

AMERICAN INTERNATIONAL UNIVERSITY-BANGLADESH

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Assignment Title: Familiarizing with the basic DC circuit terms & concepts: Introduction to laboratory equipment.

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Course Teacher: BISHWAJIT BANIK PATHIK

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Use both sides of
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Not all the points were written.

Marks Obtained

Total Marks

8	✓
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20/06/2022

Abstract

The experiment was conducted to investigate familiarizing with the basic DC circuit terms and concepts: Introduction to laboratory equipment. The objectives of this experiment are to design an electrical circuit with relevant parameters and sources, to set up the circuit with appropriate connection sources and instruments, to compare the measured value with the theoretical estimated value, to find the reason for the error in the result, and to draw a conclusion on how to overcome. In this experiment, the basic equipment like trainer board, voltmeter, ammeter, AVO meter or multimeter, DC sources, resistor etc. was observed and their operation was studied. By observing and verifying DC terms and circuits using specific theory, we learn how to measure voltages and currents using multimeter.

Theory

Ohm's Law: It is important to know that Ohm's Law deals with the relationship between voltage and current in a electrically ideal conductor. The relationship is as follows:

At fixed temperature in an electrical circuit, the current passing through a

conductor between two points is proportional to the potential difference (i.e. voltage drop or voltage) across the two points, and inversely proportional to the resistance between them. In mathematical terms, this is written as:

$$V = IR$$

In this equation, I represents the current in amperes (A), V represents the potential difference in volts (V) and R represents the resistance (Ω) which is a constant here. Potential difference is also called the voltage drop, sometimes denoted by E or U.

Current: The current (measured in amperes) is defined as the amount of electric charge flowing through a surface over time. If Q is the amount of charge that passed through the surface in the time T, then the average current I is,

$$I = \frac{Q}{T}$$

Voltage: In an electrical or electronics circuit, voltage is the difference in electrical potential between two points, measured in volts. It represents the

potential energy of an electric field that could cause an electric current to flow in a conductor. It can be classified as extra low voltage, low voltage high voltage, or extra high voltage based on the difference of electrical potential.

Voltmeter: The voltmeter measures the potential difference between two points on an electronic component. A voltage meter consists of two leads connected between the two points.

Ammeter: Ammeter measures current levels by measuring the flow of charge through it. Since ammeter measure the flow of charge, the meter must be connected to the network so that the charge flows through it.

Wattmeter: The wattmeters measures the power delivered by a source and to a dissipative element

Circuit Breaker and Fuse: Circuit breaker as an automatically operated electrical switch that is designed to protect an electrical circuit from damage caused by an excess amount of current due to

over load or short circuit. Fuse is an electrical device that removes electrical current from an electrical circuit when the current in the electrical circuit is too high.

Resistance color coding: Resistor are usually very tiny, and it is challenging to print resistance values on them. So, color bands are printed on them to represent the electrical resistance. These color bands are known as resistor color codes. They are given by several bands and together they specify the resistance value, the tolerance rate and sometimes the reliability or failure rates. The first two band indicates the resistance value and the third band serves as a multiplier.

