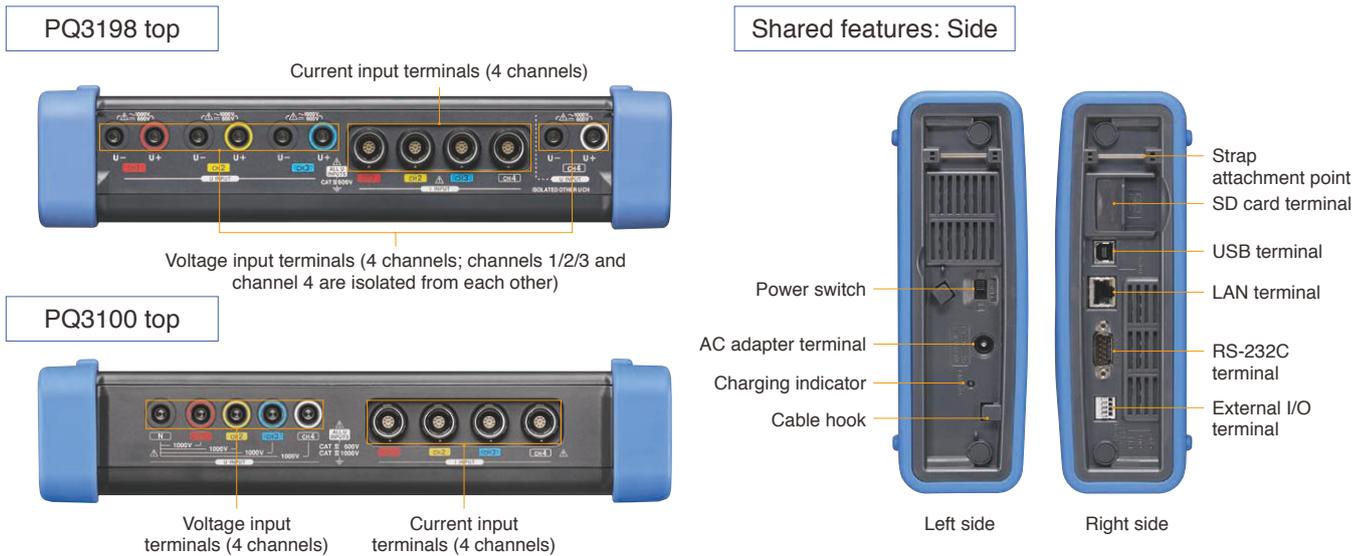


# Interfaces



## Simple comparison chart

| Model                              | PQ3198  | PQ3100   |  |
|------------------------------------|---|--|--|
| IEC 61000-4-30 standard compliance | Class A   | Class S  |  |
| Fundamental frequency              | DC/50 Hz/60 Hz/400 Hz   | DC/50 Hz/60 Hz   |  |
| Measurement lines                  | 1-phase/2-wire, 1-phase/3-wire, 3-phase/3-wire, or 3-phase/4-wire + CH 4  |  |  |
| Event parameters                   | Events that can be measured to capture anomalies  | Transient, swell, dip, interruption, frequency fluctuation, inrush current, THD  |  |
|                                    | Transient voltage   | RMS values<br>Voltage/current waveform peak<br>Voltage waveform comparison<br>Harmonics<br>Unbalance factor<br>Power   | Rapid voltage change (RVC)   |
| Measurement parameters             | Efficiency  | 2 MS/s<br>6 kV   | 200 kS/s<br>2.2 kV   |
|                                    | High-order harmonics  | CH 4 power calculation<br>Efficiency calculation   | N/A  |
|                                    | Power   | 2 kHz to 80 kHz  | N/A  |
|                                    |   | Power 2-circuit measurement  | N/A  |
|                                    | Voltage   | Active power, reactive power, apparent power, power factor, displacement power factor, active energy, reactive energy  |  |
|                                    | Current   | 1/2 RMS value (half-wave shifted 1-wave calculation), RMS value, waveform peak, DC value, unbalance factor (reverse-phase/zero-phase), frequency (1-wave/200 ms/10 sec.) |  |
|                                    | Harmonics   | Inrush current (half-wave), RMS value, waveform peak, DC value, unbalance factor (reverse-phase/zero-phase), K factor  |  |
| Flicker                            | 0th order (DC) to 50th order, voltage/current/power, phase angle (voltage/current), voltage-current phase difference, total harmonic distortion (voltage/current) |  |  |
| Event measurement                  | Inter-harmonics   | Pst, Plt, ΔV10 (3-channel simultaneous measurement)  |  |
|                                    | Maximum number of recordable events   | 0.5th order to 49.5th order, voltage/current   |  |
|                                    | Waveform acquired at time of event  | 9999 events × 366 day repeat   |  |
|                                    | Waveform acquired before event  | 200 ms   |  |
|                                    | Waveform acquired after event   | 2 waveforms  | Max. 1 sec.  |
| Voltage measurement                | Event statistics processing   | Max. 1 sec. (for 5 successive events)  | Max. 10 sec.   |
|                                    | CH 1/2/3 and CH 4 isolation   | N/A  | Display of count for each event type and each day  |
|                                    | Measurement accuracy  | Yes  | N/A  |
| Current measurement                | Maximum rated terminal-to-ground voltage  | High accuracy: ±0.1% rdg.  | ±0.2% rdg.   |
|                                    | Measurement of 4 single-phase circuits  | 600 V (CAT IV)   | 1000 V (CAT III)<br>600 V (CAT IV)   |
| Time-series measurement            | Sensor power supply   | Yes  | Yes  |
|                                    | 1 year recording  | Yes  | Yes  |
| Setup assistance                   | Recording interval times  | 1 sec. to 2 hours  | 200 ms/600 ms/1 sec. to 2 hours  |
|                                    | Simplified setup function   | Yes  | QUICK SET (navigation-style assistance from connecting the instrument to the start of recording) |
| Battery operation                  | 3 hours   | 8 hours  |  |

### PQ3198 features

The PQ3198 offers an extensive range of event parameters. This model is ideal for use in troubleshooting-related measurement since it can capture a variety of power supply anomalies. Additionally, it can measure power and efficiency across two circuits carrying different voltages (3-phase and DC, etc.).

### PQ3100 features

The PQ3100 offers the QUICK SET function, which makes it easy to generate reliable measurements. Additionally, it can record 11 sec. event waveforms, yielding extended waveforms when anomalies occur. It can also be used in applications such as load rejection testing of solar power systems.

# Specifications

The following specifications apply when the PQ3198/PQ3100 is set to a measurement frequency of 50/60 Hz. For more detailed specifications, including for when the PQ3198 is set to 400 Hz, please download the user manual from the HIOKI website.

