Precision Power Analyzer WT3000

High-end Power Meter with top precision*
Basic Power Accuracy: 0.02% of reading

- Basic Accuracy **0.01% of reading**
- Basic Power Accuracy **0.02% of reading**
- Good Readability **The Large, 8.4-inch LCD and the Range Indicator LEDs**
- Simultaneous Measurement with 2 Units (8 Power Input Elements)
- Store Function **50 ms Data Storing Interval**
- Interface **GP-IB, Ethernet, RS-232 and USB**
- Advanced Computation Function **Waveform Computation, FFT Analysis, Waveform sampling Data Saving**
- **IEC61000-3-2 Harmonic Measurement**
- **IEC61000-3-3 Voltage Fluctuation/ Flicker Measurement**

* As of July, 2013, for power meter accuracy in three-phase power meter (as investigated by Yokogawa).
Yokogawa’s power measurement technology provides best-in-class*1 precision and stability

**Precision Power Analyzer WT3000**

With basic power accuracy of ± 0.02% of reading, DC and 0.1 Hz–1 MHz measurement bandwidths, and up to four input elements, the WT3000 provides higher-accuracy measurement for inverter I/O efficiency.

More Precise. More Bandwidth. More Features.*2

- The WT3000 is a truly innovative measurement solution, combining top-level measurement accuracy with special functions. *2
- The large, 8.4-inch liquid crystal display and the range indicator LEDs ensure good readability and make the system easy to use.

The WT3000 is the answer to your measurement problems.

Have you had problems or questions such as these?
- When working with efficiency-improvement evaluation data for a high-efficiency motor, improvements cannot be seen unless measurements are taken with very high precision.
- Measurement efficiency is poor during power measurements and power supply quality measurements.

For answers to these questions, see page 6.
Better Efficiency in Power Measurements

In developing the WT3000, Yokogawa focused on improving efficiency in two basic areas. One goal was to obtain highly precise and simultaneous measurements of the power conversion efficiency of a piece of equipment. The other objective was to improve equipment evaluation efficiency by making simultaneous power evaluations and tests easier and faster.

New Innovations to Enhance the Reliable Measurement Technology

With the WT3000, we made further improvements to the basic performance specifications for even better functionality and reliability. We are confident users will appreciate these improvements to power and efficiency measurements thanks to the new power control technologies we have introduced.

A Variety of External Interface Choices

The WT3000 equips with a PC card slot (ATA flash card slot). The WT3000 is also standard-equipped with a GP-IB port. In addition, a serial (RS-232) port, Ethernet port, USB port for peripheral, and USB port for connection to PC are available as options. The variety of interface choices allows customers to use the best interfaces for a wide variety of equipment, media, and network environments.

Select the model most suited to your measurement needs.

Standard Version

★ High Accuracy and Wide Frequency Range
- Basic Power Accuracy
  \[ \pm(0.02\% \text{ of reading} + 0.04\% \text{ of range}) \]
- Frequency Range
  \[ \text{DC, 0.1 Hz to 1 MHz} \]
★ Low Power Factor Error
- Power factor influence when \( \cos\phi=0 \)
  \[ 0.03\% \text{ of } S \]
  \( S \) is reading value of apparent power
  \( \phi \) is phase angle between voltage and current
★ Current Range
- Direct Input
  \[ 0.5/1/2/5/10/20/30 \text{ [A]} \] *
  \[ 5/10/20/50/100/200/500/1000 \text{ [A]} \] *
- External Input
  \[ 5/10/20/50/100/200/500/1000 \text{ [V]} \] *
★ Voltage Range
- 15/30/60/100/150/300/600/1000 \text{ [V]} *
★ Continuous Maximum Common Mode Voltage
  \[ 1000 \text{ [Vrms]} \]
★ Data Update rate: 50 ms to 20 sec
★ Effective input range: 1% to 130%
★ Simultaneous measurement with 2 Units
★ Standard PC Card Slot
★ Storage Function (Approximately 30MB internal memory)

Motor Version

In addition to the functions of the standard version, the models offer powerful motor/inverter evaluation functions.

★ Motor Efficiency and Total Efficiency Measurement
- Analog or pulse signal from rotating sensor and torque meter can be input, and allows calculation of torque, revolution speed, mechanical power, synchronous speed, slip, motor efficiency, and total efficiency in a single unit.

Yokogawa’s highest-precision power meter*²

The WT3000 has the highest precision of the Yokogawa power meters in the WT Series. The models in the WT Series are designed to meet a wide variety of user needs. The WT3000 Series is a high price-performance series which is very popular in production line applications. The WT1800 allows measurement data to be viewed in a variety of ways, including numerical value display, waveform display, and trend display capabilities.

WT3000 ±0.02%*reading error
WT1800 ±0.10%
WT300 ±0.10%*reading error

*1 As of July, 2013, for power accuracy in a three-phase power meter
(as investigated by Yokogawa)
*2 As compared to Yokogawa’s products
**FUNCTIONS**

**WT3000 Controls: Simple to Use, Easy to View**

The WT3000 was designed with user-friendly functions and controls in response to user requests for a simpler range setting operation and more user-friendly parameter setting display process.

**Simpler range settings**

- **Range settings using direct key input**
  - The range indicator on the WT3000 is a seven-segment green LED, so the set range can be monitored at all times. The range can easily be switched using the up and down arrows.

**A wide range of standard functions**

**Format for viewing waveforms as well as numerical values**

**A Variety of display formats**

- The WT3000 lets you display input signal waveforms in addition to numerical value data. This means you don’t need to connect a special waveform analyzer just to check signal waveforms. In addition, the optional advanced computation function lets you display vectors and bar graphs for enhanced visual presentation.
  - *1 Waveforms up to approximately 10 kHz can be displayed accurately.
  - *2 Excludes single phase model.

**High-speed measurement to capture rapid data fluctuations**

**50ms data updating intervals**

- Fast updating allows you to precisely capture rapidly changing transient states in the measurement subject.
  - * The WT3000 switches between two different calculation systems depending on the data updating interval. See page 19 for details.

**Compensates for the loss**

**Compensation functions**

- This function compensates for the loss caused by the wiring of each element. The WT3000 has the following three types of correction functions to measure the power and efficiency:
  - **Wiring Compensation**
    - This function compensates for the loss caused by the wiring of each element.
  - **Efficiency Compensation**
    - The power measurement on the secondary side of a power transformer such as an inverter includes loss caused by the measurement instrument. This loss appears as error in the efficiency computation. This function compensates for this loss.
  - **Compensation for the Two-Wattmeter Method**
    - In the two-power wattmeter method, an error results when current flows through the neutral line. This function computes the currents that flows through the neutral line for measurements using the two-wattmeter method with a three-phase, three wire (3V3A) system and adds the compensation value to the measured power. * Requires the Delta computation option (/DT).

**Storing measurement data**

**Store Function**

- Voltage, current, power, and other measured data can be stored to the unit’s approximately thirty megabytes of internal memory. These data can be saved in binary or ASCII format on a PC card or USB memory. * Requires the /C5 option.

---

**Using item pages to set display preferences**

**A way to add user-defined measurement parameters**

**User-defined function**

- As many as twenty user-defined formulas can be set in the WT3000. These equations can be used to calculate various parameters, such as mean active power (see “A variety of integration functions” below).

**Efficiency calculation function**

- This function can be used to set up to four efficiency calculation formulas.

**Apparent power integration and reactive power integration**

**A Variety of integration functions**

- **Active power, current, apparent power, reactive power**
  - In addition to the active power integration function (WP) and current integration function (q) included in earlier models, the WT3000 also has a new apparent power integration function (WS) and reactive power integration function (WQ).
  - A wide effective input range for high-precision integration
  - **Average active power (using user-defined settings)**
    - Average active power can be calculated over an integration interval. This feature is useful for evaluating the power consumed by intermittent-control instruments in which the power value fluctuates.

- **Average active power**
  - \[
  \text{Average active power} = \frac{\text{Integrated power (WP)}}{\text{Integrated elapsed time (H)}}
  \]

---

**A way to add user-defined measurement parameters**

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A wide variety of optional functions make it easy to perform sophisticated power evaluations.

When you purchase a WT3000 from Yokogawa, you get to select just the options you need. This approach lets you maximize performance at a lower cost.

**Options**

**Advanced Computation (/G6)**

The advanced calculation function (/G6 option) meets these measuring needs with advanced, powerful features for making power analysis measurements more efficient.

- **Harmonic Measurement in Normal Measurement Mode**
  You can measure harmonic data while in normal measurement mode. This is effective for observing values from normal measurements and harmonic data at the same time.

- **Wide Bandwidth Harmonic Measurement**
  This dedicated harmonic measurement function is distinct from the harmonic measurements that can be taken in normal measurement mode. The function is useful for ascertaining the distortion factor and harmonic components in strain measurements of fundamental frequencies from 0.1 Hz to 2.6 kHz. It allows wide bandwidth measurements of signals that include high frequency waves, such as from power supplies and acceleration of motor rotation.

- **Waveform Computation**
  You can perform computations on measured waveforms, and display power (instantaneous voltage × instantaneous current) and other waveforms on screen.

- **Waveform Sampling Data Saving**
  You can save sampling data of input waveforms, waveform computations, and FFT computations. The data is available for any kind of computation by PC software.

**Performing IEC harmonic standards tests**

**IEC harmonic measurement mode (/G6)**

Harmonic measurement software* can be used in this dedicated mode for harmonic measurement that supports international standards. This allows confirmation of whether or not home electronics, office automation equipment, or other devices conform with harmonic standards.

* IEC standard compliant harmonic measurement requires the model 761922 harmonic measurement software.

**Voltage Fluctuation and Flicker Measurement (/FL)**

Enables voltage fluctuation/flicker measurement conforming to IEC61000-3-3. The following values related to voltage fluctuation that are stipulated by the IEC61000-3-3 standard can be calculated from the measured data: dc (relative steady-state voltage change), dmax (maximum relative voltage change), dl (relative voltage change time), short-term flicker value Pit, long-term flicker value Pil, instantaneous flicker sensation, and others. In this mode, you can judge whether voltage fluctuations in the item under test relative to a specified minimum value are within the standard.

* The range is 0V to 5V for some functions, such as frequency measurement.

**Checking the frequencies of all inputs**

**Added Frequency Measurement (/FQ)**

In addition to the standard two channels of frequency measurement, a six-channel frequency measurement option is also available. This option provides frequency measurement of voltage and current on all eight channels (with input elements 1 through 4 installed). This is necessary when you want to measure voltage and current frequency from the instrument’s I/O as well as voltage and current frequencies of multiple items under test at the same time.

