EEE 117 Laboratory

Instructor: Sergio Aguilar-Rudametkin

Lab 1: Resistance, Current, and Voltage Measurements

Lab Report by: Angelica Smith-Evans

Lab Session: Friday, 4PM-6:30PM

Due Date of Report: 09/22/2017

Date(s) of Lab: 09/8/2017 and 09/15/2017

Lab Partners: Kaicha Johnson, Rachana Tandel

1. **Introduction:**

This lab is introduced in order for students to be familiarized with simple circuit analysis techniques, such as using a voltmeter, ammeter, ohmmeter, as well as learn how to use a power source, and build a circuit using physical components, as well as a breadboard. We are to learn the significance of measuring voltage, current, and resistance in this lab through a circuit, as well as discovering significance between theoretical findings versus actual findings. This lab is also introduced in order to re-discover Kirchoff’s laws through a practical environment, as well as voltage and current division. Although these concepts are taught to us as known and proven in our previous circuits course, now we are verifying the usage through practical lab analysis.

1. **Purpose:**

The purpose of this lab is to become familiar with circuit analysis tools, as well as the concepts and ideas of practical analysis. The specific tools we become familiar working with is the digital multimeter, in order to measure accurately the resistance, voltage, and current throughout a circuit. This lab came as two separate labs mashed into one super-packed with information. The first section of this lab teaches about specifically how to use a volt and current source, as well as the multimeter. Through using these equipment, we are gaining a knowledge in which we learn how to do analysis of actual results versus theoretical. While the second portion also teaches this, it also informs us how to use the concepts of Kirchoff’s as well as current and voltage division.

1. **Discussion and Results:**

Part 1 Step 1: For the first portion of this lab, we are taking a 100Ohm resistor and sending 6V through the component. Using Ohm’s law(V=I\*R), current, I, can be calculated to be 0.06Amp. Using these theoretical values for V and R, and using P= (V^2)/R, then power P is calculated to be 0.36W. Using the multimeter, the actual resistance of the resistor is 100.248Ohm. The actual voltage is 6.018V. Using these values, the power dissipation P is 0.361W. Compared to the theoretical calculations, this is a percent error of less than 1%, 0.277%. Applying a voltage of 3.5V leads to a similar result. The actual voltage is 3.51V, while the actual current is 0.033Amp. Using these values, the theoretical value of the resistor is 106.36Ohm. Compared to the actual resistance of 100.248Ohm, this is a percentage error of 6.36%.

By applying several voltages of a difference of 1V, the current seems to change by an increase of 0.01Amp, as the voltage is increased by 1V. The chart below shows this increase as current changes with voltage increase.

|  |  |  |
| --- | --- | --- |
|  | Voltage [V] | Current [A] |
| 1 | 1.004 | 0.008 |
| 2 | 2.007 | 0.018 |
| 3 | 3.01 | 0.028 |
| 4 | 4.012 | 0.038 |
| 5 | 5.014 | 0.048 |

Part 1 Step 2:

Current limit is used to keep the current below a threshold of 0.04Amp. If we keep the threshold of current at 0.04Amp, while increasing voltage, we see that current and voltage could not be increased further once the current approaches the limit of 0.04Amp. Below is the table of how the current changes compared to the voltage from approximately 1V to approximately 3V. Because the current cannot go past 4V with the current limit, then the voltage can no longer increase due to this. Therefore, there were no readings for approximately 4V because it was not possible to use.

|  |  |  |
| --- | --- | --- |
|  | Voltage [V] | Current [A] |
| 1 | 1.004 | 0.008 |
| 2 | 2.007 | 0.018 |
| 3 | 2.922 | 0.027 |
| 4 |  |  |
| 5 |  |  |

Part 1 Step 3:

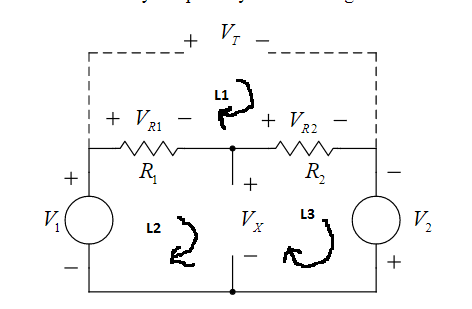
Below is the circuit in which we analyzed next, which utilizes two resistors and two power sources. The resistance of R1 =1.304 kOhm and R2 = 1.308 kOhm, while volt sources V1 =6.02V and V2=25V. Using Kirchoff’s Voltage Laws on the circuit below, we get three equations.

L1: VT - VR2 - VR1 = 0  
L2: V1 - VR1 - Vx = 0  
L3: -Vx + VR2 - V2 = 0

From here, we solve for the unknown, VT, by plugging in L3 into L2 (solving for Vx), then plugging that result back into L1,so:

VT = 31.02V

Now, we solve back for Vx, which is -9.476V. Which leaves VR1 and VR2 to be approximately 15V each.



The result after wiring the breadboard together and using the multimeter to measure the results was in agreement with our predicted values. The measured results were: VT=30.696V, VX=-9.512V, VT=15.406V, VT=15.415V which were similar to the predicted values using Kirchoff’s Voltage Law.

1. **Conclusion:**

In this lab, our team got a feel for using the multimeter and power source. Our experimentation is just a dip of our toes in the water of circuit analysis. The concepts of circuit analysis such as Kirchoff’s laws become more apparent through this lab. We had a solid and real idea of Kirchoff’s laws in the practical sense.

Our analysis of the circuits and building and testing them were a bit clumsy, and may have led to a considerable error in the execution of the lab. Another problem in this lab is faulty equipment. When doing theoretical predictions, we do not consider errors within the components that make up the circuits. There was a problem with the readings not showing up as we had hoped in the lab. We discovered after changing our wiring that the wires we used to connect to the multimeter were damaged in some way. However, this taught us to be more vigilant of the various facets of our lab analysis, and how the error may not just be our calculations, but within the equipment themselves.