

**TENMA®**

**72-10445**  
Operating Manual

**Digital Power  
Clamp Meter**



P/N:110401107552X  
REV.1  
DATE:2018/5/8

## TABLE OF CONTENTS

TITLE	PAGE
Overview	3
Unpacking Inspection	3
Safety Information	4
Rules For Safe Operation	4
International Electrical Symbols	6
The Meter Structure	7
A. The Meter Front Structure	7
B. The Meter Back and Bottom Structure	8
Functional Buttons	9
Display Symbols	12
Measurement Operation	14
A. Active power + AC Voltage + AC Current Measurement	14
B. Apparent Power + AC Voltage + AC Current Measurement	21
C. Reactive Power + AC Voltage + AC Current Measurement	24
D. Power Factor $\cos \phi$ + AC Voltage + AC Current Measurement	26
E. Phase Angle $\phi$ + AC Voltage + AC Current Measurement	28
F. Frequency Hz + AC Voltage + AC Current Measurement	30
G. Active Energy + Active Power + Time Measurement	32

## TABLE OF CONTENTS

TITLE	PAGE
H. Phase Rotation Test	34
Specifications	37
A. General Specifications	37
B. Environmental Requirements	38
Accuracy Specifications	39
A. AC Voltage (True RMS)	39
B. Frequency	39
C. AC Current (True RMS)	40
D. Active Power	40
E. Apparent Power	41
F. Reactive Power	42
G. Power Factor	43
H. Phase Angle	43
I. Active Energy	44
Maintenance	45
A. General Service	45
B. Replacing the Battery	45

### 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.**

**72-10445** is a digital power clamp meter (hereafter referred to as “the Meter”) is a handheld intelligent power 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 Phase Rotation Test

### Unpacking Inspection

Open the package case and take out the Meter. Check the following items carefully to see any missing or damaged part:

Item	Description	Qty
1	English Operating Manual	1 piece
2	Test Lead (red, black, blue and yellow color)	1 piece each color
3	Alligator Clip (red, black, blue and yellow color)	1 piece each color
4	USB Interface Cable	1 piece
5	Software	1 piece
6	Tool Box	1 piece
7	1.5V Battery (LR6)	4 pieces

In the event you find any missing or damage, please contact your dealer immediately.

## Safety Information

This Meter complies with the standards IEC61010: in pollution degree 2, overvoltage category (CAT. III 600V, CAT IV 300V) and double insulation.

CAT. III: Distribution level, fixed installation, with smaller transient overvoltages than CAT. IV.

CAT IV: Primary supply level, overhead lines, cable systems.

Use the Meter only as specified in this operating manual, otherwise the protection provided by the Meter may be impaired.

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

A **Note** identifies the information that user should pay attention to.

International electrical symbols used on the Meter and in this Operating Manual are explained on page 6.

## 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 measurement has been completed, disconnect the connection between the test leads and the circuit under test, remove the testing

leads away 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 working 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, inflammable and strong magnetic field. The performance of the Meter may deteriorate after dampened.
- Do not use the Meter if the surface of it 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, the user must make sure the Meter is power off.
- When servicing the Meter, use only the same model number or identical electrical specifications replacement parts.
- The internal circuit of the Meter shall not be altered at will to avoid damage of the Meter and any accident.
- 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 prevent the surface of the Meter from corrosion, damage and accident.
- Turn the Meter off when it is not in use and take out the battery when not using for a long time.
- Regularly check the battery as it may leak when it has been using for some time, replace the battery as soon as leaking appears. 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)

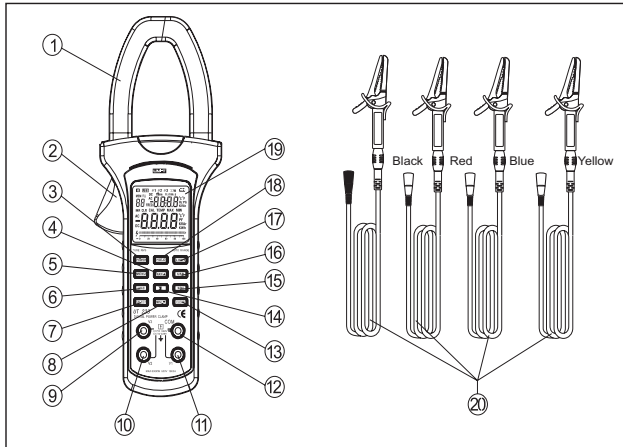


Figure 1

①	Transformer Jaw: designed to pick up the AC and DC current flowing through the conductor. It could transfer current to voltage. The tested conductor must vertically go through the Jaw center.
②	Hand Guards: to protect user's hand from touching the dangerous area.
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



