Warranty

SIMPSON ELECTRIC COMPANY warrants each instrument and other articles of equipment 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 any instrument or other article of equipment which shall within 90 days 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 stations, 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 sale 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 stations, 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.

SIMPSON ELECTRIC COMPANY
A Katy Industries Subsidiary
853 Dundee Avenue, Elgin, Illinois 60120
(312) 697-2260 • Cable SIMELCO • Telex 72-2416
IN CANADA: Bach-Simpson, Ltd., London, Ontario
IN ENGLAND: Bach-Simpson (U.K.) Ltd., Wadebridge

OPERATOR'S MANUAL

SIMPSON 255
VOLT-OHM-MILLIAMMETER

Simpson®
INSTRUMENTS THAT STAY ACCURATE

(123.01)
EFFECTIVE DATE: Immediately
EDITION: 5th
Part No. 5-118929

TABLE OF CONTENTS

Table of Contents

LIST OF ILLUSTRATIONS

NOTE: This Operator's Manual contains information essential to the operation of this Instrument. Therefore, it should be kept in a convenient place and used for reference as required.

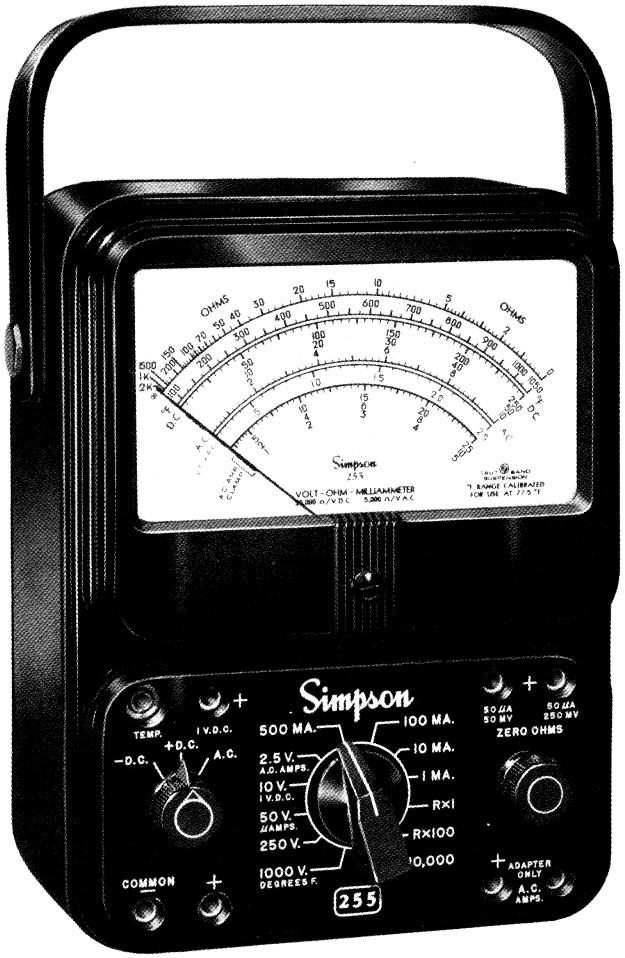

Figure 1-1. Simpson 255 Volt-Ohm-Milliammeter

SAFETY SYMBOLS

This marking adjacent to another marking or a terminal or operating device indicates that the operator must refer to an explanation in the Operating Instructions to avoid damage to the equipment and/or to avoid personal injury.

WARNING

The WARNING sign denotes a hazard. It calls attention to a procedure, practice or the like, which if not correctly performed or adhered to, could result in personal injury.

CAUTION

The CAUTION sign denotes a hazard. It calls attention to a procedure, practice or the like, which if not correctly adhered to could result in damage to or destruction of part or all of the Instrument.

WARNING

These Instruments are 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.

SHOCK HAZARD: As defined in American National Standard, C39.5, Safety Requirements for Electrical & Electronic Measuring & Controlling Instrumentation, a shock hazard shall be considered to exist at any part involving a potential in excess of 30 volts rms (sine wave) or 42.4 volts DC or peak and where a leakage current from that part to ground exceeds 0.5 milliampere, when measured with an appropriate measuring instrument defined in Section 11.6.1 of ANSI C39.5.

NOTE: The proper measuring instrument for the measurement of leakage current consists essentially of a network of a 1500 ohm non-inductive resistor shunted by a 0.15 microfarad capacitor connected between the terminals of the measuring instrument. The leakage current is that portion of the current that flows through the resistor. The Simpson 229-Series 2 AC Leakage Current Tester meets the ANSI C39.5 requirements for the measurement of AC leakage current and can be used for this purpose. To measure DC Leakage current, connect 1500 ohm non-inductive resistor in series with the 255 1mA Range.

SECTION I
INTRODUCTION

1.1 GENERAL

1.1.1 The Simpson 255 Volt-Ohm Milliammeter (hereafter referred to as the 255 or the Instrument) is a rugged, accurate, compact, easy-to-operate Instrument. It is used to measure electrical characteristics of circuits and circuit components. It is used for measurement of AC and DC voltages, direct currents, resistances, temperature and AC current (when using the AC clamp-on-ammeter adapter). To complement the circuit accuracy, the 255 features the new Simpson taut-band suspension, annular movement. The annular movement is self-shielding, and the taut-band suspension has superior repeatability due to the absence of normal pivot-jewel wear. These basic design improvements result in an instrument which guarantees years of trouble-free service in normal use. A special calibration circuit is incorporated which yields increased accuracy and facilitates recalibration to original factory accuracy should it ever be necessary.

1.1.2 The 255 utilizes the most modern components and circuit techniques. It will, therefore, take considerable abuse and still continue to function. However, it does contain a very precise instrument movement, and therefore we urge that you treat it with the care it deserves by not subjecting it to severe shock, vibration or high electrical overloads.

1.1.3 The 255 is housed in a sturdy, black phenolic case. It is molded with reinforced walls for maximum durability. All of the component parts of the tester are attached to the front panel. The entire Instrument slips into and out of the case in one piece. Conforming to the latest engineering developments, most of the component parts are mounted on a printed circuit board. This board simplifies assembly, reduces maintenance, and extends the useful life of the Instrument.

1.1.4 The Adjust-A-Vue handle is attached on each side of

the instrument case. The handle may be used to support the Instrument in a convenient sloping position for easy viewing on a bench top. The 255 can also be placed in either a vertical or horizontal position.

1.1.5 The 255 is furnished with one pair of four-foot test leads complete with test prods and detachable alligator clips on one end and elbow banana plugs on the other end. One lead is black and the other red for easy polarity identification.

1.1.6 Also supplied is a thermocouple lead with a special alligator clip for convenient mounting of the thermocouple to equipment under test.

1.1.7 The 255 is equipped with an internal 1A-3AG-250V pigtail fuse connected in series with the COM — jack.

1.2 ACCESSORIES AND SUPPLIES

1.2.1 All accessories and supplies required for the operation of the 255 are furnished with the Instrument and listed in Table 1-2. (Available replacement parts are listed in Table 5-1.)

1.3 SAFETY CONSIDERATIONS

1.3.1 This Operator's Manual contains cautions and warnings alerting the user to hazardous operating and service conditions. This information is flagged by CAUTION or WARNING headings throughout this publication, where applicable, and is defined at the front of the manual under SAFETY SYMBOLS. To ensure the safety of operating and servicing personnel and to retain the operating conditions of the instrument, these instructions must be observed.

