Lab 1 Report

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Any text in Italics is meant to draw your attention to the important formatting and content issues of the lab write up.

Abstract:

The purpose of the abstract is to give a very brief over view of what was done and what was discovered.

This lab measures current and voltage of multiple resistors using two different Digital Multi-Meters. The results show that the actual resistances of resistors vary from their specified values. In addition it was found that differing DMM's give varied results.

Introduction:

The introduction should contain 3 key points. 1) What was done in the lab 2) What was concluded from the results and 3)What was the purpose of the lab. The conclusion part should be a very brief overview of what you are going to cover in the discussion. Remember "The TA told me" is not the reason we are looking for. Also, make sure and show the connection between the theory learned in class and the lab.

Taking a circuit from design to implementation assumes that a resistor with a 100-Ohm specification physically has 100 Ohms. The first part of this lab tests this theory by measuring 20 100 Ohm resistors with a DMM. The results show that this is an unsafe assumption.

The second experiment of this lab looks to confirm the behavior of a simple voltage divider circuit. Two resistors are placed in a row and the voltage is taken across the second resistor. The results follow the general trend laid down by Ohm's and thus confirm the usefulness of a voltage divider.

Note how the above sentence ties the results into the theory of the class.

The final experiment calls for the measuring of current flowing throw two resistors. This is a good experimental test of Ohms law and if every thing is perfect the results should exactly match the theory. Once again the data shows some discrepancies but these are expected given the result from part one which states that the resistors do not have the exact specified values.

Calculations:

*Calculations should contain all of the formulas that you are going to use in the results and discussion section. It should also contain and circuit diagrams that you used in the lab. The equations and diagrams do not have to be done in the computer but they **MUST***

BE LABELED with a sequential equation number (e.g. Eqn. 4). *It is encouraged that equations be formatted on your computer. If you don't know how please E-mail your TA. Also note how there is text that leads in to each figure and equation (for example see Figure 10 that plots the results of Eqn. 5). A collection of equations and figures with no labeling makes no sense to the average reader.* ***Also note that all Figures must be labeled with a caption.***

In order to quantify the results from the first experiment it will be necessary to look at the mean and standard deviation of the acquired data. The two equations can be found in equations 1 and 2 respectively.

$$\text{Mean} = \overline{X} = \frac{\sum R}{n}$$

Eqn. 1

$$\text{Standard Deviation} = \left(\frac{\sum \left(\overline{X} - R \right)^2}{n} \right)^{\frac{1}{2}}$$

Eqn. 2

Measuring the voltage for part 2 the two resistors are set up in series with the voltage meter across the second resistor (fig.1).

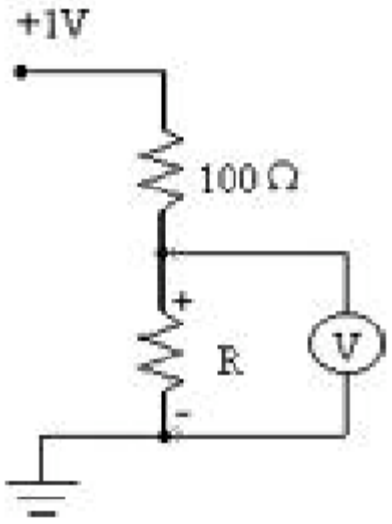


Fig. 1. Setup of series resistor voltage measurement.

The final part of the lab uses a very similar set up as part 2. Only the DMM needs to be changed to reflect the difference of measuring current versus voltage (fig. 2).

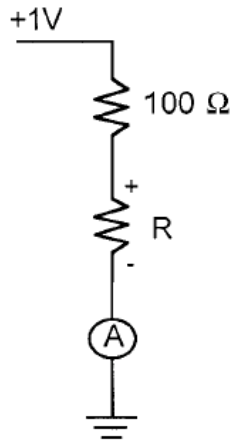


Fig. 2. Setup to measure current using DMM.

Data:

This section contains all the data collected. Again the tables must be labeled and they must be done on the computer. Points will be deducted for hand written tables, no matter how neat. Again, if you have questions on how to do this please see your TA or E-mail me. All data must be labeled with units either at the column head or with each data point. Points will be taken off for not having units on data tables.

This lab measures current and voltage of multiple resistors using two different Digital Multi-Meters. The results show that the actual resistances of resistors vary from their specified values. In addition it was found that differing DMM's give varied results. The measured resistances for part one are shown below in Table 1.