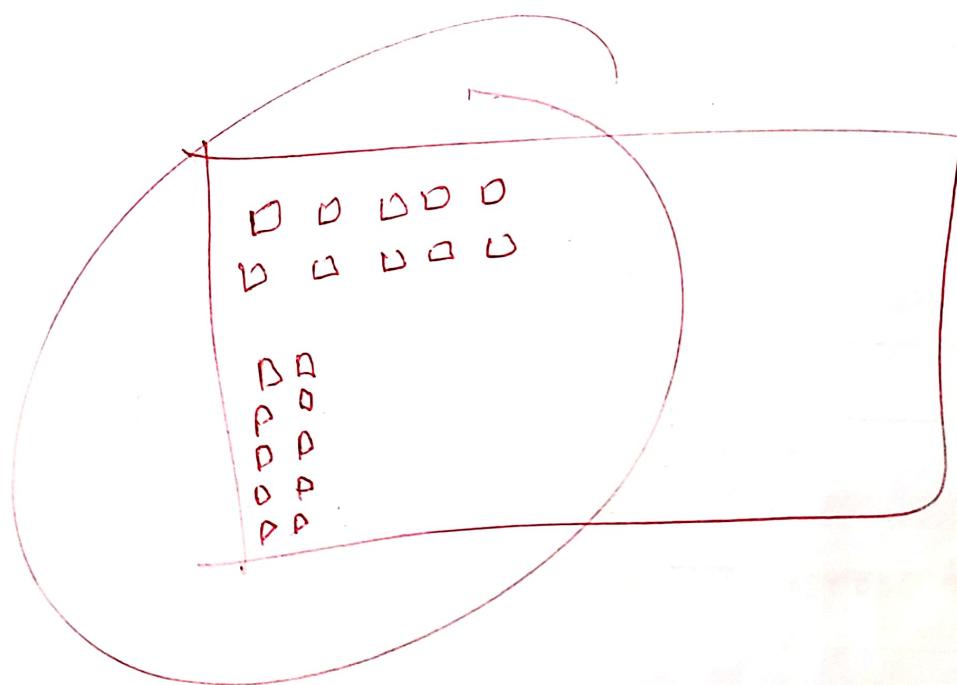
Table-1: Resistor color Table

Color	1 st dig(X)	2 nd dig(Y)	Mult	Tolerance
Black	0	0	$X Y.0 \text{ ohm}$	
Brown	1	1	$X Y0 \text{ ohm}$	
Red	2	2	$X.Y \text{ kohm}$	
Orange	3	3	$X Y \text{ kohm}$	
Yellow	4	4	$X.Y0 \text{ K.ohm}$	
Green	5	5	$X.Y \text{ Mohm}$	
Blue	6	6	$X Y \text{ Mohm}$	
Violet	7	7	$X Y0 \text{ Mohm}$	
Gray	8	8	$X.Y \text{ G ohm}$	
white	9	9	$X Y \text{ G ohm}$	
Gold			$X.Y \text{ ohm}$	5%
Silver			$0.XY \text{ ohm}$	10%
None				20%

Multimeter: A multimeter is a device used to measure voltage, resistance and current in electronics and electrical component.

Breadboard: A breadboard is a reuseable solderless device that is used for prototyping electronic circuits and experimenting with circuits layouts.

Electrical power supply: Power supply is a device or system that supplies electrical or other types of energy.



