

Note: Italics are comments, not included in report.

Laboratory Experimentation Report

Name: Alan Calder

Date: 09/28/2005 or September 28, 2005
(date of experiment)

Course Number: ECET 231

Experiment Title: Full Experiment title **Experiment Number:** 1

Lab Partner: Trevor Zimmer (Always first and last names of partner)

Objective: In this section you need to tell the overall purpose of the experiment. For example, "The purpose of this experiment was to examine the analog computer and its functions". DO NOT write "To examine the analog computer and its functions." Beginning a sentence with a prepositional phrase such as "to" or "of" or beginning a sentence with a conjunction (and but or) is incorrect style. *Write the objective in the past tense!*

Equipment List: This should be equipment used at your station with WCU number included. If the equipment has no WCU number, use the barcode number.

	WCU #
Agilent 54624A Oscilloscope	38463
Agilent DC Power Supply	98364

Relevant Theory/Background Information: Basically any information from the prelab that will be needed for calculations goes here. Word has an equation editor and should be used extensively in this section. Every equation should be explained thoroughly here. All variables should be defined so the reader can quickly pick up on what the equation is telling them.

Example:

The following is an equation to calculate the magnetic field encircling a current-carrying wire.

$$B = \frac{\mu i}{2\pi R} \quad (1)$$

where

B = magnetic flux intensity (w/m²),
μ = permeability of medium (henrys/m),
i = current (amps),
R = radial distance from wire (m).

Provide a brief description of the background information, theories and/or equations that you went over in lab that pertain to the experiment. DO NOT write a series of equations in this section without any explanation of them and then move on to the experiment section. Writing equations in this section is fine AS LONG AS you provide an explanation of them.

To insert an equation using equation editor in MS Word:

Select Insert ⇒ Object

Select 'Microsoft Equation Editor 3.0'

A box will appear that you will use to enter your equation using the tool bar given.

Experimental Data/Analysis: In this section, you must write about the experiment you have just conducted. As in the previous section, you cannot simply write out a series of equations with no explanation or include several tables in this section without providing an explanation of each. In this section, you should write out some sort of explanation of the tables if you include them or an explanation of the results of the experiment. You should write everything in complete sentences and in paragraph form. DO NOT simply copy the procedures in the lab manual! DO NOT give a how-to on how to set up the experiment; tell how you set it up yourself. In other words, don't say "First, set up the analog computer to record..." as it is written in your lab manual! Don't use what I call "you" understood commands like that. ***A good start to describing an experiment would be "The analog computer was set up to record X. After this, a plot of velocity versus time was obtained."*** Remember when you refer directly to the experiment to write in **PAST TENSE**, because you've already done it! It is okay to use the present tense if you are referring directly to a table or graph. DO NOT tell the reader to do something, as in "Refer to table 2 for further details". ***A more professional way to say this would be "Further details can be found in Table 2".*** Remember if you include a graph or table to provide an explanation of it.

Be sure to discuss the results, the outcome of the experiment. What are the implications of your findings? Refer to specific Tables or Figures when discussing the results. DO NOT USE PERSONAL PRONOUNS IN LAB REPORTS, IN ANY SECTION (in other words, do not use "I" "you" "we" "us" "our" at all in your lab reports). It is improper style to use pronouns.

A list of things that should be included in this section:

- Any circuit diagrams with a reference number that will be mentioned in the reference Section
- Data taken: This should be imported tables and/or graphs with tables having a percent error calculation. ***When in doubt, you probably have to do some sort of percent error calculation.***

$$\text{Percent Error} = \left(\frac{\text{measured} - \text{theoretical}}{\text{theoretical}} \right) \times 100 \quad (2)$$

An example of percent error is provided below in "Guideline for Effective Graphs and Tables." When labeling tables and figures, a table should be labeled at the top and a figure should be labeled at the bottom. Capitalize T and F when referring to Table 1 or Figure 5.

