

FLUKE®

1508

Insulation Tester

Users Manual

June 2005 Rev. 1, 2/09

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1508

Insulation Testers

Introduction

The Fluke model 1508 is a battery-powered insulation tester (hereafter, "the Tester"). This Tester meet CAT IV IEC 61010 standards. The IEC 61010 standard defines four measurement categories (CAT I to IV) based on the magnitude of danger from transient impulses. CAT IV Testers are designed to protect against transients from the primary supply level (overhead or underground utility service).

The Tester measures or tests the following:

- AC / DC Voltage
- Earth-Bond Resistance
- Insulation Resistance

Contacting Fluke

To contact Fluke, call:

1-888-993-5853 in USA
1-800-363-5853 in Canada
+31-402-678-200 in Europe
+81-3-3434-0181 in Japan
+65-738-5655 in Singapore
+1-425-446-5500 from anywhere in the world

Visit Fluke's web site at: www.fluke.com

Register your Tester at: register.fluke.com

Safety Information

Use the Tester only as specified in this manual. Otherwise, the protection provided by the Tester may be impaired. See Table for a list of symbols used on the Tester and in this manual.

A  **Warning** identifies hazardous conditions and actions that could cause bodily harm or death.

A  **Caution** identifies conditions and actions that could damage the Tester, the equipment under test, or cause permanent loss of data.

Warning

To avoid possible electric shock or personal injury, follow these guidelines:

- Use the Tester only as specified in this manual or the protection provided by the Tester might be impaired.
- Do not use the Tester or test leads if they appear damaged, or if the Tester is not operating properly. If in doubt, have the Tester serviced.
- Always use the proper terminal, switch position, and range for measurements before connecting Tester to circuit under test.
- Verify the Tester's operation by measuring a known voltage.
- Do not apply more than the rated voltage as marked on the Tester, between the terminals or between any terminal and earth ground.
- Use caution with voltages above 30 V ac rms, 42 V ac peak, or 60 V dc. These voltages pose a shock hazard.
- Replace the battery as soon as the low battery indicator () appears.
- Disconnect circuit power and discharge all high-voltage capacitors before testing resistance, continuity, diodes, or capacitance.
- Do not use the Tester around explosive gas or vapor.
- When using the test leads, keep your fingers behind the finger guards.

- **Remove test leads from the Tester before opening the Tester case or battery door. Never operate the Tester with the cover removed or the battery door open.**
- **Comply with local and national safety requirements when working in hazardous locations.**
- **Use proper protective equipment, as required by local or national authorities when working in hazardous areas.**
- **Avoid working alone.**
- **Use only the replacement fuse specified or the protection may be impaired.**
- **Check the test leads for continuity before use. Do not use if the readings are high or noisy.**

Table 1. Symbols

	AC (Alternating Current)		Earth Ground
	DC (Direct Current)		Fuse
	WARNING: risk of electric shock		Double Insulated
	Battery (Low battery when shown on display)		Important information; see manual

Unsafe Voltage

To alert you to the presence of a potentially hazardous voltage, when the Tester detects a voltage ≥ 30 V in insulation test, ≥ 2 V in resistance, or a voltage overload (OL), the f symbol is displayed.

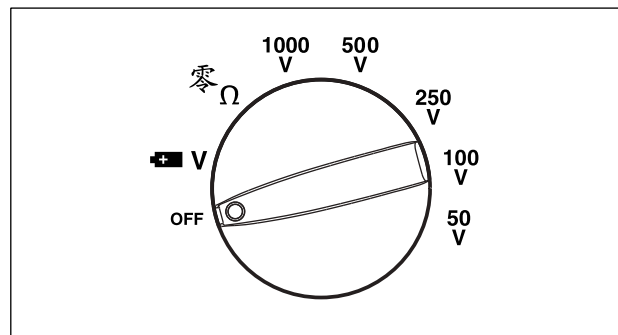
Battery Saver (Sleep Mode)

The Tester enters the "Sleep mode" and blanks the display if there is no function change or button press for 10 minutes. This is done to conserve battery power. The Tester comes out of Sleep mode when a key is pressed or when the rotary switch is turned.

The 10-minute timer is disabled during any insulation resistance or earth-bond resistance measurement. The time period starts immediately following any measurement.

