

**OPERATOR'S MANUAL**  
**SIMPSON – MODEL 651 DC VTVM**

**SECTION I**  
**GENERAL DESCRIPTION**

**INTRODUCTION**

The Simpson Model 651 DC VTVM is an accurate, compact and self-powered instrument designed to give a DC Voltage coverage heretofore found only in laboratory type instruments. High sensitivity is incorporated for transistor circuitry; high impedance for AGC measurements; and multi-range for better accuracy of reading.

By utilizing the Simpson 260 Adapter concept of combining a high quality 260\* or 270 VOM with unique adapter circuitry, a quality to cost figure is achieved that is without equal.

**ACCESSORIES FURNISHED**

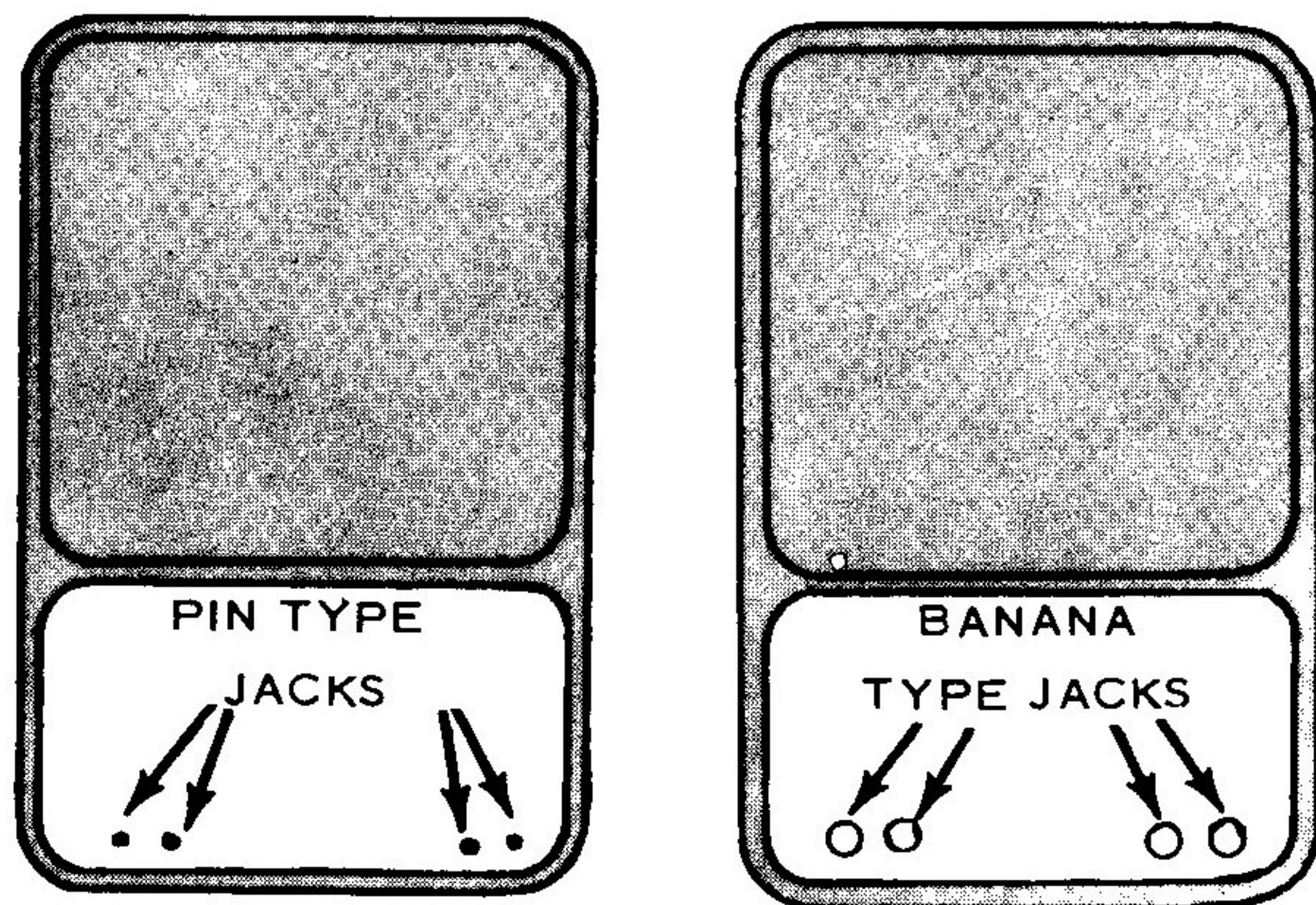
Each instrument is furnished with one DC volts probe with lead, one ground lead with banana plug and four extra pin-type plugs. If the Model 651 is to be used with a 260 Series II, it will be necessary to unscrew the four banana plugs at the top of the unit and replace with the four pin-type plugs. See Figure 2 for 260 Series identification.

