TENMA®

72-9490

Operating Manual

Digital Power Clamp Meter

TABLE OF CONTENTS

TITLE PAGE

TABLE OF CONTENTS

TITLE **PAGE**

Overview

This Operating Manual covers information on safety and cautions. Please read the relevant information carefully and observe all the Warnings and Notes strictly.

⚠ Warning

To avoid electric shock or personal injury, read the “Safety Information” and “Rules for Safe Operation” carefully before using the Meter.

Model 72-9490 is a three phase intelligent handheld digital power clamp meter (hereafter referred to as “the Meter”) which has both the features of digital current meter and also power measurement meter.

The Meter can measure Voltage, Current, Active Power, Apparent Power, Reactive Power, Power Factor, Phase Angle, Frequency, Active Energy and etc.

Unpacking Inspection

Open the carton and remove the Meter. Check the following items carefully to see if any items are missing or damaged.

Item	Description	Qty
1	English Operating Manual	1 piece
2	Red Test Lead	1 piece
3	Black Test Lead	1 piece
4	Blue Test Lead	1 piece
5	Yellow Test Lead	1 piece
6	Red Alligator Clip	1 piece
7	Black Alligator Clip	1 piece
8	Blue Alligator Clip	1 piece
9	Yellow Alligator Clip	1 piece
10	USB Interface Cable	1 piece
11	Software	1 piece
12	Tool Box	1 piece
13	1.5V Battery (LR6)	4 pieces

In the event you find any items are missing or damaged, please contact your dealer immediately.

Safety Information

This Meter complies with the Safety/ Compliances: IEC 61010 CAT. III 600V, CAT. IV 300V overvoltage and double insulation standard, pollution degree 2.

CAT. III: Distribution level, fixed installation, with smaller transient overvoltages than CAT. IV
CAT.IV: Primary supply level, overhead lines, cable systems etc.

Use the Meter only as specified in this operating manual to avoid personal injury or damage to your Meter or device under test.

In this manual, a Warning identifies conditions and actions that pose hazards to the user, or may damage the Meter or device under test.

International electrical symbols used on the Meter and in this Operating Manual are explained.

Rules For Safe Operation

⚠ **Warning**

To avoid possible electric shock or personal injury, and to avoid possible damage to the Meter or to the equipment under test, adhere to the following rules:

- **Before using the Meter, inspect the case. Do not use the Meter if it is damaged or the case (or part of the case) is removed. Look for cracks or missing plastic. Pay attention to the insulation around the connectors.**
- **Inspect the test leads for damaged insulation or exposed metal. Replace damaged test leads with identical model number or electrical specifications before using the Meter.**
- **Do not apply more than the rated voltage, as marked on the Meter.**
- **When your measurements have been completed, disconnect the connection between the test leads and the circuit under test, remove the test leads from the input terminals of the Meter and turn the Meter power off.**
- **Do not carry out the measurement when the Meter's back case and / or battery door is opened to avoid electric shock.**
- **When the Meter is operating at an effective voltage over 30V in AC, special care should be taken.**
- **Use the proper terminals and function for your measurements.**
- **Do not use or store the Meter in an environment of high temperature, humidity, explosive, flammable and strong magnetic field. The performance of the Meter may deteriorate if damp or wet.**
- **Do not use the Meter if its surface is wet or the user's hands are wet.**
- **When using the test leads, keep your fingers behind the finger guards.**
- **Replace the battery as soon as the battery indicator appears. With a low battery, the Meter might produce false readings that can lead to electric shock and personal injury.**

- When opening the battery door, make sure the Meter is off.
- When servicing the Meter, use only the same model number or identical electrical specifications replacement parts.
- Do not tamper with the internal circuits of the Meter.
- Soft cloth and mild detergent should be used to clean the surface of the Meter when servicing. No abrasive and solvent should be used to protect the surface of the Meter from corrosion, damage and accident.
- The Meter is suitable for indoor use only.
- Turn the Meter off when it is not in use and take out the battery when not using for a long time.
- Periodically check the battery as it may leak when it has not been in use for some time, replace the battery if the battery is dead or leaking. A leaking battery will damage the Meter.

International Electrical Symbols

~	AC (Alternating Current)
⏚	Grounding
⧈	Double Insulated
⚠	Warning. Refer to the Operating Manual
⊟	Deficiency of Built-In Battery
⚡	Danger of High Voltage
CE	Conforms to Standards of European Union

