



Simpson 8455 V3 And 8455A Line Loop Testers OPERATOR'S MANUAL



Model 8455 V3



Model 8455A

About this Manual

To the best of our knowledge and at the time written, the information contained in this document is technically correct and the procedures accurate and adequate to operate this instrument in compliance with its original advertised specifications.

Notes and Safety Information

This Operator's Manual contains warning symbols which alert the user to check for hazardous conditions. These appear throughout this manual where applicable, and are defined below. To ensure the safety of operating performance of this instrument, these instructions must be adhered to.



Warning, refer to accompanying documents.



Caution, risk of electric shock.



This instrument is designed to prevent accidental shock to the operator when properly used. However, no engineering design can render safe an instrument which is used carelessly. Therefore, this manual must be read carefully and completely before making any measurements. Failure to follow directions can result in a serious or fatal accident.

Warranty and Returns

SIMPSON ELECTRIC COMPANY warrants each instrument and other articles manufactured by it to be free from defects in material and workmanship under normal use and service, its obligation under this warranty being limited to making good at its factory or other article of equipment which shall within one (1) year after delivery of such instrument or other article of equipment to the original purchaser be returned intact to it, or to one of its authorized service centers, with transportation charges prepaid, and which its examination shall disclose to its satisfaction to have been thus defective; this warranty being expressly in lieu of all other warranties expressed or implied and of all other obligations or liabilities on its part, and SIMPSON ELECTRIC COMPANY neither assumes nor authorizes any other persons to assume for it any other liability in connection with the sales of its products.

This warranty shall not apply to any instrument or other article of equipment which shall have been repaired or altered outside the SIMPSON ELECTRIC COMPANY factory or authorized service centers, nor which has been subject to misuse, negligence or accident, incorrect wiring by others, or installation or use not in accord with instructions furnished by the manufacturer.

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1. INTRODUCTION

The Simpson 8455 Line Loop Testers (hereafter referred to as the 8455 or the Instrument) were specifically designed to analyze telephone line faults. Compact, rugged, and easy-to-use, they are capable of measuring DC voltage to 100 volts and loop resistances to 2M Ω (8455 V3) or 10K Ω (8455A). The voltmeter function can be used to detect and measure any DC voltage on the line and the resistance ranges can be used to identify and locate line faults.

The meter is of pivot-and-jewel construction with a 2-3/8" diameter dial with knife-edge pointer that moves across a 2-3/16" (100°) scale arc. Scales are as follows:

POINTS: 0-100 for ballistic tests
M Ω -K Ω : (8455 V3) 0-2M Ω or 0-200k Ω ranges; 0-10K Ω (8455A)
VOLTAGE: 0-100 POINTS = 0-100V

Due to the 0-100° scale arc and the 0-100 dial calibrations, the accuracies of $\pm 2\%$ of full scale and $\pm 2^\circ$ of scale arc are both represented by ± 1 scale division of the POINTS scale anywhere on the scale.

The 8455A differs from the 8455 V3 in that it substitutes a 0-10K Ω range for the 0-200K Ω range of the 8455 V3. The 2M Ω range remains for points measurements, but does not have a separate meter dial scale.

The 8455 V3 differs from earlier 8455 in that it incorporates a field replaceable switch design. The 8455A shares the field replaceable switch design.

Throughout this manual, "8455" will now refer to both the 8455 V3 and the 8455A, unless otherwise noted.

2. ITEMS AND ACCESSORIES

Table 2-1. Items and Accessories Furnished With This Instrument

Quantity	Description	Number
1	Test Lead Set	45001
1	Battery, 45V	10-867221
1	Operator's Manual	6-115458
1	Carrying Case	00836

Table 2-2. Other Available Accessories

Description	Number
Carrying Case, Polyester Padded	00836
Extra Test Lead Set	45001
Replacement Toggle Switch Boards (set of 10)	45025
Replacement Push-button "Reverse" Switch Boards (set of 10)	45026

TEST LEADS

The test lead set consists of one each, red and black, flexible test leads, 6 feet long with Telco clips at one end and ring-tongue connectors at the other end for connection to the Instrument's screw terminals.

