Improve Power Conversion Efficiency

From DC to 2MHz, industry’s proven solution for high-accuracy power analysis. The next-generation POWER ANALYZER.
Achieving true power analysis

DC, 0.1Hz to 2 MHz frequency bandwidth
Obtain even greater accuracy in high-frequency power measurements with the aid of Hioki’s current sensor phase shift function

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

<table>
<thead>
<tr>
<th>Environment temperature [°C]</th>
<th>Deviation from standard accuracy [%]</th>
</tr>
</thead>
<tbody>
<tr>
<td>-0.6</td>
<td>3x improvement in temperature characteristics compared to legacy model</td>
</tr>
<tr>
<td>-0.4</td>
<td>3x improvement in temperature characteristics compared to legacy model</td>
</tr>
<tr>
<td>-0.2</td>
<td>3x improvement in temperature characteristics compared to legacy model</td>
</tr>
<tr>
<td>0</td>
<td>3x improvement in temperature characteristics compared to legacy model</td>
</tr>
<tr>
<td>0.2</td>
<td>3x improvement in temperature characteristics compared to legacy model</td>
</tr>
<tr>
<td>0.4</td>
<td>3x improvement in temperature characteristics compared to legacy model</td>
</tr>
<tr>
<td>0.6</td>
<td>3x improvement in temperature characteristics compared to legacy model</td>
</tr>
</tbody>
</table>

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

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

*Device accuracy only
18-bit resolution, 5 MS/s sampling

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

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

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

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

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

Conversion efficiency measurement during mode measurement without switching ranges

*AAF (Anti-aliasing filter). This filter prevents aliasing errors during sampling.
Functions and Characteristics

Max Speed 10 ms, Maximum 12 ch* High Accuracy Power Calculation
Data updates in 10 ms to 200 ms. Make high speed calculations while maintaining high accuracy. Achieve measurement stability with original digital filter technology, and measure power after automatically tracking frequency fluctuations from 0.1 Hz.

Extensive Current Sensor Lineup Achieve a Combined Basic Accuracy of ±0.04%
Choose the best sensor for your application: the pull-through type for highly accurate and high current measurements up to 1000 A, the clamp type for quick and easy wire connection, or the direct input type for high accuracy and broadband. Connect a sensor for oscilloscopes for even more options. PW6001 comes equipped with a sensor power line built-in. Automated recognition functions make setup a cinch.

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

Independence harmonic analysis for a maximum of 6 systems (wideband/IEC)
0.1 Hz to 300 kHz fundamental frequency, 1.5 MHz analyzable bandwidth. Comes equipped with IEC61000-4-7-compliant harmonic analysis and up to 100th order wideband harmonic analysis.

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

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

Frequency [Hz]  |  Active Power Frequency Characteristics Example
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>600 V/50 A Range (Power Factor 0)</td>
</tr>
<tr>
<td>20</td>
<td>30 V/1 A Range (Power Factor 0)</td>
</tr>
<tr>
<td>50</td>
<td>150 V/5 A Range (Power Factor 0)</td>
</tr>
<tr>
<td>100</td>
<td>600 V/50 A Range (Power Factor 1)</td>
</tr>
<tr>
<td>200</td>
<td>30 V/1 A Range (Power Factor 1)</td>
</tr>
<tr>
<td>500</td>
<td>150 V/5 A Range (Power Factor 1)</td>
</tr>
<tr>
<td>1000</td>
<td>600 V/50 A Range (Power Factor 1)</td>
</tr>
<tr>
<td>2000</td>
<td>30 V/1 A Range (Power Factor 1)</td>
</tr>
<tr>
<td>5000</td>
<td>150 V/5 A Range (Power Factor 1)</td>
</tr>
</tbody>
</table>

Active Power Frequency Characteristics Example

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

Current Sensor Phase Shift Function

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

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

Complex calculation formulas settable on the device

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

Supports various power analysis systems

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

D/A Monitor

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

X-Y Plot

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

Applications

- Power conditioner FRT Analysis
- Motor Transient State Power Analysis
- Calculate multisystem efficiency and loss with solar power modules and similar equipment
- Calculate Ld, Lq for motor vector control
- Calculate transformer current B and H utilizing Epstein's Method

Applications

- Transformer characteristics analysis
- Power conditioner MPPT Analysis
- MPPT: Maximum Power Point Tracker

*D LabVIEW is a registered trademark of NATIONAL INSTRUMENTS
*MATLAB is a registered trademark of Mathworks, Inc.
Specially designed for current sensors to achieve highly precise measurement

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

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

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

* A low power factor measurement (LOW PF) mode for easily setting reactor and transformer loss measurement has been added.
Build a 12-channel power meter using “numerical synchronization”

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

**Measure phase difference between 2 separate points**

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

**Wide range of Motor Analysis functions**

(Motor Analysis and D/A output model)

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

<table>
<thead>
<tr>
<th>Operating mode</th>
<th>ch A</th>
<th>ch B</th>
<th>ch C</th>
<th>ch D</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Torque</td>
<td>Encoder A phase signal</td>
<td>Encoder B phase signal</td>
<td>Encoder 2 phase signal</td>
</tr>
<tr>
<td>Measurement targets</td>
<td>Motor x 1</td>
<td>Torque</td>
<td>RPM</td>
<td>Motor x 2, Motors, transmissions, etc.</td>
</tr>
<tr>
<td>Measurement parameters</td>
<td>Electric angle</td>
<td>Rotation direction</td>
<td>Motor power</td>
<td>Torque</td>
</tr>
</tbody>
</table>

**Simply transfer waveforms with “waveform synchronization”**

Data sampled at 18 bits and 5 MS/s is sent between instruments in real time, and the waveform measured by the slave is displayed as-is on the master instrument. This functionality lets you use the power analyzers to measure the voltage phase difference between two remote locations, for example at power substations, manufacturing plants, or railroad facilities.

**D/A output waveforms captured 500m away**

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

**Analog Output and 1 MS/s Waveform Output**

(Motor Analysis and D/A output model)

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

<table>
<thead>
<tr>
<th>Analog output</th>
<th>Analog output x 20 channels</th>
</tr>
</thead>
<tbody>
<tr>
<td>Waveform output</td>
<td>Waveform output x max. 12 channels*</td>
</tr>
</tbody>
</table>

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

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

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

### EV/HEV inverter and motor analysis

- **Display torque signal and pulse encoder waveforms**

#### Key features
- High-speed data update every 10 ms
- ±0.02% DC accuracy
- Wideband mode harmonic analysis
- Flexible efficiency calculation
- Noise resistance
- TrueHD 18-bit resolution
- User-defined calculations
- Z phase synchronization

#### Calculate transient state power with 10 ms high accuracy and high speed

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

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

#### Advanced electrical angle measurement function

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

#### Simultaneous measurement of 2 motor powers

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

#### Evaluate inverter motor efficiency and loss

Evaluate efficiency and loss for an inverter, motor, and overall system by simultaneously measuring the inverter’s input and output power and the motor's output. You can also create an efficiency map or loss map in MATLAB using measurement results recorded by the PW6001 at each operating point.