**Outputting measurement values as analog signals**

**D/A Output (/DA)**

- **20 Channels**
  Measured values and calculated value by user-defined function can be output as ±5V FS DC voltages from the D/A output connector on the rear panel.

- **D/A zoom**
  This function allows the any input signal range to be scaled to between -5V and 5V* in the D/A output as Upper and Lower ranges. This makes it possible to enlarge input signal fluctuations for observation using a recorder or logger.

  * The range is ±5V for some functions, such as frequency measurement.

**Video output for viewing on a larger screen**

**VGA output (/V1)**

The VGA port can be used to connect an external monitor in order to view numerical value data and waveforms on a larger screen. This capability is useful if you want to simultaneously check large amounts of data on a separate screen, or view data in a separate location.

**USB Port (Peripheral) Option (/C5)**

You can save voltage, current, power, and other kinds of data that are stored in the WT3000 to a USB Memory. The data can be saved in binary or ASCII format. You can also connect a keyboard for easy input of user-defined math expressions.
Variety of Communication Functions (GP-IB Comes Standard)

USB Port (PC) Option (/C12) * Select USB port (PC) or RS-232
The USB port (type B connector) on the rear panel of the WT3000 allows data communications with a PC.
1. USB driver required for USB communications. A USB driver is available from our Web site.

Ethernet port (/C7)
The optional Ethernet port (100BASE-TX/10BASE-T) allows you to connect the WT3000 to a LAN. Once connected, images and numerical value data saved on the WT3000 can be transferred to a PC using FTP server software or other utilities.

Serial (RS-232) (/C2) * Select USB port (PC) or RS-232

APPLICATIONS

Measurement Applications to Utilize WT3000’s Capabilities

Measurement of Inverter Efficiency

• Measuring Efficiency with High Precision: Simultaneous Measurement of Input and Output
  The WT3000 offers up to four input elements capable of simultaneous measurement of single-phase input/three-phase output, or three-phase input/three-phase output.

• Accurate Measurement of Fundamental PWM Voltage
  Motor drive technology has become more complex in recent years; pure sine wave modulated PWM is less common, and cases in which the voltage mean differs greatly from the fundamental voltage waveform arise frequently. With the optional harmonic measurement function of the WT3000, accurate measurements of commonly measured values such as active power and the fundamental or harmonic components can be taken simultaneously without changing measuring modes.

• Phase Voltage Measurement without a Neutral Line (/DT option)
  With the delta computation function, an object under test without a neutral line can be measured in a three-phase three-wire (3V3A) configuration, allowing calculation of each-phase voltage.

• High Frequency and Harmonic Measurements (Requires the /G6 Option)
  The fundamental frequencies of motors have become faster and faster. The WT3000 allows harmonic measurements of signals with fundamental frequencies as high as 2.6 kHz.

• Evaluation of Torque Speed Characteristics (Requires motor version, the /CC Option)
  Torque speed can be evaluated based on the torque and revolution speed data measured with the motor version. Also, you can confirm the cycle-by-cycle voltage, current, and power fluctuations that occur such as when starting the motor.

• Related applications
  Power conversion technologies such as those used in EVs and power conditioners
  High-precision, simultaneous measurements are required in measuring conversion efficiency in the conversion of a converter’s three-phase input to a DC bus, and the conversion from an inverter’s DC bus to three-phase output.
Evaluation of Lighting Devices

- Simultaneous Measurement of Voltage, Current, and THD (Total Harmonic distortion)

Testing of lighting devices often involves measurement of voltage, current, and THD, a parameter that indicates the quality of power. This is because distortion in voltage and current waveforms is becoming more prevalent due to the increasing complexity of control systems.

The WT3000 can simultaneously measure voltage and current with THD, eliminating these inconveniences and allowing for more accurate and rapid measurements of an instrument’s characteristics and fluctuations.

Lamp Current Measurement

Since lamp current flows inside of fluorescent tubes, normally it cannot be measured directly. However, lamp current can be displayed by measuring secondary current and cathode current and finding the difference in their instantaneous values using the delta computation function (DT option).

- Related applications
  Evaluation of power quality in equipment designed to be connected in a system, such as UPSs and power conditioners

Measurement of Power Consumption in Mobile Phones

You can measure power consumption in mobile phones, batteries, and other equipment powered by dry cells. You can perform a variety of operation tests for reducing power consumption by using the current or power integration function. This offers a powerful means of evaluating instruments, such as for checking control modes for lengthening battery life.

- Major Features
  • 5mA range for very low current measurements
  • Checking power consumption integration of mobile phones when switching modes (using integration functions)
  • Visually observing trends in power consumption using trend display functions that allow checking of temporal fluctuations
  • Checking the waveform of the consumed current
  • Null function can be used to subtract the DC offset

Use the 2A input element for small current consumption.

High Accuracy Measurements of Transformers

- High Accuracy Even at Low Power Factors

The WT3000 represents great improvement over previous models in terms of power factor error (it is approximately three times more accurate). With improved measurement accuracy in the lower power factors—such as with transformers, active power values can be measured with higher precision.

- Simultaneous Measurement of RMS and MEAN of Voltage

Voltage RMS (the true RMS value) and voltage MEAN (rectified mean value calibrated to the rms value) can be measured at the same time, allowing for measurement of corrected power (Pc).

- Phase Voltage Confirmation

The delta computation function (DT option) allows both star-delta and delta-star conversion.

Measuring Conversion Efficiency of Power Conditioner

- Conversion Efficiency Measurement

Renewable energy source of photovoltaic power generation and wind power is converted dc to ac using power conditioner. The WT3000 Precision Power Analyzer provides measurement with world-class DC and AC signal accuracies.

Reference equipment for power calibration

- Basic power accuracy of ±0.02% of reading

The WT3000 can be used as a reference instrument for periodic in-house calibration of general-purpose power measurement instruments, such as the WT300 series.
Software

Utility Software

WTViewer 760122

WTViewer is an application software tool that reads numeric, waveform, and harmonic data measured with the WT3000 Precision Power Analyzer.

- **Numeric Data**
  WTViewer can simultaneously display voltage, current, power and various other measured parameters for one to four elements individually, and for \( \sum A \) and \( \sum B \) calculations.

- **Waveform**
  Voltage and current waveforms can be monitored on the PC screen. You can confirm the voltage-current phase difference, waveform distortion, and other phenomena.

- **Measuring Harmonics**
  WTViewer can numerically or graphically display the results of measured harmonics up to the 100th order for such parameters as voltage, current, power and phase angle.
  * requires /G6 option

- **Viewing Trends**
  You can capture and view various data, measured with the WT3000 on your PC in a graphical trend format. This feature lets you monitor power supply voltage fluctuations, changes in current consumption and other time-based variations.

WTFileReader (Combined into the WTViewer)

- **WT3000 File Reader (off-line)**
  WTFileReader software can load and display data measured by the WT3000 Precision Power Analyzer that has been saved to a memory medium. That data can also be saved in CSV format.

LabVIEW driver (Free)

You can download this software program from our web site

* LabVIEW is a registered trademark of National Instruments Corporation.

Harmonic Measurement / Voltage Fluctuation and Flicker Measurement Software (761922)

- **Harmonic Measurement (G6 option)**
  The Harmonic Analysis Software (Model 761922) loads data measured by the WT3000 and performs harmonic analysis that complies with IEC61000-3-2 A2 of the edition 3.0. You can use the model 761922 harmonic measurement software to perform harmonic measurement tests conforming to IEC 61500-4-7 edition 2 (window width is 10 cycles of 50 Hz and 12 cycles of 60 Hz) with WT3000.

- **Harmonic Current Measurement Value List and Bar Graph**
  Enables PASS/FAIL evaluations of harmonic measurement results in line with standard class divisions (A, B, C, D). Displays lists of measurement values, as well as bar graphs that let you compare the measured value and standard limit value for each harmonic component.

- **Measurement Mode**
  Three modes are available for harmonic measurement:
  - Harmonic observation: Lets you view current, voltage, and phase angle for each order in a bar graph.
  - Waveform observation: Lets you view measured signals to confirm the suitability of the range and other factors.
  - Harmonic measurement (standards testing): For conducting standards tests and making the associated judgments.
  Efficiency is gained by performing tests after checking the waveform in Observation mode.

- **Flicker Measurement (FL option)**
  This function enables voltage fluctuation and flicker measurements in compliance with IEC61600-3-3 Ed2.0 (2008).
  * The flicker test can also be performed with the WT3000 alone. Using the model 761922 harmonic/flicker measurement software (sold separately), you can display trend graphs, CPF graphs, or reports of the dc, dmax, and IFS (instantaneous flicker sensation) values in addition to the WT3000 judgment results.

Note) This software cannot communicate with the WT using a serial (RS-232) interface (/C2) or USB port (PC) (/C12). The flicker measurement of three phase equipment, it requires adding frequency measurement option (/FQ).
**Standard features**

1. Voltage input terminals
2. Current external sensor input terminals
3. Current direct input terminals
4. GP-IB port
5. BNC connector for two-system synchronized measurement

**Optional features**

6. Serial (RS-232) port (option/C2) or USB port (PC) (option/C12)
7. Ethernet port (100BASE-TX/10BASE-T) (option/C7)
8. VGA port (option/V1)
9. D/A output (option/DA)
10. Torque and speed input terminals (motor version)

**CHARACTERISTICS**

**Example of basic characteristics showing the WT3000’s high precision and excellent stability**

**Example of frequency versus power accuracy characteristic**

- Error (% of reading)
- Frequency (Hz)

**Total power error with rated range input for an arbitrary power factor (50/60Hz, 30A input element)**

- Total Error (% of range)
- Power factor

**Effect of common mode voltage on reading value**

- Error (% of range)
- Frequency (Hz)
**ACCESSORIES**

### Related products

<table>
<thead>
<tr>
<th>Current Sensor Unit</th>
<th>Current Transducer</th>
<th>Clamp on Probe</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>751521,751523</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Current Sensor Unit</strong></td>
<td><strong>DC to 100 kHz/600 Apk</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Wide dynamic range: -600 A to 0 A to +600 A (DC)/600 A peak (AC)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Wide measurement frequency range: DC to 100 kHz (-3 dB)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• High-precision fundamental accuracy: ±0.05% of reading + 40 μA</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Superior noise withstanding ability and CMRR characteristic due to optimized casing design</td>
<td></td>
</tr>
<tr>
<td></td>
<td><em>751521/751523 do not conform to CE Marking</em></td>
<td></td>
</tr>
</tbody>
</table>

For detailed information, see Power Meter Accessory Catalog Bulletin 7515-52E.

