Record and Analyze Power Supply Problems Simultaneously with a Single Unit

The New World Standard for Power Quality Analysis

Never Miss the Moment
- Detect power supply problems and perform onsite troubleshooting
- Do preventive maintenance to avert accidents by managing the power quality

CAT IV-600V Safety Standard
- Meets the CAT IV safety rating required to check an incoming power line
- Safe enough to measure up to 6,000Vpeak of transient overvoltage

Easy Setup Function with PRESETS
- Just select the measurement course, wiring, and clamps
- Automatic one-step setup based on measurement conditions

Compliant with New International Standards
- International power quality measurement standard IEC 61000-4-30 Edition 2 Class A
- High precision with a basic voltage measurement accuracy of 0.1%
One Single Unit Can Solve All Your Power Supply Problems

The number of power supply problems is increasing as power systems are becoming more and more complicated - all due to the rising use of power electronics devices plus a growing installed base of large systems and distributed power supplies. The quickest way to approach these problems is to understand the situation quickly and accurately. The PW3198 Power Quality Analyzer is ready to effectively solve your power supply problems.

**Troubleshooting**

- Understand the actual power situation at the site where the problem is occurring (e.g., the equipment malfunction, failure, reset, overheating, or burning damage).
- Ideal for troubleshooting solar and wind power generation systems, EV charge stations, smart grids, tooling machines, OA equipment (e.g., computers, printers, and UPS), medical equipment, server rooms, and electrical equipment (e.g., transformers and phase-advancing capacitors).

**Field Survey and Preventive Maintenance**

- Perform long-term measurements of the power quality and study problems that are difficult to detect or that occur intermittently.
- Maintain electrical equipment and check the operation of solar and wind power generation systems.
- Manage the parameters with a control set point, such as a voltage fluctuation, flicker, and harmonic voltage.

**Power (Load) Survey**

- Study the power consumption and confirm system capacity before adding load.
Class A is defined in the international standard IEC61000-4-30, which specifies compatibility with power quality parameters, accuracy, and standards to enable comparison and discussion of the measurement results of different measuring instruments. The PW3198 is compliant with the latest IEC61000-4-30 Edition 2 Class A standard. The instrument can perform measurements in accordance with the standard, including continuous gapless calculation, methods to detect events such as dip, swell, and instantaneous power failure, and time synchronization using the optional GPS box.

**Class A**

1. **International Standard IEC61000-4-30 Edition 2 Class A**
2. **CAT IV-600V Safety**

The PW3198 is compliant with the measurement category CAT IV - 600V and can also safely test the incoming lines for both single-phase and three-phase power supplies.

**3. Easy to set up - Just select the measurement course and the PW3198 will do the rest**

- **U Events**: Record voltage and frequency and detect errors simultaneously.
- **Standard Power Quality**: Record voltage, current, frequency, and harmonic, and detect errors simultaneously.
- **Inrush current**: Measure the inrush current.
- **Recording**: Record only the TIME PLOT Data but do not detect errors.
- **EN50160**: Perform measurements in accordance with EN50160.

**4. Highly Accurate, Broadband, Wide Dynamic Range Makes for Reliable Measurements**

- **Voltage Measurement Range**
  - Line-to-line voltage (3P4W)
  - Phase voltage (1P2W, 1P3W, 3P3W)

- **Voltage Frequency Range**
  - DC to 700 kHz

Both low and high voltages can be measured in a single range.

- **Basic Measurement Accuracy (50/60 Hz)**
  - Voltage: ±0.1% of nominal voltage
  - Current: ±0.2% rdg. ±0.1% f.s. + Clamp-on sensor accuracy
  - Power: ±0.2% rdg. ±0.1% f.s. + Clamp-on sensor accuracy

World's highest level of basic measurement accuracy. Extremely accurate voltage measurement without the need to switch ranges.

- **Transient Overvoltage**
  - Transient overvoltage can also be measured in a range between the maximum 6,000 V and minimum 1 μs (2 MS/s).

- **High-order Harmonic**
  - The PW3198 is the first power quality analyzer that can measure the high-order harmonic component of up to 80 kHz.
PW3198 Never Misses the Moment a Power Supply Failure Occurs

The PW3198 can measure all waveforms of power, harmonic, and error events simultaneously. When a problem occurs with the equipment or system on your site, the PW3198 will help you detect the cause of the problem early and solve it quickly. You can depend on the PW3198 to monitor all aspects of your power supplies.

Measure All Parameters at the Same Time

Acquire the Information You Need Quickly by Switching Pages (RMS Value)

Just connect to the measurement line, and the PW3198 will simultaneously measure all parameters, such as power and harmonic. You can then switch pages to view the needed information immediately.

Reliably Detect Power Supply Failures (Event)

To detect power supply failures, measurement does not need to be performed multiple times under different conditions. The PW3198 can always monitor and reliably detect all power supply failures for which detection is enabled.

1. Transient Overvoltage (Impulse)
   A transient overvoltage is generated by a lightning strike or a contact fault or closed contact of a circuit breaker and relay, and often causes a steep voltage change and a high voltage peak.

2. Voltage Dip (Voltage Drop)
   Voltage drops for a short time as a result of large inrush current generated in the load by, for example, a starting motor.

3. Voltage Swell (Voltage Rise)
   A voltage swell is generated by a lightning strike or a heavily loaded power line being opened or closed, causing the voltage to rise instantaneously.

4. Interruption
   The power supply stops instantaneously or for a short or long time because electrical power transmission is stopped as a result of a lightning strike, or because the circuit breaker is tripped by a power supply short circuit.

5. Inrush Current
   A large current flows instantaneously at the moment electrical equipment, a motor, or similar devices are powered on.

6. High-order Harmonic
   Voltage and current waveforms are distorted by noise components generated by a semiconductor control device or the like installed in the power supply of electronic equipment.

