FLUKE®

279 FC

True-rms Thermal Multimeter

Users Manual

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11/99

This product includes software developed by the OpenSSL Project for use in the OpenSSL Toolkit (http://www.openssl.org/)

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Introduction

The 279 FC True-rms Thermal Multimeter (the Multimeter or Product) is a digital multimeter with an integrated thermal imaging camera.

The Multimeter measures or tests:

- AC voltage
- AC current with the iFlex
- DC voltage
- Volts/Hertz ratio
- Resistance
- Capacitance
- Continuity
- Diodes
- Frequency

Use the IR camera for:

- Temperature measurements
- Thermal images

Use the detachable iFlex (Flexible Current Probe) accessory for:

- AC current measurement
- Improved access to awkward-sized conductors and wires

The Multimeter supports the Fluke Connect™ Wireless System (may not be available in all regions). Fluke Connect™ is a system that wirelessly connects your Multimeter with an app on your smartphone or tablet. The app shows the Multimeter measurement or thermal image on your smartphone or tablet display. You can save these measurements and images to Fluke Cloud™ storage and share with your team.

See *Fluke Connect™ Wireless System* on page 5 for more information.

How to Contact Fluke

To contact Fluke, call one of the following telephone numbers:

- Technical Support USA: 1-800-44-FLUKE (1-800-443-5853)
- Calibration/Repair USA: 1-888-99-FLUKE (1-888-993-5853)
- Canada: 1-800-36-FLUKE (1-800-363-5853)
- Europe: +31 402-675-200
- Japan: +81-3-6714-3114
- Singapore: +65-6799-5566
- Anywhere in the world: +1-425-446-5500

Or, visit Fluke's website at www.fluke.com.

To register your product, visit http://register.fluke.com.

To view, print, or download the latest manual supplement, visit http://us.fluke.com/usen/support/manuals.

Safety Information

A **Warning** identifies conditions and procedures that are dangerous to the user. A **Caution** identifies conditions and procedures that can cause damage to the Product or the equipment under test.

⚠⚠ Warning

To prevent possible electrical shock, fire, or personal injury:

- **Carefully read all instructions.**
- **Read all safety information before you use the Product.**
- **Use the Product only as specified, or the protection supplied by the Product can be compromised.**
- **Comply with local and national safety codes. Use personal protective equipment (approved rubber gloves, face protection, and flame-resistant clothes) to prevent shock and arc blast injury where hazardous live conductors are exposed.**

- **Examine the case before you use the Product. Look for cracks or missing plastic. Carefully look at the insulation around the terminals.**
- **Do not use the Flexible Current Probe if it has damaged insulation, exposed metal, or if the wear indicator is visible.**
- **Do not use test leads if they are damaged. Examine the test leads for damaged insulation, exposed metal, or if the wear indicator shows. Check test lead continuity.**
- **The battery door must be closed and locked before you operate the Product.**
- **Do not touch voltages >30 V ac rms, 42 V ac peak, or 60 V dc.**
- **Use Product-approved measurement category (CAT), voltage, and amperage rated accessories (probes, test leads, and adapters) for all measurements.**
- **Do not exceed the Measurement Category (CAT) rating of the lowest rated individual component of a Product, probe, or accessory.**
- **Measure a known voltage first to make sure that the Product operates correctly.**
- **Limit operation to the specified measurement category, voltage, or amperage ratings.**
- **Do not use the Product above its rated frequency.**
- **Do not use in CAT III or CAT IV environments without the protective cap installed on test probe. The protective cap decreases the exposed probe metal to <4 mm. This decreases the possibility of arc flash from short circuits.**
- **Do not apply more than the rated voltage, between the terminals or between each terminal and earth ground.**
- **De-energize the circuit or wear personal protective equipment in compliance with local requirements before you apply or remove the Flexible Current Probe.**

Symbols used on the Product and in this manual are explained in Table 1.

Table 1. Symbols

Symbol	Description	Symbol	Description
⚠	WARNING. RISK OF DANGER.		Battery
	Consult user documentation.		Certified by CSA Group to North American safety standards.
⚠	WARNING. HAZARDOUS VOLTAGE. Risk of electric shock.	CE	Conforms to European Union directives.
⧈	Double Insulated		Conforms to relevant Australian EMC standards.
	Conforms to relevant South Korean EMC Standards.	BC	Conforms to the Appliance Efficiency Regulation (California Code of Regulations, Title 20, Sections 1601 through 1608), for small battery charging systems.
CAT II	Measurement Category II is applicable to test and measuring circuits connected directly to utilization points (socket outlets and similar points) of the low-voltage MAINS installation.		
CAT III	Measurement Category III is applicable to test and measuring circuits connected to the distribution part of the building's low-voltage MAINS installation.		
CAT IV	Measurement Category IV is applicable to test and measuring circuits connected at the source of the building's low-voltage MAINS installation.		
Li-ion	This product contains a Lithium-ion battery. Do not mix with the solid waste stream. Spent batteries should be disposed of by a qualified recycler or hazardous materials handler per local regulations. Contact your authorized Fluke Service Center for recycling information.		
	This product complies with the WEEE Directive marking requirements. The affixed label indicates that you must not discard this electrical/electronic product in domestic household waste. Product Category: With reference to the equipment types in the WEEE Directive Annex I, this product is classed as category 9 "Monitoring and Control Instrumentation" product. Do not dispose of this product as unsorted municipal waste.		

Fluke Connect™ Wireless System

The Multimeter supports the Fluke Connect™ Wireless System (may not be available in all regions). Fluke Connect™ uses low-power 802.15.4 wireless radio technology to wirelessly connect the Multimeter with an app on your smartphone or tablet. The wireless radio does not cause interference with meter measurements.

The app shows measurements or thermal images on your smartphone or tablet display, saves to Fluke Cloud™ storage, and shares the information with your team.

Radio Frequency Data

Note

Changes or modifications to the wireless 2.4 GHz radio not expressly approved by Fluke Corporation could void the user's authority to operate the equipment.

For complete information about radio frequency data, go to www.fluke.com/manuals and search for "*Radio Frequency Data Class B*".

Set Up for Fluke Connect App

The Fluke Connect app works with Apple and Android mobile products. The app is available for download from the Apple App Store and Google Play.

To use Fluke Connect:

1. Turn on the Multimeter. See Figure 1.

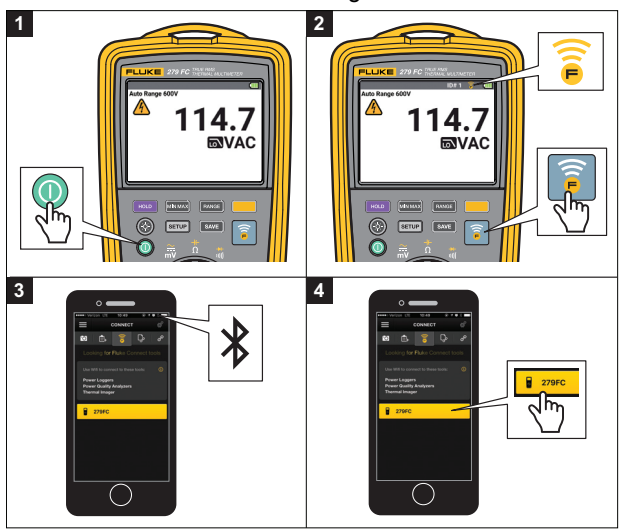


Figure 1. Fluke Connect™

2. Press to activate the radio on the Multimeter. shows on the display.
3. On your smartphone, go to **Settings** > **Bluetooth**.

   Verify that Bluetooth is turned on.
4. Go to the Fluke Connect App and in the list of connected Fluke tools, select **279 FC**.

You can now take, save, and share measurements with the app. Go to www.flukeconnect.com for more information about how to use the app.

To send an IR Camera image to the app, see page 16.

Before You Start

This section is information to know before you use the Multimeter.

⚠⚠ Warning

To prevent possible electrical shock, fire, or personal injury:

- **Disconnect power and discharge all high-voltage capacitors before you measure resistance, continuity, capacitance, or a diode junction.**
- **Do not use the HOLD function to measure unknown potentials. When HOLD is turned on, the display does not change when a different potential is measured.**

On/Off

Push ⏻ to turn on or turn off the Multimeter.

Hanging Strap

The Multimeter includes a hanging strap that allows you to hang your Multimeter so you can take measurements hands-free. See Figure 2.

