

FLUKE®

1550

MegOhmMeter

Users Manual

October 2001 Rev.1, 1/03

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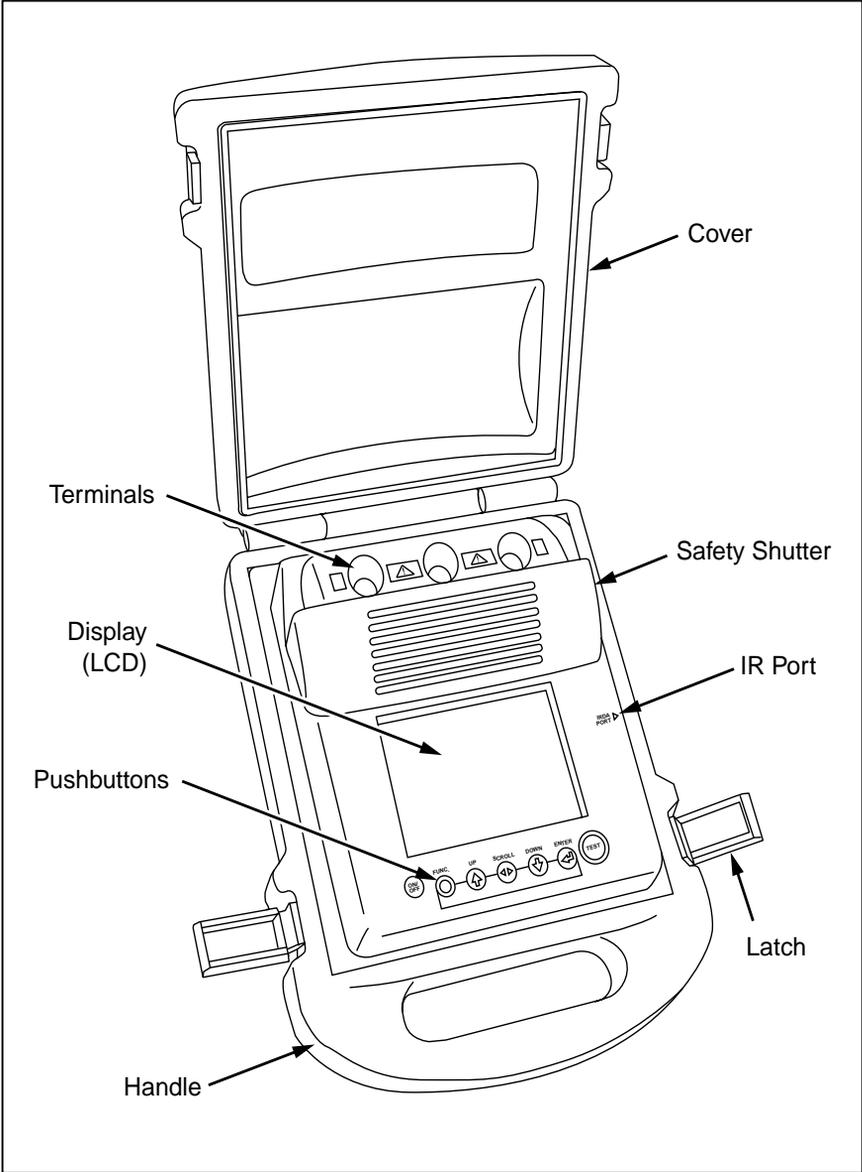
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Fluke 1550 MegOhmMeter

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1550 MegOhmMeter Users Manual

Introduction

The Fluke 1550 MegOhmMeter (hereafter "the Meter") is a high voltage insulation tester that tests general circuits, including switchgear and cables.

The Meter has the following features:

- ⇒ Four test voltage settings: 500 V, 1000 V, 2500 V, and 5000 V
- ⇒ Resistance measurement range of 0 Ω to 1 T Ω
- ⇒ Large liquid crystal display (LCD) with text display
- ⇒ Infrared (IR) port for downloading test data
- ⇒ Ramp mode that gradually increases the applied test voltage
- ⇒ Test timer and storage for test results
- ⇒ Rechargeable lead-acid battery

The Meter meets EN 61557 Parts 1 and 2; and EN 61010-1, CAT III 600 V Pollution Degree 2 standards. CAT III equipment is designed to protect against transients in equipment in fixed-equipment installations, such as distribution panels and lighting systems in large buildings.

Contacting Fluke

To contact Fluke for product information, operating assistance, service, or to get the location of the nearest Fluke distributor or Service Center, call:

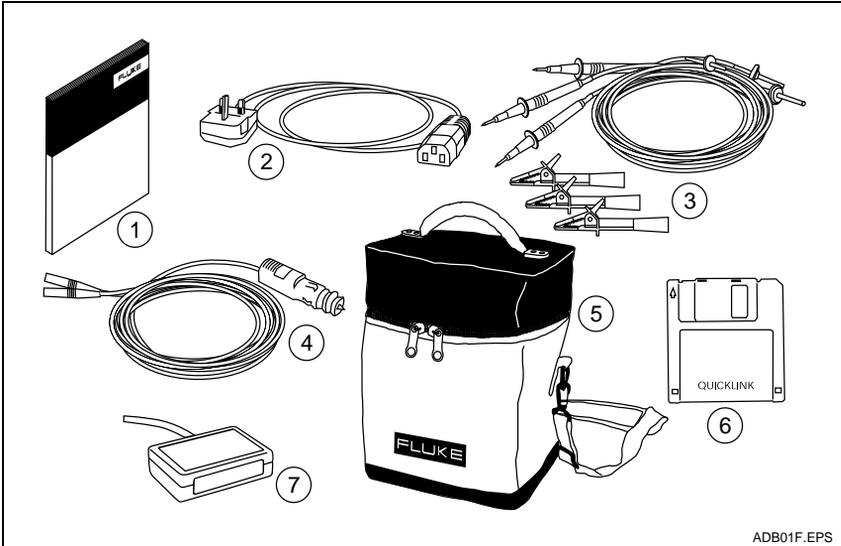
- 1-888-99FLUKE (1-888-993-5853) in U.S.A.
- 1-800-36-FLUKE (1-800-363-5853) in Canada
- +31-402-678-200 in Europe
- +81-3-3434-0181 Japan
- +65-738-5655 Singapore
- +1-425-446-5500 from other countries

