FLUKE®

# 150X Series
Insulation Testers

## Calibration Manual

PN 2465477
November 2005

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# Introduction

The Fluke Models 1503, 1507 and 1508 are battery-powered insulation testers (hereafter, Tester or UUT). These Testers 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).

Although this manual contains calibration information for Models 1503, 1507, and 1508, all illustrations and examples assume use of Model 1507. Table 1 provides a description of all the symbols used in this manual.

The information provided in this manual includes the following:

- Warnings and Safety Information
- Performance Test Procedures
- Calibration Adjustment Procedure
- Battery Replacement Procedure
- Replaceable Parts and Accessories
- Specifications

The information provided in this manual should only be used by qualified personnel. For complete operating instructions and additional safety information, refer to the *1507/1503 Insulation Testers Users Manual* or the *1508 Insulation Tester Users Manual.*

# Safety Information

**⚠⚠Warning**

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

- **Use the Meter only as specified in this manual or the protection provided by the Tester might be impaired.**
- **Do not use the Meter or test leads if they appear damaged, or if the Meter is not operating properly. If in doubt, have the Meter serviced.**
- **Always use the proper terminal, switch position, and range for measurements before connecting Meter to circuit under test.**
- **Verify the Meter's operation by measuring a known voltage.**
- **Do not apply more than the rated voltage as marked on the Meter, 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 Meter around explosive gas or vapor.**
- **When using the test leads, keep your fingers behind the finger guards.**
- **Remove test leads from the Meter before opening the Meter case or battery door. Never operate the Meter 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 |

## *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 Meter at: register.fluke.com

# 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 2nd 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 2nd 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 2nd Edition

**Batteries** ... Four AA batteries (NEDA 15A or IEC LR6)

**Battery Life** ... Insulation test use: Meter 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: Meter 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

**Compliance to EN 61557** ... IEC61557-1, IEC61557-2, IEC61557-4, IEC61557-10

**Model 1503 Accessories** ... TL224 Leads
TP74 Probes
Clips PN 1958654 (red) and PN 1958646 (black)
Holster
Remote Probe

**Model 1507 Accessories** ... TL224 Leads
TP74 Probes
Clips PN 1958654 (red) and PN 1958646 (black)
Holster
Remote Probe

**Model 1508 Accessories** ... Lead Set PN 666602
Clips PN 1670641 (red) and PN 1670652 (black)
Holster
Remote Probe

# Electrical Specifications

## 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 kΩ 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 Protection** ..... 2 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 models 1507 and 1508, 0.01 MΩ to 2000 MΩ model 1503

**Test Voltages** ..... 50, 100, 250, 500, 1000 V models 1507 and 1508, 500 and 1000 V model 1503

**Test Voltage Accuracy** ..... + 20 %, - 0 %

**Short-Circuit Test Current** ..... 1 mA nominal

**Auto Discharge** ..... Discharge 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.

## _Models 1507 and 1508_

| 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) |

## _Model 1503_

| Output Voltage | Display Range | Resolution | Test Current | Accuracy ± (% of Rdg + Digits) |
|---|---|---|---|---|
| 500 V (0 % to + 20 %) | 0.01 to 20.00 MΩ | 0.01 MΩ | 1 mA @ 500 kΩ | ± (2.0 % + 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 | ± (2.0 % + 5) |
| | 200 to 2000 MΩ | 1 MΩ | | |

## _EN61557 Specification (Models 1503 and 1507)_

The following tables are a requirement for European labeling.

| Measurement | Intrinsic Uncertainty | Operating Uncertainty [1] |
|---|---|---|
| Volts | ± (2.0 % + 3) | 30 % |
| Earth-Bond Resistance | ± (1.5 % + 3) | 30 % |
| Insulation Resistance | Depends on test voltage and range. See Insulation Test specifications. | 30 % |
| [1] This specification comes from the standard and indicates the maximum amount allowable by the standard. | | |

## EN61557 Influence Variables and Uncertainties (Models 1503 and 1507)

| Earth-Bond Resistance Influence Variable | Designation per EN61557 | Uncertainty for Insulation Resistance [1] | Uncertainty for Earth-Bond Resistance [1] |
|---|---|---|---|
| Supply Voltage | E2 | 5 % | 5 % |
| Temperature | E3 | 5 % | 5 % |
| [1] Specification confidence level 99 %. | | | |

The following tables can be used to determine the maximum or minimum display values considering maximum instrument operating error per EN61557-1, 5.2.4.

## *Insulation Resistance Maximum and Minimum Display Values (Models 1503 and 1507)*

| 50 V | | 100 V | | 250 V | | 500 V | | 1000 V | |
|---|---|---|---|---|---|---|---|---|---|
| **Limit Value** | **Minimum Display Value** | **Limit Value** | **Minimum Display Value** | **Limit Value** | **Minimum Display Value** | **Limit Value** | **Minimum Display Value** | **Limit Value** | **Minimum Display Value** |
| 0.05 | 0.07 | 0.05 | 0.07 | 0.05 | 0.07 | 0.05 | 0.07 | | |
| 0.06 | 0.08 | 0.06 | 0.08 | 0.06 | 0.08 | 0.06 | 0.08 | | |
| 0.07 | 0.09 | 0.07 | 0.09 | 0.07 | 0.09 | 0.07 | 0.09 | | |
| 0.08 | 0.10 | 0.08 | 0.10 | 0.08 | 0.10 | 0.08 | 0.10 | | |
| 0.09 | 0.12 | 0.09 | 0.12 | 0.09 | 0.12 | 0.09 | 0.12 | | |
| 0.1 | 0.13 | 0.1 | 0.13 | 0.1 | 0.13 | 0.1 | 0.13 | 0.1 | 0.1 |
| 0.2 | 0.26 | 0.2 | 0.26 | 0.2 | 0.26 | 0.2 | 0.26 | 0.2 | 0.3 |
| 0.3 | 0.39 | 0.3 | 0.39 | 0.3 | 0.39 | 0.3 | 0.39 | 0.3 | 0.4 |
| 0.4 | 0.52 | 0.4 | 0.52 | 0.4 | 0.52 | 0.4 | 0.52 | 0.4 | 0.5 |
| 0.5 | 0.65 | 0.5 | 0.65 | 0.5 | 0.65 | 0.5 | 0.65 | 0.5 | 0.7 |
| 0.6 | 0.78 | 0.6 | 0.78 | 0.6 | 0.78 | 0.6 | 0.78 | 0.6 | 0.8 |
| 0.7 | 0.91 | 0.7 | 0.91 | 0.7 | 0.91 | 0.7 | 0.91 | 0.7 | 0.9 |
| 0.8 | 1.04 | 0.8 | 1.04 | 0.8 | 1.04 | 0.8 | 1.04 | 0.8 | 1.0 |
| 0.9 | 1.17 | 0.9 | 1.17 | 0.9 | 1.17 | 0.9 | 1.17 | 0.9 | 1.2 |
| 1.0 | 1.30 | 1.0 | 1.30 | 1.0 | 1.30 | 1.0 | 1.30 | 1.0 | 1.3 |
| 2.0 | 2.60 | 2.0 | 2.60 | 2.0 | 2.60 | 2.0 | 2.60 | 2.0 | 2.6 |
| 3.0 | 3.90 | 3.0 | 3.90 | 3.0 | 3.90 | 3.0 | 3.90 | 3.0 | 3.9 |
| 4.0 | 5.20 | 4.0 | 5.20 | 4.0 | 5.20 | 4.0 | 5.20 | 4.0 | 5.2 |
| 5.0 | 6.50 | 5.0 | 6.50 | 5.0 | 6.50 | 5.0 | 6.50 | 5.0 | 6.5 |
| 6.0 | 7.80 | 6.0 | 7.80 | 6.0 | 7.80 | 6.0 | 7.80 | 6.0 | 7.8 |
| 7.0 | 9.10 | 7.0 | 9.10 | 7.0 | 9.10 | 7.0 | 9.10 | 7.0 | 9.1 |
| 8.0 | 10.40 | 8.0 | 10.40 | 8.0 | 10.40 | 8.0 | 10.40 | 8.0 | 10.4 |
| 9.0 | 11.70 | 9.0 | 11.70 | 9.0 | 11.70 | 9.0 | 11.70 | 9.0 | 11.7 |
| 10.0 | 13.0 | 10.0 | 13.0 | 10.0 | 13.0 | 10.0 | 13.0 | 10.0 | 13.0 |
| 20.0 | 26.0 | 20.0 | 26.0 | 20.0 | 26.0 | 20.0 | 26.0 | 20.0 | 26.0 |
| 30.0 | 39.0 | 30.0 | 39.0 | 30.0 | 39.0 | 30.0 | 39.0 | 30.0 | 39.0 |
| 40.0 | 52.0 | 40.0 | 52.0 | 40.0 | 52.0 | 40.0 | 52.0 | 40.0 | 53.0 |
| | | 50.0 | 65.0 | 50.0 | 65.0 | 50.0 | 65.0 | 50.0 | 65.0 |
| | | 60.0 | 78.0 | 60.0 | 78.0 | 60.0 | 78.0 | 60.0 | 78.0 |
| | | 70.0 | 91.0 | 70.0 | 91.0 | 70.0 | 91.0 | 70.0 | 91.0 |
| | | 80.0 | 104.0 | 80.0 | 104.0 | 80.0 | 104.0 | 80.0 | 104.0 |