Display Information

Hazardous Voltage

The hazardous voltage warning ⚠ shows on the display when the Multimeter detects a voltage ≥30 V.

Test Lead Alert

The display shows LEAD for a second when you turn the function switch to or from the Hz iFlex position. This is a reminder to check that the correct accessory is connected.

Display OL

If the measurement value (does not include temperature measurements) is over the limit, or outside the measurement range, the Multimeter shows **OL** in the display.



Figure 2. Hanging Strap

Battery Charge

⚠⚠ Warning

To prevent a possible electrical shock, fire, or personal injury:

- **Disconnect the battery charger and move the Product or battery to a cool, non-flammable location if the rechargeable battery becomes hot (>50 °C) during the charge period.**
- **Replace the rechargeable battery after 5 years of moderate use or 2 years of heavy use. Moderate use is defined as recharged twice a week. Heavy use is defined as discharged to cutoff and recharged daily.**
- **Batteries contain hazardous chemicals that can cause burns or explode. If exposure to chemicals occurs, clean with water and get medical aid.**
- **Do not short the battery terminals together.**
- **Do not disassemble or crush battery cells and battery packs.**
- **Do not put battery cells and battery packs near heat or fire. Do not put in sunlight.**

The Multimeter is packaged with the battery pack at <30 % charge. Before first use, make sure the battery pack is fully charged. The battery pack must be removed and charged outside of the Multimeter. See Figure 3.

To remove and charge the battery pack:

1. Turn off the Multimeter and remove all test leads.
2. Extend the tilt stand to expose the battery door.
3. Turn the battery-door latch until the unlock symbol (🔓) aligns with the arrow.
4. Lift off the battery door/tilt stand.
5. Remove the battery pack and recharge.

After battery is fully recharged:

1. Place the battery pack into the battery compartment.
2. Install the battery door/tilt stand.
3. Turn the battery-door latch until the locked symbol (🔒) aligns with the arrow.

The display shows an icon for the battery status:

 - 100 % charge

 - 50 % charge

 - 0 % charge

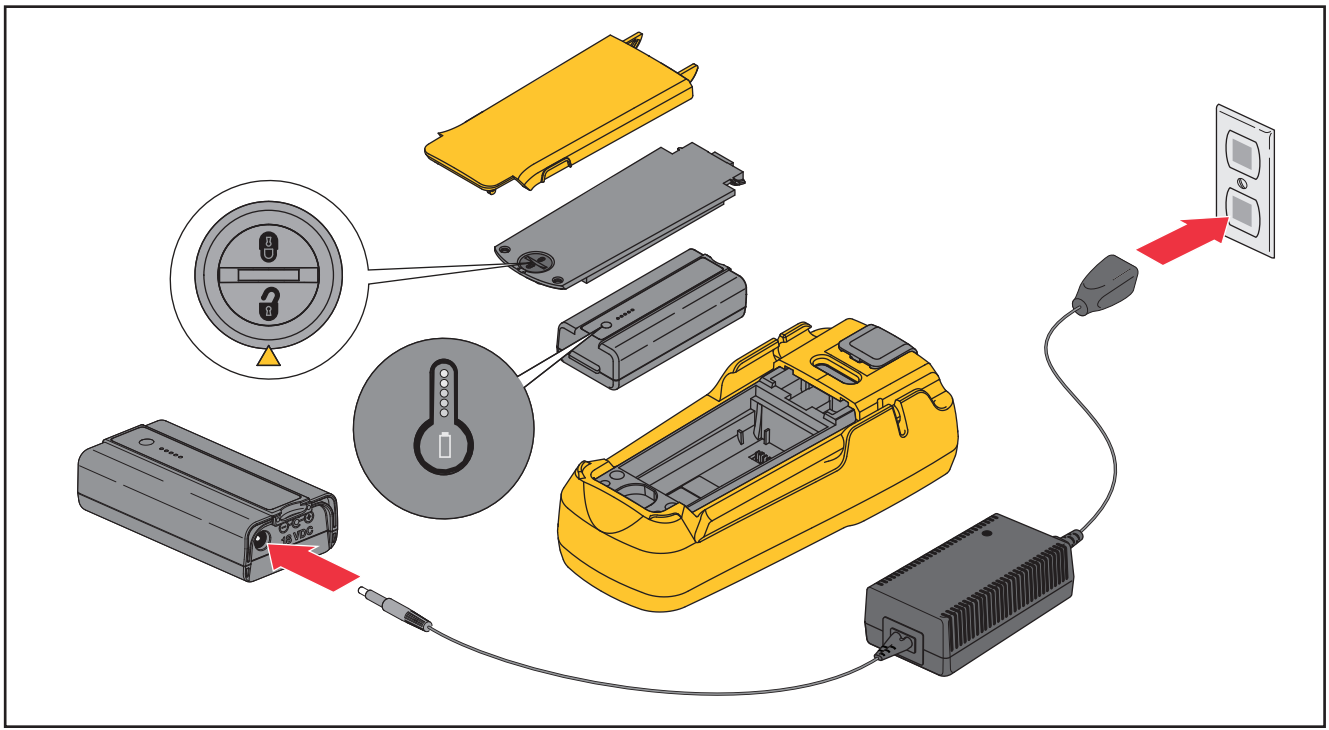


Figure 3. Battery Charge

Setup Menu

The Setup Menu includes these functions:

- on/off for the audible beeper
- on/off for automatic backlight dimming
- on/off for automatic power off (battery save)
- unit selection for temperature measurements
- image memory management
- calibration procedure
- information about your device

All setup functions remain as set when you turn off and turn on the Multimeter.

To open the Setup Menu, push SETUP. Use the top row of buttons to control actions within the Setup Menu. These buttons correspond to the softkey labels that show on the display. See Table 2.

Table 2. Setup Menu Functions



Button	Softkey	Action
SETUP	NA	Open the Setup Menu
HOLD	EXIT	Close the Setup Menu
	BACK	Go back to previous menu
MIN MAX	▲	Move the menu highlight up
RANGE	▼	Move the menu highlight down
	DONE	Accept a change to the setup
	SELECT	Open a submenu for selections
	YES	Accept the change.

Beeper

The beeper is for quick continuity tests without the need to watch the display. If on, the beeper sounds as long as a circuit is complete.

Auto Dim

Push ☼ to brighten or dim the backlight. If on, the Auto Dim feature automatically dims the backlight after 2 minutes of no use.

To set:

1. Push SETUP to open the Setup Menu.
2. Use ▲ ▼ to highlight the feature.
3. Push (Select) to open the submenu.
4. Use ▲ ▼ to set as **OFF** or **ON**.
5. Push (Done) to save the selection and exit the submenu.
6. Push HOLD (Exit) to close the Setup Menu.

Auto Off

To save battery power, you can set the Multimeter to automatically turn off after 20 minutes of no use.

To set:

1. Push SETUP to open the Setup Menu.
2. Use ▲ ▼ to highlight the feature.
3. Push (Select) to open the submenu.
4. Use ▲ ▼ to set as **OFF** or **ON**.
5. Push (Done) to save the selection and exit the submenu.

   Auto Off is always disabled when MIN MAX AVG recording or a Fluke Connect session is in progress.
6. Push HOLD (Exit) to close the Setup Menu.

Temperature Units

Select temperature unit as degrees C or degrees F.

Image Memory Management

You can save up to 100 images. When 100 images are in memory, the Multimeter prompts you to discard the oldest image before you can continue to save. Or, you can go to the Setup Menu to delete all the images in memory.

To delete all images:

1. Push SETUP.
2. Push ▲ ▼ to highlight Memory.
3. Push (Select) to open the submenu.
4. Push (Yes) to confirm or push HOLD (Back) to exit the submenu with no changes.

Calibration

For information about the calibration of your Multimeter, see the *279 FC True-rms Thermal Multimeter Calibration Manual*.

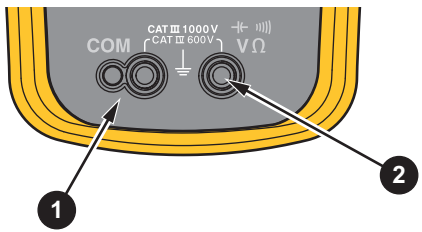
Device Information

Use the Device Information menu to find details about your Multimeter such as the serial number and firmware version.

Inputs

Table 3 is a list of the inputs for the Multimeter.