*MATLAB is a registered trademark of Mathworks, Inc.*

*Scan the QR code on the right to download a technical brief about SiC inverter power measurements.

*Scan the QR codes on the right to download technical briefs about electrical angle measurements.*
With the PW6001 you can perform harmonic analysis of fundamental waves up to 300 kHz with a band frequency of 1.5 MHz. For reactors used by chopper circuits, measure phase angles and RMS values for the current and voltage of each harmonic order through harmonic analysis synchronized with the switching frequency.

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

Applications
- Reactors
- DC Power supply
- Step-up DC Load

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

Current Sensor Phase Shift Function
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Harmonic analysis synchronized with switching frequencies
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Circuit impedance analysis
Calculate circuit impedance, resistance, and inductance by using harmonic analysis results and user defined calculations. X-Y plot functions are especially effective for impedance analysis.

High-frequency and low power factor device evaluation
Reactors are used for high harmonic current suppression as well as the voltage step up/down of chopper circuits. The PW6001’s outstanding high frequency characteristics, high-speed sampling, and noise-suppressing performance are extremely effective in evaluating high-frequency, low power factor devices (reactors, transformers, etc.).

With the addition of a low power factor measurement (LOW PF) mode to the Quick Configuration menu in Ver. 3.00, measurements can now be performed even more quickly.

Current Sensor Phase Shift Function
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*Scan the QR code on the right to download a technical brief about reactor loss measurements.
PV/Wind turbine Power Conditioner (PCS) Efficiency Measurement

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

Harmonic analysis and conductive noise evaluation
The PW6001 can perform IEC standard-based harmonic measurements that comply with IEC 61000-4-7. In wind power generation, where the generator hardware and grid operate at different frequencies, dual vector displays let you identify the tri-phase equilibrium at a glance. In addition, FFT analysis lets you evaluate conductive noise generated by devices such as switching power supplies from 2 kHz to 150 kHz.

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

Voltage frequency measurement fundamental accuracy of ± 0.01 Hz*
Perform frequency measurements required for each PCS test with world-class accuracy and stability. Achieve highly accurate frequency measurement values for a maximum of 6 ch (12 ch when there are two devices) while measuring each parameter at the same time.

* ±0.01 Hz fundamental accuracy is defined for cases where the data update is over 50 ms. Please contact us for even more precise frequency measurement.
Measure the efficiency of wireless power transmission (WPT)

Accurate measurement, even of low-power-factor power
In wireless power transfer / transmission (WPT), the inductance component of the energy transmit and receive elements lowers the power factor. The PW6001’s current sensor phase shift function can be used to accurately measure high-frequency, low-power-factor power. In WPT measurement, it’s extremely effective to combine the PW6001 with a high-bandwidth current measurement tool.

Frequency band:
DC to 3.5 MHz (-3 dB)
PW9100

Frequency band:
DC to 4 MHz
CT6904

Analyze transmission frequency harmonics
The PW6001’s harmonic analysis function can analyze fundamental harmonics of up to 300 kHz at a bandwidth of up to 1.5 MHz. For example, with a circuit that uses an 85 kHz band switching frequency (a frequency that could be used in power transmission in electric vehicle applications) as the fundamental harmonic, the analyzer is capable of simultaneously measuring voltage, current, power, and phase angle for both receive and transmit through the 15th order.

Automatic WPT TEST SYSTEM
(For more information, please see the TS2400 product catalog.)
The WPT Evaluation System TS2400 is a system for automatically measuring the reproducible data that is required to evaluate WPT hardware by integrating measurement with an XYZ stage. A single software package provides control and automatic measurement functionality for instrument configuration, transmit and receive device positioning, and data collection. The results of analyses can be presented using a variety of bar graphs.

WPT evaluation supports the following types of measurement:
• Power transfer efficiency measurement (using the PW6001)
• Automatic coupling coefficient measurement
• Voltage/temperature logging
• Magnetic flux density logging

Example of a 4D graph of transfer efficiency
Interfaces

Names of parts

<table>
<thead>
<tr>
<th>USB flash drive</th>
<th>Data viewable through dedicated application</th>
</tr>
</thead>
<tbody>
<tr>
<td>GP-IB</td>
<td>Command control</td>
</tr>
<tr>
<td>GP-IB</td>
<td>Data viewable through dedicated application</td>
</tr>
<tr>
<td>GP-IB</td>
<td>Command control</td>
</tr>
<tr>
<td>GP-IB</td>
<td>Bluetooth® logger connection</td>
</tr>
<tr>
<td>RS-232C</td>
<td>Send the D/A output of values measured with</td>
</tr>
<tr>
<td>RS-232C</td>
<td>the PW6001 (maximum of 8 items) wirelessly</td>
</tr>
<tr>
<td>RS-232C</td>
<td>to the HIOKI Wireless Logging Station LR8410</td>
</tr>
<tr>
<td>RS-232C</td>
<td>using the dedicated cable and Bluetooth®</td>
</tr>
<tr>
<td>RS-232C</td>
<td>serial conversion adapter.</td>
</tr>
<tr>
<td>External I/O</td>
<td>START/ STOP/ DATA RESET control</td>
</tr>
<tr>
<td>External I/O</td>
<td>Terminals shared with RS-232C, ±5 V/200 mA</td>
</tr>
<tr>
<td>External I/O</td>
<td>power supply possible</td>
</tr>
<tr>
<td>LAN</td>
<td>Gbit LAN supported</td>
</tr>
<tr>
<td>LAN</td>
<td>Command control</td>
</tr>
<tr>
<td>LAN</td>
<td>View data in free dedicated application</td>
</tr>
<tr>
<td>Synchronous</td>
<td>Optical connection cable connector, Duplex-LC</td>
</tr>
<tr>
<td>Synchronous</td>
<td>(2-core)</td>
</tr>
<tr>
<td>D/A output</td>
<td>Switching for 20 channels of analog output</td>
</tr>
<tr>
<td>D/A output</td>
<td>or maximum 12 channels of waveform + 8</td>
</tr>
<tr>
<td>D/A output</td>
<td>channels of analog output</td>
</tr>
<tr>
<td>Current probe</td>
<td>Power can also be supplied from the PW6001</td>
</tr>
<tr>
<td>Current probe</td>
<td>to Probe1 or Probe2 by using the sliding</td>
</tr>
<tr>
<td>Current probe</td>
<td>cover.</td>
</tr>
<tr>
<td>Motor Analysis</td>
<td>Input signals from torque meters or rotation</td>
</tr>
<tr>
<td>Motor Analysis</td>
<td>meters to measure motor power. Measure</td>
</tr>
<tr>
<td>Motor Analysis</td>
<td>motor signals including electric angle and</td>
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<tr>
<td>Motor Analysis</td>
<td>motor power from instruments such as</td>
</tr>
<tr>
<td>Motor Analysis</td>
<td>actinometers and anemometers.</td>
</tr>
<tr>
<td>USB flash drive</td>
<td>Save waveform data/measured data (csv)</td>
</tr>
<tr>
<td>USB flash drive</td>
<td>Save screen copy (bmp)</td>
</tr>
<tr>
<td>USB flash drive</td>
<td>Save interval data (csv) in real time</td>
</tr>
<tr>
<td>USB flash drive</td>
<td>at the fastest interval of 10 ms</td>
</tr>
<tr>
<td>64 MB internal memory</td>
<td>Save interval data and send it to a USB flash drive later</td>
</tr>
</tbody>
</table>

