Single-Phase AC/DC Power Meter

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

* For complete details, please refer to the specifications.
Single-Phase Power Meter with All-Round Capability

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

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

<table>
<thead>
<tr>
<th>Measured power parameters</th>
<th>Voltage</th>
<th>Current</th>
<th>Effective power</th>
<th>Apparent power</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reactive power</td>
<td>Power factor</td>
<td>Phase angle</td>
<td>Frequency</td>
<td></td>
</tr>
<tr>
<td>Integral current</td>
<td>Effective integral power</td>
<td>Waveform peak value</td>
<td>Crest factor</td>
<td></td>
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<tr>
<td>Maximum current ratio</td>
<td>Time-averaged current</td>
<td>Time-averaged effective power</td>
<td>Ripple rate</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Harmonic measurement parameters</th>
<th>Harmonic effective value</th>
<th>Harmonic effective power</th>
<th>Total harmonic distortion</th>
<th>Fundamental wave power factor (displacement power factor)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Harmonic wave content</td>
<td>Fundamentals waves</td>
<td>Harmonic wave content</td>
<td>Total harmonic distortion</td>
<td>Harmonic wave power factor (displacement power factor)</td>
</tr>
</tbody>
</table>

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

*1 : For complete details, please refer to the specifications.
from AC/DC Standby to Operating Power

PW3335

Basic accuracy of ±0.1%*, the highest in its class

Precisely measure power to determine the energy-saving performance of electrical products. Your measurements are underpinned by its reliability and accuracy.

* For complete details, please refer to the specifications.

Greater accuracy for standby power

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

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

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

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

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

Power data and harmonic data — all measured simultaneously

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

Built-in harmonic measurement

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

Power consumption and regeneration (recharging) power integrated separately

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

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

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

Measure power in accordance with international standards

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

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

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

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

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

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

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

Download free software for creating IEC62301-compliant reports from the Hioki website.
Rich interfaces and extensibility

3 D/A output types (PW3335-02, PW3335-04)

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

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

Up to 8 units of simultaneous control

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

PC communication software

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

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

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

Pair with current sensors delivering a maximum accuracy of ±0.26% to measure 30 A and up (PW3335-03, PW3335-04)

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

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

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

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

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

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

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

## PW Communicator Specifications

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

### PW3335 series

- **Frequency bandwidth**: DC, 0.1 Hz to 100 kHz
- **Sampling**: 700 kHz digital sampling
- **Voltage measurement range**: 6 V to 1000 V
- **Current measurement range**: 1 mA to 20 A
- **Power measurement range**: Determined by combination of voltage and current ranges, 6.0000 mW and up
- **Basic accuracy (DC)**: Voltage/current/power: ±0.1% rdg, ±0.1% f.s.
- **Basic accuracy (45 Hz to 66 Hz)**: Voltage/current/power: ±0.1% rdg, ±0.05% f.s.
- **Effect of power factor**: ±0.1% f.s. with 45 Hz to 66 Hz, PF = 0
- **Communication interface**: LAN
- **Synchronous control**: Up to 8 meters
- **Harmonics measurement**: Available on all models
- **Current sensor support**: PW3335-03, PW3335-04
- **Auto-range integration function**: Available
- **D/A output**: 7 channels (level output, high-speed level output and waveform output selectable)
- **Time-averaged effective integral power**: Computable
- **Maximum current ratio (MCR)**: Computable

### 3332

- **Frequency bandwidth**: 1 Hz to 100 kHz
- **Sampling**: Analog computation
- **Voltage measurement range**: 15 V to 600 V
- **Current measurement range**: 1 mA to 50 A
- **Power measurement range**: Determined by combination of voltage and current ranges, 15.0000 mW and up
- **Basic accuracy (DC)**: Voltage/current/power: ±0.1% rdg, ±0.1% f.s.
- **Basic accuracy (45 Hz to 66 Hz)**: Voltage/current/power: ±0.1% rdg, ±0.1% f.s.
- **Effect of power factor**: ±0.23% f.s. with 45 Hz to 66 Hz, PF = 0
- **Communication interface**: RS-232C
- **Synchronous control**: GP-IB
- **Harmonics measurement**: Compliant with IEC61000-4-7:2002
- **Current sensor support**: PW3335-03, PW3335-04
- **Auto-range integration function**: Available
- **D/A output**: Level output (fixed voltage, current and effective power), Waveform output (fixed voltage and current), 1-channel D/A level output
- **Time-averaged effective integral power**: Computable
- **Maximum current ratio (MCR)**: Computable