Resistor #	Resistance (Ohms)
1	99.8
2	97.5
3	94.5
4	99
5	97
6	98.3
7	98.4
8	99.8
9	99.5
10	98.3
11	98.2
12	100.3
13	99.4
14	98.2
15	99.9
16	95
17	97.9
18	99.2
19	98.9
20	97.3

Table .1. Measured resistances from DMM #1

Resistor #	Resistance (Ohms)
1	97.4
2	98.4
3	99.5
4	100
5	97.5
6	98.4
7	99.8
8	98.9
9	98.5
10	96.9
11	97.8
12	98.4
13	99.3
14	98.1
15	99.1
16	99.4
17	97.5
18	99.3
19	98.6
20	97.9

Table 2. Measured resistances from DMM #2

The voltages measured for part 2 are shown below in table 3.

Resistance (Ohms)	Voltage (Volts)
100	0.47
200	0.626
300	0.704
430	0.763
510	0.787
620	0.811
750	0.831

Table 3. Measured Voltage

The currents measured for part 3 are shown below in table 4.

Resistance (Ohms)	Current (mA)
100	4.51
200	3.07
300	2.33
430	1.76
510	1.56
620	1.28
750	1.1

Table 4. Measured Current

Table 4 is a great example of data that needs units. If the current is assumed to be amps then must you have applied 451 Volts to the resistor!

Results:

This section contains your data plotted in an easy to see and useful form. Notice how it is possible to include the graphics in the appendix or in the text. Either way the graphs need to be labeled and referenced according to these labels. Also note that the results from the calculations should be shown in this section. Each plot (figure) must be numbered, properly captioned and referred to in the text.

The resistances measured in the first part have been sorted into 1-Ohm sub-divisions and plotted in bar graphs. The graphs are attached as appendices 1 and 2 at the end of the report. The mean and the standard deviation for appendices 1 and 2 where calculated using the formulas given in eqn. 1 and 2. DMM 1 gave a mean of 98.3 Ohms and a standard deviation of 1.5 Ohms. The second DMM gave a mean of 98.5 Ohms with a standard deviation of .8 Ohms.

The data from table 3 is plotted as resistance versus voltage

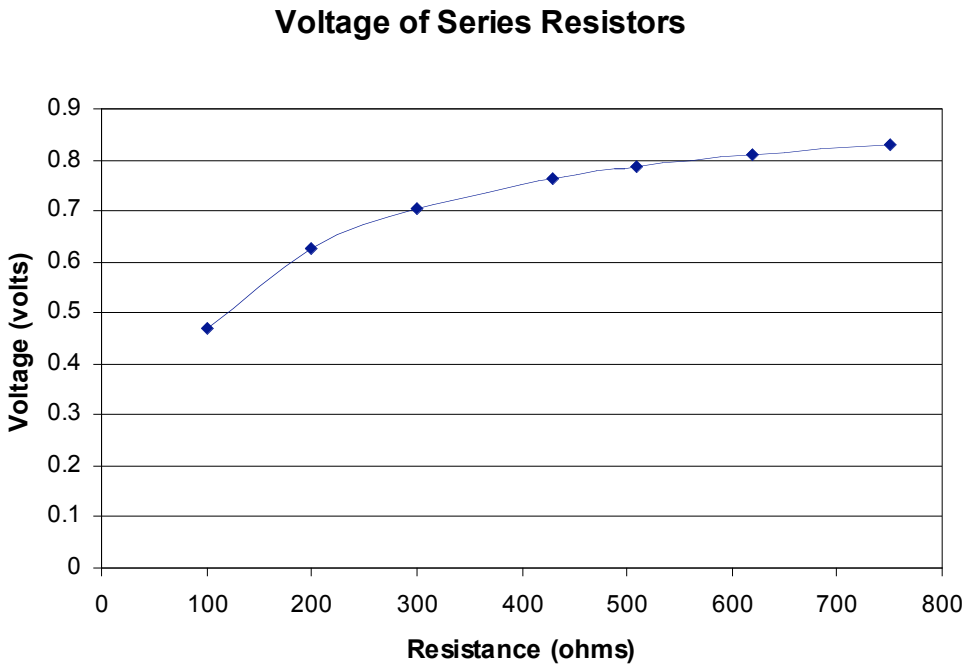


Fig. 3 Voltage Measurement of Series Resistance

The final set of results show the data from table 4 as plot of resistance versus current (Fig. 4).

