

INSTRUCTION MANUAL



DIGITAL AC/DC CLAMP METER

KEW SNAP[®] SERIES

RMS MODEL 2009

KYORITSU ELECTRICAL INSTRUMENTS WORKS, LTD., TOKYO, JAPAN

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1. Features

- Model 2009 offers True RMS measurement capability. It gives accurate RMS readings of AC current and voltage or even AC on DC current and voltage regardless of the waveform.
- Measure AC and DC current up to 2000 A.
- Tear drop shaped jaws for ease of use in crowded cable areas.
- Safety design throughout with no exposed metal parts, shielded banana plugs and recessed input terminals.
- Data hold function (like pointer lock) freezes the reading in dimly lit or hard to reach places.
- Single power/function/range switch for easy one hand operation.
- 200 Ω range ideal for checking the continuity of relays, transformers and motor coils. Diode check facility.
- 30 Hz to 1 kHz frequency response for current and voltage measurements.
- Output jack to directly read the waveform of input current. Allows waveform analysis using an oscilloscope. Also gives direct connection to a recorder.

2. Specifications

Ranges:	AC Current	200 A/2000 A	
	(True RMS)	(0–199.9 A/0–1999 A)	
	AC Voltage	200 V/750 V (0–199.9 V/0–750 V)	
	(True RMS)		
	DC Current	200 A/2000 A	
		(0–199.9 A/0–1999 A)	
	DC Voltage	20 V/200 V/1000 V (0–19.99 V/0–199.9 V/0–1000 V)	
	Resistance	200 Ω/1500 Ω	
		(0–199.9 Ω/0–1500 Ω)	
	Diode Test (\rightarrow)	0–1500 mV	
	(Open circuit voltage approx. 3 V. Measuring current I mA constant)		
Accuracy:	AC Current	±1.5% rdg ±3 dgt	at 50/60 Hz
	(True RMS)	(0–199.9A)	
		±3% rdg ±4 dgt	at 30 Hz–1 kHz
		(0–1700A)	
		±3.5% rdg	
		(1700–1999A)	
	AC Voltage	±1.5% rdg ±3 dgt	at 50/60 Hz
	(True RMS)	±2% rdg ±4 dgt	at 30 Hz–1 kHz
	DC Current	±1.5% rdg ±2 dgt	
	DC Voltage	±1% rdg ±2 dgt	
Resistance	±1.5% rdg ±2 dgt		
Diode Check	±1.5% rdg ±2 dgt		

Analogue

Output Jack: Output Impedance Approx. 200 Ω

Ranges	Output Voltage	Input Current	Accuracy
200 A DC	0~200 mV DC	0~200 A DC	±1.5% rdg.
2000 A DC		0~2000 A DC	
200 A AC	0~200 mV AC	0~200 A AC	
2000 A AC		0~2000 A AC	

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Overload Protection:	AC Current	5000 A max.
	DC Current	5000 A max.
	AC Voltage	1000 V max.
	DC Voltage	1000 V max.
	Resistance	500 V AC or DC max. for one minute
Withstand Voltage:	2500 V AC max. for one minute between electrical circuit and housing case or metal section of transformer jaws	
Insulation Resistance:	10 MΩ min./1000 V between electrical circuit and housing case or metal section of transformer jaws	
Frequency Response:	30 Hz–1 kHz	
Conductor Size:	Approx. 55 mm max.	
Dimensions:	245 mm (L) × 70 mm (W) × 41.7 mm (D)	
Weight:	Approx. 500 g (battery included)	
Power Source:	One type PP3, 6F22, 006P (or equivalent) 9 V manganese battery	
Accessories: (included)	Test leads Model 7053, battery, instruction manual, zero adjust screwdriver Model 8026 plug for output jack Model 8025 (3.5 mm diameter)	
(optional)	MULTI-TRAN Model 8008, ENERGIZER Model 8021	

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- Even when the display shows overrange voltage will be delivered linearly from output jack.

