FLUKE®

# 1550
MegOhmMeter

# Calibration Manual

PN 2003219
August 2002

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## *Introduction*

**⚠⚠Warning**

- **The information provided in this manual is for qualified personnel only.**
- **To avoid electrical shock or injury, do not perform the verification tests or calibration procedures described in this manual unless qualified to do so.**
- **Before using or servicing the MegOhmMeter, refer to Safety Information.**

The *Calibration Manual* for the 1550 MegOhmMeter (hereafter referred to as "the MegOhmMeter") provides the following information.

- Fluke Contact Information
- Precautions and Safety Information
- Performance Test Procedures
- Calibration Procedure
- Battery Replacement Procedure
- Replaceable Parts/Accessories
- Specifications

For complete operating instructions and additional safety information, refer to the *1550 Users Manual* P/N 1642871.

## 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

Address correspondence to:

| | |
|---|---|
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## Symbols

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

**Table 1. Symbols**

| | |
|---|---|
| CE | Conforms to European Union standards. |
| UL | Underwriter' Laboratories, Inc. |
| TÜV PRODUCT SERVICE GS | TÜV Product Services. Technischer Überwachungs Verein. |
| SP® | 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. |
| ♻ | Recycle |
| | Do not mix with solid waste stream. Dispose using a qualified recycler or hazardous material handler. |
| CAT III | Overvoltage (Installation) Category III, Pollution Degree 2 per IEC1010-1 refers to the level of Impulse Withstand Voltage protection provided. Typical locations include: mains, wall outlets, main distribution levels connected closer to the supply system but less than the primary supply system (CAT IV) |

# Safety Information

In this manual, a **Warning** identifies conditions and actions that pose hazard(s) to the user, a **Caution** identifies conditions and actions that may damage the MegOhmMeter or the test instruments.

**⚠⚠Warning**

**Before and after testing, confirm that the MegOhmMeter does not indicate the presence of a hazardous voltage. If the MegOhmMeter 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 MegOhmMeter**

**To avoid possible electric shock or personal injury:**

- **Use the MegOhmMeter only as specified in this manual or the protection provided by the MegOhmMeter might be impaired.**
- **Do not disconnect the test leads before a 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 MegOhmMeter 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 MegOhmMeter if it looks damaged.**
- **Take care 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 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 MegOhmMeter with any parts or cover removed.**
- **Disconnect the test leads from the circuit under test and from the MegOhmMeter before changing the fuse.**
- **Use only Fluke approved replacement fuses, parts, and accessories as specified in this manual.**
- **Do not use the MegOhmMeter if the safety shutter is impaired in any way. The safety shutter 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 the Users Manual. Do not allow other accessories or foreign objects to come into contact with the guard terminal as safety may be compromised.**

# Required Equipment

Equipment required to perform the procedures in this manual is listed in Table 2. If the recommended models are not available, equipment with equivalent specifications may be substituted.

**⚠⚠Warning**

**Repair or servicing should be performed only by qualified personnel.**

**⚠Caution**

**Do not attempt to use the 5500A, 5520A, or other standard calibrator for insulation and continuity resistance tests. Calibrator damage will result.**

