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.

OPERATOR'S MANUAL

SIMPSON 260® SERIES 6 AND 6M VOLT-OHM-MILLIAMMETERS

260® Is a Registered Trademark of The Simpson Electric Company

UL®

This symbol on the nameplate means the product is Listed by Underwriters Laboratories Inc.

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Printed in U.S.A.
33M978 (123.03)
Part No. 6-110928
EFFECTIVE DATE: Immediately
Supersedes all previous editions.
EDITION: 1st

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NOTE

This Operator's Manual contains information essential to the operation of this Instrument. Therefore, it should be kept with the Instrument at all times and not misplaced or discarded.

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 an operating 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 prior to 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 Model 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 a 1500 ohm non-inductive resistor in series with the 260-6 1mA range and use this as the measuring instrument.

Figure 1-1. Simpson 260-6 Volt-Ohm-Milliammeter

Figure 1-2. Simpson 260-6M Volt-Ohm-Milliammeter

SECTION I
INTRODUCTION

1.1 GENERAL

1.1.1 The Simpson Volt-Ohm-Milliammeters 260 Series 6 and Series 6M (hereafter referred to as the 260 or as the Instrument), are identical instruments electrically and mechanically, except that the Series 6M is equipped with a mirrored dial to eliminate parallax (Figures 1-1 and 1-2). The 260 Series 6 is a rugged, accurate, compact, easy-to-use instrument. The Instrument can be used to make accurate measurements of DC and AC voltage, direct current, resistance, decibels, and output voltage. The output voltage function is used for measuring the AC component of a mixture of AC and DC voltage. This function occurs primarily in amplifier circuits.

1.1.2 The 260 Series 6 has the following new features: a 0-1 volt DC range, 0-500 volt DC and AC ranges, a TRANSIT position on the range switch, rubber plug bumpers on the bottom of the case to reduce sliding, improved test leads and an externally accessible battery and fuse compartment. Batteries and one amp fuse can be changed quickly by loosening the single screw of the compartment cover located on the bottom of the case.

1.1.3 To complement the circuit accuracy, the 260 features a new taut-band, annular movement. The annular movement provides self-shielding, and the taut-band suspension provides a high degree of repeatability and is highly resistant to damage by shock or vibration.

1.1.4 Several internally located calibration circuits are provided to increase the initial accuracy of the 260 and to facilitate recalibration should it become necessary.

1.1.5 The 260 uses the most modern components and circuit techniques. It is assembled by well-trained personnel using quality

materials and modern equipment. This combination of design, materials, and skillful assembly results in a unit that will take considerable abuse and still provide accurate indication. If it is kept clean and is not unduly abused or misused, or subjected to extreme shock or vibration, the 260 will give many years of trouble-free service.

1.2 DESCRIPTION

1.2.1 Phenolic Case

1.2.2 The phenolic case is designed with heavy reinforced walls for maximum durability and provides excellent protection for the circuit components. The case has an externally accessible battery and fuse compartment. Access to the batteries and one amp fuse is obtained by unscrewing a single captivated screw at the bottom of the case and sliding out the compartment cover. (A spare fuse is also provided in the compartment.) Rubber plug bumpers on the bottom of the case reduce sliding should the Instrument be accidentally pulled by the test leads when it is on a workbench.

1.2.3 Printed Circuit

1.2.4 Most of the component parts are mounted on a printed circuit board which simplifies assembly and maintenance, thus extending the useful life of the Instrument.

1.2.5 Test Leads

1.2.6 Each Instrument is furnished with one pair of (Cat. No. 00125) test leads 4 feet long. One lead is black and the other red for easy polarity identification. The test lead wire consists of a large number of fine strands and is very flexible. The insulation of the wire is more than adequate for the highest voltage that the Instrument will measure. The red and black test leads have probe tips which are threaded near the base. The alligator clips may be screwed on or off either test lead to provide a probe or a clip for the operator's convenience (Table 1-2).

1.2.7 Fuse Protection

1.2.8 A 1-ampere 250-volt and a 2-ampere 600-volt high capacity fuse (1000A) are provided to protect the 260 low impedance circuits from misuse on the Ohm and Current ranges. The 1-ampere fuse is used for normal overload conditions, and the 2-ampere fuse is connected in series with the 1-ampere fuse as a protection against excessive high energy overloads applied to current or ohms ranges.

1.2.9 For maximum protection it is important to replace the 1A fuse with a Littelfuse type 312001 only. This will allow the combination of 1A and 2A BBS/KTK fuse to give maximum protection to the unit and the user under overload conditions which may occur within the measuring capability of the VOM.

1.2.10 If the instrument fails to indicate, the 1 Amp or the 2 Amp fuses may be burned out. (Refer to Paragraph 5.3 for fuse replacement.) A 1 Amp spare fuse is furnished with each Instrument. Both 1 Amp fuses are located in the battery and fuse compartment. The 2 Amp fuse is located on the instrument panel under the printed circuit board.

1.2.11 Movement Overload Protection

1.2.12 In addition to the fuse, a varistor protects the indicating Instrument circuit. The varistor limits the current through the moving coil in case of overload.

CAUTION

The fuses and varistor will prevent serious damage to the 260 in most cases of accidental overload. However, no fuse protection system is completely foolproof;therefore, any misapplication on high voltage circuits can still damage the Instrument. Also, care should always be exercised to set the switches and connect the leads properly and to avoid overload conditions.

1.3 TECHNICAL DATA

1.3.1 Table 1-1 lists the technical data for the 260-6 and 6M (RT).

Table 1-1. Technical Data

1. DC VOLTS:
   - Ranges: 0-1-2.5-10-50-250-500-1000V
   - Sensitivity: 20,000 ohms per volt
2. DC MILLIVOLTS:
   - Range: 0-250mV
   - Sensitivity: 20,000 ohms per volt
3. AC VOLTS:
   - Ranges: 0-2.5-10-50-250-500-1000V
   - Sensitivity: 5,000 ohms per volt
4. OUTPUT VOLTAGE (AC):
   - Ranges: 0-2.5-10-50-250 (limited to 350 VDC)
5. DC MICROAMPERES:
   - Range: 0-50μA
   - Voltage Drop: 250 mV
6. DC MILLIAMPERES:
   - Ranges: 0-1-10-100 -500 mA
   - Voltage Drop (Approx.): 250 mV, 250 mV, 280 mV, 400 mV
7. DC AMPERES:
   - Range: 0-10A
   - Voltage Drop (Approx.) 250 mV

8. RESISTANCE:

	R × 1	R × 100	R × 10,000
Range	0-2,000Ω	0-200,000Ω	0-20 MΩ
Center Reading	12Ω	1200Ω	120,000Ω
Nominal Open Circuit Voltage	1.5V	1.5V	9V
Nominal Short Circuit Current	125 mA	1.25 mA	75μA

9. *ACCURACY:
   - DC Voltage Ranges: 2% of Full Scale
   - DC Current
     - 0-50 μA Range: 1.5% of Full Scale
     - Other Ranges: 2% of Full Scale
   - **AC Voltage Ranges: 3% of Full Scale
   - Frequency Response: Referenced to 100 Hz (Figures 4-2 and 4-4)
   - Resistance Ranges:
     - R×1: 2.5° of Arc
     - R×100: 2° of Arc
     - R×10,000 2° of Arc
10. DECIBELS:
    - Range: —20 to +10 dB, —8 to +22dB, +6 to +36 dB, +20 to +50 dB
    - Reference Level: With zero dB power level equal to 1 mW across a 600Ω line.
11. BATTERIES:
    - Voltage: 1.5V, 9V
    - NEDA No.: 13F, 1604
12. FUSE: F1 1A, 250V, type 3AG, quick-acting Littelfuse Type 312001, F2 2A, 600V, Type BBS or KTK (Bussman)

13.	TEST LEADS:	1 red, 1 black, 48″ long.
14.	SIZE:	5½″ x 7″ x 3⅛″ (13.34 x 17.78 x 7.94 mm)
15.	WEIGHT:	3 lbs. (1.359 kg)
16.	***RATED-CIRCUIT TO-GROUND VOLTAGE:	1000V AC/DC (1500V Peak) Max.