| Basic specifications   |   | PQ3198   | PQ3100   |   |
|--|---|--|--|---|
| Number of channels   | Voltage: 4 / Current: 4   |  |  |   |
| Input terminal type  | Voltage: Plug-in terminals (safety terminals) / Current: Dedicated connectors (HIOKI PL 14)   |  |  |   |
| Connections  | Any of the following + additional input to CH 4: 1-phase/2-wire<br>1-phase/3-wire<br>1-phase/3-wire/1 voltmeter *PQ3100 only  |  |  |   |
| Input resistance   | Voltage inputs: 4 MΩ / Current inputs: 100 kΩ   |  | 3-phase/3-wire/2 power meter<br>3-phase/3-wire/3 power meter<br>3-phase/4-wire/2.5 element<br>3-phase/4-wire   |   |
| Maximum input voltage  | Voltage inputs: 1000 V AC, ±600 V DC, 6000 Vpeak  |  | Voltage inputs: 1000 V AC/DC, 2200 Vpeak   |   |
| Maximum rated terminal-to-ground voltage                         | 600 V AC (CAT IV) with an expected transient overvoltage of 8000 V  |  | 1000 V AC (CAT III) or 600 V AC (CAT IV) with an expected transient overvoltage of 8000 V  |   |
| Sampling frequency   | Parameters other than transient voltage: 200 kHz; transient voltage: 2 MHz  |  |  |   |
| A/D converter resolution   | Parameters other than transient voltage: 16 bits; transient voltage: 12 bits  |  | 16 bits  |   |
| Display range  | Voltage: 0.48 V to 780 V / Current: 0.5% to 130% of range<br>Power: 0.0% to 130% of range<br>Parameters other than above: 0% to 130% of range   |  | Voltage: 2 V to 1300 V / Current: 0.4% to 130% of range  |   |
| Effective measurement ranges                                     | Voltage: 10 V to 780 V AC, peak of ±2200 V / 1 V to 600 V DC<br>Current: 1% to 120% of range, peak of ±400% of range<br>Power: 0.15% to 130% of range<br>(When voltage and current both fall within the effective measurement range)  |  | Voltage: 10 V to 1000 V AC, peak of ±2200 V / 5 V to 1000 V DC<br>Current: 5% to 120% of range, peak of ±400% of range<br>Power: 5% to 120% of range<br>(When voltage and current both fall within the effective measurement range)  |   |
| Accuracy specifications  |   |  |  |   |
| Accuracy guarantee conditions                                    | Accuracy guarantee duration: 1 year<br>Accuracy guarantee temperature and humidity range: 23°C ±5°C, 80% RH or less / Warm-up time: 30 min. or greater  |  |  |   |
| Temperature coefficient  | 0.03% f.s./°C (DC measurement, add ±0.05% f.s./°C)  |  | 0.1% f.s./°C   |   |
| Common-mode voltage effects                                      | Within 0.2% f.s. (600 Vrms AC, 50 Hz/60 Hz, between voltage input and enclosure)  |  | Within 0.2% f.s. (1000 Vrms AC, 50 Hz/60 Hz, between voltage input and enclosure)  |   |
| External magnetic field effects                                  | Voltage: Within ±3 V<br>Current: Within 1.5% f.s. (400 Arms/m AC, in 50 Hz/60 Hz magnetic field)  |  | Within 1.5% f.s. (400 Arms/m AC, in 50 Hz/60 Hz magnetic field)  |   |
| Measurement parameters   |   |  |  |   |
| Measurement parameters   | Transient voltage   | Current waveform peak  | Reactive energy  | Inter-harmonic voltage                    |
|  | Voltage 1/2 RMS value   | Current DC   | Apparent power   | Inter-harmonic current                    |
|  | Current 1/2 RMS value   | Current RMS value  | Power factor/displacement power factor   | Harmonic voltage phase angle              |
|  | Voltage waveform peak   | Inrush current   | Voltage reverse-phase unbalance factor   | Harmonic current phase angle              |
|  | Voltage DC  | Frequency 1 wave   | Voltage zero-phase unbalance factor  | Harmonic voltage-current phase difference |
|  | Voltage RMS value (phase/line)  | Frequency 200 ms   | Current reverse-phase unbalance factor   | Voltage total harmonic distortion         |
|  | Swell   | Frequency 10 sec.  | Current zero-phase unbalance factor  | Current total harmonic distortion         |
|  | Dip   | Active power   | Harmonic voltage   | K factor                                  |
|  | Interruption  | Active energy  | Harmonic current   | IEC flicker                               |
|  | Instantaneous flicker value   | Reactive power   | Harmonic power   | ΔV10 flicker                              |
|  | Efficiency  |  | Voltage CF   | Reactive power demand amount*             |
|  | High-order harmonic components  |  | Rapid voltage change (RVC)   | Apparent power demand amount*             |
|  | Voltage waveform comparison   |  | Current CF   | Active power demand value                 |
|  |   |  | Electricity cost   | Reactive power demand value               |
|  |   |  | Apparent energy  | Apparent power demand value               |
|  |   |  | Active power demand amount*  | Power factor demand value                 |
|  |   |  |  | *Data output to SD memory card only       |
| Measurement specifications                                       |   |  |  |   |
| Transient voltage (Tran)   | Detected based on waveform after the fundamental wave component has been eliminated from the sampled waveform.  |  |  |   |
|  | Measurement range: ±6.000 kVpeak<br>Measurement band: 5 kHz (-3 dB) to 700 kHz (-3 dB)<br>Measurement accuracy: ±5.0% rdg. ±1.0% f.s.   | Measurement range: ±2.200 kVpeak<br>Measurement band: 5 kHz (-3 dB) to 40 kHz (-3 dB)<br>Measurement accuracy: ±5.0% rdg. ±1.0% f.s.   |  |   |
| Voltage 1/2 RMS value (Urms1/2), current 1/2 RMS value (Irms1/2) | Voltage 1/2 RMS value: Calculated as the RMS value for 1 sampled waveform that has been overlapped every half-wave.<br>Current 1/2 RMS value: Calculated as the RMS value every half-wave.<br>Measurement accuracy<br>Voltage: ±0.2% of the nominal voltage (for input of 10 V to 660 V)<br>±0.2% rdg. ±0.08% f.s. (for input other than above)<br>Current: ±0.3% rdg. ±0.5% f.s. + current sensor accuracy |  | Calculated as the RMS value for 1 sampled waveform that has been overlapped every half-wave.<br>Measurement accuracy<br>Voltage: ±0.3% of the nominal voltage (for input of 10 V to 660 V)<br>±0.2% rdg. ±0.1% f.s. (for input other than above)<br>Current: ±0.2% rdg. ±0.1% f.s. + current sensor accuracy   |   |
| Swell (Swell), dip (Dip), interruption (Intrpt)                  | Detected when the voltage 1/2 RMS value exceeds the threshold.<br>Measurement accuracy: Same as voltage 1/2 RMS value<br>Fluctuation data: Voltage and current 1/2 RMS value data is saved.   |  |  |   |
| Rapid voltage change (RVC)                                       | None  | Detected when the 1-sec. average of voltage 1/2 RMS values exceeds the threshold; however, if the average is less than the dip threshold or greater than the swell threshold, the event is detected as a dip (or swell), rather than as an RVC.<br>Measurement accuracy: Same as voltage 1/2 RMS value<br>ΔUss: Absolute difference between the 1-sec. average of voltage 1/2 RMS values immediately before the event and the first 1-sec. average of voltage 1/2 RMS values after the event [V]<br>ΔUmax: Absolute maximum difference between all voltage 1/2 RMS values during the event and the 1-sec. average of voltage 1/2 RMS values immediately before the event [V]<br>Fluctuation data: Voltage and current 1/2 RMS value data is saved. |  |   |
| Inrush current (Inrush)  | Same as current 1/2 RMS value. Inrush current is detected when the setting is exceeded in the positive direction.<br>Measurement accuracy: Same as current 1/2 RMS value<br>Fluctuation data: Current 1/2 RMS Value data  |  | Calculated as the current RMS value for data obtained by sampling the current waveform every half-wave. Inrush current is detected when the setting is exceeded in the positive direction.<br>Measurement accuracy: ±0.3% rdg. ±0.3% f.s. + current sensor accuracy<br>Fluctuation data: Voltage 1/2 RMS value data and inrush current RMS value data are saved. |   |
| Voltage RMS value (Urms), current RMS value (Irms)               | Measured using a 200 ms aggregate.<br>Measurement accuracy<br>Voltage: ±0.1% of the nominal voltage (for input of 10 V to 660 V)<br>±0.2% rdg. ±0.08% f.s. (input other than above)<br>Current: ±0.1% rdg. ±0.1% f.s. + current sensor accuracy   |  | Measured using a 200 ms aggregate.<br>Measurement accuracy<br>Voltage: ±0.2% of the nominal voltage (for input of 10 V to 660 V)<br>±0.1% rdg. ±0.1% f.s. (for input other than above)<br>Current: ±0.1% rdg. ±0.1% f.s. + current sensor accuracy   |   |
| Voltage DC value (Udc), current DC value (Idc)                   | Average of 200 ms aggregate values (calculated using CH 4 only)<br>Measurement accuracy<br>Voltage: ±0.3% rdg. ±0.08% f.s.<br>Current: ±0.5% rdg. ±0.5% f.s. + current sensor accuracy  |  | Average of 200 ms aggregate values<br>Measurement accuracy<br>Voltage: ±0.3% rdg. ±0.1% f.s.<br>Current: ±0.5% rdg. ±0.5% f.s. + current sensor accuracy   |   |