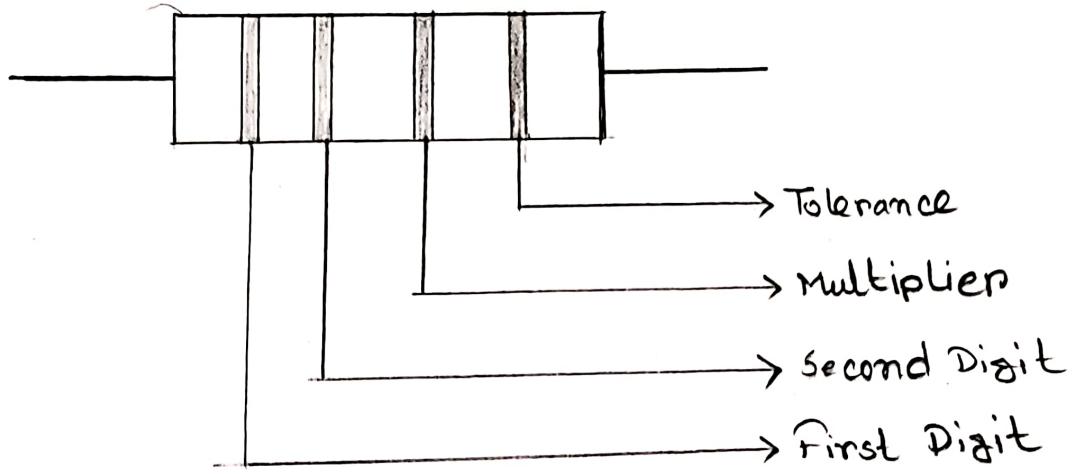


Figure-1: Resistor

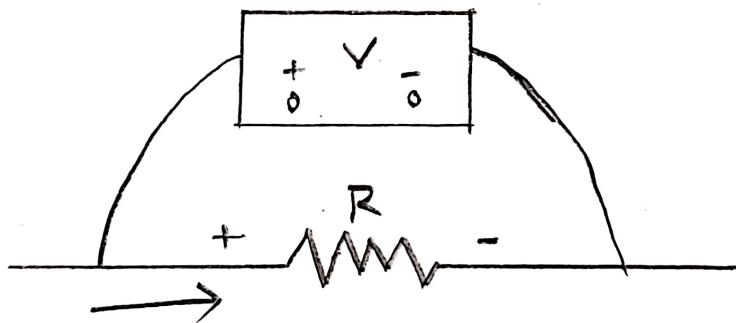


Figure-2: Voltage measurement across two point of resistor

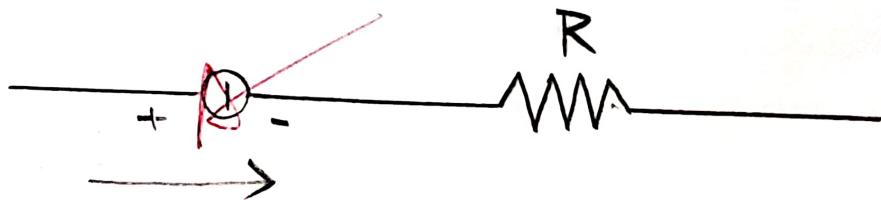


Figure-3: Demonstrate of measuring current using an ammeter

List of Equipment

1. Trainer Board.
2. Voltmeter.
3. Ammeter.
4. AVO meter or Multi meter.
5. DC source.
6. Resistor.

Experimental Data

Table-2: Resistor's resistance value by color code and ohm meter

Resistor	ID Number	Colours	Resistance by color code	Resistance by ohm meter
R ₁	22-46013-1	orange, orange red, gold	$33 \times 10^2 \pm 5\%$	3.2 k Ω
R ₂	22-47048-1	orange, white, red, gold	$39 \times 10^2 \pm 5\%$	3.9 k Ω
R ₃	22-47000-1	Brown, Black, red, gold	$10 \times 10^2 \pm 5\%$	1.0 k Ω
R ₄	22-47045-1	brown, green, red, gold	$15 \times 10^2 \pm 5\%$	1.5 k Ω
R ₅	22-46024-1	yellow, violet, red, gold	$47 \times 10^2 \pm 5\%$	4.6 k Ω

Reports

1. Show the difference between your theoretical value and Multimeter value.

Ans:

Theoretical value:

$$R_1 = 33 \times 10^2 \pm 5\%$$

$$R_2 = 39 \times 10^2 \pm 5\%$$

$$R_3 = 10 \times 10^2 \pm 5\%$$

$$R_4 = 15 \times 10^2 \pm 5\%$$

$$R_5 = 47 \times 10^2 \pm 5\%$$

Multimeter value:

$$R_1 = 3.2 \text{ k}\Omega$$

$$R_2 = 3.9 \text{ k}\Omega$$

$$R_3 = 1.0 \text{ k}\Omega$$

$$R_4 = 1.5 \text{ k}\Omega$$

$$R_5 = 4.6 \text{ k}\Omega$$

2. Do you have any difference in those values?

If you have, then explain the reason.

Ans: Yes, I have. Due to resistance has a tolerance and taking smaller value.

3. Why an ammeter can be damaged if it is connected in parallel to the load resistor?

Ans: The tolerance of an ammeter is almost zero. If it is connected in parallel, the ammeter can be damaged by huge currents entering it.

Discussion

1. The trainer board and multimeter was checked before the start of the experiment.
2. Resistor value was taken carefully according to resistor color table
3. Resistor value was also measure by ohmmeter carefully.
4. Finally all the data was placed in the data table.

Conclusion

In this experiment, the basic idea of DC terms and circuit was checked with specific theory and we learned how to measure voltage and current using multimeters. So, the experiment was successful.

Reference

- [1] <https://byjus.com/physics/resistor-color-codes/>
- [2] Robert L. Boylestad, "Introductory Circuit Analysis", Pearson, Eleventh Edition, pp# 101-126, ISBN: 0-13-173044-4
- [3] Introduction to Electrical Circuits Laboratory, Experiment 1 Lab Manual.