** Accuracies specified are for the 260 in a horizontal position.*

*** Responds to the average value of an AC current, and is calibrated to indicate the rms value of a pure sine wave.*

****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."*

1.4 ITEMS AND ACCESSORIES

1.4.1 All items and accessories required for the operation of the 260 are furnished with each instrument, and listed in Table 1-2. (Available replacement parts are listed in Table 6-1.)

1.5 DEFINITION OF ACCURACY

1.5.1 The voltage and current accuracy of this instrument is commonly expressed as a percent of full scale. This should not be confused with accuracy of reading (indication). For example, ±2% of full scale on the 10 volt range allows an error of ±0.20V at any point on the dial. This means that at full scale, the accuracy of reading would be ±2%, but at half scale it would be ±4%. Therefore, it is advantageous to select a range which gives an indication as near as possible to full scale.

1.6 SAFETY CONSIDERATIONS

1.6.1 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 adhered to.

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

Quantity	Description	Number
1	Test Lead Set-One red and one black (4 ft. long) each with combination probe tip and removable rubber-sleeved alligator clip at one end and banana plug on opposite end.	00125
*1	1.5 volt, D Cell, NEDA 13F	
*1	9.0 volt Cell, NEDA 1604	
1	1 Amp, 250V Fuse, Littelfuse Type #312001	
1	2 Amp, 600V Fuse, Bussman Type BBS or KTK	
1	Operator's Manual	6-110928

**Batteries are standard items replaceable from local retail stores.*

Table 1-3 Additional Accessories

Description	Number
Ever-Redy Carrying Case	00805
Roll-Top Safety Carrying Case	00248
Vinyl Carrying Case	01818
Deluxe Carrying Case	00812

SECTION II
INSTALLATION

2.1 GENERAL

2.1.1 This section contains information and instructions for the installation and shipping of the Simpson 260. Included are unpacking and inspection procedures, warranty, shipping, power source requirements, operating position and care.

2.2 UNPACKING AND INSPECTION

2.2.1 Examine the shipping carton for obvious signs of damage. Inspect the Instrument for possible damage incurred during shipment. If damage is noted, notify the carrier and supplier and do not attempt further use of the Instrument. If Instrument appears to be in good condition, read Operator's Manual in its entirety. Become familiar with the Instrument as instructed in the manual, then proceed to check the electrical performance as soon as possible. Also, check that all items are included with the Instrument (Table 1-2).

2.2.2. After unpacking the Instrument, you will find a 1.5V battery and a 9V battery in separate envelopes in the box with the Instrument and test leads. Two alligator clips for the test leads are in a polyethylene bag. (See Section V for instructions on how to open the battery compartment and install the batteries.)

2.3 WARRANTY

2.3.1 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 any difficulty and include the Instrument model number, series number, 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.

2.4 SHIPPING

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

2.5 POWER SOURCE REQUIREMENTS

2.5.1 There are two batteries in the ohmmeter circuits. One is a NEDA 13F D size cell that furnishes 1.5 volts for the R $\times$ 1 and R $\times$ 100 ranges. A NEDA 1604 battery furnishes 9 volts for the R $\times$ 10,000 range. The 1.5 D cell is held in place with two spring clips which also serve as battery contacts. The 9-volt battery is held in place with a spring clip but contact is made with

a separate connector that is polarized. (Always observe correct polarity when replacing the 1.5-volt D cell.)

2.6 OPERATING POSITION

2.6.1 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 either in a vertical or horizontal position. The horizontal position is preferable for greater accuracy since the Instrument is calibrated in this position.

2.7 CARE

2.7.1 Immediately clean all spilled materials from the Instrument and wipe dry. If the spillage is corrosive, use a suitable cleaner to neutralize the corrosive action, and remove the spillage.

2.7.2 Whenever the Instrument is not in use, rotate the range switch to the TRANSIT position.

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

2.7.4 Monthly Care: Verify Instrument accuracy by performing

operational checks using known, accurate, stable sources. If proper calibration equipment is not available, contact your nearest Simpson Authorized Service Center (refer to last pages of this manual). If the Instrument has not been used for 30 days, check the batteries for leakage and replace if necessary.

2.7.5 Annual Care: It is recommended that the Instrument be returned annually to your nearest Simpson Authorized Service Center, or to the factory, for an overall check, adjustment, and calibration.

2.7.6 Storage: When the Instrument is not in use, store it in a room free from temperature extremes, dust, corrosive fumes, and mechanical vibration or shock. If storage time is expected to exceed 30 days, remove batteries.

SECTION III
CONTROLS, JACKS, AND INDICATORS

3.1 GENERAL

3.1.2 All operating and adjustment controls, jacks and indicators for the Simpson 260 are described in this section along with a list (Table 3-1) describing their function. Become familiar with each item prior to operating the Instrument.

3.2 FRONT PANEL DESCRIPTION

3.2.1 Description of front panel controls, jacks, and indicators is as follows:

NOTE: The item call-out in Figure 3-1 corresponds with the numerical order of the items listed in Table 3-1.

Table 3-1. Controls, Jacks, and Indicators

1. **Front Panel:** The 260-6 Volt-Ohm-Milliammeter is a large, easy-to-read 4¼ inch indicating instrument. Below the Instrument are four controls and eight circuit jacks. Switch positions and circuit jacks are marked in white characters for easy reading.

2. **Range Switch:** Has 12 positions: May be turned in either direction. There are 5 voltage positions, 4 direct current positions, and 3 resistance positions used to select desired ranges.

