Digital Power Meter

KPM1000

Applies to the wide range of power measurements, from very low power to high power!!

Exclusively for single phase
IEC62301 First Edition compliant, ErP Directive (Lot 6 and other) standby power measurements
17 measurement items, including voltage, current, frequency, active power, phase angle, and power factor
Basic accuracy ± (0.1% reading + 0.1% range)
Current range: 5 mA to 20 A
RS232C standard interface
GPIB/USB (factory option)
The KPM1000 Digital Power Meter is a single-phase power measuring instrument that applies to the wide range of power measurements, from very low power during standby mode to high power during operation mode. It has a minimum power range of 750 mW, with resolution of 0.01 mW, and the basic accuracy of 0.1% of reading with guaranteed accuracy extending from 1% of the range while it realizes a wide dynamic range.

In recent years, eco-design regulations have been actively implemented in many countries, starting with Europe’s ErP Directive and including the United States’ Energy Star and Japan’s Top Runner Program. These regulations are being utilized by companies in their efforts to act against environmental problems and differentiate their products. Through ErP Directive Lot 6, the standby power (off mode and standby mode power consumption) of household electrical appliances and OA electronic equipment is regulated and the preparation of a declaration of conformity is required by CE marking. This requirement regulates the standby power to become 1 W or less; and starting in 2013, the regulation will be strictly reduced to 0.5 W or less. The KPM1000 can accurately measure the standby power even less than 0.5 W.

The KPM1000 complies with IEC62301 (the measurement of standby and off mode power in household and office electrical and electronic equipment products) standards, and it is capable to perform the standby power measurements required by ErP Directive Lot 6 and other regulations. System upgrades are also possible. Because of its size, weight, and various type of optional interface (some are factory options), the KPM1000 can be widely used as a beach-top instrument for measuring equipment power and also as a part of component of the test system.
**Digital Power Meter**

**KPM1000**

### High-precision resolution

Voltage, current, and power basic accuracy ±(0.1 % of reading + 0.1 % of range)

<table>
<thead>
<tr>
<th>Voltage range</th>
<th>150 V/300 V/Auto range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current range</td>
<td>5 mA/10 mA/20 mA/50 mA/100 mA/200 mA/500 mA/1 A/2 A/5 A/10 A/20 A/Auto range</td>
</tr>
<tr>
<td>Power range</td>
<td>750 mW/1.5 W/3 W/6 W/7.5 W/15 W/30 W/60 W/75 W/150 W/300 W/600 W/750 W/1.5 kW/3 kW/6 kW</td>
</tr>
</tbody>
</table>

*Automatically determined based on voltage/current range combination.

### Four-item display

Displays four measurement items simultaneously. Save the trouble from switching the measurement item. High viewability of seven-segment display provides excellent visibility even from distant positions.

### 17 diverse measurement items

- Voltage
- Current
- Active power
- Apparent power
- Reactive power
- Power factor
- Phase angle
- Frequency
- Integrated current
- Integrated power
- Integrated power in positive direction
- Integrated power in negative direction
- Integrated elapsed time
- Voltage crest factor
- Current crest factor
- Voltage peak
- Current peak

### Single-phase two-wire (measurement category: CAT II)

The measurement category is classified into several categories, such as CAT I, CAT II, CAT III, CAT IV, etc. The KPM1000 is capable of applying to the category CAT II measurement.

