HIOKI

DATA LOGGER LR8101, LR8102
POWER MEASUREMENT MODULE M7103

NEW

Solutions for PV inverter production lines

Compact PV inverter testing

- *1500 V DC accuracy guarantee*
- *Up to 12 channels in a 4U unit that fits in a 19-inch rack*
- *Up to 120 channels (10 sets of 12 channels)*
- *Synchronization Source Sharing function for more stable efficiency measurement*

CE 3 year Warranty

Product concept

Among PV inverters, string inverters are being engineered. Developers of string inverters are increasingly focusing on increasing the handled voltage and input and output circuit numbers in order to increase energy-efficiency of operation. Consequently equipment used on lines producing these inverters must support high voltages and a large number of channels. However, despite these demands that typically result in larger equipment, space on lines remain the same. This, of course creates an added demand for space economy. Hioki developed the M7103 to satisfy these requirements.

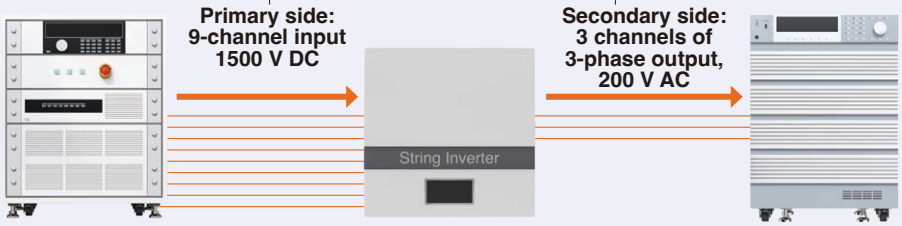
Compact PV inverter testing

Power Measurement Module M7103

- **Flexible channel expandability**
- **Compact, spacing-saving modules**
- **Single-instrument solution for testing all necessary parameters**
- **Support for direct input of 1500 V DC**

Principal test parameters

- DC voltage for individual MPPTs
- Grid AC voltage
- DC current for individual MPPTs
- Grid AC Current
- Grid voltage and current harmonics
- DC power
- AC power
- Conversion efficiency



Solar power generation simulator | **String inverter** | **Grid simulation power supply**

Advantages

1

High-accuracy measurement without differential probes, even for high voltages

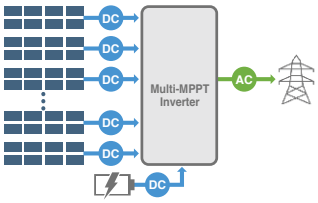
Measurement accuracy is guaranteed for voltages of to up to 1500 V DC. The instrument supports a maximum input voltage of 2000 V DC.

2

Expandable power meter ideal for PV inverter production lines

Measure multi-point power across up to 12 channels with a 4U unit that fits in a 19-inch rack. This design helps save space on production lines.

3



Efficiency measurement of multi-MPPT string inverters

The Synchronization Source Sharing function allows stable efficiency measurement across large number of channels.

Product components

A typical set consists of the Data Logger main unit, Power Supply Module, and one or more Power Measurement Modules.

Power Measurement Module
Connect up to 4

Data logger

Power Supply Module

Data logger + Power Supply Module + Power Measurement Module × 4
(for a 12-channel system)

Product line

Data Loggers

Select from two logger models. If you wish to synchronize sampling and use 5 or more Power Measurement Modules, you'll need multiple LR8102 loggers.

Standard model

Data Loggers
LR8101

Basic functionality needed to collect general-purpose data

- Connect up to 10 measurement modules per logger
- Send data to a computer via LAN

Advanced model

Data Loggers
LR8102

Support for large-scale systems and real-time simulations

- Synchronize sampling across up to 10 main unit data loggers
- Extensive communications interfaces for high-speed data transfers
- Connect up to 10 measurement modules per logger
- Send data to a computer via LAN

		LR8101	LR8102
Maximum number of connectable measurement modules		10 (M7100, M7102)	10 (M7100, M7102)
Maximum number of synchronizable loggers		-	10 (requires optical connection cables)
Communications interface(s)	LAN 1 (communications commands,data download)	Data collection and recording-condition configuration via Logger Utility; setting configuration, recording control, FTP server function, FTP client function, HTTP server function, and XCP on Ethernet (TCP) via communications commands	
	LAN 2 (real-time data output)	-	· Data output with refresh interval as short as 5 ms via UDP · XCP on Ethernet (UDP)
	CAN (real-time data output)	-	Data output with refresh interval as short as 5 ms via CAN or CAN FD
External control terminals		Pulse/logic input, external sampling input, external I/O (4), alert output (4), CAN interface (LR8102 only)	

Measurement module

1500 V DC

Power Measurement Module
M7103

- Direct input of DC 1500 V
- Up to 5 ms sampling
- Up to 3 channels of power measurement in a single module

Power

M7103	
Measurement frequency band	DC, 0.1 Hz to 100 kHz
DC, 50/60 Hz accuracy	U, I ranges: ±(0.02% rdg. + 0.03% of range) P ranges: ±(0.02% rdg. + 0.05% of range)
Number of power measurement channels	3
Voltage range	6 V to 1500 V (8 ranges)
Current range	40 mA to 2000 A (6 ranges, using current sensors)
Voltage input method	Isolated, resistive potential divider
Current input method	Isolated input via current sensors
Data refresh interval	5, 50, 200 ms
Maximum input voltage	1000 V AC, 2000 V DC
Harmonic measurement modes	Select IEC measurement mode or wideband measurement mode.

Power supply module

AC Power Supply Module
M1100

The M1100 is an AC Power Supply Module designed specifically for the M7103. It supplies power to up to four M7103 modules.

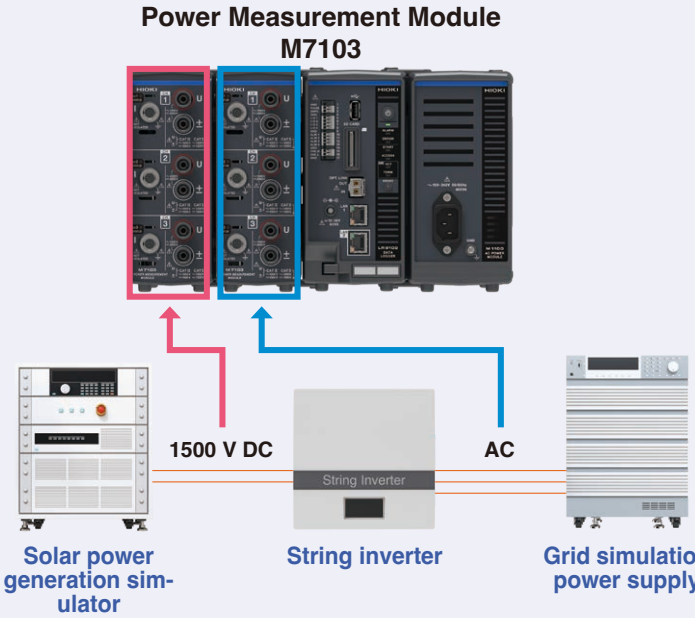
M1100	
Rated supply voltage	100 to 240 V AC
Rated power supply frequency	50, 60 Hz
Maximum rated power	400 VA (at M1100's maximum rated current and power) 300 VA (with 4 M7103 modules and 6 M7100 modules connected)

Three advantages that make possible high-accuracy, high-efficiency measurement

Advantages 1

Realize high-accuracy measurement without differential probes, even for high voltages

Manufacturers are developing PV inverters that operate at higher voltages to reduce equipment costs and transmission losses. As a result, measurement of PV inverters requires instruments that can accommodate high voltages.
The M7103 supports 1500 V DC CAT II and 1000 V DC CAT III measurement, allowing high voltages to be input directly and measured safely.
In addition, high quality measurement is assured during PV inverter testing since accuracy is guaranteed up to 1500 V DC with direct input.

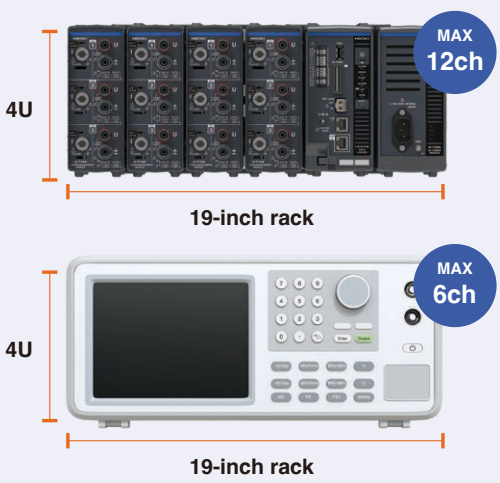


Advantages 2

Expandable power meter ideal for PV inverter production lines

The M7103 delivers multi-point power measurement across up to 12 channels in a 4U unit that fits in a 19-inch rack, helping save space and lower costs on PV inverter production lines. In addition, its expandable design means customers can add or replace modules themselves, providing flexibility when building PV inverter production lines.

Measure multi-point power across up to 12 channels with a 4U unit that fits in a 19-inch rack



- Ever-growing number of string inverters' DC-side channels

- Twice the space efficiency of a conventional power meter
- Users can add or replace modules themselves

Advantages 3

Efficiency measurement of multi-MPPT string inverters

Manufacturers are developing multi-string inverters to maximize the generating capacity of solar power systems. Multi-string inverters are controlled using maximum power point tracking (MPPT) so that they create as much power as possible per string. On production lines, measurements must be made at numerous points to test whether each MPPT is functioning properly. By using the LR8102's Synchronization Source Sharing function, the M7103 can simultaneously measure power across up to 120 channels. Furthermore, the Synchronization Source Sharing function makes possible stable efficiency measurement.

