s. sind abhängig von den Messbereichen.
- “F” in den Tabellen bezieht sich auf die Frequenz in kHz.
- ±1mA zur Gen. der DC-Messung für Strom hinzuaddieren.
- (±1mA) × (Spannungsanzeigewert) zur Gen. der DC-Messung für Wirkleistung hinzuaddieren.
- Im 200mA- oder 500mA-Messbereich, ±0,1% rdg. zu Strom und Wirkleistung, für die 1kHz < f ≤ 10kHz beträgt, hinzuaddieren.
- Werte für Spannung, Strom und Wirkleistung, für die 0,1Hz ≤ f < 10Hz beträgt, sind nur als Referenz angegeben.
- Werte für Spannung, Strom und Wirkleistung, höher als 200V oder 20A, für die 10Hz ≤ f < 16Hz beträgt, sind nur als Referenz angegeben.
- Werte für Strom und Wirkleistung höher als 20A, für die 500Hz < f ≤ 50kHz sind nur als Referenz angegeben.
- Werte für Strom und Wirkleistung höher als 15A, für die 50kHz < f ≤ 100kHz betragen, sind nur als Referenz angegeben.
- Werte für Spannung und Wirkleistung höher als 750V, für die 30kHz < f ≤ 100kHz betragen, sind nur als Referenz angegeben.

Garantierte Genauigkeitsperiode	1 Jahr
Bedingungen der garantierten Genauigkeit	Temperatur und Feuchte : 23°C ±5°C, bis 80% rel. Feuchte Warmlauf : 30 Min Eingang : Sinusschwingung, Leistungsfaktor 1, Anschluss-zu-Erde-Spannung 0V, nach Nullpunktabgleich; innerhalb des Bereichs, in dem die Grundschwingung die Bedingungen der Synchronquelle erfüllt
Temperaturcharakteristik	bis ±0,03% f.s. per °C
Einfluss des Leistungsfaktors	bis ±0,1% f.s. (45 bis 66 Hz, beim Leist.faktor = 0) Interne Schaltkreis-Spannungs-/Strom-Phasendifferenz: ±0,0573°
Einfluss der Gleichtaktspannung	bis ±0,02% f.s. (600 V, 50/60 Hz, zwischen Eingängen und Gehäuse)
Einfluss externer magnetischer Felder	magnetische Felder von 400 A/m, DC und 50/60 Hz Spannung : bis ±1,5% f.s. Strom : bis ±1,5% f.s. oder ±10 mA, je nachdem, was größer ist Wirkleistung : bis ±3,0% f.s. oder (Spannungseinflusmenge) × (±10 mA), je nachdem, welcher Wert größer ist
Magnetisierungseffekt	bis ±10 mA (nach dem Eingang von 100 A DC am Stromdirekteingang)
Einfluss eines benachbarten Kanals	bis ±10 mA (nach dem Eingang von 50 A am benachbarten Kanal)

Spannungs-/Strom-/Wirkleistungsmessung

Messarten	Gleichrichter: AC+DC, DC, AC, FND, AC+DC Umn
Effektiv-Messbereich	Spannung : 1% bis 130% des Messbereichs (jedoch: bis zu ±1.500 V Spitzenwert und 1.000 V Effektivwert) Strom : 1% bis 130% des Messbereichs Wirkleistung : 0% bis 169% des Messbereichs (jedoch: definiert, wenn die Spannung und der Strom innerhalb des Effektiv-Messbereichs fallen.)
Anzeigebereich	Spannung/ Strom : 0,5% bis 140% des Messber. (Null-Unterdrückung bei < 0,5%) Wirkleistung : 0% bis 196% des Messber. (keine Null-Unterdrückung)
Polarität	Spannung/ Strom: Anzeige nur mit dem DC-Gleichrichter Wirkleistung+: Positive: Leistungsaufnahme (keine Polaritätsanzeige) generierte oder regenerierte Leistung

Spannungs-/ Strom-/ Wirkleistungs-Kanal und Berechnungsformeln für summierte Werte

System		X: *U* (Spannung) oder *I* (Strom)	*P* (Wirkleistung)
Alle Kan.	1P2W	$X_{(i)}$	$P_{(i)}$
Sum. Werte	1P3W 3P3W	$X_{sum} = \frac{1}{2}(X_{(1)} + X_{(2)})$	$P_{sum} = (P_{(1)} + P_{(2)})$
	3P3W2M 3V3A 3P3W3M 3P4W	$X_{sum} = \frac{1}{3}(X_{(1)} + X_{(2)} + X_{(3)})$	$P_{sum} = (P_{(1)} + P_{(2)} + P_{(3)})$

(i): Messkanal

Leistungs-Kanal und Berechnungsformeln für summierte Werte

System		*S* : Scheinleistung	*Q* : Blindleistung
Alle Kan.	1P2W	$S_{(i)} = U_{(i)} \times I_{(i)}$	$Q_{(i)} = si_{(i)}\sqrt{S_{(i)}^2 - P_{(i)}^2}$
Sum. Werte	1P3W	$S_{sum} = S_{(1)} + S_{(2)}$	$Q_{sum} = Q_{(1)} + Q_{(2)}$
	3P3W	$S_{sum} = \frac{\sqrt{3}}{2}(S_{(1)} + S_{(2)})$	
	3P3W2M 3V3A	$S_{sum} = \frac{\sqrt{3}}{3}(S_{(1)} + S_{(2)} + S_{(3)})$	
	3P3W3M 3P4W	$S_{sum} = S_{(1)} + S_{(2)} + S_{(3)}$	$Q_{sum} = Q_{(1)} + Q_{(2)} + Q_{(3)}$

(i): Measurement Kanal

Wiring		λ Leistungsfaktor	ϕ: Phasenwinkel
Alle Kanäle	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. Werte	1P3W 3P3W 3P3W2M 3V3A 3P3W3M 3P4W	$\lambda_{sum} = si_{sum}\left\lvert\frac{P_{sum}}{S_{sum}}\right\rvert$	When $P_{sum} \geq 0$ $\Phi_{sum} = si_{sum}\cos^{-1}\lvert\lambda_{sum}\rvert$ (0º to ±90º) When $P_{sum} \geq 0$ $\Phi_{sum} = si_{sum}\lvert 180 - \cos^{-1}\lvert\lambda_{sum}\rvert\rvert$ (±90º to ±180º)

(i): Messkanal; das Polaritätssymbol si_{sum} wird aus dem Q_{sum}-Symbol berechnet.

