Current, Voltage, Power & Resistance with Resistors in Series Circuits (Lab 6)

Incorporating all Electrical Elements

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1.0 PURPOSE

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

2.0 EQUIPMENT NEEDED

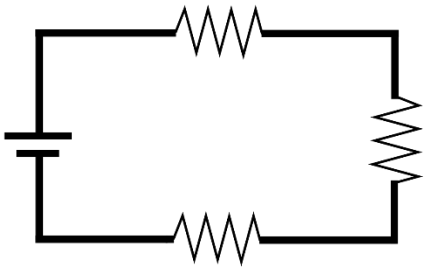
- (1x) desktop Power Supply.
- (1x) desktop Digital Multimeter.
- (3x) 4-band (1/4 watt) resistors.
- (1x) electronics breadboard.

3.0 THEORY

Calculating Power, Resistance, Current & Voltage in Series Circuits

- *A **SERIES** circuit consists of having two elements sharing one point in common. Also, the point in common is not connected to another current-carrying element (refer to Document #1).*

(Document #1 – Series Circuit)



Formula to calculate total RESISTANCE in ohms (Ω):

$R_T = R_1 + R_2 + R_3 + R_{N...}$

Formula to calculate source current in Amperes (A):

$I_s = \frac{E}{R_T}$

Formula to calculate the voltage across each resistor in Volts (V):

$V_1 = IR_1, V_2 = IR_2, V_3 = IR_3, V_N = IR_{N...}$

Formula to calculate power dissipated by each element in Watts (W):
$P_1 = V_1I_1, P_2 = V_2I_2, P_3 = V_3I_3, P_N = V_NI_N$…

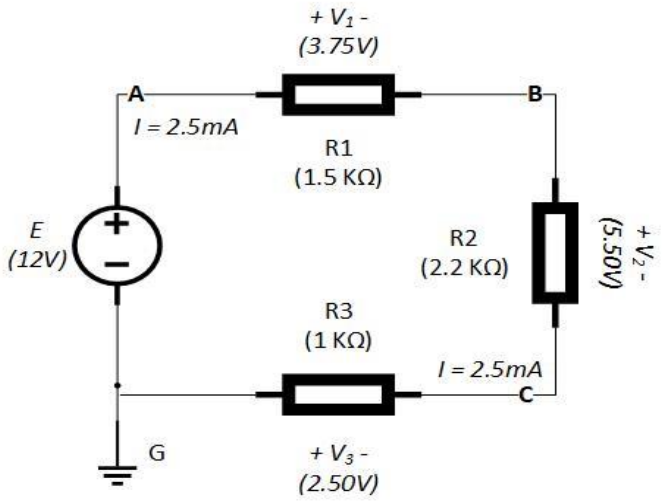
Formula to calculate power delivered by the source in Watts (W):
$P_{del} = EI$

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.1



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 2.
Step 3: Calculate the power dissipated in each resistor and write in Table 2.
Step 4: Calculate the current in each resistor and write in Table 1.
Step 5: Build the circuit of Fig.1.
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 voltages of each resistor and copy to Table 2.
Step 9: Measure the current of each resistor and copy to Table 1.
Step 10: Verify the equations (3), (4) and (5).

Table 1	Resistor			Current		
Resistor	**Color Code Value**	**Measured**	**%Error**	**Calculated**	**Measured**	**%Error**
R1	1.5 KΩ	1.48 KΩ	1.3%	2.5mA	2.5mA	0%
R2	2.2 KΩ	2.2 KΩ	0%	2.5mA	2.5mA	0%
R3	1 KΩ	900 Ω	10%	2.5mA	2.5mA	0%
Total	4.7 KΩ	4.58 KΩ	2.5%	2.5mA	2.5mA	0%

Table 2	Voltage			Power (P = V*I)
Resistor	**Color Code Value**	**Measured**	**%Error**	**Calculated from Measured Value**
R1	3.75V	3.70V	1.3%	P = 3.7 * 2.5 = 9.25mW
R2	5.50V	5.60V	1.8%	P = 5.6 * 2.5 = 14mW
R3	2.50V	2.50V	0%	P = 2.5 * 2.5 = 6.2mW
Total	11.75V	11.80V	0.4%	P = 12 * 2.5 = 30mW

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…)