Ranges	Output Voltage	Input Current
200 A DC	0~500 mV DC MAX.	0~500 A DC
2000 A DC		0~5000 A DC
200 A AC	0~350 mV AC MAX.	0~350 A AC
2000 A AC		0~3500 A AC

(Linear output is not guaranteed above 2000 A AC and 3000 A DC)

Operating Principle:	Dual integration system
Display:	Field effect 3-1/2 digit liquid crystal display with maximum reading of 1999
Overrange Indication:	"1" is displayed on highest digit (except 750 V AC, 1000 V DC, 1500 Ω, 1500 mV ranges)
Low Battery Indication:	"B" sign appears on the display
Response Time:	Approx. 2 seconds
Crest Factor:	Less than 3 as against full scale value.
Sample Rate:	Approx. 3 times per second
Data Hold:	For all ranges
Temperature & Humidity for Guaranteed Accuracy:	23°C ±5°C at 80% max. relative humidity
Storage Temperature & Humidity:	–20°C – +60°C at 85% max. relative humidity
Operating Temperature & Humidity:	–10°C – +50°C at 85% max. relative humidity

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3. Safety Notes

The 2009 is fully overload protected but:

- Do NOT exceed maximum limit for each input.
- Do NOT apply voltage across COM and OHM terminals.
- Do NOT measure current with test leads inserted into voltage or common terminal.
- Do NOT expose the instrument to the direct sun, extremes of temperature and humidity or dew fall.
- Do NOT use Model 2009 on a circuit with a voltage of higher than AC 750 V as the instrument is not designed for measurement above this voltage.
- Do NOT insert the plug into output jack when measuring voltage or resistance. Output jack is not electrically isolated from the internal circuit.

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4. Instrument Layout

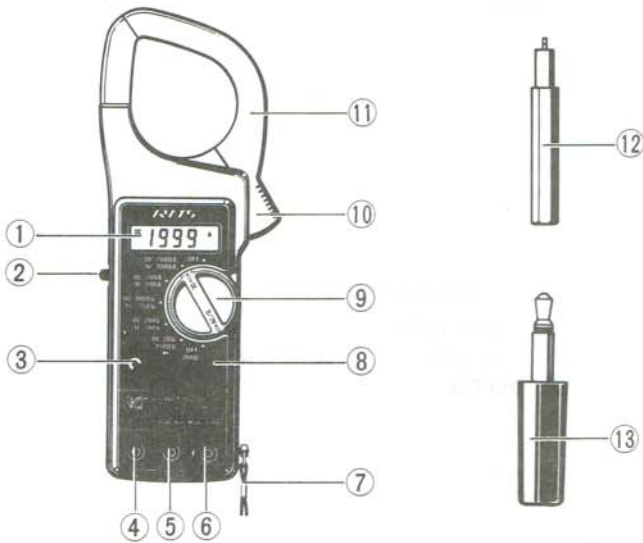


Fig. 1

(1) LCD

3-1/2 digit, liquid crystal display with maximum indication of 1999. Function symbols AC, DC, V, A and Ω and decimal point automatically appear on the display as the function/range switch is changed. "B" appears automatically for low battery warning. "I" is displayed for overrange warning.

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5. Measuring Methods

BEFORE PROCEEDING WITH MEASUREMENT, READ THE SAFETY NOTES ON PAGE 5.

5-1. Preparation

- To check battery voltage, set the function/range switch to the desired position. Battery voltage is OK when the display is clear without indication of symbol "B." When "B" appears on the display, replace the battery in accordance with the battery replacement procedure described in section 6.

Note: "B" also shows in the lower left hand corner of the display when the battery voltage becomes low during use, necessitating battery replacement.

- Make certain that the data hold button is in the off position. If a measurement is made with the data hold button is pressed in, the display will remain locked irrespective of input.

5-2. Current Measurements

CAUTION:
MAKE CERTAIN THAT ALL TEST LEADS ARE DISCONNECTED FROM THE INSTRUMENT TERMINALS.

- Set the function/range switch to 200 A or 2000 A (indicated in white for DC current and orange for AC current).
- When measuring DC current, make zero adjust to zero the display to reads 00.0 A.

