



# USER MANUAL

## 1000 A True RMS Power Clamp Meter with Bluetooth®

MODEL CM85-2







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# **USER MANUAL 1000 A True RMS Power Clamp Meter with Bluetooth®**



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# 1 Advisories

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## 1.1 Copyright

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## 1.2 Quality Assurance

The Quality Management System under which these products are developed and manufactured has been certified in accordance with the ISO 9001 standard. FLIR Systems, Inc. is committed to a policy of continuous development; therefore, we reserve the right to make changes and improvements on any of the products without prior notice.

## 1.3 Documentation

To access the latest manuals and notifications, go to the Download tab at: <https://support.flir.com>. It only takes a few minutes to register online. In the download area you will also find the latest releases of manuals for our other products, as well as manuals for our historical and obsolete products.

## 1.4 Disposal of Electronic Waste



As with most electronic products, this equipment must be disposed of in an environmentally friendly way, and in accordance with existing regulations for electronic waste. Please contact your FLIR representative for more details.


# 2 Safety

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## 2.1 Safety Notes

- Before operating the device, read, understand, and follow all safety instructions.
- Remove the batteries if the device is not used for an extended period.




## 2.2 Warning and Caution Statements

 <b>WARNING</b>
Read all safety statements before operating this device. Failure to do so can cause serious injury or death and serious damage to the meter and connected equipment.

- Do not operate the device if you do not have the correct knowledge and experience.
- Do not start a measuring procedure before you have set the function switch to the correct position.
- Do not change to the current or resistance switch position when you measure voltage.
- Do not measure the current on a circuit when the voltage is  $> 1000\text{ V}$ .
- You must disconnect the test leads from the circuit under test before manually changing the range.
- Do not replace the batteries before you remove the test leads from the device under test.
- Do not use the device if the test leads and/or the device show signs of damage.
- Use caution when measuring voltages  $> 25\text{ V AC RMS}$  or  $35\text{ V DC}$ .
- Do not perform diode, resistance, or continuity tests before you have removed the power from capacitors and other devices under test.
- Do not use the device as the only tool to identify live terminals.
- When performing voltage checks on live outlets, ensure that the tips of the test leads are touching the metal contacts that are typically recessed deep in the outlet.
- Do not touch expired or damaged batteries without gloves.
- Do not short-circuit batteries or place batteries in fire.

 <b>CAUTION</b>
Do not use the device for applications for which it was not designed or intended. This can cause damage to the protection provided by the device.



	This symbol, adjacent to another symbol or terminal, indicates that the user must refer to the manual for further information.
	This symbol, adjacent to a terminal, indicates that, under normal use, hazardous voltages may be present.
	Double insulation.


### 2.3 FCC Compliance

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions:

1. This device may not cause harmful interference.
2. This device must accept any interference received, including interference that may cause undesired operation.

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

1. Reorient or relocate the receiving antenna.
2. Increase the separation between the equipment and receiver.
3. Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
4. Consult the dealer or an experienced radio/TV technician for help.

	<b>CAUTION</b>
Exposure to Radio Frequency Radiation.	
To comply with FCC/IC RF exposure compliance requirements, a separation distance of at least 20 cm must be maintained between the antenna of this device and all persons. This device must not be co-located or operating in conjunction with any other antenna or transmitter.	

**WARNING**

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

**2.4 Industry Canada Compliance**

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions:

This device complies with Industry Canada license-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

**CAUTION**

Exposure to Radio Frequency Radiation.

To comply with RSS 102 RF exposure compliance requirements, for mobile configurations, a separation distance of at least 20 cm must be maintained between the antenna of this device and all persons. This device must not be co-located or operating in conjunction with any other antenna or transmitter.

# 3 Introduction

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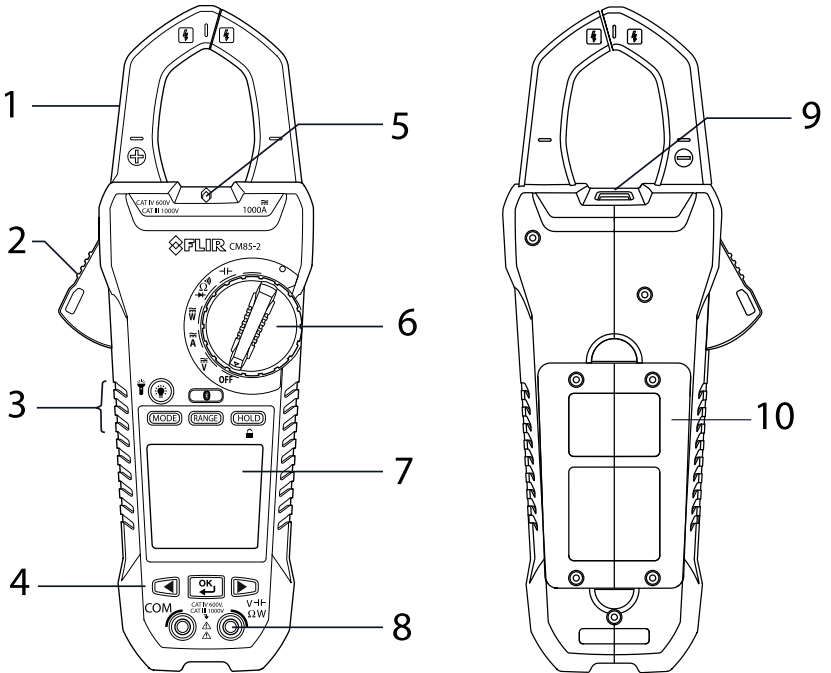
Thank you for selecting the FLIR CM85-2 1000 Amp Power Clamp Meter with Bluetooth. This device is shipped fully tested and calibrated and, with proper use, will provide years of reliable service.