The Meter Structure

A. The Meter Front Structure (see figure 1)

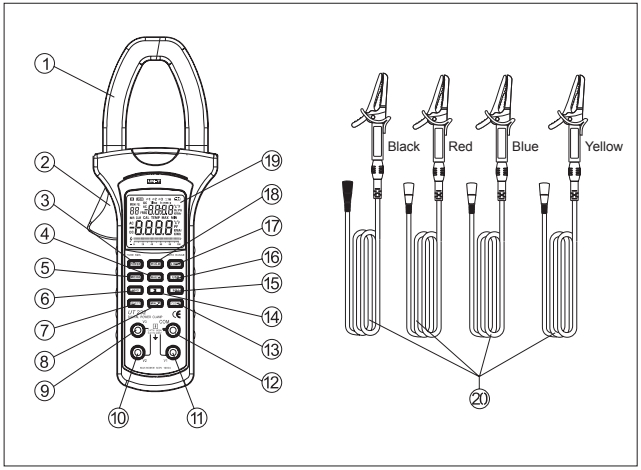


Figure 1

①	Transformer Jaw: designed to pick up the AC and DC current flowing through the conductor. The tested conductor must vertically go through the Jaw center.
②	Hand Guards.
③	Power button
④	Max/▲ button
⑤	MENU button
⑥	LOAD button (recall data)
⑦	SELECT button (press to select alternate function and sum of Watts measurement)
⑧	MIN/ ▼ button
⑨	V3 Input Terminal (Third phase measurement)
⑩	V2 Input Terminal (Second phase measurement)
⑪	V1 Input Terminal (First phase measurement)
⑫	COM Input Terminal
⑬	CLEAR button (maximum and minimum)

⑭	Σ Sigma button (Sum)
⑮	SAVE button (data store button)
⑯	USB button
⑰	LIGHT button (auto display backlight button)
⑱	HOLD button
⑲	LCD Display
⑳	Testing Leads (Red, Black, Blue and Yellow)

B. The Meter Back and Bottom Structure
(see figure 2)

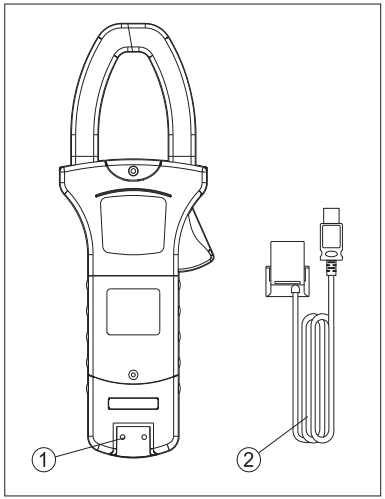


Figure 2

①	Infrared slot
②	USB Interface Cable

Functional Buttons

The table below describes the function of the main button operations.

Button	Operation Performed
POWER	Press and hold POWER for 1 second to turn the Meter on. Press POWER again to turn the Meter off.
HOLD	● Press HOLD to enter the Hold mode in any mode, H appears and the Meter beeps. ● Press HOLD again to exit the Hold mode to return to measurement mode, the Meter beeps and H disappears.
LIGHT	● Press LIGHT to turn the display backlight on. ● The display backlight will be off automatically after 30 seconds.
MENU	Press MENU to display the following functions in sequence: ● AC Voltage (main display) + Frequency (secondary display) ● AC Current (main display) + AC Voltage (secondary display) ● Active power (main display) + Phase angle (secondary display) ● Apparent power (main display) + Reactive power (secondary display) ● Power factor (main display) + Phase angle (secondary display) ● Active Energy (main display) + Time (secondary display)
MAX/▲	● Press to start recording of maximum value, it valid at voltage, current, active power and apparent power ranges only. ● Press once at LOAD mode, MR icon shown, the Meter displays the next stored reading, the left secondary display showing the index increase one. ● Press once at ∑ mode, CAL icon shown, the Meter steps through sum of active power (main display) + sum of reactive power (secondary display) and sum of power factor (main display) + sum of apparent power.

Button	Operation Performed
USB	● Press USB once to turn the USB interface on, USB appears and the Meter beeps. ● Press USB again to turn the USB interface off, USB disappears and the Meter beeps.
LOAD	● Press once to enter LOAD mode, MR appears and the Meter beeps. ● Press again to exit LOAD mode, MR disappears and the Meter beeps. ● Press and hold LOAD for 1 second to display the stored data quickly.
∑	● At Active power (main display) + Phase angle (secondary display) mode, press ∑ once button to sum up the current first phase of 3 phase measurement result. Then carry out second phase power measurement. ● Press ∑ again to sum up the second phase power measurement result, then carry out third phase power measurement. ● Press ∑ again to sum up the third phase power measurement result, then press SELECT to enter the measurement of sum of the watts mode, the display shows the 3 phase sum of the watts value.
SAVE	● Press once to store single reading, MEM appears and the Meter beeps. ● Press and hold for over 1 second to continuous store reading, MEM blinks and the Meter beeps. The index number shown on the left secondary display keep on increasing. Press SAVE again to exit. The maximum number of data store is 99, when it achieves 99, the Meter shows FUL. Press CLEAR to clear the stored reading in order to store next reading.
SELECT	● At active power (main display) + phase angle (secondary display) mode, press SELECT button to step through first phase, second phase, third phase and sum of watts. ● At other mode, press SELECT to step through first phase, second phase and the third phase.

Button	Operation Performed
MIN / ▼	● Press to start recording of minimum value, it valid at voltage, current, active power and apparent power ranges only. ● Press once at LOAD mode, MR icon shown, the Meter displays the next stored reading, the left secondary display showing the index decrease one. ● Press once at ∑ mode, CAL icon shown, the Meter steps through sum of active power (main display) + sum of reactive power (secondary display) and sum of power factor (main display) + sum of apparent power.
CLEAR	● At active energy range, press to reset time the zero, then restart the timing. ● At all other ranges, press to clear stored readings.

