High Accuracy Power Analysis. Anywhere, Anytime.
High Accuracy and Mobility. A New Value for Power Analysis.

The first-generation Power Analyzer 3390 debuted in 2009 with a collection of the latest measurement technologies packed into a compact design.

Pair with Hioki current sensors and take them anywhere to immediately make highly accurate measurements.

This was the unique value of the 3390.

Now, Hioki has enhanced this value while refining the measurement technology even further.

Proper accuracy and bandwidth to precisely measure inverter output.
Phase shift function for the exact measurement of high frequency, low power factor power.
A broad current sensor lineup that expands the range of measurement possibilities.

Refinements that empower you to conduct precise power analysis in any situation.
Complete Pursuit of Measurement Accuracy and High Frequency Characteristics

The PW3390 delivers 4 input channels and ±0.04% basic accuracy for power - the top instrument in its class. Achieve more precise measurements of the power and efficiency of high efficiency equipment used in power electronics. Further, a 200 kHz measurement band and flat amplitude and phase characteristics up to high frequencies enable the precise measurement of power at top frequency levels and low power factor.

![Example of Active Power Frequency Characteristics (150 V - 50 A Range)](image)

Power Analysis Engine That Achieves High-Speed Simultaneous Calculation on 5 Systems

Precisely capture input waveforms with 600 kS/s high-speed sampling and a high resolution 16-bit A/D converter. The power analysis engine performs independent digital processing for 5 systems: period detection, wideband power analysis, harmonic analysis, waveform analysis, and noise analysis. High-speed simultaneous calculation processing enables both precise measurements and a 50 ms data refresh rate.


**High Accuracy Pass-Through Sensor**

Pass-through sensors deliver accuracy, broad-band performance, and stability. Measure currents of up to 1000 A with a high degree of accuracy across a broad range of operating temperatures.

**High Accuracy Clamp Sensor**

Clamp for quick and easy connections. Conduct extremely accurate measurements of large currents to a maximum of 1000 A over a wide operating temperature range.

**High Accuracy Direct Wiring Sensor**

Newly developed DCCT method delivers expansive measurement range and superior measurement accuracy at a rating of 50 A.

Built-in Current Sensor Phase Shift Function

Equipped with new virtual oversampling technology. Achieve phase shift equivalent to 200 MS/s while maintaining a high speed of 500 kS/s, as well as a high resolution of 16 bits. Set and correct the phase error of the current sensor at a resolution of 0.01°. Use of the phase shift function results in a dramatic reduction of measurement error. This allows the measurement of high-frequency, low-power factor power included in the switching frequency of inverter output, which is difficult to measure with conventional equipment.

![Example of Phase Characteristic Compensation with AC/DC CURRENT SENSOR CT6402-05 (Typical Values)](image)
In the Laboratory or in the Field

**Take Highly Accurate Measurements Even in Tough Temperature Conditions**
Severe temperature environments, such as engine rooms with intense temperature changes and constant temperature rooms, can hinder high accuracy measurements. The extremely accurate pass-through and clamp type sensors both feature excellent temperature characteristics and a wide operation temperature range to help address these challenges.

**Max. 6000 A Measurement on 50 Hz/60 Hz Lines**
The CT7040 AC FLEXIBLE CURRENT SENSOR series can measure commercial power lines up to 6000 A, including solar power conditioner output. Even thick cables can be wired easily among crowded wiring or in narrow locations.

**Achieve High Accuracy Measurement Even in the Field**
Dramatically compact and light-weight form factor achieved by concentrating the calculation functions in the power analysis engine. Highly accurate measurements normally achieved in the laboratory are now also possible in the field.

**External Power Supply Not Needed for Sensor Connections**
Power can be supplied to the current sensor from the main unit, so there is no need to provide a separate external power supply for the current sensor. Connected sensors are recognized automatically, for reliable and quick measurements.

**Wiring Displays and Quick Setup Lets You Begin Measuring Immediately**
Perform wiring while checking wiring diagrams and vectors on the screen. Optimum settings are performed automatically simply by selecting a connection and using the quick setup function.

**Acquire Data from up to 8 Synchronized Units (32 Channels)**
When you connect CONNECTION CABLE 9683 to multiple PW3390 units, the control signals and internal clocks synchronize. From the master unit, you can control the measurement timing on the PW3390 units that are set as slaves. With interval measurement, you can save synchronized measurement data to a CF card or a PC to achieve simultaneous measurements across a larger number of systems.

**Extensive Interface for Linking with External Devices**
Wide variety of built-in interfaces, including LAN, USB (communication, memory), CF cards, RS-232C, synchronization control, and external control. D/A output* delivers analog output at 50 ms for up to 16 parameters. The voltage and current waveform** for each channel can also be output.

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* Built-in for PW3390-02 and PW3390-03
** During waveform output, accurate reproduction is possible at an output of 500 kS/s and with a sine wave up to 20 kHz.
Switch Screens with a Single Touch, Accessing a Variety of Power Analysis Methods

The power analysis engine allows the simultaneous, parallel calculation of all parameters. Access a variety of analysis methods simply by pressing the page keys to switch screens.

Vector

Confirm the voltage/current/power/phase angle for each harmonic order on a vector graph and as numerical values.

Waveform

Display voltage/current waveforms for 4 channels at a high speed of 500 kS/s or a maximum length of 5 seconds. Waveform data can be saved.

Harmonics Graph

Display harmonics up to the 100th order for voltage/current/power in bar graphs. Confirm the numerical data for the selected order at the same time.

Efficiency and Loss

Using active power values and motor power values, confirm efficiency $\eta$ [%] and loss [W] and total efficiency for each inverter/motor on a single unit at the same time.

Selection Display

Select 4/8/16/32 display parameters individually for each screen, and summarize them on a single screen.

Noise

Display FFT results for voltage and current as graphs and numerical values, up to a maximum of 200 kHz. This is perfect for the frequency analysis of inverter noise.

Trend

Choose up to eight measurement parameters and display a graph of their variations over time. You can also save a screenshot of the graph.

