

To Measure Resistance, Voltage (AC/DC), Current (AC) & Check Continuity Of a Given Circuit Using Multimeter

Aim

To measure resistance, voltage (AC/DC), current (AC) and check continuity of a given circuit using Multimeter.

Apparatus and material

Apparatus. Three carbon resistors, one standard resistance coil, a battery eliminator with tapping (2 V, 4 V and 6 V), a step down transformer (6-0-6 V) with two tapping (2 V and 4 V), a resistor of 100 ohm, a plug key and Multimeter.

Theory

Multimeter. It is a single measuring device acting as an Ammeter, a Voltmeter and an Ohmmeter. For this reason, it is also called **AVO** meter.

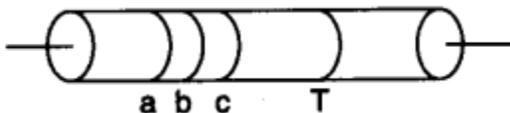
It can measure alternating as well as direct current and alternating as well as direct voltage in addition to resistance. For this purpose its panel is divided into five different sections. There are many ranges in each section so that it can measure from micro (10^{-6}) to mega (10^6) units. Rotation of a knob changes the section and the range in one section.

— Rotation of knob for change in ammeter range, brings shunt resistances of different values in circuit in parallel with the coil.

— Rotation of knob for change in voltmeter range, brings series resistances of different values in circuit in series with the coil.

— Rotation of knob for change in ohmmeter range, brings different resistances in circuit in series with the multimeter cell.

1. Carbon resistors are frequently used in electrical and electronic circuits and their values vary over a very wide range. A colour code is used to indicate the value of the resistance.



2. A carbon resistance has four different concentric coloured rings or bands on its surface. The first three bands a, b and c determine the value of the resistance and the fourth band d gives the percentage of accuracy called tolerance. The resistance of carbon resistor $R = (ab \times 10^c \pm T \%) \Omega$.
3. To read the value of carbon resistance, the following sentence is found to be of much more helpful.

B B R O Y Great Britain Very Good Wife
 0 1 2 3 4 5 6 7 8 9

The bold face letter B, B, R, O, Y, G, B, V, G and W, in above sentence correspond to the colours Black, Brown, Red, Orange, Yellow, Green, Blue, Violet, Grey and White respectively for *a* and *b*, while for the third *c*, they correspond to the multipliers 10^0 , 10^1 , 10^2 , 10^3 , 10^4 , 10^5 , 10^6 , 10^7 , 10^8 and 10^9 respectively.

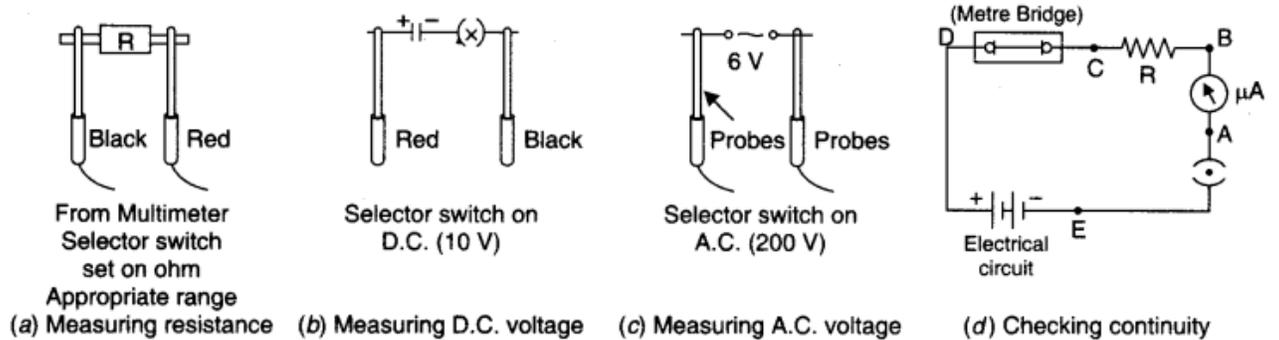
4. The following table provides the colour code for the carbon resistors :