Display Symbols (see figure 3)

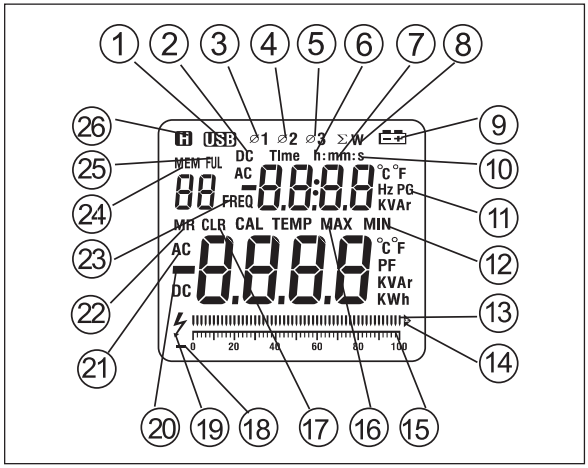


Figure 3

Number	Symbol	Meaning
①	USB	Data is transferring via USB
②	DC	Indicator for DC measurement
③	∅1	First phase symbol
④	∅2	Second phase symbol
⑤	∅3	Third phase symbol
⑥	h	Unit for hour
⑦	mm	Unit for minute
⑧	ΣW	Watt: Sum of Watt
⑨		The battery is low. ⚠Warning: To avoid false readings, which could lead to possible electric shock or personal injury, replace the battery as soon as the battery indicator appears.
⑩	s	Unit for second
⑪	Hz, PG, KVAr	Symbol of Unit. Hz: Hertz.The unit of frequency. PG: The unit of phase angle KVAr. The unit of reactive power

Number	Symbol	Meaning
⑫	MIN	Minimum reading
⑬		Analog Bar Graph
⑭		Overloading
⑮		Ruler
⑯	MAX	Maximum reading
⑰	CLR	Indicator for clear the stored reading
⑱		Ruler negative symbol
⑲		High voltage symbol
⑳		Indicates negative reading
㉑	AC	Indicator for AC voltage or current
㉒	MR	Indicator for recall the stored reading
㉓	FREQ	Frequency symbol
㉔	MEM	Indicator for data store
㉕	FUL	Indicator for data stored is full
㉖	H	Data hold is active

Measurement Operation

Starting Your Meter

- Press and hold **POWER** for one second to turn the Meter on. The default range is the last measurement range when you turned off the Meter.
- Replace the battery as soon as the battery indicator " " appears on the display.

A. AC Voltage (main display) + Frequency (secondary display) Measurement (see figure 4)

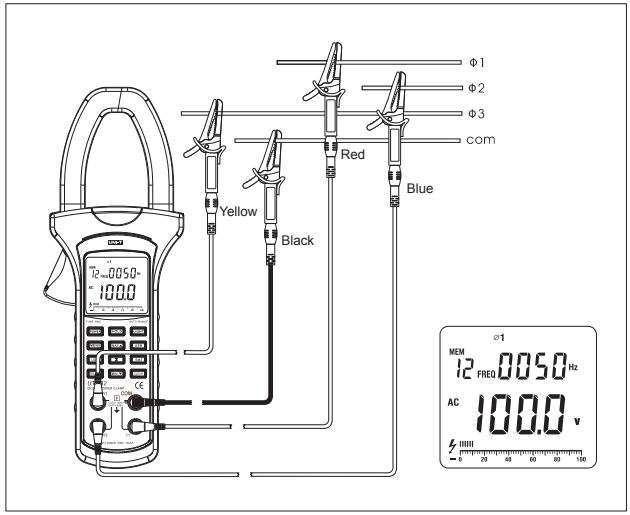


Figure 4

The AC Voltage ranges are:15V, 100V, 300V and 600V

The frequency range is:20Hz~500Hz

To measure AC voltage + frequency, connect the Meter as follows:

1. Insert the red test lead into the V1 terminal, blue test lead into the V2 terminal, yellow test lead to V3 input terminal and black test lead to the COM input terminal.
2. Press the MENU to select Voltage (main display) + Frequency (secondary display) range.
3. Connect the red test leads (V1 input terminal), blue test leads (V2 input terminal) and yellow test leads(V3 input terminal) to the corresponding three phases loaded live wire. Connect the black test lead (COM input terminal) to the corresponding three phases loaded neutral wire.
4. Press SELECT to select phase location, the display shows the corresponding phase symbol. V1 means the first phase ∅1, V2 means the first phase ∅2, V3 means the first phase ∅3.
5. The display shows the corresponding True RMS voltage value and frequency value of each phase.
6. Press MAX/▲ , the LCD displays MAX, it starts recording the maximum AC voltage True RMS value. Press MAX/▲ again to show the current AC voltage True RMS value.
7. Press MAX/▲ the LCD displays MAX, it starts recording the minimum AC voltage True RMS value. Press MAX/▲ again to show the current AC voltage True RMS value.
8. The display shows OL when the input voltage is higher than 600V rms.

Note

- When the measurement has been completed, disconnect the connection between the testing leads and the circuit under test and remove testing leads from the input terminals.

