HIOKI

# POWER ANALYZER PW6001

NEW

# Improve
# Power Conversion Efficiency

World-class accuracy in measurement and analysis of DC to high-frequency signals with a single device. The next-generation POWER ANALYZER.

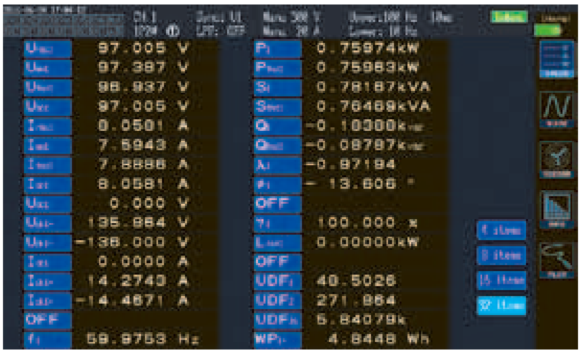
CE

FREE UP GRADE Newly Added Functions

# Achieving true power analysis

## DC, 0.1Hz to 2 MHz frequency bandwidth

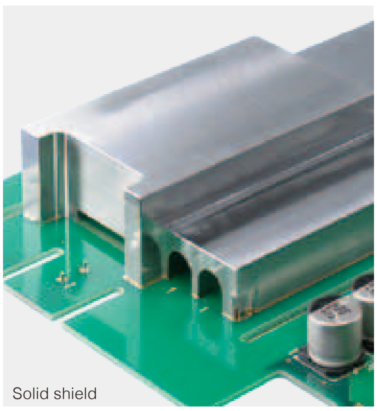
A wide frequency range is required for power measurement due to the acceleration of switching devices, especially SiC. High accuracy, broadband, and high stability. The PW6001's world-class technology-based fundamental performance makes in-depth power analysis a reality.



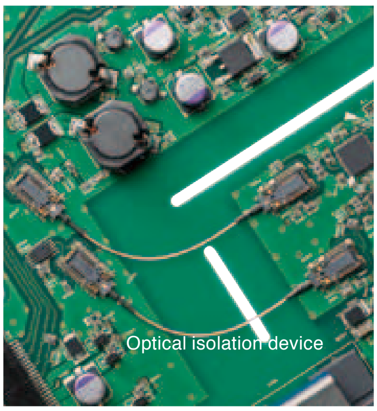
## ±0.02%* basic accuracy for power Strengthened resistance to noise and temperature fluctuations in the absolute pursuit of measurement stability

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.

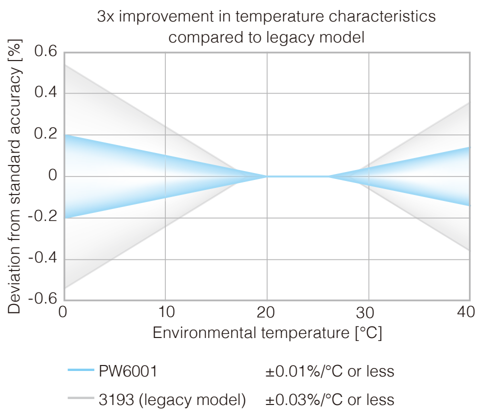
*Device accuracy only



Solid shield

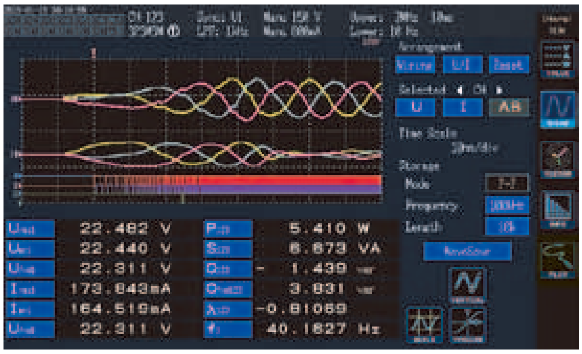


Optical isolation device



## 18-bit resolution, 5 MS/s sampling

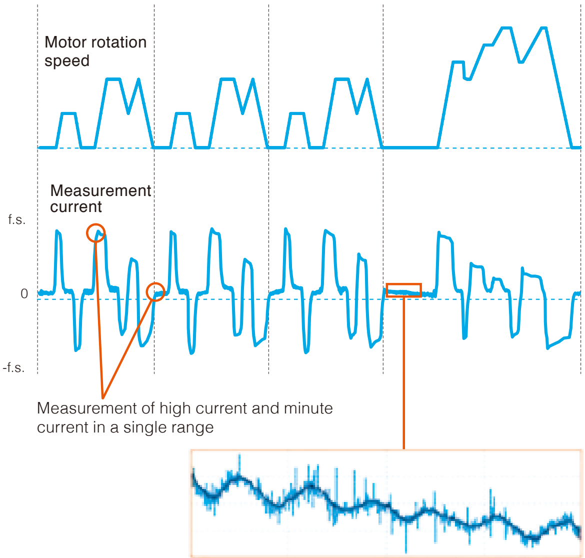
Measurements based on sampling theorem are required to perform an accurate power analysis of PWM waveforms. The Hioki PW6001 features direct sampling of input signals at 5 MS/s, resulting in a measurement band of 2 MHz. This enables analysis without aliasing error.




## 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.

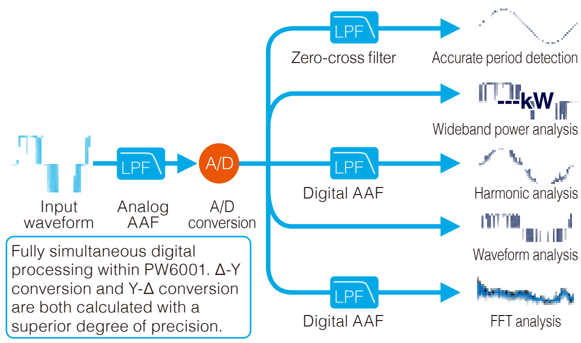
Conversion efficiency measurement during mode measurement without switching ranges




*True HD : True High Definition

## 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.



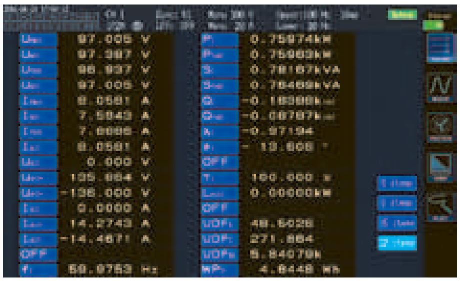

* AAF (Anti-aliasing filter): This filter prevents aliasing errors during sampling.

# Functions and Characteristics

Newly Added Functions
If you already have the PW6001, these functions will be added with the firmware version update (free of charge).

## Max Speed 10 ms, Maximum 12 ch* High Accuracy Power Calculation

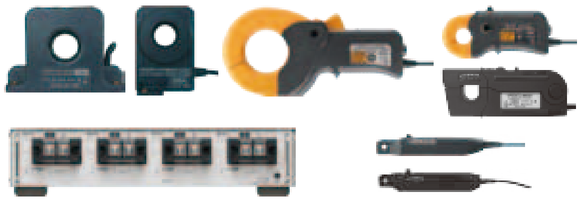
Data updates in 10 ms to 200 ms. Make high speed calculations while maintaining high accuracy. Achieve measurement stability with original digital filter technology, and measure power after automatically tracking frequency fluctuations from 0.1 Hz.



* Two 6-channel model devices, during synchronized function usage

## Extensive Current Sensor Lineup Achieve a Combined Basic Accuracy of ±0.04%

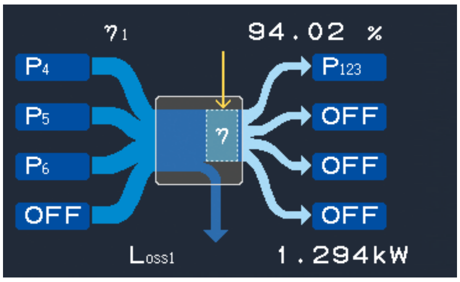
Choose the best sensor for your application: the pull-through type for highly accurate and high current measurements up to 1000 A, the clamp type for quick and easy wire connection, or the direct input type for high accuracy and broadband. Connect a 100 MHz band sensor for oscilloscopes for even more options.
PW6001 comes equipped with a sensor power line built-in. Automated recognition functions make setup a cinch.



*±0.075% = accuracy in combination with PW9100

## 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.

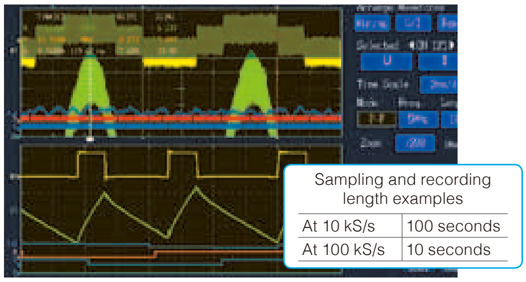



Setting up efficiency calculation formulas for power conditioners and similar equipment is simple on the dedicated screen. Simultaneously display loss and efficiency calculations for a maximum of four systems.

*Device accuracy

## Large-capacity waveform storage for waveform analysis comparable to oscilloscopes

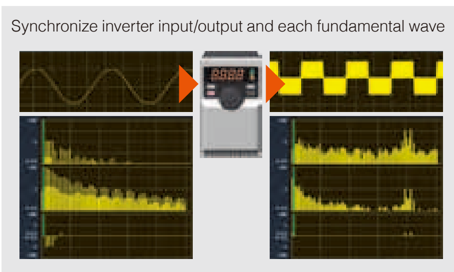
Waveform Storage of 1 MWord × (voltage-current 6 ch + Motor Analysis 4 ch). The torque sensor and encoder signals are displayed along with the voltage and current waveforms.




A range of trigger functions are also included. Cursor measurement and waveform zoom functions also render oscilloscopes unnecessary for waveform analysis.

## Independent harmonic analysis for a maximum of 6 systems (wideband/IEC)

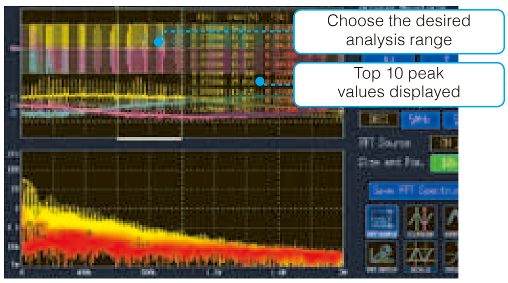
0.1 Hz to 300 kHz fundamental frequency, 1.5 MHz analyzable bandwidth. Comes equipped with IEC61000-4-7-compliant harmonic analysis and up to 100th order wideband harmonic analysis.




**Applications**
- Motor fundamental wave analysis
- Wireless power transmission waveforms
- Measuring distortion ratio of power conditioner output waveforms

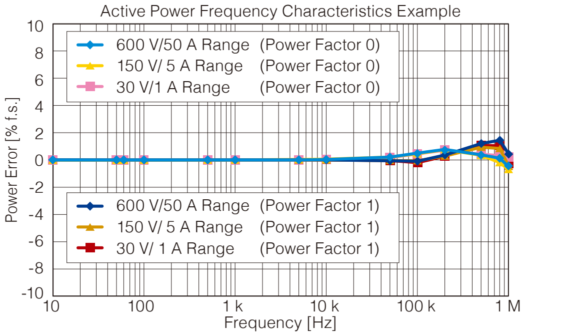
## FFT analysis of target waveforms

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.



## FREE UP GRADE 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.

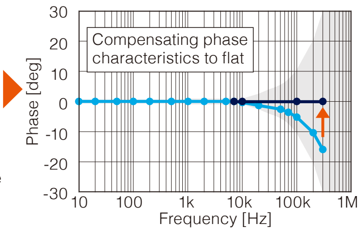



* Options to further improve high-frequency wave phase characteristics available. Contact us for more information.

## FREE UP GRADE 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.

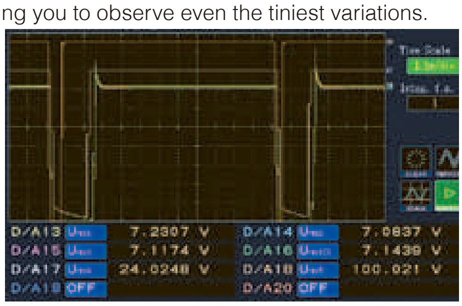
Enter current sensor phase characteristic representative value as phase compensation value (please refer to instruction manual version 03 or later)




Virtual Oversampling: Technology where deskewing processing is performed virtually within the device at a much higher sampling frequency than the actual sampling frequency.

## FREE UP GRADE D/A Monitor

View up to 8 channels of temporal 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.



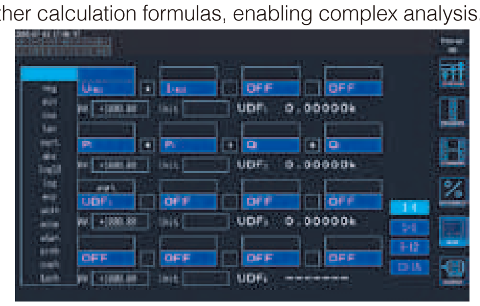
**Applications**

- Power conditioner FRT Analysis
- Motor Transient State Power Analysis

FRT (Fault Ride Through) :
Ability to continue operation despite system disturbance in the power conditioner or similar systems

## FREE UP GRADE 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.

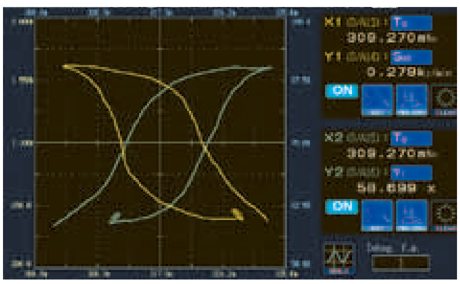


**Applications**

- 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

## FREE UP GRADE 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.



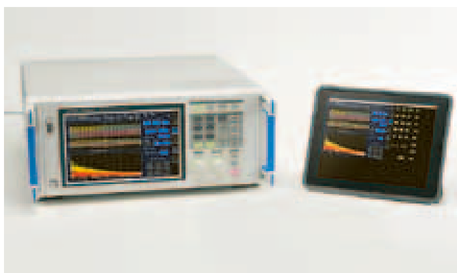
**Applications**

- Motor characteristics analysis
- Transformer characteristics analysis
- Power conditioner MPPT Analysis

MPPT: Maximum Power Point Tracker

## FREE UP GRADE Supports various power analysis systems

Improved connectivity to PCs over LAN. Remotely operate the PW6001 using a standard 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.



* 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

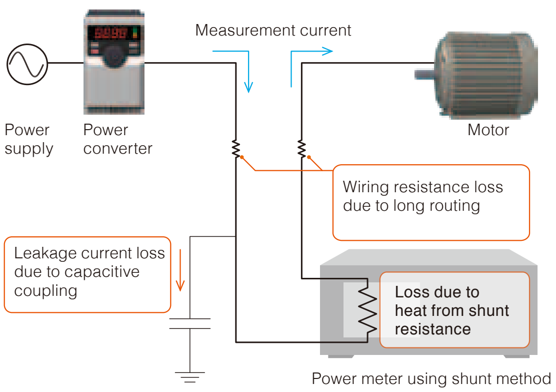
### With direct wire connection method

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.

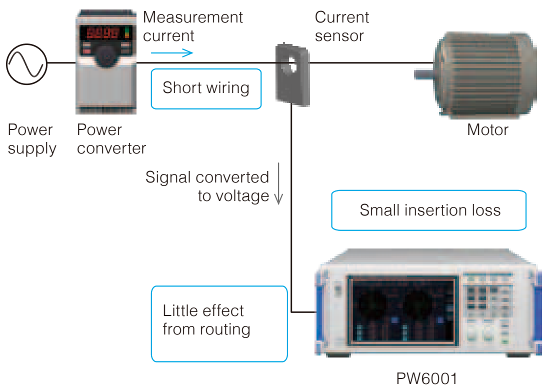
### Advantages of current sensor method

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.