X-Y Graph

Create inverter characteristic evaluations and motor torque maps. Select the desired parameter to display an X-Y plot graph.
Applications

Measure the Power Conversion Efficiency of Inverters

Key features
1. Isolated input of voltage and current on each of 4 channels for simultaneous measurement of the primary and secondary power of inverters.
2. Simultaneous measurement of all important parameters for secondary analysis of inverters, such as RMS value, MEAN value, and fundamental components.
3. Easy wiring with current sensors. Reliable confirmation of wiring with vector diagrams.
4. Current sensors reduce effects of common mode noise from inverters during power measurement.
5. Simultaneous measurement of noise components, in addition to the harmonic analysis required for the measurement of inverter control.

Highly Accurate and Fast 50 ms Calculation of Power in Transient State
Measure power transient states, including motor operations such as starting and accelerating, at 50 ms refresh rates. Automatically measure and keep up with power with fluctuating frequencies, from a minimum of 0.5 Hz.

Combined Accuracy of Current Sensors Applicable throughout Entire Range
Combined accuracy throughout the entire range is provided through the use of a built-to-order high accuracy pass-through type current sensor. Obtain highly accurate measurements regardless of range, from large to minute currents, even for loads that fluctuate greatly.

Evaluate high-frequency noise from an inverter
The enhanced noise analysis functionality provided by Version 2.00 of the instrument’s firmware lets you perform frequency analysis of noise components from DC to 200 kHz, display and automatically save the top 10 points, and manually save the FFT spectrum. This functionality is an effective tool for evaluating conductive noise from 2 kHz to 150 kHz generated by inverters and switching power supplies.

Visually assess temporal fluctuations in efficiency
The trend display lets you graph user-selected measurement parameters such as efficiency and frequency over periods of time ranging from dozens of seconds to half a month. This capability makes it possible to visually assess fluctuations, including of transient states in which measured values fluctuate abruptly and steady states in which they exhibit minuscule fluctuations. Graphs can be saved as screenshots, and values can be automatically saved.
Analyze and Measure EV/HEV Inverter Motors

Key features
1. Easy wiring and highly accurate measurements with the use of a pass-through type current sensor
2. Simultaneous measurement of all important parameters for secondary analysis of inverters, such as RMS value, MEAN value, and fundamental components
3. 0.5 Hz to 5 kHz harmonic analysis without external clock
4. Total measurement of inverter motors with built-in motor analysis function
5. Measurement of the voltage, torque, rotation rate, frequency, slip, and motor power required for motor analysis with a single unit
6. More precise measurements of electrical angle with incremental type encoders

Electric Angle Measurement of Motors (PW3390-03 only)

The PW3390-03 features a built-in electric angle measurement function required for vector control via dq coordinate systems in high-efficiency synchronized motors. Make real-time measurements of phase angles for voltage and current fundamental wave components based on encoder pulses. Further, zero-adjustment of the phase angle when induced voltage occurs allows electric angle measurement based on the inductive voltage phase. Version 2.00 of the firmware introduces the ability to display and manually set phase zero-adjustment values, making it possible to measure electrical angle using a user-selected zero-adjustment value. Electric angle can also be used as an Ld and Lq calculation parameter for synchronized motors.

Evaluate inverter motor efficiency and loss
Evaluate efficiency and loss for an inverter, motor, and overall system by simultaneously measuring the inverter’s input and output power and the motor’s output. You can also create an efficiency map or loss map in MATLAB using measurement results recorded by the PW3390 at each operating point.*MATLAB is a registered trademark of Mathworks, Inc.

Transfer to Data Logger via Bluetooth® wireless technology
Connect the PW3390 and a data logger (with support of LR8410 Link) via Bluetooth® wireless technology to wirelessly transmit 8 parameters of measurement values from the PW3390 to the data logger. In addition to the voltage, temperature, humidity, and other parameters measured by the multichannel data logger, you can also integrate the measurement values of the PW3390 and observe and record them in real time.

* Connection requires the serial - (Bluetooth® wireless technology) conversion adapter and power supply adapter recommended by Hioki. Please inquire with your Hioki distributor.
Measure the Efficiency of PV Power Conditioners (PCS)

Introducing a lineup of sensors taking measurements up to 6000 A for 50 Hz/60 Hz, and up to 2000 A for direct current. The CT9557 SENSOR UNIT lets you add the output waveforms from multiple high accuracy sensors. Use multi-cable wiring lines to take highly accurate measurements of up to 4000 A.

<table>
<thead>
<tr>
<th>Recommended current sensor by measurement target</th>
<th>DC power</th>
<th>System power 50 Hz/60 Hz</th>
<th>Inverter secondary power</th>
</tr>
</thead>
<tbody>
<tr>
<td>1000 A or less</td>
<td>CT6865-05 or CT6846-05</td>
<td>CT7742</td>
<td>CT7642</td>
</tr>
<tr>
<td>2000 A or less</td>
<td>1-cable wiring</td>
<td>CT9557 + CT6865-05 x 2</td>
<td>CT7742 + CT7642</td>
</tr>
<tr>
<td>4000 A or less</td>
<td>Less than 1-cable wiring</td>
<td>-</td>
<td>CT7044/CT7045/CT7046</td>
</tr>
<tr>
<td>6000 A or less</td>
<td>4-cable wiring</td>
<td>CT9557 + CT6865-05 x 4</td>
<td>-</td>
</tr>
</tbody>
</table>

Support for PCS Parameters

Simultaneously display the parameters required for PCS, such as efficiency, loss, DC ripple factor, and 3-phase unbalance rate. Easily check the required measured items for improved test efficiency. By matching the measurement synchronization source for both input and output, you can perform DC power measurements that are synchronized with the output AC as well as stable efficiency measurements.

Key features

1. 4 built-in channels, standard. Simultaneously measure the I/O characteristics of power conditioners.
2. Current sensors can measure even large currents with high accuracy. Reliable confirmation of wiring with vector diagrams.
3. Measure the amount of power sold/purchased from power conditioner output on interconnected systems with a single unit.
4. DC mode integration function, which responds quickly to input fluctuations such as with solar power, built in.
5. Measure ripple factor, efficiency, loss, and all other parameters that are required for the measurement of power conditioners for solar power with a single unit.