| Measurement specifications  | PQ3198   | PQ3100   |
|---|--|--|
| Voltage waveform peak (Upk), current waveform peak (Ipk)                          | Maximum and minimum points in sampled data within 200 ms aggregate<br>Measurement range<br>Voltage: $\pm 1200.0$ Vpk<br>Current: 400% current range<br>Measurement accuracy<br>Voltage: 5% of the nominal voltage (for input of 10% to 150% of the nominal voltage)<br>2% f.s. (for input other than above)<br>Current: 5% rdg. (for input of at least 50% f.s.)<br>2% f.s. (for input other than above)   | Maximum and minimum points in sampled data within 200 ms aggregate<br>Measurement range<br>Voltage: $\pm 2200.0$ Vpk<br>Current: 400% current range<br>Measurement accuracy<br>Voltage: 5% of the nominal voltage (for input of 10% to 150% of the nominal voltage)<br>2% f.s. (for input other than above)<br>Current: 5% rdg. (for input of at least 50% f.s.)<br>2% f.s. (for input other than above)   |
| Voltage waveform comparison   | Measurement method: A judgment area is automatically generated based on the previous 200 ms aggregate waveform and compared with the judgment waveform to trigger events. Waveform judgment is performed for one 200 ms aggregate at a time.<br>Comparison window width: 10 waves (for 50 Hz input) or 12 waves (for 60 Hz input)<br>Number of window points: 4096 points synchronized with harmonic calculations  | None   |
| Voltage CF value (Ucf), current CF value (Icf)                                    | None   | Calculated from the voltage RMS value and voltage waveform peak value.   |
| Frequency 1 wave (Freq_wav)   | Calculated as the reciprocal of the cumulative time of the whole cycles that occur during the duration of a single wave on voltage CH 1.<br>Measurement accuracy: $\pm 0.200$ Hz or less   |  |
| Frequency 200 ms (Freq)   | Calculated as the reciprocal of the cumulative time of the whole cycles that occur during 200 ms on voltage CH 1.<br>Measurement accuracy: $\pm 0.020$ Hz or less  |  |
| Frequency 10 sec. (Freq10s)   | Calculated as the reciprocal of the cumulative time of the whole cycles that occur during the specified 10 sec. interval on voltage CH 1.<br>Measurement accuracy: $\pm 0.003$ Hz or less (45 Hz or more)<br>$\pm 0.010$ Hz or less (less than 45 Hz)  | Measurement accuracy: $\pm 0.010$ Hz or less   |
| Active power (P), apparent power (S), reactive power (Q)                          | Active power Measured every 200 ms.<br>Apparent power Calculated from the voltage RMS value and the current RMS value.<br><br>Reactive power Calculated from the apparent power S and the active power P.<br><br>Measurement accuracy<br>Active power DC: $\pm 0.5\%$ rdg. $\pm 0.5\%$ f.s. + current sensor accuracy (CH 4 only)<br>AC: $\pm 0.2\%$ rdg. $\pm 0.1\%$ f.s. + current sensor accuracy<br>Power factor effects: 1.0% rdg. or less (for input from 40 Hz to 70 Hz with a power factor of 0.5)<br>Apparent power $\pm 1$ dgt. relative to calculation from measured values<br>Reactive power During RMS value calculation: $\pm 1$ dgt. relative to calculation from measured values   | Active power Measured every 200 ms.<br>Apparent power RMS value calculation: Calculated from the voltage RMS value and the current RMS value.<br>Fundamental wave calculation: Calculated from the fundamental wave active power and the fundamental wave reactive power.<br>Reactive power RMS value calculation: Calculated from the apparent power S and the active power P.<br>Fundamental wave calculation: Calculated from the fundamental wave voltage and current.<br>Measurement accuracy<br>Active power DC: $\pm 0.5\%$ rdg. $\pm 0.5\%$ f.s. + current sensor accuracy<br>AC: $\pm 0.2\%$ rdg. $\pm 0.1\%$ f.s. + current sensor accuracy<br>Power factor effects: 1.0% rdg. or less (for input from 40 Hz to 70 Hz with a power factor of 0.5)<br>Apparent power $\pm 1$ dgt. relative to calculation from measured values<br>Reactive power During RMS value calculation: $\pm 1$ dgt. relative to calculation from measured values<br>During fundamental wave calculation: For fundamental frequencies of 45 Hz to 66 Hz $\pm 0.3\%$ rdg. $\pm 0.1\%$ f.s. + current sensor specifications (reactive factor = 1)<br>Reactive factor effects: 1.0% rdg. or less (for input from 40 Hz to 70 Hz with a power factor of 0.5) |
| Efficiency (Eff)  | Measurement method<br>Calculated as the ratio of the active power values for the channel pair.<br>Measurement accuracy: $\pm 0.1$ dgt. relative to calculation from measured values  | None   |
| Active energy (WP+, WP-), reactive energy (WQ_LAG, WQ_LEAD), apparent energy (WS) | Energy is measured from the start of recording.<br>Active energy: Calculated separately from the active power for consumption and regeneration.<br>Reactive energy: Integrated separately from the reactive power for lag and lead.<br>Apparent energy: Integrated from the apparent power. *PQ3100 only   | Measurement accuracy<br>Active energy: Active power measurement accuracy $\pm 10$ dgt.<br>Reactive energy: Reactive power measurement accuracy $\pm 10$ dgt.<br>Apparent energy: Apparent power measurement accuracy $\pm 10$ dgt.<br>*PQ3100 only<br>Cumulative time accuracy: $\pm 10$ ppm   |
| Energy cost (Ecost)   | None   | Calculated by multiplying active energy (consumption) (WP+) by the electricity unit cost (/kWh).<br>Measurement accuracy: $\pm 1$ dgt. relative to calculation from measured values  |
| Power factor (PF), displacement power factor (DPF)                                | Displacement power factor (DPF): Calculated from the fundamental wave active power and reactive power.<br>Power factor: Calculated from the apparent power S and the active power P.<br>Displacement power factor measurement accuracy<br>For input with a voltage of 100 V or greater and current of 10% of the range or greater<br>When displacement power factor = 1: $\pm 0.05\%$ rdg.; when $0.8 \leq$ displacement power factor < 1: $\pm 1.50\%$ rdg.; when $0 <$ displacement power factor < 0.8: $\pm (1 - \cos(\varphi + 0.2865)/\cos(\varphi)) \times 100\%$ rdg. + 50 dgt. (reference value), where $\varphi$ represents the 1st-order display value for the harmonic voltage-current phase difference<br>Add the current sensor phase accuracy to each. |  |
| Demand amount   | PQ3198<br>Can be calculated using PQ ONE.  | PQ3100<br>Energy is measured during each interval. (Values are recorded but not displayed.)<br>Measurement accuracy<br>Active power demand amount (Dem_WP+, Dem_WP-): Active power measurement accuracy $\pm 10$ dgt.<br>Reactive power demand amount (Dem_WQ_LAG, Dem_WQ_LEAD): Reactive power measurement accuracy $\pm 10$ dgt.<br>Apparent power demand amount (Dem_WS): Apparent power measurement accuracy $\pm 10$ dgt.<br>Cumulative time accuracy: $\pm 10$ ppm $\pm 1$ sec. (23°C)   |
| Demand value  | Can be calculated using PQ ONE.  | Active power demand value (Dem_P+, Dem_P-), reactive power demand value (Dem_Q_LAG, Dem_Q_LEAD), apparent power demand value (Dem_S)<br>Average power values are measured during each interval.<br>Measurement accuracy: $\pm 1$ dgt. relative to calculation from measured values   |
| Power factor demand value measurement specifications (Dem_PF)                     | N/A  | Calculated from the active power demand value (consumption) (Dem_P+) and the reactive power demand value (lag) (Dem_Q_LEAD).<br>Measurement accuracy: $\pm 1$ dgt. relative to calculation from measured values  |
| Unbalance factor  | Voltage unbalance factor, reverse-phase unbalance factor (Uunb), zero-phase unbalance factor (Uunb0)<br>For 3-phase/3-wire (3P3W2M, 3P3W3M) and 3-phase/4-wire circuits, calculated using the fundamental voltage component for each of the 3 phases.<br>Measurement accuracy: $\pm 0.15\%$  | Defined accuracy: None<br><br>Current unbalance factor, reverse-phase current unbalance factor (Iunb), zero-phase unbalance factor (Iunb0)<br>For 3-phase/3-wire (3P3W2M, 3P3W3M) and 3-phase/4-wire circuits, calculated using the fundamental current component for each of the 3 phases.  |

