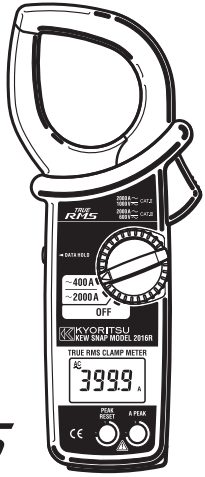
INSTRUCTION MANUAL



TRUE RMS

DIGITAL CLAMP METER

KEW SNAP SERIES

MODEL 2016R

KYORITSU ELECTRICAL INSTRUMENTS WORKS, LTD.

Contents

1. Safety Warnings

This instrument has been designed and tested according to IEC Publication 61010: Safety Requirements for Electronic Measuring Apparatus. This instruction manual contains warnings and safety rules which must be observed by the user to ensure safe operation of the instrument and retain it in safe condition. Therefore, read through these operating instructions before using the instrument.

⚠ WARNING

- Read through and understand instructions contained in this manual before using the instrument.
- Save and keep the manual handy to enable quick reference whenever necessary.
- Be sure to use the instrument only in its intended applications and to follow measurement procedures described in the manual.
- Be sure to understand and follow all safety instructions contained in the manual.

Failure to follow the above instructions may cause injury, instrument damage and/or damage to equipment under test.

○The symbol ⚠ indicated on the instrument means that the user must refer to related parts in the manual for safe operation of the instrument. Be sure to carefully read the instructions following each ⚠ symbol in this manual.

⚠**DANGER** is reserved for conditions and actions that are likely to cause serious or fatal injury.
⚠**WARNING** is reserved for conditions and actions that can cause serious or fatal injury.
⚠**CAUTION** is reserved for conditions and actions that can cause minor injury or instrument damage.

○ Following symbols are used on the instrument and in the instruction manual. Attention should be paid to each symbol to ensure your safety.


Refer to the instructions in the manual.


Indicates an instrument with double or reinforced insulation.


Indicates that this instrument can clamp on bare conductors when measuring a voltage corresponding to the applicable Measurement category, which is marked next to this symbol.


Indicates AC (Alternating Current).

Indicates DC (Direct Current).

Indicates AC and DC.

Indicates Earth.

⚠DANGER

- Never make measurement on the circuit above 750VAC or 1000VDC.
- Do not attempt to make measurement in the presence of flammable gasses, fumes, vapor or dust. Otherwise, the use of the instrument may cause sparking, which can lead to an explosion.
- Transformer jaw tips are designed not to short the circuit under test. If equipment under test has exposed conductive parts, however, extra precaution should be taken to minimize the possibility of shorting.
- Never attempt to use the instrument if its surface or your hand is wet.
- Do not exceed the maximum allowable input of any measurement range.
- Never open the battery compartment cover and the instrument case when making measurement.
- Verify proper operation on a known source before use or taking action as a result of the indication of the instrument.
- Never try to make measurement if any abnormal conditions, such as broken Transformer jaws or case is noted.
- The instrument is to be used only in its intended applications or conditions. Otherwise, safety functions equipped with the instrument doesn't work, and instrument damage or serious personal injury may be caused.

⚠WARNING

- Never attempt to make any measurement if any abnormal conditions are noted, such as broken case, cracked test leads and exposed metal parts.
- Do not turn the function selector switch with test leads connected to the instrument.
- Do not install substitute parts or make any modification to the instrument. Return the instrument to your distributor for repair or re-calibration.
- Do not try to replace the batteries if the surface of the instrument is wet.
- Always switch off the instrument and make sure to disconnect test leads before opening the battery compartment cover for battery replacement.

⚠ CAUTION

- Always make sure to check the function selector switch is set to an appropriate position before starting measurement.
- Always make sure to insert the plug of each lead fully into the appropriate terminal on the instrument.
- Be sure to set the function selector switch to the "OFF" position after use. When the instrument will not be in use for a long period, place it in storage after removing the batteries.
- Do not expose the instrument to the direct sun, high temperature or dew fall.
- Use a cloth dipped in water or neutral detergent for cleaning the instrument. Do not use abrasives or solvents.