\*Trade Mark Registered U. S. Patent Office.



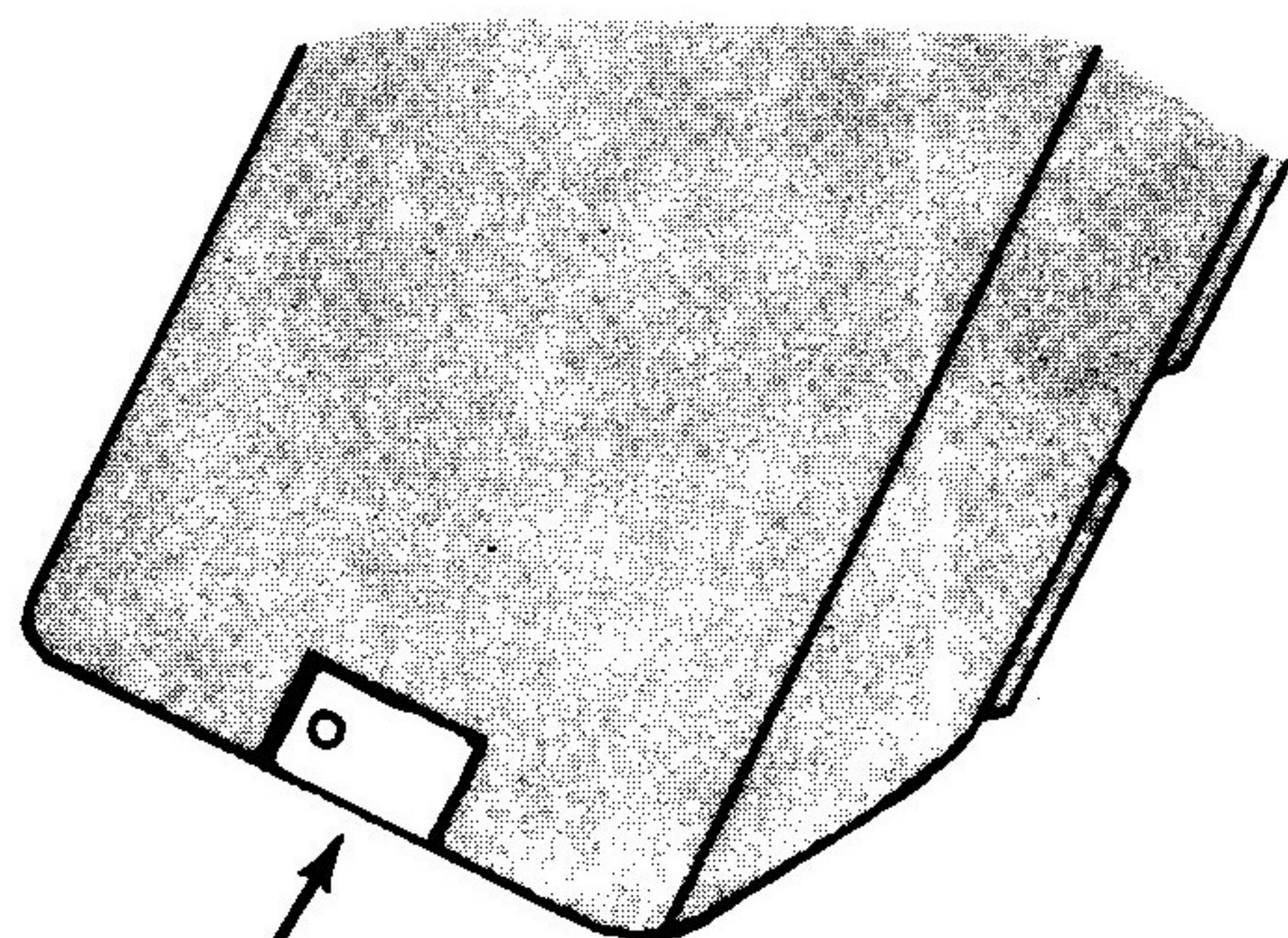
FIGURE 1 – SIMPSON MODEL 651 DC VTVM

## GENERAL DESCRIPTION



(a) 260, Series II

(b) 260, Series III



ADAPTER LOCK PROVISION  
(ONLY ON MODELS PRODUCED AFTER  
JUNE 1ST, 1959)

FIGURE 2 - 260\* SERIES IDENTIFICATION

\*Trade Mark Registered U. S. Patent Office.

## GENERAL DESCRIPTION

### SPECIFICATIONS

Ranges -

DC Volts 0-.5/1.0/2.5/5/10/25/50/100/250/500

Input Resistance

10 Megohms (minimum)

Accuracy

DC Volts

Adapter only  $\pm 1\%$

Adapter with **260**  $\pm 3\%$  F.S. (nominal)

$\pm 5\%$  of reading (nominal)

Adapter with **270**  $\pm 2\%$  F.S. (nominal)

$\pm 4\%$  of reading (nominal)

### POWER REQUIREMENTS

2 - 1.34 volt Mallory type ZM-9 mercury batteries

2 - 30 volts Eveready type 413 batteries

### SIZE

5-5/16 x 4-3/8 x 3-7/16

### WEIGHT

2 pounds

### MODIFICATION KITS

Adapter Case Kit 401 for 260 Series III and 270.

This kit is optional for converting early production (produced prior to June 1, 1959) **260** Series III or **270** cases to permit locking of the Model 651

## GENERAL DESCRIPTION

to the VOM. It consists of a new case and instructions. The new case permits the adapter latch underneath the Model 651 to be locked securely to the underside of the VOM.

Adapter Case Kit 402 for 260 Series II.

This kit is required for conversion of the 260 Series II, to electrically accommodate the Model 651. It includes the instructions and parts necessary for the conversion, and provides a 50 micro-ampere D.C. range in the instrument.

## FUNCTION OF CONTROLS

### DC VOLTS Switch

This is a 10 position switch located on the left side of the front panel which is used to select the desired D.C. volts range.

### FUNCTION Switch

The FUNCTION switch is a 3 position switch located on the right side of the front panel. The battery power to the Model 651 is turned off when this switch is in the OFF position. Turning this switch to the right turns on the battery power and also selects the desired polarity. The two operating positions are marked POS. and NEG. indicating the polarity of the D.C. probe.