| Measurement specifications   | PQ3198   | PQ3100  |                                  |         |       |                |                      |                      |                      |                 |                                 |                                 |                                 |                  |                      |                      |                      |                 |                                 |                                 |                               |                 |                                 |                                 |                               |                  |                                  |                                  |  |        |       |       |  |   |           |         |         |       |                |                      |                      |                         |                |                                 |                                 |                                 |                 |                                  |                                  |                                  |        |       |       |  |
|--|--|---|----------------------------------|---------|-------|----------------|----------------------|----------------------|----------------------|-----------------|---------------------------------|---------------------------------|---------------------------------|------------------|----------------------|----------------------|----------------------|-----------------|---------------------------------|---------------------------------|-------------------------------|-----------------|---------------------------------|---------------------------------|-------------------------------|------------------|----------------------------------|----------------------------------|--|--------|-------|-------|--|---|-----------|---------|---------|-------|----------------|----------------------|----------------------|-------------------------|----------------|---------------------------------|---------------------------------|---------------------------------|-----------------|----------------------------------|----------------------------------|----------------------------------|--------|-------|-------|--|
| Harmonic voltage (U <sub>harm</sub> ), harmonic current (I <sub>harm</sub> )   | Measurement accuracy<br>Voltage<br>0th order: $\pm 0.3\%$ rdg. $\pm 0.08\%$ f.s.<br>1st order: $\pm 5\%$ rdg.<br>2nd to 50th order: $\pm 5\%$ rdg. (for input of at least 1% of the nominal input voltage)<br>Measurement accuracy<br>Current<br>0th order: $\pm 0.5\%$ rdg. $\pm 0.5\%$ f.s. + current sensor accuracy<br>1st to 20th order: $\pm 0.5\%$ rdg. $\pm 0.2\%$ f.s. + current sensor accuracy<br>21st to 50th order: $\pm 1.0\%$ rdg. $\pm 0.3\%$ f.s. + current sensor accuracy   | Measurement accuracy<br>Voltage<br>0th order: Same as voltage DC value<br>1st order: Same as voltage RMS value<br>2nd to 50th order: $\pm 10\%$ rdg. (for input of at least 1% of the nominal input voltage)<br>Measurement accuracy<br>Current<br>0th order: Same as current DC value<br>1st to 20th order: $\pm 0.5\%$ rdg. $\pm 0.2\%$ f.s. + current sensor accuracy<br>21st to 30th order: $\pm 1.0\%$ rdg. $\pm 0.3\%$ f.s. + current sensor accuracy<br>31st to 40th order: $\pm 2.0\%$ rdg. $\pm 0.3\%$ f.s. + current sensor accuracy<br>41st to 50th order: $\pm 3.0\%$ rdg. $\pm 0.3\%$ f.s. + current sensor accuracy |                                  |         |       |                |                      |                      |                      |                 |                                 |                                 |                                 |                  |                      |                      |                      |                 |                                 |                                 |                               |                 |                                 |                                 |                               |                  |                                  |                                  |  |        |       |       |  |   |           |         |         |       |                |                      |                      |                         |                |                                 |                                 |                                 |                 |                                  |                                  |                                  |        |       |       |  |
| Harmonic power (Pharm)   | Displays the harmonic power for each channel as well as the sum of values for multiple channels.<br>Measurement accuracy<br>0th order: $\pm 0.5\%$ rdg. $\pm 0.5\%$ f.s. + current sensor accuracy<br>1st to 20th order: $\pm 0.5\%$ rdg. $\pm 0.2\%$ f.s. + current sensor accuracy<br>21st to 30th order: $\pm 1.0\%$ rdg. $\pm 0.3\%$ f.s. + current sensor accuracy  | 31st to 40th order: $\pm 2.0\%$ rdg. $\pm 0.3\%$ f.s. + current sensor accuracy<br>41st to 50th order: $\pm 3.0\%$ rdg. $\pm 0.3\%$ f.s. + current sensor accuracy  |                                  |         |       |                |                      |                      |                      |                 |                                 |                                 |                                 |                  |                      |                      |                      |                 |                                 |                                 |                               |                 |                                 |                                 |                               |                  |                                  |                                  |  |        |       |       |  |   |           |         |         |       |                |                      |                      |                         |                |                                 |                                 |                                 |                 |                                  |                                  |                                  |        |       |       |  |
| Harmonic phase angle   | Harmonic voltage phase angle (U <sub>phase</sub> ), harmonic current phase angle (I <sub>phase</sub> )   |   |                                  |         |       |                |                      |                      |                      |                 |                                 |                                 |                                 |                  |                      |                      |                      |                 |                                 |                                 |                               |                 |                                 |                                 |                               |                  |                                  |                                  |  |        |       |       |  |   |           |         |         |       |                |                      |                      |                         |                |                                 |                                 |                                 |                 |                                  |                                  |                                  |        |       |       |  |
| Harmonic voltage-current phase difference (P <sub>phase</sub> )  | Measurement accuracy<br>1st order: $\pm 1^\circ$<br>2nd to 3rd order: $\pm 2^\circ$<br>4th to 50th order: $\pm (0.05^\circ \times k + 2^\circ)$ (k: Harmonic order)<br>Add current sensor accuracy to each.  |   |                                  |         |       |                |                      |                      |                      |                 |                                 |                                 |                                 |                  |                      |                      |                      |                 |                                 |                                 |                               |                 |                                 |                                 |                               |                  |                                  |                                  |  |        |       |       |  |   |           |         |         |       |                |                      |                      |                         |                |                                 |                                 |                                 |                 |                                  |                                  |                                  |        |       |       |  |
| Inter-harmonic voltage (U <sub>iharm</sub> ), inter-harmonic current (I <sub>iharm</sub> )                               | Adds and displays the inter-harmonic component between whole number-order harmonic components following harmonic analysis, from the 0.5th to the 49.5th order.   |   |                                  |         |       |                |                      |                      |                      |                 |                                 |                                 |                                 |                  |                      |                      |                      |                 |                                 |                                 |                               |                 |                                 |                                 |                               |                  |                                  |                                  |  |        |       |       |  |   |           |         |         |       |                |                      |                      |                         |                |                                 |                                 |                                 |                 |                                  |                                  |                                  |        |       |       |  |
|  | Measurement accuracy<br>Inter-harmonic voltage (defined for harmonic input with a nominal input voltage of at least 100 V)<br>Harmonic input of 1% of the nominal input voltage or greater: $\pm 5.0\%$ rdg.<br>Harmonic input of less than 1% of the nominal input voltage: $\pm 0.05\%$ of the nominal input voltage<br>Inter-harmonic current: Accuracy not defined   | Measurement accuracy<br>Inter-harmonic voltage (defined for harmonic input with a nominal input voltage of 100 V to 440 V)<br>Harmonic input of 1% of the nominal input voltage or greater: $\pm 10.0\%$ rdg.<br>Harmonic input of less than 1% of the nominal input voltage: $\pm 0.05\%$ of the nominal input voltage<br>Inter-harmonic current: Accuracy not defined   |                                  |         |       |                |                      |                      |                      |                 |                                 |                                 |                                 |                  |                      |                      |                      |                 |                                 |                                 |                               |                 |                                 |                                 |                               |                  |                                  |                                  |  |        |       |       |  |   |           |         |         |       |                |                      |                      |                         |                |                                 |                                 |                                 |                 |                                  |                                  |                                  |        |       |       |  |
| Voltage total harmonic distortion (U <sub>thd</sub> ), current total harmonic distortion (I <sub>thd</sub> )             | THD-F: Total harmonic distortion relative to wave<br>THD-F: Total harmonic distortion relative to fundamental wave<br>THD-R: Total harmonic distortion relative to total harmonics, including fundamental wave<br>THD-R: Total harmonic distortion relative to total harmonics, including fundamental wave<br>Measurement accuracy: 0.5%<br>Defined for input as follows for a nominal input voltage of 100 V to 440 V:<br>Voltage 1st order: 100% of nominal input voltage / 5th and 7th orders: 1% of nominal input voltage<br>Current 1st order: 100% of current range / 5th and 7th orders: 1% of current range  |   |                                  |         |       |                |                      |                      |                      |                 |                                 |                                 |                                 |                  |                      |                      |                      |                 |                                 |                                 |                               |                 |                                 |                                 |                               |                  |                                  |                                  |  |        |       |       |  |   |           |         |         |       |                |                      |                      |                         |                |                                 |                                 |                                 |                 |                                  |                                  |                                  |        |       |       |  |
| High-order harmonic voltage component (U <sub>harmH</sub> ), high-order harmonic current component (I <sub>harmH</sub> ) | PQ3198<br>Measurement method<br>Calculated using the true RMS method and the waveform obtained by eliminating the fundamental wave component from 10 waves (for a 50 Hz fundamental wave) or 12 waves (for a 60 Hz fundamental wave).<br>Sampling frequency: 200 kHz<br>Display parameters<br>High-order harmonic voltage component value: Voltage RMS value for the waveform obtained by eliminating the fundamental wave component<br>High-order harmonic current component value: Current RMS value for the waveform obtained by eliminating the fundamental wave component<br>High-order harmonic voltage maximum value: Maximum RMS value for the voltage waveform obtained by eliminating the fundamental wave component for the interval extending from event IN to event OUT (leaving channel information)<br>High-order harmonic current maximum value: Maximum RMS value for the current waveform obtained by eliminating the fundamental wave component for the interval extending from event IN to event OUT (leaving channel information)<br>High-order harmonic voltage component interval: Interval extending from high-order harmonic voltage component event IN to event OUT<br>High-order harmonic current component interval: Interval extending from high-order harmonic current component event IN to event OUT<br>Measurement band: 2 kHz to 80 kHz (-3 dB)<br>Measurement accuracy<br>High-order harmonic voltage component: $\pm 10\%$ rdg. $\pm 0.1\%$ f.s. (defined for a 10 V sine wave at 5 kHz, 10 kHz, and 20 kHz)<br>High-order harmonic current component: $\pm 10\%$ rdg. $\pm 0.2\%$ f.s. (defined for a 1% f.s. sine wave at 5 kHz, 10 kHz, and 20 kHz)<br>Saved waveforms<br>Event waveform, high-order harmonic waveform (8000 points of data over 40 ms starting after the first 200 ms aggregate to exceed the threshold) | PQ3100<br>N/A   |                                  |         |       |                |                      |                      |                      |                 |                                 |                                 |                                 |                  |                      |                      |                      |                 |                                 |                                 |                               |                 |                                 |                                 |                               |                  |                                  |                                  |  |        |       |       |  |   |           |         |         |       |                |                      |                      |                         |                |                                 |                                 |                                 |                 |                                  |                                  |                                  |        |       |       |  |
| K factor (zoom factor) (KF)  | Calculated using the harmonic current RMS values for the 2nd to 50th orders.   |   |                                  |         |       |                |                      |                      |                      |                 |                                 |                                 |                                 |                  |                      |                      |                      |                 |                                 |                                 |                               |                 |                                 |                                 |                               |                  |                                  |                                  |  |        |       |       |  |   |           |         |         |       |                |                      |                      |                         |                |                                 |                                 |                                 |                 |                                  |                                  |                                  |        |       |       |  |
| Instantaneous flicker value measurement (P <sub>inst</sub> )   | Measurement method<br>As per IEC 61000-4-15  |   |                                  |         |       |                |                      |                      |                      |                 |                                 |                                 |                                 |                  |                      |                      |                      |                 |                                 |                                 |                               |                 |                                 |                                 |                               |                  |                                  |                                  |  |        |       |       |  |   |           |         |         |       |                |                      |                      |                         |                |                                 |                                 |                                 |                 |                                  |                                  |                                  |        |       |       |  |
| IEC flicker (P <sub>st</sub> -P <sub>lt</sub> )  | P <sub>st</sub> is calculated after measuring continuously for 10 min., while P <sub>lt</sub> is calculated after measuring continuously for 2 hours, as per IEC 61000-4-15.<br>Measurement accuracy: P <sub>st</sub> : $\pm 5\%$ rdg. (defined as Class F1 [PQ3198] or Class F3 [PQ3100] performance testing under IEC 61000-4-15)  |   |                                  |         |       |                |                      |                      |                      |                 |                                 |                                 |                                 |                  |                      |                      |                      |                 |                                 |                                 |                               |                 |                                 |                                 |                               |                  |                                  |                                  |  |        |       |       |  |   |           |         |         |       |                |                      |                      |                         |                |                                 |                                 |                                 |                 |                                  |                                  |                                  |        |       |       |  |
| $\Delta V_{10}$ flicker ( $\Delta V_{10}$ )  | Values calculated using the flicker visibility function curve are converted to 100 V and measured in a gap-less manner every minute.<br>$\Delta V_{10}$ 1-minute values, 1-hour average value, 1-hour maximum value, 1-hour 4th largest value, overall maximum value (during measurement interval)<br>Measurement accuracy: $\pm 2\%$ rdg. $\pm 0.01$ V (with a fundamental wave of 100 Vrms [50/60 Hz], a fluctuation voltage of 1 Vrms [99.5 Vrms to 100.5 Vrms]), and a fluctuation frequency of 10 Hz)<br>Alarm: Set from 0.00 to 9.99 V to generate contact output if the threshold value is exceeded during any given minute.  |   |                                  |         |       |                |                      |                      |                      |                 |                                 |                                 |                                 |                  |                      |                      |                      |                 |                                 |                                 |                               |                 |                                 |                                 |                               |                  |                                  |                                  |  |        |       |       |  |   |           |         |         |       |                |                      |                      |                         |                |                                 |                                 |                                 |                 |                                  |                                  |                                  |        |       |       |  |
| RMS value frequency characteristics  | <table border="1"> <thead> <tr> <th>Frequency</th> <th>Voltage</th> <th>Current</th> <th>Power</th> </tr> </thead> <tbody> <tr> <td>40 Hz to 70 Hz</td> <td>Defined by RMS value</td> <td>Defined by RMS value</td> <td>Defined by RMS value</td> </tr> <tr> <td>70 Hz to 360 Hz</td> <td><math>\pm 1\%</math> rdg. <math>\pm 0.2\%</math> f.s.</td> <td><math>\pm 1\%</math> rdg. <math>\pm 0.5\%</math> f.s.</td> <td><math>\pm 1\%</math> rdg. <math>\pm 0.5\%</math> f.s.</td> </tr> <tr> <td>360 Hz to 440 Hz</td> <td>Defined by RMS value</td> <td>Defined by RMS value</td> <td>Defined by RMS value</td> </tr> <tr> <td>440 Hz to 5 kHz</td> <td><math>\pm 5\%</math> rdg. <math>\pm 0.2\%</math> f.s.</td> <td><math>\pm 5\%</math> rdg. <math>\pm 0.5\%</math> f.s.</td> <td><math>\pm 5\%</math> rdg. <math>\pm 1\%</math> f.s.</td> </tr> <tr> <td>5 kHz to 20 kHz</td> <td><math>\pm 5\%</math> rdg. <math>\pm 0.2\%</math> f.s.</td> <td><math>\pm 5\%</math> rdg. <math>\pm 0.5\%</math> f.s.</td> <td><math>\pm 5\%</math> rdg. <math>\pm 1\%</math> f.s.</td> </tr> <tr> <td>20 kHz to 50 kHz</td> <td><math>\pm 20\%</math> rdg. <math>\pm 0.4\%</math> f.s.</td> <td><math>\pm 20\%</math> rdg. <math>\pm 0.5\%</math> f.s.</td> <td></td> </tr> <tr> <td>80 kHz</td> <td>-3 dB</td> <td>-3 dB</td> <td></td> </tr> </tbody> </table>  | Frequency   | Voltage                          | Current | Power | 40 Hz to 70 Hz | Defined by RMS value | Defined by RMS value | Defined by RMS value | 70 Hz to 360 Hz | $\pm 1\%$ rdg. $\pm 0.2\%$ f.s. | $\pm 1\%$ rdg. $\pm 0.5\%$ f.s. | $\pm 1\%$ rdg. $\pm 0.5\%$ f.s. | 360 Hz to 440 Hz | Defined by RMS value | Defined by RMS value | Defined by RMS value | 440 Hz to 5 kHz | $\pm 5\%$ rdg. $\pm 0.2\%$ f.s. | $\pm 5\%$ rdg. $\pm 0.5\%$ f.s. | $\pm 5\%$ rdg. $\pm 1\%$ f.s. | 5 kHz to 20 kHz | $\pm 5\%$ rdg. $\pm 0.2\%$ f.s. | $\pm 5\%$ rdg. $\pm 0.5\%$ f.s. | $\pm 5\%$ rdg. $\pm 1\%$ f.s. | 20 kHz to 50 kHz | $\pm 20\%$ rdg. $\pm 0.4\%$ f.s. | $\pm 20\%$ rdg. $\pm 0.5\%$ f.s. |  | 80 kHz | -3 dB | -3 dB |  | <table border="1"> <thead> <tr> <th>Frequency</th> <th>Voltage</th> <th>Current</th> <th>Power</th> </tr> </thead> <tbody> <tr> <td>40 Hz to 70 Hz</td> <td>Defined by RMS value</td> <td>Defined by RMS value</td> <td>Defined by active power</td> </tr> <tr> <td>70 Hz to 1 kHz</td> <td><math>\pm 3\%</math> rdg. <math>\pm 0.2\%</math> f.s.</td> <td><math>\pm 3\%</math> rdg. <math>\pm 0.2\%</math> f.s.</td> <td><math>\pm 3\%</math> rdg. <math>\pm 0.2\%</math> f.s.</td> </tr> <tr> <td>1 kHz to 10 kHz</td> <td><math>\pm 10\%</math> rdg. <math>\pm 0.2\%</math> f.s.</td> <td><math>\pm 10\%</math> rdg. <math>\pm 0.2\%</math> f.s.</td> <td><math>\pm 10\%</math> rdg. <math>\pm 0.2\%</math> f.s.</td> </tr> <tr> <td>40 kHz</td> <td>-3 dB</td> <td>-3 dB</td> <td></td> </tr> </tbody> </table> | Frequency | Voltage | Current | Power | 40 Hz to 70 Hz | Defined by RMS value | Defined by RMS value | Defined by active power | 70 Hz to 1 kHz | $\pm 3\%$ rdg. $\pm 0.2\%$ f.s. | $\pm 3\%$ rdg. $\pm 0.2\%$ f.s. | $\pm 3\%$ rdg. $\pm 0.2\%$ f.s. | 1 kHz to 10 kHz | $\pm 10\%$ rdg. $\pm 0.2\%$ f.s. | $\pm 10\%$ rdg. $\pm 0.2\%$ f.s. | $\pm 10\%$ rdg. $\pm 0.2\%$ f.s. | 40 kHz | -3 dB | -3 dB |  |
| Frequency  | Voltage  | Current   | Power                            |         |       |                |                      |                      |                      |                 |                                 |                                 |                                 |                  |                      |                      |                      |                 |                                 |                                 |                               |                 |                                 |                                 |                               |                  |                                  |                                  |  |        |       |       |  |   |           |         |         |       |                |                      |                      |                         |                |                                 |                                 |                                 |                 |                                  |                                  |                                  |        |       |       |  |