Rotary Switch Positions

Turn the Tester on by selecting any measurement function. The Tester 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 in Figure and described in Table .



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Figure 1. Rotary Switch

Table 2. Rotary Switch Selections

Switch Position	Measurement Function
 V	AC or DC voltage from 0.1 V to 600.0 V.
零 Ω	Ohms from 0.01 Ω to 20.00 k Ω .
1000 V 500 V 250V 100V 50V	Ohms from 0.01 M Ω to 10.0 G Ω . Performs insulation tests with 50, 100, 250, 500 and 1000 V.

⚠ ⚠ Warning

To avoid shock, injury, or damage to the Tester, use only accessories with 1000 V CAT III or 600 V CAT IV rating.

Buttons and Indicators

Use the buttons to activate features that augment the function selected with the rotary switch. There are also two indicators on the front of the Tester which light up when active. The buttons and indicators are shown in Figure and described in Table .

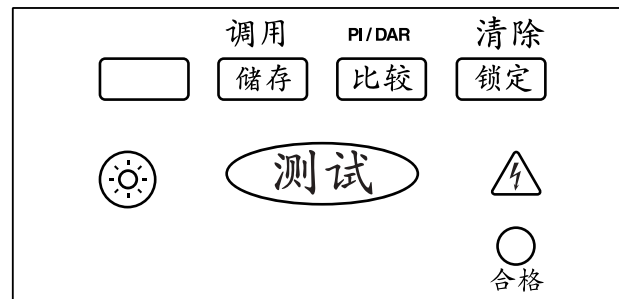


Figure 2. Buttons and Indicators

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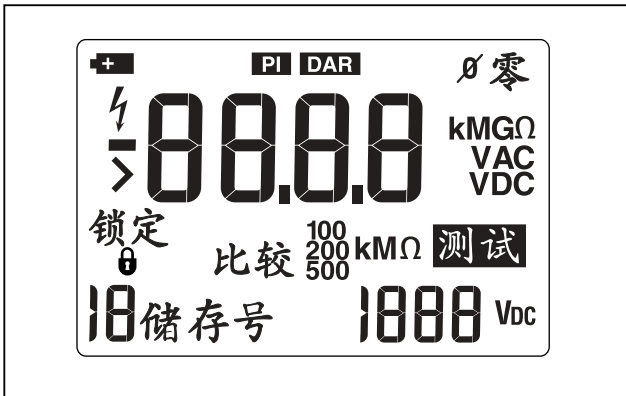
Table 3. Buttons and Indicators

Button/ Indicator	Description
	Press the blue button to select alternate measurement functions.
	Saves the last insulation or earth-bond measurement.
	Shifted function. Retrieves any measurements stored in memory.
	Sets a pass/fail limit for insulation tests.
	Shifted function. Press to configure the Tester for a polarization index or dielectric absorption ratio test. The test will start when you press the  button.
	Test lock. When pressed before  button, the test remains active until you press the lock or test button again to release the lock.
	Shifted function. Clears all memory locations.

Button/ Indicator	Description
	Turns the backlight on and off. The backlight goes off after 2 minutes.
	Initiates an insulation test when the rotary switch is an INSULATION position. Causes the Tester to source (output) a high voltage and measure insulation resistance. Initiates a resistance test when the rotary switch is in the ohms position.
	Unsafe 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 OL in the + V switch positions, and when batt appears on the display. The  also appears when insulation test is active.
	Pass indicator. Indicates when the insulation resistance measurement is greater than the selected compare limit.

Understanding the Display

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



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Figure 3. Display Indicators

Table 4. Display Indicators

Indicator	Description
锁定 0	Indicates an insulation or resistance test is locked on.
- >	Minus or greater than symbols
⚡	Unsafe voltage warning.
+	Low battery. Indicates when it is time to replace the battery. When + is on, the backlight button is disabled to conserve battery life. ⚠ ⚠ Warning To avoid false readings, which could lead to possible electric shock or personal injury, replace the battery as soon as the low battery indicator appears.

Table 5. Display Indicators (cont.)

Indicator	Description
PI DAR	Polarization index or dielectric absorption ratio test is selected.
0 零	Ohms lead zero is active.
VAC, VDC, Ω , k Ω , M Ω , G Ω	Measurement units
8888	Primary display
测试	Insulation test indicator. Appears when insulation test voltage is present.
V _{DC}	Volts
1888	Secondary display
比较	Indicates selected pass/fail compare value.
18 储存号	Storage memory location.