B. AC Current (main display) + AC Voltage (secondary display) Measurement (see figure 5)

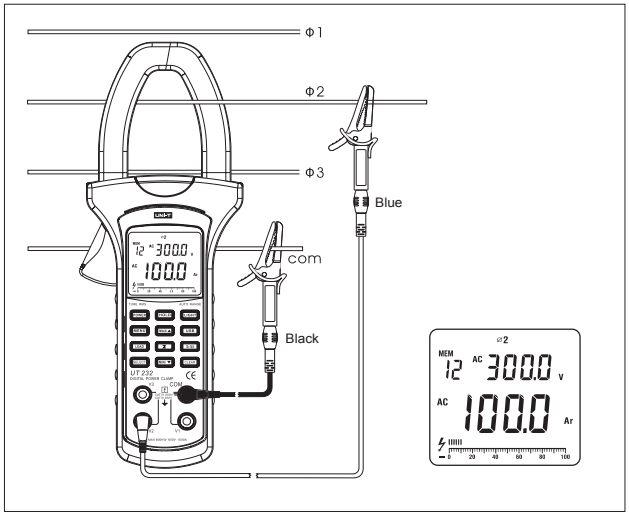


Figure 5

The AC current ranges are: 40A, 100A, 400A and 1000A

The AC Voltage ranges are: 15V, 100V, 300V and 600V

To measure AC current + AC voltage, connect the Meter as follows:

1. Press the MENU to select AC Current (main display) + AC Voltage (secondary display) range.
2. Press the lever to open the transformer jaw.
3. Center the conductor within the transformer jaw, then release the Meter slowly until the trasnformer jaw is completely closed, Make sure the conductor to be tested is placed at the center of the transformer jaw, otherwise it will casue deviation. The Meter can only measure one conductor at a time, to meausre more than one condutor at a time will cause deviation.
4. The double display shows the AC current True RMS value and AC voltage True RMS value.
5. Press MAX/▲, the LCD displays MAX, it starts recording the maximum AC current True RMS value. Press MAX/▲again to show the present AC True RMS value.

6. Press MIN/▼, the LCD displays MAX, it starts recording the minimum AC current True RMS value.
   Press MIN/▲, again to show the present AC current True RMS value.
7. The display shows OL when the current of the tested conductor is higher than 1000A rms.

Note

- When the measurement has been completed, disconnect the connection between the conductor under test and the jaw, and remove the conductor away from the transformer jaw of the Meter.

C. Active Power (main display) + Phase Angle (secondary display) Measurement

The active power ranges are: 40A, 100A, 400A and 1000A

The phase angle ranges are: 0° ~360°

⚠ **Warning**

To avoid damage to the Meter or personal injury, do not exceed AC voltage 600V v.r.s and AC Current 1000A v.r.s.

To measure active power + phase angle, connect the Meter as follows:
1. Press the MENU to select Active power (main display) + Phase angle (secondary display) range.
2. Press the lever to open the transformer jaw, and clamp the corresponding lead to the proper conductor to be tested.
   If user needs to measure any phase of the 3 phase, then only clamp them to that phase's conductor.
3. Connecting method (see figure 6, 7, 8):

- *When measuring 3 phase 4 wires, connect the Meter as shown in figure 6*

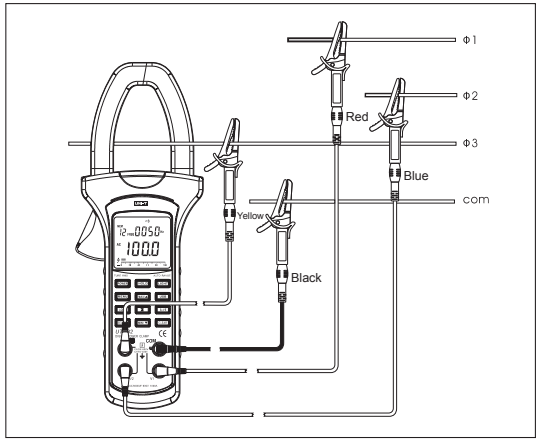


Figure 6

- Insert red test leads to V1 input terminal.
- Insert blue test leads to V2 input terminal
- Insert yellow test leads to V3 input terminal and connect each lead to the corresponding live wire of the 3 phase.
- Insert black test leads to COM input terminal and connect it to the neutral wire of the 3 phase.

1) *When measuring 3 phase 3 wires, connect the Meter as shown in figure 7*

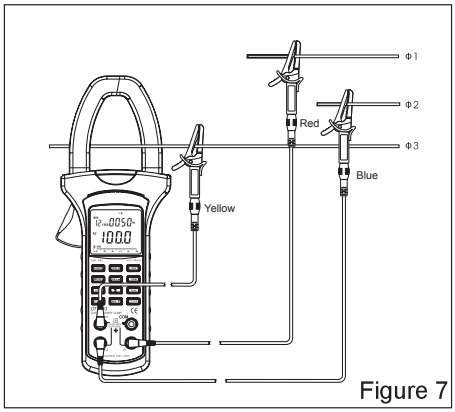


Figure 7

- Insert red test leads to V1 input terminal.
- Insert blue test leads to V2 input terminal
- Insert yellow test leads to V3 input terminal and connect it to the neutral wire of the 3 phase.

2) Press the lever to open the transformer jaw, and clamp them to the corrresponding phase of tested conductor. If user needs to mesaure any phase of the 3 phase, then clamp them to that phase's conductor.