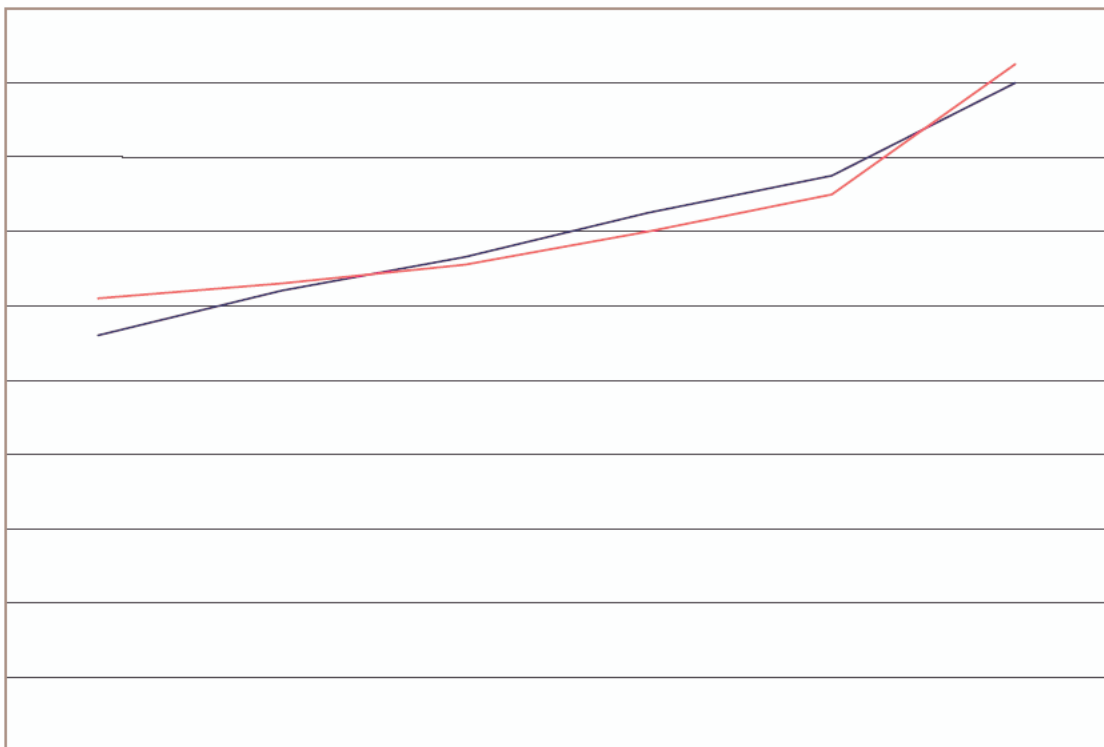
- ***Most importantly is the analysis of data in the body of this section!***

The following section is a step-by-step instructional guide to producing charts and graphs.

Guidelines for Effective Graphs and Tables

Graphs

Without the correct information, a graph is nothing more than a line on a piece of paper. With correct labeling and support information, a graph is a powerful tool of analysis. Let's begin by looking at an example of a bad graph in the drawing below.



Current Plot.

This graph tells the reader nothing. The caption says “Current Plot” but this really means nothing without support information. The drawing can not be referenced in other parts of the report. The two plots are color coded which helps some, but if the reader is not using a color printer, the color coding loses its effectiveness. Besides, nothing in the graph tells what the colors mean.

A more effective graph is provided in Figure 1. Figure 1 has the same information as the first graph, but this time the information has meaning. The following enhancements are added to support the information given by the plots.

1. Axes and Scales. The axis and scale in both the x and y direction give the graph limits and bounds for the information that it contains. It is best to show a zero at the origin if possible without compressing the plots to one side of the graph. The scales should have a simple counting order and use scientific notation if needed.
2. Axis label. Each axis should have a label giving the name of the variable, the symbol of the variable used in equations, and the unit of the variable in parentheses. Notice in Figure 1 that the drain current is displayed in milliamperes not amps. This information is available to the reader because of the axis label.