Table 5. Error Messages

Message	Description
batt	Appears on the primary display and indicates that the battery is too low for reliable operation. The Tester will not operate at all until the battery is replaced. The + also appears when batt is on the primary display.
>	Indicates an out of range value.
CAL Err	Invalid calibration data. Calibrate the Tester.

Input Terminals

Input terminals are shown in Figure and described in Table .

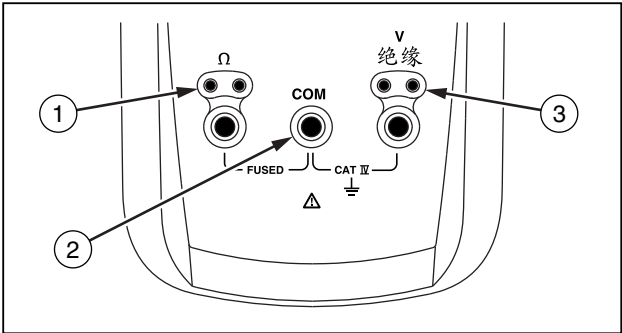


Figure 4. Input Terminals

Table 6. Input Terminal Descriptions

Item	Description
①	Input terminal for resistance measurement.
②	Common (return) terminal for all measurements.
③	Input terminal for volts or insulation test.

Power-Up Options

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

Table 7. Power-Up Options

Button	Description
	 V switch position turns on all LCD segments.  Ω switch position displays the software version number.  $1000V$ switch position displays the model number.
	Starts the Calibration mode. The Tester displays $\square RL$ and enters Calibration mode when the button is released.

Note

Power Up options are active when the button is pressed.

Making Measurements

The figures on the following pages show how to make measurements.

When connecting the test leads to the circuit or device, connect the common (**COM**) test lead before connecting the live lead; when removing the test leads, remove the live lead before removing the common test lead.

Warning

To avoid electric shock, injury, or damage to the Tester, disconnect circuit power and discharge all high-voltage capacitors before testing.

Measuring Volts

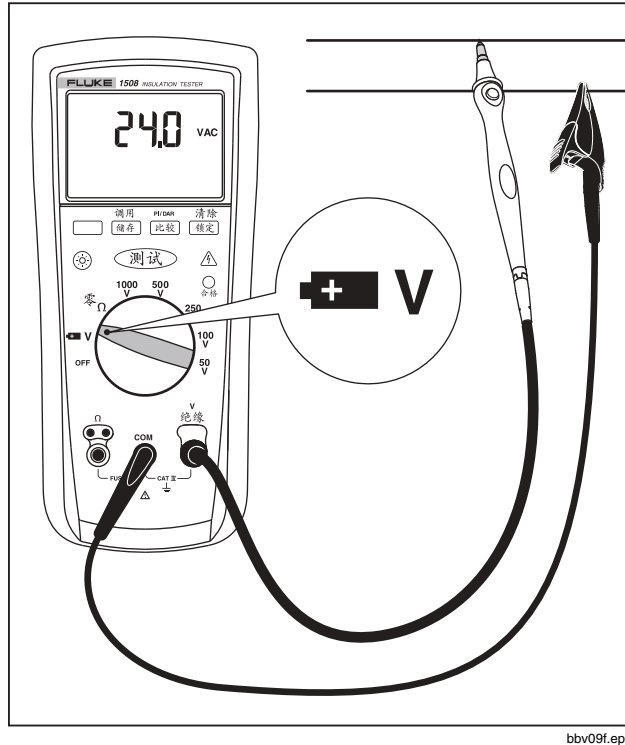


Figure 5. Measuring Volts

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Measuring Earth-Bond Resistance

Resistance tests should only be performed on de-energized circuits. Check the fuse before testing. See Testing the Fuse later in this manual. Connecting to an energized circuit while the test is active will blow the fuse.

Note

Measurements can be adversely affected by impedances of additional operating circuits connected in parallel or by transient currents.

To measure resistance:

1. Insert test probes in the Ω and com input terminals.
2. Turn the rotary switch to the Ω position.
3. Short the ends of the probes together, press the blue button and wait until dashes appear on the display. The Tester measures the probe resistance, stores the reading in memory, and subtracts it from readings. The probe resistance reading is saved even when the Tester is turned off. If the probe resistance is $>2 \Omega$, the resistance will not be saved.
4. Connect the probes to the circuit to be measured. The Tester automatically detects if the circuit is energized.