Measurement categories (Over-voltage categories)

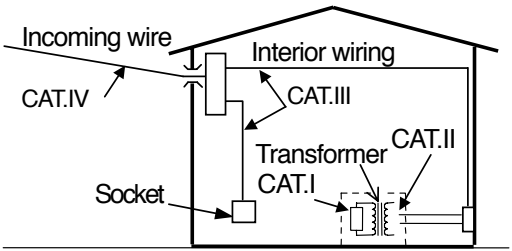
To ensure safe operation of measuring instruments, IEC61010 establishes safety standards for various electrical environments, categorized as CAT I to CAT IV, and called measurement categories. Higher-numbered categories correspond to electrical environments with greater momentary energy, so a measuring instrument designed for CAT III environments can endure greater momentary energy than one designed for CATII.

CAT.I :Secondary electrical circuits connected to an AC electrical outlet through a transformer or similar device.

CAT.II:Primary electrical circuits of equipment connected to an AC electrical outlet by a power cord.

CAT.III:Primary electrical circuits of the equipment connected directly to the distribution panel, and feeders from the distribution panel to outlets.

CAT.IV:The circuit from the service drop to the service entrance, and to the power meter and primary over-current protection device (distribution panel).



2. Features

- Tear-drop-shaped jaws for ease of use in crowded cable areas.
- Provides a wide measuring range from 0 up to 2000A.
- Accurate true-RMS reading of AC current with distorted waveform.
- Measures current variation as short as 10 msec with peak-hold feature.
- Designed to CAT.Ⅲ 600V/CAT.Ⅱ 1000V and pollution degree 2 specified by the international safety standard IEC 61010-2-032.
- Data hold function to allow for easy readings in dimly lit or hard-to-read locations.
- Sleep feature to extend battery life.
- Provides a dynamic range of 4,000 counts full scale.
- Wide frequency range from 40Hz to 1kHz (0-1500A).
- Transformer jows fitted with guard to further improve safety.
- Protected throughout by double or reinforced insulation "⊡".

3. Specifications

●Measuring Ranges and Accuracy(at 23 ±5 , relative humidity 45-75%)

AC Current (～400A, ～2000A)

Range	Measuring Range	Resolution	Accuracy （Frequency Range）	Maximum Measurement Time
400 A	0 ～400.0 A	0.1 A	±1.5%rdg±3dgt（45～65Hz）	Continuous
			±2.5%rdg±3dgt（40～1kHz）	
2000 A	0 ～1000 A	1 A	±2.0%rdg±5dgt（45～65Hz）	
	1000～1500 A		±3.0%rdg±5dgt（40～1kHz）	15min
	1500～2000 A		±4.0%rdg （50/60Hz）	5 min

●CF (Crest Factor) CF=3 or less
accuracy+1% (45～65Hz)、less than AC3000A Peak

●Electromagnetic compatibility (EMC)
EN61000-4-2 Electrostatic discharge immunity(ESD)
Performance criteria B

●Operating System	Dual Integration
●Display	Liquid crystal display (maximum 4000 counts)
●Low Battery Warning	"BATT"symbol is displayed on the digital display.
●Overrange Indication	"OL" is displayed where input exceeds the upper limit of a range.
●Response Time	Approx. 2 seconds. (F.S.)
●Sleep function	Automatically powered down in about 10 minutes after the last switch operation.
●Data Hold	Available in all ranges provided the peak measurement mode is not activated.
●Storage Temperature and Humidity	-20-60:, relative humidity up to 85%without condensation.
●Operating Temperature and Humidity	0-40:, relative humidity up to 85%without condensation.
●Conductor Size	Approx. 54.5A diameter max.
●Overload Protection	2400A AC for 10sec.
●Withstand Voltage	5500V AC, 50/60Hz for 1 minute between electrical circuit and housing case or metal part of the jaws
●Insulation Resistance	10MΩ or greater at 1000V between electrical circuit and housing cases or, metal parts of jaws.
●Safety Standard	IEC 61010-1/-2-032 Over-voltage CAT.Ⅲ 600V/ CAT.Ⅱ 1000V, pollution degree 2. IEC 61326(EMC).
●Dimensions	247(L)x105(W)x49(D)mm
●Weight	Approx. 440g(battery included).
●Power Source	Two R6P(DC1.5V) batteries or equivalent
●Current Consumption	Approx. 10mA max. (Approx. 20 μA in the sleep mode)