3. TECHNICAL DATA

Table 3-1. Technical Data

1. **DC Volts:**
Range: 0-100V (0-100 POINTS)
Sensitivity: 1000 ∇ /V (8455 V3), 3333 ∇ /V (8455A)
Accuracy: $\pm$ 2% of full scale (FS).

2. **Resistance:**

Range	Center Scale	Measuring Range	Accuracy	V Max. Open Ckt.	I Short Ckt. (Typ)
RX1	100 k ∇	0-2 M ∇	$\pm$ 2° of arc	48V	0.45 mA
R4 10	10 k ∇	0-200 k ∇	$\pm$ 2° of arc	48V	4.5 mA
OHMS	500 ∇	0-10 k ∇	$\pm$ 2° of arc	1.2V	2.4 mA

3. **Ballistic Tests:** (Capacitive kick in POINTS) (Typ)

Capacity (μ F)	.5	1	1.5	2	2.5	3	3.5	4
POINTS kick	39	61	77	89	99	25*	29*	32*

* With R4 10 push-button depressed (8455 V3 only)

4. **Size**

Case only: 3-5/8" W x 5-1/2" L x 2-1/2" H

Overall: 3-5/8" W x 5-1/2" L x 3" H

5. **Weight:** 1 lb. (0.45kg) (approx.)

6. **Rated Circuit-To-Ground Voltage*:** 100 V DC

* Per ANSI C39-5, April, 1974: The maximum voltage, with respect to ground, which may be safely and continuously applied to the circuits of an instrument.

4. UNPACKING AND INSPECTION

Before unpacking, examine the shipping carton for signs of damage. If the carton is damaged, unpack and inspect the Instrument. If the Instrument is damaged, notify the carrier or supplier immediately.

Check that all items and accessories are included with the instrument as listed in Table 2-1.

5. ELECTRICAL CHECKOUT

After determining that the 8455 is undamaged, check the Instrument for electrical performance.

- a. Install the battery supplied with the Instrument. If necessary, refer to the battery replacement procedure (page 17, paragraph 18.3).
- b. Connect the ring-tongue connectors of the test leads to the Instrument screw terminals. Connect the red test lead to the right screw and the black test lead to the left screw. With these connections, the polarity color coding of the test leads will be correct when the REVERSE switch is set to its normal position (opposite from REVERSE).

- c. Short the test clips together and set the ON/OFF switch to ON. The meter should indicate upscale.
- d. Adjust the BATTERY ADJUSTMENT control until the meter pointer rests over the 100 POINTS mark on the scale. If this cannot be done, the battery is likely weak. Refer to Section 18, for battery testing and replacement instructions.
- e. While holding the R4 10 button depressed (8455 V3 only), Repeat step “d”.
- f. Set the ON/OFF switch to OFF and connect the test clips to a battery or low voltage (less than 100V DC) source to assure that the voltage (POINTS) range is functioning correctly.

6. WARRANTY

The Simpson Electric Company warranty is printed on the inside front cover of this manual. Read it carefully before requesting any warranty repairs.

NOTE: For all assistance, contact the nearest Simpson Authorized Service Center.

7. SHIPPING

Pack the Instrument carefully, and ship it prepaid and insured.

8. CONTROLS, CONNECTORS AND INDICATOR

This section describes the 8455 front panel controls and its features. Become familiar with each control and its function before using the Instrument.

Item numbers in Table 8-1 correspond to the identifying numbers in Figure 8-1.