**IEC62301-compliant reporting software**

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

**LabVIEW Driver**

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

**Comparison with Hioki legacy Model 3332**
## Specifications

### Input Specifications

**Measurement line type**
- Single-phase 2-wire (12V)

**Input methods**
- Voltage Isolated input, resistive voltage divider method

**Voltage ranges**
- AUTO/ 6.0000 V/ 15.000 V/ 30.000 V/ 60.000 V/ 150.00 V/ 300.00 V/ 600.00 V/

**Current ranges**
- AUTO/ 1.0000 mA/ 2.0000 mA/ 5.0000 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)

**Input resistance**
- Voltage input terminal: 1 mA to 100 mA range 520 mΩ or less
- 1 mA to 100 mA range 520 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

**Synchronization sources**
- U, I, DC (fixed to 200 ms)

**Measurement items**
- Voltage
  - Current
  - Apparent power
  - Phase angle
  - Frequency
  - Active power
  - Power factor
  - Integration time
  - Current waveform peak value
  - Voltage crest factor
  - Maximum current ratio
  - Time average active power
  - Voltage ripple rate

**Harmonic parameters**
- Harmonic voltage RMS value
- Harmonic current RMS value
- Total harmonic current distortion
- Fundamental wave voltage
- Fundamental wave active power
- Fundamental wave apparent power
- Fundamental wave reactive power
- Fundamental wave voltage current phase difference
- Harmonic voltage content percentage
- Harmonic current content percentage

**Rectifiers**
- AC : DC, AC : DC measurement
- Display of true RMS values for both voltage and current
- AC : DC Umm : 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

**Zero-cross Filter**
- 100 Hz: 0.1 Hz to 100 Hz
- 5 kHz: 0.1 Hz to 5 kHz
- 100 kHz: 0.1 Hz to 100 kHz

### Active power

**Frequency (f) in kHz**

<table>
<thead>
<tr>
<th>Frequency (f)</th>
<th>Input &lt; 50 kHz</th>
<th>50 kHz &lt; f &lt; 10 kHz</th>
<th>10 kHz &lt; f &lt; 16 Hz</th>
<th>f &lt; 45 Hz</th>
<th>45 Hz ≤ f &lt; 66 Hz</th>
<th>66 Hz ≤ f &lt; 100 kHz</th>
<th>100 kHz ≤ f &lt; 500 kHz</th>
<th>f &lt; 1 kHz</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voltage</td>
<td>±0.1%rdg.</td>
<td>±0.1%rdg.</td>
<td>±0.1%rdg.</td>
<td>±0.2%rdg.</td>
<td>±0.1%rdg.</td>
<td>±0.2%rdg.</td>
<td>±0.3%rdg.</td>
<td>±0.3%rdg.</td>
</tr>
<tr>
<td>Current</td>
<td>±0.1%rdg.</td>
<td>±0.1%rdg.</td>
<td>±0.1%rdg.</td>
<td>±0.2%rdg.</td>
<td>±0.1%rdg.</td>
<td>±0.2%rdg.</td>
<td>±0.3%rdg.</td>
<td>±0.3%rdg.</td>
</tr>
</tbody>
</table>

**Effective measuring range**

| Voltage      | ±1% to ±3% of the range (1000 V range, up to 1000 V) |
| Current      | ±1% to ±3% of the range (1000 V range, up to 1000 V) |

**Guaranteed accuracy period**

| Zero-cross Filter | 1 year |

**Conditions of guaranteed accuracy**

- Temperature coefficient: ±0.03% per °C or less.
- However, 1 mA range, ±0.06% per °C or less.
Effect of power factor
\[ \pm 0.1\% / \text{x}, \text{ or less (45 to 66 Hz, at power factor } = 0) \]
Internal circuitry voltage/current phase difference: \[ \pm 0.05\% \]

Effect of common mode voltage
\[ \pm 0.01\% / \text{x}, \text{ or less (600 V, 50 Hz/60 Hz, applied between input terminals and enclosures) } \]