3. **Function Switch:** The function switch has three positions: —DC, +DC and AC. To measure DC current or voltage, set the

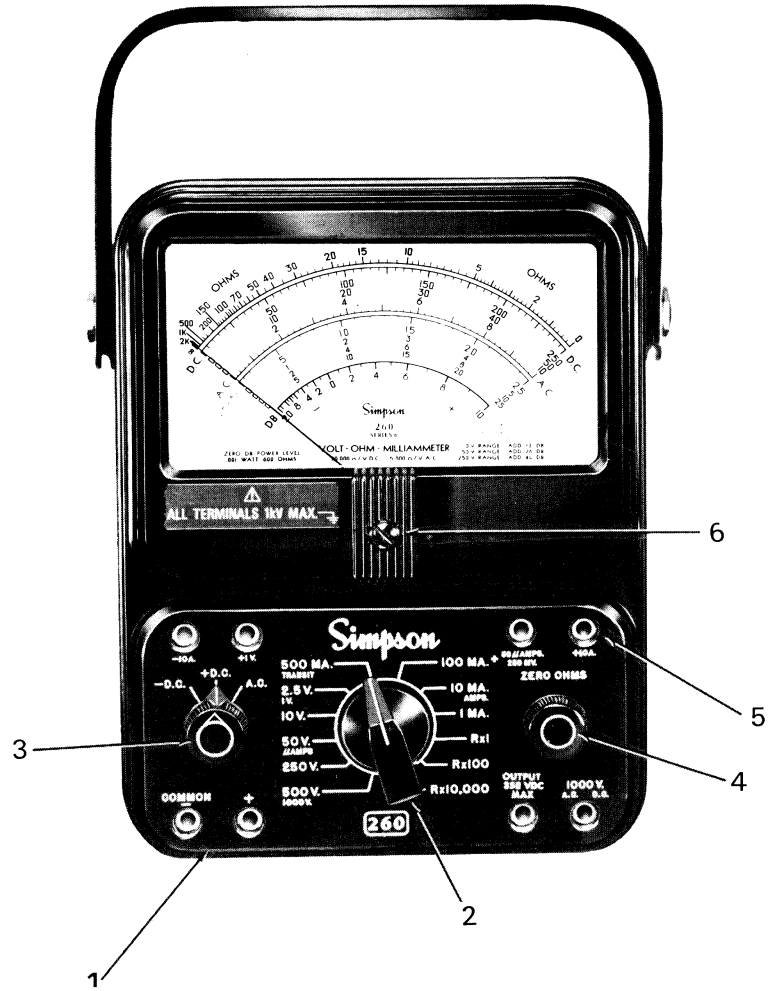

Figure 3-1. Front Panel Controls, Jacks and Indicators

function switch at the —DC or +DC position, depending on the polarity of the signal applied across the test leads. To measure AC voltage set the function switch to the AC position. For resistance measurement, the switch may be set in either the +DC or —DC position. The polarity of the internal ohmmeter battery voltage at the (+) pos jack is identical to the function switch polarity setting and opposite at the (—) common jack.

4. **Zero Ohms:** This control is used to compensate for variation in the voltage of the internal batteries.

5. **Circuit Jacks:** There are eight jacks on the front panel marked with the functions they represent (Figure 3-1). These jacks provide the electrical connections to the test leads. The COMMON (—) jack is used (in conjunction with the black test lead) as the reference point for the measurement of all the functions with the exception of the 10A range. (Refer to the Operation Section for details.)

6. **Pointer Adjust For Zero:** With the Volt-Ohm-Milliammeter in an operating position, check that the pointer indicates zero at the left end of the scale when there is no input. If pointer is off zero, adjust the screw located in the case below the center of the dial. Use a small screwdriver to turn the screw slowly clockwise or counterclockwise until the pointer is exactly over the zero mark at the left end of the scale. With the indicating pointer set on the zero mark, reverse the direction of rotation of the zero adjuster. Rotate the zero adjuster a sufficient amount to introduce mechanical freedom or "play" but insufficient to disturb the position of the indicating pointer. This procedure will avoid disturbances to the zero setting by subsequent changes in temperature, humidity, vibration, and other environmental conditions.

SECTION IV
OPERATION

WARNING

Before proceeding with the operation of the 260, review the SHOCK HAZARD definition printed on page vi of the manual. Also, do not use this Instrument and its accessories on induction heating, X-ray machines, or power sub-stations where high voltage and low impedance equipment is used.

4.1 GENERAL

4.1.1 This section of the manual contains information required to use and operate the 260 in a safe and proper manner.

4.2 SAFETY PRECAUTIONS

4.2.1 The 260 should only be used 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 of circuits where a shock hazard might exist. Notify a nearby person that you are making, or intend to make such measurements.

4.2.3 Locate all voltage sources and accessible current paths before making measurement connections. Be sure the equipment is properly grounded and the right rating and type of fuse(s) is installed. Set the Instrument to the proper range before applying power.

CAUTION

Continuity of all parts required to be connected to the protective grounding means shall be verified by either visual inspection or electrical test.

REMEMBER: Voltages may appear unexpectedly in defective equipment. An open bleeder resistor may result in a capacitor retaining a dangerous charge. Turn off power and discharge all capacitors before connecting or disconnecting test leads to and from the circuit being measured.

4.2.4 Inspect the test leads for cracks, breaks or crazes in the insulation, prods, and connectors before each use. If any defects are noted, replace the test leads immediately.

4.2.5 Do not make measurements 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 by a buzzing sound, or by 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 an electrical malfunction.

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 Instrument.

4.2.7 For maximum safety, do not touch test leads or Instrument while power is applied to the circuit under test.

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

4.2.9 Do not make measurements using test leads of lesser safety than those originally furnished with the Instrument.

4.2.10 Do not touch any object which could provide a current path to the common side of the circuit under test or power line

ground. Always stand on a dry insulating surface capable of withstanding the voltage being measured, or that could be encountered.

4.2.11 The range or function switch should only be changed when the power to the circuit under measurement is turned off. This will provide maximum safety to the user, eliminate arcing at the switch contacts, and prolong the life of the Instrument.

NOTE: Do not exceed the maximum rated circuit-to-ground voltage of the Instrument (Table 1-1, item 16).

4.2.12 POLARITY CORRECTION

4.2.13 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 50 μA/250 mV range, or 5A range, polarity can be corrected only by reversing the test leads.

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.

4.3 DC VOLTAGE MEASUREMENT 0-250 mV RANGE

WARNING

Prior to making voltage measurements, review the SAFETY PRECAUTIONS listed in paragraph 4.2. Also, when using the 260 as a millivoltmeter, care must be taken to prevent damage to the indicating instrument from excessive voltage. Before using the 250 millivolt range, use the 1.0-volt DC range to determine that the voltage measured is not greater than 250 millivolts (or 2.5 volt DC).

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

b. Plug the black test lead in the — COMMON jack and the red test lead into the +50 μAMPS/250mV jack.

c. Set the range switch at 50 μAMPS (COMMON)position with 50V .

d. Connect the black test lead to the negative side of the circuit being measured and the red test lead to the positive side of the circuit.

e. Read the voltage on the black scale marked DC and use the figures marked 0-250. Read directly in millivolts.

4.4 DC VOLTAGE MEASUREMENT 0-1V RANGE

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

b. Plug the black test lead into the -COMMON jack and the red test lead into the +1V jack.

c. Set the range switch at 1V (COMMON position with 2.5V).

d. Connect the black test lead to the negative side of the circuit being measured and the red test lead to the positive side of the circuit.

e. Read the voltage on the black scale marked DC and use the figures marked 0-10. Then divide the reading by 10.

