ECEN 214 - Lab Report

Lab Number: 1

Lab Title: Introduction to Electrical Circuits and Measurements

Section Number: 502

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Lab Date: February 3, 2023

Due Date: February 10, 2023

TA: Pranabesh Bhattacharjee

A. Procedure:

Task 1 – Fixed DC Voltage Source Measurement

The objective of Task 1 was to transform a fixed DC voltage source into a variable one. A 9V power supply was connected to the breadboard and resistors (100Ω, 1KΩ, 10KΩ, and 100KΩ) were loaded to observe the voltage changes and record data.

Task 2 –Variable DC Voltage Source Measurement

Task 2 aimed to utilize a voltage divider to determine the behavior of variable resistors. Three scenarios were studied to gain a comprehensive understanding of variable resistors and their impact on circuits. For the first scenario, Resistor 1 was designated as the variable resistor and incorporated into the voltage divider circuit, ensuring that the voltage matched the prelab calculations. The potentiometer was then used as the variable resistor and the loaded resistors were recorded for both 5V and 1.5V voltage divider circuits. In the second scenario, Resistor 2 served as the variable resistor and the process was repeated, swapping Resistor 1 and 2. In the third scenario, both Resistor 1 and 2 were designated as variable resistors, with the potentiometer set to 10KΩ. The loaded resistors were recorded for both 5V and 1.5V voltage divider circuits.

B. Data Tables:

Table 1: Task 1 Data Results

Resistor Values	**Voltage Values**
0 Ω	**9.00 V**
100 Ω	**8.99 V**
1 KΩ	**9.00 V**
10 KΩ	**9.00 V**
100 KΩ	**9.00 V**

Table 2: Resistor 1 as Variable Resistor and Resistor 2 Fixed Resistor

Load Resistors	**Lower Voltage (1.5 Volts)**
100 Ω	**88 mV**
1 KΩ	**0.58 V**
10 KΩ	**1.34 V**
100 KΩ	**1.5 V**
	High Voltage (5 Volts)
100 Ω	**0.5 V**
1 KΩ	**2.6 V**
10 KΩ	**4.5 V**
100 KΩ	**4.9 V**

Table 3: Resistor 2 as Variable and Resistor 1 as Fixed Resistor

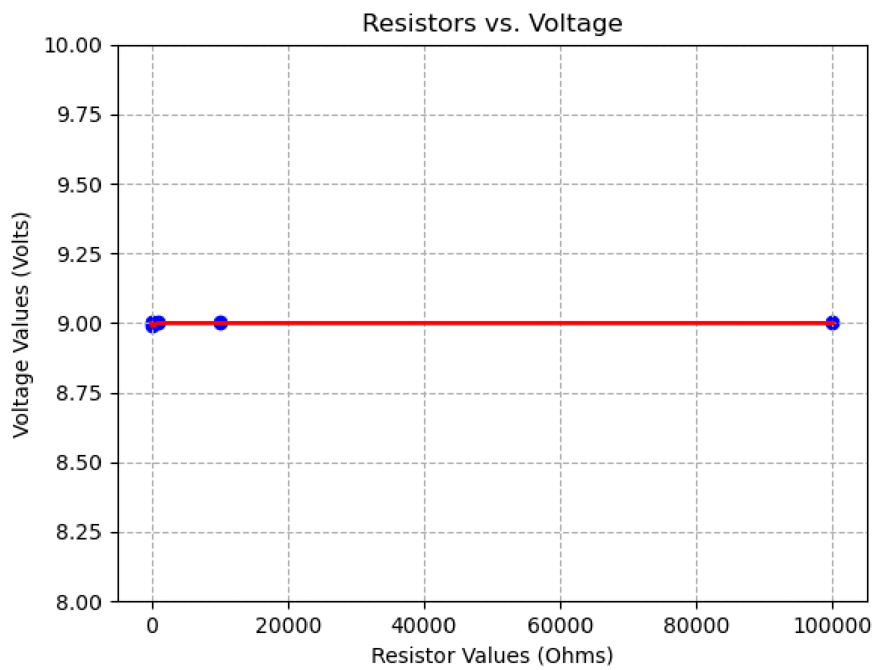
Load Resistors	**Lower Voltage (1.5 V)**
100 Ω	**0.17 V**
1 KΩ	**1.3 V**
10 kΩ	**5.0 V**
100 KΩ	**4.87 V**
	High Voltage (5 V)
100 Ω	**0.16 V**
1 KΩ	**0.84 V**
10 KΩ	**1.45 V**
100 KΩ	**1.5 V**