Effect of magnetic field
400 A/m, DC and 50 Hz/60 Hz magnetic field
Voltage: \[ \pm 1.5\% / \text{x}, \text{ or less } \]
Current: \[ \pm 1.5\% / \text{x}, \text{ or less than or equal to the following value, whichever is greater } \]
200 ma/500 ma/1 mA/2 A/5 A/10 A/20 A range: \[ \pm 20 \text{ mA} \]
1 ma/2 ma/3 ma/5 mA/10 mA/20 ma/50 ma/100 ma range: \[ \pm 200 \mu \text{A} \]
Active power: \[ 
\pm 3.0\% / \text{x}, \text{ or less than or equal to the following value, whichever is greater } \]
200 ma/500 ma/1 A/2 A/5 A/10 A/20 A range:
Voltage (influence quantity): \[ \pm (20 \text{ mA}) \]
Current (influence quantity): \[ \pm (200 \mu \text{A}) \]

Effect of self-heating
With input of at least 15 A to current input terminals
Effective measurement range
AC input signal:
\[ \pm 0.025+0.005\times(1-15)\% / \text{rdg. or less } \]
DC input signal:
\[ \pm (0.025+0.005-0.1\times(1-10)\% \text{ma}) \text{ or less } \]
Current range:
\[ \pm (0.025+0.005-0.1\times(1-15)\mu \text{A}) \text{ or less } \]
Current read value (A)
Active power: above current influence quantity \[ \times \] (voltage read value) or less

The effects of self-heating will continue to manifest themselves until the input resistance temperature falls, even if the current value is low.

Voltage/ Current/ Active Power Measurement Specifications

<table>
<thead>
<tr>
<th>Measurement types</th>
<th>Rectifiers: AC, DC, AC, FND, AC+DC Umn</th>
</tr>
</thead>
</table>
| Effective measuring range | Voltage: \[ \pm 1\% \text{ to } \pm 150\% \text{ of the range. } \text{However, up to } \pm 1500 \text{ V peak value and } 1000 \text{ V RMS value } \]
Current: \[ \pm 1\% \text{ to } \pm 150\% \text{ of the range } \]
Active Power: \[ \pm 0\% \text{ to } \pm 225\% \text{ of the range. However, valid when the voltage and current fall within the effective measurement range. } \]

Display range
Voltage: Up to \[ \pm 152\% \text{ of the range. However, zero-suppression when less than } 0.5\% \]
Current: Up to \[ \pm 152\% \text{ of the range. However, zero-suppression when less than } 0.5\% \text{ or less than } 9 \mu \text{A. } \]
Active Power: \[ \pm 0\% \text{ to } \pm 231\% \text{ of the range (no zero-suppression) } \]

Polarity
Voltage/Current
Displayed when using DC rectifier
Active Power: Positive: Power consumption (no polarity display) Negative: generation or regenerated power

Frequency Measurement Specifications

<table>
<thead>
<tr>
<th>Number of measurement channels</th>
<th>2 (Voltage, current)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measurement method</td>
<td>Calculated from input waveform period (reciprocal method)</td>
</tr>
<tr>
<td>Measurement ranges</td>
<td>100 Hz/500 Hz/5 kHz/100 kHz (linked to zero-cross filter)</td>
</tr>
</tbody>
</table>
| Measurement accuracy | \[ \pm 0.1\% \text{ rdg. } \pm 1\text{ dgt. However, for 1 mA range, } \pm 0.2\% \text{ rdg. } \pm 1\text{ dgt. } \]
| 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: \[ 0.1 \text{ sec. / 1 sec. / 10 sec. (linked to synchronization timeout setting) } \]

Display format
\[ \text{0.1000 Hz to 9.9999 Hz, } 9.9900 \text{ Hz to } 99.999 \text{ Hz, } 99.9000 \text{ kHz to } 999.999 \text{ kHz, } 999.9000 \text{ kHz to } 1000.000 \text{ kHz } \]

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

<table>
<thead>
<tr>
<th>Measurement types</th>
<th>Rectifiers, Apparent Power/ Reactive Power/ Power Factor AC+DC, AC, FND, AC+DC Umn</th>
</tr>
</thead>
<tbody>
<tr>
<td>Effective measuring range</td>
<td>As per voltage, current, and active power effective measurement ranges</td>
</tr>
</tbody>
</table>

Power Calculation Formulas

\[ S = \Re \cdot \Im \cdot \cos \theta \]

\[ Q = \Im \cdot \Re \cdot \sin \theta \]

\[ P = \Re \cdot \Im \cdot \cos \theta \]