1.4 TECHNICAL DATA

1.4.1 Table 1-1 lists the technical data for the 255.

Table 1-1. Technical Data

1. Ranges:

DC Voltage (20k ohms/volt)	Accuracy (per cent of full scale)
.050 V .250 V 1.0 V 2.5 V 10 V 50 V 250 V 1000 V	±2%

AC Voltage (5k ohms/volt)	Accuracy (per cent of full scale)
2.5 V 10 V 50 V 250 V 1000 V	±3% + Freq. response error (Figure 4-3)

Direct Current	mV Drop	Accuracy (per cent of full scale)
50μa	250	±1%
50μa	50	±1%
1mA	50	
10mA	50	
100mA	50	±2%
500mA	50	

2. *Rated Circuit-to-Ground Voltage: 1000 Volts AC/DC

3. Resistance:

			Accuracy (degrees of arc)
R x 1	0-2000 ohms	12 ohm center	2.5°
R x 100	0-200k ohms	1200 ohm center	2.0°
R x 10k	0-20 megohms	120k ohm center	2.0°

** Per ANSI C39.5 April 1974. "The maximum voltage, with respect to ground, which may safely and continuously be applied to the circuit of an Instrument".*

4. Temperature:

	Accuracy (77.5°F Ambient)
+100°F to 1050°F	30°F
+350°F (Calibration Point)	±1%

5. Overall Dimensions: 5¼" x 7" x 3⅛"

6. Weight: 3½ lbs.

7. Alternating Current:

Using Amp-Clamp (00532)	Accuracy (% of full scale)	Using Amp-Clamp (0531)	Accuracy (% of full scale)
0-5 amps 0-10 amps 0-25 amps 0-50 amps 0-100 amps 0-250 amps	±5%	0-5 amps 25 amps 100 amps 250 amps	±5%

8. Frequency Response:

Ac Voltage Ranges: The frequency response of the AC voltage ranges is essentially flat over the wide range of 20 cycles per second to 100,000 cycles per second (Figure 4-3).

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

Quantity	Description	Part Number
1	Thermocouple Lead Assembly	Cat. No. 00163
2	4 ft. Test Leads	Cat. No. 00115
1	No. 950 D Flashlight Cell	1-111798
4	No. 915 AA Flashlight Cell	1-111802
1	Operator's Manual	5-118929

Table 1-3. Available Accessories

HIGH VOLTAGE PROBES	Catalog No.
5kV DC 20kΩ/v (used with 00115 test leads)	00506
5kV AC 5kΩ/v (used with 00115 test leads)	00505
10kV DC 20kΩ/v	00034
10kV AC 5kΩ/v	00036
40kV DC 20kΩ/v	00168
TEST LEADS	
Combination Probe Tip Leads, one red and one black with removable alligator clips	00115
Crocodile Clip Test Leads, one red and one black	07500
Thermocouple Lead (5 ft.)	00163
AC CURRENT ADAPTERS	
Model 150 Amp-Clamp (2.5 VAC range)	00532
Model 151, Line Splitter	00534
Replacement Test Leads (For Model 150)	00533
CARRYING CASES	
Leather Case	01818
Ever-Redy Leather Case	00805
Special 255 Utility Case, Vinyl	00549
Carrying Case, 150 Amp-Clamp	00548
Roll Top Safety Case	0249
Deluxe Case	00812

SECTION II
INSTALLATION

2.1 GENERAL

2.1.1 This section contains information and instructions for the installation and shipping of the 255. Included are unpacking and inspection procedures, warranty, shipping, power source requirements, installation and care.

2.2 UNPACKING AND INSPECTION

2.2.1 Unpack and inspect the Instrument for possible damage in shipment. Check the electrical performance as soon as possible. If damage is noted, notify the carrier and supplier before using

the Instrument. Also, check that all items are included (Table 1-2).

2.2.2. Save the shipping carton and packing materials for future storing or shipping of the Instrument.

2.3 SHIPPING

2.3.1 Pack the Instrument carefully and ship it prepaid to the proper destination. Insure the Instrument.

2.4 WARRANTY

2.4.1 The Simpson Electric Company warranty policy is printed on the inside front cover of this manual. Read it carefully prior to requesting a warranty repair.

> **NOTE:** For assistance of any kind, including help with the Instrument under warranty, contact the nearest Authorized Service Center for instructions (listed on the last pages of this manual). If it's necessary to contact the factory directly, give full details of the difficulty and include the Instrument model number, serial number (at the back of the Instrument) and date of purchase. Service data or shipping instructions will be mailed promptly. If an estimate of charges for non-warranty or other service work is required, a maximum charge estimate will be quoted. This charge will not be exceeded without prior approval.

2.5 INSTALLATION

2.5.1 A handle is attached to the side of the instrument case. The handle may be used to support the Instrument in a convenient, sloping position for easy viewing. The VOM case can also be placed in either a vertical or horizontal position. The horizontal

position is preferable for greater accuracy since the Instrument is calibrated in this position.

2.5.2 After proper completion of visual inspection and installation of batteries, check for performance of the Instrument.

2.6 CARE

WARNING

Do not attempt to clean this Instrument with the test leads connected to a power source.

2.6.1 Immediately clean all spilled materials from the Instrument and wipe dry. If necessary, moisten a cloth with soap and water to clean plastic surfaces.

2.6.2 Do not allow the battery to fully discharge. When the batteries reach the end of their useful life, they should be replaced promptly. Failure to do so may result in corrosion at the battery contacts due to battery leakage.

2.6.3 Whenever possible, avoid exposure or usage in areas which are subject to temperature and humidity extremes, vibration, mechanical shock, dust, corrosive fumes, or strong electrical or electromagnetic interferences.

2.6.4 Monthly Care: Verify Instrument calibration by performing operational checks using known value sources. If the need for calibration is indicated, contact the nearest Authorized Service Center.

2.6.5 Annual Care: It is recommended that the Instrument be returned annually to an Authorized Service Center or the factory for a complete overall check and calibration.

2.6.6 Storage: When the Instrument is not in use, store it in a

location free from temperature extremes, dust, corrosive fumes, and mechanical vibration or shock.

SECTION III
CONTROL, CONNECTORS, AND INDICATORS

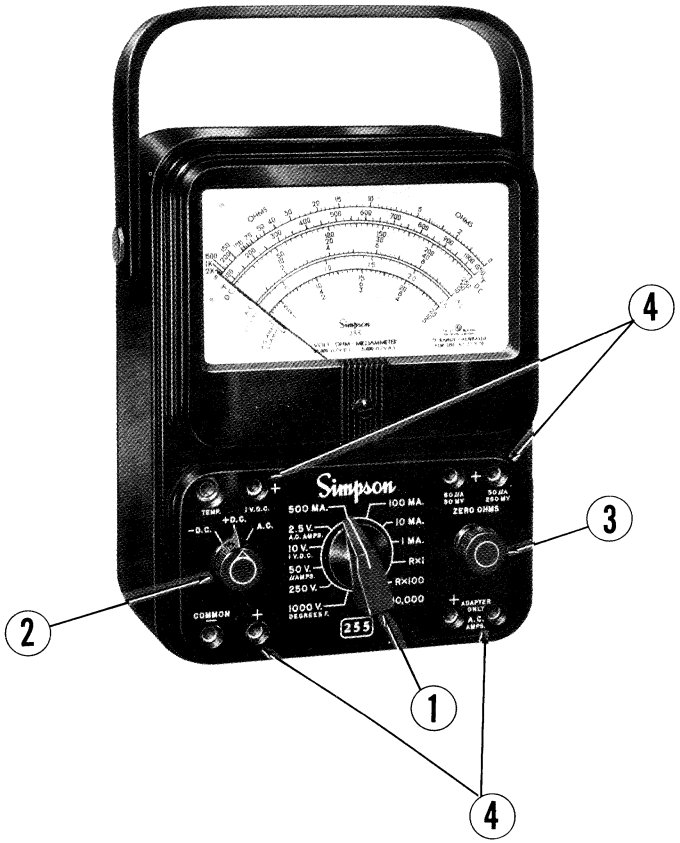

Figure 3-1. Front Panel Description

3.1 GENERAL

3.1.1 All operating and adjusting controls, connectors and indicators are described in Table 3-1. Become familiar with each item prior to operating the Instrument for the first time.

