Experiment No.2

Ohm's Law

1. Introduction

1.1 Objective:

This experiment aims to learn how o investigate Ohm's Law

1.2 Components:

- DC power supply.
- Electrical and electronic system trainer.
- Connecting wire.
- Multimeter.

1.3 Theory

In Fig.(1), the tungsten filament of the light bulb offers a considerable amount of opposition, or what is called ELECTRICAL RESISTANCE, to the passage of electric current through it. Because of the high resistance of the filament, the battery voltage V must be relatively high to produce the amount of current (I) required to heat the filament to incandescence.

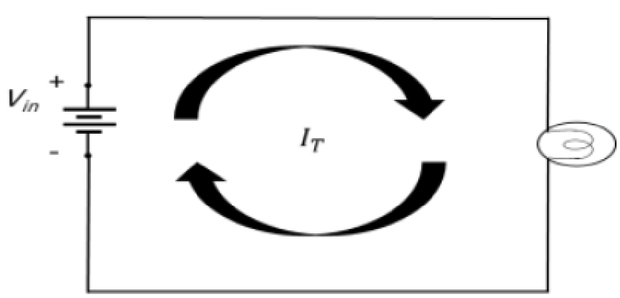

Figure 1

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R denotes the amount of electrical resistance, and in electrical diagrams, the presence of resistance is represented by the symbol. Using this symbol, we have redrawn Fig.(1) as Fig.(2), in which R denotes the "electrical resistance" of the tungsten filament in the light bulb.

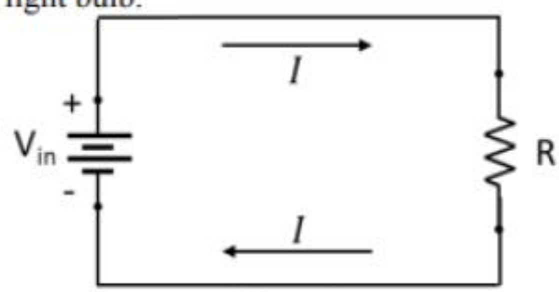

Figure 2

We have already learned that substances that offer little resistance to the passage of current is called "conductors," while those that offer great resistance are called "insulators."
The first comprehensive investigation into the nature and measurement of electrical resistance was made by the German physicist Ohm (as in "home") around the year 1826. After a lengthy series of experiments, Ohm was able to report that

"The current in a conductor is directly proportional to the potential difference between the terminals of the conductor and inversely proportional to the resistance of the conductor"

The above constitutes are called OHM'S LAW. If we let

V = potential difference (emf) applied to the conductor,
I = current in the conductor,
R = resistance of the conductor

Therefore, if we express V in volts, I in amperes, and R in ohms, then the basic OHM'S LAW is R I V = The relationship between V & I can be represented in Fig.(3).

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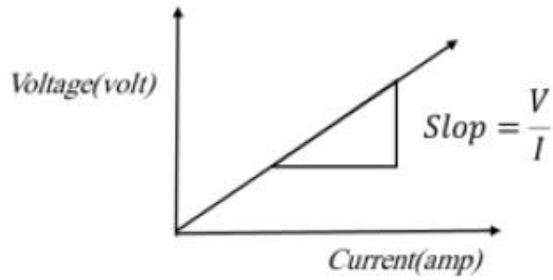

Figure 3

There are, of course, many grades of conductors (and insulators). Take, for example, two metals such as copper and tungsten. Both are classified as "conductors," but a copper wire is a better conductor than a tungsten wire of the same length and diameter; Conductor: A material, which gives up free electrons early and offers little opposition to current flow and the unit of conductance, is (siemens). The inverse of resistance called conductance (G) where:

$$G= \frac{1}{R}$$

2. Experiment procedure:

1. Connect the circuit as shown in Fig. 4

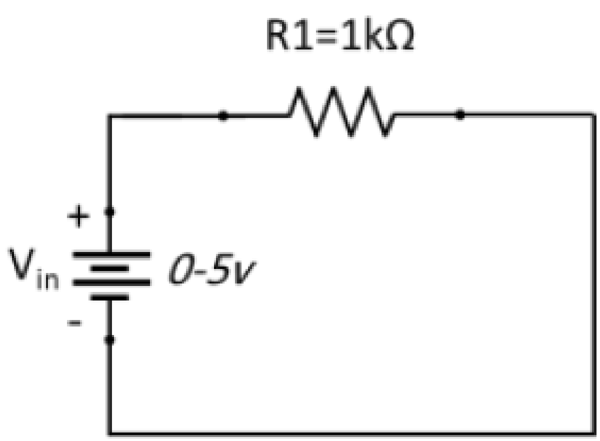

Figure 4

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2. Increase the DC voltage from zero in steps of 1 V up to 5 V, and record the voltage across the variable resistor R_1 =1 kΩ.
3. Tabulate your results in a table as shown in Table (1).

Table (1)

Input voltage (Volt)	Measured Current (mA)	Calculated Current (mA)
1		
2		
3		
4		
5		

4. Fix the input DC voltage to 2V, and change the variable resistor R1 from 1kΩ up to 5kΩ according to Table (2), and measure the current in each step.
5. Tabulate your results in a table as shown in Table (2).

Table (2)

Resistor (kΩ)	Measured Current (mA)	Calculated Current (mA)
1		
2		
3		
4		
5		

3. Discussion:

1. Draw the relationship between V & I from the table in step 3.
2. Draw the relationship between R & I from the table in step 5.

3. What are the reasons behind the difference between the measured and calculated values of current in Tables 1 and 2?
4. Is it necessary that the relationship between V & I start with the original point (0, 0), and why?
5. For the table in step 5, find G in each step.
6. What do the slopes represent in V & I relationship?
7. Why should the graphic be a straight line in step (3)?

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