<i>Letter</i> <i>(helpful to memory)</i>	<i>Colour</i>	<i>Figure</i> <i>a. b.</i>	<i>Multiplier</i> <i>(c)</i>	<i>Colour</i> <i>(for the fourth band)</i>	<i>Tolerance</i> <i>T</i>
B	Black	0	10^0	Gold	5%
B	Brown	1	10^1	Silver	10%
R	Red	2	10^2	No colour	20%
O	Orange	3	10^3		
Y	Yellow	4	10^4		
G	Green	5	10^5		
B	Blue	6	10^6		
V	Violet	7	10^7		
G	Grey	8	10^8		
W	White	9	10^9		
	Gold		10^{-1}		
	Silver		10^{-2}		

Procedure

1. Mark the given carbon resistors as R_1, R_2, R_3 .
2. Note the colour of first, second, third and fourth ring for each resistor.
3. Plug in the probes of the multimeter in appropriate terminals. Select the appropriate range, short the other ends of probes and adjust zero. Turn the terminal marked 'Adjust' such that the needle of the meter shows full scale deflection and reads zero ohm.
4. Separate the metallic ends of the probes. Insert the resistor R_1 to be measured in between the metallic ends of the two probes and read the deflection of the pointer on the range selected.
5. Repeat the step 4 for other resistors R_2 and R_3 each time selecting the appropriate range and testing the zero.

6. Now convert using the colour code table, the values of resistors in ohms and write their values with tolerance.



Using a multimeter to measure : (a) resistance, (b) D.C. voltage, (c) A.C. voltage and (d) resistance and checking continuity.

(b) D.C. Voltage

1. Select a D.C. source of potential difference, 6 V battery eliminator or a battery.
2. Plug the probes black in com and red in +.
3. Select D.C. volt, by turning the selector switch to range 10 V D.C. volts,
4. Touch and press other ends of probes such that red is on battery terminal marked + and black on and not the reading.
5. Insert red probe in terminals marked 4 V, 2 V in succession and note readings.

(c) A.C. Volts

1. Turn the selector A.C. (200 Volt).
2. Touch and press the probes other ends to two terminals of A.C. source of potential drop and note the reading.
3. Use red probe in terminals 4 V and 2 V in succession and record the reading.

(d) Continuity of given circuit

1. Set the selector switch to ohm, range $M\Omega$.
2. Touch and press the ends of probes at A and B, full scale deflection indicates continuity.
3. Similarly check in succession the continuity between terminals B and C and terminals C and D.

Never place the probes ends between terminals connected with the terminals of the battery.

In digital electronic Multimeter for continuity test rotor is set to mark 0 and a buzzer , sounds when probes are connected to ends of components tested.

Observations

(a) For Measurement of Resistance :

Resistor used	Colour and Codes of Rings				Value and tolerance from colour code (Ω)	Value by multimeter (Ω)	% Difference
	1	2	3	4			
R ₁ R ₂ R ₃	Orange	Red	Brown	Silver	$32 \times 10^1 \pm 5\%$	330	+ 10.0

(b) Measurement of Voltage:

A.C. or D.C. Volts	Obs. S. No.	Voltage between terminals V_0 (Volt)	Voltage reading as measured by multimeter V (Volt)	Difference in Voltage reading and volt. marked $2V - V_0$ (volt)
	1. 2. 3.			
	1. 2. 3.			

Inference

1. The measured values by multimeter match with decoded values of resistors.
2. A.C. and D.C. voltages marked on voltage sources match with voltage measured by multimeter.

Precautions

1. Instructions for handling the multimeter should be gone through thoroughly as it is a very handy instrument and is likely to get damaged if carelessly or ignorantly used.
2. Select the appropriate parameter current, voltage or resistance to the measured and set it on appropriate range.
3. If range of the parameter measured is not known, start with maximum. For measuring V , never connect more than maximum 600 V.

Viva Voce

Question. 1. A carbon resistor of $47 \text{ k } \Omega$ is to be marked with rings of different colours for its identification. Write the sequence of colours.

Answer. Yellow, violet the orange.

Question. 2. What is Multimeter?

Answer. This is an instrument used for measuring the current, voltage (A.C./D.C.) and resistance (high/low).

Question. 3. A carbon resistor has coloured strips in the sequence yellow, violet, brown and gold. What is its resistance?

Answer. $470 \Omega \pm 5\%$.

Question. 4. What is an ammeter?

Answer. It is an instrument which is used for measuring the strength of current in amperes directly.

Question. 5. What is voltmeter?

Answer. It is an instrument which is used for measuring the potential difference between the two points of the circuit directly in volts.