**Table 2. Required Equipment**

| Equipment | Minimum Required Characteristics | Recommended Model |
|---|---|---|
| **HV Probe** | 6 kV, ± 1% (1000:1 Divider) | Fluke 80k-6 |
| **Digital Multimeter** | 500 mVdc to 1V: ±0.02% | Agilent 3458A |
| [1]**Load with Guard Terminal** | Resistances<br>200 kΩ, ± 1.25 %, 500 V<br>500 kΩ, ± 1.25 %, 500 V<br>1 MΩ, ± 1.25 %, 1 kV<br>2.5 MΩ, ± 1.25 %, 2.5 kV<br>5 MΩ, ± 1.25 %, 5 kV<br>1 GΩ, ± 1.25 %, 5 kV<br>100 GΩ, ± 5 %, 500 V<br>200 GΩ, ± 5%, 1 kV<br>500 GΩ, ± 5 %, 2.5 kV<br>1 TΩ, ± 5 %, 5 kV | Combinations of:<br>Welwyn F Series,<br>Welwyn MFP2 Series<br>And Vishay HTS-523 |
| [2]**Capacitors w/ Bleeder Resistors** | 0.1 uF, ± 5 %, 500 V, Polypropylene<br>1 uF, ± 5 %, 2.5 kV, Polypropylene | |
| **Calibrator** | DC current: 2 mA<br>Accuracy: ± 1.25%<br>DC Voltage: 0 - 550 V<br>Accuracy: ± 0.005 %<br>AC Voltage: 0 - 240 V, 60 Hz<br>Accuracy: ± 1.25 % | Fluke 5520A |
| **AC Hi-pot Tester** | 3 kV @ 20 mA | Instek GPT-705 |
| **IR Transceiver and Cable** | | Fluke IR 120 |
| **Lab Supply** | 12 Vdc with 2 Amp capability | |
| **Personal computer** | IBM compatible, with Microsoft Windows | |

1. Resistors must have a voltage coefficient consistent with the test voltage used.
2. Can use (3) each, 0.033 µF, 2 kV capacitors in series and (8) each, 8 µF, 450 V capacitors in series to obtain required values. The 0.033 µF capacitors should have a 33 MΩ bleeder resistor across each capacitor. The 8 µF capacitors should have a 15 MΩ bleeder resistor across each capacitor.

# Performance Test Procedure

**⚠⚠Warning**

**To avoid electric shock hazard, do not contact the output terminals while performing the following procedures. There are potentially dangerous voltages at the MegOhmMeter output terminals when the MegOhmMeter is in the MΩ TEST function.**

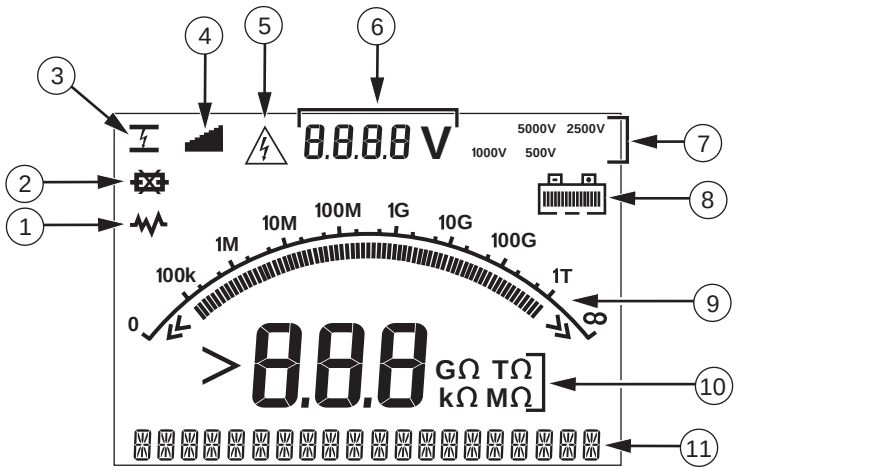
The following performance tests ensure that the MegOhmMeter, referred to as "the UUT" (Unit Under Test) in this section of the manual, is in proper operating condition and meets the published accuracy specifications. If the UUT fails any of the performance test steps, repair is needed. Refer to Contacting Fluke for service information.

## Button Test

Operate each of the front panel buttons in turn. All buttons should have a similar feel and tactile click when operated.

## Display Test

Turn the UUT on several times while observing the display during power up. Compare the display with the example in Figure 1. Check all segments for clarity and contrast.