4.5 DC VOLTAGE MEASUREMENT 0-2.5 THROUGH 0-500V RANGE

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

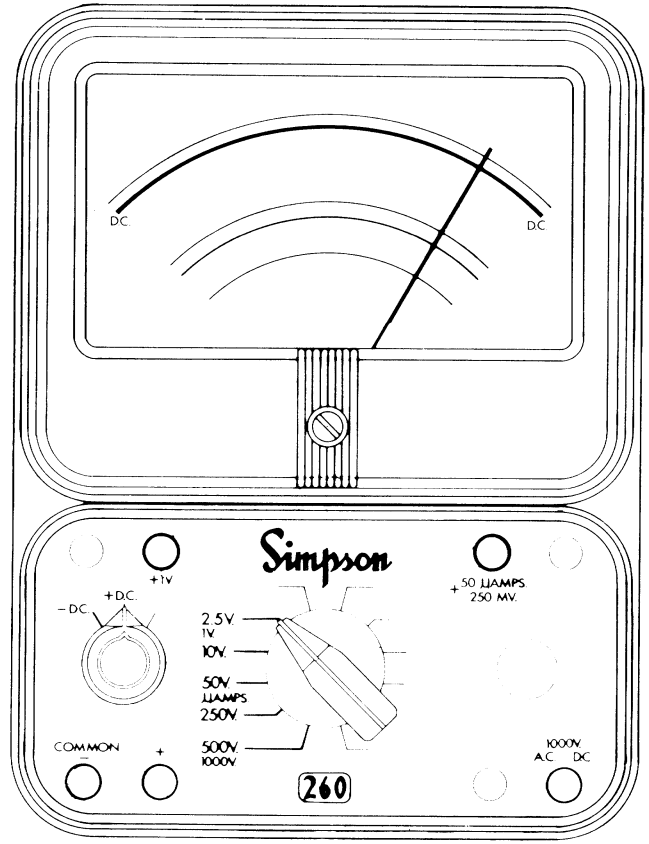

Figure 4-1. Jacks and Switch Positions for Measuring DC Voltage

b. Plug the black test lead into the -COMMON jack and the red test lead into the + jack.

c. Set the range switch at one of the five voltage range positions marked 2.5V, 10V, 50V, 250V or 500V.

NOTE: When in doubt as to the voltage present, always use the highest voltage range as a protection to the Instrument. If the voltage is within a lower range, the switch may be set for the lower range to obtain a more accurate reading. Be sure power is off in the circuit being measured and all capacitors discharged.

d. Connect the black test lead to the negative side of the circuit being measured and the red test lead to the positive side of the circuit.

e. Turn on the power in the circuit being measured.

f. Read the voltage on the black scale marked DC. For the 2.5V range, use the 0-250 figures and divide by 100. For the 10V, 50V, and 250V ranges, read the figures directly. For the 500V range, use the 0-50 figures and multiply by 10.

NOTE: Turn off power to the circuit and wait until the meter indicates zero before disconnecting the test leads.

4.6 DC VOLTAGE MEASUREMENT 0-1000V RANGE

WARNING

Be extremely careful when working with high voltage circuits. Do not touch the Instrument or test leads while power is on in the circuit being measured.

4.6.1 Before proceeding with the following steps, review the Safety Precautions in Paragraph 4.2.

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

b. Set the range switch at 1000V (dual position with 500V).

c. Plug the black test lead into the -COMMON jack and the red test lead into the 1000V jack.

d. Be sure power is off in the circuit being measured and all capacitors discharged. Connect the black test lead to the negative side of the circuit being measured and the red test lead to the positive side of the circuit.

e. Turn on power in circuit being measured.

f. Read the voltage using the 0-10 figures on the black scale marked DC. Multiply the reading by 100.

REMEMBER: Turn off power to the circuit and wait until the meter indicates zero before disconnecting the test leads.

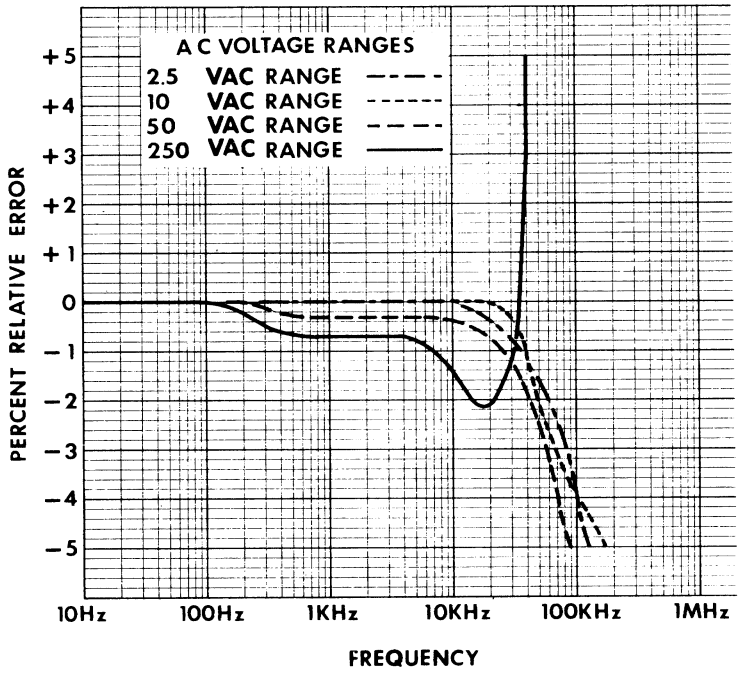

Figure 4-2. Frequency Response, AC Voltage Ranges

4.7 AC VOLTAGE MEASUREMENT 0-2.5 THROUGH 0-500V RANGE

CAUTION

When measuring line voltage, such as from a 120 volt, 240 volt or 480 volt source, be sure that the range switch is set to the proper voltage position.

4.7.1 The 260 responds to the 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, and depending upon its waveform, the reading may be either higher or lower than the true rms value of the measured voltage. Thus an error may be introduced if the 260 is used to measure a nonsinusoidal waveform. Also, accuracy is lessened at higher input frequencies (Figure 4-2).

4.7.2 Before proceeding with the following steps, review the Safety Precautions in Paragraph 4.2.

a. Set the function switch at AC (Figure 4-3).

b. Set the range switch at one of the five voltage range positions marked 2.5V, 10V, 50V, 250V or 500V. (When in doubt as to actual voltage present, always use the highest voltage range as a protection to the Instrument. If the voltage is within a lower range, the switch may be set for the lower range to obtain a more accurate reading.)