Table 3. Inputs



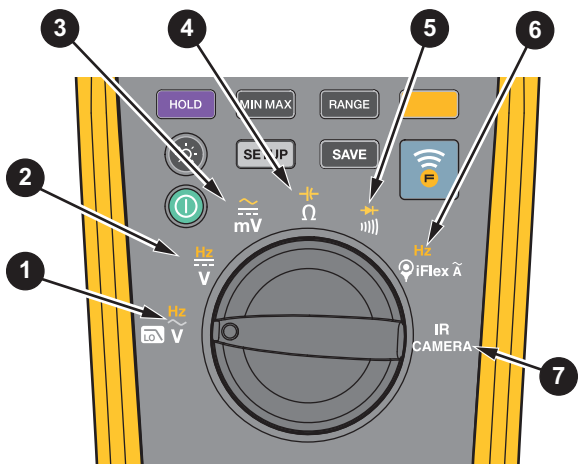
Input	Description
1	• COM - Return terminal for all measurements. • Input for iFlex Current Probe.
2	VΩ - Input for voltage, resistance, diode, capacitance, and voltage frequency.

Rotary Switch and Pushbuttons

Use the rotary switch to select a function on the Multimeter. The position of the rotary switch can have more than one function. These functions are labeled with text in different colors. Push  (the yellow button) to toggle the Multimeter between the functions. For example, frequency, capacitance, and diode tests are functions that you set with the yellow button.

Table 4 is a list of the rotary dial functions. Table 5 is a list of the button functions.

Table 4. Rotary Switch Positions



	Function
1	AC voltage measurement from 0.060 V to 1000 V. Push [ ] to measure frequency from 2 Hz to 999.9 Hz. Push [ ] again to measure Volts/Hertz.
2	DC voltage from 0.001 V to 1000 V. Push [ ] to measure frequency from 2 Hz to 999.9 Hz.
3	DC voltage measurements from 0.1 mV to 600 mV. Push [ ] to measure ac voltage from 6 mV to 600 mV.[1]
4	Resistance measurements from 0.1 Ω to 50 MΩ. Push [ ] to measure capacitance from 1 nF to 9999 µF.
5	Continuity. Beeper turns on at <25 Ω and turns off at >250 Ω. Push [ ] for diode test. Shows OL above 2.0 V.
6	AC current measurements from 1 A to 2500 A. Push [ ] again to measure frequency from 2 Hz to 999.9 Hz.
7	Turn on the IR camera and measure temperature.

[1] This function will stay in ac or dc when the function switch is moved to another position and back to this function. Even when turned to off and back to this function.

Table 5. Pushbuttons

Button	Switch Position	Function
⏻	Not related to switch position	Turn on and turn off the Multimeter.
RANGE	❶❷❹❺	Set the Multimeter to manual range and scroll through each range. Push and hold for 1 second to set the Multimeter to auto range.
MIN MAX	❶❷❸❹❺❻	Start the MIN MAX record function. Steps the display through MAX, MIN, AVG (average), and input signal measurement. Push and hold for 1 second to stop MIN MAX record.
HOLD	❶❷❸❹❺❻	Stop and hold the measurement on the display.
☼	Not related to switch position	Push once to turn on the backlight. Push again to toggle the backlight between the low setting and high setting. If Auto Dim is turned on, the backlight goes to the low setting automatically after 2 minutes of no use.
SETUP	Not related to switch position	Opens the Setup Menu. See page 10 for more information.
SAVE	Not related to switch position	When FC is turned on, send a Multimeter measurement to the mobile app. See page 5 for more information.
	All positions	Turns on and turns off the radio. See page 5 for more information.

IR Camera Mode

⚠⚠ Warning

To prevent personal injury, see emissivity information for actual temperatures. Reflective objects result in lower than actual temperature measurements. These objects pose a burn hazard.

The IR Camera mode uses the ironbow palette. The display shows a center point marker for the temperature measurement. Temperature units of measurement are selected in the Setup Menu. See *Setup Menu* on page 10 for more information.

A temperature scale is shown on right edge of the display. White is the highest temperature reading. Black is the lowest temperature reading.

The Multimeter has a lens cover to protect the camera lens. Open the lens cover before you capture an image. Close the lens cover when not in the IR Camera mode.

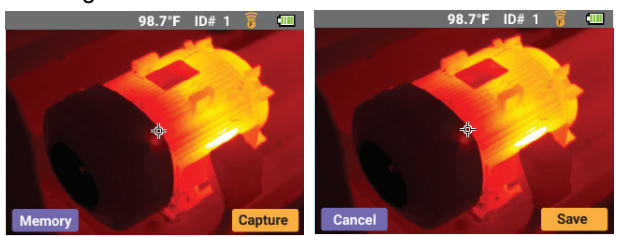
Note

Do not use magnets near the Multimeter as they can interfere with the IR Camera.

Capture an Image

To capture an image from the display:

1. Push (Capture).
2. Push HOLD to cancel the capture or to save the image.



With the Fluke Connect app you can expand your use of these images. See *Set Up for Fluke Connect App* on page 5 for more information about how to connect to the mobile app.

All IR Cameras need sufficient warm-up time for the most accurate temperature measurements and best image quality. This time can often vary by model and by environmental conditions. Although most IR Cameras are fully warmed up in 3-5 minutes, it is always best to wait a minimum of 10 minutes if the most accurate temperature measurement is very important to your application. When you move an IR Camera between environments with large differences in ambient temperature, more adjustment time can be required.

Review and Delete Images

To review images from the IR Camera mode:

1. Push HOLD (Memory).

   The Multimeter is in Memory Review mode.

2. Push MIN MAX / RANGE (arrow soft keys) to scroll through the images.
3. To delete the image on the display, push (Delete) and then push again to confirm.
4. To exit Memory Review mode, push HOLD (Exit).

Basic Measurements

⚠⚠ Warning

To prevent possible electrical shock, fire, or personal injury, disconnect power and discharge all high-voltage capacitors before you measure resistance, continuity, capacitance, or a diode junction.

This section is about how to make basic measurements with the Multimeter.

When you connect the test leads to the circuit or device, always:

- Connect the common (COM) test lead before the live lead.
- Remove the live test lead before the common test lead.

Basic measurements and tests:

- AC and DC Voltage Measurements. See Figure 4.
- Volts/Hertz Ratio. See Figure 6.
- Resistance Measurements. See Figure 7.
- Capacitance Measurements. See Figure 8.
- Continuity Test. See Figure 9.
- AC Current Measurements. See Figure 10.
- Diode Test. See Figure 11.
- Frequency Measurements. See Figure 12.

AC and DC Voltage Measurements

To set the dc or ac range:

1. Turn the rotary dial to $\widetilde{\overline{\text{mV}}}$. See Figure 4.
2. Push [ ] to toggle the voltage between millivolts dc and millivolts ac.
3. Push RANGE to scroll through each range.