### *Insulation Resistance Maximum and Minimum Display Values (cont.)*

| 50 V | | 100 V | | 250 V | | 500 V | | 1000 V | |
|---|---|---|---|---|---|---|---|---|---|
| **Limit Value** | **Minimum Display Value** | **Limit Value** | **Minimum Display Value** | **Limit Value** | **Minimum Display Value** | **Limit Value** | **Minimum Display Value** | **Limit Value** | **Minimum Display Value** |
| | | 90.0 | 117.0 | 90.0 | 117.0 | 90.0 | 117.0 | 90.0 | 117.0 |
| | | | | 100.0 | 130.0 | 100.0 | 130.0 | 100.0 | 130.0 |
| | | | | | | 200.0 | 260.0 | 200.0 | 260.0 |
| | | | | | | 300.0 | 390.0 | 300.0 | 390.0 |
| | | | | | | 400.0 | 520.0 | 400.0 | 520.0 |
| | | | | | | | | 500.0 | 650.0 |
| | | | | | | | | 600.0 | 780.0 |
| | | | | | | | | 700.0 | 910.0 |
| | | | | | | | | 800.0 | 1040.0 |
| | | | | | | | | 900.0 | 1170.0 |
| | | | | | | | | 1000.0 | 1300.0 |
| | | | | | | | | 2000.0 | 2600.0 |

### *Earth-Bond Resistance Maximum Display Values (Models 1503 and 1507)*

| Limit Value | Maximum Display Value | Limit Value | Maximum Display Value | Limit Value | Maximum Display Value |
|---|---|---|---|---|---|
| 0.4 | 0.28 | 7.0 | 4.9 | 100.0 | 70.0 |
| 0.5 | 0.35 | 8.0 | 5.6 | 200.0 | 140.0 |
| 0.6 | 0.42 | 9.0 | 6.3 | 300.0 | 210.0 |
| 0.7 | 0.49 | 10.0 | 7.0 | 400.0 | 280.0 |
| 0.8 | 0.56 | 20.0 | 14.0 | 500.0 | 350.0 |
| 0.9 | 0.63 | 30.0 | 21.0 | 600.0 | 420.0 |
| 1.0 | 0.7 | 40.0 | 28.0 | 700.0 | 490.0 |
| 2.0 | 1.4 | 50.0 | 35.0 | 800.0 | 560.0 |
| 3.0 | 2.1 | 60.0 | 42.0 | 900.0 | 630.0 |
| 4.0 | 2.8 | 70.0 | 49.0 | 1000.0 | 700.0 |
| 5.0 | 3.5 | 80.0 | 56.0 | 2000.0 | 1400.0 |
| 6.0 | 4.2 | 90.0 | 63.0 | | |

# Basic Maintenance

This basic maintenance section of the manual contains tests and procedures that require no equipment other than the Meter and some consumables such as fuses and batteries. Also, internal access is limited to the battery and fuse compartment.

## Cleaning

When cleaning is necessary, wipe the Meter with a damp cloth and mild detergent. Do not use abrasives or solvents. Dirt of moisture on the terminals can affect readings.

## Testing the Batteries

**⚠⚠Warning**

**To avoid electrical shock or personal injury, replace the batteries as soon as the battery indicator (🔋) appears. A weak battery can cause false readings.**

The Meter continuously monitors battery voltage. If the low battery icon (🔋) appears on the display, there is minimal battery life left. Prior to performing the performance tests check the batteries, and replace if necessary.

The following procedure tests the batteries under load:

1. Turn the rotary switch to the 🔋 **V** position with no probes inserted.
2. Press the blue key to initiate the fully loaded battery test. The voltage function display clears and the measured battery voltage is shown in the primary display for 2 seconds, the voltage display then returns. The displayed voltage should be within 5.5 to 6.2 V. If voltage is lower than 5.2 V, replace the batteries and repeat the test.

## Replacing the Batteries and/or Fuse

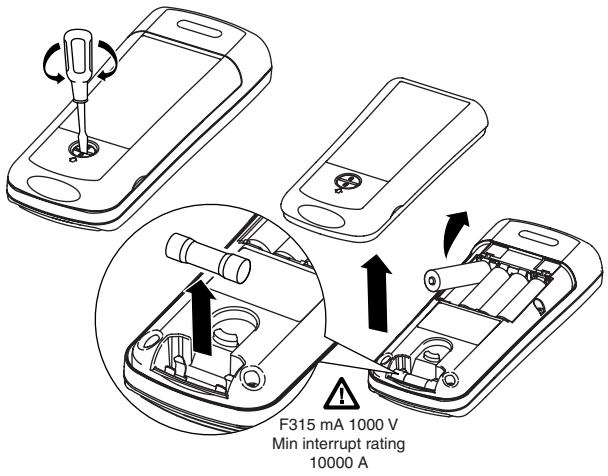
Replace the fuse and batteries as shown in Figure 1. Follow the steps below to replace the batteries.

**⚠⚠Warning**

**To avoid shock, injury, or damage to the Meter:**

- **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 yellow boot from the Meter. Use the thumb-hole to press on the rear of the Meter and peel the boot from the Meter.
2. Remove the battery door by using a standard screwdriver to turn the battery door lock until the unlock symbol aligns with the arrow.
3. Lift the bottom of the battery door away from the Meter to access the fuse and battery compartment.
4. Remove and replace the batteries and or fuse as shown in Figure 1.
5. Replace the battery door and secure by turning the battery door lock until the lock symbol (🔒)aligns with the arrow.
6. Position the bottom of the Meter in the bottom of the boot, and press the top of the Meter firmly into the boot.



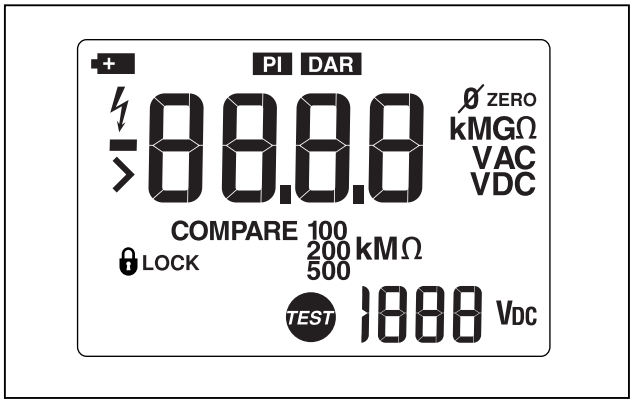

ecz15f.eps

| | |
|---|---|
| Fuse, Fast, 315 mA, 1000 V, Min Interrupt Rating 10000 A | Fluke PN 2279339 |
| Battery, 1.5 V AA Alkaline, NEDA 15A, IEC LR6 | Fluke PN 376756 |

**Figure 1. Replacing the Fuse and Batteries**

## Testing the Display

Press and hold the blue key, and simultaneously turn the UUT on. Compare the display with the example in Figure 2. Check all segments for clarity and contrast.




bbw01f.eps

**Figure 2. Display Test**

## Backlight Test

The display backlight is a toggle function controlled by the ☼ key. Each press of ☼ causes the backlight to change states, on to off or off to on. To test the backlight, press the ☼ key twice to verify that the toggle function is working. Turn the backlight off.

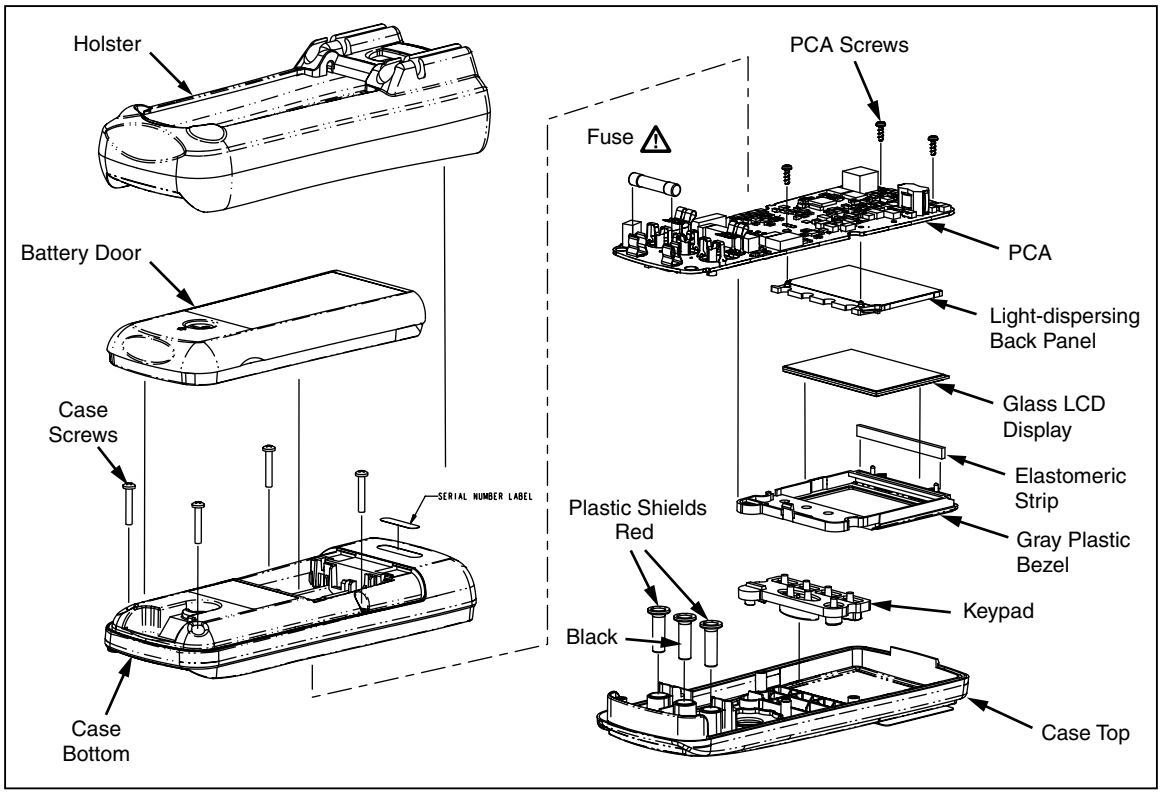
### Keypad Test

The keypad consists of six keys located above the rotary switch.