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

Register your Meter at register.fluke.com.

Unpacking the Meter

The Meter comes with the items shown in Figure 1. If the Meter is damaged or an item is missing, contact the place of purchase immediately.



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Item	Description
①	Users Manual
②	AC Power Cord
③	⚠ Test Cables with Alligator Clips (red, black, green)
④	DC Charger Lead
⑤	Soft Carrying Case
⑥	Quicklink Communication Software Disk
⑦	Infrared Adapter with interface cable

Figure 1. Standard Accessories

⚠ ⚠ Warning

The supplied test leads are for use with this instrument only. Do not use with other equipment.

Safety Information

⚠ ⚠ Warning

Before and after testing, confirm that the Meter does not indicate the presence of a hazardous voltage. (See Figure 3.) If the Meter beeps continuously and a hazardous voltage is shown on the display, disconnect test leads and remove power from the circuit under test.

⚠ ⚠ Warning: Read Before Using the Meter

- To avoid possible electric shock or personal injury:
- Use the Meter only as specified in this manual, or the protection provided by the Meter might be impaired.
- Do not disconnect the test leads before the test has been completed and the test voltage at the terminals has returned to zero. This ensures that any charged capacitance is fully discharged.
- Ensure there is no power to the circuit under test and that all circuit capacitances are fully discharged prior to testing with this instrument.
- Avoid working alone or around explosive gas, vapor or dust.
- Do not use the Meter in a wet environment.
- Inspect the test leads for damaged insulation or exposed metal. Check test lead continuity. Replace damaged leads. Do not use the Meter if it looks damaged.
- Be careful when working above 30 V ac rms, 42 V ac peak and 60 V dc. Such voltages pose a shock hazard.
- When using the probes, keep your fingers behind the finger guards.
- Measurements can be adversely affected by impedances of additional operating circuits connected in parallel.
- Place test leads in proper input terminals.
- Do not use the Meter with any parts or cover removed.
- Disconnect the test leads from the circuit under test and from the Meter before changing the fuse.
- Use only Fluke approved replacement fuse(s), parts, and accessories as specified in this manual.
- Do not use the Meter if the safety shutter is impaired in any way. The safety shutter (see Frontispiece) prevents access to the test terminals and charger terminals at the same time.
- There are no user replaceable parts inside the instrument.
- Use the guard terminal only as specified in this manual. Do not allow other accessories or foreign objects to come into contact with the guard terminal as safety may be compromised.

Symbols

Symbols on the Meter and in the manual are explained Table 1.

Table 1. Symbols

	Conforms to European Union standards.
	Underwriter Laboratories, Inc.
	TÜV Product Services. Technischer Überwachungs Verein.
	Conforms to Canadian Standards Association requirements.
	Risk of danger. Important information. See Manual.
	Potentially hazardous voltage
	Fuse
	Equipment protected by double or reinforced insulation.
	Interference is present. Displayed value might be outside of specified accuracy.

Operating the Meter

Turning the Meter On and Off

To turn the Meter on and off:

1. Press  to turn on the Meter.

The Meter performs a self-check, self-calibration, displays the current software version, and starts in Ready mode.

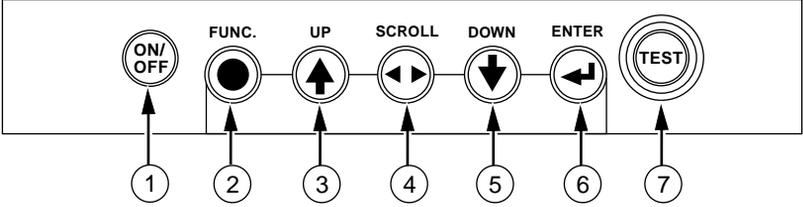
In Ready mode, you can:

- ⇒ Change test parameters
- ⇒ Start an insulation test
- ⇒ View stored test results
- ⇒ Download test results

2. Press  again to turn off the Meter.

Using the Pushbuttons

Use the pushbuttons (Figure 2) to control operation of the Meter, select test results for viewing, and scroll through selected test results.