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

Software

PC Communication Software – PW Communicator

PW Communicator is a free application that connects to the PW6001 via a communications interface (Ethernet, RS-232C, or GP-IB), making it easy to configure the instrument’s settings and to monitor or save measured values and waveform data from a computer. The software can simultaneously connect to up to 8 HIOKI power measuring instruments, including the PW6001, Power Analyzer PW3390, Power Meter PW3335, PW3336, and PW3337, and it can provide integrated control over multiple models. The software can also be used to simultaneously save measurement data on the computer and calculate efficiency between instruments.

LabVIEW driver and MATLAB toolkit

Hioki’s LabVIEW driver and MATLAB toolkit can be used to build data collection and measurement systems. We also offer a number of sample programs to help you get started.

*LabVIEW is a registered trademark of National Instruments.
*MATLAB is a registered trademark of Mathworks, Inc.
### Specifications

#### Power measurement

<table>
<thead>
<tr>
<th>Measurement lines</th>
<th>1-phase (2P2W)</th>
<th>1-phase (3P3W)</th>
<th>3-phase (3P3W, 3V3A, 3P3V)</th>
<th>3-phase (3P3W, 3V3A, 3P3W)</th>
</tr>
</thead>
</table>

#### Input terminal profile

- **Probe 1:** Dedicated connector (ME15W)
- **Probe 2:** Standard input and output terminal

#### Probe 2 power supply

- 12 V ±0.5 V, -12 V ±0.5 V, max. 600 mA, up to a max. of 700 mA for up to 3 channels

#### Voltage inputs

- Max. 6 channels; each input channel provides 1 channel for simultaneous voltage and current input

#### Input terminal profile

- **Probe 1** inputs 5 V, ±12 V peak (10 ms or less)
- **Probe 2** inputs 8 V, ±15 V peak (10 ms or less)

#### Current measurement

- **Probe 1** inputs 5 V, ±12 V peak (10 ms or less)
- **Probe 2** inputs 20 A / 200 A / 500 A / 1000 A / 2000 A / 5000 A

#### Input resistance

- **Probe 1** inputs 4 MΩ ±50 kΩ
- **Probe 2** inputs 1 MΩ ±50 kΩ

#### Maximum rated voltage

- **Probe 1** inputs 1000 V, ±200 V peak (10 ms or less)
- **Probe 2** inputs 10 V, ±20 V peak (10 ms or less)

#### Power range

- 200 kVA to 6.000 V, 200 V to 2000 V

#### Cred factor

- 3 (relative to voltage/current range)

#### Input power (5 Hz / 1 Hz)

<table>
<thead>
<tr>
<th>Measurement source</th>
<th>Voltage accuracy</th>
<th>Current accuracy</th>
<th>Frequency accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Probe 1</td>
<td>±0.008 × f% rdg. ±0.5% f.s.</td>
<td>±0.008 × f% rdg. ±0.5% f.s.</td>
<td>±0.1°</td>
</tr>
<tr>
<td>Probe 2</td>
<td>±0.047 × f-19% ±2% f.s. ±0.05°</td>
<td>±0.055 × f-19% ±2% f.s. ±0.05°</td>
<td>±0.05°</td>
</tr>
</tbody>
</table>

#### Power factor

- 0.1 Hz ≤ f < 30 Hz: ±0.1% rdg. ±0.2% f.s. ±0.1°
- 30 Hz ≤ f ≤ 45 Hz: ±0.05% rdg. ±0.1% f.s. ±0.1°
- 45 Hz ≤ f ≤ 60 Hz: ±0.05% rdg. ±0.1% f.s. ±0.1°

#### Frequency measurement

- 1 Hz ≤ f ≤ 2 MHz: ±0.0084% rdg. ±0.5% f.s. ±0.05°
- 50 kHz ≤ f ≤ 100 kHz: ±0.014% rdg. ±0.2% f.s. ±0.05°

#### Frequency accuracy

- ±0.05% rdg. ±1°: (other than the conditions mentioned above, when the sine wave is at least 30% relative to the measurement source)

#### Display format

- 0.01 Hz to 2 MHz (Display shows 0.0001 Hz or — when measurement is not possible.)

#### Accuracy

- ±0.018° (Only when measuring 45 Hz with a minimum measurement interval of 50 ms and input of at least 50% relative to the voltage range when measuring the frequency waveform)

#### Power factor

- ±0.05% rdg. ±1°: (other than the conditions mentioned above, when the sine wave is at least 30% relative to the measurement source's measurement range)

#### Frequency measurement

- 0.01 Hz to 2 MHz (Display shows 0.0001 Hz or — when measurement is not possible.)

#### Accuracy

- ±0.018° (Only when measuring 45 Hz with a minimum measurement interval of 50 ms and input of at least 50% relative to the voltage range when measuring the frequency waveform)

#### Power factor

- ±0.05% rdg. ±1°: (other than the conditions mentioned above, when the sine wave is at least 30% relative to the measurement source’s measurement range)
### Integration measurement

<table>
<thead>
<tr>
<th>Measurement modes</th>
<th>Select RMS or DC for each connection (DC mode can only be selected when connecting a DC sensor with a 180° connection)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measurement parameters</td>
<td>Current integration (Ih+, Ih-, Ih), active power integration (WP+, WP-, WP)</td>
</tr>
<tr>
<td></td>
<td>8th and 9th are measured only in DC mode. Only Hir is measured in RMS mode.</td>
</tr>
</tbody>
</table>

**Measurement method**  
Digital signal bases on current and active power values  
DC mode: Every sampling interval, current values and instantaneous power values are integrated separately for each frequency band.  
RMS mode: The RMS current values and active power value are integrated for each measurement interval. Only active power is integrated separately for each frequency band.