Frequenzmessung

Anzahl der Messkanäle	3
Messquelle	U (VHz) oder I (AHz) je Kanal
Messmethode	berechnet aus der Periode des Eingangssignals (Reziprokes Frequenzmessverfahren)
Messbereich	500 Hz/200 kHz (verlinkt zum Nulldurchgangs-Filter)
Messgenauigkeit	±0,1% rdg. ±1 dgt. (0°C bis 40°C)
Effektiv-Messbereich	0,1 Hz bis 100 kHz Für Sinuseingang von mind. 20% des Messbereichs der Messquelle. Unterer Messgrenzwert für Frequenz: 0,1 s / 1 s / 10 s
Anzeigeformat	0,1000 Hz bis 9.9999 Hz, 9,900 Hz bis 99,999 Hz, 99,00 Hz bis 999,99 Hz, 9,900 kHz bis 9.9999 kHz, 9,900 kHz bis 99,999 kHz, 99,00 kHz bis 220,00 kHz

Scheinleistung/ Blindleistung/ Leist.faktor/ Phasenwinkel: Messdaten

Messarten	Gleichrichter Scheinleistung/ Blindleistung/ Leist.Faktor : AC+DC, AC, FND, AC+DC Umn Phasenwinkel : AC, FND
Messbereich	wie Effektiv-Messbereiche für Spannung, Strom und Wirkleistung
Anzeigebereich	Scheinleistung/ Blindleistung : 0% bis 196% des Bereichs (keine Nullunterdrückung) Leistungsfaktor: ±0,0000 bis ±1.0000 Phasenwinkel: +180,00 bis -180,00
Polarität	Blindleistung/ Leistungsfaktor/ Phasenwinkel Polarität je nach voreilender/nacheilender Relazion der steigender Flanke des Spannungssignals und der steigender Flanke des Stromsignals. + : Strom nacheilend zu Spannung (keine Polaritätsanzeige) - : Strom voreilend zu Spannung

Spannungsspitzenwert- /Stromspitzenwertmessung

Messmethode	Messung der Signalspitzenwerte (für positive und negative Polarität), basierend auf abgetasteten Spannungs-Momentanwerten.
Abtastfrequenz	ca. 700 kHz
Messbereichs-Konfiguration	

Spannungspitzenbereich

Spannungsbereich	15V	30V	60V	150V	300V	600V	1000V
Spannungsspitzenbereich	90,000V	180,00V	360,00V	900,00V	1,8000kV	3,6000kV	6,0000kV

Stromspitzenbereich

Strombereich	200mA	500mA	1A	2A	5A	10A	20A	50A
Stromspitzenbereich	1,2000A	3,0000A	6,0000A	12,000A	30,000A	60,000A	120,00A	300,00A

Messgenauigkeit	Wie die Spannungs oder Strommessgen. für DC und wenn 10 Hz ≤ f ≤ 1 kHz (f.s.: Spannungspitzenbereich oder Stromspitzenbereich). Dient als Referenzwert wenn 0,1 Hz ≤ f < 10 Hz und wenn 1 kHz überschritten wird.
Effektiv-Messbereich	±5% bis ±100% des Spannungsspitzenbereichs (bis zu ±1.500 V) oder ±5% bis ±100% des Stromspitzenbereichs (bis zu ±100 A)
Anzeigebereich	±0,3% bis ±102% des Spannungsspitzenbereichs oder des Stromspitzenbereichs (Werte unter ±0,3% werden nullunterdrückt)

Scheitelfaktor der Spannungs-/Strommessung

Messmethode	Berechnung aus Anzeigewerten je Aktualisierungsintervall für Spannung und Spannungsspitzen oder Strom und Stromspitzenwerte.
Effektiv-Messbereich	wie Effektiv-Messbereiche für Spannung und Spannungssignalspitzen oder Strom und Stromsignalspitzen.
Anzeigebereich	1,0000 bis 612,00 (keine Polarität)

Synchronsteuerung

Funktionen	Berechnungs-Timing, Aktualisierung der Anzeige, Aktualisierung der Daten, Integrations-Start/Stopp/Reset, Anzeige halten, Tastensperre und Nullpunktabgleich des Slave-Geräts 3336/3337(PW) werden mit dem Master-Gerät 3336/3337(PW) synchronisiert.
Anschluss	BNC-Anschluss × 1 (nicht isoliert)
Anschluss-Bezeichnung	EXT SYNC
I/O-Einstellungen	Off: Synchronsteuerung deaktiviert (aus) In : der EXT SYNC-Anschluss dient als Eingang und ein Synchronisierungssignal kann eingegeben werden (Slave). Out: der EXT SYNC-Anschluss dient als Ausgang und ein Synchronisierungssignal kann eingegeben werden (Master).
Anzahl der Geräte	für die Synchronsteuerung werden 1 Master- und 7 Slave-Geräte (insgesamt 8) miteinander verbunden

Spannungswelligkeitsrate / Stromwelligkeitsrate

Messmethode	Berechnung der AC-Komponenten (Spitze-Spitze [Spitzenbreite]) als proportionell zur Spannungs- oder Strom-DC-Komponenten
Effektiv-Messbereich	Wie für Spannung und Spannungsspitzenwerte oder Strom und Stromspitzenwerte
Anzeigebereich	0,00[%] bis 500,00[%]
Polarität	keine

Effizienzmessung

Messmethode	Berechnung der Effizienz η [%] aus dem Verhältnis der Wirkleistungswerte für Kanäle und Verdrahtung
Messsysteme und Berechnungsformeln	basierend auf AC+DC gleichgerichteter Wirkleistung

