USER MANUAL

Ardent 400A / 1000A AC-DC Power Digital Clamp Meter

ARD-CMP400ACDC | ARD-CPM1000ACDC

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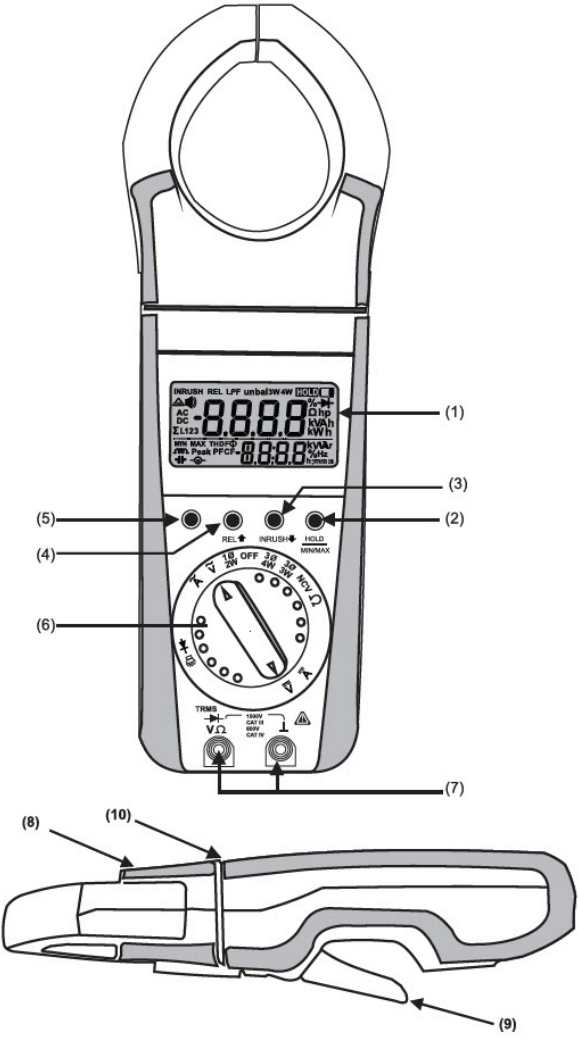
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REL
INRUSH
HOLD
MIN/MAX
OFF
TRMS

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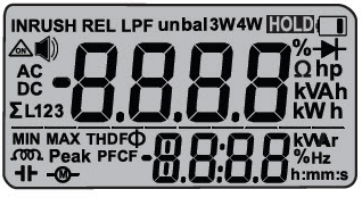

INRUSH REL LPF unbal 3W4W HOLD
AC
DC
ΣL123
MIN MAX THDFΦ
Peak PFCF
%
Ω hp
kVAh
kW h
kVAr
%Hz
h:mm:s

1.0 Parts Identification Diagram

(1) Liquid Crystal Display (LCD)
(2) Data hold and MIN/MAX
(3) Down and Inrush
(4) Up and Relative function
(5) Multifunction
(6) Function selector switch
(7) Terminal sockets
(8) Rotary mechanism for clamp jaws
(9) Safe trigger mechanism
(10) Limit for safe access
(11) See chapter 5 for more information on the LCD screen

Note: This diagram will be referenced throughout the manual.

2.0 Safety Features and Precautions

This meter is manufactured and tested in compliance with the safety standard IEC 61010-1:2010. However, the safety of both the user and the instrument cannot be guaranteed in the event of incorrect operation or negligent handling.

To maintain the safe and proper condition of the meter and to ensure safe operation, it is absolutely necessary to carefully and completely read these operating instructions before use.

Intended Use

- Use the instrument only as intended under the specified environmental and electrical operating conditions. Do not use in explosion prone environments.
- Before using the instrument to determine that a circuit is not hazardous, live test the viability of the measurement by checking a known voltage of similar magnitude.
- Use only proper accessories supplied by the manufacturer.
- Repairs and alterations may be performed only by a skilled person authorized by the manufacturer.
- When the battery symbol is displayed, the instrument may measure incorrectly.
- Measurements of components within circuits may produce incorrect results.

Observe the following safety precautions:

- The meter must only be operated by persons who under stand the danger of shock hazards and know how to apply safety precautions. Shock hazards exist anywhere, where voltages of more than 30 V (TRMS)may occur.
- Operators must use individual protective equipment if hazardous live parts of installation could be accessible.
- Avoid working alone in shock hazardous environment while carrying out measurement
- Keep hands/fingers behind the edge that separates rotating jaws with hand held part (22). This is the limit of the hand held part during measurement.
- The maximum allowable voltage between any terminal sockets (7) and earth is 1000 V.
- Unexpected voltages can occur at devices under test (e.g. defective devices). For example, capacitors can be dangerously charged.
- Verify that test leads are in good condition, e.g. no cracked insulation, no open circuits in the leads or connectors.
- The meter must not be used for measurements on circuits with corona discharge (high voltage).
- Be particularly careful when measurements are made in HF electrical circuits. Dangerous composite voltages may be present.
- Measurements under moist ambient conditions are not permitted.
- Do not exceed permissible overload limits of the measuring ranges. Limit values can be found in the table “Measuring Ranges” in chapter 17 “Specifications.”
- Do not use the clamp meter if obvious wear in jaw opening is visible.
- Adherence to the instructions in this manual is crucial for maintaining the safety features of the digital multimeter.

Cat I	Measurements in electrical circuits which are not directly connected to the mains: for example electrical systems in motor vehicles and aircraft, batteries, etc.
Cat II	Measurements in electrical which are electrically connected o the low-voltage mains:with plugs, e.g. at home, in the office or laboratory, etc.
Cat III	Measurements in building installations, stationary power consumers, distributor terminals, devices connected permanently to the distributor.
Cat IV	Measurements at power sources for low-voltage installations, meters, mains terminals, primary over voltage protection devices.

Table 1: Safety Category Ratings per IEC61010

~	AC - Alternating Current		See explanation in manual
⎓	DC - Direct Current		Double insulation Protection Class II
≂	Either AC or DC		Ground

Table 2: International Symbols

3.0 Initial Start-Up

Battery

The meter includes a 9V flat-cell battery in accordance with IEC 6 F 22 or IEC 6 LR 61.

Switching the Meter ON

Rotate the function selector switch or knob from “OFF" position to another. Switch "ON" is acknowledged by a sound signal.

NOTE: Electrical discharge and high frequency interference can cause incorrect displays, and may block the measuring sequence. To reset, switch the meter off and back on. If this procedure is unsuccessful, briefly disconnect the battery from the contact terminals.

Automatic Power-Off

The meter turns off automatically, when neither a pushbutton nor the function selector switch is operated for about 10 minutes.

Preventing Automatic Power-Off

To prevent automatic "TURN OFF" select "CONTINUOUSLY ON" mode. For this, press “INRUSH↓” pushbutton and the “MIN/MAX and Hold " pushbutton together. The function is shown on the LCD by the symbol "⚠ON."

Turning the Meter OFF

Rotate the function selector switch to the OFF position.

4.0 Liquid Crystal Display (LCD)

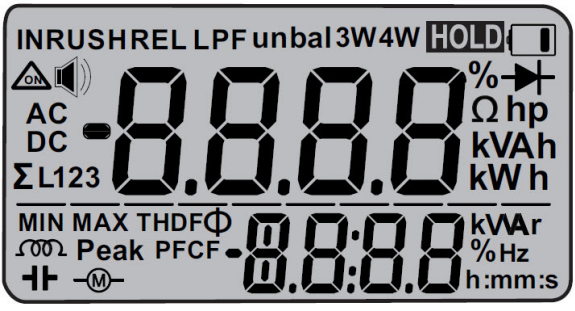


Fig. 1 Liquid Crystal Display (LCD)

The clamp meter LCD is as shown in figure 1. The digital display shows the measured value with sign. Description of remaining symbols is shown in table 3.

V	Volts
A	Amperes
W	Active Power
VW	Apparent Power
VAr	Reactive Power
Ah	Ampere Hour
Wh	Watt Hour
INRUSH	AC Inrush Current Measurement
REL	Relative measurement
LPF	Low Pass Filter
unbal	Unbalance
bal	Balance
HOLD	Hold function
3W	Three Wire
4W	Four Wire
	Continuously On
	Continuity Mode
AC	Alternating Current
DC	Direct Current
Ω	Resistance Measurement
hp	Horsepower
L1	Phase 1 Readings
L2	Phase 2 Readings
L3	Phase 3 Readings
ΣL123	Three-phase System Parameters
MIN	Minimum Value
MAX	Maximum Value
	Low Battery
	Diode Measurement
	Inductive
	Capacitave
THD	Total Harmonic Distortion
DF	Distortion Factor
PF	Power Factor
CF	Crest Factor
ϕ	Phase Angle
PEAK	Peak Value of Current or Voltage
HZ	Hertz
K	Multiplied by 1,000 (Kilo)
h:mm:ss	Hours:Minutes:Seconds
	Motor Application

Table 3: Liquid Crystal Display (LCD) Symbols

4.2 Display with Backlight

This instrument is provided with a selectable backlight for taking measurements in poor lighting conditions.

