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**FLUKE®**

# **1587 FC/1587/1577**

Insulation Multimeter

**Users Manual**

April 2005 Rev.3, 9/15

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## ***Introduction***

The Fluke 1587 FC, 1587, 1587T, and 1577 are battery-powered, true-RMS insulation multimeters (the Product or Meter) with a 6000-count display. Although this manual describes the operation of all models, all illustrations and examples assume use of Model 1587 FC.

The Meter measures or tests:

- AC / DC voltage and current
- Resistance
- Continuity
- Insulation resistance
- Voltage and current frequency
- Diodes (all 1587 models)
- Temperature (all 1587 models)
- Capacitance (all 1587 models)

The 1587 FC supports the Fluke Connect™ Wireless System (may not be available in all regions). Fluke Connect™ is a system that wirelessly connects your Meter with an app on your smartphone or tablet. The app shows the Meter measurement on your smartphone or tablet screen. You can save these measurements with Fluke Connect™ to share with your team.

More information about how to use Fluke Connect is on page 30.

## Contacting 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](http://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. See Table 1 for a list of symbols used on the Meter and in this manual.

### Warning

**To prevent possible electric shock, fire, or personal injury:**

- **Read all safety information before you use the Product**
- **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 test leads if they are damaged. Examine the test leads for damaged insulation and measure a known voltage.**
- **Do not use the Meter around explosive gas, vapor, or in damp or wet environments.**
- **Do not touch voltages >30 V ac rms, 42 V ac peak, or 60 V dc.**
- **Only use probes, test leads, and accessories that have the same measurement category, voltage, and amperage ratings as the Product.**

















- **Keep fingers behind the finger guards on the probes.**
- **Do not exceed the Measurement Category (CAT) rating of the lowest rated individual component of a Product, probe, or accessory.**
- **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.**
- **Do not work alone.**
- **Do not apply more than the rated voltage between the terminals or between each terminal and earth ground.**
- **Limit operation to the specified measurement category, voltage, or amperage ratings.**
- **Use Product-approved measurement category (CAT), voltage, and amperage rated accessories (probes, test leads, and adapters) for all measurements.**
- **Measure a known voltage first to make sure that the Product operates correctly.**
- **Use the correct terminals, function, and range for measurements.**
- **Measure for hazardous voltage without the Low-Pass Filter.**
- **Do not use the Product if it operates incorrectly.**
- **Replace the battery when the low battery indicator () shows to prevent incorrect measurements.**
- **Remove the batteries if the Product is not used for an extended period of time, or if stored in temperatures >50 °C. If the batteries are not removed, battery leakage can damage the Product.**
- **The battery door must be closed and locked before you operate the Product.**
- **Remove all probes, test leads, and accessories before the battery door is opened.**
- **Do not use the Product if it is damaged.**
- **Disable the Product if it is damaged.**

Table 1. Symbols

Symbol	Description	Symbol	Description
	WARNING.RISK OF DANGER.		WARNING. HAZARDOUS VOLTAGE. Risk of electric shock.
	Consult user documentation.		Battery (Low battery when shown on display.)
	AC (Alternating Current)		Earth
	DC (Direct Current)		Fuse
	Double Insulated		Conforms to relevant South Korean EMC Standards.
	Conforms to relevant Australian EMC standards.		Certified by CSA Group to North American safety standards.
	Conforms to European Union directives.		Certified by TÜV SÜD Product Service.
<b>CAT II</b>	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.		
<b>CAT III</b>	Measurement Category III is applicable to test and measuring circuits connected to the distribution part of the building's low-voltage MAINS installation.		
<b>CAT IV</b>	Measurement Category IV is applicable to test and measuring circuits connected at the source of the building's low-voltage MAINS installation.		
	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.		

## Unpack List

Table 2 is a list of accessories included with your Product.

**Table 2. Unpack List**

Accessory	Model	
	1587, 1587T, 1587 FC	1577
Leads	TL224	TL224
Probes	TP74	TL74
Clips	AC285	AC285
Holster	Yes	Yes
Hard Case	Yes	Yes
K Type Thermocouple	Yes	No
Remote Probe	Yes	Yes

## Accessories

Table 3 is list of optional accessories that are available for the Product.