| 40 Hz to 70 Hz   | Defined by RMS value   | Defined by RMS value  | Defined by RMS value             |         |       |                |                      |                      |                      |                 |                                 |                                 |                                 |                  |                      |                      |                      |                 |                                 |                                 |                               |                 |                                 |                                 |                               |                  |                                  |                                  |  |        |       |       |  |   |           |         |         |       |                |                      |                      |                         |                |                                 |                                 |                                 |                 |                                  |                                  |                                  |        |       |       |  |
| 70 Hz to 360 Hz  | $\pm 1\%$ rdg. $\pm 0.2\%$ f.s.  | $\pm 1\%$ rdg. $\pm 0.5\%$ f.s.   | $\pm 1\%$ rdg. $\pm 0.5\%$ f.s.  |         |       |                |                      |                      |                      |                 |                                 |                                 |                                 |                  |                      |                      |                      |                 |                                 |                                 |                               |                 |                                 |                                 |                               |                  |                                  |                                  |  |        |       |       |  |   |           |         |         |       |                |                      |                      |                         |                |                                 |                                 |                                 |                 |                                  |                                  |                                  |        |       |       |  |
| 360 Hz to 440 Hz   | Defined by RMS value   | Defined by RMS value  | Defined by RMS value             |         |       |                |                      |                      |                      |                 |                                 |                                 |                                 |                  |                      |                      |                      |                 |                                 |                                 |                               |                 |                                 |                                 |                               |                  |                                  |                                  |  |        |       |       |  |   |           |         |         |       |                |                      |                      |                         |                |                                 |                                 |                                 |                 |                                  |                                  |                                  |        |       |       |  |
| 440 Hz to 5 kHz  | $\pm 5\%$ rdg. $\pm 0.2\%$ f.s.  | $\pm 5\%$ rdg. $\pm 0.5\%$ f.s.   | $\pm 5\%$ rdg. $\pm 1\%$ f.s.    |         |       |                |                      |                      |                      |                 |                                 |                                 |                                 |                  |                      |                      |                      |                 |                                 |                                 |                               |                 |                                 |                                 |                               |                  |                                  |                                  |  |        |       |       |  |   |           |         |         |       |                |                      |                      |                         |                |                                 |                                 |                                 |                 |                                  |                                  |                                  |        |       |       |  |
| 5 kHz to 20 kHz  | $\pm 5\%$ rdg. $\pm 0.2\%$ f.s.  | $\pm 5\%$ rdg. $\pm 0.5\%$ f.s.   | $\pm 5\%$ rdg. $\pm 1\%$ f.s.    |         |       |                |                      |                      |                      |                 |                                 |                                 |                                 |                  |                      |                      |                      |                 |                                 |                                 |                               |                 |                                 |                                 |                               |                  |                                  |                                  |  |        |       |       |  |   |           |         |         |       |                |                      |                      |                         |                |                                 |                                 |                                 |                 |                                  |                                  |                                  |        |       |       |  |
| 20 kHz to 50 kHz   | $\pm 20\%$ rdg. $\pm 0.4\%$ f.s.   | $\pm 20\%$ rdg. $\pm 0.5\%$ f.s.  |                                  |         |       |                |                      |                      |                      |                 |                                 |                                 |                                 |                  |                      |                      |                      |                 |                                 |                                 |                               |                 |                                 |                                 |                               |                  |                                  |                                  |  |        |       |       |  |   |           |         |         |       |                |                      |                      |                         |                |                                 |                                 |                                 |                 |                                  |                                  |                                  |        |       |       |  |
| 80 kHz   | -3 dB  | -3 dB   |                                  |         |       |                |                      |                      |                      |                 |                                 |                                 |                                 |                  |                      |                      |                      |                 |                                 |                                 |                               |                 |                                 |                                 |                               |                  |                                  |                                  |  |        |       |       |  |   |           |         |         |       |                |                      |                      |                         |                |                                 |                                 |                                 |                 |                                  |                                  |                                  |        |       |       |  |
| Frequency  | Voltage  | Current   | Power                            |         |       |                |                      |                      |                      |                 |                                 |                                 |                                 |                  |                      |                      |                      |                 |                                 |                                 |                               |                 |                                 |                                 |                               |                  |                                  |                                  |  |        |       |       |  |   |           |         |         |       |                |                      |                      |                         |                |                                 |                                 |                                 |                 |                                  |                                  |                                  |        |       |       |  |
| 40 Hz to 70 Hz   | Defined by RMS value   | Defined by RMS value  | Defined by active power          |         |       |                |                      |                      |                      |                 |                                 |                                 |                                 |                  |                      |                      |                      |                 |                                 |                                 |                               |                 |                                 |                                 |                               |                  |                                  |                                  |  |        |       |       |  |   |           |         |         |       |                |                      |                      |                         |                |                                 |                                 |                                 |                 |                                  |                                  |                                  |        |       |       |  |
| 70 Hz to 1 kHz   | $\pm 3\%$ rdg. $\pm 0.2\%$ f.s.  | $\pm 3\%$ rdg. $\pm 0.2\%$ f.s.   | $\pm 3\%$ rdg. $\pm 0.2\%$ f.s.  |         |       |                |                      |                      |                      |                 |                                 |                                 |                                 |                  |                      |                      |                      |                 |                                 |                                 |                               |                 |                                 |                                 |                               |                  |                                  |                                  |  |        |       |       |  |   |           |         |         |       |                |                      |                      |                         |                |                                 |                                 |                                 |                 |                                  |                                  |                                  |        |       |       |  |
| 1 kHz to 10 kHz  | $\pm 10\%$ rdg. $\pm 0.2\%$ f.s.   | $\pm 10\%$ rdg. $\pm 0.2\%$ f.s.  | $\pm 10\%$ rdg. $\pm 0.2\%$ f.s. |         |       |                |                      |                      |                      |                 |                                 |                                 |                                 |                  |                      |                      |                      |                 |                                 |                                 |                               |                 |                                 |                                 |                               |                  |                                  |                                  |  |        |       |       |  |   |           |         |         |       |                |                      |                      |                         |                |                                 |                                 |                                 |                 |                                  |                                  |                                  |        |       |       |  |
| 40 kHz   | -3 dB  | -3 dB   |                                  |         |       |                |                      |                      |                      |                 |                                 |                                 |                                 |                  |                      |                      |                      |                 |                                 |                                 |                               |                 |                                 |                                 |                               |                  |                                  |                                  |  |        |       |       |  |   |           |         |         |       |                |                      |                      |                         |                |                                 |                                 |                                 |                 |                                  |                                  |                                  |        |       |       |  |
| <b>Measurement settings</b>  |  |   |                                  |         |       |                |                      |                      |                      |                 |                                 |                                 |                                 |                  |                      |                      |                      |                 |                                 |                                 |                               |                 |                                 |                                 |                               |                  |                                  |                                  |  |        |       |       |  |   |           |         |         |       |                |                      |                      |                         |                |                                 |                                 |                                 |                 |                                  |                                  |                                  |        |       |       |  |
| Current sensor and current range   | See current sensor specifications.   |   |                                  |         |       |                |                      |                      |                      |                 |                                 |                                 |                                 |                  |                      |                      |                      |                 |                                 |                                 |                               |                 |                                 |                                 |                               |                  |                                  |                                  |  |        |       |       |  |   |           |         |         |       |                |                      |                      |                         |                |                                 |                                 |                                 |                 |                                  |                                  |                                  |        |       |       |  |
| Power range  | Determined automatically based on the current range being used.  |   |                                  |         |       |                |                      |                      |                      |                 |                                 |                                 |                                 |                  |                      |                      |                      |                 |                                 |                                 |                               |                 |                                 |                                 |                               |                  |                                  |                                  |  |        |       |       |  |   |           |         |         |       |                |                      |                      |                         |                |                                 |                                 |                                 |                 |                                  |                                  |                                  |        |       |       |  |
| VT ratio, CT ratio   | 0.01 to 9999.99  |   |                                  |         |       |                |                      |                      |                      |                 |                                 |                                 |                                 |                  |                      |                      |                      |                 |                                 |                                 |                               |                 |                                 |                                 |                               |                  |                                  |                                  |  |        |       |       |  |   |           |         |         |       |                |                      |                      |                         |                |                                 |                                 |                                 |                 |                                  |                                  |                                  |        |       |       |  |
| Nominal input voltage  | 50 V to 780 V in 1 V increments  | 50 V to 800 V in 1 V increments   |                                  |         |       |                |                      |                      |                      |                 |                                 |                                 |                                 |                  |                      |                      |                      |                 |                                 |                                 |                               |                 |                                 |                                 |                               |                  |                                  |                                  |  |        |       |       |  |   |           |         |         |       |                |                      |                      |                         |                |                                 |                                 |                                 |                 |                                  |                                  |                                  |        |       |       |  |
| Frequency  | 50 Hz / 60 Hz / 400 Hz   | 50 Hz / 60 Hz   |                                  |         |       |                |                      |                      |                      |                 |                                 |                                 |                                 |                  |                      |                      |                      |                 |                                 |                                 |                               |                 |                                 |                                 |                               |                  |                                  |                                  |  |        |       |       |  |   |           |         |         |       |                |                      |                      |                         |                |                                 |                                 |                                 |                 |                                  |                                  |                                  |        |       |       |  |
| Selection of calculation method  | Urms: Phase voltage / Line voltage<br>Power factor: PF / DPF<br>THD: THD-F / THD-R<br>Harmonics: All levels / All content percentages / Content percentages for U and P, levels for I  | Urms: Phase voltage / Line voltage<br>PF/Q/S: RMS value calculation / Fundamental wave calculation<br>THD: THD-F / THD-R<br>Harmonics: All levels / All content percentages / Content percentages for U and P, levels for I   |                                  |         |       |                |                      |                      |                      |                 |                                 |                                 |                                 |                  |                      |                      |                      |                 |                                 |                                 |                               |                 |                                 |                                 |                               |                  |                                  |                                  |  |        |       |       |  |   |           |         |         |       |                |                      |                      |                         |                |                                 |                                 |                                 |                 |                                  |                                  |                                  |        |       |       |  |
| Energy cost  | N/A  | Unit cost: 0.0000 to 99999.9 (per kWh) / Currency unit: 3 alphanumeric characters   |                                  |         |       |                |                      |                      |                      |                 |                                 |                                 |                                 |                  |                      |                      |                      |                 |                                 |                                 |                               |                 |                                 |                                 |                               |                  |                                  |                                  |  |        |       |       |  |   |           |         |         |       |                |                      |                      |                         |                |                                 |                                 |                                 |                 |                                  |                                  |                                  |        |       |       |  |
| Flicker  | P <sub>st</sub> , P <sub>lt</sub> / $\Delta V_{10}$  | P <sub>st</sub> , P <sub>lt</sub> / $\Delta V_{10}$ / Off   |                                  |         |       |                |                      |                      |                      |                 |                                 |                                 |                                 |                  |                      |                      |                      |                 |                                 |                                 |                               |                 |                                 |                                 |                               |                  |                                  |                                  |  |        |       |       |  |   |           |         |         |       |                |                      |                      |                         |                |                                 |                                 |                                 |                 |                                  |                                  |                                  |        |       |       |  |
| Filter   | Select P <sub>st</sub> or P <sub>lt</sub> for flicker.<br>230 V lamp / 120 V lamp  |   |                                  |         |       |                |                      |                      |                      |                 |                                 |                                 |                                 |                  |                      |                      |                      |                 |                                 |                                 |                               |                 |                                 |                                 |                               |                  |                                  |                                  |  |        |       |       |  |   |           |         |         |       |                |                      |                      |                         |                |                                 |                                 |                                 |                 |                                  |                                  |                                  |        |       |       |  |