±0.01 Hz’ Basic Accuracy for Voltage Frequency Measurements

Perform the frequency measurements that are required for various PCS tests with industry-leading accuracy and stability. Take highly accurate frequency measurements on up to 4 channels simultaneously, while also measuring other parameters at the same time.

* If you require even higher accuracy for frequency, please inquire with your local Hioki distributor.
**Test Automobile Fuel Economy**

Taking fuel economy measurements that comply with WLTP international standards requires the precise measurement of current integration and power integration for the recharging/discharging of each battery in the system. High accuracy clamp current sensors, the excellent DC accuracy of the PW3390, and the ability to integrate current and power at 50 ms intervals are extremely effective in meeting this application.

Easily connect high accuracy clamp-type sensors without cutting the cables. Sensors operate over a temperature range of -40°C to 85°C (-40°F to 185°F), characteristics that enable highly accurate measurements even inside the engine room of a car.

**Evaluate WLTC Mode Performance - A New Fuel Economy Standard**

Taking fuel economy measurements that comply with WLTP international standards requires the precise measurement of current integration and power integration for the recharging/discharging of each battery in the system. High accuracy clamp current sensors, the excellent DC accuracy of the PW3390, and the ability to integrate current and power at 50 ms intervals are extremely effective in meeting this application.

**Optimal Current Sensors for Automotive Testing**

Easily connect high accuracy clamp-type sensors without cutting the cables. Sensors operate over a temperature range of -40°C to 85°C (-40°F to 185°F), characteristics that enable highly accurate measurements even inside the engine room of a car.

**Current and Power Integration Function by Polarity**

DC integration measurement integrates the recharging power and discharging power by polarity for every sample at 500 kS/s, and measures positive-direction power magnitude, negative-direction power magnitude, and the sum of positive- and negative-direction power magnitude during the integration period. Accurate measurement of recharging power and discharging power is possible even if there is rapid repetition of battery recharging/discharging.

**Link to Peripheral Devices via External Control**

Use external control terminals to START/STOP integration and capture screen shots. This makes it easy to control operations from console switches and link to the timing of other instruments when measuring the performance of an actual automobile.
Download software, drive rs, and the Communications Command Instruction Manual from the Hioki website. [https://www.hioki.com](https://www.hioki.com)

"PW Communicator" PC Communication Software
PW Communicator is an application program for communicating between a PW3390 series power analyzer and a PC. Use the program to quickly and easily control the PW3390 and collect measurement data on a PC.

**Numerical value monitoring**
Display the PW3390’s measurement values on the PC screen. You can freely select up to 32 values, such as voltage, current, power, and harmonics.

**Waveform monitoring**
Monitor the measured voltage, current, and waveforms on the PC screen. Waveform data can be saved as an image or CSV file.

**Meter setting**
Change the settings of the connected PW3390 from the PC screen.

**Measure with multiple units**
In addition to the PW3390, it is also possible to perform batch control of up to 8 devices from the HIOKI PW6001 Power Analyzer and the PW3335, PW3336, and PW3337 Power Meter series. You can also simultaneously record measured data to the PC, and perform efficiency calculations for measuring instruments. SIN, SUM, and other arithmetic operations can be used to perform complex calculations.

**Record in CSV format**
Record measured data to a CSV file at regular time intervals. The minimum recording interval is 50 ms.

**Download files**
Download files from the PW3390’s media (CF card or USB memory stick) to a PC.

**Supported operating systems**
Windows 10/Windows 8/Windows 7 (32-bit/64-bit)  *Windows is a registered trademark of Microsoft in the U.S.*

**LabVIEW driver**
Use the bundled LabVIEW driver to build a measurement system via a simple programming interface that lets you place icons on a window and connect them with lines. Multiple sample programs for configuring settings and downloading data are available, so you can get started right away.

**Remote control using a web browser**
Use the PW3390’s HTTP server function to connect to a computer via a LAN interface. You can configure settings or check data from a remote location using a virtual control panel that is displayed in the browser window.

*LabVIEW is a registered trademark of National Instruments.*
### Specifications

#### 1. Power Measurement Input Specifications

<table>
<thead>
<tr>
<th>Measurement line type</th>
<th>Single-phase 2-wire (1P2W), Single-phase 3-wire (1P3W), 3-phase 3-wire (3P3W), 3-phase 4-wire (3P4W)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CH1</td>
<td>1P2W</td>
</tr>
<tr>
<td>CH2</td>
<td>1P2W</td>
</tr>
<tr>
<td>CH3</td>
<td>1P2W</td>
</tr>
<tr>
<td>CH4</td>
<td>1P2W</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Pattern</th>
<th>CH1</th>
<th>CH2</th>
<th>CH3</th>
<th>CH4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pattern 1</td>
<td>1P2W</td>
<td>1P2W</td>
<td>1P2W</td>
<td>1P2W</td>
</tr>
<tr>
<td>Pattern 2</td>
<td>1P2W</td>
<td>1P2W</td>
<td>1P2W</td>
<td>1P2W</td>
</tr>
<tr>
<td>Pattern 3</td>
<td>3P3W</td>
<td>1P2W</td>
<td>1P2W</td>
<td>1P2W</td>
</tr>
<tr>
<td>Pattern 4</td>
<td>1P2W</td>
<td>1P2W</td>
<td>1P2W</td>
<td>1P2W</td>
</tr>
<tr>
<td>Pattern 5</td>
<td>3P3W</td>
<td>1P2W</td>
<td>1P2W</td>
<td>1P2W</td>
</tr>
<tr>
<td>Pattern 6</td>
<td>3P3W</td>
<td>1P2W</td>
<td>1P2W</td>
<td>1P2W</td>
</tr>
</tbody>
</table>

#### Input channels

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

#### Measurement input terminal type

- Voltage: Push-in type (safety factor)
- Current: Dedicated custom connectors (ME11W9)

#### Voltage range

- 15 V to 100 V (Select for each measurement system. AUTO range available.)