7. Unbalance
   An increase or decrease in the load connected to each phase of the three-phase power supply or an unbalanced operation of equipment and devices causes the load of a particular phase to become heavy so that voltage and current waveforms are distorted, voltage drops, or negative phase sequence voltage is generated.
The PW3198 can simultaneously record 8,000 or more parameters, such as voltage, current, power, power factor, frequency, integral power, harmonic, and flicker, at the specified recording interval. The PW3198 never fails to capture the peak because it performs calculations continuously and records the maximum, minimum, and average values within the recording interval.

**TIME PLOT Recording of All Parameters**

- **Voltage drop occurred!**
- **Harmonic Recording**
- **Flicker and ΔV10 Recording**
- **Integral Power Recording**

**Event Waveforms**

Capture up to 55,000 Instantaneous Waveforms of Power Supply Failures

The PW3198 can record up to 1,000 instantaneous waveforms of power supply failures (up to 55,000 when repeat recording is set to ON) while performing TIME PLOT recording.

**Event List**

This list records instantaneous waveforms of power supply failures (events), such as a voltage drop or inrush current, along with the time or other information. Events are always monitored, regardless of the recording interval of the TIME PLOT recording.

**Event Waveform**

The PW3198 lets you view the instantaneous waveform (200 ms) of a power supply failure in the window.

- **Inrush current occurs**
- **RMS value changes over 30 seconds**
- **Voltage drop caused by inrush current caused by the start of the motor**

**Simultaneous Recording of TIME PLOT Data and Event Waveforms**

Switch windows with one touch.
Use Model 9624-50 PQA-HiVIEW PRO (version 2.00 or later) with a PC to analyze the data collected by the PW3198.

**Viewer Function**

Display and analyze the data recorded by the PW3198 POWER QUALITY ANALYZER.

- **Event List Window**
  - Display a list of power supply failures (events) that occurred.

- **TIME PLOT Window**
  - Display the TIME PLOT (recorded trend) data as well as changes in the voltage/current RMS values, harmonic, and many other parameters.

- **Event Waveform Window**
  - Display the waveform of an event that occurred, plus the vector, harmonic, DMM, and instantaneous harmonic values.

- **ITIC Curve Display Window**
  - Analyze the ITIC (CBEMA) curve (tolerance curve) used in the power quality standards in the United States.

**Report Creation Function**

Automatically and effortlessly create rich reports for compliance and record management.

- **Report output items:** Voltage/current RMS value fluctuation graph, harmonic fluctuation graph, inter-harmonics fluctuation graph, flicker graph, integral power graph, demand graph, total harmonic voltage/current distortion rate list, EN50160 window (Overview, Harmonic, Measurement Results Category), worst case, transient waveform, maximum/minimum value list, all event waveforms/detailed list, and setup list.

**Print Examples**

- RMS Value Voltage Fluctuations
- All Event Detailed List
- TIME PLOT Recording of Parameters
- EN50160

**Other Functions**

- **CSV Conversion of Measurement Data**
  - Convert data in the range specified in the TIME PLOT window into CSV format and then save for further processing. The 9624-50 can also convert event waveforms into CSV format. Open CSV data using any commercially available spreadsheet software for advanced data management and analysis.

- **Download Measurement Data via USB/LAN**
  - Data in the SD card inserted in the PW3198 can be downloaded to a PC via USB or LAN.

- **EN50160 Display Function**
  - EN50160 is a power quality standard for the EU. In this mode, evaluate and analyze power quality in accordance with the standard. You can display the Overview, Harmonic, and Measurement Results Category windows.

**9624-50 Specifications**

- **Delivery media:** CD-R
- **Operating environment:** All compatible PC
- **OS:**
  - Windows XP, Windows Vista (32-bit)
  - Windows 7 (32/64-bit)
- **Memory:** 512 MB or more
Useful Functions for a Wide Variety of Applications

**Large Capacity Recording with SD Card**

Data is recorded to a large capacity SD card. The data can be transferred to a PC and analyzed using dedicated application software. If your PC is not equipped with an SD card slot, simply connect a USB cable between the PW3198 and the PC. The PC will then recognize the SD card as removable media.

<table>
<thead>
<tr>
<th>Repeat record</th>
<th>Recording period</th>
</tr>
</thead>
<tbody>
<tr>
<td>OFF</td>
<td>Max. 35 days</td>
</tr>
<tr>
<td></td>
<td>Reference value: ALL DATA (all items recorded), repeat recording OFF, and TIME PLOT interval 1 minute or longer</td>
</tr>
<tr>
<td>ON</td>
<td>Max. 55 weeks (about 1 year)</td>
</tr>
<tr>
<td></td>
<td>Reference value: ALL DATA (all items recorded), repeat recording ON (1 week x 55 times), and TIME PLOT interval 10 minutes or longer</td>
</tr>
</tbody>
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**Simultaneously Measure Three-phase Lines and Grounding Wire**

Apart from the main measurement line, you can also measure the AC/DC voltage on another line using Channel 4.

**Yes! Simultaneously!**

- Measure the primary and secondary sides of UPS
- Two-line voltage analysis
- Measure three-phase lines and grounding wire
- Measure neutral lines to detect short circuits
- Measure the input and output of a DC-AC converter for solar power generation

**Remote Measurement Using HTTP Server Function**

You can use any Internet browser to remotely operate the PW3198, plus download the data stored in the SD card using dedicated software (LAN access required).

**GPS Time Synchronization**

The PW9005 GPS BOX lets you synchronize the clock on the PW3198 to the UTC standard time. Eliminate time differences between multiple PQAs and correctly analyze measurement data taken by several instruments.

**Backup and Recovery from Power Failure**

The PW3198 uses the new large capacity BATTERY PACK Z1003, enabling continuous measurement for three hours even if a power failure occurs. In addition, a power failure processing function restarts measurement automatically even if the power is cut off completely during measurement.

**An Assortment of Clamp-on Sensors Covers a Broad Range of Measurements**

In addition to current sensors for measuring 100A AC, 500A AC, 1000A AC and 5000A AC rated currents, a 5A AC sensor is also available. In addition, HIOKI’s CLAMP ON LEAK SENSORS enable you to accurately measure for leakage current down to the mA level, while the new CT969X-90 AC/DC Clamp On Sensors further widen applications by supporting DC current testing.