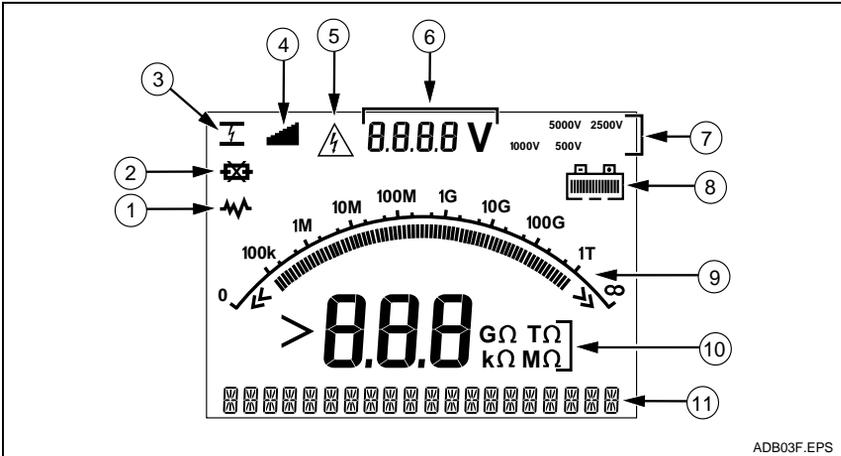
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Item	Button	Description
①		Turns the Meter off and on.
②		Function button. From Ready mode, the Function button scrolls through test voltage selection, ramp test setup, time limit setup, and results (memory functions). In Results mode, use the Function button to choose between the view, download, and delete screens.
③		Up button. Used to scroll through test voltages, stored test results, timer duration, and to select memory locations. Also used to answer “yes” to yes/no prompts.
④		Scroll button. After you select a memory location, use the Scroll button to display the test parameters and test results stored in the memory location.
⑤		Down button. Used to scroll through test voltages, stored test results, timer duration, and to select memory locations. Also used to answer “no” to yes/no prompts.
⑥		Enter button. Used to select the Result function. After you select the Result function, use the up and down buttons to move through the stored tests. Use the scroll button to view test parameters and test results.
⑦		Test button. Starts and stops a test. Push and hold the button for 1 second to start a test. Push the button again to stop a test.

Figure 2. Pushbuttons

Understanding the Display

Display annunciators are shown and described in Figure 3.



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Item	Description
①	Interference present. Displayed readings may be outside the specified accuracy range.
②	Blown Guard fuse indicator.
③	Electrical breakdown in Ramp mode.
④	Ramp mode indicator.
⑤	Potentially hazardous voltage is present at the test terminals. ⚠ ⚠ Warning: Before and after testing, confirm that the Meter does not indicate the presence of a hazardous voltage. If the Meter beeps continuously and a hazardous voltage is present, disconnect test leads and remove power from the circuit under test.
⑥	Voltage sourced by the Meter <u>or</u> from the circuit under test that is present at terminals of the Meter.
⑦	Test voltage selection (500 V, 1000 V, 2500 V, or 5000 V)
⑧	Battery charge status.
⑨	Bar graph display of insulation resistance.
⑩	Digital display of insulation resistance.
⑪	Text display. Indicates voltage, test current, capacitance, and menu options.

Figure 3. Display Features

Charging the Battery

⚠ ⚠ Warning

To avoid possible electric shock or personal injury, disconnect the test leads from the Meter before charging the battery.

Pb ⚠ Note

This instrument contains a lead-acid battery. Do not mix with the solid waste stream. Spent batteries should be disposed of by a qualified recycler or hazardous materials handler. Contact your authorized Fluke Service Center for disposal and recycling information.

Storing rechargeable lead-acid batteries in a low-charged state could lead to reduced life and/or damage. Fully charge the battery before storing for extended periods and check the charge at regular intervals.

The Meter is powered by a rechargeable 12 V lead-acid battery. You can recharge the battery using the AC power cord or the DC charger leads that are shipped with the Meter.

Fully charging the battery typically takes 12 hours. Avoid charging in extremes of temperature. Recharge the battery if the Meter has been stored for extended periods. Figure 4 shows how to connect the Meter to a power supply.

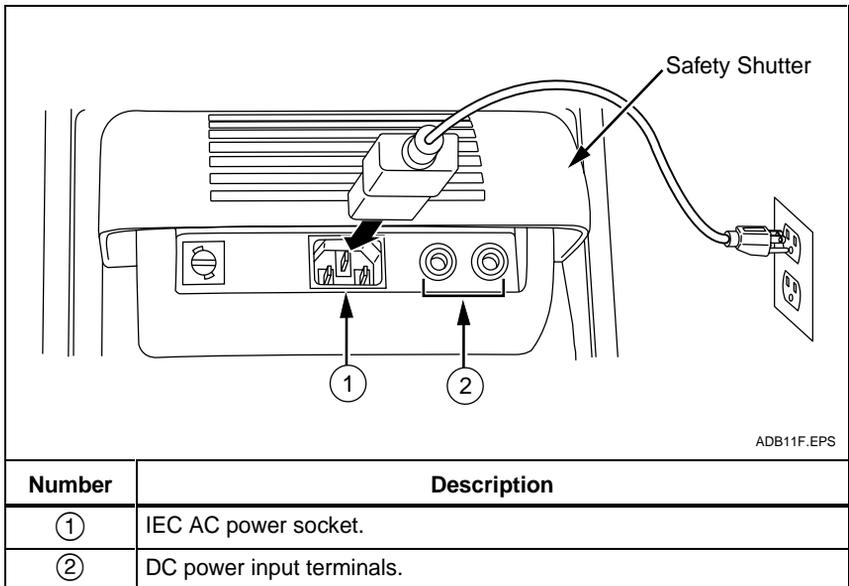


Figure 4. Power Supply Connections

To recharge the battery using an AC power supply:

1. Turn the Meter off.
2. Disconnect the test leads and/or any connectors from the Meter.
3. Rotate the safety shutter toward the top of the Meter to expose the power supply connections.
4. Connect the AC power cord to the IEC AC power socket (①) on the Meter.
5. Connect the other end of the power cord to an AC power supply. See "General Specifications" later in this manual for AC charger input specifications.
6. The LCD on the Meter displays `CHARGING`. When the Meter is in Charging mode, no other operations are possible.