⑭	Σ 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 figure2)

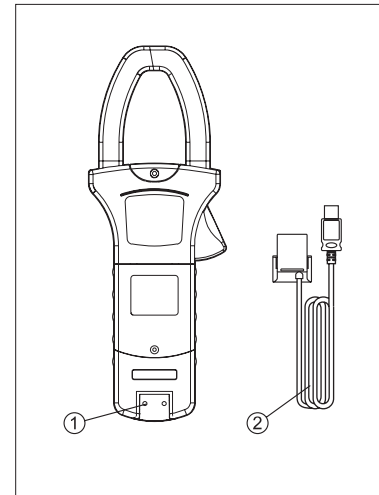


Figure 2

①	Infrared slot
②	USB Interface Cable

## Functional Buttons

Below table indicated for information about the functional button operations.

Button	Operation Performed
<b>POWER</b>	<ul style="list-style-type: none"> <li>● Press and hold <b>POWER</b> for 1 second to turn the Meter on.</li> <li>● Press <b>POWER</b> again to turn the Meter off.</li> </ul>
<b>HOLD</b>	<ul style="list-style-type: none"> <li>● Press <b>HOLD</b> to enter the Hold mode in any mode, <b>H</b> appears and the Meter beeps.</li> <li>● Press <b>HOLD</b> again to exit the Hold mode to return to measurement mode, the Meter beeps and <b>H</b> disappears.</li> </ul>
<b>LIGHT</b>	<ul style="list-style-type: none"> <li>● Press <b>LIGHT</b> to turn the display backlight on.</li> <li>● The display backlight will be off automatically after 30 seconds.</li> </ul>
<b>MENU</b>	Press <b>MENU</b> to display the following functions in sequence:

Button	Operation Performed
<b>MENU</b>	<ul style="list-style-type: none"> <li>● Active power (main display) + AC Voltage (left secondary display) + AC Current (right secondary display)</li> <li>● Apparent Power (main display) + AC Voltage (left secondary display) + AC Current (right secondary display)</li> <li>● Reactive Power (main display) + AC Voltage (left secondary display) + AC Current (right secondary display)</li> <li>● Power Factor (main display) + AC Voltage (left secondary display) + AC Current (right secondary display)</li> <li>● Phase Angle (main display) + AC Voltage (left secondary display) + AC Current (right secondary display)</li> <li>● Frequency (main display) + AC Voltage (left secondary display) + AC Current (right secondary display)</li> <li>● Active Energy (main display) + Active Power (left secondary display) + Time (right secondary display)</li> </ul>

Button	Operation Performed
<b>MENU</b>	<ul style="list-style-type: none"> <li>● Phase Rotation Test</li> </ul>
<b>MAX/▲</b>	<ul style="list-style-type: none"> <li>● Press to start recording of maximum value, it valid at voltage, current, active power, apparent power and reactive power ranges only.</li> <li>● Press once at LOAD mode, MR icon shown, the Meter displays the next stored reading</li> </ul>
<b>LOAD</b>	<ul style="list-style-type: none"> <li>● Press once to enter LOAD mode, MR appears and the Meter beeps.</li> <li>● Press again to exit LOAD mode, MR disappears and the Meter beeps.</li> <li>● Press and hold <b>LOAD</b> for 1 second to display the stored data quickly.</li> </ul>
<b>SELECT</b>	<ul style="list-style-type: none"> <li>● At Active power (main display) + AC Voltage (left secondary display) + AC Current (right secondary display) mode, press <b>SELECT</b> button to step through first phase, second phase, third phase and sum of watts.</li> </ul>

Button	Operation Performed
<b>SELECT</b>	<ul style="list-style-type: none"> <li>● At other mode except Phase Rotation Test, press <b>SELECT</b> to step through first phase, second phase and the third phase.</li> </ul>
<b>SAVE</b>	<ul style="list-style-type: none"> <li>● Press once to store single reading,</li> <li>● Press and hold for over 1 second to continuous store reading. Press <b>SAVE</b> again to exit. The maximum number of data store is 99, when it achieves 99, the Meter shows FULL. Press <b>CLEAR</b> to clear the stored reading in order to store next reading.</li> </ul>
<b>CLEAR</b>	<ul style="list-style-type: none"> <li>● At active energy range, press to reset time the zero, then restart the timing.</li> <li>● At all other ranges, press to clear stored readings.</li> </ul>
<b>MIN / ▼</b>	<ul style="list-style-type: none"> <li>● Press to start recording of minimum value, it valid at voltage, current, active power, apparent power and reactive power ranges only.</li> </ul>