Voltage Waveform Peak Value/ Current Waveform Peak Value Measurement Specifications

<table>
<thead>
<tr>
<th>Measurement method</th>
<th>Measures the waveform's peak value (for both positive and negative polarity) based on sampled instantaneous voltage values.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voltage</td>
<td>Voltage range</td>
</tr>
<tr>
<td>6.0000 V</td>
<td>36.000 V</td>
</tr>
<tr>
<td>15.000 V</td>
<td>90.000 V</td>
</tr>
<tr>
<td>30.000 V</td>
<td>180.000 V</td>
</tr>
<tr>
<td>60.000 V</td>
<td>360.000 V</td>
</tr>
<tr>
<td>150.00 V</td>
<td>900.00 V</td>
</tr>
<tr>
<td>300.00 V</td>
<td>1.8000 kV</td>
</tr>
<tr>
<td>600.00 V</td>
<td>3.6000 kV</td>
</tr>
<tr>
<td>1.0000 kV</td>
<td>6.0000 kV</td>
</tr>
</tbody>
</table>

| 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 |
| 100.000 mA | 600.000 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 |

Voltage Crest Factor/Current Crest Factor Measurement Specifications

<table>
<thead>
<tr>
<th>Measurement method</th>
<th>Calculates the ratio of the waveform peak value to the voltage RMS value.</th>
</tr>
</thead>
</table>
| Effective measuring range | \[ \pm 5\% \text{ to } \pm 100\% \text{ of current peak range, however, up to } \pm 60 \text{ A } \]

Display range
Up to \[ \pm 102\% \text{ of current peak range, however, the value 0 will be displayed if the current RMS value triggers the instrument's zero suppression function. } \]

Voltage Ripple Rate/ Current Ripple Rate Measurement Specifications

<table>
<thead>
<tr>
<th>Measurement method</th>
<th>Calculates the AC component (peak to peak [peak width]) as a proportion of the voltage or current DC component.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Effective measuring range</td>
<td>As per voltage and voltage waveform peak value, or current and current waveform peak value effective measurement ranges.</td>
</tr>
</tbody>
</table>

Display range
Up to \[ 612.00 \text{ (No polarity) } \]

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.

\[ + \text{ : When current lags voltage (no polarity display) } \]

\[ - \text{ : When current leads voltage} \]
### Functional Specifications

**Auto-range (AUTO)**

Automatically changes the voltage and current range according to the input. The range is increased by 50% only when the peak is exceeded.

**Range select**

Selects whether to enable (turn on) or disable (turn off) individual voltage and current ranges. Ranges can be selected with the range keys. Range switching occurs during auto-range operation. Range switching occurs 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, reactive power, 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

<table>
<thead>
<tr>
<th>Number of averaging iterations</th>
<th>Display update interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 (OFF)</td>
<td>200 ms</td>
</tr>
<tr>
<td>2</td>
<td>400 ms</td>
</tr>
<tr>
<td>5</td>
<td>1 s</td>
</tr>
<tr>
<td>10</td>
<td>2 s</td>
</tr>
<tr>
<td>25</td>
<td>5 s</td>
</tr>
<tr>
<td>50</td>
<td>10 s</td>
</tr>
<tr>
<td>100</td>
<td>20 s</td>
</tr>
</tbody>
</table>

**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.

### Integration Measurement Specifications

**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
- Stopping/starting integration and resetting integrated values during power outages
- Stopping integration when power returns

### Time Average Current/ Time Average Active Power Measurement Specifications

**Measurement method**

Calculates the average by dividing the current or active power against 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

±50% to ±100% of the range (Has polarity when using the DC rectifier.)

Time Average Active Power

±50% to ±3745.4% of the range (Has polarity)
Harmonic Measurement Specifications

| Measurement 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 phase angle
- Harmonic current content percentage
- Harmonic active power
- Harmonic active power content percentage
- Harmonic active power phase angle
- Harmonic active power content phase
- Total harmonic voltage distortion
- Fundamental wave power
- Fundamental wave active power
- Fundamental wave reactive power
- Fundamental wave voltage content percentage
- Fundamental wave voltage phase difference
- Fundamental wave voltage phase angle

- Add ±1 mA to DC measurement accuracy for current.
- Add (±1 μA) × (voltage read value) to 10 Hz to 8 kHz measurement accuracy for current.
- Add (±10 μA) × (voltage read value) to DC measurement accuracy for current.
- Add (±10 μA) × (voltage read value) to 10 Hz to 8 kHz measurement accuracy for current.
- Add ±10 μA to DC measurement accuracy for current.