To recharge the battery using a DC power supply:

1. Turn the Meter off.
2. Disconnect the test leads and/or any connectors from the Meter.
3. Rotate the safety shutter toward the top of the Meter to expose the power supply connections.
4. Connect the DC charger lead to the 4 mm DC power input terminals (②) on the Meter.
5. Connect the other end of the DC charger lead to the cigarette lighter of a car. See "General Specifications" later in this manual for DC charger input specifications.
6. The Meter displays the word `CHARGING`. When the Meter is in Charging mode, no other operations are possible.

Using the Guard Terminal

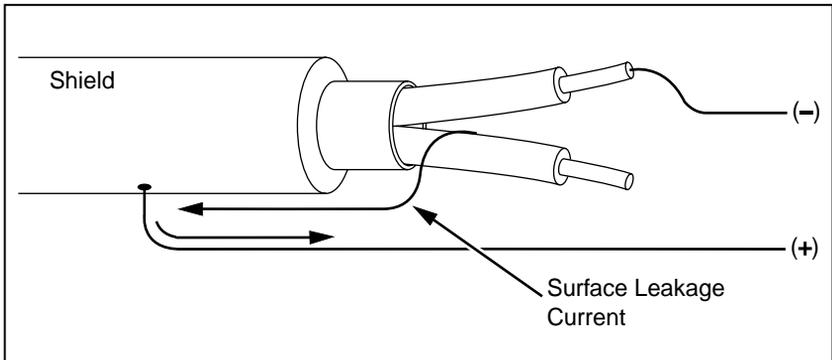
Note

Insulation resistance is measured between the + and – output connections. The Guard terminal (G) is at the same potential as the negative (–) terminal but is not in the measurement path.

For most tests, only two test leads are used, connecting the positive (+) and negative (–) terminals on the Meter to the circuit under test. The Guard (G) terminal is left unconnected.

When measuring very high resistances, you can obtain more accurate readings by making a three-wire measurement using the Guard terminal. The Guard terminal is at the same potential as the negative (–) terminal, and can be used to prevent surface leakage or other unwanted leakage currents from degrading the accuracy of the insulation resistance measurement.

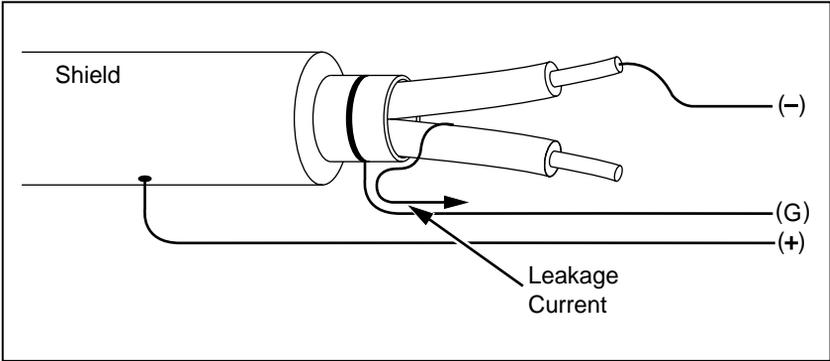
Figure 5 shows how to measure the resistance from one of the conductors to the outer shield. In this case, there is a leakage current along the surface of the inner insulation near the end of the cable. This leakage adds to the current that the negative terminal detects, and will cause the Meter to read a lower resistance than it should.



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Figure 5. Surface Leakage Current

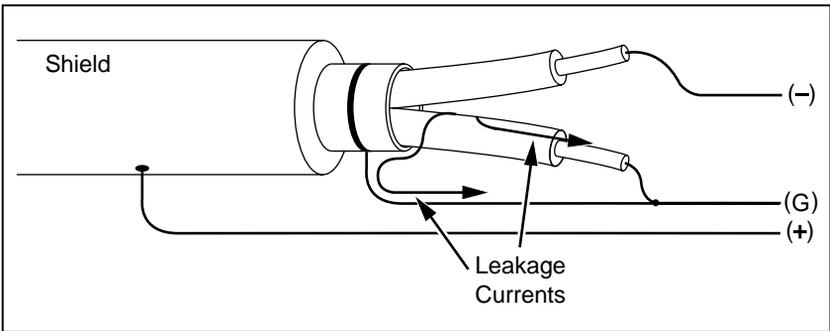
Figure 6 shows how to prevent surface current leakage by connecting a lead from the Guard terminal to a conductor wrapped around the inner insulation. The surface leakage current is directed to the Guard terminal. This removes the leakage current from the measurement path between the positive and negative terminals, and improves the accuracy of the test readings.



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Figure 6. Guard Terminal Connection

Figure 7 shows how to improve the measurement setup by connecting the Guard terminal to the unused wire and coupling it to the inner insulation. This insures that the Meter measures the leakage between the selected conductor and the outer shield, but eliminates the leakage path between conductors.



