METRIC BRIDGE

General Physics Laboratory (PHY119) Fall 2014

1 Introduction

The resistance of a conductor depends on its length, cross sectional area, and the surrounding temperature. For a conductor with constant cross section kept at room temperature, the resistance is proportional to the length only. In this experiment, we will make use of this proportionality between the resistance and length, to find the value of an unknown resistor.

2 Objective

1. Determination of an unknown resistance using meter bridge.

3 Theory

The meter bridge is the simplest form of Wheatstone bridge. The construction of the meter bridge is shown in Figure 1.

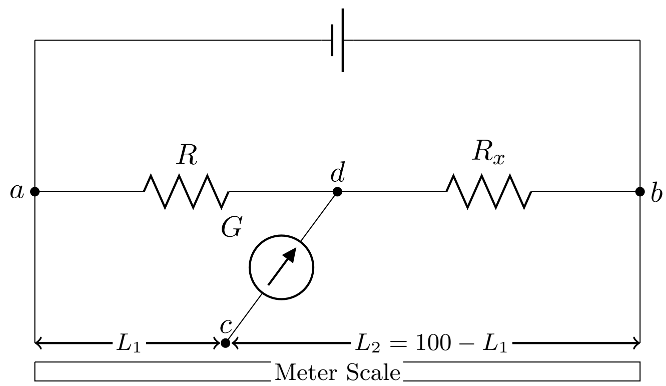

Figure 1: Schematic diagram for meter bridge

It consists of a one meter conducting wire fixed on a meter scale. This wire is connected with two resistors, R and R_x. The resistance of R is known while the resistance of R_x is to be determined. A galvanometer is connected with the help of a jockey across cd and a voltage source is connected across ab.

If the jockey is moved along the wire until it reaches to a point where the galvanometer reads no current (null point), the voltages at point c and d are equal. This implies that the potential difference across the resistor R and the segment of length L_1 is equal. Similarly, the potential difference across the resistor R_x and the segment of length L_2 is equal. If we denote the resistance of the line segments as R_{L1} and R_{L2} respectively, then with the help of Ohm's law we can write,

$$iR = IR_{L1} \tag{1}$$

$$iR_x = IR_{L2} \tag{2}$$

where i is the current through resistors R_x and R, and I is the current through the wire.

If we divide equation 2 in equation 1, we get,

$$\frac{R_x}{R} = \frac{R_{L2}}{R_{L1}} \tag{3}$$

If the wire is assumed to have a uniform cross section, and also assumed to be at the same temperature through out the process, then the length is the only variable affecting the resistance. Therefore, for the wire segment, the ratio of the resistance could be replaced by the ratio of lengths. This is expressed as,

$$\frac{R_x}{R} = \frac{L_2}{L_1} \tag{4}$$

From this equation, we could find the resistance of the unknown resistor R_x.

$$R_x = R\frac{L_2}{L_1} \tag{5}$$

4 Equipment

Metric Bridge – Power Supply (cell) – Unknown Resistor – Galvanometer – 3 Resistors – Connecting Wires – Pencil Jockey.

5 Procedure

1. Connect the apparatus as shown in the figure 1.
2. Choose a value for the variable resistance from the three resistors (100 Ω, 220 Ω , 470 Ω).
3. Adjust the value of the power supply voltage to a value less than 5 Volt .
4. Move the jockey on the wire until you reach the null point in the galvanometer. (Note: don't slide the jockey continuously over the wire).
5. Take the reading of L_1 on the null point.
6. Record your measurements in the following table,

R (Ω)	L_1 (m)	L_2(m)	L_1/L_2

7. Repeat the steps (2 to 6) for different values of resistors .

8. Plot a graph between R and L_1/L_2 .

9. Calculate the slope and find the unknown resistance.

10. Find percentage error.

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