Switching the Backlight On

Press the multifunction (yellow) and UP/REL keys simultaneously.

Switching the Backlight Off

Press the multifunction (yellow) and UP/REL keys simultaneously.

5.0 Measurement Value Storage Hold

5.1 Hold Function

The HOLD function allows the user to automatically hold the measured values. The meter holds the measured value on the digital display with a sound signal and displays “HOLD” on the LCD display. The probes or clamp can be removed from the measuring point and the measured value on the digital display can be read. The analog indication is not influenced by the HOLD feature.

Pressing HOLD on any of the parameter screens (AC voltage, current, active power, etc.) holds all other measured parameters.

To activate the HOLD function:

- Momentarily pres the HOLD / MIN/MAX key.

To switch off the HOLD function:

- Press the HOLD pushbutton for approximately 2s.
  - This is acknowledged by sound signals.
- Operate the function selector switch.
- Turn the clamp meter off and on again.

6.0 MIN/MAX Function

With the MIN/MAX function, you can hold the minimum and maximum measured value which was applied to the input of the multimeter after activating MIN/MAX function. The most important application is the determination of the minimum and the maximum value for long-term monitoring of measured parameters.

To activate the MIN/MAX function:

- Press the MIN/MAX key twice.

To switch off the MIN/MAX function:

- Press the MIN/MAX pushbutton for approximately 2s.
  - This is acknowledged by sound signals.
- Operate the function selector switch.
- Turn the clamp meter off and on again.

NOTE: MIN/MAX is not applicable for harmonics and the parameters on the sub-display. MIN/MAX is also not applicable for 3P3W and 3P4W unbalanced load.

Figure 2 shows the procedure for entering in HOLD and MIN/MAX functions.

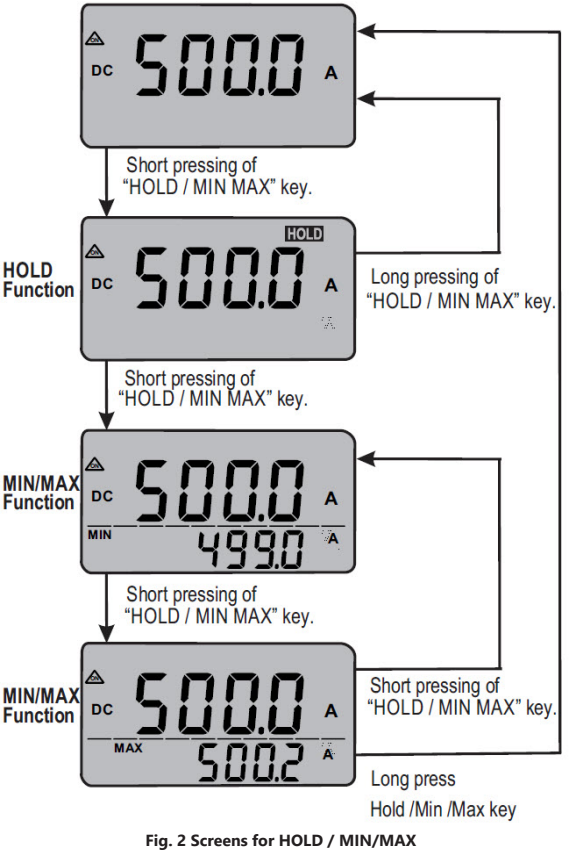


Fig. 2 Screens for HOLD / MIN/MAX

7.0 Relative Function (REL)

With the REL function, the use can see the measured value with respect to some value. REL function is applicable for voltage, current, and resistance functions only. To activate the "Relative" function, press the REL↑ pushbutton and the current measured value will be captured.

The turn the "REL " function off, perform one of the following:

- Press the REL↑ pushbutton.
  - This is acknowledged by sound signals.
- Operate the function selector switch.
- Turn the clamp meter off and on again.

8.0 Voltage Measurement

According to the voltage to be measured, set the function selector switch to **V** as shown in figure 3.

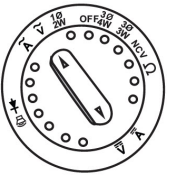


Fig. 3 Voltage measurement knob position

Connect the test leads as shown in figure 4. The "⊥" socket should be connected to the lowest potential ground available.

Select the appropriate working mode (AC, DC or AC/DC) by long-pressing the yellow function key. This is acknowledged by a sound signal.

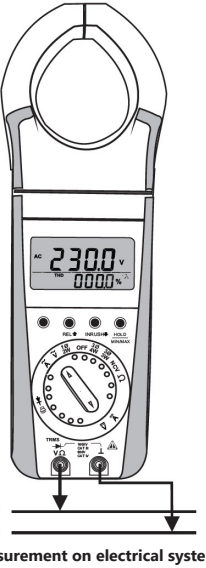


Fig. 4 Voltage measurement on electrical systems up to 1000 V

For AC Voltage mode, the following parameters can be measured (refer to figure 6 for navigation):

8.1 Total Harmonic Distortion (THD)

Power Clamp meter can measure THD up to 49th harmonic. By default meter is present on THD measurement screen.

$$THD = \sqrt{\frac{\sum_{n=2}^{49} (\text{n}^{\text{th}}\text{ order harmonic voltage RMS value})^2}{(\text{Fundamental wave voltage RMS value})^2}} \times 100\ \%$$

8.2 Distortion Factor (DF)

Power Clamp Power can measure DF up to 49th Harmonic.

$$DF = \sqrt{\frac{\sum_{n=2}^{49} (\text{n}^{\text{th}}\text{ order harmonic voltage RMS value})^2}{(\text{Voltage RMS value})^2}} \times 100\ \%$$

8.3 Crest Factor

Power Clamp meter can measure CF. CF is the ratio between the value the peak voltage and corresponding RMS voltage.

$$\mathbf{CF} = \frac{V_m \text{ (Peak Voltage Value)}}{V_{RMS} \text{ (RMS Voltage Value}}$$

8.4 Peak Max / Peak Min

Peak Max/Min is the Positive / Negative peak value of measuring waveform. It updates continuously as the waveforms peak.

8.5 Frequency

Power Clamp meter measures frequency from 45 to 65 Hz.

8.6 Individual Harmonic Measurement

The Power Clamp meter can measure individual harmonics up to 49th Harmonic. Measured harmonic can also be seen in percent (%) w.r.t. fundamental voltage.

Short-pressing the relative (REL) key, the meter shows the next individual harmonic (H02, and so on) amplitude after the fundamental, i.e., H01. Similarly, when the display shows harmonic in terms of %, short-pressing the relative (REL) key will show the next individual harmonic level % (from h01 to h49)as shown in figure 6.

8.7 Low-Pass Filtering (LPF) Measurement Mode

These meters have a LPF mode for voltage measurement. In LPF mode, the meter measures voltage below cut off frequency. The cutoff frequency of clamp meter for LPF mode is 400 Hz. This means that meter will measure voltage having frequency below 400 Hz.

NOTE: If display shows OL then it indicates Voltage Overload i.e > 1020 V .

To enter into LPF mode, simultaneously press the yellow multifunction pushbutton and HOLD / MIN/MAX pushbutton. The same voltage parameters described in 8.1 through 8.6 can be toggled through in LPF mode.