## 3.1 Key Features

- 10,000 digit display
- Bluetooth data streaming
- High power worklight
- Auto and manual ranging
- Auto AC/DC 1000 Ampere/Voltage measurements
- True RMS readings in AC and AC + DC modes
- Resistance, Continuity, Diode, and Capacitance measurements
- Power and Harmonic Distortion measurements
- Phase Rotation indication
- Non-contact Voltage Detector
- Inrush Current function
- Data Hold and Peak Hold
- Minimum, Maximum and Average reading memory
- VFD mode (low-pass filter)
- CAT IV-600 V, CAT III-1000 V rated







# 4 Meter Descriptions

## 4.1 Meter Parts










1. Clamp jaws
2. Clamp trigger
3. Control button area (Section 4.3, *Control and Navigation Buttons*)
4. Navigation buttons
5. Non-contact voltage detector alert lamp (red)
6. Function switch (Section 4.2, *Function Switch*)
7. Display (LCD)
8. Probe terminals
9. Worklight
10. Battery compartment

## 4.2 Function Switch

	Capacitance measurements
	Diode tests (use <b>MODE</b> button to select)
	Continuity tests (use <b>MODE</b> button to select)
$\Omega$	Resistance measurements (use <b>MODE</b> button to select)
	Power measurements
	Current clamp measurements
	Voltage measurements
<b>OFF</b>	Meter power OFF

## 4.3 Control and Navigation Buttons

<b>MODE</b>	Auto-Select mode is the default state. Short press to manually select a mode. Long press to return to Auto-Select. See Section 5.2, <i>Auto and Manual Select Modes</i> .
<b>RANGE</b>	Auto-Range is the default state. Short press to manually select a range. Long press to return to Auto-Range. See Section 5.3, <i>Auto and Manual Range Modes</i> .
<b>HOLD</b> 	Press to freeze or release the displayed reading. See Section 5.4, <i>Data Hold Modes</i> . Long press to enable/disable keypad Lock mode. In Hold mode, the beeper sounds and the display flashes when the measured signal is > held reading (for voltage, current, and power measurements).
 	Short press to control the display Backlight. Long press to control the Worklights.
	Press to switch Bluetooth communication ON/OFF. See Section 5.13, <i>Streaming Measurements with METERLiNK</i> .
<b>OK</b> 	Press to confirm a selection or to return (back up).
	Navigation left arrow button.
	Navigation right arrow button.

## 4.4 Display Indicators

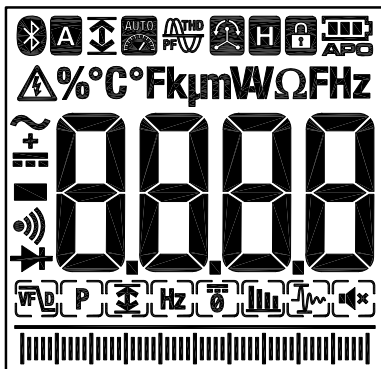




























Figure 4.1 Display icons and indicators.

	Bluetooth communication
	Auto Select mode. See Section 5.2, <i>Auto and Manual Select Modes</i>
	Maximum, Minimum, and Average reading icons ( L to R)
	Peak Maximum and Peak Minimum reading icons (L to R)
	Auto range
	Power factor
	Harmonic distortion
	Phase rotation mode
	Data Hold mode
	Battery status
	Auto power off (APO) active
	Measured voltage is > 30 V DC or AC V RMS

	AC measured signal
	DC measured signal
	AC + DC signal
	Continuity function
	Diode test
	Lock mode active
<b>OL</b>	Out-of-range indication
	VFD mode extended function icon
	Peak mode extended function icon
	Minimum, Maximum, and Average reading extended function icon
	DC zero mode extended function icon
	Harmonic distortion extended function icon
	Inrush current extended function icon
	Frequency extended function icon
	Silent mode extended function icon

# 5 Operation



## CAUTION


Before operating the device, you must read, understand, and follow all instructions, dangers, warnings, cautions, and notes.

When the meter is not in use, the function switch should be set to the OFF position.

When connecting the probe leads to the device under test, connect the negative lead before connecting the positive lead. When removing the probe leads, remove the positive lead before removing the negative lead.

## 5.1 Powering the Meter

Move the function switch from the OFF position to switch on the meter.


If the battery indicator  shows that the battery voltage is low or if the meter does not power on, replace the battery. See Section 6.2, *Battery replacement*.

### 5.1.1 Auto Power Off (APO)

The meter enters sleep mode after 30 minutes of inactivity. The meter beeps three times 9 seconds before powering off. Press any button or turn the function switch, to prevent the meter from powering off. The auto power off timeout is then reset. To disable auto power off (APO) press the MODE button while turning on the meter.