#### Current range

- 2 A/2 A A/2 A A/2 A
- 4 A/2 A A/2 A A/2 A A/2 A
- 6 A/2 A A/2 A A/2 A A/2 A A/2 A
- 10 A/2 A A/2 A A/2 A A/2 A
- 20 A/2 A A/2 A A/2 A A/2 A A/2 A A/2 A
- 40 A/2 A A/2 A A/2 A A/2 A A/2 A A/2 A
- 400 A/2 A A/2 A A/2 A A/2 A A/2 A A/2 A

#### Sampling

- 500 kHz/1 MHz

#### Measurement frequency range

- DC: 0.5 Hz to 200 kHz

#### Synchronization frequency

- 0.5 Hz to 5 kHz

#### Synchronization source

- 1P2W, 1P3W, 3P think (with the motor evaluation installed module and CH2 set for pulse input).
- DC 0 ms or 100 ms fixed
- Selectable for each measurement channel (UI for each channel measured using the synchronization source)
- The zero-crossing filter automatically matches the digital LPF when either U or I is selected.
- Two filter levels (strong or mild)
- Operation and accuracy are determined when the zero-crossing filter is disabled (pf)
- Operation and accuracy are determined when U or I is selected and measured input is 30% f.s. or above.

#### Data update interval

- 50 ms

#### Cross-zeroing filter

- OFF (50 Hz/60 Hz/100 Hz/150 Hz/200 Hz/250 Hz)
- ON (50 Hz/60 Hz/100 Hz/150 Hz/200 Hz/250 Hz)

#### Polarity determination

- Motor torque, rpm, motor power, slip

#### Voltage measurement rectification method

- Select which voltage and current values to use for calculating apparent and reactive power, and power factor
- RMS/MEAN (Voltage and current in each phase system)

#### Display resolution

- 99,995 counts (other than the integrated value)
- 999,999 counts (Integrated value)

### Accuracy

#### DC

- ±0.02% rdg. ±0.02% f.s.
- ±0.02% rdg. ±0.01% f.s.
- ±0.02% rdg. ±0.01% f.s.
- ±0.02% rdg. ±0.01% f.s.
- ±0.02% rdg. ±0.01% f.s.
- ±0.02% rdg. ±0.01% f.s.
- ±0.02% rdg. ±0.01% f.s.

#### AC

- ±0.02% rdg. ±0.02% f.s.
- ±0.02% rdg. ±0.01% f.s.
- ±0.02% rdg. ±0.01% f.s.
- ±0.02% rdg. ±0.01% f.s.
- ±0.02% rdg. ±0.01% f.s.
- ±0.02% rdg. ±0.01% f.s.
- ±0.02% rdg. ±0.01% f.s.

#### Spectral accuracy

- Frequency range 0.5 Hz ≤ f ≤ 1 kHz
- ±0.02% rdg. ±0.01% f.s.
- ±0.02% rdg. ±0.01% f.s.
- ±0.02% rdg. ±0.01% f.s.
- ±0.02% rdg. ±0.01% f.s.
- ±0.02% rdg. ±0.01% f.s.
- ±0.02% rdg. ±0.01% f.s.

#### Frequency measurement accuracy

- ±0.00% rdg. ±0.00% f.s.
- ±0.00% rdg. ±0.00% f.s.
- ±0.00% rdg. ±0.00% f.s.
- ±0.00% rdg. ±0.00% f.s.
- ±0.00% rdg. ±0.00% f.s.
- ±0.00% rdg. ±0.00% f.s.

### 2. Frequency Measurement Specifications

#### Measurement channel

- 1P (U1 to U4)

#### Measurement method

- Spectral analysis + zero-crossing sample value correction

#### Measuring range

- 0.5 Hz to 1 kHz

#### Data update interval

- 50 ms (measurement frequency-dependent at 45 Hz and below)

#### Accuracy

- ±0.02% rdg. ±0.02% f.s.
- ±0.02% rdg. ±0.02% f.s.
3. Integration Measurement Specifications

Measurement mode: Selectable between RMS or DC for each wiring mode.

Measurement items: Current integration (Ih, Ih-, Ih+), harmonic current integration (Ih, Ih+), active power integration (WP, WP+, WP-), and only for DC-mode measurements: in RMS mode, integral current effective values between measurement intervals, and power independent active power value.

Measurement interval: 20 ms, data update interval.

Measurement range: Integration: 0 ~ 9999.9 A (0 to 10.0 V). RMS measurement: No greater than 9999.9 mV.

Integration time accuracy: ±0.01% rdg. ±0.01% f.s. (1 kHz to 100 kHz ±0.01% rdg. ±0.01% f.s.) measurement range.

Integration accuracy: ±0.005% rdg. ±0.005% f.s. (1 kHz to 100 kHz ±0.01% rdg. ±0.01% f.s.) measurement range.

4. Harmonic Measurement Specifications

Number of measurement channels: 4 channels.

Measurement items: Harmonic measurements not available for multiple systems with different frequencies.

Measurement accuracy: ±0.02% rdg. ±0.02% f.s. (1 kHz to 100 kHz ±0.01% rdg. ±0.01% f.s.) measurement range.

Measurement method: Noise measurement: Maximum of the ten highest level and frequency voltage and current waveforms of a period.

SNR measurement: Noise amplitude (rms level with in synchronous frequency range) ±0.05% rdg. ±0.05% f.s.

FFT calculation window: 20 bits.

Anti-aliasing filter: Digital filter automatically set based on (synchronization frequency)

Windows: Rectangular, Hanning, flat.

Zero-crossing synchronization (in all channels in same window), with gap. 500 ks/s sampling, after digital anti-aliasing filter.

Filter settings: Equal thinning between zero crossings (with interpolation calculation).

Frequency range: 0 Hz ≤ f < 1 kHz ±0.03% rdg. ±0.1% f.s. Hz < f ≤ 10 kHz ±0.4% rdg. ±0.5% f.s. kHz < f ≤ 100 kHz ±1.0% rdg. ±1.0% f.s.

5. Noise Measurement Specifications

Calculation channels: 1 (Select one from CH1 to CH4).

