Dhaka International University

Department of Computer Science and Engineering

PHY-104: Electricity and Magnetism Lab

Experiment 2

Identification of Resistor Color Codes and Verification of Ohm's Law

---

OBJECTIVES

1) To determine the value of a selection of resistors using three different methods:
   a) Using the color codes.
   b) Using the digital Ohmmeter.
   c) Using Ohm's Law.
2) Verification of Ohm's law

THEORY

Many electrical circuits contain multiple variations of resistor networks. Resistors play a vital role in the distribution and limiting of electric current in a circuit. Students must learn to identify and measure the values of these components to effectively design and troubleshoot electrical and electronic circuits. Each resistor has three to five colored bands on them that represent different values. Reading and decoding these bands allow you to determine a resistor's value and accuracy. As shown in the following diagrams figure (1), there are 5-band resistors and 4-band resistors. Form both 5- and 4-band resistors, the last band indicates tolerance. The tolerance is a percentage that determines the expected range of resistance values based on the marked value.

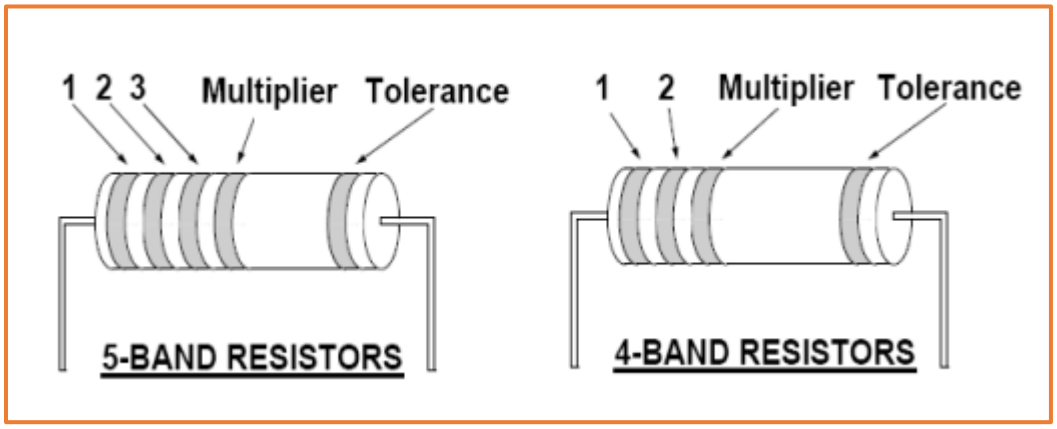


Figure 1: 5-Band and 4-Band resistors.

The first method for read resistor colors in Fig. (2).