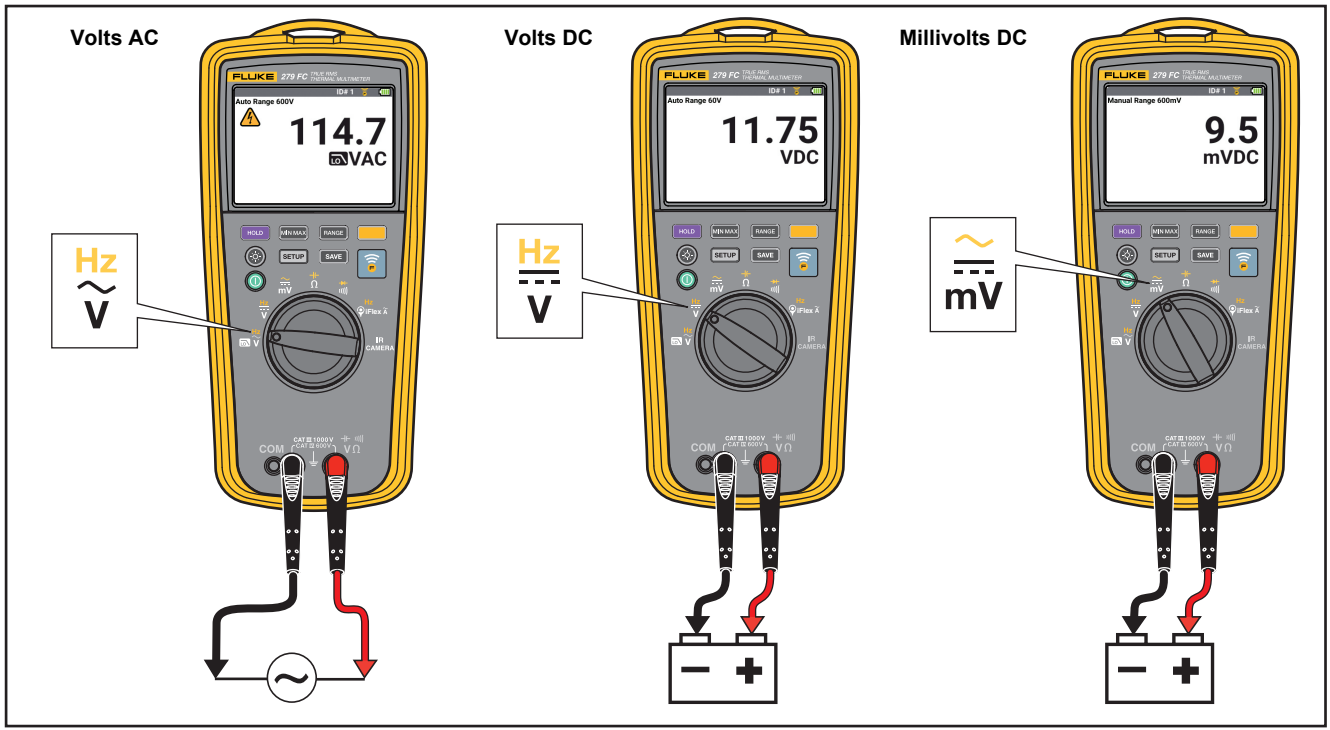


Figure 4. AC and DC Voltage Measurements

Volts/Hertz Ratio

The Multimeter can show the ratio of volts to frequency of the ac signal. See Figure 6.

When the Multimeter is set to the Volts/Hz function, the voltage range is set to manual. If the voltage increases to a value larger than the range, the Multimeter shows **OL** in the display. If the voltage drops to less than 5 % of the range, the value shown in the display can be invalid.

Low-Pass Filter

AC measurements use an ac low-pass filter (LO). The filter blocks unwanted voltages above 1 kHz. See Figure 5. The lower frequency voltages pass with reduced accuracy to the measurement below 1 kHz. The low-pass filter can improve measurement performance on composite sine waves that are typically generated by inverters and variable frequency motor drives.

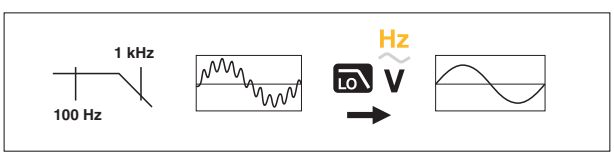


Figure 5. Low-Pass Filter

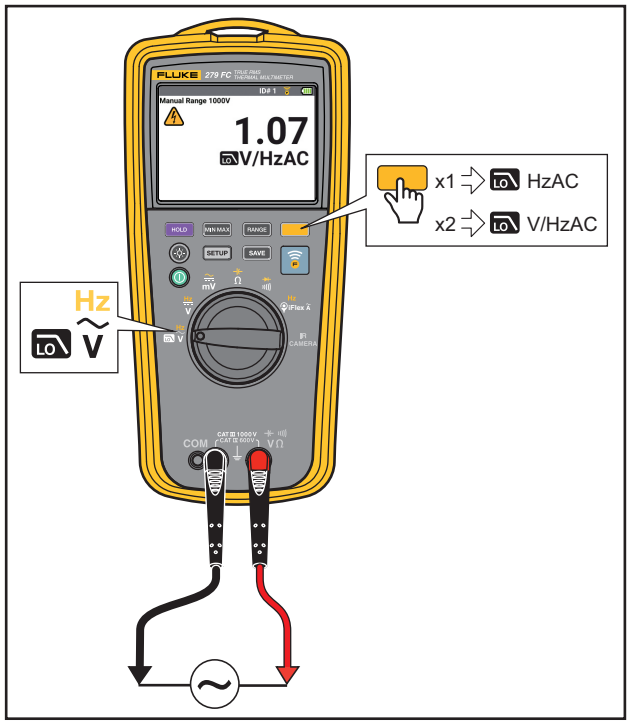


Figure 6. Volt/Hertz Ratio

Resistance Measurements

⚠⚠ Warning

To prevent possible electrical shock, fire, or personal injury, disconnect power and discharge all high-voltage capacitors before you measure resistance, continuity, capacitance, or a diode junction.

The Multimeter sends a small current through the circuit for resistance measurements. Because the current flows through all possible paths between the probes, the resistance measured is the total resistance of all paths between the probes. See Figure 7.

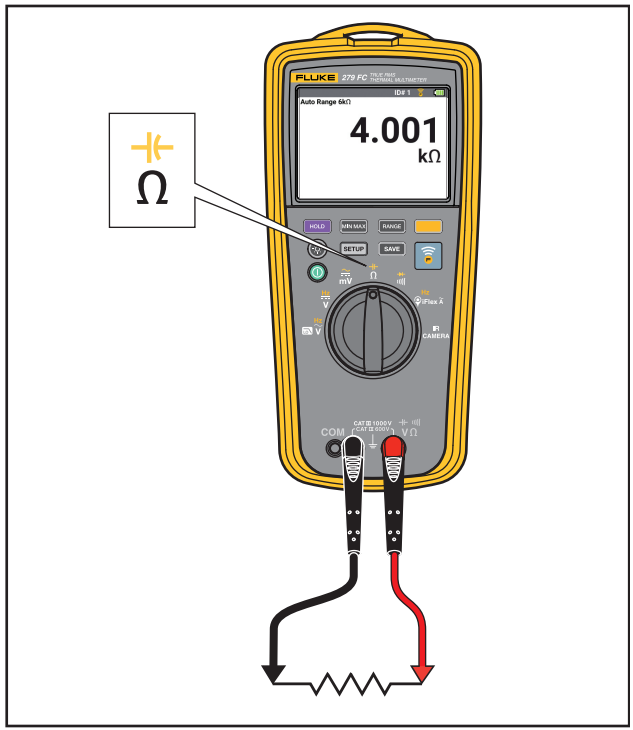


Figure 7. Resistance Measurements

Capacitance Measurements

⚠⚠ Warning

To prevent possible electrical shock, fire, or personal injury, disconnect power and discharge all high-voltage capacitors before you measure resistance, continuity, capacitance, or a diode junction.

The Multimeter makes a capacitance measurement by charging a capacitor with a known current, measures the resulting voltage, then calculates the capacitance. See Figure 8.

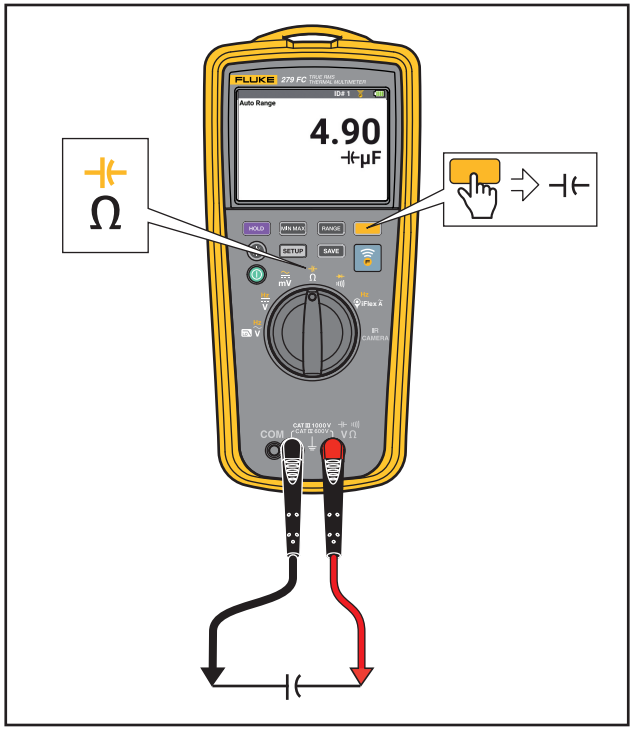


Figure 8. Capacitance Measurements

Continuity Test

⚠⚠ Warning
To prevent possible electrical shock, fire, or personal injury, disconnect power and discharge all high-voltage capacitors before you measure resistance, continuity, capacitance, or a diode junction.

The continuity test uses a beeper that sounds when a closed circuit is sensed. The beeper lets you do continuity tests without the necessity to look at the display. See Figure 9.

OL shows on the display when the circuit is open.