### Adapters and Cables

| **758917** |
| **Measurement leads** |
| Two leads in a set. Use 758917 in combination with 758922 or 758929. Total length: 75 cm. Rating: 1000 V, 32 A |

| **758922** |
| **Small alligator adapters** |
| For connection to measurement leads (758917). Two in a set. Rating: 300 V |

| **758929** |
| **Large alligator adapters** |
| For connection to measurement leads (758917). Two in a set. Rating: 1000 V |

| **758921** |
| **Safety terminal adapter set** |
| Screw-fastened adapters. Two adapters in a set. 1.5 mm Allen wrench included for tightening. |

| **701959** |
| **Safety mini-clip set (hook Type)** |
| 2 pieces (red and black) in one set. Rating: 1000V |

| **758924** |
| **Conversion adapter** |
| For conversion between male BNC and female banana plug |

| **366924/25** |
| **BNC cable (BNC-BNC 1m/2m)** |
| For connection to simultaneously measurement with 2 units, or for input external trigger signal. |

| **B9284LK** |
| **External Sensor Cable** |
| For connection the external input of the WT3000 to current sensor. Length:50cm |

| **751552** |
| **Current Clamp on Probe** |
| **AC 1000 Arms (1400 Apeak)** |
| • Measurement frequency range: 30 Hz to 5 kHz |
| • Basic accuracy: ±0.3% of reading |
| • Maximum allowed input: AC 1000 Arms, max 1400 Apeak (AC) |
| • Current output type: 1 mA |

*751521/751523 and CT series do not conform to CE Marking.*

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**Typical Voltage/Current Connections**

**Measurement using current sensor**

- Unit whose current is to be measured
- CT1000 Connector (B8200JQ)
- BNC-BNC (female-female type)
- Connection example

**Measurement using clamp-on probe**

- Unit whose voltage is to be measured
- Power meter’s current direct input terminal
- CT60/CT200/CT1000

**Measurement using voltage input terminal**

- Unit whose voltage is to be measured
- Power meter’s voltage input terminal

---

* A burden resistor is required for the CT1000, CT200, CT60, and 751574.
There are limitations on some specifications and functions. See the individual product catalogs for details.

When checking the measurable crest factor of our power measuring instruments, even if some measured signals exist whose crest factors are larger than the specifications of the instrument (the crest factor standard at the rated input), you can measure signals having crest factors larger than the specifications by setting a measurement range that is large relative to the measured signal. For example, even if you set CF = 3, CF3 or higher measurements are possible as long as the measured range (RMS) is 60% or less than the measuring range. Also, for a setting of CF = 3, measurements of CF = 300 are possible with the minimum effective input (1% of measuring range).

The crest factor is the ratio of the waveform peak value and the RMS value.

\[
\text{Crest factor (CF, peak factor)} = \frac{\text{waveform peak}}{\text{RMS value}}
\]

* However, the peak value of the measured signal must be less than or equal to the continuous maximum allowed input

### Comparison of Specifications and Functions in WT3000, Other WT Series Models

<table>
<thead>
<tr>
<th>WT3000</th>
<th>WT1800</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Range</strong></td>
<td><strong>Range</strong></td>
</tr>
<tr>
<td>Basic power accuracy (50/60 Hz)</td>
<td>0.02% of reading + 0.04% of range</td>
</tr>
<tr>
<td>Measurement power bandwidth</td>
<td>DC, 0.1 Hz to 1 kHz</td>
</tr>
<tr>
<td>Input elements</td>
<td>1, 2, 3, 4</td>
</tr>
<tr>
<td>Voltage range</td>
<td>15/20/25/30/50/100/150/300/500/1000 [V] (when crest factor is 3)</td>
</tr>
<tr>
<td></td>
<td>7.5/15/20/25/30/50/100/150/300/500 [V] (when crest factor is 6)</td>
</tr>
<tr>
<td>Current range</td>
<td>5m/10m/20m/50m/100m/200m/500m/1000/2500/5000 [A] (when crest factor is 3)</td>
</tr>
<tr>
<td></td>
<td>2.5m/5m/10m/20m/50m/100m/200m/500m/1000/2500/5000 [A] (when crest factor is 6)</td>
</tr>
<tr>
<td><strong>Measurement parameters</strong></td>
<td><strong>Measurement parameters</strong></td>
</tr>
<tr>
<td>Max measurement parameters</td>
<td>Voltage, current, active power, reactive power, apparent power, power factor, phase angle, peak voltage, peak current, crest factor</td>
</tr>
<tr>
<td>Peak hold (measurable maximum value hold)</td>
<td>✓</td>
</tr>
<tr>
<td>Max hold</td>
<td>✓</td>
</tr>
<tr>
<td>Voltage RMS/MEAN simultaneous measurement</td>
<td>✓</td>
</tr>
<tr>
<td>RMS/MEAN, DC simultaneous measurement</td>
<td>✓</td>
</tr>
<tr>
<td>Mean active power</td>
<td>✓ (user-defined function)</td>
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<tr>
<td>Active power amount (W)</td>
<td>✓</td>
</tr>
<tr>
<td>Apparent power amount (VA)</td>
<td>✓</td>
</tr>
<tr>
<td>Reactive power amount (VAR)</td>
<td>✓</td>
</tr>
<tr>
<td>Frequency</td>
<td>2 channels (up to 8 channels with option /FQ)</td>
</tr>
<tr>
<td></td>
<td>3 ch up to 12 channels with option /FQ</td>
</tr>
<tr>
<td>Efficiency</td>
<td>✓</td>
</tr>
<tr>
<td>Phase angle between phases (fundamental wave)</td>
<td>µ (GSA)</td>
</tr>
<tr>
<td>Meter evaluation</td>
<td>Torque, rotating speed input (motor version /opt.)</td>
</tr>
<tr>
<td></td>
<td>Torque and rotational velocity input (opt.)</td>
</tr>
<tr>
<td>FFT spectral analysis</td>
<td>µ (GSA)</td>
</tr>
<tr>
<td>User-defined functions</td>
<td>✓ (GSA)</td>
</tr>
<tr>
<td>Voltmeter</td>
<td>✓ (GSA)</td>
</tr>
<tr>
<td>Current, voltage, power</td>
<td>600,000</td>
</tr>
<tr>
<td></td>
<td>60,000</td>
</tr>
<tr>
<td>Power amount, current amount</td>
<td>999,999</td>
</tr>
<tr>
<td></td>
<td>999,999</td>
</tr>
<tr>
<td>Timebase</td>
<td>300,000</td>
</tr>
<tr>
<td>Digital sampling rate</td>
<td>2.5 kS/s ( optionally)</td>
</tr>
<tr>
<td>Display format</td>
<td>Numerical values, waveforms, trends, bar graphs, vectors</td>
</tr>
<tr>
<td></td>
<td>Numerical values, waveforms, trends, bar graphs, vectors</td>
</tr>
<tr>
<td>Sampling frequency</td>
<td>Approximately 300 KHz</td>
</tr>
<tr>
<td></td>
<td>Approximately 300 KHz</td>
</tr>
<tr>
<td><strong>Display resolutions</strong></td>
<td><strong>Display resolutions</strong></td>
</tr>
<tr>
<td>Harmonic measurement</td>
<td>µ (GSA)</td>
</tr>
<tr>
<td>Dual Harmonic Measurement</td>
<td>µ (GSA)</td>
</tr>
<tr>
<td>Harmonic measurement in normal measurement mode</td>
<td>µ (GSA)</td>
</tr>
<tr>
<td>Multiphase vector harmonic measurement</td>
<td>µ (GSA)</td>
</tr>
<tr>
<td>RIA measurement</td>
<td>1% (opt.)</td>
</tr>
<tr>
<td>Cycle-by-cycle measurement</td>
<td>µ (opt.)</td>
</tr>
<tr>
<td>Compensation function</td>
<td>µ (opt.)</td>
</tr>
<tr>
<td>Delta calculation function</td>
<td>µ (opt.)</td>
</tr>
<tr>
<td>DA output</td>
<td>20 channels (DA/option)</td>
</tr>
<tr>
<td></td>
<td>20 channels (DA/option)</td>
</tr>
<tr>
<td>Synchro resolver</td>
<td>µ (opt.)</td>
</tr>
<tr>
<td><strong>Other features</strong></td>
<td><strong>Other features</strong></td>
</tr>
<tr>
<td>Interfaces</td>
<td>GPIB, RS-232 (GII/option), USB (C12)</td>
</tr>
<tr>
<td></td>
<td>VGA output (V1/option), Ethernet (C7/option)</td>
</tr>
<tr>
<td>Communication command compatibility</td>
<td>None (communication commands vary from product to product)</td>
</tr>
<tr>
<td>Communication command standards</td>
<td>Commands in IEEE488.2 standard</td>
</tr>
<tr>
<td>Sampling interval</td>
<td>50m/100m/200m/500m/1000m/2500m/5000m/10000m (GSA)</td>
</tr>
<tr>
<td></td>
<td>50m/100m/200m/500m/1000m/2500m/5000m/10000m (GSA)</td>
</tr>
<tr>
<td>Remote control</td>
<td>RS-232/485 (GSA/option)</td>
</tr>
<tr>
<td></td>
<td>USB (GSA/option)</td>
</tr>
<tr>
<td>Printer</td>
<td>Built-in printer (front side)</td>
</tr>
<tr>
<td></td>
<td>Built-in printer (front side)</td>
</tr>
</tbody>
</table>

There are limitations on some specifications and functions. See the individual product catalogs for details.
## WT3000 SPEC

### WT3000 Specifications

**Inputs**

<table>
<thead>
<tr>
<th>Item</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Input terminal type</strong></td>
<td>Voltage Plug in terminal (safety terminal) Current • Direct input: Large binding post • External sensor input: insulated BNC connector</td>
</tr>
<tr>
<td><strong>Input type</strong></td>
<td>Voltage Floating input, resistive potential method Current Floating input, shunt input method</td>
</tr>
</tbody>
</table>