3336(PW)

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

3337(PW)

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

Effektiv-Messbereich	wie der Effektiv-Messbereich der Wirkleistung
Anzeigebereich	0,00[%] bis 200,00[%]

Funktionen

Autmatische Messbereichseinstellung (AUTO)	Automatische Einstellung des Spannungs- und Strommessbereichs für jedes System, dem Eingang entsprechend Messbereich erhöhen : wenn der Eingang höher als 130% des Messbereichs ist oder wenn der Spitzenwert überschritten wurde. Messbereich verringern : wenn der Eingang niedriger als 15% des Messbereichs ist. keine Bereichsänderung jedoch, wenn der untere Spitzenwert erreicht wird.
Durchschnittswertberechnung (AVG)	. Für Spannung, Strom, Wirkleistung, Scheinleistung und Blindleistung. . Der Leistungsfaktor und Phasenwinkel werden aus den gemittelten Daten berechnet. . Messwerte (außer Spitzenwerte, Leistungsfaktor, Frequenz, Integrationswerte, T.AV, Scheitelfaktor, Stromwelligkeitsrate, Gesamtverzerrung der Oberschwingungen, und Oberschwingungen) werden gemittelt. . Methode : einfache Durchschnittswertberechnung . Anzahl der Iterationen und Aktualisierungsintervall der Anzeige

Anzahl der Iterationen	1(OFF)	2	5	10	25	50	100
Aktualisierungs-Intervall	200ms	400ms	1s	2s	5s	10s	20s

Skalierung (VT, CT)	Benutzerdefiniertes VT- und CT-Verhältnis für Messwerte. Diese Einstellungen können separat für jedes Messsystem gesetzt werden. VT-Einstellbereich : OFF (1,0), 0,1 bis 1,000 (Einst.: 0000) CT-Einstellbereich : OFF (1,0), 0,001 bis 1,000 (Einst: 0000)
HOLD (HOLD)	. Die Aktualisierung der Messwerte wird gestoppt und Messwerte werden zu einem Zeitpunkt angezeigt. . Auch für Messdaten aud der Kommunikationsfunktion. . Interne Berechnung (inkl. Integration und abgelaufene Integrationszeit) wird fortgeführt. . Analogausgang und Signalausgang werden nicht gehalten.
Den Maximalwert/ Minimalwert halten (MAX/MIN HOLD)	. Erfassung von Max.- und Min.-Messwerten und Max.- und Min.-Messwerten für die Spannungs- und Stromspitzen, die Anzeige wird gehalten. . Füt Daten mit Polarität: die Anzeige des Max.- und Min.-Wertes für die Absolutwerte wird gehalten (so dass die positive und negative Polaritätswerte ersichtlich sind). . Interne Berechnungen (inkl. Integration und abgelaufene Integrationszeit) werden weitergeführt. . Analogausgang und Signalausgang werden nicht gehalten.
Nullpunkt-Abgleich (0 ADJ)	Entmagnetisierung der Stromeingangs-Einheit DCCT und Nullpunktabgleich des Stromeingangs-Offsets.
Tastensperre (KEY LOCK)	Alle Tasten außer SHIFT und KEY LOCK werden im Messmodus gesperrt.
Backup	Back-Up für Einstellungen und Integrationsdaten nach dem Ausschalten des Geräts und im Falle eines Stromversorgungsausfalls.
System-Reset	. Initialisierung der Geräte-Einstellungen. . Kommunikations-relevante Einstellungen (Kom.-Geschwindigkeit, Adresse und LAN-Einstellungen) werden nicht zurückgesetzt.

Integrationsmessung

Messarten	Gleichrichter: AC+DC, AC+DC Umn Strom: Das Ergebnis der Strom-Effektivwert-Integration (Anzeigewerte) wird einmalig in jedem Aktualisierungsintervall (ca. 200 ms) als ein Integrationswert angezeigt. Wirkleistung: Das Ergebnis der Integration der Wirkleistungswerte durch Polarität, berechnet einmalig in jedem Zyklus für die gewählte Synchronquelle, wird als ein Integrationswert angezeigt. Gleichrichter: DC Das Ergebnis der Integration von Momentandaten der Abtastung von Strom und Wirkleistung durch Polarität wird als ein Integrationswert angezeigt. (Wenn die Wirkleistung AC- und DC-Komponenten enthält, wird die DC-Komponente nicht integriert)

Integrationsmessung

Messparameter	Gleichzeitige Integration folgender 6 Parameter für jeden Kanal (insgesamt 18 Parameter): Summe der Strom-Integrationswerte (angezeigt als Ah) Positive Strom-Integrationswerte (angezeigt als Ah+) Negative Strom-Integrationswerte (angezeigt als Ah-) Summe der Wirkleistungs-Integrationswerte (angezeigt als Wh) Positive Wirkleistungs-Integrationswerte (angezeigt als Wh+) Negative Wirkleistungs-Integrationswerte (angezeigt als Wh-)
Integrationszeit	1 min. bis 10,000 h., einstellbar in 1 min.-Sätzen
Integrationszeit-Genauigk.	±100 ppm ±1 dgt. (0°C bis 40°C)
Integrations-messgenauigkeit	(Genauigkeit der Strom- oder Wirkleistungsmessung) + (±0,01% rdg. ±1 dgt.)
Effektiv-Messbereich	bis PEAK OVER U oder PEAK OVER I angezeigt wird
Auflösung der Anzeige	999.999 (6 Digit + Dezimalpunkt)
Funktionen	. Stoppen der Integration mit der Zeitsteuerung (timer) . Anzeige der abgelaufenen Integrationszeit (wird als TIME auf dem Bildschirm angezeigt) . Zusätzliche Integration durch wiederholtes Starten/Stoppen . Back-Up von Intergationswerten und der abgelaufenen Integrationszeit während eines Stromversorgungsausfalls . Stoppen der Integration nach einem Stromversorgungsausfall
Externe Steuerung	Integration stoppen/starten und Reset von Integrationswerten durch externe Steuerung
Messbereich	entspricht dem eingestellten Messbereich für die START-Integration

