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Monday, 21 February 2022 10:46 PM

North South University

ECE

Lab Report-1

Experiment No: 1&2
Experiment Title: Verification of Ohm's Law & Series Circuit

Course Code: EEE141L
Course Name: Electrical Circuit Lab

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E-1

Objective: The objective is to verify ohm's law using both math and a Multimeter. keeping in mind How to varify and masure resistors.

Component list:

- Trainer board
- Resistors (3.3 KΩ, 5.6 KΩ)
- Digital Multimeter (DMM)
- connecting wire
- Multisim

Circuit diagram:

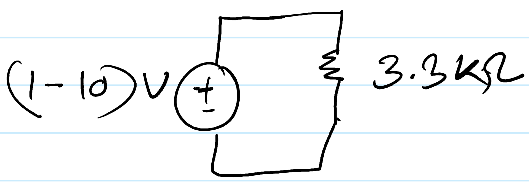


Fig: circuit : 1

Table-1

Resistance using color				Resistence + tol	Resistence using DMM	% Error
Band 1	Band-2	Band-3	Band-4			
Orange	Orange	Red	Gold	3.3 ± 5%	3.3k	0%
Green	Blue	Red	Gold	5.6 + 5%	5.6k	0%

Table-2

3.3kΩ	Experimental		Reading
voltage	Current I 10^{-4}	voltage IR V	Power I^2R mW
2	6	2	1.21
4	12	4	4.85
6	18	6	10.9
8	2.4	8	19.4
10	3	10	30.303

Table-3

5.6kΩ	Experimental		Reading
voltage	Current I 10^{-4}	voltage IR V	Power I^2R mW
2	3.5	2	0.71
4	7.1	4	2.85
6	10	6	6.43
8	14	8	11.43
10	1.7	10	17.86

Question/Answer:

1

State ohm's law:

Current through a conductor between two points is directly proportional to the voltage across the two points

$$I \propto V$$

which with a constant Resistance yeilds

$$V = RI$$

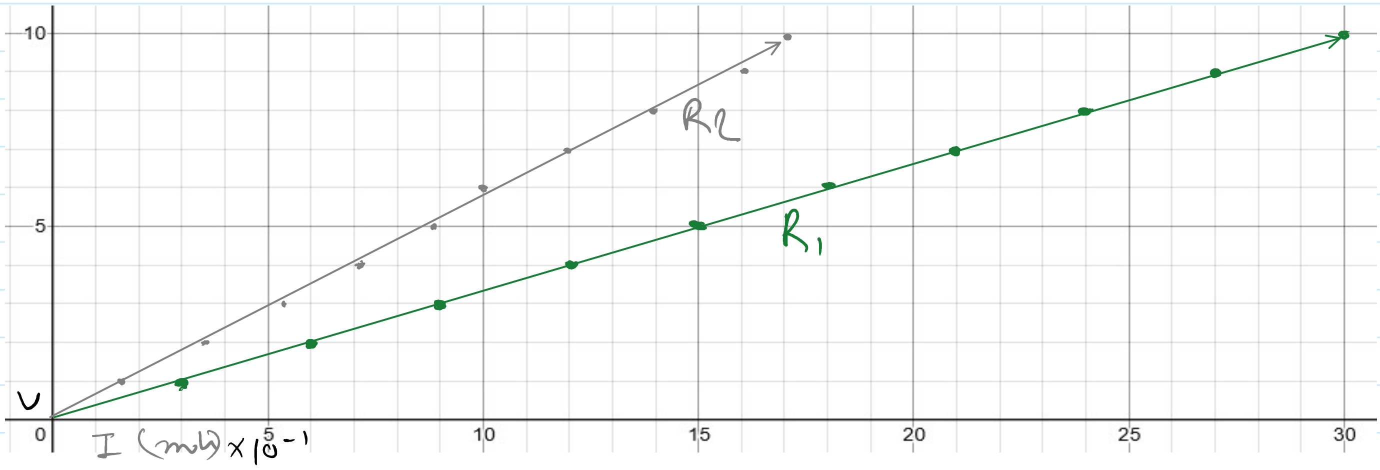
(2)