**Measurement range (rated value)**

| Voltage | 15 V, 30 V, 60 V, 100 V, 150 V, 300 V, 600 V, 1000 V (for crest factor 3) 7.5 V, 15 V, 30 V, 50 V, 75 V, 150 V, 300 V, 500 V (for crest factor 6) Current (2A input element) • Direct input: 5mA, 10mA, 20mA, 50mA, 100mA, 200mA, 500mA, 1A, 2A (for crest factor 3) 2.5mA, 5mA, 10mA, 25mA, 50mA, 100mA, 250mA, 500mA, 1A (for crest factor 6) • External sensor input: 50 mV, 100 mV, 200 mV, 500 mV, 1 V, 2 V, 5 V, and 10 V (for crest factor 3) 25 mV, 50 mV, 100 mV, 250 mV, 500 mV, 1 V, 2.5 V, and 5 V (for crest factor 6) Current (30A input element) • Direct input: 500 mA, 1 A, 2 A, 5 A, 10 A, 20 A, and 30 A (for crest factor 3) 250 mA, 500 mA, 1 A, 2.5 A, 5 A, 10 A, 15 A (for crest factor 6) • External sensor input: 50 mV, 100 mV, 200 mV, 500 mV, 1 V, 2 V, 5 V, and 10 V (for crest factor 3) 25 mV, 50 mV, 100 mV, 250 mV, 500 mV, 1 V, 2.5 V, and 5 V (for crest factor 6) |

**Input impedance**

| Voltage | Input impedance: Approx. 10 MΩ, input capacitance: Approx. 5 pF Current (2A input element) • Direct input: Approx. 50 mΩ ± approx. 0.07 μH • External sensor input: Input resistance: Approx. 1 MΩ, input capacitance: Approx. 40 pF Current (30A input element) • Direct input: Approx. 5.5 mΩ ± approx. 0.03 μH • External sensor input: Input resistance: Approx. 1 MΩ, input capacitance: Approx. 40 pF |

**Simultaneous maximum voltage (1s or less)**

| Voltage | Peak value of 2500 V or RMS value of 1500 V, whichever is less. Current (2A input element) • Direct input: Peak value of 9 A or RMS value of 3 A, whichever is less. • External sensor input: Peak value less than or equal to 10 times the measurement range. Current (30A input element) • Direct input: Peak value of 150 A or RMS value of 50 A, whichever is less. • External sensor input: Peak value less than or equal to 10 times the measurement range. |

**Continuous maximum allowable input**

| Voltage | Peak value of 1600 V or RMS value of 1100 V, whichever is less. Current (2A input element) • Direct input: Peak value of 6 A or RMS value of 2.2 A, whichever is less. • External sensor input: Peak value less than or equal to 5 times the measurement range. Current (30A input element) • Direct input: Peak value of 96 A or RMS value of 33 A, whichever is less. • External sensor input: Peak value less than or equal to 5 times the measurement range. |

**Continuous maximum common mode voltage (Input HD)**

| Voltage | Voltage input terminals, current input terminals 1000 Vrms External current sensor input connector 600 Vrms |

**Rated voltage to ground**

| Voltage | Voltage input terminals, current input terminals 1000 Vrms External current sensor input connector 600 Vrms |

**Influence from common mode voltage**

Apply 1000 Vrms with the voltage input terminals shorted and the current input terminals open. • 50/60 Hz: ±0.01% of range or less • Reference value up to 200 kHz Voltage: <3 range × % of range or less. However, 3% or less. Current direct input and current sensor input: ± (max. range/range) × 0.001 × % of range or less. However, 0.01% or more. The units are 1 kV/hz. The max. range within equations is 30 A or 2 A or 10 V. **Line filter** Select OFF, 500 Hz, 5.5 kHz, or 50 kHz. **Frequency filter** Select OFF, or DN **A/D converter** Simultaneous voltage and current conversion and 16-bit resolution. Conversion speed (sampling rate): Approximately 5 μs See harmonic measurement items for harmonic display. **Range switching** Can be set for each input element. **Auto range functions** Increasing range value • When the measured values of U and I exceed 110% of the range rating • When the peak value exceeds approximately 330% of the range rating (or approximately 600% for crest factor 6) Decreasing range value • When the measured values of U and I fall to 30% or less of the range rating, and Upk and Ipk are 300% or less of the lower range value (or 600% for crest factor 6) **Display**

Display 8.4-inch color TFT LCD monitor Total number of pixels* 640 (horiz.) x 480 (vert.) dots Waveshape display resolution 501 (horiz.) x 432 (vert.) dots Same as the data update rate. Exceptions are listed below. • The display update interval of numeric display (4, 8, and 16 items) is 250 ms when the data update rate is 50 ms or 100 ms. • The display update interval of numeric display (ALL, Single List, and Dual List) is 500 ms when the data update rate is 50 ms to 250 ms. • The display update rate of the trend display, bar graph display, and vector display is 1 s when the data update rate is 50 ms to 500 ms. • The display update interval of the waveshape display is approximately 1 s when the data update rate is 50 ms to 1 s. However, it may be longer depending on the trigger setting. * Up to 0.02% of the pixels on the LCD may be defective. **Calculation Functions**

### Calculation Functions

<table>
<thead>
<tr>
<th>Function</th>
<th>Formula</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voltage</td>
<td>U1 (U2)</td>
</tr>
<tr>
<td>Current</td>
<td>I1 (I2)</td>
</tr>
<tr>
<td>Power</td>
<td>P1+P2+P3+P4</td>
</tr>
<tr>
<td>Angle (φ)</td>
<td>Σq–1+q–2+q–3+q–4</td>
</tr>
<tr>
<td>Power factor</td>
<td>Ση–1+η–2+η–3+η–4</td>
</tr>
<tr>
<td>Frequency</td>
<td>f1×f2×f3×f4</td>
</tr>
<tr>
<td>Time</td>
<td>t1×t2×t3×t4</td>
</tr>
<tr>
<td>Speed</td>
<td>r1×r2×r3×r4</td>
</tr>
</tbody>
</table>

Note 1) The instrument’s apparent power (S), reactive power (Q), power factor (η), and phase angle (φ) are calculated using measured values of voltage, current, and active power. Note 2) The value of Q in the QΣ is calculated using the preceding minus sign (−) when the current input leads the voltage input, and a plus sign when it lags the voltage input, so the value of Q may be negative. **Waveform Display (WAVE display)**

**Waveform display limits** Voltage and current from elements 1 through 4 Motor version torque and waveform of revolution speed

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### Precision Power Analyzer WT3000
Accuracy

| Conditions | These conditions are all accuracy condition in this section. | Temperature: 23 ± 1°C, Humidity: 30% to 75%, input waveform: Sinewave, Common mode voltage: 0 V, Crest factor: 3, Line filter: OFF, (power factor): 1, After warm-up. After zero level, compensation or range value change while wired. Is frequency (kHz), 6-month |

30A input element, 2A input element (500mA, 1A, 2A range), Voltage input

<table>
<thead>
<tr>
<th>Voltage/current</th>
<th>Power</th>
</tr>
</thead>
<tbody>
<tr>
<td>DC</td>
<td></td>
</tr>
<tr>
<td>0.05% of reading+0.5% of range (30A, Sensor)</td>
<td>0.05% of reading+0.3% of range (2A, 2A direct current)</td>
</tr>
<tr>
<td>0.1% of reading+0.5% of range (30A, Sensor)</td>
<td>0.1% of reading+0.3% of range (2A, 2A direct current)</td>
</tr>
</tbody>
</table>

| DC              |       |
| 0.05% of reading+0.5% of range (sensor) | 0.1% of reading+0.3% of range (sensor) |
| 0.1% of reading+0.5% of range (sensor) | 0.1% of reading+0.3% of range (sensor) |

Add 2μA/°C to the DC accuracy, 0.02 mA/°C to the DC accuracy of the external current sensor input.

Add 0.2% of reading when it is 100 ms, and 0.1% of reading when 50 ms.

For temperature changes after zero level compensation or range change, add 2μA/°C to the 2A current accuracy, 0.02 mA/°C to the DC accuracy of the external current sensor input.

For temperature changes after zero level compensation or range change on the current sensor input, add 0.2 μA/°C to the DC accuracy of the external current sensor input.

Accuracy of waveform display data, Upk and Ipk

Add 0.03% of reading+0.05% of range of the voltage DC accuracy, 0.02 mA/°C to the voltage DC accuracy, 0.02 μA/°C to the voltage DC accuracy, and influence of voltage times influence of current to the power DC accuracy.

Accuracy of phase angle between the voltage and current.

Power calculation:

\[ P = V \times I \times \cos \phi \]

Where:

- \( P \) is the power in watts.
- \( V \) is the voltage in volts.
- \( I \) is the current in amperes.
- \( \cos \phi \) is the power factor.

Power factor dependency:

- At power factor 0.00, power reading is accurate.
- At power factor 0.99, power reading is accurate.
- At power factor 1.00, power reading may be in error (i.e., 0.00% – 1.00%).

The line filter may be used to improve the accuracy of the power reading.

When the current input changes to a small value, the generated heat continues until the temperature of the shunt resistor inside the WT3000 lowers.

Additions to accuracy according to the data update rate

Add 0.05% of reading when it is 100 ms, and 0.1% of reading when 50 ms.

- For temperature changes after zero level compensation or range change, add 2μA/°C to the 2A current accuracy, 0.02 mA/°C to the DC accuracy of the external current sensor input.
- For temperature changes after zero level compensation or range change on the current sensor input, add 0.2 μA/°C to the DC accuracy of the external current sensor input.
- Accuracy of waveform display data, Upk and Ipk.
- Add 3% of range to the accuracy above. However, add 3% of range +5mA for external input (reference value). Effective input range is within ±100% (within ±100% of the crest factor).
- Influenced by changes in temperature after zero level correction or range value changes.
- Add 50dpm of range/°C to the voltage DC accuracy, 0.2 mA/°C to the 30A input current DC accuracy, 3μA/°C to the 2A current accuracy, 0.02 μA/°C to the external current DC accuracy, and influence of voltage times influence of current to the power DC accuracy.

For self-generated heat caused by current input on an input DC signal, add 0.00004 × 1% of reading × 4 × 10 = 0.05% to the current accuracy. I is the current (A). The influence from self-generated heat continues until the temperature of the shunt resistor inside the WT3000 lowers even if the current input changes to a small value.

2A input element

For self-generated heat caused by current input on an input DC signal, add 0.004 × 1% of reading × 6 = 0.02% to the current accuracy. I is the current (A). The influence from self-generated heat continues until the temperature of the shunt resistor inside the WT3000 lowers even if the current input changes to a small value.