1. To test the keypad, turn the rotary switch to **V** and momentarily press each of the six keys. Each press of an operational key will cause the Meter to beep. No beep in response to a key press indicates a defective keypad.
2. Reset the Meter by turning it **OFF**, and then to any other position.

## Disassembling and Reassembling the Meter

This section of the manual provides instructions for disassembling and reassembling the Meter. The instructions are limited to major replaceable assemblies and do not include component-level detail. See Figure 3 for an exploded view of the major assemblies. Also, the emphasis is placed on disassembly. However, when appropriate, an italicized entry at the end of each disassembly procedure provides critical hints for reassembly.




ecz20f.eps

**Figure 3. Disassembling the Meter**

## Removing the Boot

The standard Meter comes equipped with a snug-fitting yellow rubber boot. The boot helps protect the Meter from rough handling and is normally left on the Meter. The first step in disassembling the Meter is to remove the boot.

Use the following procedure to remove the boot:

1. Looking at the Meter, place your thumbs on the top corners of the boot and firmly grasp the Meter.
2. Using both thumbs, push the boot up and over both corners of the Meter.
3. Continue pushing on the boot until both of its inside corners are resting on top of the Meter.
4. Now, rest the heel of one hand behind the display, and place all four fingers of the same hand along the upper front edge of the boot.
5. Firmly grasp the Meter with the other hand, and using your fingers, peel the boot over the top of the Meter.
6. Slide the Meter up and out of the boot.

*Note*

*To install the boot, position the bottom of the Meter in the bottom of the boot, and press the top of the instrument firmly into of the boot.*

## Removing the Battery Door

**⚠⚠WARNING**

**To avoid the risk of electrical shock, turn the rotary switch to OFF, and remove the test leads from the front-panel terminals before removing the battery cover.**

With the boot removed, the next step in disassembling the Meter is to remove the battery door. Use the following procedure to remove the door:

1. Locate the black slotted lock on the lower rear of the Meter.
2. Using a standard screwdriver, turn the battery-door lock until the unlock symbol aligns with the arrow. The door is now unlocked.
3. Lift the bottom of the battery door away from the Meter. Removing the battery door provides access to the fuse and battery compartment.
4. If necessary, remove and replace the batteries and/or fuse as shown in Figure 1.

*Note*

*To install the battery door, first, slide the top of the door into position, and then, secure it by turning the battery door lock until the lock symbol* (🔒) *aligns with the arrow.*

## Opening the Bottom Case

With the battery door removed, the next step in disassembling the Meter is to remove the bottom case. Use the following procedure to remove the bottom case:

*Note*

*When removing the back cover, it is not necessary to remove the fuse or the batteries.*

1. Locate the four Philips head screws on the bottom case, two next to the batteries and two next to the fuse.
2. Using a Philips screwdriver, remove the four screws.
3. Separate the front and bottom cases at the fuse-end the Meter. Tilt the freed end of the cover up, and lift it away from the top case.

*Note*

*To install the bottom case, first, position and press together the display-end of the top and bottom cases. Then, prior to installing all four screws, press the fuse-end of the covers together.*

## Removing the PCA

With the bottom case removed, the next step in disassembling the Meter is to remove the printed circuit assembly (PCA). Refer to Figure 3 and use the following procedure to remove the PCA:

1. One Philips screw attaches the PCA to the top case. Locate the screw near the center of the PCA, and remove it.
2. Two chrome plated springs on the PCA form an electrical connection (clip) to the two recessed INSULATION(+) terminals on the top case. Break these connections by carefully pulling each of the springs back and away from the terminals. See Figure 4.

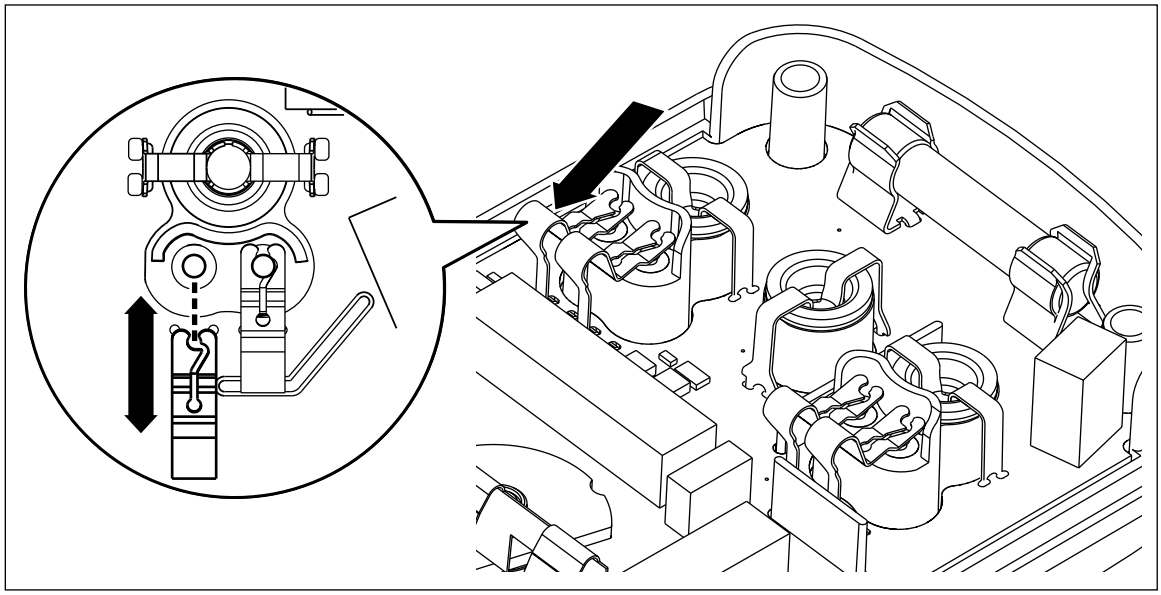


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**Figure 4. Insulation Terminal Clips**

3. With one hand over the PCA, roll the top case over (face up) and lift it away from the PCA.

*Note*

*Two red and one black plastic shields are used to isolate the user from the input terminals. With the PCA removed, these shields are loose and can fall away from the PCA.*

4. Remove and set aside all three shields for use during reassembly

**⚠⚠WARNING**

**To avoid risk of electrical shock, make sure the plastic input terminals are properly positioned on the PCA before attaching it to the top case.**

To install the PCA, proceed as follows:

1. With the PCA face-up, place all three plastic shields into position on the PCA.
2. Lower the top cover onto the PCA, and roll both parts over (PCA up).
3. Connect (snap) the chrome plated springs to the **INSULATION** terminals.
4. Install the screw that attaches the PCA to the top case.

## Removing the LCD

With the PCA removed, the final step in disassembling the Meter is to remove the LCD assembly from the PCA. Refer to Figure 5 and use the following procedure to remove the LCD assembly:

1. Remove the two screws from the display end of the PCA.
2. Hold the PCA face down with the fuse-end of the PCA toward you. Locate the screw-hole near the center of the assembly. This hole is the one used to attach (with a screw) the PCA to the top case.
3. Now, locate the gray plastic tab just above and to the left of the hole. Using your thumbnail press the tab down and toward the display end of the PCA. This will release the LCD assembly from the PCA.

**⚠Caution**

**To avoid damaging the plastic guide pins on the LCD assembly, keep the LCD assembly parallel to the PCA when separating the two parts.**

4. Without tilting the PCA, lift it straight up and away from the LCD assembly.
5. To keep loose parts from falling away from the LCD assembly, keep it face-down, and set it in a safe place.

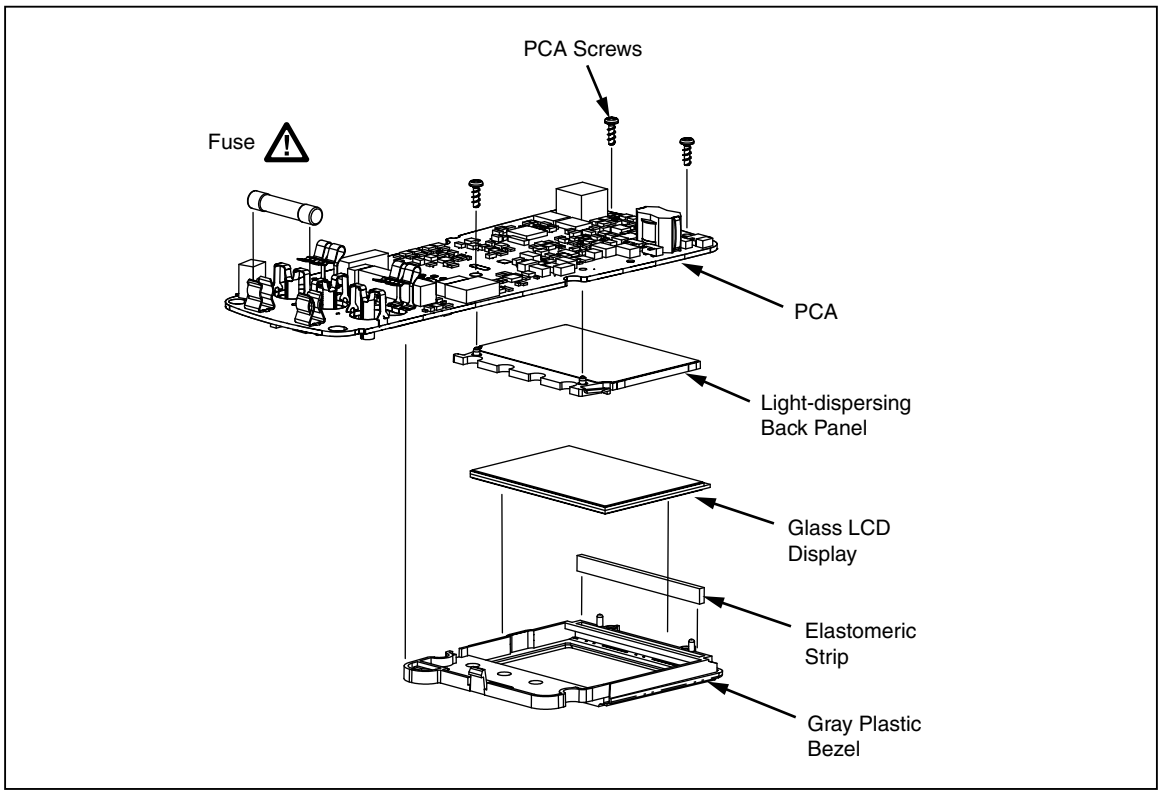


**Figure 5. Accessing the LCD**

## Replacing the LCD

The LCD assembly consists of four pieces as shown in Figure 5:

- Translucent light-dispersing back panel
- Flexible elastomeric conducting strip
- Plastic bezel for housing the assembly's components
- Glass LCD display

With the LCD assembly removed from the PCA, use the following procedure to replace the LCD:

1. Lift the translucent light dispersing back panel off of the plastic bezel.
2. Remove the pink and black elastomeric strip from its slot in the bezel.
3. Remove the old glass LCD display from the bezel.