**Other Measurement Applications**

- Flicker measurement
  Measure flicker in conformance with IEC 61000-4-15 Ed2.
- Phase voltage check for Δ connection
  Use the Δ-Y and Y-Δ conversion function to measure phase voltage using a virtual neutral point.
- 400 Hz line measurement
  Measure at a power line frequency of 50/60 Hz as well as 400 Hz.
The power supply of the office equipment sometimes shuts down

**Survey Objective**
The power supply of a printer at the office shuts down even though it is not operated. Equipment other than the printer can also sometimes perform a reset unexpectedly.

**Measurement Method**
Setup is very easy. Just install the PW3198 on the site, and measure the voltage, current, and power. To troubleshoot, just select the clamp-on sensor and wiring, and then select the “U Events” course.

**Analysis Report**
No failure occurred during the measurement period, but a periodic voltage drop was confirmed. The voltage drop may have been caused by the periodic start and operation of the electrical equipment connected to the power supply line. Equipment, such as a laser printer, copier, and electrical heater, may start themselves periodically due to residual heat. An instantaneous voltage drop is likely to have been caused by inrush current from equipment that consumes a large amount of power.

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Medical equipment malfunctions

**Survey Objective**
Replacing the equipment with a new one by the service provider did not improve the malfunction. A survey of the power supply was required to clarify the cause.

**Measurement Method**
Select the “U Events” course in the PW3198 in the same way as with the office equipment example.

**Analysis Report**
It was determined that a voltage dip (voltage drop) occurred and impacted the operation of the equipment. If a voltage dip occurs every day on a regular basis, the probable cause is the start of a large air-conditioning unit, pump, heater, or similar equipment.

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Surveying a Solar Power Generation System

**Survey Objective**
- Maintain a solar power generation system and check its operation (verify the power quality)
- Troubleshoot (impact on the peripheral equipment, operation shutdown, etc.)

**Measurement Method**
Set up the PW3198 on the site and measure the voltage, current, and power. To survey the power quality, select the “Standard power quality measurement” course in the PRESETS menu. To measure the DC voltage, connect channel 4 to the primary side of the solar panel.

**Analysis Report**
All parameters can be recorded simultaneously with a single measurement.
- Identify changes in the output voltage of the power conditioner
- Presence or absence of the occurrence of a transient overvoltage
- Frequency fluctuation important for system interconnection
- Identify changes in the harmonic voltage and current included in the output
- Power (AC), integral power (AC), etc.
**PW3198 Specifications**

### Measurement items

**Voltage**
- (TIME PLOT Recording)
  - Measurement items: RMS voltage, Frequency, DC voltage, Harmonic voltage (0 to 50th order), Inter-harmonic voltage (0.5 to 49.5th), Total harmonic voltage distortion factor
- Power measurement items: Harmonic power (0 to 50th)

**Current**
- (TIME PLOT Recording)
  - Measurement items: RMS current, Waveform current peak, Harmonic current phase angle (0 to 50th), Inter-harmonic current (0.5 to 49.5th), Total harmonic current distortion factor

**Power**
- (TIME PLOT Recording)
  - Measurement items: Active power, Reactive power, Apparent power, Power factor

**EVENT**
- Measurement items: Voltage swell, Voltage dip, Interruption, Inrush current

### Input specifications

**Measurement circuits**
- Single-phase 2-wire (1P2W), single-phase 3-wire (1P3W), three-phase 3-wire (3P3W2M, 3P4W2.5E) or three-phase 4-wire (3P4W) plus one extra input channel (must be synchronized to reference channel during AC/DC measurement)

**Fundamental frequency of measurement circuit**
- 50Hz, 60Hz, 400Hz

**Input channels**
- Voltage: 4 channels (U1 to U4), Current: 4 channels (I1 to I4)

**Input methods**
- Voltage: Isolated and differential inputs
- Current: Insulated clamp-on sensors

**Input resistance**
- Voltage: 4MΩ
- Current: insulated clamp-on sensors (voltage output)

### Measurement ranges**

**Voltage measurement ranges**
- Transient measurement: 600.00V

**Power ranges**
- (TIME PLOT Recording)
  - Current sensor: 50A / 500A / 5kA / 50kA
  - CT9667 (500A) / 9667 (5kA) / 9667 (50kA)

**PW3198 current ranges**
- Current sensor: 50A / 500A / 5kA / 50kA
- CT9667 (500A) / 9667 (5kA) / 9667 (50kA)

**PW3198 Power ranges**
- (automatically configured based on current range)
  - Current range: 5.0000A / 50.000A / 500.000A
  - Power range (W / VA / var)

### Basic specifications

**Maximum recording period**
- 55 weeks (with repeated recording set to [1 Week]), 55 iterations
- 55 days (with repeated recording set to [1 Day]), 55 iterations
- 35 days (with repeated recording set to [OFF])

**Maximum recordable events**
- 55,000 events (with repeated recording on)
- 1000 events (with repeated recording off)

**TIME PLOT data settings**
- TIME PLOT interval (MIN/MIN/AVG) within each interval recorded
  - 1s, 3s, 10s, 30s, 1m, 5m, 10m, 15m, 30m, 1h, 2h, 150 cycle (at 50Hz), 180 cycle (at 60Hz), 1200 cycle (at 400Hz)
- Screen copy interval (screen shot at each interval saved to SD card)
  - OFF, 5m, 10m, 30m, 1h, 2h
- Timer EVENT interval (200ms instantaneous waveform saved at each interval)
  - OFF, 1m, 5m, 10m, 30m, 1h, 2h
- Timer start and End
  - OFF: Start recording manually
  - ON: Start time and End time can be configured
- Repeated recording settings (maximum 55 iterations)
  - OFF: Recording is not repeated
- 1Week: 55 weeks maximum in 1week segmentations
- 1Day: 55 days maximum in 1day segmentations
- Repeat time
  - Daily Start time and End time can be configured when Repeated recording set to 1Day.