Measurement example using the direct wire connection method




Measurement example using the current sensor method

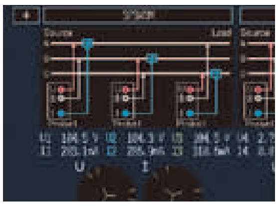



Compared to the direct wire connection method, measurement with conditions closer to the actual operation environment of a power converter is achieved.

## Seamless operability

Simple settings and intuitive operating interface

Simple settings based on measured waveforms



Wiring confirmation function, to avoid wiring mistakes

Dual knobs for vertical/horizontal manipulation of waveforms

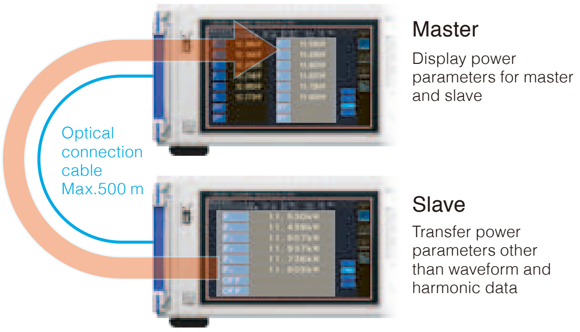

One-touch data saving with dedicated key

Enter handwritten memos on the screen, or use the onscreen keypad


9-inch touch screen with soft keypad

## Build a 12-channel power meter using "numerical synchronization"

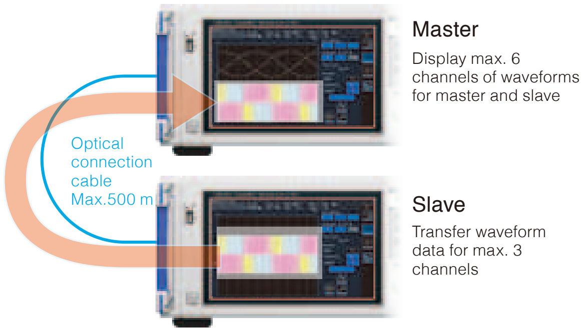
For multi-point measurements, use the numerical synchronization function to transfer power parameters from the slave device to aggregate at the master in real-time, essentially enabling you to build a 12-channel power analysis system




- Real-time display of slave instrument measurement values on master instrument screen
- Real-time efficiency calculations between master/slave
- Save data for 2 units on recording media in master instrument
- Use the slave's measured values on the master's user-defined calculations

## Simply transfer waveforms with "waveform synchronization"

Achieve real-time* transfer of 5 MS/s 18-bit sampling data. Measurement waveforms on the slave instrument are displayed without modification on the master unit, paving the way for new applications for power analyzers, such as measurement of the voltage phase difference between two separate devices.



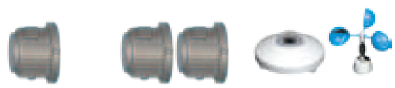

- Real-time display of slave instrument waveforms on master instrument screen
- Harmonic analysis and fundamental wave analysis for master instrument and slave instrument
- Simultaneously measure waveforms on master device while using the slave to trigger

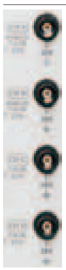
* For both master instruments and slave instrument, waveform synchronization operates only when there are 3 or more channels. Max. ±5 sampling error.

## 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.



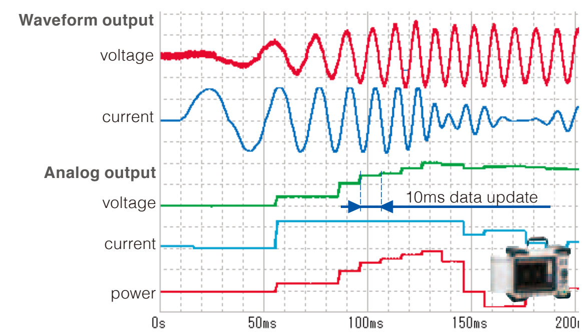
| Operating mode | | Single | Dual | Independent input |
|---|---|---|---|---|
|  | ch A | Torque | Torque | Voltage/ Pulse |
| | ch B | Encoder A phase signal | Torque | Voltage/ Pulse |
| | ch C | Encoder B phase signal | RPM | Pulse |
| | ch D | Encoder Z phase signal | RPM | Pulse |
| Measurement targets | | Motor x 1 | Motor x 2 | Pyranometer/ anemometer and other output signals |
| Measurement parameters | | Electric angle<br>Rotation direction<br>Motor power<br>RPM<br>Torque<br>Slip | Motor power x 2<br>RPM x 2<br>Torque x 2<br>Slip x 2 | Voltage x 2<br>& Pulse x 2<br>or<br>Pulse x 4 |

## Analog Output and 1 MS/s Waveform Output

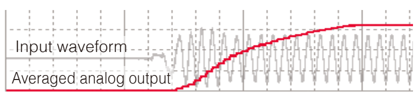
(Motor Analysis and D/A output model)

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*.

| | |
|---|---|
| Analog output | Analog output x 20 channels |
| Waveform output | Waveform output x max. 12 channels*<br>& analog output x 8 channels |



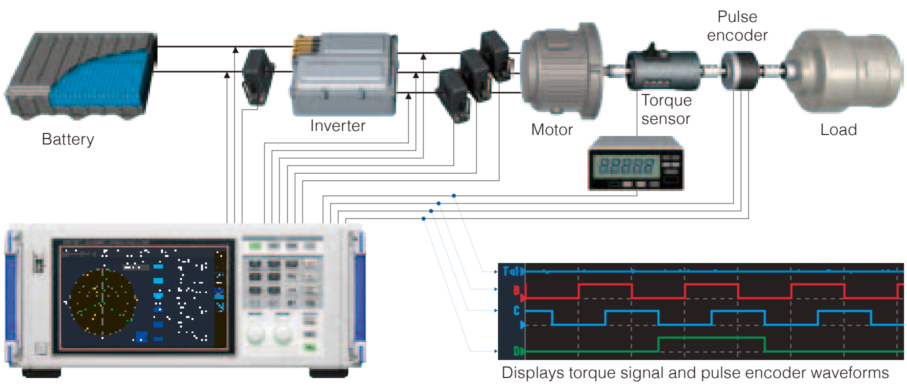

Averaging processing reproduces output responses similar to the Hioki legacy Model 3193




*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



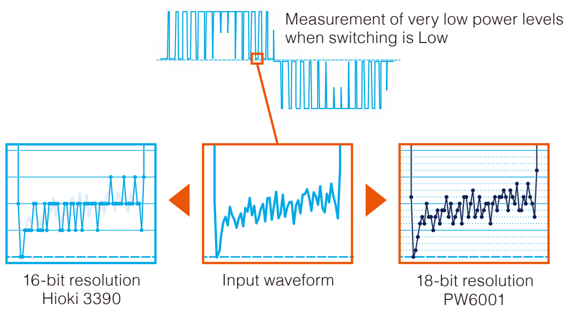
Displays torque signal and pulse encoder waveforms

### Key features

- Accuracy guaranteed @ 10ms data update
- 5MS/s high-speed sampling
- ±0.02% DC accuracy
- Wideband mode harmonic analysis
- Flexible efficiency calculation
- Noise resistance
- TrueHD 18-bit resolution
- User-defined calculations
- Current sensor phase shift function

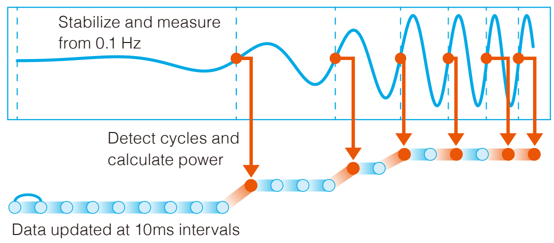
### 5 MS/s speed and high 18-bit resolution make SiC measurements a reality

High resolution is required for the high precision measurement of PWM waveforms for SiC semiconductors with low ON resistance. TrueHD 18-bit is achieved at a level of precision that has never been seen before.




### 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 10ms update rates. Automatically measure and keep up with power with fluctuating frequencies, from a minimum of 0.1 Hz.




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.

### FREE UP GRADE 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-phasic and B-phasic pulses.

Calculation of the d, and q-axis inductances

$$Ld = \frac{vq - Ke \cdot \omega - R \cdot iq}{\omega \cdot id}$$

$$Lq = \frac{R \cdot id - vd}{\omega \cdot iq}$$

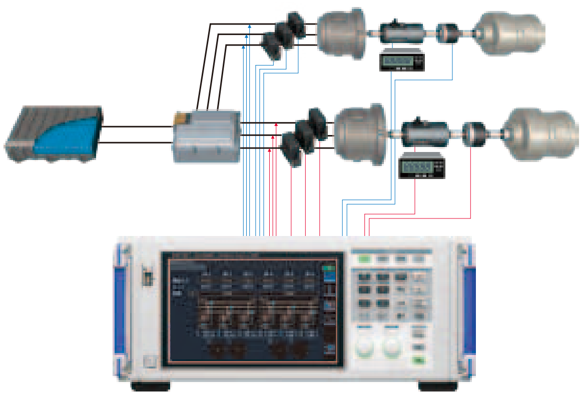
Calculate the Ld and Lq values with user-defined operation

* For more information about electrical angle measurements, please refer to the “HIOKI Power Analyzer PW6001’s PMSM Parameter Identification Methodology” available on the HIOKI website.

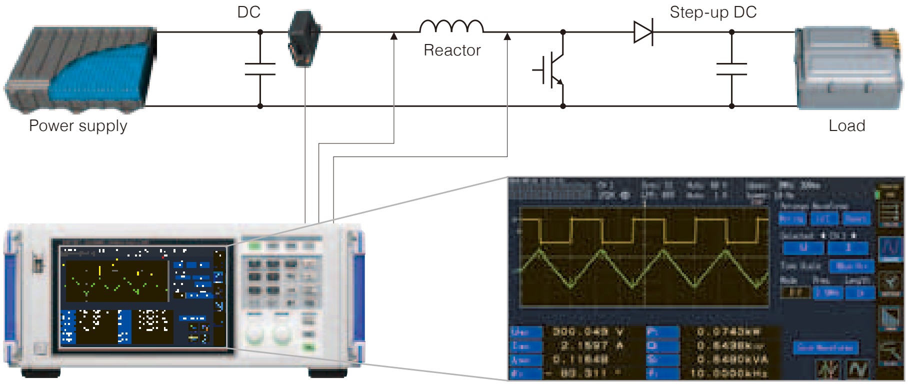
### Simultaneous measurement of 2 motor powers

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.

Example of 2 motor measurement



# Chopper circuit reactor loss measurement

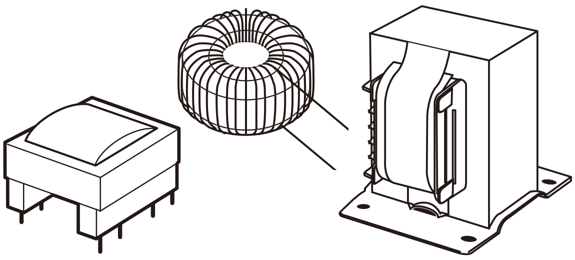



**Key features**

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

## High-frequency and low power factor device evaluation

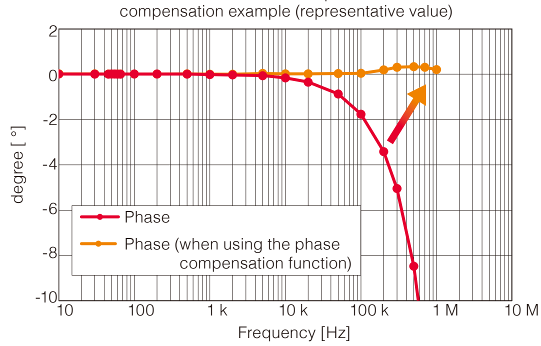
Reactors are used for high harmonic current suppression as well as the voltage step up/down of chopper circuits. The PW6001's outstanding high frequency characteristics, high-speed sampling, and noise-suppressing performance are extremely effective in evaluating high-frequency, low power factor devices.



## Current Sensor Phase Shift Function

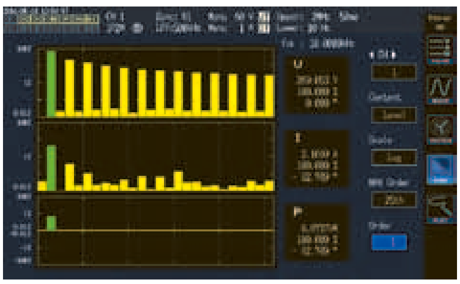
In addition to the PW6001's flat, broad frequency characteristics, sensor phase error compensation allows highly accurate high-frequency and low power factor device analysis.

AC/DC Current Box PW9100's phase characteristic compensation example (representative value)



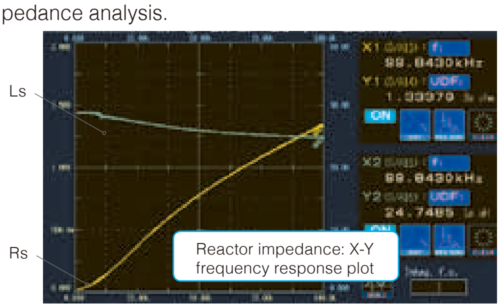

## Harmonic analysis synchronized with switching frequencies

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.



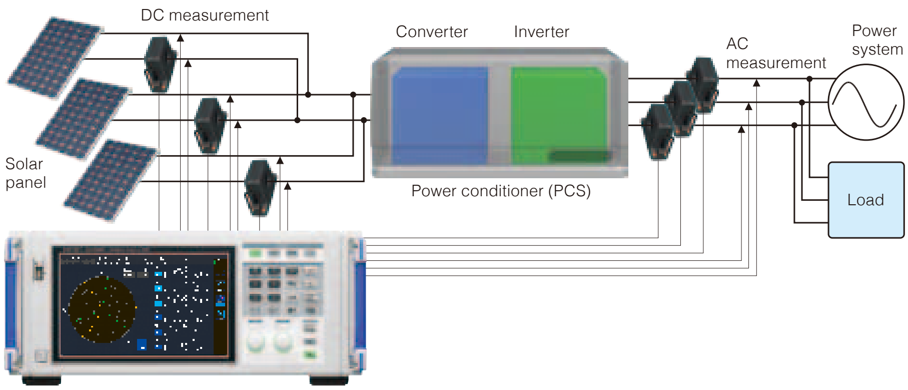
## Circuit impedance analysis

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.




- Impedance Z [Ω] = fundamental frequency voltage / fundamental frequency current
- Serial resistance RS [Ω] = Z × cos (voltage phase angle - current phase angle)
- Serial inductance Ls [H] = Z × sin (voltage phase angle - current phase angle) / (2 × π × frequency)

# PV Power Conditioner (PCS) Efficiency Measurement

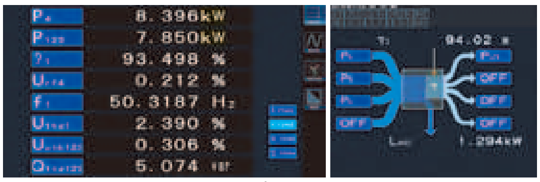



**Key features**

- ±0.02% DC accuracy
- Frequency accuracy ±0.01 Hz
- Various measurement parameters
- Independent input for Motor Analysis
- IEC mode harmonic analysis
- Integration of purchased electricity

## Supports PCS-specific measurements

Simultaneously display the necessary parameters for PCS such as efficiency, loss, fundamental wave reactive power Qfnd, DC ripple ratio, three-phrase 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.