Fig. 5 Low Pass Filter (LPF) mode for voltage measurement

- "----" is displayed for THD, DF, CF, Freq and Harmonics if voltage level is below measurement band or applied voltage is OL value i.e. 1020 V.
- "----" is displayed for THD, DF and Harmonics if signal frequency is out of measuring band i.e. Freq Except 45Hz to 65Hz.
- Meter will display 0 V if V <0.5V and in LPF mode meter will display 0 V if V < 1V

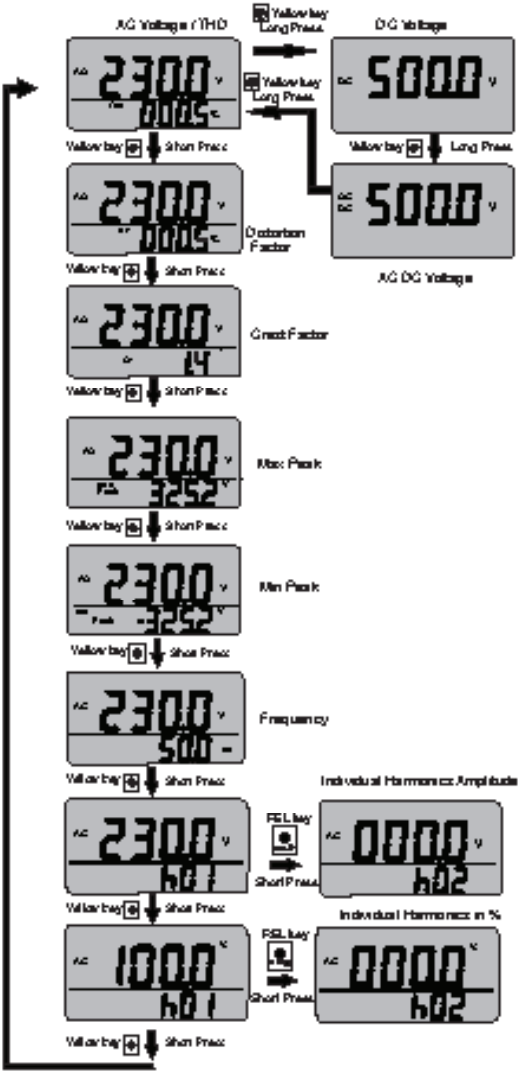


Fig. 6 Voltage measurement screens

9.0 Current Measurement

- Set the function selector switch to A~ as shown in figure 7.

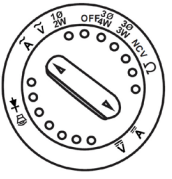


Fig. 7 Current measurement knob position

- Connect the Clamp as shown in figure 8 for current measurement. To measure current through cable push the trigger (present at back) to open the jaws and clamp the jaws around the cable as shown in figure 8.
- Select the appropriate working mode (AC, DC, or AC/DC) by long-pressing the yellow function pushbutton.

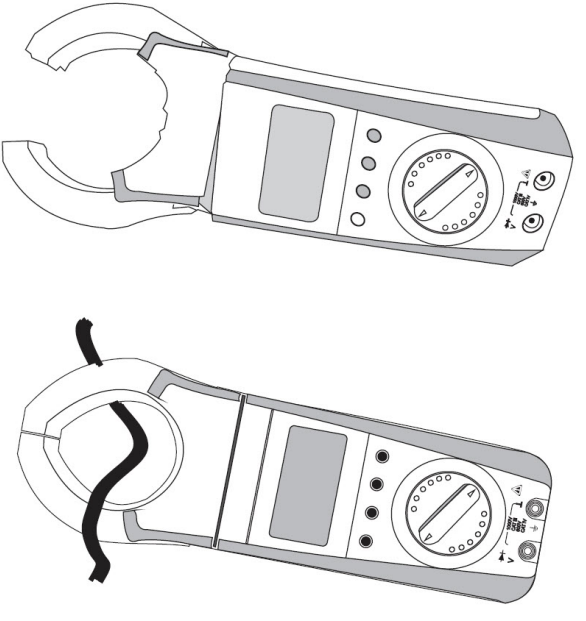


Fig. 8 Current measurement

Rotary mechanism for clamp jaws:

In conventional clamp meters, the jaws are locked on the same plane as the meter. When current measurement is done on vertical bus bars, overhead cables, or cables in congested places, a conventional meter's display may be impossible to read.

The ARDENT clamp meters have a rotary mechanism for the clamp jaws. These rotary clamp jaws can be rotated at different angles at a 30° step with a maximum up to 90° in both clockwise and anti-clockwise directions as shown in figure 9. This allows the user to align the clamp jaws in the orientation of bus bar/ conductor while keeping the display and keys facing the user, as shown in figure 10.

NOTE: For better accuracy, position the conductor at the marking on the center of the jaws.

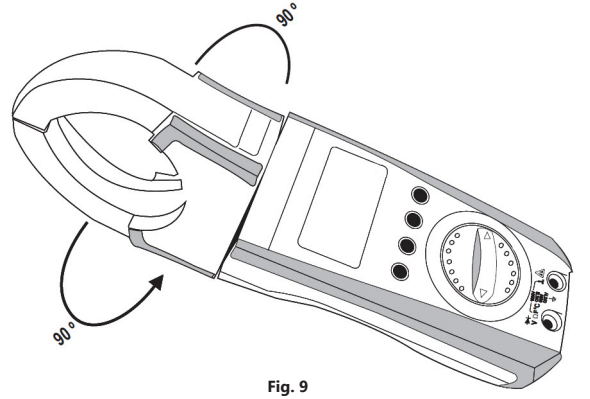


Fig. 9

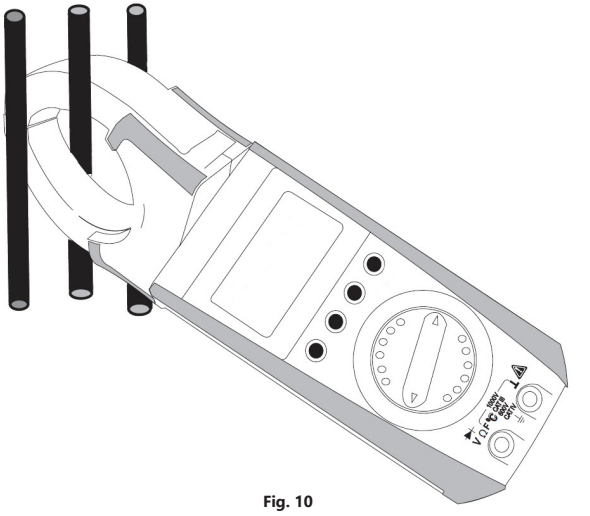


Fig. 10

For DC and ACDC current measurement mode , connect the meter to the conductor to be measured as shown in figures 9 and 10. The zero adjustment functionality is available for DC current up to + / - 5 A. To make zero adjustment, long-press HOLD key on meter.
The meter acknowledge zero setting by a sound signal.

For AC Current mode, the following parameters are measured (refer to figure 12 for navigation):

9.1 Total Harmonic Distortion (THD)

Power Clamp meter can measure THD up to 49th harmonic. By default meter is present on THD measurement screen.

$$THD = \sqrt{\frac{\sum_{n=2}^{49} (\text{n}^{\text{th}} \text{ order harmonic voltage RMS value})^2}{(\text{Fundamental wave voltage RMS value})^2}} \times 100\ \%$$

9.2 Distortion Factor (DF)

Power Clamp Power can measure DF up to 49th Harmonic.

$$DF = \sqrt{\frac{\sum_{n=2}^{49} (\text{n}^{\text{th}} \text{ order harmonic voltage RMS value})^2}{(\text{Voltage RMS value})^2}} \times 100\ \%$$

9.3 Crest Factor (CF)

Power Clamp meter can measure Crest Factor (CF). CF is the ratio between the value the peak voltage and corresponding RMS voltage.

$$\mathbf{CF} = \frac{I_m \text{ (Peak Voltage Value)}}{I_{RMS} \text{ (RMS Voltage Value}}$$

9.4 Peak Max / Peak Min

Peak Max /Min is the Positive / Negative peak value of measuring waveform. It updates continuously as the waveforms peak.

9.5 Frequency

Power Clamp meter measures frequency from 45 to 65 Hz.

9.6 Individual Harmonic Measurement

The Power Clamp meter can measure individual harmonics up to 49th Harmonic. Measured harmonic can also be seen in percent (%) w.r.t. fundamental voltage.

Short-pressing the relative (REL) key, the meter shows the next individual harmonic (H02, and so on) amplitude after the fundamental, i.e., H01. Similarly, when the display shows harmonic in terms of %, short-pressing the relative (REL) key will show the next individual harmonic level % (from h01 to h49) as shown in figure 12.

9.7 Low-Pass Filtering (LPF) Measurement Mode

These meters have a LPF mode for current measurement. In LPF mode, the meter measures current below th specified cut off frequency of 400 Hz. This means that meter will measure current having frequency below 400 Hz.

NOTE: If display shows OL then it indicates Current Overload i.e > 1020 V .

To enter into LPF mode, simultaneously press the yellow multifunction pushbutton and HOLD / MIN/MAX pushbutton.

