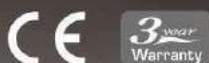# HIOKI

Improve
Power Conversion Efficiency

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

CE 3 year Warranty

Scan QR Code
to Watch Video

All new current sensor
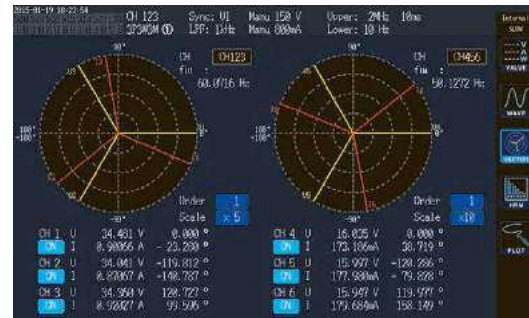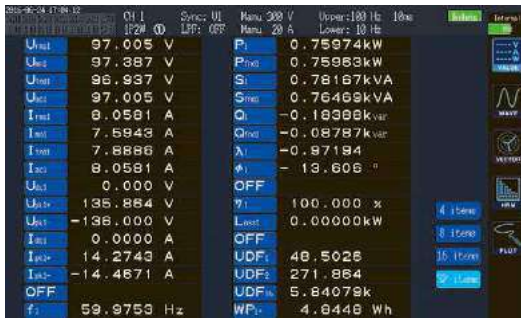Newly Added Option

Ver. 3.00
Newly Added Functions

Achieving true power analysis

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

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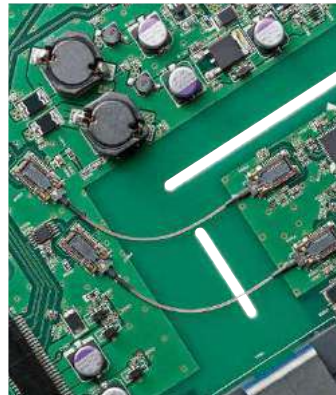

±0.02%* basic accuracy for power
Strengthened resistance to noise and temperature fluctuations in the absolute pursuit of measurement stability

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
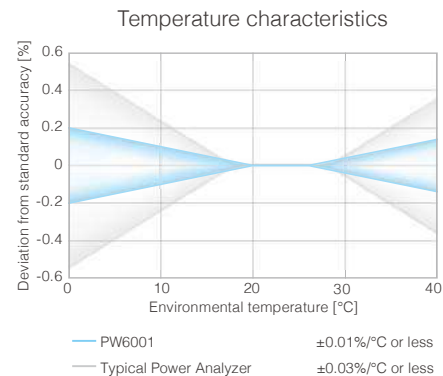

Solid shield

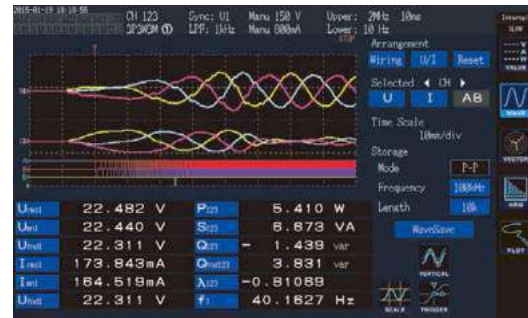Optical isolation device

Temperature characteristics

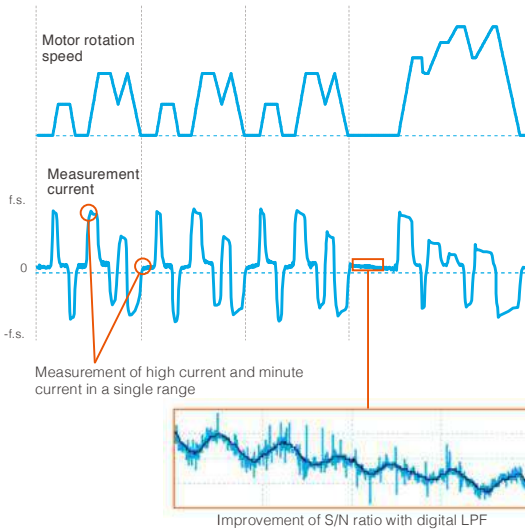| | PW6001 | ±0.01%/°C or less |
| | Typical Power Analyzer | ±0.03%/°C or less |

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.

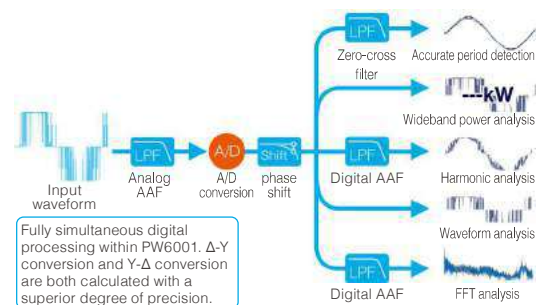Conversion efficiency measurement during mode measurement without switching ranges

Motor rotation speed

Measurement current

f.s.