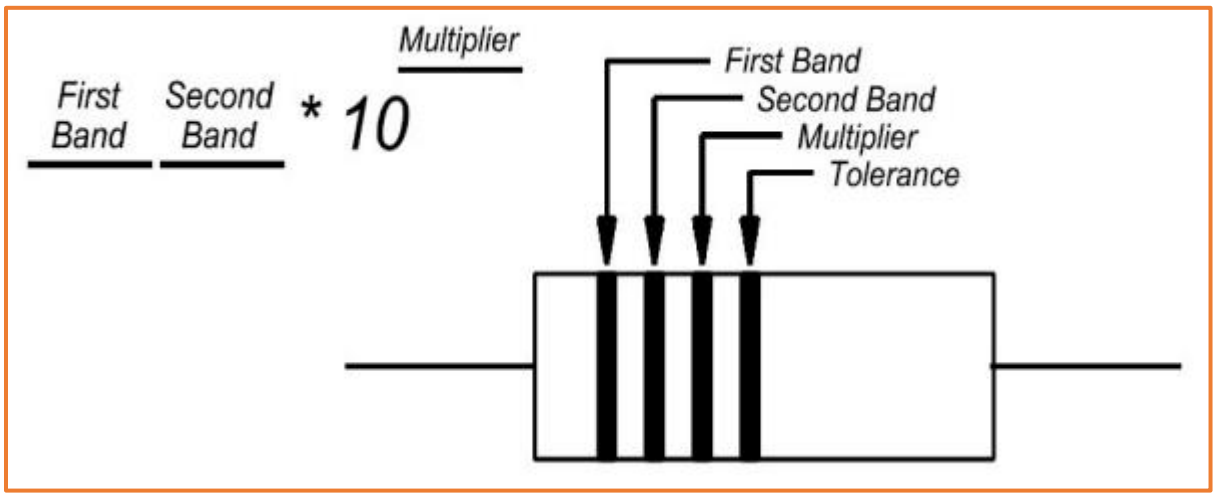
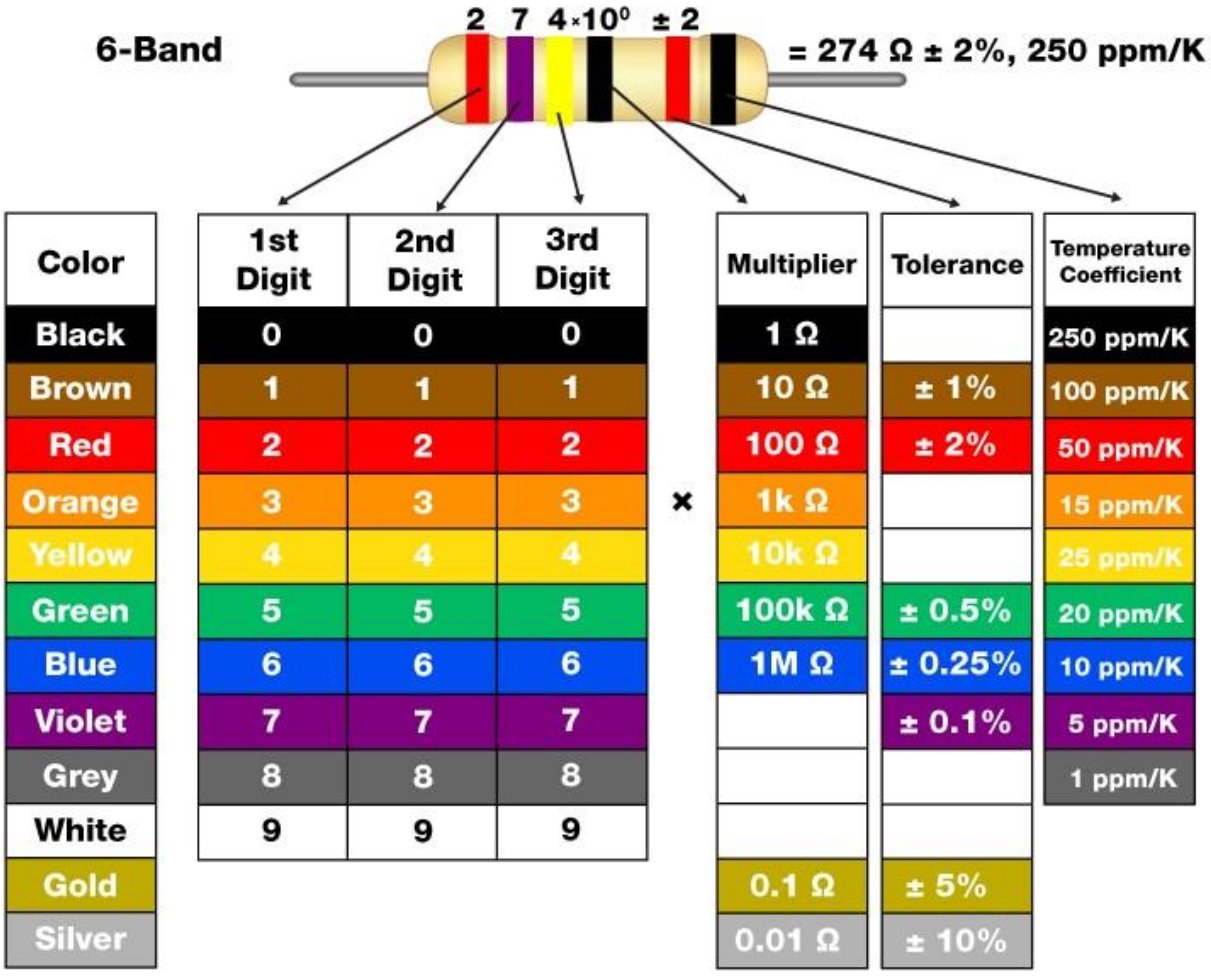


Figure 2: Method to read resistor using color code.

How to Read Resistor Color Codes



Ohm's Law deals with the relationship between voltage and current in an ideal conductor. This relationship states that: The potential difference (voltage) across an ideal conductor is proportional to the current through it. The constant of proportionality is called the "resistance", R. If the current through a conductor is 'I' and the potential difference between two endpoints of that conductor (also known as voltage) is 'V,' then according to Ohm's law:

$$V \propto I$$

$$Or, \qquad \frac{V}{I} = Constant = R$$

$$Or, \qquad V = IR$$

Where V is the potential difference between two points which include a resistance R. I is the current flowing through the resistance.

