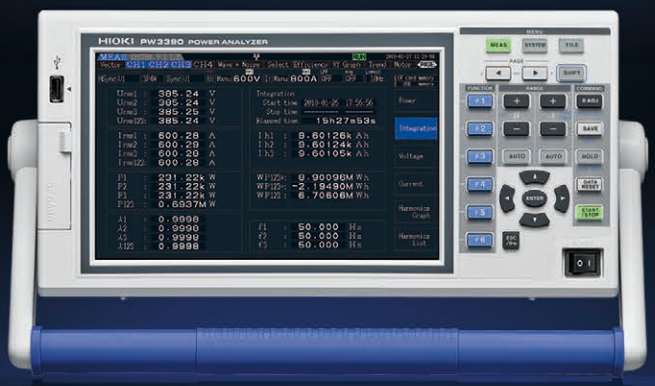
HIOKI

POWER ANALYZER Series



CE 3year Warranty

High-precision Power Analysis Through Sensing Technology

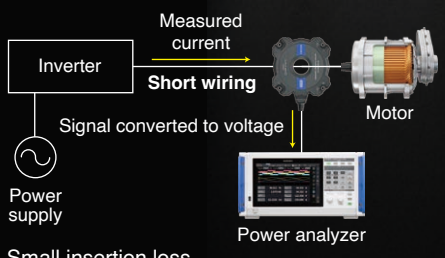
Superior affinity between power analyzers and current sensors

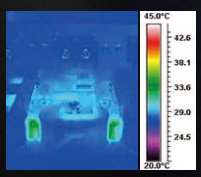
Hioki develops both power analyzers and current sensors. Advanced sensing technology is a prerequisite for accurate power analysis. Given the high affinity between current sensors and power analyzers, precise power analysis is possible.

For high voltage measurements above 1500 V
AC/DC HIGH VOLTAGE DIVIDER VT1005
Divides and outputs voltages of up to 5000 V

The current sensor method is an approach to making measurements that closely resemble the actual operating environment

Measurement example using the current sensor method

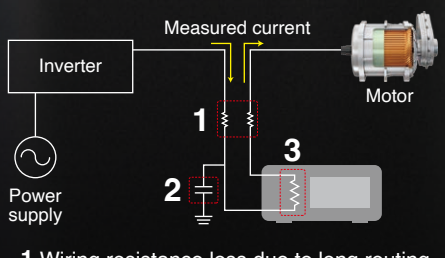


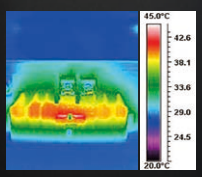


Temperature after current sensing (Continues for 10 min.)

Small insertion loss
Little effect from routing

Measurement example using the direct wiring method



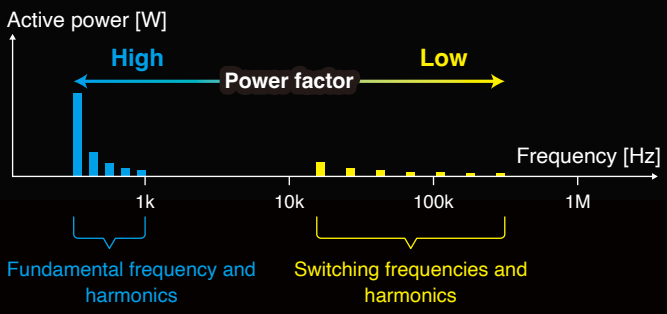


Temperature after current sensing (Continues for 10 min.)

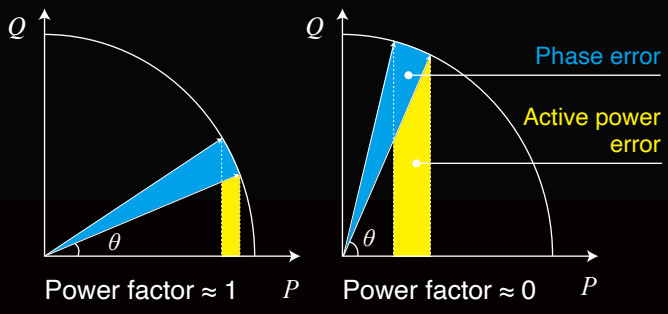
1 Wiring resistance loss due to long routing
2 Leakage current loss due to capacitive coupling
3 Instrument loss due to shunt resistance

Important points in evaluating high-efficiency inverters

When evaluating the power conversion efficiency of an inverter, the inverter's input and output power are measured, and its efficiency is calculated. PWM (pulse width modulated) inverter output, which has been widely used in recent years, contains the fundamental and its harmonic, the switching frequencies, and its harmonic component. Since switching frequencies are high, current sensors that can measure over a wide bandwidth are needed for the measurement process.