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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.<br>⚠ **Warning: Before and after testing, confirm that the MegOhmMeter does not indicate the presence of a hazardous voltage. If the MegOhmMeter beeps continuously and a hazardous voltage is present, disconnect test leads and remove power from the circuit under test.** |
| ⑥ | Voltage sourced by the MegOhmMeter or from the circuit under test that is present at terminals of the MegOhmMeter. |
| 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 1. Display**

## Flash Test

Connect an AC hi-pot tester between the black LV charger socket and the neutral/live wire of the UUT mains inlet lead. Perform a flash test at 3 kV ac. No breakdown or flashover shall occur.

## Charging Test

1. With the MegOhmMeter switched off, connect a mains supply to the AC supply receptacle and check that the UUT display shows **Charging**.
2. Disconnect the mains supply and check that the UUT turns off.
3. Connect a 12 Vdc, 2 A lab supply to the LV charger lead and check that the UUT display shows **Charging**.
4. Disconnect the supply and check that the UUT turns off.

## Insulation Accuracy Test

Using the various resistances shown in Table 3, perform the UUT insulation accuracy test. Push TEST to start or discontinue a test.

*Notes*

- *For best results, allow for settling of up to 60 seconds when measuring high-value resistances (100 GΩ and above) and take care to avoid stray currents. Perform the test on a conductive work surface that is connected to the UUT's GUARD terminal and the load GUARD terminal.*
- *Motion/body capacitance can affect the stability of the reading at higher resistances. When taking the measurements above 1 GΩ, remain as motionless as possible.*

The capacitance reading is obtained by pressing ◄► after a test has started.

**Table 3. Insulation Accuracy Test**

| Step | Voltage Range | Resistance | UUT Display Limits | |
|---|---|---|---|---|
| | | | Minimum | Maximum |
| 1 | 500 V | 100 GΩ | 80 GΩ | 120 GΩ |
| 2 | 500 V | 1 GΩ | 0.95 GΩ | 1.05 GΩ |
| 3 | 500 V | 500 kΩ | 475 kΩ | 525 kΩ |
| 4 | 500 V | 200 kΩ | 190 kΩ | 210 kΩ |
| 5 | 1kV | 200 GΩ | 160 GΩ | 240 GΩ |
| 6 | 1kV | 1 GΩ | 0.95 GΩ | 1.05 GΩ |
| 7 | 1kV | 1 MΩ | 0.95 MΩ | 1.05 MΩ |
| 8 | 2.5 kV | 500 GΩ | 400 GΩ | 600 GΩ |
| 9 | 2.5 kV | 1 GΩ | 0.95 GΩ | 1.05 GΩ |
| 10 | 2.5 kV | 2.5 MΩ | 2.37 MΩ | 2.63 MΩ |
| 11 | 5 kV | 1 TΩ | 0.80 TΩ | 1.20 TΩ |
| 12 | 5 kV | 1 GΩ | 0.95 GΩ | 1.05 GΩ |
| 13 | 5 kV | 5 MΩ | 4.75 MΩ | 5.25 MΩ |
| 14 | 500 V | 0.1 uF | 0.05 uF | 0.15 uF |
| 15 | 2.5 kV | 1 uF | 0.82 uF | 1.18 uF |

## *Output Voltage Test*

In Table 4 the UUT output voltage is checked with various loads applied. In this test a voltmeter with a high-voltage probe must be connected to the load resistor to measure the UUT output voltage.

**Table 4. Output Voltage Test**

| Step | 1550 Voltage Range | Load Resistor | Reading Limits | |
|---|---|---|---|---|
| | | | Minimum | Maximum |
| 1 | 500 V | 500 kΩ | 500 V | 550 V |
| 2 | 500 V | No Load | 500 V | 550 V |
| 3 | 1 kV | 1 MΩ | 1000 V | 1100 V |
| 4 | 1 kV | No Load | 1000 V | 1100 V |
| 5 | 2.5 kV | 2.5 MΩ | 2500 V | 2750 V |
| 6 | 2.5 kV | No Load | 2500 V | 2750 V |
| 7 | 5 kV | 5 MΩ | 5000 V | 5500 V |
| 8 | 5 kV | No Load | 5000 V | 5500 V |

## *Short Circuit Current Test*

To verify the UUT short circuit current, use the following procedure:

1. Connect an ammeter between the UUT + and - terminals.
2. Turn the UUT on and allow to startup.
3. Wait for **Test Voltage** to appear on the display and set the test voltage to 5000 V by pushing ⏫.
4. Push TEST and note that the ammeter reading is within the reading limits referred to in Table 5.
5. Push TEST to discontinue the test.