3) When measuring 3 phases 3wires:(see figure 9, 10,11, 12, 13, 14, 15)

- Press SELECT to choose first phase ∅1, see figure 9. The double displays show the acitve power kW value and also the PG value of ∅1.
- If necessary, press ∑ to get the sum of watts as figure 10.
- After sum up the current power measurement value of the first phase, then press SELECT to choose the second phase ∅2, as figure 11
- The double display shows the value of acitve power kW and PG of ∅2.
- Fncessary, press ∑ to get the sum of watts as figure 12.
- After sum up the current power meaursuremnt value of the second phase, then press SELECT again to choose the third phase ∅3, as figure 13.
- The double display shows the value of acitve power KW and PG of ∅3.
- If ncessary, press ∑ to get the sum of watts as figure 14.
- After sum up the current power measurement value of the third phase, finally press SELECT again to display the 3 phase sum of acitve power value and reactive power value.
- Press MAX/▲ or MIN/▼ as figure 15 to step through in sequence three phase sum of active power+three phase sum of reacitve power, and three phase sum of power factor + 3 phase sum of apparent power.

- *When measuring single phase 2 wires, connect the Meter as shown in figure 8*

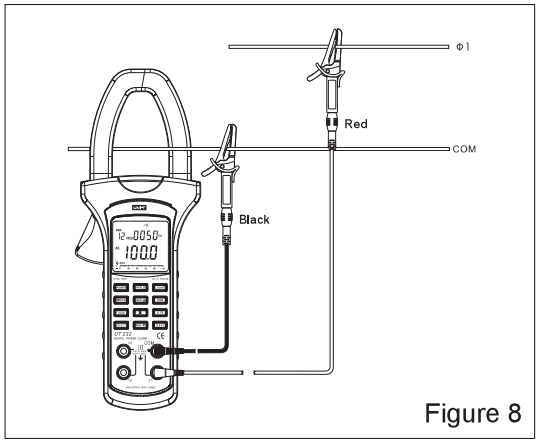


Figure 8

- Insert red test lead to **V1**, **V2** or **V3** input terminal corresponding to one of ∅**1**, ∅**2** or ∅**3** phase
- Insert black test leads to **COM** input terminal.
- Connecting the two test leads to live and neutral wires.

4. When measuring 3 phases 4 wires:
   (see figure 9, 10, 11, 12, 13, 14, 15, 16)

   - Press **SELECT** to choose phase ∅1, see as shown in figure 9. The display show the active power kW value and also the PG value of ∅1.

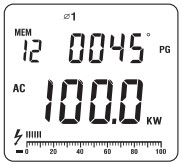


Figure 9

   - If necessary, press Σ to get the sum of the power measurement as shown in figure 10.

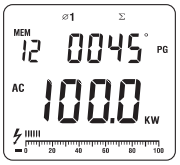


Figure 10

   - After summing up the current power measurement valueof the first phase, then press **SELECT** to choose phase ∅2 as shown in figure 11.

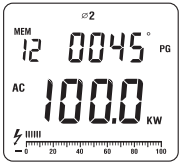


Figure 11

   - The display shows the value of active power kW and PG of ∅2.
   - If ncessary, press Σ to get the sum of the power measurement as shown in figure 12

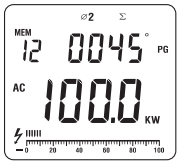


Figure 12

- After summing up the current power measurement value of the second phase, then press **SELECT** again to choose tphase ∅3 as shown in figure 13.

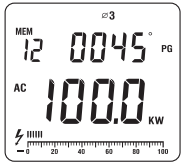


Figure 13

- The display shows the value of active power KW and PG of ∅3.
- If necessary press Σ to get the sum of the power measurement as shown in figure 14.

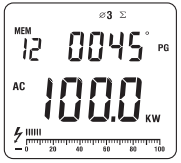


Figure 14

- After summing up the current power measurement value of the third phase, finally press **SELECT** again to display the three phase sum of active power value and reactive power value.
- Press MAX/▲ or MIN/▼ as shown in figure 15 to step through in sequence three phase sum of active power and three phase sum of reactive power, and three phasesumof power factor and three phase sum of apparent power.

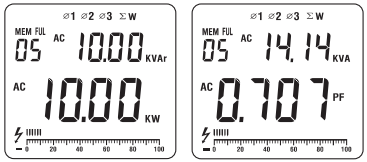


Figure 15

5. When measuring 3 phase 3 wires:
   - The first and second phase measuring method is same as 3 phase 4 wires.
   - Jump over the third phase measurement.
   - Press **SELECT** to display the 3 phase sum of active power and reactive power.
   - Press **MAX/▲** or **MIN/▼** as figure 16 to step through in sequence three phase sum of active power and three phase sum of reactive power, and three phase sum of power factor and three sum of apparent power.

