The ohmmeter

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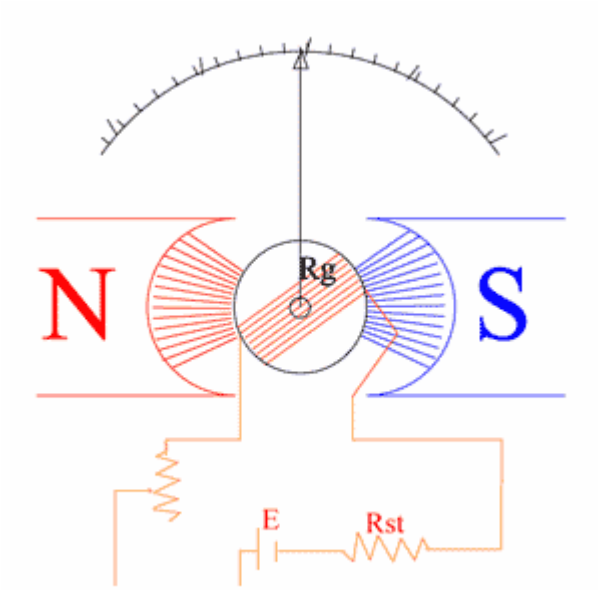
Based on :-

1- The standard resistance acts as R_m which decreases the current

2- When the voltage remains const.

3- We can remove the scale of the voltmeter and recalibrate the device to measure current intensity and resistance depending on the inversely prop. Between them .



$$I \alpha \frac{1}{R}$$

function :

To measure the value of an unknown resistance

structure :

It is a modified galvanometer by joining a high constant R (to pass a very weak current) & variable R (to control the current passed to adjust the

pointer to zero scale of the ohmmeter) and a cell of 1.5 volts all in series The device has two test terminals.

(A , B) to connect the unknown resistance between them .

Using it to measure R:

1- when the test terminals are connected - circuit (closed), maximum current flows, the pointer moves to zero ohm. (and max. Current)

2- by the rheostate we can adjust the pointer to reach to zero Ω
By adjusting the variable R, a suitable current passes till the pointer stops at zero Ω .

3- Join the unknown R ? between the two test terminals in series (R_T increases, I decreases) the pointer stops, indicating the value of R_x.

NOTES :

$$I_{max} = \frac{E}{R_g + R_{rh} + R_{st.} + r}$$

1- Law of ohmmeter

$$I = \frac{e.m.f}{R_g + R_{rh} + R_{st} + R_x + r}$$

Its scale is not uniform because the current passed through it is inversely proportional to the Total R and not to the measured R_x .

$$I = \frac{1}{R_s + R_g + R_x + r}$$

$$I = \frac{1}{Const + R_x}$$

2- when the unknown resistance equal the resistance of the device (R_g + R_{st} + r + R_{rh})

therefore the resistance of the circuit increases to its double so , the current decreases to its half .

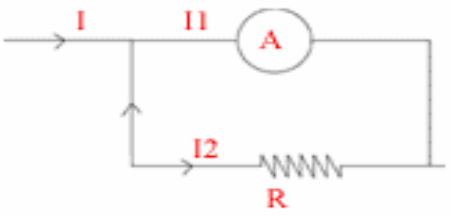
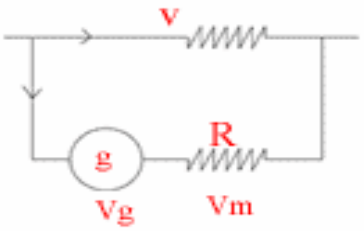
If the unknown resistance equal 2 times the resistance of the device the current decreases to its third

G .R :-

The scale of ohmmeter opposite to that of the galvanometer (current scale) Because