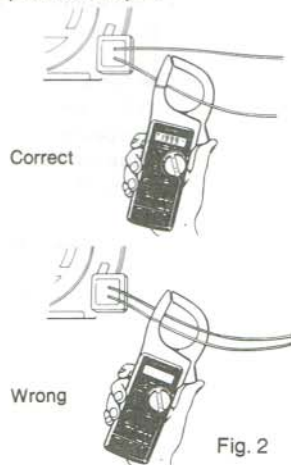


Fig. 2

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(2) Data Hold Push Button

This is a similar function to pointer lock. Simply push the data hold button to lock the reading. This allows easy reading in dimply lit or crowded cable areas. After the reading is taken, push the data hold button again to release the lock.

(3) Output Jack

The current picked up by the transformer jaws is also delivered through this jack. Insert the plug (13) into this jack to observe the waveform of input current on the oscilloscope or obtain output for recorder connection.

(4) OHM Terminal

Accepts the red test leads for resistance measurement. Positive (+) resistance measuring voltage is delivered from this terminal.

(5) COM Terminal

Accepts the black test leads for voltage or resistance measurement.

(6) Volt Terminal

Accepts the red test leads for voltage measurement.

(7) Safety Hand Strap

Prevents the instrument from slipping off the hand during use.

(8) DC Amp Zero Adjust Variable Resistor

This is used for zero adjustment required for DC current measurement.

(9) Power/Function/Range Switch

Selects function and range. Range switch positions on the front panel are respectively marked in white for DC current/voltage and in orange for AC current/voltage and resistance. Always turn the switch off after use.

(10) Jaw Trigger

Operates the transformer jaws. Press to open the jaws.

(11) Transformer Jaws

Picks up current flowing through the conductor.

(12) Zero Adjust Screwdriver

Turn the zero adjust variable resistor using this screwdriver.

(13) Plug for Output Jack

Insert this plug into output jack to obtain current output. Connect suitable connection cord to the plug when it is used.

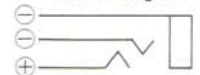
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- Press the jaw trigger to open the transformer jaws and clamp onto one conductor only (Fig. 2).

It is recommended that the conductor be placed at the centre of the closed jaws for maximum accuracy. Read the current directly off the display.

- To read output from output jack connect a suitable cord to the plug (Fig. 3) and insert into output jack with other ends of the cord connected to the volt and common terminals of the digital multimeter (Fig. 4). To observe the waveform of input current, connect the cord to the input terminals of an oscilloscope.

Circuit Diagram



3.5 mm diameter. Positive (+) and negative (-) terminals to be connected to a cord as shown in Fig. 3.



Fig. 3

Since linear output is available even when the display shows over-range, a wide scope of measurement would be possible depending on the instrument chosen for connection to the output jack. The output from this jack does not change whether Model 2009 is set for AC or DC measurement function. Therefore, the zero adjustment is recommended with the instrument set to DC or AC current ranges.



Fig. 4

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Note: Output jack is not isolated from internal circuit. The negative (–) side of this output jack is in circuit with the COM terminal of the instrument. Therefore, always ensure that the plug is disconnected from output jack before making voltage or resistance measurement. Also, unless measuring voltage make certain that the voltage test leads are disconnected from the instrument to avoid a possible hazard. Please note that it is possible to use a 9 V DC external power supply for the Model 2009, but care should be taken to connect + to + and – to – of the battery snap.

Because of common connection between the recorder output terminal and earth, care must be taken to ensure that the external power supply is not earthed and preferably of the double insulated type.

5-3. Voltage Measurements

CAUTION:
MAKE SURE THAT TEST LEAD OR PLUG IS NOT CONNECTED TO OUTPUT JACK.

- (1) Set the function/range switch to 20 V, 200 V, 750 V or 1000 V (indicated in white for DC voltage and in orange for AC voltage).
- (2) Insert the red test lead into the VOLT terminal of the instrument and black test lead into the COM terminal (Fig. 5).
- (3) Connect the prod tip or alligator clip of the test leads to the circuit under test (Fig. 6). Read the AC voltage directly off the display.