3.2 FRONT PANEL DESCRIPTION

3.2.1 Table 3-1 lists all front panel controls, connectors and indicators.

Table 3-1. Front and Rear Panel Description

1. **Range Switch:**
   The range switch, in the center of the lower front panel, has 12 positions. It may be turned in either direction to obtain any desired range and circuit position. There are six voltage ranges for DC and five for AC, six ranges for direct current, and three resistance ranges. The range switch also selects the proper position for making temperature measurements and AC current measurements when using the AC clamp-on adapter.
2. **Function Switch:**
   The function switch is located at the left hand side of the lower part of the front panel. It has three positions: —DC, +DC and AC. When direct current, DC voltage, or resistance is to be measured, the function switch may be set to —DC or +DC, depending on the polarity of current or voltage under test. This switch eliminates any need to reverse the test leads at the test points. (See paragraph 4.3.2.)
3. **Zero Ohms:**
   The control at the lower right on the panel is marked ZERO OHMS. This variable resistance in the ohmmeter circuit is used to compensate for the aging of the internal batteries. Use it to adjust the meter indication to zero (at the right end of the upper meter scale) with the test leads shorted together, whenever the ohmmeter circuit is used.
4. **Circuit Jacks:**
   - There are eight jacks, two located in each corner of the front panel. These are the connection points for the test leads. Plug the elbow prods of the test leads into the proper jacks to obtain the circuit and range desired for each application.
   - At the lower left are the COMMON — and + jacks. These are the jacks that will be used most. Connect the black test lead to COMMON – for all circuits and ranges, except the (0531) amp clamp and

temperature ranges. Connect the red test lead to the + jack for all circuits and ranges except those designated by the other circuit jacks.

- Across the top of the panel are jacks marked TEMP (for use with the thermocouple lead), +1VDC, +50μA 50mV, and +50μA 250mV. For the temperature range, connect the thermocouple to the TEMP jack. To use the 1 volt DC range, plug the red test lead into the +1VDC jack.
- For the 50 microampere or 50 millivolt DC range, the red test lead is plugged into the +50μA 50mV jack. For the 50 microampere or 250 millivolt range, plug the red test lead into the +50μA 250 mV jack.
- In the lower right hand corner of the panel are two jacks marked AC Amperes adapter only. (These two jacks are used in conjunction with Catalog No. 0531* AC Clamp-On-Ammeter Adapter to provide four AC current ranges on the tester.) The jack marked + is connected to the red plug on the clamp-on-ammeter unit.

** Cat. No. 0531 AC Clamp-On-Adapter has been replaced by Cat. No. 00532, a six range AC Clamp-On-Adapter (Figure 3-2).*

CAUTION

Do not attempt to measure AC current without using the Clamp-On-Ammeter Adapter. To do so will result in damage to the meter movement.

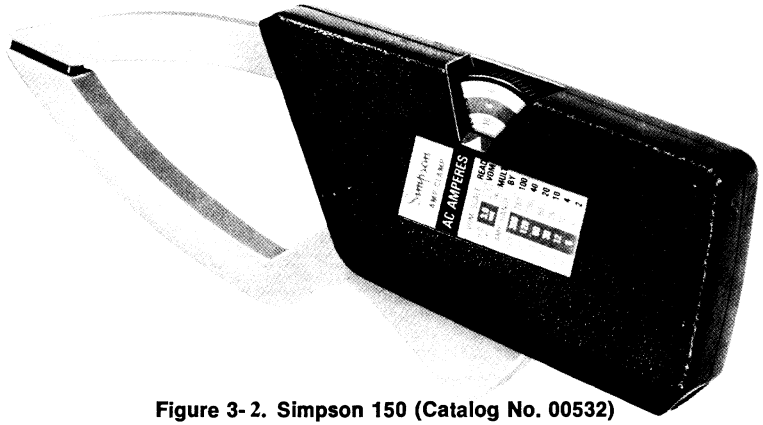

Figure 3-2. Simpson 150 (Catalog No. 00532) AC Clamp-On-Ammeter Adapter

SECTION IV
OPERATION

4.1 GENERAL

WARNING

Before proceeding with the operation of the 255, review the SHOCK HAZARD at the front of this manual.

4.1.1 This section of the manual contains information required to use and operate the 255 in a safe and proper manner.

4.2 SAFETY PRECAUTIONS

4.2.1 The 255 is designed to be used only by personnel qualified to recognize shock hazards and trained in the safety precautions required to avoid possible injury.

4.2.2 Do not work alone when making measurements where a shock hazard can exist. Notify a nearby person that you are making or intend to make such measurements.

REMEMBER: Voltages might appear unexpectedly in defective equipment. An open bleeder resistor can result in a capacitor retaining a dangerous charge. Remove all power from the 255 before making connections or disconnections.

4.2.3 Locate all voltage sources and accessibility paths prior to making any measurement or connections.

4.2.4 Before each use, inspect the test leads, prods, connectors and power cable for cracks, breaks or crazes in the insulation. If any defects exist, destroy and replace the defective item(s) immediately.

4.2.5 Measurements should not be made in a circuit where corona is present. Corona can be identified by a pale-blue color

emanating from sharp metal points in the circuit, or a buzzing sound, or the odor of ozone. In rare instances, such as around germicidal lamps, ozone might be generated as a normal function. Ordinarily, the presence of ozone indicates the presence of high voltage and probably a malfunction of some kind.

4.2.6 Hands, shoes, floor, and workbench must be dry. Avoid making measurements under humid, damp, or other environmental conditions that could affect the dielectric withstanding voltage of the test leads or the Instrument.

4.2.7 Do not touch test leads, circuit, or Instrument while power is applied to the circuit being measured.

4.2.8 Use extreme caution when making measurements in a circuit where dangerous composite voltages could be present, such as in an r-f amplifier.

4.2.9 Do not use test leads which differ from those originally furnished with the Instrument.

4.3 ADJUST POINTER FOR ZERO

4.3.1 Before any measurements are made, check to see that the pointer indicates zero when the meter is in operating position. If the pointer is off zero, adjust the screw, located in the phenolic case below the center of the meter scale (Figure 1-1). Turn this screw slowly clockwise, or counterclockwise, until the pointer is exactly over the zero mark at the left side of the scale.