Durchschn. Zeit bei Strom- / Wirkleistungsmessung (T.AV)

Messmethode	Berechnung durch Teilen des Integratioswertes durch die Integrationszeit
Messgenauigkeit	±(Strom- oder Wirkleistungs-Messgenauigkeit) ±(±0,01%rdg. ±1dgt.)
Effektiv-Messbereich	wie bei Strom- oder Wirkleistungsmessung

Oberschwingungsmessung (interne Funktion)

Measurement method	. Gleichzeitige Nulldurchgangsberechnungsmethode (Aufteilung der Werte nach Kanälen, gemäß der Verdrahtung) . Gleichmäßige Ausdünnung zwischen Nulldurchgangsereignissen nach Bearbeitung mit einem digitalen Antialiasing-Filter . Interpolationsberechnungen (Lagrange-Interpolation) . Wenn die Synchronisierungsfrequenz zwischen 45 Hz bis 66 Hz liegt » gemäß IEC 61000-4-7:2002 » Lücken und Überlappungen können bei anderen Messfrequenzen als 50 Hz oder 60 Hz auftreten . Wenn die Synchronisierungsfrequenz nicht im 45 Hz bis 66 H-Bereich liegt » weder Lücken noch Überlappungen werden auftreten
Synchronisationsquelle	konform mit der Synchronisierungsquelle (SYNC) der allgemeinen Messdaten
Messkanäle	3
Messparameter	. Effektivwert (RMS) der harm. Spannung . Prozebtanteil der harm. Spannung % . Phasenwinkel der harm. Spannung . Effektivwert des harm. Stroms . Prozentanteil des harm. Stroms % . Phasenwinkel des harm. Stroms . Harm. Wirkleistung . Oberschwingungsanteil Wirkleistung % . Phasendifferenz der harm. Spannung/ des h. Stroms . Gesamtverzerrung der harm. Spannung . Gesamtverzerrung des harm. Stroms . Grundschwingung der Spannung . Strom-Grundschwingung . Grundschwingung der Wirkleistung . Grundschwingung der Scheinleistung . Grundschwingung der Blindleistung . Leistungsfaktor der Grundschwingung . Phasendifferenz der Spannungs-/Strom-Grundschwingung . Phasendifferenz der Grundschwingung für zwischenkanalige Spannung . Phasendifferenz der Grundschwingung für zwischenkanaligen Strom . Folgende Parameter können als Daten während der PC-Kommunikation heruntergeladen, jedoch nicht angezeigt werden: . Phasenwinkel der harm. Spannung . Phasenwinkel des harm. Stroms . Phasendifferenz der harm. Spannung/ des harm. Stroms
FFT-Wortlänge	32 Bit
Anzahl FFT-Punkte	4.096
Fenster-Funktion	rechteckig
Breite des Analysefensters	45 Hz ≤ f < 56 Hz 178,57 ms bis 222,22 ms (10 Zyklen) 56 Hz ≤ f < 66 Hz 181,82 ms bis 214,29 ms (12 Zyklen) andere Frequenzen 185,92 ms bis 214,08 ms
Daten-Aktualisierung	abhängig von der Festerbreite
Synchronizations-Frequenzbereich	10 Hz bis 640 Hz

Höchste analysierte Ordnung	
Synchron. Frequenzbereich (f)	Analysierte Ordnung
10 Hz ≤ f < 45 Hz	50.
45 Hz ≤ f < 56 Hz	50.
56 Hz ≤ f ≤ 66 Hz	50.
66 Hz < f ≤ 100 Hz	50.
100 Hz < f ≤ 200 Hz	40.
200 Hz < f ≤ 300 Hz	25.
300 Hz < f ≤ 500 Hz	15.
500 Hz < f ≤ 640 Hz	11.

Oberer Grenzwert für analysierte Ordnung	2. bis 50.

Messgenauigkeit f.s.: Messbereich

Frequenz (f)	Spannung, Strom, Wirkleistung
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.

Für DC hinzuaddieren: ±1 mA zu Strom und (±1 mA) × (Spannungsanzeigewert) zu Wirkleistung.

Anzeige

Anzeige	7-Stellen-LED
Anzahl der angezeigten Parameter	4
Auflösung	Nicht integrierte Werte: 99.999 count Integrierte Werte: 999.999 count
Aktualisierungsrate	200 ms ±50 ms (ca. 5 Mal pro s) bis 20 s (je nach Anzahl von Mittelungs-Iterationen)

Eingangsdaten für externe Stromzangen (eingebaut)

Anschluss	Isolierte BNC-Anschlüsse, 1 pro Kanal
Stromzangentyp-Einstellung	Off / Typ 1 / Typ 2 Wenn deaktiviert (off), wird das Eingangssignal am externen Stromzangeneingang ignoriert.
Stromzangen	Typ 1 9661 (500 A AC) 9669 (1,000 A AC) 9660 (100 A AC) 9667(CT) (500 A / 5,000 A AC) Typ 2 (9555-10 und 9217L wird benötigt; bei Bestellung angeben) 9272-10 (20 A/200 A AC) 9277 (20 A AC/DC) 9278 (200 A AC/DC) 9709 (500 A AC/DC) 6862(CT) (50 A AC/DC) 6863(CT) (200 A AC/DC) CT6865 (1,000 A AC/DC)
Strommessbereich	Autom. / 10 A / 20 A / 50 A Benutzerdefiniert für jede Verdrahtungsart. Kann bei der manuellen Einstellung des CT-Verhältnisses direkt abgelesen werden.
Leistungsmessbereichs-Konfiguration	Abhängig von der Kombination der Spannungs und Strombereiche; von 60,000W bis 15,000MW (betrifft auch VA, var)
Messgenauigkeit Strom, Wirkleistung	

Frequenz	Eingang < 50%f.s.	50%f.s. ≤ Eingang < 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.: jeder Messbereich
•Für die Genauigkeit des Stroms oder der Wirkleistung wird zu den obigen Werten die Genauigkeit der Stromzange hinzuaddiert.
Der Effektiv-Messbereich und die Frequenz-Charakteristik passen sich der Spezifikation der Stromzange.
•Strom- und Wirkleistungswerte, für die 0,1 Hz ≤ f < 10 Hz dienen nur als Referenzwerte.
•Spannungswerte über 200 V und Wirkleistungswerte, für die 10 Hz ≤ f < 16 Hz dienen nur als Referenzwerte.

