



ATK-2209

Clamp Meter

User's Manual



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I. SAFETY INFORMATION

- ❑ Read the following safety information carefully before operating the meter.
- ❑ To avoid damages to the instrument, do not exceed the maximum limits of the input values shown in the technical specification tables.
- ❑ Do not use the meter or test leads if they look damaged.
- ❑ Use extreme caution when working around bare conductors or bus bars. Accidental contact with the conductor could result in electric shock.
- ❑ Use the meter only as specified in this manual; otherwise, the protection provided by the meter may be impaired.
- ❑ Read the operating instructions before use and follow all safety information.
- ❑ Caution when working with voltages above 60VDC or 30VAC RMS. Such voltages cause a shock hazard.
- ❑ Before taking resistance measurements or testing acoustic continuity, disconnect circuit from main power supply and all loads from circuit.
- ❑ **U.S. Pat. No. Des. 447,070**

Safety symbols



Caution refer to this manual before using the meter.



Dangerous voltages.



Meter is protected throughout by double insulation or reinforced insulation.

When servicing, use only specified replacement parts.



Comply with EN-61010-1, IEC 1010-2-32

II. TECHNICAL SPECIFICATIONS

2-1 Environment Conditions :

- ① Installation categories III
- ② Pollution degree 2
- ③ Altitude up to 2000 meters
- ④ Indoor use only
- ⑤ Relatively humidity 80% max.
- ⑥ Operation ambient 0 ~ 50°C

2-2 Maintenance :

- ① Repairs or servicing not covered in this manual should only be performed by qualified personnel.
- ② Periodically wipe the case with a dry cloth. Do not use abrasives or solvents on this instrument.

2-3 Features :

2-3-1 HVAC :

- ① Check current draw in motors and compressors.
- ② Use MAX/MIN/Recording in the temperature mode to assess the efficiency.
- ③ Test run/start capacitors.
- ④ To identify low voltage control signals.
- ⑤ Measure flame safeguard device current draw.
- ⑥ To identify power sources
- ⑦ Analyze temperature and power data with the aid of the time stamp.
- ⑧ Insulation test up to 100M Ω .


2-3-2 Electrical :

- ① Check for energized circuits and balance loads.
- ② 1 ϕ /3 ϕ (3P3W/3P4W) power analyzer.
- ③ Evaluate electrical contacts.
- ④ Capture in-rush current readings of motor.
- ⑤ Determine peak power demand periods.
- ⑥ Verify the stability of voltage.
- ⑦ Monitor motors and other loads for excess heat.
- ⑧ Check motor run/start capacitor values.

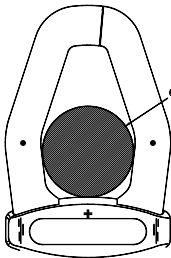
2-3-3 Function :

- ① **True RMS. ACV, ACA.**
- ② **9999 counts dual display LCD with unit sign.**
- ③ **Trms ACA** : 0.01A to 999.9A.
(Auto/Manual : 99.99A, 999.9A)
- Trms ACV** : 2.0mV to 600.0V.
(Auto/Manual : 999.9mV, 9.999V, 99.99V 600.0V)
- 1 ϕ /3 ϕ AC KVA** : 10VA to 600.0KVA. (Auto Ranges)
- 1 ϕ /3 ϕ AC KVAR** : 10VAR to 600.0KVAR. (Auto Ranges)
- 1 ϕ /3 ϕ AC KW** : 10W to 600.0KW. (Auto Ranges)
- 1 ϕ /3 ϕ AC HP** : 0.01HP to 800.0HP. (Auto Ranges)
- 1 ϕ /3 ϕ Phase Angle (θ)** : $-60^\circ \sim 0^\circ \sim +60^\circ$ ($>60^\circ$ only for reference)
- DCV** : 2.0mV to 600.0V.
(Auto/Manual : 999.9mV, 9.999V, 99.99V, 600.0V)
- AC+DC Trms μ A**: 0.20 μ A to 999.9 μ A.
(Auto/Manual : 99.99 μ A, 999.9 μ A)
- Frequency** : 40.0Hz to 999.9Hz
- Capacitance** : 1nF to 7000 μ F
(Auto/Manual : 10.000 μ F, 100.00 μ F, 1000.0 μ F, 7000 μ F)
- Temperature** : -50.0°C to 900.0°C / -58.0°F to 999.9°F
- Resistance** : 0.1 Ω to 99.99 M Ω .
(Auto/Manual : 999.9 Ω , 9.999K Ω , 99.99K Ω ,
999.9K Ω , 9.999M Ω , 99.99M Ω)
- Continuity** : $<40.0\Omega$ on 999.9 Ω Range.
- Diode** : 1mV to 2.000V. (continuity $< 40\text{mV}$)
- Power Factor (PF)** : $\cos\theta$ only for reference
- ④ **1 ϕ /3 ϕ Dual KW+HP, KW+PF, KW+KVAR, KVA+ θ and A+V, 5 types display.**
- ⑤ **Dual display A+Hz, V+Hz.**
- ⑥ **Data hold mode (there are 5 types display in KW function).**
- ⑦ **Auto Power Off and to disable Auto Power off function.**