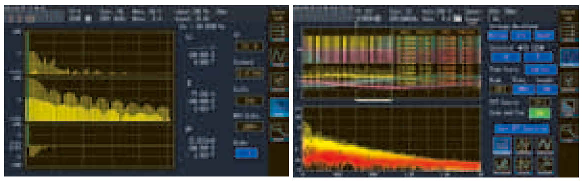


P4: DC power (panel output)
P123: 3-phase power (power conditioner output)
η1: Conversion efficiency
Urf4: Ripple rate

f1: Frequency
Uthd1: Voltage total harmonic distortion
Uunb123: Unbalance rate
Qfnd123: Fundamental wave reactive power

## Harmonic analysis and higher order harmonic analysis (noise analysis)

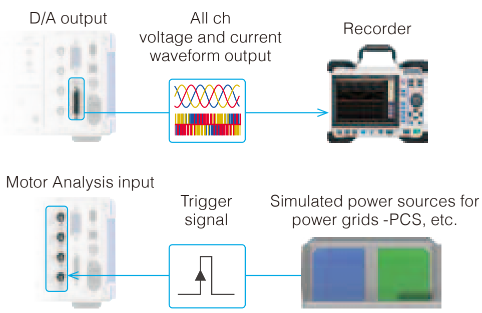
Equipped with IEC standard mode supporting IEC61000-4-7. Arbitrarily set THD calculated upper limit orders also based on the standard's requirements. In addition, measure 2 kHz – 150 kHz high-order harmonics (noise that is not synchronized with the power frequency) through FFT analysis.
General CTs are not defined for accuracy beyond 60Hz. On the other hand, Hioki current sensors are guaranteed for accuracy even for harmonic measurements.



Measure output harmonics and noise through input waveform FFT analysis

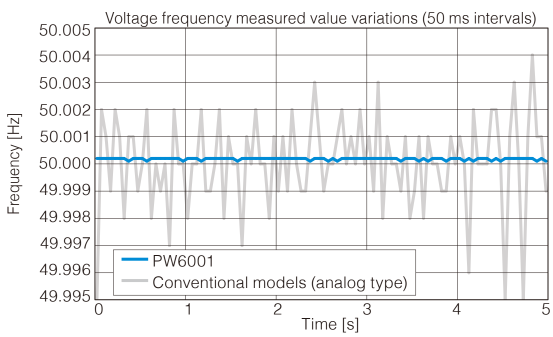
## Simplify the evaluation system

An evaluation system using simple connections can be configured in models with Motor Analysis and D/A output options. With the D/A output function, all ch voltage and currents are waveform output at 16 bit and 1 MS/s. Even if differential probes or current probes are not available, waveform observations can be performed alongside a recorder. In addition, when using the Motor Analysis channel as an input trigger, you can make highly accurate analysis of simulated power sources for power grids or PCS waveforms.



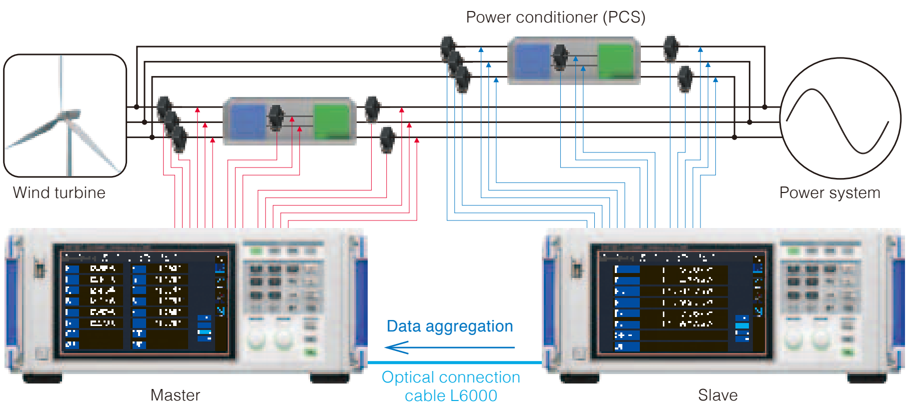

## FREE UP GRADE Voltage frequency measurement fundamental accuracy of ± 0.01 Hz*

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.

# Power conversion for wind power generation




**Key features**

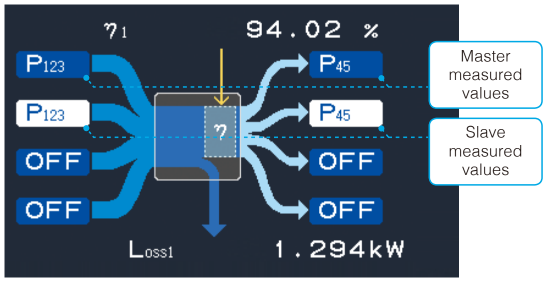
- Zero-cross filter
- Numerical synchronization Max. 12 channels
- Flexible efficiency calculation
- 2-system vector display
- IEC mode harmonic analysis

## Simultaneous analysis of system and power generation

With the dual vector display, you can see the 3-phase balancing conditions for both the system and power generation at a glance.

## PCS efficiency measurements

Perfectly synchronize and measure a two-system PCS by using the numerical synchronization function.




All power parameters can be aggregated on the master instrument, and the efficiency for each or the overall efficiency can be calculated and displayed.

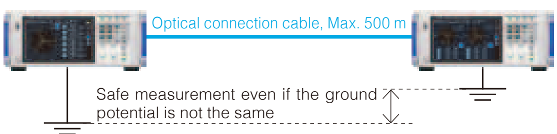
# Test and evaluate substations, plants and railroads

**Key features**

- Waveform synchronization
- D/A waveform output
- Waveform synchronization

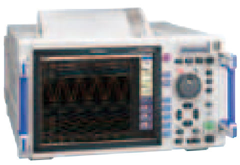
## Measure phase difference between 2 separate points

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.




## 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 Hioki MEMORY HiCORDER, timing tests and simultaneous analysis of multiple channels for 3-phase power are possible.



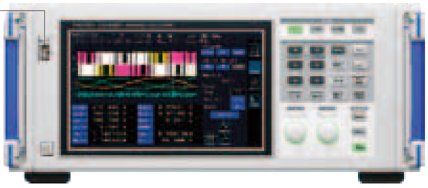
Max. analog 32 channels + logic 32 channels
MEMORY HiCORDER MR8827

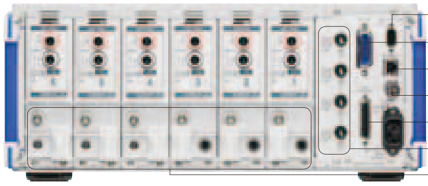
* The waveform that is output has a delay of 7 μs to 12 μs, depending on the distance.

# Interface

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

## Names of parts




| | |
|---|---|
| GP-IB | Data viewable through dedicated application<br>Command control |
| RS-232C | Data viewable through dedicated application<br>Command control<br>Bluetooth® logger connection<br>Send the D/A output of values measured with the PW6001 (maximum of 8 items) wirelessly to the Hioki Wireless Logging Station LR8410 using the dedicated cable and Bluetooth® serial conversion adapter. (Approx. 30m* line of sight)The observable output resolution is dependent on the LR8410's resolution.<br>* The presence of obstructions (walls, metal, etc.) may shorten the communication range or destabilize the signal.<br>* Bluetooth® is a trademark of Bluetooth SIG, Inc. and licensed for use by HIOKI E.E. CORPORATION. |
| External I/O | START/ STOP/ DATA RESET control<br>Terminals shared with RS-232C, ±5 V/200 mA power supply possible |
| LAN | Gbit LAN supported<br>Command control<br>View data in free dedicated application |

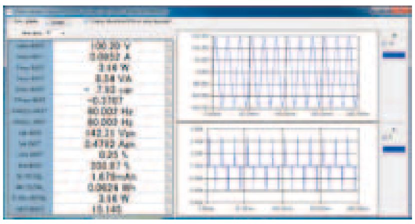
| | |
|---|---|
| Synchronous control | Optical connection cable connector, Duplex-LC (2-core) |
| D/A output (PW6001-11 to 16 only) | Switching for 20 channels of analog output or maximum 12 channels of waveform + 8 channels of analog output |
| Current probe input component | Power can also be supplied from the PW6001 to Probe1 or Probe2 by using the sliding cover. |
| Motor Analysis input component | Input signals from torque meters or rotation meters to measure motor power. Measure motor signals including electric angle and motor power from instruments such as actinometers and anemometers. |
| USB flash drive | Save waveform data/measured data (csv)<br>Save screen copy (bmp)<br>Save interval data (csv) in real time<br>at the fastest interval of 10 ms |
| 64 MB internal memory | Save interval data and<br>send it to a USB flash drive later |

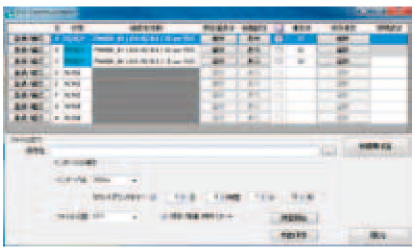
# Software

Download the software and drivers below from the HIOKI website at www.hioki.com

## PC Communication Software PW Communicator

PW Communicator is a dedicated application software for communicating between a PW6001 power meter and a PC. Free download is available from the Hioki website. The application contains convenient functions for setting the PW6001, monitoring the measurement values, acquiring data via communication, computing efficiency, and much more.





| | |
|---|---|
| Value monitoring | Display the PW6001's measurement values on the PC screen. Freely select up to 64 values, such as voltage, current, power, and harmonics. |
| Waveform monitoring | Monitor the voltage, current, and waveforms measured by the meter right on the PC screen. |
| Meter setting | Configure the connected PW6001 from the PC screen. |
| Measure with multiple units | Compute the input/output efficiency of a power converter and similar operations when using multiple units of PW6001. In addition to the PW6001, you can also batch control other Hioki power meters, such as the PW3335, PW3336, and PW3337. |
| Save in CSV format | Record 180 or more measurement data to a CSV file at fixed intervals.The shortest interval between recordings is 200 ms. |

| | |
|---|---|
| Operating environment | PC/AT-compatible |
| OS | Windows 10/Windows 8/Windows 7 (32 bit/64 bit)<br>*Windows is a registered trademark of Microsoft Corporation. |
| Memory | 2GB or more recommended |
| Interface | LAN, RS-232C, GP-IB |

### FREE UP GRADE LabVIEW driver

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

### FREE UP GRADE MATLAB Toolkit

Control the PW6001 with MATLAB through a LAN connection and read the PW6001's waveform binary data.
*MATLAB is a registered trademark of Mathworks, Inc.

# Specifications

## Power measurement

| | |
|---|---|
| Measurement lines | 1-phase/2-wire (1P2W), 1-phase/3-wire (1P3W),<br>3-phase/3-wire (3P3W2M, 3V3A, 3P3W3M), 3-phase/4-wire (3P4W) |

| | CH1 | CH2 | CH3 | CH4 | CH5 | CH6 |
|---|---|---|---|---|---|---|
| Pattern 1 | 1P2W | 1P2W | 1P2W | 1P2W | 1P2W | 1P2W |
| Pattern 2 | 1P3W / 3P3W2M | | 1P2W | 1P2W | 1P2W | 1P2W |
| Pattern 3 | 1P3W / 3P3W2M | | 1P2W | 1P3W / 3P3W2M | | 1P2W |
| Pattern 4 | 1P3W / 3P3W2M | | 1P3W / 3P3W2M | | 1P3W / 3P3W2M | |
| Pattern 5 | 3P3W3M / 3V3A / 3P4W | | | 1P2W | 1P2W | 1P2W |
| Pattern 6 | 3P3W3M / 3V3A / 3P4W | | | 1P3W / 3P3W2M | | 1P2W |
| Pattern 7 | 3P3W3M / 3V3A / 3P4W | | | 3P3W3M / 3V3A / 3P4W | | |

For 2-channel combinations, select 1P3W or 3P3W2M.
For 3-channel combinations, select 3P3W3M, 3V3A, or 3P4W.

| Number of channels | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| Pattern 1 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Pattern 2 | – | ✓ | ✓ | ✓ | ✓ | ✓ |
| Pattern 3 | – | – | – | – | – | ✓ |
| Pattern 4 | – | – | – | ✓ | – | ✓ |
| Pattern 5 | – | – | ✓ | ✓ | ✓ | ✓ |
| Pattern 6 | – | – | – | – | ✓ | ✓ |
| Pattern 7 | – | – | – | – | – | ✓ |

Connection patterns that can be selected based on the number of channels:
[✓] Can be selected, [–] Cannot be selected

| | |
|---|---|
| Number of input channels | Max. 6 channels; each input unit provides 1 channel for simultaneous voltage and current input |
| Input terminal profile | Voltage: Plug-in terminals (safety terminals)<br>Probe 1: Dedicated connector (ME15W)<br>Probe 2: BNC (metal) + power supply 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 |
| Input method | Voltage measurement unit: Photoisolated input, resistance voltage divider<br>Current measurement unit: Isolated input from current sensor (voltage output) |
| Voltage range | 6 V / 15 V / 30 V / 60 V / 150 V / 300 V / 600 V / 1500 V |
| Current range (Probe 1) | 400 mA / 800 mA / 2 A / 4 A / 8 A / 20 A (with 20 A sensor)<br>4 A / 8 A / 20 A / 40 A / 80 A / 200 A (with 200 A sensor)<br>1 A / 2 A / 5 A / 10 A / 20 A / 50 A (with 50 A sensor)<br>10 A / 20 A / 50 A / 100 A / 200 A / 500 A (with 500 A sensor)<br>20 A / 40 A / 100 A / 200 A / 400 A / 1 kA (with 1000 A sensor) |
| (Probe 2) | 1 kA / 2 kA / 5 kA / 10 kA / 20 kA / 50 kA (with 0.1 mV/A sensor)<br>100 A / 200 A / 500 A / 1 kA / 2 kA / 5 kA (with 1 mV/A sensor)<br>10 A / 20 A / 50 A / 100 A / 200 A / 500 A (with 10 mV/A sensor; with 3274 or 3275)<br>1 A / 2 A / 5 A / 10 A / 20 A / 50 A (with 100 mV/A sensor; with 3273 or 3276)<br>100 mA / 200 mA / 500 mA / 1 A / 2 A / 5 A (with 1 V/A sensor; with CT6700 or CT6701)<br>(0.1 V / 0.2 V / 0.5 V / 1.0 V / 2.0 V / 5.0 V range) |
| Power range | 2.40000 W to 4.50000 MW (depending on voltage and current combinations) |
| Crest factor | 3 (relative to voltage/current range rating);<br>however, 1.33 for 1500 V range, 1.5 for 5 V Probe 2 range<br>300 (relative to minimum valid voltage and current input);<br>however, 133 for 1500 V range, 150 for 5 V Probe 2 range |
| Input resistance (50 Hz / 60 Hz) | Voltage inputs: 4 MΩ ±40 kΩ<br>Probe 1 inputs: 1 MΩ ±50 kΩ; Probe 2 inputs: 1 MΩ ±50 kΩ |
| Maximum input voltage | Voltage inputs: 1000 V, ±2000 Vpeak (10 ms or less)<br>Input voltage frequency of 250 kHz to 1 MHz, (1250 - f) V<br>Input voltage frequency of 1 MHz to 5 MHz, 50 V<br>Unit for f above: kHz<br>Probe 1 inputs: 5 V, ±12 Vpeak (10 ms or less)<br>Probe 2 inputs: 8 V, ±15 Vpeak (10 ms or less) |
| Maximum rated voltage to earth | Voltage input terminal (50 Hz/60 Hz)<br>CATIII 600V; anticipated transient overvoltage: 6000V<br>CATII 1000V; anticipated transient overvoltage: 6000V |
| Measurement method | Voltage/current simultaneous digital sampling with zero-cross synchronized calculation |
| Sampling | 5 MHz / 18 bits |
| Frequency band | DC, 0.1 Hz to 2 MHz |
| Synchronization frequency range | 0.1 Hz to 2 MHz |
| Synchronization source | U1 to U6, I1 to I6, DC (fixed at data update rate),<br>Ext1 to Ext2<br>The zero-cross point of the waveform after passing through the zero-cross filter is used as the standard for U or I selection. |
| Data update rate | 10 ms / 50 ms / 200 ms<br>When using simple averaging, the data update rate varies based on the number of averaging iterations. |
| LPF | 500 Hz / 1 kHz / 5 kHz / 10 kHz / 50 kHz / 100 kHz / 500 kHz / OFF<br>Approx. 500 kHz analog LPF + digital IIR filter (Butterworth characteristics equivalent)<br>Except when off, add ±0.1% rdg. to the accuracy.<br>Defined for frequencies that are less than or equal to 1/10 of the set frequency. |
| Polarity detection voltage | Current zero-cross timing comparison |
| Measurement parameters | Voltage (U), current (I), active power (P), apparent power (S), reactive power (Q), power factor (λ), phase angle (φ), frequency (f), efficiency (η), loss (Loss), voltage ripple factor (Urf), current ripple factor (Irf), current integration (Ih), power integration (WP), voltage peak (Upk), current peak (Ipk) |
| Effective measurement range | Voltage, current, power: 1% to 110% of range |
| Zero-suppression range | Select from OFF / 0.1% f.s. / 0.5% f.s.<br>When set to OFF, a value may be displayed even when receiving zero input. |
| Zero-adjustment | Zero-adjustment of input offsets that are less than ±10% f.s. for voltage and ±10% f.s. ±4 mV for current |
| Accuracy | Sine wave input with a power factor of 1 or DC input, terminal-to-ground voltage of 0 V, after zero-adjustment<br>Within the effective measurement range |