Temperatur-charakteristik	Strom, Wirkleistung : ±0,08% f.s./°C (Temperatur-Koeffizient des Geräts; f.s.: Messbereich des Geräts); Temperatur-Koeffizienten der Stromzange zur obigen Angaben hinzuaddieren.
Einfluß des Leistungsfaktors	· Gerät: bis ±0,15% f.s. (45 Hz bis 66 Hz mit Faktor = 0) · Phasendifferenz des internen Schaltkreises für Spannung/Strom: ±0,086° · Phasengenauigkeit der Stromzange zur obigen Angaben für Phasendifferenz des interner Schaltkreises für Spannung/Strom hinzuaddieren.
Genauigkeit der Stromspitzenwert-messung	· (Genauigkeit der Stromzange) + (±2,0% f.s.) (f.s.:Stromspitzenbereich) Zu den obigen Werten die Genauigkeit der Stromzange hinzuaddieren.
Genauigkeit der Oberschwingungs-messung	

Frequenz	Spannung	Strom, Wirkleistung
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.: jeder Messbereich
•Für die Genaugkeit des Stroms oder der Wirkleistung, wird zu den obigen Werten die Genauigkeit der Stromzange hinzuaddiert.

D/A-Ausgang (3336-02/-03(PW) und 3337-02/-03(PW))

Anzahl der Kanäle	16
Konfiguration	16-bit D/A-Wandler (Polarität + 15 Bit)
Ausgangs-parameter	U1 bis U3 (Spannungspegel) oder u1 bis u3 (Momentanspannungssignal) (umschaltbar) I1 bis I3 (Strompegel) oder i1 bis i3 (Momentanstromsignal) (umschaltbar) P1 bis P3 (Wirkleistungspegel) oder p1 bis p3 Momentanleistungssignal) (umschaltbar) Psum (Wirkleistungspegel) oder Hi-Psum (High-Speed-Wirkleistungspegel) (umschaltbar) Psum- und Hi-Psum-Ausgang mit 1P2W-System nicht möglich (0 V). P12 wird ausgegeben bei der Verwendung von 1P3W, 3P3W, oder 3P3W2M, und P123 bei der Verwendung von 3V3A, 3P3W3M, oder 3P4W. D/A1 bis D/A3 : einen der 3 Kanäle oder den Gesamtwert für Spannung, Strom, Wirkleistung, Scheinleistung, Blindleistung, Leistungsfaktor, Phasenwinkel, harm. Gesamtverzerrung Spannung/Strom, Phasendifferenz für zwischenkanalige Spannung/Strom -Grundschwingung, Scheitelfaktor Spannung/Strom, Zeitdurchschnitt für Strom/Wirkleistung, Spannung/Strom-Oberschwingungsanteil, Frequenz, Effizienz, Stromintegration, Wirkleistungsintegration (Oberschwingungsausgang für individuelle Ordnungen nicht möglich). Hi-P1 bis Hi-P3 und Hi-Psum (High-Speed-Wirkleistungspegel): fest AC+DC Für anderen Pegelausgang AC+DC, AC+DC Umn, DC, AC oder fnd auswählen.
Ausgangs-genauigkeit	f.s.: Relativ zum Nennwert der Ausgangsspannung für jeden Ausgangsparameter Pegel-Ausgang : (Messgenauigket des Ausgangsparameters) + (±0,2% f.s.) Ausgang des High-Speed-Wirkleistungspegels : (Messgenauigket des Ausgangsparameters) + (±0,2% f.s.) Momentansignalausgang : (Messgenauigket des Ausgangsparameters) + (±1,0% f.s.) Momentanspannung, Momentanstrom: Effektivwert-Pegel (RMS) Momentanleistung: Durchschnittswert-Pegel
Frequenzband des Ausgangs	Momentansignalausgang, High-Speed-Wirkleistungspegel Bei DC oder 10 Hz bis 5 kHz, siehe Genauigkeitsangaben oben.
Ausgangsspannung	Pegelausgang Spannung, Strom, Wirkleistung, Scheinleistung, Blindleistung, Zeitdurchschnitt Strom/Wirkleistung : ±2 V DC für ±100% vom Messbereich Leistungsfaktor : ±2 V DC bei ±0,0000, 0 V DC bei ±1,0000 Phasenwinkel : 0 V DC bei 0,00°, ±2 V DC bei ±180,00° Oberschwingungsanteil Spannung/Strom, Gesmtverzerrung harm. Spannung/Strom : + 2 V DC at 100.00% Scheitelfaktor Spannung/Strom : +2 V DC bei 10,000 Frequenz : je nach Messwert. +2 V DC pro 100 Hz von 0,1000 Hz bis 300,00 Hz +2 V DC pro 10 kHz von 300,01 Hz bis 30,000 kHz +2 V DC pro 100 kHz von 30,001 kHz bis 220,00 kHz Effizienz : +2 V DC bei 200,00% Stromintegration, Wirkleistungsintegration : ±5 V DC bei (Bereich) × (eingestellte Integrationszeit) Signalausgang : 1 V f.s. relativ zu 100% des Messbereichs
Max. Ausgangspannung	ca. ±12 V DC
Aktualisierungsrate	Pegelausgang : Fest bei 200 ms ±50 ms (ca. 5 x/s.) unabhängig von der Anzahl der eingestellten durchschn. Wiederholungen und Benutzung der Haltefunktion. Signalausgang : ca. 11,4 µs (ca. 87.5 kHz) High-Speed P-Pegel : Akualisierung ein Mal pro Zyklus für das Eingangssignal, das als Synchronisieungsquelle gesetzt wurde.
Ansprechzeit	Pegelausgang : bis 0,6 s (wenn das Ausgangssignal abrupt von 0% auf 90%, oder von 100% auf 10% übergeht, ist dies die notwendige Zeit, um die Messbereichgenauigkeit zu gewährleisten) Signalausgang: bis 0,2 ms Ausgang für Wirkleistungspegel: 1 Zyklus
Temperaturcharakteristik	bis ±0,05% f.s./°C
Ausgangswiderstand	100 Ω ±5 Ω