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Figure 7. Improved Guard Terminal Connection

Making Measurements

Connecting to the Circuit Under Test

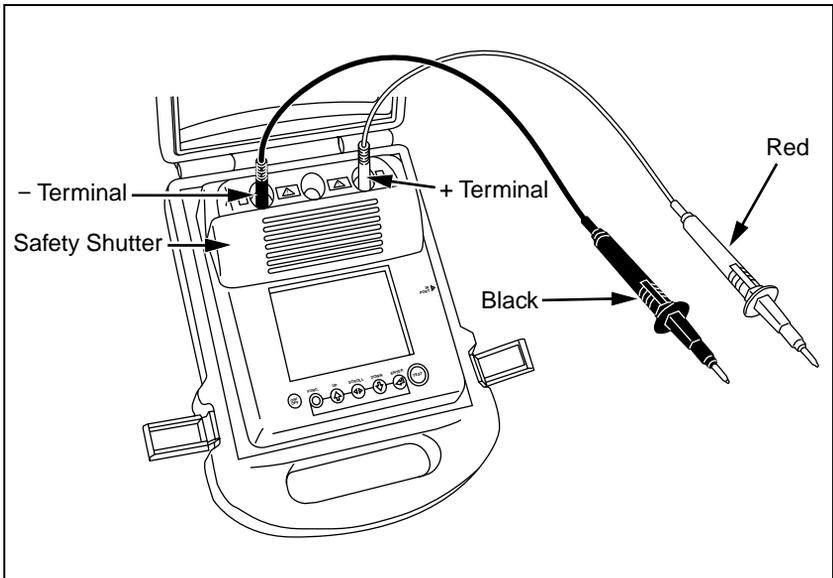
⚠ ⚠ Warning

To avoid possible electric shock or personal injury:

- Remove all power from the circuit under test and discharge circuit capacitance before testing a circuit with the Meter.
- Connect the test leads to the Meter inputs before connecting to the circuit under test.
- Before and after testing, confirm that the Meter does not indicate the presence of a hazardous voltage at the terminals. If the Meter beeps continuously and a hazardous voltage is shown on the display, disconnect test leads and remove power from the circuit under test.

To connect to the circuit under test:

1. Rotate the safety shutter to expose the terminal connections.
2. Insert the test leads in the terminals shown (Figure 8) and connect the test leads to the circuit under test.



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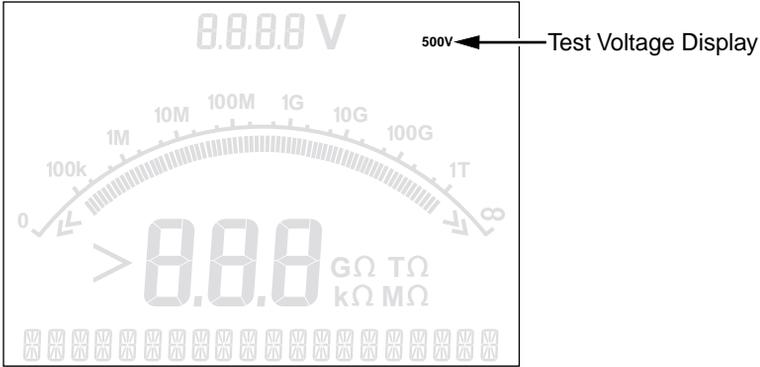
Figure 8. Connecting to the Circuit Under Test

Setting the Test Voltage

To set the test voltage:

1. Press  to turn on the Meter.

The Meter will be in TEST VOLTAGE mode with a 500 V default test voltage.



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2. Press  or  to scroll through the test voltage options (500 V, 1000 V, 2500 V, and 5000 V).

The selected test voltage appears in the upper-right of the display.

Note

The nominal test voltage is 5 % to 10 % higher than the test voltage you select.

Performing an Insulation Test

⚠ ⚠ Warning

Measuring insulation resistance requires the application of potentially dangerous voltages to the circuit. This may include exposed bonded metalwork.

To avoid possible electric shock or personal injury:

- Remove all power from the circuit under test and discharge circuit capacitance before testing a circuit with the Meter.
- Before proceeding, ensure that the installation is wired correctly and no personnel are endangered by any tests.
- First connect the test leads to the Meter inputs before you make connection to the circuit under test.

To perform an insulation test:

1. Press  to turn on the Meter.

The Meter will be in TEST VOLTAGE mode with a 500 V default test voltage.

2. Press  or  to scroll through the test voltage options (500 V, 1000 V, 2500 V, and 5000 V).

The selected test voltage appears in the upper-right of the display.

Note

The nominal test voltage is 5 % to 10 % higher than the test voltage you select.

3. Connect the probes to the circuit you want to test.

⚠ ⚠ Warning

To avoid possible electric shock or personal injury: before and after testing, confirm that the Meter does not indicate the presence of a hazardous voltage at the terminals. If the Meter beeps continuously and a hazardous voltage is shown on the display, disconnect test leads and remove power from the circuit under test.

4. Press  for one second to start the insulation test.

The Meter beeps 3 times as the test begins and the  icon flashes on the display indicating potentially hazardous voltages may be present on the test terminals.



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The digital display indicates the measured insulation resistance after the circuit has stabilized. The bar graph displays this value continuously (in real time) as a trend.

5. Press  a second time to terminate the test.

The Meter beeps when a potentially hazardous voltage remains on the test terminals due to charged circuit capacitances or from the presence of an external voltage.