## GENERAL DESCRIPTION

### NOTE

When the Model 651 is not in use, keep the FUNCTION switch set at OFF to prolong battery life.

### ZERO ADJ. (Electrical)

With the Adapter energized and properly connected to a 260 or 270, and the DC VOLTS switch placed in the desired voltage range position, the ZERO ADJ. control is turned to the right or left until the pointer is directly over the zero mark on the 260/270 scale. When making this adjustment, the D.C. probe should be connected to the ground lead. When changing ranges or polarity, it may be necessary to re-adjust for zero.

### 260 - 651 Switch

The small switch at the bottom center of the front panel is a convenience switch. It permits use of the Multimeter alone without detaching the Model 651.

## SECTION II

### OPERATING INSTRUCTIONS

#### 1. Initial Adjustments

##### a. 260/270 Control Settings.

1. With the Model 651 disconnected, check the meter pointer position for zero indication in its operating position. If the pointer is off zero, adjust the bakelite screw just under the meter. Refer to the VOM Operator's Manual for this adjustment.

2. Set the **260/270** polarity switch to the +DC position.

3. Set the **260/270** range switch to the 50V position.

##### b. Model 651 Control Settings.

1. Set the FUNCTION switch to the OFF position.

2. Set the DC VOLTS range switch to the 500 position.

3. Set the 260-651 switch to the 651 Adapter position.

##### c. Connecting the 651 to the 260/270.

1. Insert the top four plugs of the Model 651 into the lower four jacks of the **260/270**.

2. Insert the short lead from the Model 651 into the 50  $\mu$ AMPS jack.

3. Position the adapter locking latch underneath the instrument, to secure the two units.

### CAUTION

If your **260/270** case does not have the locking provision, avoid applying excessive pressure to the top of the Adapter when it is connected to the Multimeter. A modification kit which includes a new case with an adapter locking provision is recommended for optimum rigidity (see page 3).