**Table 3. Accessories**

Accessory	Part Number
ToolPak™ Magnetic Meter Hanger Kit	go to <a href="http://www.fluke.com/tpak">www.fluke.com/tpak</a>
AC 400A Clamp	I400

## **Hazardous Voltage**

To alert you to the presence of a potentially hazardous voltage, when the Meter detects a voltage  $\geq 30$  V or a voltage overload (OL), the  $\text{⚡}$  symbol is displayed.

## **Test Lead Alert**

To remind you to check that the test leads are in the correct terminals, LEAd shows momentarily when you move the rotary switch to or from the  $\frac{\infty}{\text{mA}}$  position.

### **⚠⚠ Warning**

**To prevent possible electric shock, fire, or personal injury, use the correct terminals, function, and range for measurements.**

## **Battery Saver (Sleep Mode)**





The Meter enters "Sleep mode" and blanks the display if there is no function change or button press for 20 minutes. This is done to conserve battery power. The Meter comes out of Sleep mode when a key is pressed or when the rotary switched is turned.

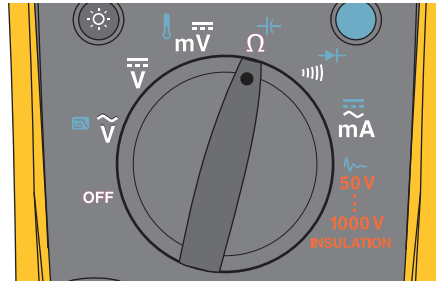
To disable Sleep mode, hold down the blue button while you turn on the Meter. Sleep mode is always disabled in the MIN MAX AVG recording mode, AutoHold mode, or when the insulation test is active.

## Rotary Switch Positions

Turn the Meter on by selecting any measurement function. The Meter presents a standard display for that function (range, measurement units, modifiers, etc.). Use the blue button to select any rotary switch alternate functions (labelled with blue letters). Rotary switch selections are shown and described in Table 4.

**Table 4. Rotary Switch Selections**







Switch Position	Measurement Function	1587 FC	1587	1587T	1577
	AC voltage from 30.0 mV to 1000 V.	●	●	●	●
	AC voltage with 800 Hz VFD low-pass filter.	●	●	●	
	DC voltage 1 mV to 1000 V.	●	●	●	●
	DC mV 0.1 mV to 600 mV.	●	●	●	●



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Table 4. Rotary Switch Selections (cont.)

Switch Position	Measurement Function	1587 FC	1587	1587T	1577
	Temperature from - 40 °C to + 537 °C (- 40 °F to + 998 °F). Celsius is the default temperature measurement unit. The temperature measurement you select is retained in memory when the Meter is turned off.	●	●	●	
$\Omega$	Ohms from 0.1 $\Omega$ to 50 M $\Omega$ .	●	●	●	●
	Capacitance from 1 nF to 9999 $\mu$ F.	●	●	●	
	Continuity test. Beeper turns on at <25 $\Omega$ and turns off at >100 $\Omega$ .	●	●	●	●
	Diode test. There is no ranging in this function. Displays $\Omega$ above 6.600 V.	●	●	●	
	AC mA from 3.00 mA to 400 mA (600 mA overload for 2 minutes maximum). DC mA from 0.01 mA to 400 mA (600 mA overload for 2 minutes maximum).	●	●	●	●
 INSULATION	Ohms from 0.01 M $\Omega$ to 2 G $\Omega$ . The last selected output voltage setting is retained in memory when the Meter is turned off.	●	●	●	
	Ohms from 0.01 M $\Omega$ to 600 M $\Omega$ . The last selected output voltage setting is retained in memory when the Meter is turned off.				●
	Performs insulation test with: 50 V, 100 V, 250 V, 500 V (default), and 1000 V source	●	●		
	500 V (default) and 1000 V source				●
	50 V (default) and 100 V source			●	
	Press the blue button to activate smoothing during insulation testing.	●	●	●	

## Buttons

Use the buttons to activate features that augment the function selected with the rotary switch. The buttons are shown and described in Table 5.