Note

The insulation test terminates automatically under the following conditions:

- *User stop*
 - *Timer limit reached*
 - *Interference on test circuit*
 - *Breakdown occurs*
 - *Battery depleted*
6. When the test is complete, STORE RESULT? is displayed.
- Press  to save the measured insulation resistance and the test parameters and return the Meter to Ready mode.
- Or
- Press  to ignore the test results and return the Meter to Ready mode. Results will not be stored.

Performing a Ramp Test

The Ramp test is an automated test that checks the insulation for a breakdown. During a Ramp test, the output voltage starts at 0 V and increases linearly until it reaches the specified test voltage (500 V, 1000 V, 2500 V, or 5000 V) or until a sudden drop in measured resistance) is detected. *Then the Ramp stops, the test voltage drops to zero, and the voltage at the breakdown point is stored in memory on the Meter.*

To perform a Ramp test:

1. Press  to turn on the Meter.

The Meter will be in TEST VOLTAGE mode with a 500 V default test voltage.

2. Press  or  to scroll through the test voltage options (500 V, 1000 V, 2500 V, and 5000 V). The selected test voltage appears in the upper-right of the display.

Note

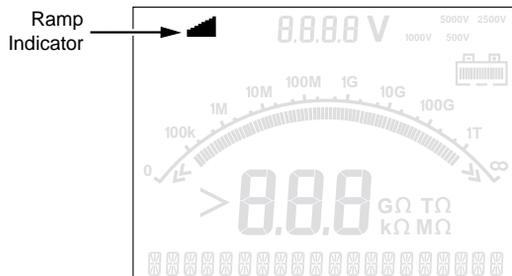
The nominal test voltage is 5-10 % higher than the voltage you select.

3. Connect the probes to the circuit you want to test.

Warning

To avoid possible electric shock or personal injury: before and after testing, confirm that the Meter does not indicate the presence of a hazardous voltage at the terminals. If the Meter beeps continuously and a hazardous voltage is shown on the display, disconnect test leads and remove power from the circuit under test.

4. Press  to select the RAMP TEST function.



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5. Press  to toggle the Ramp test option on. A blinking  appears in the upper left-hand corner of the display if selected. Press  or  to toggle the Ramp test option off.

6. Press  for one second to start the Ramp test.

The Meter beeps when a potentially hazardous voltage remains on the test terminals due to charged circuit capacitances or from the presence of an external voltage.

If a breakdown is detected, the Ramp stops, the test voltage drops to zero, and the voltage at the breakdown point is stored in memory on the Meter.

7. Press  again when the Ramp test is completed.

The Meter beeps two times when the test ends.

8. When the test is complete, STORE RESULT? is displayed.

- Press  to save the measured insulation resistance and the test parameters. The Meter returns to Ready mode.

Or

- Press  to ignore the test results and return the Meter to Ready mode.

Making a Timed Test

You can program the Meter to make tests that run for a set time at a set voltage. The time can be set in 1 minute increments to 99 minutes. During a timed test, the time limit appears on the right bottom of the display. The elapsed time is shown in the middle. To make a timed test:

1. Press  to turn on the Meter. The Meter will be in TEST VOLTAGE mode with a 500 V default test voltage.
2. Press  or  to scroll through the test voltage options (500 V, 1000 V, 2500 V, and 5000 V). The selected voltage appears in the upper-right of the display.

Note

The nominal test voltage is 5-10 % higher than the voltage you select.

3. Connect the probes to the circuit you want to test.

Warning

To avoid possible electric shock or personal injury: before and after testing, confirm that the Meter does not indicate the presence of a hazardous voltage. If the Meter beeps continuously and a hazardous voltage is shown on the display, disconnect test leads and remove power from the circuit under test.

4. Press  to scroll to the desired test function. Then press  to select the TIME LIMIT function.
5. Press  to set the test time.
6. Press  for 1 second to start the test. The Meter beeps 3 times as the test begins and the  icon flashes on the display. The bottom row on the display shows test current, time elapsed, and duration of test.
7. When the test is complete, STORE RESULT? is displayed.
 - Press  to save the measured insulation resistance and the test parameters. The Meter returns to Ready mode.

Or

 - Press  to ignore the test results and return the Meter to Ready mode.

Viewing Results Stored in Memory

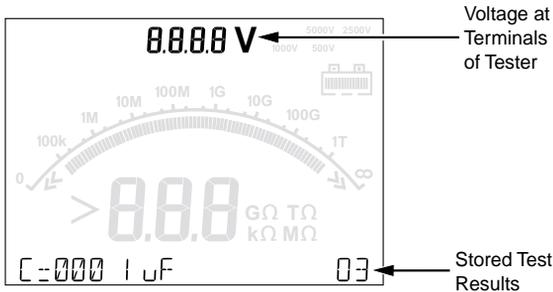
The Meter can store 99 sets of test data, including:

- ⇒ Limit – timer on or off
- ⇒ Timer reading at termination of test
- ⇒ Capacitance
- ⇒ Ramp on or off
- ⇒ Selected test voltage and measured test voltage
- ⇒ Test current
- ⇒ Reason for ending the test.

To view stored test data:

1. Press  to turn on the Meter.
2. Press  to select the RESULTS function.

When a voltage is present at the terminals, that voltage is always shown on the top-center of the display, regardless of whether that voltage is sourced by the Meter or is from the circuit under test.



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3. Press  to access the test results storage locations. The memory location appears on the bottom-right of the display.
4. Press  or  to scroll through the different stored tests.
5. Press  to view the stored test data for a specific test. Test data appears on the alphanumeric text display and on the LCD.
6. Press  to return the Meter to Ready mode.