### MEASURING DC VOLTAGES

1. Place the FUNCTION switch of the Model 651 in the POS. or NEG. position, depending upon the polarity of the voltage to be measured.

2. Rotate the DC VOLTS switch of the Model 651 to any one of the ten voltage positions. If the voltage to be measured is unknown, always use the highest voltage range first. After the first reading, the switch can be reset to a lower range if needed, for a more accurate reading.

## OPERATING INSTRUCTIONS

3. Connect the probe lead to the connector marked DCV, and plug the black test lead into the jack marked GND.

4. Turn on power to the circuit under test and connect the ground lead of the 651 to the common side of the circuit to be tested. Place the end of the probe on the point to be checked. If the pointer deflects to the left of zero, the polarity is incorrect and the FUNCTION switch should be switched to the other polarity position.

5. Read the voltage on the black arc of the **260/270** which is second from the top. Use the appropriate scale for the range selected as follows:

651 RANGE SELECTED	<b>260/270</b> SCALE	DIVIDE OR MULTIPLY BY
.5 Volts	0-50	÷ 100
1.0 Volts	0-10	÷ 10
2.5 Volts	0-250	÷ 100
3.0 Volts	0-50	÷ 10
10.0 Volts	0-10	Read Directly
25.0 Volts	0-250	÷ 10
50.0 Volts	0-50	Read Directly
100.0 Volts	0-10	× 10
250.0 Volts	0-250	Read Directly
500.0 Volts	0-50	× 10

## OPERATING INSTRUCTIONS

When not in use, place the FUNCTION switch of the Model 651 in its OFF position to prolong battery life.

### NOTE

Before setting the FUNCTION switch at OFF set the 260-651 switch at 260 Direct. This prevents overdriving the VOM pointer when the Model 651 power is turned off.

## SECTION III

### MAINTENANCE

#### CARE

The Model 651 is a very rugged instrument designed to withstand the wear of every day service work. Nevertheless, it should receive the care given to other fine electronic equipment and should not be subjected to excessively rough treatment.

#### CASE REMOVAL

To remove the instrument from the case, remove the four screws located in the four corners on the back of the instrument case. All the components

## MAINTENANCE

are attached to the front panel. Be sure the instrument is detached from the Multimeter and test leads are removed.

### BATTERY REPLACEMENT

The unit contains two 1.34 volt Mallory mercury batteries No. ZM-9, and two 30 volt Eveready batteries No. 413.

To maintain optimum performance from the Model 651, the batteries should be periodically checked. If the voltage falls below 25% of rated voltage, the battery(s) should be replaced. To remove the battery(s), open the unit as described above and merely grasp both ends of the battery, and pull in an outwardly direction. When replacing, be certain that the polarity of the battery(s) corresponds with the polarity marks on the chassis. Battery(s) replacement will not affect the calibration.

#### NOTE

Toward the end of life, the voltages of the 30 volt B batteries may differ and it may not be possible to zero adjust the 651. If the weaker battery has greater than 25% of its rated voltage, interchange the two for an extended period of use.

## MAINTENANCE

### CALIBRATION

The Model 651 has been carefully calibrated at the factory and no further changes should be necessary.

#### NOTE

If recalibration appears to be necessary, check both the Multimeter used and the Model 651 to determine which unit may require re-calibration.