<table>
<thead>
<tr>
<th>Display resolution</th>
<th>999999 (9 digits + decimal point), starting from the resolution at which 1% of the measurement range is exceeded</th>
</tr>
</thead>
<tbody>
<tr>
<td>Integration time</td>
<td>10 sec. to 999999 min. in 1 sec. steps</td>
</tr>
<tr>
<td>Integration time accuracy</td>
<td>±0.02% rdg. (±0.02% f.s.)</td>
</tr>
<tr>
<td>Integration accuracy</td>
<td>±(current or active power accuracy) ±(data update rate)</td>
</tr>
<tr>
<td>Backup function</td>
<td>None</td>
</tr>
</tbody>
</table>

### Harmonics measurement

<table>
<thead>
<tr>
<th>Number of measurement channels</th>
<th>Max. 6 channels, based on the number of built-in channels</th>
</tr>
</thead>
<tbody>
<tr>
<td>Synchronization source</td>
<td>Based on the synchronization source setting for each connection.</td>
</tr>
</tbody>
</table>

**Measurement parameters**  
Harmonic RMS value, harmonic RMS value ratio, harmonic voltage phase angle, harmonic current phase angle, harmonic active power, harmonic power harmonic current ratio, harmonic voltage/current phase difference, total voltage harmonic distortion, total current harmonic distortion, voltage unbalance ratio, current unbalance ratio

<table>
<thead>
<tr>
<th>FFT processing word length</th>
<th>32 bits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anti-aliasing</td>
<td>Digital filter (automatically configured based on synchronization frequency)</td>
</tr>
<tr>
<td>Window function</td>
<td>Rectangular, Hamming, Hanning, Flat-top</td>
</tr>
<tr>
<td>Synchronizing</td>
<td>OFF / FFT sub-group / Type 2 (harmonic group)</td>
</tr>
<tr>
<td>THD calculation method</td>
<td>YNO_F_7 THD_R (Synchronization applied to all connections) Select calculation order from order 1 to order 100 (however, limited to the maximum analysis order for each channel).</td>
</tr>
</tbody>
</table>

(1) IEC standard mode

**Measurement method**  
Zero-cross synchronisation calculation method (same window for each synchronisation source)  
Fixed sampling interpolation calculation method with average thinning in Windows 6000-4.7:2002 compliant with gap overlap

**FFT analysis**

<table>
<thead>
<tr>
<th>Measurement channel</th>
<th>Voltage and current waveforms - 1 channel (selected from input channels)</th>
</tr>
</thead>
</table>

**Motor analysis (PW6001-11 to -16 only)**

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

<table>
<thead>
<tr>
<th>Measurement range</th>
<th>Voltage ±1000 V / ±1000 V / ±1000 V / ±1000 V</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input range</td>
<td>1% to 115% ±5%</td>
</tr>
<tr>
<td>Sampling speed</td>
<td>50 kHz, 16 bits</td>
</tr>
<tr>
<td>Response speed</td>
<td>0.2 ms (when LPF is OFF)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Measurement method</th>
<th>Inequality sign, X.XXXXX: 6-digit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measurement accuracy</td>
<td>±0.05% rdg. / ±0.05% ±3 dgt. / ±0.05% ±3 dgt. / ±0.05% ±3 dgt.</td>
</tr>
<tr>
<td>Temperature coefficient</td>
<td>±0.05% f.s.</td>
</tr>
<tr>
<td>Effects of common-mode voltage</td>
<td>±0.02% f.s. / ±0.05% f.s. / ±0.15% f.s. / ±0.25% f.s. / ±0.50% f.s. / ±1.0% f.s. / ±2.0% f.s. / ±5.0% f.s. / ±10% f.s.</td>
</tr>
<tr>
<td>Display range</td>
<td>From the range ±x-suppression range setting to ±50%</td>
</tr>
<tr>
<td>Detection level</td>
<td>0.5 V or less, 200 V or more</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Measurement</th>
<th>0.1 Hz to 300 kHz</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency</td>
<td>0.1 Hz to 300 kHz</td>
</tr>
<tr>
<td>Window number</td>
<td>Maximum analysis order</td>
</tr>
<tr>
<td>0.1 Hz to 800 Hz</td>
<td>1000 Hz</td>
</tr>
<tr>
<td>80 Hz to 1.6 kHz</td>
<td>600 Hz</td>
</tr>
<tr>
<td>1.6 kHz to 6.4 kHz</td>
<td>600 Hz</td>
</tr>
<tr>
<td>6.4 kHz to 30 kHz</td>
<td>600 Hz</td>
</tr>
<tr>
<td>30 kHz to 100 kHz</td>
<td>600 Hz</td>
</tr>
<tr>
<td>100 kHz to 300 kHz</td>
<td>600 Hz</td>
</tr>
</tbody>
</table>

| Phase-zero adjustment | The instrument provides phase-zero-adjustment functionality using keys or the display screen. |

**Throttle**

<table>
<thead>
<tr>
<th>Trigger slope</th>
<th>Rising edge, falling edge</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trigger level</td>
<td>±300% of the range for the waveform, in 0.1% steps</td>
</tr>
</tbody>
</table>

**Motor waveforms**  
CH A: Analog DC input / Frequency input / Pulse input  
CH B: Analog DC input / Frequency input / Pulse input  
CH C: Pulse input  
CH D: Pulse input

**Operating mode**  
Single, dual, or independent input

<table>
<thead>
<tr>
<th>Motor waveform parameters</th>
<th>D/A-equipped models only</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input resistance</td>
<td>DC ±50 kΩ</td>
</tr>
<tr>
<td>Input method</td>
<td>Function-selected input and single-end input</td>
</tr>
<tr>
<td>Motor waveform</td>
<td>Frequency, Voltage, Current, Harmonics, Phasor power, Motor power</td>
</tr>
<tr>
<td>Maximum input voltage</td>
<td>±20 V (analog DC and pulse operation)</td>
</tr>
<tr>
<td>Additional conditions</td>
<td>Frequency measurement, Motor power</td>
</tr>
<tr>
<td>Guaranteed accuracy</td>
<td>Input: Terminal-to-ground voltage of 0 V, after zero-adjustment</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Detection level</th>
<th>Low: 0.5 V or less, 200 V or more</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measurement</td>
<td>0.1 Hz to 300 kHz</td>
</tr>
<tr>
<td>Minimum detection width</td>
<td>0.1 mHz or more</td>
</tr>
<tr>
<td>Measurement accuracy</td>
<td>±0.05% rdg. / ±0.05% ±3 dgt. / ±0.05% ±3 dgt. / ±0.05% ±3 dgt.</td>
</tr>
<tr>
<td>Display range</td>
<td>From 0.1 mHz to 1000 kHz</td>
</tr>
<tr>
<td>Minimum detection level</td>
<td>0.1 mHz or more</td>
</tr>
<tr>
<td>Measurement accuracy</td>
<td>±0.05% rdg. / ±0.05% ±3 dgt. / ±0.05% ±3 dgt. / ±0.05% ±3 dgt.</td>
</tr>
<tr>
<td>Tone</td>
<td>1 kHz to 800 kHz</td>
</tr>
</tbody>
</table>

**Motor frequency division setting range**  
1 kHz to 800 kHz

**Mechanical angle origin detection**  
Can be set in single mode (detected based on leadoff of CH B and CH C).
D/A output (PW6001-11 to -16 only)

Number of output channels 20 channels

Output terminal profile 0-3525 pA per connector x 1

Output details - Switchable between waveform output and analog output (select from basic measurement parameters).
- Waveform output is fixed to CH1 to CH12.