4.3.2 POLARITY CORRECTION

4.3.3 When making DC measurements with the test leads connected to the + and -COMMON jacks, polarity can be reversed with the function switch without reversing the test leads. When making measurements on the 50μA/50mV, 50μA/250mV and 1 VDC range, polarity can be corrected only by reversing the test leads.

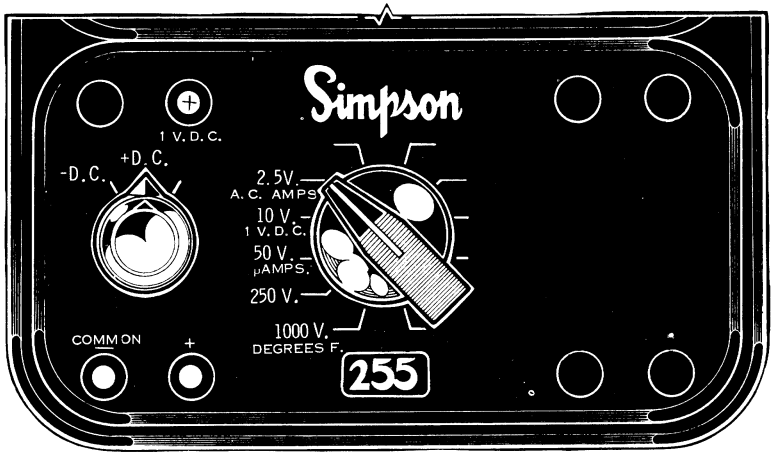

Figure 4-1. Jacks and Switch Positions for DC Volts

NOTE: Change the range switch or function switch positions only when the power to the circuit being measured is turned off or when the test leads are disconnected. In addition to safety, this practice will eliminate arcing at the switch contacts and prolong the life of the Instrument.

4.4 DC VOLTAGE MEASUREMENTS, 0 to 50 and 0 to 250 MILLIVOLT RANGES ONLY:

CAUTION

Extreme care should be used when using the 255 as a millivoltmeter, in order to prevent damage to the meter. An excessive voltage applied to the meter can be detrimental to the meter movement. Before making any of th following DC voltage measurements, the AC Clamp-On-Ammeter Adapter and the thermocouple lead must be disconnected from the tester.

a. Set the function switch at +DC (Figure 4-1). Insert the black test lead into the COMMON — jack. If the voltage to be

measured is below 50 millivolts, insert the red lead into the 50μA 50mV jack or, if the voltage is above 50 millivolts, insert the red lead into the 50μA 250mV jack.

b. Set the range switch at μAmps (COMMON position with 50V).

c. Connect the black test lead to the negative side of the circuit to be measured and the red test lead to the positive side of the circuit.

d. Read the voltage on the black arc marked DC. Use the figures marked 0 to 50 when the red test lead is in the 50μA 50mV jack, and use the figures marked 0 to 250 when the red test lead is in the 50μA 250mV jack; read directly in millivolts.

e. If the meter reads in reverse, turn off the power in the circuit being measured and reverse the polarity of the test leads. (The function switch does not reverse the polarity on these ranges.)

f. Turn off the power to the circuit being measured before disconnecting meter leads.

WARNING

If these ranges are to be used for measuring the drop across a shunt or other circuit in which the voltage (with respect to ground) exceeds 42.4 volts, de-energize the circuit before connecting or disconnecting test leads.

4.5 DC VOLTAGE MEASUREMENTS, 0 to 1000 VOLTS:

a. Review the Safety Precautions in paragraph 4.2.

b. Set the function switch on the left side of the front panel to +DC (Figure 4-1).

c. Plug the black test lead into the COMMON — jack and the red test lead into the + jack.

d. Set the range selector switch to the desired range. When in doubt as to the voltage present, always use the highest range as a protection to the Instrument.

e. De-energize the circuit to be measured and discharge the capacitors (if any).

f. Connect the black test lead to the negative side of the circuit to be measured and the red test lead to the positive side of the circuit.

g. Turn on the power in the circuit to be tested. If the pointer deflects to the left of zero, the anticipated polarity is opposite the actual circuit polarity. Turn off the power in the circuit being tested. Set the function switch at —DC and turn on the power again. This setting will correct the polarity as applied to the meter.

h. Observe the meter reading. If the voltage is within a lower range, the switch may be set for the lower range to obtain a more accurate reading.

i. Read the voltage on the black arc marked DC, then do the following:

- For the 2.5V range, use the 0 to 250 figures and divide by 100.
- For the 10V, 50V, and 250V ranges read the figures directly on the scale.
- For the 1000V range, use the 0 to 10 figures and multiply by 100.

j. Turn off the power in the circuit being measured before disconnecting meter leads.

4.6 DC VOLTAGE MEASUREMENTS, 1 VOLT RANGE:

a. Review the Safety Precautions in paragraph 4.2.

b. Set the function switch at +DC (Figure 4-1).

c. Plug the black test lead into the COMMON — jack and the red test lead into the +1VDC jack.

d. Set the range selector to the 1 VDC position (COMMON with the 10V range).

e. De-energize the circuit to be measured and discharge the capacitors (if any).

f. Connect the black test lead to the negative side of the circuit to be measured and the red test lead to the positive side of the circuit.

g. Turn on the power in the circuit to be tested. If the pointer deflects to the left of zero, the anticipated polarity is opposite the actual circuit polarity. Turn off the power in the circuit. Reverse the polarity of the test leads to the circuit being measured and turn the power on again. This procedure will correct the polarity as applied to the meter.

h. Read the voltage on the black arc marked DC. Use the 0 to 10 figures and divide by 10.

i. Turn off the power in the circuit being measured before disconnecting the meter leads.

4.7 MEASURING AC VOLTAGES 0 TO 1000 VOLTS:

WARNING

Before making any of the following AC voltage measurements, the AC Clamp-on ammeter adapter and the thermocouple lead must be disconnected from the Instrument.

NOTE: The Simpson 255 responds to the full-wave average value of an AC waveform. It is calibrated in terms of the rms value of a pure sine wave. If the waveform is nonsinusoidal, the reading might be either higher or lower than the true rms value, and could result in a

substantial error. Also, accuracy is lessened at higher input frequencies (Figures 4-3).

a. Review the Safety Precautions in paragraph 4.2.
b. Set the function switch to AC (Figure 4-2).
c. Set the range selector to the appropriate range. If in doubt, set it to the highest range.
d. Plug the black test lead into the COMMON — jack and the red lead into the + jack.
e. De-energize the circuit to be measured and discharge capacitors (if any).