For temperature changes after zero level compensation or range change, add 0.05% of reading when it is 100 ms, and 0.1% of reading when 50 ms.

- Range of guaranteed accuracy by frequency, voltage, and current
All accuracies between 0.1 Hz and 10 Hz are reference values.
- Additions to accuracy according to the data update rate
Add 0.05% of reading when it is 100 ms, and 0.1% of reading when 50 ms.
- Accuracy of phase angle between the voltage and current
All accuracies between 0.1 Hz and 10 Hz are reference values.
- Accuracy of crest factor 3: Range accuracy of crest factor 3 for two times range.
Precision Power Analyzer WT3000

**Functions**

- **Measurement method**
  - Digital multiplication method
- **Crest factor**
  - 3 or 6 (when inputting rated values of the measurement range), and 300 relative to the minimum valid input. However, 1.6 or 3.2 at the maximum range (when inputting rated values of the measurement range), and 160 relative to the minimum valid input.

- **Measurement period**
  - Interval for determining the measurement function and performing calculations. Period used to determine and compute the measurement function.
  - The measurement period is set by the zero crossing of the reference signal (synchronization source) when the data update interval is 50 ms, 100 ms, 5 s, 10 s, or 20 s (excluding half watt HP as well as amper hour q during DC mode).
  - Measured through exponential averaging on the sampled data within the data update interval when the data update interval is 250 ms, 500 ms, 1 s, or 2 s.
  - For harmonic measurement, the measurement period is from the beginning of the data update interval to 9000 points at the harmonic sampling frequency.

- **Wiring**
  - You can select one of the following five wiring settings.
    - 1P2W (single phase, two wire), 1P3W (single phase, three wire), 3P3W (3 phase, 3 wire), 3P4W (3 phase, 4 wire), 3P3W(3VA) (3 phase, 3 wire, 3 volt/3 amp measurement).
  - However, the number of available wiring settings varies depending on the number of installed input elements. Up to four, or only one, two, or three wiring settings may be available.

- **Compensation Functions**
  - Efficiency Compensation
  - Compensation of instrument loss during efficiency calculation
  - **Wiring Compensation**
  - Compensation of instrument loss due to wiring
  - **2 Wattmeter Method Compensation** (/DT option)
  - Compensation for 2 wattmeter method

- **Scaling**
  - When inputting output from external current sensors, VT, or CT, set the current sensor conversion ratio, VT ratio, CT ratio, and power coefficient in the range from 0.0001 to 99999.9999.
  - The average calculations below are performed on the harmonic sampling frequency.
  - The average calculations below are performed on the range from 0.0001 to 99999.9999.
  - The average calculations below are performed on the waveform display settings.
  - The average calculations below are performed on the waveform display settings.
  - The average calculations below are performed on the waveform display settings.
  - The average calculations below are performed on the waveform display settings.

- **Input filter**
  - Line filter or frequency filter settings can be entered.
  - The average calculations below are performed on the normal measurement parameters of voltage U, current I, power P, apparent power S, reactive power Q. Power factor l and phase angle θ are determined by calculating the average of P and S. Select exponential or moving averaging.
  - Exponential average
  - Select an attenuation constant of 2, 4, 8, 16, 32, or 64.
  - Moving average
  - Select the number of averages from 8, 16, 32, 64, 128, or 256.
  - The average calculations below are performed on the waveform display settings.
  - Select exponential or moving averaging.

- **Averaging**
  - Select an attenuation constant of 2, 4, 8, 16, 32, or 64.
  - Moving average
  - Select the number of averages from 8, 16, 32, 64, 128, or 256.
  - The average calculations below are performed on the waveform display settings.
  - Select exponential or moving averaging.

- **Data update rate**
  - Select 50 ms, 100 ms, 250 ms, 500 ms, 1 s, 2 s, 5 s, 10 s, or 20 s.

- **Response time**
  - At maximum, twice the data update rate (only during numerical display).

- **Hold**
  - Holds the data displayed.

- **Single**
  - Executes a single measurement during measurement hold.

- **Zero level compensation**
  - Null Compensates the zero level.

**Integration**

- **Mode**
  - Select a mode of Manual, Standard, Continuous (repeat), Real Time Control Standard, or Real Time Control Continuous (repeat).

- **Timer**
  - Integration can be stopped automatically using the integration timer setting.
  - 0000000000-1000000000 time base.

- **Count over**
  - If the count over integration time reaches the maximum integration time (10000 hours), or if the integration value reaches max/min display integration value (±9999999 M), the elapsed time and value is saved and the operation is stopped.
  - The maximum integration time (10000 hours).

- **Accuracy**
  - ± (power accuracy or current accuracy) ± time accuracy

- **Time accuracy**
  - ± 0.02% of reading

- **Remote control**
  - EXT START, EXT STOP, EXT RESET, EXT HOLD, EXT SINGLE and EXT PRINT (all input signals) / INTEG BUSY (output signal). Requires /DA option.

**Display**

- **• Numerical display function**
  - Display resolution 600000
  - **Number of display items**
    - Select 4, 8, 16, all, single list, or dual list.

- **• Waveform display items**
  - **No. of display rasters**
    - 501
  - **Display format**
    - Peak-peak compressed data
  - **Time axis**
    - Range from 0.5 ms–2 s/div. However, it must be 1/10th of the data update rate.

**Triggers**

- **Trigger Type**
  - Edge type
  - **Trigger Mode**
    - Select Auto or Normal. Triggers are turned OFF automatically during integration.
  - **Trigger Source**
    - Select voltage, current, or external clock for the input to each input element.
  - **Trigger Slope**
    - Select (Rising), (Falling), or (Rising/Falling).
  - **Trigger Level**
    - When the trigger source is the voltage or current input to the input elements. Set in the range from the center of the screen to ±100% (top/bottom edge of the screen). Setting resolution: 0.1%.

- **Vertical axis Zoom**
  - Voltage and current input to the waveform display axis input element can be zoomed along the vertical axis.
  - Set in the range of 0.1 to 100 times.

- **ON/OFF**
  - ON/OFF can be set for each voltage and current input to the input element.

- **Format**
  - You can select 1, 2, 3, or 4 splits for the waveform display.

- **Interpolation**
  - Select dot or linear interpolation.

- **Graticule**
  - Select graticule or cross-grid display.

- **Other display ON/OFF**
  - Upper/lower limit (scale value), and waveform label ON/OFF.

- **Cursor measurements**
  - When you place the cursor on the waveform, the value of that point is measured.

**Zoom function**

- No time axis zoom function
  - Since the sampling frequency is approximately 200 kHz, waveforms that can be accurately reproduced are those of about 10 kHz.

- **• Vector Display/Bar Graph Display**
  - **Vector display**
    - Vector display of the phase difference in the fundamental waves of voltage and current.
  - **Bar graph display**
    - Displays the size of each harmonic in a bar graph.

- **• Trend display**
  - Number of measurement channels Up to 16 parameters
  - Displays trends (transitions) in numerical data of the measurement functions in a sequential line graph.

**Saving and Loading Data**

- Settings, waveform display data, numerical data, and screen image data can be saved to media.*
  - Saved settings can be loaded from a medium.
  - * PC card, USB memory (/C5 option)

**Store function**

- **Internal memory size**
  - Approximately 30 MB
  - **Store interval** (waveform OFF).
  - Maximum 50ms/c to 99 hour 59 minutes 58 seconds.

**Guideline for Storage Time**

- **Waveform Display OFF, Integration Function OFF**
  - **Number of measurement channels (Per CH)**
    - 1ch: 10, 50 ms
    - 2ch: 100, 1 s
    - 4ch: 200, 10 s
  - **Storable Amt. of Data**
    - 1ch: Approx. 10 hr 20 m
    - 2ch: Approx. 5 hr
    - 4ch: Approx. 2 hr 30 m

**Note:** Depending on the user-defined math, integration, and other settings, the actual measurement time may be shorter than stated above.

Store function can't use in combination with auto print function.

**Motor Evaluation Function (-M, Motor Version)**

- **Measurement Function**
  - Method of Determination: Equation

- **Rotating speed**
  - Width of input signal from the resolver sensor is DC voltage (analog signal)
  - Input voltage from resolver sensor x scaling factor
  - Scaling factor: Number of revolutions per 1 V input voltage
  - When the input signal from the resolver sensor is a number of pulses
  - Number of input pulses from resolver sensor per minute
  - Scaling factor

- **Torque**
  - When the type of input signal from the torque meter is DC voltage (analog signal)
  - Input voltage from torque meter x scaling factor
  - Scaling factor: Torque per 1 V input voltage
  - When the type of input signal from the torque meter is number of pulses
  - Input voltage from torque sensor x scaling factor
  - Scaling factor: Number of input pulses per revolution

- **Sync**
  - 120 x freq. of the freq. meas. source

- **Motor output**
  - Phases: Number of phases
  - Hz: Frequency
  - Synct: Speed
  - Motor: torque
  - Sens: Sensitivity

- **Motor output**
  - 2nd generation/Torque x scaling factor
Revolution signal, torque signal

- When revolution and torque signals are DC voltage (analog input)
  - Connector type: Insulated BNC connector
  - Input range: 1 V to 2 V, 5 V, 10 V, 20 V
  - Effective input range: 0% to 110% of measurement range
  - Input resistance: Approximately 1 MΩ
  - Continuous maximum allowed input: ±22 V
  - Continuous maximum common mode voltage: ±42 Vpeak or less
  - Accuracy: ±(0.1% of reading + 0.1% of range)
  - Temperature coefficient: ±0.03% of range°C

- When revolution and torque signals are pulse input

**Integrated Value**

- D/A output: Approx. ±7 V

**Built-in Printer (B5 Optional)**

- Printing method: Thermal line-dot
- Dot density: 8 dots/mm
- Paper width: 112 mm
- Effective recording width: 104 mm
- Recorded information: Screenshots, list of measured values, harmonic bar graph
- Auto print function: Measured values are printed out automatically. However, auto print function can’t be used in combination with store function.