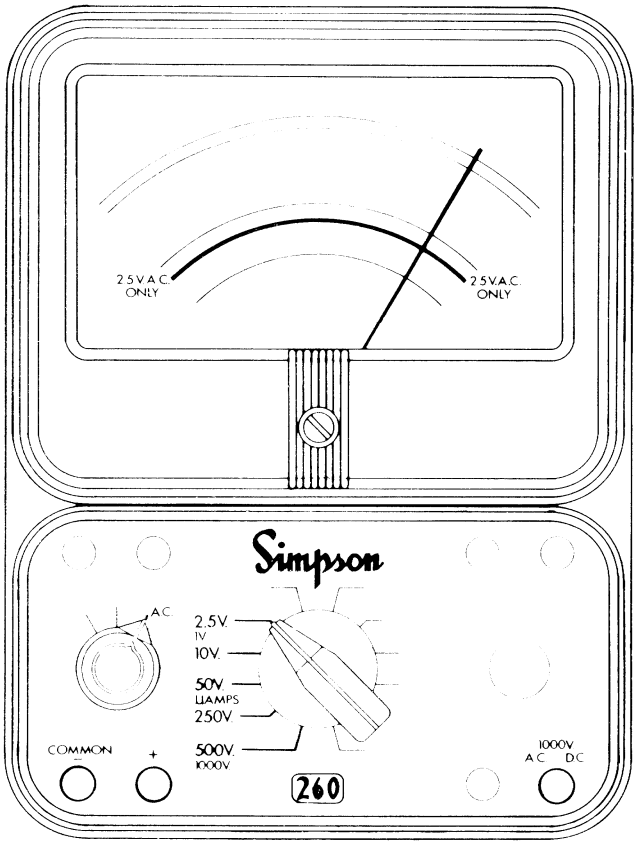

Figure 4-3. Jacks and Switch Positions for Measuring AC Voltage

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

d. Connect the test leads across the voltage source.

e. Turn on power in the circuit being measured.

f. For the 0-2.5V range read the value directly on the scale marked 2.5 VAC. For the 10V, 50V, and 250V ranges, read the red scale marked AC and use the black figure immediately above the scale. For the 500V range, read the red scale marked AC and use the 0-50 figures. Multiply the reading by 10.

4.8 AC VOLTAGE MEASUREMENT 0-1000V RANGE

WARNING

Be extremely careful when working in high voltage circuits. Do not touch the Instrument or test leads while the power is on in the circuit being measured.

4.8.1 Before proceeding with the following steps, review the Safety Precautions in Paragraph 4.2.

a. Set the function switch at AC (Figure 4-3).

b. Set the range switch at 1000V (dual position with 500V).

c. Plug the black test lead in the COMMON jack and the red test lead in the 1000V jack.

d. Be sure the power is off in the circuit being measured and that all capacitors have been discharged. Connect the test leads to the circuit.

e. Turn on the power in the circuit being measured.

f. Read the voltage on the red scale marked AC. Use the 0-10 figures and multiply by 100.

4.9 OUTPUT VOLTAGE MEASUREMENT

4.9.1 It is necessary to measure the AC component of an output voltage where both AC and DC voltage levels exist. This occurs primarily in amplifier circuits. The 260 has a 0.1 μF, 400 volt capacitor in series with the OUTPUT jack. The capacitor blocks the DC component of the current in the test circuit, but allows the AC or desired component to pass on to the indicating instrument circuit. The blocking capacitor may alter the AC response at low frequencies but is usually ignored at audio frequencies (Figure 4-4).

CAUTION

When using OUTPUT, do not apply to a circuit where the DC voltage component exceeds 350 volts.

4.9.2 Before proceeding with the following steps, review the Safety Precautions in Paragraph 4.2.

a. Set the function switch at AC (Figure 4-5).

b. Plug the black test lead into the -COMMON jack and the red test lead into the OUTPUT jack.

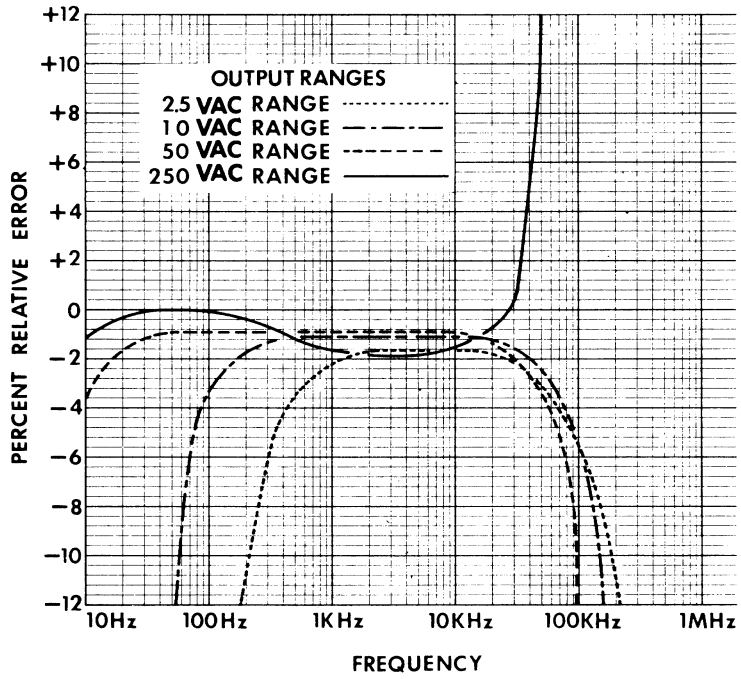

Figure 4-4. Frequency Response Output Ranges

c. Set the range switch at one of the range positions marked 2.5V, 10V, 50V, or 250V.

d. Connect the test leads across the circuit being measured with the black test lead to the ground side.

e. Turn on the power in the test circuit. Read the output voltage on the appropriate AC voltage scale. For the 0-2.5V range, read the value directly on the scale marked 2.5 VAC. For the 10V, 50V, or 250V ranges, use the red scale marked AC and read the black figures immediately above the scale.

4.10 DECIBEL MEASUREMENT

a. For some applications, output voltage and audio frequency voltage are frequently measured in terms of decibels. The decibel scale (dB) at the bottom of the dial is marked from —20 to +10 (Figure 4-6).

b. To measure decibels, read the dB scale in accordance with instructions for measuring AC. For example, when the range switch is set on the 2.5V position, the dB scale is read directly.

c. The dB readings on the scale are referenced to zero dB power level of .001 watt in 600 ohms, or 0.775 VAC across 600 ohms.

d. For the 10V range, read the dB scale and add +12 dB to the reading. For the 50V range, read the dB scale and add +26 dB to the reading. For the 250V range, read the dB scale and add +40 db to the reading.

e. If the zero dB level is .006 watt in 500 ohms, subtract 7 dB from the reading.

