

operating and  
maintenance instructions

**Volt-Ohm-Milliammeter  
Type WV-38A**

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RCA | Electronic Instruments | Harrison, N.J. 07029

## **Safety Precautions**

For proper operation, the ground (black) lead of the WV-38A should be connected to the ground of the equipment under test, before any other connections are made. An important point to remember is that there is always danger inherent in testing electrical equipment. Therefore, the operator should thoroughly familiarize himself with the equipment under test before working on it, bearing in mind that high voltages may appear at unexpected points in defective equipment. Additional precautions which experience in the industry has shown to be important are listed below:

1. It is good practice to remove power before connecting test leads to high-voltage points. If this is impractical, be especially careful to avoid accidental contact with equipment racks and other objects which can provide a ground. Working with one hand in your pocket and standing on a properly insulated floor lessens the danger of shock.

2. Filter capacitors may store a charge large enough to be lethal. Therefore, discharge filter capacitors before attaching test leads.

3. Remember that leads with broken insulation provide the additional hazard of high voltages appearing at exposed points along the leads. Check test leads for frayed or broken insulation before working with them.

4. To lessen the danger of accidental shock, disconnect test leads immediately after test is completed.

5. Remember that the risk of severe shock is only one of the possible hazards. Even a minor shock can place the operator in jeopardy of more serious risks, such as a bad fall or contact with a source of higher voltage.

6. The experienced operator continuously guards against injury and does not work on hazardous circuits unless another person is available to assist in case of accident.

## Description

The RCA WV-38A Volt-Ohm-Milliammeter is a completely portable, all-purpose measuring instrument. The WV-38A will measure rms values of AC sine-wave voltages from 0.1 volt to 5000 volts; DC voltages from 0.005 volt to 5000 volts; DC current from 1 microampere to 10 amperes; resistance from 0.2 ohm to 20 megohms; and decibels from -20 db to +50 db. Input resistance is 20,000 ohms-per-volt on DC, and 5000 ohms-per-volt on AC.

Features of this versatile test instrument include the use of precision resistors in all measuring circuits, and a large, easy-to-read meter with sensitive  $50\mu\text{A}$  movement. The panel has been specially designed with two-color markings for simplified operation.\*

A convenient function switch is provided with AC, +DC, and -DC positions. The +DC and -DC positions of this switch reverse the polarity of the test leads—a feature that is also helpful in checking the front-to-back resistance ratio of electrolytic capacitors and many types of semi-conductor devices.

Two special silicon diodes are used to protect the meter movement against burnout due to accidental overload.\* A fuse protects the precision multiplier in the ohms network.

The WV-38A is completely portable, requiring no external power source. Five internal batteries (not provided) are used for the ohms function (4 penlight cells and 1 "D"-size flashlight cell). The unit weighs only  $3\frac{1}{2}$  pounds, and measures  $6\frac{7}{8}$  inches by  $5\frac{1}{4}$  inches by  $3\frac{1}{8}$  inches. Convenient clips are provided on the handle for carrying the test leads. The WV-38A is attractively styled, with a rugged, lightweight, bakelite case.

\*Included on wired instruments with serial numbers above 20,000, and on kits with serial numbers above 66,000 K.

### Items Supplied with WV-38A

- |                                       |                                  |
|---------------------------------------|----------------------------------|
| 1—Red Test Lead and Probe             | 1—Black Test Lead with Alligator |
| 1—Slip-on Alligator Clip and Red Boot | Clip and Black Boot              |
|                                       | 1—Warranty - Registration Card   |
|                                       | 1—Instruction Book               |

(Batteries Not Supplied)

### Available Accessories for WV-38A

- |         |  |
|---------|--|
| WG-297  | High Voltage Probe   |
| WG-210  | Resistor 900 Megohm for H.V. Probe (10 x multiplier for 5000 V. range) |
| WG-211  | Resistor 495 Megohm for H.V. Probe (100 x multiplier for 250 V. range) |
| WG-270A | Vinyl Carrying Case  |

## Specifications

### Electrical

**DC Voltmeter (at full scale) :**

Ranges ..... 0 to .25, 1.0, 2.5, 10, 50, 250, 1000, 5000 volts  
 Input resistance ..... 20,000 ohms-per-volt  
 Circuit loading ..... 50 microamperes bleeder current  
 Accuracy .....  $\pm 3\%$

**AC Voltmeter (at full scale) :**

Ranges ..... 0 to 2.5, 10, 50, 250, 1000, 5000 volts  
 Input Resistance ..... 5000 ohms-per-volt  
 Circuit loading ..... 200 microamperes bleeder current  
 Accuracy .....  $\pm 5\%$   
 Frequency Response (reference 1000 cps) flat within  $\frac{1}{2}$  db  
 from 10 cps to 50 kc on the 2.5, 10, and 50 volt ranges.

**DC Current (at full scale) :**

Ranges .....  $\left\{ \begin{array}{l} 0 \text{ to } 50 \text{ microamperes} \\ 0 \text{ to } 1 \text{ milliampere} \\ 0 \text{ to } 10 \text{ milliamperes} \\ 0 \text{ to } 100 \text{ milliamperes} \\ 0 \text{ to } 500 \text{ milliamperes} \\ 0 \text{ to } 10 \text{ amperes} \end{array} \right.$

Insertion Loss ..... 0.25 volt  
 Accuracy .....  $\pm 3\%$

**DC Ohms :**

Ranges	Scale Ends	Center Scale	Full Scale Currents
R X 1	0-2000	12 ohms	120 MA
R X 100	0-200,000	1200 ohms	1.2 MA
R X 10,000	0-20,000,000	120,000 ohms	0.06 MA
Accuracy	..... $\pm 3^\circ$ of pointer position for exact value		

**Internal Batteries :**

R X 1 ..... Size D Cell,  $1\frac{1}{2}$  volts  
 R X 100 ..... Size D Cell,  $1\frac{1}{2}$  volts  
 R X 10,000 ..... 4 Penlite Cells in series with D cell,  $7\frac{1}{2}$  volts

**AF Output (at full scale) :**

Ranges ..... 0 to 2.5, 10, 50, 250 volts  
 Input Resistance ..... 5000 ohms-per-volt  
 Circuit Loading ..... 200 microamperes  
 Accuracy .....  $\pm 5\%$

**Note :**

An internally connected 0.1  $\mu$ f DC blocking capacitor permits out-put measurements in presence of DC voltages.