- The primary display shows ---- until you press the **测试** button and a valid resistance reading is obtained.
 - The high voltage symbol (⚡) along with a primary display of >2 V warns if voltage greater than 2 V ac or dc is present. In this condition, the test is inhibited. Disconnect the Tester and remove power before proceeding.
 - If the Tester chirps when you press the **测试** button, the test is inhibited because voltage is present at the probes.
5. Push and hold the **测试** button to start the test. The **测试** icon appears on the lower portion of the display until you release the **测试** button. The resistance reading appears on the primary display until a new test is started or a different function or range is selected.

When resistance is higher than the maximum display range, the Tester displays the > symbol and the maximum resistance for the range.

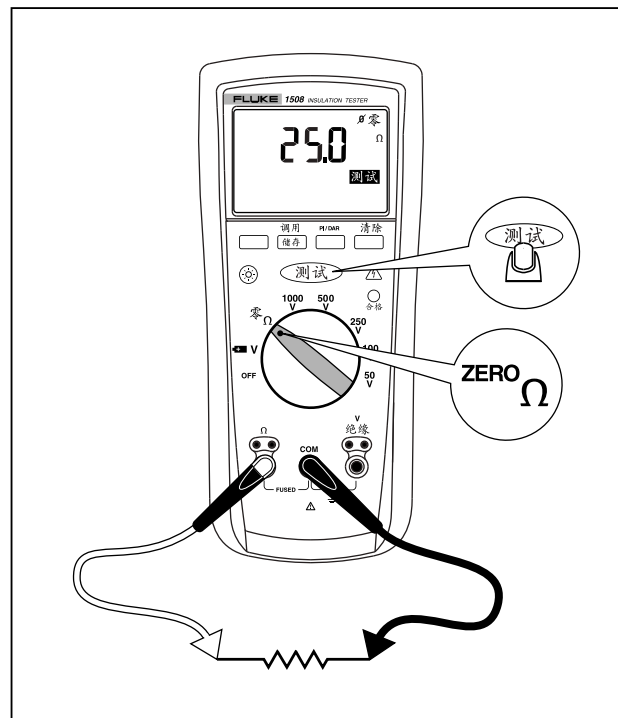


Figure 6. Measuring Earth-Bond Resistance

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Measuring Insulation Resistance

Insulation tests should only be performed on de-energized circuits. To measure insulation resistance set up the Tester as shown in Figure and follow the steps below:

1. Insert test probes in the v and com input terminals.
2. Turn the rotary switch to the desired test voltage.
3. Connect the probes to the circuit to be measured. The Tester automatically detects if the circuit is energized.
 - The primary display shows - - - until you press  and a valid insulation resistance reading is obtained.
 - The high voltage symbol () along with a primary display of >30 V warns if voltage more than 30 V ac or dc is present. In this condition, the test is inhibited. Disconnect the Tester and remove power before proceeding.
5. Push and hold  to start the test. The secondary display shows the test voltage applied to the circuit under test. The high voltage symbol () along with a primary display showing the resistance in M Ω or G Ω appears. The  icon appears on the lower portion of the display until  is released.

When resistance is higher than the maximum display range, the Tester displays the  symbol and the maximum resistance for the range.
6. Keep the probes on the test points and release the  button. The circuit under test then discharges through the Tester. The resistance reading appears on the primary display until a new test is started or a different function or range is selected or > 30 V is detected.