#### [Measurement categories]

- Service entrance
- Distribution panel
- Indoor wiring
- Fixed equipment
- Electric meter
- Pole transformer
- Outlet

#### [Maximum transient voltage]

<table>
<thead>
<tr>
<th>Line-to-Neutral Voltage (V)</th>
<th>Measurement Category (II)</th>
<th>Measurement Category (III)</th>
<th>Measurement Category (IV)</th>
</tr>
</thead>
<tbody>
<tr>
<td>50</td>
<td>500</td>
<td>800</td>
<td>1500</td>
</tr>
<tr>
<td>100</td>
<td>800</td>
<td>1500</td>
<td>2500</td>
</tr>
<tr>
<td>150</td>
<td>1000</td>
<td>2500</td>
<td>4000</td>
</tr>
<tr>
<td>200</td>
<td>2500</td>
<td>4000</td>
<td>6000</td>
</tr>
<tr>
<td>600</td>
<td>4000</td>
<td>6000</td>
<td>8000</td>
</tr>
<tr>
<td>1000</td>
<td>6000</td>
<td>8000</td>
<td>12000</td>
</tr>
</tbody>
</table>

*Measurement categories II, III, and IV apply only to measurements with the main power supply up to an AC effective value of 1000 V.

### Separate positive and negative measurements of cumulative power

The unit is suitable for measuring power consumption and regeneration of solar power conditioners and other system interconnection inverters.

#### Example of display

- Integrated elapsed time display
  - **24:00:00**
- Integrated power (total) display [net power]
  - **4566665**
- Integrated power (positive direction) display [purchased power]
  - **624352**
- Integrated power (negative direction) display [sold power]
  - **57687**

### Simple operation

The KPM1000 can be operated intuitively without reliance on a manual.

#### RS232C standard interface

*GPIB, USB (factory option)

**Rear panel**

### Crest factor 6

Obtaining crest factor 6 realizes to perform high-precision measurements of waveforms having a small effective value but large peak value.

*Allowable crest factor of voltage measurement is 3.

#### Crest factor calculation

\[
\text{Crest factor} = \frac{\text{Peak value}}{\text{Effective value}}
\]

#### With the KPM1000:

\[
\text{Crest factor} = \frac{(\text{measurement range } \times 6)}{\text{Measured value (effective value)}}
\]

- Voltage (measurement range × 3)/measured value or 900 Vpk, whichever is less
- Current (measurement range × 6)/measured value or 120 Apk, whichever is less
**APPLICATION**

**Power measurement and application examples**

- **Measurement with direct input (Less than 20 A of DUT)**

  - Digital Power Meter KPM1000
  - Test lead TL40

  - **Options**
    - Utilization of Assist Tool
    - **Digital Power Meter KPM1000**
    - PT (potential transformer)
    - **Digital Power Meter KPM1000**
    - CT (current transformer)
    - **Digital Power Meter KPM1000**
    - DUT
      - Microwave ranges, microwave ovens, etc.
    - Ac power supply
    - Various connector adapters TL40/41/42/43/44/45
    - Test lead
    - TL40

  - **DUT**
    - Microwaves, microwave ovens, etc.

  - **AC power supply**

  - **Measurement using CT (current transformer) and PT (potential transformer) (Exceeds 20 A of DUT)**

  - Digital Power Meter KPM1000
  - Test lead TL40
  - **Options**
    - Utilization of Assist Tool
    - **Digital Power Meter KPM1000**
    - PT (potential transformer)
    - **Digital Power Meter KPM1000**
    - CT (current transformer)
    - **Digital Power Meter KPM1000**
    - DUT
      - (20 A or greater), high voltage equipment, etc.
    - Ac power supply
    - Various connector adapters TL40/41/42/43/44/45
    - Test lead
    - TL40

  - **DUT**
    - Microwave ranges, microwave ovens, etc.

  - **AC power supply**

- **Utilization of Assist Tool**

  - A handy application software Assist Tool can be downloaded from the WEB. It makes the operation possible from a PC as you would from the main unit panel. And as a data logger, it can easily acquire the long term periods of data, too.

  - **Collective display of measurement parameters**
    - 17 measurement items can be displayed in a single window.

- **Measurement data logging feature**

  - Using the Assist Tool, you can import waveform data to the PC in the CSV format with a simple connection and a single press of a button.
  - When an application such as Excel is used, graphs can easily be created.