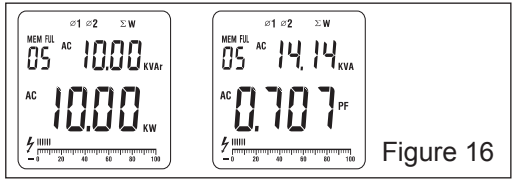


Figure 16

6. The maximum power is 600kW of single phase, **OL** will be displayed when it is over than that. The maximum range is 1800kW of three phase sum of active power, **OL** will be displayed when it is over than that.
7. Press **MAX/▲ ,** the display shows MAX, it starts recording the maximum active power value. Press again to display the current active power value.
8. Press **MIN/▼ ,** the display shows MIN, it starts recording the minimum active power value. Press again to display the current active power value.

Note
- When there is no input or single phase, the Meter displays OL, Σ button is not valid.
- It can only sum up and save the current measurement value. The maximum and minimum value cannot sum up and save.
- Only at this range can carry out sum of watts measurement, other ranges cannot carry out this measurement.
- When testing has been completed, disconnect the connection between the testing leads and the circuit under test and remove testing leads from the input terminals.

D. Apparent Power (main display) + Reactive Power (secondary display) Measurement

⚠ **Warning**

To avoid damage to the Meter or personal injury, do not exceed AC voltages of 600V rms and AC Current of 1000A rms.

To test for Apparent power (main display) + Reactive power (secondary display), connect the Meter as follows:

1. Press the **MENU** to select Apparent power (main display) + Reactive power (secondary display) range.
2. Press the lever to open the transformer jaw, and clamp them to the corrresponding phase of tested conductor. If user needs to mesaure any phase of the 3 phase, then clamp them to that phase's conductor.
3. The connecting method of 3 phases 4 wires, 3 phases 3 wires or single phase 2 wires, see figure 6, 7 and 8
4. When measuring 3 phase 4 wires: (see figure 17, 18, 19)
   - Press **SELECT**to choose the first phase ∅1, see figure 17.

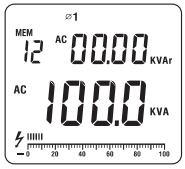


Figure 17

   - The double display shows the first phase value of apparent power kVA and reactive power Kvar.
   - Then press **SELECT** again to choose the second phase ∅2, see figure 18.

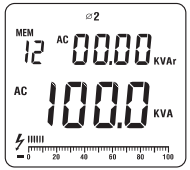


Figure 18

- The double display shows the second phase value of apparent power kVA and reactive power Kvar.
- Press **SELECT** again to choose the third phase ∅3, see figure 19.

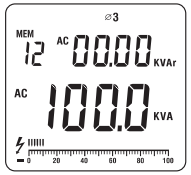


Figure 19

- The double display shows the third phase value of apparent power kVA and reactive power Kvar.

5. When measuring 3 phase 3 wires:
   - The first phase and secodn phase operating method is same as three phase 4 wires.
   - Jump over the third phase measurement.
6. The maximum measuring range is 600kW when measuring single phase apparent power kVA and reactive power Kvar, OL wil be displayed when it is over than that.
7. Press **MAX/▲,** the display shows MAX, it starts recording the maximum apparent power value. Press again to display the current apparent power value.
8. Press **MIN/▼,** the display shows MIN, it starts recording the minimum apparent power value. Press again to display the current apparent power value.

Note

- When testing has been completed, disconnect the connection between the testing leads and the circuit under test and remove testing leads from the input terminals.

E. Power Factor (main display) + Phase Angle (secondary display) Measurement

⚠ **Warning**

To avoid damage to the Meter or personal injury, do not exceed AC voltages of 600V rms and AC Current of 1000A rms.

To test for Power factor (main display) + Phase angle (secondary display), connect the Meter as follows:

1. Press the **MENU** to select Power factor (main display) + Phase angle (secondary display) range.
2. Press the lever to open the transformer jaw, and clamp them to the corrresponding phase of tested conductor. If user needs to mesaure any phase of the 3 phase, then clamp them to that phase's conductor.
3. The connecting method of 3 phases 4 wires, 3 phases 3 wires or single phase 2 wires, see figure 6, 7 and 8
4. When measuring 3 phase 4 wires: (see figure 20, 21, 22)

- Press **SELECT** to choose the first phase ∅1, see figure 20.

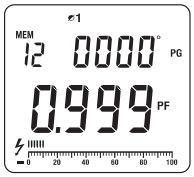


Figure 20

- The double display shows the first phase value of power factor PF and phase angle PG.
- Then press **SELECT** again to choose the second phase ∅2, see figure 21.

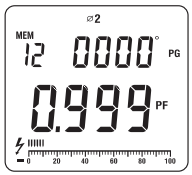


Figure 21

- The double display shows the second phase value of power factor PF and phase angle PG.
- Press **SELECT** again to choose the third phase ∅3, see figure 22.

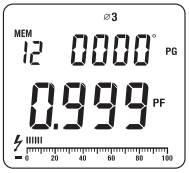


Figure 22

- The double display shows the third phase value of power factor PF and phase angle PG.

5. When measuring 3 phase 3 wires:
   - The first phase and second phase operating method is same as three phase 4 wires.
   - Jump over the third phase measurement.
6. MAX/▲ and MIN/ ▼ are not valid when measuring power factor.

Note
- When testing has been completed, disconnect the connection between the testing leads and the circuit under test and remove testing leads from the input terminals.

F. Active Energy (main display) + Time (secondary display) Measurement

⚠ **Warning**

To avoid damage to the Meter or personal injury, do not exceed AC voltages of 600V rms and AC Current of 1000A rms.