IA conversion resolution 16 bits (1 part = 1 bit)

Output refresh rate Analog waveform output 10 ms / 50 ms / 200 ms (based on data update rate for the selected parameter)
- 1 kHz

Output voltage Analog output ±5 V DC (rms. approx. ±12 V DC)
Switchable between ±5 V as, ±10 V as, crest factor of 2.5 or 4 times, or setting applies to all channels.

Output resistance 100 ± 0.2 Ω

Output accuracy Analog output Output measurement parameter measurement accuracy ±0.2% f.s. (DC level)
Waveform output Measurement accuracy ±0.5% f.s. (±10 V f.s.) (rms value, up to 50 kHz)

Temperature coefficient ±0.05% f/s ±0.1°C

Display section

Display characters English, Japanese, Chinese (simplified)

Display 9" WVGA TFT color LCD (800 × 480 dots)

Display refresh rate
- Approx. 200 ms (independent of internal data update rate)
- Based on the number of averaging iterations.

(3) Numerical display screen
- All-waveform display, waveform + numerical display

(4) Harmonic display screen
- Displays the voltage and current values used to calculate apparent and reactive power and power factor.

(5) Vector display screen
- Displays measured values and motors combined in the connection.

(6) Power formula selection
- Compatible with TYPE1 as used by the Hioki 3193 and 3390.

(7) Current sensor phase shift calculation
- Compares the current sensor's harmonic phase characteristics using calculation formulas.

(8) Efficiency and loss calculations
- Calculates the power factor and phase angle formulas.

(9) Efficiency display
- Displays the exercise power reference value and power phase angle formulas.

(10) Voltage display
- Displays a connection-specific vector graph along with associated real values and phase angles.

(11) Numerical display screen
- Displays harmonic-measured values on the instrument's screen.

Function

Calculation function
(1) Rectifier
Selects the voltage and current values used to calculate apparent and reactive power and power factor.

Operating mode RMS/mean (can be selected for each connection’s voltage and current)

(2) Scaling
The range is set to OFF for 0.0001 to 9999.99

For/of range OFF/0.1 to 9999.99

(3) Averaging (AVG)
All instantaneous measured values, including harmonics, are averaged.

Operating mode OFF / Simple averaging / Exponential averaging

Operation
- Simple averaging: Averaging is performed for the number of simple averaging iterations for each data update cycle, and the output data is updated. The data update rate is lengthened by the number of averaging iterations.
- Exponential averaging: Data is exponentially averaged using a time constant defined by the data update rate and the exponential averaging response rate.

During averaging operation, averaged data is used for all analog output and data save.

(4) User-defined calculations
- Non-specific basic measurement parameters are calculated using the specified calculation formulas.

Function

Calculation function
(1) Display patterns
- Supports real-time waveform measurement parameters.

(2) Transient function
- Displays a connection-specific vector graph along with associated real values and phase angles.

(3) Display patterns
- Displays all waveform, waveform + numerical display, or cursor measurement supported.

(4) Harmonic display screen
- Displays the exercise power reference value and power phase angle formulas.

Function

Calculation function
(1) Rectifier
Selects the voltage and current values used to calculate apparent and reactive power and power factor.

Operating mode RMS/mean (can be selected for each connection’s voltage and current)

(2) Scaling
The range is set to OFF for 0.0001 to 9999.99

For/of range OFF/0.1 to 9999.99

(3) Averaging (AVG)
All instantaneous measured values, including harmonics, are averaged.

Operating mode OFF / Simple averaging / Exponential averaging

Operation
- Simple averaging: Averaging is performed for the number of simple averaging iterations for each data update cycle, and the output data is updated. The data update rate is lengthened by the number of averaging iterations.
- Exponential averaging: Data is exponentially averaged using a time constant defined by the data update rate and the exponential averaging response rate.

During averaging operation, averaged data is used for all analog output and data save.

(4) User-defined calculations
- Non-specific basic measurement parameters are calculated using the specified calculation formulas.

Calculation function
(1) Transformer
- The voltage and current ranges for each connection are automatically changed.

(2) Harmonic display screen
- Displays all waveform, waveform + numerical display, or cursor measurement supported.

(3) Display patterns
- Displays all waveform, waveform + numerical display, or cursor measurement supported.
Simplified Graph Function

(1) D/A Monitor Graph

Functions
Graph measured values chosen as D/A output items in chronological order.
Illustrated waveforms are Peak-Peak compressed by setting time axis to data at data update rate, and data is not recorded.

Operations
Start and stop drawing with the RUN/STOP button. Illustrate the displayed value during hold and peak hold. Illustration data is cleared when the Clear button is pressed during changes in settings related to measured values of range and D/A output items.

Number of illustrated items
Maximum of 8 items

Illustrated items
Operates simultaneously with D/A output items from CH13 to CH20 settings.

Time axis
10 ms to 50 s (Cannot be selected below the data update rate)

Vertical axis
Autoscaling (operates to fit data on screen within screen display range with time axis). Manual: (user sets displayed maximum value and minimum value)

(2) X-Y Plot

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

Automatic save function

Functions
Saves the selected measured values in effect for each interval.

Save parameters
User-selected from all measured values, including harmonic measured values.

Maximum amount of saved data
Internal memory: 64 MB (data for approx. 1800 measurements)
USB flash drive: Approx. 100 MB per file (automatically segmented) × 20 files

Data format
CSV file format

Manual save function

(1) Measurement data

Functions
The [SAVE] key saves specified measured values at the time it is pressed. Comment text can be entered for each saved data point, up to a maximum of 20 alphanumeric characters.
*The manual save function for measurement data cannot be used while automatic save is in progress.

Save destination
USB flash drive

Save parameters
User-selected from all measured values, including harmonic measured values.