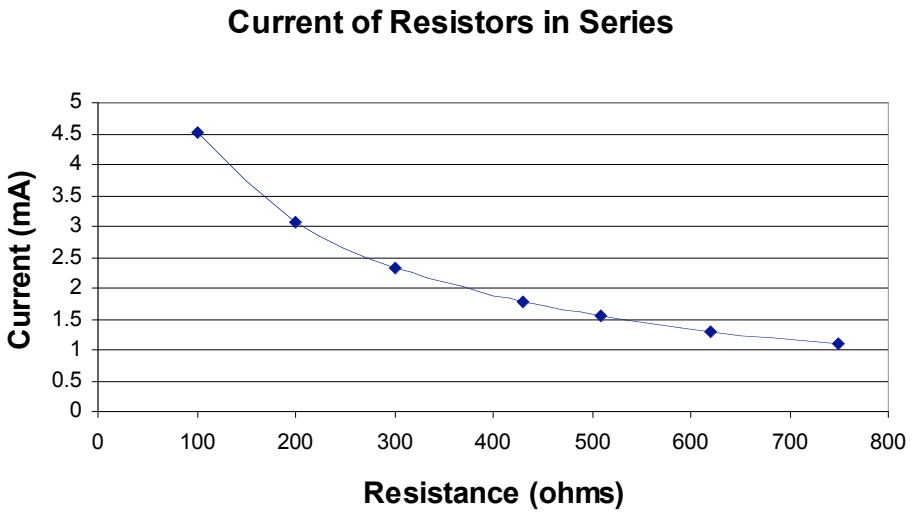


Fig 4. Measured Current of Resistors in Series

Discussion of Results:

Discussion of the results should be a general overview of what the results were followed by a comparison to the theory behind the data. There will almost always be some discrepancy between the measured data and the theory. You should comment on the difference and what might account for this difference.

Part one of this lab measured the resistance of 20 100 Ohm resistors and the data from figure 1 and 2 shows that none of them are exactly 100 Ohms and most are below that value. It is expected that the manufacturing perfect 100 Ohm resistors would be next to impossible but the fact that the mean is below 100 Ohms is interesting. The difference in statistics between the two DMMs implies that the variance in resistor values is not entirely due to manufacturing concerns. Most likely this variance between DMMs is mostly due to bad connections while measuring resistance. A bad connection could easily increase the measured resistance of the resistor.

Part two of the lab looked at how the voltage changes versus resistance in a circuit with two resistors in series. The purpose of this circuit is to divide the applied voltage into two different values. Figure 3 shows the voltage starting off close to .5 volts and increasing towards 1 volt. Both the starting point and end point make sense. At 100 Ohms both the resistors are the same value and the voltage should be split equally between the two. The fact that the measured voltage is below .5 volts implies that the second resistor had a resistance that was actually smaller than the other one. Given the results from part one this would make sense. The voltage asymptotically approaches 1 volt and it should. If the second resistor became considerably larger than the 100 Ohm resistor there would still be a small amount of voltage dropped across the first resistor and thus the second resistor would have a voltage just a little smaller than one volt.

The final part of the lab looks at the current of two resistors in parallel as the resistance increases. Ohms law would predict the current to follow a trend of one over the resistance. Figure 4 shows this to be the case.

In most cases it would be useful to calculate one or two points according to theory and see how they match up.

Observations:
This section would include any observations of yours that don't fit into the general flow of the lab.

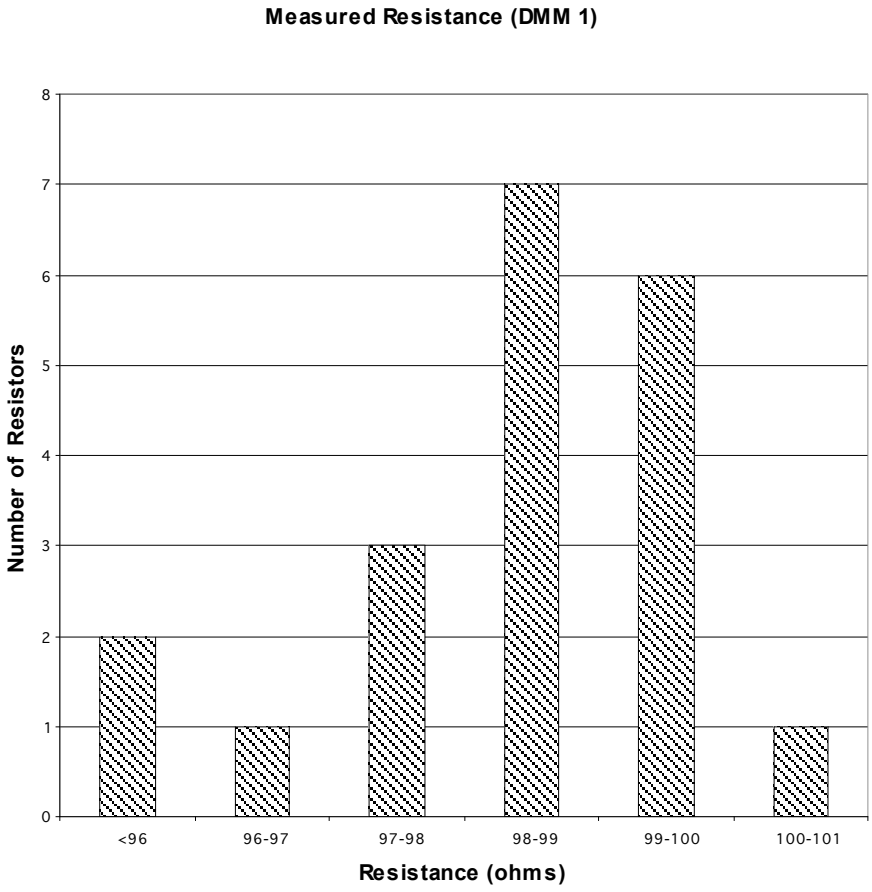
Conclusion:

The conclusion should be a brief overview of what was gained from this lab. KEY results of the lab, including new material learned, discrepancies between theory and experiment, observations of theory learned in class and new techniques learned should be given here.

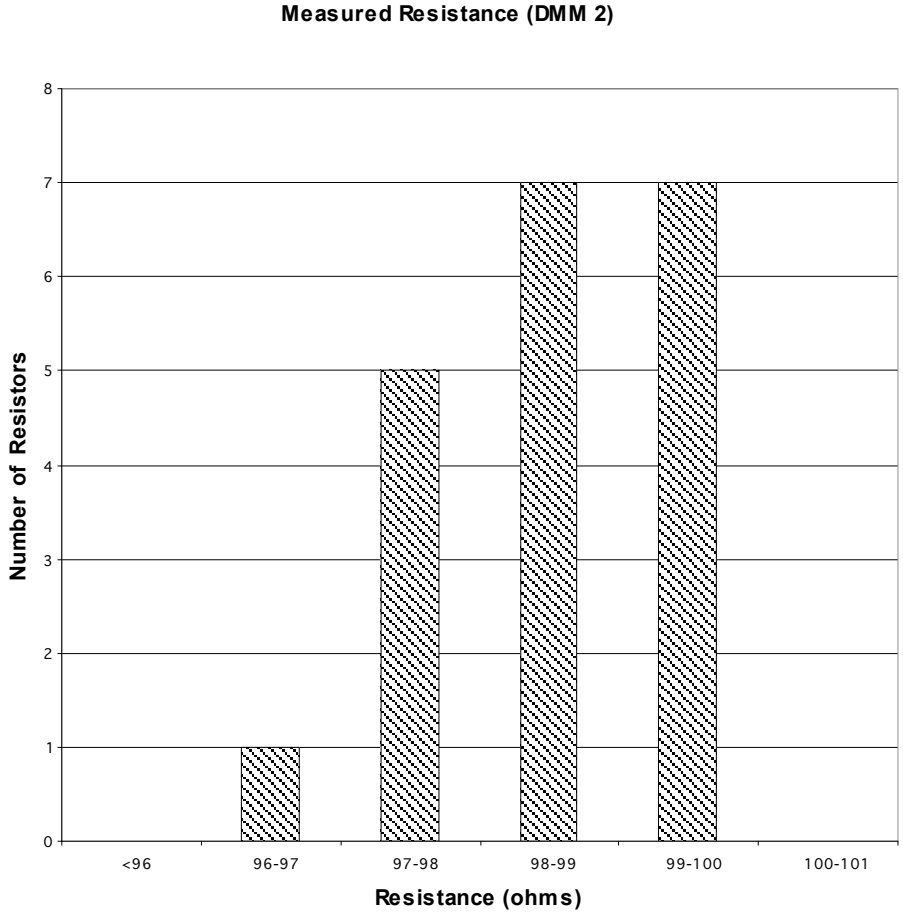
This lab has shown that there is a certain amount of error built in to the manufacturing of resistors and that there is variance when measuring devices. The lab also confirmed that the voltage divider circuit works and that Ohms law is accurate in predicting the impediment of current with increased resistance.

The appendices can be used to list auxiliary data and calculations. Data and other material used to support calculations or other results (figures, plots) in the main body can be placed in the appendix and referred to in the text body.

Appendix 1



Appendix 2


Measured Resistance (DMM 2)
Number of Resistors
0
1
2
3
4
5
6
7
8
<96
96-97
97-98
98-99
99-100
100-101
Resistance (ohms)