**Recording items settings**
- Power (Small): Recording basic parameters
- P&Harm (Normal): Recording basic parameters and harmonics
- All Data (Full): Recording P&Harm items and inter-harmonics

**Memory data capacity**
- Max. 32 GB with SD Card; only use of the HIOKI 2GB SD Memory Card Model Z4001 is guaranteed by HIOKI.
- Contact your HIOKI representative for special order larger capacity cards that offer the HIOKI guarantee.
**Display specifications**

- **Display**: 6.5-inch TFT color LCD (640 x 480 dots)

**External Interface Specifications**

- **SD card interface**: Saving of binary data, Saving and Loading setting files, Saving and Loading screen copies
  - Slot: SD standard compliant
  - Compatible card: SD memory card/ SDHC memory card
  - Supported memory capacity: Max. 32 GB with SD Card; only use of the HIOKI 2GB SD Memory Card Model Z4001 is guaranteed by HIOKI.
  - Media full processing: Saving of data to SD memory card is stopped

- **RS-232C Interface**: Measurement and control using GPS-synchronized time (connecting GPS BOX)
  - Connector: D-sub9pin
  - Connection destination: GPS box (cannot be connected to computer)

- **LAN Interface**: 1. HTTP server function (compatible software: Internet Explorer Ver.6 or later, Remote operation application function, measurement start and stop control functions, system configuration function, event list function (capable of displaying event waveforms, event vectors, and event harmonic bar graphs))
  - 2. Downloading of data from the SD memory card using the 9624-50 PQA-HiView Pro
    - Connector: RJ-45
    - Transmission method: 10BASE-T, 100BASE-TX

- **USB2.0 Interface**: 1. Recognizes the SD memory card as a removable disk when connected to a computer.
  - The instrument cannot be connected during recording (including standby operation) or analysis.
  - 2. Download data from the SD memory card using the 9624-50 PQA-HiView Pro
    - The instrument cannot be connected during recording (including standby operation) or analysis.
    - Connector: Series B receptacle
    - Connection destination: Computer (WindowsXP, WindowsVista/32bit, Windows7/32/64bit)

**External control interface**

- **Connector**: 4-pin screwless terminal block
- **External event input**: External event input at TTL low level (at falling edge of 1V or less and when shorted) between GND terminal and [EVENT IN] terminal
  - Min. pulse width: 30 ms; rated voltage: -0.5 V to +6.0 V
- **External event output**: Internal event output format setting:
  - Operation: TTL low output at event generation between [GROUND] terminal and [EVENT OUT] terminal
  - Pulse width:
    - Short pulse output: TTL low output at event generation between [GROUND] terminal and [EVENT OUT] terminal
    - Long pulse output: TTL low output at event generation between [GROUND] terminal and [EVENT OUT] terminal (No external event output at START event)
  - 30/10 alarm:
    - TTL low output at 30/10 alarm between [GROUND] terminal and [EVENT OUT] terminal
    - Low level while alarm occurring; reverts to high at data reset

**Environment and safety specifications**

- **Operating environment**: Indoors, altitude up to 3000 m (measurement category is lowered to 600 V CAT III when above 2000m), Pollution degree 2
- **Storage temperature and humidity**: -20 to 50°C (-4 to 122°F) 80% RH or less (non-condensing)
- **Operating temperature and humidity**: 0 to 50°C (32 to 122°F) 80% RH or less (non-condensing)
- **Dust and water resistance**: IP30 (EN60529)
- **Maximum input voltage**: Voltage input section 1000 VAC, DC±600 V, max. peak voltage ±6000 Vpeak
- **Current input section**: 3VAC, DC±4.24V
- **Maximum rated voltage to earth**: Voltage input terminal 600 V (Measurement Categories IV, anticipated transient overvoltage 8000 V)
- **Dielectric strength**: 6.88 kVrms (850/60 Hz, 1 mA sense current); Between voltage measurement terminals (U1 to U3) and voltage measurement terminals (U4) 4.30 kVrms (1 mA@50/60 Hz, 1 mA sense current); Between voltage input terminal (U1 to U3) and current input terminals/interfaces Between voltage (U4) and current measurement terminals, and interfaces
- **Applicable standards**: Safety EN61010
  - EMC EN61326 Class A, EN61000-3-2, EN61000-3-3
Measurement Specifications

**RMS voltage/ RMS current refreshed each half-cycle**

- **Measurement method**: RMS voltage refreshed each half-cycle
  - True RMS type, RMS voltage values are calculated using sample data for 1 waveform derived by overlapping the voltage waveform every half-cycle
  - RMS current is calculated using current waveform data sampled every half-cycle
- **Sampling frequency**: 200kHz
- **Measurement range, resolution**: ±6.0000kVpeak, 0.0001kV
- **Measurement accuracy**: ±0.2%rdg. ±0.08%f.s. (With input outside the range of 1.666% f.s. to 110% f.s. or a nominal input voltage of less than 100 V)

**Swell/ Dip/ Interruption**

- **Display item**: Swell : Swell height, Swell duration
  - Dip : Dip depth, Dip duration
  - Interruption : Interruption depth, Interruption duration
- **Measurement method**: A swell is detected when the RMS voltage refreshed each half-cycle exceeds the threshold in the positive direction
  - A dip is detected when the RMS voltage refreshed each half-cycle exceeds the threshold in the negative direction
  - An interruption is detected when the RMS voltage refreshed each half-cycle exceeds the threshold in the negative direction
- **Range and accuracy**: See RMS voltage refreshed each half-cycle

**Inrush current**

- **Display item**: Maximum current of RMS current refreshed each 1/2 cycle
- **Measurement method**: Detected when the RMS current refreshed each 1/2 cycle exceeds the threshold in a positive direction
- **Range and accuracy**: See RMS current refreshed each half-cycle