Data format
CSV file format

(2) Waveform data

Functions
Within touch panel: Use Save Waveforms Button to save waveform data during that session.
Input comments for each set of saved data
*Cannot be operated when waveform data is invalid during storage and automatic saving.

Save destination
USB flash drive

Save parameters
User-selected from all measured values, including harmonic measured values.

Data format
CSV file format (read-only attribute included), binary file format (BIN format)

(3) Screenshots

Functions
The [COPY] key saves a screenshot to the save destination.

Save destination
USB flash drive

Comment entry
OFF/On - up to 40 letters/symbols

Data format
CSV file format (read-only attribute included), binary file format (BIN format)

(4) Settings data

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

Save destination
USB flash drive

(5) FFT data

Functions
Within touch panel: Use Save FFT Spectrum button to save waveform data during that session.
Input comments for each set of saved data
*Cannot be operated when waveform data is invalid during storage and automatic saving.

Save destination
USB flash drive

Comment entry
OFF/On - up to 40 letters/symbols

Data format
CSV file format (with read-only attribute set)

Two-instrument synchronization function

Functions
Sends data from the connected slave instrument to the master instrument, which performs calculations and displays the results.
In numerical synchronization mode, the master instrument operates as a power meter with up to 12 channels.
In waveform synchronization mode, the master instrument operates while synchronizing up to three channels from the slave instrument at the waveform level.

Operating mode
OFF / Numerical synchronization / Waveform synchronization

Synchronized items
Numerical synchronization mode: Data update timing, start/stop data reset
Waveform synchronization mode: Voltage/current sampling timing

Synchronization delay
Numerical synchronization mode: Max. 20 µs
Waveform synchronization mode: Up to 5 samples

Transfer items
Numerical synchronization mode
X1, X2, Y1, and Y2 operate in synchronization with D/A output item settings for CH13, 14, 15, and 16 respectively.

Waveform synchronization mode
Basic measurement parameters for up to six channels (including motor data).
Voltage/current sampling waveforms for up to three channels (not including motor data). However, the maximum number of channels is limited to a total of six, including the master instrument’s channels.

General Specifications

Operating environment
Indoors at an elevation of up to 2000 m in a Pollution Level 2 environment

Temperature and humidity
10°C to 55°C, 80% RH or less (no condensation)

Dielectric strength
50 kV/60 Hz 1.4 kV rms AC for 1 min. (sensed current of 1 mA) between voltage input terminals and instrument enclosure, and between current sensor input terminals and interfaces.
1 kV rms AC for 1 min. (sensed current of 3 mA) between motor input terminals (Ch. A, Ch. B, Ch. C, and Ch. D) and the instrument enclosure

Standards
EN50101
EMC
EN61200 Class A

Rated supply voltage
100 V AC to 240 V AC, 50 Hz / 60 Hz

Maximum rated power
200 VA

External dimensions
Approx. 430 mm (16.93 in) W × 177 mm (6.97 in) H × 450 mm (17.72 in) D (excluding protruding parts)
Mass
Approx. 14 kg (49.4 oz) (PW6001-18)

Backup battery life
Approx. 10 years (reference value at 23°C) (Battery that stores time and setting conditions)

Product warranty period
5 year

Guaranteed accuracy period
6 months (1-year accuracy ± 6-month accuracy x 1.5)

Post-adjustment accuracy guaranteed period
6 months

Accuracy guarantee conditions
Accuracy guarantee temperature and humidity range: 23°C ±3°C, 80% RH or less
Warm-up time: 30 min. or more

 Accuracy guarantee temperature and humidity range: 23°C ±3°C, 80% RH or less
Warm-up time: 30 min. or more

Accessories
Instruction manual x 1, power cord x 1, 2-sub-25-pin connector x 1 (PW6001-1x only)

Other functions

Clock function
Auto-calendar, automatic leap year detection, 24-hour clock

Actual time accuracy
When the instrument is on, ±100 ppm; when the instrument is off, within ±2 seconds/day (5°C)

Sensor identification
Current sensors connected to PRO/NET are automatically detected.

Zero-adjustment function
After the A/D and sensor’s DEMAG signal is sent, zero-correction of the voltage and current input offsets is performed.

Touch screen correction
Position calibration is performed for the touch screen.

Key lock
While the key lock is engaged, the key lock icon is displayed on the screen.
### High-accuracy sensors: direct connection type (connect to Probel input terminal)

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

<table>
<thead>
<tr>
<th>AC/DC CURRENT BOX PW9100-03</th>
<th>AC/DC CURRENT BOX PW9100-04</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>External Appearance</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of input channels</td>
<td>3ch</td>
</tr>
<tr>
<td>Rated primary current</td>
<td>50 A AC/DC</td>
</tr>
<tr>
<td>Frequency band</td>
<td>DC to 3.5 MHz (-3 dB)</td>
</tr>
<tr>
<td>Measurement terminals</td>
<td>Terminal block (with safety cover), M6 screws</td>
</tr>
<tr>
<td>Basic accuracy</td>
<td>0.02% rdg., ±0.05% f.s. (amplitude), ±0.1% (phase) (At 45 c/s ± 65 Hz)</td>
</tr>
<tr>
<td>Frequency response (Amplitude)</td>
<td></td>
</tr>
<tr>
<td>to 45 Hz: ±0.1% rdg., ±0.02% f.s.</td>
<td></td>
</tr>
<tr>
<td>to 1 kHz: ±0.1% rdg., ±0.01% f.s.</td>
<td></td>
</tr>
<tr>
<td>to 50 kHz: ±0.1% rdg., ±0.005% f.s.</td>
<td></td>
</tr>
<tr>
<td>to 100 kHz: ±0.1% rdg., ±0.005% f.s.</td>
<td></td>
</tr>
<tr>
<td>to 1 MHz: ±0.1% rdg., ±0.05% f.s.</td>
<td></td>
</tr>
<tr>
<td>3.5 MHz: 3 dB Typical</td>
<td></td>
</tr>
<tr>
<td>Input resistance</td>
<td>≤1.0 mΩ or less (50 Hz/50 Hz)</td>
</tr>
<tr>
<td>Operating temperature range</td>
<td>Temperature: 0°C to 40°C (32°F to 104°F), Humidity: 80% R.H. or less (no condensation)</td>
</tr>
<tr>
<td>Effects of common-mode voltage (CMRR)</td>
<td>50 Hz/60 Hz: 120 dB or greater, 100 kHz: 120 dB or greater (Effect on output voltage/common-mode voltage)</td>
</tr>
<tr>
<td>Maximum voltage to ground</td>
<td>1000 V (measurement category II), 600 V (measurement category III), anticipated transient overvoltage: 6000 V</td>
</tr>
<tr>
<td>Dimensions</td>
<td>430 mm (16.93 in) W × 88 mm (3.46 in) H × 260 mm (10.24 in) D, Cable length: 3 m (9.84 ft)</td>
</tr>
<tr>
<td>Mass</td>
<td>3.7 kg (130.5 oz)</td>
</tr>
</tbody>
</table>