Fig. 11 Low Pass Filter (LPF) mode for current measurement

- "----" is displayed for THD, DF, CF, Freq and Harmonics if voltage level is below measurement band or applied voltage is OL value i.e. 1020 V.
- "----" is displayed for THD, DF and Harmonics if signal frequency is out of measuring band i.e. Freq Except 45Hz....65Hz.
- Meter will display 0 A if I <0.5A and in LPF mode meter will display 0 A if I < 1A
- For better accuracy, do not apply voltage at input terminal

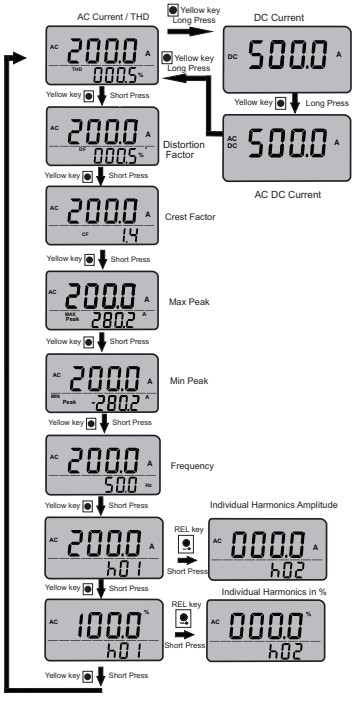
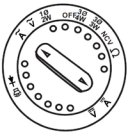


Fig. 12 Current measurement screens

9.8 Inrush Current Measurement

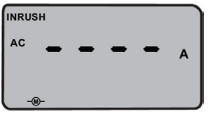
The power clamp meter is capable of measuring AC inrush current. This functionality allows for measurement of transient current that occurs during motor startup. To perform this measurement, the clamp meter should be securely clamped around the motor's power line. Prior to initiating the motor, the meter must be set to its inrush current measurement mode. Upon motor startup, the instrument will automatically capture and hold the peak inrush current value detected within a 100-millisecond measurement period. Refer to figure 13 for further illustration and follow the steps below:

Step1: Keep knob position on AAC



Step 2: Clamp the meter around live conductor of motor

Step 3: Press INRUSH pushbutton to set the meter to inrush mode. Meter will wait for trigger to occur. Display will be as follows:



Step 4: Start the motor. Clamp meter will be triggered by inrush current >5A. Inrush current for 100 ms is measured.

NOTE: On harmonics screen, INRUSH key is used to scroll harmonics. Inrush mode can not be activated in harmonics screen.

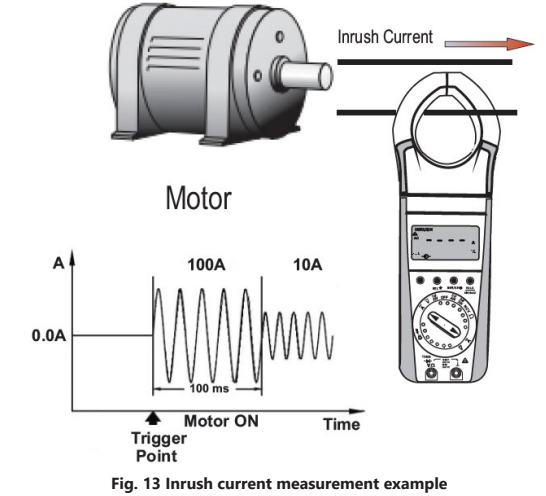
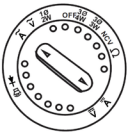


Fig. 13 Inrush current measurement example

9.9 Ampere Hour Measurement (AHr)

Power Clamp Meter can measure Ahr for AC and DC current. Clamp meter can accumulate Ahr for max time of 23:59 Hrs. Maximum value of accumulated Ahr can be 999.9 Ahr. After 999.9 Ahr meter will display OL.

Step1: Keep knob position on A~.



Step 2a: For Ahr in AC current, pres REL and INRUSH pushbuttons simultaneously. Clamp meter will start measuring in AC ampere hours.

Step2b: For Ahr in DC current, long press (>2s) yellow function key. Clamp meter will enter DC current mode. Press REL and INRUSH simultaneously. Clamp meter will start measuring in DC ampere hours.

10.0 Single Phase Power Measurement

- According to the single phase Power to be measured, set the function selector switch to 1Ø 2W position as shown in figure 14.

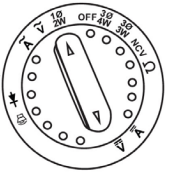


Fig. 14 Power measurement knob position

- Connect the voltage test leads as shown in figure 15.
- Connect the Clamp as shown in figure 15.
- Select the appropriate working mode i.e. AC or DC power by long-pressing yellow key (function key).

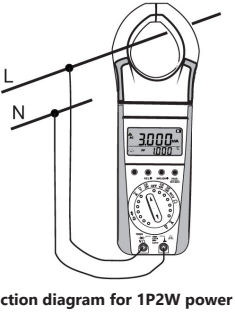


Fig. 15 Connection diagram for 1P2W power measurement

For AC Power mode, the following parameters are measured (refer to figure 16 for navigation):

10.1 Apparent Power, Active Power, Reactive Power

KVA, KW, KVAr

KVA = V*I

KW = V*I*Cos(**Ø**)

KVAr = V*I*Sin(**Ø**)

10.2 PF and Ø (Power Factor and Phase Angle)

PF = KW / KVA

Ø = COS^{-1} (PF)

10.3 Horsepower (HP)

HP = KW*0.7456

For DC Power mode, the following parameters are measured (refer to figure 16 for navigation):

10.4 DC Power (Active Power)

KW = V*I

For DC power measurement mode, zero adjustment functionality is available. To make zero adjustment, long press HOLD key on meter. The meter acknowledge zero setting by a sound signal, by auto zero function maximum + / - 5 A DC can be nullified.

- If display shows OL.U, then it indicates Voltage Overload. (>1020V)
- If display shows OL.I, then it indicates Current Overload. (>1020A) Overload.
- If display shows OL, then it indicates both current and voltage Overload.
- If display shows +ve active power, then the power flows from power source to load.
- If display shows -ve active power, then the power flows from load to power source.
- If display shows +ve power factor, then the phase of current is lagging behind the voltage (Inductive load).
- If display shows -ve power factor, then the phase of current is leading before the voltage (Capacitive load).
- OL.U, OL.I, and OL logic will remain same for 3P3W and 3P4W balanced system.

Power Display Ranging for 1P2W, 3P3W, and 3P4W

- For measurement of power total, there is a total of 4 Ranges are available 9.999 kVA, 99.99 kVA, 999.9 kVA and 9999 kVA. These ranges also apply for the kVA for hp, kVAr and kW values.
- Meter will select the appropriate range of all powers (i.e. kW, hp and kVAr) based on kVA reading. For example :
  V = 230V, I = 102A and Angle = 0 then kVA = 230*102 = 23.46 kVA
  kW = 230*102 * COS 0 = 23.46 kW and kVAr = 230*102*SIN 0 = 0 kVAr
- Horsepower (HP) Range is also based on kVA range, except in some cases where it is displayed one range higher than kVA. For example:
  kVA = 82.53 so at maximum value of kW = kVA at PF = 1,
  hp = kW / 0.7456 = 110.0 so in this case hp is display in 999.9 range.

- 9.999 kVA range is only applicable for V <100 V and I < 100 A.
- If V > 500 V and I < 25 A then, In this kind of situation a very small amount of current can cause a large amount of fluctuation in power reading.
  To avoid this fluctuation, the meter will display power in 999.9 kVA range.
- The ranging logic described above is equally applicable to DC power systems (where ranging is based on kW due to the absence of kVA), as well as both balanced and unbalanced three-phase four-wire (3P4W) and three-phase three-wire (3P3W) system configurations.

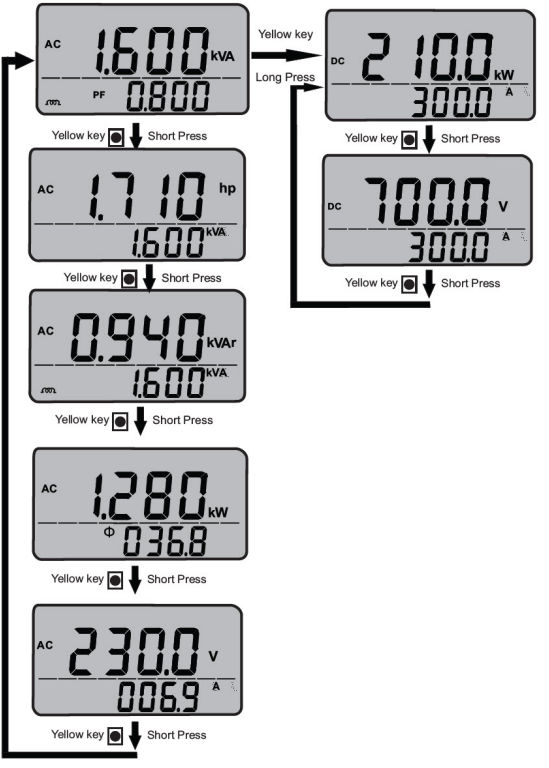
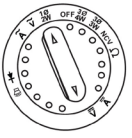


Fig. 16 Power measurement screens

10.5 kWh 1-Phase 2-Wire (1P2W) Measurement

Power clamp meter accumulates AC or DC power to measure the energy up to 9999 kWh. Beyond this limit it shows OL. Clamp meter can accumulates energy max up to 23.59 hrs. To measure Energy in AC power system follow the below steps:

Step1: Keep knob position as shown below.