**Decibel Levels (Zero DB is 1 milliwatt in 600 ohms) :**

2.5 V. range .....	-20 to +10 DB
10 V. range .....	- 8 to +22 DB
50 V. range .....	+ 6 to +36 DB
250 V. range .....	+20 to +50 DB

(May be read on Output or AC positions)

**Mechanical Specifications**

**Dimensions—(less handle)**

Height .....	6 <sup>7</sup> / <sub>8</sub> inches
Width .....	5 <sup>1</sup> / <sub>4</sub> inches
Depth .....	3 <sup>1</sup> / <sub>8</sub> inches
Weight .....	3 <sup>1</sup> / <sub>2</sub> pounds

**Meter Scales**

There are five separate scales on the meter. The top black scale is used when measuring Ohms. The second black scale is used to read DC voltages and currents. The two red scales are used when measuring AC voltages, the lower one being used only for the 2.5 V. range. The bottom scale on the meter is used for decibel measurements. A chart, located at the lower right hand corner of the scale for convenience, is used when making decibel measurements.

**Range Switch**

The Range Switch, located at the center of the control panel, has 12 positions. The Range Switch may be turned in either direction to obtain the function and range desired.

**Function Switch**

The Function Switch located at the upper left-hand corner of the panel has three positions, "AC", "+DC", and "-DC".

To measure all AC voltages and to make decibel measurements, the switch must be set to the "AC" position.

For positive direct current and DC voltage measurements, the switch must be set to the "+DC" position.

The "-DC" position reverses the polarity of the "-COMMON" and "+ jacks, permitting direct measurement of negative direct current and DC voltage. This switch position can also be used as a convenient means of reversing the polarity of the test leads when checking the front-to-back resistance ratio of electrolytic capacitors and many types of semiconductor devices.

## **Operating Section**

### **Zero Setting of Pointer**

The pointer of the meter must indicate zero when the WV-38A is in the normal operating position. If the pointer does not indicate Zero, the adjustment screw located at the lower center of the meter cover should be readjusted.

### **Use of Range and Meter Scales**

The meter scales on the WV-38A have been designed to provide ease of operation and quick readability over a wide range of measurements. Scales have been grouped according to the type of measurement for which they are used.

Because of the wide number of measurement ranges provided on the WV-38A, it is often possible to take voltage or resistance readings on two ranges and scales. For greatest accuracy in voltage and current measurements, always use the range which will provide an on-scale reading which is nearest to the full-scale point. For example: 48 DC Volts can be read from either the 50 Volt or the 250 Volt range. Because the 50 Volt range will provide a reading nearest the full-scale point, the 50 Volt range only should be used if a reading of best accuracy is to be obtained. This general rule applies to all AC and DC Voltage ranges. For resistance measurements, however, the range selected should be the one which provides a reading nearest the center of the scale, because the WV-38A provides the most accurate Ohms readings at mid-scale points.

For some measurements it will be necessary to use a multiplying factor with the scale to obtain the correct reading. The required multiplication is indicated by the setting of the range switch. For example: when the range switch is set to the 1000 V. position for voltage measurement, the 0 to 10 scale is used, but the reading is multiplied by 100 times.

#### **CAUTION:**

When making voltage or current measurements, it is good practice to make a trial measurement at a higher range setting than is considered necessary, because repeated overload may destroy the meter movement or impair the accuracy of indications.

It is also good practice for personal protection to turn off all power to the circuit under test when connecting or disconnecting the test leads. The power to the circuit under test must be turned off when in-circuit resistance measurements are made, otherwise damage to the WV-38A may result.

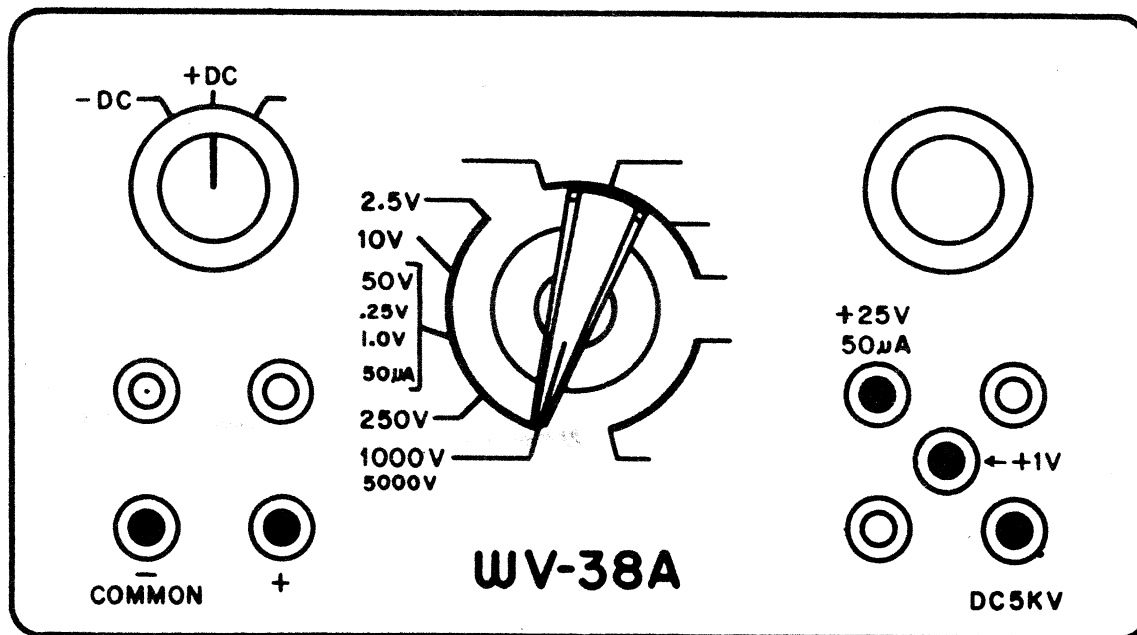


Figure 1. D-C Voltage Measurement

### DC Voltage Measurement (See Fig. 1.)

1. Set the AC-DC Switch to the "+DC" or "-DC" position as required.
2. Set the Range Switch to a position considerably higher than the voltage to be measured.
3. Plug the black test lead into the "-COMMON" jack on the control panel.
4. Plug the red test lead into the "+" jack on the control panel when the 2.5 V., 10 V., 50 V., 250 V. or 1000 V., range is used.
5. Connect the test leads to the voltage source to be measured.
6. Reset the Range Switch to a position which gives a suitable pointer deflection.
7. Read the DC voltage from the scale corresponding to the range selected.