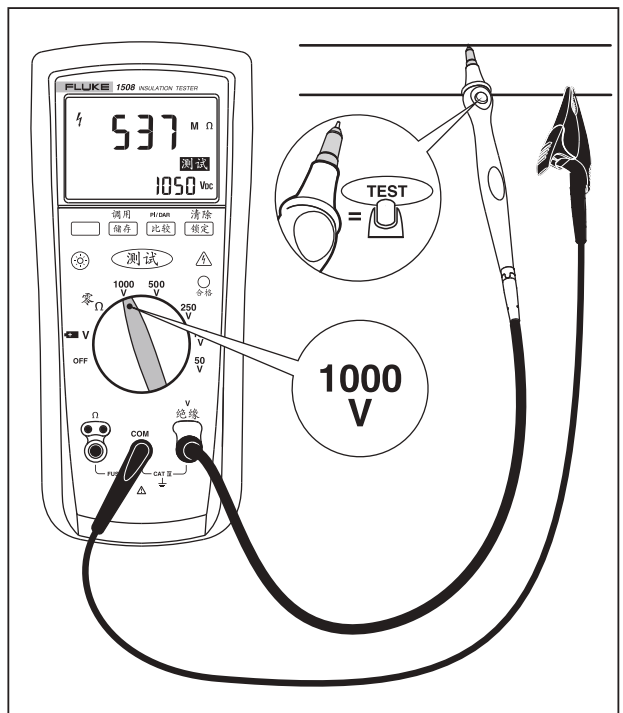


Figure 7. Measuring Insulation Resistance

Measuring Polarization Index and Dielectric Absorption Ratios

Polarization Index (PI) is the ratio of the 10-minute insulation resistance to the 1-minute insulation resistance. Dielectric Absorption Ratio (DAR) is the ratio of the 1-minute insulation resistance to the 30 second insulation resistance.

Insulation tests should only be performed on de-energized circuits. To measure the polarization index or dielectric absorption ratio:

1. Insert test probes in the **V** and **com** input terminals.

Note

Because of the time required to perform the PI and DAR tests, use of test clips is recommended.

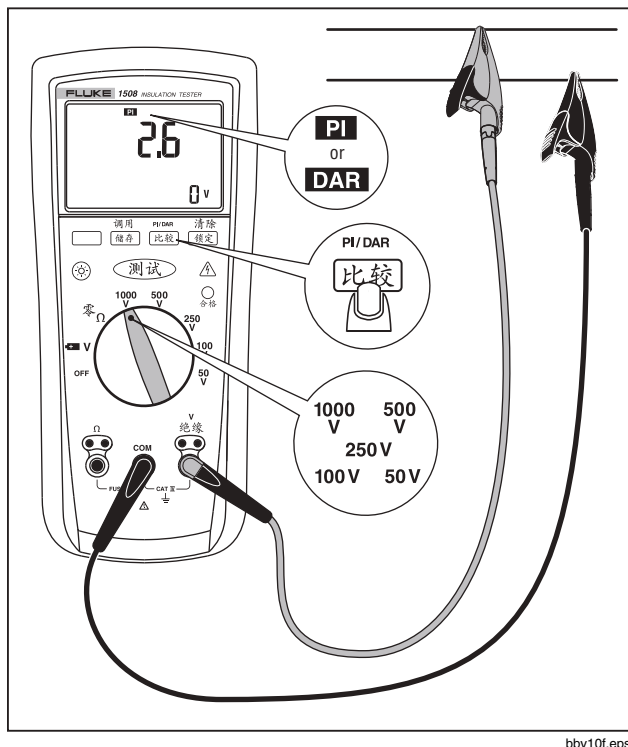
2. Turn the rotary switch to the desired test voltage position.
3. Press the buttons to select polarization index or dielectric absorption ratio.
4. Connect the probes to the circuit to be measured. The Tester automatically detects if the circuit is energized.

- The primary display shows ---- until you press the  button and a valid resistance reading is obtained.
 - The high voltage symbol (⚡) along with a primary display of >30 V warns if voltage greater than 30 V ac or dc is present. If high voltage is present, the test is inhibited.
5. Press and release  to start the test. During testing, the secondary display shows the test voltage applied to the circuit under test. The high voltage symbol (⚡) along with a primary display showing the resistance in MΩ or GΩ appears. The  icon appears on the lower portion of the display until the test is finished.

When the test is completed, the PI or DAR value is displayed on the primary display. The circuit under test will automatically be discharged through the Tester. If either value used to calculate PI or DAR was greater than the maximum display range, or the 1 minute value was greater than 5000 MΩ, the primary display will show Err.

- When resistance is higher than the maximum display range, the Tester displays the > symbol and the maximum resistance for the range.

- To interrupt a PI or DAR test before it is completed, momentarily press . When you release , the circuit under test will automatically be discharged through the Tester.