Active power spectogram for an inverter's output power.
The ability to measure low-powerfactor, high-frequency components is essential.

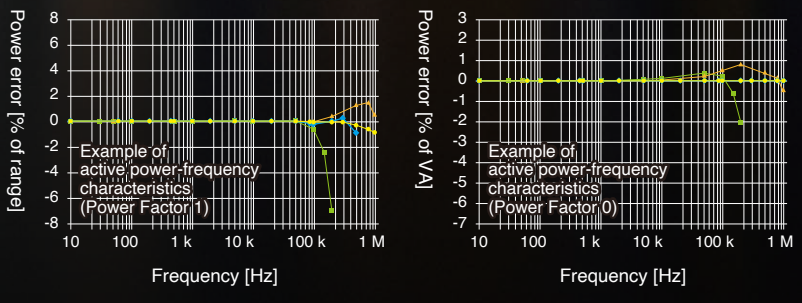


At low power factors, phase error has a significant effect on power error.
Phase accuracy of current sensor is important.

For high current measurements above 2000 A

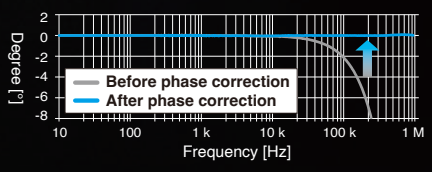
SENSOR UNIT CT9557
The current sensor output is added and output
Accurately measures large currents up to 8000 A (4 wires)

Current sensor with defined phase accuracy can accurately measure power



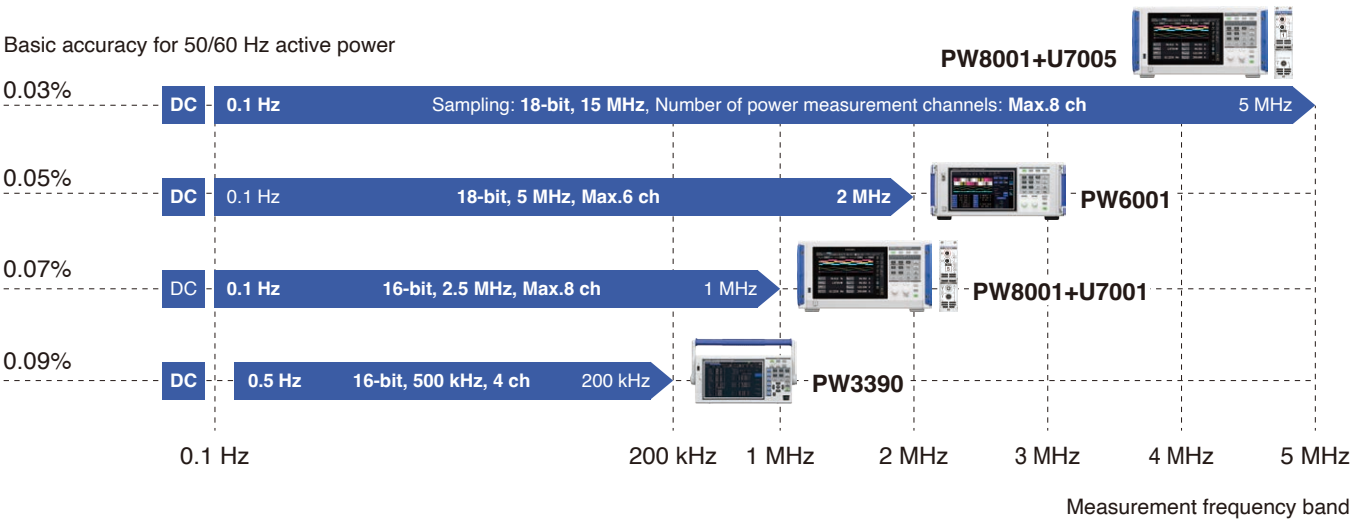
PW8001+U7005 (1500 V/50 A range)
PW8001+U7001 (1500 V/50 A range)
PW6001 (600 V/50 A range)
PW3390 (150 V/50 A range)