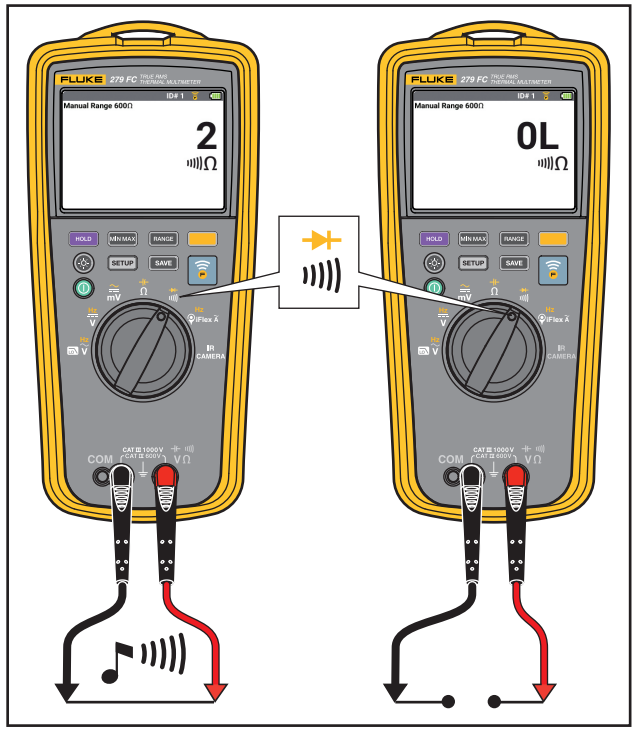


Figure 9. Continuity Tests

AC Current Measurements

⚠⚠ Warning

To prevent possible electrical shock, fire, or personal injury:

- **Do not measure ac current in circuits carrying more than 1000 V or 2500 A with the Flexible Current Probe.**
- **Do not apply the Flexible Current Probe around or remove from HAZARDOUS LIVE conductors.**
- **Do not use the Flexible Current Probe if the inner contrasting insulation color is showing.**
- **Take special care during fitting and removal of the Flexible Current Probe. Deenergize the installation under test or wear suitable protective clothing.**

To measure:

1. Connect the iFlex Current Probe to the input on the Multimeter. See Figure 10.
2. Center the conductor perpendicularly inside the flexible probe area. If this is not possible, an additional measurement error of ±2 % of reading can occur.
3. Avoid taking measurements close to other current-carrying conductors if possible.
4. Keep the probe coupling more than 2.5 cm (1 inch) away from the conductor.
5. Observe the ac current value.

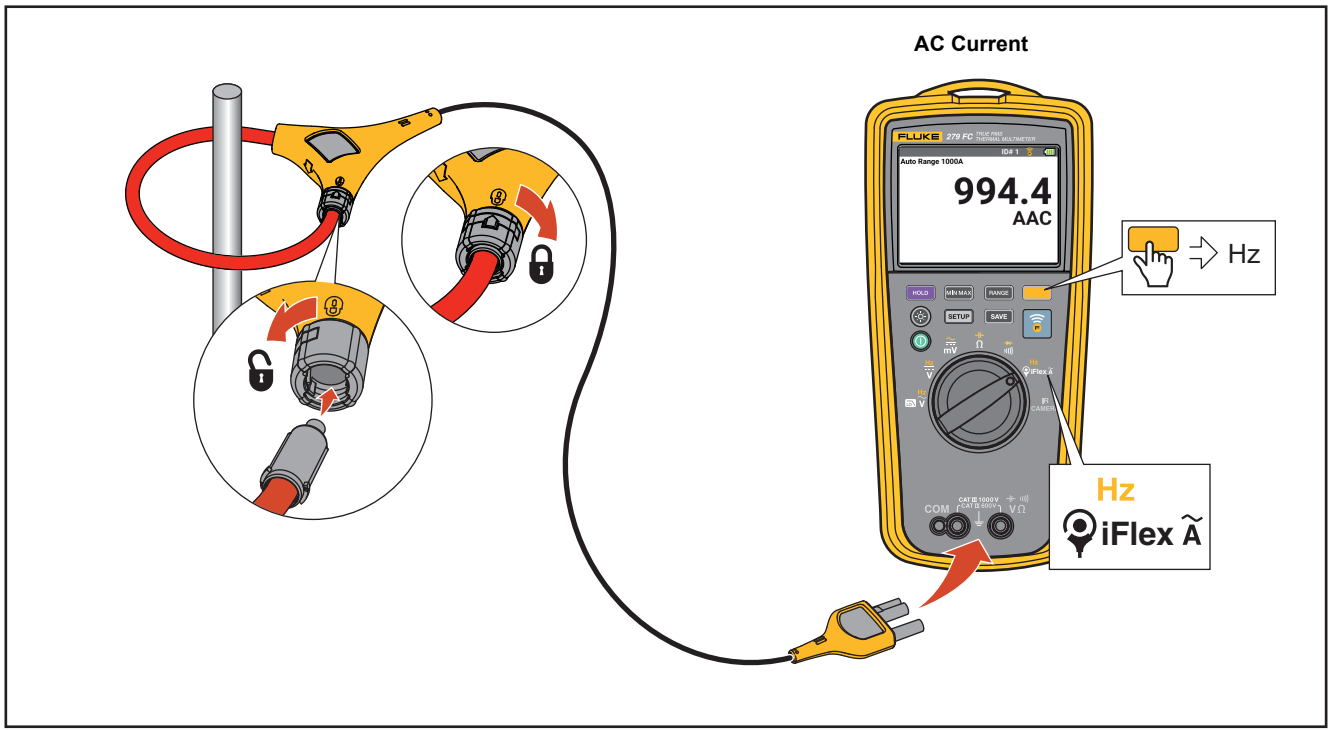


Figure 10. AC Current Measurements

Diode Test

⚠⚠ Warning

To prevent possible electrical shock, fire, or personal injury, disconnect power and discharge all high-voltage capacitors before you measure resistance, continuity, capacitance, or a diode junction.

You can test diodes, transistors, silicon-controlled rectifiers (SCRs), and other semiconductor devices with the Multimeter. The test function sends a current through the semiconductor junction and then measures the voltage drop across the junction. A good silicon junction drops between 0.5 V and 0.8 V.

For a diode test on a diode out-of-circuit, set up the Multimeter as shown in Figure 11. For forward-bias measurements on a semiconductor component, put the red test lead on the positive terminal of the component and put the black test lead on the negative terminal of the component.

In a circuit, a good diode has a forward-bias measurement of 0.5 V to 0.8 V. A reverse-bias measurement includes the resistance of other pathways between the probes.

A short beep sounds if the diode is good (<0.85 V). A continuous beep sounds if the measurement is ≤0.100 V or short circuit. The display shows **OL** if the diode is open.