Externe Steuerung (eingebaut)

Funktionen	Integration Start/Stopp, Integrations-Reset und Halten über externe Strg.
Externe Steuerung	Eingangssignalpegel: 0 bis 5 V (High-Speed CMOS-Pegel oder kurzgeschlossen [Lo]/open [Hi])

Funktionen	Externes Steuersignal	Externer Steueranschluss
Start	Hi → Lo	START/STOP
Stopp	Lo → Hi	
Reset	Lo-Intervall von mind. 200 ms	RESET
Hold on	Hi → Lo	HOLD
Hold off	Lo → Hi	

GP-IB-Schnittstelle [3336-01/-03(PW), 3337-01/-03(PW)]

Methode	Normengerecht mit IEEE488.1 1978; siehe IEEE488.2 1987 Schnittstellen-Funktionen: SH1, AH1, T6, L4, SR1, RL1, PP0, DC1, DT1, C0 Fernsteuerung durch Fernbedienung
Adresse	00 bis 30

RS-232C-Schnittstelle (eingebaut)

Stecker	D-Sub 9-polig × 1
Kommunikations-methode	Full duplex, Start-Stopp-Synchronisierung, Stop bits: 1 (fest), Datenbits: 8 (fest), Parität: keine Fernsteuerung durch Fernbedienung
Kom. Geschwindigkeit	9600bps/ 38400bps

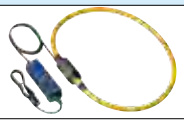
LAN-Schnittstelle (eingebaut)

Stecker	RJ-45 × 1
Elektrische Daten	normengerecht mit IEEE802.3
Übertragungsmethode	10BASE-T/100BASE-TX (automatische Erkennung)
Protokoll	TCP/IP
Funktionen	HTTP-Server (Fernsteuerung, Firmware-Updates) Einzelne Ports (Befehlssteuerung, Datentransfer) Fernsteuerung durch Fernbedienung (REMOTE-Diode leuchtet auf.)

Allgemeine Daten (Produkt-Garantie: 1 Jahr)

Betriebsumgebung	In Innenräumen, bis zu 2000 m Meereshöhe, Verschmutzungsgrad 2
Betriebstemperatur und -feuchte	0 to 40°C, bis 80% rel. Feuchte (nicht kondensierend)
Lagertemperatur und -feuchte	-10 bis 50°C, bis 80% rel. Feuchte (nicht kondensierend)
Spannungsfestigkeit	4.290 Veff AC (Prüfstrom: 1 mA) Zwischen Spannungseingängen und (Gehäuse, Schnittstellen und Ausgängen) Zwischen Strom-Direkteingängen und (Gehäuse, Schnittstellen und Ausgängen) Zwischen Spannungseingängen und Strom-Direkteingängen
Max. Spannung gegen Erde	Spannungseingang, Strom-Direkteingang Messkategorie III 600 V (Prüfstoßspannung 6000 V) Messkategorie II 1000 V (Prüfstoßspannung 6000 V)
Max. Eingangsspannung	Zwischen Spannungseingängen U: 1,000 V, ±1,500 V_{Spitze}
Max. Eingangsstrom	Zwischen +/- Strom-Direkteingängen I: ±70 A, ±100 A_{Spitze}
Normenkonformität	Sicherheit : EN61010, EMV : EN61326 Class A/ EN61000-3-2/ EN61000-3-3
Max. Netzspannung	100 VAC bis 240 VAC, Netzfrequenz : 50/60 Hz
Max. Stromaufnahme	bis 40 VA
Abmessungen	ca. 305B × 132H × 256T mm (ohne herausragende Teile)
Gewicht	3336(PW)-Serie ca. 5 kg, 3337(PW)-Serie ca. 6 kg
Zubehör	Bedienungsanleitung × 1, Messanleitung × 1, Netzkabel × 1

Optionen für die Strommessung [Typ 1] - Technische Daten (anschließbar an die Stromzangen-Eingänge der 3336/3337(PW)-Serie.)

Modell	STROMZANGE 9660	STROMZANGE 9661	STROMZANGE 9669	FLEXIBLE STROMZANGE CT9667
Erscheinungsbild				
Primärstrom	100A AC	500A AC	1000 A AC	500A AC, 5000A AC
Max. Leiterdurchmesser	Max.φ15mm	Max.φ46mm	Max. φ55 mm, 80 ×20 mm Busschiene	Max. φ254mm
Amplitudengenauigkeit *	±0,3%rdg.±0,02%f.s. *	±0,3%rdg.±0,01%f.s. *	±1,0%rdg.±0,01%f.s. *	±2,0%rdg.±0,3%f.s. *
Phasengenauigkeit *	bis ±1° *	bis ±0,5° *	bis ±1° *	bis ±1° *
Frequenzcharakteristik	bis ±1,0% für 66Hz bis 5kHz (Abweichung von der spezifizierten Genauigkeit)		innerhalb ±2% bei 40Hz bis 5kHz (Abweichung von der Genauigkeit)	bis ±3dB für 10 Hz bis 20kHz (innerhalb ±3dB)
Betriebstemperatur u. -feuchte	0 bis 50°C, bis 80% rel. Feuchte (nicht kondensierend)			0 bis 40°C, bis 80% rel. Feuchte, 40 bis 50°C, bis 50% rel. Feuchte
Einfluss der Leiterposition	innerhalb ±0,5% (Abweichung von der Mitte)		innerhalb ±1,5% (Abweichung von der Mitte)	innerhalb ±3% (Abweichung von der Mitte)
Einfluss externer elektromagn. Felder	Äquivalent zu 0,1A oder weniger (400A/m,55Hz)		Äquivalent zu 1A oder weniger (400A/m, 55Hz)	1,5% f.s. oder weniger (400A/m, 55Hz)
Max. Spannung gegen Erde	CAT III 300Veff		CATIII 600Veff	CATIII 1000 Veff, CATIV 600 Veff
Abmessungen, Gewicht	46W × 135H × 21Dmm, 230g	78B × 152H × 42T mm, 380g	99,5B × 188H × 42T mm, 590g	Schaltkreisbox: 35B × 120,5H × 34T mm, 140 g
Stromversorgung	—	—	—	LR6 alkalische Batterien x2, oder AC-Netzteil (Option)
Optionen	—	—	—	AC-NETZTEIL 9445-03