Downloading Your Test Results

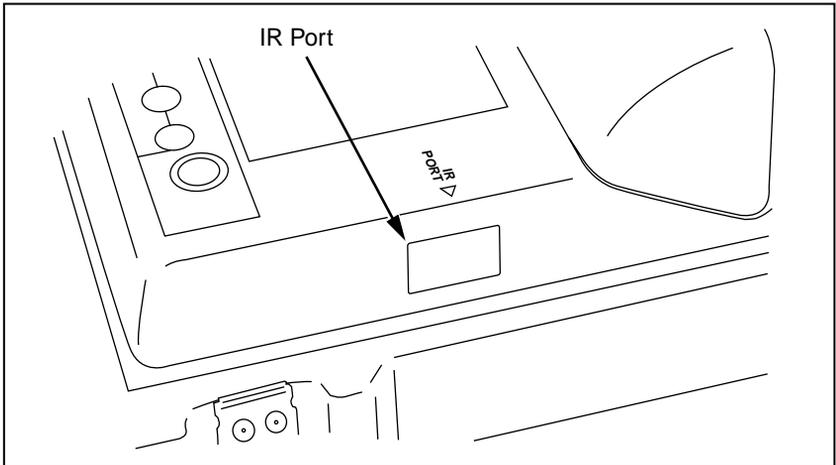
You can use the download function to download all of your stored test data to a PC using the IR (infrared) port.

An infrared adapter is supplied with the Fluke 1550 MegOhm Meter and is used to download stored test data from the Meter to a PC. Figure 9 shows the location of the IR port on the Meter.

Note

You must keep the infrared adapter steady or data transfer errors may occur.

For best results, place the infrared adapter on a flat surface in line with the IR port on the Meter.



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Figure 9. IR Port on 1550 MegOhmMeter

Installing the Quicklink Software

You need to install the Quicklink software on your PC to download stored test data.

To install the Quicklink software, insert the Quicklink disk in your PC and follow the installation instructions on the disk.

Downloading Test Results to PC

To download your test results to a PC:

1. Using the cable provided, connect the infrared adapter to an unused COM port on your PC.
2. Run the Quicklink software on your PC and click on the download icon.
3. Press  to turn on the Meter.
4. Press  to select the RESULTS function.
5. Press  to access the stored test results.
6. Press  to access the DOWNLOAD function.
7. Specify the PC COM port you are using on the Quicklink download dialog.
8. Click the "start" to initiate the download.
9. Press  to download stored test results to the connected PC.

The download dialog shows the progress of the download as test results are received on the PC.

If errors are reported, repeat the download procedure.

Note

Verify that the download was successful before deleting the stored test results on the Fluke 1550.

Deleting Your Test Results

To delete all of your saved test results:

1. Press  to turn on the Meter.
2. Press  to select the RESULTS function.
3. Press  to access the stored test results.
4. Press  two times to access the DELETE? function.
5. Press  to delete all stored test results or press  to return to Ready mode.

The REALLY DEL? prompt appears.

6. Press  to confirm the deletion or press  to return to Ready mode.
When you press , all stored test results are permanently deleted.

⚠ Caution

The delete function deletes all of your stored test results.

Maintaining the Meter

⚠⚠ Warning

To avoid possible electric shock or personal injury, do not attempt to repair or service your Meter beyond what is described in this manual. The Meter should be serviced by qualified service personnel only.

There are no user-replaceable parts inside the Meter.

Cleaning

⚠⚠ Warning

To avoid possible electric shock or personal injury, remove excess water from the cloth before cleaning the Meter to ensure that water does not enter any terminal.

Periodically wipe the case with a damp cloth and mild detergent. Do not use abrasives or solvents to clean the Meter.

Replacing the Guard Fuse

⚠ Replace the Guard fuse with a F (Fast) 100 mA H 250 V fuse.

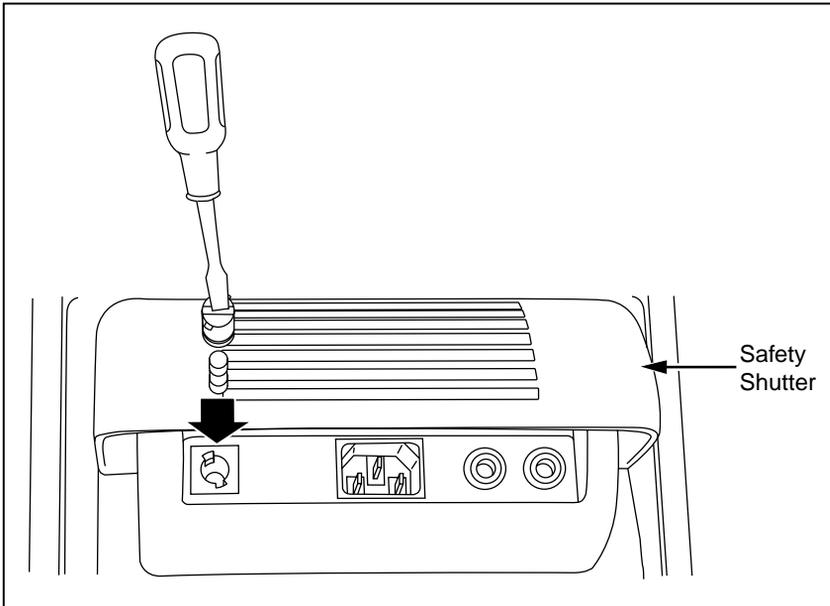
⚠⚠ Warning

To avoid electric shock, personal injury or damage to the Meter:

- Replace the fuse in accordance with the following procedure, using **ONLY** the replacement fuse specified in this manual.
- Disconnect the test leads and / or any connectors.