HIOKI specifies the phase accuracy of current sensors for more accurate power measurement. By correcting the phase characteristics of the current sensor with a power analyzer, low power factor power can be accurately measured down to higher frequencies.



Example of the phase correction for the CT6904A AC/DC current sensor

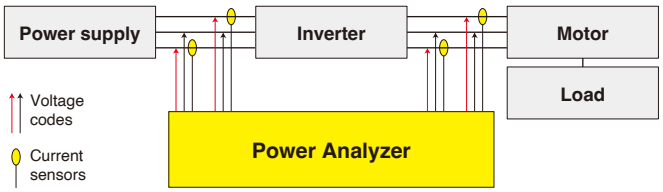
Power analyzer lineup

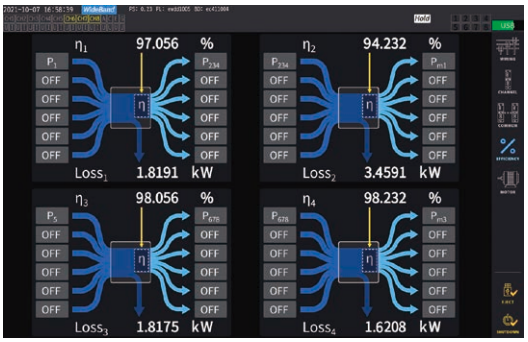


Applications

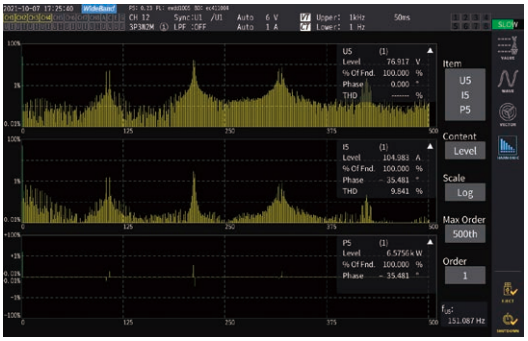
Power conversion efficiency evaluation of inverters

Measure input and output power for power conversion devices like inverters and calculate efficiency and loss.





Efficiency and loss calculations (PW8001)



Harmonic analysis of the 500th-order (PW8001)

Detect power conversion efficiency and loss

Number of power measurement channels	
PW8001	Up to 8 channels (specified at time of purchase)
PW6001	Up to 6 channels (specified at time of purchase)
PW3390	4 ch

Efficiency and loss calculations	
PW8001	Max.4 each for efficiency and loss (with Auto mode)
PW6001	Max.4 each for efficiency and loss
PW3390	Max.3 each for efficiency and loss

The PW8001's Auto mode automatically switches calculation formulas depending on the direction of power flow. (Ordinarily, calculation formulas are switched manually depending on the direction of power flow.)

Accuracy for active power*	DC	50 Hz/60 Hz	10 kHz
PW8001+U7005	±(0.02% + 0.03%)	±(0.01% + 0.02%)	±(0.05% + 0.05%)
PW8001+U7001	±(0.02% + 0.05%)	±(0.02% + 0.05%)	±(0.2% + 0.05%)
PW6001	±(0.02% + 0.05%)	±(0.02% + 0.03%)	±(0.15% + 0.1%)
PW3390	±(0.05% + 0.07%)	±(0.04% + 0.05%)	±(0.2% + 0.1%)

*±(% of reading + % of range)

Harmonics measurement

	Synchronization frequency range	Maximum analysis order
PW8001+U7005	0.1 Hz to 1.5 MHz	500th
PW8001+U7001	0.1 Hz to 1 MHz	500th
PW6001	0.1 Hz to 300 kHz	100th
PW3390	0.5 Hz to 5 kHz	100th

The instrument can perform harmonic analysis for each channel's voltage, current, and active power and display the results. The PW8001 and PW6001 can analyze harmonics for individual channels, and they can simultaneously measure harmonics in multiple circuits at different frequencies.