- **Acquisition of voltage and current waveform data**

  - You can easily import voltage and current waveforms to a PC. It is difficult to imagine what type of waveform they actually have even when the peak values, crest factors, and power factor values are viewed. Also, it is difficult to use and take measurements with an instrument such as an oscilloscope with linear measurements of surroundings. With this function, voltage and current waveform data can easily be imported to a PC in the CSV format. When an application such as Excel is used, graphs can easily be created.

- **Measurement of integrated power**

- **Measurement of standby power**

- **Other, advanced settings**

- **Communication settings**

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**Free download from our Web site**
Measurement of standby power

- Measurements complying with IEC62301 First Edition standards can be performed. It is possible to measure the “standby and off mode power” of the household and office electrical and electronic equipment products required by the standard such as ErP Directive Lot 6.

[What is the ErP Directive?]

The ErP Directive* is a directive that requires ecodesigns (environmentally conscious designs) for energy-related products (ErP). An energy-related product is defined as “a product that does not directly consume energy but affects energy consumption in the stage of usage.” Therefore, the ErP Directive requires ecodesigns not only for electronic and electrical equipment and other products that directly consume energy but for products that indirectly affect energy consumption and reduction (such as windows and equipment that utilizes water). Specifically targeted products and requirements are determined by implementation measures (IMs) for each product field (lot). Environmentally compliant designs and limiting values for energy usage and energy efficiency are established particularly for the purpose of improving energy efficiency.

*DIRECTIVE 2009/125/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 21 October 2009 establishing a framework for the setting of ecodesign requirements for energy-related products

### Power consumption of household electrical appliances and office electronic and electrical equipment in standby mode and off mode (Commission Regulation(EC) No 1275/2008)

<table>
<thead>
<tr>
<th>Values prescribed by ErP Directive Lot 6</th>
<th>Phase 1</th>
<th>Phase 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date of commencement for mandatory implementation of measure</td>
<td>7-Jan-10</td>
<td>7-Jan-13</td>
</tr>
<tr>
<td>Off mode power consumption</td>
<td>1 W or less</td>
<td>0.5 W or less</td>
</tr>
<tr>
<td>Standby mode power consumption</td>
<td>1 W or less</td>
<td>0.5 W or less</td>
</tr>
<tr>
<td>(2 W or less when information or status is displayed)</td>
<td>(1 W or less when information or status is displayed)</td>
<td></td>
</tr>
</tbody>
</table>

Related options

**OT01-KPM**
- AC outlet cable
- 125 V/15 A

**OT02-KPM**
- AC Multi-outlet cable
- 250 V/15 A

**SD010-KPM**
- IEC62301 First Edition measurement application software
- This is special application software for performing standard tests easily.
### Specifications

**Input**
- Measurement line: Single-phase, two-wire system (measurement category: CAT II) *1
- Voltage input terminal: Safety terminal
- Current input terminal: M6 terminal block
- Rated measured voltage: 300 Vrms
- Rated measured current: 20 Arms
- Maximum allowable input voltage: 300 Vpk or 360 Vrms
- Maximum allowable input current: 120 Apk or 24 Arms
- Maximum isolation voltage: 300 V
- Input impedance:
  - Current input: 6 MΩ ± 10%
  - Voltage input: 500 mA
- Line filter (LPF): Off ±(3 % of range)

**Effective input range**
- 1% to 120% of the range
  - When the value exceeds 120 % of the range or when a peak over-range occurs

**Accuracy**
- ±(0.1 % of reading + 0.2 % of range)

**One-year accuracy**
- ±3 % of range

**Input impedance**
- Maximum allowable input current: 120 Apk or 24 Arms
- Voltage input: 6 MD ± 10 %
- Current input: 2 mA or less
- Line filter (LPF): 500 Hz (can be turned on or off)