Step 2a: For kWh in AC Power Press REL and INRUSH key simultaneously. Clamp meter will start measuring kWh.

Step 2b: For kWh in DC power system, long press (>2 Secs) the yellow function key. Clamp meter enters In DC power mode. Now Press REL and INRUSH key simultaneously. Clamp meter will start measuring DC energy.

- kWh measurement is also possible in 3P3W and 3P4W balanced load by using simultaneous pressing REL and INRUSH key.
- To reset the energy measurement, exit the energy measurement mode and re-enter it, or alternatively, restart the meter and then enter the energy measurement mode.
- If display shows -ve Energy then the power flows from load to power source.

11.0 3-Phase 4-Wire Power (3P4W) Measurement

Set the function selector switch to $\frac{3\emptyset}{4W}$ position as shown in figure 17.

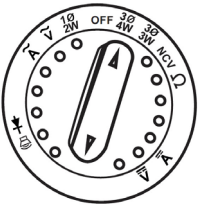


Fig. 17 3-phase 4-wire knob position

Using power Clamp meter, the power of both balanced and unbalanced systems can be measured. After positioning of selector switch to $\frac{3\emptyset}{4W}$ position, meter will toggle between unbalanced and balance system options using Up and Down keys. After pressing Yellow key, select any system type and proceed for measurement.

- System Current and System Voltage readings will not be shown for unbalanced system(3P3W as well as 3P4W).
- If display shows OL.U then it indicates Voltage Overload. (>1020 V)
- If display shows OL.I then it indicates Current Overload. (>1020 A)
- If display shows OL then it indicates both current and voltage Overload.
- If display shows +ve active power then the power flows from power source to load.
- If display shows -ve active power then the power flows from load to power source.
- If display shows +ve power factor then the phase of current is lagging behind the voltage (Inductive load).
- If display shows -ve power factor then the phase of current is leading before the voltage (Capacitive load).

11.1 3-Phase 4-Wire (3P4W) Unbalanced Load Power Measurement

The user is able to measure 3-Phase power using a single meter. Steps for measurement of 3 ph power are as follows:

1 Configure Clamp meter to unbalanced power measurement mode

2 Meter will show L1-n and I -1 on display . Connect meter to phase L1 as shown in figure 19. After connection, press function (Yellow) key, meter will display measured apparent Power and PF for phase L1 on LCD.

3 Wait for 5-10 sec so that measured value gets stable and then press function(Yellow) key to store readings of phase L1. After pressing function key meter will show L2-n and I-2 on display, which indicates that connect meter to phase L2.

4 Now disconnect meter from phase L1 and connect to phase L2. Repeat Steps 2, 3 and 4 for phase L2 and L3.

5 After storing readings of phase L3 , meter will show System apparent power and PF . At this point all measurements are finished. Now remove all input connections of meter and analyze all measured data.

6 Measured data includes Active, Reactive, Apparent Power, Power Factor, phase angle, horse power, voltage, current. All these parameters are measured for individual phase and for system also. After step 6, press function (yellow) key and then scroll through all above measured parameters one by one. Pressing the "up" or "down" key will show measured data for individual phases (L1 or L2 or L3) and for system (**Σ**L123).

System Power (Σ L123) = L1 Power + L2 Power + L3 Power

In a three-phase four-wire unbalanced system, it is essential to allow the power measurement reading on each screen to stabilize before storing the value. Storing readings prematurely by pressing the yellow key, without ensuring stabilization, may result in inaccurate measurements.

Furthermore, in a three-phase four-wire unbalanced system, if any phase voltage or line current value exceeds the meter's measurement limit (OL), the system power will be displayed as OL.

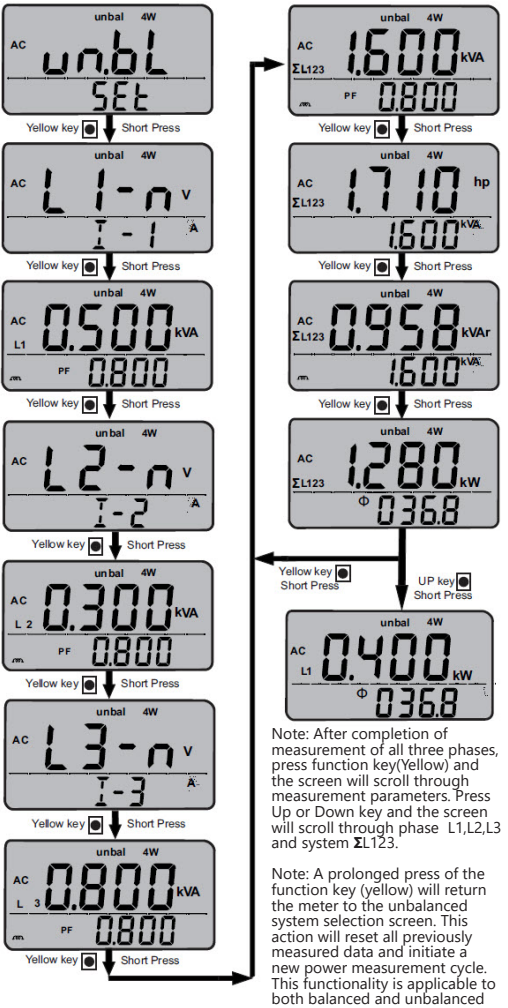


Fig. 18 Power measurement 3-phase 4-wire unbalanced load

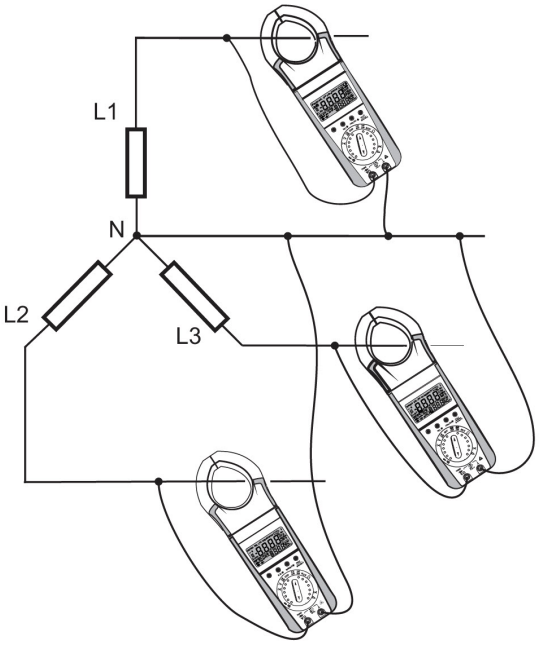


Fig. 19 Connection diagram for 3P4W unbalanced load

In a balanced three-phase load, power measurement can be performed by measuring a single phase. The procedure for single-phase power measurement is as follows:

Configure the clamp meter to the balanced power measurement mode.

The meter display will indicate "L1-n" and "I-1". Connect the meter to Phase 1 as illustrated in Figure 20.

After establishing the connection, press the function (yellow) key. The meter's LCD will display the measured apparent power and power factor.

In a balanced load, the measured parameters are continuously updated. The hold function can be engaged to freeze all displayed values. Once held, the meter's input connections can be safely removed to facilitate data analysis.

The measured data encompasses active power, reactive power, apparent power, power factor, phase angle, horsepower, voltage, and current. All these parameters are measured for the entire system (Σ L123). Pressing the function (yellow) key allows the user to sequentially scroll through each of these measured parameters. Refer to figure 21 for visual guidance.