2-4 General Specifications :

- Maximum voltage between any terminal and earth ground** : 600Vrms.
- Numerical dual display** : Dual display 4 digits LCD maximum reading 9999.(10,000 Count Reading)
- Battery life** : approx. 32hr
- Low battery indication** : The  is displayed when the battery voltage drops below the operating voltage.
- Auto power off time** : approx. 30 minutes. (To disable Auto Power Off, please refer to 4-11)
- Sampling rate** : 2.5 times / sec (Digital display)
1 times /6 sec (on KW, KVA)
- Jaw opening diameter** : Cables ϕ 42mm.
- Operating temperature and humidity** : 0°C to 50°C (32°F to 122°F)
R.H. < 80% non-condensing.
- Temperature coefficient** : 0.1× (specified accuracy)/°C
(<18 or >28°C, <64 or >82°F)
- Storage temperature and humidity** : -10°C to 60°C (14°F to 140°F)
R.H. < 70% non-condensing.
- Dimensions** : 228(L) x 76(W) x 39mm(H).
- Weight** : Approx. 465g.
- Accessories** : Carrying case, Test leads, Battery (one 006p 9V), One pair of alligator clip & Instruction manual.

2-5 Measurement Specifications :



Accuracy : \pm (% of reading + number of digits) at 18°C to 28°C (64°F to 82°F) with relative humidity to 80%.

The current error is specified within the largest circle which can be drawn inside the jaw.

AC Current (50Hz to 400Hz) : Trms

Range	Resolution	Accuracy	Sensitivity	Overload Protection
99.99A	10mA	\pm 2% \pm 20dgts (50, 60Hz) \pm 4% \pm 20dgts (40~400Hz)	0.10A	1000A
999.9A	100mA		1.0A	

μA Trms : (AC+DC) (Burden Voltage : 5mV/μA)

Range	Resolution	Accuracy	Sensitivity	Overload Protection
99.99μA	10nA	±1% ±20dpts	0.20μA	600V
999.9μA	100nA		2.0μA	

AC Voltage (50Hz to 400Hz) : Trms

Range	Resolution	Accuracy	Sensitivity	Overload Protection
999.9mV	0.1mV	±1% ±20dpts (50, 60Hz) ±2% ±20dpts (40~100Hz)	2.0mV	600V
9.999V	1mV	±1% ±20dpts (50, 60Hz) ±2% ±20dpts (40~400Hz)	0.020V	
99.99V	10mV		0.20V	
600.0V	100mV		2V	

Input impedance : 3M Ω**DC Voltage :**

Range	Resolution	Accuracy	Sensitivity	Overload Protection
999.9mV	0.1mV	±1.0% ±20dpts	2.0mV	600V
9.999V	1mV		0.020V	
99.99V	10mV		0.20V	
600.0V	100mV		2V	

Input impedance : 3M Ω**Resistance (Continuity<40Ω on the 999.9Ω range) :**

Range	Resolution	Accuracy	Overload Protection
999.9Ω	100mΩ	±1% ±10dpts	600V
9.999KΩ	1Ω		
99.99KΩ	10Ω		
999.9KΩ	100Ω		

MΩ:

Range	Resolution	Accuracy	Overload Protection
9.999MΩ	1KΩ	±5% ±10dpts	600V
99.99MΩ	10KΩ		

Capacitance :

Range	Resolution	Accuracy	Overload Protection
10.000μF	1nF	±1.5% ±5dpts	600V
100.00μF	10nF		
1000.0μF	100nF		
7000μF	1μF	±2.5% ±15dpts	

Diode (Continuity<40mV) :

Range	Resolution	Accuracy	Overload Protection
2.000V	1mV	±2% ±1dgt	600V

Temperature (K-Type thermocouple) :

Range	Resolution	Accuracy	Overload Protection
-50°C to 900°C	0.1°C	±1%±1°C	30V _{AC} or 60V _{DC}
-58°F to 1000°F	0.1°F	±1% ±2°F	

1φ/3φ TRUE Power (KW) : (PF>0.5 or θ <60°)