0

-f.s.

Measurement of high current and minute current in a single range

Improvement of S/N ratio with digital LPF

*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.

Zero-cross filter — Accurate period detection

Wideband power analysis

Input waveform

Analog AAF

A/D conversion

phase shift

Digital AAF — Harmonic analysis

Waveform analysis

Digital AAF — FFT analysis

Fully simultaneous digital processing within PW6001. Δ-Y conversion and Y-Δ conversion are both calculated with a superior degree of precision.
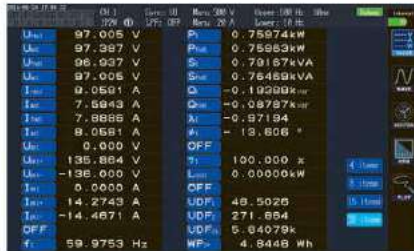
* AAF (Anti-aliasing filter): This filter prevents aliasing errors during sampling.

Functions and Characteristics

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

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

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

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

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.

Synchronize inverter input/output and each fundamental wave

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

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 2000 A, the clamp type for quick and easy wire connection, or the direct input type for high accuracy and broadband. Connect a sensor for oscilloscopes for even more options.
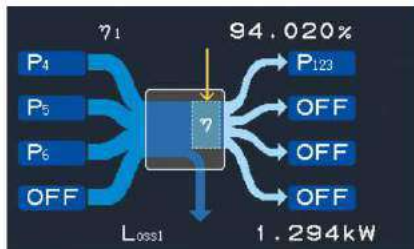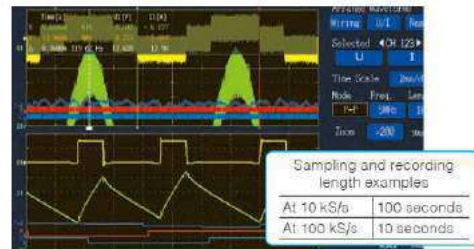PW6001 comes equipped with a sensor power line built-in. Automated recognition functions make setup a cinch.

*±0.075% = accuracy in combination with PW9100

Ver. 3.00 Large-capacity waveform storage for oscilloscope/ PQA-level waveform analysis

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.

Sampling and recording length examples	
At 10 kS/s	100 seconds
At 100 kS/s	10 seconds

In addition to level triggers, Ver. 3.00 now includes event trigger functions triggered by RMS value and frequency fluctuations. Cursor measurement and waveform zoom functions also render oscilloscopes unnecessary for waveform analysis.

FFT analysis of target waveforms

Analyze frequencies up to 2 MHz across 2 channels. Specify any waveform analysis range you like and view the 10 highest peak values and frequencies. Observe frequency components that do not show up in harmonics and save the measured results.
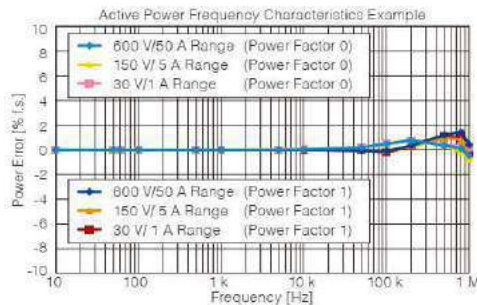
Ver. 3.00 Newly Added Functions Ver.3.00
If you already have the PW6001, these functions will be added with the firmware version update (free of charge).

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.
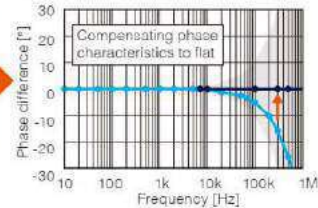

Active Power Frequency Characteristics Example

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

D/A Monitor

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

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

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

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.
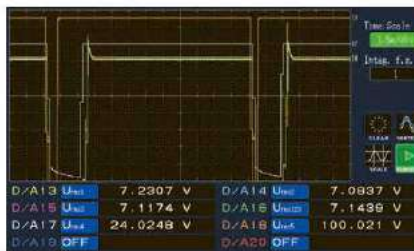

Enter current sensor phase characteristic representative value as phase compensation value (please refer to instruction manual version 03 or later)

*Scan the QR code on the right to download a technical brief about current sensor phase shift.