Ploting V vs I graph for each resistor value in graph

As we getting Data form mullisim we get the value form multi-meter and ploating the value on graph

V	$I_{3.3}(10^{-4})$	$I_{5.6}(10^{-4})$
1	3	1.7
2	6	3.5
3	9	5.3
4	12	7.1
5	15	8.9
6	18	10
7	21	12
[illegible]	[illegible]	[illegible]

6	18	[illegible]
7	21	12
8	24	14
9	27	16
10	30	17



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given variable voltage V {1-10}, while

R = {3.3 kΩ, 5.6 kΩ}

As we know,

$$V = IR$$

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

V	$I = \frac{V}{R_1}$ (10^{-9}) $R_1 = 3.3k\Omega$	$I = \frac{V}{R_2}$ (10^{-9}) $R_2 = 5.6k\Omega$
1	3	1.7
2	6	3.5
3	9	5.3
4	12	7.1

3	9	5.3
4	12	7.1
5	15	8.9
6	18	10
7	21	12
8	24	14
9	27	16
10	30	17

This graph is indentical to (ex-2) making it so that mutimeter form multiom is same Ohom law.

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we know that

$$\text{slope}(m) = \frac{\text{Rise}}{\text{Run}}$$

Here we get

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

form graph in mutlimeter

	mutimeter		ohoms law	
	R (kΩ)	R′ (kΩ)	$\bar{R}$ (kΩ)	$\bar{R}'$ (kΩ)
1	3.3	5.6	3.3	5.6
2	3.3	5.6	3.3	5.6
3	3.3	5.6	3.3	5.6
4	3.3	5.6	3.3	5.6
5	3.3	5.6	3.3	5.6
6	3.3	5.6	3.3	5.6
7	3.3	5.6	3.3	5.6

6	3.3	5.6	3.3	5.6
7	3.3	5.6	3.3	5.6
8	3.3	5.6	3.3	5.6
9	3.3	5.6	3.3	5.6
10	3.3	5.6	3.3	5.6

$\Sigma R = 33$ $\Sigma R' = 56$ $\Sigma R = 3.3$ $\Sigma R' = 5.6$

multimeter mean

$$M_R = \frac{\sum^N R}{N} = \frac{33}{10} = 3.3$$

$$M_{R'} = \frac{\sum^N R}{N} = \frac{56}{10} = 5.6$$

ohom meter:

$$M_{\bar{R}} = \frac{\sum^N \bar{R}}{N} = \frac{33}{10} = 3.3$$

$$M_{\bar{R}'} = \frac{\sum^N \bar{R}}{N} = \frac{56}{10} = 5.6$$

difference $R_{3.3} = (M_R - M_{\bar{R}}) = \frac{(3.3 - 3.3)}{10} \%$
$= 0\%$

diffenee $\bar{R}_{5.6} = (M_{R'} - M_{\bar{R}'}) = (5.6 - 5.6)\%$
$= 0\%$

So there is no differnce between as they identical

Discussion:

Both mutlsim and ohoms law had same result as its doesn't have flaws which is present in real world which could be coming form tollerene equipment in accurey and also form lose connection. But it help creating proof and vaidation of ohoms law.

E-2

Objective:

- learn How to connect a serise circuit a breadboard

- validate the voltage divider rules
- verify Kirchhoff's voltage law

Component list:

- Trainer board
- Resistors (3.3KΩ, 4.7KΩ, 5.6KΩ)
- Digital Multimeter (DMM)
- Connecting wire

Circuit Diagram:

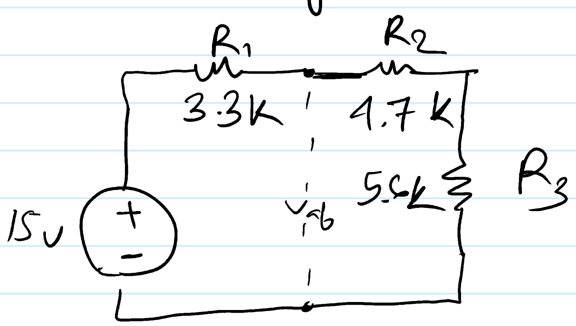

Fig: circuit

Table-1

Resistance using colour coding					Resistance of DMM	%Error
Band-1	Band-2	Band-3	Band-4	Resistance ± tol		
orange	orange	Red	Gold	3.3 ±5%	3.3	0
Yellow	Violet	Red	Gold	4.7 ±5%	4.7	0
Green	Blue	Red	Gold	5.6 ±5%	5.6	0