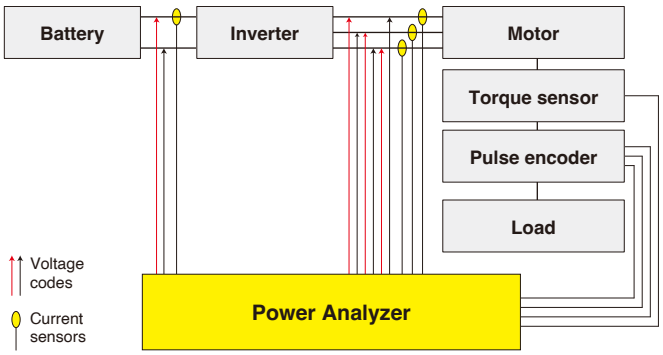
Common-mode rejection ratio (CMRR)

	50 Hz/60 Hz	100 kHz
PW8001+U7005	120 dB or greater	110 dB or greater
PW8001+U7001	100 dB or greater	80 dB typical
PW6001	100 dB or greater	80 dB or greater
PW3390	80 dB or greater	-

When evaluating an equipment that produces noise, such as an inverter, it is essential to consider how effectively the device can withstand noise.

Evaluation of inverters and motors

Efficiency and loss can be calculated from the power on the input and output sides of inverters and motors. Torque meter and pulse encoder signals can be input to the power analyzer to simultaneously analyze and record the motor's torque, rotation speed, and mechanical output.



Motor analysis

Number of motors that can be simultaneously analyzed	
PW8001	Max. 4 motors
PW6001	Max. 2 motors
PW3390	1 motor

Input signals from a torque meter and pulse encoder to analyze motor torque, speed, rotational direction, and electrical angle.

user-defined calculations (used when calculating motor parameters)	
PW8001	Up to 20 equations can be set
PW6001	Up to 16 equations can be set
PW3390	-

Set calculation formulas as desired and display the results in real time. Calculate Ld and Lq motor parameters from electrical angle measurements.

Correction of torque meter measurement error	
PW8001	Zero correction, nonlinear correction*, friction correction*
PW6001	Zero correction
PW3390	Zero correction

*Enter the calibration values and points for compensating the sensor's error to calibrate the torque meter's value.

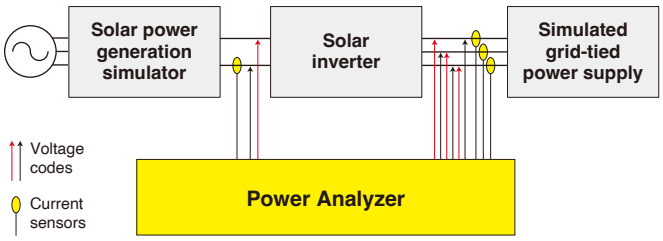
CAN or CAN FD output function

PW8001	Yes
PW6001	-
PW3390	-

The PW8001 can output measurement data to a CAN bus in real time as CAN or CAN FD signals, which can be recorded along with ECU data.

Solar inverter efficiency measurements

Measure a solar inverter's input and output power and calculate efficiency and loss. Evaluate power generation systems that require measuring high voltages and multiple circuits, such as a multi-string solar inverter.



Maximum input voltage

PW8001+U7005	1000 V AC/DC, ±2000 V peak
PW8001+U7001	1000 V AC, 1500 V DC, ±2000 V peak
PW6001	1000 V AC/DC, ±2000 V peak
PW3390	1500 V AC/DC, ±2000 V peak

Use the VT1005 (option) to measure voltages of up to 5000 V with a power analyzer.

IEC standard compliant harmonic and flicker measurement

	IEC harmonics measurement	IEC Flicker Measurement
PW8001	Yes	Yes
PW6001	Yes	-
PW3390	-	-

Measure harmonics in compliance with the IEC 61000-4-7 standard and flicker in compliance with the IEC 61000-4-15 standard.