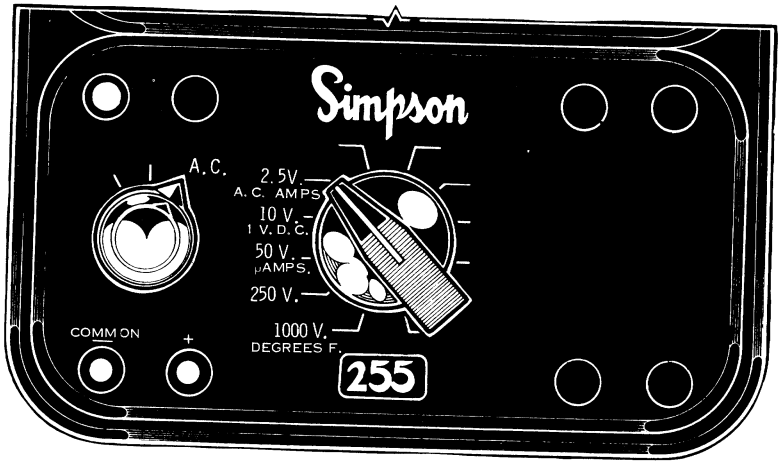

Figure 4-2. Jacks and Switch Positions for AC Volts

f. Connect the test leads across the voltage source.
g. Turn on the power in the circuit to be measured and observe the meter reading. If indication is in the lower part of the scale, switch to a lower range to obtain the highest on-scale reading for maximum accuracy.
h. Read the voltage as follows (Figure 4-2):

   For the 0-2.5V range, read the value directly on the scale marked 2.5 V.A.C. For the 10V., 50V., and 250V, ranges, read the red scale marked A.C. and use the black figures immediately above the scale. For the 1000 range, read the red scale marked A.C. and use the 0-10 figures. Multiply the reading by 100.

i. Turn off power to the circuit and discharge the capacitors (if any) before disconnecting test leads.

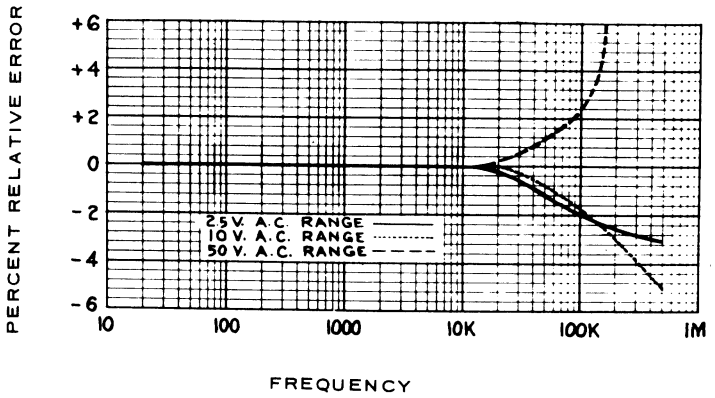

Figure 4-3. Frequency Response for the Simpson 255

4.8 MEASURING AC CURRENT, 0 to 250 AMPERES

CAUTION

The AC AMPERES jacks are intended (only) for use with the (Catalog No. 0531) AC Clamp-On-Ammeter Adapter. Measuring AC current in any other way using these jacks will result in damage to the meter movement. Before attempting to use the 255 for measuring AC current, all test leads and the thermocouple lead must be disconnected from the tester.

4.8.1 Connections For Catalog No. 0531 Amp-Clamp (obsolete):

- Connect the red plug from the amp-clamp to the + AC AMPS jack and the black plug to the other AC AMPS jack.
- Set the function switch to + DC.
- Set the range switch to 2.5V (AC amps).

4.8.2 Connections For Catalog No. 00532 Amp-Clamp (replaces 0531):

- Connect the two leads from the amp-clamp to the COMMON – and the + jacks (either polarity).
- Set the function switch to AC (Figure 4-4).
- Set the range switch to 2.5V (AC amps).

4.8.3 Using the Amp-Clamp:

- Set the range switch on the amp-clamp to the range desired. If in doubt about the current expected, start with the highest range and then re-set to a lower range after the preliminary reading.
- Clamp the amp-clamp jaws around a single wire of the circuit to be measured (clamping around both wires of a circuit will result in no reading). To measure current in a power cord, a line splitter must be used. (The Simpson 151 line splitter was designed for this purpose and is available as an accessory.) An adapter may be fabricated with an appropriate plug and

socket connected together with two separate wires. (Be sure to connect the third grounding wire if the power cord is a 3-wire type.)

CAUTION

Motor starting surges may overload and damage the instrument. Either start with the highest range and re-set the amp-clamp to a lower range after the motor has started, or start the motor before applying the amp-clamp.

- Make certain the clamp jaws are closed tightly. Keep the jaws clean to ensure they close tightly.
- Observe the meter reading while holding the amp-clamp so that the wire is centered as accurately as possible within the jaws.
- Re-set the amp-clamp to a lower range if necessary to obtain the highest on-scale reading.

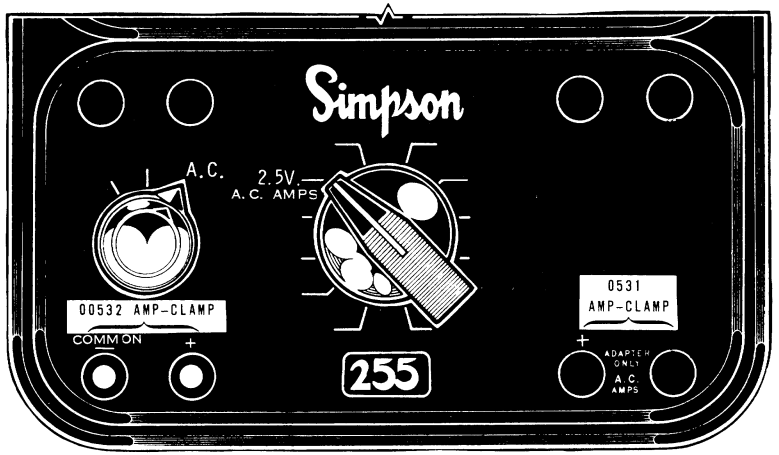

Figure 4-4. Jacks and Switch Positions for AC Amperes

- When finished, remove the amp-clamp and the line splitter (if any).

NOTE: Read 2.5VAC red scale arc in terms of amps when using Catalog No. 00532 Amp Clamp. (Refer to Simpson 150 Amp-Clamp Operator's Manual.)

4.9 MEASURING RESISTANCES

CAUTION

When using the ohmmeter ranges, the AC Clamp-On-Ammeter Adapter and the thermocouple lead must be disconnected from the tester.

4.9.1 Zero Ohms Adjust: Each time the ohmmeter circuit is used, check the zero indication on the meter before measuring resistance. Check and adjust after switching to a different range.

To set the ZERO OHMS control, proceed as follows:

- Set the range switch to the resistance range to be used and the function switch to either —DC or +DC (Figure 4-5).
- Connect the black test lead to the COMMON — jack and the red test lead to the + jack.
- Clip the contact end of the test leads together to short out the resistance circuit.
- Observe the meter indication. It should read 0 on the right end of the OHMS arc, at the top of the dial.
- If the pointer does not read 0, rotate the ZERO OHMS knob until it does. If the pointer cannot be adjusted to read 0, one or more batteries should be replaced.
- When the pointer shows zero, unclip the shorted test leads; the ohmmeter circuit is now ready to measure resistance.