Figure 8-1. Front Panel Controls

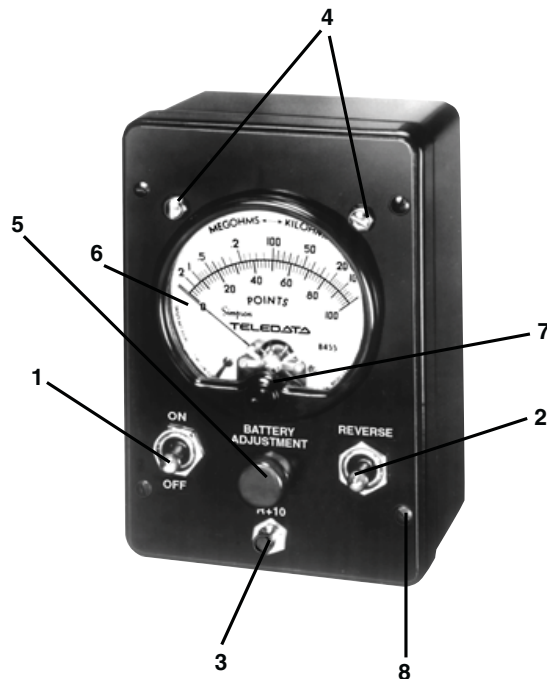


Table 8-1. Controls, Connectors and Indicator

- | | | |
|----|------------------------|--|
| 1. | ON/OFF Switch: | Selects the voltmeter function (OFF) or the resistance measuring function (ON). In the ON position, the internal battery is connected to energize the resistance function. |
| 2. | REVERSE Switch: | Transposes the test lead connections to reverse polarity (both functions). |

3. a. **R4 10 Push-button:**
(8455 V3) Changes resistance range from 0-2M Ω to 0-200k Ω while depressed.
- b. **Press For Ohms Push-button:**
(8455A) Ohms function when depressed; points function when released.
4. **Test Lead Connections:** Screw terminals to which the test leads are connected.
5. **Battery Adjustment:** Control to enable correction for battery condition when calibrating resistance measuring ranges (zero k Ω adjustment).
- NOTE:** The Model 8455A ohms range is internally calibrated and is not affected by the battery adjustment control.
6. **Indicating Meter:** Displays measured values of resistance (M Ω -K Ω), (8455 V3) or (k Ω - Ω) 8455A, POINTS (ballistic tests) or DC voltage (100 POINTS = 100V).
7. **Mechanical Zero Adjuster:** This screwdriver adjustment corrects minor mechanical disturbances to the indicator's zero position (when electrically de-energized).
8. **Case Assembly Screws (4):** Screws to be removed to access battery.

9. SAFETY PRECAUTIONS

The following safety symbols may be found in this manual and/or on the Instrument. They call attention to procedures, practices or conditions which, if not correctly performed, adhered to, or observed, could result in:



Damage to the Instrument and/or equipment under test.



Injury to Persons



This Instrument is designed to prevent accidental shock to the operator when properly used. However, no engineering design can guarantee how safe an instrument is if used carelessly. Therefore, this manual must be read carefully and completely before making any measurements. Failure to follow directions can result in a serious or fatal accident.

NOTE: The following precautions are suggestions and reminders of commonly recognized safe practices to adopt and specific hazards to be avoided and are not implied to be sufficient to safeguard untrained personnel in all circumstances.

1. The 8455 should only be used by personnel who are qualified to recognize shock hazards and are trained in the safety precautions required to avoid possible injury.
2. Do not connect any terminal of this Instrument to a circuit point at which a voltage exceeding 100 volts DC may exist with respect to earth ground. (Refer to Table 8-1, item 4).
3. This Instrument is intended only for indoor use or in sheltered outdoor locations. To prevent fire or shock hazards, do not expose Instrument to rain or moisture.
4. Before using this Instrument, check both the Instrument and the test leads for missing, damaged, deteriorated or faulty insulation. Do not use the instrument until it has been properly repaired.
5. DC voltages under 60V are not considered to be a shock hazard; however, the meter is capable of measurements up to 100V. If the Instrument is to be used to measure voltages exceeding 60V DC, precautions should be taken to avoid bodily contact with the energized circuit.
6. Do not make electrical measurements where the air may contain explosive concentrations of gas or dust such as in mines, grain elevators, gasoline stations or in the presence of charging batteries, until determined to be safe by qualified personnel. Note that even metallic dust can be explosive.
7. Do not use this Instrument to make electrical measurements on blasting circuits or blasting caps.

10. OPERATION

10.1 Mechanical Zero Adjustment

For accuracy of all measurements, the meter pointer must rest directly over the 0 POINTS mark at the left end of the dial scale when the ON/OFF switch is set to the OFF position. If the pointer is not in that position, rotate the mechanical zero adjust screw (Figure 8-1, item 7) in either direction until it does.

10.2 Battery Adjustment (Resistance Ranges)

For accuracy of resistance measurements, the meter pointer must rest directly over the 100 POINTS mark at the right end of the dial scale when the ON/OFF switch is set to the ON position and the test clips are shorted together. If the pointer is not in that position, adjust the BATTERY ADJUSTMENT control (Figure 8-1, item 5).