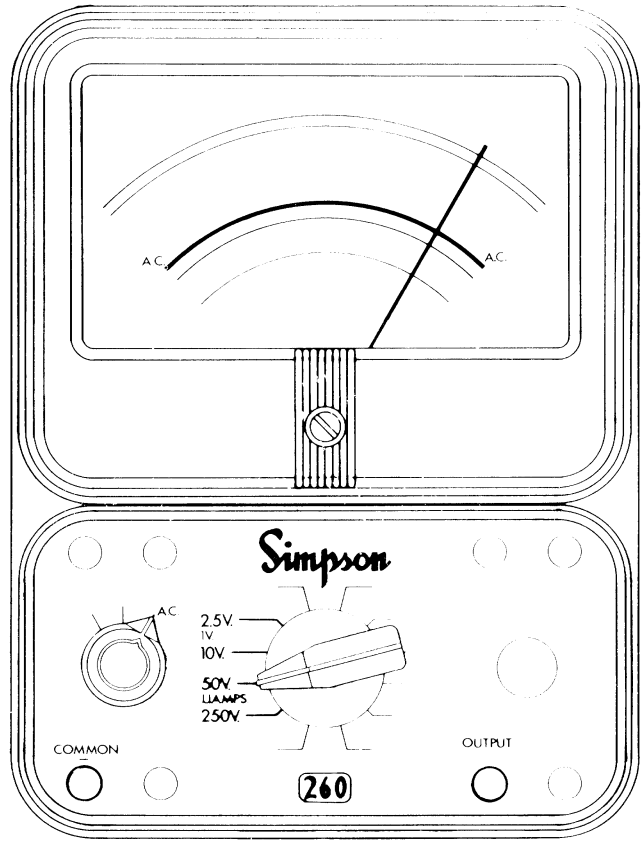

Figure 4-5. Jacks and Switch Positions for Output Measurement

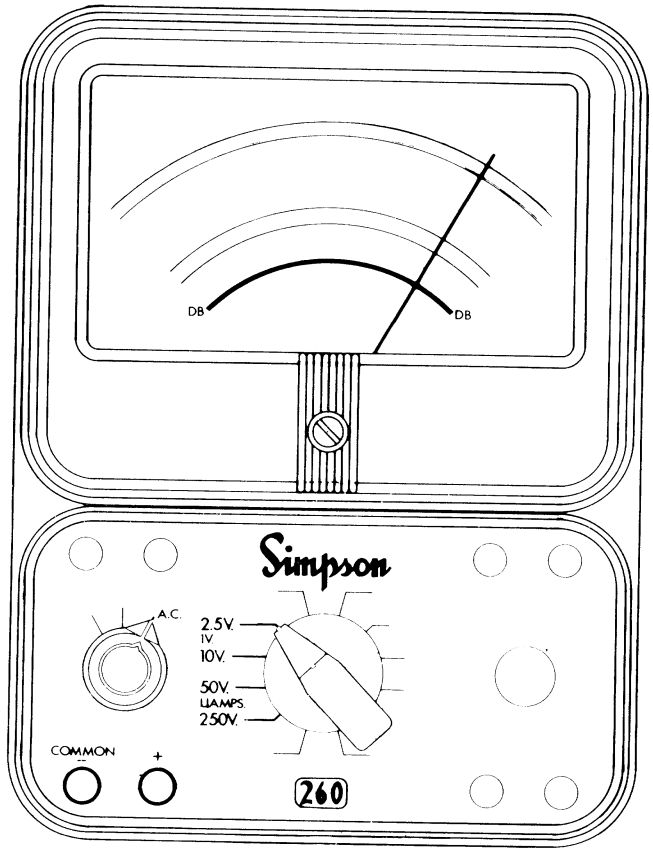

Figure 4-6. Jacks and Switch Positions for Measuring Decibels

4.11 DIRECT CURRENT MEASUREMENT

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.
- Never exceed the Circuit-To-Ground voltage of the instrument (1000 V max; Table 1-1, item 16).
- Always connect the Instrument in series with the ground side of the circuit.
- In all direct current measurements, make certain the power to the circuit being tested has been turned off before connecting and disconnecting test leads or restoring circuit continuity.

4.12 DIRECT CURRENT MEASUREMENT 0-50μA RANGE

a. Set the function switch at +DC.

b. Plug the black test lead into the —COMMON jack and the red test lead into the +50μAMPS/250mV jack.

c. Set the range switch at 50μAMPS (dual position with 50V).

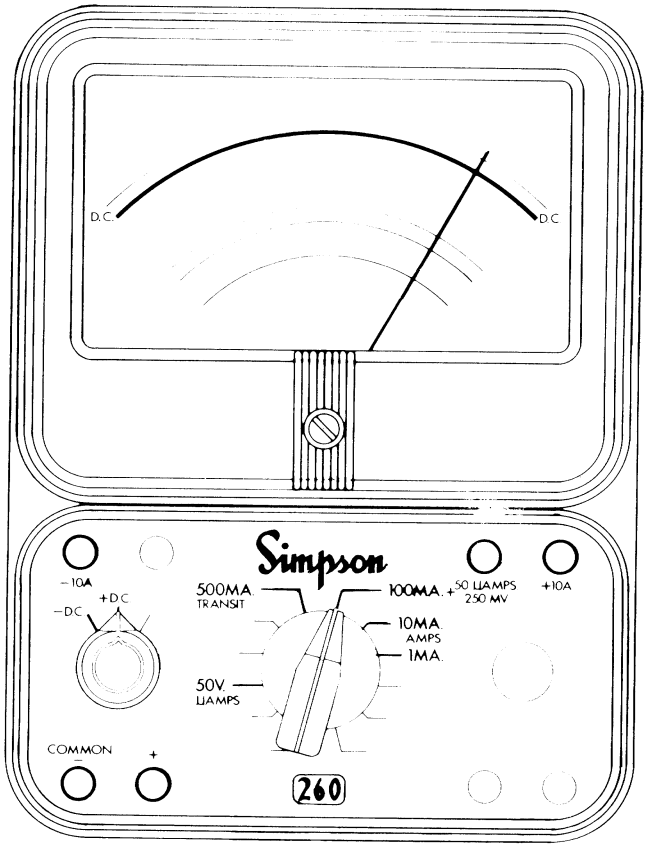

Figure 4-7. Jacks and Switch Positions for Measuring Direct Current

d. Open the ground side of the circuit in which the current is being measured. Connect the VOM in series with the circuit. Connect the red test lead to the positive side and the black test lead to the negative side.

e. Read the current on the black DC scale. Use the 0-50 figures to read directly in microamperes.

4.13 DIRECT CURRENT MEASUREMENT 0-1mA THROUGH 0-500mA RANGE

a. Set the function switch at +DC (Figure 4-7).

b. Plug the black test lead into the -COMMON jack and the red test lead into the + jack.

c. Set the range switch at one of the four range positions marked 1 mA, 10 mA, 100 mA or 500 mA.

d. Open the grounded side of the circuit in which the current is being measured. Connect the VOM in series with the circuit. Connect the red test lead to the positive side and the black test lead to the negative side.

e. Turn the power on. Read the current in milliamperes on the black DC scale. For the 1mA range, use the 0-10 figures and divide by 10. For the 10mA range, use the 0-10 figures directly. For the 100mA range, use the 0-10 figures and multiply by 10. For the 500mA range, use the 0-50 figures and multiply by 10.

f. Turn the power off and disconnect the test leads.

4.14 DIRECT CURRENT MEASUREMENT 0-10A RANGE

a. Plug the black test lead into the -10A jack and the red test lead into the +10A jack.

b. Set the range switch at 10 AMPS (dual position with 10mA).

c. Open the ground side of the circuit in which the current is being measured. Connect the VOM in series with the circuit. Connect the red test lead to the positive side and the black test lead to the negative side.

NOTE: The function switch has no effect on polarity for the 10 AMPS range.

d. Turn the power on. Read the current directly on the black DC scale. Use the 0-10 figures to read directly in amperes.

e. Turn the power off and disconnect the test leads.

CAUTION

When using the 10 ampere range, never remove a test lead from its panel jack while the current is flowing through the circuit. Otherwise, injury to the user and damage to the instrument may occur.

4.15 TRANSIT POSITION

4.15.1 The 500 mA range switch position is also the TRANSIT position. The additional damping of the movement in the TRANSIT position will reduce pointer swing when the 260 is carried.