Button	Operation Performed
MIN / ▼	<ul style="list-style-type: none"><li>● Press once at LOAD mode, MR icon shown, the Meter displays the previous stored reading.</li></ul>
$\Sigma$	<ul style="list-style-type: none"><li>● At Active power (main display) + Phase angle (secondary display) mode, press <math>\Sigma</math> once button to sum up the current first phase of 3 phase measurement result. Then carry out second phase power measurement.</li><li>● Press <math>\Sigma</math> again to sum up the second phase power measurement result, then carry out third phase power measurement.</li><li>● Press <math>\Sigma</math> again to sum up the third phase power measurement result, then press <b>SELECT</b> to enter the measurement of sum of the watts mode, the display shows the 3 phase sum of the watts value (Power factor + Active power + Reactive power).</li></ul>

## Display Symbols (see figure 3)

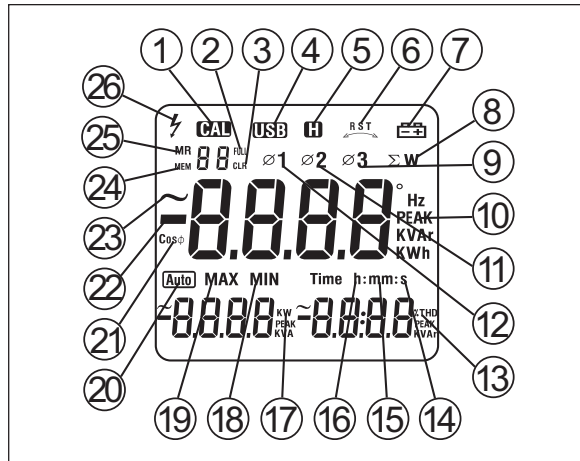


Figure 3


Number	Symbol	Meaning
①	<b>CAL</b>	Calibration symbol
②	<b>FUL</b>	Indicator for data stored is full
③	<b>CLR</b>	Indicator for clear the stored reading
④	<b>USB</b>	Data Output is in progress
⑤		Data hold is active
⑥	<b>RST</b>	Phase sequence
⑦		The battery is low. <b>⚠ 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.</b>
⑧	<b>ΣW</b>	Watt: Sum of Watt
⑨	∅3	Third phase symbol
⑩	<b>PEAK</b>	Primary reading unit symbol
⑪	∅2	Second phase symbol
⑫	∅1	First phase symbol

## Model 72-10445: OPERATING MANUAL

Number	Symbol	Meaning
⑬	<b>%THD</b>	Right secondary display unit symbol
⑭	<b>S</b>	Unit for second
⑮	<b>mm</b>	Unit for minute
⑯	<b>h</b>	Unit for hour
⑰	<b>KW</b>	Left secondary display unit symbol
⑱	<b>MIN</b>	Minimum reading
⑲	<b>MAX</b>	Maximum reading
⑳	<b>Auto</b>	Auto ranging indicator
㉑	<b>Cos<math>\phi</math></b>	Cos indicator
㉒	<b>—</b>	Indicates negative reading
㉓	<b>~</b>	Indicator for AC voltage or current
㉔	<b>MEN</b>	Indicator for data store
㉕	<b>MR</b>	Indicator for recall the stored reading
㉖	<b>⚡</b>	High voltage symbol

## Measurement Operation

### Preparation

- Press and hold **ON/OFF** button 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. Active power (main display) + AC Voltage (left secondary display) + AC Current (right secondary display) Measurement (see figure 4)

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

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

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

### Warning

**To avoid damages to the Meter or injury to the user, do not measure higher than AC voltage 600V RMS and AC current 1000A RMS.**

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

1. Press the **MENU** to select Active power (main display) + AC Voltage (left secondary display) + AC Current (right secondary display) range.
2. Press the lever to open the transformer jaw, and clamp them to the corresponding phase of tested conductor. If user needs to measure any phase of the 3 phase, then clamp them to that phase's conductor.
3. Connecting method (see figure 4, 5, 6):