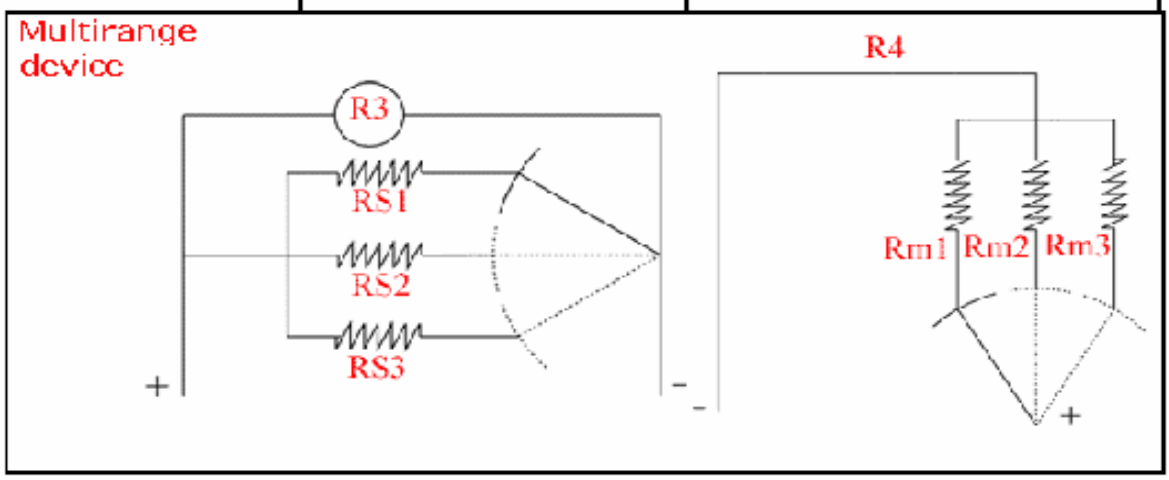
$$R \alpha \frac{1}{I}$$

Modification of (G)

Comparison	II. The d.c ammeter (A)	III. The d.c voltmeter (v)
Function	To measure d.c "I"	to measure d.c voltage
Scale	in amperes or Millie or micro amperes	in volts or Millie or micro volts
connection in circuit	in series, to measure the actually current passes through the circuit	in parallel across the two points affect where the connection in parallel keep P.d fixed .
internal resistance	very small R by joining a small R in parallel with its coil so , it does not affect the current to be measure	very high R by joining a high R in series with its coil (to draw a negligible current and does not alter the original (v)
Structure		
Conversion	By joining a small R_s resistance in parallel to decrease its resistance	By joining a high R_m in series to increase its resistance
The divider	The shunt resistance :- 1- Decrease the resistance of the ammeter 2- Convert galvanometer into ammeter extend the range of Ammeter	The multiplier :- 1- increase resistance of voltmeter 2- convert galvanometer into voltmeter . 3- extend the range of voltmeter

Comparison	II. The d.c ammeter (A)	III. The d.c voltmeter (v)
Proof	By joining a small R (shunt) (to allow the almost part of current to pass through it) or to divide I "I" can be determined by: $R_S = \frac{R_g I_g}{I - I_g}$ $\therefore V_g = V_s$ $I_g R_g = I_s R_s$ $I_g R_g = (I - I_g) R_s$ $\therefore R_S = \frac{I_g R_g}{I - I_g}$	By joining a high R (multiplier) (to produce the almost voltage drop between its two ends.) Or to divide v "V" can be determined by: $R_m = \frac{V - V_g}{I_g}$ $V = V_g + V_m$ $V - V_g = V_m$ $V - V_g = I_g R_m$ $Rm = \frac{V - V_g}{I_g}$ $Rm = \frac{V - I_g R_g}{I_g}$ OR: $V_T = I_T \times R_T$

Multirange device



unknown I Or v value = $\frac{point\ er\ reading(4)}{full\ \ scale\ reading(20)}$ × switch indication = 0.02 A or volt

We can use a single device in measuring several maximum readings.