FFT processing

- FFT processing word length: 32 bits
- FFT processing: FFT processing word length: 32 bits

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:
  - 10 Hz ≤ f < 45 Hz:
    - Analysis order: 56 Hz ≤ f < 56 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 and 50th

Measurement accuracy

- Frequency (f): Measurement range
  - 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. ±0.2%f.s.
  - 5 kHz ≤ f < 50 kHz: ±4.0% rdg. ±0.1%f.s.
- Power: Measurement range
  - DC: ±0.4% rdg. ±0.2%f.s.
  - AC: ±(0.6+0.07×F)%rdg.
- Active Power: Measurement range
  - DC: ±0.4% rdg. ±0.2%f.s.
  - AC: ±(0.6+0.07×F)%rdg.
- Harmonic voltage RMS value: Harmonic voltage content percentage
- Harmonic voltage phase angle: Harmonic current RMS value
- Harmonic current content phase: Harmonic current phase angle
- Total harmonic voltage distortion: Total harmonic current distortion
- Fundamental wave power: Fundamental wave content percentage
- Fundamental wave active power: Fundamental wave apparent power factor
- Fundamental wave reactive power: Fundamental wave power factor
- Fundamental wave voltage content percentage
- Harmonic voltage phase angle: Harmonic current phase angle
- Harmonic voltage phase angle: Harmonic current phase angle
- Harmonic active power: Harmonic active power content percentage
- Harmonic current content percentage: Harmonic current active power content percentage
- Harmonic active power: Harmonic active power content percentage
- Harmonic current content percentage: Harmonic current active power content percentage
- Harmonic active power: Harmonic active power content percentage
- Harmonic current content percentage: Harmonic current active power content percentage
- Harmonic active power: Harmonic active power content percentage
- Harmonic current content percentage: Harmonic current active power content percentage

Display Specifications

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

External Current Sensor Input Specifications

<table>
<thead>
<tr>
<th>Terminal</th>
<th>Isolated BNC terminals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current sensor type switching</td>
<td>Off / TYPE.1 / TYPE.2</td>
</tr>
<tr>
<td>Current measurement range</td>
<td>Auto / 1 A / 2 A / 5 A (range noted on panel)</td>
</tr>
</tbody>
</table>

Supported current sensors

- TYPE.1
  - (Can be directly connected)
  - 9661 Clamp on Sensor (500 A AC)
  - 9662 Clamp on Sensor (1000 A AC)
  - 9667 Flexible Clamp on Sensor (500 A/ 5000 A AC switchable)

- TYPE.2
  - (Requires Sensor Unit 9555-10 and Connection Cable L9217)
  - 9272-10 Clamp on Sensor (20 A / 200 A AC)
  - 9277 Universal Clamp on CT (20 A AC/DC)
  - 9278 Universal Clamp on CT (200 A AC/DC)
  - 9279 Universal Clamp on CT (500 A AC/DC)
  - 9709 AC/DC Current Sensor (500 A AC/DC)
  - CT6862 AC/DC Current Sensor (50 A AC/DC)
  - CT6863 AC/DC Current Sensor (200 A AC/DC)
  - CT6865 AC/DC Current Sensor (1000 A AC/DC)
  - CT6841 AC/DC Current Probe (20 A AC/DC)
  - CT6843 AC/DC Current Probe (200 A AC/DC)

Current measurement range

- Auto: 1 A / 2 A / 5 A range (noted on panel)
- Can be read directly by manually setting the CT ratio.