| | Voltage (U) | Current (I) |
|---|---|---|
| DC | ±0.02% rdg. ±0.03% f.s. | ±0.02% rdg. ±0.03% f.s. |
| 0.1 Hz ≤ f < 30 Hz | ±0.1% rdg. ±0.2% f.s. | ±0.1% rdg. ±0.2% f.s. |
| 30 Hz ≤ f < 45 Hz | ±0.03% rdg. ±0.05% f.s. | ±0.03% rdg. ±0.05% f.s. |
| 45 Hz ≤ f ≤ 66 Hz | ±0.02% rdg. ±0.02% f.s. | ±0.02% rdg. ±0.02% f.s. |
| 66 Hz < f ≤ 1 kHz | ±0.03% rdg. ±0.04% f.s. | ±0.03% rdg. ±0.04% f.s. |
| 1 kHz < f ≤ 50 kHz | ±0.1% rdg. ±0.05% f.s. | ±0.1% rdg. ±0.05% f.s. |
| 50 kHz < f ≤ 100 kHz | ±0.01xf% rdg. ±0.2% f.s. | ±0.01xf% rdg. ±0.2% f.s. |
| 100 kHz < f ≤ 500 kHz | ±0.008xf% rdg. ±0.5% f.s. | ±0.008xf% rdg. ±0.5% f.s. |
| 500 kHz < f ≤ 1 MHz | ±(0.021xf-7)% rdg. ±1% f.s. | ±(0.021xf-7)% rdg. ±1% f.s. |
| Frequency band | 2 MHz (-3 dB, typical) | 2 MHz (-3 dB, typical) |

| | Active power (P) | Phase difference |
|---|---|---|
| DC | ±0.02% rdg. ±0.05% f.s. | – |
| 0.1 Hz ≤ f < 30 Hz | ±0.1% rdg. ±0.2% f.s. | ±0.1° |
| 30 Hz ≤ f < 45 Hz | ±0.03% rdg. ±0.05% f.s. | ±0.05° |
| 45 Hz ≤ f ≤ 66 Hz | ±0.02% rdg. ±0.03% f.s. | ±0.05° |
| 66 Hz < f ≤ 1 kHz | ±0.04% rdg. ±0.05% f.s. | ±0.05° |
| 1 kHz < f ≤ 10 kHz | ±0.15% rdg. ±0.1% f.s. | ±0.4° |
| 10 kHz < f ≤ 50 kHz | ±0.15% rdg. ±0.1% f.s. | ±(0.040xf)° |
| 50 kHz < f ≤ 100 kHz | ±0.012xf% rdg. ±0.2% f.s. | ±(0.050xf)° |
| 100 kHz < f ≤ 500 kHz | ±0.009xf% rdg. ±0.5% f.s. | ±(0.055xf)° |
| 500 kHz < f ≤ 1 MHz | ±(0.047xf-19)% rdg. ±2% f.s. | ±(0.055xf)° |

- Unit for f in accuracy calculations as mentioned in the table above: kHz
- Voltage and current DC values are defined for Udc and Idc, while frequencies other than DC are defined for Urms and Irms.
- When U or I is selected as the synchronization source, accuracy is defined for source input of at least 5% f.s.
- The phase difference is defined for a power factor of zero during f.s. input.
- Add the current sensor accuracy to the above accuracy figures for current, active power, and phase difference.
- For the 6 V range, add ±0.05% f.s. for voltage and active power.
- Add ±20 μV to the DC accuracy for current and active power when using Probe 1 (however, 2 V f.s.).
- Add ±0.05% rdg. ±0.2% f.s. for current and active power when using Probe 2, and add ±0.2° to the phase at or above 10 kHz.
- The accuracy figures for voltage, current, active power, and phase difference for 0.1 Hz to 10 Hz are reference values.
- The accuracy figures for voltage, active power, and phase difference in excess of 220 V from 10 Hz to 16 Hz are reference values.
- The accuracy figures for voltage, active power, and phase difference in excess of 750 V for values of f such that 30 kHz < f ≤ 100 kHz are reference values.
- The accuracy figures for voltage, active power, and phase difference in excess of (22000/f [kHz]) V for values of f such that 100 kHz < f ≤ 1 MHz are reference values.
- Add ±0.02% rdg. for voltage and active power at or above 1000 V (however, figures are reference values).
  Even for input voltages that are less than 1000 V, the effect will persist until the input resistance temperature falls.
- For voltages in excess of 600 V, add the following to the phase difference accuracy:
  - 500 Hz < f ≤ 5 kHz: ±0.3°
  - 5 kHz < f ≤ 20 kHz: ±0.5°
  - 20 Hz < f ≤ 200 kHz: ±1°

| Measurement parameters | Accuracy |
|---|---|
| Apparent power | Voltage accuracy + current accuracy ±10 dgt. |
| Reactive power | Apparent power accuracy +<br>$(\sqrt{2.69 \times 10^{-4} \times f + 1.0022 - \lambda^2} - \sqrt{1 - \lambda^2}) \times 100\%$ f.s. |
| Power factor | φ of other than ±90°:<br>$\pm\left(1 - \frac{\cos(\phi + \text{phase difference accuracy})}{\cos(\phi)}\right) \times 100\%$rdg. ± 50dgt.<br>φ of ±90°:<br>±cos (φ + phase difference accuracy) × 100% f.s. ±50 dgt. |
| Waveform peak | Voltage/current RMS accuracy ±1% f.s.<br>(f.s.: apply 300% of range) |

f: kHz; φ: Display value for voltage/current phase difference;
λ: Display value for power factor

| | |
|---|---|
| Effects of temperature and humidity | Add the following to the voltage, current, and active power accuracy within the range of 0°C to 20°C or 26°C to 40°C:<br>±0.01% rdg./°C (add 0.01% f.s./°C for DC measured values)<br>For current and active power when using Probe 2, ±0.02% rdg./°C (add 0.05% f.s./°C for DC measured values)<br>Under conditions of 60% RH or greater:<br>Add ±0.0006 × humidity [%RH] × f [kHz]% rdg. to the voltage and active power accuracy.<br>Add ±0.0006 × humidity [%RH] × f [kHz]° for the phase difference. |
| Effects of common-mode voltage | 50 Hz/60 Hz : 100 dB or greater (when applied between the voltage inputterminals and the enclosure)<br>100 kHz : 80 dB or greater (reference value)<br>Defined for CMRR when the maximum input voltage is applied for all measurement ranges. |
| Effects of external magnetic fields | ±1% f.s. or less (in a magnetic field of 400 A/m, DC or 50 Hz/ 60 Hz) |
| Effects of power factor | φ of other than ±90°: $\pm\left(1 - \frac{\cos(\phi + \text{phase difference accuracy})}{\cos(\phi)}\right) \times 100\%$rdg.<br>φ of ±90°: ±cos (φ + phase difference accuracy) × 100% f.s. |

## Frequency measurement

| | |
|---|---|
| Number of measurement channels | Max. 6 channels (f1 to f6), based on the number of input channels |
| Measurement source | Select from U/I for each connection. |
| Measurement method | Reciprocal method + zero-cross sampling value correction<br>Calculated from the zero-cross point of waveforms after application of the zero-cross filter. |
| Measurement range | 0.1 Hz to 2 MHz<br>(Display shows 0.00000 Hz or ----- Hz if measurement is not possible.) |
| Accuracy | ±0.01Hz (Only when measuring 45-66 Hz with a minimum measurement interval of 50 ms and sine input of at least 50% relative to the voltage range when measuring the voltage frequency.)<br>±0.05% rdg ± 1 dgt. (other than the conditions mentioned above, when the sine wave is at least 30% relative to the measurement source's measurement range) |
| Display format | 0.10000 Hz to 9.99999 Hz, 9.9000 Hz to 99.9999 Hz,<br>99.000 Hz to 999.999 Hz, 0.99000 kHz to 9.99999 kHz,<br>9.9000 kHz to 99.9999 kHz, 99.000 kHz to 999.999 kHz,<br>0.99000 MHz to 2.00000 MHz |

## Integration measurement

| | |
|---|---|
| Measurement modes | Select RMS or DC for each connection (DC mode can only be selected when using an AC/DC sensor with a 1P2W connection). |
| Measurement parameters | Current integration (Ih+, Ih-, Ih), active power integration (WP+, WP-, WP)<br>Ih+ and Ih- are measured only in DC mode. Only Ih is measured in RMS mode. |
| Measurement method | Digital calculation based on current and active power values<br>DC mode: Every sampling interval, current values and instantaneous power values are integrated separately for each polarity.<br>RMS mode: The current RMS value and active power value are integrated for each measurement interval. Only active power is integrated separately for each polarity. |
| Display resolution | 999999 (6 digits + decimal point), starting from the resolution at which 1% of each range is f.s. |
| Measurement range | 0 to ±9999.99 TAh/TWh |
| Integration time | 10 sec. to 9999 hr. 59 min. 59 sec. |
| Integration time accuracy | ±0.02% rdg. (0°C to 40°C) |
| Integration accuracy | ±(current or active power accuracy) ±integration time accuracy |
| Backup function | None |

## Harmonics measurement

| | |
|---|---|
| Number of measurement channels | Max. 6 channels, based on the number of built-in channels |
| Synchronization source | Based on the synchronization source setting for each connection. |
| Measurement modes | Select from IEC standard mode or wideband mode (setting applies to all channels). |
| Measurement parameters | Harmonic voltage RMS value, harmonic voltage content ratio, harmonic voltage phase angle, harmonic current RMS value, harmonic current content ratio, harmonic current phase angle, harmonic active power, harmonic power content ratio, harmonic voltage/current phase difference, total voltage harmonic distortion, total current harmonic distortion, voltage unbalance ratio, current unbalance ratio |
| FFT processing word length | 32 bits |
| Antialiasing | Digital filter (automatically configured based on synchronization frequency) |
| Window function | Rectangular |
| Grouping | OFF / Type 1 (harmonic sub-group) / Type 2 (harmonic group) |
| THD calculation method | THD_F / THD_R (Setting applies to all connections.) Select calculation order from 2nd order to 100th order<br>(however, limited to the maximum analysis order for each mode). |

### (1) IEC standard mode

| | |
|---|---|
| Measurement method | Zero-cross synchronization calculation method (same window for each synchronization source)<br>Fixed sampling interpolation calculation method with average thinning in window<br>IEC 61000-4-7:2002 compliant with gap overlap |
| Synchronization frequency range | 45 Hz to 66 Hz |
| Data update rate | Fixed at 200 ms. |
| Analysis orders | 0th to 50th |
| Window wave number | When less than 56 Hz, 10 waves; when 56 Hz or greater, 12 waves |
| Number of FFT points | 4096 points |

Accuracy

| Frequency | Harmonic voltage and current | Harmonic power | Phase difference |
|---|---|---|---|
| DC (0th order) | ±0.1% rdg. ±0.1% f.s. | ±0.1% rdg. ±0.2% f.s. | -- |
| 45 Hz ≤ f ≤ 66 Hz | ±0.2% rdg. ±0.04% f.s. | ±0.4% rdg. ±0.05% f.s. | ±0.08° |
| 66 Hz < f ≤ 440 Hz | ±0.5% rdg. ±0.05% f.s. | ±1.0% rdg. ±0.05% f.s. | ±0.08° |
| 440 Hz < f ≤ 1 kHz | ±0.8% rdg. ±0.05% f.s. | ±1.5% rdg. ±0.05% f.s. | ±0.4° |
| 1 kHz < f ≤ 2.5 kHz | ±2.4% rdg. ±0.05% f.s. | ±4% rdg. ±0.05% f.s. | ±0.4° |
| 2.5 kHz < f ≤ 3.3 kHz | ±6% rdg. ±0.05% f.s. | ±10% rdg. ±0.05% f.s. | ±0.8° |

Unit for f in accuracy calculations as mentioned in the table above: kHz
Power is defined for a power factor of 1.
Accuracy specifications are defined for fundamental wave input that is greater than or equal to 50% of the range.
Add the current sensor accuracy to the above accuracy figures for current, active power, and phase difference.
Add ±0.02% rdg. for voltage and active power at or above 1000 V (however, figures are reference values).
Even for input voltages that are less than 1000 V, the effect will persist until the input resistance temperature falls.