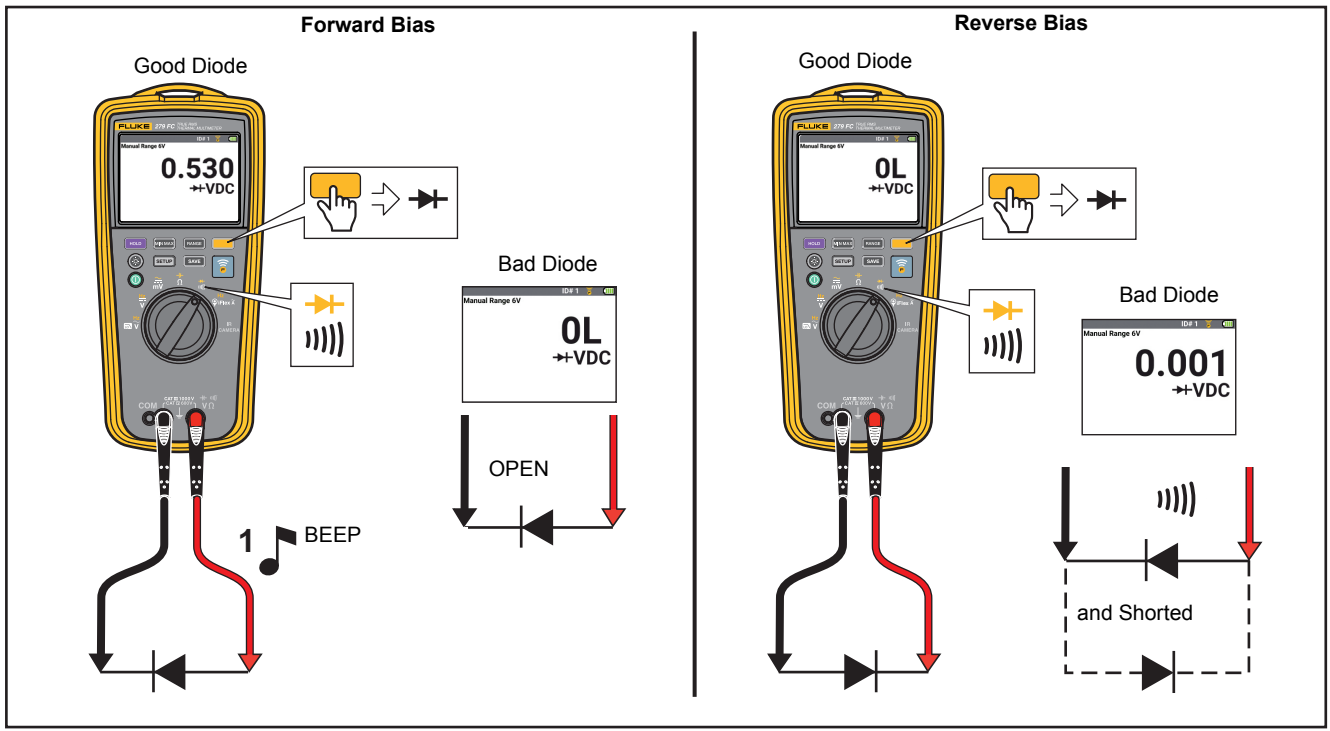


Figure 11. Diode Test

Frequency Measurements

A frequency measurement is a count of the number of times an ac voltage or current signal passes through a threshold point each second.

The Multimeter auto ranges to one of these frequency ranges:

- 2.00 Hz to 99.99 Hz
- 100.0 Hz to 999.9 Hz

Hints for frequency measurements:

- If a measurement shows 0 Hz or is not stable, the input signal can be below or near a trigger level. A lower range increases the sensitivity of the Multimeter and can usually repair these problems.
- An input signal with distortion can cause a frequency measurement to be higher than usual. The distortion can cause the frequency counter to sense multiple triggers. A higher voltage range decreases the input sensitivity and can correct this problem. In general, the lowest frequency is the correct one.

Be sure that you use the correct accessory for the measurement type. See Figure 12.

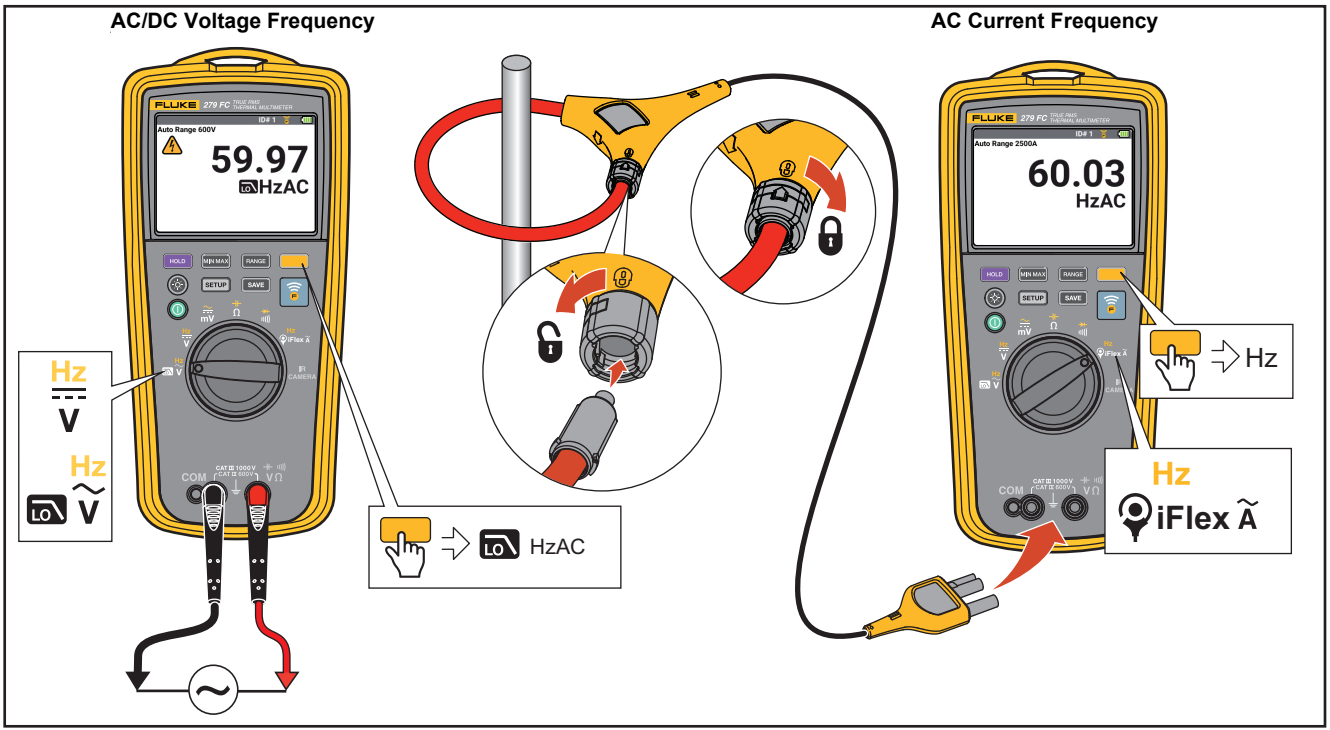


Figure 12. Frequency Measurement

Measurement Features

This section is about the Multimeter features you can use for measurements.

MIN MAX AVG Record Mode

The MIN MAX AVG record mode records the minimum and maximum input values, and calculates a running average of all measurements. The Multimeter beeps when it senses a new high value or new low value.

Note

For dc functions, accuracy is the specified accuracy of the measurement function, ±12 counts for changes longer than 250 ms in duration.

For ac functions, accuracy is the specified accuracy of the measurement function ±40 counts for changes longer than 900 ms in duration.

To start a MIN MAX AVG record session:

1. Make sure the Multimeter is set to the correct measurement function and on the correct range.

   Auto range is disabled while in a MIN MAX AVG record session.

2. Push MINMAX.

   MINMAX and **MAX** show on the display.

   The measurement in the display is the maximum value measured. It will change only when a new maximum value is sensed.

3. To pause MIN MAX AVG record session, push HOLD.

   HOLD shows in the display while record is paused. Recorded values are not deleted.

4. To continue the record session, push HOLD again.

5. To exit and erase the MIN, MAX, and AVG values, push MINMAX for 1 second or turn the rotary switch.
6. To see the other recorded values (minimum and average), push MINMAX.

   Each push of MINMAX steps through the recorded value for MAX, MIN, or AVG. When no label shows in this display location, the display shows the live input signal measurement.

Note

Auto Off (battery save) is disabled in MIN MAX AVG record mode.

Display Hold

⚠⚠ Warning

To prevent possible electrical shock, fire, or personal injury, do not use the HOLD function to measure unknown potentials. When HOLD is turned on, the display does not change when a different potential is measured.

In the display hold mode, the Multimeter holds the measurement on the display.

To hold a measurement on the display:

1. Push HOLD.

   The display shows **HOLD** when display hold is turned on.

2. Push HOLD again to stop hold mode and show measurements on the display.

Auto Range and Manual Range

The Multimeter has auto range and manual range.

When you turn on the Multimeter, it is set to auto range and **Auto** shows in the display. In auto range, the Multimeter selects the lowest range to display the highest available precision (resolution) for the input signal.

To set the Multimeter to manual range:

1. Push RANGE once to go to manual range.

   Manual shows in the display.

2. Push RANGE again to go to the next range. Each push of RANGE will cycle the Multimeter through the available ranges for the setting. The display updates to show the range in use.
3. Push and hold RANGE >1 second to exit manual range and go to auto range. Or turn the rotary switch to a different function.

Note

The auto/manual range function is disabled for the V/HzAC, mV, continuity, and diode measurements and the MIN MAX AVG record and Hold modes. If you push RANGE when in a function that does not have ranges, the Multimeter beeps twice to alert you to an invalid operation.