## Model 72-10445: OPERATING MANUAL

- **When measuring 3 phase 4 wires, connect the Meter as figure 4.**

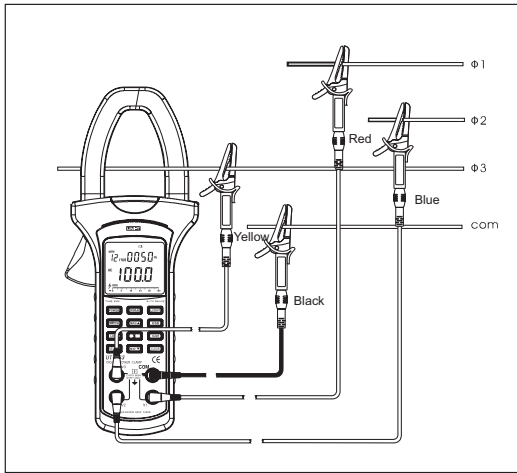
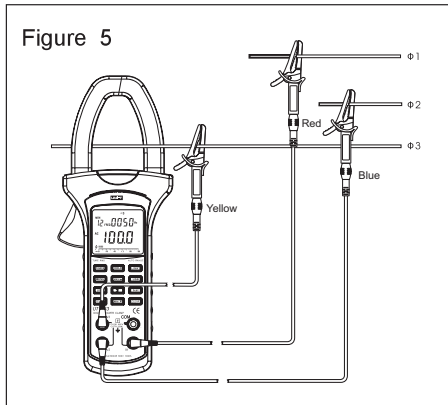


Figure 4

- Insert red test leads to V1 input terminal.
- Insert blue test leads to V2 input terminal
- Insert yellow test leads to V3 input terminal
- Connect red blue and yellow test leads to every live wire of the 3 phase.
- Insert black test leads to COM input terminal and connect it to the neutrual wire of the 3 phase.
- You must specify that this connection is used when the main transformer have STAR connection.



- 1) When measuring 3 phases 3 wires, connect the Meter as figure. 5



- 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 connecting it to every live wire of the 3 phase.
- 2) Press the lever to open the transformer jaw, and clamp them to the corresponding phase of tested conductor. If user needs to measure any phase of the 3 phase, then clamp them to that phase's conductor.

- 3) When measuring 3 phases 3 wires: (see figure 7, 8, 9, 10, 11, 12, 13).

- Press **SELECT** to choose first phase  $\varnothing 1$ , see figure 7. The triple displays show the active power kW value, the voltage value and the current value of  $\varnothing 1$ .
- If necessary, press  $\Sigma$  to get the sum of watts as figure 8.
- After sum up the current power measurement value of the first phase, then press **SELECT** to choose the second phase  $\varnothing 2$ , as figure 9.
- The triple displays show the value of active power kW, AC voltage V and AC current A of  $\varnothing 2$ .
- If necessary, press  $\Sigma$  to get the sum of watts as figure 10.
- After the sum up the current power measurement value of the second phase, then press **SELECT** again to choose the third phase  $\varnothing 3$ , as figure 11.
- The triple displays show the value of active power kW, AC voltage V and AC current A of  $\varnothing 3$ .
- If necessary, press  $\Sigma$  to get the sum of watts as figure 12.

## Model 72-10445: OPERATING MANUAL

- After the sum up the current power measurement value of the third phase, finally press **SELECT** again to display the 3 phases sum of watt value (sum of power factor + sum of active power + sum of reactive power).
- **When measuring single phase 2 wires, connect the Meter as figure 6**

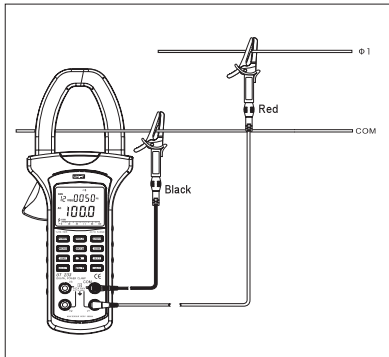


Figure 6

- Insert red test lead to **V1, V2 or V3** input terminal
- corresponding to one of,  $\phi 1, \phi 2$  or  $\phi 3$  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 or 3 phases 3 wires:(see figure 7, 8, 9, 10, 11, 12, 13).
  - Press **SELECT** to choose first phase  $\phi 1$ , see figure 7. The triple displays show the active power kW value, the voltage value and the current value of  $\phi 1$ .



Figure 7

- If necessary, press  $\Sigma$  to get the sum of watts as figure 8.



Figure 8

- After the sum up the current power measurement value of the first phase, then press **SELECT** to choose the second phase  $\varnothing 2$ , as figure 9.

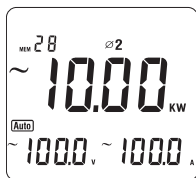


Figure 9

- The triple displays shows the value of active power kW, AC voltage V and AC current A of  $\varnothing 2$ .
- If necessary, press  $\Sigma$  to get the sum of watts as figure 10.

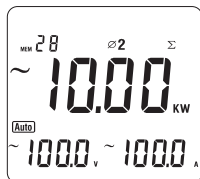


Figure 10

- After the sum up the current power measurement value of the second phase, then press **SELECT** again to choose the third phase  $\varnothing 3$ , as figure 11.