**Table 5. Buttons**

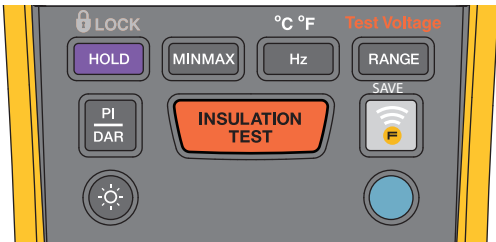











		1587 FC	1587	1587T	1577
Button	Description				
<b>HOLD</b>	<p>Press to freeze the displayed value. Press again to release the display.</p> <p>When a reading changes, the display updates and the Meter beeps.</p> <p>In Insulation Test mode, this schedules a test lock the next time you press  on the Meter or on the remote probe. The test lock acts to hold down the button until your press  or  again to release the lock.</p> <p>In MIN MAX AVG or Hz mode, this button is the display hold.</p>	●	●	●	●
<b>MINMAX</b>	<p>Press to start retaining maximum, minimum, and average values. Press successively to display maximum, minimum, average, and present values. Press and hold to cancel MIN MAX AVG.</p>	●	●	●	
<b>Hz</b>	<p>Activate frequency measurement.</p> <p>Toggles between degrees C and degrees F.</p>	●	●	●	

Table 5. Buttons (cont.)

Button	Description	1587 FC	1587	1587T	1577
	Changes Ranging mode from Auto (default) to Manual Ranging mode. Switches between available ranges in a function. Press and hold to return to Auto Ranging mode. In Insulation Test mode, switches between available source voltages.	●	●	●	●
	Toggles between degrees C and degrees F.		●	●	
	Turns the backlight on and off. The backlight goes off after two minutes.	●	●	●	●
	Initiates an insulation test when the rotary switch is on the <b>INSULATION</b> position. Causes the Meter to source (output) a high voltage and measure insulation resistance.	●	●	●	●
	The blue button functions as a shift key. Press to access blue functions on the rotary switch.	●	●	●	●
	Configures the Tester for a polarization index (PI) or dielectric absorption ratio test (DAR). Press to configure for PI mode, press again to configure for DAR mode. The test starts when you press the  .	●			
	<ul style="list-style-type: none"> <li>Turn on the radio and set the Product to the module mode.  shows in the display when the radio is on.</li> <li>When used with the Fluke Connect App on your smart device, saves a measurement to the Fluke Connect app.</li> <li>Press &gt;2 s. to turn off the radio and exit the module mode.</li> </ul>	●			

## Display

Display indicators are shown and described in Table 6. Error messages that may appear on the display are described in Table 7.

### ⚠⚠ Warning

To prevent possible electric shock or personal injury, replace the battery when the low battery indicator (🔋) shows to prevent incorrect measurements.

Table 6. Display Indicators

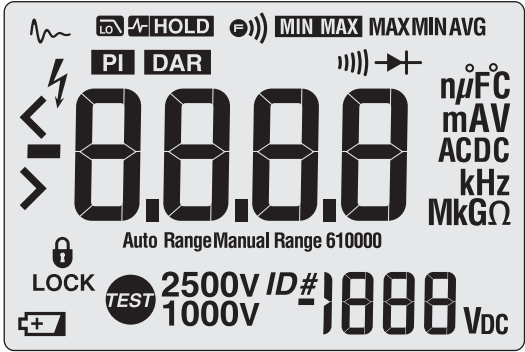















		Model			
		1587 FC	1587	1587T	1577
					
Indicator	Description				
	Low battery. Time to replace the battery. When 🔋 is on, the backlight button is disabled to conserve battery life. 1587 FC model: module mode is disabled when the battery is low.	●	●	●	●
 LOCK	Indicates a test lock will be applied the next time you press  on the Meter or on the remote probe. The test lock acts to hold down the button until you press  or  again.	●	●	●	●
< - >	Less than, minus, or greater than symbols	●	●	●	●

Table 6. Display Indicators (cont.)

Indicator	Description	1587 FC	1587	1587T	1577
	Hazardous voltage warning. Indicates 30 V or greater (ac or dc depending on the rotary switch position) is detected on the input. Also appears when the display shows $\overline{UL}$ in the $\tilde{V}$ , $\overline{V}$ , or $m\overline{V}$ switch positions, and when $\overline{batt}$ appears on the display. The $\overline{L}$ also appears when insulation test is active, or in Hz.	●	●	●	●
	“Smoothing” enabled. Smoothing dampens display fluctuations of rapidly changing inputs by digital filtering. Smoothing is available for insulation testing on 1587 models only. For more on smoothing, see <i>Power-Up Options</i> .	●	●	●	
	Indicates the VFD low-pass filter function for ac volts is selected.	●	●	●	
 <b>HOLD</b>	Indicates AutoHold is active.	●	●	●	●
 <b>HOLD</b>	Indicates display hold is active.				
 <b>MIN MAX</b> <b>MAX MIN AVG</b>	Indicates minimum, maximum, or average reading has been selected using the  button.	●	●	●	
	Continuity test function is selected.	●	●	●	●
	Diode test function is selected.	●	●	●	
nF, $\mu$ F, °C, °F, AC, DC, V, mV, mA, Hz, kHz, $\Omega$ , k $\Omega$ , M $\Omega$ , G $\Omega$	Measurement units.	●	●	●	●
	Primary display.	●	●	●	●
V <sub>DC</sub>	Volts source for Insulation test.	●	●	●	●