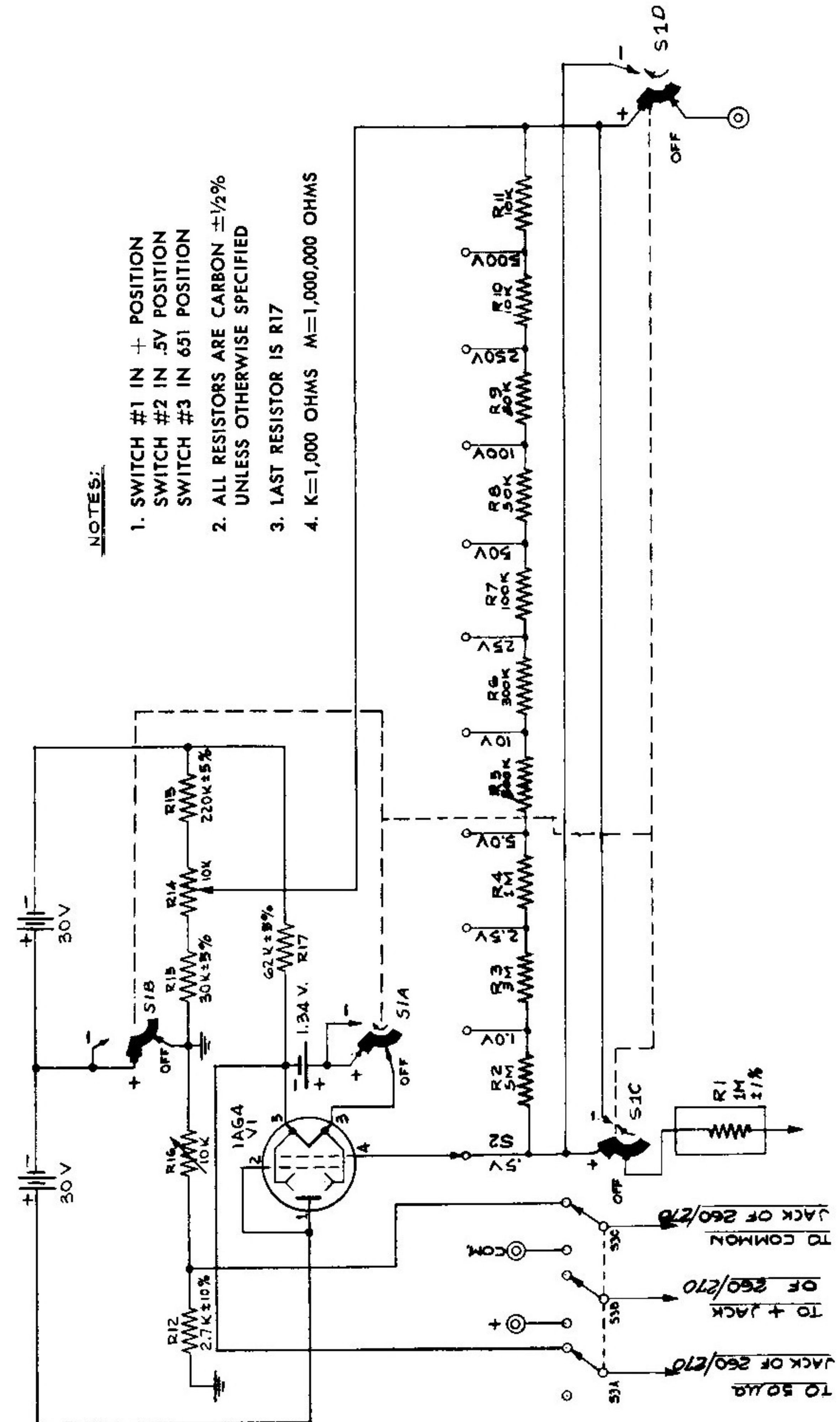
When the 1AG4 tube is replaced, use the following procedure:

1. Allow the Model 651 to warm up for approximately  $\frac{1}{4}$  hour. Set the FUNCTION switch in the POS. position.
2. With test leads attached to the unit, connect the DC probe to the ground lead and adjust the ZERO ADJ. control for zero. Disconnect (separate) the leads.
3. Apply 0.5 volt, with the range switch set in the 0.5 volt position. Check for exactly a full-scale indication. If necessary, adjust R-16 until the meter reads correctly.

4. Check each remaining voltage range with an appropriate voltage standard. The accuracy on each range should be better than  $\pm 3\%$  F.S. If it is not, check the attenuator resistors.

### REPLACEMENT OF PARTS

All the components of the Model 651 have been engineered for use over a long period of time. However, there are conditions under which parts may become damaged or faulty and require replacement. Refer to the circuit diagram, Figure 3, to help identify and locate any suspected part. All parts should be ordered from your local Simpson Authorized Parts station, with the part number specified in your order. See the list of Authorized Repair and Parts Stations beginning on page 15.