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Figure 8. Measuring Polarization Index and Dielectric Absorption Ratios

Using the Compare Function

Use the Compare function to set a pass/fail compare level for the insulation measurements. To use the Compare function:

1. Press the **PI/DAR 比较** button to select the desired compare value. You can choose from 100 k Ω , 200 k Ω , 500 k Ω , 1 M Ω , 2 M Ω , 5 M Ω , 10 M Ω , 20 M Ω , 50 M Ω , 100 M Ω , 200 M Ω , and 500 M Ω .
2. Perform insulation tests as described earlier in this manual.
3. The green pass indicator will appear if the measured value is greater than the selected value.
4. Press and hold the **PI/DAR 比较** button for 1 second to disable the Compare function. The pass indicator will turn off when you start a new test or choose a new compare value.

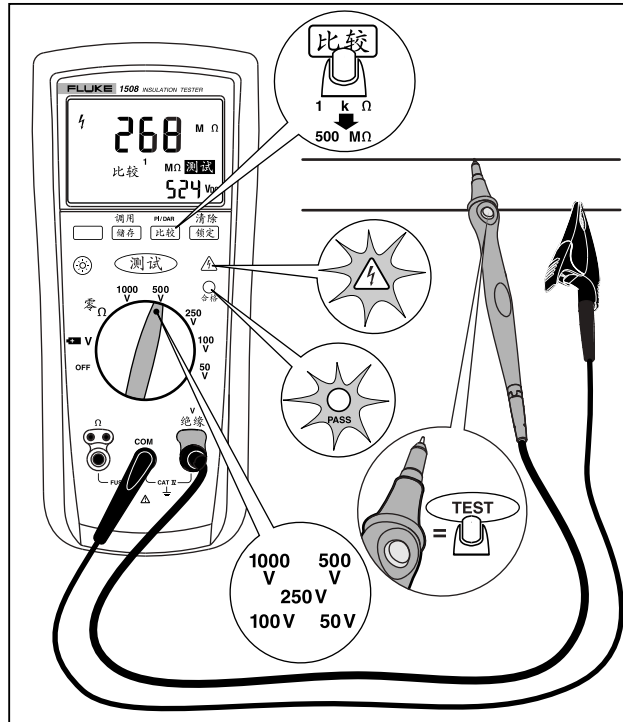


Figure 9. Using the Compare Function

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Using the Memory Function

You can store up to 19 insulation or earth-bond measurements on the Tester. The measurements are stored in a last in, first out format. If more than 19 measurements are stored, the earliest will be deleted to make room for the latest.

Storing a Measurement

Press the **调用** (Call) button to save the last measurement taken.

Recalling a Measurement

Press the blue button and then the **调用** (Call) button to recall the last saved measurement. The measurement will be displayed on the primary display and the stored data count will be displayed on the secondary display. Press the blue button and the **调用** (Call) button again to recall the previous saved result. You can repeat this step until the displayed stored data count is one. The next displayed measurement will be the newest. Press the **调用** (Call) button to exit the recall display.

Clearing Memory

Press the blue button and then the **清除** (Clear) button. The primary display will show c r?. Press the blue button and then the **清除** (Clear) button again to clear all memory locations.

Cleaning

Periodically wipe the case with a damp cloth and mild detergent. Do not use abrasives or solvents. Dirt or moisture in the terminals can affect readings. Allow time for drying before using the Tester.

Testing the Batteries

The Tester continuously monitors battery voltage. If the low battery icon (🔋) appears on the display, there is minimal battery life left. To test the batteries:

1. Turn the rotary switch to the 🔋 V position with no probes inserted.
2. Press the blue button to initiate the fully loaded battery test. The voltage function displays clear and the measured battery voltage is shown in the primary display for 2 seconds, the voltage display then returns.

Testing the Fuse

⚠️⚠️ Warning

To avoid electrical shock or injury, remove the test leads and any input signals before replacing the fuse.

Test the fuse as described below and shown in Figure .
Replace the fuse as shown in Figure .

1. Turn the rotary switch to the 🔌 position.
2. Press and hold (测试). If the display reading is FUSE, the fuse is bad and should be replaced.