### (2) Wideband mode

| | |
|---|---|
| Measurement method | Zero-cross synchronization calculation method (same window for each synchronization source) with gaps<br>Fixed sampling interpolation calculation method |
| Synchronization frequency range | 0.1 Hz to 300 kHz |
| Data update rate | Fixed at 50 ms. |

Maximum analysis order and Window wave number

| Frequency | Window wave number | Maximum analysis order |
|---|---|---|
| 0.1 Hz ≤ f < 80 Hz | 1 | 100th |
| 80 Hz ≤ f < 160 Hz | 2 | 100th |
| 160 Hz ≤ f < 320 Hz | 4 | 60th |
| 320 Hz ≤ f < 640 Hz | 2 | 60th |
| 640 Hz ≤ f < 6 kHz | 4 | 50th |
| 6 kHz ≤ f < 12 kHz | 2 | 50th |
| 12 kHz ≤ f < 25 kHz | 4 | 50th |
| 25 kHz ≤ f < 50 kHz | 8 | 30th |
| 50 kHz ≤ f < 101 kHz | 16 | 15th |
| 101 kHz ≤ f < 201 kHz | 32 | 7th |
| 201 kHz ≤ f ≤ 300 kHz | 64 | 5th |

| | |
|---|---|
| Phase zero-adjustment | The instrument provides phase zero-adjustment functionality using keys or communications commands (only available when the synchronization source is set to Ext). |
| Accuracy | Add the following to the accuracy figures for voltage (U), current (I), active power (P), and phase difference. (Unit for f in following table: kHz) |

| Frequency | Harmonic voltage and current | Harmonic power | Phase difference |
|---|---|---|---|
| DC | ±0.1% f.s. | ±0.2% f.s. | - |
| 0.1 Hz ≤ f < 30 Hz | ±0.05% f.s. | ±0.05% f.s. | ±0.1° |
| 30 Hz ≤ f < 45 Hz | ±0.1% f.s. | ±0.2% f.s. | ±0.1° |
| 45 Hz ≤ f ≤ 66 Hz | ±0.05% f.s. | ±0.1% f.s. | ±0.1° |
| 66 Hz < f ≤ 1 kHz | ±0.05% f.s. | ±0.1% f.s. | ±0.1° |
| 1 kHz < f ≤ 10 kHz | ±0.05% f.s. | ±0.1% f.s. | ±0.6° |
| 10 kHz < f ≤ 50 kHz | ±0.2% f.s. | ±0.4% f.s. | ±(0.020×f)° ±0.5° |
| 50 kHz < f ≤ 100 kHz | ±0.4% f.s. | ±0.5% f.s. | ±(0.020×f)° ±1° |
| 100 kHz < f ≤ 500 kHz | ±1% f.s. | ±2% f.s. | ±(0.030×f)° ±1.5° |
| 500 kHz < f ≤ 900 kHz | ±4% f.s. | ±5% f.s. | ±(0.030×f)° ±2° |

Unit for f in accuracy calculations as mentioned in the table above: kHz
The figures for voltage, current, power, and phase difference for frequencies in excess of 300 kHz are reference values.
When the fundamental wave is outside the range of 16 Hz to 850 Hz, the figures for voltage, current, power, and phase difference for frequencies other than the fundamental wave are reference values.
When the fundamental wave is within the range of 16 Hz to 850 Hz, the figures for voltage, current, power, and phase difference in excess of 6 kHz are reference values.
Accuracy values for phase difference are defined for input for which the voltage and current for the same order are at least 10% f.s.

## Waveform recording

| | |
|---|---|
| Number of measurement channels | Voltage and current waveforms: Max. 6 channels (based on the number of installed channels)<br>Motor waveforms *: Max. 2 analog DC channels + max. 4 pulse channels |
| Recording capacity | 1 Mword × ((voltage + current) × number of channels + motor waveforms *) |
| Waveform resolution | 16 bits (Voltage and current waveforms use the upper 16 bits of the 18-bit A/D.) |
| Sampling speed | Voltage and current waveforms: Always 5 MS/s<br>Motor waveforms *: Always 50 kS/s<br>Motor pulse *: Always 5 MS/s |
| Compression ratio | 1/1, 1/2, 1/5, 1/10, 1/20, 1/50, 1/100, 1/200, 1/500<br>(5 MS/s, 2.5 MS/s, 1 MS/s, 500 kS/s, 250 kS/s, 100 kS/s, 50 kS/s, 25 kS/s, 10 kS/s)<br>However, motor waveforms* are only compressed at 50 kS/s or less. |
| Recording length | 1 kWord / 5 kWord / 10 kWord / 50 kWord / 100 kWord / 500 kWord / 1 Mword |
| Storage mode | Peak-to-peak compression or simple thinning |
| Trigger mode | SINGLE or NORMAL (with forcible trigger setting) |
| Pre-trigger | 0% to 100% of the recording length, in 10% steps |
| Trigger source | Voltage and current waveform, waveform after voltage and current zero-cross filter, manual, motor waveform*, motor pulse* |
| Trigger slope | Rising edge, falling edge |
| Trigger level | ±300% of the range for the waveform, in 0.1% steps |

*Motor waveform and motor pulse: Motor Analysis and D/A-equipped models only

## FFT analysis

| | |
|---|---|
| Measurement channel | Voltage-Current Waveform - 1 channel (selected from input channels)<br>Motor Waveform - Analog DC<br>Analysis performed only when FFT screen is displayed |
| Calculation type | RMS spectrum |
| Number of FFT points | 1,000, 5,000, 10,000 or 50,000 points |
| FFT processing word length | 32 bits |
| Analysis position | Any desired position among the waveform record data |
| Antialiasing | Automatic Digital Filter (during simple thinning mode)<br>None (During Peak-Peak compression mode, use the Max value and perform FFT) |
| Window function | Rectangular/Hanning/Flat-top |
| Max. analysis frequency | Linked with compression ratio of waveform records.<br>2 MHz, 1 MHz, 400 kHz, 200 kHz, 100 kHz, 40 kHz, 20 kHz, 10 kHz or 4 kHz / 20 kHz, 10 kHz, or 4kHz during analog DC input<br>(Mentioned above frequency - frequency resolution) becomes the maximum analysis frequency |
| FFT peak value display | Compute 10 frequencies and voltage-current peak value levels (local maximum value) each starting from the top, ordered by level / For FFT calculation results, recognize as the peak value when the data on both sides is lower than the original data |

## Motor Analysis (PW6001-11 to -16 only)

| | |
|---|---|
| Number of input channels | 4 channels<br>CH A: Analog DC input / Frequency input / Pulse input<br>CH B: Analog DC input / Frequency input / Pulse input<br>CH C: Pulse input<br>CH D: Pulse input |
| Operating mode | Single, dual, or independent input |
| Input terminal profile | Isolated BNC connectors |
| Input resistance (DC) | 1 MΩ ±50 kΩ |
| Input method | Function-isolated input and single-end input |
| Measurement parameters | Voltage, torque, rpm, frequency, slip, motor power |
| Maximum input voltage | ±20 V (analog DC and pulse operation) |
| Additional conditions for guaranteed accuracy | Input: Terminal-to-ground voltage of 0 V, after zero-adjustment |

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

| | |
|---|---|
| Measurement range | ±1 V / ±5 V / ±10 V |
| Effective input range | 1% to 110% f.s. |
| Sampling | 50 kHz, 16 bits |
| Response speed | 0.2 ms (when LPF is OFF) |
| Measurement method | Simultaneous digital sampling, zero-cross synchronization calculation method (averaging between zero-crosses) |
| Measurement accuracy | ±0.05% rdg. ±0.05% f.s. |
| Temperature coefficient | ±0.03% f.s./°C |
| Effects of common-mode voltage | ±0.01% f.s. or less with 50 V applied between the input terminals and the enclosure (DC / 50 Hz / 60 Hz) |
| LPF | OFF (20 kHz) / ON (1 kHz) |
| Display range | From the range's zero-suppression range setting to ±150% |
| Zero-adjustment | Voltage ±10% f.s., zero-correction of input offsets that are less |

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

| | |
|---|---|
| Detection level | Low: 0.5 V or less; high: 2.0 V or more |
| Measurement frequency band | 0.1 Hz to 1 MHz (at 50% duty ratio) |
| Minimum detection width | 0.5 μs or more |
| Measurement accuracy | ±0.05% rdg. ±3 dgt. |
| Display range | 1.000 kHz to 500.000 kHz |

### (3) Pulse input (CH A / CH B / CH C / CH D)

| | |
|---|---|
| Detection level | Low: 0.5 V or less; high: 2.0 V or more |
| Measurement frequency band | 0.1 Hz to 1 MHz (at 50% duty ratio) |
| Minimum detection width | 0.5 μs or more |
| Pulse filter | OFF / Weak / Strong (When using the weak setting, positive and negative pulses of less than 0.5 μs are ignored. When using the strong setting, positive and negative pulses of 5 μs are ignored.) |
| Measurement accuracy | ±0.05% rdg. ±3 dgt. |
| Display range | 0.1 Hz to 800.000 kHz |
| Unit | Hz / r/min. |
| Frequency division setting range | 1~60000 |
| Rotation direction detection | Can be set in single mode (detected based on lead/lag of CH B and CH C). |
| Mechanical angle origin detection | Can be set in single mode (CH B frequency division cleared at CH D rising edge). |

## D/A output (PW6001-11 to -16 only)

| | |
|---|---|
| Number of output channels | 20 channels |
| Output terminal profile | D-sub 25-pin connector × 1 |
| Output details | - Switchable between waveform output and analog output (select from basic measurement parameters).<br>- Waveform output is fixed to CH1 to CH12. |
| D/A conversion resolution | 16 bits (polarity + 15 bits) |
| Output refresh rate | Analog output: 10 ms / 50 ms / 200 ms (based on data update rate for the selected parameter)<br>Waveform output: 1 MHz |

| | | |
|---|---|---|
| Output voltage | Analog output<br>Waveform output | ±5 V DC f.s. (max. approx. ±12 V DC)<br>Switchable between ±2 V f.s. and ±1 V f.s., crest factor of 2.5 or greater.<br>Setting applies to all channels. |
| Output resistance | 100 Ω ±5 Ω | |
| Output accuracy | Analog output | Output measurement parameter measurement accuracy ±0.2% f.s. (DC level) |
| | Waveform output | Measurement accuracy ±0.5% f.s. (at ±2 V f.s.)<br>or ±1.0% f.s. (at ±1 V f.s.)<br>(RMS value level, up to 50 kHz) |
| Temperature coefficient | ±0.05% f.s./°C | |

# Display section

| | |
|---|---|
| Display characters | English, Japanese, Chinese (simplified) |
| Display | 9” WVGA TFT color LCD (800 × 480 dots)<br>with an LED backlight and analog resistive touch panel |
| Display value resolution | 999999 count (including integration values) |
| Display refresh rate | Measured values: Approx. 200 ms (independent of internal data update rate)<br>When using simple averaging, the data update rate varies based on the number of averaging iterations.<br>Waveforms: Based on display settings |

# External interface

## (1) USB flash drive interface

| | |
|---|---|
| Connector | USB Type A connector × 1 |
| Electrical specifications | USB 2.0 (high-speed) |
| Power supplied | Max. 500 mA |
| Supported USB flash drives | USB Mass Storage Class compatible |
| Recorded data | - Save/load settings files<br>- Save measured values/automatic recorded data (CSV format)<br>- Copy measured values/recorded data (from internal memory)<br>- Save waveform data, save screenshots (compressed BMP format) |

## (2) LAN interface

| | |
|---|---|
| Connector | RJ-45 connector × 1 |
| Electrical specifications | IEEE 802.3 compliant |
| Transmission method | 10Base-T / 100Base-TX / 1000Base-T (automatic detection) |
| Protocol | TCP/IP (with DHCP function) |
| Functions | HTTP server (remote operations)<br>Dedicated port (data transferring, command control)<br>FTP server (file transferring) |

## (3) GP-IB interface

| | |
|---|---|
| Communication method | IEEE 488.1 1987 compliant developed with reference to IEEE 488.2 1987<br>Interface functions: SH1, AH1, T6, L4, SR1, RL1, PP0, DC1, DT1, C0 |
| Addresses | 00 to 30 |
| Functions | Command control |

## (4) RS-232C interface

| | |
|---|---|
| Connector | D-sub 9-pin connector × 1, 9-pin power supply compatible, also used for external control |
| Communication method | RS-232C, EIA RS-232D, CCITT V.24, and JIS X5101 compliant<br>Full duplex, start stop synchronization, data length of 8, no parity, 1 stop bit |
| Flow control | Hardware flow control ON/OFF |
| Communications speed | 9,600 bps / 19,200 bps / 38,400 bps / 57,600 bps / 115,200 bps / 230,400 bps |
| Functions | Command control<br>LR8410 Link supported (dedicated connector is required)<br>Used through exclusive switching with external control interface |

## (5) External control interface

| | |
|---|---|
| Connector | D-sub 9-pin connector × 1, 9-pin power supply compatible, also used for RS-232C |
| Power supplied | OFF/ON (voltage of +5 V, max. 200 mA) |
| Electrical specifications | 0/5 V (2.5 V to 5 V) logic signals or contact signal with terminal shorted or open |
| Functions | Same operation as the [START/STOP] key or the [DATA RESET] key on the control panel<br>Used through exclusive switching with RS-232C |

## (6) Two-instrument synchronization interface

| | |
|---|---|
| Connector | SFP optical transceiver, Duplex-LC (2-wire LC) |
| Optical signal | 850 nm VCSEL, 1 Gbps |
| Laser class | Class 1 |
| Fiber used | 50/125 $\mu$m multi-mode fiber equivalent, up to 500 m |
| Functions | Sends data from the connected slave instrument to the master instrument, which performs calculations and displays the results. |

# Auto-range function

| | |
|---|---|
| Functions | The voltage and current ranges for each connection are automatically changed in response to the input. |
| Operating mode | OFF/ON (selectable for each connection) |
| Auto-range breadth | Broad/narrow (applies to all channels)<br>Wide: The range is increased by one if the peak value is exceeded for the connection or if there is an RMS value that is greater than or equal to 110% f.s. The range decreases by two if all rms values drop below 10% f.s. within the connection<br>Narrow: The range is increased by one if the peak value is exceeded for the connection or if there is an RMS value that is greater than or equal to 105% f.s. The range decreases by one if all rms values drop below 40% f.s. within the connection<br>The voltage range decrease multiplies and judges the range $\frac{1}{\sqrt{3}}$ when the Δ-Y transformer is on |

# Time control function

| | |
|---|---|
| Timer control | OFF, 10 sec. to 9999 hr. 59 min. 59 sec. (in 1 sec. steps) |
| Actual time control | OFF, start time/stop time (in 1 min. steps) |
| Intervals | OFF / 10 ms / 50 ms / 200 ms / 500 ms / 1 sec. / 5 sec. / 10 sec. / 15 sec. / 30 sec.<br>1 min. / 5 min. / 10 min. / 15 min. / 30 min. / 60 min. |

# Hold functionality

| | |
|---|---|
| Hold | Stops updating the display with all measured values and holds the value currently being displayed.<br>Used exclusively with the peak hold function. |
| Peak hold | Updates the measured value display each time a new maximum value is set.<br>Used exclusively with the hold function. |

# Calculation functionality

## (1) Rectifier

| | |
|---|---|
| Functions | 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

| | |
|---|---|
| VT (PT) ratio | OFF/ 0.00001 to 9999.99 |
| CT ratio | OFF/ 0.01 to 9999.99 |

## (3) Averaging (AVG)

| | |
|---|---|
| Functions | 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.<br>Exponential averaging: Data is exponentially averaged using a time constant defined by the data update rate and the exponential averaging response rate.<br>During averaging operation, averaged data is used for all analog output and save data. |

Number of simple averaging iterations:

| Number of averaging iterations | | 5 | 10 | 20 | 50 | 100 |
|---|---|---|---|---|---|---|
| Data update rate | 10 ms | 50 ms | 100 ms | 200 ms | 500 ms | 1 sec. |
| | 50 ms | 250 ms | 500 ms | 1 sec. | 2.5 sec. | 5 sec. |
| | 200 ms | 1 sec. | 2 sec. | 4 sec. | 10 sec. | 20 sec. |

Exponential averaging response rate:

| Setting | | FAST | MID | SLOW |
|---|---|---|---|---|
| Data update rate | 10 ms | 0.1 sec. | 0.8 sec. | 5 sec. |
| | 50 ms | 0.5 sec. | 4 sec. | 25 sec. |
| | 200 ms | 2.0 sec. | 16 sec. | 100 sec. |

These values indicate the time required for the final stabilized value to converge on ±1% when the input changes from 0% f.s. to 90% f.s.