* : 45 bis 66Hz

Optionen für die Strommessung [Typ 2] - Technische Daten (Stromversorung 9555-10 und Anschlusskabel 9217(L) werden benötigt.)

Modell	STROMZANGE 9272-10	BREITBAND-STROMZANGE 9277	BREITBAND-STROMZANGE 9278
Erscheinungsbild			
Primärstrom	20A/200A AC	20A AC/DC	200A AC/DC
Max. Leiterdurchmesser	Max.φ 46mm	Max.φ 20mm	
Amplitudengenauigkeit *	±0,3%rdg.±0,01%f.s. *	±0,5%rdg.±0.05%f.s. (30 Minuten nach dem Einschalten und der Magnetisierung) *	
Phasengenauigkeit *	bis ±0,2°	±0,2° (30 Minuten nach dem Einschalten und der Magnetisierung) *	
Frequenz-charakteristik** (typisch)	1Hz bis 5Hz: ±2%rdg.±0,1%f.s. 1kHz bis 5kHz: ±1%rdg.±0,05%f.s. (±1,0°) 10kHz bis 50kHz: ±5%rdg.±0,1%f.s.	DC bis 1kHz: ±1,0% (±0,5°) 1 k bis 50 kHz: ±2,5 % (±2,5°) 50 k bis 100 kHz: ±5.0 % (±5,0°)	
Betriebstemperatur u. -feuchte	0°C bis 50°C, bis 80% rel. Feuchte, (nicht kondensierend)	0°C bis 40°C, bis 80% rel. Feuchte, (nicht kondensierend)	
Einfluss der Leiterposition	innerhalb ±0,2%rdg. (Abweichung von der Mitte)	innerhalb ±0,2%rdg. (Abweichung von der Mitte)	innerhalb ±1,5%rdg. (Abweichung von der Mitte)
Einfluss externer elektromagn. Felder	Äquivalent zu 0,1A oder weniger (400A/m, 55Hz)	Äquivalent zu 0,2A oder weniger (400A/m, 55Hz und DC)	Äquivalent zu 1A oder weniger (400A/m, 55Hz und DC)
Max. Spannung gegen Erde	CAT III 600Veff	CAT III 300Veff	CAT III 300Veff
Abmessungen, Gewicht	78B × 188H × 35T mm, 430g	176B × 69H × 27T mm, 470g	
Stromversorgung	Stromversorgung 9555-10		
Optionen (angeben)	Stromversorgung 9555-10, Anschlusskabel 9217(L)		

Modell	AC/DC STROMZANGE 6862(CT)	AC/DC STROMZANGE 6863(CT)	AC/DC STROMZANGE 9709	AC/DC STROMZANGE CT6865
Erscheinungsbild				
Primärstrom	50A AC/DC	200A AC/DC	500A AC/DC	1000A AC/DC
Max. Leiterdurchmesser	Max.φ 24mm		Max.φ 36mm	
Amplituden-genauigkeit *	±0,05 %rdg.±0,01 % f.s. , ±0,2° (unmittelbar nach dem Einschalten bei DC und 16Hz bis 400Hz)		±0,05 %rdg.±0,01 % f.s. , ±0,2° (10 minutes after power is turned on)	±0,05 %rdg.±0,01 % f.s. , ±0,2°
Phasengenauigkeit *	±0,05 %rdg.±0,01 % f.s. , ±0,2° (unmittelbar nach dem Einschalten bei DC und 16Hz bis 400Hz)		±0,05 %rdg.±0,01 % f.s. , ±0,2° (10 Minuten nach dem Einschalten)	±0,05 %rdg.±0,01 % f.s. , ±0,2°
Frequenz-charakteristik** (typisch)	DC bis 16 Hz: ±0,1%rdg.±0,02%f.s.(±0,3°) 5kHz bis 10kHz: ±1%rdg.±0,02%f.s. (±1,0°) 500kHz bis 1M Hz: ±30%rdg.±0,05%f.s. ***	DC bis 16 Hz: ±0,1%rdg.±0,02%f.s.(±0,3°) 5kHz bis 10kHz: ±1%rdg.±0,02%f.s. (±1,0°) 300kHz bis 500k Hz: ±30%rdg.±0,05%f.s.***	DC bis 45Hz: ±0,2%rdg.±0,02%f.s.(±0,3°) 5kHz bis 10kHz: ±2%rdg.±0.1%f.s. (±2,0°) 20kHz bis 100kHz: ±30%rdg.±0.1%f.s. (±30°)	DC bis 16Hz: ±0.1%rdg.±0,02%f.s.(±0,3°) 500Hz bis 10kHz: ±5%rdg.±0,05%f.s. 10kHz bis 20kHz: ±30%rdg.±0.1%f.s.
Betriebstemperatur u. -feuchte	-30°C bis 85°C, bis 80% rel. Feuchte, (nicht kondensierend)		9709: 0°C bis 50°C, bis 80% rel. F.	-30°C bis 85°C, bis 80% rel. F.
Einfluss der Leiterposition	innerhalb ±0,01%rdg. (Abweichung von der Mitte)	innerhalb ±0,01%rdg. (Abweichung von der Mitte)	innerhalb ±0,05%rdg. (Abweichung von der Mitte)	innerhalb ±0,05%rdg. (Abweichung von der Mitte)
Einfluss externer elektromagn. Felder	Äquivalent zu 10mA oder weniger (400A/m, 60Hz und DC)	Äquivalent zu 50mA oder weniger (400A/m, 60Hz und DC)	Äquivalent zu 50mA oder weniger (400A/m, 60Hz und DC)	Äquivalent zu 200mA oder weniger (400A/m, 60Hz und DC)
Max. Spannung gegen Erde	CAT III 1000Veff	CAT III 1000Veff	CAT III 1000Veff	CAT III 1000Veff
Abmessungen, Gewicht	70B × 100H × 53T mm, 6862(CT): 340g, 6863(CT): 350g		160B × 112H × 50T mm, 9709: 850g, 9895(CT): 1000g	
Stromversorgung	Stromversorgung 9555-10			
Optionen (angeben)	Stromversorgung 9555-10, Anschlusskabel 9217(L)			