**Display items**

<table>
<thead>
<tr>
<th>Measurement items</th>
<th>Voltage, current, active power, apparent power, reactive power, power factor, phase angle, frequency, integrated current, integrated power, positive integrated power, negative integrated power, integration time/voltage crest factor, current crest factor, voltage peak, current peak.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Display update interval</td>
<td>100 ms, 200 ms, 500 ms, 1 s, 2 s, 5 s, 10 s.</td>
</tr>
</tbody>
</table>

**Number of display items**
- 4 items simultaneously.

**Voltage measurement function**
- Measurement range
  - Resolution: 150 V 0.01 V
  - Resolution: 300 V 0.01 V
- Allowable crest factor: 3

**Current measurement function**
- Measurement range
  - Resolution: 5 mA 0.0001 mA
  - Resolution: 10 mA 0.001 mA
  - Resolution: 20 mA 0.001 mA
  - Resolution: 50 mA 0.001 mA
  - Resolution: 100 mA 0.001 mA
  - Resolution: 200 mA 0.01 mA
  - Resolution: 500 mA 0.1 mA
  - Resolution: 1 A 0.1 mA
  - Resolution: 2 A 0.1 mA
  - Resolution: 5 A 0.1 mA
  - Resolution: 10 A 1 mA
  - Resolution: 20 A 1 mA
- Allowable crest factor: 6

**Accuracy**
- ±(0.1 % of reading + 0.1 % of range)
  - When the value exceeds 120 % of the range or when a peak over-range occurs

**Power measurement function**
- Measurement range
  - Resolution: 750 W 0.01 mW
  - Resolution: 1.5 W 0.1 mW
  - Resolution: 6 W 0.1 mW
  - Resolution: 7.5 W 0.1 mW
  - Resolution: 10 W 0.1 mW
  - Resolution: 20 W 0.1 mW
  - Resolution: 30 W 0.1 mW
  - Resolution: 40 W 0.1 mW
  - Resolution: 60 W 0.1 mW
  - Resolution: 75 W 0.1 mW
  - Resolution: 150 W 0.1 mW
  - Resolution: 300 W 0.1 mW
  - Resolution: 600 W 0.1 mW
  - Resolution: 750 W 0.1 mW
  - Resolution: 1.5 kW 0.1 mW
  - Resolution: 3 kW 0.1 mW
  - Resolution: 6 kW 0.1 mW
- Accuracy
  - ±0.4 % of VA
- Influence of the power factor
  - Power factor 0.4 Hz to 96 Hz
  - Power factor 0.1 % to 144 % of the range

**Measurement (combination of the voltage and current ranges)**
- Effective input range
  - 45 Hz ≤ f ≤ 66 Hz
  - LPF: Off ±(0.1 % of reading + 0.2 % of range)
  - 66 Hz < f ≤ 400 Hz
  - LPF: Off ±(0.1 % of reading + 0.2 % of range)
  - 400 Hz < f ≤ 1 kHz
  - LPF: Off ±(0.1 % of reading + 0.2 % of range)
  - 1 kHz < f ≤ 3 kHz
  - LPF: Off ±(3 % of range)

**One-year accuracy**
- ±3 % of range

- **UP condition**
  - When the value is less than 30 % of the range, the value is less than or equal to 90 % of the next lower range, and a peak overrange is not occurring

- **DOWN condition**
  - When the value exceeds 120 % of the range or when a peak over-range occurs

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*1* Applies to measurements on circuits directly connected to a low-voltage installation. This category applies to measurements on circuits of equipment on the primary side of a transformer. Such pieces of equipment have a power cord connected to a power outlet. Examples are household appliances and portable tools.