Synchronized power and efficiency measurement across up to 120 channels with the Synchronization Source Sharing function

- **Zero-cross data for the module making AC measurements is shared to define calculation intervals.**
- **The primary instrument's synchronization source is shared with the secondary instrument.**

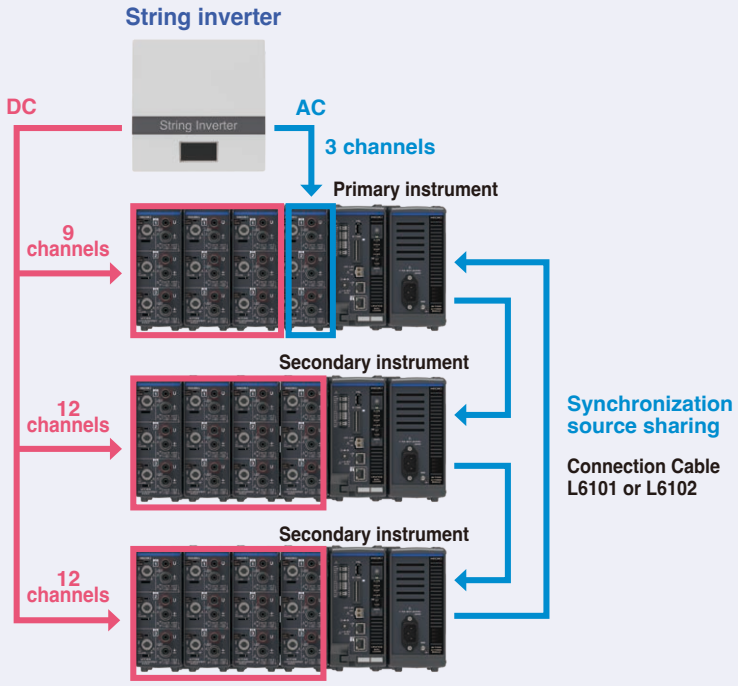
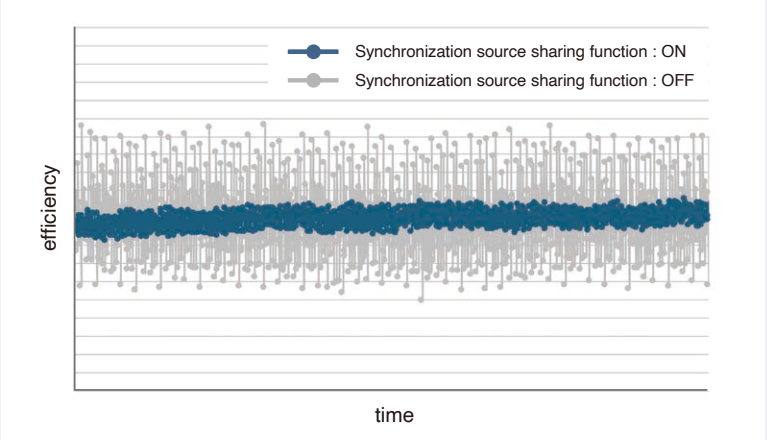


Image of the effect of the synchronous source sharing function



- **With conventional power meters, multiple instruments had to be used to measure inverter efficiency, causing measured values to exhibit instability. As a result, the efficiency values calculated for high-efficiency inverters could exceed 100%.**
- **By using the M7103's Synchronization Source Sharing function to ensure consistent calculation intervals across multiple instruments, stable efficiency measurement can be accomplished.**

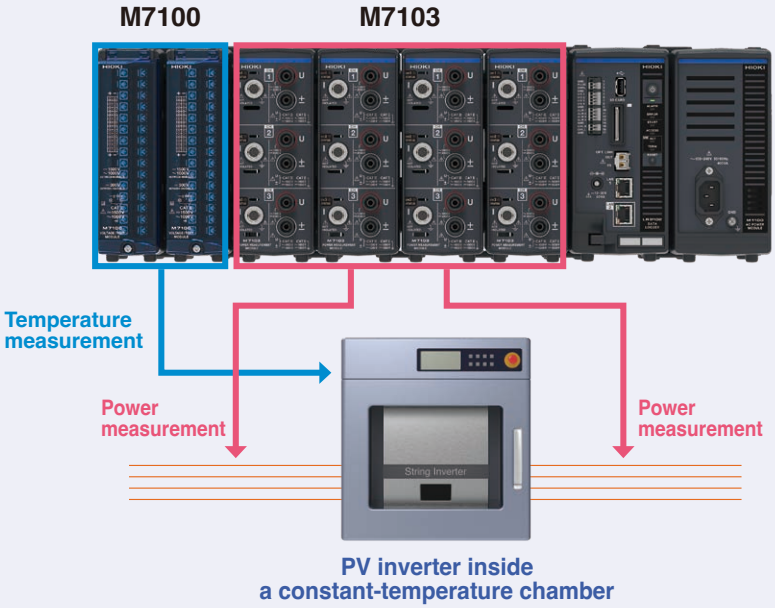
*When using the synchronization source sharing function, the primary instrument cannot aggregate and output data for all secondary instruments.

- Application using room temperature measurement
- Related software

Application

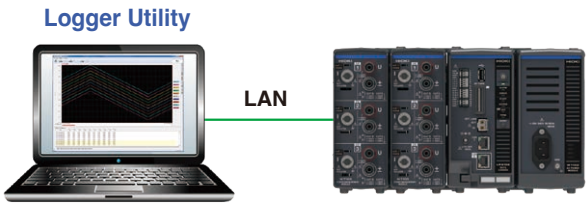
Single-instrument solution for environmental testing of PV inverters

Since PV inverters must operate properly even in harsh environments, environmental testing is essential.
In many cases, such testing includes simultaneous measurement of temperature in addition to voltage, current, and power measurement to check for abnormal heating. By adding the M7100 or M7102, temperature and power can be evaluated simultaneously with a single data file.



Software

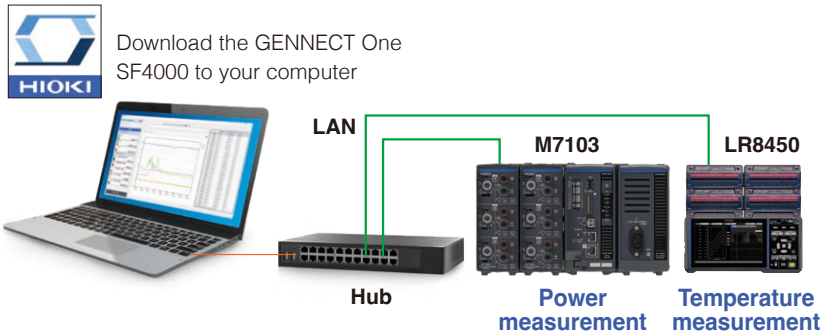
Logger Utility: collect data on a computer at an interval as short as 5 ms



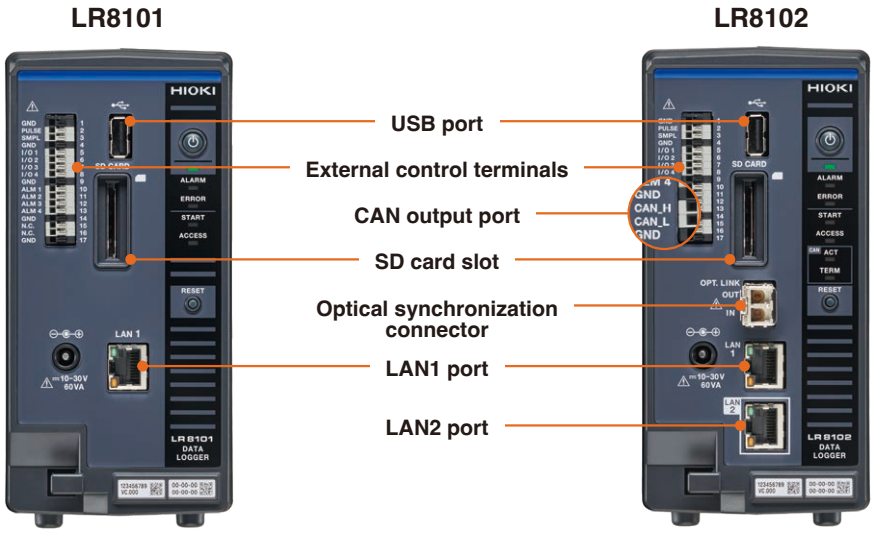
Logger Utility basic specifications	
Recording interval	5 ms
Simultaneous recording	600 channels (up to 300 channels per module)
Connectable instruments	Up to 5
Connection method	1 LAN port

GENNECT One SF4000

GENNECT One can connect to up to 30 instruments, such as Hioki's Memory HiLogger (with the M7103 Power Measurement Module) or LR8450 to monitor data in real time and display it as a list or graph. The software is extremely useful for comprehensive evaluation and analysis involving parameters like power and temperature.



Interfaces



LAN ports

LAN1 can be used to configure settings using communications commands and to collect data. LAN2 (LR8102 only) can be used to output measurement data in real time using the UDP protocol.

CAN output port (LR8102 only)

This port can be used to output measured values to a CAN bus in real time while measurement is in progress.

Optical synchronization (LR8102 only)

Increase the LR8102's maximum channel to 3000 by connecting multiple LR8102s with optical connection cables (sold separately).

External control terminals

Alarm functionality

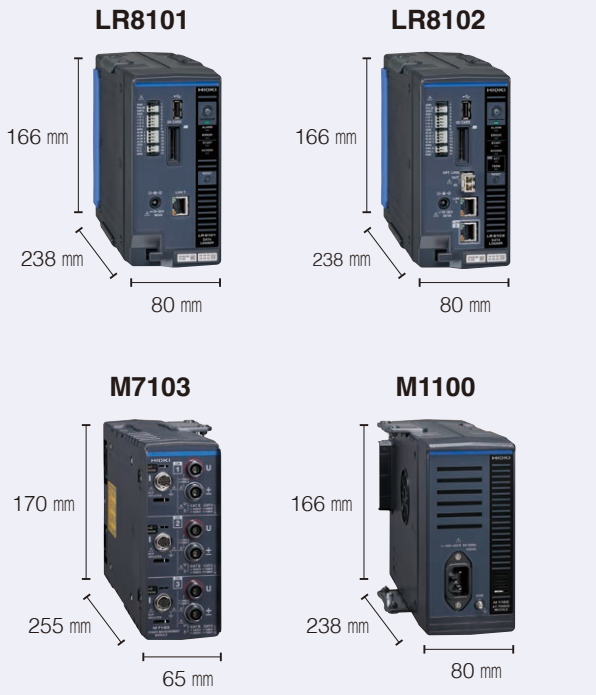
You can have the logger sound a tone or output an alarm signal to an external device when the measurement data satisfies the set condition.

External sampling

Data can be sampled and recorded in synchronization with an external clock.

External dimensions

* Excluding protruding parts



* Excluding protruding parts

When connected to 4 Power Measurement Module M7103 units

When connected to 4 Power Measurement Module M7103 units and 6 Voltage/Temp Unit M7100 units

Data Logger LR8101/LR8102 specifications

General specifications

Maximum number of connectable modules	10
Measurement modules	M7100 Wireless Voltage/Temp Module (15 channels) M7102 Wireless Voltage/Temp Module (30 channels)
Operating temperature and humidity range	–10°C to 50°C (14°F to 122°F), 80% RH or less (non-condensing)
Storage temperature and humidity range	–20°C to 60°C (–4°F to 140°F), 80% RH or less (non-condensing)
External dimensions	Approx. 80W× 166H × 238D mm (3.1W × 6.5H × 9.4D in.) (excluding protruding parts)
Weight	Approx. 1.5 kg (3.3 lb.)
Included accessories	Operating Precautions × 1, Startup Guide × 1, DVD × 1

Power supply

AC adapter	Z1016 AC Adapter (drives instrument at 12 V DC ±10%)
External power supply	10 V to 30 V DC

Interfaces

Number of LAN ports	LR8101: 1 LR8102: 2
LAN1 functionality	Collecting data and setting recording conditions using Logger Utility Setting IP address initial settings using Logger Utility Configuring settings and controlling recording using communication commands Manually acquiring data using the FTP server Automatically sending data via FTP (FTP client) HTTP server function XCP on Ethernet (TCP) NTP client function
LAN2 functionality (LR8102 only)	Measurement data can be output by UDP XCP via Ethernet (UDP)
USB interface (host)	USB drive Guaranteed operation: Z4006 (16 GB)
SD card slot	SD/SDHC memory card support Guaranteed operation: Z4001 (2 GB), Z4003 (8 GB)
External control terminals	Pulse/logic input, external sampling input, external I/O (4), alarm output (4), CAN interface (LR8102 only), GND terminals (5)