*Note*

*Make sure the new LCD display is clean (free of lint and finger prints) before placing it in position in the bezel.*

4. Position the new glass LCD display in the bezel; the silver face should face the rear, and the stepped portion of the glass should be directly under the elastomeric slot on the bezel.
5. Drop the elastomeric strip into its slot on the bezel.
6. Position the translucent light-dispersing back panel over the silver side of the glass LCD display. Make sure the guide pins on the light dispersing back panel are facing up and that they are on the side opposite the elastomeric strip.

7. While holding the LCD assembly (face down) in one hand, position the PCA (fuse side up) over the bezel; match the guide holes in the PCA with the plastic guide pins on the bezel and the translucent light dispersing back panel. After the LCD assembly is in position, lock it in place by pressing (below the display) the bezel against the PCA; listen for the tab on the bezel to snap (lock) into position on the PCA.
8. Secure the PCA to the LCD assembly by installing the two screws that attach the PCA to the bezel. These screws also ensure contact between the glass LCD display, the elastomeric strip, and the PCA.

## Reassembling the Meter

To reassemble the Meter, logically reverse the previous disassembly procedures. In the process, make sure to re-establish all electrical connections; specifically, the elastomeric strip for the LCD, the red and black plastic shields for the input terminals, and the two spring contacts for the Insulation Test Probe. Also make sure all parts are correctly aligned and positioned; do not force-fit any of the parts into position.

# Required Tools and Equipment

Table 2 lists the required equipment for performing the Performance Test and Calibration adjustments. If a recommended model is not available, use a substitute with equivalent or better specifications

**Table 2. Required Equipment**

| Equipment | Required Characteristics | Recommended Model |
|---|---|---|
| Calibrator | **AC Voltage Range:** 0 - 600 V<br>Accuracy: +/- 0.5%<br>Frequency Range: 50 Hz - 400 Hz<br>Accuracy: +/-3%<br>**DC Voltage:** 0 - 600 V<br>Accuracy: +/-0.5%<br>**Ohms Range:** 0 - 20 kΩ<br>Accuracy: +/-0.37 %<br>**Insulation Resistance:** 50 kΩ - 60 MΩ<br>Accuracy: +/-0.37% | Fluke 9100 w/135 option |
| DMM | **DC Volts:** 0 - 1000 V<br>Accuracy: +/-5%<br>**DC Current:** 0 - 2 mA<br>Accuracy: +/-1% | Fluke 189 |
| HV Divider | **DC Voltage Range:** 1 kV -5 kV<br>Accuracy: 1%<br>**Division Ratio:** 1000:1<br>Input resistance; 1000 MΩ | Fluke 80k-6 |
| HV Resistor | 9 GΩ Resistor for Insulation Test | Ohmite # MOX-400239007F |
| Precision Resistor | Resistor, wirewound, 2 Ω, +- 0.1%, 3 W, 50ppm, axial | IRC # RWR89S2R00BR |
| Precision Resistor | Resistor, R05a, MF, 50 k, +-0.1%, 0.25 W, 25 ppm | Fluke PN 810580 |

# Performance Tests

The following series of tests comprise a performance test for verifying the accuracy of the Meter (UUT) and its performance level. The performance test is recommended as an acceptance test for incoming inspection and as a calibration procedure for periodically ensuring the accuracy of the Meter. Fluke recommends running the performance test at least once a year.

No adjustments are required during the performance test, and it is not necessary to open the case. If the Meter does not pass all parts of the performance tests, repair and/or calibration adjustment are required. A calibration adjustment procedure is given later in this manual. If significant repairs are required, contact Fluke as described toward the front of this manual. If user repairs are appropriate, refer to the list of user-replaceable parts toward the end of this manual.

## Testing the Voltage Function

To verify the accuracy of the voltage measuring function, do the following:

1. Turn the UUT rotary switch to the **V** function.
2. Connect the Calibrator to the **INSULATION** and **COM** terminals of the UUT.
3. Apply the input level for each step listed in Table 3.
4. Compare the reading on the UUT display with the Display Reading in Table 3.
5. If the display reading falls outside of the range shown in Table 3, the Meter does not meet specification.

**Table 3. Voltage Accuracy Tests**

| Step | Function | Range | Applied Input | Display Reading | |
|---|---|---|---|---|---|
| | | | | Low Limit | High Limit |
| 1. | V | 600.0 V | 400 mV, 0 Hz | 0.1 | 0.7 |
| 2. | | | 8 V, 0 Hz | 7.5 | 8.5 |
| 3. | | | 8 V, 400 Hz | Display must show V ac annunciator | |
| 4. | | | 50 V, 0 Hz | 48.7 | 51.3 |
| 5. | | | 100 V, 0 Hz | 97.7 | 102.3 |
| 6. | | | 250 V, 0 Hz | 244.7 | 255.3 |
| 7. | | | 500 V, 0 Hz | 489.7 | 510.3 |
| 8. | | | 120 V, 60Hz | 117.3 | 122.7 |
| 9. | | | 230 V, 50 Hz | 225.1 | 234.9 |
| 10 | | | 645 V, 400 Hz, | 631.8 | 658.2 |

## Discharge Circuit Test

The following Discharge Circuit Test is a safety related test that verifies input jack wiring to the PCA, the RSOB contacts, RSOB PCA pads, and other active discharge components on the PCA.

1. Place a Shorting Bar across the UUT **COM** and **INSULATION** input terminals.

2. Set the UUT rotary switch to 1000 V, and press TEST.
3. Release the TEST key and remove the short from the UUT input terminals.

**⚠Caution**

**To avoid damage to the DMM, DO NOT press the UUT TEST key during the following steps.**

4. Connect the test DMM to the UUT **INSULATION** and **COM** terminals
5. Set the test DMM to Ω function.
6. Verify that the test DMM reading is between 2000 and 3000 Ω.

## *Testing the Insulation Function*

**⚠⚠Warning**

**To avoid possible electric shock or personal injury, avoid contact with the UUT when testing the insulation function. Pressing the TEST key produces a potentially dangerous voltage, at the UUT insulation output terminals, when the Meter is in the Insulation function.**

**⚠Caution**

**To avoid damage to the calibrator, do not attempt to use the 5500A, 5520A or other standard calibrator for the insulation tests.**

**⚠Caution**

**To avoid damage to the Fluke 9100 make sure to select the insulation test function prior to pushing the UUT TEST key.**

### *Insulation Resistance Accuracy Tests*

To test the insulation resistance accuracy complete the test steps in Table 4, using the following procedure.

1. Connect the UUT **INSULATION** and **COM** terminals to the calibrator output terminals.
2. Set the calibrator to the insulation resistance test function.
3. Turn the UUT rotary function switch to an **INSULATION** function.
4. Select the UUT insulation voltage range per Table 4.
5. Apply the calibrator output from Table 4.
6. Press the UUT TEST key.
7. Verify that the UUT reading is within the display reading limits shown in Table 4.

**Table 4. Insulation Resistance Accuracy Test**

| Step | Insulation Voltage Range | Applied | Display Units | Display Reading Limits | |
|---|---|---|---|---|---|
| | | | | 1503 | 1507/1508 |
| 1. | 1000 V | 1.9 GΩ | MΩ | 1862 to 1938 | n/a |
| 2. | 1000 V | 1 MΩ | | 0.5 to 1.5 | 0.5 to 1.5 |
| 3. | 1000 V | 49 MΩ | | 47.5 to 50.5 | 47.8 to 50.2 |
| 4. | 1000 V | 60 MΩ | | 58.3 to 61.7 | 58.6 to 61.4 |
| 5. | 500 V | 500 kΩ | | 0.44 to 0.56 | 0.44 to 0.56 |
| 6. | 250 V | 250 kΩ | | n/a | 0.20 to 0.30 |
| 7. | 100 V | 100 kΩ | | n/a | 0.6 to 0.15 |

## *Full-Scale Insulation Resistance Accuracy Test, 1000 V Range (Models 1507 and 1508)*

The following test verifies the full-scale accuracy of the 1000 V range using a separate 9-GΩ resistor. Prior to performing the accuracy test, verify that the 9-GΩ resistor is within specifications as follows:

### 9-GΩ Resistor Test

1. Make a divider network using a certified precision 50-kΩ resistor (within +/- 0.1% accuracy) in series with the 9-GΩ resistor.
2. Connect the calibrator and UUT to the resistor divider as shown in Figure 6.
3. Set the UUT to the mV function.
4. Set the output of the calibrator to 1000 V.
5. Check that the UUT reading is within 5.34 to 5.66 mV.
6. Set the calibrator for 0 V output and remove the calibrator from the divider network.

### Accuracy Test

1. Remove the 50-kΩ resistor from the divider.
2. Connect the 9-GΩ resistor to the UUT **INSULATION** terminals.
3. Turn the UUT rotary function switch to the 1000 V range.
4. Push the TEST key and verify that the display reading is within the limits of 7.8 to 10.2 GΩ.