**RMS voltage, RMS current**

- **Display items**: RMS voltage : RMS voltage for each channel and AVG (average) RMS voltage for multiple channels
  - RMS current : RMS current for each channel and AVG (average) RMS current for multiple channels
- **Measurement method**: AC+DC True RMS type (Current DC value: with release of new clamp-on sensor)
  - RMS voltage calculated from 10 cycles (50 Hz) or 12 cycles (60 Hz)
- **Sampling frequency**: 200kHz
- **Measurement range, resolution**: ±3.6000kVpeak, 0.0001kV
- **Measurement accuracy**: ±0.1% of nominal voltage (With 1.666% f.s. to 110% f.s. and a nominal input voltage of at least 100 V)
  - ±0.2%rdg. ±0.08%f.s. (With input outside the range of 1.666% f.s. to 110% f.s. or a nominal input voltage of less than 100 V)
  - ±0.2%rdg. ±0.08%f.s. + clamp-on sensor accuracy

**Voltage waveform peak/ Current waveform peak**

- **Display item**: Positive peak value and negative peak value
- **Measurement method**: Measured every 10 cycles (50 Hz) or 12 cycles (60 Hz)
  - maximum and minimum points sampled during approx. 200 ms aggregation
- **Sampling frequency**: 200kHz
- **Measurement range, resolution**: ±1200.0 Vpeak, 0.01V
  - Current waveform peak : The quadruple of RMS current measurement range (Based on clamp-on sensor in use; See Input specifications)

**Voltage waveform comparison**

- **Display item**: Event detection only
- **Measurement method**: A judgment area is automatically generated from the previous 200 ms aggregation waveform, and events are generated based on a comparison with the judgment waveform. Waveform judgments are performed once for each 200 ms aggregation.
- **Comparison window width**: 10 cycles (50 Hz), 12 cycles (60 Hz)
  - No. of window points : 4096 points synchronized with harmonic calculations

**Frequency cycle**

- **Measurement method**: Calculated as the reciprocal of the accumulated whole-cycle time during one U1 (reference channel) cycle
- **Measurement range, resolution**: 70.000Hz, 0.001Hz
- **Measurement accuracy**: ±0.20Hz or less (for input from 10% f.s. to 110% f.s.)

**Frequency**

- **Measurement method**: Calculated as the reciprocal of the accumulated whole-cycle time during approx. 200ms period of 10 or 12 U1 (reference channel) cycles
- **Measurement range, resolution**: 70.000Hz, 0.001Hz
- **Measurement accuracy**: ±0.20Hz or less

**10-sec frequency**

- **Measurement method**: Calculated as the reciprocal of the accumulated whole-cycle time during the specified 10s period for UT (reference channel) as per IEC61000-4-30
- **Measurement range, resolution**: 70.000Hz, 0.001Hz
- **Measurement accuracy**: ±0.01Hz or less
### Harmonic Voltage/ Harmonic Current (including fundamental component)

**Measurement method**
Average value during approx. 20ms aggregation synchronized with the reference channel (CH4 only).

**Sampling frequency**
200kHz

**Measurement range, resolution**
600.00V, 0.01V

**Measurement accuracy**
±0.3% rdg., ±0.08%f.s.

#### High-order harmonic voltage component/ High-order harmonic current component

**Measurement method**
Based on clamp-on sensor in use (with release of new clamp-on sensor).

**Sampling frequency**
200kHz

**Measurement range, resolution**
Based on clamp-on sensor in use; see Input specifications.

**Measurement accuracy**
±0.5% rdg. ±0.5%f.s. + clamp-on sensor accuracy

### Voltage unbalance factor/ Current unbalance factor (negative-phase, zero-phase)

**Measurement method**
Calculated using various components of the three-phase fundamental wave (line-to-line voltage) for three-phase 3-wire (3P3W2M, 3P3W3M) and three-phase 4-wire connections.

**Sampling frequency**
200kHz

**Measurement range, resolution**
Component is V and unbalance factor is 0.00% to 100.00%

**Measurement accuracy**
Voltage unbalance factor : ±0.15%
Current unbalance factor : ±0.15%

### Power factor / Displacement power factor

**Display items**
Active power : Active power for each channel and sum value for multiple channels.
Apparent power : Apparent power of each channel and its sum for multiple channels
Reactive power : Reactive power of each channel and its sum for multiple channels

**Measurement method**
Uses IEC61000-4-7:2002.

**Measurement range, resolution**
V and unbalance factor is 0.00% to 100.00%

**Measurement accuracy**
Active power : ±0.2% rdg. ±0.1%f.s. + clamp-on sensor accuracy
Apparent power : ±1 dgt. for calculations derived from the various measurement values
Reactive power : ±1 dgt. for calculations derived from the various measurement values

### Active energy / Reactive energy

**Display items**
Active energy : WP+ (consumption), WP- (regeneration); Sum of multiple channels
Reactive energy : WQLAG (lag), WQLEAD (lead); Sum for multiple channels Elapsed time

**Measurement method**
Calculated from RMS voltage U, RMS current I, and active power P

**Measurement range, resolution**
Depends on the voltage × current range combination; see Input specifications.

**Measurement accuracy**
Active energy : Active power measurement accuracy ±10 dgt.
Reactive energy : Reactive power measurement accuracy ±10 dgt.

### Voltage unbalance factor/ Current unbalance factor (negative-phase, zero-phase)

**Display items**
Voltage unbalance factor : Negative-phase unbalance factor, zero-phase unbalance factor
Current unbalance factor : Negative-phase unbalance factor, zero-phase unbalance factor

**Measurement method**
Calculated using various components of the three-phase fundamental wave (line-to-line voltage) for three-phase 3-wire (3P3W2M, 3P3W3M) and three-phase 4-wire connections.