Calculation item: voltage noise/CURRENT noise.

Calculation spectrum: RF noise spectrum.

Calculation method: Fast 500 ks/s sampling, after digital anti-aliasing filter.

FFT calculation window: 20 bits.

FFT data points: 1000000/10000000/100000000 (according to displayed waveform recording length).

Anti-aliasing filter: Automatic digital filter varies with maximum analysis frequency.

Windows: Rectangular, Hanning, flat-top.

Window function: By FFT points within gap, 400 Hz, 1.5 s, 2 s, or 5 s, with gap.

 ⇒ accuracy

Frequency range: 0.5 Hz to 50 Hz ±0.01% rdg. ±0.01% f.s.

Accuracy: Frequency(0.5 Hz), Current(0.2%)

Communication:

Waveform output: Measured values: 200 ms (independent of LSB accuracy) and auto-recorded data (CSV format).

Noise interference frequency: 5 kHz to 10 kHz.

-6. Motor Analysis Specifications (Model PW3390-03)

Number of measurement channels: 4 channels.

Measurement input terminal type: CH A: Analog input (DC input and current input selectable), CH B: Analog input (DC input and current input selectable), CH Z: Pulse input.

Measurement input terminal: Insulated BNC jacks.

Input impedance (DC): 1 MΩ ± 100 kΩ.

Input range: 0 Hz to 100 Hz.

Input range: 0 Hz to 100 Hz.

Input range: Volume, voltage, rotation rate, frequency, slip, and motor power.

Synchronization source: CH A, CH B, CH Z, for each channel.

Maximum output frequency: 1 kHz to 10 kHz (for slip calculation).

Maximum output voltage: 16 V (during analog, frequency, and pulse input).

Maximum output current: 50 V (50 Hz/80 Hz).

(1). Analog DC Input (CH A/CH B)

Input range: 0 Hz to 100 Hz.

Sampling: 50 kHz/10 bits.

Response time: 1 ms (measuring zero to full scale, with LPT port).

Measurement method: Digital sampling and zero-crossing synchronous calculation system (cumulative average of intervals between zero crossings).

Measurement accuracy: ±0.03% rdg. ±0.03% f.s.

Temperature coefficient: ±0.03%/°C.

Effect of common mode voltage: Not more than ±0.01% rdg. ±0.01% f.s. between 50 V (DC) or 50 Hz/60 Hz between measurement jacks and PW3390 chassis.

Effect of external magnetic field: Not more than ±0.05% rdg. ±0.05% f.s. (at 400 A/m DC and 50 Hz/60 Hz magnetic fields).

(2). Frequency Input (CH A only)

Valid range: ±5.0 kHz ±0.01% rdg. ±0.01% f.s.

Measurement range: ±5.0 kHz ±0.01% rdg. ±0.01% f.s.

Data output interval: According to synchronization source.

Measurement accuracy: ±0.005% rdg. ±0.005% f.s.

Total display area: 0 ≤ f < 2 kHz ±0.05% rdg. ±0.05% f.s.

Zero adjustment: Corrected input offset of ±0.01% rdg. ±0.01% f.s.

Sweeping range: 1 Hz to 100 kHz.

Memory (memory only for RMS mode measurement).

FFT calculation system: THD calculation THD-F/THD-R

Highest order analysis window waveforms:

-7. Input/Output Option Specifications (Models PW3390-02 and PW3390-03)

Number of output channels: 16 channels.

Output contents: CH1 to CH8: Selectable analog/waveform outputs, CH9 to CH16: Analog output.

Output items: Analog output: Select a basic measurement item for each output channel.

Waveform output: Output voltage or current measured waveforms.

Data output interval: 16 bits (plaintext ±10 bits).

Output accuracy: Analog output: Measurement accuracy ±0.2% f.s. DC level, Waveform output: Measurement accuracy ±0.5% f.s. ±0.5% f.s. (at +1 V f.s. and ±0.5% f.s. (at -1 V f.s.) measurement within synchronous frequency range).

Output update interval: Output update: 50 ms (accuracy of input data update interval of selected parameter) Waveform output: 500 kHz.

Output voltage: Analog output: ±5 V DC (approx. ±12 V DC max.) Waveform output: ±4 V ±V switchable, crest factor of 2.5 or greater Setting applies to all channels.

Output impedance: 100 Ω ± 0.

Temperature coefficient: ±0.05%/°C.

(3). Display Specifications

Display type: 8-inch TFT color LCD (800×480 dots).

Resolution: 1920×1080 pixels.


Function: Data transfer and command control.

(2). USB Memory Interface

Connectivity: USB type A connection × 1.

Function: USB Mass Storage Class.

USB power supply: 500 mA maximum.

USB storage device support: USB Mass Storage Class.

Function: Save and load settings files, Save waveform data, Save measured waveform values and recorded data (from CF card), Save waveform data, Save FFT spectrum for noise measurement, Saved waveform screen images.

(3). LAN Interface

Connectivity: RJ-45 connector × 1.

Function: TCP/IP.

Transmission method: TCP/IP.

Function: FTP server (remote operation), Dedicated port (data transfer and command control).

(4). CF Card Interface

Slot: One Type 1.

Compatibility card: CompactFlash memory card (32 MB or higher).

Function: Save and load settings files, Save waveform data, Save displayed measurement values and auto-recorded data (CSV format), Copy measurement/recorded data (from USB storage), Save waveform data, Save FFT spectrum for noise measurement, Saved waveform screen images.
**5. RS-232C Interface**

- Method: RS-232C [EIA RS-232C] [CITIF 1.24] [IEC 61150] compatible
- Full duplex, start-stop synchronization, 8-bit data, no parity, one stop bit
- Hardware flow control, DTR and RTS signals

- Connector: D-9 pin on connector ×1

- Communication speeds: 2400 bps, 19200 bps, 14400 bps

- Function: Command control, Bluetooth low energy (Bluetooth LE) support

**6. Synchronization Control Interface**

- Signal inputs:
  - One 8-pin, pin sequence: START/STOP, DATA, RESET, EVENT

- Connector types:
  - One 9-pin female mini-DIN jack

- Signal specification:
  - S: 5 V/0 V

- Min. input: 20 ms

- Max. signal delay: 2 μs (tunnel edge)

**7. External Control Interface**

- Connector types:
  - 4-pin round connector ×1; also used as synchronization control interface

- Signal specifications:
  - Signal: Logic level of 0 V - 5 V

- Function: Integration start, integration stop, data reset, event (does not act as the synchronization control function)

- Cannot be used at the same time as a synchronization control.