**Characteristics**

- **Maximum Measurable Current:** 50 A AC/DC
- **Amplitude Characteristics:** ±0.02% rdg., ±0.005% f.s. (amplitude), ±0.1% (phase) (At 45 c/s ± 65 Hz)
- **Frequency Characteristics:**
  - to 45 Hz: ±0.1% rdg., ±0.02% f.s.
  - to 1 kHz: ±0.1% rdg., ±0.01% f.s.
  - to 50 kHz: ±0.1% rdg., ±0.005% f.s.
  - to 100 kHz: ±0.1% rdg., ±0.005% f.s.
  - to 1 MHz: ±0.05% rdg., ±0.005% f.s.
  - 3.5 MHz: 3 dB Typical
- **Input Resistance:** ≤1.0 mΩ or less (50 Hz/50 Hz)
- **Operating Temperature Range:** Temperature: 0°C to 40°C (32°F to 104°F), Humidity: 80% R.H. or less (no condensation)
- **Effects of Common-Mode Voltage (CMRR):** 50 Hz/60 Hz: 120 dB or greater, 100 kHz: 120 dB or greater (Effect on output voltage/common-mode voltage)
- **Maximum Voltage to Ground:** 1000 V (measurement category II), 600 V (measurement category III), anticipated transient overvoltage: 6000 V
- **Dimensions:** 430 mm (16.93 in) W × 88 mm (3.46 in) H × 260 mm (10.24 in) D, Cable length: 3 m (9.84 ft)
- **Mass:** 3.7 kg (130.5 oz)

**Wiring connection example 1 – Existing direct-input connection method**

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

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

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

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

The CT6904 delivers a measurement band that is 40× greater than the previous model along with high accuracy and a 500 A rating, making it a world-class current sensor that provides the ultimate level of performance when used in conjunction with the Power Analyzer PW6001. (The sensor is also available in an 800 A rated version. Please contact Hioki for details.)

#### 4 MHz Measurement Range, 40× Conventional Models

Newly developed opposed split coil technology is used in winding (CT) areas, achieving a wide measurement range from DC to 4 MHz.

**High Noise Resistance Common-Mode Rejection Ratio (CMRR) of 120 dB or More (100 kHz)**

Completely shielding the sensor’s opposed split coil with a solid shield featuring a proprietary shape lets the sensor deliver high accuracy measurement that is not affected by nearby voltages.
High-accuracy sensors: pull-through type (connect to Probe1 input terminal)

**Model**
- AC/DC CURRENT SENSOR CT6862-05
- AC/DC CURRENT SENSOR CT6863-05
- AC/DC CURRENT SENSOR 9708-05
- AC/DC CURRENT SENSOR CT6865-05

**Appearance**

**Rated primary current**
- 50 A AC/DC
- 200 A AC/DC
- 500 A AC/DC
- 1000 A AC/DC

**Frequency band**
- DC to 1 MHz
- DC to 500 kHz
- DC to 100 kHz
- DC to 20 kHz

**Diameter of measurable conductors**
- Max. ø 24 mm (0.94")
- Max. ø 24 mm (0.94")
- Max. ø 36 mm (1.42")
- Max. ø 36 mm (1.42")

**Basic accuracy**
- ±0.05 % rdg. ±0.01 % f.s. (amplitude)
- ±0.05 % rdg. ±0.01 % f.s. (amplitude)
- ±0.05 % rdg. ±0.01 % f.s. (amplitude)
- ±0.05 % rdg. ±0.01 % f.s. (amplitude)

**Frequency characteristics (Amplitude)**
- to 16 Hz: ±0.1 % rdg. ±0.02 % f.s.
- to 50 Hz: ±0.1 % rdg. ±0.02 % f.s.
- to 100 Hz: ±0.1 % rdg. ±0.02 % f.s.
- to 20 kHz: ±0.1 % rdg. ±0.1 % f.s.

**Operating Temperature**
- -40°C to 85°C (-40°F to 185°F)

**Effect of conductor position**
- Within ±0.05 % rdg. (50 A, DC to 100 Hz)
- Within ±0.05 % rdg. (50 A, DC to 100 Hz)
- Within ±0.05 % rdg. (DC 100 A)
- Within ±0.05 % rdg. (DC 100 A)

**Effect of external magnetic fields**
- 10 mA equivalent or lower (400 A/m, 60 Hz and DC)
- 50 mA equivalent or lower (400 A/m, 60 Hz and DC)
- 200 mA equivalent or lower (400 A/m, 60 Hz and DC)
- 500 mA equivalent or lower (400 A/m, 60 Hz and DC)

**Maximum rated voltage to earth**
- CAT III 1000 V rms
- CAT III 1000 V rms
- CAT III 1000 V rms
- CAT III 1000 V rms

**Dimensions**
- 70W (2.76") × 100H (3.94") × 53D (2.09") mm
- 70W (2.76") × 100H (3.94") × 53D (2.09") mm
- 70W (2.76") × 100H (3.94") × 53D (2.09") mm
- 70W (2.76") × 100H (3.94") × 53D (2.09") mm

**Mass**
- 340 g (12.0 oz)
- 350 g (12.3 oz)
- 850 g (30.0 oz)
- 980 g (35.3 oz)

**Derating properties**

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

**Model**
- AC/DC CURRENT PROBE CT6861-05
- AC/DC CURRENT PROBE CT6863-05
- AC/DC CURRENT PROBE CT6844-05
- AC/DC CURRENT PROBE CT6845-05
- AC/DC CURRENT PROBE CT6846-05

**Appearance**

**Rated primary current**
- 20 A AC/DC
- 200 A AC/DC
- 500 A AC/DC
- 500 A AC/DC
- 1000 A AC/DC

**Frequency band**
- DC to 1 MHz
- DC to 500 kHz
- DC to 100 kHz
- DC to 20 kHz

**Diameter of measurable conductors**
- Max. ø 20 mm (0.79")
- Max. ø 20 mm (0.79")
- Max. ø 50 mm (1.97")
- Max. ø 50 mm (1.97")
- Max. ø 50 mm (1.97")

**Basic accuracy**
- ±0.3 % rdg. ±0.01 % f.s. (amplitude)
- ±0.3 % rdg. ±0.01 % f.s. (amplitude)
- ±3.3 % rdg. ±0.02 % f.s. (amplitude)
- ±3.3 % rdg. ±0.02 % f.s. (amplitude)
- ±3.3 % rdg. ±0.02 % f.s. (amplitude)

**Frequency characteristics (Amplitude)**
- to 500 Hz: ±0.3 % rdg. ±0.02 % f.s.
- to 500 Hz: ±0.3 % rdg. ±0.02 % f.s.
- to 500 Hz: ±0.3 % rdg. ±0.02 % f.s.
- to 500 Hz: ±0.3 % rdg. ±0.02 % f.s.
- to 500 Hz: ±0.3 % rdg. ±0.02 % f.s.