**Measurement range**
Voltage unbalance factor : Component is V and unbalance factor is 0.00% to 100.00%
Current unbalance factor : Component is A and unbalance factor is 0.00% to 100.00%

**Measurement accuracy**
Voltage unbalance factor : ±0.15%
Current unbalance factor : ±0.15%

### High-order harmonic voltage component/ High-order harmonic current component

**Display items**
For single incidents and continuous transient incidents
- High-order harmonic voltage component value
- High-order harmonic current component value

**Measurement method**
The waveform obtained by eliminating the fundamental component is calculated using the true RMS method during 10 cycles (50 Hz) or 12 cycles (60 Hz) of the fundamental wave

**Sampling frequency**
200kHz

**Measurement range, resolution**
High-order harmonic voltage component : 600.00V, 0.01V
High-order harmonic current component : Based on clamp-on sensor in use; See Input specifications

**Measurement accuracy**
High-order harmonic voltage component : ±10% rdg. ±0.1%f.s.
High-order harmonic current component : ±10% rdg. ±0.2%f.s. + clamp-on sensor accuracy

### Harmonic voltage/ Harmonic current (including fundamental component)

**Display items**
Select either RMS or content percentage; From 0 to 50th order

**Measurement method**
Uses IEC61000-4-7:2002.

**Comparison window width**
10 cycles (50 Hz), 12 cycles (60 Hz)

**No. of window points**
4096 points synchronized with harmonic calculations

**Measurement range, resolution**
Harmonic voltage : 600.00V, 0.01V
Harmonic current : Based on clamp-on sensor in use; see Input specifications

**Measurement accuracy**
See measurement accuracy with a fundamental wave of 50/60 Hz When using an AC-only clamp sensor, 0th order is not specified for current and power.
### Total harmonic voltage/ Total harmonic current distortion factor

**Display items**
- THD-P (total harmonic distortion factor for the fundamental wave)
- THD-R (total harmonic distortion factor for the total harmonic including the fundamental wave)

**Measurement method**
- Based on IEC61000-4-7:2002
- Max. order: 50th

**Comparison window width**
- 10 cycles (50 Hz), 12 cycles (60 Hz)

**No. of window points**
- 4096 points synchronized with harmonic calculations

**Measurement range, resolution**
- 0.00 to 100.00% (Voltage), 0.00 to 500.00% (Current)

**Measurement accuracy**
- ±5% rdg.

### Harmonic power (including fundamental component)

**Display item**
- Select either RMS or content percentage;
- From 0 to 50th order

**Measurement method**
- Uses IEC61000-4-7:2002

**Comparison window width**
- 10 cycles (50 Hz), 12 cycles (60 Hz)

**No. of window points**
- 4096 points synchronized with harmonic calculations

**Measurement range, resolution**
- Depends on the voltage × current range combination; See input specifications

**Measurement accuracy**
- See measurement accuracy with a fundamental wave of 50/60 Hz (When using an AC-only clamp sensor, order 0 is not specified for current and power)

### Harmonic voltage phase angle / Harmonic current phase angle (including fundamental component)

**Display item**
- Harmonic phase angle components for whole orders

**Measurement method**
- Uses IEC61000-4-7:2002

**Comparison window width**
- 10 cycles (50 Hz), 12 cycles (60 Hz)

**No. of window points**
- 4096 points synchronized with harmonic calculations

**Measurement range, resolution**
- -180.00° to 0.00° to 180.00°

**Measurement accuracy**
- —

### Harmonic voltage-current phase angle and inter-harmonic current

**Display item**
- Indicates the difference between the harmonic voltage phase angle and the harmonic current phase angle.

**Measurement method**
- Uses IEC61000-4-7:2002

**Comparison window width**
- 10 cycles (50 Hz), 12 cycles (60 Hz)

**No. of window points**
- 4096 points synchronized with harmonic calculations

**Measurement range, resolution**
- -180.00° to 0.00° to 180.00°

**Measurement accuracy**
- —

### Inter-harmonic voltage and inter-harmonic current

**Display item**
- Select either RMS or content percentage; from 2 to 50th orders

**Measurement method**
- Uses IEC61000-4-7:2002

**Comparison window width**
- 10 cycles (50 Hz), 12 cycles (60 Hz)

**No. of window points**
- 4096 points synchronized with harmonic calculations

**Measurement range, resolution**
- Inter-harmonic voltage: 600.00V, 0.01V
- Inter-harmonic current: 600.00A, 0.01A

**Measurement accuracy**
- Inter-harmonic voltage: ±0.05% of nominal voltage
- Inter-harmonic current: ±0.05% of nominal voltage

### K Factor (multiplication factor)

**Measurement method**
- Calculated using the harmonic RMS current of the 2nd to 50th orders

**Comparison window width**
- 10 cycles (50 Hz), 12 cycles (60 Hz)

**No. of window points**
- 4096 points synchronized with harmonic calculations

**Measurement range, resolution**
- 0.00 to 500.00

**Measurement accuracy**
- —

### Instantaneous flicker

**Display item**
- As per IEC61000-4-15

**Measurement method**
- User-selectable from 230 V lamp/120 V lamp (when Pst and Plt are selected for flicker measurement)/4 types of Ed filter (230 V lamp 50/60 Hz, 120 V lamp 60/50 Hz)

**Measurement range, resolution**
- 99.999, 0.001

#### ΔV10 Flicker

**Display items**
- ΔV10 measured at one minute intervals, average value for one hour, maximum value for one hour, fourth largest value for one hour, total (within the measurement interval) maximum value

**Measurement method**
- Calculated values are subject to 100 V conversion following gap-less measurement once each minute

**Measurement range, resolution**
- 0.00 to 99.999V

**Measurement accuracy**
- ±0.5% rdg. ±0.01 V (with a fundamental wave of 100 Vrms [50/60 Hz], a fluctuation voltage of 1 Vrms, and a fluctuation frequency of 10 Hz)

**Threshold**
- 0.00 to 9.99V alarm output is generated when the reading for each minute is compared to the threshold and found to be greater

#### IEC Flicker

**Display items**
- Short interval Flicker Pst, long interval Flicker Plt

**Measurement method**

**Measurement range**
- Pst ±5% rdg. (specified within range 0.1000 to 20.000 using IEC61000-4-15 Ed1 and IEC61000-4-15 Ed2 Class F1 performance test)

**Flicker filter**
- Select 230 V lamp Ed1, 120 V lamp Ed1, 230 V lamp Ed2, or 120 V lamp Ed2.
Clamp-on sensors specifications (Options)