Note: In rare applications where high energy rf is present, such as measuring dc "keep-alive" voltage on TR tubes in radar equipment, it may be necessary to disconnect meter-protection diodes CR3 and CR4.

### Special .25 Volt, 1 Volt, and 5000 Volt Ranges

Note: When using the .25 V and 1 V jacks, the Function Switch must be set to the "+DC" position. Meter polarity must be observed by applying the red test lead to the positive circuit point and the black test lead to the negative circuit point.

8. To use the .25 volt range, set the Range Switch to the ".25" position, and plug the red test lead into the "+.25 V/50μA" jack.
9. To use the 1 volt range, set the Range Switch to the "1.0 V" position, and plug the red test lead into the "+1 V" jack.
10. To use the 5000 volt range, set the Range Switch to the 5000 V position, and plug the red test lead into the "DC 5 KV" jack.

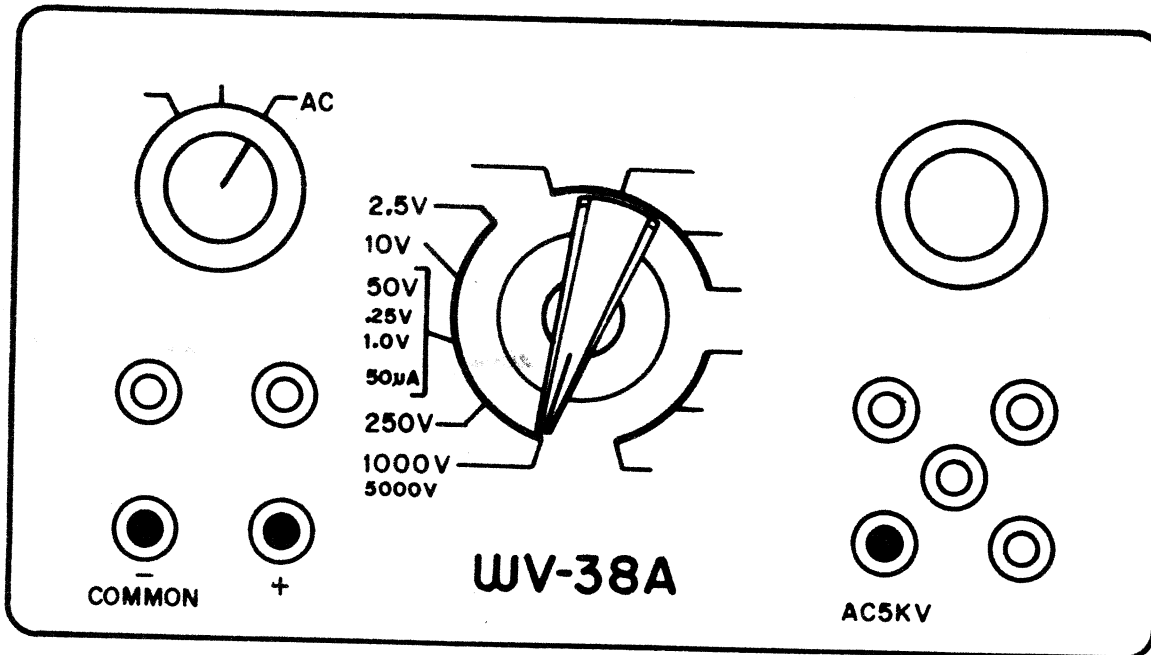


Figure 2. A-C Voltage Measurement

### AC Voltage Measurement (See Fig. 2.)

1. Set the AC-DC Switch to the "AC" position.
2. Set the Range Switch to a position considerably higher than the voltage to be measured.
3. Plug the black test lead into the "—COMMON" jack on the control panel.
4. Plug the red test lead into the "+" jack on the control panel when the 2.5 V, 10 V, 50 V, 250 V, or 1000 V range is used. When the 5000 V range is used, the red test lead must be plugged into the "AC5KV" jack.
5. Connect the test leads to the voltage source to be measured.
6. Reset the Range Switch to a position which gives a suitable pointer deflection.
7. Read the AC voltage from the scale corresponding to the range selected.