4.16 RESISTANCE MEASUREMENTS

4.16.1 When resistance is measured, VOM batteries B1 and B2 furnish power for the circuit. Since batteries are subject to variation in voltage and internal resistance, the Instrument must be adjusted to zero before measuring a resistance, as follows:

a. Turn range switch to desired ohms range.

b. Plug the black test lead into the -COMMON jack and the red test lead into the + jack.

c. Connect ends of test leads together to short the VOM resistance circuit.

d. Rotate the ZERO OHMS control until pointer indicates zero ohms. If pointer cannot be adjusted to zero, one or both of the batteries must be replaced. (For battery replacement, refer to Section V.)

e. Disconnect shorted ends of test leads.

4.17 MEASURING RESISTANCE

a. Before measuring resistance in the circuit make sure the power is off to the circuit being tested and all capacitors are dis-

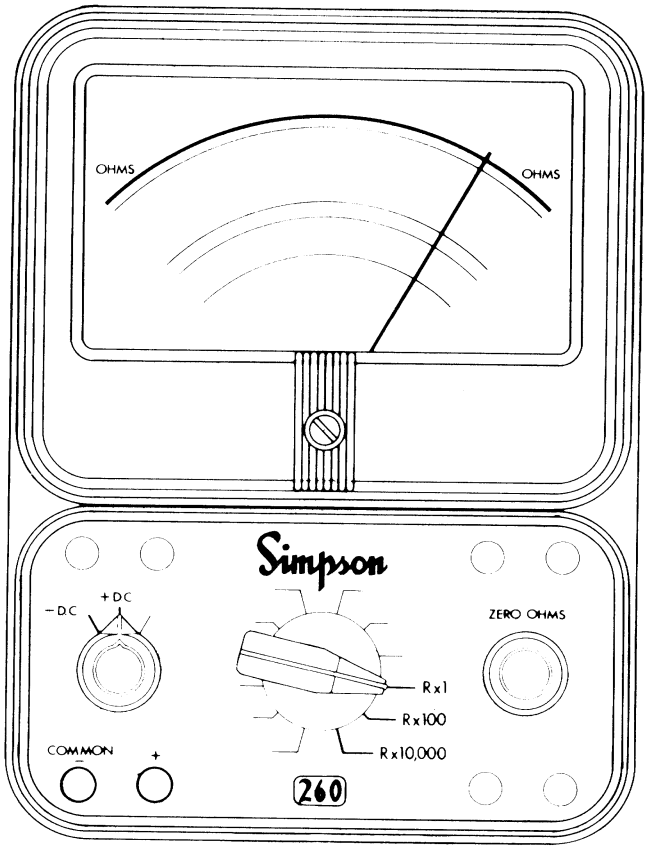

Figure 4-8. Jacks and Switch Positions for Measuring Resistance

charged. Disconnect shunted component from the circuit before measuring its resistance.

b. Set the range switch to one of the resistance range positions as follows (Figure 4-8):

1. Use R × 1 for resistance readings from 0 to 200 ohms.
2. Use R × 100 for resistance readings from 200 to 20,000 ohms.
3. Use R × 10,000 for resistance readings above 20,000 ohms.

c. Set the function switch at either -DC or +DC position:

Operation is the same in either position except if there are semiconductors in the circuit. (See Paragraph 4.2.1) Adjust ZERO OHMS control for each resistance range.

d. Observe the reading on the OHMS scale at the top of the dial. *Note: the OHMS scale reads from right to left for increasing values of resistance.*

e. To determine the actual resistance value, multiply the reading by the factor at the switch position. (K on the OHMS scale equals one thousand.)

4.18 RESISTANCE MEASUREMENT OF SEMICONDUCTORS

CAUTION

Make sure that the OHMS range being used will not damage any of the semiconductors (refer to Table 1-1, item 8, Section I).

4.18.1 If there is a "forward" and "backward" resistance such as in diodes, the resistance should be relatively low in one direction (for forward polarity) and higher in the opposite direction. Rotate the function switch between the two DC positions to reverse polarity. This will determine if there is a difference between the resistance in the two directions. To check a semiconductor in or out of a circuit (forward and reverse bias resistance measurements), consider the following *before* making the measurement:

a. The polarity of the internal ohmmeter battery voltage at the (+) pos jack is identical to the function switch, polarity setting, and opposite to the (—) common jack.

b. Ensure that the range selected will not damage the semiconductor. (Refer to Table 1-1 in Section I, and review the specification limits of the semiconductor according to the manufacturer's ratings.)

c. If the semiconductor is a silicon diode or conventional silicon transistor, no precautions are normally required.

d. If the semiconductor material is germanium, check the ratings of the device and refer to Table 1-1, item 8, Section I.

NOTE: The resistance of diodes will measure differently from one resistance range to another on the same VOM with the function switch in a given position. For example, a diode which measures 80 ohms on the R × 1 range may measure 300 ohms on the R × 100 range. The difference in values is a result of the diode characteristics and is not indicative of any fault in the VOM.

SECTION V

OPERATOR SERVICING

5.1 GENERAL

5.1.1 The following paragraphs of this section describe the battery replacement, fuse replacement, removing the instrument case, and test lead inspection and procedures for the Simpson 260.

5.2 BATTERY REPLACEMENT

a. Two batteries are used inside the case to supply power for resistance measurements. One is a 1.5-volt D cell and the other is a 9-volt battery. When it is no longer possible to adjust the pointer to zero for the R $\times$ 1 and R $\times$ 100 ranges (refer to ZERO OHMS ADJUSTMENT paragraph 4.16) replace the 1.5-volt cell. When it is no longer possible to adjust the pointer to zero on the R $\times$ 10,000 range, replace the 9-volt battery.

b. Recommended replacement batteries are:
1.5-volt D cell, NEDA 13F (Burgess No. 2;Eveready No. 950).
9-volt battery, NEDA 1604 (Burgess 2U6 or Eveready 216).

c. To install or replace a battery, de-energize and disconnect test leads from the Instrument, then remove the cover to the externally accessible battery compartment by loosening the single captivated screw.

NOTE: Batteries should be replaced before their useful life has expired. Failure to do so may result in corrosion and battery leakage.

d. Observe polarity when replacing the 1.5-volt D cell and connect as indicated. The D cell is held in place with spring clips which also act as battery contact clips. The 9-volt battery contacts and connector are polarized. To remove the 9-volt battery, first withdraw battery with mated connector from the compartment. Then remove the connector.

5.3 FUSE REPLACEMENT

5.3.1 One-Ampere Fuse:

5.3.2 The 1-ampere fuse (also the spare) is located in the externally accessible battery and fuse compartment. Access to the compartment is obtained by de-energizing and disconnecting the test leads and loosening the single captivated screw on the compartment cover. To replace a burned out fuse,remove the 9-volt battery, then replace the fuse.

5.3.3 Two-Ampere Fuse:

5.3.4 The 2-ampere fuse is located within the instrument panel under the printed circuit board. (To gain access to the fuse, see paragraph 5.4.)

NOTE: It is important to replace the 1 and 2 ampere fuse with the specified fuse type only. (See paragraph 1.2.9 and replacement parts list, Table **6-1**, for proper fuse type.)