*2* When the value is less than 30 % of the range, the value is less than or equal to 90 % of the next lower range, and a peak overrange is not occurring

*3* The peak current accuracy is defined for a sine wave whose frequency is between 45 Hz and 66 Hz. Accuracy: ± (0.1 % of reading + 3.1 % of range)

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**Effective input range**
- 1% to 120 % of the range
  - When the value exceeds 120 % of the range or when a peak over-range occurs

**Accuracy**
- ±(0.1 % of reading + 0.2 % of range)

**One-year accuracy**
- ±3 % of range

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*1* Under the following conditions: within the effective input range, within six months after the last calibration, at a temperature of 23 °C ± 5 °C, sine wave, power factor of 1, and common mode voltage of 0 V. If the waveform is asymmetrical (waveforms such as half-wave rectified waveforms and full-wave rectified waveforms), errors will occur.

*2* When you are using the 5 mA range and the input is less than 10 % of the range, add (0.1 % of reading + 0.2 % of range)

*3* The peak current accuracy is defined for a sine wave whose frequency is between 45 Hz and 66 Hz. Accuracy: ± (0.1 % of reading + 3.1 % of range)
### Frequency measurement function
- **Measurement range**: 10 Hz to 10 kHz
- **Measured item**: Voltage or current
- **Measurement input level**: 30% to 120% of the measurement range
- **Frequency filter**: On (cutoff frequency: 500 Hz) or off
- **Accuracy**: ±(0.06 % of reading)

### Math features
- **Apparent power**: \[ VA = V \cdot A \]
- **Reactive power**: \[ var = \sqrt{(VA)^2 - W^2} \]
- **Power factor**: \[ PF = \frac{W}{VA} \]
- **Crest factor**: \[ \text{Peak value}/\text{RMS value} \]
- **Moving average (averaging)**: Off, 2, 4, 8, 16, 32, 64
- **Select range for the PT ratio**: 1 to 2000 in steps of 1
- **Select range for the CT ratio**: 1 to 2000 in steps of 1
- **Accuracy of leading phase and lagging phase detection**: ±10°

1. This is determined through a digital computation using the voltage, current, and active power. For distorted signal input, the value obtained on the KPM1000 may differ from that obtained on other instruments that use a different method.
2. The measurement accuracy is determined by an expression whose components are the measurement accuracies of the voltage, current, and active power.

### Integration feature
- **Integration Accuracy**: (Accuracy of the power or current ± 0.1 % of reading)
- **Timer**
  - **Selectable range**: 0 hours 00 minutes to 9999 hours 59 minutes
  - **Accuracy**: ±0.02 %

1. You can use the timer setting to automatically stop integration.

### Other functions
- **Synchronization source**: Voltage, current, off (the full display update interval)
- **Display hold**: Holds the displayed values; you can switch between displayed (measured) values

### Communication function
- **RS232C (standard), GPIB/USB (select either, factory option)**

### General specifications

<table>
<thead>
<tr>
<th>AC input</th>
<th>Normal input rating</th>
<th>100 V to 240 V, 50 Hz to 60 Hz</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Voltage range</td>
<td>90 V to 250 V</td>
</tr>
<tr>
<td></td>
<td>Maximum power consumption</td>
<td>70 VA</td>
</tr>
<tr>
<td></td>
<td>Withstand voltage</td>
<td>Between the voltage and current input terminals and the chassis and interface</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Between the voltage and current input terminals and the AC input</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1980 Vac for 5 minutes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Between the AC input and the chassis</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1500 Vac for 1 minute</td>
</tr>
<tr>
<td></td>
<td>Insulation resistance</td>
<td>Between the voltage and current input terminals and the AC input</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Between the AC input and the chassis</td>
</tr>
<tr>
<td></td>
<td></td>
<td>100 MΩ or greater at 500 Vdc</td>
</tr>
<tr>
<td></td>
<td>Environmental conditions</td>
<td>Operating environment</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Indoor use, overvoltage category II</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Operating temperature</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Operating humidity</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Storage temperature</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Storage humidity</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Altitude</td>
</tr>
<tr>
<td></td>
<td>Earth continuity</td>
<td>0.1 Ω or less at 25 Aac</td>
</tr>
<tr>
<td>Safety</td>
<td>*1</td>
<td>Complies with the requirements of the following directive and standard</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Low Voltage Directive 2006/95/EC *2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>EN61010-1, class I, pollution degree 2</td>
</tr>
<tr>
<td>Electromagnetic compatibility (EMC)</td>
<td>*1 *2 *3</td>
<td>Complies with the requirements of the following directive and standard</td>
</tr>
<tr>
<td></td>
<td></td>
<td>EMC Directive 2004/108/EC</td>
</tr>
<tr>
<td></td>
<td></td>
<td>EN 61326-1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Compliance condition: The maximum length of all cabling and wiring connected to the KPM1000 must be less than 3 m.</td>
</tr>
</tbody>
</table>

