

Introduction

During this exercise you will measure the voltages and currents in a parallel DC circuit. The results will be used to verify the circuit theory that applies to parallel DC circuits including Kirchoff's Current Law and the Current Divider Equation.

A Variable Resistance box will be used to provide the resistors required for this experiment. The box contains three sets of resistors (red, black, and blue), each consisting of three parallel-connected switched resistors (1200Ω, 600Ω, and 300Ω), one or more of which can be selected by toggling ON or OFF their associated switches, as shown in the figure below:

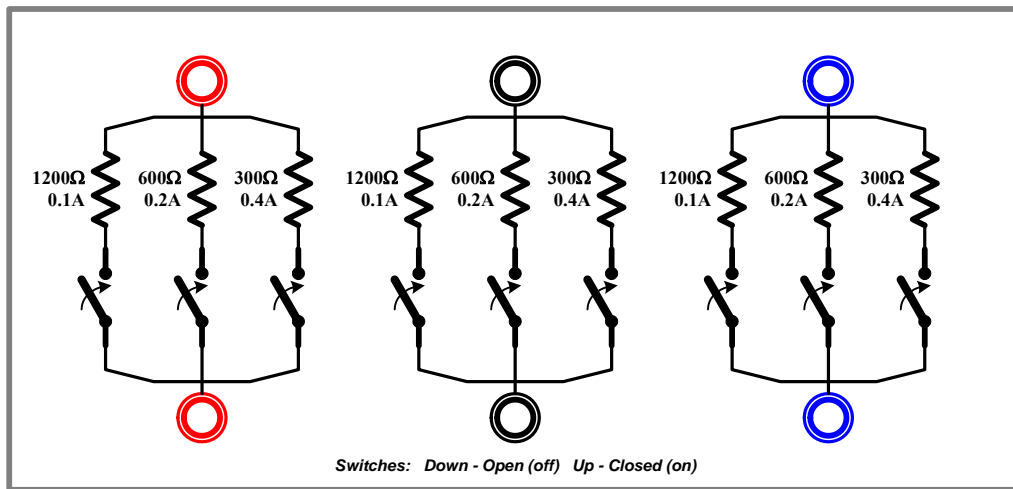


Figure 2.1 – Variable Resistance Box

Prelab

1. For one set of resistors (red, black or blue), calculate the theoretical resistance values relating to each of the possible switch (resistor) combinations. Record the results in the $R_{EQ(calc)}$ column of **Table 2.1**.
2. Using a digital multimeter (DMM), measure the actual resistance values of one set of resistors for each of the possible switch combinations. Record your results in the R_{DMM} column of **Table 2.1**.

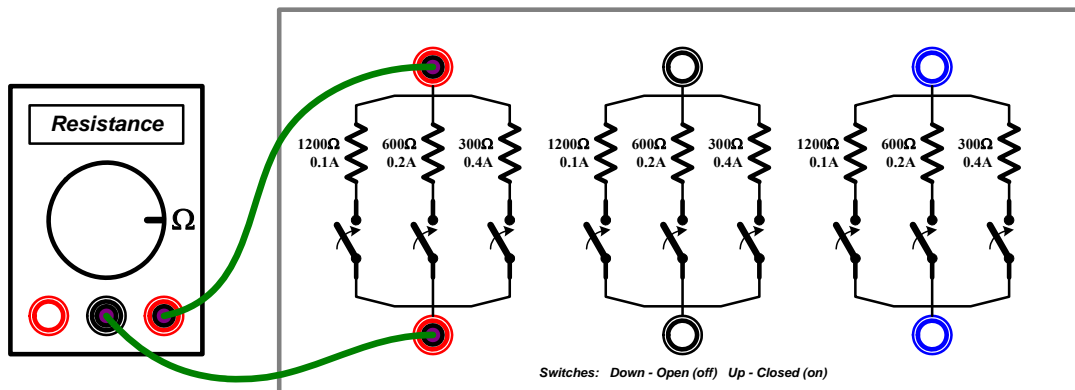


Figure 2.2 – Resistance Measurements

Procedure (Parallel DC Circuits)

1. Set the switches for the three sets of resistors in the Variable Resistance box to obtain each of the theoretical resistance values for R_4 , R_5 , and R_6 , as shown in **Figure 2.3**, and then use a DMM to measure the values of those resistors. Record the results in **Table 2.2**.
2. Utilize the resistors in the Variable Resistance box in order to construct the parallel resistance circuit shown in **Figure 2.3**.