**NOTES:**

1. SWITCH #1 IN + POSITION  
SWITCH #2 IN .5V POSITION  
SWITCH #3 IN 651 POSITION
2. ALL RESISTORS ARE CARBON  $\pm 1/2\%$   
UNLESS OTHERWISE SPECIFIED
3. LAST RESISTOR IS R17
4. K=1,000 OHMS M=1,000,000 OHMS

FIGURE 3 - SCHEMATIC DIAGRAM, MODEL 651 DC VTVM\*

## MAINTENANCE

### PARTS LIST

Reference Symbol	Description	Simpson Part No.
R1	Resistor, 1 megohm, $\pm 1\%$ , $\frac{1}{2}$ w	1-113392
R2	Resistor, 5 megohms, $\pm \frac{1}{2}\%$ , $\frac{1}{2}$ w	1-118181
R3	Resistor, 3 megohms, $\pm \frac{1}{2}\%$ , $\frac{1}{2}$ w	1-118182
R4	Resistor, 1 megohm, $\pm \frac{1}{2}\%$ , $\frac{1}{2}$ w	1-118183
R5	Resistor, 500K ohms, $\pm \frac{1}{2}\%$ , $\frac{1}{2}$ w	1-118184
R6	Resistor, 300K ohms, $\pm \frac{1}{2}\%$ , $\frac{1}{2}$ w	1-118185
R7	Resistor, 100K ohms, $\pm \frac{1}{2}\%$ , $\frac{1}{2}$ w	1-118186
R8	Resistor, 50K ohms, $\pm \frac{1}{2}\%$ , $\frac{1}{2}$ w	1-118187
R9	Resistor, 30K ohms, $\pm \frac{1}{2}\%$ , $\frac{1}{2}$ w	1-118188
R10	Resistor, 10K ohms, $\pm \frac{1}{2}\%$ , $\frac{1}{2}$ w	1-118189
R11	Resistor, 10K ohms, $\pm \frac{1}{2}\%$ , $\frac{1}{2}$ w	1-118189
R12	Resistor, 2.7K ohms, $\pm 10\%$ , $\frac{1}{2}$ w	1-113942
R13	Resistor, 220 ohms, $\pm 5\%$ , $\frac{1}{2}$ w	1-117536
R14	Potentiometer, 10K ohms, $\pm 30\%$ , $\frac{1}{2}$ w	1-118118
R15	Resistor, 30K ohms, $\pm 5\%$ , $\frac{1}{2}$ w	1-114878
R16	Rheostat, 10K ohms, $\pm 10\%$ , 1 w	1-118269
R17	Resistor, 62K ohms, $\pm 5\%$ , $\frac{1}{2}$ w	1-115449
S1	Switch, 4-poles, 3-positions	1-118125
S2	Switch, 1-pole, 10-positions	1-118054
S3	Switch, 3-poles, 2-positions	1-118102
V1	Tube, type 1AG4	1-118493
	D.C. Volts Probe	10-890067
	Ground Lead	10-837547

## SIMPSON WARRANTY REPAIR STATIONS

### AND PARTS DEPOTS

<p>*California, Los Angeles Quality Electric Company 3700 South Broadway States: So. California below Fresno and Arizona</p>	<p>ADams 2-4201</p>
<p>*California, San Francisco Pacific Electrical Instrument Lab. 111 Main Street States: No. California above Fresno and Nevada</p>	<p>GARfield 1-7185</p>
<p>Canada Bach-Simpson Ltd. 1255 Brydges Street P.O. Box 484 London, Ontario, Canada</p>	<p>GLadstone 1-9490</p>
<p>*Colorado, Denver Meter-Master Instrument Service 2379 Downing Street States: Wyoming, Utah, Colo. and New Mexico</p>	<p>RAce 2-8670</p>
<p>*Georgia, Atlanta Electro-Tech Equipment 690 Murphy Avenue S. W. States: Alabama, Georgia, Florida, No. &amp; So. Carolina, and Tenn.</p>	<p>PLaza 3-4128</p>

\*Parts Depots