### Dimensions

| Dimensions | See the outline drawing |
| Weight | Approx. 2.5 kg (5.51 lb.) |

### Accessories
- **Power cord (three-pronged)**: 1
- **Safety plugs (solder-connection type)**: 1 set (red and black)
- **CD-ROM**: 1
- **Quick start**: English: 1, Japanese: 1
- **Safety information**: 1 (contains English, Chinese, and Japanese)
- **Packing list**: 1 (contains both English and Japanese)

1. Does not apply to specially ordered or modified KPM1000s.
2. Limited to products that have the CE mark on their panels.
3. The measured values may be affected by noise.
   Use shielded cables for the communication cables. The act of connecting measuring cables may cause radio interference, in which case users may be required to correct the interference.
### Ordering Information

#### Main unit

<table>
<thead>
<tr>
<th>Model</th>
<th>Part</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>KPM1000</td>
<td>Digital Power Meter</td>
<td>IEC62301 First Edition compliant</td>
</tr>
</tbody>
</table>

#### Option

<table>
<thead>
<tr>
<th>Test lead</th>
<th>TL40</th>
<th>Red/black One each 1000 V/ CATII, max 32 A</th>
<th>Length: 1 m</th>
</tr>
</thead>
<tbody>
<tr>
<td>Safety plug (screw connection type)</td>
<td>TL41</td>
<td>Red/black One each 1000 V/ CATII, max 32 A</td>
<td></td>
</tr>
<tr>
<td>Safety plug (solder connection type)</td>
<td>TL42</td>
<td>Red/black One each 1000 V/ CATII, max 32 A</td>
<td></td>
</tr>
<tr>
<td>Safety plug (clamp connection type)</td>
<td>TL43</td>
<td>Red/black One each 600 V/ CATII, max 10 A</td>
<td></td>
</tr>
<tr>
<td>Alligator clip</td>
<td>TL44</td>
<td>Red/black One each 1000 V/ CATII, max 32 A</td>
<td></td>
</tr>
</tbody>
</table>

#### Fork terminal adapter

| TL45        | Red/black One each 1000 V/ CATII, max 20 A |                   |

#### AC outlet cable

| OT01-KPM | 125 V/15 A |                   |

#### AC Multi-outlet cable

| OT02-KPM | 250 V/15 A |                   |

#### Other

<table>
<thead>
<tr>
<th>Model</th>
<th>Part</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>KRA2</td>
<td>Rack mount adapter (EIA)</td>
<td>inch size, 2U width</td>
</tr>
<tr>
<td>KRA100</td>
<td>Rack mount adapter (JIS)</td>
<td>Millimeter size, 2U width</td>
</tr>
<tr>
<td></td>
<td>GPIB interface *</td>
<td>Factory option</td>
</tr>
<tr>
<td></td>
<td>USB interface *</td>
<td></td>
</tr>
<tr>
<td>SD010-KPM</td>
<td>For IEC62301 measurement</td>
<td>IEC62301 First Edition compliant</td>
</tr>
<tr>
<td></td>
<td>Application software</td>
<td></td>
</tr>
</tbody>
</table>

* This is a factory option. Either one shall be attached to the main unit.

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