●Accessories — Two R6P batteries
Instruction manual
Carrying case Model 9098

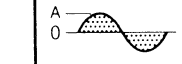
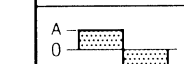
●Optional Accessories — Clamp Adaptor Model 8008

***Effective Value (RMS)**

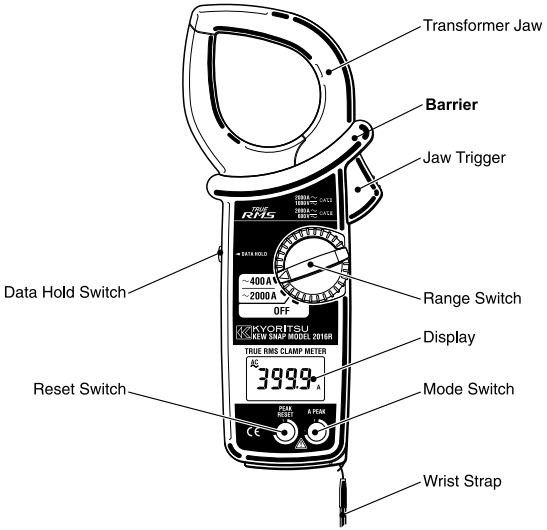
Most alternating currents and voltages are expressed in effective values, which are also referred to as RMS (Root-Mean-Square) values. The effective value is the square root of the average of square of alternating current or voltage values.

Many clamp meters using a conventional rectifying circuit have "RMS" scales for AC measurement. The scales are, however, actually calibrated in terms of the effective value of a sine wave though the clamp meter is responding to the average value. The calibration is done with a conversion factor of 1.111 for sine wave, which is found by dividing the effective value by the average value. These instruments are therefore in error if the input current has some other shape than sine wave.

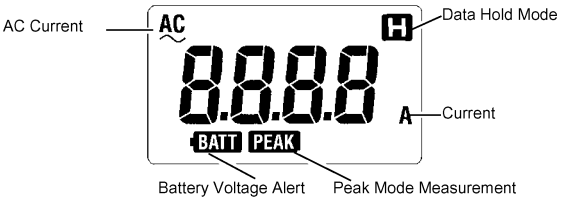
*CF (Crest Factor) is found by dividing the peak value by the effective value.
Examples:
Sine wave: CF=1.414
Square wave with a 1: 9 duty ratio: CF=3

Waveform	Effective value Vms	Average value Vavg	Conversion factor Vms/Vavg	Reading errors for average sensing instruments	Crest factor CF
	$\frac{1}{\sqrt{2}}A$ $\fallingdotseq 0.707$	$\frac{2}{\pi}A$ $\fallingdotseq 0.637$	$\frac{\pi}{2\sqrt{2}}$ $\fallingdotseq 1.111$	0%	$\sqrt{2}$ $\fallingdotseq 1.414$
	A	A	1	$\frac{A\times 1.111 - A}{A}\times 100$ $= 11.1\%$	1
	$\frac{1}{\sqrt{3}}A$	0.5 A	$\frac{2}{\sqrt{3}}$ $\fallingdotseq 1.155$	$\frac{0.5A\times 1.111 - \frac{A}{\sqrt{3}}}{\frac{A}{\sqrt{3}}}$ $\times 100 = -3.8\%$	$\sqrt{3}$ $\fallingdotseq 1.732$
	$A\sqrt{D}$	$A\frac{f}{T}$ $= A \cdot D$	$\frac{A\sqrt{D}}{AD} = \frac{1}{\sqrt{D}}$	$(1.111\sqrt{D}-1)$ $\times 100\%$	$\frac{A}{A\sqrt{D}} = \frac{1}{\sqrt{D}}$

4. Instrument Layout



● L C D INDICATOR



5. Preparation for Measurement

5-1 Checking Battery Voltage

(1) Set the range switch to any position other than "OFF".