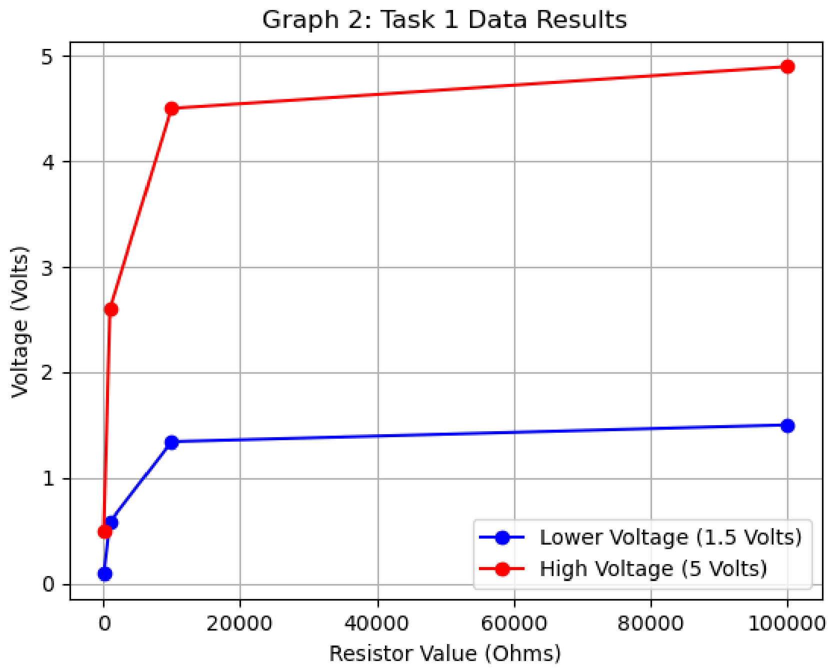
Table 4: Resistor 1 and Resistor 2 as variables

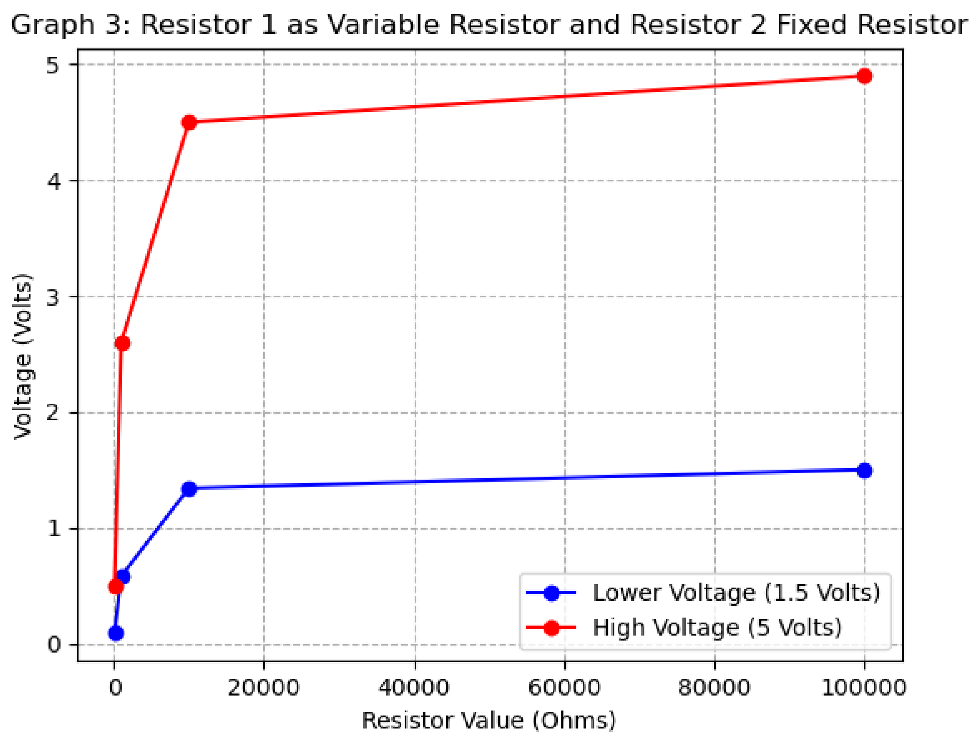
Load Resistor	Lower Voltage
100 Ω	0.20 V
1 KΩ	1.5 V
10 KΩ	4.0 V
100 KΩ	4.9 V
	High Voltage
100 Ω	0.1 V
1 KΩ	0.6 V
10 KΩ	1.3 V
100 KΩ	1.5 V