Range	Resolution	Accuracy	Overload Protection
60.00KW (<100A)	10W	±5%rdg ±20dgts (50, 60Hz)	600VAC/ 1000AAC
600.0KW (>100A)	100W		

1φ/3φ Horse Power (HP) : (PF>0.5 or θ <60°)

Range	Resolution	Accuracy	Overload Protection
80.00HP (<100A)	0.01HP	±5%rdg ±20dgts (50, 60Hz)	600VAC/ 1000AAC
800.0HP (>100A)	0.1HP		

1φ/3φ Reactive Power (KVAR) : (PF>0.5 or θ <60°)

Range	Resolution	Accuracy	Overload Protection
60.00KVAR (<100A)	10VAR	±5%rdg ±20dgts (50, 60Hz)	600VAC/1000AAC
600.0KVAR (>100A)	100VAR		

1φ/3φ Apparent Power (KVA) :

Range	Resolution	Accuracy	Overload Protection
60.00KVA (<100A)	10VA	±2.5%rdg ±20dgts	600VAC/1000AAC
600.0KVA (>100A)	100VA		

1φ/3φ Phase Angle (50Hz, 60Hz) :

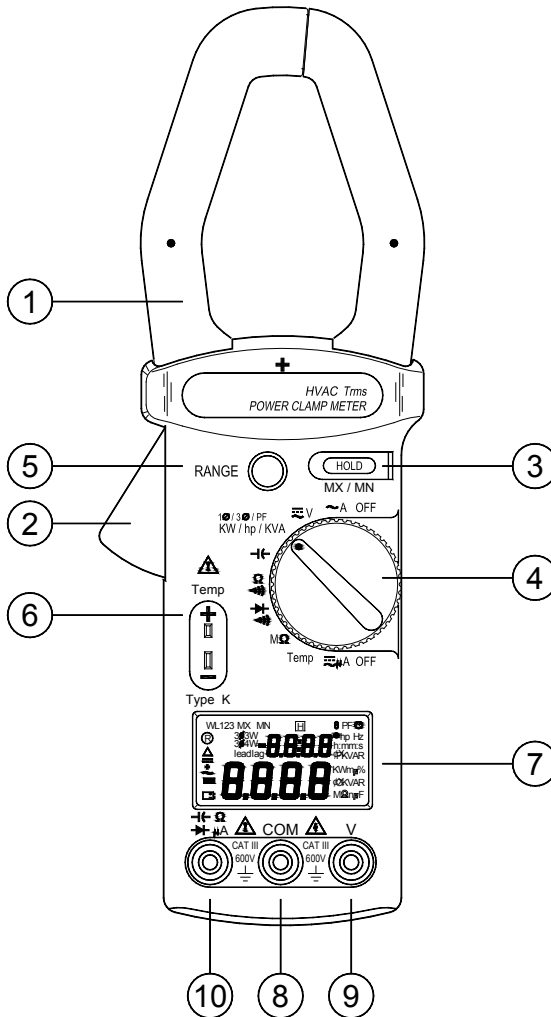
Range	Resolution	Accuracy	Sensitivity
-60° ~ 0° ~ +60°	0.1°	±6.0°	ACV>100V, ACA>10A

Frequency :

Range	Resolution	Accuracy	Sensitivity
40Hz/1KHz	0.1Hz	±0.5%rdg ±2dgts	ACV>1.2V, ACA>6A

III. PARTS & CONTROLS

3-1 Description of Parts & Control



(Figure-1)

(1). Transformer jaws (+ mark face to source) :

Pick up the AC current flowing through the conductor.

(2). Jaw opening trigger.

(3). Data Hold (MX/MN) key :

a. Data Hold mode :

Press it to hold the measured value.

Press again to release. (capacitance function not included)

b. Maximum and Minimum

- ① Select the desired ACA, ACV, DCV, °C/°F or μ A function and perform the measurement.
- ② Keep pressing "MX/MN" key for 2 seconds. Shows "®" and "MX MN" marks on LCD. At this moment, the Auto Power Off function is automatically disabled.
- ③ Press "MX/MN" key. Shows "MX" on LCD. The recorded Maximum value and time displayed.
- ④ Press "MX/MN" key. Shows "MN" on LCD. The recorded Minimum value and time displayed.
- ⑤ Press "MX/MN" key. Shows "MX MN" on LCD. The current value and time displayed.
- ⑥ Step ③ ④ ⑤ can be cycled.
- ⑦ Keep pressing "MX/MN" key for 2 seconds to release.

Note : The default time setting is "minute : second". If over 60 minutes, it will be "hour : minute". The Maximum of time period is 100 hours.

(4). Function selector :

For selection of desired function.

(5). RANGE key :

a. In ACA, ACV, DCV, μ A, Capacitance and Resistance function.

