Lab 9 – Series/Parallel Resistors

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The purpose of this lab is to:

Experiment with series circuits and verify that the simulation, analysis (calculations) and test results all agree.

From the resistor kit select 8 resistors: 2 each 470Ω, 2 each 1kΩ, and 1 each of the following:

2.2kΩ, 3.3kΩ, 4.7kΩ, 10kΩ

Measure and record the value of each resistor. Connect the resistors as shown in Figure 1. Measure and record the total resistance, RT. Then connect the resistors as shown in Figure 2, the 9V come from the Elvis II (Modular Engineering Educational Laboratory Platform). Then measure and record with the Digital Multimeter the current and voltages of the series circuit.



Figure 1

**Series/Parallel Circuit**

Equipment needed:

1 – Digital Multimeter

1 – Elvis II

8 – resistors.

|  |  |  |
| --- | --- | --- |
|  | Expected | Measured |
| R1 = | 470Ω | 462.22Ω |
| R2 = | 470Ω | 456.52Ω |
| R3 = | 1kΩ | 989.8kΩ |
| R4 = | 1kΩ | 986.4kΩ |
| R5 = | 2.2kΩ | 2.153kΩ |
| R6 = | 3.3kΩ | 3.247kΩ |
| R7 = | 4.7kΩ | 4.636kΩ |
| R8 = | 10kΩ | 9.797kΩ |

Expected = value you expect it to be

Measured = using Digital Multimeter

|  |  |  |  |
| --- | --- | --- | --- |
|  | Calculated | Simulated | Measured |
| R34 = | 500Ω | 500Ω | 494.42Ω |
| R567 = | 1.031kΩ | 1.031kΩ | 1.0122kΩ |
| R345678 = | 11.531kΩ | 11.531kΩ | 11.305kΩ |
| R2345678 = | 451.593Ω | 451.593Ω | 438.95kΩ |
| RT = | 921.593Ω | 921.593Ω | 901.6Ω |

Calculated = using Excel calculations

Simulated = Multisim simulation

Measured = using Digital Multimeter



Figure 2

**Series/Parallel Circuit**

|  |  |  |  |
| --- | --- | --- | --- |
|  | Calculated | Simulated | Measured |
| V1 = | 9V | 9V | 9.028V |
| IT = | 9.766mA | 9.766mA | 9.887mA |
| VA = | 4.410V | 4.41V | 4.3972V |
| VB = | 4.219V | 4.219V | 4.2044V |
| VC = | 3.835V | 3.825V | 3.8103V |

Calculated = using Excel calculations

Simulated = Multisim simulation

Measured = using Digital Multimeter

Adjust R2 so that the VA voltage is equal to 4.5V. Then measure the value of the new R2 and calculate and simulate a value that would produce the 4.5V.

|  |  |  |  |
| --- | --- | --- | --- |
|  | Measured | Simulated | Calculated |
| VA = | 4.5000V | 4.5V | 4.5V |
| R2 = | 479.7Ω | 489.9Ω | 489.97Ω |

Calculated = using Excel calculations

Simulated = Multisim simulation

Measured = using Digital Multimeter

Observations: Algebraically finding the resistance the potentiometer would end up being was kind of interesting. To make the VA voltage 4.5V—half of the 9V supply—the resistance of R2345678 would have to equal R1, which was 470Ω. Since R2 was in parallel with R345678, I needed to find the value of R2 that would satisfy the equation (R2\*R345678)/(R2+R345678)=470. After rewriting the equation that came out to about 489.972Ω.