**Operating Temperature**
- -40°C to 85°C (-40°F to 185°F)
- -40°C to 85°C (-40°F to 185°F)
- -40°C to 85°C (-40°F to 185°F)
- -40°C to 85°C (-40°F to 185°F)
- -40°C to 85°C (-40°F to 185°F)

**Effect of conductor position**
- Within ±0.1 % rdg. (20 A, DC to 100 Hz input)
- Within ±0.1 % rdg. (20 A, DC to 100 Hz input)
- Within ±0.1 % rdg. (DC 100 A input)
- Within ±0.1 % rdg. (DC 100 A input)
- Within ±0.1 % rdg. (DC 100 A input)

**Effect of external magnetic fields**
- 50 mA equivalent or lower (400 A/m, 60 Hz and DC)
- 100 mA equivalent or lower (400 A/m, 60 Hz and DC)
- 200 mA equivalent or lower (400 A/m, 60 Hz and DC)
- 500 mA equivalent or lower (400 A/m, 60 Hz and DC)
- 1000 mA equivalent or lower (400 A/m, 60 Hz and DC)

**Maximum input current**
- 200 mA equivalent or lower
- 500 mA equivalent or lower
- 1000 mA equivalent or lower
- 1000 mA equivalent or lower
- 1000 mA equivalent or lower

**Dimensions**
- 238W (9.37") W × 116 (4.57") H
- 238W (9.37") W × 116 (4.57") H
- 238W (9.37") W × 116 (4.57") H
- 238W (9.37") W × 116 (4.57") H
- 238W (9.37") W × 116 (4.57") H

**Mass**
- 350 g (12.0 oz)
- 370 g (13.1 oz)
- 400 g (14.1 oz)
- 860 g (30.3 oz)
- 990 g (35.3 oz)

**Derating properties**

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Custom cable lengths also available. Please inquire with your Hioki distributor.
### Wide-band probes (connect to Probe2 input terminal)

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

### Sensor switching method

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

When connecting CT6862-05, CT6863-05, CT6862-05, CT6894, CT6885-05, CT6841-05, CT6803-05, CT6845-05, CT6846-05, PW9100-03, PW9100-04

**Wideband probe terminal:** Slide the cover to the right.

When connecting 3273-50, 3274, 3275, 3276, CT6700 or CT6701
Model: POWER ANALYZER PW6001

Current measurement options

<table>
<thead>
<tr>
<th>Model</th>
<th>Model No. (Order Code)</th>
<th>Number of built-in channels</th>
<th>Motor Analysis &amp; D/A Output</th>
</tr>
</thead>
<tbody>
<tr>
<td>PW6001-01</td>
<td>CT6862-05</td>
<td>1ch</td>
<td>—</td>
</tr>
<tr>
<td>PW6001-02</td>
<td>CT6863-05</td>
<td>2ch</td>
<td>—</td>
</tr>
<tr>
<td>PW6001-03</td>
<td>CT6904</td>
<td>3ch</td>
<td>—</td>
</tr>
<tr>
<td>PW6001-04</td>
<td>9709-05</td>
<td>4ch</td>
<td>—</td>
</tr>
<tr>
<td>PW6001-05</td>
<td>CT6865-05</td>
<td>5ch</td>
<td>—</td>
</tr>
<tr>
<td>PW6001-06</td>
<td>CT6841-05</td>
<td>6ch</td>
<td>—</td>
</tr>
<tr>
<td>PW6001-11</td>
<td>CT6846-05</td>
<td>1ch</td>
<td>—</td>
</tr>
<tr>
<td>PW6001-12</td>
<td>CT6844-05</td>
<td>2ch</td>
<td>—</td>
</tr>
<tr>
<td>PW6001-13</td>
<td>CT6864-05</td>
<td>3ch</td>
<td>—</td>
</tr>
<tr>
<td>PW6001-14</td>
<td>CT6843-05</td>
<td>4ch</td>
<td>—</td>
</tr>
<tr>
<td>PW6001-15</td>
<td>CT6865-05</td>
<td>5ch</td>
<td>—</td>
</tr>
<tr>
<td>PW6001-16</td>
<td>CT6862-05</td>
<td>6ch</td>
<td>—</td>
</tr>
</tbody>
</table>

Voltage measurement options

<table>
<thead>
<tr>
<th>Model</th>
<th>Model No. (Order Code)</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>L9243</td>
<td>PW9100-06</td>
<td>6ch</td>
</tr>
<tr>
<td>L9245</td>
<td>PW9100-05</td>
<td>5ch</td>
</tr>
<tr>
<td>L9246</td>
<td>PW9100-04</td>
<td>4ch</td>
</tr>
<tr>
<td>L9247</td>
<td>PW9100-03</td>
<td>3ch</td>
</tr>
<tr>
<td>L9248</td>
<td>PW9100-02</td>
<td>2ch</td>
</tr>
<tr>
<td>L9249</td>
<td>PW9100-01</td>
<td>1ch</td>
</tr>
</tbody>
</table>

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

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

CONNECTION CABLE CT9904
1 m cable, required to connect the PW6001 to the CT9557’s addition waveform output terminal.

Other
The following made-to-order items are also available.
Please contact your Hioki distributor or subsidiary for more information.
- Carrying case (hard trunk, with casters)
- D/A output cable, D-sub 25-pin-BNC (male), 20 ch conversion, 2.5 m (8.20 ft) length
- Bluetooth® serial converter adapter cable 1 m (3.28 ft)
- Rackmount fittings (EIA, JIS)
- Optical connection cable, Max. 500 m (1640.55 ft) length
- PW9100 5 A rated version, CT6904 800 A rated version
- 2000A pull-through type sensor (DC to 5 kHz, φ80 mm)

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DISTRIBUTED BY

HIOKI (Shanghai) SALES & TRADING CO., LTD.
TEL +86-21-6391-0090/0092 FAX +86-21-6391-0360
http://www.hioki.cn / E-mail: info@hioki.com.cn

HIOKI SINGAPORE PTE. LTD.
TEL +65-6634-7677 FAX +65-6634-7477
E-mail: info-sg@hioki.com.sg

HIOKI EUROPE GmbH
TEL +49-6173-3234063 FAX +49-6173-3234064
E-mail: info-kr@hioki.eu

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