- ① Press the key to launch. Shows ® on LCD.
- ② Press the key again to select the desired range.
- ③ Keep pressing the key for 2 seconds to exit Manual Range but Autorange mode. ® mark will disappear.

b. In 1 ϕ /3 ϕ KW/HP/KVA function.

- ① Press "HOLD" key to keep the measured value in memory.
- ② Press "RANGE" key to view the KW+HP, KW+PF, KW+KVAR, KVA+ θ and A+V dual display.
- ③ Press "HOLD" key to exit this mode (1 ϕ).

c. In Temp function.

Press **RANGE** key to select °C or °F.

(6). Temperature input jack. Only Type K thermocouple input is accepted.

(7). LCD display :

4 digits with indications for measurement values, unit symbols, decimal point, polarity, over range, and low battery ; etc.

(8). COM Jack :

Connect black test lead for Voltage, Power, Capacitance, Resistance, Diode, Continuity and Micro ampere measurement.

(9). " V " Jack :

Connect red test lead for Voltage and Power measurement as a positive terminal.

(10). " Ω → μA " jack :

Connect red test lead for Capacitance, Resistance, Diode, Continuity and Micro ampere measurement as a positive terminal.

IV. OPERATING INSTRUCTION

4-1 AC+DC Voltage Measurement

WARNING

Maximum input is 600V. Do not attempt to take any voltage measurement that exceeds limit. Exceeding limit could cause electrical shock and damage to the clamp meter.

- ① Set the rotary switch to the "V" position.
- ② Insert the test leads into the jack. (Black to COM and Red to V)
- ③ Connect the test leads in PARALLEL to the measured circuit.
- ④ The meter will automatically switch to ACV or DCV.

NOTE

The sensitivity for voltage measurement is 1.2V, and the frequency range is 40 - 1KHz. If the frequency is less than 40 Hz, the LCD may show .Hz .

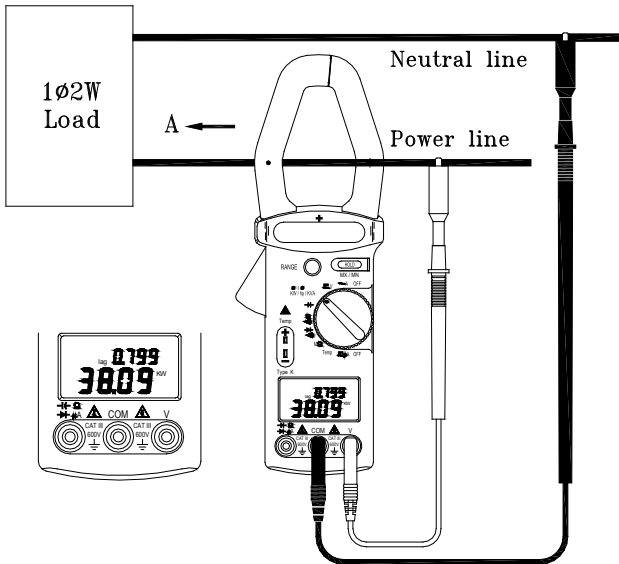
4-2 AC Current Measurement

- ① Set the rotary switch to the "**~A**" position.
- ② Press the trigger to open the jaw and fully close the conductor.

NOTE

The sensitivity for current frequency measurement is 6A, and the frequency range is 40 ~ 400Hz. If the frequency is less than 40 Hz, the LCD may show .Hz .

4-3 1 ϕ AC Power KW, HP, KVA, KVAR, PF (Power Factor) and θ (Phase Angle) Measurement



(Figure-2)

- ① Set the rotary switch to the "**KW/KVA**" position (refer to figure 2).
- ② Insert the test leads into the jack. (Black to COM and Red to V)
- ③ Connect the Black lead (COM) to the neutral line.
- ④ Connect the Red lead (V) to the power line and clamp the same conductor where V (red) terminal is connected.
- ⑤ Press "**RANGE**" key to select **KW+HP (Horse Power)**, **KW+PF (Power Factor)**, **KW+KVAR**, **KVA+ θ (Phase Angle)** or **A+V** 5 types display.

$$\textcircled{6} \text{ PF} = \frac{\text{KW}}{\text{KVA}} = \cos \theta \quad (\theta = \text{Phase Angle})$$