10.3 Storage and/or Transport

Keep the ON/OFF switch in the OFF position at all times except when making measurements. This will prevent battery discharge in the event that the test clips are accidentally shorted together during storage or transport.

NOTE: Before making a resistance or ballistics test, connect the Instrument to the line with the ON/OFF switch in the OFF position (voltage measurement) to detect the presence of unexpected DC voltages. The presence of DC voltages will cause inaccurate test readings and may damage the meter.

10.4 R4 10 Push-button (8455 V3)

This push-button is used for resistance measurements only. While the button is depressed, the resistance range becomes 1/10 of the dial markings and the indication is then divided by 10. For example, if the value indicated is less than 10 K Ω , the scale divisions are very small. By depressing the R4 10 button, 0-10 K Ω is spread across 1/2 of the scale and a more accurate reading can be obtained. If, in a ballistic test, the meter pointer kicks off-scale (past 100 POINTS), holding the R4 10 button will reduce the “kick” to a readable value.

10.5 Reverse Switch

This switch is primarily for convenience when making ballistic tests. Operating the switch back and forth transposes the test leads to produce the capacitive charging “kick” when connected to an open line conductor. It can also be used to reverse the polarity of the test leads for voltage measurements.

NOTE: The Instrument can be operated in any convenient position; however, maximum reading accuracy is obtained with panel in horizontal position as the Instrument was calibrated in this position.

11. TEST FOR GROUND

- a. Open conductors toward Central Office.
- b. Set the Instrument to measure resistance (ON/OFF switch to ON; “Press for Ohms” depressed, 8455A).
- c. Short test clips together and adjust BATTERY ADJUSTMENT control for meter reading of full scale (100 POINTS).

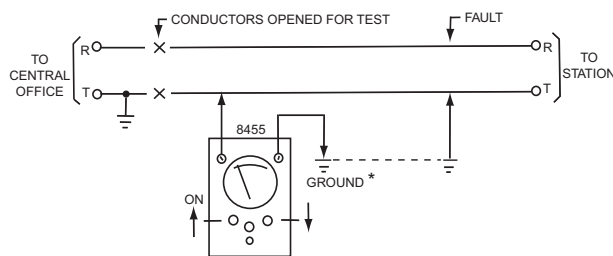


Figure 11- 1. Test for Ground

- d. Connect one test clip to ground*.

*GROUND: A connection to metallic cable sheath or wrap, to cable suspension strand, to ground rod, or to grounded (T) conductor of an adjacent pair.

- e. Connect the other clip to conductor giving a meter deflection.
- f. Note the exact value of resistance indicated. For resistance less than 10 k Ω , hold R4 10 button depressed and divide indicated value by 10 (8455 V3).
- g. To calculate distance to fault, refer to Section 17.

12. TEST FOR SHORT CIRCUIT

- a. Open conductors toward Central Office.
- b. Set the Instrument to measure resistance (ON/OFF switch to ON; “Press for Ohms” depressed, 8455A).
- c. Short test clips together and adjust BATTERY ADJUSTMENT control for meter reading of full scale (100 POINTS).
- d. Check both conductors for grounds.
- e. Connect test clips across line pair.

- f. Note the exact value of resistance indicated. For resistance less than 10 K Ω , hold R4 10 button depressed and divide indicated value by 10 (8455 V3).
- g. To calculate distance to fault, refer to Section 17.

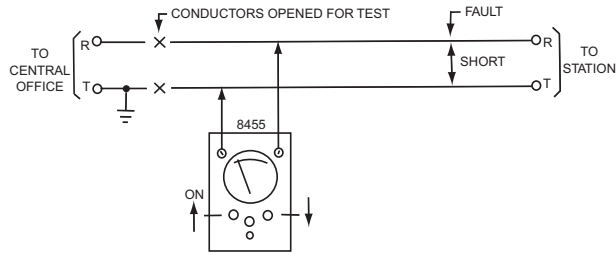


Figure 12-1. Test for Short Circuit

13. TEST FOR CROSSED CONDUCTORS

- a. Open conductors toward Central Office.
- b. Set Instrument to measure resistance (ON/OFF switch to ON; "Press for Ohms" depressed, 8455A).
- c. Short test clips together and adjust BATTERY ADJUSTMENT control for meter reading of full scale (100 POINTS).
- d. Connect test clips to combinations of conductors until a meter indication is obtained. These are the crossed conductors.
- e. Note the exact value of resistance indicated. For resistance less than 10 K Ω , hold R4 10 button depressed and divide indicated value by 10 (8455 V3).
- f. To calculate distance to fault, refer to Section 17.