Multi-string solar inverters evaluation

Optical link interface	
PW8001	Analysis of up to 16 channels
PW6001	Analysis of up to 12 channels
PW3390	-

Connect two power analyzers with the optical link interface to aggregate and analyze measured data on one instrument.

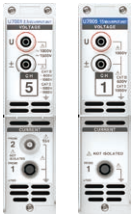
Power analyzer lineup

	Model	PW8001+U7005	PW8001+U7001	PW6001	PW3390
	Applications	For measurement of SiC and GaN inverters and reactor/transformer loss	For measurement of high-efficiency IGBT inverters and solar inverters	For measurement of high-efficiency IGBT inverters	For portability and high accuracy
Basic accuracy	Basic accuracy for 50/60 Hz power*1	±(0.01% + 0.02%)	±(0.02% + 0.05%)	±(0.02% + 0.03%)	±(0.04% + 0.05%)
	Accuracy for DC power*1	±(0.02% + 0.03%)	±(0.02% + 0.05%)	±(0.02% + 0.05%)	±(0.05% + 0.07%)
	Accuracy for 10 kHz power*1	±(0.05% + 0.05%)	±(0.2% + 0.05%)	±(0.15% + 0.1%)	±(0.2% + 0.1%)
	Accuracy for 50 kHz power*1	±(0.15% + 0.05%)	±(0.4% + 0.1%)	±(0.15% + 0.1%)	±(0.4% + 0.3%)
Measurement	Measurement frequency band	DC, 0.1 Hz to 5 MHz	DC, 0.1 Hz to 1 MHz	DC, 0.1 Hz to 2 MHz	DC, 0.5 Hz to 200 kHz
	Number of power measurement channels	1 to 8 channels, specify U7001 or U7005 when placing an order (mixed available)		1 to 6 channels, a specify when ordering	4 channels
	Voltage, current ADC sampling	18-bit, 15 MHz	16-bit, 2.5 MHz	18-bit, 5 MHz	16-bit, 500 kHz
	Voltage range	6 V, 15 V, 30 V, 60 V, 150 V, 300 V, 600 V, 1500 V		6 V, 15 V, 30 V, 60 V, 150 V, 300 V, 600 V, 1500 V	15 V, 30 V, 60 V, 150 V, 300 V, 600 V, 1500 V
	Current range	100 mA to 2000 A*2	**probe1:** 100 mA to 2000 A*2 **probe2:** 100 mV, 200 mV, 500 mV, 1 V, 2 V, 5 V	**probe1:** 100 mA to 2000 A*2 **probe2:** 100 mV, 200 mV, 500 mV, 1 V, 2 V, 5 V	100 mA to 8000 A*2
	Data update rate	1 ms, 10 ms, 50 ms, 200 ms		10 ms, 50 ms, 200 ms	50 ms
	Common-mode rejection ratio (CMRR)	50/60 Hz: 120 dB or greater 100 kHz: 110 dB or greater	50/60 Hz: 100 dB or greater 100 kHz: 80 dB typical	50/60 Hz: 100 dB or greater 100 kHz: 80 dB or greater	50/60 Hz: 80 dB or greater
	Temperature coefficient	0.01%/°C		0.01%/°C	0.01%/°C
	Voltage input method	Photoisolated input, resistor voltage division	Isolated input, resistor voltage division	Photoisolated input, resistor voltage division	Isolated input, resistor voltage division
	Current input method	Isolated input from current sensor		Isolated input from current sensor	Isolated input from current sensor
Current input	External current sensor input	Yes (ME15W)	Yes (ME15W, BNC)	Yes (ME15W, BNC)	Yes (ME15W)
	Power supplied to external current sensor	Yes		Yes	Yes
	Current sensor phase shift calculation	Yes (auto)		Yes	Yes
Voltage input	Maximum input voltage	1000 V, ±2000 V peak	1000 V AC, 1500 V DC, ±2000 V peak	1000 V, ±2000 V peak (10 ms)	1500 V, ±2000 V peak
	Maximum rated line-to-ground voltage	600 V CAT III 1000 V CAT II	600 V AC/1000 V DC CAT III 1000 V AC/1500 V DC CAT II	600 V CAT III 1000 V CAT II	600 V CAT III 1000 V CAT II
Analysis/calculation	Efficiency and loss calculations	Yes (Max.4 each for efficiency and loss, auto*3)		Yes (Max.4 each for efficiency and loss)	Yes (Max.3 each for efficiency and loss)
	Motor analysis Number of channels Input format	Yes*4 Max. 4 motors Analog DC, frequency, pulse		Yes*4 Max. 2 motors Analog DC, frequency, pulse	Yes*4 1 motor Analog DC, frequency, pulse
	Torque meter correction	Zero correction, nonlinear correction, friction correction		Zero correction	Zero correction
	Harmonics measurement Max. analysis order Synchronization frequency range	Yes (8, for each channel) 500th 0.1 Hz to 1.5 MHz	Yes (8, for each channel) 500th 0.1 Hz to 1 MHz	Yes (6, for each channel) 100th 0.1 Hz to 300 kHz	Yes 100th 0.5 Hz to 5 kHz
	IEC harmonics measurement	Yes		Yes	-
	IEC flicker measurement	Yes		-	-
	FFT spectrum analysis	Yes (DC to 4 MHz)	Yes (DC to 1 MHz)	Yes (DC to 2 MHz)	Yes (DC to 200 kHz)
	User-defined calculations	Yes		Yes	-
	Delta conversion	Yes (Δ-Y, Y-Δ)		Yes (Δ-Y, Y-Δ)	Yes (Δ-Y)
	D/A output	Yes*4 20 ch (waveform output, analog output)		Yes*4 20 ch (waveform output, analog output)	Yes*4 16 ch (waveform output, analog output)
Display	Display	10.1" WVGA TFT color LCD		9" WVGA TFT color LCD	9" WVGA TFT color LCD
	Touch screen	Yes		Yes	-
Interface	External storage media	USB 3.0		USB 2.0	USB 2.0, CF card
	LAN (100BASE-TX, 1000BASE-T)	Yes		Yes	Yes (10BASE-T and 100BASE-TX only)
	GP-IB	Yes		Yes	-
	RS-232C	Yes (maximum 115,200 bps)		Yes (maximum 230,400 bps)	Yes (maximum 38,400 bps)
	External control	Yes		Yes	Yes
	Synchronization of multiple instruments	Yes (up to 4 instruments)		-	Yes (up to 8 instruments)
	Optical link	Yes*4		Yes	-
	CAN or CAN FD	Yes*4		-	-
Dimensions, weight (W×H×D)		430 mm × 221 mm × 361 mm (16.93 in.× 8.70 in. × 14.21 in.), 14 kg (493.84 oz.)		430 mm× 177 mm× 450 mm (16.93 in.× 6.97 in.× 17.72 in.) 14 kg (493.84 oz.)	340 mm× 170 mm × 156 mm (13.39 in.× 6.69 in.× 6.14 in.) 4.6 kg (162.26 oz.)