**Table 5. Short Circuit Current Test**

| Step | 1550 Voltage Range | Reading Limits | |
|---|---|---|---|
| | | Minimum | Maximum |
| 1 | 5000 V | 1.20 mA | 1.80 mA |

### Voltage Measurement Accuracy

To verify voltage measurement accuracy of the Live Circuit Warning function, apply the voltages listed in Table 6 to the + and - terminals of the UUT. Verify that:

- The UUT reading is within the display limits of Table 6.
- The UUT is beeping at a 1-second interval.
- ⚠ is flashing on the display.

**Table 6. Voltage Measurement Test**

| Step | Voltage Source Output | UUT Display | UUT Tone | UUT Display Limits | |
|---|---|---|---|---|---|
| | | | | Minimum | Maximum |
| 1 | -34 Vdc | Flashing Hazard | Beeps | 30 V | 38 V |
| 2 | 240 Vac, 60 Hz | Flashing Hazard | Beeps | 226 V | 254 V |

## Calibration Procedure

The MegOhmMeter should be calibrated yearly to ensure compliance with its specifications.

### Interface Connection

Calibration is performed through software using a computer and IR (infrared) adapter, refer to Figure 2.

Connect the infrared adapter with the interface cable to a COM port of the computer. Place the IR 120 Infrared Communications Adapter so that the lens is aimed at the UUT IR Port. The IR 120 may be placed up to 1 meter from the UUT.

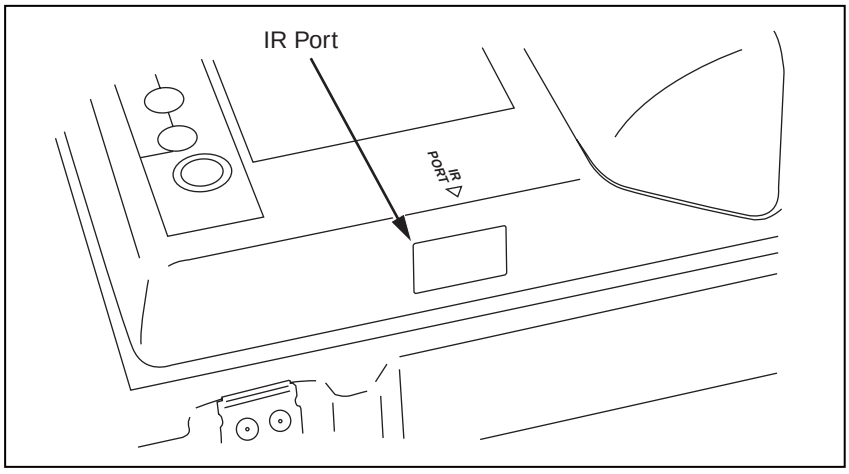


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**Figure 2. IR Port on the MegOhmMeter**

## *Instrument Setup*

Turn the MegOhmMeter on and wait for **Test Voltage** to appear on the display. From the computer terminal, activate the HyperTerminal program from the Windows Start menu. Set the communications settings to:

Bits per second (Baud) = 9600

Data bits = 8

Parity = None

Stop bits = 1

Flow control = None

The calibration menu can now be displayed by typing “homer” on the terminal. The following menu options will be displayed:

----> Calibrate HV Output and Measurement

Calibrate Current Measurement

Calibrate Charge Measurement

Calibrate Battery Status

Install Default Opvars

Dump Opvars

Dump Raw ADC Readings

**⚠Caution**

**The UUT UP and DOWN keys or the ↑ and ↓ keys of the terminal, are used for moving the cursor to the desired menu option. Do not push the terminal ENTER key for any of these options at this time.**

**⚠⚠Warning**

**While performing the following procedures, the equipment and user can be exposed to dangerous high voltage when the UUT is in the “Calibrate HV Output and Measurement” mode.**

## *Normalizing the HV Probe and Digital Multimeter*

1. Connect the HV probe and digital multimeter to the 5520A **NORMAL** output terminals, observing polarity. Manually set the multimeter for a range that has a 10 MΩ input impedance (e.g., 100 V) and provides a maximum resolution for a 500 mV and 5000 mV input.
2. Set the 5520A output to 506 V and note the digital multimeter reading. Record this value.
3. Set the 5520A output to 1000 V and note the voltmeter reading. If the error is > 0.025 % from the nominal value, calculate the error from nominal into a percentage. Multiply 5005 V by this percentage and algebraically add to 5005 V. Record this value.
4. Set the 5520A to standby and disconnect the HV probe and digital multimeter.

## HV Calibration

1. Connect the HV probe and digital multimeter to the output terminals of the UUT, observing polarity.
2. Go to the main calibration menu as described in “Instrument Setup”. Using the terminal ↑ and ↓ key, move the cursor to “Calibrate HV Output and Measurement” option.
3. Press the **ENTER** terminal key. The UUT momentarily displays **HV OFFSET** then flashes ⚠ with PWM 0075, while emitting a beep at 1-second intervals.
4. Use the ↑ and ↓ keys on the terminal to modify the UUT output value to as close as possible to the value recorded in step 2 of “Normalizing the HV Probe and Digital Multimeter”. The nominal value for this adjustment is between 502 and 510 V.
5. Press the **ENTER** terminal key. The UUT now increases its output to nominally 5000 V.
6. Use the ↑ and ↓ keys on the terminal to modify the UUT output value to as close as possible to the value obtained in step 3 of “Normalizing the HV Probe and Digital Multimeter”. The nominal value for this adjustment is between 5000 V and 5010 V.
7. Press the **ENTER** terminal key. The HV generation and measurement functions are now calibrated.
8. Disconnect the HV probe and digital multimeter from the UUT.

## Current Calibration

1. Go to the main calibration menu as described in Instrument Setup. Using the terminal ↑ and ↓ keys, move the cursor to the “Calibrate Current Measurement” option.
2. Attach a current source to the LO and GUARD terminals of the UUT, connecting the current source LO to UUT GUARD terminal.
3. Press the **ENTER** terminal key.
4. Apply 2 mAdc to the UUT.
5. Press the **ENTER** terminal key. The calibration takes a few seconds.
6. The current measurement is now calibrated. Disconnect the current source.

## Charge Calibration

1. Go to the main calibration menu as described in Instrument Setup, and use the terminal ↑ and ↓ keys to move the cursor to the “Calibrate Charge Measurement” option.
2. Press the **ENTER** terminal key.
3. Attach a current source to the LO and GUARD terminals of the UUT, connecting the current source LO to UUT Guard.
4. Apply 2 mAdc to the UUT.
5. Press the **ENTER** terminal key. The Calibration takes about 40 Seconds. The charge/capacitance measurement function is now calibrated.
6. Put the 5520A in standby. To restore normal operation, cycle the power off and back on.

This completes the Calibration Procedure.

# Additional Procedures

*Note*

*The following additional procedures are used during factory calibration and repair but should not be performed in the field. They are included for information only.*

### Battery Calibration (Calibrate Battery)

Battery calibration **should not** be performed, as it requires disconnecting the battery and replacing it with a power supply. The battery calibration was performed during the measurement PCB test.