<table>
<thead>
<tr>
<th>Clamp-on sensor</th>
<th>CLAMP ON SENSOR 9694</th>
<th>CLAMP ON SENSOR 9660</th>
<th>CLAMP ON SENSOR 9661</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Appearance</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Primary current rating</td>
<td>5A AC</td>
<td>100A AC</td>
<td>500A AC</td>
</tr>
<tr>
<td>Output voltage</td>
<td>10mV/A AC</td>
<td>AC 1mV/A AC</td>
<td>AC 1mV/A AC</td>
</tr>
<tr>
<td>Measurement range</td>
<td>See input specifications</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Amplitude accuracy</td>
<td>±0.3%rdg. ±0.02% t.s. *</td>
<td>±0.3%rdg. ±0.02% t.s. *</td>
<td>±0.3%rdg. ±0.01% t.s. *</td>
</tr>
<tr>
<td>Phase accuracy</td>
<td>±2° or less *</td>
<td>±1° or less *</td>
<td>±0.5° or less *</td>
</tr>
<tr>
<td>Maximum allowable input *</td>
<td>50 A continuous *</td>
<td>130 A continuous *</td>
<td>550 A continuous *</td>
</tr>
<tr>
<td>Maximum rated voltage to earth</td>
<td>CAT III 300Vrms</td>
<td></td>
<td>CAT III 600 Vrms</td>
</tr>
<tr>
<td>Frequency characteristics</td>
<td>±1.0% or less for 66Hz to 5kHz (deviation from specified accuracy)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cord length</td>
<td>3m (9.84ft)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Measurable conductor diameter</td>
<td>Max. φ15mm (0.59&quot;)</td>
<td></td>
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</tr>
<tr>
<td>Dimensions, Mass</td>
<td>46W(1.8&quot;)×135H(5.3&quot;)×21D(0.8&quot;)mm, 230g (8.1oz.)</td>
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<td><strong>Clamp-on sensor</strong></td>
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<tr>
<td><strong>CLAMP ON SENSOR 9669</strong></td>
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<tr>
<td><strong>FLEXIBLE CLAMP ON SENSOR CT9667</strong></td>
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<tr>
<td><strong>Appearance</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Primary current rating</td>
<td>1000 A AC</td>
<td>5000A AC</td>
<td></td>
</tr>
<tr>
<td>Output voltage</td>
<td>0.5mV/A AC</td>
<td></td>
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</tr>
<tr>
<td>Measurement range</td>
<td>See input specifications</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Amplitude accuracy</td>
<td>±1.0%rdg. ±0.01% t.s. *</td>
<td>±2.0%rdg. ±0.01% t.s. *</td>
<td>±3.0%rdg. ±0.3% t.s. *</td>
</tr>
<tr>
<td>Phase accuracy</td>
<td>±1° or less *</td>
<td>±1° or less *</td>
<td></td>
</tr>
<tr>
<td>Maximum allowable input *</td>
<td>1000 A continuous *</td>
<td>1000 A continuous *</td>
<td></td>
</tr>
<tr>
<td>Maximum rated voltage to earth</td>
<td>CATIII 600Vrms</td>
<td>CATIII 1000 Vrms</td>
<td>CATIV 600 Vrms</td>
</tr>
<tr>
<td>Frequency characteristics</td>
<td>Within ±2% at 40Hz to 5kHz (deviation from accuracy)</td>
<td>±3dB or less for 10 Hz to 20kHz (within ±3dB)</td>
<td></td>
</tr>
<tr>
<td>Cord length</td>
<td>3m (9.84ft)</td>
<td>Sensor to circuit: 2m (6.56ft)</td>
<td>Circuit to connector: 1m (3.28ft)</td>
</tr>
<tr>
<td>Measurable conductor diameter</td>
<td>Max. φ55mm (2.17&quot;)</td>
<td>Max. φ254mm (10&quot;)</td>
<td></td>
</tr>
<tr>
<td>Dimensions, Mass</td>
<td>99.5W (3.9&quot;)×188H (7.4&quot;)×42D (1.6&quot;)mm, 590g (20.8 oz.)</td>
<td>Circuit box: 35W (1.3&quot;)×120.5H (4.7&quot;)×34D (1.3&quot;)mm, 140 g (4.9 oz.)</td>
<td></td>
</tr>
<tr>
<td>Power supply</td>
<td>—</td>
<td>LR6 alkaline battery x2, AC Adapter (option)</td>
<td>or external 5 to 15 V DC power supply</td>
</tr>
<tr>
<td>Options (sold separately)</td>
<td>AC ADAPTER 9445-02 (universal 100 to 240VAC, 9V/1A output for USA)</td>
<td>AC ADAPTER 9445-03 (universal 100 to 240VAC, 9V/1A output for Europe)</td>
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<tr>
<td><strong>Clamp-on sensor</strong></td>
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<tr>
<td><strong>CLAMP ON SENSOR 9695-02</strong></td>
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</tr>
<tr>
<td><strong>CLAMP ON SENSOR 9695-03</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Appearance</strong></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Primary current rating</td>
<td>50A AC</td>
<td>100A AC</td>
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</tr>
<tr>
<td>Output voltage</td>
<td>10mV/A AC</td>
<td>1mV/A AC</td>
<td></td>
</tr>
<tr>
<td>Measurement range</td>
<td>See input specifications</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Amplitude accuracy</td>
<td>±0.3%rdg. ±0.02% t.s. *</td>
<td>±0.3%rdg. ±0.02% t.s. *</td>
<td>±0.3%rdg. ±0.02% t.s. *</td>
</tr>
<tr>
<td>Phase accuracy</td>
<td>Within ±2° *</td>
<td>Within ±1° *</td>
<td></td>
</tr>
<tr>
<td>Maximum allowable input *</td>
<td>130 A continuous *</td>
<td>130 A continuous *</td>
<td></td>
</tr>
<tr>
<td>Maximum rated voltage to earth</td>
<td>CATIII 300Vrms (insulated conductor)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Frequency characteristics</td>
<td>Within ±2% at 40Hz to 5kHz (deviation from accuracy)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cord length</td>
<td></td>
<td>CONNECTION CORD 9219 (sold separately) is required.</td>
<td></td>
</tr>
<tr>
<td>Measurable conductor diameter</td>
<td>Max. φ15mm (0.59&quot;)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dimensions, Mass</td>
<td>51W (2.0&quot;)×58H (2.3&quot;)×19D (0.75&quot;)mm, 50g (1.8oz.)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Options (sold separately)</td>
<td>CONNECTION CORD 9219 (Cord length: 3m (9.84ft))</td>
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</tr>
</tbody>
</table>

Note: CONNECTION CORD 9219 (sold separately) is required.