HP (Horse Power) : HP = 746 Watts


KVA (Apparent Power) : KVA = (V*A)/1000

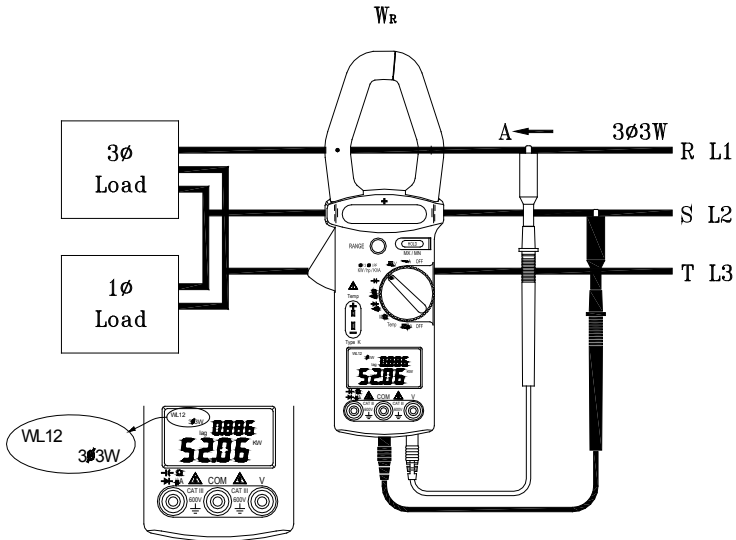
KVAR (Reactive Power) : KVAR = $\sqrt{(\text{KVA})^2 - (\text{KW})^2} = \text{KVA} * \sin \theta$

NOTE

1. The "+" sign printed on Panel must face to the power source for accurate measurement.
2. If the power supply of the device under test is switching mode, the meter KW, PF and θ reading may be incorrect.

4-4 3 ϕ 3W AC Power KW, HP, KVA, KVAR, PF (Power Factor) and θ (Phase Angle) Measurement

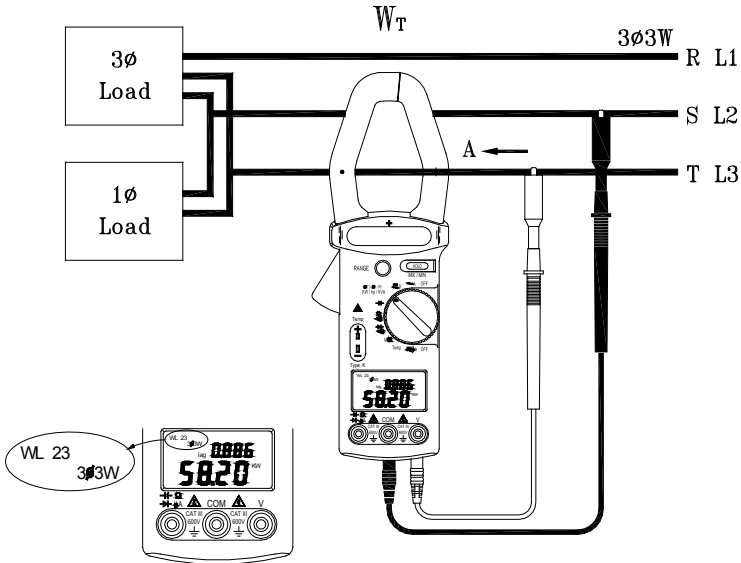
- ① First, measure $W_{RS(L1L2)}$ (refer to figure 3).
 - a. Set the rotary switch to the " V".
 - b. Keep pressing "**HOLD**" key then set the rotary switch to "KW/KVA", the 3 ϕ 3W and W_{L12} symbol appear.
 - c. Insert the test leads into the jack.
 - d. Select a phase (eg. S or L2) as COM and connect the test probe of the COM (black) terminal to that phase (eg. S or L2).
 - e. Connect the test probe of V (red) terminal to the second phase (eg. R or L1).
 - f. Clamp the same phase as step e. (eg. R or L1).
 - g. The power clamp will automatically select proper range.
 - h. Wait until the reading is stable (about 6 seconds). Press "**HOLD**" key to store the measured value. The W_{L23} symbol will appear.



(Figure-3)

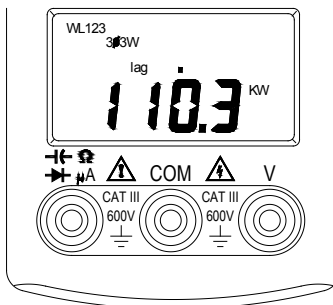
② Second, measure $W_{TS(L3L2)}$ (refer to figure 4).

- a. Disconnect the test probe from the phase where jaws is clamp on in previous measurement.
- b. Connect the test probe to the third phase (eg. T or L3).
- c. Clamp the third phase where test probe is connected to (eg. T or L3)
- d. The power clamp will automatically select proper range.
- e. Wait until the reading is stable (about 6 seconds). Press the “**HOLD**” key to store the measured value.