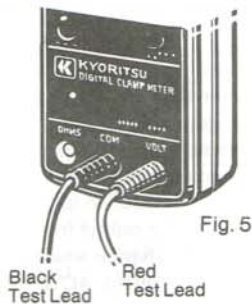


Fig. 5

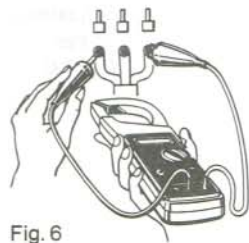


Fig. 6

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CAUTION:
MAKE SURE THAT THERE IS NO VOLTAGE IN THE CIRCUIT OR COMPONENTS BEING MEASURED.

- (1) Set the function/range switch (orange end) to 200 Ω or 1500 Ω (1500 Ω and 200 Ω are located at the same position).
- (2) Insert the red test lead into the OHM terminal of the instrument and the black test lead into the COM terminal (Fig. 7).
- (3) Make certain that the display shows over-range. By shorting the test leads (Fig. 8) make sure that the display reads zero (00.0 Ω). A count of 00.2 Ω may appear. This is due to the resistance of the test leads, etc. and does not indicate a faulty condition.
- (4) Connect the test leads to the circuit under test. Read the resistance directly off the display.
- (5) For diode test, set the function/range switch to 1500 Ω / > position. Connect the test leads to the diode under test. Read the forward voltage of the diode directly off the display. When the test leads are connected reversely the display shows over-range. (test current for diode test is 1 mA).



Fig. 7



Fig. 8

5-6. How to Use Data Hold Function

Push the data hold button to freeze the reading. This allows easy reading in dimly lit or crowded cable areas.

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- (4) For DC voltage measurement, connect the prod tip or alligator clip of the red test lead to the positive (+) side of the circuit under test and the black test lead to the negative (–) side. Read the DC voltage directly off the display.

5-4. True RMS Value Measurements

Most of the conventional clamp meters (average responding, calibrated in RMS of a sine wave) are designed for sine waves of small distortion only. If they are used to measure distorted waveforms such as a chopping, square or sawtooth waveform, a large amount of measurement error will be introduced, thus making it impossible to take accurate measurements of True RMS values. The model 2009 True RMS capability provides accurate measurements of True RMS values regardless of the waveform. It also permits measurements of AC only of AC plus DC coupled current and voltage.

Here reference is made to the crest factor which is defined to be the ratio of True RMS value to the peak value as represented by the following formula:

$$\text{Crest Factor} = \frac{\text{Peak Value}}{\text{True RMS Value}}$$

The crest factor for Model 2009 is 3. This means that a maximum current or voltage value to be measured is 3 times the rated full scale value of each range (except for 750 V and 2000 A AC ranges). Be careful that accurate measurements cannot be made if an input signal is greater than this maximum. Also, note that any input up to 4 to 6 digit will be displayed as "000" due to the arrangement of the present circuitry.

5-5. Resistance Measurements & Diode Test

6. Battery Replacement

When "B" sign for low battery warning appears at the lower left hand corner of the display, replace the battery as follows:

- (1) Disconnect the test leads from the instrument and set the function/range switch to OFF position.
- (2) Replace the battery by sliding the battery compartment cover in the direction of the arrow (Fig. 9).
- (3) Install a new battery Type PP3, 6F22, 006P 9 V (or equivalent) dry battery.
A new battery will last about 16 hours on continuous operation. (36 hours for alkaline battery)