### Install Default Opvars (Default Opvars)

**Do not use.** This option installs default values into all of the opvars (**Op**erational **Var**iables for calibration stored in non-volatile memory). Full re-calibration is required after this command including battery re-calibration.

### Dump Opvars (Dump Opvars)

This option causes the opvars and current settings to be displayed on the terminal. The opvars may be useful for fault finding.

### Dump Raw ADC Readings (Diagnostics)

This option displays the raw readings from the three ADC channels: voltage, current, and charge. The first column displays the current range, which may also be incremented using 'S' or SCROLL. This feature can be useful to identify faults with the input circuitry.

# Battery Replacement Procedure

**⚠⚠Warning**

**To avoid electrical shock or personal injury, remove the test leads and any input signals before opening the case or replacing the battery or fuse. To prevent damage or injury, install ONLY batteries or fuses specified for the product.**

**⚠Caution**

**Do not attempt to repair or service the MegOhmMeter unless qualified to do so and you have the relevant calibration, performance test, and service information.**

**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 MegOhmMeter is powered by 12 V lead acid battery, Fluke P/N 1669932. The battery can be recharged using the AC power cord or the DC charger leads that are shipped with the MegOhmMeter.

Fully charging the battery typically takes 12 hours. Avoid charging in extremes of temperature. Recharge the battery if the MegOhmMeter has been stored for extended periods.

If the battery needs to be replaced, refer to Figures 3 and use the following procedure to replace the battery.

## Disassembly

**⚠Caution**

**Disassembly must be performed using proper ESD handling techniques. Place the unit on an anti-static mat and use a grounded wrist strap during the following procedure.**

1. Disconnect the test leads from any live source and power off the MegOhmMeter. Remove the mains supply cable and LV charging leads from the instrument.
2. With the case latched, turn the unit over and place the instrument on a level surface with feet up.
3. Remove the 4 screws and feet from the Rotomould case. This frees the entire electronic chassis from the case and cover.
4. Set the unit upright, unsnap the case latches and open the cover. Remove the instrument chassis from the case and set it on the anti-static mat so that the instrument panel and LCD are face down.
5. Unscrew and remove the two chassis standoffs that protrude from the battery-mounting bracket.
6. Remove the two screws at each end of the battery bracket assembly.
7. To gain access to the battery connections, rotate the battery as shown in Figure 3.
8. Remove the positive and negative sleeved connectors from the battery. Take note of how the battery and the unit are assembled. It will be necessary for reassembly.