*1: ±(% of reading + % of range) *2: 6 ranges, based on sensor *3: The position of terms set on the input and output sides is switched depending on the sign of the measured values.
*4: Sold separately

Model No. (Order code)

PW8001

Model	Number of channels	Motor analysis	Waveform and D/A output	CAN or CAN FD interface	Optical link interface
PW8001-01	1 to 8 channels, specify U7001 or U7005 when placing an order (mixed available)  U7001 U7005	-	-	-	-
PW8001-02		-	Yes	-	-
PW8001-03		-	-	Yes	-
PW8001-04		-	-	-	Yes
PW8001-05		-	Yes	-	Yes
PW8001-06		-	-	Yes	Yes
PW8001-11		Yes	-	-	-
PW8001-12		Yes	Yes	-	-
PW8001-13		Yes	-	Yes	-
PW8001-14		Yes	-	-	Yes
PW8001-15		Yes	Yes	-	Yes
PW8001-16		Yes	-	Yes	Yes

PW6001

Model	Number of channels	Motor analysis	Waveform and D/A output
PW6001-01	1 ch	-	-
PW6001-02	2 ch	-	-
PW6001-03	3 ch	-	-
PW6001-04	4 ch	-	-
PW6001-05	5 ch	-	-
PW6001-06	6 ch	-	-
PW6001-11	1 ch	Yes	Yes
PW6001-12	2 ch	Yes	Yes
PW6001-13	3 ch	Yes	Yes
PW6001-14	4 ch	Yes	Yes
PW6001-15	5 ch	Yes	Yes
PW6001-16	6 ch	Yes	Yes