System Power (ΣL123) = L1 Power * 3

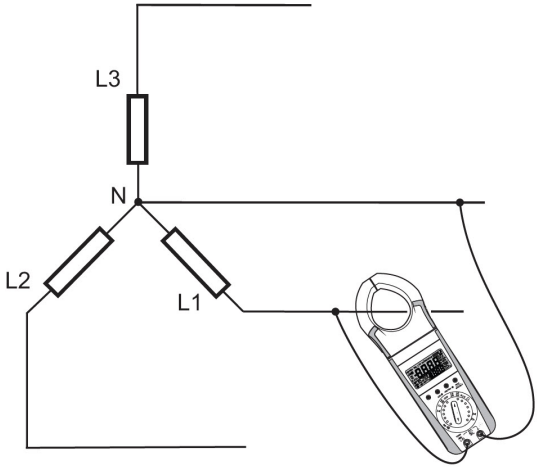


Fig. 20 Connection diagram for 3P4W balanced load

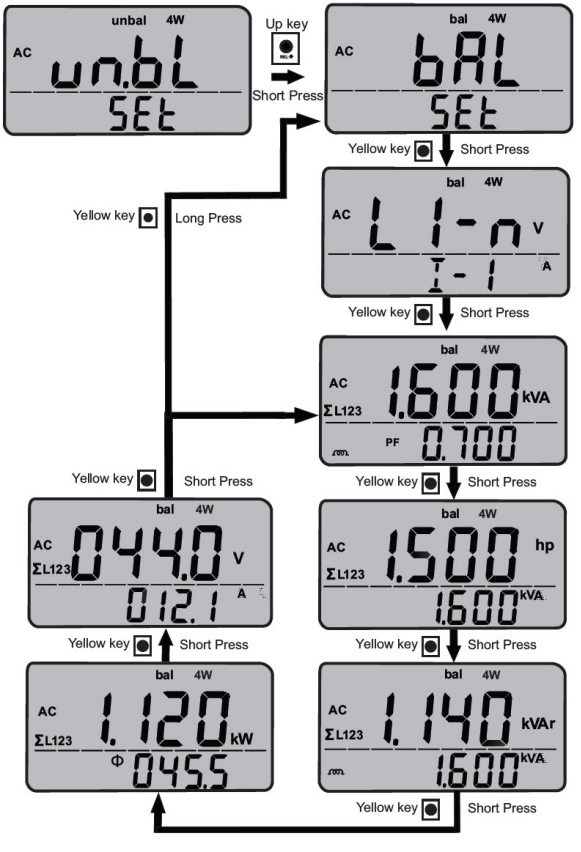


Fig. 21 Power measurement 3P4W balanced load

12.0 3-Phase 3-Wire (3P3W) Power Measurement

To measure power in a three-phase three-wire system, position the function selector switch to the $\frac{3\text{Ø}}{3\text{W}}$ setting as shown in figure 22.

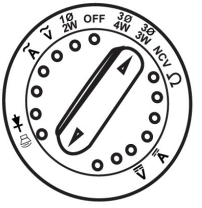


Fig. 22 3-phase 3-wire knob position

This power clamp meter is capable of measuring power in both balanced and unbalanced three-phase three-wire systems. After setting the selector switch to the "33WØ" position, the meter will toggle between the "unbalanced" and "balanced" system options using the Up and Down keys. Pressing the yellow key will allow you to select the appropriate system type and proceed with the measurement.

- System Current and System Voltage readings will not be shown for unbalanced system(3P3W as well as 3P4W).
- If display shows OL.U then it indicates Voltage Overload. (>1020 V)
- If display shows OL.I then it indicates Current Overload. (>1020 A)
- If display shows OL then it indicates both current and voltage Overload.
- If display shows +ve active power then the power flows from power source to load.
- If display shows -ve active power then the power flows from load to power source.
- If display shows +ve power factor then the phase of current is lagging behind the voltage (Inductive load).
- If display shows -ve power factor then the phase of current is leading before the voltage (Capacitive load).

12.1 3P3W Unbalanced Load Power Measurement

Three-phase power measurements can be performed using a single power clamp meter. The procedure for measuring three-phase power is as follows:

1 Configure Clamp meter to unbalance power measurement mode.

2 Meter will show L1-2 and I -1 on display. Now connect meter to phase 1 as shown in fig 22.

3 After connection press function (Yellow) key, meter will display measured apparent Power and PF of phase 1-2 on LCD.

4 Allow 5 to 10 seconds for the measured value to stabilize. Subsequently, press the function (yellow) key to store the readings for Phase 1-2. Upon pressing the function key, the meter display will indicate "L3-2" and "I-3", prompting the connection of the meter to Phase 3-2.

5 Disconnect meter from phase 1-2 and connect to phase 3-2. Repeat Step 2,3 and 4 for phase 3-2.

6 After storing readings of phase 3-2 , meter will show System apparent power and PF. At this point all measurements are finished.
Now we can remove all input connections of meter and analyze all measured data.

7 The measured data includes active power, reactive power, apparent power, power factor, phase angle, and horsepower. These parameters are measured for Phase 1-2, Phase 3-2, and the total system (**Σ**L123).
Following Step 6, pressing the function (yellow) key allows sequential scrolling through each of the aforementioned measured parameters. Additionally, pressing the Up or Down key enables the user to view the measured data specifically for Phase 1-2, Phase 3-2, and the total system (**Σ**L123). Refer to figure 23 for further detail.

System Power (**Σ**L123) = L1-2 Power + L2-3 Power

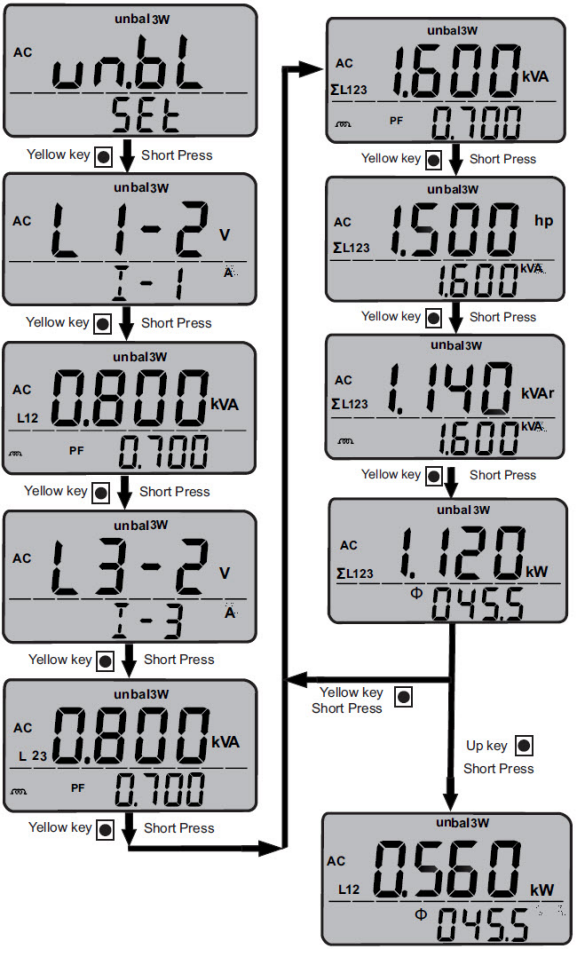


Fig. 23 Power Measurement 3P3W Unbalanced Load

Upon completion of measurements for individual phases, pressing the YELLOW key will cycle through the measured parameters. Pressing the UP and DOWN keys will allow navigation through the measured data for Phase L1-2, Phase L2-3, and the total system ΣL123.
A prolonged press of the yellow key will return the meter to the unbalanced/balanced system type selection screen, resetting all measured data and initiating a new measurement sequence. This functionality is applicable to both system types.

In a three-phase three-wire unbalanced system, it is crucial to allow the power measurement reading on each screen to stabilize before storing the value. Prematurely storing readings by pressing the yellow key, without ensuring stabilization, may lead to inaccurate measurements.
Furthermore, in a three-phase three-wire unbalanced system, if any phase voltage or line current value exceeds the meter's measurement limit (OL), the system power will be displayed as "OL."

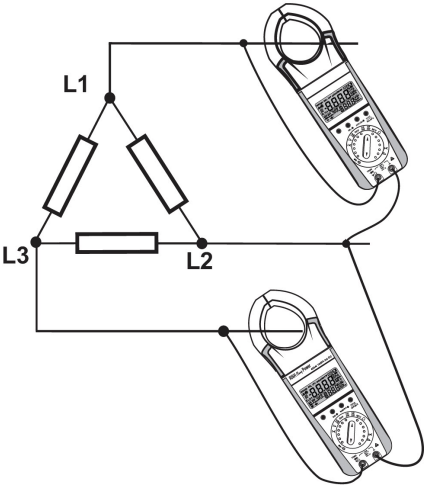


Fig. 24 Connection Diagram for 3P3W Unbalanced Load

In a balanced three-phase load, power measurement can be performed by measuring the power of the Phase 1-2 combination. The procedure for this measurement is as follows:

1 Configure the clamp meter to the balanced power measurement mode.

2 The meter display will indicate "L1-2" and "I-1". Connect the meter to Phase 1-2 as illustrated in figure 25.

3 After establishing the connection, press the function (yellow) key. The meter's LCD will display the measured apparent power and power factor.