To test for Active Energy (main display) + Time (secondary display), connect the Meter as follows:

1. Press the **MENU** to select Power factor (main display) + Phase angle (secondary display) range.
2. Press the lever to open the transformer jaw, and clamp them to the corrresponding phase of tested conductor. If user needs to mesaure any phase of the 3 phase, then clamp them to that phase's conductor.
3. The connecting method of 3 phase 4 wires, 3 phases 3 wires or single phase 2 wires, see figure 6, 7 and 8
4. Press SELECT to choose one of the three phases (∅1, ∅2, ∅3), see figure 23.

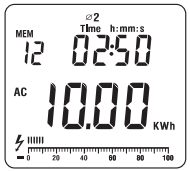


Figure 23

- The double display shows the value of tested object's active engergy kWh value and the measuring time of the corresponding phase.
- The measuring reading gets increasing along with the time increases. Press **HOLD** to read a particular time kWh value. Then the reading and time are locked, but still continuous accumulate measuring time.
- After read the data, press **HOLD** again to continous measurement. kWh value continous accumulate and the measuring time jumps to the present measuring time.
- When the measuring time is over 24 hours or the Meter is switched to other measuring ranges, active energy measuring will stop.

- The maximum reading of acitve energy is 9999kWh. **OL** will be displayed when the reading is over than that.

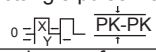
5. **MAX/▲** and **MIN/▼**are not valid when measuring active energy.
6. Press **CLEAR** to reset the time.

Note

- When there is no input signal, it cannot carry out active energy measurement.
- When there is input signal, the maximum waiting time is approximately 10s before timing.
- When testing has been completed, disconnect the connection between the testing leads and the circuit under test and remove testing leads from the input terminals.

True RMS Measurement and Average Value Measurement

- The True RMS measurement method can measure accurately the effective value of non-sine wave input signal.
- Average value measurement method can measure the mean value of one sine wave input signal, and then displays it as RMS value
- When the input waveform has distortion, measuring tolerance will be included. The total tolerance depends on the total distortion. Below table 1 shows the waveform coefficient and the relationship and the requested changing factor of sine wave, square wave, peak wave of triangle wave, RMS value and average value.

Input Waveform	PK-PK	0-PK	RMS	AVG
Sine waveform 	2.828	1.414	1.000	0.900
complete sine waveform 	1.414	1.414	1.000	0.900
Half wine waveform 	2.828	2.828	1.414	0.900
square waveform 	1.800	0.900	0.900	0.900
commutate square waveform 	1.800	1.800	1.272	0.900
Rectangle pulse waveform D=X/Y 	0.9/D	0.9/ D	0.9/D	0.9/D
triangle waveform 	3.600	1.800	1.038	0.900

Specifications

A. General Specifications

- Maximum Voltage between any Terminal and grounding: Refer to different range input protection voltage.
- Display: Multi LCD displays, Maximum display 9999.
- Ranges: Auto
- Overloading: Display **OL**.
- Battery Deficiency: Display .
- Data Holding: Display H
- Data Logging: Maximum 99, Single or Continuous records
- Data Recall
- Maximum and Minimum value display: Voltage, Current, Active Power and Apparent Power ranges
- Display Backlight: White color
- Computer connection: USB
- Calibration Feature
- Sleep Mode: To preserve battery life, the Meter automatically turns off if you do not turn press any button for approximately 15 minutes, except at active energy range.
- Sampling: 3 times per second.
- Max. Jaw Size: 55mm diameter.
- Analog Bar Graph
- Power: 4 x 1.5V battery (LR6)
- Storage Temperature: -10°C~60°C
- Dimensions: 303mm x 112mm x 39mm
- Weight: Approximate 601g

B. Environmental Requirements

- The Meter is suitable for indoor use.
- Altitude: Operating: 2000m
  Storage: 10000m
- Temperature and humidity:
  - Operating:
    0°C ~ 30°C (≤85%R.H)
    30°C ~ 40°C (≤75%R.H)
    40°C ~ 50°C (≤45%R.H)
  - Storage:
    -10°C ~ +60°C (≤85%R.H)
- Safety/ Compliances: IEC 61010 CAT. III 600V, CAT. IV 300V overvoltage and double insulation standard, pollution degree 2.
- Certification: CE

Accurate Specifications

Accuracy: ±(a% reading + b digits), guaranteed for 1 year.
Operating temperature: 23°C ± 5°C
Operating humidity: 45~75%R.H

A. AC Voltage (True RMS)

Range	Resolution	Accuracy	Allowable Maximum overload protection voltage	Input Impedance
15V	0.1V	±(1.2%+5)	600 RMS	10MΩ
100V				
300V				
600V				

B. Frequency

Range	Resolution	Accuracy
20Hz~500Hz	1Hz	±(0.5%+5)

C. AC Current (True RMS)

Range	Resolution	Accuracy	Allowable Maximum overload protection current
40A	0.1A	±(2%+5)	1000A RMS
100A			
400A			
1000A	1A		