PW3390

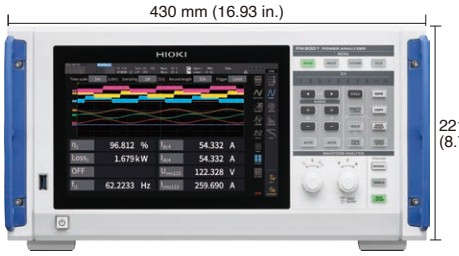
Model	Number of channels	Motor analysis	Waveform and D/A output
PW3390-01	4 ch	-	-
PW3390-02	4 ch	-	Yes
PW3390-03	4 ch	Yes	Yes

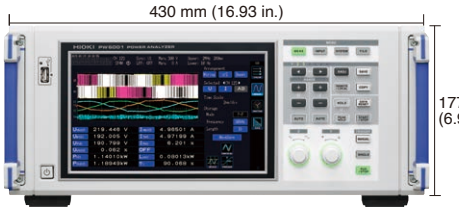
Scan for more details on each product.

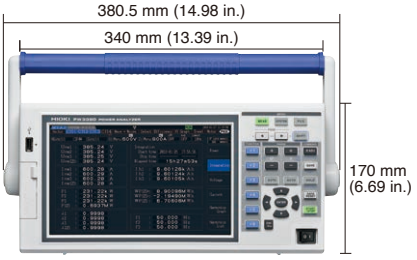
PW8001 PW6001

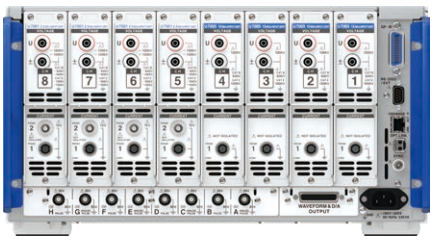
PW3390 Current Sensors

CT9557 VT1005









PW8001-15
Four U7001 units installed
Four U7005 units installed

PW6001-16

PW3390-03

Current sensor lineup

Model	Appearance	Rated current	Maximum peak current	Frequency range	Amplitude accuracy 50 Hz/ 60 Hz	Diameter of measurable conductors	Cable length	Automatic phase correction*1	Operating temperature
Pass-through types									
CT6862-05		50 Arms	±141 A peak	DC to 1 MHz	±0.05 % rdg ±0.01 % f.s.	ϕ 24 mm (0.94 in.)	3 m (9.84 ft.)	-	-30°C to 85°C -22°F to 185°F
CT6872 CT6872-01		50 Arms	±200 A peak	DC to 10 MHz	±0.03 % rdg ±0.007 % f.s.	ϕ 24 mm (0.94 in.)	3 m (9.84 ft.) 10 m (32.81 ft)	Yes	-40°C to 85°C -40°F to 185°F
CT6863-05		200 Arms	±565 A peak	DC to 500 kHz	±0.05 % rdg ±0.01 % f.s.	ϕ 24 mm (0.94 in.)	3 m (9.84 ft.)	-	-30°C to 85°C -22°F to 185°F
CT6873 CT6873-01		200 Arms	±350 A peak*2	DC to 10 MHz	±0.03 % rdg ±0.007 % f.s.	ϕ 24 mm (0.94 in.)	3 m (9.84 ft.) 10 m (32.81 ft)	Yes	-40°C to 85°C -40°F to 185°F
CT6875A CT6875A-1		500 Arms	±1500 A peak*2	DC to 2 MHz DC to 1.5 MHz	0.04 % rdg ±0.008 % f.s.	ϕ 36 mm (1.42 in.)	3 m (9.84 ft.) 10 m (32.81 ft)	Yes	-40°C to 85°C -40°F to 185°F
CT6904A CT6904A-1		500 Arms	±1000 A peak*2	DC to 4 MHz DC to 2 MHz	±0.02 % rdg ±0.007 % f.s.	ϕ32 mm (1.26 in.)	3 m (9.84 ft.) 10 m (32.81 ft)	Yes	-10°C to 50°C 14°F to 122°F
CT6904A-2 CT6904A-3		800 Arms	±1200 A peak*2	DC to 4 MHz DC to 2 MHz	±0.025 % rdg ±0.009 % f.s.	ϕ32 mm (1.26 in.)	3 m (9.84 ft.) 10 m (32.81 ft)	Yes	-10°C to 50°C 14°F to 122°F
CT6876A CT6876A-1		1000 Arms	±1800 A peak*2	DC to 1.5 MHz DC to 1.2 MHz	0.04 % rdg ±0.008 % f.s.	ϕ 36 mm (1.42 in.)	3 m (9.84 ft.) 10 m (32.81 ft)	Yes	-40°C to 85°C -40°F to 185°F