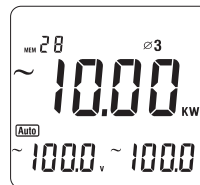


Figure 11

- The triple displays shows the value of active power kW, AC voltage V and AC current A of  $\varnothing 3$ .
- If necessary, press  $\Sigma$  to get the sum of watts as figure 12.

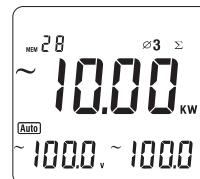


Figure 12

## Model 72-10445: OPERATING MANUAL

- After the sum up the current power measurement value of the third phase, finally press SELECT again to display the 3 phases sum of watt value (sum of power factor + sum of active power + sum of reactive power).

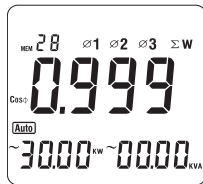


Figure 13

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

## Note

- When there is no input or single phase, the Meter displays **OL**.  $\Sigma$  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.
- USB interface connection is invalid when carrying out sum of watt 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.

### B. Apparent Power (main display) + AC Voltage (left secondary display) + AC Current (right secondary display) Measurement

#### Warning

To avoid damages to the Meter or injury to the user, do not measure higher than AC voltage 600V RMS and AC current 1000A RMS.

To test for Apparent Power (main display) + AC Voltage (left secondary display) + AC Current (right secondary display), connect the Meter as follows:

1. Press the **MENU** to select Apparent Power (main display) + AC Voltage (left secondary display) + AC Current (right secondary display) range.
2. Press the lever to open the transformer jaw, and clamp them to the corresponding phase of tested conductor. If user needs to measure 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 4, 5 and 6

4. When measuring 3 phase 4 wires: (see figure 14, 15, 16)
  - Press **SELECT** to choose the first phase  $\varnothing 1$ , see figure 14.

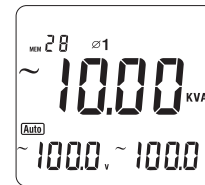


Figure 14

- The triple displays shows the first phase value of apparent power kVA, AC voltage V and AC current A..
- Then press **SELECT** again to choose the second phase  $\varnothing 2$ , see figure 15.

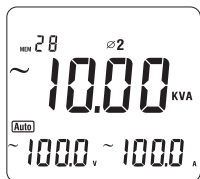


Figure 15

- The triple displays shows the second phase value of apparent power kVA, AC voltage V and AC current A.
- Press **SELECT** again to choose the third phase ∅3, see figure 16.

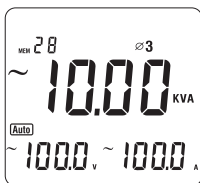


Figure 16

- The triple displays shows the third phase value of apparent power kVA, AC voltage V and AC current A.
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. The maximum measuring range is 600kW when measuring single phase apparent power kVA, **OL** will be displayed when it is over than that.
  7. Press **MAX/▲** the display shows MAX, it starts recording the maximum apparent power value, AC voltage value and AC current value. Press again to display the current apparent power value, AC voltage value and AC current value.
  8. Press **MIN/▼** the display shows MIN, it starts recording the minimum apparent power value, AC voltage value and AC current value. Press again to display the current apparent power value, AC voltage value and AC current 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.



### C. Reactive Power (main display) + AC Voltage (left secondary display) + AC Current (right secondary display) Measurement

#### Warning

To avoid damages to the Meter or injury to the user, do not you measure higher than AC voltage 600V RMS and AC current 1000A RMS.

To test for Reactive Power (main display) + AC Voltage (left secondary display) + AC Current (right secondary display), connect the Meter as follows:

1. Press the **MENU** to select Reactive Power (main display) + AC Voltage (left secondary display) + AC Current (right secondary display) range.
2. Press the lever to open the transformer jaw, and

clamp them to the corresponding phase of tested conductor. If user needs to measure 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 4, 5 and 6.
4. When measuring 3 phase 4 wires: (see figure 17, 18, 19)
  - Press **SELECT** to choose the first phase  $\varnothing 1$ , see figure 17.

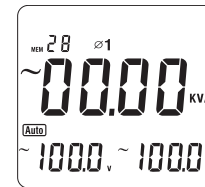


Figure 17

- The triple displays shows the first phase value of reactive power Kvar, AC voltage V and AC current A.

## Model 72-10445: OPERATING MANUAL

- Then press **SELECT** again to choose the second phase  $\varnothing 2$ , see figure 18.

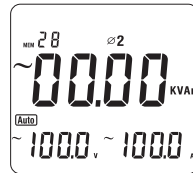


Figure 18

- The triple displays shows the second phase value of reactive power Kvar, AC voltage V and AC current A.
- Press **SELECT** again to choose the third phase  $\varnothing 3$ , see figure 19.