**Function Specifications**

**1. Control Functions**

- SELECTING THE CALCULATION METHOD
  - Scaling calculation
    - Automatically selects voltage and current ranges according to measured amplitudes on each phase.
    - Operating states: Selectable or off for each phase system
    - Auto-ranging spans: Wide/Narrow (common to all wiring systems)

- TIMING CONTROLS
  - Interval
    - OFF: 0 ms/100 ms/200 ms/500 ms/1 ms/5 ms/10 ms/20 ms/50 ms
    - Setting determines the maximum data-saving capacity
  - Timing controls:
    - OFF: Time/RTC
    - Time: 10 ms to 9999.59.5 (in seconds)
    - RTC: Real-time clock
    - Start and stop times (in minutes)

- HOLD FUNCTION
  - Stops all updating of displayed measurement values and waveforms, and holds display.
  - Internal calculations such as integration and averaging, clock, and peak-over display continue to update.

- PEEK FUNCTION
  - All measurement values are updated to display the maximum value for each measurement.
  - Displayed waveforms and integration values continue to be updated with instantaneous values.

**2. Calculation Functions**

- Stealing calculation
  - VT(FT) ratio: 1.00 to 999.99

- Average calculation
  - OFF/FAS/10N/100N/1000N/SLOW/DIS
  - Exponentially averages all instantaneous measurement values including harmonics (but not peak, integration, or FFT noise values).
  - Applied to displayed values to avoid over-saved data.
  - Response speed (time remains within specified accuracy when input changes from 0 to 100% Lx)
    - FAST: 0.2 ms, MEDIUM: 1.0 s, SLOW: 5 s
    - FAST: 0.02 ms

- 3-P calculation
  - For 3P3M systems, converts between the time-to-frequency phase and voltage phase waveforms using a virtual center point.
  - All voltage parameters including harmonics such as the rms voltage are calculated as phase voltage waveforms.
  - Ua + Ua.Ub + Ua.Uc

- Selecting the calculation method
  - Type 1: SPECIFIED when valid waveform
  - Type 2: ALL when valid waveform

- Current sensor phase correction calculations
  - Corrects phase errors and the selected sensor's phase characteristics.
  - Connection points are set using frequency and phase difference (set separately for each wiring model)
  - Frequency: 0.01 Hz to 999.999 kHz
    - Phase difference: 0° to 360° (in 0.1° increments)
  - However, the time difference calculated from the frequency phase difference is limited to a maximum of 200 ms in 5.0 ms increments.

**3. Display Functions**

**Wiring Check screen**
- The wiring diagram and voltage/current vectors are displayed for the selected wiring system(s).
- The correct range for the wiring system is shown on the vector display, to confirm proper measurement cable connections.

**Independent wiring system display mode**
- Displays power and harmonic measurement values for channels 1 to 4.
- A composite measurement line pattern is displayed for each system.
- Basic, voltage, current, and power measurement parameters, harmonics (harmonic graph, harmonic list, and harmonic vector screen)

**Display Selections screen**
- Select to display any of: 4, 16, or 32 of the basic measurement parameters.

**Efficiency and Loss screen**
- The efficiency and loss obtained by the specified calculation formulas are displayed numerically.
- Three efficiency and three loss values are displayed.

**Waveform & Noise screen**
- Voltage and current waveforms sampled at 500 kHz and noise measurements are displayed on compressed screen.
- Power: 3Ph, 3W, 3M
- Sampling frequency: 50 kHz
- Time base: 0.1 s to 200 min
- Display parameters (4 patterns)

**Drive Data**
- Measured values assigned to the USB CF 512 \( \times \) GB analog output parameters

**5. Synchronous Control Function**
- Function Selection: Synchronous measurement is available using sync cables to connect Model PW3000 (maximizes accuracy).
- Internal settings match, auto-save is available while synchronized.

**Synchronous Function**
- Only data synchronously acquired (except for FFT calculations), integration start/stop, data reset, event settings.

**Event Items**
- Hold, manual, save, screenshot

**Synchronization timing**
- Time data update interval
  - Within 10 s after power-on by a slave PW3000
  - Start and stop reset, event

**Protocol**
- Save the waveform being displayed by means of [Waveform/Noise] display.
- File format: CSV format
- FFT data
  - Save the noise measurement FFT spectrum shown on the Waveform/Noise screen.
  - File format: CSV format

**6. Bluetooth® Logger Connectivity**
- Function Selection: Sends measured values wirelessly to logger by using a Bluetooth® serial conversion adapter.

**Supported Devices**
- Hioki LR8410 Link-compatible loggers (LR8410, LR8416)

**Send Data**
- Measured values assigned to the USB CF 512 \( \times \) GB analog output parameters

**7. Other Functions**

**Display language selection**
- Japanese, Chinese, English, Chinese

**Beep sound**
- OFF/ON

**Screen color schemes**
- COLOR1 (blue-green), COLOR2 (gray), COLOR3 (gray-blue), COLOR4 (orange), COLOR5 (blue)

**Data storage**
- Waveform and noise selection
  - Wire/wireless display (screen measurement only)
  - LCD backlight: ON: min. 10 min/10 s/20 min/60 min

**Memory**
- Total memory: 8 GB

**RTC clock**
- Auto-calender, leap-year 36,000-hour clock

**RTC accuracy**
- ±3 s per day @25°C (±77°F)

**Sensor recognition**
- Sensor recognition: Sensor information automatically recognized when connected (Excluding the CT1000 series sensors)

**Warning indicators**
- When peak over voltages occurs on voltage and current measurement channels, when no sensor is detected