| Recording settings                        | PQ3198  | PQ3100   |
|---|---|--|
| Recording interval                        | 1/3/15/30 sec., 1/5/10/15/30 min., 1/2 hr., 150 (50 Hz)/180 (60 Hz)/1200 (400 Hz) cycle   | 200/600 ms, 1/2/5/10/15/30 sec., 1/2/5/10/15/30 min., 1/2 hr., 150/180 cycle<br>*When set to 200/600 ms, harmonic data saving (except total harmonic distortion and K factor), event recording, and copy key operation during recording are not available.   |
| Saving of screenshots                     | Off/On<br>The display screen is saved as a BMP file for each recording interval. Min. interval: 5 min.  |  |
| Folder/file names                         | Not user-configurable / Set to either automatic or user-specified (5 single-byte characters).   |  |
| <b>Event specifications</b>               |   |  |
| Event detection method                    | The detection method for measured values for each event is noted in the measurement specifications.<br>External events: Events are detected by detecting a signal input to the EVENT IN terminal.<br>Manual events: Events are detected based on operation of the MANUAL EVENT key.   |  |
| Synchronized saving of events             | Event waveforms: A 200 ms instantaneous waveform is recorded when an event occurs.<br>Transient waveform: Instantaneous waveforms are recorded for 2 ms before the transient voltage waveform detection point and for 2 ms after the detection point.<br>Fluctuation data: RMS value fluctuation data is recorded every half-wave for the equivalent of 0.5 sec. before the event occurs and 29.5 sec. after the event occurs.<br>High-order harmonic waveform: A 40 ms instantaneous waveform is recorded when a high-order harmonic event occurs. | Event waveforms: A 200 ms instantaneous waveform is recorded when an event occurs.<br>Transient waveform: Instantaneous waveforms are recorded for 1 ms before the transient voltage waveform detection point and 2 ms after the detection point.<br>Fluctuation data: RMS value fluctuation data is recorded every half-wave for the equivalent of 0.5 sec. before the event occurs and 29.5 sec. after the event occurs. |
| <b>Event settings</b>                     |   |  |
| Event hysteresis                          | 0% to 100%  |  |
| Timer event count                         | Off, 1/5/10/30 min., 1/2 hr.<br>Events are generated at the selected interval.  | Off, 1/2/5/10/15/30 min., 1/2 hr.<br>Events are generated at the selected interval.  |
| Waveforms before events                   | 2 waves   | Off (0 sec.) / 200 ms / 1 sec.<br>The time for which to record instantaneous waveforms before events occur can be set.   |
| Waveforms after events                    | Successive events: Off/1/2/3/4/5<br>The set number of events is repeated each time an event occurs.   | Off (0 sec.)/200 ms/400 ms/1 sec./5 sec./10 sec.<br>The time for which to record instantaneous waveforms after events occur can be set.  |
| <b>Other functionality</b>                |   |  |
| Copying of screenshots                    | Copy using the COPY key; results are saved to the SD card. Data format: Compressed BMP  |  |
| Removal of SD card while recording data   | Not supported   | A message is displayed if the user pressed the F key on the FILE screen while recording with a recording interval of 2 sec. or greater; the SD card can be removed once message is reviewed.   |
| Automatic detection of current sensors    | When selected on the settings screen, connected sensors that support the HIOKI PL 14 connector are automatically detected.  |  |
| Processing in the event of a power outage | If the instrument is equipped with a BATTERY PACK Z1003 with a remaining charge, the instrument will switch automatically to battery power and continue recording. If no charged BATTERY PACK Z1003 is installed, measurement will stop (settings will be preserved), and the instrument will start recording again when power is restored. However, integrated values and other data will be reset.  |  |
| <b>Interfaces</b>                         |   |  |
| SD memory card                            | Compatible cards: Z4001, Z4003  |  |
| LAN                                       | Remote operation via an Internet browser<br>Manual downloading of data via the FTP server function  | Remote operation via an Internet browser<br>Manual downloading of data via the FTP server function<br>Automatic transmission of data via the FTP client function<br>Email notifications  |
| USB                                       | USB 2.0 (Full Speed, High Speed), Mass Storage Class  |  |
| RS-232C                                   | Synchronization of clock with GPS (when using GPS BOX PW9005)   | Acquisition of measurement and settings data via communications commands<br>LR8410 Link support  |
| External control                          | 4 screwless terminals<br>External event input, external start/stop, external event output (non-isolated), $\Delta V10$ alarm  | 4 screwless terminals<br>External event input, external event output (isolated), $\Delta V10$ alarm  |
| <b>General specifications</b>             |   |  |
| Operating location                        | Indoor use, Pollution Level 2, elevations of up to 3000 m (Measurement category is reduced to CAT III [600 V] at elevations in excess of 2000 m [6561.68 ft].)  | Indoor use, Pollution Level 2, elevations of up to 3000 m (Measurement category is reduced to CAT II [1000 V] or CAT III [600 V] at elevations in excess of 2000 m [6561.68 ft].)  |
| Operating temperature and humidity range  | 0°C to 30°C, 95% RH or less (non-condensing)<br>30°C to 50°C, 80% RH or less (non-condensing)   | -20°C to 50°C, 80% RH or less (non-condensing)   |
| Storage temperature and humidity range    | 10°C greater than operating temperature and humidity range  |  |
| Dustproofness and waterproofness          | IP30 (EN 60529)   |  |
| Standard compliance                       | Safety: EN 61010 EMC: EN 61326 Class A  |  |
| Standard compliance                       | Harmonics: IEC 61000-4-7, IEC 61000-2-4 Class 3<br>Power quality: IEC 61000-4-30, EN 50160, IEEE 1159<br>Flicker: IEC 61000-4-15  |  |
| Power supply                              | AC ADAPTER Z1002 100 V to 240 V AC, 50 Hz/60 Hz; anticipated transient overvoltage: 2500 V; maximum rated power: 80 VA (including AC adapter)<br>BATTERY PACK Z1003 Charging time: Max. 5 hr. 30 min.<br>Continuous battery operating time: About 3 hr.   | Continuous battery operating time: About 8 hr.   |
| Internal memory                           | N/A   | 4 MB   |
| Maximum recording time                    | 1 year  |  |
| Maximum number of recordable events       | 9999  |  |
| Time functions                            | Auto-calendar, automatic leap year detection, 24-hour clock   |  |
| Real time accuracy                        | Within $\pm 0.3$ sec./day (with instrument powered on at 23°C $\pm 5^\circ\text{C}$ )   | Within $\pm 0.5$ sec./day (with instrument powered on and within operating temperature range)  |
| Display                                   | 6.5-inch TFT color LCD  |  |
| Display languages                         | English / Japanese / Chinese (simplified and traditional) / Korean / German / French / Italian / Spanish / Turkish / Polish   |  |
| External dimensions                       | 300 mm (11.81 in.) (W) $\times$ 211 mm (8.31 in.) (H) $\times$ 68 mm (2.68 in.) (D) (not including protruding parts)  |  |
| Weight                                    | 2.6 kg (91.7 oz) (including BATTERY PACK Z1003)   | 2.5 kg (88.2 oz) (including BATTERY PACK Z1003)  |