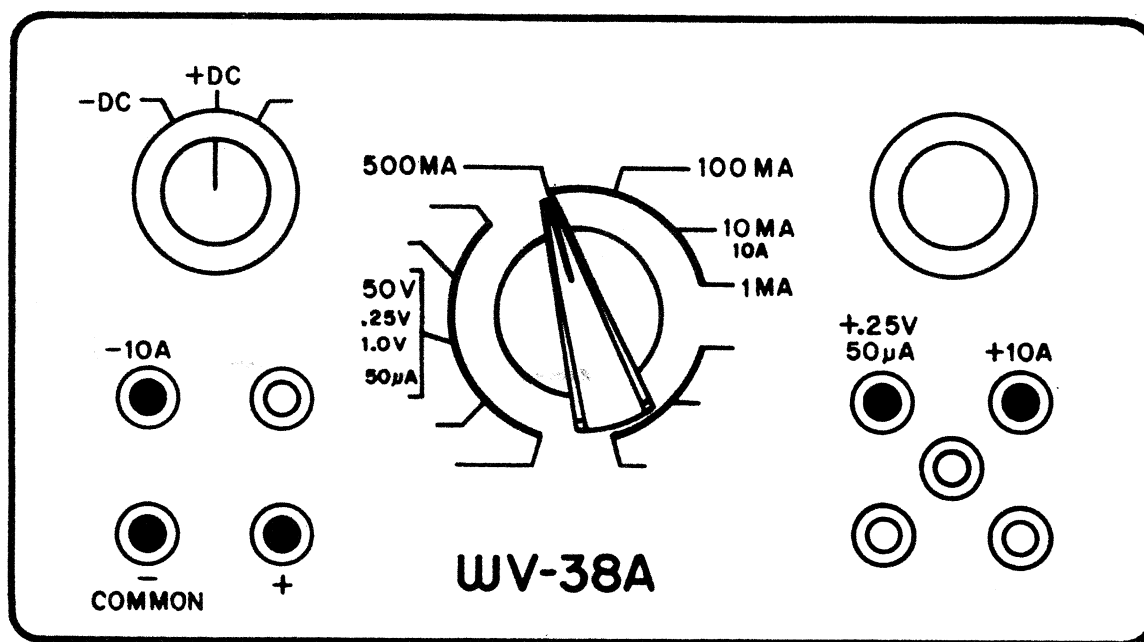


Figure 3. D-C Current Measurements

### DC Current Measurement (See Fig. 3.)

1. Set the AC-DC Switch to the "+DC" or "-DC" position as required.
2. Set the Range Switch to a position considerably higher than the current to be measured.
3. Plug the black test lead into the "-COMMON" jack on the control panel for all ranges with the exception of the 10 AMPS range.
4. Plug the red test lead into the "+" jack on the control panel for all ranges with the exception of the 10A and 50 $\mu$ A ranges.
5. Connect the test leads in series with the current flow to be measured.
6. Reset the Range Switch to a position which gives a suitable pointer deflection.
7. Read the DC current from the scale corresponding to the range selected.
8. To use the 50 $\mu$ A range, set the Range Switch to the "50 $\mu$ A" position, and the Function Switch to "+DC". Plug the red test lead into the "+.25 V/50 $\mu$ A" jack. Meter polarity must be observed by applying the red test lead to the most positive current connection and the black lead to the negative connection.
9. To use the 10 AMP range plug the black test lead into the "-10A" jack, and the red test lead into the "+10A" jack. On this current range the AC-DC Switch must be set to the "+DC" position, and the Range Switch set to the 10A position. Meter polarity must be observed by applying the red test lead to the most positive circuit connection and the black lead to the other circuit connection.

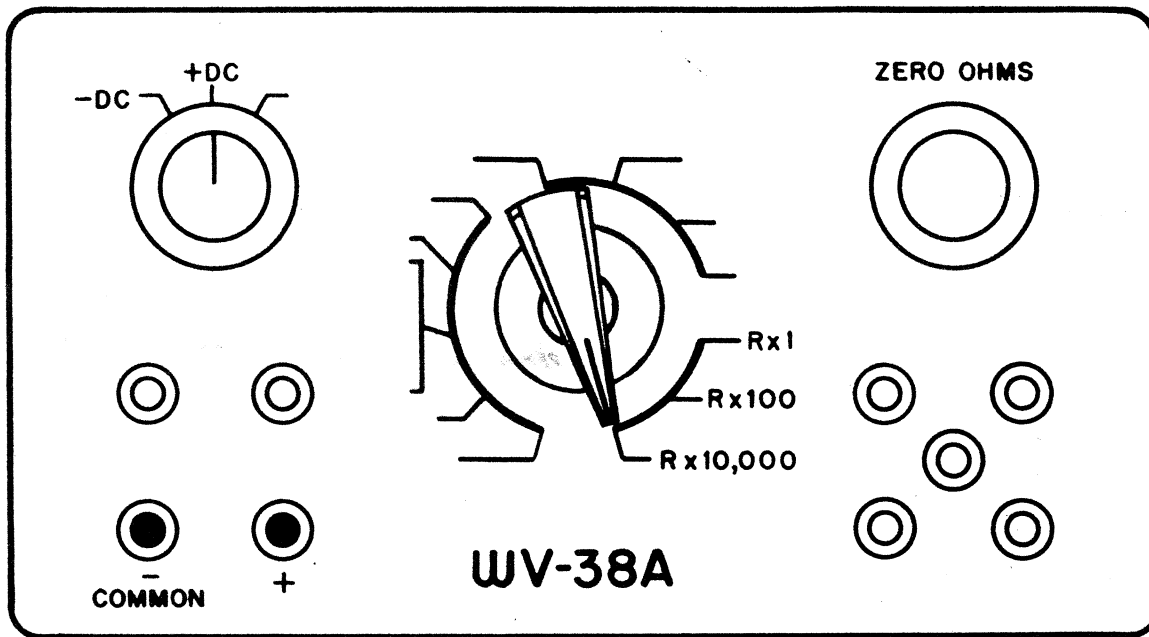


Figure 4. DC Ohms Measurement

### Ohms Measurement (See Fig. 4.)

1. Set the Function Switch to the "+DC" position.
2. Set the Range Switch to the appropriate position.
3. Plug the black test lead into the "-COMMON" jack on the control panel.
4. Plug the red test lead into the "+" jack on the control panel.
5. Short the test leads together and adjust the ZERO OHMS control until the pointer indicates "0" (full scale clockwise).
6. Connect the test leads to the resistance to be measured.
7. Reset the Range Switch if necessary to a position which gives a suitable pointer deflection. If this is necessary, repeat steps 5 and 6 before proceeding with step 8.
8. Read the resistance from the OHMS scale, and multiply by the range factor.

**CAUTION:** Low-current, low-resistance devices, such as thermocouples and meter movements, may be damaged unless a range above "R X 1" is used, because the WV-38A applies up to 1.5 volts across the resistance under measurement when the range selector is set at "R X 1".

To facilitate checking the front-to-back resistance ratio of electrolytic capacitors and semiconductor devices, the test lead polarity can be reversed simply by setting the Function Switch to the "-DC" position.