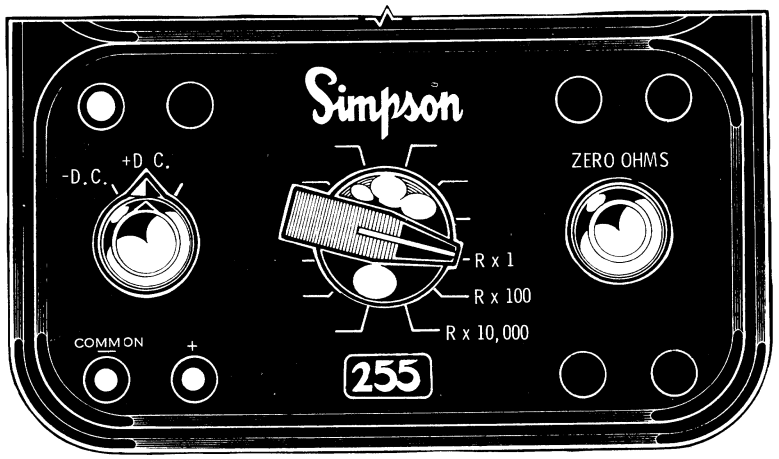

Figure 4-5. Jacks and Switch Positions for Resistances

4.9.2 Measuring Resistances: Before making any resistance measurement, ensure that there is no voltage present across the device where reistance is to be tested. To measure resistance, proceed as follows:

a. Set the range switch in one of the resistance range positions as follows:
   - Use R x 1 for resistance readings from 0 to 200 ohms.
   - Use R x 100 for resistance readings from 200 to 20,000 ohms.
   - Use R x 10,000 for resistance readings above 20,000 ohms.

b. Set the function switch at either —DC or +DC.

c. Connect the black test lead to the COMMON — jack and the red test lead to the + jack.

d. Short the test leads together and adjust for zero ohms (paragraph 4.3.1).

e. Separate the test leads and connect them across the resistance

which is to be measured. If there is a forward and backward resistance, such as in rectifiers, switch back and forth between the two DC positions of the function switch to reverse the polarity of the voltage which appears at the ends of the test leads.

NOTE: The resistance of such rectifiers will measure different values on different resistance ranges of the 255. For instance, a crystal diode which measures 80 ohms on the R x 1 range may measure 300 ohms on the R x 100 range. This is normal and is a result of the diode's characteristics. The difference in values does not indicate any fault in the ohmmeter.

f. Read the indication on the OHMS arc at the top of the dial. Note that this arc reads from right to left for increasing values.

g. Multiply the reading by the multiplier factor at the switch position for the resistance value in ohms. K on the dial stands for thousand.

4.10 MEASURING DIRECT CURRENTS, 0 to 50 MICROAMPERES:

CAUTION

Never connect the test leads across any voltage when the 255 is used as a current meter, except when it is used as a 0-50 millivoltmeter or a 0-250 millivoltmeter. This connection will damage the Intrument. When making a current measurement always connect the meter in series with the load. When making any direct current measurements, the AC Clamp-On-Ammeter Adapter and the thermocouple lead must be disconnected from the tester.

WARNING

- Do not change the range setting of the Range or Function Switches while the circuit under measurement is energized.
- Never disconnect the test leads from the circuit under measurement while the circuit is energized.
- Always turn the power off and discharge all the capacitors before the setting of the switches is changed, or the leads disconnected.
- Always connect the Instrument in series with the ground side of the circuit.
- Never exceed the Citcuit-To-Ground voltage of the Instrument (1000V max: Table 1-1, Item 2).

a. Review the Safety Precautions in paragraph 4.2.

b. Set the function switch at +DC (Figure 4-6).

c. Connect the black test lead to the COMMON — jack and the red test lead to either the 50μA 50mV or the 50μA 250mV jack.

d. Set the range switch at μAmps (COMMON position with 50V).

e. De-energize the circuit to be measured and discharge the capacitors (if any).

f. Open the circuit in which the current is to be measured. Connect the meter in series with the circuit. Connect the red test lead toward the positive side and the black test lead toward the negative side.

g. Turn on the power in the circuit to be measured. Observe the meter if the pointer is deflected to the left, turn off the power and reverse the leads, and turn on the power.

h. Read the current directly on the black D.C. arc. Use the 0-50 figures. The current value is shown in microamperes.

i. Turn off the circuit power. Remove the test leads and restore the circuit continuity.

NOTE: In all direct current measurements be certain the power to the circuit being tested has been turned off before disconnecting test leads and restoring circuit continuity.

4.11 MEASURING DIRECT CURRENTS, 0 to 500 MILLIAMPERES

a. Review the Safety Precautions in paragraph 4.2.

b. Set the function switch at +DC (Figure 4-6).

c. Connect the black test lead to the COMMON — jack and the red test lead to the + jack.

d. Set the range switch to the range required. When in doubt of the current that may be present, start with the highest range.

e. De-energize the circuit to be measured and discharge the capacitors (if any).

f. Open the circuit to be measured. Connect the meter in series with the circuit. Connect the red test lead toward the positive side and the black test lead toward the negative side.

g. Turn on the power in the circuit to be measured. Observe the meter. If the pointer is deflected to the left, the current polarity is opposite that which was anticipated. Turn off the power; set the function switch at —DC. Turn on the power again.

h. Read the current directly on the black DC arc.

- For the 1 MA range, use the 0-10 figures and divide by 10.
- For the 10 MA range, use the 0-10 figures directly.
- For the 100 MA range, read the 0-10 figures and multiply by 10.
- For the 500 MA range, read the 0 to 50 figures and multiply by 10.
- The current values are in milliamperes.

i. Turn off the circuit power. Remove the test leads and restore circuit continuity.

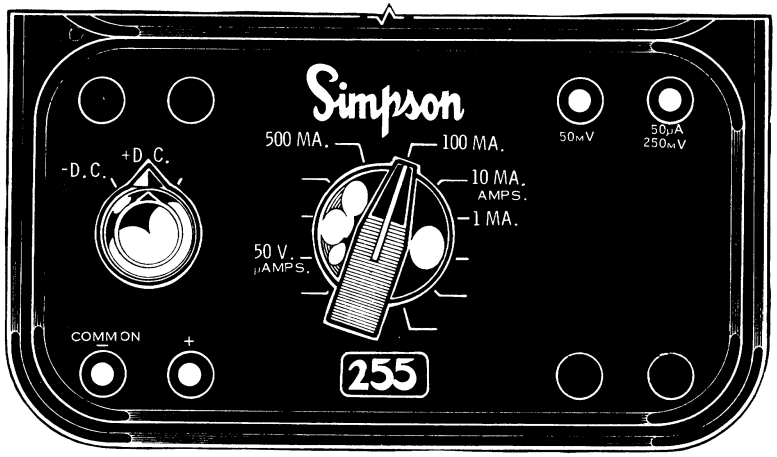

Figure 4-6. Jacks and Switch Positions for Direct Currents

4.12 TEMPERATURE MEASUREMENT, +100°F to +1050°F:

4.12.1 To correct for errors when the ambient temperature is other than 77.5°F proceed as follows:

- If the room ambient temperature is below 77.5°F, add the difference between the actual room temperature and 77.5° to the reading on the tester.
- If the room ambient temperature is above 77.5°F, subtract the difference between the actual room temperature and 77.5° from the reading on the tester.

Before attempting to use the tester for temperature measurements, all other test leads must be disconnected from the Instrument.