# Options

[\*1] PQ3198 only. [\*2] PQ3100 only.

| Model  | AC CURRENT SENSOR<br>CT7126  | AC CURRENT SENSOR<br>CT7131   | AC CURRENT SENSOR<br>CT7136   |
|--|--|---|---|
| Appearance   |   |    |    |
| Rated measured current   | 60 A AC  | 100 A AC  | 600 A AC  |
| Measurable wire diameter   | 15 mm (0.59 in.) or less   |   |   |
| Current range and combined amplitude accuracy (45 to 66 Hz)<br>*Accuracy guaranteed up to 120% of range. | Current range Combined accuracy<br>50.000 A 0.4% rdg. + 0.112% f.s.<br>5.0000 A 0.4% rdg. + 0.22% f.s.<br>500.00 mA 0.4% rdg. + 1.3% f.s. [*2] | Current range Combined accuracy<br>100.00 A 0.4% rdg. + 0.12% f.s.<br>50.000 A 0.4% rdg. + 0.14% f.s.<br>5.0000 A 0.4% rdg. + 0.50% f.s. [*2] | Current range Combined accuracy<br>500.00 A 0.4% rdg. + 0.112% f.s.<br>50.000 A 0.4% rdg. + 0.22% f.s.<br>5.0000 A 0.4% rdg. + 1.3% f.s. [*2] |
| Phase accuracy (45 to 66 Hz)   | Within $\pm 2^\circ$   | Within $\pm 1^\circ$  | Within $\pm 0.5^\circ$  |
| Maximum allowable input (45 to 66 Hz)  | 60 A continuous  | 130 A continuous  | 600 A continuous  |
| Maximum rated terminal-to-ground voltage   | CAT III (300 V)  |   | CAT III (1000 V), CAT IV (600 V)  |
| Frequency band   | Accuracy defined up to 20 kHz  |   |   |
| Dimensions / weight / cord length  | 46 mm (1.81 in.) (W) $\times$ 135 mm (5.31 in.) (H) $\times$ 21 mm (0.83 in.) (D) / 190 g / 2.5 m (8.20 ft.)                                   |   | 78 mm (3.07 in.) (W) $\times$ 152 mm (5.98 in.) (H) $\times$ 42 mm (1.65 in.) (D) / 350 g / 2.5 m (8.20 ft.)                                  |

| Model  | AC FLEXIBLE CURRENT SENSOR<br>CT7044  | AC FLEXIBLE CURRENT SENSOR<br>CT7045  | AC FLEXIBLE CURRENT SENSOR<br>CT7046  |
|--|---|---|---|
| Appearance   |  |  |  |
| Rated measured current   | 6000 A AC   |   |   |
| Measurable wire diameter   | 100 mm (3.94 in.) or less   | 180 mm (7.09 in.) or less   | 254 mm (10.00 in.) or less  |
| Current range and combined amplitude accuracy (45 to 66 Hz)<br>*Accuracy guaranteed up to 120% of range. | Current range<br>5000.0 A/500.00 A<br>50.000 A                                    | Combined amplitude accuracy<br>1.6% rdg. + 0.4% f.s.<br>1.6% rdg. + 3.1% f.s.     |   |
| Phase accuracy (45 to 66 Hz)   | Within $\pm 1.0^\circ$  |   |   |
| Maximum allowable input (45 to 66 Hz)  | 10,000 A continuous   |   |   |
| Maximum rated terminal-to-ground voltage   | 1000 V AC (CAT III), 600 V AC (CAT IV)  |   |   |
| Frequency band   | 10 Hz to 50 kHz (within $\pm 3$ dB)   |   |   |
| Dimensions / cord length   | Flexible loop cross-sectional diameter: 7.4 mm (0.29 in.) / 2.5 m (8.20 ft.)      |   |   |
| Weight   | 160 g   | 180 g   | 190 g   |