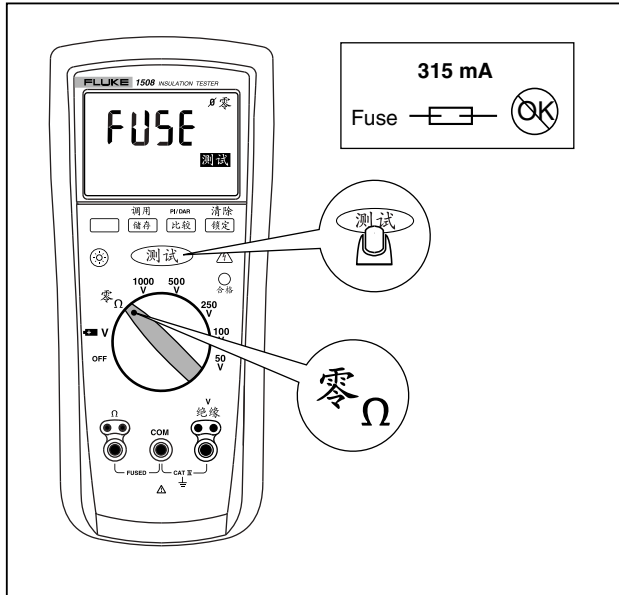


Figure 10. Testing the Fuse

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Replacing the Batteries and Fuse

Replace the fuse and batteries as shown in Figure . Follow the steps below to replace the batteries.

⚠⚠ Warning

To avoid shock, injury, or damage to the Tester:

- To avoid false readings, which could lead to possible electric shock or personal injury, replace the batteries as soon as the battery indicator (🔋) appears.
- Use **ONLY** fuses with the amperage, interrupt, voltage, and speed ratings specified.
- Turn the rotary switch to **OFF** and remove the test leads from the terminals.

1. Remove the battery door by using a standard screwdriver to turn the battery door lock until the unlock symbol aligns with the arrow.
2. Remove and replace the batteries.
3. Replace the battery door and secure by turning the battery door lock until the lock symbol aligns with the arrow.