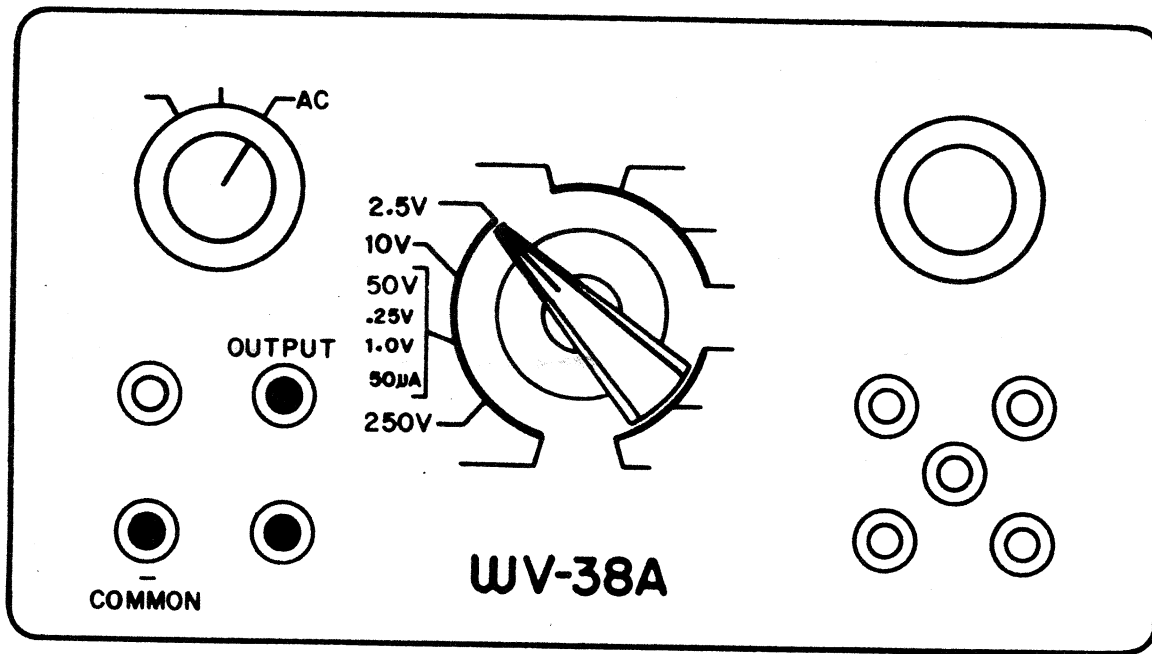


Figure 5. Decibel Measurement

### AF Output (Decibel) Measurement (See Fig. 5.)

1. Set the Function Switch to the "AC" position.
2. Set the Range Switch to a position considerably higher than the decibel measurement to be made.
3. Plug the black test lead into the "—COMMON" jack on the control panel.
4. Plug the red test lead into the "OUTPUT" jack on the control panel.
5. Connect the test leads to the AC source to be measured.
6. Reset the Range Switch to a position which gives a suitable pointer deflection.
7. Read the decibel measurement directly from the DB scale when using the 2.5 V. range. When using the 10 V, 50 V, or 250 V range refer to the chart located at the lower right hand corner of the meter scale, for the decibel factor that must be added to the meter indication for the proper decibel measurement.

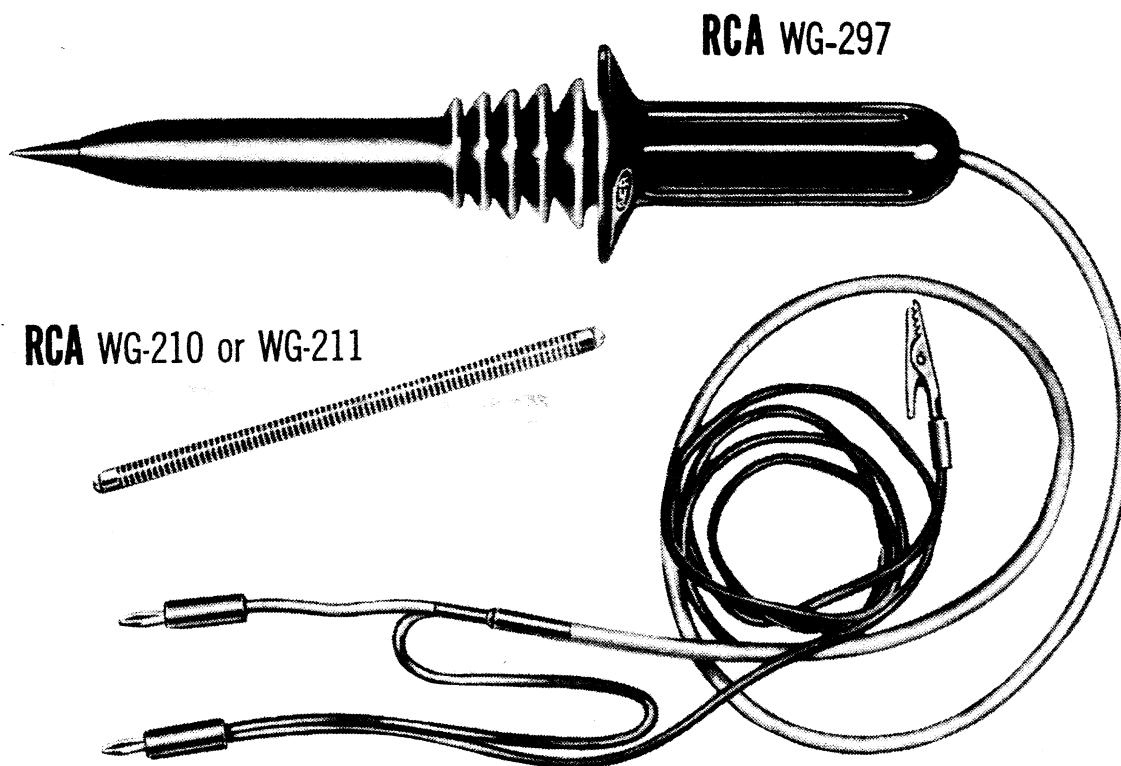


Figure 6. WG-297 High Voltage Probe

### Accessory High-Voltage Probe

(Available on Separate Order)

The WG-297 High-Voltage Probe, in combination with a multiplier resistor, as illustrated in Fig. 6, extends the DC rating of the WV-38A to a maximum of 50,000 volts for use in high-impedance circuits. The WG-210 Multiplier Resistor, which has a resistance of 900 megohms, multiplies the 5000 V. DC range by a factor of 10 times. (I.E. 50,000 V. DC.) Similarly the WG-211A multiplier resistor, which has a resistance of 495 megohms, multiplies the 250 V. DC range by a factor of 100 times. (I.E. 25,000 V. DC.) These probes and multiplier combinations make possible measurements in TV high-voltage power supplies and other high-impedance circuits having inherently poor regulation.

### Applications

The WV-38A is designed to measure the significant characteristics of electrical and electronic circuits. It will measure the voltage, the current, and the resistance of all DC circuits. For AC circuits, the measurement is indicated as R.M.S. volts or decibels. The decibel ranges are based on a zero level of 1 milliwatt in 600 ohms. Either part of a mixed AC and DC voltage can be measured separately with the WV-38A. The AC voltage can be measured individually through the use of the output circuit, and the DC voltage can be measured directly through the DC voltage circuit.