**Warning indicators for all channels**
- Displays on all pages of the MESS screen.

**Key-lock**
- Logs off by holding the ESC key for three seconds.

**System reset**
- Reverts all settings to factory defaults

**Power-on reset**
- Returns all settings including language and communications settings, to factory default settings

**Media content list display, format media, create folders, delete files and folders, copy between storage media

**General Specifications**

**Operating conditions**
- Altitude: 2,000 m (6,600 ft) or less, 0°C to 35°C (41°F to 95°F)
- Humidity: 0% to 80% (RH) or less

**Accuracy**
- Current: 0.5 % of reading + 0.1% of reading (see corresponding specification)

**Storage temperature and humidity**
- Temperature: 10°C to 55°C (14°F to 131°F)
- Humidity: 0% to 85% RH (no condensation)

**Power supply**
- Input voltage: 200 V to 240 V, 50/60 Hz
- Maximum rated voltage: 140 VA

**Backup battery life**
- Battery life: approximately 3 years

**Dimensions**
- 340 mm (13.5 in) x 57 mm (2.3 in) x 9 mm (0.3 in)

**Product warranty period**
- 3 year

**Accessories**
- Instruction Manual x1, Measurement Leads x1, Power cord x1, USB cable (0.6 m (2.0 ft)) x1, Input cord label x2, D-sub connector x1 (PW3000-02, PW3000-03)
### High Accuracy Sensor, Pass-Through Type

<table>
<thead>
<tr>
<th>AC/DC CURRENT SENSOR</th>
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<th>AC/DC CURRENT SENSOR</th>
</tr>
</thead>
<tbody>
<tr>
<td>CT8662-05</td>
<td>CT8683-05</td>
<td>CT9708-05</td>
<td>CT8804-05</td>
</tr>
</tbody>
</table>

#### External Appearance
- AC/DC 50 A rms
- AC/DC 200 A rms
- AC/DC 500 A rms
- AC/DC 500 A rms

#### Rated primary current
- AC/DC 50 A rms
- AC/DC 200 A rms
- AC/DC 500 A rms
- AC/DC 500 A rms

#### Frequency band
- DC to 1 MHz
- DC to 500 kHz
- DC to 100 kHz
- DC to 4 MHz

#### Diameter of measurable conductors
- φ 24 mm (0.94 in) or less
- φ 24 mm (0.94 in) or less
- φ 36 mm (1.42 in) or less
- φ 32 mm (1.26 in) or less

#### Basic accuracy
- For DC, 16 Hz to 400 Hz: Amplitude: ±0.05% rdg., ±0.01% f.s. Phase: ±0.2°
- For DC, 45 Hz to 98 Hz: Amplitude: ±0.05% rdg., ±0.01% f.s. Phase: ±0.2°
- For 45 Hz to 65 Hz: Amplitude: ±0.1% rdg., ±0.01% f.s. Phase: ±0.05°

#### Frequency characteristics (Amplitude)
- To 16 Hz: ±0.01% rdg., ±0.02% f.s.
- To 50 kHz: ±0.1% rdg., ±0.2% f.s.
- To 1 MHz: ±0.5% rdg., ±1% f.s.

#### Operating temperature range
- -30°C to 85°C (-22°F to 185°F)
- 9°C to 50°C (48°F to 122°F)
- -10°C to 50°C (14°F to 122°F)

#### Effects of external magnetic fields
- In 400 A/m magnetic field (DC and 60 Hz): 50 mA or less
- In 400 A/m magnetic field (DC and 60 Hz): 50 mA or less
- In 400 A/m magnetic field (DC and 60 Hz): 50 mA or less

#### Maximum rated voltage to ground
- CAT III 1000 V
- CAT III 1000 V
- CAT III 1000 V
- CAT III 1000 V

#### Dimensions
- 160 mm (6.30 in) W x 112 mm (4.41 in) H x 50 mm (1.97 in) D, Cable length: 3 m (9.84 ft)
- 160 mm (6.30 in) W x 112 mm (4.41 in) H x 50 mm (1.97 in) D, Cable length: 3 m (9.84 ft)
- 160 mm (6.30 in) W x 112 mm (4.41 in) H x 50 mm (1.97 in) D, Cable length: 3 m (9.84 ft)
- 160 mm (6.30 in) W x 112 mm (4.41 in) H x 50 mm (1.97 in) D, Cable length: 3 m (9.84 ft)

#### Mass
- Approx. 980 g (34.6 oz)
- Approx. 980 g (34.6 oz)
- Approx. 980 g (34.6 oz)
- Approx. 980 g (34.6 oz)

---

### High Accuracy Sensor, Clamp Type

<table>
<thead>
<tr>
<th>AC/DC CURRENT PROBE</th>
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<th>AC/DC CURRENT PROBE</th>
<th>AC/DC CURRENT PROBE</th>
</tr>
</thead>
<tbody>
<tr>
<td>CT8665-05</td>
<td>CT8841-05</td>
<td>CT8843-05</td>
<td>CT8844-05</td>
</tr>
</tbody>
</table>

#### External Appearance
- AC/DC 1000 A mask

#### Rated primary current
- AC/DC 20 A rms
- AC/DC 200 A rms
- AC/DC 500 A rms

#### Frequency band
- DC to 20 kHz
- DC to 500 kHz
- DC to 1 kHz

#### Diameter of measurable conductors
- φ 36 mm (1.42 in) or less (insulated conductor)
- φ 24 mm (0.94 in) or less (insulated conductor)
- φ 20 mm (0.79 in) or less (insulated conductor)

#### Basic accuracy
- For DC, 16 Hz to 66 Hz: Amplitude: ±0.05% rdg., ±0.01% f.s. Phase: ±0.2°
- For DC, < 1 kHz: Amplitude: ±0.05% rdg., ±0.01% f.s. Phase: ±0.2°
- For DC, ≥ 1 kHz: Amplitude: ±0.3% rdg., ±0.2% f.s.

#### Frequency characteristics (Amplitude)
- To 16 Hz: ±0.01% rdg., ±0.02% f.s.
- To 10 kHz: ±0.1% rdg., ±0.2% f.s.
- To 1 MHz: ±0.5% rdg., ±1% f.s.