| Model  | AC/DC AUTO-ZERO CURRENT SENSOR<br>CT7731   | AC/DC AUTO-ZERO CURRENT SENSOR<br>CT7736   | AC/DC AUTO-ZERO CURRENT SENSOR<br>CT7742  |
|--|--|--|---|
| Appearance   |                           |                           |    |
| Rated measured current   | 100 A AC/DC  | 600 A AC/DC  | 2000 A AC/DC  |
| Measurable wire diameter   | 33 mm (1.30 in.) or less   |  | 55 mm (2.17 in.) or less  |
| Current range and combined amplitude accuracy<br>*Accuracy guaranteed up to 120% of range. | DC   | Current range Combined accuracy<br>500.00 A 2.5% rdg. + 1.1% f.s.<br>50.000 A 2.5% rdg. + 6.5% f.s.          | Current range Combined accuracy<br>5000.0 A 2.0% rdg. + 0.7% f.s. [*1]<br>2000.0 A 2.0% rdg. + 1.75% f.s. [*2]<br>1000.0 A 2.0% rdg. + 1.5% f.s. [*2]<br>500.00 A 2.0% rdg. + 2.5% f.s. |
|  | 45 to 66 Hz  | 100.00 A 1.1% rdg. + 0.6% f.s.<br>50.000 A 1.1% rdg. + 1.1% f.s. [*1]<br>10.000 A 1.1% rdg. + 5.1% f.s. [*2] | 500.00 A 2.1% rdg. + 0.7% f.s.<br>50.000 A 2.1% rdg. + 6.1% f.s.  |
| Phase accuracy (45 to 66 Hz)   | Within $\pm 1.8^\circ$   |  | Within $\pm 2.3^\circ$  |
| Offset drift   | Within $\pm 0.5\%$ f.s.  | Within $\pm 0.1\%$ f.s.  | Within $\pm 0.1\%$ f.s.   |
| Maximum allowable input (45 to 66 Hz)  | 100 A continuous   | 600 A continuous   | 2000 A continuous   |
| Maximum rated terminal-to-ground voltage   | 600 V AC/DC (CAT IV)   | 1000 V AC/DC (CAT III), 600 V AC/DC (CAT IV)   |   |
| Frequency band   | DC to 5 kHz ( $-3$ dB)   |  |   |
| Dimensions / weight / cord length  | 58 mm (2.28 in.) (W) $\times$ 132 mm (5.20 in.) (H) $\times$ 18 mm (0.51 in.) (D) / 250 g / 2.5 m (8.20 ft.) | 64 mm (2.52 in.) (W) $\times$ 160 mm (6.30 in.) (H) $\times$ 34 mm (1.34 in.) (D) / 320 g / 2.5 m (8.20 ft.) | 64 mm (2.52 in.) (W) $\times$ 195 mm (7.68 in.) (H) $\times$ 34 mm (1.34 in.) (D) / 510 g / 2.5 m (8.20 ft.)  |

| Model   | AC LEAK CURRENT SENSOR CT7116  |                        |
|---|--|------------------------|
| Appearance  | Designed specifically for leak current measurement   |                        |
| Rated measured current                                      | 6 A AC   |                        |
| Measurable conductor diameter                               | 40 mm or less (insulated conductor)  |                        |
| Current range and combined amplitude accuracy (45 to 66 Hz) | Current range  | Combined accuracy      |
|   | 5.0000 A   | 1.1% rdg. + 0.16% f.s. |
|   | 500.00 mA  | 1.1% rdg. + 0.7% f.s.  |
| 50.000 mA   | 1.1% rdg. + 6.1% f.s. [*2]   |                        |
| Phase accuracy (45 to 66 Hz)                                | Within ±3°   |                        |
| Frequency band  | 40 Hz to 5 kHz (±3.0% rdg. ±0.1% f.s.)   |                        |
| Residual current characteristics                            | 5 mA or less (for a pair of round-trip wires carrying 100 A)   |                        |
| External magnetic field effects                             | 5 mA equivalent, max. 7.5 mA (400 A/m, 50/60 Hz)   |                        |
| Dimensions / weight / cord length                           | 74 mm (2.91 in.) (W) × 145 mm (5.71 in.) (H) × 42 mm (1.65 in.) (D) / 340 g / 2.5 m (8.20 ft.)   |                        |

### Option for connecting legacy current sensor models



**CONVERSION CABLE L9910**  
Output connector conversion: BNC → PL 14  
Use by connecting to one of the following legacy sensor models:

CLAMP ON SENSOR 9694/9660/9661/9669  
AC FLEXIBLE CURRENT SENSOR CT9667-01/CT9667-02/CT9667-03  
\*Conversion cable does not supply power to the sensor.  
CLAMP ON LEAK SENSOR 9657-10/9675

### Current sensor options



**EXTENSION CABLE L0220-01**  
2 m (6.56 ft.)  
**EXTENSION CABLE L0220-02**  
5 m (16.50 ft.)  
**EXTENSION CABLE L0220-03**  
10 m (32.81 ft.)

### Voltage measurement options

HIOKI provides quotations for voltage cord extensions, terminal connector conversions, and other options on a case-by-case basis. Please contact your HIOKI distributor for details.



**MAGNETIC ADAPTER 9804-01**  
Alternative tip for the L1000 series voltage cords, red ×1, φ11 mm (0.43 in)

**MAGNETIC ADAPTER 9804-02**  
Alternative tip for the L1000 series voltage cords, black ×1, φ11 mm (0.43 in)



**GRABBER CLIP L9243**  
Alternative tips for the L1000 series voltage cords



**OUTLET TEST LEAD L1020**  
For Japan (3-prong, P/N/E), 2 m (6.56 ft) length,  
\*Please contact HIOKI for cords for use in countries other than Japan.

### Magnetic straps



**MAGNETIC STRAP Z5004**

**MAGNETIC STRAP Z5020**  
Extra strength

### PQ3198 options



**WIRING ADAPTER PW9000**  
When three-phase 3-wire connection, the voltage cord to be connected can be reduced from 6 to 3



**WIRING ADAPTER PW9001**  
When three-phase 4-wire connection, the voltage cord to be connected can be reduced from 6 to 4



**PATCH CORD L1021-01**  
Banana branch-banana, Red: 1, 0.5 m (1.64 ft) length, for branching from the L9438s or L1000s, CAT IV 600 V, CAT III 1000 V



**PATCH CORD L1021-02**  
Banana branch-banana, Black: 1, 0.5 m (1.64 ft) length, for branching from the L9438s or L1000s, CAT IV 600 V, CAT III 1000 V



**GPS BOX PW9005**  
To synchronize the PQ3198 / PW3198 clock to UTC

### Interfaces



**SD MEMORY CARD Z4001**  
2GB Z4001  
2 GB capacity



**SD MEMORY CARD Z4003**  
8GB Z4003  
8 GB capacity



**RS-232C CABLE 9637**  
9 pin - 9 pin, cross,  
1.8 m (5.91 ft) length



**LAN CABLE 9642**  
Straight Ethernet cable, supplied with straight to cross conversion adapter, 5 m (16.41 ft) length

### About SD memory cards

Be sure to use genuine HIOKI SD memory cards with HIOKI instruments. Use of other SD memory cards may prevent data from being properly saved or loaded as proper operation is not guaranteed.

### Carrying cases and waterproof boxes



**CARRYING CASE C1009**  
Bag type, Includes compartment for options



**CARRYING CASE C1001**  
Soft type, Includes compartment for options



**CARRYING CASE C1002**  
Hard trunk type, Includes compartment for options



**Waterproof box**  
For outdoor installation, IP65

### Standard accessories (also available for separate purchase)



**Comes with the PQ3198**  
**VOLTAGE CORD L1000**  
Red/ Yellow/ Blue/ Gray each 1,  
Black 4, 3m (9.84ft) length,  
Alligator clip ×8



**AC ADAPTER Z1002**  
For main unit, 100 to 240 V AC



**Comes with the PQ3100**  
**VOLTAGE CORD L1000-05**  
Red/ Yellow/ Blue/ Gray/ Black each 1, 3 m (9.84 ft) length,  
Alligator clip ×5



**BATTERY PACK Z1003**  
NiMH, Charges while installed in the main unit

# Models

| Product name       |   | POWER QUALITY ANALYZER PQ3198   |  |  |
|--------------------|---|---|--|--|
| Model (order code) | PQ3198  | PQ3198-92   | PQ3198-94  |  |
| Bundle contents    |  | <b>POWER QUALITY ANALYZER PQ3198</b><br>VOLTAGE CORD L1000    Color clips    Measurement guide<br>AC ADAPTER Z1002    Spiral tubes    PQ ONE (software CD)<br>BATTERY PACK Z1003    Strap    SD MEMORY CARD Z4001<br>USB cable    User manual |  |  |
|                    | —   | <br>AC CURRENT SENSOR<br>CT7136 (x4)   | <br>AC FLEXIBLE CURRENT SENSOR<br>CT7045 (x4) |  |
|                    | —   | <br>CARRYING CASE C1009<br>PATCH CORD L1021-02 (x3)  |  |  |

| Product name       |   | POWER QUALITY ANALYZER PQ3100   |  |  |  |
|--------------------|---|---|--|--|--|
| Model (order code) | PQ3100  | PQ3100-91   | PQ3100-92  | PQ3100-94  |  |
| Bundle contents    |  | <b>POWER QUALITY ANALYZER PQ3100</b><br>VOLTAGE CORD L1000-05    Color clips    Measurement guide<br>AC ADAPTER Z1002    Spiral tubes    PQ ONE (software CD)<br>BATTERY PACK Z1003    Strap    User manual<br>USB cable    User manual |  |  |  |
|                    | —   | <br>AC CURRENT SENSOR<br>CT7136 (x2)   | <br>AC CURRENT SENSOR<br>CT7136 (x4) | <br>AC FLEXIBLE CURRENT SENSOR<br>CT7045 (x4) |  |
|                    | —   | <br>CARRYING CASE C1009<br>SD MEMORY CARD Z4001  |  |  |  |

**Related products**



**No-metal-contact voltage sensor**

Check power quality with a no-metal-contact logger

**CLAMP ON POWER LOGGER PW3365-20**

- Record maximum, minimum, average, and energy values by time interval for parameters including voltage, current, power, frequency, and harmonics.

For details 



**New, more easily clampable design**

Clamp meters designed for exceptional ease of use

**CLAMP METER CM4375-50, CM4141-50**

- Ascertain transient current when power equipment starts up.
- Simultaneously measure RMS values and maximum crest values for inrush current.

For details 

*Note: Company names and product names appearing in this catalog are trademarks or registered trademarks of various companies.*

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