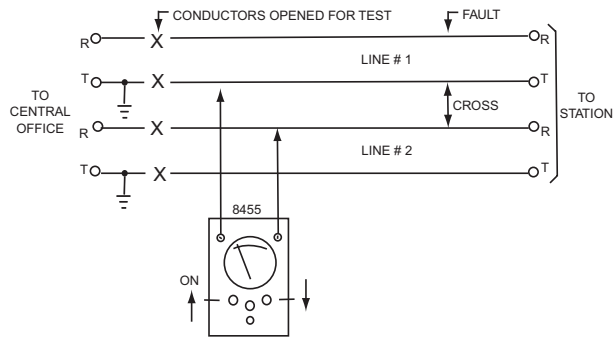


Figure 13-1. Test for Crossed Conductors

14. TEST FOR OPEN

- a. Open conductors toward Central Office.
- b. Set the Instrument to measure resistance (ON/OFF switch to ON).
- c. Connect one test clip to ground*.
- d. Connect the other test clip to the good conductor (not open).
- e. Operate the REVERSE switch back and forth slowly (allow time for the pointer to return to zero each time) and note maximum POINTS value of the momentary deflection of the meter.

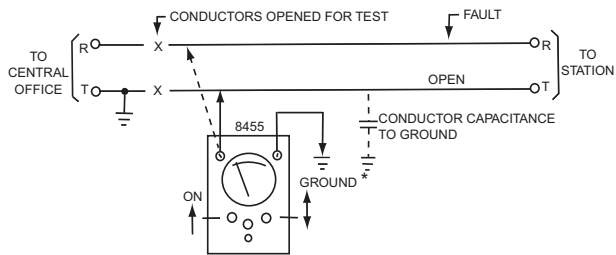


Figure 14-1. Test for Open

*GROUND: A connection to metallic cable sheath or wrap, to cable suspension strand, to ground rod, or to grounded (T) conductor of an adjacent pair.

NOTE: If meter deflects beyond 100 POINTS, try adjusting the BATTERY ADJUSTMENT control for a deflection of 100 POINTS. If this fails, it will be necessary

to hold the R4 10 push-button depressed during the test (8455 V3). The POINTS value noted in this test is the reference value by which the open line will be evaluated.

- f. Move the test clip from the good conductor to the open conductor.
- g. Repeat step “e”, except **do not** change the setting of the BATTERY ADJUSTMENT control. Note the POINTS value of the meter deflection.
- h. The relative values of the meter deflections in steps “e” and “g” indicate approximate distance to the open.
- i. The chart below provides a rough approximation of the distance to the open for various deflection POINTS of the open line as a percentage of the deflection POINTS of the good line.

Open Line “POINTS” (as % of good line “POINTS”)	Approximate Distance To Open
100	100% of line length
90	80% of line length
80	60% of line length
60	45% of line length
40	30% of line length
20	15% of line length
10	10% of line length
5	5% of line length

15. TEST FOR SPLIT

15.1 Identify Split Conductor of Line #2.

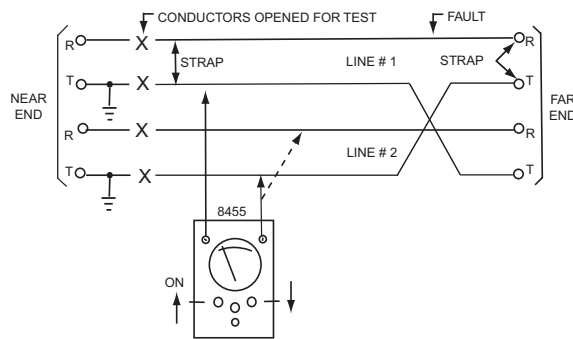


Figure 15-1. Test for Split

- a. Open all four conductors at the near end.
- b. Strap short across line #1 at the near end.
- c. Strap short across line #1 at the far end.
- d. Set the Instrument to measure resistance (ON/OFF switch to ON; “Press for Ohms” depressed, 8455A).
- e. Connect one test clip to strapped connection of line #1.
- f. Connect the other test clip first to one conductor of line #2 and then the other conductor. The conductor that causes a deflection of the meter is the split conductor of line #2.