Table-2

Experimental readings				Theoretical values			
V_S	V_{R_1}	V_{R_2}	V_{R_3}	V_S	V_{R_1}	V_{R_2}	V_{R_3}
15	3.640	5.184	6.176	3.640		5.184	6.176
% Error							
V_S		V_{R_1}		V_{R_2}		V_{R_3}	
15		0		0		0	

Table-3

Potential rise	Potential drop $(V_{R_1}+V_{R_2}+V_{R_3})$	Are voltage rises and drops equal
15 V	(3.64 + 5.184 + 6.176) = 15 V	yes

Table-4

Experimental reading		Theoretical values	
Vab	Req	Vab	Req
11.36V	13.6Ω	11.36V	13.6Ω
% Error			
Vab		Req	
0		0	

Question/Answer:

1

Voltage division Rule:

When in a series circuit is connected

the current remain the same but voltage is devided by by the multitude of each Resistors

Voltage of curcuit

magnatude of X Resistor

$$V_X = \frac{E R_X}{R_T}$$

voltage of X Resistor

Total Resitor of curcuit

2

Table-2

Expermental reeding:

R_S (total Resistence) $= R_1 + R_2 + R_3$

$= 3.3 + 4.7 + 5.6$

$= 13.6\ \Omega$

$V_S = I_S R_S$

$I_S = \frac{V}{R_S} = \frac{15}{13.6} = 1.103\ A$

$V_{R_1} = I_S R_1 = 3.640\ V$

$V_{R_2} = I_S R_2 = 5.184\ V$

$V_{R_3} = I_S R_3 = 6.176\ V$

Theoratical value:

$$R_S' \text{ (total Resistence)} = R_1 + R_2 + R_3$$
$$= 3.3 + 4.7 + 5.6$$
$$= 13.6\,\Omega$$

$$V_S' = I_S' R_S'$$

$$I_S' = \frac{V_S'}{R_S'} = \frac{15}{13.6} = 1.103\,A$$

$$V_{R_1}' = I_S R_1 = 3.640V$$
$$V_{R_2}' = I_S R_2 = 5.184V$$
$$V_{R_3}' = I_S R3 = 6.176V$$

Error:

$$V_S = \frac{(V_S - V_S')}{V_S} \times 100\% = \frac{0}{V_1} \times 100\%$$
$$= 0\%$$

$$V_1 = \frac{(V_1 - V_1')}{V_1} \times 100\% = \frac{0}{V_1} \times 100\%$$
$$= 0\%$$

$$V_2 = \left(\frac{V_2 - V_2'}{V_1}\right) 100\% = \frac{0}{V_2} \times 100\%$$
$$= 0\%$$

$$V_3 = \left(\frac{V_3 - V_3'}{V_3}\right) 100\% = \frac{0}{V_3} \times 100\%$$
$$= 0\%$$

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Theoritical calculation:

$$V_{ab} = V - V_a$$
$$= 15 - I_s R_1$$
$$= 15 - 3.64 = 13.36\,V$$

To measure Theoratical value we use multimiter place between ab and by measuring voltage we get

$$V'_{ab} = 13.36\,V$$

Error:

$$\text{Error} = \frac{\text{Theoratical} - \text{Experiment}}{\text{Theoratial}} \times 100\%$$

$$= \frac{V_{ab} - V'_{ab}}{V_{ab}} \times 100\% = 0\%$$

⑤

R_{eq} by Theoretical value:

$R_{eq} = R_1 + R_2 + R_3 = 3.3 + 4.7 + 5.6 = 13.6\,\Omega$

R_{eq} by Experimental value:

R'_{eq} by measuring via multimeter we get

$R'_{eq} = R_1' + R_2' + R_3' = 3.3 + 4.7 + 5.6 = 13.6\,\Omega$

Discussion: