Writing a Progress Report

Physics 605, Spring 2019

I. Why progress reports.

If later in your career you are working for a company, or perhaps you are working in a scientific collaboration, you are more likely to be writing progress reports, or science papers, or analysis notes, than you are to write a classic "lab report". Depending on the situation, such a report can be quite similar to a classic lab report, or be much shorter, or longer (i.e. your PhD thesis). The progress reports in this course should be less work than a traditional lab report. I do expect a well written, concise report of what you did, and specifically what you learned, in each lab. You may also use the progress report to submit feedback on how the course is going for you, what worked, and what did not work, where you are getting overwhelmed. You should also write who helped you, and whom you have helped.
One of the key things we are looking for in your report is accuracy. How accurately do you describe what you did, how accurate is your schematic, how accurate was your data. Be precise!

II. Progress report layout.

For the progress reports, you can assume that the person reading the report is at least as knowledgeable as you are, so there is no need to be pedantic in your writing. Do explain clearly and **precisely** what you accomplished in the lab, what you learned, and where you are still confused. Also report on who helped you, and who you helped.
Each progress report needs to have at least the following elements:

1. Your full name, and the name(s) of the lab partner(s) you worked with during this lab.
2. A very brief introduction on what the lab was about, so it is not out of context.
3. A report on what you accomplished this lab.
    a. If you made measurements, make a table, or graph, or some other way to list the results of the measurement. Be precise and be specific!
    b. If you made a specific circuit, provide a schematic of this circuit. Schematics need to be **professionally done**, see the resources section on MyCourses for website where you can draw schematics.
    c. Answer all the specific questions that were asked in the lab.
    d. If you did not quite finish the lab tasks, explain why.
    e. Do the "outside of lab" components and report on them.
4. Clearly tell me what you learned. You can intersperse this with item 3 if you prefer.
    a. Specific things you learned.
    b. Any observations you made.
    c. Who helped you, whom did you help.
5. A brief conclusion.

Write the progress report using a typesetting program (LaTex, Word, etc) and submit the report electronically on MyCourses as a pdf file.

III. Example Progress Report:

Name: Maurik Holtrop Lab partner: Tony Rogers January 26, 2019

LAB1

Introduction:

In this lab we became familiar with the breadboard and power supply, the multimeter, and the oscilloscope. We calibrated the multimeter and oscilloscope against a high accuracy BK voltmeter. We also measured the internal resistance of the oscilloscope and the multimeter in voltmeter and ammeter mode, and the internal resistor of the power supply.

Accomplishments: Voltmeter Calibration

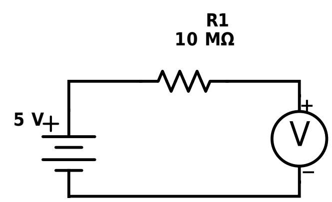
We first calibrated the voltmeter and the oscilloscope against the high accuracy BK voltmeter. We used the fixed 5 V power supply output, and the variable power supply output. The results are in the table below:

Supply [V]	BK reading	Voltmeter	V dev [%]	Oscilloscope	V dev [%]
5	5.001	5.02	0.380%	5	-0.020%
1.8 - 15	7.465	7.48	0.201%	7.5	0.469%
1.8 - 15	10.203	10.28	0.755%	10.2	-0.029%

Conclusion: We concluded that each of the measuring devices are fairly accurate, to about a percent. In retrospect, we realize that it would be a better measurement if we had used more voltage settings, and perhaps made a plot of the results. We found that the accuracy of the oscilloscope readings greatly depends on the vertical scale setting.

Accomplishments: Voltmeter internal resistance

Next we measured the internal resistance of the voltmeter function of the multimeter and the oscilloscope by measuring voltages with a large value resistor in series with the voltmeter. The schematic is shown on the right (This was created with "SchemeIt") This effectively makes a voltage divider where one of the resistors it the internal resistor of the voltmeter. We used several values for the resistor R1, and read the voltage on the voltmeter for each value. We then used the formula $R_{int} = \frac{V_m}{V_{in}-V_m} R_1$ to compute the internal resistance. The results are in the table below.

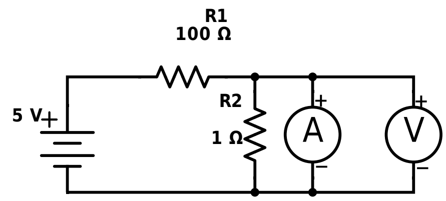


R1	Fluke 87 [V]	R_int	Fluke 75 [V]	R_int2	Scope	R_int3
0	4.973		4.988		4.964	
5.00E+06	3.418	10.99 MΩ	3.32	10.04 MΩ	0.831	1.003 MΩ
1.00E+07	2.636	11.28 MΩ	2.649	11.40 MΩ	0.46	1.019 MΩ
2.00E+07	1.784	11.19 MΩ	1.792	11.27 MΩ	0.233	9.831 MΩ
3.00E+07	1.338	11.04 MΩ	1.342	11.09 MΩ		
Average		11.13 MΩ		10.95 MΩ		1.002 MΩ

Conclusion: We conclude that the internal resistance of a multimeter set to voltmeter is about 11 MΩ, a very high value. This means that for most circuits, with resistances much less than 1 MΩ, the measurement error will be very small. Once the resistance gets close to 1 MΩ, the internal resistance of the voltmeter will need to be considered. The oscilloscope has about 10 times less resistance, so it will disturb the circuit it measures on more easily.

Accomplishments: Ammeter Internal Resistance

To measure the internal resistance of the ammeter function of the multimeter, we used a resistor of 100 Ω to limit the overall current to 50 mA, and a small resistor of around 1 Ω parallel to the ammeter so that we get reasonable readings for the current. We then connected a voltmeter across the ammeter to make the computation of the internal resistance value easier. The diagram is shown on the right. The table of the results are shown below. The formula used for Rint is <insert your own formula!>.



R2	V (V)	I (mA)	Rint
X	0.0665	49.67	1.339
2	0.0401	29.9	1.340
1	0.0287	21.39	1.340
0.5	0.0182	13.66	1.336

Conclusion: We conclude that the internal resistance of the ammeter set to the mA scale is 1.34 Ω. This is a fairly small value, but it will still slightly affect a circuit where it measures.

Things I Learned

- Layout of the breadboard: which holes are connected.
- Working of the power supply on the breadboard. The two knobs at the top allow me to set the voltage I want.
  - I observed that at some settings the voltage was not quite stable, but jumped around. I avoided these settings.
- How the voltmeter function and ammeter function on the multimeter work.
- How to measure a voltage with the oscilloscope.
  - Mary, from the group next to me, pointed out to me the "measure" button, which makes it easier to read the voltages. Click on the measure button and then select show all measurements.
  - If the vertical scale is set too high (i.e. 5 Volt per division), then on the measurements section the min and max voltage measured are quite far apart, even though the input voltage is stable. The TA, Tony, explained to me that this is because the oscilloscope makes only an 8-bit measurement, so has an accuracy that is ±1/128 of full scale. A better result was obtained when setting the scale to 1 Volt.
  - I do not understand the horizontal scale on the oscilloscope, nor many of the other functions.
- How to read the value of a resistor. With some resistors it is difficult to know which direction to read!
- How to use resistors in the breadboard to make a voltage divider.
  - I helped John on the bench behind us with his divider. He had the resistor in the wrong hole so it did not line up with the wire.
- How to use a voltage divider to deduce the internal resistance of the voltmeter or the ammeter.
- I was greatly helped by the group next to us, Alison and Nick, who were able to explain to us how to get going with the oscilloscope.