**Table 6. Display Indicators (cont.)**







Indicator	Description	1587 FC	1587	1587T	1577
1000	Secondary display for insulation test voltage.	●	●	●	●
<b>Auto Range</b> <b>Manual Range</b> 610000	Display range in use.	●	●	●	●
2500V 1000V	Source voltage rating for insulation test: 50, 100, 250, 500 (default) or 1000 V on the 1587. 500 (default) and 1000 V ranges available on the 1577. 50 (default) and 100 V on the 1587T.	●	●	●	●
	Insulation test indicator. Appears when insulation test voltage is present.	●	●	●	●
	Shows the Product is in PI or DAR mode.	●			
	Shows that the radio is enabled.	●			
<b>ID#</b>	When the Product is discovered by a Fluke Connect device, an ID number is shown on the secondary display. The ID number also shows on the Fluke Connect device with the Product's model number.	●			



Table 7. Error Messages

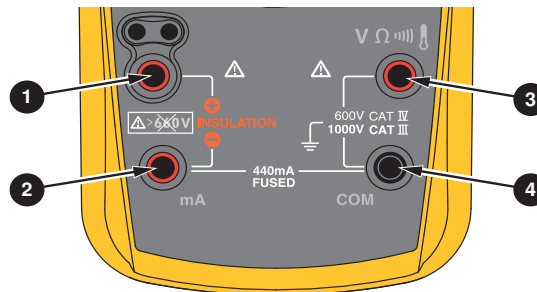
Message	Description
batt	Appears on the primary display and indicates that the battery is too low for reliable operation. The Meter will not operate at all until the battery is replaced. The  also appears when batt is on the primary display.
batt	Appears on the secondary display and indicates that the battery is too low to perform an insulation test. The  button is disabled until the battery is replaced. This message disappears when the rotary switch is turned to any other function.
OPEN	Appears when an open thermocouple is detected.
LEAD	Test lead alert. The message appears briefly and a single beep will sound when you move the switch in or out of the  position.
IS-- Err	Model detect error. Service Meter if this is displayed.
dsc	Meter cannot discharge a capacitor.
EPPr Err	Invalid EEPROM data. Have the Meter serviced.
CAL Err	Invalid calibration data. Calibrate the Meter.

## Input Terminals

Input terminals are shown and described in Table 8.

Table 8. Input Terminal Descriptions

Item	Description
①	 input terminal for insulation test.
②	 input terminal for insulation test. Use for ac and dc milliamp measurements to 400 mA and current frequency measurements.
③	1577: input terminal for voltage, continuity, resistance 1587: input terminal for voltage, continuity, resistance, diode, capacitance, voltage frequency, and temperature measurements.
④	Common (return) terminal for all measurements except insulation test.



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## Power-Up Options

Holding a button down while turning the Meter on activates a power-up option. Power-up options allow you to use additional features and functions of the Meter. To select a power-up option, hold down the appropriate button indicated while turning the Meter from **OFF** to any switch position. Power-up options are cancelled when the Meter is turned **OFF**. Power-up options are described in Table 9.