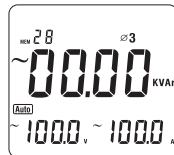


Figure 19

- The triple displays shows the third phase value of reactive power Kvar, AC voltage V and AC current A.
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. The maximum measuring range is 600kW when measuring single phase reactive power Kvar, **OL** will be displayed when it is over than that.
  7. **MAX** and **MIN** are not valid at this measurement mode.

### 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.

### D. Power Factor $\cos \varnothing$ (main display) + AC Voltage (left secondary display) + AC Current (right secondary display) Measurement

#### Warning

To avoid damages to the Meter or injury to the user, do not measure higher than AC voltage 600V RMS and AC current 1000A RMS.

To test for Power Factor (main display) + AC Voltage (left secondary display) + AC Current (right secondary display), connect the Meter as follows:

1. Press the **MENU** to select Power Factor (main display) + AC Voltage (left secondary display) + AC Current (right secondary display) range.
2. Press the lever to open the transformer jaw, and clamp them to the corresponding phase of tested conductor. If user needs to measure 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 4, 5 and 6.

4. When measuring 3 phase 4 wires: (see figure 20, 21, 22)

- Press **SELECT** to choose the first phase  $\varnothing 1$ , see figure 20.



Figure 20

- The triple displays shows the first phase value of power factor  $\cos \varnothing$ , AC Voltage V and AC Current A.
- Then press **SELECT** again to choose the second phase  $\varnothing 2$ , see figure 21.

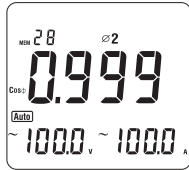


Figure 21

- The triple displays shows the second phase value of power factor  $\cos \varnothing$ , AC Voltage V and AC Current A.
- Press **SELECT** again to choose the third phase  $\varnothing 3$ , see figure 22.

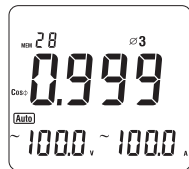


Figure 22

- The triple displays shows the third phase value of power factor  $\cos \varnothing$ , AC Voltage V and AC Current A.

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 at this measurement mode.

### 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. Phase Angle $\varnothing$ (main display) + AC Voltage (left secondary display) + AC Current (right secondary display) Measurement

#### Warning

To avoid damages to the Meter or injury to the user, do not measure higher than AC voltage 600V RMS and AC current 1000A RMS.

To test for Phase Angle (main display) + AC Voltage (left secondary display) + AC Current (right secondary display), connect the Meter as follows:

1. Press the **MENU** to select Phase Angle (main display) + AC Voltage (left secondary display) + AC Current (right secondary display) range.
2. Press the lever to open the transformer jaw, and clamp them to the corresponding phase of tested conductor. If user needs to measure 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 4, 5 and 6

4. When measuring 3 phase 4 wires: (see figure 23, 24, 25)

- Press **SELECT** to choose the first phase  $\varnothing 1$ , see figure 23.



Figure 23

- The triple displays shows the first phase value of phase angle  $\varnothing$  AC Voltage V and AC Current A.
- Then press **SELECT** again to choose the second phase  $\varnothing 2$ , see figure 24.

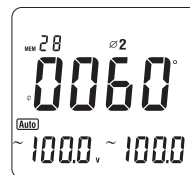


Figure 24

## Model 72-10445: OPERATING MANUAL

- The triple displays shows the second phase value of phase angle  $\varnothing$  AC Voltage V and AC Current A.
- Press **SELECT** again to choose the third phase  $\varnothing 3$ , see figure 25.



Figure 25

- The triple displays shows the third phase value of phase angle  $\varnothing$  AC Voltage V and AC Current A.

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 at this measurement mode.

### 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. Frequency Hz (main display) + AC Voltage (left secondary display) + AC Current (right secondary display) Measurement

#### Warning

To avoid damages to the Meter or injury to the user, do not measure higher than AC voltage 600V RMS and AC current 1000A RMS.

Frequency Measurement only measures the frequency of voltage signal not the frequency of current signal.

To test for Frequency Hz (main display) + AC Voltage (left secondary display) + AC Current (right secondary display), connect the Meter as follows:

1. Press the **MENU** to select Frequency Hz (main display) + AC Voltage (left secondary display) + AC Current (right secondary display) range.
2. Press the lever to open the transformer jaw, and clamp them to the corresponding phase of tested conductor. If user needs to measure 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 4, 5 and 6
4. When measuring 3 phase 4 wires: (see figure 26, 27, 28)
  - Press **SELECT** to choose the first phase  $\varnothing 1$ , see figure 26.