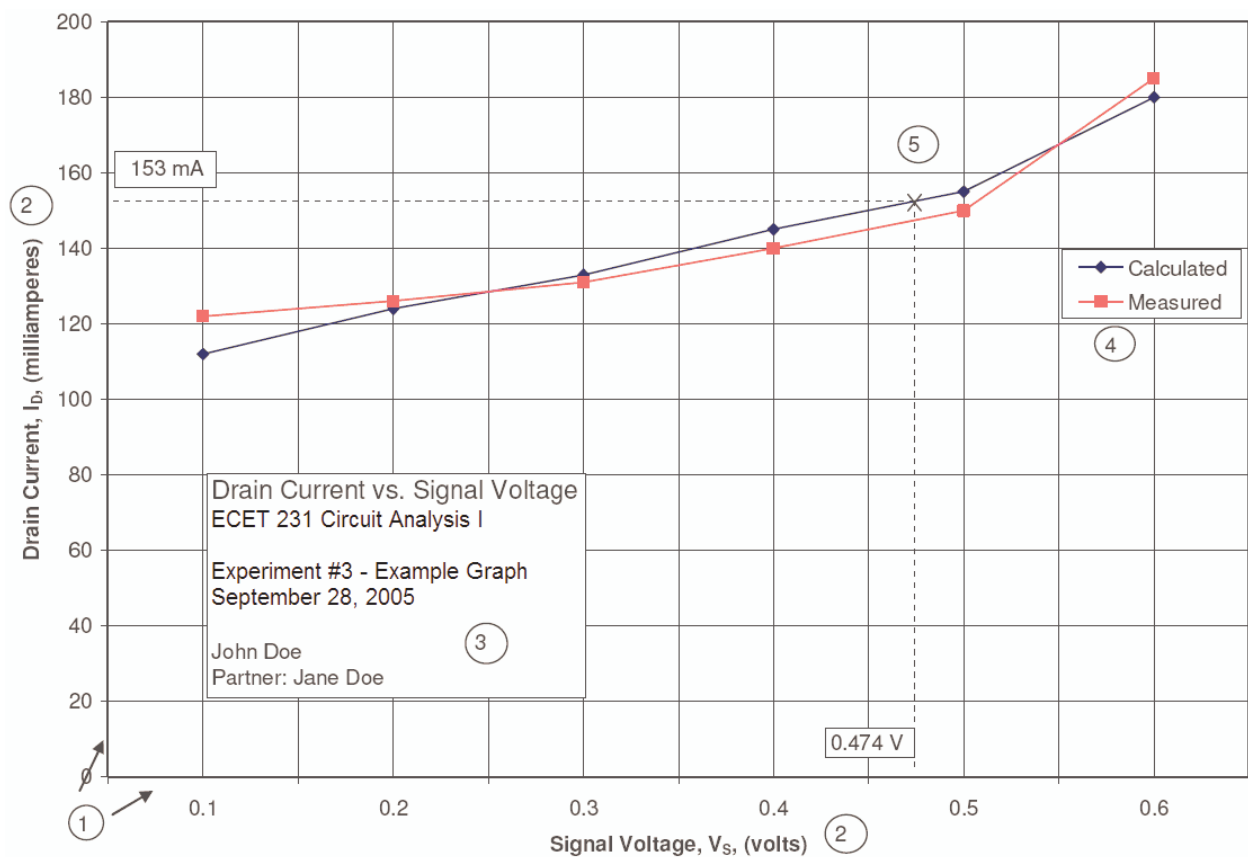


Figure 1. Drain Current vs. Signal Voltage.

3. Title Block. This title block is important for given the conditions in which the data was taken. It makes the graph complete and allows it to be used without the rest of the report (i.e. It can be used in a presentation.). The title block should have the name of the graph, course number and name, experiment number and name, date the data was collected, your name and partner's name.
4. Symbol Coded Plots. As previously mentioned, color coding is useful only if printed by a color printer or viewed on a screen. Effective graphs use symbol coding. When symbol coding is used, a key is needed to explain the different plots. This key can be separate as shown in Figure 1 or can be included with the title block.

5. Point of Interest. Sometimes certain points in the plots are needed or are important for some reason. These points should be referenced to the axes and values given.
6. Figure Caption. The caption below the graph gives it a name that can be used throughout the report. For example, the phrase "Figure 1" has been used many times before this explanation and it should have been obvious that the statement was referring to this graph. The caption should at least include the title of the graph and may include additional information such as special condition in which the data points were taken. An example of this is temperature of the component or frequency of the input signal.