(2) When the display is clear without "BATT" showing, proceed to measurement.

(3) When the display blanks or "BATT" is indicated, replace the batteries according to section 8: battery replacement.

NOTE

● The sleep feature automatically turns the instrument off in a certain period of time after the last switch operation. Therefore, the display may be blank with the range switch set to a position other than "OFF". To operate the instrument in this case, set the switch back to the "OFF" position, then to the desired position, or press any button.

5-2 Checking Switch Setting and Operation

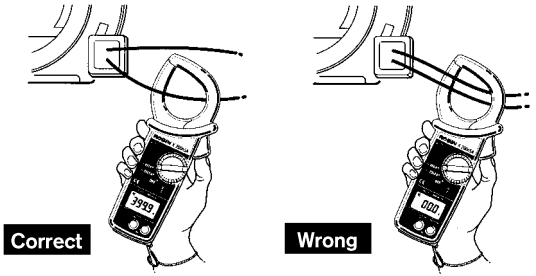
Make sure that the range switch is set to the correct position, the instrument is set to the correct mode and the data hold function is deactivated. Otherwise, desired measurement cannot be made. (See section 6 for measurement instructions and section 7 for notes on functions.)

6. Measurement

Current Measurement

⚠WARNING

- Do not make measurement on a circuit above 750V AC. This may cause shock hazard or damage to the instrument or equipment under test.
- The transformer jaws are made of metal and their tips are not insulated. Where the equipment under test has exposed metal parts, be especially careful about the hazard of possible shorting.
- Do not make measurement with the battery compartment cover removed from the instrument.
- When measuring current above 1000A, make sure to stop measurement within the maximum measuring time shown below. Otherwise, the transformer jaws may overheat and may cause a fire or deformation of molded parts, which will degrade insulation.
  1000-1500A: 15min. 1500-2000A: 5min.
- Keep your fingers and hands behind the barrier during measurement.



6-1 AC Current Measurement (Normal Mode)

(1) Set the range switch to the "∼400A" or "∼2000A" position and make sure that the current under test does not exceed the upper limit of the measuring range you are selecting.
(2) Press the trigger to open the transformer jaws and clamp them onto the conductor under test.
(3) Take the reading on the display.

NOTE

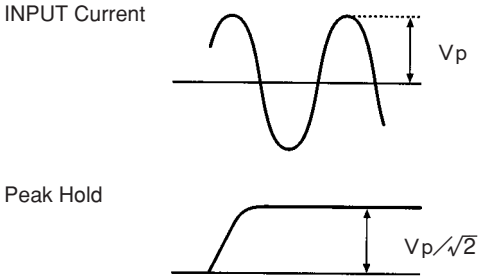
- During current measurement, keep the transformer jaws fully closed. Otherwise, accurate measurement cannot be made. The maximum measurable conductor size is 54.5mm in diameter.
- When measuring high value currents, the transformer jaws may buzz. This is not a fault and does not affect the accuracy.

6-2 Peak Current Measurement

(1) Set the range switch to the "～400A" or "～2000A" position.
(2) Press the mode button to select the peak mode. "PEAK" will be shown on the display.
(3) Press the trigger to open the transformer jaws and clamp them onto the conductor under test. Then, press the reset button.
(4) The display shows the current's crest value divided by the square root of two. Therefore, when the current is sinusoidal, the reading equals RMS value.
(5) To reset the display, press the reset button.
(Note: When this is done, the reading goes off for about one second.)
(6) After the measurement is completed, press the mode button to return to the normal mode.