To replace the Guard fuse (Figure 10):

1. Turn off the Meter.
2. Rotate the safety shutter toward the top of the Meter to expose the power supply connections and Guard fuse receptacle.
3. Remove the fuse holder by using a standard-blade screwdriver to turn the fuse holder until it unlocks.
4. Remove the fuse holder from the Meter and the fuse from the fuse holder.
5. Install the new fuse and ready the Meter for use.



ADB12F.EPS

Figure 10. Replacing the Guard Fuse

Principle of Measurement and Resistance

The Meter measures resistance by applying a voltage to the insulation under test, measuring the resulting current through the circuit, and then calculating the resistance of the circuit.

The resistance is then established by performing the following calculation:

$$R = \frac{V}{I} \text{ (Ohm's Law)}$$

Replacement Parts and Accessories

Table 2. Replacement Parts

Parts	Part No.
Test Lead - Red	1642584
Test Lead - Black	1642591
Test Lead - Green	1642600
Test Clip - Red	1642617
Test Clip - Black	1642621
Test Clip - Green	1642639
AC Power Cord (North America)	284174
AC Power Cord (Continental Europe)	769422
AC Power Cord (UK)	769455
AC Power Cord (Australia)	658641
AC Power Cord (S. Africa)	1552363
Soft Carrying Case	1642656
⚠ Guard Fuse, F (Fast) 100 mA H 250 V to IEC127	1642663
DC Charger Lead	1642695
⚠ Charger Fuse, 5 A, 1.5-in x 0.25-in quick blow (Fast) fuse	1643479
Infrared Adapter	1642688
Quicklink 1550 Communication Software	1642674
Users Manual	1642871

Specifications

General Specifications

Display	75 mm x 105 mm	
Power	12 V lead-acid rechargeable battery. Yuasa NP2.8-12	
Charger Input (AC)	85 V to 250 V ac 50/60 Hz 50 VA This Class II (double insulated) instrument is supplied with a Class 1 (grounded) power cord. The protective earth terminal (ground pin) is not connected internally. <u>The extra pin is for added plug retention only.</u>	
Charger Input (DC)	10 to 15 V dc, 30 VA	
⚠ Guard Fuse	F (Fast) 100 mA H 250 V to IEC127	
⚠ Charger Fuse	5 A, 1.5-in x 0.25-in quick blow (F) fuse	
Dimensions (H x W x L)	170 mm x 242 mm x 330 mm (6.7 in. x 9.5 in. x 13.0 in.)	
Weight	4 Kg (8.8 lbs.)	
Temperature (operating)	-20 °C to 40 °C (-4 °F to 104 °F)	
Temperature (storage)	-20 °C to 65 °C (-4 °F to 149 °F)	
Humidity	80 % to 31 °C decreasing linearly to 50 % at 40 °C	
Altitude	2000 m	
Enclosure Sealing	IP40	
Input Overload Protection	600 V to earth ground	
Electromagnetic Compatibility	EN 61326	
Certifications	UL, CE, CSA, TÜV	
Safety Compliance	EN 61010, EN 61557 Parts 1 and 2 IEC 61010-1, CAT III V 600, Pollution Degree 2	
Typical Battery Charge Capability Note At higher temperatures, the battery requires charging more frequently.	Test Voltages	Number of Tests
	500 V	3600
	1 kV	3200
	2.5 kV	2500
	5 kV	1500

Electrical Specifications

Accuracy is specified for 1 year after calibration at operating temperatures of 0 °C to 35 °C. For operating temperatures between –20 °C to 0 °C and 35 °C to 40 °C, these tolerances double.

Insulation		
Test Voltage (DC)	Insulation Resistance Range	Accuracy (+/- reading)
500 V	<200 kΩ 200 kΩ to 10 GΩ 10 GΩ to 100 GΩ >100 GΩ	unspecified 5% 20% unspecified
1000 V	<200 kΩ 200 kΩ to 20 GΩ 20 GΩ to 200 GΩ >200 GΩ	unspecified 5% 20% unspecified
2500 V	<200 kΩ 200 kΩ to 50 GΩ 50 GΩ to 500 GΩ >500 GΩ	unspecified 5% 20% unspecified
5000 V	<200 kΩ 200 kΩ to 100 GΩ 100 GΩ to 1 TΩ >1 TΩ	unspecified 5% 20% unspecified
Bar graph range:		0 to 1 TΩ
Insulation test voltage accuracy:		-0 %, +10 % at 1 mA load current
Induced ac mains current rejection:		2 mA maximum
Charging rate for capacitive load:		5 seconds per μF

Leakage current measurement	
Range	Accuracy
1 nA to 2 mA	+/- (5 % + 2 nA)
Capacitive measurement	
Range	Accuracy
0.01 μF to 15.00 μF	+/- (15 % of reading + 0.03 μF)
Timer	
Range	Resolution
0 to 99 minutes	Setting: 1 minute Indication: 1 second
Live circuit warning	Warning range: 30 V to 600 V ac/dc, 50/60 Hz Voltage accuracy: +/- (5 % + 2 V)