*: 45 to 66Hz

CONNECTION CORD 9219
Clamp-on AC/DC sensor

**Appearance**

Includes CT9691 × 1, CT6590 × 1

**CT9691, CT9692, CT9693 (Clamp sensor) specifications**

<table>
<thead>
<tr>
<th>CT9691</th>
<th>CT9692</th>
<th>CT9693</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary current rating</td>
<td>100A AC/DC</td>
<td>200A AC/DC</td>
</tr>
<tr>
<td>Maximum input range (RMS value)</td>
<td>100Arms continuous</td>
<td>200Arms continuous</td>
</tr>
<tr>
<td>Frequency band</td>
<td>DC to 10 kHz (-3dB)</td>
<td>DC to 20 kHz (-3dB)</td>
</tr>
<tr>
<td>Cord length</td>
<td>2m (6.5 ft)</td>
<td></td>
</tr>
<tr>
<td>Measurable conductor diameter</td>
<td>35 mm (1.38&quot;) or less</td>
<td>33 mm (1.3&quot;) or less</td>
</tr>
<tr>
<td>Dimensions, Mass</td>
<td>53W(2.09&quot;) × 129H(5.08&quot;) × 18D(0.71&quot;) mm, 230g (8.1 oz.)</td>
<td>62W(2.44&quot;) × 167H(6.57&quot;) × 35D(1.38&quot;) mm, 410g (14.5 oz.)</td>
</tr>
</tbody>
</table>

**CT6590 (SENSOR UNIT) specifications**

<table>
<thead>
<tr>
<th>CT6590</th>
<th>CT9690</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency band</td>
<td>DC to 10 kHz (-3dB)</td>
</tr>
<tr>
<td>Cord length</td>
<td>1m (3.3ft)</td>
</tr>
<tr>
<td>Dimensions, Mass</td>
<td>36W(1.42&quot;) × 120H(4.72&quot;) × 34D(1.34&quot;) mm (excluding protruding parts), 165g(5.8 oz.) (including batteries)</td>
</tr>
<tr>
<td>Power supply</td>
<td>L18 alkaline battery x2, optional AC adapter, or 5 V to 15 VDC external power</td>
</tr>
<tr>
<td>Options (sold separately)</td>
<td>AC ADAPTER 9445-02 (universal 100 to 240VAC, 9V/1A output/for USA)</td>
</tr>
</tbody>
</table>

*: Derating according to frequency
<table>
<thead>
<tr>
<th>Current measurement</th>
<th>Application software</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>9694</strong> 5A AC, φ15mm (0.59“)</td>
<td><strong>POWER QUALITY ANALYZER PW3198</strong> (Bundled accessories)</td>
</tr>
<tr>
<td><strong>9661</strong> 500A AC, φ46mm(1.81“)</td>
<td><strong>SD MEMORY CARD 2GB Z4001</strong></td>
</tr>
<tr>
<td><strong>CT9667</strong> 500A AC/ 5000A AC (selectable), φ25mm (1“), Power supply: LR6 alkaline battery or AC ADAPTER 9445-02/03 (sold separately)</td>
<td><strong>VOLTAGE CORD L1000</strong>, <strong>AC ADAPTER Z1002</strong> (selectable), φ25mm (1“), Power supply: LR6 alkaline battery or AC ADAPTER 9445-02/03 (sold separately)</td>
</tr>
<tr>
<td><strong>9660</strong> 100A AC, φ75mm (2.95“), 800(3.15“)×200(7.87“) mm busbar</td>
<td><strong>BATTERY PACK Z1003</strong> (Ni-MH, 7.2 V/4500 mAh)</td>
</tr>
<tr>
<td><strong>9695-02</strong> (50A AC)</td>
<td><strong>POQA-HiVIEW PRO 9624-50</strong> Use Model 9624-50 PQA-HiVIEW PRO (version 2.00 or later) with a PC to analyze the data collected by the PW3198.</td>
</tr>
<tr>
<td><strong>9695-03</strong> (100A AC)</td>
<td><strong>IMPORTANT</strong> Use only the SD Card Z4001 sold by HIOKI.</td>
</tr>
<tr>
<td><strong>9695-03</strong> (100A AC)</td>
<td><strong>AC ADAPTER Z1002</strong> 100V AC to 240V AC</td>
</tr>
<tr>
<td><strong>9695-03</strong> (100A AC)</td>
<td><strong>POQA-HiVIEW PRO 9624-50</strong> and bundled accessories</td>
</tr>
<tr>
<td><strong>9669</strong> 1000A AC, φ55mm(2.17“), 800(3.15“)×200(7.87“) mm busbar</td>
<td><strong>BUNDLED ACCESSORIES</strong></td>
</tr>
<tr>
<td><strong>9629-10</strong> CT ratio 10:1, AC1000A, φ55mm(2.17“), 800(3.15“)×200(7.87“) mm busbar, Cord length : 3m (10.8“)</td>
<td><strong>POQA-HiVIEW PRO 9624-50</strong> Use Model 9624-50 PQA-HiVIEW PRO (version 2.00 or later) with a PC to analyze the data collected by the PW3198.</td>
</tr>
<tr>
<td><strong>9657</strong> 10A AC (up to 5A on Model PW3198), φ40mm(1.57“)</td>
<td><strong>SD MEMORY CARD 2GB Z4001</strong></td>
</tr>
</tbody>
</table>