15.2 Identify Split Conductor of Line #1.

- Remove the strap from line #1 at the near end.
- Connect one test clip to the split conductor of line #2 (identified in Paragraph 15.1, step f.).
- Connect the other test clip first to one conductor of line #1 and then the other conductor. The conductor that does not cause a deflection of the meter is the split conductor of line #1.

16. TEST FOR VOLTAGE

- Open line in trouble toward Central Office.
- Set the Instrument to measure voltage (ON/OFF switch to OFF).
- Connect one test clip to ground*.

*GROUND: A connection to metallic cable sheath or wrap, to cable suspension strand, to ground rod, or to grounded (T) conductor of an adjacent pair.

- Connect the other test clip to one conductor and then to the other. If the meter deflects to the left of zero, the polarity is incorrect. Set the REVERSE switch to its other position to obtain an up-scale reading.
- The meter will indicate the value of any DC voltage that may be present on a line conductor (with respect to ground) or, by connecting the clips to both conductors, any voltage present across the line. (100 POINTS = 100 volts).

NOTE: The Instrument will not indicate the presence of AC voltage.

- When the REVERSE switch is in the normal position (opposite to the REVERSE position) and the meter deflects upscale, the polarity of the voltage is positive (+) at the red test lead if the leads have been connected to the Instrument properly (refer to page 8, Section 5, step b.).

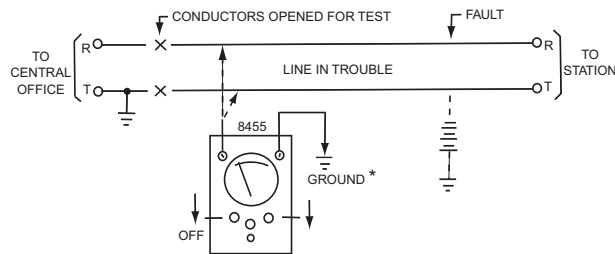


Figure 16-1. Test for Voltage

17. CALCULATING DISTANCE TO FAULT

- Open conductors toward Central Office.
- Set the Instrument to measure resistance (ON/OFF switch to ON; "Press for Ohms" depressed, 8455A).
- Short test clips together and adjust BATTERY ADJUSTMENT control for meter reading of full scale (100 POINTS).
- Connect one test clip to each conductor. The resistance value indicated is the

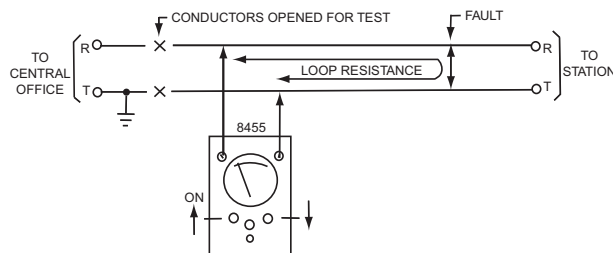


Figure 17-1. Calculating Distance to Fault

- loop resistance (the two conductors in series).
- e. The resistance to the fault is the loop resistance divided by 2. To calculate the distance to the fault in feet, refer to the table below for feet per ohm of resistance.

Table 5. Feet Per Ohm of Resistance

Conductor Gauge	Feet Per Ohm (approx.)
19	125
22	62
24	40
26	25

- f. Select the “Feet Per Ohm” value for the line conductor gauge and multiply it by the resistance to the fault.

$$\text{Distance to Fault} = \frac{\text{Loop Resistance} \times \text{Feet Per Ohm}}{2}$$

- g. The actual distance may be shorter than calculated due to the unknown resistance of the fault itself, if any, which will be included in the loop resistance.
- h. When calculating distance to a ground fault (refer to table 5), only one conductor is being measured. Do not divide the measured value by 2. Consider the possible additional error that may be due to the unknown resistance of the ground path as well as that of the fault.