#### Operating temperature range
- -30°C to 85°C (-22°F to 185°F)
- 9°C to 50°C (48°F to 122°F)
- -10°C to 85°C (-14°F to 185°F)

#### Effects of external magnetic fields
- In 400 A/m magnetic field (DC and 60 Hz): 50 mA or less
- In 400 A/m magnetic field (DC and 60 Hz): 50 mA or less
- In 400 A/m magnetic field (DC and 60 Hz): 50 mA or less

#### Maximum rated voltage to ground
- CAT III 1000 V
- CAT III 1000 V
- CAT III 1000 V
- CAT III 1000 V

#### Dimensions
- 153 mm (6.02 in) W x 75 mm (2.95 in) H x 41 mm (1.61 in) D, Cable length: 3 m (9.84 ft)
- 153 mm (6.02 in) W x 75 mm (2.95 in) H x 41 mm (1.61 in) D, Cable length: 3 m (9.84 ft)
- 153 mm (6.02 in) W x 75 mm (2.95 in) H x 41 mm (1.61 in) D, Cable length: 3 m (9.84 ft)

#### Mass
- Approx. 350 g (12.3 oz)
- Approx. 350 g (12.3 oz)
- Approx. 400 g (14.1 oz)

---

Custom cable lengths also available. Please inquire with your Hioki distributor.
Model : POWER ANALYZER PW3390

Model No. (Order Code) | D/A output | Motor analysis
---|---|---
PW3390-01 | — | —
PW3390-02 | ○ | —
PW3390-03 | ○ | ○

Accessories: Instruction Manual x1, Measurement Guide x1, Power cord x1, USB cable x1, Input cord label x2, D-sub 25-pin connector x1 (PW3390-02, PW3390-03)

• The optional voltage cord and current sensor are required for taking measurements.
• Motor analysis and D/A output cannot be changed or added after delivery.

Current Measurement Options

<table>
<thead>
<tr>
<th>Name (Note)</th>
<th>Model No. (Order Code)</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC/DC CURRENT SENSOR (50 A)</td>
<td>CT6682-05</td>
</tr>
<tr>
<td>AC/DC CURRENT SENSOR (200 A)</td>
<td>CT6683-05</td>
</tr>
<tr>
<td>AC/DC CURRENT SENSOR (500 A)</td>
<td>NEW CT6904</td>
</tr>
<tr>
<td>AC/DC CURRENT SENSOR (1000 A)</td>
<td>CT6685-05</td>
</tr>
<tr>
<td>AC/DC CURRENT PROBE (20 A)</td>
<td>CT6684-05</td>
</tr>
<tr>
<td>AC/DC CURRENT PROBE (200 A)</td>
<td>CT6683-05</td>
</tr>
<tr>
<td>AC/DC CURRENT PROBE (500 A, ø 20 mm (0.79 in))</td>
<td>CT6684-04</td>
</tr>
<tr>
<td>AC/DC CURRENT PROBE (500 A, ø 50 mm (1.97 in))</td>
<td>CT6845-05</td>
</tr>
<tr>
<td>AC/DC CURRENT PROBE (1000 A)</td>
<td>CT6646-05</td>
</tr>
</tbody>
</table>

CLAMP ON SENSOR (AC 20 A/200 A)

CT6646-05

PW9100-03

PW9100-04

AC/DC AUTO ZERO CURRENT SENSOR (2000 A)

CT7742

CT7642

AC FLEXIBLE CURRENT SENSOR

CT7642

CT7742

PW9100-03

PW9100-04

AC/DC CURRENT SENSOR (6000 A, ø 100 mm (3.94 in))

CT7444

CT7404

AC FLEXIBLE CURRENT SENSOR (6000 A, ø 180 mm (7.09 in))

CT7405

AC FLEXIBLE CURRENT SENSOR (6000 A, ø 254 mm (10.00 in))

CT7406

SENSOR UNIT (Sensor power supply with 4 channel summing function)

CT9557

* CONVERSION CABLE CT9900 is required to connect to PW3390.
** CONNECTION CABLE CT9904 is required to connect to PW3390.

Built-To-Order (Current Measurement)

PW9100 5A-rated model

9709-05 high-accuracy model

CT8862-01 high-accuracy model

CT8863-01 high-accuracy model

AC/DC 2000 A high accuracy sensor, pass-through type

Voltage Measurement Options

<table>
<thead>
<tr>
<th>VOLTAGE CORD L9438-50</th>
<th>Red, black: 1 each, 1000 V specification, Cord length: 3 m (9.84 ft) CAT IV 600 V, CAT III 1000 V</th>
</tr>
</thead>
<tbody>
<tr>
<td>VOLTAGE CORD L1000</td>
<td>Red, yellow, blue, gray: 1 each, Black: 4 1000 V specification, Cord length: 3 m (9.84 ft) CAT IV 600 V, CAT III 1000 V</td>
</tr>
</tbody>
</table>

WIRING ADAPTER PW9000

When making a 3-phase 3-wire (3P3W3M) connection, this product allows you to reduce the number of voltage cords from 6 to 3.

EXTENSION CABLE L9438-50

RED, black: 1 each, 1000 V specification, Cable length: 1.5 m (4.92 ft) For extension of L9438-50 or L1000 CAT IV 600 V, CAT III 1000 V |

PATCH CORD L1021-01

Banana branch-banana, Red: 1 Cable length: 0.5 m For branching from the L9438-50 or L1000 CAT IV 600 V, CAT III 1000 V |

Other Options

PC CARD 512 MB 9728
PC CARD 1 GB 9729
PC CARD 2 GB 9630

Use only PC cards sold by HIOKI. Compatibility and performance are not guaranteed for PC cards made by other manufacturers. You may be unable to read or save data to such cards.

CARRYING CASE 9794

Carrying Case for PW3390 and 3390

448 mm (17.64 in) W x 618 mm (24.33 in) H x 296 mm (11.61 in) D

Please contact your Hioki distributor or subsidiary for more information.

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