### Checking Capacitors

The R X 10,000 range of the WV-38A permits some indication of capacitor leakage resistance. A good paper or mica capacitor under 1  $\mu$ f will indicate above the 20 megohm mark ("2K") after the initial surge required to charge the capacitor is completed. If the resistance indicated is less than 20 meg., the capacitor probably has defective insulation. The time required to charge the capacitor will vary with the capacity. The greater the capacity, the more the pointer will swing and the longer it will take for it to return to infinity. If the capacitor is shorted, the pointer will not return to infinity. If the capacitor is open, there will be no initial pointer deflection. Very small capacitors will indicate only a slight deflection and a rapid return to infinity. Electrolytic capacitors, however, normally indicate some leakage, after charging. The amount of leakage is generally related to the capacitance and voltage rating. For example, a low voltage, high capacitance unit will indicate more leakage (lower resistance) than a high-voltage, low capacitance unit. When testing an electrolytic capacitor, the red lead must be connected to the positive and the black lead to the negative terminal of the capacitor, and the function switch on the WV-38A must be in the "+DC" position.

### Checking Rectifiers

The resistance of copper oxide, selenium, silicon and crystal rectifiers can be measured in both directions. The resistance measured should be quite large in one direction and very small in the opposite direction. The front-to-back resistance ratio can be checked easily by setting the Function Switch from "+DC" to "-DC", thus reversing the polarity of the test leads.

### Use of an Isolation Resistor

In certain sensitive circuits in radio and TV receivers and other I.F. or R.F. high-gain amplifiers, it is not possible to connect leads without disturbing the normal operation of the circuits. Usually, DC voltage measurements in such circuits requires the use of a VTVM with a resistor-isolation probe, such as an RCA VoltOhmyst. However, when the VoltOhmyst is not available, the WV-38A can be substituted, if a resistor is used in series with the instrument, clipped onto the end of the red probe. If an exact measurement is not required, almost any value of resistor, higher than the circuit impedance, will isolate the instrument so it will not overly disturb the circuit. When an exact measurement has to be made, a resistor should be used which exactly multiplies the input resistance of the instrument so that the reading can be made on one of the higher scales. The following table gives values of resistors to be used:

Range	Resistor	Reading Multiplier	Scale to Read
2.5 V	50 K	2 X	5 V
2.5 V	150 K	4 X	10 V
50 V	1 Meg.	2 X	100 V
250 V	5 Meg.	2 X	500 V

## **WV-38A VOM**

### **Circuit Description**

#### **Metering Circuit**

The WV-38A meter circuit for the AC Volts, DC Volts, and DC current functions consists of the calibrating potentiometer R22, connected in series with the 50 $\mu$ A meter movement.

In the ohms function, the calibrating potentiometer is replaced by R25, the front panel ZERO OHMS control.

Some models of the WV-38A have two special silicon diodes (CR3 and CR4) connected across the meter terminals to prevent damage to the meter movement due to accidental overload.

#### **DC Volts**

The eight ranges of the DC volts circuit are obtained by adding successively higher values of resistors in series with the meter circuit.

The .25 V range is connected directly to the meter circuit. The voltage divider network used for the remaining ranges is composed of R27, R1, R2, R3, R4, R5, and R29.

#### **AC Volts**

The diodes CR1 and CR2, along with R20 and R21, form a full-wave rectifier circuit, converting the AC signal input to pulsating DC voltage.

The six AC voltage ranges, as with the DC voltage section, are obtained by using a voltage-divider network. The resistors in this network are R10, R11, R12, R13, R14, and R28. R24 is a 6K potentiometer for calibrating the low AC ranges. R23, also a 6K potentiometer, is for calibrating the high AC ranges.

#### **DC Current**

The DC current ranges are obtained by switching the appropriate values of shunt resistance across the meter circuit to maintain 50 $\mu$ A full-scale deflection. The ranges and shunting resistors are listed below:

Range	Series Resistors Shunting Meter
50 $\mu$ A	No shunt used
1 ma	R6, R7, R8, R9, and R26
10 ma	R6, R7, R8, and R26
100 ma	R7, R8, and R26
500 ma	R8 and R26
10 Amp	R26

#### **Resistance**

In resistance measurements, the ohms control, R-25, is connected in series with the meter, and is used for calibrating or "zeroing" each range.

In the R x 1 and R x 100 ranges, the 1.5V "D" cell battery is applied to the circuit. In the R x 10,000 range, the four 1.5V penlight cells are also used, resulting in 7.5 volts. The battery voltage is applied to the meter circuit and shunt resistors of the particular range so that when the test leads are shorted, 50 $\mu$ A of current pass through the meter, causing full-scale deflection.

When a resistor is placed across the test leads, current flow through the meter will be reduced in proportion to the value of the resistor, thus causing the pointer to deflect down-scale to the appropriate reading.

In the R x 1 range, R16 and R17 are in series with the meter circuit, and R19 is shunting the meter circuit.

In the R x 100 range, R17 is connected in series with the meter circuit, and R16 and R19, connected in series, shunt the meter circuit. R15 is in series with the 1.5V battery.

In the R x 10,000 range, R16, R17, and R19, connected in series, are shunting the meter circuit. R18 is connected in series with the batteries (7.5V).

The 1 amp fuse is connected in series with the —COMMON jack, and serves to protect the resistors used for ohms measurement against damage due to accidental overload.

### Maintenance

The WV-38A may be removed from its case simply by removing four screws from the rear of the case. The meter, panel, laminated circuit board and batteries are removed as a complete unit.