Figure 26

## Model 72-10445: OPERATING MANUAL

- The triple displays shows the first phase value of frequency Hz, AC Voltage V and AC Current A.
- Then press **SELECT** again to choose the second phase  $\varnothing 2$ , see figure 27



Figure 27

- The triple displays shows the second phase value of Frequency Hz AC Voltage V and AC Current A.
- Press **SELECT** again to choose the third phase  $\varnothing 3$ , see figure 28.

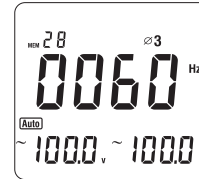


Figure 28

- The triple displays shows the third phase value of Frequency Hz, AC Voltage V and AC Current A.
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 at this measurement mode.

### 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.



## G. Active Energy (main display) + Active Power (left secondary display) + Time (right secondary display) Measurement



### Warning

To avoid damages to the Meter or injury to the user, do not measure higher than AC voltage 600V RMS and AC current 1000A RMS.

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

1. Press the **MENU** to select Active Energy (main display) + Active Power (left secondary display) + Time (right secondary display) range.
2. Press the lever to open the transformer jaw, and clamp them to the corresponding phase of tested conductor. If user needs to measure 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 4, 5 and 6.

4. Press **SELECT** to choose one of the three phases ( $\varnothing 1$ ,  $\varnothing 2$ ,  $\varnothing 3$ ), see figure 29.



Figure 29

- The double display shows the value of tested object's active energy kWh value and the measuring time of the corresponding phase.
- The measured reading increases while time increases. Press **HOLD** to read a particular time kWh value. The reading and time will be paused, but the accumulating values will still be measured in the background.
- After read the data, press **HOLD** again to continuous measurement. kWh value continuous accumulate and the measuring time jumps to the present measuring time.

## Model 72-10445: OPERATING MANUAL

- 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 active□□ energy is 9999kWh. **OL** will be displayed when the reading is over than that.
5. **MAX/▲** and **MIN/▼** are not valid at this measurement mode.
  6. Press **CLEAR** to reset the time.
  7. USB interface feature is not valid in this measurement mode.

### Note

- When there is no input signal, it cannot carry out active energy measurement.
- When there is input signal, the maximum waiting time is around 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.

## H. Phase Sequence

For Phase Sequence Judging, connect the Meter as follows:

1. Press the **MENU** to select AC Voltage (main display) + AC Voltage (left secondary display) + AC Voltage (right secondary display) range as figure 30.

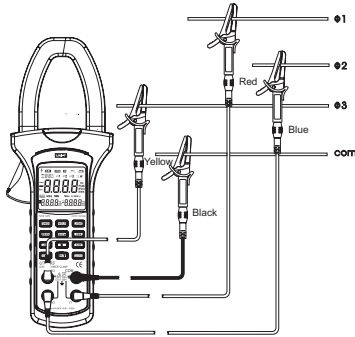


Figure 30

- Insert red test lead into **V1** input terminal.
- Insert blue test lead into **V2** input terminal.
- Insert yellow test lead into **V3** input terminal.
- Insert black test lead into **COM** input terminal.
- Connect these four test leads to the circuit under test or the loading of three phases and grounding terminal
- For the loaded return circuit of 3 phases 4 wires, the Meter shows the phase sequence result as figure 31, 32 and 33:



Figure 31  
=phase missing



Figure 32  
=negative phase sequence



Figure 33  
=positive phase sequence

## Model 72-10445: OPERATING MANUAL

2. Positive phase sequence is shown as below figure 34.

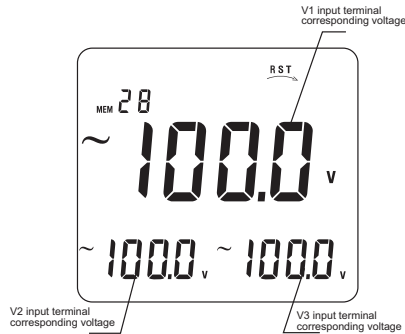
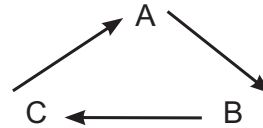


Figure 34

When V1 input terminal, V2 input terminal and V3 input terminal base on the below table connecting A phase, B phase and C phase, all three phases voltage are over 100V, LCD displays positive phase sequence result



Positive phase sequence

	Input Terminal		
	V1	V2	V3
A, B, C phases	A	B	C
	B	C	A
	C	A	B
Checking Result	Positive phase sequence		

3. Negative phase sequence is shown as below figure. When V1 input terminal, V2 input terminal and V3 input terminal base on the below table connecting A phase, B phase and C phase, all three phases voltage are over 100V, LCD displays negative phase sequence result, as figure 35.