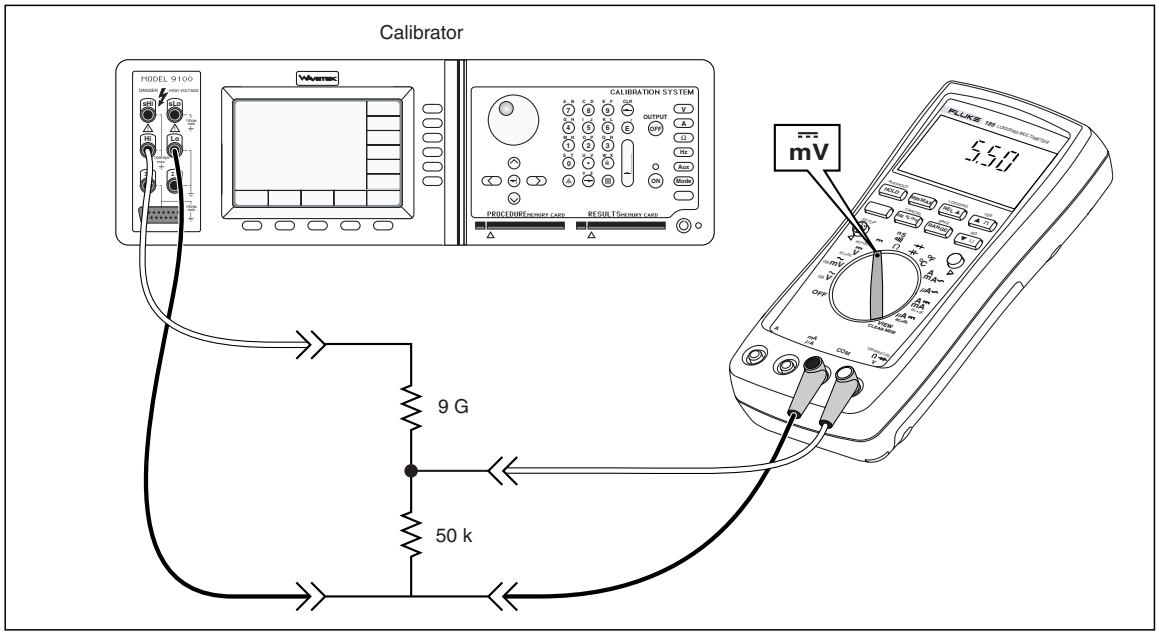


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**Figure 6. 9-GΩ Resistor Verification**

### *5 % of Full Scale, Insulation Resistance Accuracy Test, 50 V Range (Models 1507 and 1508)*

The following test verifies the minimum insulation resistance accuracy, of the 50 V range, using a separate 50-kΩ resistor.

1. Connect a 50-kΩ, +-0.1%, 0.25 W, 25 PPM resistor to the UUT **INSULATION** and **COM** terminals.
2. Turn the UUT rotary function switch to the 50 V insulation range.
3. Press the UUT (TEST) key.
4. Verify that the Meter display reading is within the Limits of 0.00 and 0.10.

### *Insulation Function, External Sense*

The following test verifies that the Meter will sense a voltage >30 V when present on the circuit under test.

1. Connect the UUT **INSULATION** and **COM** output terminals to the calibrator voltage output terminals.
2. Turn the UUT rotary function switch to an insulation function.
3. Apply 35 V, 50 Hz to the UUT.
4. Verify that the UUT displays >30 V in the primary display, and the red LED lightning bolt comes on.

## *Source Voltage Accuracy Test, "R" Nominal*

Complete the test steps in Table 5 to verify source voltage of the insulation function under load.

1. Connect the test DMM and calibrator in parallel to the UUT **INSULATION** and **COM** terminals. See Figure 7.
2. Put the calibrator in the insulation test function.
3. Set the calibrator for the applied load shown in Table 5 for Steps 1-4.

**⚠Caution**
**To avoid overranging the test DMM, a HV Divider must be used in conjunction with the DMM for testing the 1000 V range.**

4. Press (TEST) and verify that the UUT and Test DMM voltage readings are within the limits of Table 5. Record both of these readings.
5. Replace the calibrator with a separate 50-kΩ resistor.
6. Press (TEST) and verify that the UUT display reading and DMM display. reading are within the limits of Table 5 for Step 5. Record both of these readings.
7. Using the DMM reading as the reference, calculate the UUT voltage reading error %, (DMM V - UUT V / DMM V) x 100, and record for later use.

**Table 5. Source Voltage Accuracy Test, R-Nominal**

| Step | UUT Function | Meter Range | Applied Load | DMM Display Reading | UUT Display Reading | UUT Voltage Reading Error % |
|---|---|---|---|---|---|---|
| 1. | Insulation | 1000 V | 1 MΩ | 1000 V to 1200 V | 1000 V to 1200 V[1] | |
| 2. | Insulation | 500 V | 500 k | 500 V to 600 V | 500 V to 600 V | |
| 3. | Insulation | 250 V | 250 kΩ | 250 V to 300 V | 250V to 300 V | |
| 4. | Insulation (1507/1508) | 100 V | 100 kΩ | 100 V to 120 V | 100 V to 120 V | |
| Remove the Calibrator and apply a separate 50 kΩ resistor for the following step. | | | | | | |
| 5. | Insulation (1507/1508) | 50 V | 50 kΩ | 50 V to 60 V | 50 V to 60 V | |
| [1] Must use HV divider with DMM for this reading. | | | | | | |

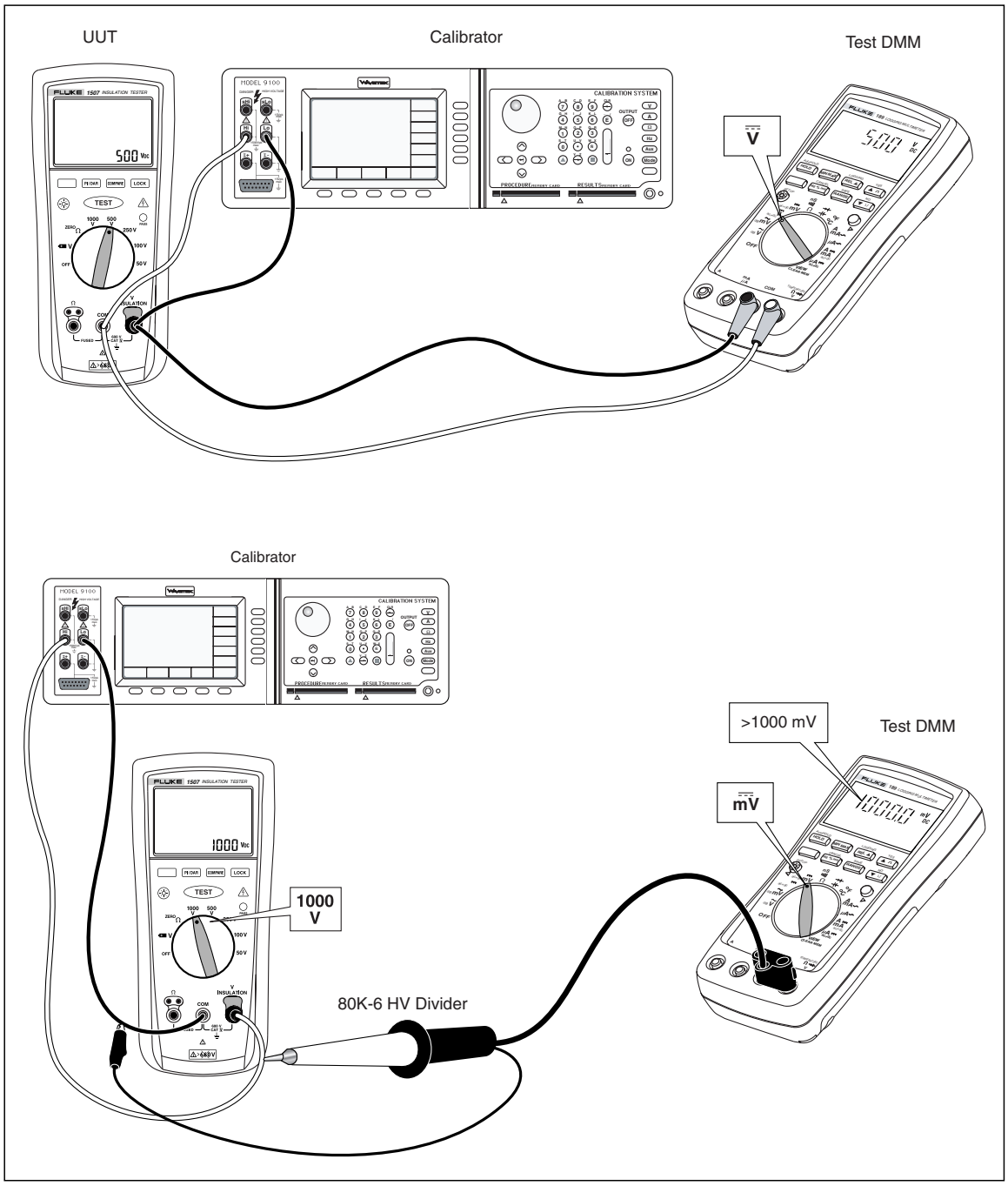


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**Figure 7. Source Voltage Accuracy Test, "R" Nominal**

## *Source Voltage Accuracy Test, Open Circuit*

The open circuit source voltage accuracy can be determined, by calculation, using the Meter Voltage Reading Error % previously noted. Complete the following test to verify the actual open circuit source voltage.

1. Set the UUT rotary function switch to an insulation test function.
2. Press (TEST) and record the UUT display reading for each step in Table 6.