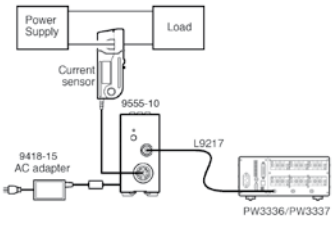
* : 45 bis 66 Hz, DC: DC-kompatible Stromzangen ** : mit Unterlastung *** : keine Phasen-Präzisionsregulation

Stromzangen-Optionen für Typ 2

	Stromversorgung 9555-10
Erscheinungsbild	
Kompatible Strom-zangen	9272-10, 9277, 9728, 6862(CT), 6863(CT), 9709, 6865(CT)
Ausgänge	BNC-Anschlüsse
Stromversorgung	AC-Netzteil 9418-15 (100 bis 240 V AC)
Zubehör	Bedienungsanleitung, AC-Netzteil 9418-15

	Anschlussleitung L9217
Erscheinungsbild	
Kabellänge	3 m
Anschlüsse	Isolierte BNC - isolierte BNC

Typ 2 Anschluss-Diagramm



Hauptgerät

LEISTUNGSMESSGERÄT	3336(PW)	(2-Kanäle)
	3336-01(PW)	(2-Kanäle, mit GP-IB)
	3336-02(PW)	(2-Kanäle, mit D/A-Ausgang)
	3336-03(PW)	(2-Kanäle, mit GP-IB und D/A-Ausgang)
LEISTUNGSMESSGERÄT	3337(PW)	(3-Kanäle)
	3337-01(PW)	(3-Kanäle, mit GP-IB)
	3337-02(PW)	(3-Kanäle, mit D/A-Ausgang)
	3337-03(PW)	(3-Kanäle,mit GP-IB und D/A-Ausgang)

Zubehör: Bedienungsanleitung × 1, Messanleitung × 1, Netzkabel × 1

Optionen für die Strommessung: Typ 1 (weitere Informationen siehe S. 11.)
Zum Anschließen an die Stromzange-Eingänge der 3336/3337(PW).

Für 50/60Hz-Netzversorgungen

STROMZANGE
9660
100A AC
φ15mm

STROMZANGE
9661
500A AC
φ46mm

STROMZANGE 9669
1000A AC
φ55mm
80×20 mm Busschienen

FLEXIBLER STROMSENSOR 9667(CT)
500A AC/ 5000A AC (wählbar),
φ254mm,
Stromversorgung: LR06 alkalische Batterien oder AC-NETZTEIL 9445-03 (bei Bestellung angeben)

Optionen für die Strommessung: Typ 2
(weitere Informationen siehe S. 11.)

STROMVERSORGUNG 9555-10 und ANSCHLUSSKABEL 9217(L) werden benötigt

STROMZANGE
9272-10
20A/ 200A AC
φ46mm
Stromversorgung: 9555-10

BREITBAND-STROMZANGE
9277
20A AC/DC
φ20mm
Stromversorgung: 9555-10

BREITBAND-STROMZANGE
9278
200A AC/DC
φ20mm
Stromversorgung: 9555-10

STROMVERSORGUNG
9555-10
Stromversorgung:
100V bis 240V AC
(50/60Hz)

AC/DC STROMZANGE
6862(CT)
50A AC/DC
φ24mm
Stromversorgung: 9555-10

AC/DC STROMZANGE
6863(CT)
200A AC/DC
φ24mm
Stromversorgung: 9555-10

AC/DC STROMZANGE
9709
500A AC/DC
φ36mm
Stromversorgung: 9555-10

AC/DC STROMZANGE
6865(CT)
1000A AC/DC
φ36mm
Stromversorgung: 9555-10

ANSCHLUSSKABEL
9217(L)
Für Stromzangenausgang
Kabellänge: 3m
Isolierte BNC - isolierte BNC

Optionen für die Kommunikation und Steuerung

RS-232C-KABEL
9637
Kabellänge: 1,8m)
9-polig - 9-polig

RS-232C-KABEL
9638
Kabellänge: 1.8m (5.91ft)
9-polig - 25-polig

GP-IB ANSCHLUSSKABEL
9151-02
Kabellänge: 2m

LAN-KABEL
9642
Kabellänge: 5m
Lieferung mit einem gerade/ gekreuztem-Adapterkabel

ANSCHLUSSKABEL
9165
Für synchronisierte Steuerung
Kabellänge: 1,5 m,
Metall-BNC - Metall-BNC

Das Gerät darf ausschließlich von ausgebildeten Elektrofachkräften und/oder elektrotechnisch unterwiesenen Personen benutzt werden. Es darf nicht von elektrotechnischen Laien verwendet werden.

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Ursprungsdatei: PW3337E1-36M-03N vom 13.06.2013