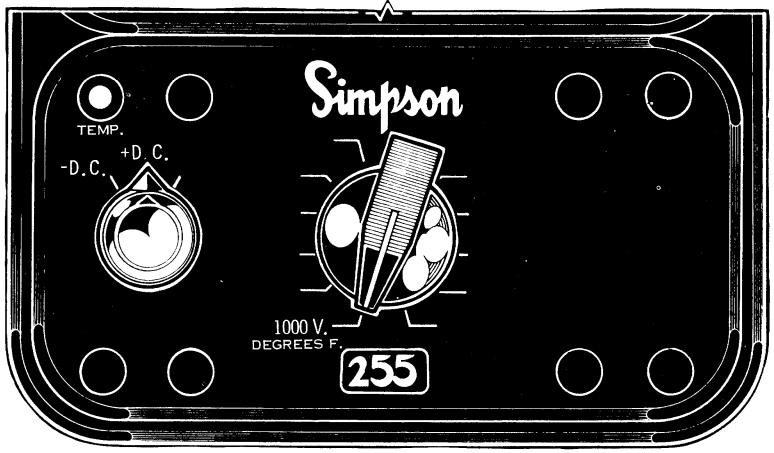

Figure 4-7. Jacks and Switch Position for Temperature Measurement

- Set range switch to the position marked DEGREES F (common with the 1000V position, (Figure 4-7).
- Set the function switch to +DC position.
- Plug the thermocouple lead (Catalog No. 0163, Figure 4-8) into the jack marked TEMP.
- Place brazed end of the thermocouple lead in area where temperature is to be measured. A clip is provided to hold the lead in the desired position.

  Make certain that the metal thermocouple tip does not accidentally come in contact with electrical connections.
- Read temperature directly from (temperature) scale on meter.
- Remove thermocouple from the area where temperature is being measured and disconnect the lead at the meter.

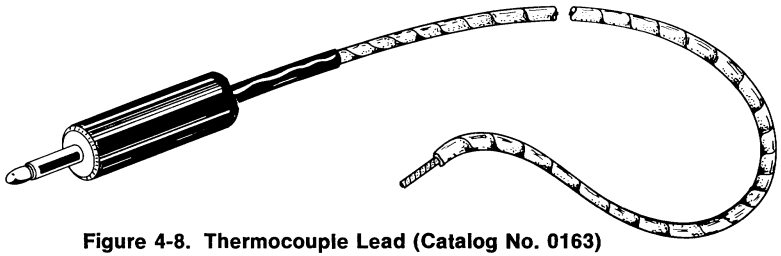

Figure 4-8. Thermocouple Lead (Catalog No. 0163)

WARNING

These servicing instructions are for use by qualified personnel only. To avoid electrical shock, do not perform any servicing other than that contained in the operating instructions unless you are qualified to do so.

SECTION V
SERVICING INSTRUCTIONS

5.1 GENERAL

5.1.1 This section explains the necessary procedures needed to effectively service this Instrument. Read these instructions carefully and follow them when servicing the 255.

5.2 HOW TO OPEN THE CASE

5.2.1 The case is designed to provide easy and quick access for all necessary adjustments and replacement of parts. Use a ¼-inch screwdriver to remove the four screws through the bottom of the case. Slip the entire front panel straight forward out of the case. The meter, the front panel, the printed circuit, and the batteries are attached and are removed as a unit.

5.3 BATTERY REPLACEMENT

5.3.1 There are five batteries inside the case behind the front panel. They are used to supply power for resistance measurements. One is a large size (Size D) flashlight cell, and the other four are smaller (Size AA) flashlight cells.

5.3.2 When it is no longer possible to bring the meter pointer to 0 for the R x 1 and R x 100 ranges (ZERO OHMS ADJUST, paragraph 2.7.1), replace the large cell with a fresh one. When it is no longer possible to bring the pointer to 0 on the R x 10,000 range, replace the four smaller cells with fresh ones. This will restore operation of the ohmmeter circuit.

NOTE: Failure to replace worn or leaking batteries may result in extensive damage to the 255. Therefore, periodic checks should be made to avert battery failure.

5.4 OBSERVE POLARITY

5.4.1 When cells are replaced, make sure to observe the polarity of the battery circuit. Battery polarity is shown on the panel. The cells are held in place with specially designed spring clips which also act as battery contacts.

5.5 RECTIFIER PLACEMENT AND RECALIBRATION

5.5.1 There are two small rectifiers located at the top of the printed circuit near the large 1.5 volt cell; they are used to rectify the AC voltages for measurement. They are shown as D-1 and D-2 in the overall schematic diagram (Figure 5-1). Both rectifiers act in the meter circuit to effectively create a full wave rectifying action. If either or both should fail, the AC readings will be in error.

5.5.2 In case of AC voltage failure, replace the defective diode. Observe polarity when connecting it into the circuit.

5.5.3 After replacing either or both diodes, test the accuracy of the AC voltage indication. If necessary, recalibrate the circuit by adjusting rheostats R-28 and R-23 as follows:

a. Set the function switch at AC and the range switch at 250V.

b. Connect the red test lead to the + jack and the black test lead to the COMMON — jack.

WARNING

Avoid contact with the circuitry when making the following adjustments (with the case removed).

c. From a standard voltage source, apply 250 volts AC to the red and black test leads. Adjust rheostat R-23 (which is in the upper-right corner on the printed circuit board) so the meter reads full scale. Turn power off.

NOTE: If no standard voltage supply is available for the above procedure, use this alternate method.

- Set the function switch at AC and the range switch at 2.5V.
- Insert the red test lead in the + jack and the black test lead in the COMMON — jack.
- Connect the test leads to a fresh 1.5 volt flashlight cell. Connect the red test lead to the positive post of the battery and the black test lead to the negative post.
- Adjust rheostat R-28 fully clockwise. It is located in the extreme upper left corner of the printed circuit board.
- Rheostate R-23 is located in the upper right corner of the printed circuit board. Adjust it so the meter reads 1.8 volts on the 2.5VAC arc.
- Adjust R-28 so the meter pointer moves back to 1.7.1 volts on the same arc (the pointer will indicate 6 on the OHMS scale when it is in this position).

5.6 RESISTOR REPLACEMENT

5.6.1 Almost all of the resistors are mounted on the rear of the printed circuit and are easily accessible for troubleshooting and repair:

- When it is necessary to replace any of the resistors in the circuit, obtain an equivalent resistor. Order it from the nearest Authorized Service Center and specify the Simpson part number as shown in the parts list. Clip the defective resistor off the printed circuit board, leaving sufficient lead length in the board to be used as connections for the replacement.
- Carefully twist the leads of the new resistor around the leads left from the defective resistor and solder each connection. Trim away all excess and check that you have not caused any short circuit to any other part.

5.7 REMOVING THE PRINTED CIRCUIT

5.7.1 To service parts located between the printed circuit board and the front panel, remove the printed circuit as follows:

a. Set the function switch at +DC and the range switch at 2.5V.
b. Remove the knob for the ZERO OHMS control.
c. Remove the two screws through the lower part of the printed circuit board.
d. Remove the two hex nuts from the meter studs on the top of the printed circuit board.
e. Carefully pry out the battery contact at the + terminal for the small 1.5 volt cell, and the battery contact to — side of large 1.5V battery.
f. Lift the printed circuit board away from the front panel. The entire board, with the switch wafers in place, will come up in one piece.
g. After removal, do not turn knobs on front panel or move any rotors on switches until reassembled.

5.8 FUSE REPLACEMENT

5.8.1 Remove the front panel from the case and disconnect the burned-out fuse, using a small (60-watt or less) soldering iron. (Replace with a 1 amp, 250 volt pigtail fuse, type 3AG or equivalent only.)