## 5.2 Auto and Manual SELECT Modes

In Auto Select mode, the meter attempts to automatically select the proper operating mode (e.g., AC or DC measurement) based on the input signal. In Manual Select mode, the desired operating mode is selected manually.

Auto Select mode is the default mode of operation. When a new function is selected with the function switch, the starting mode is Auto Select and the indicator is displayed .


To enter the Manual Select mode, press the **MODE** button (the Auto icon will switch off). To manually select the operating mode, press the **MODE** button repeatedly.

- To return to the Auto Select mode, press and hold the **MODE** button until the Auto indicator is displayed.



### 5.3 Auto and Manual RANGE Modes

In Auto Range mode, the meter automatically selects the most appropriate measurement scale. In Manual range mode, the desired range (scale) is set manually.


Auto range mode is the default mode of operation. When a new function is selected with the function switch, the starting mode is Auto range and the indicator is displayed .

To enter Manual range mode, press the **RANGE** button (the Auto Range icon will switch off). To change the range, press the **RANGE** button repeatedly until the desired range is displayed.

To return to the Auto range mode, press and hold the **RANGE** button until the Auto Range indicator is displayed.

### 5.4 Data Hold Modes

In Hold mode, the display freezes the last reading.


Press the HOLD button to toggle the hold mode ON/OFF. In Hold mode, the  indicator is displayed.

#### 5.4.1 Smart Hold



In Smart Hold mode, the meter will beep continuously, and the display will flash, when the measured signal is larger than the displayed reading. For voltage, current, and power measurement modes only.

### 5.5 Silent Mode

In Silent mode, the alert beeper is disabled. Silent mode does not affect the continuity beeper.

Use the navigation buttons to select the Silent mode icon , see Section 5.6.3.1.


### 5.6 Voltage/Current Measurements and Extended Functions

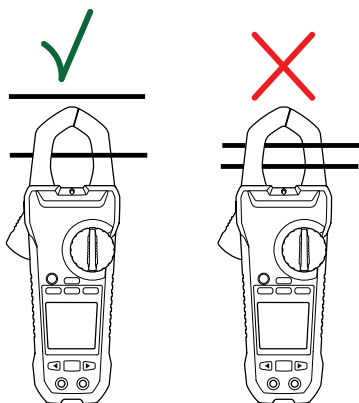
	<b>CAUTION</b>
If the measured voltage is > 30 V DC or AC V RMS, the  indicator is displayed.	

### 5.6.1 Voltage Measurements

1. Set the function switch to the **V** position.
2. To manually select AC, DC, or AC + DC measurement, press the **MODE** button repeatedly. Refer to Section 5.2, *Auto/Manual select mode*.
3. To manually select the measurement range (scale), press the **RANGE** button repeatedly. Refer to Section 5.3, *Auto/Manual range mode*.
4. Insert the black probe lead into the negative COM terminal and the red probe lead into the positive **V** terminal.
5. Connect the probe leads in parallel to the part under test.
6. Read the voltage value on the display.

### 5.6.2 Current Measurements

	<b>WARNING</b>
Do not measure the current on a circuit when the voltage is > 1000 V. This can cause damage to the instrument and can cause injury to persons.	
When measuring current using the clamp, enclose only one conductor in the clamp.	



**Figure 5.1** Correct (left image) and incorrect (right) clamping. Clamp onto one conductor only.

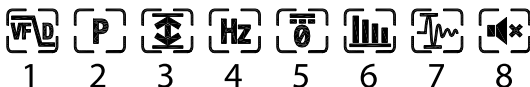
1. Ensure that the probe leads are disconnected from the meter.
2. Set the function switch to the **A** position.
3. To manually select AC, DC, or AC + DC measurement, press the **MODE** button repeatedly. Refer to Section 5.2, *Auto/Manual Select mode*.

4. To manually select the measurement range (scale), press the **RANGE** button repeatedly. Refer to Section 5.3, *Auto/Manual Range mode*.
5. Press the trigger to open the clamp jaws. Fully enclose one conductor (refer to Fig. 5.1). For optimum results, center the conductor in the jaws.
6. Read the current value on the display.

### 5.6.3 Extended Functions

#### 5.6.3.1 Selecting an Extended Function

The extended function icons, applicable for the selected measurement type, are shown on the bottom of the display. The navigation buttons are used to select a mode icon and to enable/disable the mode:



**Figure 5.2** Extended function icons (refer to numbered list below).

1. VFD mode
2. Peak mode
3. MIN-MAX-AVG memory mode
4. Frequency mode
5. DC zero mode
6. Harmonic Distortion mode
7. Inrush current mode
8. Silent mode (beeper off)

Use the **LEFT** and **RIGHT** navigation buttons to navigate to a mode icon. The currently selected icon will flash.

Press the **OK** button to enable/disable the selected (flashing) mode.

When a mode is enabled, its icon is framed (a box appears around the icon).

#### 5.6.3.2 Peak Mode

In Peak mode, the meter captures and displays the positive and negative peak values, and updates only when a higher/lower value is registered. Peak mode is available when measuring AC current or voltage in Manual select mode.


Use the navigation buttons to select and enable Peak mode.

Press the **OK** button to toggle between the display of Peak Maximum and Peak Minimum. In Peak Max mode, the  $\uparrow$  indicator is displayed. In Peak Min mode, the  $\downarrow$  indicator is displayed.