3. Using the previously determined Meter Voltage Reading Error %, calculate the actual open circuit output voltage for each voltage range. Verify that the calculated value is within the limits shown in Table 6. The formula is UUT Recorded Reading x UUT Voltage Reading Error % + Recorded UUT Display Reading.

**Table 6. Source Voltage Accuracy Test, Open Circuit**

| Step | Function | Range | Recorded UUT Display Readings | Calculated UUT Output Voltage Limits |
|---|---|---|---|---|
| 1. | Insulation | 1000 V | | 1000 V to 1200 V |
| 2. | Insulation | 500 V | | 500 V to 600 V |
| 3. | Insulation (1507/1508) | 250 V | | 250 V to 300 V |
| 4. | Insulation (1507/1508) | 100 V | | 100 V to 120 V |
| 5. | Insulation (1507/1508) | 50 V | | 50 V to 60 V |

### _I Nominal Test:_

The following test verifies the UUT's ability to maintain the nominal insulation test current while loaded.

1. Connect the DMM and Calibrator to the UUT **INSULATION** and **COM** terminals as shown in Figure 8.
2. Set the calibrator to an insulation resistance test function.
3. Set the calibrator for the insulation resistance called out in Table 7 for Steps 1-4.
4. Set the DMM function switch to µADC.
5. Press the (TEST) key and verify that the DMM display reading is > 1000.0 µA for steps 1-4.
6. Disconnect the calibrator and replace it with a separate 50-kΩ resistor.
7. Set the UUT to the 50 V range and press the (TEST) key. Verify that the DMM display reading is > 1000.0 µA for step 5.

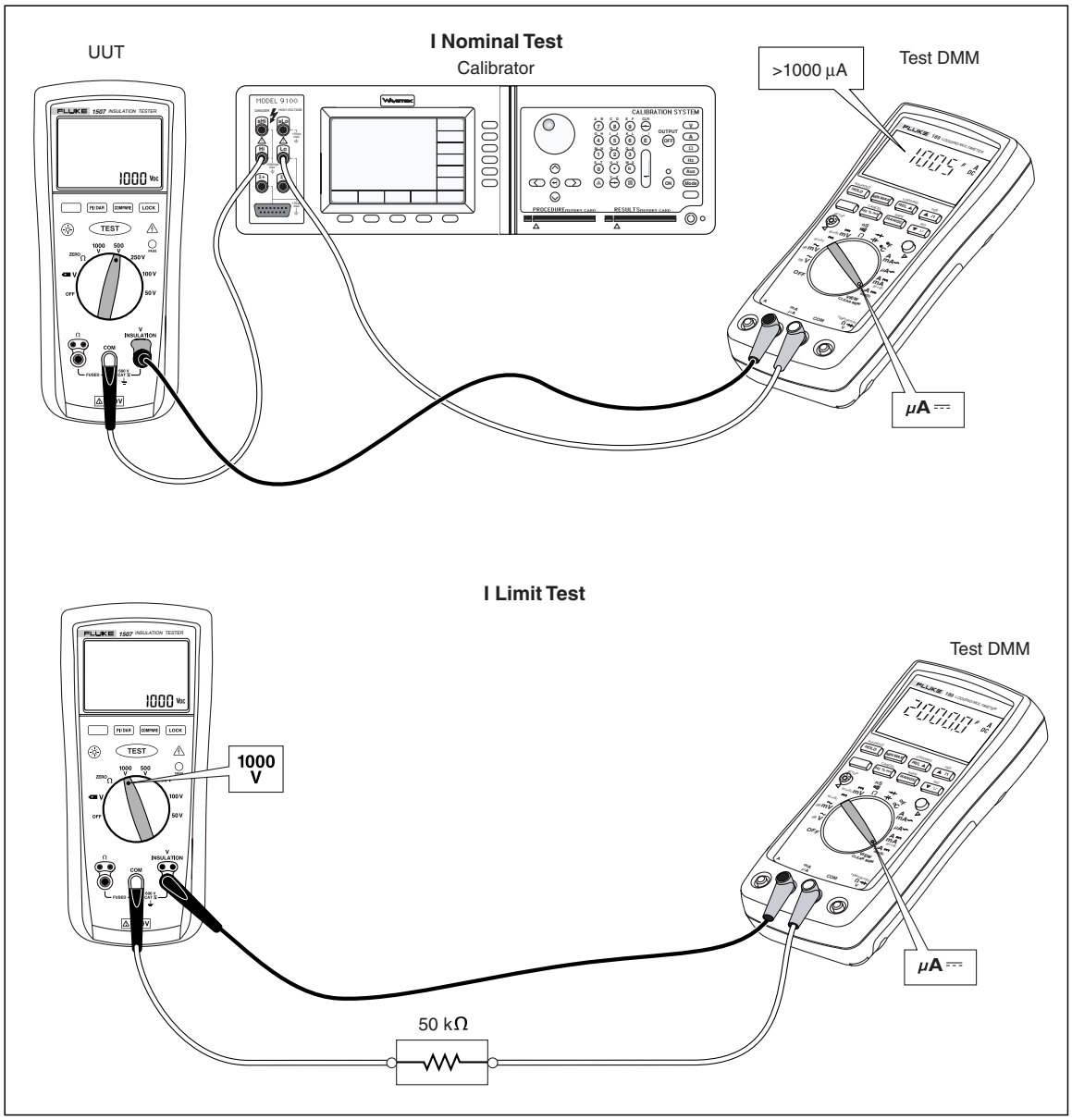


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**Figure 8. I Nominal Test/I Limit Test Connection**

**Table 7. I Nominal Test/Limit Test**

| Step | Function | Range | Applied Load | DMM Display Reading |
|---|---|---|---|---|
| 1. | Insulation | 1000 V | 1 MΩ | >1000 |
| 2. | Insulation | 500 V | 500 kΩ | |
| 3. | Insulation | 250 V | 250 kΩ | |
| 4. | Insulation (1507/1508) | 100 V | 100 kΩ | |
| Remove the Calibrator and apply a separate 50 kΩ resistor for the following test | | | | |
| 5. | Insulation (1507/1508 | 50 V | 50 kΩ | >1000 |

### _I Limit Test:_

The following test verifies the UUT's internal insulation function and current limit operation.

1. Connect the DMM and 50-kΩ resistor to the UUT **INSULATION** and **COM** terminals as shown in Figure 8.
2. Set DMM function switch to µADC.
3. Set the UUT rotary switch to the 1000 V range.
4. Press and hold the TEST key.
5. The DMM reading should be <2000.0 µA.

## _Testing the "Ω" Function_

### _Earth Bond Resistance Accuracy Tests_

To test earth bond resistance accuracy, complete the test steps in Table 8, using the following procedure.

1. Connect the UUT **COM** and **Ω** terminals to the calibrator.
2. Set the calibrator to the Ohms function.
3. Turn the UUT rotary function switch to the **Ω** function.
4. Apply the calibrator output for Steps 1-3.
5. Press the TEST key, and verify that the UUT reading is within the display reading limits shown in Table 8.
6. Apply a separate 2-Ω precision resistor directly to the UUT **Ω** and COM terminals using the shortest leads possible to minimize lead resistance, or press the blue key to zero out the test leads prior to connecting to the resistor.
7. Press TEST, and verify that the reading is within the display reading limits for Step 4.

**Table 8. Earth Bond Resistance Tests**

| Step | Meter Range | Applied | Display Units | Display Reading | |
|---|---|---|---|---|---|
| | | | | Low Limit | High Limit |
| 1. | 2000 Ω | 810.0 Ω | Ω | 795 | 825 |
| 2. | 2000 Ω | 990.0 Ω | Ω | 972 | 1008 |
| 3. | 20.00 KΩ | 18.0 kΩ | kΩ | 17.70 | 18.30 |
| Remove calibrator and apply a separate 2 Ω resistor for the following step. | | | | | |
| 4. | 20.00 Ω | 2.0 Ω | Ω | 1.94 | 2.06 |

## *2-Ohm Output Current Test*

The following procedure verifies the minimum current for a 2-Ω Load in continuity function.

1. Connect a 2-Ω resistor and DMM to the UUT as shown in Figure 9.
2. Set the DMM rotary function switch to the mVDC function.
3. Set the UUT rotary function switch to the **Ω** function.
4. Press the (TEST) key and record the DMM voltage reading.
5. Using Ohms Law (V = I x R where: V = Voltage, I = Current, and R = Resistance), calculate the current through the 2-Ω resistor.
6. The current should be greater the 200 mA.

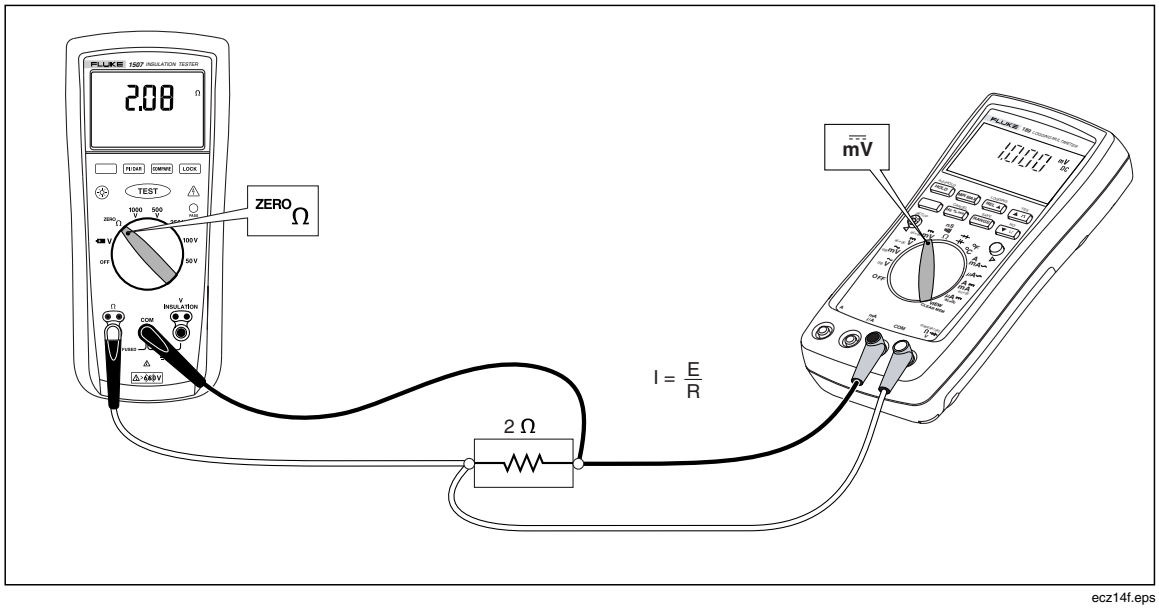


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**Figure 9. 2-Ω Output Current Test**

### *Open Circuit Voltage Test*

The following test confirms that the open circuit voltage is within limits.