Synchronized operation (multiple loggers can operate in a synchronized manner; LR8102 only)

Maximum number of synchronizable instruments	10

AC Power Supply Module M1100 specifications

General specifications

Location of use	Indoors, Level 2 pollution, maximum elevation of 2000 m
Operating temperature and humidity range	0°C to 40°C, 80% RH or less (non-condensing)
Storage temperature and humidity range	-10°C to 50°C, 80% RH or less (non-condensing)
Standard compliance	Safety: EN 61010 EMC: EN 61326, Class A
Power supply	•Grid power Rated supply voltage: 100 to 240 V AC (assuming voltage fluctuations of ±10% of the rated supply voltage) Rated power supply frequency: 50, 60 Hz Anticipated transient overvoltage: 2500 V Maximum rated power: 400 VA (at the M1100's maximum rated current and power) 300 VA (with 4 M7103 modules and 6 M7100 modules connected) Normal power consumption: 55 W (with 2 M7103 modules connected and CT6872 sensors connected to all current channels while measuring 20 A AC with 1000 V input for all voltage channels)
External dimensions	Approx. 80W × 166H × 238D mm (3.1W × 6.5H × 9.4D in.) (excluding protruding parts)
Weight	Approx. 2.0 kg (4.4 lb.)
Product warranty	3 years
Accessories	•Power cord •User documents

Power Measurement Module M7103 specifications

General specifications

Location of use	Indoors, Level 2 pollution, maximum elevation of 2000 m
Operating temperature and humidity range	0°C to 40°C 80% RH or less (non-condensing)
Storage temperature and humidity range	-10°C to 50°C 80% RH or less (non-condensing)
Standard compliance	Safety: EN 61010 EMC: EN 61326, Class A
Standard compliance	IEC 61000-4-7:2002 + A1:2008 (when using IEC measurement mode)
External dimensions	Approx. 65W × 170H × 255D mm (2.5W × 6.7H × 10.0D in.) (excluding protruding parts)
Weight	Approx. 1.5 kg (3.3 lb.)
Product warranty	3 years

Power Measurement Module M7103 specifications

Power measurement input specifications

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

Connections (wiring)	CH1	CH2	CH3
1P2W × 3	1P2W		
1P3W & 1P2W	1P3W		1P2W
3P3W2M	3P3W2M		1P2W
3V3A	3V3A		
3P3W3M	3P3W3M		
3P4W	3P4W		

Number of power channels	3 (voltage: 3 terminals, U1 to U3; current: 3 terminals, I1 to I3)
Input terminals	Voltage: plug-in terminals (safety terminals) Current: dedicated connectors (ME15W)
Input type	Voltage: isolated, resistive potential divider Current: isolated input via current sensors (voltage output)
Voltage ranges	6, 15, 30, 60, 150, 300, 600, 1500 V
Current ranges	0.04, 0.08, 0.2, 0.4, 0.8, 2 A (2 A sensor) 0.4, 0.8, 2, 4, 8, 20 A (20 A sensor) 4, 8, 20, 40, 80, 200 A (200 A sensor) 40 A, 80 A, 200 A, 400 A, 800 A, 2 kA (2000 A sensor) 0.1, 0.2, 0.5, 1, 2, 5 A (5 A sensor) 1, 2, 5, 10, 20, 50 A (50 A sensor) 10, 20, 50, 100, 200, 500 A (500 A sensor) 20 A, 40 A, 100 A, 200 A, 400 A, 1 kA (1000 A sensor) When using CT9920 Conversion Cable: Select sensor output rate. 400 A, 800 A, 2 kA, 4 kA, 8 kA, 20 kA (100 µV/A) 40, 80, 200, 400 A, 800 A / 2 kA (1 mV/A) 4, 8, 20, 40, 80, 200 A (10 mV/A) 0.4, 0.8, 2, 4, 8, 20 A (100 mV/A) 0.04, 0.08, 0.2, 0.4, 0.8, 2 A (1 V/A) Can be selected separately for each connection. (However, different types of current sensors cannot be mixed on the same connection.)
Crest factor	3 (relative to voltage and current range ratings), but 1.35 for 1500 V range
Input resistance, input capacitance	Voltage inputs: 3 MΩ ±30 kΩ, 1.5 pF typical Current sensor inputs: 1 MΩ ±50 kΩ
Maximum input voltage	Voltage inputs: 1000 V AC, 2000 V DC Current sensor inputs: 8 V, ±12 V peak
Maximum rated terminal-to-ground voltage	1000 V AC/DC, CAT III, anticipated transient overvoltage of 8000 V 1000 V AC, 1500 V DC, CAT II, anticipated transient overvoltage of 8000 V
Measurement method	Simultaneous voltage and current digital sampling with zero-cross synchronization calculations
Sampling	500 kHz, 16 bits
Frequency band	DC, 0.1 Hz to 100 kHz
Effective measurement range	1% to 110% of range
Effects of conductive radio frequency electromagnetic fields	At 10 V, 6% of full scale for current and active power (when using the 9272-05) At 10 V, 30% of full scale for current and active power (when using the CT9920) ("Full scale" is defined as the full scale of sensor's rating.)
Effects of radiative radio frequency electromagnetic fields	At 10 V/m, 6% of full scale for current and active power (when using 9272-05 only) ("full scale" is defined as the full scale of sensor's rating.)
Synchronized frequency range	0.1 Hz to 100 kHz Lower limit frequency: 0.1, 1, 10 Hz
Synchronization source	U1 to U3, I1 to I3, DC (varies with data refresh interval) Can be set separately for each connection When IEC measurement mode is selected, select U or I only. Neither operation nor accuracy are guaranteed if the synchronization source is less than 1% of range. Neither operation nor accuracy are guaranteed if synchronization cannot be detected. Modules set to function as secondary units with the synchronization source sharing function use the synchronization source selected with the primary instrument.
LPF	Select from OFF, 500 Hz, and 5 kHz. When using a setting other than "OFF," add ±0.05% of reading to accuracy. 500 Hz: accuracy defined at 60 Hz and lower 5 kHz: accuracy defined at 500 Hz and lower Peak values are determined using post-LPF values. Over-peak event judgments are made using pre-digital-LPF values.
Data refresh interval	Select from 5, 50, and 200 ms.
Lead/lag polarity judgment	Voltage/current zero-cross timing comparison A digital low-pass filter serves as the zero-cross filter.
Measurement parameters	Voltage (U), current (I), active power (P), apparent power (S), reactive power (Q), power actor (λ), phase angle (ϕ), voltage frequency (fU), current frequency (fI), voltage ripple ratio (Urf), current ripple ratio (Irf), current integration (Ih), power integration (WP), voltage peak (Upk), current peak (Ipk)

Power measurement accuracy specifications

Accuracy guarantee conditions

Accuracy guarantee duration: 1 year
Accuracy guarantee temperature and humidity range: 23°C ±3°C, 80% RH or less
Warm-up time: 30 min. or greater
Accuracy is guaranteed when the input satisfies the following conditions.
Sine wave input
Power factor of 1 or DC input
Terminal-to-ground voltage of 0 V
Within effective measurement range
Fundamental wave satisfies synchronization source conditions
Ambient temperature is ±1°C after zero adjustment is done

Voltage, current, active power, and power phase angle accuracy

Frequency	±(% of reading + % of range)	
	Voltage (U)	Current (I)
DC	0.02% + 0.03%	0.02% + 0.03%
0.1 Hz ≤ f < 45 Hz	0.1% + 0.1%	0.1% + 0.1%
45 Hz ≤ f ≤ 440 Hz	0.02% + 0.03%	0.02% + 0.03%
440 Hz < f ≤ 1 kHz	0.03% + 0.05%	0.03% + 0.05%
1 kHz < f ≤ 10 kHz	0.15% + 0.05%	0.15% + 0.05%
10 kHz < f ≤ 100 kHz	0.1f*% + 0.1%	0.1f*% + 0.1%

Frequency	±(% of reading + % of range)	°
	Active power (P)	Power phase angle
DC	0.02% + 0.05%	–
0.1 Hz ≤ f < 45 Hz	0.1% + 0.1%	±0.05
45 Hz ≤ f ≤ 440 Hz	0.02% + 0.05%	±0.05
440 Hz < f ≤ 1 kHz	0.05% + 0.05%	±0.1
1 kHz < f ≤ 10 kHz	0.3% + 0.1%	±0.5
10 kHz < f ≤ 100 kHz	0.2f*% + 0.1%	±(0.05f*)

*The symbol "f" indicates frequency in kHz.
• For voltage and current DC accuracy figure are defined for Udc and Idc. Accuracy for other frequencies is defined for Urms and Irms.
• Accuracy for when U or I is selected as the synchronization source is defined for input of 5% of range or greater.
• Accuracy for power phase angle is defined for 100% input with a power factor of 0.
• For current, active power, and power phase angle, add the current sensor's accuracy to the above accuracy figures.
• For voltage, current, active power, and power phase angle figures of 0.1 Hz ≤ f < 10 Hz are reference values.
• For voltages exceeding 200 V, active power, and power phase angle figures for 10 Hz ≤ f < 16 Hz are reference values.
• For voltages exceeding 750 V, active power, and power phase angle figures for 30 kHz < f ≤ 100 kHz 16 Hz are reference values.
• For 1000 V < DC voltage ≤ 1500 V, add 0.05% of reading to voltage and active power. (Even if the input voltage is less than 1000 V, measured values may be affected until the input resistor's temperature falls.)
• Power phase angle values other than 45 Hz to 66 Hz are reference values.
• Add the following to power phase angle accuracy for voltages more than 600 V:
0.1 Hz < f ≤ 500 Hz, ±0.1°
500 Hz < f ≤ 5 kHz, ±0.3°
5 kHz < f ≤ 20 kHz, ±0.5°
20 kHz < f ≤ 100 kHz, ±1°
• When the frequency is other than DC and the data refresh interval setting is 5 ms, add ±0.05% of reading to the voltage and current accuracy and ±0.1% of reading to the active power accuracy.
• When using a data refresh interval setting of 5 ms, add ±0.05° to the power phase angle accuracy.
• When using the 6 V range for voltage measurement, add ±0.03% of range to the voltage and active power accuracy.
• The active measurement range for the 9272-05 is 0.5% to 100% of the sensor's full scale.
• When the input is "100% of range < input ≤ 110% of range," multiply the range error by 1.1.
• If the temperature varies by ±1°C or more after zero-adjustment, add ±0.01% of range to the voltage, current, and active power DC accuracy.