## (4) User-defined calculations

| | |
|---|---|
| Functions | User-specified basic measurement parameters are calculated using the specified calculation formulas. |
| Calculated items | Four basic measured items or constants with a maximum of 6-digits; operators are four-arithmetic operators.<br>UDFn = ITEM1 □ ITEM2 □ ITEM3 □ ITEM4<br>ITEMn : basic measured item, or constant of up to 6 digits<br>□ : any one of +, -, *, or /<br>UDFn can also be selected for ITEMn, with calculations performed in the order of n.<br>The functions that can be selected and calculated in regards to each ITEMn are as follows: neg, sin, cos, tan, sqrt, abs, log10 (common logarithm), log (logarithm), exp, asin, acos, atan, sinh, cosh, tanh<br>When a UDFn with an n higher than the current UDF is encounted, previously calculated values are used |
| Number of allowed calculations | 16 formulas (UDF1 to UDF16) |
| Maximum value setting | Set for each UDFn in the range 1.000 μ to 100.0 T / Functions as a UDFn range |
| Unit | Up to 6 characters in ASCII for each UDFn |

## (5) Efficiency and loss calculations

| | |
|---|---|
| Calculated items | Active power value (P), fundamental wave active power (Pfnd), and motor power (Pm) (Motor Analysis and D/A-equipped models only) for each channel and connection |
| Number of calculations that can be performed | Four each for efficiency and loss |
| Formula | Calculated items are specified for Pin(n) and Pout(n) in the following format:<br>Pin = Pin1 + Pin2 + Pin3 + Pin4, Pout = Pout1 + Pout2 + Pout3 + Pout4<br>$\eta = 100 \times \frac{\lvert Pout \rvert}{\lvert Pin \rvert}$, Loss = \|Pin\| - \|Pout\| |

## (6) Power formula selection

| | |
|---|---|
| Functions | Selects the reactive power, power factor, and power phase angle formulas. |
| Formula | TYPE1 / TYPE2 / TYPE3<br>TYPE1: Compatible with TYPE1 as used by the Hioki 3193 and 3390.<br>TYPE2: Compatible with TYPE2 as used by the Hioki 3192 and 3193.<br>TYPE3: The sign of the TYPE1 power factor and power phase angle are used as the active power signs. |

## (7) Delta conversion

| | |
|---|---|
| Functions | Δ-Y: When using a 3P3W3M or 3V3A connection, converts the line voltage waveform to a phase voltage waveform using a virtual neutral point.<br>Y-Δ: When using a 3P4W connection, converts the phase voltage waveform to a line voltage waveform.<br>Voltage RMS values and all voltage parameters, including harmonics, are calculated using the post-conversion voltage. |

## (8) Current sensor phase shift calculation

| | |
|---|---|
| Functions | Compensates the current sensor's harmonic phase characteristics using calculations. |
| Compensation value settings | Compensation points are set using the frequency and phase difference.<br>Frequency: 0.1 kHz to 999.9 kHz (in 0.1 kHz steps)<br>Phase difference: 0.00deg to ±90.00deg (0.01deg intervals)<br>However, the difference in time calculated from the frequency phase difference can be up to 98 $\mu$s in 0.5ns intervals |

# Display functionality

## (1) Connection confirmation screen

| | |
|---|---|
| Functions | Displays a connection diagram and voltage and current vectors based on the selected measurement lines.<br>The ranges for a correct connection are displayed on the vector display so that the connection can be checked. |
| Mode at startup | User can select to display the connection confirmation screen at startup (startup screen setting). |
| Simple settings | Commercial power supply / Commercial power supply high-resolution HD / DC / DC high-resolution HD / PWM / High-frequency / Other |

## (2) Vector display screen

| | |
|---|---|
| Functions | Displays a connection-specific vector graph along with associated level values and phase angles. |

## (3) Numerical display screen

| | |
|---|---|
| Functions | Displays power measured values and motor measured values for up to six instrument channels. |
| Display patterns | Basic by connection: Displays measured values for the measurement lines and motors combined in the connection. There are four measurement line patterns: U, I, P, and Integ.<br>Selection display: Creates a numerical display for the measurement parameters that the user has selected from all basic measurement parameters in the location selected by the user. There are 4-, 8-, 16-, and 32-display patterns. |

## (4) Harmonic display screen

| | |
|---|---|
| Functions | Displays harmonic measured values on the instrument's screen. |
| Display patterns | Display bar graph: Displays harmonic measurement parameters for user-specified channels as a bar graph.<br>Display list: Displays numerical values for user-specified parameters and user-specified channels. |

## (5) Waveform display screen

| | |
|---|---|
| Functions | Displays the voltage and current waveforms and motor waveform. |
| Display patterns | All-waveform display, waveform + numerical display<br>Cursor measurement supported |

# Simplified Graph Function

(1) D/A Monitor Graph

| | |
|---|---|
| Functions | Graph measured values chosen as D/A output items in chronological order<br>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<br>Illustrate the displayed value during hold and peak hold<br>Illustrated data is cleared when 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/dot to 48 min/dot (Cannot be selected below the data update rate) |
| Vertical axis | Autoscaling (operates to fit data on screen within screen display range with time axis)<br>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<br>Dot illustrations are done at data update rate, and data is not recorded<br>Illustration data can be cleared / a total of two combinations of graphs can be displayed: X1-Y1 or X2-Y2<br>Gauge display, displayed max value and min value settings are allowed<br>X1, Y1, X2, and Y2 operate in synchronization with D/A output item settings for CH13, 14, 15, and 16 respectively |

# Automatic save function

| | |
|---|---|
| Functions | Saves the specified measured values in effect for each interval. |
| Save destination | OFF / Internal memory / USB flash drive |
| Saved 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)<br>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.<br>Comment text can be entered for each saved data point, up to a maximum of 20 alphanumeric characters.<br>*The manual save function for measurement data cannot be used while automatic save is in progress. |
| Save destination | USB flash drive |
| Saved 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<br>Input comments for each set of saved data<br>*Cannot be operated when waveform data is invalid during storage and automatic saving |
| Save destination | USB flash drive - Assign destinations for saved data |
| Comment entry | OFF/ON - up to 40 letters/symbols |
| 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.<br>*This function can be used at an interval of 1 sec or more while automatic saving is in progress. |
| Save destination | USB flash drive |
| Comment entry | OFF / Text / Handwritten<br>When set to [Text], up to 40 alphanumeric characters<br>When set to [Handwritten], hand-drawn images are pasted to the screen. |
| Data format | Compressed BMP |

(4) Settings data

| | |
|---|---|
| Functions | Saves settings information to the save destination as a settings file via functionality provided on the File screen.<br>In addition, previously saved settings files can be loaded and their settings restored on the File screen.<br>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<br>Input comments for each set of saved data<br>*Cannot be operated when waveform data is invalid during storage and automatic saving |
| Save destination | USB flash drive - Assign destinations for saved data |
| 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.<br>In numerical synchronization mode, the master instrument operates as a power meter with up to 12 channels.<br>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<br>Numerical synchronization cannot be selected when the data update rate is 10 ms.<br>Waveform synchronization operates only when master device has more than 3 channels |
| Synchronized items | Numerical synchronization mode: Data update timing, start/stop/data reset<br>Waveform synchronization mode: Voltage/current sampling timing |
| Synchronization delay | Numerical synchronization mode: Max. 20 μs<br>Waveform synchronization mode: Up to 5 samples |
| Transfer items | Numerical synchronization mode: Basic measurement parameters for up to six channels (including motor data)<br>Waveform synchronization mode: 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. |

# Basic formula

| Parameter \ Wiring | 1P2W | 1P3W | 3P3W2M | 3V3A | 3P3W3M | 3P4W |
|---|---|---|---|---|---|---|
| Voltage, current RMS value (True RMS) | $Xrms(i)=\sqrt{\frac{1}{M}\sum_{S=0}^{M-1}(X_{(i)s})^2}$ | $Xrms(i)(i+1) = \frac{1}{2}(Xrms(i) + Xrms(i+1))$ | | $Xrms123 = \frac{1}{3}(Xrms1+ Xrms2+Xrms3)$<br>$Xrms456 = \frac{1}{3}(Xrms4+ Xrms5+ Xrms6)$ | | |
| Voltage, current average value rectification RMS equivalent | $Xmn(i) = \frac{\pi}{2\sqrt{2}}\frac{1}{M}\sum_{S=0}^{M-1}\lvert X_{(i)s}\rvert$ | $Xmn(i)(i+1) = \frac{1}{2}(Xmn(i)+Xmn(i+1))$ | | $Xmn123 = \frac{1}{3}(Xmn1+ Xmn2+ Xmn3)$<br>$Xmn456 = \frac{1}{3}(Xmn4+ Xmn5+ Xmn6)$ | | |
| Voltage, current AC component | $Xac(i) = \sqrt{(X_{rms(i)})^2 - (X_{dc(i)})^2}$ | | | | | |
| Voltage, current Average value | $Xdc(i) = \frac{1}{M}\sum_{S=0}^{M-1}X_{(i)s}$ | | | | | |
| Voltage, current Fundamental wave component | X1(i) for harmonic voltage and current in the harmonic formula | | | | | |
| Voltage, current peak values | $Xpk+(i) = X(i)s$ Max. value for M items<br>$Xpk-(i) = X(i)s$ Min. value for M items | | | | | |
| Active power | $P(i) = \frac{1}{M}\sum_{S=0}^{M-1}(U_{(i)s} \times I_{(i)s})$ | $P(i)(i+1) = P(i)+P(i+1)$ | | $P123=P1+P2$<br>$P456=P4+P5$ | $P123 = P1+P2+P3$<br>$P456 = P4+P5+P6$ | |
| | - When connecting 3P3W3M and 3P4W, use phase voltage for voltage waveform *u(i)s*. 3P3W3M: *u1s = (U1s - U3s)/3, u2s = (U2s - U1s)/3, u3s = (U3s - U2s)/3*<br>- When connecting 3V3A, use line-to-line voltage for voltage *U(i)*. (The same formula is used for 3P3W2M and 3V3A.)<br>- The polarity sign for active power *P* indicates the direction of current during power consumption (+*P*) and power regeneration (-*P*). | | | | | |
| Apparent power | $S(i) = U(i)\times I(i)$ | $S(i)(i+1) = S(i)+S(i+1)$ | $S(i)(i+1)= \frac{\sqrt{3}}{2}(S_{(i)}+S_{(i+1)})$ | $S123=\frac{\sqrt{3}}{3}(S1+S2+S3)$<br>$S456=\frac{\sqrt{3}}{3}(S4+S5+S6)$ | $S123 = S1+S2+S3$<br>$S456 = S4+S5+S6$ | |
| | Select rms / mn for *U(i)* and *I(i)*.<br>When connecting 3P3W3M and 3P4W, use phase voltage for voltage *U(i)*.<br>When connecting 3V3A, use line-to-line voltage for voltage *U(i)*. | | | | | |
| Reactive power | When selecting formula type 1 and type 3 | | | | | |
| | $Q(i) = si(i)\sqrt{S_{(i)}^2-P_{(i)}^2}$ | $Q(i)(i+1) = Q(i)+Q(i+1)$ | | $Q123=Q1+Q2$<br>$Q456=Q4+Q5$ | $Q123=Q1+Q2+Q3$<br>$Q456=Q4+Q5+Q6$ | |
| | When selecting formula type 2 | | | | | |
| | $Q(i) = \sqrt{S_{(i)}^2-P_{(i)}^2}$ | $Q(i)(i+1) = \sqrt{S_{(i)(i+1)}^2- P_{(i)(i+1)}^2}$ | | $Q123=\sqrt{S_{123}^2- P_{123}^2}$,<br>$Q456=\sqrt{S_{456}^2- P_{456}^2}$ | | |
| | - The polarity sign *si* for reactive power *Q* for formula type 1 and type 3 indicates leading and lagging polarity, [None] indicates lagging polarity (LAG), and [-] indicates leading polarity (LEAD).<br>- For polarity sign *si(i)*, lead and lag for voltage waveform *U(i)s* and current waveform *I(i)s* are acquired for each measurement channel (i).<br>- When connecting 3P3W3M and 3P4W, use phase voltage for voltage waveform *U(i)s*. 3P3W3M: *u1s = (U1s - U3s)/3, u2s = (U2s - U1s)/3, u3s = (U3s - U2s)/3*<br>- There is no polarity sign when formula type 2 is selected. | | | | | |
| Power factor | When selecting formula type 1 | | | | | |
| | $\lambda_{(i)} = si_{(i)}\left\lvert\frac{P_{(i)}}{S_{(i)}}\right\rvert$ | $\lambda_{(i)(i+1)} = si_{(i)(i+1)}\left\lvert\frac{P_{(i)(i+1)}}{S_{(i)(i+1)}}\right\rvert$ | | $\lambda_{123} = si_{123}\left\lvert\frac{P_{123}}{S_{123}}\right\rvert$, $\lambda_{456} = si_{456}\left\lvert\frac{P_{456}}{S_{456}}\right\rvert$ | | |
| | When selecting formula type 2 | | | | | |
| | $\lambda_{(i)} = \left\lvert\frac{P_{(i)}}{S_{(i)}}\right\rvert$ | $\lambda_{(i)(i+1)} = \left\lvert\frac{P_{(i)(i+1)}}{S_{(i)(i+1)}}\right\rvert$ | | $\lambda_{123} = \left\lvert\frac{P_{123}}{S_{123}}\right\rvert$, $\lambda_{456} = \left\lvert\frac{P_{456}}{S_{456}}\right\rvert$ | | |
| | When selecting formula type 3 | | | | | |
| | $\lambda_{(i)} = \frac{P_{(i)}}{S_{(i)}}$ | $\lambda_{(i)(i+1)} = \frac{P_{(i)(i+1)}}{S_{(i)(i+1)}}$ | | $\lambda_{123} = \frac{P_{123}}{S_{123}}$, $\lambda_{456} = \frac{P_{456}}{S_{456}}$ | | |
| | - The polarity sign si for power factor λ for formula type 1 indicates leading and lagging polarity, [None] indicates lagging polarity (LAG), and [-] indicates leading polarity (LEAD).<br>- For polarity sign *si(i)*, lead and lag for voltage waveform *U(i)s* and current waveform *I(i)s* are acquired for each measurement channel *(i)*. *si12*, *si34*, and *si123* are acquired from the signs for *Q12*, *Q34*, and *Q123*.<br>- For formula type 3, the polarity sign for active power *P* is used. | | | | | |
| Power phase angle | When selecting formula type 1 | | | | | |
| | $\phi_{(i)}=si_{(i)}\cos^{-1}\lvert\lambda_{(i)}\rvert$ | $\phi_{(i)(i+1)} = si_{(i)(i+1)}\cos^{-1}\lvert\lambda_{(i)(i+1)}\rvert$ | | $\phi_{123} = si_{123}\cos^{-1}\lvert\lambda_{123}\rvert$, $\phi_{456} = si_{456}\cos^{-1}\lvert\lambda_{456}\rvert$ | | |
| | When selecting formula type 2 | | | | | |
| | $\phi_{(i)} = \cos^{-1}\lvert\lambda_{(i)}\rvert$ | $\phi_{(i)(i+1)} = \cos^{-1}\lvert\lambda_{(i)(i+1)}\rvert$ | | $\phi_{123} = \cos^{-1}\lvert\lambda_{123}\rvert$, $\phi_{456} = \cos^{-1}\lvert\lambda_{456}\rvert$ | | |
| | When selecting formula type 3 | | | | | |
| | $\phi_{(i)} = \cos^{-1}\lambda_{(i)}$ | $\phi_{(i)(i+1)} = \cos^{-1}\lambda_{(i)(i+1)}$ | | $\phi_{123} = \cos^{-1}\lambda_{123}$, $\phi_{456} = \cos^{-1}\lambda_{456}$ | | |
| | - For formula type 1, the polarity sign *si* indicates leading and lagging polarity, [None] indicates lagging polarity (LAG), and [-] indicates leading polarity (LEAD).<br>- For polarity sign *si(i)*, lead and lag for voltage waveform *U(i)s* and current waveform *I(i)s* are acquired for each measurement channel *(i)*. *si12*, *si34*, and *si123* are acquired from the signs for *Q12*, *Q34*, and *Q123*.<br>- For formula type 3, the polarity sign for active power *P* is used.<br>- When calculating formula type 1 and type2, *cos-1*\|λ*(i)*\| is used when P ≥ 0; \|*180-cos-1*\|λ\|\| is used when P < 0. | | | | | |
| Voltage and current ripple factor | $\frac{(X_{pk+(i)} - X_{pk-(i)})}{2\times\lvert X_{dc(i)}\rvert}\times 100$ | | | | | |