CT6877A CT6877A-1		2000 Arms	±3200 A peak*2	DC to 1 MHz	0.04 % rdg ±0.008 % f.s.	ϕ80 mm (3.15 in.)	3 m (9.84 ft.) 10 m (32.81 ft)	Yes	-40°C to 85°C -40°F to 185°F
Clamp types									
CT6830	NEW 	2 Arms	±4.3 A peak	DC to 100 kHz	±0.3 % rdg ±0.05 % f.s.	ϕ5 mm (0.20 in.)	4 m, 20 cm*4 (13.12 ft., 7.87 in.)	Yes	-40°C to 85°C (-40°F to 185°F)
CT6831	NEW 	20 Arms	±43 A peak	DC to 100 kHz	±0.3 % rdg ±0.01 % f.s.	ϕ5 mm (0.20 in.)	4 m, 20 cm*4 (13.12 ft., 7.87 in.)	Yes	-40°C to 85°C (-40°F to 185°F)
9272-05		20 Arms, 200 Arms	±71 Apeak, ±430 Apeak	1 Hz to 100 kHz	±0.3 % rdg ±0.01 % f.s.	ϕ46 mm (1.81 in.)	3 m (9.84 ft.)	-	0°C to 50°C 32°F to 122°F
CT6841A		20 Arms	±60 A peak*2	DC to 2 MHz	±0.2 % rdg ±0.01 % f.s.	ϕ20 mm (0.79 in.)	3 m (9.84 ft.)	Yes	-40°C to 85°C -40°F to 185°F
CT6843A		200 Arms	±600 A peak*2	DC to 700 kHz	±0.2 % rdg ±0.01 % f.s.	ϕ20 mm (0.79 in.)	3 m (9.84 ft.)	Yes	-40°C to 85°C -40°F to 185°F
CT6844A		500 Arms	±800 A peak*2	DC to 500 kHz	±0.2 % rdg ±0.01 % f.s.	ϕ20 mm (0.79 in.)	3 m (9.84 ft.)	Yes	-40°C to 85°C -40°F to 185°F
CT6845A		500 Arms	±1500 A peak*2	DC to 200 kHz	±0.2 % rdg ±0.01 % f.s.	ϕ50 mm (1.97 in.)	3 m (9.84 ft.)	Yes	-40°C to 85°C -40°F to 185°F
CT6846A		1000 Arms	±1900 A peak*2	DC to 100 kHz	±0.2 % rdg ±0.01 % f.s.	ϕ50 mm (1.97 in.)	3 m (9.84 ft.)	Yes	-40°C to 85°C -40°F to 185°F
Direct-wired types									
PW9100A-3*3		50 Arms	±200 A peak*2	DC to 3.5 MHz	±0.02 % rdg ±0.005 % f.s.	M6 screw terminals	3 ch	Yes	0°C to 40°C 32°F to 104°F
PW9100A-4*3		50 Arms	±200 A peak*2	DC to 3.5 MHz	±0.02 % rdg ±0.005 % f.s.	M6 screw terminals	4 ch	Yes	0°C to 40°C 32°F to 104°F

*1: When using PW8001 *2: Within 20 ms and 40°C (104°F) or less *3: Special specification PW9100A with a rated current of 5A can also be ordered.
*4: Between sensor to multiplexer, Between multiplexer to output connector

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