AC Zero Input Behavior of True-rms Meters

Average responding meters can accurately measure only pure sinewaves. A true-rms meter can accurately measure distorted waveform signals. A minimum input voltage is necessary for true-rms converters to make a correct measurement. Because of this minimum input, true-rms meter measurements are only specified for 1 % to 100 % of range. Non-zero digits that are shown on a true-rms meter when the test leads are open or shorted are possible. This has no effect on the ac measurement accuracy of signals that are >1 % of range.

Unspecified input levels on the lowest ranges are:

- AC voltage <1 % of 600 mV ac or 6 mV ac.
- AC current <1 A.

SmartView® Software

Firmware updates are available through SmartView® desktop software installed on your PC.

To download Smartview:

1. Go to http://www.fluke.com/downloads/smartview. Follow the prompts to find the SmartView that supports your Product.
2. Click on the “Download” link to transfer the SmartView installer to your PC that operates on Windows 7® or newer.
3. When the download is complete, click Setup.exe and follow the prompts for installation. Administrator privileges are required for the installation. If prompted, restart the computer when installation is complete.

Firmware Updates

To download firmware:

1. Open SmartView® on the PC.
2. Connect a USB 2.0 (High Speed) cable to the Multimeter.

   Plug in the large (USB “A”) connector of the cable to your PC and the small (USB “Mini B”) connector to the Multimeter.

   Windows automatically installs the necessary device driver for communication with the Multimeter. SmartView recognizes the connection with the Multimeter and shows a new toolbar menu item.
3. If a new firmware release is available, SmartView prompts you to download the firmware file.
4. Once the firmware file is downloaded, the Multimeter reboots and starts the firmware installation.

   Note

   Do not turn off the Multimeter until the update is complete.
5. To complete the firmware update, the Multimeter reboots.

IR Image Management

You can manage your IR images through SmartView® desktop software installed on your PC. Use SmartView to download and delete the IR images from the Multimeter.

To download or delete IR images:

1. Open SmartView® on the PC.
2. Connect a USB 2.0 (High Speed) cable to the Multimeter.

   Plug in the large (USB “A”) connector of the cable to your PC and the small (USB “Mini B”) connector to the Multimeter.
3. With SmartView, choose from the following options:
   - Download New - download only the new files created after the previous download.
   - Download All - download all files.
   - Download All & Delete - download all files and delete from the MultiMeter.
   - Delete All - delete all files on the Multimeter.

Maintenance

⚠⚠ Warning

To prevent a possible electrical shock, fire, or personal injury:

- **Remove the input signals before you clean the Product.**
- **Use only specified replacement parts.**
- **Have an approved technician repair the Product.**
- **Disconnect the battery charger and move the Product or battery to a cool, non-flammable location if the rechargeable battery becomes hot (>50 °C) during the charge period.**
- **Replace the rechargeable battery after 5 years of moderate use or 2 years of heavy use. Moderate use is defined as recharged twice a week. Heavy use is defined as discharged to cutoff and recharged daily.**
- **Batteries contain hazardous chemicals that can cause burns or explode. If exposure to chemicals occurs, clean with water and get medical aid.**
- **Do not short the battery terminals together.**
- **Do not disassemble or crush battery cells and battery packs.**
- **Do not put battery cells and battery packs near heat or fire. Do not put in sunlight.**

Multimeter Care

Clean the holster with a damp cloth and weak detergent. Do not use a solvent or cleaners with abrasives.

Dirt or moisture in the terminals can cause incorrect measurements.

To clean the terminals:

1. Turn off the Multimeter and remove all test leads.
2. Shake out dirt that can possibly be in the terminals.
3. Soak a clean swab with weak detergent and water.
4. Move the swab around in each terminal.
5. Dry each terminal with canned air to push the water and detergent out of the terminals.

Lens Care

When the IR Camera is not in use, close the lens cover.

⚠ Caution

To prevent damage to the infrared lens:

- **Carefully clean the infrared lens. The lens has a delicate anti-reflective coating.**
- **Do not clean too vigorously as this can damage the anti-reflective coating.**

For lens care you will need a cleansing liquid such as a commercial lens cleaning liquid with alcohol, ethyl alcohol, or isopropyl alcohol and a lint-free cloth or tissue. A pressurized air can is used to remove loose particulates.

To clean the lens:

1. Blow off particulates from the lens surface with pressurized air can or dry nitrogen-ion gun if available.
2. Soak the lint-free cloth in the alcohol liquid.
3. Squeeze the cloth to remove excess liquid or dab on dry cloth.
4. Wipe the lens surface in one circular motion and discard the cloth.
5. Use a new cloth with liquid if you need to repeat the procedure.

Parts and Accessories

Read this manual to make sure the Product is used correctly. If the Multimeter does not turn on, check the battery. See *Battery Charge* on page 8.

Replacement parts and accessories are shown in Table 6 and Figure 13.

For more information about parts and accessories, see *How to Contact Fluke* on page 2.

Table 6. Accessories and Replacement Parts

Item	Description	Fluke Part or Model Number
❶	Battery Door Assembly (includes tilt stand)	4693466
❷	Test Lead Set	TL175
❸	Alligator Clip, Black Alligator Clip, Red	AC175
❹	279 FC Quick Reference Guide	4694103
❺	279 FC Safety Information	4717467
❻	9-inch Hanger Strap	TPAK80-4-8001
	Hanging Clip	TPAK80-2003
❼	USB A to USB mini-B Cable	1671807
❽	Soft Carry Case	3087338
❾	7.4 V 3000 mAh Rechargeable Lithium-Ion Battery	BP500
❿	15 V dc Charger	BC500
⓫	10 in. iFlex Current Probe	i2500-10
	18 in. iFlex Current Probe	i2500-18

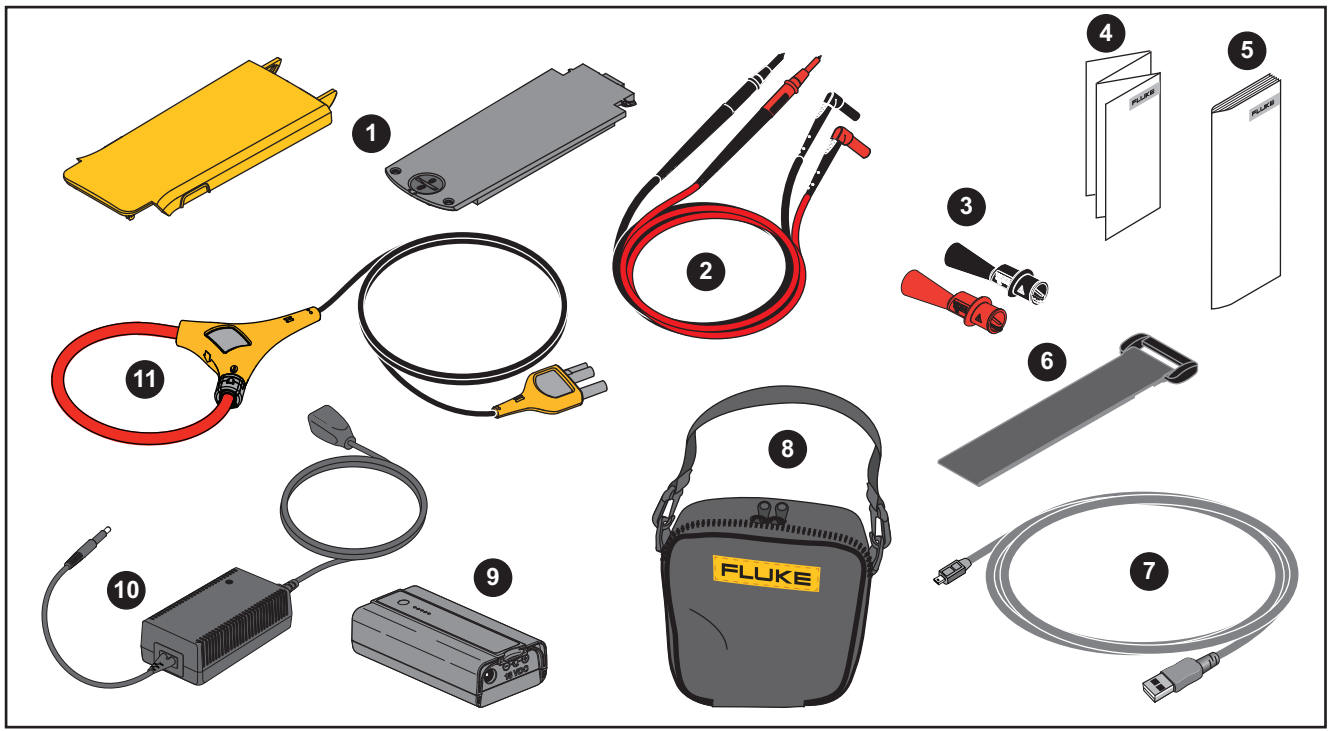


Figure 13. Accessories and Replacement Parts

Specifications

Maximum Voltage between any Terminal and Earth Ground ..... 1000 V

Temperature

- Operating ..... -10 °C to +50 °C
- Storage (without battery) ..... -20 °C to +60 °C