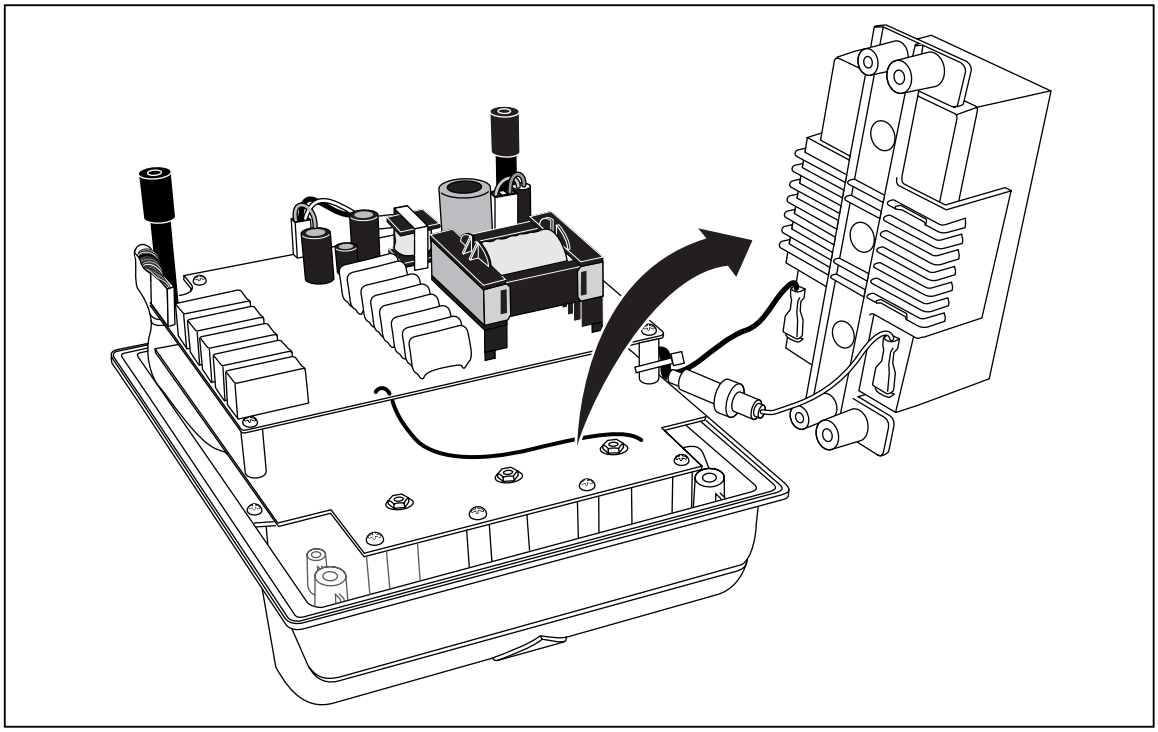

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**Figure 3. 1550 Disassembly**

## *Re-assembly*

1. Place the new battery assembly in position, and attach sleeved connectors to the battery, observing correct polarity.
2. Reverse steps 2 through 6 of the disassembly procedure to re-assemble the MegOhmMeter.

## Replacing the Guard Fuse

**⚠⚠Warning**

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

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

To replace the Guard fuse (refer to Figure 4):

1. Turn off the MegOhmMeter.
2. Rotate the safety shutter toward the top of the MegOhmMeter 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 counter clockwise until it unlocks.
4. Lift out the fuse holder and remove the fuse from the fuse holder.
5. Install the new fuse and drop the fuse holder back into the MegOhmMeter.
6. Tighten and lock the fuse holder by turning it clockwise with the screwdriver.