1. Connect a DMM directly to the UUT Ω terminals observing correct polarity.
2. Set the DMM rotary function switch to the VDC function.
3. Set the UUT rotary function switch to the Ω function.
4. Press TEST and verify that the DMM reading is >4.0 V but <8.0 V.

## *Calibration Adjustment*

The Meter features closed-case calibration adjustment using known reference sources. The Meter measures the applied reference source, calculates correction factors and stores the correction factors in nonvolatile memory.

The following sections present the features and Meter function keys that are used during the calibration adjustment procedure. Perform the calibration adjustment procedure should the Meter fail any performance test listed earlier in this manual.

### *Calibration Adjustment Counter*

The Meter contains a calibration adjustment counter. The counter is incremented each time a calibration adjustment procedure is completed. The value in the counter can be recorded and used to show that no adjustments have been made during a calibration cycle.

Use the following steps to view the Meter's calibration counter.

1. While holding down LOCK, turn the rotary function switch from OFF to V. The Meter displays CAL.
2. Press the blue key once to see the calibration counter. For example n003.
3. Turn the rotary function switch to OFF

### *Calibration Adjustment Password*

Enter the correct four key password to start the calibration adjustment procedure. The password can be changed or reset to the default as described in following paragraphs. The default password is 1234.

### *Changing the Password*

Use the following steps to change the Meter's password:

1. While holding down LOCK, turn the rotary function switch from OFF to V. The Meter displays CAL.
2. Press the blue key once to see the calibration counter.
3. Press the blue key again to start the password entry. The Meter displays ----.
4. The Meter's keys represent the digits indicated below when entering or changing the password:

   Blue Key = 1  LOCK = 2  ☼ = 3  TEST = 4

5. Press the four keys to enter the old password. If changing the password for the first time, press the blue key (1), LOCK (2), ☼ (3), TEST (4).

6. Press ☼ to change the password. The Meter displays ---- if the old password is correct. If the password is not correct, the Meter emits a double beep, displays ---- and the four key password must be entered again. Repeat step 4.
7. Press the four keys of the new password.
8. Press the blue key to store the new password.

## *Restoring the Default Password*

If you forget the calibration password, the default password ( 1234) can be restored using the following steps.

**⚠⚠Warning**

**To avoid electrical shock or personal injury, remove the test leads and any input signal before removing the Meter's bottom case.**

1. Remove the back case from the UUT. Leave the PCA in the top case.
2. Apply 6.0 V across the battery contact pads (J8) + and - on the PCA. See Figure 10.
3. Short across the Cal keypad (S8) on the back of the PCA. See Figure 10.
4. Turn the rotary knob from **OFF** to **V**. The UUT will beep and display CAL. The default password is now restored.
5. Remove the 6.0 V supply, turn the rotary switch to **OFF**, and install the back case on the UUT.

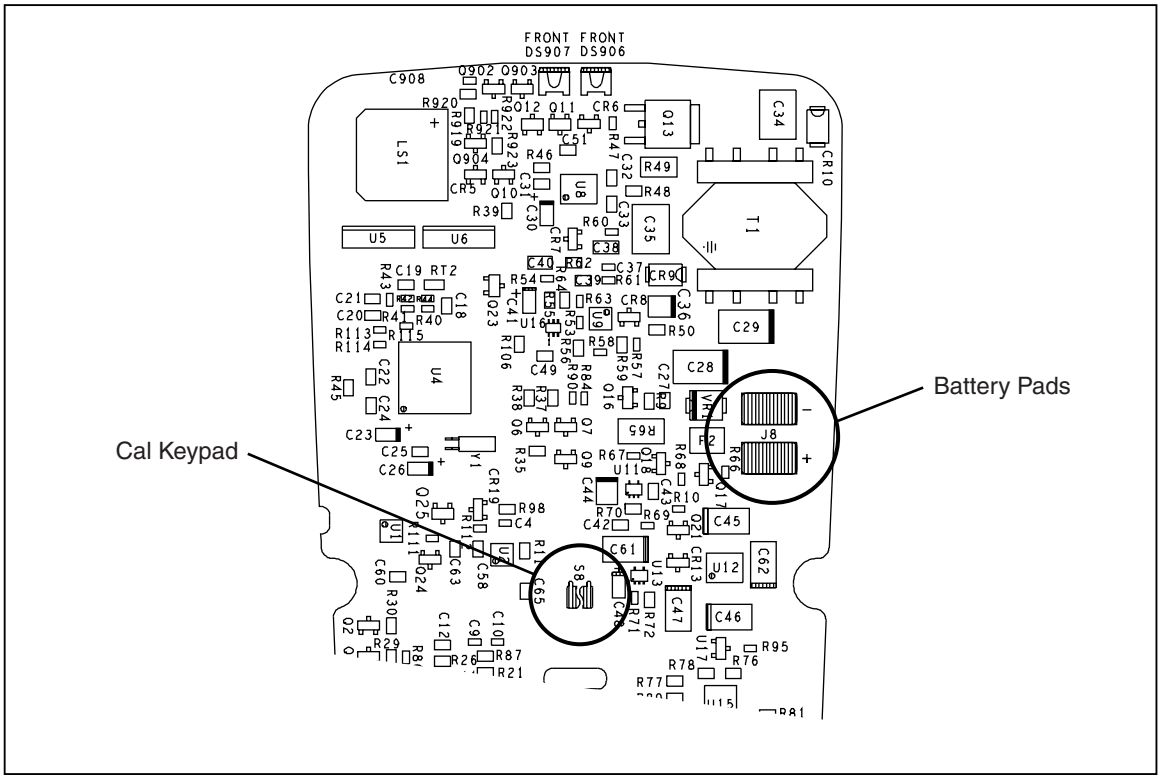


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**Figure 10. Restoring the Default Password**

# Keys Used in the Calibration Steps

The Meter keys behave as follows when performing the calibration adjustment procedure.

TEST stores the calibration value and advance to the next step.

☼ ignores the calibration value and advance to the next step. This key is also used to exit calibration function after the calibration adjustment sequence is complete.

## Calibration Adjustment Procedure

Use the following steps to make calibration adjustments to the Meter. If the Meter is turned off before completion of the adjustment procedure, the calibration constants are not changed.

1. Remove batteries from UUT battery compartment. Connect a + 5.0 V lab supply to the + and - battery terminals.
2. While holding down LOCK, turn the rotary function switch from OFF to VAC. The Meter displays CAL.
3. Press the blue button once to see the calibration counter.
4. Press blue button again to start the password entry. ---- appears on the display.
5. Press four keys to enter the password.
6. Press the blue button to go to the first calibration step. The Meter displays C-01 if the password is correct. If the password is not correct, the Meter emits a double beep, displays ---- and the password must be entered again. Repeat step 4.
7. Using Table 9, apply the input value listed for each calibration adjustment step. For each step, position the rotary function switch and apply the input to the terminals as indicated in Table 9.
8. After each input value is applied, press TEST to accept the value and proceed to the next step (C-02 and so forth).

*Note*

*After pressing TEST, wait until the step number advances before changing the calibrator source or turning the Meter rotary function switch. If the Meter rotary function switch is not in the correct position, or if the measured value is not within the anticipated range of the input value, the Meter emits a double beep and will not continue to the next step. Some adjustment steps take longer to execute than others (10 to 15 seconds). For these steps, the Meter will beep when the step is complete. Not all steps have this feature.*

9. After the final step, the display shows End to indicate that the calibration adjustment is complete. Press ☼ to go to meter mode.

*Note*

*Set the calibrator to standby prior to changing the function switch position and or after completing adjustment of each function. If the calibration adjustment procedure is not completed correctly, the Meter will not operate correctly.*

**Table 9. Calibration Adjustment Steps**

| Switch Position | Input Terminal | Adjustment Step | Input Value |
|---|---|---|---|
| 1000 V Insulation | + : COM<br>- : A gnd (remote test probe pin) | C-01 | 0m A, 0 Hz |
| | | C-02 | 15u A, 0 Hz |
| | | C-03 | 0.18 mA, 0 Hz |
| | | C-04 | 1.8 mA, 0 Hz |
| Continuity | | C-05 | 0.5 mA, 0 Hz |
| | | C-06 | 5.0 mA, 0 Hz |
| | | C-07 | 0.5 mA, 0 Hz |
| | | C-08 | 5.0 mA, 0 Hz |
| | | C-09 | 5.0 mA, 0 Hz |
| | | C-10 | 300 mA, 0 Hz |
| Volts | + : Volts Input<br>- : COM | C-11 | 25.0 V, 0 Hz |
| | | C-12 | 750 V, 0 Hz |
| Continuity | + : Continuity Input<br>- : COM | C-13 | 0.5 V, 0 Hz |
| | | C-14 | 5.0 V, 0 Hz |
| 1000 V Insulation | None | C-15 | |
| Continuity | +: Continuity Input<br>-: COM | C-16 | 2.00 Ω (Use external resistor, 0.1 %, 3 W, 50 PPM) [1] |
| Any | +: Battery + Terminal<br>-: Battery - Terminal | C-18 | + 5 V |

[1] Must certify that this resistor is within 1.998 Ω to 2.002 Ω. This resistor should be mounted directly to the Meter **Ω** and **COM** terminals to minimize lead resistance.