Power range configuration

- Depends on the combination of voltage ranges and current ranges; from 24.000 W to 5.0000 MW (also applies to VA, var)

Measurement accuracy

- Current/Active Power
  - Frequency (f): Input < 100%f.s. 100%f.s.
  - DC: ±0.1%rdg. ±0.1%f.s.
  - AC: ±(0.23+0.07×F)%rdg.
  - 5 kHz: ±(0.6+0.07×F)%rdg.
  - 1 kHz: ±0.1%rdg. ±0.2%f.s.
  - 50 kHz: ±(0.3+0.07×F)%rdg.
  - 1 kHz: ±0.1%rdg. ±0.2%f.s.
  - 1 MHz: ±0.1%rdg. ±0.2%f.s.
- Active Power
  - Frequency (f): Input < 100%f.s. 100%f.s.
  - DC: ±0.1%rdg. ±0.1%f.s.
  - AC: ±(0.23+0.07×F)%rdg.
  - 5 kHz: ±(0.6+0.07×F)%rdg.
  - 1 kHz: ±0.1%rdg. ±0.2%f.s.
  - 50 kHz: ±(0.3+0.07×F)%rdg.
  - 1 kHz: ±0.1%rdg. ±0.2%f.s.

- 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 0.1 Hz ≤ f < 10 Hz.
  - Values for voltage and active power in excess of 750 V for which 10 Hz ≤ f ≤ 16 Hz.
  - Values for voltage and active power in excess of 30 kHz < f ≤ 100 kHz.
  - Values for voltage, current, and active power for which 0.1 Hz ≤ f < 10 Hz.
  - Values for voltage and active power in excess of 750 V for which 10 Hz ≤ f ≤ 16 Hz.
  - Values for voltage and active power in excess of 750 V for which 0.1 Hz ≤ f < 10 Hz.
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 = 1)
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

<table>
<thead>
<tr>
<th>Frequency (f)</th>
<th>Voltage, Current, Active power</th>
</tr>
</thead>
<tbody>
<tr>
<td>DC</td>
<td>±0.4% f.s. ±0.2% f.s.</td>
</tr>
<tr>
<td>10 Hz ≤ f &lt; 20 Hz</td>
<td>±0.4% f.s. ±0.2% f.s.</td>
</tr>
<tr>
<td>30 Hz ≤ f &lt; 60 Hz</td>
<td>±0.3% f.s. ±0.15% f.s.</td>
</tr>
<tr>
<td>400 Hz ≤ f &lt; 1 kHz</td>
<td>±0.4% f.s. ±0.2% f.s.</td>
</tr>
<tr>
<td>1 kHz ≤ f &lt; 5 kHz</td>
<td>±1.0% f.s. ±0.5% f.s.</td>
</tr>
<tr>
<td>5 kHz ≤ f &lt; 8 kHz</td>
<td>±4.0% f.s. ±1.2% f.s.</td>
</tr>
</tbody>
</table>

• 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 CT6841/CT6843, add ±2 mV to the CT6841/CT6843 accuracy after performing CT6841/CT6843 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 V.f.s. or 3 V.f.s., linked to display updates
High-speed level output
2 V.f.s. or 3 V.f.s., linked to synchronization interval
Waveform output
1 V.f.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 V.f.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
(Only Parameter measurement accuracy) + (±0.2% f.s.)
High-speed level output
(Only Parameter measurement accuracy) + (±0.2% f.s.)
Waveform output
(Only 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%/°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]
**Instrument**

*POWER METER PW3335 series*  
Accessories: Instruction manual ×1, Power cord ×1, Voltage and current input terminal safety cover ×2

**PW3335**  
With LAN terminal and RS-232C terminal

**PW3335-01**  
With LAN terminal and GP-IB terminal

**PW3335-02**  
With LAN terminal, RS-232C terminal and D/A output terminal

**PW3335-03**  
With LAN terminal, RS-232C terminal and external current sensor input terminals

**PW3335-04**  
With LAN terminal, RS-232C terminal and GP-IB terminal and D/A output terminal

**Options**

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

**Current measurement options [Type 2]**  
Requires Sensor Unit 9555-10 and Connection Cable L9217

**Type 2 Current sensor options**

**SENSOR UNIT 9555-10**  
Power supply 100 V to 240 V AC (50Hz/60Hz)

**Connection Cord L9217**  
For sensor output, Isolated BNC to isolated BNC  
Cord length: 3m

**Communications and control options**

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

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

**GP-IB CONNECTOR CABLE 9151-02**  
Cable length: 5 m (16.41 ft)  
supplied with straight to cross conversion cable

**LAN CABLE 9642**  
Cable length: 5 m (16.41 ft)  
metal BNC to metal BNC

**Connection Cord 9165**  
For synchronized control  
Cable length: 1.5 m (4.92 ft)

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