Or

Ohm’s law states that the current through a conductor between two points is directly proportional to the voltage across the two points, and inversely proportional to the resistance between them. V, I, and R, the parameters of Ohm's law.

$$I = \frac{V}{R}$$

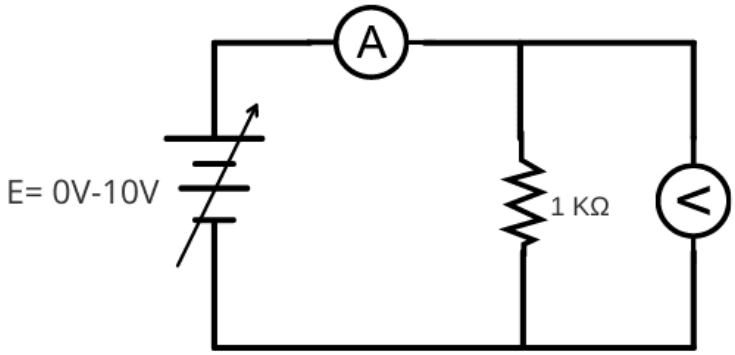
Ohm's law is among the most fundamental relationships in electrical engineering. It relates the current, voltage, and resistance for a circuit element so that if we know two of the three quantities, we can determine the third. Thus, if we measure the current flowing in a resistor of known value, we can deduce the voltage across the resistance according to V = IR. Similarly, if we measure the voltage across a resistor and the current through it, we calculate the resistance of the element to be R = V/I. Not only does this reduce the number of measurements that must be made, it also provides a way to check the results of several different measurement methods.

LIST OF COMPONENTS

Here is a list of ingredients used in this experiment.

1. Variable dc power supply
2. Resistor
3. Jumper wire
4. Breadboard
5. Ammeter
6. Voltmeter
7. Calculator

CIRCUIT DIAGRAM



PROCEDURE

1. Implement the circuit on the breadboard as shown in circuit diagram.
2. Initially set the VDC supply to 0 V and note the current on ammeter.
3. Increase the voltage to 1 V, observe the ammeter and note the readings.
4. Repeat the above step for 2 V, 3V … 10 V.
5. Plot a graph for measured readings.
6. Compare the plot with theoretical calculations.

RESULT

Table 1: Calculation of resistance using color code and multi-meter.

S. No.	I Band	II Band	III Band	IV Band	V Band	Value of Resistance (Ω)	Resistance Measured with Multi-meter (Ω)
1.							
2.							
3.							
4.							

Table 2: Different readings of voltmeter and ammeter.

SI. No	Voltage(V)	Current(A)
1.		
2.		
3.		
4.		
5.		
6.		
7.		

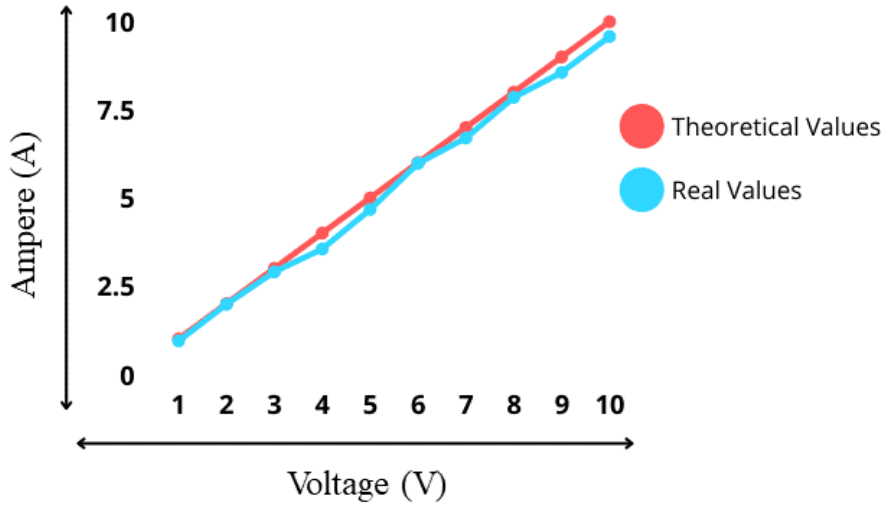


Figure 3: The current vs voltage characteristics.

The resistance of a given conductor will be R= 1/ slope

CONCLUSION

By investigating the observation table, it is proved that the ratio of potential difference and current is constant. Thus, potential difference at the ends of the conductor is directly proportional to the current flowing through it. Thus, ohm's law is verified by this experiment.

PRECAUTIONS

1) All the connection should be tight.
2) Ammeter is always connected in series in the circuit while voltmeter is parallel to the conductor.
3) The electrical current should not flow the circuit for long time, otherwise its temperature will increase and the result will be affected.
4) Maximum reading of voltmeter should be greater than the electromotive force of the cell.
5) It should be care that the values of the components of the circuit is does not exceed to their ratings (maximum value).
6) Before the circuit connection it should be check out working condition of all the components.