METER BRIDGE - COMBINATION OF RESISTANCES

Aim: To verify the laws of combination of resistances in series and using meter bridge.

Apparatus: Meter Bridge, battery, two resistor, plug key, resistance box, galvanometer and jockey.

Principle:

The series or parallel combinations of two resistors are connected in the left gap of Meter Bridge R. A standard resistance S is connected in the right gap of the meter bridge. When the bridge is balanced the current through the galvanometer is zero, (the jockey is at the point C). The balancing condition is,

$$\frac{\text{Effective resistance of combination } (\boldsymbol{R_S \text{ or } R_P})}{S} = \frac{Reisitance\ of\ the\ wire\ AC}{Resistance\ of\ the\ wire\ BC} = \frac{l}{100-l},$$

($\because$ R $\boldsymbol{\alpha}$ l)

The effective resistance of combination is given by

$$R_S \ or \ R_P = S\left(\frac{l}{100-l}\right)$$

Formula:

Resistance

$$R = \frac{Sl}{100 - l}\ \Omega$$

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Equivalent resistance in series, $R_s = R_1 + R_2\ \Omega$

Where:

S – Standard resistance.

l – Balancing length.

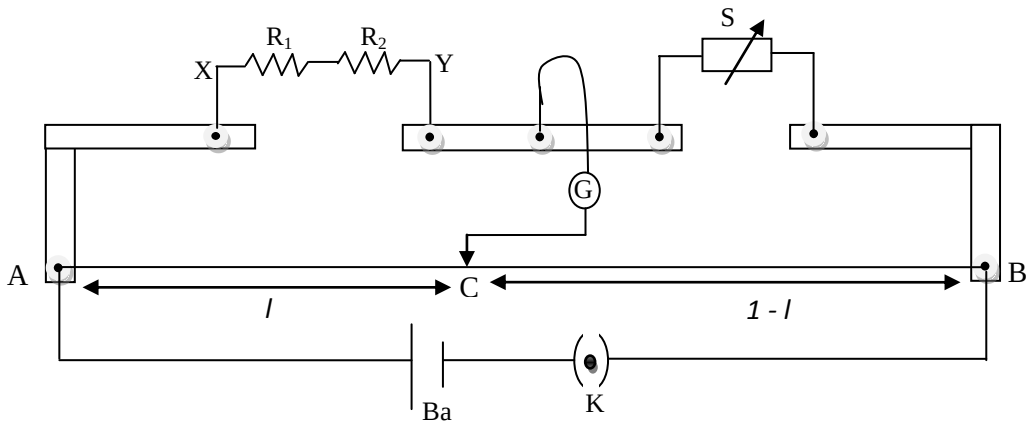
R_1 and R_2 – Individual resistances.

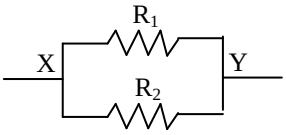
Procedure:

1. The connections are made as shown in the circuit diagram. i.e, the two resistors are connected in series
2. A suitable resistance S is unplugged in the standard resistance box.
3. The circuit is checked for opposite deflections by placing jockey at the two ends of the meter bridge wire AB alternately.
4. The jockey is moved on the wire from the end A towards B till the galvanometer shows zero deflection.
5. The balancing length l is measured. The equivalent resistance of the series combination is calculated using the formula $R_S = \frac{Sl}{100-l}$.
6. The experiment is repeated for different values of S and average value of R_s is found. The theoretical value of equivalent resistance is calculated using the formula $R_s = R_1 + R_2$.
7. Now the two resistors are connected in parallel on the left gap of Meter Bridge.

8. The jockey is moved on the wire and hence balancing length l is measured. The equivalent resistance of the parallel combination is calculated using the formula $R_s = \frac{Sl}{100-l}$.

Circuit Diagram:





Where:

R_1 and R_2 - given resistors, S – Standard resistance box, G – Galvanometer , Ba – Battery , K – plug key,

AB – Meter Bridge wire, AC – Balancing length.

Observations:

1. Resistance of given resistor, R_1 = ……Ω
2. Resistance of given resistor, R_2 = ……Ω

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To verify the laws of combination of resistance in series:

S.No	Resistance S in Ω	Balancing length l in m	$R_s = \frac{S\,l}{100-l}$ in Ω
1			
2			
3			

Mean R_S= ……..Ω

Calculations:

Theoretical, $Rs = R_1 + R_2$

Result:

Theoretical value of resistances in series, R_s = ….Ω

Experimental value of resistances in series, R_s = ….Ω

Experimental values are in good agreement with theoretical values, thus the laws of combination of resistances in series are verified.

PRECAUTIONS:

1. The connections should be neat, clean and tight.
2. All the plugs in the resistance box should be tight.
3. Move the jockey gently over the bridge wire and do not rub it.
4. The plug in key K should be inserted only when the observation to be taken.

Source of error:

1. Connections may be loose.
2. The wire may not have uniform thickness.