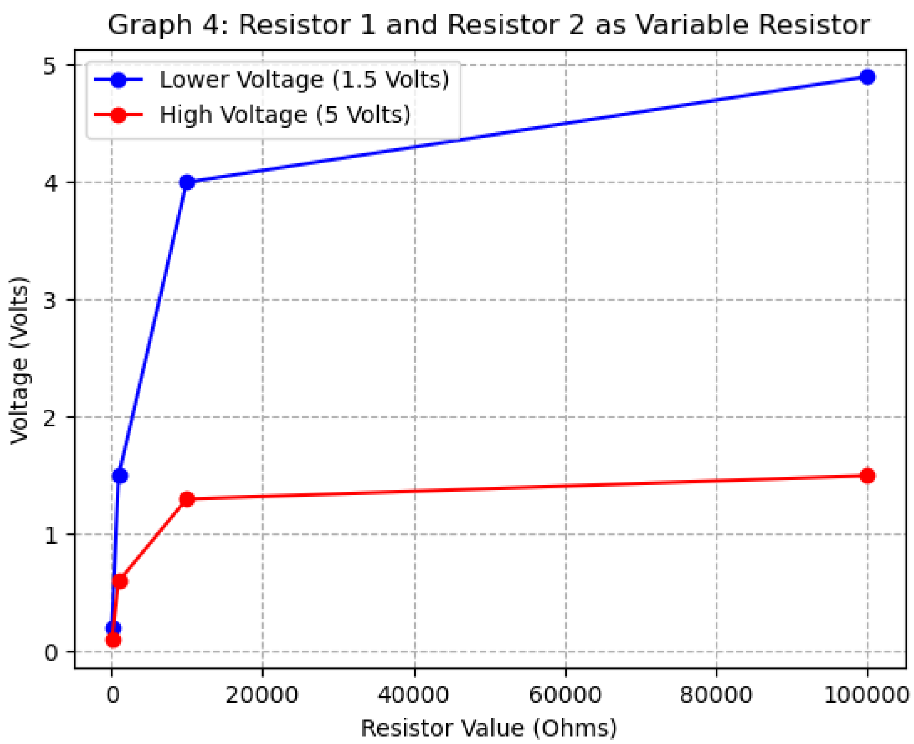
Equation 1: $\frac{V_1 R_2}{R_1 + R_2}$ **Equation 2:** $V = IR$

C. Data Tables:




Graph 2: Task 1 Data Results
Voltage (Volts)
Resistor Value (Ohms)
Lower Voltage (1.5 Volts)
High Voltage (5 Volts)
0
1
2
3
4
5
0
20000
40000
60000
80000
100000


Graph 3: Resistor 1 as Variable Resistor and Resistor 2 Fixed Resistor
Voltage (Volts)
Resistor Value (Ohms)
Lower Voltage (1.5 Volts)
High Voltage (5 Volts)
0
1
2
3
4
5
0
20000
40000
60000
80000
100000



D. Sample Calculations:

$$V_2 = V_1 \frac{R_2}{R_1+R_2} \rightarrow V_2 = \frac{(1.5V)(100\Omega)}{R_1 + 100\Omega} = 88mV$$

$$V_2 = V_1 \frac{R_2}{R_1+R_2} \rightarrow V_2 = \frac{(1.5V)(100k\Omega)}{R_1 + 100k\Omega} = 1.5V$$

$$V_2 = V_1 \frac{R_2}{R_1+R_2} \rightarrow V_2 = \frac{(5V)(100\Omega)}{R_1 + 100\Omega} = .5V$$

$$V_2 = V_1 \frac{R_2}{R_1+R_2} \rightarrow V_2 = \frac{(5V)(100k\Omega)}{R_1 + 100k\Omega} = 4.9V$$

E. Discussion:

1. For each of the configurations, what sensitivity did the circuit have to load resistance?

According to the data, the graphs were the same in the instance of resistor one as a variable, resistor two as a variable, and both resistors as a variable.

2. If we wanted to make the circuits you used less sensitive to load resistance, how could/ would you change things?

To make the circuits less sensitive to the load resistance, one can lower the voltage in the circuit. This is due to Ohm's law, V= IR. If the resistance is bigger then the voltage will be bigger as well. This also works in the case that the voltage is smaller , it will not be affected as much.

3. Towards that end, would we be better off using larger or smaller values in the voltage divider?

Smaller resistors would be better due to the bigger the resistors, the higher the voltage would be. This would cause more power due to the voltage being squared while the resistance is now in the power equation.

F. Conclusion:

This lab allowed students to become familiar with how to use common electrical measurements by using digital multimeters in order to receive accurate results. Students were also introduced to new elements such as a potentiometer to use as a variable resistor. The task presented to the students was to make a fixed DC voltage source into a variable DC voltage source. In order to do this, we used a voltage divider circuit. Within the circuit, we created different circumstances to determine how each resistor would affect the circuit if it was a variable resistor. This allowed us to observe the correlation between the output voltage and the load resistor.