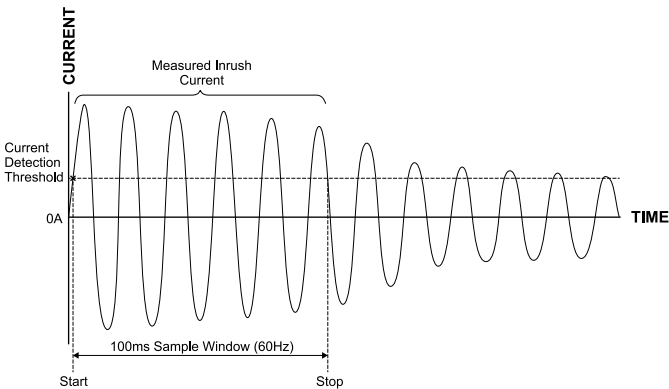
Long press the **OK** button to disable Peak mode.

### 5.6.3.3 Inrush Current Mode

In Inrush current mode, the meter displays the highest current reading in the first 100 ms after the trigger point (current detection threshold, see Fig. 5.3 below). The current detection threshold is 1.00 A for the 100.00 A range and 10.0 A for the 1000.0 A range. Inrush current mode is available when measuring AC current in manual Select mode.

1. Connect the meter to the unpowered circuit under test.
2. Set the meter to **A**.
3. Use the navigation buttons to select  and enable Inrush current mode.
4. Turn on power to the circuit under test.


Note: If the inrush current under test is > 100 A AC, manually set the range to 600 A before activating the inrush current mode, see Section 5.3, *Auto/Manual range mode*.



**Figure 5.3** Inrush Current Operation


### 5.6.3.4 DC Zero


The DC zero feature removes offset values and improves the accuracy of DC current measurements. DC Zero mode is available when measuring DC or AC + DC current in manual Select mode.

1. Ensure that there is no conductor in the clamp jaws.
2. Use the navigation buttons to select  and enable DC Zero mode.

#### 5.6.3.5 Frequency Measurements





In Frequency mode, the meter measures and displays frequency. Frequency mode is available when measuring AC current or voltage in manual Select mode.

	<b>CAUTION</b>
Do not switch to the Frequency mode until the meter is setup and actively measuring voltage or current.	

Use the navigation buttons to select  and enable the Frequency mode.

#### 5.6.3.6 Minimum, Maximum, and Average Memory



The meter captures and displays the minimum or maximum values and updates only when a higher or lower value is registered. The meter can also display the average of all values recorded.

1. Use the navigation buttons to select  and enable MIN/MAX/AVG mode.
2. Press the **OK** button repeatedly to cycle through the maximum, minimum, and average reading displays. The corresponding icons are displayed: , , or .
3. Long press the **OK** button to exit.

#### 5.6.3.7 Harmonic Distortion Mode

The meter displays the distortion percentage for the first 25 harmonics and the total harmonic distortion. Harmonic Distortion mode is available when measuring AC current or voltage in manual Select mode.

The harmonic distortion is expressed as  $H_n = (\text{RMS of an individual harmonic } n) / (\text{RMS of the fundamentals}) \times 100\%$ .

1. Use the navigation buttons to select  and enable Harmonic Distortion mode.
2. While in Harmonic Distortion mode, use the **LEFT** and **RIGHT** navigation buttons to navigate through the individual and total harmonic data. H01, H02, ..., Hn is displayed.
3. When the total harmonic distortion is displayed, the  indicator appears in the upper part of the display and **thd** is shown in the main display.


4. Press **OK** to switch the display between Harmonic Order Indication mode and Percentage mode.
5. Long press **OK** to exit.

#### 5.6.3.8 VFD Mode (Low Pass Filter)

The VFD mode eliminates high frequency noise in voltage measurements using a low-pass filter. The VFD mode is designed for variable frequency drive (VFD) measurements. This mode is available for AC current and voltage measurements.

Use the navigation buttons to select  and activate the VFD mode.

### 5.7 Non-Contact Voltage Detector

	<b>CAUTION</b>
<p>Test on a known live circuit before continuing.</p> <p>If the non-contact voltage alert lamp is not illuminated, voltage could still be present, use caution.</p>	




Hold the clamp tips of the meter very close to the voltage source.

If voltage is present, the non-contact voltage alert lamp (see Section 4.1, *Meter parts*) will switch on.

### 5.8 Power Measurements

#### 5.8.1 Single Phase Power Measurements

1. Set the function switch to the **W** position.
2. Insert the black probe lead into the negative COM terminal and the red probe lead into the positive W terminal.
3. Press the trigger to open the clamp jaws. Fully enclose one conductor (refer to Fig. 5.1). For optimum results, center the conductor in the jaws.  
Note: The + symbol on the jaw should be directed toward the power source.
4. Connect the probe leads in parallel to the part under test.
5. Read the active power value on the display.
  - If the value is displayed without a sign, the power is flowing from the power source to the load.
  - If the value is displayed with a minus sign (–), the power is flowing from the power load to the source.