*X*: Voltage *U* or Current *I*,
*(i)*: Measurement channel, *M*: Number of samples during synchronized timing period, *s*: Sample point number

# Motor analysis formulae

| Measurement parameters | Setting | Formula |
|---|---|---|
| Voltage | Analog DC | $\frac{1}{M}\sum_{S=0}^{M-1}A_s$<br>*M*: Number of samples during synchronized timing period;<br>*s*: Sample point number |
| Pulse frequency | Pulse | Pulse frequency |
| Torque | Analog DC | $\frac{1}{M}\sum_{S=0}^{M-1}A_s \times$ scaling setting<br>*M*: Number of samples during synchronized timing period;<br>*s*: Sample point number |
| | Frequency | $\frac{\text{(Measurement frequency - fc setting)} \times \text{rated torque value}}{\text{fd setting}}$ |
| RPM | Analog DC | $\frac{1}{M}\sum_{S=0}^{M-1}A_s \times$ scaling setting<br>*M*: Number of samples during synchronized timing period;<br>*s*: Sample point number |
| | Pulse | $si\,\frac{60 \times \text{pulse frequency}}{\text{Pulse count setting}}$<br>The polarity sign *si* is acquired based on the A-phase pulse rising/falling edge and the B-phase pulse logic level (high/low) when direction of rotation detection is enabled in single mode. |
| Motor power | | $\text{Torque} \times \frac{2\times\pi\times\text{RPM}}{60} \times \text{unit coefficient}$<br>The unit coefficient is 1 if the torque unit is N·m, 1/1000 if mN·m, and 1000 if kN·m. |
| Slip | | $100\times\frac{2\times 60\times\text{input frequency} - \lvert\text{RPM}\rvert\times\text{pole number setting}}{2\times 60\times\text{input frequency}}$<br>The input frequency is selected from f1 to f6. |

## General Specifications

| | |
|---|---|
| Operating environment | Indoors at an elevation of up to 2000 m in a Pollution Level 2 environment |
| Storage temperature and humidity | -10°C to 50°C, 80% RH or less (no condensation) |
| Operating temperature and humidity | 0°C to 40°C, 80% RH or less (no condensation) |
| Dielectric strength | 50 Hz/60 Hz<br>5.4 kV rms AC for 1 min. (sensed current of 1 mA)<br>Between voltage input terminals and instrument enclosure, and between current sensor input terminals and interfaces<br>1 kV rms AC for 1 min. (sensed current of 3 mA)<br>Between motor input terminals (Ch. A, Ch. B, Ch. C, and Ch. D) and the instrument enclosure |
| Standards | Safety EN61010<br>EMC EN61326 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 x 177 mm (6.97 in)H x 450 mm (17.72 in)D (excluding protruding parts) |
| Mass | Approx. 14 kg (49.4 oz) (PW6001-16) |
| Backup battery life | Approx. 10 years (reference value at 23°C)<br>(lithium battery that stores time and setting conditions) |
| Product warranty period | 1 year |
| Guaranteed accuracy period | 6 months (1-year accuracy = 6-month accuracy × 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<br>Warm-up time: 30 min. or more |
| Accessories | Instruction manual x 1, power cord x 1,<br>D-sub 25-pin connector × 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 ±3 sec./day (25°C) |
| Sensor identification | Current sensors connected to Probe1 are automatically detected. |
| Zero-adjustment function | After the AC/DC current 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. |

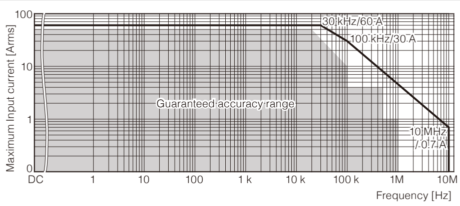
## Rack mount support

Full rack size ideal for incorporation into test benches and product inspection lines

# Current sensors

### High-accuracy sensors: direct connection type (connect to Probe1 input terminal)

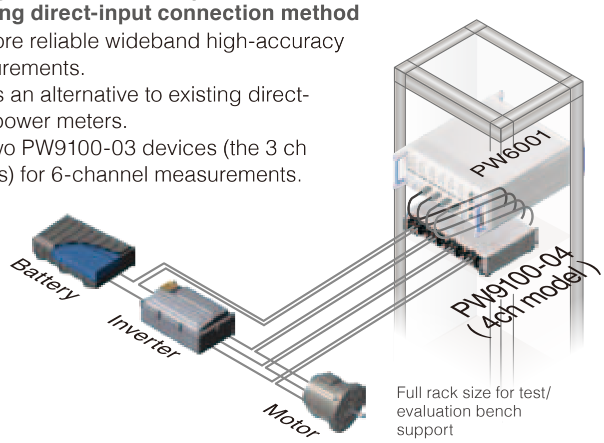
The newly developed DCCT method provides world-leading measurement bands and accuracy at a 50 A rating. Delivering a direct-coupled type current testing tool that brings out the PW6001 POWER ANALYZER's maximum potential. (A 5 A-rated version is also available. Contact us for more information.)

| | AC/DC CURRENT BOX PW9100-03 | AC/DC CURRENT BOX PW9100-04 |
|---|---|---|
| External Appearance |  |  |
| Number of input channels | 3ch | 4 ch |
| Rated primary current | 50 A AC/DC | |
| Frequency band | DC to 3.5 MHz (-3 dB) | |
| Measurement terminals | Terminal block (with safety cover), M6 screws | |
| Basic accuracy | ±0.02% rdg. ±0.005% f.s. (amplitude), ±0.1 deg (phase)<br>(At 45 ≤ f ≤ 65 Hz)<br>±0.02% rdg. ±0.007% f.s. (amplitude)<br>(At DC) | |
| Frequency response (Amplitude) | to 45 Hz: ±0.1% rdg. ±0.02% f.s.<br>to 1 kHz: ±0.1% rdg. ±0.01% f.s.<br>to 50 kHz: ±1% rdg. ±0.02% f.s.<br>to 100 kHz: ±2% rdg. ±0.05% f.s.<br>to 1 MHz: ±10% rdg. ±0.05% f.s.<br>3.5 MHz: -3 dB Typical | |
| Input resistance | 1.5 mΩ or less (50 Hz/60 Hz) | |
| Operating temperature range | Temperature: 0°C to 40°C (32°F to 104°F),<br>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<br>(Effect on output voltage/common-mode voltage) | |
| Maximum voltage to ground | 1000 V (measurement category II), 600 V (measurement category III),<br>anticipated transient overvoltage: 6000 V | |
| Dimensions | 430 mm (16.93 in) W × 88 mm (3.46 in) H × 260 mm (10.24 in) D,<br>Cable length: 0.8 m (2.62 ft) | |
| Mass | 3.7 kg (130.5 oz) | 4.3 kg (151.7 oz) |
| Derating Characteristics |  | |



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

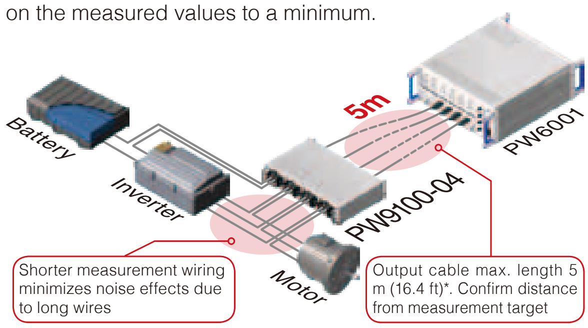
For more reliable wideband high-accuracy measurements.
Use as an alternative to existing direct-input power meters.
Use two PW9100-03 devices (the 3 ch models) for 6-channel measurements.





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

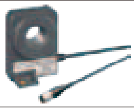
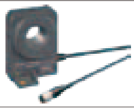
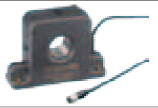
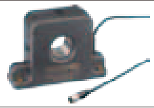
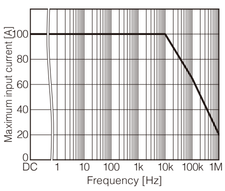
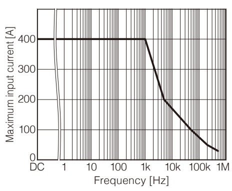
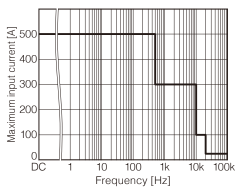
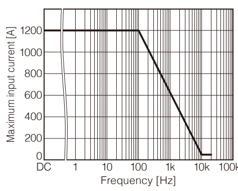
Shorten the wiring for current measurement by installing the PW9100 close to the measurement target. This will also keep the effects of wiring resistance, capacity coupling and other objective factors on the measured values to a minimum.





*Requires CT9902 EXTENSION CABLE

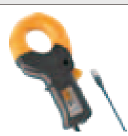
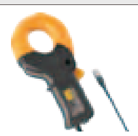
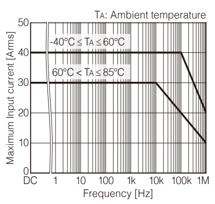
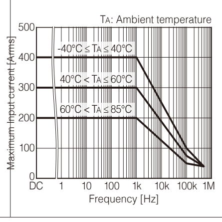
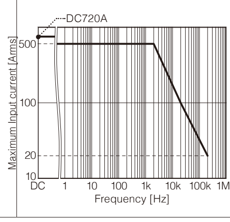
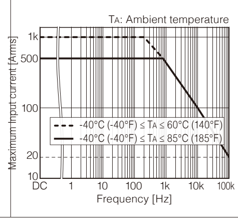
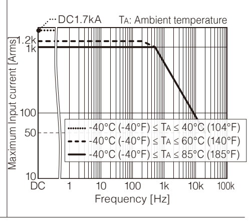
# High-accuracy sensors: pull-through type (connect to Probe1 input terminal)

| Model | AC/DC CURRENT SENSOR CT6862-05 | AC/DC CURRENT SENSOR CT6863-05 | AC/DC CURRENT SENSOR 9709-05 | 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.φ 24mm (0.94") | Max.φ 24 mm (0.94") | Max.φ 36 mm (1.42") | Max.φ 36 mm (1.42") |
| Basic accuracy | ±0.05 % rdg.±0.01 % f.s. (amplitude)<br>±0.2° (phase, not defined for DC)<br>(At DC and 16 Hz to 400 Hz) | ±0.05 % rdg.±0.01 % f.s. (amplitude)<br>±0.2° (phase, not defined for DC)<br>(At DC and 16 Hz to 400 Hz) | ±0.05 % rdg.±0.01 % f.s. (amplitude)<br>±0.2° (phase, not defined for DC)<br>(At DC and 45 Hz to 66 Hz) | ±0.05 % rdg.±0.01 % f.s. (amplitude)<br>±0.2° (phase, not defined for DC)<br>(At DC and 16 Hz to 66 Hz) |
| Frequency characteristics (Amplitude) | to 16 Hz: ±0.1% rdg. ±0.02% f.s.<br>400Hz to 1kHz: ±0.2% rdg. ±0.02% f.s.<br>to 50 kHz: ±1.0% rdg. ±0.02% f.s.<br>to 100 kHz: ±2.0% rdg. ±0.05% f.s.<br>to 1 MHz: ±30% rdg. ±0.05% f.s. | to 16 Hz: ±0.1% rdg. ±0.02% f.s.<br>400Hz to 1kHz: ±0.2% rdg. ±0.02% f.s.<br>to 10 kHz: ±1.0% rdg. ±0.02% f.s.<br>to 100 kHz: ±5.0% rdg. ±0.05% f.s.<br>to 500 kHz: ±30% rdg. ±0.05% f.s. | to 45 Hz: ±0.2% rdg. ±0.02% f.s.<br>66 Hz to 500 Hz: ±0.2% rdg. ±0.02% f.s.<br>to 5 kHz: ±0.5% rdg. ±0.05% f.s.<br>to 10 kHz: ±5.0% rdg. ±0.10% f.s.<br>to 100 kHz: ±30% rdg. ±0.10% f.s. | to 16 Hz: ±0.1% rdg. ±0.02% f.s.<br>66 Hz to 100 Hz: ±0.5% rdg. ±0.02% f.s.<br>to 500 Hz: ±1.0% rdg. ±0.02% f.s.<br>to 5 kHz: ±5.0% rdg. ±0.05% f.s.<br>to 20 kHz: ±30% rdg. ±0.1% f.s. |
| Operating Temperature | -30°C to 85°C (-22°F to 185°F) | -30°C to 85°C (-22°F to 185°F) | 0°C to 50°C (32°F to 122°F) | -30°C to 85°C (-22°F to 185°F) |
| Effect of conductor position | Within ±0.01% rdg. (DC to 100 Hz) | Within ±0.01% rdg. (DC to 100 Hz) | Within ±0.05% rdg. (DC 100 A) | Within ±0.05% rdg. (AC1000 A,50/60 Hz) |
| Effect of external magnetic fields | 10 mA equivalent or lower<br>(400 A/m, 60 Hz and DC) | 50 mA equivalent or lower<br>(400 A/m, 60 Hz and DC) | 50 mA equivalent or lower<br>(400 A/m, 60 Hz and DC) | 200 mA equivalent or lower<br>(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") x 100H (3.94") x 53D (2.09") mm<br>Cable length: 3 m (9.84 ft) | 70W (2.76") x 100H (3.94") x 53D (2.09") mm<br>Cable length: 3 m (9.84 ft) | 160W (6.30") x 112H (4.41") x 50D (1.97") mm<br>Cable length: 3 m (9.84 ft) | 160W (6.30") x 112H (4.41") x 50D (1.97") mm<br>Cable length: 3 m (9.84 ft) |
| Mass | 340 g (12.0 oz.) | 350 g (12.3 oz.) | 850 g (30.0 oz.) | 980 g (35.3 oz) |
| Derating properties |  |  |  |  |



Custom cable lengths also available. Please inquire with your Hioki distributor.