4 In a balanced load, the measured parameters are continuously updated. The hold function can be engaged to freeze all displayed values. Once held, the meter's input connections can be safely removed to facilitate data analysis.

The measured data includes active power, reactive power, apparent power, power factor, phase angle, horsepower, voltage, and current. All these parameters are measured for the entire system (ΣL123). Pressing the function (yellow) key allows the user to sequentially scroll through each of these measured parameters. Refer to figure 26 for visual guidance.

System Power (**Σ**L123) = VL1-2 * I1 * 1.732

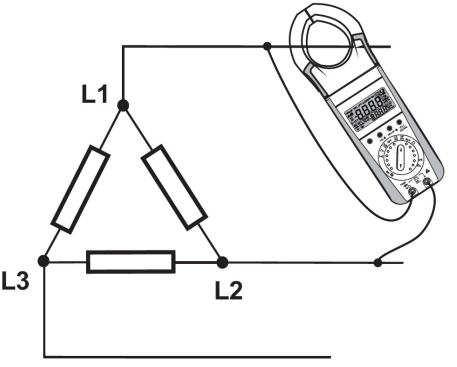


Fig 25 Connection Diagram for 3P3W Balanced Load

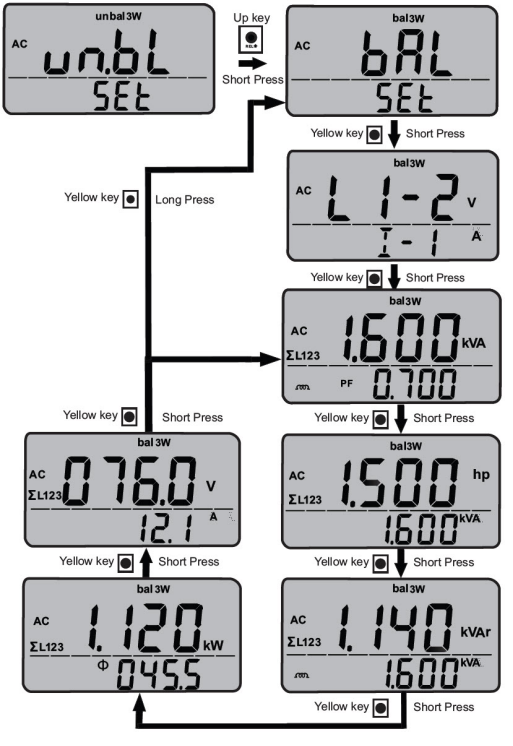


Fig 26 Power Measurement 3P3W Balanced Load

13.0 Non-Contact Voltage (NCV) Detection

To activate the Non-Contact Voltage (NCV) detection mode, position the selector switch to the "NCV" setting.

The NCV function enables the detection of AC voltage exceeding 100 V at 50/60 Hz. To perform NCV detection, bring the left jaw of the clamp meter into proximity with the voltage-carrying conductor. The presence of voltage will be indicated by an audible beeper and a blinking backlight.

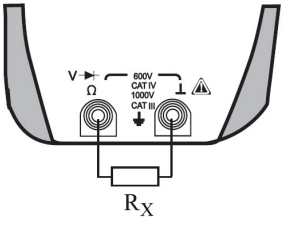
Caution: Even if voltage is not detected by the NCV feature, always exercise extreme caution and avoid direct contact with any bare wires or cables.

14.0 Resistance, Continuity, and Diode Measurement

ATTENTION: Verify that the device under test is electrically dead. External voltages would falfisy the measurement results.

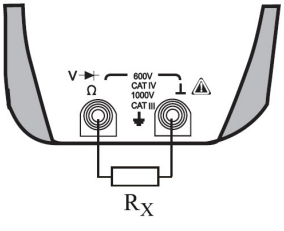
For Resistance or continuity or diode measurement, place function selector switch to **Ω** position.

For Resistance and continuity measurement, connect device under test as shown below:



he clamp meter is capable of measuring resistance up to 4000 ohms. In continuity measurement mode, the meter will emit a continuous audible tone if the measured resistance falls within the approximate range of 0 to 40 ohms.

For Diode measurement connect device under test (DUT) as shown below:



The measuring instrument displays forward voltage in volts. As long as voltage drop does not exceed the maximum display value of 2.2V, several instruments can be tested in series. OL will be displayed on display when diode is connected in reverse bias.

NOTE: Resistors and semiconductor paths in parallel to the diode distort the measurement results.

15.0 Empty Positions

Empty positions on dial indicates no function is available on these positions. The digital display will look like as in figure 27. There are three empty positions present on the dial.

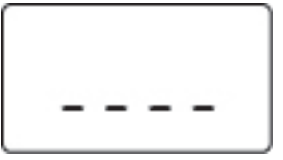


Fig 27 Empty positions

16.0 Specifications

NOTE: Accuracy claimed for power and current when conductor is positioned at the center of the jaw.

Measuring Function	Measuring Range	Resolution	Digital Display Deviation ±(% of RDG+digits)	
VDC	999.9 V	0.1 V	±(0.5% of rdg + 5 dgt)	
V ~	999.9 V	0.1 V	±(0.75% of rdg + 5 dgt)	
V ACDC	999.9 V	0.1 V	±(1.25% of rdg + 5 dgt)	
LPF V~	999.9 V	0.1 V	50 to 60 Hz	±(0.75% of rdg + 5 dgt)
			61 to 400 Hz	±(5.0% of rdg + 5 dgt)
Power Clamp 1000A ADC	999.9A	0.1A	±(1.5% of rdg + 5 dgt) [1]	
Power Clamp 400A ADC	99.99A	0.01A	Display value <1000 add 10 dgt	±(1.5% of rdg + 0.2A) [1]
	400A	0.1A		±(1.5% of rdg + 5 dgt) [1]
Power Clamp 1000A AC	999.9A	0.1A	±(3.0% of rdg + 5 dgt) [1]	
Power Clamp 400A A AC	99.99A	0.01A	Display value <1000 add 10 dgt	±(3.0% of rdg + 5 dgt) [1]
	400A	0.1A		±(3.0% of rdg + 5 dgt) [1]
Power Clamp LPF 1000A A AC	999.9A	0.1A	50 to 60 Hz	±(1.5% of rdg + 5 dgt) [1]
			61 to 400 Hz	±(5.0% of rdg + 5 dgt)
Power Clamp LPF 400A A AC	99.99A	0.01A	50 to 60 Hz	±(1.5% of rdg + 0.3A)
			61 to 400 Hz	±(5.0% of rdg + 5 dgt)
	400A	0.1A	50 to 60 Hz	±(1.5% of rdg + 5 dgt)
			61 to 400 Hz	±(5.0% of rdg + 5 dgt)
Active Power [2]	9.999 kW	1 W	±(2% of rdg+5 dgt) [1]	
	99.99 kW	10 W		
	999.9 kW	100 W		
	9999 kW	1 kW		
Reactive Power [2]	9.999 kVAr	1 VAr		
	99.99 kVAr	10 VAr		
	999.9 kVAr	100 VAr		
	9999 kVAr	1 kVAr		
Apparent Power [2]	9.999 kVA	1 VA		
	99.99 kVA	10 VA		
	999.9 kVA	100 VA		
	9999 kVA	1 kVA		
Horsepower [2]	9.999 hp	1 hp		
	99.99 hp	10 hp		
	999.9 hp	100 hp		
	9999 hp	1 hp		

Measuring Function	Measuring Range	Resolution	Digital Display Deviation ±(% of RDG+digits)
kWh [2]	9.999 kWh	0.001 kWh	±(3% of rdg+5 dgt)
	99.99 kWh	0.01 kWh	
	9999 kWh	0.1 kWh	
	9999 kWh	1 kWh	
Ahr	999.9 Ahr	0.1 Ahr	
Phase Angle [2]	0.0 to 360°	0.1°	±3°
Power Factor [2]	-1 → 0 → 1	0.001	
Harmonics (RMS & %) [3]	1 to 13	0.1 V 0.1A 0.1%	±(3% of rdg+10 dgt)
	14 to 49		±(5% of rdg+20 dgt)
THD [3]	0 to 99.9%	0.1%	±(3% of rdg+20 dgt)
DF [3]	0 to 99.9%	0.1%	±(3% of rdg+20 dgt)
Crest Factor [3]	1.0 to 2.9	0.1	±(2% of rdg+3 dgt)
	3.0 to 5.0	0.1	±(3% of rdg+5 dgt)
Power Clamp 1000 A Peak	1400A/1400 V	1A	±(3% of rdg+3 dgt)
Power Clamp 400 A Peak	100A	0.1A	±(3% of rdg+10 dgt)
	560 A/1000 V	1A/1 V	±(3% of rdg+3 dgt)
Power Clamp 1000 A Inrush [4]	999.9A	0.1A	±(3% of rdg+5 dgt)
Power Clamp 400 A Inrush [4]	99.99A	0.01A	±(3% of rdg+0.3 A)
	400A	0.1A	±(3% of rdg+5 dgt)
Resistance	4000 Ohm	1 Ohm	±(0.5% of rdg+5 dgt)
Continuity	< 40 Ohm	1 Ohm	±(0.5% of rdg+5 dgt)
Diode	0 to 2.2 V	0.001 V	±(0.5% of rdg+5 dgt)