**RGB Video Signal (VGA) Output Section (V1 Optional)**

- Connector type: 15-pin D-Sub (receptacle)
- Output format: VGA compatible

**Advanced Calculation (/G6 optional)**

- **Wide Bandwidth Harmonic Measurement**

  **Item**
<table>
<thead>
<tr>
<th>Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measured source</td>
</tr>
<tr>
<td>Format</td>
</tr>
<tr>
<td>Frequency range</td>
</tr>
<tr>
<td>Measured source</td>
</tr>
<tr>
<td>PLL source</td>
</tr>
<tr>
<td>Input level</td>
</tr>
</tbody>
</table>

- **FFT data length**

  | FFT data length | 9000 |
  | FFT processing word length | 32 bits |

- **Sample rate (sampling frequency)**

  | Window function | Rectangular |
  | Anti-aliasing filter | Set using a line filter (OFF, 500 Hz, 5.5 kHz, or 50 kHz). |

**PLL source synchronization method**

- **Fundamental Frequency of the PLL Source (Hz)**

<table>
<thead>
<tr>
<th>Sample Rate (S/s)</th>
<th>Window Width against the FFT Data Length (Frequency of the Fundamental Wave)</th>
<th>Upper Limit of the Measured Order</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 to 20</td>
<td>1 x 3000</td>
<td>3</td>
</tr>
<tr>
<td>20 to 40</td>
<td>1 x 1500</td>
<td>6</td>
</tr>
<tr>
<td>40 to 55</td>
<td>1 x 900</td>
<td>10</td>
</tr>
<tr>
<td>55 to 75</td>
<td>1 x 750</td>
<td>12</td>
</tr>
<tr>
<td>75 to 150</td>
<td>1 x 450</td>
<td>20</td>
</tr>
<tr>
<td>150 to 360</td>
<td>1 x 360</td>
<td>25</td>
</tr>
<tr>
<td>440 to 1100</td>
<td>1 x 150</td>
<td>60</td>
</tr>
<tr>
<td>1100 to 2600</td>
<td>1 x 60</td>
<td>150</td>
</tr>
</tbody>
</table>

**External sampling clock method**

- **Fundamental Frequency of the PLL Source (Hz)**

<table>
<thead>
<tr>
<th>Sample Rate (S/s)</th>
<th>Window Width against the FFT Data Length (Frequency of the Fundamental Wave)</th>
<th>Upper Limit of the Measured Order</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.1 to 66</td>
<td>1 x 3000</td>
<td>3</td>
</tr>
</tbody>
</table>

**ASA1072A 305 User Manual**
**Accuracy**

- **When the line filter (500 Hz) is ON**
  - Frequency | Voltage and Current | Power |
  - 0.1 Hz ≤ f ≤ 10 Hz | 0.7% of reading + 0.3% of range | 1.4% of reading + 0.4% of range |
  - 60 Hz ≤ f ≤ 60 Hz | 0.7% of reading + 0.3% of range | 1.4% of reading + 0.4% of range |

- **When the line filter (5.5 kHz) is ON**
  - Frequency | Voltage and Current | Power |
  - 0.1 Hz ≤ f ≤ 10 Hz | 0.15% of reading + 0.3% of range | 0.25% of reading + 0.4% of range |
  - 750 Hz ≤ f ≤ 30 Hz | 0.5% of reading + 0.4% of range | 0.5% of reading + 0.4% of range |

- **When the line filter is OFF**
  - Frequency | Voltage and Current | Power |
  - 0.1 Hz ≤ f ≤ 10 Hz | 0.15% of reading + 0.3% of range | 0.25% of reading + 0.4% of range |
  - 60 Hz ≤ f ≤ 60 Hz | 0.15% of reading + 0.3% of range | 0.25% of reading + 0.4% of range |

If the fundamental frequency is between 1 kHz and 2.6 kHz
- Add 0.5% of reading to the voltage and current accuracy for frequencies greater than 1 kHz.
- Add 1% of reading to the power accuracy for frequencies greater than 1 kHz.

### IEC Harmonic Measurement

- **Measured source**
  - Select an input element or an external unit.

- **Format**
  - PLL synchronization method

- **Frequency range**
  - Fundamental frequency of the PLL source is in the range of 45 Hz to 66 Hz.

- **PLL source**
  - Select the voltage or current of each input element (external sensor range is greater than or equal to 500 mV) or the external clock (fundamental frequency).
  - Input level
  - Greater than or equal to 50% of the measurement range rating when the crest factor is 3.
  - Greater than or equal to 100% of the measurement range rating when the crest factor is 6.
  - Be sure to turn the frequency filter ON.

### FFT Parameters

- **FFT data length**: 4096
- **FFT processing word length**: 32 bits
- **Window function**: Rectangular
- **Anti-aliasing filter**: Select using a line filter (5.5 kHz).

### Interharmonic measurement

- Select OP1, OP2, or type 3.

### Sample rate

- (Sampling frequency), window width, and upper limit of measured order

### Accuracy

- **When the line filter (5.5 kHz) is ON**
  - Frequency | Voltage and Current | Power |
  - 45 Hz ≤ f ≤ 66 Hz | 0.7% of reading + 0.3% of range | 1.4% of reading + 0.4% of range |
  - 66 Hz ≤ f ≤ 440 Hz | 0.15% of reading + 0.4% of range | 0.25% of reading + 0.5% of range |

- **Display update**
  - Depends on the PLL source.

### Waveform Computation

- **Voltage, current, and active power of each input element**
- **Angular frequency and speed (analog input)**
- **Torque (analog input)**
- **(Approximately 200 ms when the frequency of the PLL source is 45 Hz to 66 Hz.)**

### Specifications

- **Compressed source**
  - Voltage, current, and active power of each input element; torque (analog input); speed (analog input) of motor input; and motor output

- **Equation**
  - Two equations (MATHEMATICAL)

- **Sampling clock**
  - Fixed to 200 kHz

### Data Update

- **Data update interval**
  - Computing time
**FFT Function Specifications**

- **Compensated source**
  - Voltage, current, active power, and reactive power of each input element.
  - Active power and reactive power of an L wiring unit.
  - Torque and speed signals (analog input) of motor input (option).
  - Type: PS (power spectrum)

- **Number of computations**
  - Two computations (FFT1 and FFT2)

- **Maximum frequency of analysis**
  - 100 kHz

- **Number of points**
  - 20,000 points or 200,000 points

- **Measurement period for the computation**
  - 100 ms or 1 s

- **Frequency resolution**
  - 10 Hz or 1 Hz

- **Window function**
  - Rectangular, Hanning, or Flattop

- **Anti-aliasing filter**
  - Set using a line filter (OFF, 500 Hz, 5.5 kHz, or 50 kHz).

- **Display update**
  - Delta update rate or (measurement period of the FFT + FFT computing time), whichever is longer

*The measurement period is 1 s when the number of FFT points is 200 k (when the frequency resolution is 1 kHz).

- The measurement period is 100 ms when the number of FFT points is 20 k (when the frequency resolution is 10 Hz).

**Harmonic Measurement in Normal Measurement**

- **Frequency range**
  - Range in which the fundamental frequency of the PLL source is 10 Hz to 2600 Hz

- **PLL source**
  - Select the voltage or current of each input element (external current sensor range is greater than or equal to 500 mV)
  - External current sensor (Ex Clk).

- **Input level**
  - Greater than or equal to 50% of the measurement range rating when the crest factor is 3
  - Greater than or equal to 100% of the measurement range rating when the crest factor is 6

- **Window function**
  - Rectangular, Hanning, or Flattop

**Note**

To measure and display harmonic data requires a data update rate of 500 ms or more.

**Sample rate (sampling frequency)**, window width, and upper limit of measured order during PLL synchronization

**Fundamental the PLL Source (Hz)**

<table>
<thead>
<tr>
<th>Sample Rate (S/s)</th>
<th>Window Width against the FFT Data Length (Frequency of the Fundamental Wave)</th>
<th>Upper Limit of the Measured Order</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 to 20</td>
<td>t × 3000</td>
<td>3</td>
</tr>
<tr>
<td>20 to 40</td>
<td>t × 1500</td>
<td>6</td>
</tr>
<tr>
<td>40 to 55</td>
<td>t × 900</td>
<td>10</td>
</tr>
<tr>
<td>55 to 75</td>
<td>t × 750</td>
<td>12</td>
</tr>
<tr>
<td>75 to 150</td>
<td>t × 450</td>
<td>20</td>
</tr>
<tr>
<td>150 to 440</td>
<td>t × 360</td>
<td>25</td>
</tr>
<tr>
<td>440 to 1100</td>
<td>t × 150</td>
<td>60</td>
</tr>
<tr>
<td>1100 to 2600</td>
<td>t × 60</td>
<td>150</td>
</tr>
</tbody>
</table>

**Accuracy**

- **When the line filter (5.5 kHz) is ON**

  - **Fundamental the PLL Source (Hz)**
  - **Sample Rate (S/s)**
  - **Window Width against the FFT Data Length (Frequency of the Fundamental Wave)**
  - **Upper Limit of the Measured Order**

- **Voltage and Current**
  - Error range = ±1.2% of reading + 0.15% of range
  - Greater than or equal to 500 mV)
  - For nth order component input, add (n/m+1)/25% of (the nth order reading) to the n+mth order accuracy
  - For nth order input, add (n/m+1)/50% of (the nth order reading) to the n+mth order accuracy
  - For nth order input, add (n/m+1)/75% of (the nth order reading) to the n+mth order accuracy
  - For nth order input, add (n/m+1)/100% of (the nth order reading) to the n+mth order accuracy
  - For nth order input, add (n/m+1)/150% of (the nth order reading) to the n+mth order accuracy
  - For nth order input, add (n/m+1)/175% of (the nth order reading) to the n+mth order accuracy

- **Power**
  - Error range = ±1.2% of reading + 0.15% of range
  - Greater than or equal to 500 mV)
  - For nth order component input, add (n/m+1)/50% of (the nth order reading) to the n+mth order accuracy
  - For nth order input, add (n/m+1)/75% of (the nth order reading) to the n+mth order accuracy
  - For nth order input, add (n/m+1)/100% of (the nth order reading) to the n+mth order accuracy
  - For nth order input, add (n/m+1)/150% of (the nth order reading) to the n+mth order accuracy
  - For nth order input, add (n/m+1)/175% of (the nth order reading) to the n+mth order accuracy

If the fundamental frequency is between 1 kHz and 2.6 kHz, add 0.5% of reading to the voltage and current accuracy and 1% of reading to the power accuracy when the frequency exceeds 1 kHz.