(Figure-4)

- ③ The power clamp will process those two sets of data (W_{L12} , W_{L23}), and show the result on the LCD. W_{L123} symbol will be shown to indicate the watt of 3φ3W power (refer to figure 5). At this moment, the watt of 3φ3W power is stored to the memory.



(Figure-5)

- ④ If willing to read the details of that singly data record, press “**HOLD**” key to select desired W_{L12} , W_{L23} or W_{L123} display then press “**RANGE**” key to select **KW+HP (Horse Power)**, **KW+PF (Power Factor)**, **KW+KVAR**, **KVA+ θ (Phase Angle)** or **A+V** 5 types display.
- ⑤ $W_{3\phi 3W} = W_{RS(L1L2)} + W_{TS(L3L2)}$

$$KVA_{3\phi 3W} = \sqrt{KW^2_{3\phi 3W} + KVAR^2_{3\phi 3W}}$$

$$PF_{3\phi 3W} = \frac{KW_{3\phi 3W}}{KVA_{3\phi 3W}}$$

- ⑥ **Set the rotary switch to other position exit this mode and clear the stored data.**

NOTE

Once a phase is selected as COM, users can not change this selection in the subsequent measurement. For example, if S (or L2) phase is selected, S (or L2) phase is always connected to the COM during measurement of W_{RS} (or W_{L1L2}) and W_{TS} (or W_{L3L2}) in 3ϕ 3W unbalanced power.

NOTE

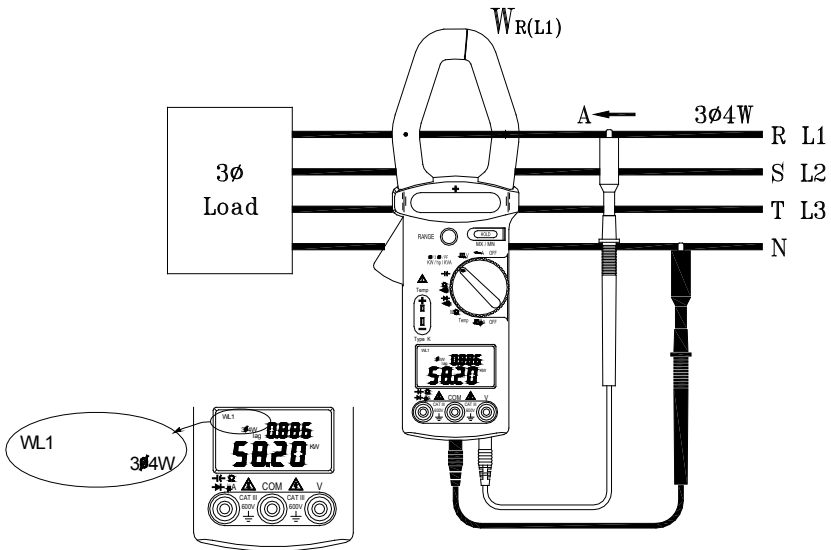
1. The "+" sign printed on Panel must face the power source for accurate measurement.
2. If the device under test is switching mode power, the meter KW, PF and θ reading maybe incorrect.

NOTE

In the $3\phi 3W$ unbalanced power measurement, one of W_{RS} or W_{TS} could be negative. Users must make sure all the connections and clamping are correct to obtain correct power.

4-5 3 ϕ W AC Power KW, HP, KVA, KVAR, PF (Power Factor) and θ (Phase Angle) Measurement