# Service and Parts

User service is limited to replacing parts. Table 10 identifies the replacement parts used by all models, Tables 11, 12, and 13 identify the replacement parts unique to each model. Figure 10 shows the location of each part. To order replacement parts refer to *Contacting Fluke* earlier in this manual.

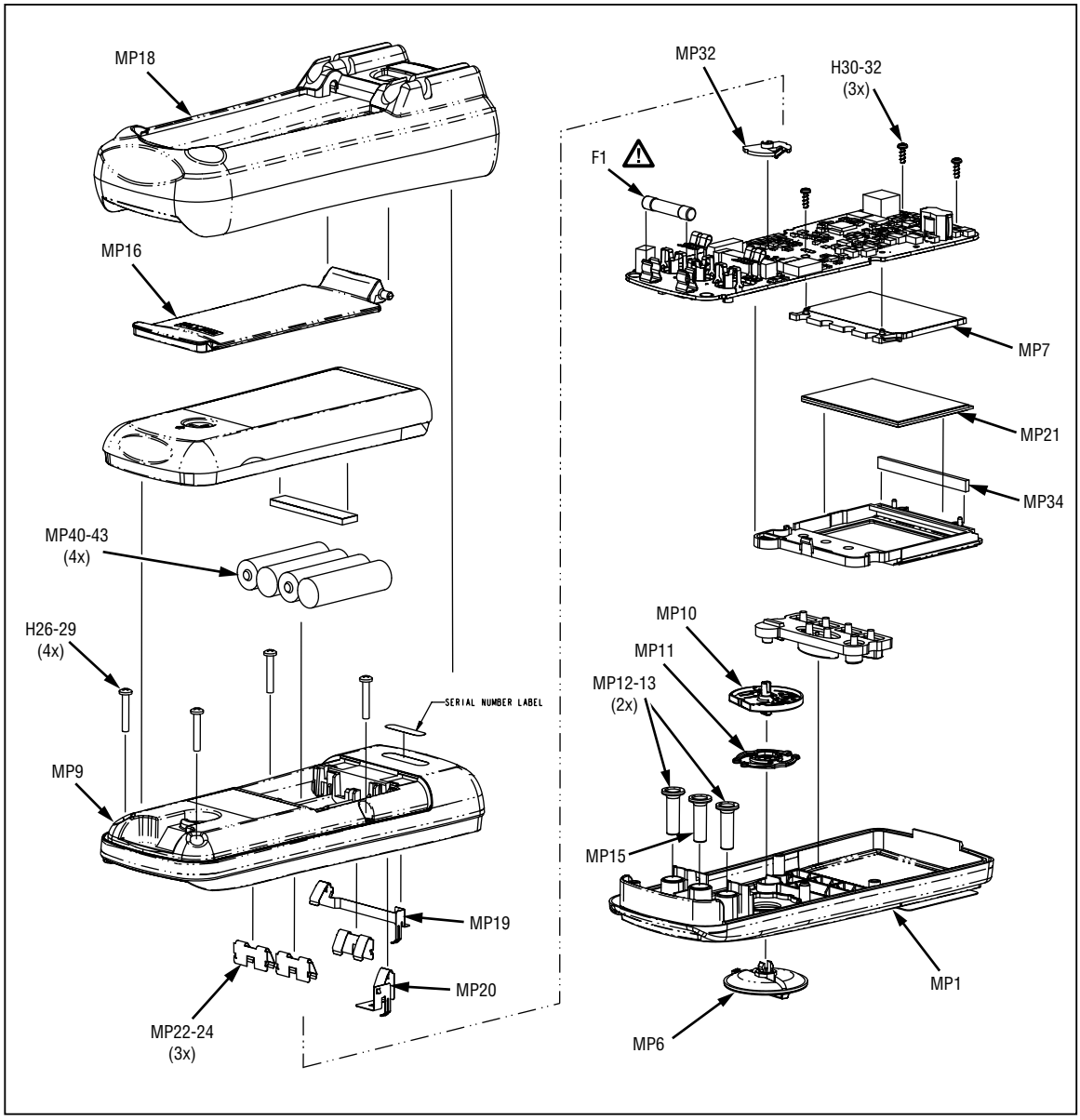


**Figure 11. 150X Replacement Parts**

**Table 10. Generic 150X Replacement Parts**

| Ref Des | Description | P/N | Qty |
|---|---|---|---|
| MP4 | 102-406-003,PROBE CAP,GS-38 RED | 1942029 | 1 |
| MP6 | FLUKE-15X7-8008,KNOB | 2278007 | 1 |
| MP7 | FLUKE-15X7-8001,FLUKE-15X7-8001, BACKLIGHT | 2168609 | 1 |
| MP9 | FLUKE-1508-8003-02,BOTTOM CASE | 2388589 | 1 |
| MP10 | FLUKE-15X7-8009,HOUSING ASSY,RSOB | 2278018 | 1 |
| MP11 | FLUKE-15X7-8010,DETENT SPRING | 2278029 | 1 |
| MP12-13 | FLUKE-15X7-8011,INSULATOR,RECEPTACLE, RED | 2278128 | 2 |
| MP15 | FLUKE-15X7-8011-01,INSULATOR,RECEPTACLE, BLACK | 2278137 | 1 |
| MP16 | FLUKE-15X7-8012,TILT STAND | 2278143 | 1 |
| MP18 | FLUKE-15X7-8014,HOLSTER | 2278162 | 1 |
| MP19 | FLUKE-15X7-8016,BATTERY CONTACT,NEG | 2281317 | 1 |
| MP20 | FLUKE-15X7-8017,BATTERY CONTACT,POS | 2281321 | 1 |
| MP21 | LCD,TN,3.0V,TRANSFLECTIVE,1/4-DUTY,1/3-BIAS | 2156884 | 1 |
| MP22-24 | FLUKE 89-4-8012 ,BATTERY CONTACT, DUAL | 666435 | 3 |
| MP40-43 | BATTERY,PRIMARY,MNO2-ZN,1.5V,2.24AH,15A,LR6,ALKALINE,AA,14X50MM,BULK | 376756 | 4 |
| H26-29 | SCREW,5-14,.750,PAN,PHILLIPS,STEEL,BLK CHROMATE,THREAD FORMING | 832246 | 4 |
| H30-32 | SCREW,4-14,.312,PAN,PHILLIPS,STEEL,ZINC-CLEAR,THD FORM,#3 HEAD | 642931 | 3 |
| MP32 | FLUKE 87-8004,CONTACT,PTF | 822676 | 1 |
| F1 ⚠ | FUSE,315 MA,1000 V AC/DC,FAST,6.35 X 32 MM,BULK | 2279339 | 1 |
| MP44 | FLUKE-165X-8008,PROBE,MULTIFUNCTIONAL | 2000757 | 1 |
| MP34 | CONNECTOR,ELASTOMERIC,.01IN CTR,.218 IN HIGH,.090 IN THICK,2.43 IN LONG,BULK | 2396462 | 1 |

**Table 11. 1508 Specific Parts**

| Ref Des | Description | P/N | Qty |
|---|---|---|---|
| MP1 | FLUKE-1508-8004-01,CASE TOP,PAD XFER | 2282457 | 1 |
| MP2 | FLUKE-1508-8005-03,BRACKET,MASK,PAD XFER | 2282504 | 1 |
| MP3 | FLUKE-1508-8018,KEYPAD | 2388514 | 1 |
| MP5 | FLUKE-1508-8007-02,DOOR,ACCESS | 2388550 | 1 |
| MP46 | FLK 19-8014,TEST LEAD SET | 666602 | 1 |
| MP47 | ALLIGATOR CLIP,600/1000V,2MM JACK,RED | 1670641 | 1 |
| MP48 | ALLIGATOR CLIP,600/1000V,2MM JACK,BLACK | 1670652 | 1 |
| MP36 | 1508 USERS MANUAL (Chinese and English) | 2416024 | 1 |

**Table 12. 1507 Specific Parts**

| Ref Des | Description | P/N | Qty |
|---|---|---|---|
| MP1 | FLUKE-1507-8004-01,CASE TOP, PAD XFER | 2282433 | 1 |
| MP2 | FLUKE-1507-8005-02,BRACKET,MASK,PAD XFER | 2282491 | 1 |
| MP3 | FLUKE-1507-8018-01,KEYPAD | 2388523 | 1 |
| MP5 | FLUKE-1507-8007-03,DOOR,ACCESS | 2388561 | 1 |
| MP46 | TL224-4201,175-263-011 TEST LEADS RA2S | 2070140 | 1 |
| MP47 | 021-236-003,ALL.CLIP EX-LARGE RED IEC1010 | 1958654 | 1 |
| MP48 | 021-236-001,ALL. CLIP EX-LARGE BLK IEC1010 | 1958646 | 1 |
| MP49 | PROBE,TEST,BANANA JACK,4MM TIP,RED W/CAP, 175-290-003 | 2099044 | 1 |
| MP50 | PROBE,PROBE,TEST,BANANA JACK,4MM TIP,BLACK W/CAP,175-290-001 | 2427138 | 1 |

**Table 13. 1503 Specific Parts**

| Ref Des | Description | P/N | Qty |
|---|---|---|---|
| MP1 | FLUKE-1503-8004-01,CASE TOP,PAD XFER | 2282416 | 1 |
| MP2 | FLUKE-1503-8005-01,BRACKET,MASK,PAD XFER | 2282484 | 1 |
| MP3 | FLUKE-1503-8018-02,KEYPAD | 2388538 | 1 |
| MP5 | FLUKE-1503-8007-04,DOOR,ACCESS | 2388577 | 1 |