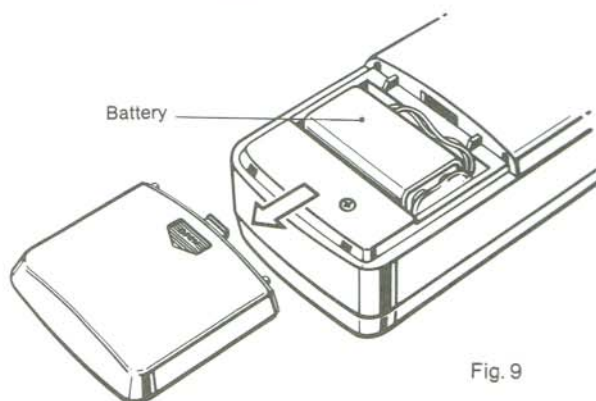


Fig. 9

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7. Other Measuring Methods Using Optional Accessories

Following accessories are available as options:

Model 8021 KEW ENERGIZER
Model 8008 MULTI-TRAN

7-1. Using Model 8021

Model 8021 ENERGIZER permits Model 2009 to make AC current and voltage measurements of household electrical appliances which are normally furnished with "twin" conductor line cords and plugs for household power outlets.

- (1) As shown below, Model 2009 clamped onto "1 ×" position of the ENERGIZER is to measure current flowing through a twin conductor line cord (up to 10 A AC) (Fig. 10).
- (2) To measure a low current more accurately, clamp onto "5 ×" or "10 ×" position. Divide the reading by 5 or 10 to obtain a true current value.

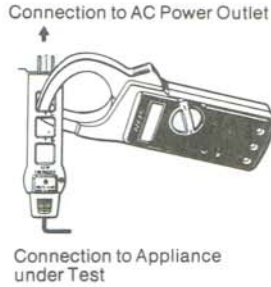


Fig. 10

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7-2. Using Model 8008

Model 8008 MULTI-TRAN is designed to measure AC current higher than 2000 A or large bus-bars (up to 150 × 100 mm) and conductors (up to 100 mm diameter).

- (1) As shown below, open the transformer jaws of Model 2009 and close them over the pickup coil of Model 8008 MULTI-TRAN to measure up to 3000 A AC. Since the input to output ratio is 10 to 1, take the reading on Model 2009 and multiply by 10 (Fig. 12).

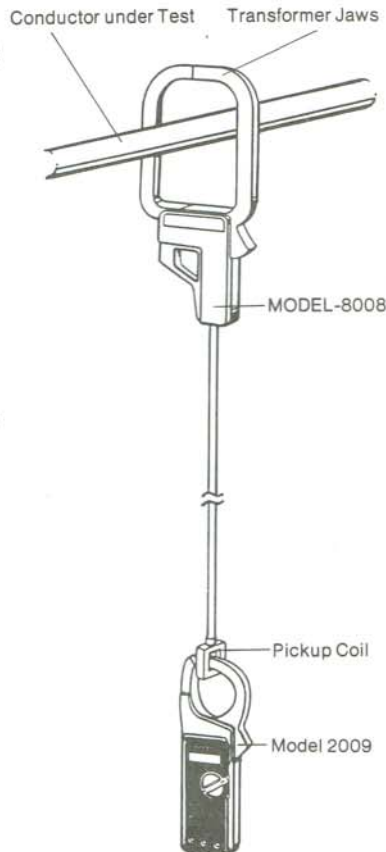
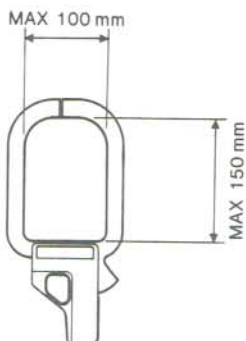


Fig. 12

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- (3) When measuring AC voltage, connect the ENERGIZER to AC power outlet or appliance under test the same way as outlined for AC current measurement. With the test leads plugged into the VOLT and OHM terminals of the instrument, connect one test lead prod to the "VOLTLEAD" terminal on one side of the energizer and the other prod to the "VOLTLEAD" terminal on the other side (Fig. 11). This will permit easy voltage measurement up to 300 V AC without the trouble of cutting off the cord.

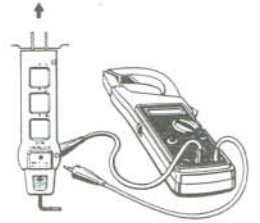


Fig. 11

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