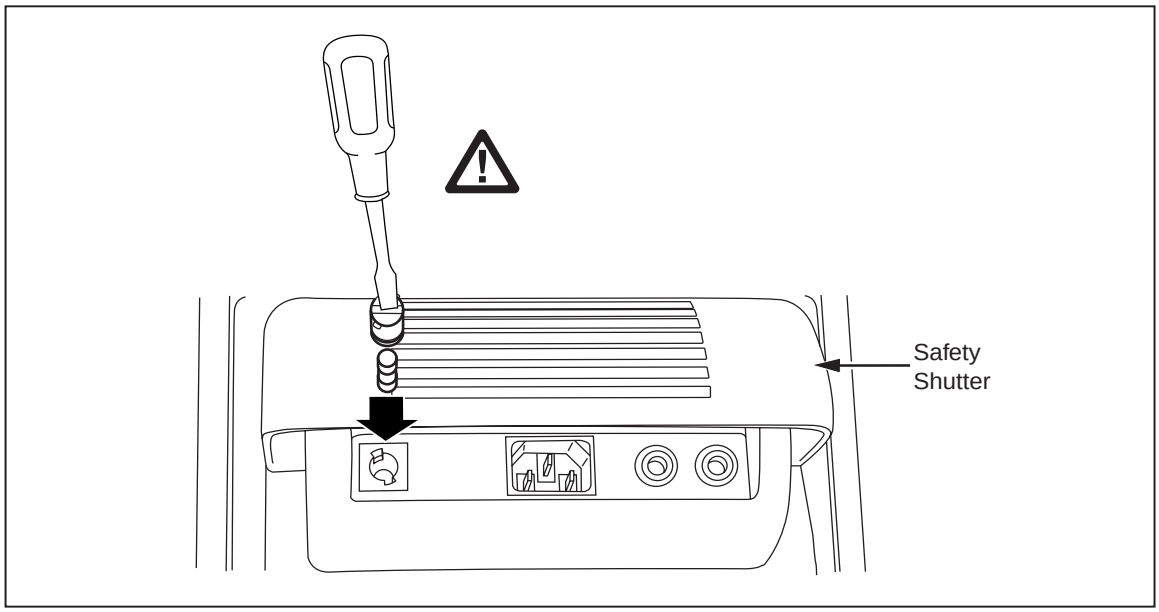


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**Figure 4. Replacing the Guard Fuse**

# Cleaning

**⚠⚠Warning**

**To avoid possible electric shock or personal injury, remove excess water from the cloth before cleaning the MegOhmMeter 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 MegOhmMeter.

# Replacement Parts/Accessories

Replacement parts are listed in Table 7.

**Table 7. Replacement Parts**

| Parts | Part Number |
|---|---|
| Test Cable Red | 1642584 |
| Test Cable Black | 1642591 |
| Test Cable Green | 1642600 |
| Test Clip Red | 1642617 |
| Test Clip Black | 1642621 |
| Test Clip Green | 1642639 |
| Carry Case | 1642656 |
| ⚠Guard Fuse, 100 mA, 250 V, Type F (Fast) to IEC127 | 1642663 |
| IR20, IRDA Adapter and Cable | 1642688 |
| Rotomould Base & Cover | 1642859 |
| Living Hinge for Rotomould Case | 1670893 |
| Battery and Housing Assembly | 1669932 |
| Latch for Rotomould Case | 1670887 |
| AC Power Cord (S. Africa) | 1552363 |
| AC Power Cord (Australia) | 658641 |
| AC Power Cord (UK) | 769455 |
| AC Power Cord (Continental Europe) | 789422 |
| AC Power Cord (North America) | 284174 |
| Soft Carrying Case | 1642658 |
| DC Charger Cable | 1642695 |
| ⚠ Charger Fuse, 5 A, 1.5-in X 0.25-inch, Quick Blow (Fast) Fuse | 1643479 |
| CD ROM (Includes QuickLink HVT Communication Software and Users Manuals [English, French, German, Spanish]) | 1989912 |

# Specifications

## General Specifications

| | | |
|---|---|---|
| **Display** | 75 mm x 105 mm | |
| **Power** | 12 V lead-acid rechargeable battery.<br>Yuasa NP2.8-12 | |
| **Charger Input (AC)** | 85 V to 250 V ac 50/60 Hz 50 VA | |
| **Charger Input (DC)** | 10 to 15 V dc, 30 VA | |
| ⚠ **Guard Fuse** | HBC 100 mA, 250 V, Type F (Fast) 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<br>(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<br>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<br>IEC 61010-1, CAT III V 600,<br>Pollution Degree 2 | |
| **Typical Battery Charge Capability**<br>Note<br>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<br>200 kΩ to 10 GΩ<br>10 GΩ to 100 GΩ<br>> 100 GΩ | unspecified<br>5%<br>20%<br>unspecified |
| 1000 V | < 200 kΩ<br>200 kΩ to 20 GΩ<br>20 GΩ to 200 GΩ<br>> 200 GΩ | unspecified<br>5%<br>20%<br>unspecified |
| 2500 V | < 200 kΩ<br>200 kΩ to 50 GΩ<br>50 GΩ to 500 GΩ<br>> 500 GΩ | unspecified<br>5%<br>20%<br>unspecified |
| 5000 V | <200 kΩ<br>200 kΩ to 100 GΩ<br>100 GΩ to 1 TΩ<br>>1 TΩ | unspecified<br>5%<br>20%<br>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<br>Indication: 1 second |
| **Live Circuit Warning** | |
| Warning range: 30 V to 600 V ac/dc, 50/60 Hz<br>Voltage accuracy: +/- (5 % + 2 V) | |