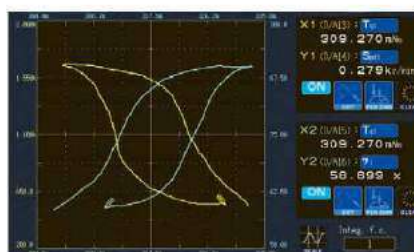## Complex calculation formulas settable on the device

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

Supports various power analysis systems

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

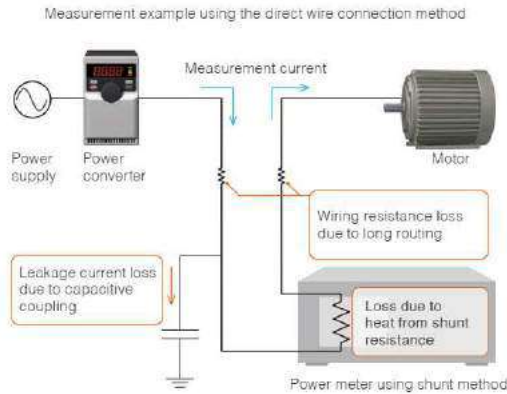* LabVIEW is a registered trademark of NATIONAL INSTRUMENTS
*MATLAB is a registered trademark of Mathworks, Inc.

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.

Ver. 3.00 Seamless operability

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

9-inch touch screen with soft keypad

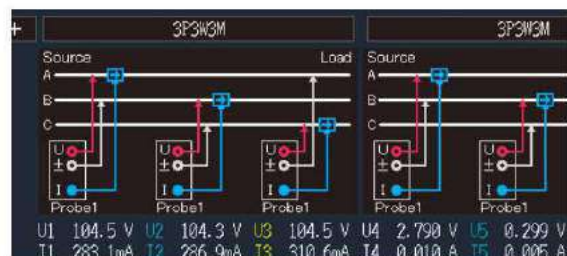Enter handwritten memos on the screen, or use the onscreen keypad

Dual knobs for vertical/horizontal manipulation of waveforms.

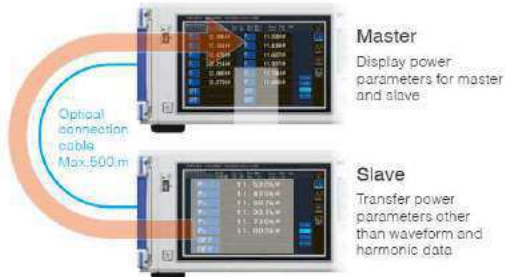One-touch data saving with dedicated key

Quick Configuration screen*

Wiring confirmation function, to avoid wiring mistakes

* A low power factor measurement (LOW PF) mode for easily setting reactor and transformer loss measurement has been added.

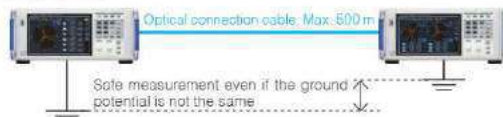## Build a 12-channel power meter using "numerical synchronization"

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

Master
Display power parameters for master and slave

Optical connection cable Max. 500 m

Slave
Transfer power parameters other than waveform and harmonic data

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

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.

Optical connection cable: Max. 500 m

Safe measurement even if the ground potential is not the same

Wide range of Motor Analysis functions
(Motor Analysis and D/A output model)

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

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, Motors, transmissions, etc.	Pyranometer/ anemometer and other output signals
Measurement parameters		Electric angle Rotation direction Motor power RPM Torque Slip	Motor power x 2 RPM x 2 Torque x 2 Slip x 2	Voltage x 2 & Pulse x 2 or Pulse x 4

Simply transfer waveforms with "waveform synchronization"

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

Master
Display max. 6 channels of waveforms for master and slave

Optical connection cable Max. 500 m

Slave
Transfer waveform data for max. 3 channels

- 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
- D/A output of the slave instrument's waveform from the master instrument

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

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.

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* & analog output x 8 channels

Waveform output
voltage
current

Analog output
voltage
current
power

10ms data update

0s   50ms   100ms   150ms   200ms

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

Input waveform

Averaged analog output

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

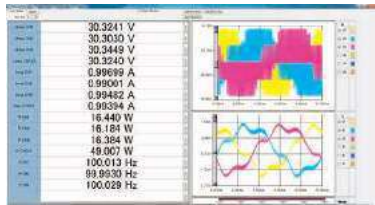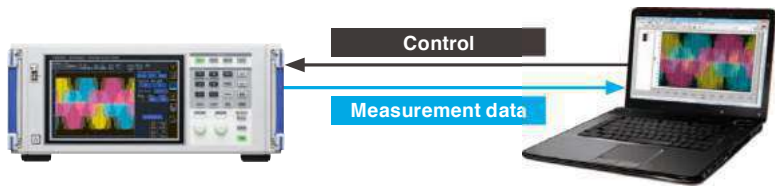# Interfaces   Names of parts

USB flash drive

RS-232C, External I/O
GP-IB
LAN
Synchronous control
D/A output
Motor Analysis Input
Current probe input