5.4 REMOVING THE INSTRUMENT CASE

5.4.1 To gain access to the inside of the Instrument panel, for replacing the fuse, first: de-energize and disconnect the test leads, and remove the cover from the battery compartment, then remove the four case-fastening screws. Second: after removing the screws, lift the case from the panel.

NOTE: When replacing the case, make certain that the wires leading to the battery compartment are seated in their respective slots within the compartment wall. This will prevent damage to the wire insulation during mating of panel and case.

5.5 TEST LEAD INSPECTION

5.5.1 Periodic inspection of the test leads is recommended to detect cuts, burned areas, deterioration or other damage that could reduce the insulation strength of the leads.

NOTE: Before returning the Instrument to service, check the performance ratings and make sure that the electrical and mechanical configurations have been restored to their original applications.

Figure 5-1. Battery and Fuse Compartment.

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 VI

SERVICING INSTRUCTIONS

6.1 GENERAL

NOTE

This instrument must be serviced by qualified personnel. To aid in troubleshooting a schematic diagram is enclosed. The replacement parts list (Table 6-1) describes the components and refers to Simpson part numbers. Reference Symbol numbers correlate the components shown on the schematic diagram with the parts list.

6.1.1 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.

6.2 REPLACEMENT PARTS AND SCHEMATIC DIAGRAM

6.2.1 To obtain replacement parts, address order to the nearest Authorized Service Center (listed on the last pages of this manual). Refer to paragraph 2.3.1 for ordering instructions.

Table 6-1. Replacement Parts

Reference Symbol	Description	Part No.
R1	Rheostat, 200 kΩ	1-110193
R2	Rheostat, 5 kΩ	5-114099

R3	Resistor, 15 kΩ	5-110756
R4	Resistor, 45 kΩ	1-114192
R5	Resistor, 150 kΩ	1-113366
R6	Resistor, 800 kΩ	1-113363
R7	Resistor, 4 MΩ	1-113362
R8	Resistor, 5 MΩ	5-110454
R9	Resistor, 7.5 MΩ	5-111668
R10	Resistor, 2.5 MΩ	5-111669
R11	Resistor, 0.025Ω Shunt, 10A (Calibrate in VOM)	3-811793
R12	Resistor, 0.468Ω (Bobbin)	10-675254
R13	Resistor, 2Ω (Bobbin)	10-805077
R14	Resistor, 22.5Ω (Bobbin)	10-805076
R15	Resistor, 238Ω	1-115897
R16	Resistor, 11Ω, 5W (Wire Wound)	5-119567
R17	Resistor, 1.109 kΩ	5-112938
R18	Resistor, 123.5Ω	5-112939
R19	Resistor, 17.55 kΩ	5-113020
R20	Resistor, 113.7 kΩ	5-112941
R21	Potentiometer, 11.25 kΩ	5-115263
R22	Rheostat, 5 kΩ	1-116254
R23	Resistor, 4 kΩ	5-114835
R24	Resistor, 4 kΩ	5-114835
R25	Rheostat, 5 kΩ	1-116254
R26	Resistor, 7.5 kΩ	1-113370
R27	Resistor, 37.5 kΩ	1-113393
R28	Resistor, 200 kΩ	1-113365
R29	Resistor, 1 MΩ	1-113392

R30	Resistor, 1.25 MΩ	5-115068
C1	Capacitor, 0.1 μF, 400V	1-113733
D1	Diode, Germanium	1-115970
D2	Diode, Germanium	1-115970
V1	Varistor, Silicon	1-110670
F1	Fuse, 1 Amp, 250V; 3AG (1¼" x ¼") Quick acting (Littelfuse Type 312001)	1-112507
F2	Fuse, 2 Amp, 600V (Bussman Type BBS or KTK)	5-119056
F1	Knobs: For Function Switch	1-115789
	Knobs: For Zero Ohms Adjust	1-115790
	Knobs: For Range Switch (less Set Screw)	3-260180
	Knobs: Set Screw (for Knob 3-260180)	1-114178
	Case Assembly, Phenolic, Complete, (including handle less Battery Compartment Cover)	10-861725
	Battery Compartment Cover Assembly	10-861724
	Rubber Bumper Plug	5-115039
	260-6, 260-6RT Indicating Instrument with Panel Assembly	D13721
	260-6M, 260-6MRT Indicating Instrument with Panel Assembly	D13722
	Cover Assembly for Indicating Instrument	0-005674
	Probe Tip Leads, one red and one black	00125
	Label, UL Listing	6-110977
	Label, Operator Servicing	6-110960
	Label, Battery and Fuse Data	6-110959
	Label, Terminal Rating	6-110979
	Label, Warning	6-111474

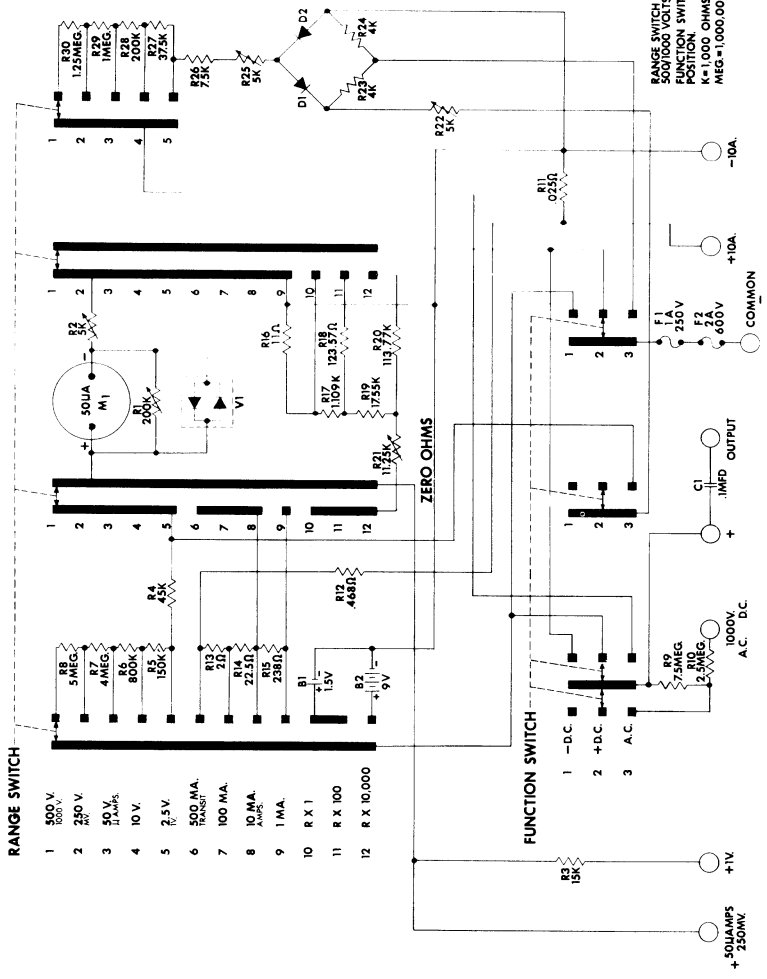

Figure 6-1. Schematic Diagram