18. OPERATOR MAINTENANCE

This section describes how to maintain the Instrument in good operating condition. This Instrument is carefully designed and constructed with high quality components. By providing reasonable care and following instructions in this manual, the user can expect a long service life of the Instrument.

Servicing, other than described in this Section, should be performed only by one of the Authorized Service Centers, or by the factory.

18.1 Inspection For Damage Or Deterioration

Examine the Instrument and its test leads frequently for damaged or deteriorated insulation that may expose internal metal parts that may be a shock hazard. Replace any damaged components before using the Instrument or allowing others to use it.

If the Instrument panel and/or test leads become soiled, clean them with a clean rag dampened with a mild, detergent-water solution. Rinse with a clean water dampened cloth, and dry thoroughly. Do not allow liquid to enter the Instrument case.

18.2 Access To Battery Or Switches

1. Disconnect the test leads from any circuitry.
2. Remove the four screws, one near each corner of the front panel (refer to item 8 in Figure 3-1), and carefully lift the panel assembly, the cushioning pad and the battery out of the case. The battery and switches will now be accessible for service.
3. Replace the panel. Place the cushioning pad between the circuit board and the battery, dressing the battery leads so they will not be pinched between the panel and case when the panel screws are tightened.

18.3 Battery Replacement

1. When the BATTERY ADJUSTMENT control can no longer adjust the meter to zero kilohms in both ranges, replace the battery.
2. Remove the panel from the case in accordance with paragraph 18.2.
3. Disconnect the leads from the battery and attach them to the new battery, red lead to the “+” terminal and black lead to the “-” terminal.
4. The correct battery to be used with this Instrument is a 45V, Simpson PN: 10-867221.
5. Battery condition can be checked on the 8455 V3 by setting the ON/OFF switch to OFF (REVERSE switch to normal) and touching red test lead clip to battery “+” terminal. A meter indication of at least 35 POINTS (35 V) is required for resistance measurements. A new battery will indicate about 48 POINTS (48 V).
6. On the 8455A, the battery must be removed before testing with the volts function.
7. Replace the panel. Place cushioning pad between circuit board and battery, dressing battery leads so they will not be pinched between the panel and case when panel screws are tightened.

18.4 Switch Replacement

To replace the switch:

1. Remove test leads and the four screws located near meter face from the front cover (figure 18.4-1).
2. Detach the mounting nut from the defective toggle switch (Figure 18.14-2).
3. Unplug the worn-out or broken switch and plug in a new one (Figure 18.14-3).
4. Replace the panel. Place the cushioning pad between the circuit board and the battery, dressing the battery leads so they will not be pinched between the panel and case when the panel screws are tightened.

**Push-Button Style
also available**

Figure 18-3

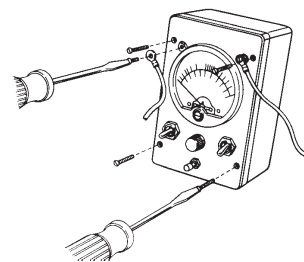
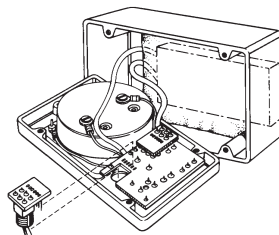


Figure 18-1

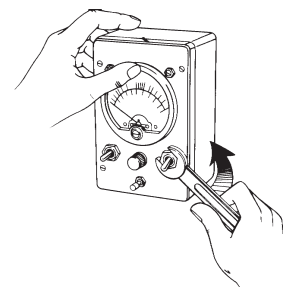


Figure 18-2

18.5 Care

1. When the Instrument is not in use, set the ON/OFF switch to OFF to prevent battery discharge if the test lead clips should accidentally be shorted together.
2. If the Instrument is to be stored for more than one month, remove the battery to avoid corrosion damage.
3. Instruments subjected to rough handling and/or transport should be checked frequently for specified accuracies. If such facilities are not available, the Instrument may be sent to the factory Service Department for an overall checkout, repair, if needed, and calibration.



When an Instrument must be stored and/or transported in a vehicle in very cold weather, it will be subject to condensation when brought into a warm building. Therefore, do not attempt high voltage measurements until certain that the Instrument is completely dry.