5.9 REPLACEMENT PARTS AND SCHEMATIC DIAGRAM

NOTE: This instrument must be serviced by qualified personnel. To aid in troubleshooting a schematic diagram is enclosed. The accompanying parts list (Table 5-1) describes the components and refers to Simpson part numbers. Reference symbol numbers correlate the components shown on the schematic diagram with the parts list.

5.9.1 The following information is provided as an adjunct to the overall text contained in this manual and should be read and understood thoroughly prior to ordering replacement parts for the Instrument.

5.9.2 To obtain replacement parts, address order to the nearest Authorized Service Center (listed on the last pages of this manual). Refer to paragraph 2.4.1 for ordering instructions.

Table 5-1. Replacement Parts List

Reference Symbol	Description	Part No.
R1	Resistor, 1138 ohms	1-113372
R2	Resistor, 110 ohms	1-113373
R3	Resistor, 21,850 ohms	1-113369
R4	Resistor, 117,700 ohms	1-113367
R5	Resistor, 47.6 ohms (bobbin)	10-675263
R6	Resistor, 37,500 ohms	1-113393
R7	Resistor, 200,000 ohms	1-113365
R8	Resistor, 800,000 ohms	1-113363
R9	Resistor, 3.75 megohms	1-115765
R10	Resistor, 49,000 Ω	5-110388
R11	Resistor, 1500 Ω	5-118602
R12	Resistor, 150,000 ohms	1-113366
R13	Resistor, 1 MΩ	1-113392
R14	Resistor, 4 MΩ	1-113362
R15	Resistor, 15 MΩ	1-115763
R16	Resistor, 11.2 Ω (bobbin)	10-805073
R17	Resistor, Shunt 500 MA	5-110393
R18	Resistor, 4.5 Ω (bobbin)	10-675264
R19	Resistor, 0.402 Ω (bobbin)	10-675265
R20	Resistor, 4000 Ω	5-110390
R21	Resistor, 19,000 Ω	5-110389
R22	Resistor, 3900 Ω	1-110723
R23	Rheostat, 5000 Ω ±10%	1-116254
R24	Resistor, 5000 Ω	1-113425
R25	Resistor, 5000 Ω	1-113425
R26	Resistor, 7500 Ω	1-113370
R27	Rheostat, 750 Ω ±10%	5-110391
R28	Rheostat, 5000 Ω ±10%	1-116254
R29	Potenitometer, 20,000 Ω ±20%	5-110392
R30	Rheostat, 150 Ω ±10%	5-110395
R31	Potentiometer, 10, 000 Ω ±30%	5-110295
D1	Diode, Germanium	1-115970
D2	Diode, Germanium	1-115970
D3	Varistor, Silicon	1-110670
F1	Fuse, 1 amp, 250V, Pigtail type 3AG or equivalent	1-117702
	Meter Assembly	15-302255
	Test Lead Set (one Red and one Black)	00115
	Thermocouple Lead	00163
	1-110210 Jack, Phono for Temp. Lead	1-110210
	3-812201 Nut, for Jack	3-812201
	Phenolic Case (Less Handle)	3-320141
	Handle Assembly	10-860158
	KNOBS: Function Switch	1-115789
	Range Switch	3-260180
	Zero Ahms Adjust	1-115790

Replacement Parts

Set Screw (for Knob 3-260180)	1-114178
Batteries: 1.5V Size D (NEDA #13F)	1-111798
1.5V Size AA (NEDA #15F)	1-111802
Clip Alligator, Twin	5-110407
Cover Assembly (Meter) Complete with Glass and Hardware	0-005572

NOTES

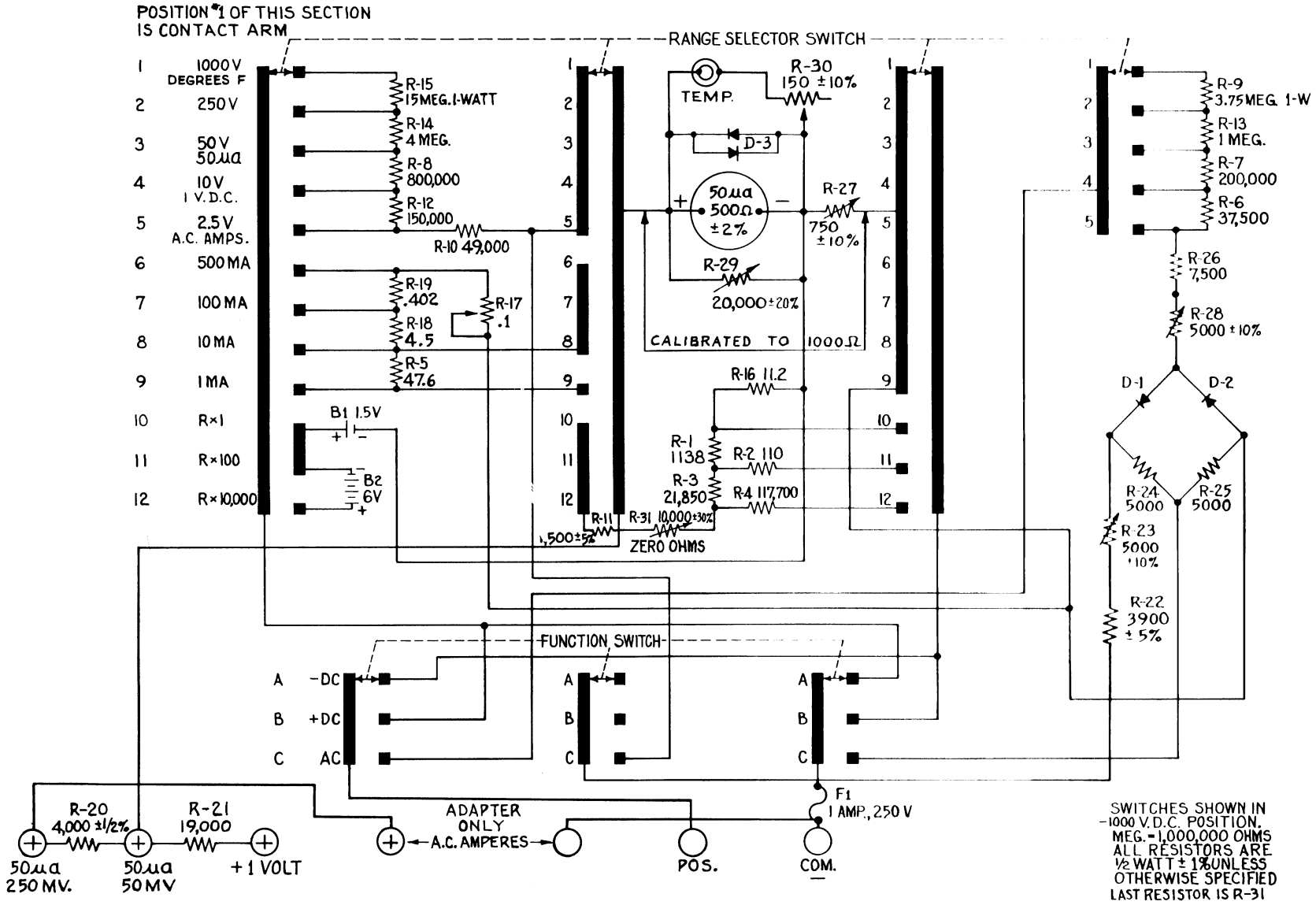

Figure 5-1. Simpson 255, Schematic Diagram