Display (LCD)

- Size ..... 8.9 cm (3.5 in.) diagonal
- Update rate 4/sec
- Volts, amps, ohms ..... 6000 counts
- Frequency ..... 10 000 counts
- Capacitance ..... 1000 counts

Battery (BP500) ..... Li-ion 7.4 V, 3000 mAh, customer-replaceable

- Discharge ..... -10 °C to +50 °C
- Charge ..... 0 °C to +40 °C
- Storage ..... -20 °C to +35 °C

Battery Life ..... 10 hours minimum

Relative Humidity ..... 0 % to 90 % (0 °C to 35 °C)
0 % to 75 % (35 °C to 40 °C)
0 % to 45 % (40 °C to 50 °C)

Battery Power Supply ..... Input 100-240 Vac (±) 10 %, 50/60 Hz. Output 15 Vdc, 2 A.

Altitude

- Operating ..... 2000 m
- Storage ..... 12 000 m

Temperature Coefficient ..... 0.1 X (specified accuracy) /°C (<18 °C or >28 °C)

Size (HxWxL) ..... 5.7 cm x 9.4 cm x 21.6 cm (2.3 in x 3.7 in x 8.5 in)
Weight ..... 0.80 kg (1.75 lb)
Safety
General ..... IEC 61010-1: Pollution Degree 2
Measurement ..... IEC61010-2-032: CAT IV 600 V / CAT III 1000 V
IEC61010-2-033: CAT IV 600 V / CAT III 1000 V
Li-ion Battery ..... IEC 62133
Electromagnetic Compatibility (EMC)
International ..... IEC 61326-1: Portable Electromagnetic Environment
CISPR 11: Group 1, Class A, IEC 61326-2-2
Group 1: Equipment has intentionally generated and/or uses conductively-coupled radio frequency energy that is necessary for the internal function of the equipment itself.
Class A: Equipment is suitable for use in all establishments other than domestic and those directly connected to a low-voltage power supply network that supplies buildings used for domestic purposes. There may be potential difficulties in ensuring electromagnetic compatibility in other environments due to conducted and radiated disturbances.
Emissions that exceed the levels required by CISPR 11 can occur when the equipment is connected to a test object.
Korea (KCC) ..... Class A Equipment (Industrial Broadcasting & Communication Equipment)
Class A: Equipment meets requirements for industrial electromagnetic wave equipment and the seller or user should take notice of it. This equipment is intended for use in business environments and not to be used in homes.
Wireless Radio with Adapter
Frequency Range ..... 2402 MHz to 2480 MHz
Output Power ..... <10 mW

Detailed Specifications

For all specifications: Accuracy is specified for 1 year after calibration, at operating temperatures of 18 °C to 28 °C, with relative humidity at 0 % to 90 %. Accuracy specifications take the form of ±([% of Reading] + [Number of least significant digits]).

AC Voltage Measurements

Range[1]	Resolution	Measurement[2][3][4]		
		45 Hz to 65 Hz	65 Hz to 200 Hz	200 Hz to 500 Hz
600.0 mV	0.1 mV	±(1.0 % + 3)		
6.000 V	0.001 V	±(1.0 % + 3)	±(4.0 % + 3)[5]	±(15.0 % + 3)[5]
60.00 V	0.01 V			
600.0 V	0.1 V			
1000 V	1 V			

[1] All ac voltage ranges are specified from 1 % of range to 100 % of range.
[2] Crest factor of ≤3 at 4000 counts, decreasing linearly to 1.5 at full scale.
[3] For non-sinusoidal waveforms, add –(2 % of reading + 2 % full scale) typical, for crest factor up to 3.
[4] Do not exceed 10^7 V-Hz.
[5] Full-time low-pass filter.

DC Voltage, Continuity, Resistance, Diode Test, and Capacitance Measurements

Function	Range	Resolution	Measurement
mV	600.0 mV	0.1 mV	0.09 % + 2
V	6.000 V	0.001 V	0.09 % + 2
	60.00 V	0.01 V	
	600.0 V	0.1 V	
	1000 V	1 V	0.15 % + 2
)))	600	1 Ω	Meter beeps at <25 Ω, beeper detects opens or shorts of 600 µs or longer.
Ω	600.0	0.1 Ω	0.5 % + 2
	6.000 kΩ	0.001 kΩ	0.5 % + 1
	60.00 kΩ	0.01 kΩ	
	600.0 kΩ	0.1 kΩ	
	6.000 MΩ	0.001 MΩ	
	50.00 MΩ	0.01 MΩ	1.5 % + 3
Diode Test	2.000 V	0.001 V	1 % + 2
⊣⊢	1000 nF	1 nF	1.2 % + 2
	10.00 µF	0.01 µF	
	100.0 µF	0.1 µF	
	9999 µF[1]	1 µF	10 % typical

[1] In the 9999 µF range for measurements to 1000 µF, the measurement accuracy is 1.2 % + 2.

AC Current with iFlex i2500

Range .....1.0 A ac to 2500 A ac

Resolution

1.0 A to 999.9 A .....0.1 A

1000 A to 2500 A .....1 A

Measurement .....3 % ±5 digits (45 Hz to 500 Hz)

Crest Factor (50 Hz/60 Hz) add 2 % for C.F. >2

1100 A.....3.0

1400 A.....2.5

2500 A.....1.42

Frequency Measurement

Range	Resolution	Measurement [1]
99.99 Hz	0.01 Hz	0.1 % + 1
999.9 Hz	0.1 Hz	0.1 % + 1

[1] Frequency is specified up to 500 Hz.
Minimum sensitivity:
- 5 % of range in V ac and V dc to 500 Hz
- 2 Amps in A ac

Input Characteristics

Function	Overload Protection	Input Impedance (nominal)	Common Mode Rejection Ratio (1 kΩ unbalance)		Normal Mode Rejection
V⎓	1100 V rms	>10 MΩ <100 pF	>120 dB at dc, 50 Hz or 60 Hz		>60 dB at 50 Hz or 60 Hz
V~	1100 V rms	>10 MΩ <100 pF	>60 dB, dc to 60 Hz		
mV~	1100 V rms	>10 MΩ <100 pF	>120 dB at dc, 50 Hz or 60 Hz		>60 dB at 50 Hz or 60 Hz
		Open Circuit Test Voltage	**Full Scale Voltage**		**Typical Short Circuit Current**
			To 6 MΩ	**50 MΩ**	
Ω / ⊣⊢	1100 V rms	<2.7 V dc	<0.7 V dc	<0.9 V dc	<350 µA
ıı)) / ⊣▶	1100 V rms	<2.7 V dc	2.000 V dc		<1.1 mA

MIN MAX Recording

Function	Measurement
DC Functions	The specified accuracy of the measurement function ±12 counts for changes >350 ms in duration.
AC Functions	The specified accuracy of the measurement function ±40 counts for changes >900 ms in duration.

Infrared Camera

Temperature

Temperature Measurement Range	-10 °C to +200 °C
Temperature Measurement Accuracy	±5 °C or ±5 %, whichever is greater, at 25 °C (Ambient) for target temperatures below 20 °C, add 0.05 °C for each degree °C.
Temperature Coefficient	0.2 °C or 0.2 %, whichever is greater, for each °C from 25 °C
Emissivity	0.95 fixed

Image Performance

Image Capture Frequency	8 Hz
Detector Type	Uncooled Vanadium Oxide
Thermal Sensitivity (NETD)	≤200 mK
Infrared Spectral Band	7.5 µm to 14 m
IR Image Resolution	102 x 77
Field of View	36 ° (w) x 27 ° (h)
Focus Mechanism	Fixed focus
Distance-to-Spot	162:1

Image Presentation

Palette	Ironbow
Level and Span	Auto

Image Capture and Data Storage

Image Capture	Image available for review before a save
Storage Medium	Internal memory, stores up to 100 images
Image Transfer	Fluke Connect™ / SmartView®
File Format	is2