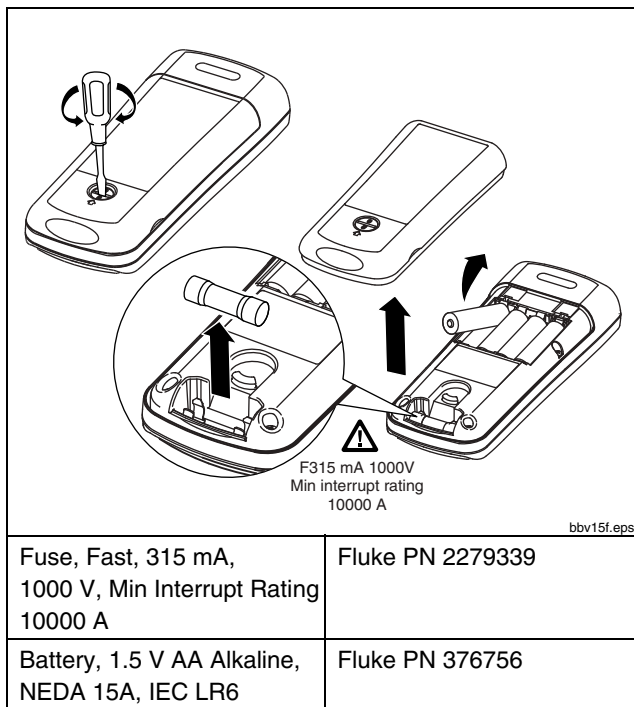


Figure 11. Replacing the Fuse and Battery

Specifications

General Specifications

Maximum Voltage Applied to any Terminal	600 V ac rms or dc
Storage Temperature	-40 °C to 60 °C (-40 °F to 140 °F)
Operating Temperature	-20 °C to 55 °C (-4 °F to 131 °F)
Temperature Coefficient	0.05 x (specified accuracy) per °C for temperatures < 18 °C or > 28 °C (< 64 °F or > 82 °F)
Relative Humidity	Noncondensing 0 % to 95 % @ 10 °C to 30 °C (50 °F to 86 °F) 0 % to 75 % @ 30 °C to 40 °C (86 °F to 104 °F) 0 % to 40 % @ 40 °C to 55 °C (104 °F to 131 °F)
Vibration	Random, 2 g, 5-500 Hz per MIL-PRF-28800F, Class 2 instrument
Shock	1 meter drop per IEC 61010-1 2 nd Edition (1 meter drop test, six sides, oak floor)
Electromagnetic Compatibility	In an RF field of 3 V/M, accuracy = specified accuracy (EN 61326-1:1997).
Safety	Complies with ANSI/ISA 82.02.01 (61010-1) 2004, CAN/CSA-C22.2 NO. 61010-1-04, and IEC/EN 61010-1 2 nd Edition for measurement category IV 600 V (CAT IV)
Certifications	CSA per standard CSA/CAN C22.2 No. 61010.1-04; TUV per standard IEC/EN 61010-1 2 nd Edition
Batteries	Four AA batteries (NEDA 15A or IEC LR6)
Battery Life	Insulation test use: Tester can perform at least 1000 insulation tests with fresh alkaline batteries at room temperature. These are standard tests of 1000 V into 1 MΩ with a duty cycle of 5 seconds on and 25 seconds off. Resistance Measurements: Tester can perform at least 2500 earth-bond resistance measurements with fresh alkaline batteries at room temperature. These are standard tests of 1 Ω with a duty cycle of 5 seconds on and 25 seconds off.
Size	5.0 cm H x 10.0 cm W x 20.3 cm L (1.97 in H x 3.94 in W x 8.00 in L)
Weight	550 g (1.2 lb.)

IP Rating	IP40
Altitude	Operating: 2000 m CAT IV 600 V, 3000 m CAT III 600 V Non Operating (Storage): 12,000 m
Over-Range Capability	110% of range
Accessories	Lead Set PN 666602 Clips PN 1670641 (red) and PN 1670652 (black) Holster Remote Probe

AC/DC Voltage Measurement

Accuracy

Range	Resolution	50 Hz to 400 Hz ± (% of Rdg + Digits)
600.0 V	0.1 V	± (2 % + 3)

Input Impedance	3 MΩ (nominal), <100 pF
Common Mode Rejection Ratio (1 k• unbalanced)	>60 dB at dc, 50 or 60 Hz
Overload Protection	600 V rms or dc

Earth-Bond Resistance Measurement

Range	Resolution	Accuracy ¹ ± (% of Rdg + Digits)
20.00 Ω	0.01 Ω	± (1.5 % + 3)
200.0 Ω	0.1 Ω	
2000 Ω	1 Ω	
20.00 kΩ	0.01 kΩ	
1. Accuracies apply from 0 to 100% of range.		

Overload Protection2 V rms or dc

Open Circuit Test Voltage> 4.0 V, < 8 V

Short Circuit Current.....> 200.0 mA

Insulation Specifications

Measurement Range.....0.01 MΩ to 10 GΩ

Test Voltages50, 100, 250, 500, 1000 V

Test Voltage Accuracy+ 20 %, - 0 %

Short-Circuit Test Current1 mA nominal

Auto DischargeDischarge time <0.5 second for C = 1 μF or less

Live Circuit Detection:Inhibit test if terminal voltage > 30 V prior to initialization of test.

Maximum Capacitive Load.....Operable with up to 1 μF load.

Accuracy

Output Voltage	Display Range	Resolution	Test Current	Accuracy ± (% of Rdg + Digits)
50 V (0 % to + 20 %)	0.01 to 20.00 MΩ	0.01 MΩ	1 mA @ 50 kΩ	± (3 % + 5)
	20.0 to 50.0 MΩ	0.1 MΩ		
100 V (0 % to + 20 %)	0.01 to 20.00 MΩ	0.01 MΩ	1 mA @ 100 kΩ	± (3 % + 5)
	20.0 to 100.0 MΩ	0.1 MΩ		
250 V (0 % to + 20 %)	0.01 to 20.00 MΩ	0.01 MΩ	1 mA @ 250 kΩ	± (1.5 % + 5)
	20.0 to 200.0 MΩ	0.1 MΩ		
500 V (0 % to + 20 %)	0.01 to 20.00 MΩ	0.01 MΩ	1 mA @ 500 kΩ	± (1.5 % + 5)
	20.0 to 200.0 MΩ	0.1 MΩ		
	200 to 500 MΩ	1 MΩ		
1000 V (0 % to + 20 %)	0.1 to 200.0 MΩ	0.1 MΩ	1 mA @ 1 MΩ	± (1.5 % + 5)
	200 to 2000 MΩ	1 MΩ		
	2.0 to 10.0 GΩ	0.1 GΩ		± (10 % + 3)