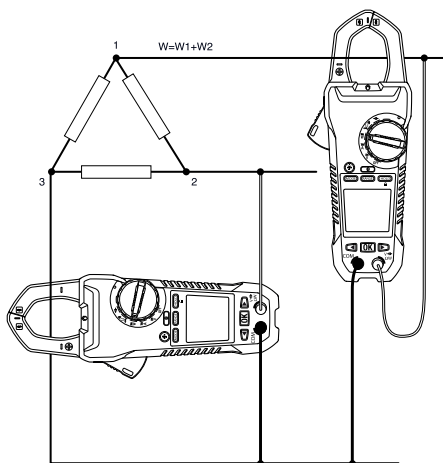
- 
6. To measure and display the power factor, press the **MODE** button repeatedly until the  indicator is displayed.
  7. Read the power factor value on the display.
    - If the value is displayed without a sign, the phase of the current signal is lagging the voltage signal (inductive load).
    - If the value is displayed with a minus sign (-), the phase of the current signal is leading the voltage signal (capacitive load).
  8. To return to active power measurements, press the **MODE** button repeatedly until the  (power factor) and the  (phase rotation) indicators switch off. If an overload occurs, a display alert will appear, as shown in the left column of the table below.

<b>OL. V</b>	Voltage overload or both voltage and current overload.
<b>OL. A</b>	Current overload.
<b>OL. kW</b>	Active power overload.






### 5.8.2 Three-Phase Power Measurements

#### 5.8.2.1 Three-Phase Three-Wire Balanced/Unbalanced

The power of a three-phase three-wire delta configuration is measured in two steps, in accordance with Fig. 5.4. The total power is the sum of the two measurements:  $W = W1 + W2$ .



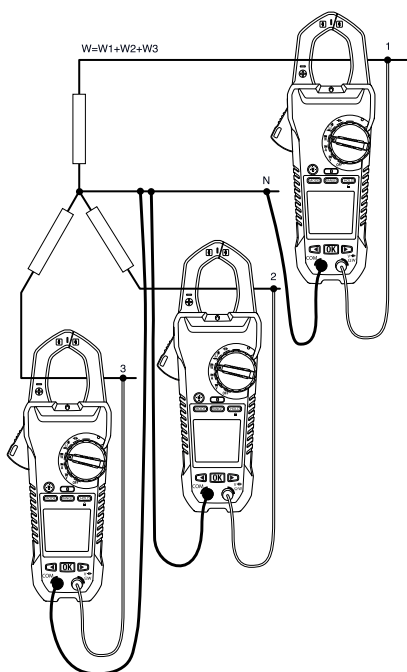
**Figure 5.4** Three-phase, three-wire test setup.

1. Set the function switch to the **W** position.
2. If the  or the  indicator is displayed, press the **MODE** button repeatedly until they switch off.
3. Take two measurements of the active power, in accordance with Fig. 5.4.
4. To measure and display the power factor, press the **MODE** button repeatedly until the  indicator is displayed.
5. Read the power factor value on the display.
  - If the value is displayed without a sign, the phase of the current signal is lagging the voltage signal (inductive load).
  - If the value is displayed with a minus sign (-), the phase of the current signal is leading the voltage signal (capacitive load).
6. To return to active power measurements, press the **MODE** button repeatedly until the  and  indicators switch off.




#### 5.8.2.2 Three-Phase Four-Wire Balanced/Unbalanced



The power of a three-phase four-wire configuration is measured in three steps, accordance with Fig. 5.5. The total power is the sum of the three measurements:  $W = W1 + W2 + W3$ .





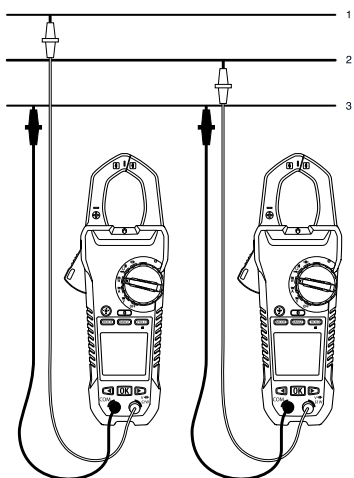
**Figure 5.5** Three-phase, four-wire test setup.

1. Set the function switch to the **W** position.
2. If the  or the  indicator is displayed, press the **MODE** button repeatedly until they switch off.
3. Take three measurements of the active power, in accordance with Fig. 5.5.
4. To measure and display the power factor, press the **MODE** button repeatedly until the  indicator is displayed.
5. Read the power factor value on the display.
  - If the value is displayed without a sign, the phase of the current signal is lagging the voltage signal (inductive load).
  - If the value is displayed with a minus sign (-), the phase of the current signal is leading the voltage signal (capacitive load).


- 
- To return to active power measurements, press the **MODE** button repeatedly until the  and  indicators switch off.

### 5.8.3 Phase Rotation

With the meter set to Phase rotation mode, it is possible to determine the phase rotation for a three-wire system. Note: The system frequency must be stable.



**Figure 5.6** Phase Rotation test setup.

- Set the function switch to the **W** position.
- Enter Phase Rotation mode by pressing the **MODE** button repeatedly until the  indicator is displayed.
- Connect the red test lead to the presumed phase line **1** (L1) and the black test lead to the presumed phase **N**.
- One of the following results is displayed:
  - OLV** flashes if the voltage is > 1000 V.
  - Lo V** flashes if the voltage is < 30 V.
  - Out F** flashes if the frequency is > 65 Hz or < 45 Hz.
- If normal, **L1** is displayed for about 3 seconds. Then **L2** is displayed and the meter beeps twice.