- **When the line filter is OFF**

  - **Fundamental the PLL Source (Hz)**
  - **Sample Rate (S/s)**
  - **Window Width against the FFT Data Length (Frequency of the Fundamental Wave)**
  - **Upper Limit of the Measured Order**

- **Voltage and Current**
  - Error range = ±1.2% of reading + 0.15% of range
  - Greater than or equal to 500 mV)
  - For nth order component input, add (n/m+1)/50% of (the nth order reading) to the n+mth order accuracy
  - For nth order input, add (n/m+1)/75% of (the nth order reading) to the n+mth order accuracy
  - For nth order input, add (n/m+1)/100% of (the nth order reading) to the n+mth order accuracy
  - For nth order input, add (n/m+1)/150% of (the nth order reading) to the n+mth order accuracy
  - For nth order input, add (n/m+1)/175% of (the nth order reading) to the n+mth order accuracy

If the fundamental frequency is between 1 kHz and 2.6 kHz, add 0.5% of reading to the voltage and current accuracy and 1% of reading to the power accuracy when the frequency exceeds 1 kHz.

**Waveform Sampling Data Saving Function**

- **Parameters**
  - Voltage waveform, current waveform, analog input waveform of torque and speed waveform calculation, FFT, performing data

- **Data type**
  - CSV format, WVF format

- **Storage**
  - USB memory (1/4 option)
  - Waveform calculation function (MATH) cannot be used with FFT calculation at the same time.
**Voltage Fluctuation/Flicker Measurement (FL optional)**

- **Normal Flicker Measurement Mode**
  - **Item**
  - **Specifications**
  - Measurement items:
    - (Measurement Functions): 
      - Dmax: Maximum relative voltage change
      - D(t): The time during which the relative voltage change during a voltage fluctuation period exceeds the threshold level
    - The maximum value within a observation period is displayed for the items above.
    - Pat: Short-term flicker value
    - Pt: Long-term flicker value
  - **Observation period** 30 min to 15 s
  - **Observation period count** 1–89

- **Measurement of dfm caused by Manual Switching Mode**
  - **Item**
  - **Specifications**
  - Measurement:
    - Dm: Maximum relative voltage change
  - **Observation period** 1 minute
  - **Observation period count** 24
  - **Averaging**
    - Average of 22 measured dfm values excluding the maximum and minimum values among 24 values

- **Items Common to Measurement Modes**
  - **Item**
  - **Specifications**
  - **Target voltage/frequency** 230 V 50 Hz or 120 V 60 Hz
  - **Measured item** All installed elements
  - **Measured source input** Voltage (current measurement function not available)
  - **Flicker scale** 0.01 to 6400P.U. (20%) divided logarithmically into 1024 levels
  - **Display Update** 2 s (dc, dmax, and d(t)) for every completion of an observation period (Pat)
  - **Communication output**
    - dc, dmax, d(t), Pvt, P, instantaneous flicker sensation (IFS), and cumulative probability function (CPF)
  - **Printer output** Screen image
  - **External storage output**: Screen image
  - **Accuracy**
    - dc, dmax: 4% (at dcmax = 4%)
    - Pat: ±5% (at Pat = 1)
    - For every completion of an observation period (Pvt)
  - **Conditions for the accuracy above**
    - Ambient temperature: 23 ± 1°C
    - Line filter: OFF
  - **Input voltage range**
    - 220V to 250V at the 300V measuring range (50Hz)
    - 110V to 130V at the 150V measuring range (50Hz)

**Cycle-by-cycle measurement (CC optional)**

- **Synch source**
  - Select an external source of U1, U1, I2, I2, U3, I3, U4, or I4.
- **Number of measurements** 10-3000
- **Timeout time** 0.1-3600 seconds (set in units of seconds), 0 (approximately 24 hours)
- **Synch source frequency range**
  - 1 Hz to 1000 Hz (for U and I)
  - 0.1 Hz to 1000 Hz (for external sync source)
- **Accuracy**
  - U, I, P:
    - Add (0.3+2 f)% of readings in (0.05+0.05 f)% of the accuracy to the accuracy of the calculated measurement.
  - For external sensor input:
    - Add (100+100 f)% of the accuracy to the accuracy of the calculated measurement.

**GP-IB Interface**

- Use one of the following by NATIONAL INSTRUMENTS:
  - PT-GP8B and PCI-GP8B+
  - PCMCIA-GP8B and PCMCIA-GP8B+
- Use driver NI-488.2M version 1.60 or later.
- Conforms electrically and mechanically to EIA Std 488-1978 (JIS C 1901-1987).
- Functional specification SH1, AH1, TS, A4, SR1, RL1, PPO, DC1, DT1, and C0.
- Conforms to protocol IEEE Std 488.2-1987.
- **Encoding**
  - ISO (ASCII)
- **Mode**
  - Addressable mode
- **Address**
  - 0-30
- **Clear remote mode**
  - Remote mode can be cleared using the LOCAL key (except during Local Lockout).

**Ethernet Communications (C7 Optional)**

- **Number of communication ports** 1
- **Connector type** RJ-45 connector
- **Electrical and mechanical specifications** Conforms to IEEE 802.3.
- **Transmission system** Ethernet 10BASE-T/100BASE-TX
- **Transmission rate** 10 Mbps/100Mbps
- **Protocol** TCP/IP
- **Supported Services**
  - FTP server (FTP client)
  - Network driver
  - LPR client (network printer), SMTP client (mail transmission), Web server, DHCP, DNS, Remote control
- **Connector Type** RJ-45 connector

**Serial (RS-232) Interface (C2 Optional)**

- **Connector type** 9-pin D-Sub (plug)
- **Electrical Specifications** Conforms with EIA 574 (EIA-232 (RS-232) standard for 9-pin)
- **Connection type** Point-to-point
- **Communication mode** Full duplex
- **Synchronization method** Start-stop synchronization
- **Baud rate** Select from the following:
  - 1200, 2400, 4800, 9600, 19200 bps

**USB port (PC)(C12 Optional)**

- **Connector type** Type B connector (receptacle)
- **Electrical and Mechanical Specifications** Conforms to USB Rev.1.1
- **Speed** Max. 12 Mbps
- **Number of Ports** 1
- **Supported service** Remote control
- **Supported Systems** Standard USB ports that run Windows 2000 or Windows XP with USB port as a standard. (A separate device driver is required for connecting to a PC.)

**USB port (Peripheral)(C5 Optional)**

- **Connector type** Type A connector (receptacle)
- **Electrical and Mechanical Specifications** Conforms to USB Rev.1.1
- **Speed** Max. 12 Mbps
- **Number of Ports** 2
- **Supported keyboards** 104 keyboard (US) and 109 keyboard (Japanese) conforming to USB HID Class 1.1 devices
- **Supported USB memory devices** USB (USB memory) flash memory
- **Power supply** 5 V, 500 mA (per port)
- **However, device whose maximum current consumption exceeds 100 mA cannot be connected simultaneously to the two ports.**

**External I/O**

- **i-O section for Master/Slave Synchronization Signals**
  - **Connector type** BNC connector: Both slave and master

**General Specifications**

- **Warm-up time** Approximately thirty minutes.
- **Operating temperature** 5–40°C
- **Operating humidity** 20–80% (when printer is used)
- **Storage environment** -25 to 60°C (No condensation may be present)
- **Rated power consumption** 150 VA (when used in printer)
- **Battery backup** Setup information and internal clock are backed up with lithium battery (No condensation may be present)
- **Weight** Approximately 15 kg (including main unit, 4 input elements, and options)
- **Battery backup** Setup information and internal clock are backed up with lithium battery
- **Warning for Class A instruments**
  - This is a Class A instrument based on Emission standards EN61326-1 and EN55011, and is designed for an industrial environment.
  - Operation of this equipment in a residential area may cause radio interference, in which case users will be responsible for any interference which they cause.
AC signals have waveforms that fluctuate repeatedly when viewed instantaneously. Therefore, measuring the power values of AC signals requires averaging for each period in a repeated interval, or averaging the data of several periods using a filtering process. The WT3000 automatically selects the appropriate calculation method (one of the above two methods) based on the data updating period. This approach ensures fast response and high stability as suitable for the particular measurement objective.

- When the data updating period is 50ms, 100ms, 5s, 10s, or 20s

Measurement values are determined by applying an Average for the Synchronous Source Period (ASSP) calculation to the sample data within the data updating period. (Note that this excludes power integrated values WP, as well as current integrated value q in DC mode). With ASSP, a frequency measurement circuit is used to detect the input signal period set as the synchronous source. Sample data corresponding to an interval which is an integer multiple of the input period are used to perform the calculation. Based on its fundamental principles, the ASSP method allows measurement values to be obtained simply by averaging an interval corresponding to a single period, so it is useful in cases where the data updating period is short or when measuring the efficiency of low-frequency signals.

This method will not provide correct measurement values unless the period of the set synchronous source signal is accurately sensed. Therefore, it is necessary to check whether the frequency of the synchronous source signal has been accurately measured and displayed. See the user’s manual for notes on the synchronous source signal and frequency setting.

- When the data updating period is 250ms, 500ms, 1s, or 2s

Measurement values are determined by applying an Exponential Average for Measuring Period (EAMP) calculation to the sample data within the data updating period. With EAMP, the sample data are averaged by applying a digital filtering process. This method does not require accurate detection of the input period. EAMP provides excellent measurement value stability.

See page 12 of the specifications for information on the relationship between the data updating period and the lowest measurement frequency.

### Selecting formulas for calculating apparent power and reactive power

There are several types of power—active power, reactive power, and apparent power. Generally, the following equations are satisfied:

* Active power $P = U I \cos \phi$ (1)
* Reactive power $Q = U I \sin \phi$ (2)
* Apparent power $S = \sqrt{P^2 + Q^2}$ (3)

In addition, these power values are related to each other as follows:

* (Apparent power $S^2$) = (Active power $P^2$) + (Reactive power $Q^2$) (4)

U: Voltage RMS
I: Current RMS
$\phi$: Phase between current and voltage

Three-phase power is the sum of the power values in the individual phases. These defining equations are only valid for sinewaves. In recent years, there has been an increase in measurements of distorted waveforms, and users are measuring sinewave signals less frequently. Distorted waveform measurements provide different measurement values for apparent power and reactive power depending on which of the above defining equations is selected. In addition, because there is no defining equation for power in a distorted wave, it is not necessarily clear which equation is correct. Therefore, three different formulas for calculating apparent power and reactive power for three-phase four-wire connection are provided with the WT3000.