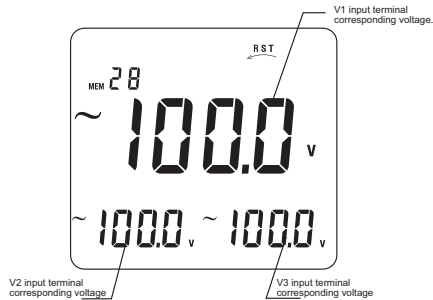
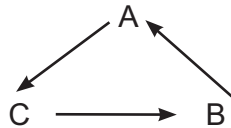


Figure 35



### Negative phase sequence

	Input Terminal		
	V1	V2	V3
A, B, C phases	A	C	B
	B	A	C
	C	B	A
Checking Result	Negative phase sequence		



4. When any one phase's voltage has no signal or less than 100V at 3 phases 4 wires overload mode, the LCD display missing phase result.
5. USB interface feature is not valid in this measurement mode.

### Note

- Positive and negative phase sequence test voltage range is 100V ~500V.
- 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.

### Specifications

#### A. General Specifications

- Maximum Voltage between any Terminals 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 .
- Data Logging: Maximum 99, Single or Continuous record and recall data
- Maximum and Minimum value display: Voltage, Current, Active Power, Apparent Power and Reactive Power ranges
- Display Backlight
- Computer connection: USB
- Sleep Mode: To preserve battery life, the Meter automatically turns off if you do not turn press any button for around 15 minutes., except at active energy range.
- Analogue Bar Graph
- Sampling: High speed: 2 times per second, Low speed: 1 time per 3 seconds, Mid speed: 1 time per 2 seconds.
- Max. Jaw Size: 55mm diameter.
- Power: 4 x 1.5V Alkaline battery (LR6 AA)
- Dimensions: 303mm x 112mm x 39mm
- Weight: Approximate 601g

## B. Environmental Requirements

- 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:
  - 20°C~ +70°C (≤85%R.H)
- Safety/ Compliances: IEC 61010 CAT.III 600V,  
CAT.IV 300V overvoltage and double insulation  
standard, pollution degree 2.
- Certification: CE

### Accuracy Specifications

Accuracy:  $\pm(a\% \text{ reading} + b \text{ digits})$ , guaranteed for 1 year from date of purchase.

Operating temperature:  $23^{\circ}\text{C} \pm 5^{\circ}\text{C}$

Operating humidity: 45~75%R.H

#### A. AC Voltage (True RMS)

Range	Resolution	Accuracy	Allowable Maximum overload protection voltage	Input Impedance
15V	0.1V	$\pm(1.2\%+5)$	600V RMS	10M $\Omega$
100V				
300V				
600V				

#### B. Frequency

Range	Resolution	Accuracy
20Hz~500Hz	1Hz	$\pm(0.5\%+5)$



### 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 ( $W = V \times A \times \cos \phi$ )

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		At 15/1000A range: ±(3%+10) Others: ±(3%+5)			
Resolution		<100kW: 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		Voltage 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		At 15/1000A range: $\pm(3\%+10)$ Others: $\pm(3\%+5)$			
Resolution		<100kVA: 0.01kVA $\geq$ 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		Voltage 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 : ± (4%+5)			
Resolution		<100kVar: 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)	$\pm 0.022$	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°	$\pm 1^\circ$	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	$\pm(3\%+2)$	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 with cotton bar with detergent, as dirt or moisture in the terminals can affect readings.
- Turn the Meter power off when it is not in use.
- Take out the battery when it is not using for a long time.
- Do not use or store the Meter in a place of humidity,

high temperature, explosive, inflammable and strong magnetic field.

### B. Replacing the Battery (see figure 36)

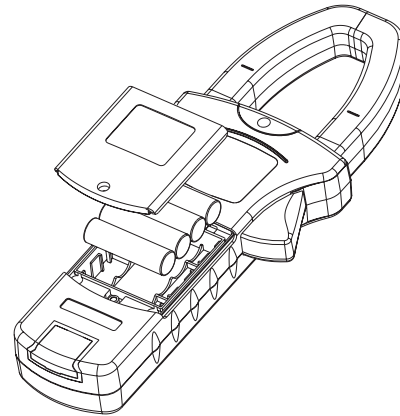



Figure 36

 **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 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 battery (LR6).
5. Rejoin the case bottom and the battery compartment, and reinstall the screw.

\*END\*

This operating manual is subject to change without notice.





Copyright 2012 Tenma Test Equipment.  
All rights reserved.

Tenma Test Equipment  
300 S. Riverside Plaza #2200  
Chicago IL, 60606  
USA  
[www.Tenma.com](http://www.Tenma.com)