- 
6. Move the red test lead to the presumed phase line **2** (L2) immediately, before the **L2** display icon switches off.
  7. One of the following results is displayed:
    - **123** indicates clockwise or forward rotation, which means that the presumed phase line **1** (L1) is ahead of the presumed phase line **2** (L2).
    - **321** indicates counterclockwise or reversed rotation, which means that the presumed phase line **2** (L2) is ahead of the presumed phase line **1** (L1).
    - **Dashes** indicate that the meter is unable to determine the results.
    - **Lo V** indicates that the test leads may have been removed before completing the testing procedure.
  8. To repeat the test, press the **OK** button again.

### 5.9 Resistance Measurements



#### WARNING

Do not perform diode, resistance, or continuity tests before you have removed the power from capacitors and other devices under test. Injury to persons can occur.

1. Set the function switch to the  $\Omega$  position.
2. Ensure that the meter is set to the resistance measurement mode. If the  $\rightarrow$  or the  $\Rightarrow$  indicator is displayed, press the **MODE** button repeatedly until they are switched off.
3. Insert the black probe lead into the negative **COM** terminal and the red probe lead into the positive terminal.
4. Touch the tips of the probe across the circuit or component under test.
5. Read the resistance value on the display.

### 5.10 Capacitance Measurements



#### WARNING

Do not perform capacitance tests before you have removed power to the capacitor or other devices under test. Injury to persons can occur.

To protect the internal components, if a capacitor that is being tested has a charge, the meter will first discharge it and show **OL**. After a complete discharge the meter will conduct a normal test. **OL** may also be displayed if the incorrect input is provided (e.g., measuring voltage while in capacitance mode).

1. Set the function switch to the  $\text{-|}$  position.

2. If necessary, use the **MODE** button to select capacitance measurement mode. The  $\text{M}\text{H}$  indicator will be displayed.
3. Insert the black probe lead into the negative COM terminal and the red probe lead into the positive terminal.
4. Touch the tips of the probe across the part under test.
5. Read the capacitance value on the display.

Note: For large capacitors, allow time for the reading to stabilize.

### 5.11 Continuity Test



#### WARNING

Do not perform diode, resistance, or continuity tests before you have removed the power from capacitors and other devices under test. Injury to persons can occur.

1. Set the function switch to the  $\text{M}\text{H}$  position.
2. Insert the black probe lead into the negative COM terminal and the red probe lead into the positive terminal.
3. Use the **MODE** button to select continuity measurement. The  $\text{M}\text{H}$  indicator will be displayed.
4. Touch the tips of the probe across the circuit or component under test.
5. When the resistance is  $< 30$ , the beeper is on. When the resistance is  $> 150$  the beeper is off. When the resistance is between 30 and 150, the beeper can be on or off.

### 5.12 Smart Diode Test

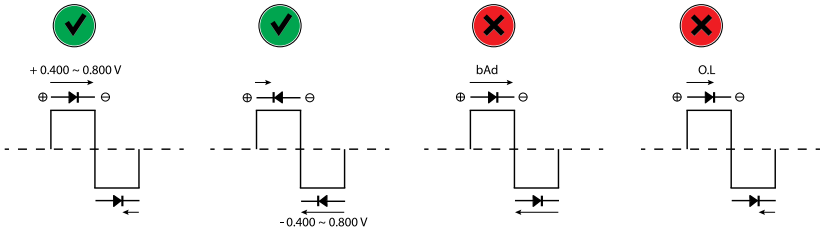


#### WARNING

Do not perform diode, resistance, or continuity tests before you have removed the power from capacitors and other devices under test. Injury to persons can occur.

1. Set the function switch to the diode position  $\text{D}\text{I}$ .
2. Insert the black probe lead into the negative COM terminal and the red probe lead into the positive terminal.
3. Use the **MODE** button to select the diode test function. The diode indicator  $\text{D}\text{I}$  will be displayed.
4. Touch the tips of the probe across the diode or semiconductor junction under test.
5. If the reading is between  $\pm 0.40$  and  $0.80\text{V}$ , the component is good.
6. If the reading shows **bAD** or **O.L.**, then the component is defective.

This meter checks diodes using an alternating test signal, allowing you to check the diode without having to reverse polarity manually. The meter displays  $\pm 0.4$  to  $0.8$  V for a good diode, **bAd** for a shorted diode, and **O.L** for an open diode (see Fig. 5.7).



**Figure 5.7** Smart diode operation.

## 5.13 Streaming Measurements with METERLiNK

### 5.13.1 General

You can stream readings from the meter to a mobile device running the METERLiNK® app. Obtain the METERLiNK app from Google Play (Android™ devices) or the APP store (iOS® devices).

Refer to the separate METERLiNK user manual for complete information. The user manual is available from the FLIR support site, see the Customer Support section of this manual.

The Bluetooth range is 32 ft. (10 m) maximum.