NOTE

- In the peak measurement mode, the data hold feature is disabled.
- When a measured value is 9 counts or less, it is corrected to 0.



7. Notes on Functions

7-1 Data Hold

This function can be used to freeze the measured value on the display.

(1) Press the data hold button. The reading becomes frozen and the "H" symbol is shown on the display, indicating the instrument is in the data hold mode.
(2) To exit the data hold mode, press the data hold button again to release it.

NOTE

- When the range switch is turned while the instrument is in the data hold mode, the data hold function remains activated. To make measurement in this case, release the data hold button by pressing it and exit the data hold mode.
- The data hold function is disabled in the peak measurement mode on the AC current range.
- When the sleep function is activated, the data hold mode turns to the normal mode.

7-2 Sleep Function

This is a function to prevent the instrument from being left powered on in order to conserve battery life.

(1) The instrument automatically enters the sleep (powered-down) mode about 10 minutes after the last switch operation.
(2) To exit the sleep mode, press the data hold, reset or mode button or turn the range switch back to "OFF", then to any other position.

[How to Exit the Sleep Mode]

(1) Turning the range switch from "OFF" to another position with the data hold switch pressed disables the sleep function and "P.OFF" is shown on the display (power hold). This enables continuous use of the instrument.

(2) To enable the sleep function, turn the range switch back to "OFF", then to any other position.

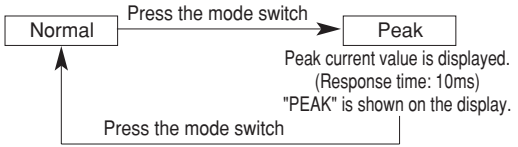
NOTE

● The instrument consumes a small amount of current in the sleep mode. When the instrument is not in use, make sure to set the range switch to "OFF".

7-3 Mode Switching Function

On a AC current ("∼400A" or "∼2000A") range, press the mode switch to cycle through the measurement modes. The instrument is initially set to the normal mode and can be switched to the peak by means of the mode switch. (See section 6-2 for peak current measurement.)

〈AC Current Range(400A or 2000A)〉



8. Battery Replacement

⚠WARNING

●To avoid electric shock hazard, make sure to set the range switch to "OFF" before trying to replace batteries.

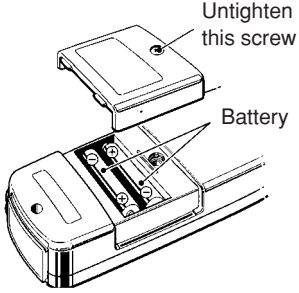
⚠ CAUTION

●Do not mix new and old batteries.
●Make sure to install batteries in correct polarity as indicated in the battery compartment.

NOTE

● If the instrument is powered on, but the display is blank or "BATT" is shown on the display, replace the batteries.

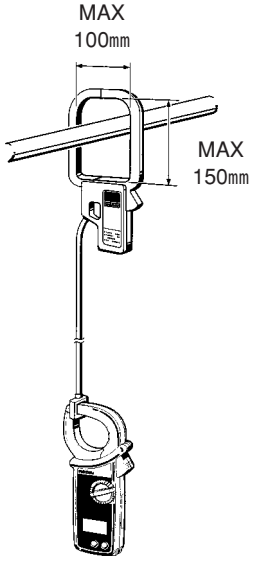
(1) Set the range switch to the "OFF" position.
(2) Unscrew and remove the battery compartment on the bottom of the instrument.
(3) Replace the batteries observing correct polarity. Use two new R6P batteries.
(4) Re-place and screw the battery compartment cover.



9. Optional Accessories

Clamp Adaptor MODEL 8008 extends MODEL 2016R's capability, allowing measurement up to 3000A or on a large bus-bar or conductor.

(1) Set the range switch to "～400A".
(2) As shown in the figure below, clamp MODEL 2016R onto the pickup coil of MODEL 8008.
(3) Clamp MODEL 8008 onto the bus-bar or conductor under test.
(4) Take the reading on MODEL 2016R and multiply it by 10.



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