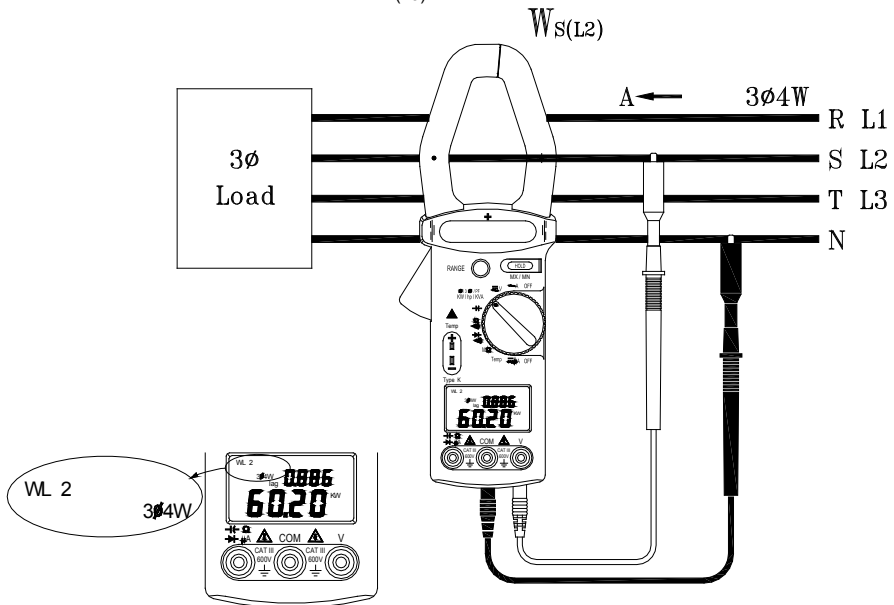
- ① First, measure $W_{R(L1)}$ (refer to figure 6).
 - a. Set the rotary switch to the “ \sim V” position.
 - b. Press and hold down the “**RANGE**” key then set the rotary switch to “KW/KVA” position, the 3 ϕ W and W_{L1} symbols appear.
 - c. Insert the test leads into the input jack.
 - d. Connect the neutral line to the COM (black) terminal.
 - e. Connect the test probe of the V (red) terminal to the first phase (eg. R or L1).
 - f. Clamp on to the same phase (eg. R or L1).
 - g. The power clamp meter will automatically select proper range.
 - h. Wait until the reading is stable (about 6 seconds), press the “**HOLD**” key, and W_{L1} symbol will disappear and W_{L2} symbol appears to instruct users to take measurement of $W_{S(L2)}$.



(Figure-6)

- ② Second, measure $W_{S(L2)}$ (refer to figure 7)
 - a. Disconnect the test probe from the phase where jaws is clamp on in previous measurement.
 - b. Connect the test probe of the V (red) terminal to the second phase (eg. S or L2).

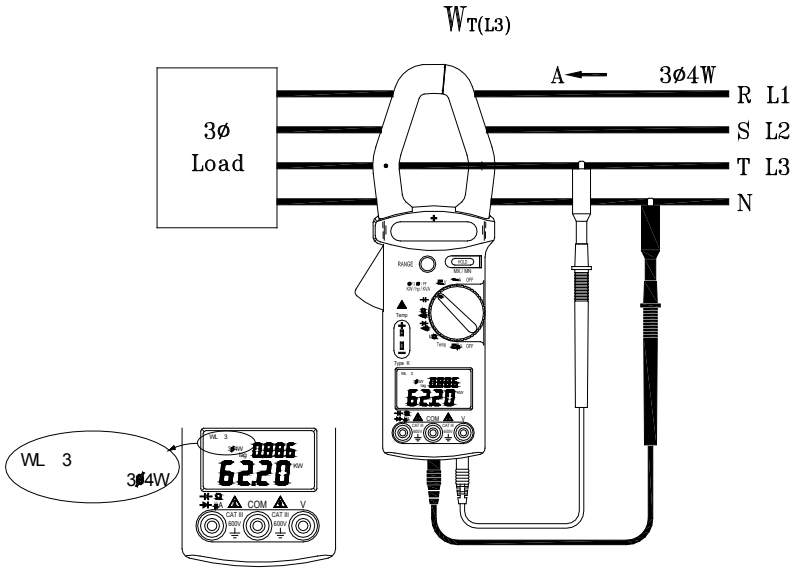
- c. Clamp the phase where test probe is connected to (eg. S or L2 phase)
- d. The power clamp will automatically select proper range.
- e. Wait until the reading is stable (about 6 seconds), press the “**HOLD**” key and W_{L2} symbol will disappear. W_{L3} symbol will appear to instruct users to take measurement of $W_{T(L3)}$.



(Figure-7)

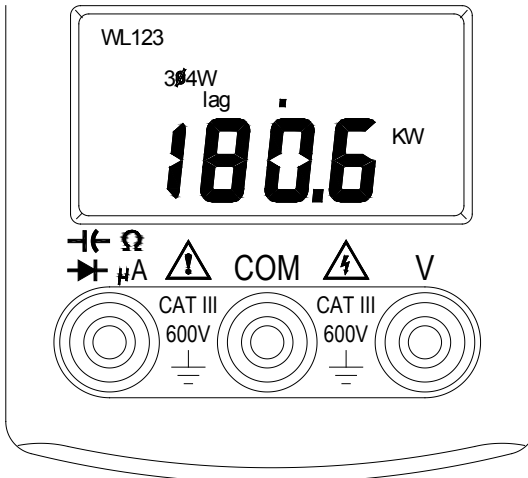
③ Third, measure $W_{T(L3)}$ (refer to figure 8)

- a. Disconnect the test probe from the phase where jaws clamped in previous measurement.
- b. Connect the test probe of the V (red) terminal to the third phase (eg. T or L3 phase).
- c. Clamp the phase where test probe is connected to (eg. T or L3).
- d. The power clamp will automatically select proper range.
- e. Wait until the reading is stable (about 6 seconds), press the “**HOLD**” key and W_{L3} symbol will disappear.