### 5.13.2 METERLiNK Application Basic Steps

1. Open the METERLiNK app on your mobile device.
2. Turn the clamp meter on and set the rotary switch to the desired position.
3. On the clamp meter, press the Bluetooth button.
4. Pair the clamp meter with the METERLiNK app.
5. Set METERLiNK to the *Measurements* mode.
6. Connect the meter to the circuit under test.
7. The measurements will be visible in the METERLiNK app.
8. Refer to the separate METERLiNK user manual for complete instructions. Documentation is available from the customer support site (see the *Customer Support* section).

# 6 Maintenance

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## 6.1 Cleaning and Storage

Clean the meter with a damp cloth and mild detergent; do not use abrasives or solvents. If the meter is not to be used for an extended period, remove the batteries, and store them separately.

## 6.2 Battery Replacement

1. To avoid electrical shock, disconnect the meter if connected to a circuit, remove the probe/thermocouple leads from the terminals, and set the function switch to the OFF position before attempting to replace the batteries.
2. Unscrew and remove the battery compartment cover.
3. Replace the six standard AAA batteries, observing correct polarity.
4. Secure the battery compartment cover.

### **NOTE**

Never dispose of used batteries or rechargeable batteries in household waste. As consumers, users may be legally required to take used batteries to appropriate collection sites, the retail store where the batteries were purchased, or wherever batteries are sold.

### **6.2.1 Disposal of Electronic Waste**

As with most electronic products, this equipment must be disposed of in an environmentally friendly way, and in accordance with existing regulations for electronic waste. Please contact your FLIR Systems representative for more details.

# 7 Specifications

## 7.1 General Specifications

Display digits	10,000 maximum
Measurement rate	3 readings per second
Over-range indication	<b>OL</b> or <b>—OL</b>
Auto Power Off	Approx. 30 minutes
Low battery indication	Replace the batteries when the battery status indicator appears
Power requirement	6 x 1.5 V AAA alkaline batteries
Battery life	50 hours (backlight, worklight, and Bluetooth off)
Environment conditions	Indoor use only
Calibration	One-year cycle
Operating temperature	32 to 50°F (0 to 10°C) non-condensing 50 to 86°F (10 to 30°C) < 80% RH 86 to 104°F (30 to 40°C) < 75% RH 104 to 122°F (40 to 50°C) < 45% RH
Storage temperature	14 to 122°F (-10 to 50°C)
Dimensions	10.9 x 4.0 x 2.0 in. (276 x 101 x 50 mm)
Weight	1.4 lbs. (0.65 kg) including batteries
Bluetooth range	33 ft. (10 m) maximum
Temperature coefficient	0.2 x (specified accuracy)/°C, <64.4°F (18°C), >82.4°F (28°C)
Over-voltage	IEC 61010-1 CAT IV-600 V, CAT III-1000 V, IEC 61010-2-033
Operating altitude	6562 ft. (2000 m)
Jaw opening	1.77 in. (45 mm)
Conductor size	1.65 in. (42 mm)
Pollution degree	2
EMC	EN 61326-1
Drop test	4 ft. (1.2 m)

## 7.2 Electrical Specifications

Accuracy is  $\pm$  (% reading + number of digits (d)) at 73.4°F  $\pm$ 9°F (23°C  $\pm$ 5°C), <80% RH.

### 7.2.1 Voltage (True RMS)

Function	Range	Accuracy (of reading)
DC V	99.99 V	$\pm$ (0.7% + 2 digits)
	999.9 V	
AC V	99.9 V	$\pm$ (1% + 5d) 50 to 500 Hz
	999.9 V	
VFD (AC V)	99.9 V	$\pm$ (1% + 5d) 50 to 60 Hz
	999.9 V	

Notes:

The display shows '0' when AC measurements are < 20 digits.

Overload protection: 1000 V RMS

Input impedance: 10 M $\Omega$  //, <100 pF

AC conversion type: AC coupled, true RMS responding, calibrated to the RMS value of a sine wave input. Accuracies are given for sine waves at full scale and non-sine waves below half scale. For non-sine waves (50/60 Hz), add the following crest factor corrections:

For a crest factor of 1.4 to 2.0, add 1.0% to the accuracy.

For a crest factor of 2.0 to 2.5, add 2.5% to the accuracy.

For a crest factor of 2.5 to 3.0, add 4.0% to the accuracy.

Crest Factors:

3 @ 460 V, 460 A

2 @ 690 V, 690 A

AC + DC V accuracy = AC V specification + DC V specification.



**7.2.2 Current (True RMS)**

Function	Range	Accuracy (of reading)
DC A	99.99 A	$\pm (2\% + 0.5 \text{ A})$
	999.9 A	$\pm (2\% + 5d)$
AC A	99.9 A	$\pm (2\% + 5d)$ 50 to 60 Hz
	999.9 A	$\pm (2.5\% + 5d)$ 60 to 400 Hz
VFD (AC A)	99.9 A	$\pm (2\% + 5d)$
	999.9 A	50 to 60 Hz

Notes:

The display shows '0' when the AC measurement is < 20 digits.

Overload protection: 1000 A RMS.

Position error:  $\pm 1\%$  of reading.

AC conversion type and additional accuracy is same as for the AC voltage.  
 AC + DC A accuracy = AC A specification + DC A specification. The DC A is affected by the temperature and the residual magnetism. Use the DC A zero function to compensate.