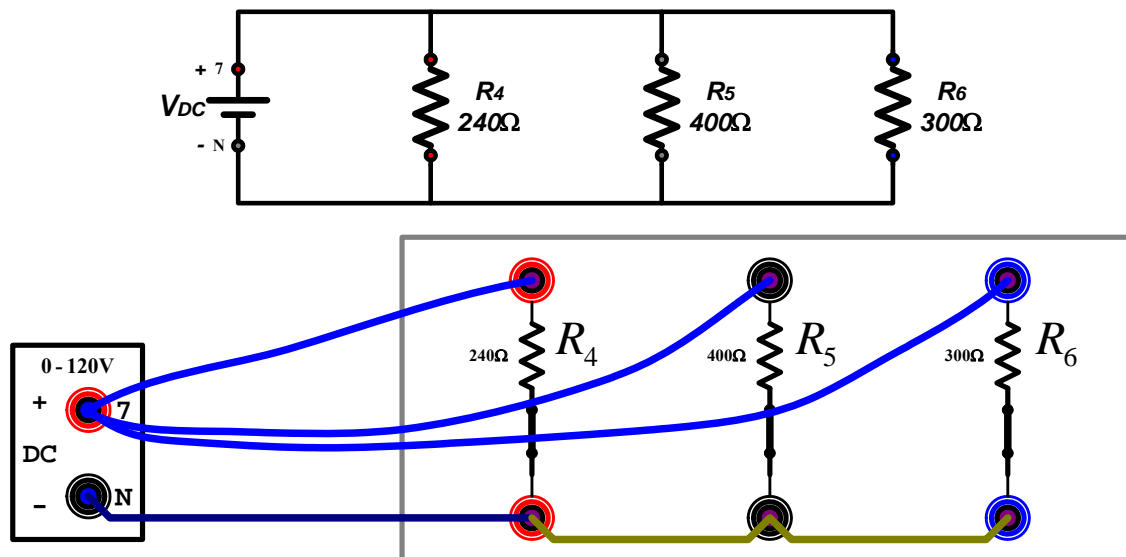


Figure 2.3 - Parallel DC Circuit and LabVolt Connections

3. Using a DMM to verify the voltage magnitude, **switch ON** the Lab-Volt supply and **adjust** the variable DC source to output **36 volts**.
4. **Measure** the **voltage** across each of the resistors, V_4 , V_5 , and V_6 , the **current** flowing into each of the resistors, I_4 , I_5 , and I_6 , and the **current** flowing out of the DC voltage source, I_{DC} , all as shown below in **Figure 2.4**. Record the values in **Table 2.3**.

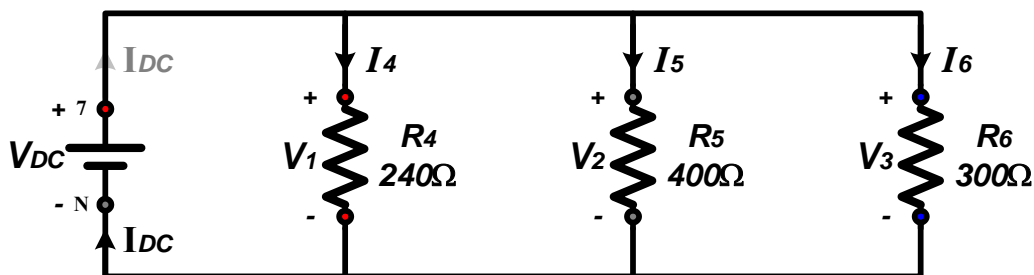


Figure 2.4 - Parallel DC Voltages and Currents

5. **Raise** the source voltage from 36 volts to **72 volts** and **repeat** the measurements specified in step 3.
6. **Lower** the source voltage back down to **0 volts** and switch **OFF** the Lab-Volt supply.
7. Have your instructor **check your results** before disassembling your circuit.

In-Lab Calculations

THE FOLLOWING STEPS ARE TO BE COMPLETED INDIVIDUALLY DURING THE LAB SESSION:

Note – you must show at least one sample calculation that includes the utilized formulas, the numbers entered into the formulas, and the final numerical results for each calculation required in this section.

8. For each of the source voltage settings, **add** the three measured resistor currents I_4 , I_5 , and I_6 , in order to determine the total current flowing through all three resistors, $I_{456\text{sum}}$. Record the results in **Table 2.4**.

Compare the summation current $I_{456\text{sum}}$ to the measured source current I_{DC} in terms of a relative difference calculation.

9. Using your measured resistor values from Table 2.2, determine the actual parallel equivalent resistance for the three resistors, $R_{\text{eq(parallel)}}$, and then use this value in order to **calculate** the **theoretical source current**, I_{DCT} . Record the results in **Table 2.5**.
10. Utilize the **source current**, I_{DCT} , determined in the previous step and the **current-divider equation** in order to calculate the set of **theoretical resistor currents**, I_{4T} , I_{5T} , and I_{6T} , that are expected to flow in the circuit for each of the source voltage settings. Record the results in **Table 2.5**.

Do the results correlate well to the currents measured during the experimental portion of the lab?

11. Utilize the theoretical source and resistor currents recorded in Table 2.5 and the source voltages in order to calculate the total source power, P_{source} , and the individual resistor powers, P_4 , P_5 , and P_6 . Record the results in **Table 2.6**.
12. Add the three individual resistor powers, determined in the previous step, in order to calculate the total power consumed by all three resistors, $P_{456\text{sum}}$. Record the results in **Table 2.6**.

Prelab

1200Ω	600Ω	300Ω	R_{EQ(calc)} (Ω)	R_{DMM} (Ω)
off	off	off		
off	off	ON		
off	ON	off		
off	ON	ON		
ON	off	off		
ON	off	ON		
ON	ON	off		
ON	ON	ON		

Table 2.1 – Calculated & Measured Parallel Resistance Values

Experimental Procedure

R₄ (Ω)	R₅ (Ω)	R₆ (Ω)

Table 2.2 – Measured Resistance Values

V_{DC} (V)	V₄ (V)	V₅ (V)	V₆ (V)	I₄ (mA)	I₅ (mA)	I₆ (mA)	I_{DC} (mA)
36 V							
72 V							

Table 2.3 – Measured Parallel Voltages and Currents

In-Lab Calculations

	Measured (From Table 2.2)	Calculated	
V _{DC}	I _{DC} (mA)	I _{456sum} (mA)	RD (%)
36 V			
72 V			

Table 2.4 – Total Current Comparison for Parallel DC Circuit

V _{DC}	I _{DCT} (mA)	I _{4T} (mA)	I _{5T} (mA)	I _{6T} (mA)
36 V				
72 V				

Table 2.5 – Theoretical Parallel Resistor Currents
 (show your work in the space below)

V _{DC}	P ₄ (W)	P ₅ (W)	P ₆ (W)	P _{source} (W)	P ₄₅₆ (W)	RD (%)
36 V						
72 V						

Table 2.6 – Calculated Resistor and Source Powers
 (show your work in the space below)