GP-IB	Data viewable through dedicated application Command control
RS-232C	Data viewable through dedicated application Command control Bluetooth® logger connection 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. * The presence of obstructions (walls, metal, etc.) may shorten the communication range or destabilize the signal. * 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 Terminals shared with RS-232C, ±5 V/200 mA power supply possible
LAN	Gbit LAN supported Command control 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) Save screen copy (bmp) Save interval data (csv) in real time at the fastest interval of 10 ms
64 MB internal memory	Save interval data and send it to a USB flash drive later

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

Software

Control

Measurement data

PW Communicator   LabVIEW *   MATLAB *

PC Communication Software – PW Communicator

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

LabVIEW driver and MATLAB toolkit

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

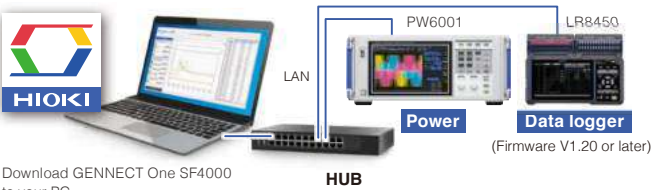*LabVIEW is a registered trademark of National Instruments.
*MATLAB is a registered trademark of Mathworks, Inc.

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

GENNECT One SF4000

The SF4000 is a free application software that lets you display and save measurement data on a PC in real-time after connecting the PW6001 to the PC via Ethernet.

The application is also compatible with other Hioki measuring instruments such as Memory HiLogger LR8450 and the Wireless Logging Station LR8410, letting you connect up to 15 units at the same time to monitor, graph and display lists of measured values from multiple instruments all at once and in real-time. This is especially effective for performing a total analysis of power, temperature and other factors of equipment.

PW6001   LR8450
LAN
Power   Data logger
(Firmware V1.20 or later)

Download GENNECT One SF4000
to your PC   HUB

Model: POWER ANALYZER PW6001

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   *1. With 10m cable

Model	Model No. (Order Code)	Note
AC/DC CURRENT SENSOR	CT6862-05	(50A)
AC/DC CURRENT SENSOR	CT6863-05	(200A)
AC/DC CURRENT SENSOR	CT6904	(500A)
AC/DC CURRENT SENSOR	CT6875	(500A)
AC/DC CURRENT SENSOR *1	CT6875-01	(500A)
AC/DC CURRENT SENSOR	CT6876	(1000A)
AC/DC CURRENT SENSOR *1	CT6876-01	(1000A)
AC/DC CURRENT SENSOR	CT6877	(2000A)
AC/DC CURRENT SENSOR *1	CT6877-01	(2000A)
AC/DC CURRENT PROBE	CT6841-05	(20A)
AC/DC CURRENT PROBE	CT6843-05	(200A)
AC/DC CURRENT PROBE	CT6844-05	(500 A, φ20 mm)
AC/DC CURRENT PROBE	CT6845-05	(500 A, φ50 mm)
AC/DC CURRENT PROBE	CT6846-05	(1000 A)
AC/DC CURRENT BOX	PW9100-03	(50 A, 3 ch)
AC/DC CURRENT BOX	PW9100-04	(50 A, 4 ch)

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

CONVERSION CABLE CT9900
HIOKI PL23 (10 pin) to HIOKI ME15W (12 pin) connector
For use with CT6862, CT6863, CT6841, CT6843, CT6844, CT6845, CT6846.

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

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

Voltage measurement options

VOLTAGE CORD L9438-50
CATIV 600V, CATIII 1000V
1000 V specifications, Black/ Red, 3 m (9.84 ft) length, Alligator clip ×2

VOLTAGE CORD L1000
CATIV 600V, CATIII 1000V
1000 V specifications, Red/ Yellow/ Blue/ Gray each 1, Black 4, Alligator clip ×8, 3m (9.84ft) length

CONNECTION CORD L9257
CATIV 600V, CATIII 1000V
1000 V specifications, red/ black × 1 ea., 1.2 m length

GRABBER CLIP L9243
Attaches to the tip of the banana plug cable, Red/ Black: 1 each, 185 mm (7.28 in) length

L1021-01 Red × 1
L1021-02 Black × 1
CATIV 600V, CATIII 1000V
PATCH CORD
Banana branch to banana clip, for branching voltage input, 0.5 m length

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, 2.5 m (8.20 ft) length
- Bluetooth® serial converter adapter cable 1 m (3.28 ft)
- Rackmount fittings (EIA, JIS)
- Optical connection cable, Max. 500 m (1640.55 ft) length
- PW9100 5 A rated version, CT6904 800 A rated version

D/A output cable   Carrying case   Rackmount fittings

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Ueda, Nagano 386-1192 Japan
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