1) For DC A, make zero autocorrection by long-pressing the HOLD key

For Power Clamp 1000 A

2) Accuracy defined for V ≥ 10 V and I ≥ 5A
Add 10 digits to accuracy when power is <5.000 kW/kVAr or < 6.700 hp

3) Accuracy defined for V ≥ 10 V and I ≥ 10A

4) Accuracy defined for I ≥ 10A

For Power Clamp 400 A

2) Accuracy defined for V ≥ 10 V and I ≥ 4A
Add 10 digits to accuracy when power is <5.000 kW/kVAr or < 6.700 hp

3) Accuracy defined for V ≥ 10 V and I ≥ 10A

4) Accuracy defined for I ≥ 5A

For power clamp 1000A

- In 1P2W mode maximum power meter can measure is, 1000 kVA / 1000 kVAr / 1000 kW / 1341 hp
- In 3P4W mode maximum power meter can measure is, 3000 kVA / 3000 kVAr / 3000 kW / 4023 hp
- In 3P3W mode maximum power meter can measure is, 1732 kVA / 1732 kVAr / 1732 kW / 2322 hp

For power clamp 400A

- In 1P2W mode maximum power meter can measure is, 400 kVA / 400 kVAr / 400 kW / 536 hp
- In 3P4W mode maximum power meter can measure is, 1200 kVA / 1200 kVAr / 1200 kW / 1608 hp
- In 3P3W mode maximum power meter can measure is, 693 kVA / 693 kVAr / 693 kW / 928 hp

Measuring Function	Measuring Range	Overload Capacity	
		Overload Value	Overload Duration
VDC - VAC - VACDC	999.9 V	1000V AC/DC	Cont.
Power Clamp 1000A ADC - AAC - AACDC	999.9A	1100 A AC/ DC	
Power Clamp 400A ADC - AAC - AACDC	99.99A	440 A AC/DC	
	400A		
Active Power Reactive Power Apparent Power Horsepower kWh	9.999 kW/kVA/kVAr/hp/kWh	1000 V AC/DC 1100 A AC/DC for power clamp 1000 A 440 A AC/DC for power clamp 400 A	
	99.99 kW/kVA/kVAr/hp/kWh		
	999.9 kW/kVA/kVAr/hp/kWh		
	999.9 kW/kVA/kVAr/hp/kWh		
Ahr	999.9 Ahr		
Inrush	1000A/400A		
Resistance/ Continuity	4000 Ohm	1000 V AC/DC eff/rms sine wave	10 seconds
Diode	2.2 V		

Influence Quantities and Variations

Influence Quality	Range of Influence	Measured Quantity/ Measuring Range	Variation [1] ±(% of RDG+digits)
Temperature	0 to 21°C and 25 to 50°C	VAC	0.15 x Intrinsic Error / 0°C
		VDC	
		VAC/VDC	
		AAC	
		ADC	
		AAC/ADC	
		DC Power	
		Resistance/Diode/ Continuity	
Frequency of the Measured Quantity	40 Hz to 50 Hz and 60 Hz to 400 Hz	VAC	1 x Intrinsic Error
		VAC/ADC	
		AAC	
		AAC/ADC	
	45 Hz to 65 Hz [2]	AC Power	
Crest Factor [1]	1.4 to 2	VAC VDC	1% + Intrinsic Error
	2 to 2/5		2.5% + Intrinsic Error
	2.5 to 5		4% + Intrinsic Error
Supply Voltage	When "low battery" symbol is on	All ranges	1 x Intrinsic Error
Relative Humidity	75%	All ranges	1 x Intrinsic Error

1. CF 2 @ 690V, 690A for Power Clamp Meter 1000A AC/DC
   CF 2 @ 690V, 280A for Power Clamp Meter 400A AC/DC
   CF 3 @ 460V, 460A for Power Clamp Meter 1000A AC/DC
   CF 3 @ 690V, 186A for Power Clamp Meter 400A AC/DC
   CF 4 @ 345V, 345A for Power Clamp Meter 1000A AC/DC
   CF 4 @ 345V, 140A for Power Clamp Meter 400A AC/DC
   CF 5 @ 280V, 280A for Power Clamp Meter 1000A AC/DC
   CF 5 @ 280V, 112A for Power Clamp Meter 400A AC/DC

2. Except for 50 or 60 Hz

Digital Display

Display	7 segment
Character height	Main display: 11.5 mm Sub display: 7.2 mm
Number of digits	4 digits
Maximum count	9999 counts for V, I, and P; 4 counts for resistance
Overrange indication	"OL" is displayed
Polarity indication	"-" sign is displayed for negative values

Power Supply

Battery	9V flat cell battery; manganese-dioxide cell according to IEC 6F22, alkaline-manganese cell according to IEC 6LR61
Consumption	14 mA average (without backlight)
Battery life	Approximately 48 hours

Electromagnetic Capability

Emission	EN 61326 : 2012, Class B	
Immunity	IEC 61326:2012	
	IEC 61000-4-2	8 kV atmosphere discharge 4 kV contact discharge
	IEC 61000-4-3	3 V/m

Safety	IEC 61010-1-2010-06
Measuring category	CAT IV 600V CAT III 1000V
Pollution degree	2
High voltage test	7.4 kVAC between housing and input 4.26 kVAC between jaws and input
Ingress protection	IP50 for hours IP 20 for terminal

Environmental Conditions

Functional temperature range	0 to 55°C [32 to 131°F]
Storage temperature range	-20 to 70°C [-4 to 158°F]
Altitude	Up to 2000m

Mechanical Configuration

Dimensions	90 x 270 x 70 mm [3.5 x 10.6 x 2.8 in]
Weight	600g [1.3 lb] including battery and holster

Reference Conditions

Ambient temperature	23°C ± 2 K
Relative humidity	45% to 55% RH
Frequency of measured quantity	50 Hz or 60 Hz
Power factor	0.5L → 1 → 0.5C
Waveform of measured quantity	Sinusoidal
Battery voltage	8V ± 0.1V

17.1 Maintenance

ATTENTION: Disconnect the meter from the measuring circuit before replacing the battery.

17.1 Battery

Before initial start-up, or after storage of your instrument, make sure that no leakage has occurred at the instrument battery. Repeat this inspection at regular intervals.

If battery leakage has occurred, electrolyte from the battery must be carefully and completely removed and a new battery must be installed, before the instrument can be placed back into operation.

If the symbol appears in the LCD display (battery voltage < 6.5 V), replace the battery as soon as possible. You can continue to take measurements, but reduced measuring accuracy may result. "bAtt" will be displayed on LCD when battery voltage drops below 5 V. After that, measurement will not be possible.

Replacing the Battery

- Place the multimeter on its face, loosen the screw present on the rear side and remove the battery cover from bottom side.
- Remove the battery from the battery compartment and carefully disconnect battery connectors.
- Snap the battery connectors to a new 9V battery and insert the battery into the battery compartment.
- Replace the battery cover by fitting it into slots on battery compartment
- Tighten the battery cover with the screws.

17.2 Periodic Check-up

The clamp meter does not require any specific maintenance. The surface between jaws should be cleaned with a dry cloth before operating. Avoid use of cleaners, abrasives, or solvents.

18.0 Replacement Parts

Part Number	*Description*
ARD-PRB-STD	ARDENT standard tip test lead set, replacement, CAT IV 600V/CAT III 1000V, 48in length
ARD-PRB-FPT	ARDENT fine tip test lead set, replacement, CAT IV 600V/CAT III 1000V, 48in length
ARD-AG-CLP-1	ARDENT alligator clip set, CAT IV 600V/CAT III 1000V. For use with ARD-PRB-STD
ARD-CM-CASE-1	ARDENT carrying case, polyester canvas, 10.50 x 3.50 x 3.50in, 3 compartments.

ARDENT

AutomationDirect
3505 Hutchinson Rd.
Cumming, GA 30040
(800) 633-0405

ARD-CMP400ACDC
ARD-CMP1000ACDC

Rev. A: 4/30/2025