Within the body of the report talk about the figure. You can say something like:

"The waveform from terminal 3 was recorded and included in Figure 2. The waveform was determined to be a ramp function with a peak-to-peak voltage of 17.6 volts. A -0.53 volt offset was recorded for this waveform by measuring the relative distance between the maximum and minimum peak voltages to ground."

Notice the past tense. Talk about every figure you include. If you don't, then ask yourself "Why did I include the figure?"

Tables

Tables also provide the reader with useful information if supported correctly. Table 1 shows the values used in Figure 1, but containing additional information that is better represented in a table. Tables are better for some data while graphs are more effective for other.

Table 1. Percent Error between the Calculated and Measured Drain Current.

Signal Voltage (volts)	Calculated Drain Current (milliamperes)	Measured Drain Current (milliamperes)	Percent Error (%)
0.1	112	122	8.93
0.2	124	126	1.61
0.3	133	131	-1.50
0.4	145	140	-3.45
0.5	155	150	-3.23
0.6	180	185	2.78

The important thing about constructing a table is to include the units with each variable.

Sample Calculations

A sample calculation is a good method of supporting your data and to prove that your work is correct. Sample calculations usually are needed with table information as well as other questions that may be asked in the post-lab. Make a subheading at the end of the Experimental Data/Analysis section for sample calculations and number each new calculation. Below is an example of a sample calculation for the table above.

Experimental Data / Analysis

...

...

Sample Calculations

1. Sample calculation of percent error between the calculated and measured drain current.

$$\begin{aligned}\% \text{ error} &= \left(\frac{\text{measured value} - \text{theoretical value}}{\text{theoretical value}} \right) \times 100 \\ &= \left(\frac{122 - 112}{112} \right) \times 100 = 8.93\%\end{aligned}$$

2. Sample calculation ...

Conclusion: In the Conclusion section provide your final thoughts regarding the experiment. You can use this space to expand further on the implications of the outcome from the experimental data section. ***What did you learn from this experiment?*** Has the theory been substantiated? Have the objectives been met? You may also discuss way to improve the experiment or mention topics of further investigation.

List of Attachments: Make sure you include a listing here of any attached graphs or charts that can not be inserted in the body of the report. For example plots from an X-Y recorder. There should always be original data as an attachment.

- Original Data

References: Here include any reference material you used (textbook, etc) in writing this experiment. This also holds true for any figures of circuit diagrams or the like taken from the internet, textbook or lab handout for that week. DO NOT list the instructor as a lab reference. There should always be a lab handout listed as a reference for every report written.

[1] Laboratory handout "Measurements Lab"

[2] "Fundamentals of electric circuit analysis" by Clayton R. Paul, Wiley & Sons, 2001.

Finally, remember to type out the Honor Code at the end of your lab report **and initial it.**

This report was submitted in compliance with the WCU Academic Honesty Policy (2005-06 WCU Catalog, p 60) _____. (Student's Initials)

Initials should be written and not typed!

Labs should be single-spaced within each section of the report, and you should double-space between sections. You should **boldface** all your headings and write the content of the headings in regular text format. Your reports should use 12 point font.

When will your lab report be marked "not acceptable"?

Labs will be marked "not acceptable" if there are more than four errors (such as spelling or grammar errors) in a section. So, for example, if you make five mistakes in the experimental data section but everything else in the other sections is fine, it will still be given a grade of "not

acceptable” by the English grader. If you do not adequately address all of the required content for each section (for example, if you just write out a series of equations and their answer in the experimental data section), it could be marked “not acceptable” and/ or points may be deducted from your grade. Also, **make sure you include every heading** in the lab report. Points will be counted against you if you do not. Please be aware of these particular problems and avoid them. *Also format your page numbers in the format of this handout so that in the event of missing pages the instructor will not think you simply left something out. To do this, follow the procedure below:*

Select **view** ⇒ **Headers and Footers**

This will show all headers and footers for the paper. Also a header and footer bar will appear.

Place cursor in the footer (at the bottom of the page) and click to align right.

Click on ‘Insert Autotext’ bar.

Choose ‘Page X of Y’

This should create your page numbers automatically as Page 1 of 4, etc.