*Note*

*Power Up options are active when the button is pressed.*

**Table 9. Power-Up Options**

Button	Description
<b>HOLD</b>	$\tilde{V}$ (V ac and mA ac) switch position turns on all LCD segments.
	$\bar{V}$ (V dc) switch position displays the software version number.
	m $\bar{V}$ (mV) switch position displays the model number.
	$\Omega^{\dagger}$ (Ohms/Capacitance) switch position turns on the backlight and the radio LED.
	$\text{    }^{\dagger}$ (Continuity/Diode) switch position starts the Calibration Mode. The Meter shows $\square$ and enters the Calibration Mode when you release the button.
	<b>INSULATION</b> switch position initiates a fully loaded battery test and displays the charge level of the battery until the button is released.
	Enables "Smoothing" mode for all of the functions except insulation. The display shows 5--- until the button is released. Smoothing dampens display fluctuations of rapidly changing inputs by digital filtering.
 (Blue)	Disables automatic power-off ("Sleep mode"). Display shows P <sub>o</sub> FF until you release the button. Sleep mode is also disabled while the Meter is in a MIN MAX AVG Recording mode, AutoHold mode, and when performing an insulation test.
	Disables the beeper. The display shows bEEP until you release the button.
	Disables the automatic backlight timeout. Display shows L <sub>o</sub> FF until you release the button.



## AutoHold Mode

### Warning

**To prevent electrical shock, do not use the Display AutoHold mode to determine if a circuit is live. Unstable or noisy readings will not be captured.**

In the AutoHold mode, the Meter holds the reading on the display until it detects a new stable reading. Then the Meter beeps and displays the new reading.

- Press **HOLD** to activate AutoHold. **A-HOLD** shows on the display.
- Press **HOLD** again or turn the rotary switch to resume normal operation.

## MIN MAX AVG Recording Mode

The MIN MAX AVG mode records minimum and maximum input values. The Meter beeps and records a new value when the inputs go below the recorded minimum value, or above the recorded maximum value. This mode can be used to capture intermittent readings, record maximum readings while you are away or record readings while you are operating the equipment under test and cannot watch the Meter. MIN MAX AVG mode can also calculate an average of all readings taken since the MIN MAX AVG mode was activated.

The Meter tracks the minimum, maximum, and average values for each display which are updated 4 times per second.

To use MIN MAX AVG recording:

- Make sure the Meter is in the desired measurement function and range. (Autoranging is disabled in the MIN MAX AVG mode).
- Press **MINMAX** to activate MIN MAX AVG mode. **MIN MAX** shows on the display.
- Press **MINMAX** to step through the high (MAX), low (MIN), average (AVG), and present readings.
- To pause MIN MAX AVG recording without erasing stored values, press **HOLD**. **HOLD** shows on the display.
- To resume MIN MAX AVG recording, press **HOLD** again. **HOLD** turns off.
- To exit and erase stored readings, press **MINMAX** for one second or turn the rotary switch.

## Manual Ranging and Auto Ranging

The Meter has both Manual Range and Auto Range modes.

- In the Auto Range mode, the Meter selects the range with the best resolution.
- In the Manual Range mode, you override Auto Range and select the range yourself.

When you turn the Meter on, it defaults to Auto Range and **Auto Range** is shown.

1. To enter the Manual Range mode, press **RANGE**. **Manual Range** is shown.
2. In the Manual Range mode, press **RANGE** to increment the range. After the highest range, the Meter wraps to the lowest range.

### *Note*

*You cannot manually change the range in the MIN MAX AVG, or Display HOLD modes.*

*If you press **RANGE** while in MIN MAX AVG, or Display HOLD the Meter beeps twice, indicating an invalid operation and the range does not change.*

3. To exit Manual Range, press **RANGE** for one second or turn the rotary switch. The Meter returns to Auto Range and **Auto Range** is shown.

## AC Zero Input Behavior of True RMS Meters

True RMS Meters accurately measure distorted waveforms, but when the input leads are shorted together in the AC functions, the Meter displays a residual reading between 1 and 30 counts. When the test leads are open, the display readings may fluctuate due to interference. These offset readings are normal. They do not affect the Meter's ac measurement accuracy over the specified measurement ranges.

Unspecified input levels are:

- AC voltage: below 5 % of 600 mV ac, or 30 mV ac.
- AC current: below 5 % of 60 mA ac, or 3 mA ac.

## VFD Low-Pass Filter (all 1587 Models)

The 1587 is equipped with an ac low-pass filter to measure the output of variable frequency motor drives (VFD). For ac voltage or ac frequency ( $\tilde{v}$ ) measurements, press the blue button to activate the Low-Pass Filter function (**LPF**). The Meter continues measuring in the selected ac mode, but now the signal diverts through a filter that blocks unwanted frequencies above 800 Hz. Refer to Figure 1. The low pass filter can improve measurement performance on composite sine waves that are typically generated by inverters and variable frequency motor drives.