**7.2.3 Peak Hold (AC only)**

Function	Range	Accuracy (of reading)
AC V (not true RMS)	140.0 V	$\pm (3.0\% + 15d)$
	1400 V	
AC A (not true RMS)	140.0 A	$\pm (3.5\% + 15d)$
	1400 A	

Notes:

Overload protection: 1000 V RMS, 1000 A RMS

Accuracy defined for sine waves, AC V > 5 V RMS / AC A  $\geq$  5 A RMS, frequency 50 to 400 Hz. Only suitable for repetitive events.

### 7.2.4 Frequency

Function	Range	Accuracy (of reading)
Frequency (Hz)	20.00 to 99.99 Hz	± (0.5% + 3d)
	20.0 to 999.9 Hz	
	0.02 to 9.999 kHz	

Notes:

Overload protection: 1000 V RMS, 1000 A RMS

Sensitivity:

10 to 100 V RMS for AC 100 V range.

10 to 100 A RMS for AC 100 A range (> 400 Hz unspecified).

100 to 1000 V RMS for AC 1000 V range.

100 to 1000 A RMS for AC 1000 A range (> 400 Hz unspecified).

The reading will be 0.0 for signals below 10.0 Hz.

### 7.2.5 Total Harmonic Distortion

Function	Range	Accuracy (of reading)
AC A / AC V	99.9%	± (3.0% + 10d)

### 7.2.6 Harmonic Distortion Measurements

Harmonic Order	Range	Accuracy (of reading)
H01 to H12	99.9%	± (5.0% + 10d)
H13 to H25		± (10.0% + 10d)

Notes:

Overload protection: 1000 V RMS, 1000 A RMS

If ACV < 10 V RMS or ACA < 10 A RMS, **rdy** is displayed.

If the fundamental frequency is outside the range 45 to 65 Hz, **out.F** is displayed.

**7.2.7 Inrush Current**

Function	Range	Accuracy (of reading)
AC A	99.99 A	$\pm (3.0\% + 0.3 \text{ A})$
	999.9 A	$\pm (3.0\% + 5\text{d})^*$

\* For measured values <1000 digits, add 5 digits to the accuracy.

Overload protection: 1000 V RMS, 1000 A RMS.

Accuracy is defined for sine waves, AC A  $\geq 10$  A RMS, 50/60 Hz.

Integration time approx. 100 ms.

**7.2.8 Active Power (Watts)**

Function	Range	Accuracy (of reading)
DC power	9.999 kW (10 V, 5 A min.)	$\pm (3\% + 0.05 \text{ kW})$
	99.99 kW (10 V, 5 A min.)	$\pm (3\% + 0.5 \text{ kW})$
	999.9 kW (10 V, 5 A min.)	$\pm (3\% + 10\text{d})$
AC power	9.999 kW (10 V, 5 A min.)	$\pm (3\% + 10\text{d})$
	99.99 kW (10 V, 5 A min.)	
	999.9 kW (10 V, 5 A min.)	

Notes:

The range is determined by the V/A range (9.999 kW: 100 V, 100 A; 99.99 kW: 1000 V, 100 A, or 100 V, 1000 A; 999.9 kW: 1000 V, 1000 A).

Overload protection: 1000 V RMS, 1000 A RMS.

Accuracy defined for:

AC W: Sine waves, AC V  $\geq 10$  V RMS, AC A  $\geq 5$  A RMS.

Frequency 50 to 60 Hz, PF = 1.00.

DC W: DC V  $\geq 10$  V, DC A  $\geq 5$  A.

**7.2.9 Power Factor**

Function	Range	Accuracy
Power Factor (PF)	-1.00 to 0.00 to +1.00	$\pm (3^\circ + 1\text{d})$

Note: Overload protection: 1000 V RMS, 1000 A RMS

### 7.2.10 Resistance, Continuity, and Diode

Function	Range	Accuracy
Resistance	999.9 $\Omega$	$\pm (1\% + 5d)$
	9.999 k $\Omega$	$\pm (1\% + 3d)$
	99.99 k $\Omega$	
Continuity	999.9 $\Omega$	$\pm (1\% + 5d)$
Diode	0.40 to 0.80 V	$\pm 0.1$ V

Notes:

Overload protection: 1000 V RMS.

Maximum test current: Approx. 0.1 mA.

Maximum open circuit voltage for  $\Omega$ : Approx. 1.0 V.

Maximum open circuit voltage for diode: Approx.  $\pm 1.8$  V.

Continuity threshold:  $<30$   $\Omega$  beeper on.  $>150$   $\Omega$  beeper off. Between 30 and 150  $\Omega$  the beeper can be on or off.

Continuity beeper: 2 kHz tone.

Continuity response time:  $<100$  ms.

### 7.2.11 Capacitance

Function	Range	Accuracy
Capacitance	3.999 $\mu$ F	$\pm (1.9\% + 8d)$
	39.99 $\mu$ F	
	399.9 $\mu$ F	
	3.999 mF	

Note: Overload protection: 1000 V RMS.

# 8 CUSTOMER SUPPORT

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Visit the link below for customer support and documentation downloads.

<https://support.flir.com>

# 9 Warranty

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This meter is protected by the FLIR Limited Lifetime Warranty. To read the warranty document, please visit the site below.

[www.flir.com/testwarranty](http://www.flir.com/testwarranty)





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**Website**

<http://www.flir.com>

**Customer support**

<http://support.flir.com>

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