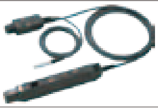
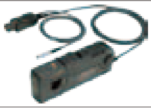
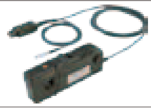
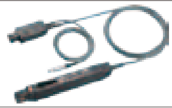
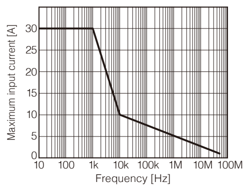
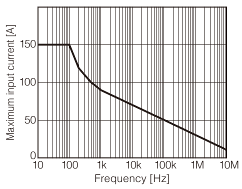
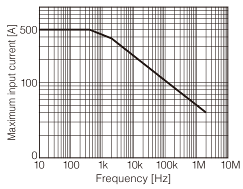
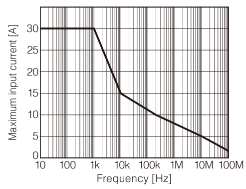
# High-accuracy sensors: clamp type (connect to Probe1 input terminal)

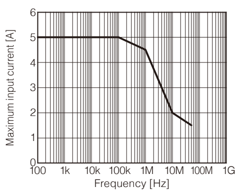
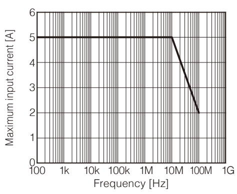
| Model | AC/DC CURRENT PROBE CT6841-05 | AC/DC CURRENT PROBE CT6843-05 | AC/DC CURRENT PROBE CT6844-05 | AC/DC CURRENT PROBE CT6845-05 | AC/DC CURRENT PROBE CT6846-05 |
|---|---|---|---|---|---|
| Appearance |  |  |  |  |  |
| Rated primary current | 20 A AC/DC | 200 A AC/DC | 500 A AC/DC | 500 A AC/DC | 1,000 A AC/DC |
| Frequency band | DC to 1 MHz | DC to 500 kHz | DC to 200 kHz | DC to 100 kHz | DC to 20 kHz |
| Diameter of measurable conductors | Max.φ 20 mm (0.79")<br>(insulated conductor) | Max.φ 20 mm (0.79")<br>(insulated conductor) | Max.φ 20 mm (0.79")<br>(insulated conductor) | Max.φ 50 mm (1.97")<br>(insulated conductor) | Max.φ 50 mm (1.97")<br>(insulated conductor) |
| Basic accuracy | ±0.3% rdg. ±0.01% f.s. (amplitude)<br>±0.1° (phase)<br>(At DC < f ≤ 100 Hz)<br>±0.3% rdg. ±0.05% f.s. (amplitude)<br>(At DC) | ±0.3% rdg. ±0.01% f.s. (amplitude)<br>±0.1° (phase)<br>(At DC < f ≤ 100 Hz)<br>±0.3% rdg. ±0.02% f.s.(amplitude)<br>(At DC) | ±0.3% rdg. ±0.01% f.s. (amplitude)<br>±0.1° (phase)<br>(At DC < f ≤ 100 Hz)<br>±0.3% rdg. ±0.02% f.s. (amplitude)<br>(At DC) | ±0.3% rdg. ±0.01% f.s. (amplitude)<br>±0.1° (phase)<br>(At DC < f ≤ 100 Hz)<br>±0.3% rdg. ±0.02% f.s. (amplitude)<br>(At DC) | ±0.3% rdg. ±0.01% f.s. (amplitude)<br>±0.1° (phase)<br>(At DC < f ≤ 100 Hz)<br>±0.3% rdg. ±0.02% f.s. (amplitude)<br>(At DC) |
| Frequency characteristics (Amplitude) | to 500 Hz: ±0.3% rdg. ±0.02% f.s.<br>to 1 kHz: ±0.5% rdg. ±0.02% f.s.<br>to 10 kHz: ±1.5% rdg. ±0.02% f.s.<br>to 100 kHz: ±5.0% rdg. ±0.05% f.s.<br>to 1 MHz: ±30% rdg. ±0.05% f.s. | to 500 Hz: ±0.3% rdg. ±0.02% f.s.<br>to 1 kHz: ±0.5% rdg. ±0.02% f.s.<br>to 10 kHz: ±1.5% rdg. ±0.02% f.s.<br>to 50 kHz: ±5.0% rdg. ±0.02% f.s.<br>to 500 kHz: ±30% rdg. ±0.05% f.s. | to 500 Hz: ±0.3% rdg. ±0.02% f.s.<br>to 1 kHz: ±0.5% rdg. ±0.02% f.s.<br>to 10 kHz: ±1.5% rdg. ±0.02% f.s.<br>to 50 kHz: ±5.0% rdg. ±0.02% f.s.<br>to 200 kHz: ±30% rdg. ±0.05% f.s. | to 500 Hz: ±0.3% rdg. ±0.02% f.s.<br>to 1 kHz: ±0.5% rdg. ±0.02% f.s.<br>to 10 kHz: ±1.5% rdg. ±0.02% f.s.<br>to 20 kHz: ±5.0% rdg. ±0.02% f.s.<br>to 100 kHz: ±30% rdg. ±0.05% f.s. | to 500 Hz: ±0.5% rdg. ±0.02% f.s.<br>to 1 kHz: ±1.0% rdg. ±0.02% f.s.<br>to 5 kHz: ±2.0% rdg. ±0.02% f.s.<br>to 10 kHz: ±5.0% rdg. ±0.05% f.s.<br>to 20 kHz: ±30% rdg. ±0.10% 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. (DC to 100 Hz) | Within ±0.1% rdg. (DC to 100 Hz) | Within ±0.1% rdg. (DC to 100 Hz) | Within ±0.2% rdg. (DC to 100 Hz) | Within ±0.2% rdg. (DC to 100 Hz) |
| Effect of external magnetic fields | 50 mA equivalent or lower<br>(400 A/m, 60 Hz and DC) | 50 mA equivalent or lower<br>(400 A/m, 60 Hz and DC) | 100 mA equivalent or lower<br>(400 A/m, 60 Hz and DC) | 150 mA equivalent or lower<br>(400 A/m, 60 Hz and DC) | 150 mA equivalent or lower<br>(400 A/m, 60 Hz and DC) |
| Dimensions | 153W (6.02") × 67H (2.64") × 25D (0.98") mm<br>Cable length: 3 m (9.84 ft) | 153W (6.02") × 67H (2.64") × 25D (0.98") mm<br>Cable length: 3 m (9.84 ft) | 153 (6.02") W × 67 (2.64") H × 25 (0.98") D mm<br>Cable length: 3 m (9.84 ft) | 238 (9.37") W × 116 (4.57") H × 35 (1.38") D mm<br>Cable length: 3 m (9.84 ft) | 238 (9.37") W × 116 (4.57") H × 35 (1.38") D mm<br>Cable length: 3 m (9.84 ft) |
| Mass | 350 g (12.3 oz) | 370 g (13.1 oz) | 400 g (14.1 oz) | 860 g (30.3 oz) | 990 g (34.9) |
| Derating properties |  |  |  |  |  |



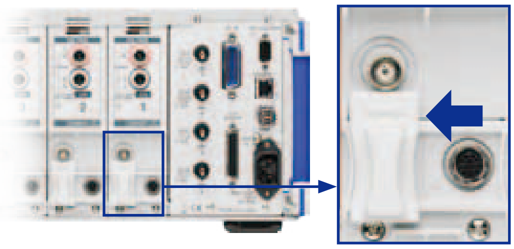
Custom cable lengths also available. Please inquire with your Hioki distributor.

# Wide-band probes (connect to Probe2 input terminal)

| Model | CLAMP ON PROBE 3273-50 | CLAMP ON PROBE 3274 | CLAMP ON PROBE 3275 | CLAMP ON PROBE 3276 |
|---|---|---|---|---|
| Appearance |  |  |  |  |
| Rated primary current | 30 A AC/DC | 150 A AC/DC | 500 A AC/DC | 30 A AC/DC |
| Frequency band | DC to 50 MHz (-3 dB) | DC to 10 MHz (-3 dB) | DC to 2 MHz (-3 dB) | DC to 100 MHz (-3 dB) |
| Diameter of measurable conductors | Max.φ 5 mm (0.20”) (insulated conductors) | Max.φ 20 mm (0.79”) (insulated conductors) | Max.φ 20 mm (0.79”) (insulated conductors) | Max.φ 5 mm (0.20”) (insulated conductors) |
| Basic accuracy | 0 to 30 A rms ±1.0% rdg. ±1 mV<br>30 A rms to 50 A peak ±2.0% rdg.<br>(At DC and 45 to 66 Hz) | 0 to 150 A rms ±1.0% rdg. ±1 mV<br>150 A rms to 300 A peak ±2.0% rdg.<br>(At DC and 45 to 66 Hz) | 0 to 500 A rms ±1.0% rdg. ±5 mV<br>500 A rms to 700 A peak ±2.0% rdg.<br>(At DC and 45 to 66 Hz) | 0 to 30 A rms ±1.0% rdg. ±1 mV<br>30 A rms to 50 A peak ±2.0% rdg.<br>(At DC and 45 to 66 Hz) |
| Operating temperature | 0°C to 40°C (32°F to 104°F) | 0°C to 40°C (32°F to 104°F) | 0°C to 40°C (32°F to 104°F) | 0°C to 40°C (32°F to 104°F) |
| Effect of external magnetic fields | 20 mA equivalent or lower (400 A/m, 60 Hz and DC) | 150 mA equivalent or lower (400 A/m, 60 Hz and DC) | 400 mA equivalent or lower (400 A/m, 60 Hz and DC) | 400 mA equivalent or lower (400 A/m, 60 Hz and DC) |
| Dimensions | 175W (6.89”) x 18H(0.71”) x 40D (1.57”) mm<br>Cable length: 1.5 m | 176W (6.93”) x 69H (2.72”) x 27D(1.06”) mm<br>Cable length: 2 m | 176W (6.93”) x 69H (2.72”) x 27D(1.06”) mm<br>Cable length: 2 m | 175W (6.89”) x 18H(0.71”) x 40D (1.57”) mm<br>Cable length: 1.5 m |
| Mass | 230 g (8.1 oz) | 500 g (17.6 oz) | 520 g (18.3 oz) | 240 g (8.5 oz) |
| Derating properties |  |  |  |  |

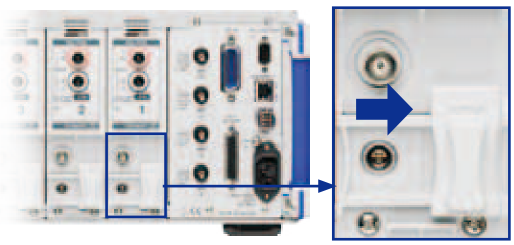
| Model | CURRENT PROBE CT6700 | CURRENT PROBE CT6701 |
|---|---|---|
| Appearance |  |  |
| Rated primary current | 5 Arms AC/DC | 5 Arms AC/DC |
| Frequency band | DC to 50 MHz (-3 dB) | DC to 120 MHz (-3 dB) |
| Diameter of measurable conductors | Max.φ 5 mm (0.20”) (insulated conductors) | Max.φ 5 mm (0.20”) (insulated conductors) |
| Basic accuracy | typical ±1.0% rdg. ±1 mV<br>±3.0% rdg. ±1 mV<br>(At DC and 45 to 66 Hz) | typical ±1.0% rdg. ±1 mV<br>±3.0% rdg. ±1 mV<br>(At DC and 45 to 66 Hz) |
| Operating temperature | 0°C to 40°C (32°F to 104°F) | 0°C to 40°C (32°F to 104°F) |
| Effects of external magnetic fields | 20 mA equivalent or lower (400 A/m, 60 Hz and DC) | 5 mA equivalent or lower (400 A/m, 60 Hz and DC) |
| Dimensions | 155W (6.10”) x 18H(0.71”) x 26D (1.02”) mm<br>Cable length: 1.5 m | 155W (6.10”) x 18H(0.71”) x 26D (1.02”) mm<br>Cable length: 1.5 m |
| Mass | 250 g (8.8 oz) | 250 g (8.8 oz) |
| Derating properties |  |  |

## Sensor switching method



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

When connecting
CT6862-05, CT6863-05, 9709-05, CT6865-05, CT6841-05, CT6843-05, CT6844-05, CT6845-05, CT6846-05, PW9100-03, PW9100-04



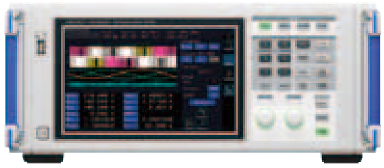
Wideband probe terminal: Slide the cover to the right.

When connecting
3273-50, 3274, 3275, 3276, CT6700 or CT6701

## Model: POWER ANALYZER PW6001 ....Lineup

| Model No. (Order Code) | Number of built-in channels | Motor Analysis & D/A Output |
|---|---|---|
| PW6001-01 | 1ch | — |
| PW6001-02 | 2ch | — |
| PW6001-03 | 3ch | — |
| PW6001-04 | 4ch | — |
| PW6001-05 | 5ch | — |
| PW6001-06 | 6ch | — |
| PW6001-11 | 1ch | ✓ |
| PW6001-12 | 2ch | ✓ |
| PW6001-13 | 3ch | ✓ |
| PW6001-14 | 4ch | ✓ |
| PW6001-15 | 5ch | ✓ |
| PW6001-16 | 6ch | ✓ |

Accessories: Instruction manual × 1, power cord × 1, D-sub 25-pin connector (PW6001-11 to -16 only) × 1



PW6001-16 (with 6 channels and Motor Analysis & D/A Output

- The optional voltage cord and current sensor are required for taking measurements.
- Specify the number of built-in channels and inclusion of Motor Analysis & D/A Output upon order for factory installation. These options cannot be changed or added at a later date.

## Current measurement options

| Model | Model No. (Order Code) |
|---|---|
| AC/DC CURRENT SENSOR (50A) | CT6862-05 |
| AC/DC CURRENT SENSOR (200A) | CT6863-05 |
| AC/DC CURRENT SENSOR (500A) | 9709-05 |
| AC/DC CURRENT SENSOR (1000A) | CT6865-05 |
| AC/DC CURRENT PROBE (20A) | CT6841-05 |
| AC/DC CURRENT PROBE (200A) | CT6843-05 |
| AC/DC CURRENT PROBE (500 A, ϕ20 mm) | CT6844-05 |
| AC/DC CURRENT PROBE (500 A, ϕ50 mm) | CT6845-05 |
| AC/DC CURRENT PROBE (1000 A) | CT6846-05 |
| AC/DC CURRENT BOX (50 A, 3 ch) | PW9100-03 |
| AC/DC CURRENT BOX (50 A, 4 ch) | PW9100-04 |

| Model | Model No. (Order Code) |
|---|---|
| CLAMP ON PROBE (30A) | 3273-50 |
| CLAMP ON PROBE (150A) | 3274 |
| CLAMP ON PROBE (500A) | 3275 |
| CLAMP ON PROBE (30A) | 3276 |
| CURRENT PROBE (5A) | CT6700 |
| CURRENT PROBE (5A) | CT6701 |

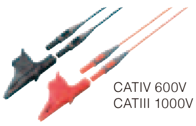
CONVERSION CABLE CT9900

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.

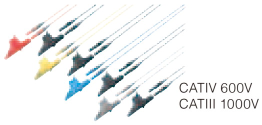
## Voltage measurement options

VOLTAGE CORD L9438-50




1000 V specifications, Black/ Red, 3 m (9.84 ft) length, Alligator clip ×2

VOLTAGE CORD L1000



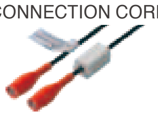

1000 V specifications, Red/ Yellow/ Blue/ Gray each 1, Black 4, Alligator clip x8, 3m (9.84ft) length

GRABBER CLIP 9243

Attaches to the tip of the banana plug cable, Red/ Black: 1 each, 196 mm (7.72 in) length, CAT III 1000 V

## Connection options

CONNECTION CORD L9217



For motor signal input, Cord has insulated BNC connectors at both ends, 1.6 m (5.25 ft) length

LAN CABLE 9642

Straight Ethernet cable, supplied with straight to cross conversion adapter, 5 m (16.41 ft) length

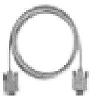
RS-232C CABLE 9637

For the PC, 9 pins - 9 pins, cross, 1.8m (5.91 ft) length

GP-IB CONNECTOR CABLE 9151-02

2m (6.56 ft) length

CONNECTION CABLE 9444



For external control interface, 9 pin - 9 pin straight, 1.5 m (4.92 ft) length

OPTICAL CONNECTION CABLE L6000

For synchronized control, 50/125 µm wavelength multimode fiber, 10 m (32.81 ft) length

## 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
- 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 rating version
- 2000A pull-through type sensor

Carrying case



HIOKI

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