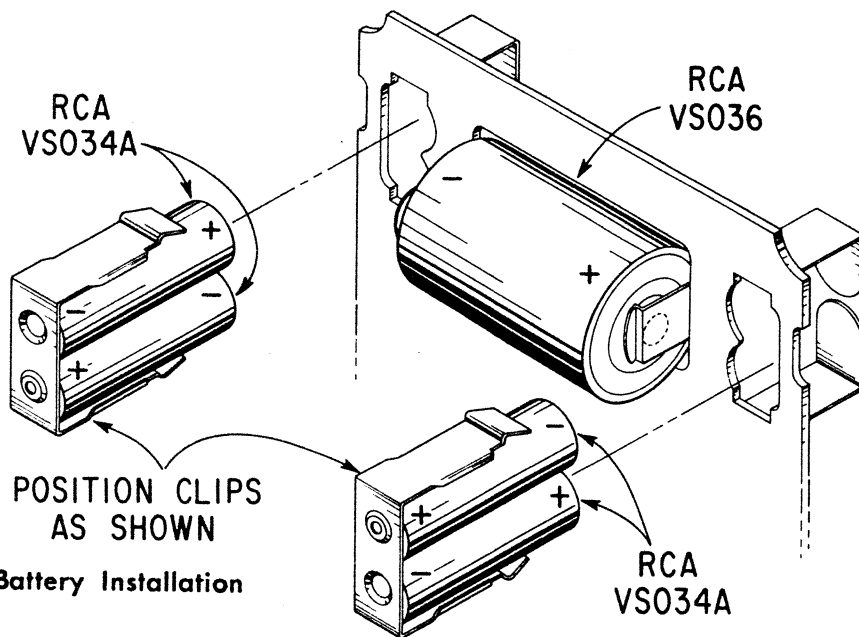


Figure 7. Battery Installation

The need for battery replacement is indicated when the instrument will not zero properly on the Ohms ranges. If it is not possible to zero the R X 1 and R X 100 ranges, the large "D" cell requires replacement. If it is not possible to zero the R X 10,000 range, the four penlite cells require replacement. It is generally good practice to replace all batteries when a replacement is needed.

The batteries are installed in the instrument as shown in Figure 7, above. It is important that the batteries are installed with the polarity exactly as shown in the illustration, and that the battery clips make proper contact with the terminals.

## **Resistor Replacement**

Almost all of the resistors contained in the WV-38A are mounted on the rear of the laminated circuit board, which simplifies troubleshooting and repair. When replacing a resistor, the defective resistor should be removed from the laminated circuit board and the holes in the laminated circuit board should be opened to accept the lead from the new resistor. The holes may be opened with the use of a toothpick or appropriate probe while the solder is melted. Care should be taken to prevent any short circuit to any other part nearby when replacing the resistor.

## **Fuse Replacement**

The fuse contained in the WV-38A is used to protect the Ohms-Multiplier resistors against burnout due to accidental misuse (applying voltage to the leads when the Range Switch is in the "R X 1" or "R X 100" positions). This fuse may be replaced by unsoldering the lead to the AC-DC Switch and clipping the other lead. The new fuse may be soldered onto the lead clipped from the defective fuse. Care should be taken to prevent any short circuit, and if necessary, a piece of insulating sleeving may be placed over the fuse to prevent a short circuit.

**NOTE:** A burned out fuse will make the instrument inoperative on all functions in which the "—COMMON" jack is used.

## **DC Calibration**

If an accurate DC Current source is available, it is recommended that the calibration potentiometer, R-22, be set using the DC Current function of the WV-38A, as follows:

1. Set the Function Switch to "DC" and the Range Switch to "1 MA."
2. Connect the test leads from the "—COM" and "+" jacks to a 1 Ma current source.
3. Adjust R-22 so that the meter indicates 1 MA (full-scale deflection).

R-22 can also be adjusted using a DC voltage source, as described below:

1. Set the Function Switch to "DC" and the Range Switch to the "2.5 V" range.
2. Connect the test leads from the "—COM" and "+" jacks to a 2.5 V DC source.
3. Adjust R-22 so that the meter indicates 2.5 V (full-scale deflection).

**NOTE:** A fresh 1.5 V battery can be used to calibrate R-22 on the 2.5 V range. Connect the test leads to the battery terminals, and adjust R-22 to indicate 1.57 volts (157 on the 250 scale).



## **Rectifier Replacement**

There are two small rectifiers located at the top of the laminated circuit board. If either, or both rectifiers become defective, the WV-38A will give incorrect indications when measuring AC voltages. When replacing a rectifier, be sure to observe the polarity of the defective rectifier before removing. The new rectifier must be replaced in the proper polarity, and the AC voltage ranges must be recalibrated by adjusting variable resistors "R23" and "R24." To recalibrate the AC ranges of the WV-38A, proceed as follows:

### **AC Calibration**

1. Set the AC-DC Switch to the "AC" position.
2. Set the Range Switch to the "250 V" position.
3. Connect the test leads to a known AC voltage source of 250 V AC.
4. Adjust variable resistor "R23" until the meter indicates full scale.
5. Remove the test leads from the 250 volt AC source.
6. Set the Range Switch to the "2.5 V" position.
7. Connect the test leads to a known AC voltage source of 2.5 V AC.
8. Adjust variable Resistor "R24" until the meter indicates full scale.
9. Remove the test leads from the 2.5 V AC source.

### **Removing the Laminated Circuit Board**

When it is necessary to gain access to the under-side of the laminated circuit board or to the parts located between it and the front panel; the laminated circuit board must be removed. To remove the laminated circuit board, proceed as follows:

1. Set the Range Switch to the "2.5 V" position.
2. Remove the knobs from the AC-DC Switch and the ZERO OHMS control by pulling.
3. Remove the knob from the Range Switch by loosening the set screw. DO NOT turn switch from its position.
4. Remove the three self-tapping screws which hold the laminated circuit board onto the panel posts.
5. Remove the two hex nuts and washers from the meter studs.
6. Remove laminated circuit board, observing copper rings placed between the board and the meter. DO NOT lose or misplace these copper rings as they function as the contacts from the laminated circuit board to the meter. When replacing the board, make certain that the copper rings are placed between the laminated circuit board and the meter, otherwise, the WV-38A will not function properly. Also dress the interconnecting leads away from the "AC5KV" and DC5KV" eyelets and resistors.