(Figure-8)

- ④ The power clamp will process these three sets of data (W_{L1} , W_{L2} , W_{L3}) and show the result on the LCD. W_{L123} symbol will be shown to indicate the watt of 3φ 4W power (refer to figure 9).
At this moment, the of 3φ4W power are stored in the memory.



(Figure-9)

⑤ If willing to read the details of that singly data record, please “**HOLD**” key to select desired WL1, WL2, WL3 or WL123 display then press “**RANGE**” key to select **KW+HP (Horse Power)**, **KW+PF (Power Factor)**, **KW+KVAR**, **KVA+ θ (Phase Angle)** or **A+V 5 types display**.

⑥ $W_{3\phi 4W} = W_{R(L1)} + W_{S(L2)} + W_{T(L3)}$

$$KVA_{3\phi 4W} = \sqrt{KW^2_{3\phi 4W} + KVAR^2_{3\phi 4W}}$$

$$PF_{3\phi 4W} = \frac{KW_{3\phi 4W}}{KVA_{3\phi 4W}}$$

⑦ **Set the rotary switch to other position exit this mode and clear the stored data.**

NOTE

1. The "+" sign printed on Panel must face the power source for accurate measurement.
2. If the device under test is switching mode power, the meter KW, PF and θ reading maybe incorrect.


NOTE

In the 3 ϕ 4W power measurement, all three W_R or W_S and W_T must be positive. If users find one negative power, check the connection of test leads and clamping of jaw. Make sure all the connections and clamping are correct to obtain correct power.

4-6 Resistance & Continuity Measurement

WARNING

Before taking any in circuit resistance measurement, remove Power form the circuit being tested and discharge all capacitors.

- ① Before taking resistance measurements, make sure the circuit is not live and discharge any capacitors present in the circuit.
- ② Set the rotary switch to the " Ω ,  " or "M Ω " range.
- ③ Insert the test leads into the input jack. (Black to COM and Red to Ω).
- ④ Connect the test leads to the circuit being measured and read the displayed value.
- ⑤ When the reading is below 40 Ω , it will be indicated by a continuous beeping.

4-7 Capacitance Measurement

- ① Fully discharge the capacitor being tested, will speed test response time.
- ② Insert the test leads into the input jack. (Black to COM and Red to $\rightarrow(\leftarrow$)
- ③ Set rotary switch to the " $\rightarrow(\leftarrow$ " position.
- ④ Connect the red test lead to the anode side and black test lead to the cathode side of the capacitor being tested.
- ⑤ Read capacitance value on LCD.

4-8 Diode & Continuity Measurement

- ① Set the rotary switch to the " $\rightarrow\rightarrow\rightarrow\rightarrow$ " range.
- ② Insert the test leads into the input jack. (Black to COM and Red to $\rightarrow\rightarrow$)
- ③ Connect the red test lead to the anode side and black test lead to the cathode side of the Diode being tested.
- ④ When the reading is below 40mV, it will be indicated by a continuous beeping.

4-9 Temperature Measurement

- ① Set the rotary switch to the "Temp" position.
- ② Press "RANGE" key to select desired °C or °F temperature units.
- ③ Insert the Type K thermocouple to the Temp jack.
- ④ Use temperature probe to touch the object being measured and read the displayed value.

4-10 AC+DC Micro-Ampere Measurement

- ① Set the rotary switch to the " $\overline{\sim}$ μ A" position.
- ② Insert the test leads into the input jack. (Black to COM and Red to μ A)
- ③ Connect the test leads series to the circuit being measured and read the displayed value.

4-11 To disable Auto Power Off function

The meter will automatically enter sleep mode if no button pressed and no function changed for 30 minutes to save power consumption.

- ① Set the rotary switch to "OFF" position.
- ② Press and hold "HOLD" key then set the rotary switch to "~A" position, the auto power off function will be disabled.


The auto power off mark "⌚" will disappear.

Auto power off mode is enabled each time you turn on the meter and is automatically disabled in the "MX/MN" mode.

V. BATTERY REPLACEMENT

WARNING

To prevent electrical hazard or shock, turn off clamp meter and disconnect test leads before removing back cover.

- ① As battery power is not sufficient, LCD will display . Replacement with one new battery type 9 V is required.
- ② Set Range switch to OFF position.
- ③ Use a screwdriver to unscrew the screw secured on back cover. Take out the batteries and replace with one new battery Type 9V.
- ④ Place back cover and secure with the screw.