Apparent power accuracy

Voltage accuracy + current accuracy ±10 digits

Reactive power accuracy

In any cases except for ø = 0°or ±180°

$$(\text{Accyracy of apparent power}) \pm \left\{1 - \frac{\sin[\phi + (\text{Accuracy of power phase angle})]}{\sin\phi}\right\} \times (100\% \text{ of reading})$$
$$\pm\left(\sqrt{1.001 - \lambda^2} - \sqrt{1 - \lambda^2}\right) \times (100\% \text{ of range})$$

In the case of ø = 0°or ±180°

(Accuracy of apparent power) ± sin(Accuracy of power phase angle) × (100% of range) ± (3.16% of range)

λ is the measurement value of the power factor

Power factor measurement accuracy

In any cases except for ϕ = ±90°

$$\pm\left\{1 - \frac{\cos[\phi + (\text{Accuracy of power phase angle})]}{\cos\phi}\right\} \times (100\% \text{ of reading}) \pm (50 \text{ digits})$$

In the case of ø = ±90°

±cos[φ + (Accuracy of power phase angle)] × (100% of range) ± (50 digits)

ø is the measurement value of the power phase angle
Both are defined at the time of rated input of the voltage and current ranges

Measurement accuracy of waveform peak

Voltage and current RMS value accuracy ±1% of range (applying 300% of range as peak range)

Effects of temperature

Add the following to the voltage, current, and active power accuracy within the range of 0°C to 20°C and 26°C to 40°C:
±0.01% of reading per °C
Add another 0.01% of range per °C for DC.

Common-mode rejection ratio (effects of common-mode voltage)

At 50/60 Hz: 100 dB or greater
Defined for all measurement ranges when the maximum input voltage is applied between the voltage input terminals and the enclosure.

Effects of external magnetic fields

±1% of range or less (400 A/m, in magnetic field of DC or 50/60 Hz)

Effect of power factor on active power

Other than when ϕ = ±90°: ±(1 - cos(ϕ + power phase angle accuracy) / cos(ϕ)) × 100% of reading
When ϕ = ±90°: ±cos(ϕ + power phase angle accuracy) × 100% of VA

Zero adjustment

Voltage: internal offset of ±20% of range or less is corrected to 0.
Current: input offset of ±20% of range or less is corrected to 0.

Zero suppression

Can switch OFF/ON (when set to "ON," reading of 0.5% of range or less are zero-suppressed.)

Frequency measurement specifications

Measurement parameters	Power channel voltage and current (fU1 to fU3, fI1 to fI3)
Measurement method	Reciprocal method + correction of zero-cross sampling values
Measurement range	Within the synchronization frequency range of 0.1 Hz to 100 kHz (displayed as 0.0000 Hz when a frequency is not detected), the measurement lower limit frequency is 0.1, 1, or 10 Hz The data refresh interval when measuring frequencies that are greater than or equal to the data refresh interval depends on the frequency.
Accuracy	±0.005 Hz: when measuring voltage frequency that is 45 to 66 Hz, the measurement range is 15 V or higher, and it is a sine wave input of 50% or more of range ±0.05% of reading: in conditions other than above, when measuring a sine wave that is below 30% of the measurement range
Format	0.10000 Hz to 9.99999 Hz, 10.0000 Hz to 99.9999 Hz, 100.000 Hz to 999.999 Hz, 1.00000 kHz to 9.99999 kHz, 10.0000 kHz to 99.9999 kHz, 100.000 kHz
Effects of conductive radio frequency electromagnetic fields	At 10 V, 6% of reading for current frequency or less (when using CT9920)
Effects of radiative radio frequency electromagnetic fields	At 10 V/m, 6% or less of current frequency reading (when using 9272-05)

Integration measurement specifications

Measurement modes	RMS, DC (DC can only be selected when using an AC/DC sensor and with 1P2W wiring.)
Measurement parameters	Current integration (Ih+, Ih-, Ih), active power integration (WP+, WP-, WP) Ih+ and Ih- can only be measured in DC mode. Only Ih can be measured in RMS mode.
Measurement method	Digital integration from current and active power (When averaging measured values, calculations are performed using pre-averaging values.) During DC mode operation: current and instantaneous power values for each sampling interval are integrated separately by polarity. During RMS mode operation: The current RMS values and active power values for each data refresh interval are integrated. Only active power values are integrated separately by polarity. (Active power values are integrated separately by polarity for each cycle of the synchronization source.) The active power integration sum values for multi-phase wiring connections are integrated separately by polarity for each measurement interval.
Measurement interval	Same as the data refresh interval
Measurement resolution	999999 (6 digits + decimal point) Start from the resolution that treats 1% of each range as 100% of range
Measurement range	0 to ±9999.99 TAh/TWh (however, the integration time must be no greater than 9999 hr. 59 min.) Integration will stop if any integration value or the integration time exceeds the above upper limit.
Integration time accuracy	±100 ppm ±1 digit
Integration accuracy	±(accuracy of current or active power) ±(integration time accuracy)

Harmonic measurement shared specifications

Number of measurement power channels	3
Synchronization source	Same as specified in basic measurement specifications Uses the voltage/current/power measurement synchronization source selected for each wiring connection
Measurement modes	Select between IEC measurement mode and wideband measurement mode
Measurement parameters	Harmonic voltage RMS value, harmonic voltage content percentage, harmonic voltage phase angle, harmonic current RMS value, harmonic current content percentage, harmonic current phase angle, harmonic active power, harmonic active power content percentage, harmonic voltage and current phase angle difference, total harmonic voltage distortion, total harmonic current distortion, voltage unbalance factor, current unbalance factor
FFT processing word length	32 bits
Anti-aliasing	Digital filter (automatically set based on synchronization frequency
Window function	Rectangular
Grouping	OFF, TYPE1 (harmonic sub-group), TYPE2 (harmonic group)
THD calculation method	THD_F, THD_R Calculation order: select 2nd to 50th (up to maximum analyzable order for each mode)

IEC measurement mode's harmonic measurement specifications

Measurement method	Zero-cross synchronization calculation method (same sampling window for each synchronization source) Fixed sampling interpolation calculation method (re-sampling at a lower rate within the sampling window) IEC 61000-4-7:2002 + A1:2008 compliant (with gap overlap)
Synchronized frequency range	45 to 66 Hz (synchronization source does not operate during DC measurement)
Data refresh interval	Fixed at approx. 200 ms (when set to 5 ms or 50 ms, a data refresh interval of 200 ms is used for harmonic measurements only)
Maximum analyzable order	50th
Number of waves per sampling window	At less than 56 Hz: 10 waves At 56 Hz or greater: 12 waves
Number of FFT points	8192 points
Measurement accuracy	

Frequency	Voltage or current	Power	Phase difference
DC (fundamental)	±0.1% of reading ±0.1% of range	±0.1% of reading ±0.2% of range	--
45 Hz ≤ f ≤ 66 Hz	±0.2% of reading ±0.04% of range	±0.4% of reading ±0.05% of range	±0.08°
66 Hz < f ≤ 440 Hz	±0.5% of reading ±0.05% of range	±1.0% of reading ±0.05% of range	±0.08°
440 Hz < f ≤ 1 kHz	±0.8% of reading ±0.05% of range	±1.5% of reading ±0.05% of range	±0.4°
1 kHz < f ≤ 2.5 kHz	±2.4% of reading ±0.05% of range	±4% of reading ±0.05% of range	±0.4°
2.5 kHz < f ≤ 3.3 kHz	±6% of reading ±0.05% of range	±10% of reading ±0.05% of range	±0.8°

Wideband measurement mode's harmonic measurement conditions

Measurement method	Zero-cross synchronization calculation method (same sampling window for each synchronization source; with gaps) Fixed sampling interpolation calculation method
Synchronized frequency range	0.1 Hz to 30 kHz
Data refresh interval	Fixed at 50 ms When set to 5 ms, a data refresh interval of 50 ms is used for harmonic measurements only. When set to 200 ms, values obtained by 50 ms measurement for 4 times averaged.
Maximum analyzable order and window wave number	

Fundamental wave frequency	Window wave number	Maximum analyzable order
0.1 Hz ≤ f ≤ 200 Hz	1	50th
200 Hz < f ≤ 400 Hz	2	50th
400 Hz < f ≤ 600 Hz	4	50th
600 Hz < f ≤ 1 kHz	4	30th
1 kHz < f ≤ 2 kHz	8	15th
2 kHz < f ≤ 4 kHz	16	7th
4 kHz < f ≤ 6 kHz	32	5th
6 kHz < f ≤ 10 kHz	64	3rd
10 kHz < f ≤ 30 kHz	128	1st

Number of FFT points	Selected automatically from 2048, 4096, and 8192 points.
Measurement accuracy	Add the following to each measurement module's voltage/current/power/phase accuracy. However, add 0.05% of reading for fundamental waves of 2 kHz or greater.

Frequency	Voltage/current/power ±(% of reading)	Phase ±(°)
DC	0.05%	–
0.1 Hz ≤ f ≤ 200 Hz	0.01%	0.1°
200 Hz < f ≤ 1 kHz	0.03%	0.1°
1 kHz < f ≤ 10 kHz	0.08%	0.6°
10 kHz < f ≤ 30 kHz	0.15%	(0.020 × f) ±0.5°

•The symbol f in the above table indicates frequency in kHz.
•If the fundamental wave does not fall within the range of 16 Hz to 850 Hz, the voltage/current/power accuracy and phase difference accuracy values for frequencies other than the fundamental wave are reference values.
•If the fundamental wave falls within the range of 16 Hz to 850 Hz, the voltage/current/power and phase difference accuracy values for frequencies greater than 6 kHz are reference values.
•Phase difference accuracy is defined for input of at least 10% of range for voltage and current in the same order.

Function specifications

Auto range function

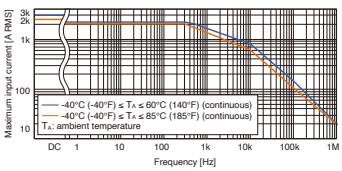
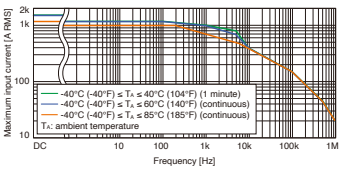
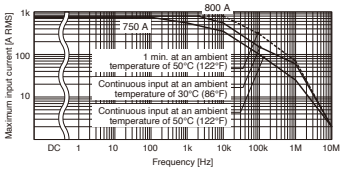
Functionality	The voltage and current ranges for each wiring connection are changed automatically based on input.
Operating modes	OFF/ON (can be selected separately for each connection)
Range-switching conditions	**Move up one range** When any of the following conditions are satisfied for at least 1 channel in the connection: •RMS value ≥ 110% of range •|Peak value| ≥ 300% of range **Move down one range** When all of the following conditions are satisfied for all channels in the connection: •RMS value ≤ 40% of range •|PEAK value| ≤ 280% of the range immediately below For voltage range changes when Δ-Y conversion is enabled, determinations are made after multiplying the range by 1/√3. All RMS and peak values used in determining the range are instantaneous (not averaged) values. Peak values prior to LPF passage are used to determine ranges.