D. Active Power (W=V x A x COS ∅)

Current / Voltage		Voltages Range			
		15V	100V	300V	600V
Current Range	40A	0.60kW	4.00kW	12.00kW	24.00kW
	100A	1.50kW	10.00kW	30.00kW	60.00kW
	400A	6.00kW	40.00kW	120.0kW	240.0kW
	1000A	15.00kW	100.0kW	300.0kW	600.0kW
Accuracy		±(3%+5)			
Resolution		<1000kW: 0.01kW ≥100kW: 0.1kW			

Remarks:

- Allowable maximum overload protection voltage: 600V RMS
- Allowable maximum overload protection current: 1000A RMS

E. Apparent Power (VA = V x A)

Current / Voltage		Voltages Range			
		15V	100V	300V	600V
Current Range	40A	0.60kVA	4.00kVA	12.00kVA	24.00kVA
	100A	1.50kVA	10.00kVA	30.00kVA	60.00kVA
	400A	6.00kVA	40.00kVA	120.0kVA	240.0kVA
	1000A	15.00kVA	100.0kVA	300.0kVA	600.0kVA
Accuracy		± (3%+5)			
Resolution		<1000kVA: 0.01kVA ⩾ 100kVA: 0.1kVA			

Remarks:

- Allowable maximum overload protection voltage: 600V RMS
- Allowable maximum overload protection current: 1000A RMS

F. Reactive Power (Var = V x A x SIN ∅)

Current / Voltage		Voltages Range			
		15V	100V	300V	600V
Current Range	40A	0.60kVar	4.00kVar	12.00kVar	24.00kVar
	100A	1.50kVar	10.00kVar	30.00kVar	60.00kVar
	400A	6.00kVar	40.00kVar	120.0kVar	240.0kVar
	1000A	15.00kVar	100.0kVar	300.0kVar	600.0kVar
Accuracy		15V/1000A Range: ± (4%+20) Other Ranges: ± (4%+5)			
Resolution		<1000kVar: 0.01kVar ≥100kVar: 0.1kVar			

Remarks:

- Allowable maximum overload protection voltage: 600V RMS
- Allowable maximum overload protection current: 1000A RMS

G. Power Factor (PF = W / VA)

Range	Accuracy	Resolution	Measuring Condition
0.3~1 (capacitive or inductive)	± 0.022	0.001	The minimum measuring current 10A The minimum measuring voltage 45V
0.3~1 (capacitive or inductive)	For reference only		Measuring current less than 10A OR Measuring voltage less than 45V

Remarks:

- Allowable maximum overload protection voltage: 600V RMS
- Allowable maximum overload protection current: 1000A RMS

H. Phase Angle (PG=acos (PF))

Range	Accuracy	Resolution	Measuring Condition
0° ~360°	± 1°	1°	The minimum measuring current 10A The minimum measuring voltage 45V
0° ~360°	For reference only		Measuring current less than 10A OR Measuring voltage less than 45V

Remarks:

- Allowable maximum overload protection voltage: 600V RMS
- Allowable maximum overload protection current: 1000A RMS

I. Active Energy (kWh)

Range	Accuracy	Resolution
1~9999kWh	±(3%+2)	0.001kWh

Remarks:

- Allowable maximum overload protection voltage: 600V RMS
- Allowable maximum overload protection current: 1000A RMS

MAINTENANCE

This section provides basic maintenance information including battery replacement instruction.

⚠ **Warning**

Do not attempt to repair or service your Meter unless you are qualified to do so and have the relevant calibration, performance test, and service information.

To avoid electrical shock or damage to the Meter, do not get water inside the case.

A. General Service

- Periodically wipe the case with a damp cloth and mild detergent. Do not use abrasives or solvents.
- To clean the terminals, wipe with cotton or lint free cloth and mild detergent. Dirt or moisture on the terminals may affect readings.
- Turn the Meter off when not in use.
- Remove the battery when not in use for an extended period of time.
- Do not store the Meter in places of high temperature, humidity, explosive/flammable environments, or in a strong magnetic field.

B. Replacing the Battery (see figure 24)

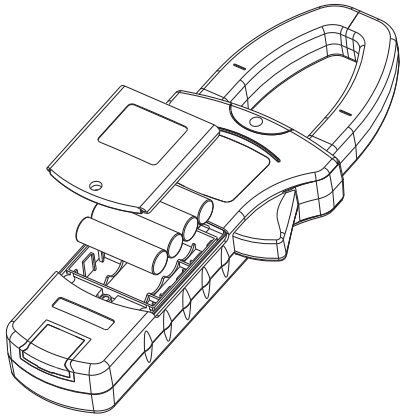


Figure 24

⚠ **Warning**

To avoid false readings, which could lead to possible electric shock or personal injury, replace the battery as soon as the battery indicator " 🔋 " appears.

Make sure the transformer jaw and the tests leads are disconnected from the circuit being tested before opening the case bottom.

To replace the battery:

1. Press **POWER** to turn the Meter off and remove all the connections from the input terminals.
2. Turn the Meter's front case face down.
3. Remove the screw from the battery door, and separate the battery door from the case bottom.
4. Take out the old battery and replace with 4 x 1.5V batteries (LR6).
5. Rejoin the case bottom and the battery door, and reinstall the screw.

Manufacturer:
Tenma Test Equipment
405 S. Pioneer Blvd.
Springboro, OH 45066
http://www.tenma.com