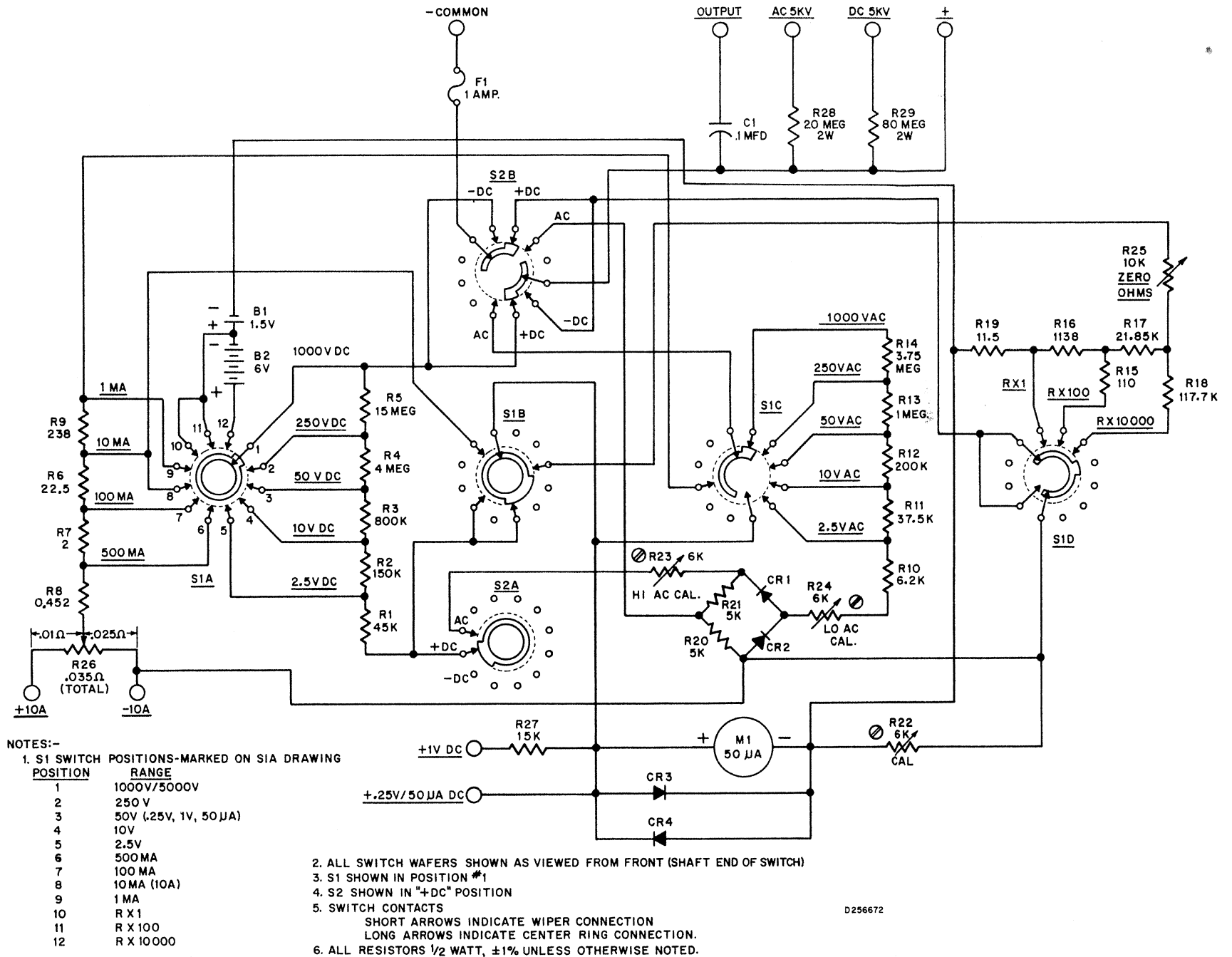
## Replacement Parts List

### WV-38A Volt-Ohm Milliammeter

When ordering replacement parts, include the stock number and description of the part, the instrument type. Parts without stock numbers are standard catalog items.  
 All parts should be ordered from your local RCA distributor.

Symbol No.	Description	Stock No.	Symbol No.	Description	Stock No.
<b>Resistors</b>			<b>Rectifier</b>		
R1	45K Ohms 1% 1/2 W	217743	CR1,	Crystal Diode Type IN87..	230099
R2	150K Ohms 1% 1/2 W	56483-A	CR2,		
R3	800K Ohms 1% 1/2 W	93843	CR3,		
R4	4 Megohms 1% 1/2 W	218881	CR4		
R5	15 Megohms 1% 1W	99317	<b>Fuse</b>		
R6	22.5 Ohms 1% 1W (blue)	218815	F1	Fuse Pigtail 3AG 1 AMP	212492
R7	2.0 Ohms 1% 1W (yellow)	218813		250V	
R8	0.452 Ohms 1% 1W (red)	218812	<b>Batteries</b>		
R9	238 Ohms 1% 1/2 W	218806	B1	Type D 1.5V	VS-036
R10	6200 Ohms 1% 1/2 W	236084	B2	Type A 1.5V	VS-034
R11	37500 Ohms 1% 1/2 W	218809	<b>Switches</b>		
R12	200K Ohms 1% 1/2 W	56733	S1	Range Switch	218877
R13	1 Megohms 1% 1/2 W	208022	S2	Function Switch	218876
R14	3.75 Megohms 1% 1W	218880	<b>Miscellaneous</b>		
R15	110 Ohms 1% 1/2 W	237613		Panel—with eyelet	218994
R16	1138 Ohms 1% 1/2 W	218807		assembly	
R17	21.85K 1% 1/2 W	218808		Case—(less handle	218993
R18	117.7K 1% 1/2 W	218810		assembly)	
R19	11.5 Ohms 1% 1W (green)	218814		Handle—including clips	219092
R20	5K 1% 1/2 W	209637		and hardware)	
R21	5K 1% 1/2 W	209637		Printed circuit board	219091
R22,				(less parts)	
R23,				Battery holder (U shaped	219179
R24	Variable 6000 Ohms	225351		for penlight cells)	
R25	Variable 10,000 Ohms	219488		Penlight Battery Clip	219178
R26	Shunt Assy. 10 AMP	219489		Flashlight Battery Clip	
R27	15K Ohms 1% 1/2 W	97761		Test Leads	221711
R28	20 Megohms 1% 2W	218816		Red, with probe	
R29	80 Megohms 1% 2W	218817		Black	221712
<b>Meter</b>				Meter case, plastic,	218995
				front and rear	
M1	Meter 50 Microamperes including plastic case and scale	218818		Knob pointer 1 inch	213831
<b>Capacitor</b>				Knob small with mark	219486
C1	Capacitor 0.1 MFD 400V			Knob small no mark	219487
				Screw—Handle mtg.	219093
				Clip—Lead Holder	219094
				(on handle)	
				Probe—Red Probe	219107
				and Tip	

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Schematic WV-38A

NOTE: In some instruments R10 is 7.5 K, and R22, R23 and R24 are 4 K.

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