Current, Voltage, Power & Resistance with Resistors in Parallel Circuits (Lab 7)

Incorporating all Electrical Elements

Leonardo Fusser, 1946995

Experiment Performed on **16 October 2019**
Report Submitted on **21 October 2019**

Department of Computer Engineering Technology
Circuit Analysis & Simulation I
Mohamed Tavakoli

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1.0 PURPOSE

- Measuring wattage (power) across resistors.
- Measuring resistance across resistors.
- Measuring voltage across resistors.
- Measuring current through resistors.

2.0 EQUIPMENT NEEDED

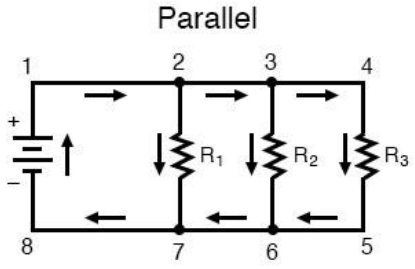
- (1x) desktop Power Supply.
- (1x) desktop Digital Multimeter.
- (3x) 4-band (1/4 watt) resistors.
- (1x) electronics breadboard.

3.0 THEORY

Calculating Power, Resistance, Current & Voltage in Parallel Circuits

- *A **PARALLEL** circuit consists of having two elements sharing two points in common (refer to Document #1).*

(Document #1 – Parallel Circuits)



Formula to calculate total RESISTANCE in ohms (Ω):

$$\frac{1}{R_{EQ}} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + \frac{1}{R_{N...}}$$

Formula to calculate source current in Amperes (A):

$$I_s = \frac{E}{R_{EQ}}$$

Formula to calculate the current through the elements in Amperes (A):

$$I_s = I_1 + I_2 + I_3 + I_{N...}$$

Formula to calculate the voltage across each resistor in Volts (V):
$E = V_1 = V_2 = V_3 = V_{N...}$

Formula to calculate power dissipated by each element in Watts (W):
$[P_1 = V_1I_1]\ [P_2 = V_2I_2]\ [P_3 = V_3I_3]\ [P_N = V_NI_{N...}]$

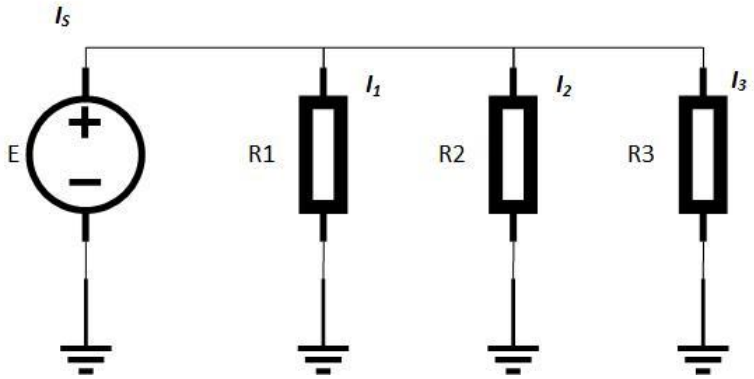
Formula to calculate power delivered by the source in Watts (W):
$P_{del} = EI$

Formula to calculate the total power dissipated by the elements in Watts (W):
$P_{del} = P_1 + P_2 + P_3 + P_{N...}$

4.0 EXPERIEMNTAL RESULTS

Results from the Procedure section:

Fig.2



PROCEDURE:

Step 1: Calculate by color code and Measure the values of the resistors, and copy to Table 1.
Step 2: Calculate voltages of each resistor and copy to Table 1.
Step 3: Calculate the power dissipated in each resistor and write in Table 1.
Step 4: Calculate the current in each resistor and write in Table 1.
Step 5: Build the circuit of Fig.2.
Step 6: Ask your teacher to verify your circuit before you connect power supply.
Step 7: Set the voltage source to 12V and limit the current to 500mA.
Step 8: Measure the current of each resistor and copy to Table 1.
Step 9: Verify the equations (2), (3), (4) and (5).

Table 1		Voltage of Resistors			Current			
Resistor	**Value**	**Calculated**	**Measured**	**%Error**	**Calculated**	**Measured**	**%Error**	**Power**
R1	1KΩ	12V	11.99V	0.08%	12mA	12.10mA	0.8%	144mW
R2	2.2KΩ	12V	11.99V	0.08%	5.45mA	5.40mA	0.9%	65.4mW
R3	3.2KΩ	12V	11.99V	0.08%	3.75mA	3.60mA	4%	45mW

CALCULATIONS:

(%Error Voltage of Resistors)

%Error = $\frac{Measured-Calculated}{Calculated}$ * 100 = $\frac{11.99V-12V}{12V}$ * 100 = **0.08%** *(Same for the others below in the table)*

(Calculated Current)

V = I*R, 12 = I*1KΩ, I = **12mA**
V = I*R, 12 = I*2.2KΩ, I = **5.45mA**
V = I*R, 12 = I*3.2KΩ, I = **3.75mA**

(%Error Current)

%Error = $\frac{Measured-Calculated}{Calculated}$ * 100 = $\frac{12.10mA-12mA}{12mA}$ * 100 = **0.8%**
%Error = $\frac{Measured-Calculated}{Calculated}$ * 100 = $\frac{5.40mA-5.45mA}{5.45mA}$ * 100 = **0.9%**
%Error = $\frac{Measured-Calculated}{Calculated}$ * 100 = $\frac{3.60mA-3.75mA}{3.75mA}$ * 100 = **4%**

(Power)

P = I*V, P = 12mA*12V, P = **144mW**
P = I*V, P = 5.45mA*12V, P = **65.4mW**
P = I*V, P = 3.75mA*12V, P = **45mW**

5.0 Conclusion

- Purpose of this lab has been achieved.
- Understood how to measure power across the 3 resistors and voltage source.
- Understood how to measure resistance across the 3 resistors in the circuit.
- Understood how to measure voltage across the 3 resistors in the circuit.
- Understood how to measure current through the 3 resistors in the circuit.
- Adapted/ learned more advanced functions in lab equipment (PLCs, store function, etc…)