Calculation functions

Rectification method	Functionality		Selects the voltage and current values used in apparent power, reactive power, and power factor calculations
	Method		RMS, Mean (can be selected separately for voltage and current for each connection.)
Scaling	VT (PT) ratio		0.01 to 9999.99 (VT × CT may not exceed 1.0E+06)
	CT ratio		0.01 to 9999.99 (VT × CT may not exceed 1.0E+06)
Averaging	Functionality		Averages all instantaneous measured values, including harmonic measured values (except peak values, integrated values, and harmonic data with a 5 ms data refresh interval) When averaging is enabled, saved data will also be the averaged values.
	Method		Moving average Averages values using the number of data points specified by the moving average count for each data refresh interval and refreshes output data The data refresh interval is the same as when not performing average processing. Voltage (U), current (I), and power (P) are averaged, and calculated values are calculated from those values. With regards to harmonic parameters, instantaneous values are averaged for RMS values and content percentage values. Phase angle is calculated based on the results of averaging the post-FFT real and imaginary parts. Phase difference, distortion factor, and unbalance factor are calculated using the above averaged data. Ripple ratio is calculated based on data obtained by averaging the difference between positive and negative peak values.
	Moving average count		10, 20, 40, 100
Delta conversion	Functionality	Δ-Y	Uses a virtual neutral point with 3P3W3M and 3V3A connections to convert the line-to-line voltage waveform to a phase voltage waveform
		Y-Δ	When using a 3P4W connection, it converts the phase voltage waveform to a line-to-line voltage waveform. The calculation is made using the voltage after conversion of all voltage parameters, including harmonics such as voltage RMS values. However, over-peak events are determined based on pre-conversion values.
Calculation equation selection	Functionality		Selects the calculation equations for reactive power, power factor, and power phase angle
	Calculation equation		TYPE1, TYPE2, TYPE3 TYPE1: provides compatibility with the TYPE1 equations used by the PW3390, 3193, and 3390 TYPE2: provides compatibility with the TYPE2 equations used by the 3192 and 3193 TYPE3: uses the active power sign as the power factor sign (TYPE1, TYPE2, and TYPE3 are compatible with the PW8001's calculation equations)
Synchronization source sharing function	Functionality		Shares zero-cross timing between connected modules Selects the power channels to synchronize from the module set as primary The zero-cross timing for the selected power channel is shared with all power channels for modules set to secondary
	Operation modes		OFF, Primary, Secondary (only one module can be set to primary)
	Synchronization power channel selection		CH1 to CH3 (of the module set to primary)
	Synchronized parameters		Zero-cross timing

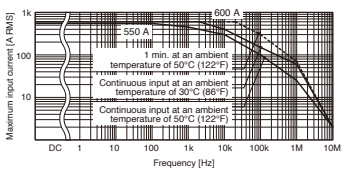
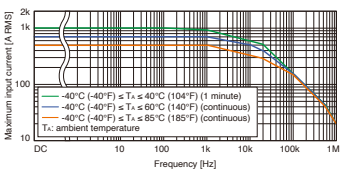
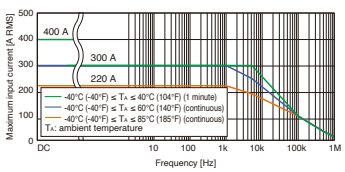
Overview of supported current sensors and specifications

High-accuracy pass-through current sensors

	CT6877A, CT6877A-1*1		CT6876A, CT6876A-1*1		CT6904A-2, CT6904A-3*1	
Appearance					Wideband 4 MHz  Build-to-order product CT6904A-2 CT6904A-3	
Rated current	2000 A AC/DC		1000 A AC/DC		800 A AC/DC	
Frequency band	DC to 1 MHz		CT6876A: DC to 1.5 MHz CT6876A-1: DC to 1.2 MHz		CT6904A-2: DC to 4 MHz CT6904A-3: DC to 2 MHz	
Diameter of measurable conductors	Max. ϕ 80 mm (3.14 in.)		Max. ϕ 36 mm (1.42 in.)		Max. ϕ 32 mm (1.25 in.)	
Accuracy Sensor only (amplitude) ±(% of reading +% of full scale) Full scale is the rated current of sensor	DC	±0.04% ±0.008%	DC	±0.04% ±0.008%	DC	±0.030% ±0.009%
	DC < f < 16 Hz	±0.1% ±0.02%	DC < f < 16 Hz	±0.1% ±0.02%	DC < f < 16 Hz	±0.2% ±0.025%
	16 Hz ≤ f < 45 Hz	±0.05% ±0.01%	16 Hz ≤ f < 45 Hz	±0.05% ±0.01%	16 Hz ≤ f < 45 Hz	±0.1% ±0.025%
	45 Hz ≤ f ≤ 66 Hz	±0.04% ±0.008%	45 Hz ≤ f ≤ 66 Hz	±0.04% ±0.008%	45 Hz ≤ f ≤ 65 Hz	±0.025% ±0.009%
	66 Hz < f ≤ 100 Hz	±0.05% ±0.01%	66 Hz < f ≤ 100 Hz	±0.05% ±0.01%	65 Hz < f ≤ 850 Hz	±0.05% ±0.009%
	100 Hz < f ≤ 500 Hz	±0.1% ±0.02%	100 Hz < f ≤ 500 Hz	±0.1% ±0.02%	850 Hz < f ≤ 1 kHz	±0.1% ±0.013%
	500 Hz < f ≤ 1 kHz	±0.2% ±0.02%	500 Hz < f ≤ 1 kHz	±0.2% ±0.02%	1 kHz < f ≤ 5 kHz	±0.4% ±0.025%
	1 kHz < f ≤ 10 kHz	±0.5% ±0.02%	1 kHz < f ≤ 5 kHz	±0.5% ±0.02%	5 kHz < f ≤ 10 kHz	±0.4% ±0.025%
	10 kHz < f ≤ 50 kHz	±1.5% ±0.05%	5 kHz < f ≤ 10 kHz	±0.5% ±0.02%	10 kHz < f ≤ 50 kHz	±1.0% ±0.025%
	50 kHz < f ≤ 100 kHz	±2.5% ±005%	10 kHz < f ≤ 50 kHz	±2.0% ±0.05%	50 kHz < f ≤ 100 kHz	±1.0% ±0.063%
	100 kHz < f ≤ 700 kHz	±(0.025 × f kHz)%	50 kHz < f ≤ 100 kHz	:±3.0% ±0.05%	100 kHz < f ≤ 300 kHz	±2.0% ±0.063%
	—		100 kHz < f ≤ 1 MHz	±(0.03 × f kHz)% ±0.05%	300 kHz < f ≤ 1 MHz	±5.0% ±0.063%
Operating temperature	-40°C to 85°C (-40°F to 185°F)		-40°C to 85°C (-40°F to 185°F)		-10°C to 50°C (-14°F to 122°F)	
Maximum rated voltage to earth	CATIII 1000 V		CATIII 1000 V		CATIII 1000 V	
Dimensions	Approx. 229W × 232H × 112Dmm (approx. 9.02W × 9.13H × 4.41D in.)		Approx. 160W × 112H × 50D mm (approx. 6.30W × 4.41H × 1.97D in.)		Approx. 139W × 120H × 52D mm (approx. 5.47W × 4.72H × 2.05D in.)	
Cable length	CT6877A: approx. 3 m (9.84 ft.) CT6877A-1: approx. 10 m (32.81 ft.)		CT6876A: approx. 3 m (9.84 ft.) CT6876A-1: approx. 10 m (32.81 ft.)		CT6904A-2: approx. 3 m (9.84 ft.) CT6904A-3: approx. 10 m (32.81 ft.)	
Weight	CT6877A: approx. 5 kg (176.4 oz.) CT6877A-1: approx. 5.3 kg (186.9 oz.)*1		CT6876A: approx. 970 g (34.2 oz.) CT6876A-1: approx. 1.3 kg (45.8 oz.)*1		CT6904A-2: approx. 1.15 kg (40.5 oz.) CT6904A-3: approx. 1.45 kg (51.1 oz.)*1	
Derating properties					

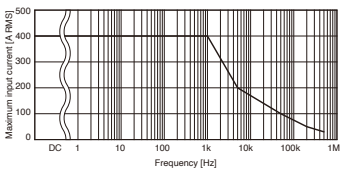
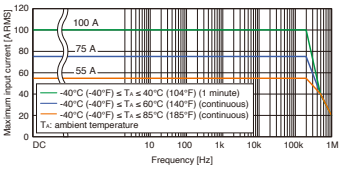
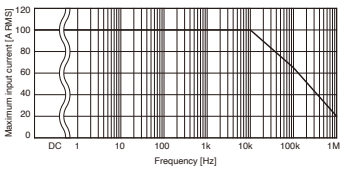
*1 The CT6877A-1, CT6876A-1, and CT6904A-3 have a 10 m cable. For the CT6877A-1, add ±(0.005 × f kHz)% of reading for amplitude accuracy. Also add ±(0.015 × f kHz)° for phase accuracy frequencies 1 kHz < f ≤ 700 kHz.
For the CT6876A-1, add ±(0.005 × f kHz)% of reading for amplitude accuracy and ±(0.015 × f kHz)° for phase accuracy for frequencies of 1 kHz < f ≤ 1 MHz.
For the CT6904A-3, add ±(0.015 × f kHz)% of reading for amplitude accuracy for frequencies of 50 kHz < f ≤ 1 MHz.

High-accuracy pass-through current sensors

	CT6904A, CT6904A-1*2		CT6875A, CT6875A-1*2		CT6873, CT6873-01*2	
Appearance	Wideband 4 MHz  Build-to-order product CT 6904A-1				Wideband 10 MHz 	
Rated current	500 A AC/DC		500 A AC/DC		200 A AC/DC	
Frequency band	CT6904A: DC to 4 MHz CT6904A-1: DC to 2 MHz		CT6875A: DC to 2 MHz CT6875A-1: DC to 1.5 MHz		DC to 10 MHz	
Diameter of measurable conductors	Max. ϕ 32 mm (1.25 in.)		Max. ϕ 36 mm (1.42 in.)		Max. ϕ 24 mm (0.94 in.)	
Accuracy Sensor only (amplitude) ±(% of reading +% of full scale) Full scale is the rated current of sensor	DC	±0.025% ±0.007%	DC	±0.04% ±0.008%	DC	±0.03% ±0.002%
	DC < f < 16 Hz	±0.2% ±0.02%	DC < f < 16 Hz	±0.1% ±0.02%	DC < f ≤ 16 Hz	±0.1% ±0.01%
	16 Hz ≤ f < 45 Hz	±0.1% ±0.02%	16 Hz ≤ f < 45 Hz	±0.05% ±0.01%	16 Hz < f ≤ 45 Hz	±0.05% ±0.01%
	45 Hz ≤ f ≤ 65 Hz	±0.02% ±0.007%	45 Hz ≤ f ≤ 66 Hz	±0.04% ±0.008%	45 Hz < f ≤ 66 Hz	±0.03% ±0.007%
	65 Hz < f ≤ 850 Hz	±0.05% ±0.007%	66 Hz < f ≤ 100 Hz	±0.05% ±0.01%	66 Hz < f ≤ 100 Hz	±0.04% ±0.01%
	850 Hz < f ≤ 1 kHz	±0.1% ±0.01%	100 Hz < f ≤ 500 Hz	±0.1% ±0.02%	100 Hz < f ≤ 500 Hz	±0.05% ±0.01%
	1 kHz < f ≤ 5 kHz	±0.4% ±0.02%	500 Hz < f ≤ 1 kHz	±0.2% ±0.02%	500 Hz < f ≤ 3 kHz	±0.1% ±0.01%
	5 kHz < f ≤ 10 kHz	±0.4% ±0.02%	1 kHz < f ≤ 5 kHz	±0.4% ±0.02%	3 kHz < f ≤ 5 kHz	±0.2% ±0.02%
	10 kHz < f ≤ 50 kHz	±1.0% ±0.02%	5 kHz < f ≤ 10 kHz	±0.4% ±0.02%	5 kHz < f ≤ 10 kHz	±0.2% ±0.02%
	50 kHz < f ≤ 100 kHz	±1.0% ±0.05%	10 kHz < f ≤ 50 kHz	±1.5% ±0.05%	10 kHz < f ≤ 1 MHz	±(0.018 × f kHz)% ±0.05%
	100 kHz < f ≤ 300 kHz	±2.0% ±0.05%	50 kHz < f ≤ 100 kHz	±2.5% ±0.05%	—	
	300 kHz < f ≤ 1 MHz	±5.0% ±0.0	100 kHz < f ≤ 1 MHz	±(0.025 × f kHz)% ±0.05%	—	
Operating temperature	-10°C to 50°C (-14°F to 122°F)		-40°C to 85°C (-40°F to 185°F)		-40°C to 85°C (-40°F to 185°F)	
Maximum rated voltage to earth	CATIII 1000 V		CATIII 1000 V		CATIII 1000 V	
Dimensions	Approx. 139W × 120H × 52D mm (approx. 5.47W × 4.72H × 2.05D in.)		Approx. 160W × 112H × 50D mm (approx. 6.30W × 4.41H × 1.97D in.)		Approx. 70W × 110H × 53D mm (approx. 2.76W × 4.33H × 2.09D in.)	
Cable length	CT6904A: approx. 3 m (9.84 ft.) CT6904A-1: approx. 10 m (32.81 ft.)		CT6875: approx. 3 m (9.84 ft.) CT6875A-1: approx. 10 m (32.81 ft.)		CT6873: approx. 3 m (9.84 ft.) CT6873-01: approx. 10 m (32.81 ft.)	
Weight	CT6904A: approx. 1.05 kg (37.0 oz.) CT6904A-1: approx. 1.35 kg (47.6 oz.)*2		CT6875: approx. 820 g (28.9 oz.) CT6875A-1: approx. 1.15 kg (40.6 oz.)*2		CT6873: approx. 370 g (13.1 oz.) CT6873-01: approx. 690 g (24.3 oz.)*2	
Derating properties					

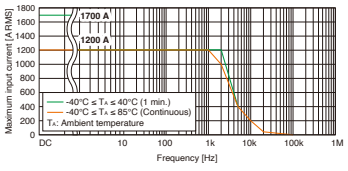
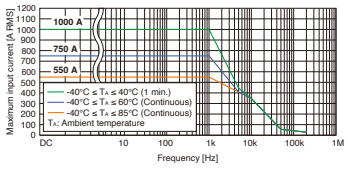
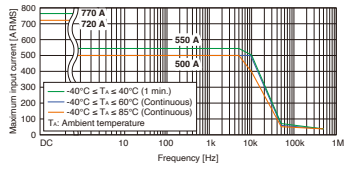
*2 The CT6904A-1, CT6875A-1, and CT6873-01 have a 10 m cable. For the CT6904A-1, add ±(0.015 × f kHz)% of reading for amplitude accuracy for frequencies of 50 kHz < f ≤ 1 MHz.
For the CT6875A-1, add ±(0.005 × f kHz)% of reading for amplitude accuracy and ±(0.015 × f kHz)° for phase accuracy for frequencies of 1 kHz < f ≤ 1 MHz.
For the CT6873-01, add ±(0.015 × f kHz)° for phase accuracy for frequencies of 1 kHz < f ≤ 1 MHz.

High-accuracy pass-through current sensors

	CT6863-05		CT6872, CT6872-01*3		CT6862-05	
Appearance			Wideband 10 MHz 			
Rated current	200 A AC/DC		50 A AC/DC		50 A AC/DC	
Frequency band	DC to 500 kHz		DC to 10 MHz		DC to 1 MHz	
Diameter of measurable conductors	Max. ϕ 24 mm (0.94 in.)		Max. ϕ 24 mm (0.94 in.)		Max. ϕ 24 mm (0.94 in.)	
Accuracy (Sensor only (amplitude) ±(% of reading +% of full scale) Full scale is the rated current of sensor)	DC	±0.05% ±0.01%	DC	±0.03% ±0.002%	DC	±0.05% ±0.01%
	DC < f ≤ 16 Hz	±0.10% ±0.02%	DC < f ≤ 16 Hz	±0.1% ±0.01%	DC < f ≤ 16 Hz	±0.10% ±0.02%
	16 Hz ≤ f < 400 Hz	±0.05% ±0.01%	16 Hz < f ≤ 45 Hz	±0.05% ±0.01%	16 Hz ≤ f < 400 Hz	±0.05% ±0.01%
	400 Hz ≤ f ≤ 1 kHz	±0.2% ±0.02%	45 Hz < f ≤ 66 Hz	±0.03% ±0.007%	400 Hz ≤ f ≤ 1 kHz	±0.2% ±0.02%
	1 kHz < f ≤ 5 kHz	±0.7% ±0.02%	66 Hz < f ≤ 100 Hz	±0.04% ±0.01%	1 kHz < f ≤ 5 kHz	±0.7% ±0.02%
	5 kHz < f ≤ 10 kHz	±1.0% ±0.02%	100 Hz < f ≤ 500 Hz	±0.06% ±0.01%	5 kHz < f ≤ 10 kHz	±1.0% ±0.02%
	10 kHz < f ≤ 50 kHz	±2.0% ±0.02%	500 Hz < f ≤ 1 kHz	±0.1% ±0.01%	10 kHz < f ≤ 50 kHz	±1.0% ±0.02%
	50 kHz < f ≤ 100 kHz	±5.0% ±0.05%	1 kHz < f ≤ 5 kHz	±0.15% ±0.02%	50 kHz < f ≤ 100 kHz	±2.0% ±0.05%
	100 kHz < f ≤ 300 kHz	±10% ±0.05%	5 kHz < f ≤ 10 kHz	±0.15% ±0.02%	100 kHz < f ≤ 300 kHz	±5.0% ±0.05%
	300 kHz < f ≤ 500 kHz	±30% ±0.05%	10 kHz < f ≤ 1 MHz	±(0.012 × f kHz)% ±0.05%	300 kHz < f ≤ 700 kHz	±10% ±0.05%
	—		—		700 kHz < f < 1 MHz	±30% ±0.05%
Operating temperature	-30°C to 85°C (-22°F to 185°F)		-40°C to 85°C (-40°F to 185°F), 80% RH or less		-30°C to 85°C (-22°F to 185°F)	
Maximum rated voltage to earth	CATIII 1000 V		CATIII 1000 V		CATIII 1000 V	
Dimensions	Approx. 70W × 100H × 53D mm (approx. 2.76W × 3.94H × 2.09D in.)		Approx. 70W × 110H × 53D mm (approx. 2.76W × 4.33H × 2.09D in.)		Approx. 70W × 100H × 53D mm (approx. 2.76W × 3.94H × 2.09D in.)	
Cable length	Approx. 3 m (9.84 ft.)		CT6872: approx. 3 m (9.84 ft.) CT6872-01: approx. 10 m (32.81 ft.)		Approx. 3 m (9.84 ft.)	
Weight	Approx. 350 g (12.3 oz.)		CT6872: approx. 370 g (13.1 oz.) CT6872-01: approx. 690 g (24.3 oz.)*3		Approx. 340 g (12.0 oz.)	
Derating properties						

*3 The CT6872-01 has a 10 m cable. For the CT6872-01, add ±(0.015 × f kHz)° for phase accuracy for frequencies of 1 kHz < f ≤ 1 MHz.
Custom cable lengths are also available. Please inquire with your Hioki distributor.

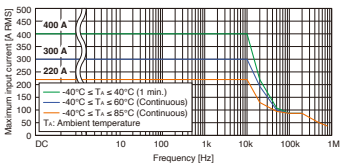
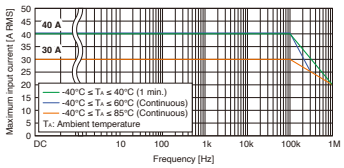
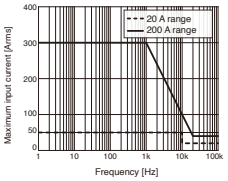
High-accuracy pass-through current sensors

	CT6846A		CT6845A		CT6844A	
Appearance						
Rated current	1000 A AC/DC		500 A AC/DC		500 A AC/DC	
Frequency band	DC to 100 kHz		DC to 200 kHz		DC to 500 kHz	
Diameter of measurable conductors	Max. ϕ 50 mm (1.97 in.)		Max. ϕ 50 mm (1.97 in.)		Max. ϕ 20 mm (0.79 in.)	
Accuracy (Sensor only (amplitude) ±(% of reading +% of full scale) Full scale is the rated current of sensor)	DC	±0.2% ±0.02%	DC	±0.2% ±0.02%	DC	±0.2% ±0.02%
	DC < f ≤ 100 Hz	±0.2% ±0.01%	DC < f ≤ 100 Hz	±0.2% ±0.01%	DC < f ≤ 100 Hz	±0.2% ±0.01%
	100 Hz < f ≤ 500 Hz	±0.5% ±0.02%	100 Hz < f ≤ 500 Hz	±0.3% ±0.02%	100 Hz < f ≤ 500 Hz	±0.3% ±0.02%
	500 Hz < f ≤ 1 kHz	±1.0% ±0.02%	500 Hz < f ≤ 1 kHz	±0.5% ±0.02%	500 Hz < f ≤ 1 kHz	±0.5% ±0.02%
	1 kHz < f ≤ 5 kHz	±2.0% ±0.02%	1 kHz < f ≤ 5 kHz	±1.0% ±0.02%	1 kHz < f ≤ 5 kHz	±1.0% ±0.02%
	5 kHz < f ≤ 10 kHz	±5.0% ±0.02%	5 kHz < f ≤ 10 kHz	±1.5% ±0.02%	5 kHz < f ≤ 10 kHz	±1.5% ±0.02%
	10 kHz < f ≤ 50 kHz	±30% ±0.02%	10 kHz < f ≤ 20 kHz	±5.0% ±0.02%	10 kHz < f ≤ 50 kHz	±5.0% ±0.02%
	—		20 kHz < f ≤ 50 kHz	±10% ±0.05%	50 kHz < f ≤ 100 kHz	±15% ±0.05%
	—		50 kHz < f ≤ 100 kHz	±30% ±0.05%	100 kHz < f ≤ 300 kHz	±30% ±0.05%
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)	
Dimensions	Approx. 238W × 116H × 35D mm (approx. 9.37W × 4.57H × 1.38D in.)		Approx. 238W × 116H × 35D mm (approx. 9.37W × 4.57H × 1.38D in.)		Approx. 153W × 67H × 25D mm (approx. 6.02W × 2.64H × 0.98D in.)	
Cable length	Approx. 3 m (9.84 ft.)		Approx. 3 m (9.84 ft.)		Approx. 3 m (9.84 ft.)	
Weight	Approx. 990 g (34.9 oz.)		Approx. 860 g (30.3 oz.)		Approx. 400 g (14.1 oz.)	
Derating properties						

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

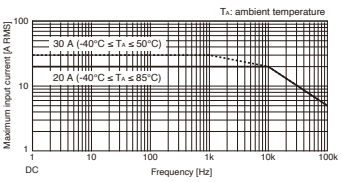
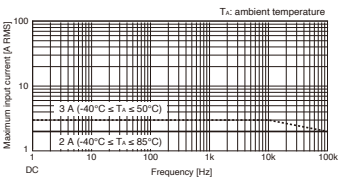
High-accuracy clamp current sensors

General use clamp sensor

	CT6843A		CT6841A		9272-05	
Appearance						
Rated current	200 A AC/DC		20 A AC/DC		200 A/20 A AC switching	
Frequency band	DC to 500 kHz		DC to 1 MHz		1kHz to 100 kHz	
Diameter of measurable conductors	Max. ϕ 20 mm (0.79 in.)		Max. ϕ 20 mm (0.79 in.)		Max. ϕ 46 mm (1.81 in.)	
Accuracy (Sensor only (amplitude) ±(% of reading +% of full scale) Full scale is the rated current of sensor)	DC	±0.2% ±0.02%	DC	±0.2% ±0.05%	1 Hz ≤ f < 5 Hz	±2.0% ±0.10%
	DC < f ≤ 100 Hz	±0.2% ±0.01%	DC < f ≤ 100 Hz	±0.2% ±0.01%	5 Hz ≤ f < 10 Hz	±1.0% ±0.05%
	100 Hz < f ≤ 500 Hz	±0.3% ±0.02%	100 Hz < f ≤ 500 Hz	±0.3% ±0.02%	10 Hz ≤ f < 45 Hz	±0.5% ±0.02%
	500 Hz < f ≤ 1 kHz	±0.5% ±0.02%	500 Hz < f ≤ 1 kHz	±0.5% ±0.02%	45 Hz < f ≤ 66 Hz	±0.3% ±0.01%
	1 kHz < f ≤ 5 kHz	±1.0% ±0.02%	1 kHz < f ≤ 5 kHz	±1.0% ±0.02%	66 Hz < f ≤ 1 kHz	±0.5% ±0.02%
	5 kHz < f ≤ 10 kHz	±1.5% ±0.02%	5 kHz < f ≤ 10 kHz	±1.5% ±0.02%	1 kHz < f ≤ 5 kHz	±1.0% ±0.05%
	10 kHz < f ≤ 50 kHz	±5.0% ±0.02%	10 kHz < f ≤ 50 kHz	±2.0% ±0.02%	5 kHz < f ≤ 10 kHz	±2.5% ±0.10%
	50 kHz < f ≤ 100 kHz	±10% ±0.05%	50 kHz < f ≤ 100 kHz	±5.0% ±0.05%	10 kHz < f ≤ 50 kHz	±5.0% ±0.10%
	100 kHz < f ≤ 300 kHz	±15% ±0.05%	100 kHz < f ≤ 300 kHz	±10% ±0.05%	50 kHz < f ≤ 100 kHz	±30.0% ±0.10%
	300 kHz < f ≤ 500 kHz	±30% ±0.05%	300 kHz < f ≤ 500 kHz	±15% ±0.05%	—	
	—		500 kHz < f < 1 MHz	±30% ±0.05%	—	
Operating temperature	-40°C to 85°C (-40°F to 185°F)		-40°C to 85°C (-40°F to 185°F)		0°C to 50°C (32°F to 122°F)	
Maximum rated voltage to earth	—		—		CATIII AC 600 V RMS	
Dimensions	Approx. 153W × 67H × 25D mm (approx. 6.02W × 2.64H × 0.98D in.)		Approx. 153W × 67H × 25D mm (approx. 6.02W × 2.64H × 0.98D in.)		Approx. 78W × 188H × 35D mm (approx. 3.07W × 7.40H × 1.38D in.)	
Cable length	Approx. 3 m (9.84 ft.)		Approx. 3 m (9.84 ft.)		Approx. 3 m (9.84 ft.)	
Weight	Approx. 370 g (13.1 oz.)		Approx. 350 g (12.3 oz.)		Approx. 450 g (15.9 oz.)	
Derating properties						

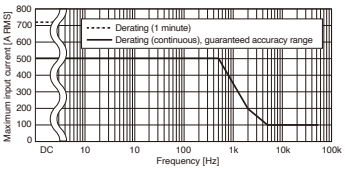
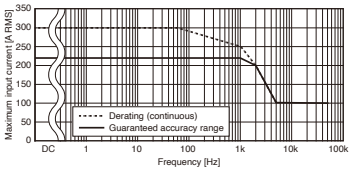
Custom cable lengths also available. Please inquire with your Hioki distributor.

High-accuracy clamp current sensors

	CT6831		CT6830	
Appearance	NEW 		NEW 	
Rated current	20 A AC/DC		2 A AC/DC	
Frequency band	DC to 100 kHz		DC to 100 kHz	
Diameter of measurable conductors	Max. ϕ 5 mm (0.20 in.)		Max. ϕ 5 mm (0.20 in.)	
Accuracy (Sensor only (amplitude) ±(% of reading + % of full scale) Full scale is the rated current of sensor)	DC	±0.3% ±0.10%	DC	±0.3% ±0.10%
	DC < f ≤ 66 Hz	±0.3% ±0.01%	DC < f ≤ 66 Hz	±0.3% ±0.01%
	66 Hz < f ≤ 500 Hz	±0.3% ±0.02%	66 Hz < f ≤ 500 Hz	±0.3% ±0.02%
	500 Hz < f ≤ 1 kHz	±0.5% ±0.05%	500 Hz < f ≤ 1 kHz	±0.5% ±0.05%
	1 kHz < f ≤ 5 kHz	±1.0% ±0.10%	1 kHz < f ≤ 5 kHz	±1.0% ±0.10%
	5 kHz < f ≤ 10 kHz	±5.0% ±0.10%	5 kHz < f ≤ 10 kHz	±5.0% ±0.10%
	10 kHz < f ≤ 100 kHz	±30% ±0.02%	10 kHz < f ≤ 100 kHz	±30% ±0.02%
Operating temperature	Sensor: -40°C to 85°C (-40°F to 185°F), 80% RH or less Relay box: -25°C to 50°C (-77°F to 122°F), 80% RH or less		Sensor: -40°C to 85°C (-40°F to 185°F), 80% RH or less Relay box: -25°C to 50°C (-77°F to 122°F), 80% RH or less	
Dimensions	Sensor: approx. 76.5W × 23.4H × 14.2D mm (approx. 3.00W × 0.92H × 0.56D in.) Relay box: approx. 80W × 20H × 26.5D mm (approx. 3.15W × 0.79H × 1.04D in.)		Sensor: approx. 76.5W × 23.4H × 14.2D mm (approx. 3.00W × 0.92H × 0.56D in.) Relay box: approx. 80W × 20H × 26.5D mm (approx. 3.15W × 0.79H × 1.04D in.)	
Cable length	Between sensor and relay boxr: approx. 4 m (13.12 ft.) Between relay box and output connector: approx. 0.2 m (0.66 ft.)		Between sensor and relay box: approx. 4 m (13.12 ft.) Between relay box and output connector: approx. 0.2 m (0.66 ft.)	
Weight	Approx. 160 g (5.64 oz.)		Approx. 160 g (5.64 oz.)	
Derating properties				

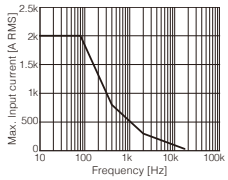
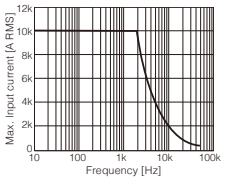
Custom cable lengths are also available. Please inquire with your Hioki distributor.

High-accuracy clamp current sensors

		CT6834, CT6834-01		CT6833, CT6833-01	
Appearance		NEW 		NEW 	
Rated current		500 A AC/DC		200 A AC/DC	
Frequency band		DC to 50 kHz		DC to 50 kHz	
Diameter of measurable conductors		Max. ϕ 20 mm (0.79 in.)		Max. ϕ 20 mm (0.79 in.)	
Accuracy	Sensor only (amplitude) ±(% of reading + % of full scale) Full scale is the rated current of sensor	DC	±0.07% ±0.01%	DC	±0.07% ±0.01%
		DC < f < 16 Hz	±0.15% ±0.01%	DC < f < 16 Hz	±0.15% ±0.01%
		16 Hz ≤ f ≤ 66 Hz	±0.07% ±0.007%	16 Hz ≤ f ≤ 66 Hz	±0.07% ±0.007%
		66 Hz < f ≤ 100 Hz	±0.07% ±0.007%	66 Hz < f ≤ 100 Hz	±0.07% ±0.007%
		100 Hz < f ≤ 500 Hz	±0.1% ±0.01%	100 Hz < f ≤ 500 Hz	±0.1% ±0.01%
		500 Hz < f ≤ 1 kHz	±0.25% ±0.02%	500 Hz < f ≤ 1 kHz	±0.25% ±0.02%
		1 kHz < f ≤ 20 kHz	±(0.25 × f)% ±0.02%	1 kHz < f ≤ 20 kHz	±(0.25 × f)% ±0.02%
Operating temperature		Sensor: -40°C to 85°C (-40°F to 185°F), 80% RH or less Relay box: -25°C to 50°C (-77°F to 122°F), 80% RH or less		Sensor: -40°C to 85°C (-40°F to 185°F), 80% RH or less Relay box: -25°C to 50°C (-77°F to 122°F), 80% RH or less	
Dimensions		Sensor: approx. 149W × 46H × 16.5D mm (approx. 5.87W × 1.81H × 0.65D in.) Relay box: approx. 126W × 57H × 20.5D mm (approx. 4.96W × 2.24H × 0.81D in.)		Sensor: approx. 149W × 46H × 16.5D mm (approx. 5.87W × 1.81H × 0.65D in.) Relay box: approx. 126W × 57H × 20.5D mm (approx. 4.96W × 2.24H × 0.81D in.)	
Cable length		CT6834: approx. 5 m (16.40 ft.) including relay box CT6834-01: approx. 10 m (32.81 ft.) including relay box		CT6833: approx. 5 m (16.40 ft.) including relay box CT6833-01: approx. 10 m (32.81 ft.) including relay box	
Weight		CT6834: approx. 500 g (17.64 oz.) CT6834-01: approx. 710 g (25.05 oz.)		CT6833: approx. 500 g (17.64 oz.) CT6833-01: approx. 710 g (25.05 oz.)	
Derating properties					

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

Standard sensors

	CT7642, CT7742	CT7044, CT7045, CT7046
Appearance		
Rated current	2000 A AC/DC	6000 A AC
Frequency band	CT7642: DC to 10 kHz CT7742: DC to 5 kHz	10 Hz to 50 kHz (±3 dB)
Diameter of measurable conductors	ϕ 55 mm (2.17 in) or less	CT7044: ϕ 100 mm (3.94 in) or less CT7045: ϕ 180 mm (7.09 in) or less CT7046: ϕ 254 mm (10.00 in) or less
Basic accuracy	For DC, 45 Hz to 66 Hz Amplitude: ±1.5% rdg. ±0.5% f.s. For up to 66 Hz Phase:±2.3 °	For 45 to 66 Hz, with flexible cable core Amplitude: ±1.5% rdg. ±0.25% f.s. Phase:±1.0 °
Frequency characteristics (Amplitude)	66 Hz to 1 kHz ±2.5% rdg. ±1.0% f.s.	—
Operating temperature	-25°C to 65°C (-13°F to 149°F)	-25°C to 65°C (-13°F to 149°F)
Effect of conductor position	±1.0% rdg. or less	±3.0% or less
Effect of external magnetic fields	In 400 A/m magnetic field (DC) 0.2% f.s. or less	In 400 A/m magnetic field (50 Hz/60 Hz) CT7044, CT7045 : 2.0% f.s. or less CT7046 : 2.5% f.s. or less
Output connector	HIOKI PL14*	HIOKI PL14*
Dimensions	Approx. 64W x 195H x 34D mm (approx. 2.52W x 7.68H x 1.34D in.)	Circuit box: approx. 25W x 72H x 20D mm (approx. 0.98W x 2.83H x 20D in.)
Cable length	Approx. 2.5 m (8.20 ft.)	Approx. 2.5 m (8.20 ft.)
Weight	Approx. 510 g (18.0 oz.)	CT7044: approx.160 g (5.6 oz.) CT7045: approx.174 g (6.1 oz.) CT7046: approx.186 g (6.6 oz.)
Derating properties		

* CT9920 (sold separately) is required to connect M7103 to the sensor with HIOKI PL14 on the output connector.

Direct-wiring type high-accuracy current sensors

The DCCT (Direct Connection Current Transducer) method allows world-class measurement range and measurement accuracy at a rating of 50 A.
(A 5 A rating version is also available. Please inquire with your Hioki distributor.)

	PW9100A-3	PW9100A-4
Appearance		
Number of input channels	3ch	4ch
Rated current	50 A AC/DC	
Frequency band	DC to 3.5 MHz (-3 dB)	
Basic accuracy	For 45 Hz to 65 Hz [Amplitude]: ±0.02% rdg. ±0.005% f.s. Phase: ±0.1 ° For DC [Amplitude]: ±0.02% rdg. ±0.007% f.s.	
Maximum rated voltage to earth	CATII 1000 V, CATIII 600 V	

Scan the QR code to view the PW9100A website product page.

CONVERSION CABLE CT9920

Required to connect current sensors with the HIOKI PL14 connection to the PW3390 to the M7103

[Applicable products]
CT7742, CT7642, CT7044, CT7045, CT7046

Measure large currents of up to 8000 A

Sensor Unit CT9557 is used for adding and outputting current sensor outputs for multi-wire lines. It can measure high currents of up to 8000 A (4-wire lines) with high accuracy.

SENSOR UNIT CT9557

Option CONNECTION CABLE CT9904
Cable length: 1 m (3.28 ft.) the CT9904 is required to connect to the M7103.

CT9557 specifications		
Connectable current sensor	Current sensors are listed on pp. 12–15*	
Summed waveform output accuracy ±(% of reading + % of full scale)	DC	±0.06% ±0.03%
	to 1 kHz	±0.06% ±0.03%
	to 10 kHz	±0.10%. ±0.03%
	to 100 kHz	±0.20% ±0.10%
	to 300 kHz	±1.0% ±0.20%
	to 700 kHz	±5.0% ±0.20%
	to 1 MHz	±10.0% ±0.50%
Operating temperature and humidity	-10°C to 50°C (14°F to 122°F), 80% RH or less	
Power supply	100 V to 240 V AC (50, 60 Hz)	
Output connector	HIOKI ME15W (male connector)	
Dimensions	Approx. 116W × 67H × 132D mm (approx. 4.57W × 2.64H × 5.20D in.)	
Weight	Approx. 420 g (14.8 oz.)	
Included accessories	AC ADAPTER Z1002, Power cord	

Wiring	Current	Using sensors
Single-cable or bundled wiring	1000 A	CT6876A CT6846A
	2000 A	CT6877A
2-cable wiring	2000 A	CT9557 + CT6876A × 2 or CT9557 + CT6846A × 2
	4000 A	CT9557 + CT6877A × 2
3-cable wiring	3000 A	CT9557 + CT6876A × 3 or CT9557 + CT6846A × 3
	6000 A	CT9557 + CT6877A × 3
4-cable wiring	4000 A	CT9557 + CT6876A × 4 or CT9557 + CT6846A × 4
	8000 A	CT9557 + CT6877A × 4

*When connecting CT7642, CT7742, CT7044, CT7045, CT7046, optional conversion cable CT9920 is required.

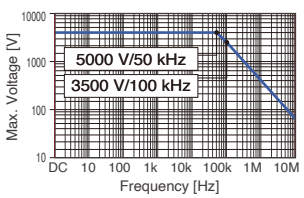
Measure high voltages of up to 5000 V

The AC/DC High Voltage Divider VT1005 divides and outputs voltages of up to 5000 V.

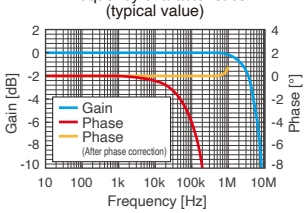
AC/DC HIGH VOLTAGE DIVIDER VT1005

VT1005 specifications	
Maximum rated voltage	5000 V RMS, ±7100 V peak (Provided this falls within the frequency derating curve illustrated)
Maximum rated voltage (line-to-ground)	No measurement category: 5000 V AC/DC (7100 V peak, Anticipated transient overvoltage 0 V) Measurement category II: 2000 V AC/DC (Anticipated transient overvoltage 12000 V) Measurement category III: 1500 V AC/DC (Anticipated transient overvoltage 10000 V)
Measurement accuracy	±0.08% (DC), ±0.04% (50, 60 Hz), ±0.17% (50 kHz)
Frequency flatness	Band where amplitude falls within ±0.1% range: 200 kHz (typical) Band where phase falls within ±0.1° range: 500 kHz (typical) (*5)
Measurement bandwidth	DC to 4 MHz (Amplitude and phase accuracy specified up to 1 MHz)
Voltage dividing ratio	1000 : 1
Common-mode voltage rejection ratio (CMRR)	50, 60 Hz: 90 dB (typical), 100 kHz: 80 dB (typical)
Operating temperature and humidity range	-10°C to 50°C (14°F to 122°F), 80% RH or less (non-condensing)
Power supply	100 V to 240 V AC (50, 60 Hz)
Dimensions	Approx. 195.0W × 83.2H × 346.0D mm (approx. 7.7W × 3.3H × 13.6D in.)
Weight	Approx. 2.2 kg (approx. 77.6 oz.)
Measurement method	Differential input
Included accessories	- L1050-01 Voltage Cord (1.6 m/ 5.25 ft) - L9217 Connection Cord (insulated BNC, 1.6 m/ 5.25 ft) - 9704 Conversion Adapter (insulated-female BNC-to-banana plug) - Power cord

Frequency derating curve



Frequency characteristics (typical value)



Selection Guide

STEP 1 Choose a data logger

Choose a logger based on the number of channels and data output method.

Standard model
Data Logger LR8101

or

Advanced model
Data Logger LR8102

(The AC adapter is not required if using a Power Supply Module.)

STEP 2 Choose measurement modules

+

or

Power Measurement Module M7103	Voltage/Temp Module M7100	Voltage/Temp Module M7102
3ch	15ch	30ch
Up to 1500 V	Up to 1500 V	Up to 600 V

STEP 3 Choose current sensors and voltage cords

Choose current sensors, voltage cords, and other components according to the purpose of measurement.

(For more information about sensors suitable for use with the Voltage/Temp Unit, see the Data Logger LR8101/LR8102 brochure or Battery Charging/Discharging Testing Solutions brochure.)

STEP 4 Provide a power supply module

(A Power Supply Module is required if using the M7103.)

AC Power Module M1100

STEP 5 Prepare a LAN cable

Connect the computer to the logger (LAN1 port).

A hub and one LAN cable to each logger are needed in order to simultaneously configure multiple devices.
(The LAN1 port is used for configuring the instrument's settings, even when using UDP output.)

LAN Cable 9642
Straight-through LAN with crossover conversion connector, 5 m (16.4 ft.)

STEP 6 Choose how to output data

■ Output data from LAN1

There's no need to provide additional LAN cables as described in Step 4.

■ Output data from LAN2 LR8102 only

An additional LAN cable is required if you wish to output data from the LAN2 port. Use of Cat 7 cabling is recommended since large amounts of data will be transferred at high speed.

■ Output data from CAN LR8102 only

One CAN cable is required for each logger.

CAN Cable 9713-01
With one end terminating in bare wires; length: 1.8 m (5.9 ft.)

STEP 7 Synchronize measurement LR8102 only

If you wish to synchronize measurement of multiple loggers, you'll need one optical connection cable for each logger. Choose either the L6101 or the L6102 based on the required length.

Optical Connection Cable L6101
Length: 1 m (3.3 ft.)

Optical Connection Cable L6102
Length: 10 m (32.8 ft.)

Logger option

Synchronization cable

For synchronizing measurement of multiple loggers

LR8102 only

Optical Connection Cable L,6101
Length: 1 m (3.3 ft.)
Optical Connection Cable L6102
Length: 10 m (32.8 ft.)

Measurement

LAN Cable 9642
Straight-through LAN with crossover conversion connector, 5 m (16.4 ft.)

Storage media

Be sure to use storage media supplied by Hioki. Instruments may not be able to write to or read from storage media other than Hioki media; proper operation not guaranteed.

SD Memory Card Z4001
2 GB

SD Memory Card Z4003
8 GB

USB Drive Z4006
16 GB

Module options

Voltage cords other

VOLTAGE CORD L9438-50
banana-banana (red, black, 1 each), alligator clip, spiral tube, approx. 3 m (9.84 ft.) length / CATIV 600 V, CATIII 1000 V

VOLTAGE CORD L1000
banana-banana (red,yellow, blue, gray, 1 each, black × 4), alligator clip,approx. 3 m (9.84 ft.) length / CATIV 600 V, CATIII 1000 V

VOLTAGE CORD L1025
banana-banana (red,yellow, blue, gray, 1 each, black × 4), alligator clip,approx. 3 m (9.84 ft.) length / CATIV 600 V, CATIII 1000 V

GRABBER CLIP L9243
GRABBER CLIP (red, black, 1 each) Attaches to the tip of the banana plug cable CATII 1000 V

PATCH CORD L1021-01
for branching voltage input, banana branch to banana clip (red × 1), 0.5 m (1.64 ft.) length / CATIV 600 V, CATIII 1000 V

PATCH CORD L1021-02
for branching voltage input, banana branch to banana clip (black × 1), 0.5 m (1.64 ft.) length / CATIV 600 V, CATIII 1000 V

WIRING ADAPTER PW9000
When making a 3-phase 3-wire (3P3W3M) connection, this product allows you to reduce the number of voltage cords from 6 to 3. CATIV 600 V, CATIII 1000 V

WIRING ADAPTER PW9001
When making a 3-phase 4-wire (3P4W) connection, this product allows you to reduce the number of voltage cords from 6 to 4. CATIV 600 V, CATIII 1000 V

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