#### TYPE1 (method used in normal mode with older WT Series models)

With this method, the apparent power for each phase is calculated from equation (3), and reactive power for each phase is calculated from equation (4). Next, the results are added to calculate the power:

- Active power: $P = P_1 + P_2 + P_3$
- Apparent power: $S = S_1 + S_2 + S_3$
- Reactive power: $Q = Q_1 + Q_2 + Q_3$

**Note:** $S_1$, $S_2$, and $S_3$ are calculated with a positive sign for the leading phase and a negative sign for the lagging phase.

#### TYPE2

The apparent power for each phase is calculated from equation (3), and the results are added together to calculate the three-phase apparent power (same as in TYPE1). Three-phase reactive power is calculated from three-phase apparent power and three-phase active power using equation (4).

- Active power: $P = P_1 + P_2 + P_3$
- Apparent power: $S = S_1 + S_2 + S_3$
- Reactive power: $Q = Q_1 + Q_2 + Q_3$

#### TYPE3 (method used in harmonic measurement mode with WT1600 and PZ4000)

This is the only method in which the reactive power for each phase is directly calculated using equation (3). Three-phase apparent power is calculated from equation (4).

- Active power: $P = P_1 + P_2 + P_3$
- Apparent power: $S = S_1 + S_2 + S_3$
- Reactive power: $Q = Q_1 + Q_2 + Q_3$

### Accessories

#### Instrument Carts.

**701960**
Compact Instrument Cart
500 × 560 × 755 mm (WDH)
- A: Keyboard and mouse mount
- Top shelf: Equipment not exceeding 610 (W) × 400 (D) × 88 (H) mm
- Middle shelf: Equipment not exceeding 450 (W) × 300 (D) × 60 (H) mm
- Bottom shelf: Equipment not exceeding 610 (W) × 400 (D) × 88 (H) mm
- Maximum load: 20 kg on each shelf

**701962**
All-purpose Instrument Cart
467 × 693 × 713 mm (WDH)
- Top shelf: Equipment not exceeding 450 (W) × 200 (D) × 570 (H) mm
- Middle shelf: Equipment not exceeding 450 (W) × 240 (D) × 300 (H) mm
- Bottom shelf: Equipment not exceeding 450 (W) × 200 (D) × 570 (H) mm
- Maximum load: 20 kg on each shelf

**701961**
Deluxe Instrument Cart
570 × 580 × 839 mm (WDH)
- A: Keyboard and mouse mount
- Top shelf: Equipment not exceeding 610 (W) × 400 (D) × 88 (H) mm
- Middle shelf: Equipment not exceeding 610 (W) × 400 (D) × 88 (H) mm
- Bottom shelf: Equipment not exceeding 610 (W) × 400 (D) × 88 (H) mm
- Maximum load: 50 kg on each shelf

* The photo shows the mount holding a DL7400.

**External dimensions of Yokogawa power meters (excluding protrusions)**

<table>
<thead>
<tr>
<th>Model</th>
<th>Width (mm)</th>
<th>Height (mm)</th>
<th>Depth (mm)</th>
<th>Compact mount (WxDxH)</th>
<th>Deluxe mount (WxDxH)</th>
<th>Optional-protrusion mount (WxDxH)</th>
</tr>
</thead>
<tbody>
<tr>
<td>WT3000/WT1800</td>
<td>426</td>
<td>177</td>
<td>450</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>WT1600</td>
<td>426</td>
<td>177</td>
<td>450</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>WT7200/WT310</td>
<td>213</td>
<td>88</td>
<td>379</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>WZ2560/WT330</td>
<td>213</td>
<td>132</td>
<td>379</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>PZ4000</td>
<td>426</td>
<td>177</td>
<td>450</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>

* The back side includes protrude beyond the back shelves of the mounts.
### Model and Suffix Codes

#### Precision Power Analyzer WT3000

<table>
<thead>
<tr>
<th>Model</th>
<th>Suffix Codes</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>760300</td>
<td>01</td>
<td>WT3000 1 input element model</td>
</tr>
<tr>
<td>760301</td>
<td>02</td>
<td>WT3000 2 input elements model</td>
</tr>
<tr>
<td>760302</td>
<td>03</td>
<td>WT3000 3 input elements model</td>
</tr>
<tr>
<td>760303</td>
<td>04</td>
<td>WT3000 4 input elements model</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Element number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>30A input element for 760301 model</td>
</tr>
<tr>
<td>02</td>
<td>30A input element for 760302 model</td>
</tr>
<tr>
<td>03</td>
<td>30A input element for 760303 model</td>
</tr>
<tr>
<td>04</td>
<td>30A input element for 760304 model</td>
</tr>
<tr>
<td>10</td>
<td>2A input element for 760301 model</td>
</tr>
<tr>
<td>20</td>
<td>2A input element for 760302 model</td>
</tr>
<tr>
<td>30</td>
<td>2A input element for 760303 model</td>
</tr>
<tr>
<td>40</td>
<td>2A input element for 760304 model</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Version</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>760300</td>
<td>Standard Version</td>
</tr>
<tr>
<td>760301</td>
<td>MK1 Version</td>
</tr>
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</table>

<table>
<thead>
<tr>
<th>Power cord</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>G</td>
<td>UL/CSA standard</td>
</tr>
<tr>
<td>H</td>
<td>VDE standard</td>
</tr>
<tr>
<td>M</td>
<td>BS standard</td>
</tr>
<tr>
<td>D</td>
<td>VBR standard</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Options</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>S2</td>
<td>Advanced Computation (EC, standard-testing*, harmonics, FFT, Waveform computation)</td>
</tr>
<tr>
<td>G1</td>
<td>Delta Calculation</td>
</tr>
<tr>
<td>TQ</td>
<td>Arbitrary Frequency Measurement</td>
</tr>
<tr>
<td>OI</td>
<td>UART I/O Input</td>
</tr>
<tr>
<td>Y1</td>
<td>VGA Output</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>RS-232</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>-5</td>
<td>Serial-232 Interface</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>USB port (PC)</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>-5A</td>
<td>USB port (Peripheral)</td>
</tr>
</tbody>
</table>

| -D | Ethernet function |
| -C | Cycle by Cycle |

| P0 | Voltage Proximate, Filterer |

| Safety terminal adapter 758931 | Description |

| * Use these products with low-voltage circuits (42V or less). |

| Subject to change without notice. |

### Application Software

<table>
<thead>
<tr>
<th>Model</th>
<th>Product</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>760132</td>
<td>WTV/Viewe Software</td>
<td>Data acquisition software</td>
</tr>
<tr>
<td>761922</td>
<td>Harmonic/Voltage flicker Measurement Software</td>
<td>Standard-compliant measurement</td>
</tr>
</tbody>
</table>

### Rack Mount

<table>
<thead>
<tr>
<th>Model</th>
<th>Product</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>761530-B4</td>
<td>Rack mounting kit</td>
<td>For EVA</td>
</tr>
<tr>
<td>761530-U1</td>
<td>Rack mounting kit</td>
<td>For RJ</td>
</tr>
</tbody>
</table>

### Accessory (sold separately)

<table>
<thead>
<tr>
<th>Model</th>
<th>Product</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>758917</td>
<td>Test lead set</td>
<td>A set of 0.6m long, red and black test leads</td>
</tr>
<tr>
<td>758919</td>
<td>Small alligator-clip</td>
<td>Rated at 500V and used in a pair</td>
</tr>
<tr>
<td>758920</td>
<td>Large alligator-clip</td>
<td>Rated at 1000V and used in a pair</td>
</tr>
<tr>
<td>758923</td>
<td>Safety terminal adapter</td>
<td>Screw-hold type. Two adapters to a set.</td>
</tr>
<tr>
<td>758931</td>
<td>Safety terminal adapter</td>
<td>Screw-hold type. Two adapters to a set. 1.5 mm hex wrench is attached</td>
</tr>
<tr>
<td>758932</td>
<td>Test terminal adapter</td>
<td>Banana-socket adapter. Two adapters to a set.</td>
</tr>
<tr>
<td>710959</td>
<td>Safety mini-clip</td>
<td>Hook type. Two in a set</td>
</tr>
<tr>
<td>758924</td>
<td>Conversion adapter</td>
<td>BNC-banana (pin/terminal) adapter</td>
</tr>
<tr>
<td>764925</td>
<td>BNC-BNC cable</td>
<td>1m</td>
</tr>
<tr>
<td>764927</td>
<td>BNC-BNC cable</td>
<td>2m</td>
</tr>
<tr>
<td>701959</td>
<td>Safety mini-clip</td>
<td>Hook type. Two in a set</td>
</tr>
</tbody>
</table>

### Mounts

<table>
<thead>
<tr>
<th>Model</th>
<th>Product</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>751535-E4</td>
<td>Rack mounting kit</td>
<td>For EIA</td>
</tr>
</tbody>
</table>

### Current Sensor Unit

<table>
<thead>
<tr>
<th>Model</th>
<th>Product</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>710521</td>
<td>Single-phase</td>
<td>DC to 100 kHz (± 3 dB). 600 A to 0 A to 600 A (DC)</td>
</tr>
<tr>
<td>715123</td>
<td>Three-phase U, V, W</td>
<td>Basic accuracy: ± 0.05% of rating + 40 mV; Superior noise withstandability and CMRR characteristics due to optimized casing design</td>
</tr>
</tbody>
</table>

### AC/DC Current sensor /Clamp on Probe

<table>
<thead>
<tr>
<th>Model</th>
<th>Product Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>C1000</td>
<td>AC-DC Current sensor</td>
<td>DC: 550 Hz; ±0.05% of reading + 350 A; 1000 Apk</td>
</tr>
<tr>
<td>C1000</td>
<td>AC-DC Current sensor</td>
<td>AC: 550 Hz; ±0.05% of reading + 350 A; 1000 Apk</td>
</tr>
<tr>
<td>C100</td>
<td>AC-DC Current sensor</td>
<td>DC: 600 Hz; ±0.05% of reading + 350 A; 60 Apk</td>
</tr>
<tr>
<td>C150</td>
<td>AC-DC Current sensor</td>
<td>AC: 75 kHz; 1800 Arms (1000 Arms)</td>
</tr>
</tbody>
</table>

### Exterior

<table>
<thead>
<tr>
<th>Unit</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>32</td>
<td></td>
</tr>
<tr>
<td>427</td>
<td></td>
</tr>
<tr>
<td>426</td>
<td></td>
</tr>
<tr>
<td>425</td>
<td></td>
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<tr>
<td>424</td>
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