Physics 320 - Fall 2017
Lab 1 - Resistors and Multimeter

Objective: Be able to read the resistance of a resistor by looking at the color code. To understand the function of a potentiometer and multimeter and use a protoboard and Ohm's Law to determine resistance.

To Turn In: Your data (neatly organized) and the answers to the questions.

Introduction

The purpose of this lab is to introduce you to some of the equipment you will be using. You will also find it useful to be able to look at a resistor in a circuit and read what the resistance value is. The way to determine that with human sized resistors is via the color coded stripes on the resistor. You can of course look up "resistor color code" in your favorite search engine but that gets tiresome. I will discuss a simple way to remember the code in class.

Part 1 - Resistors

Step 1 - There are five bins labeled A, B, C, D, E on the counter. Get one resistor from each bin making sure you keep track of the bin from which you got it. Determine from the color code on each resistor the nominal resistance of each resistor. Once you have written down the value for each resistor, bring your results to me. After I have checked the results, I will give you a digital multimeter (DMM).

    Step 2 - Measure the resistance of each resistor with the DMM in ohmmeter mode. It is sufficient to connect the DMM leads to each end of a resistor to measure its resistance. **Are the resistance values within the nominal range of uncertainty for each resistor?**
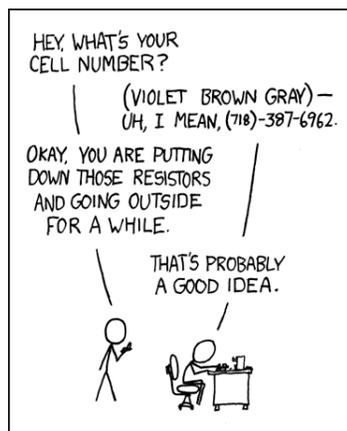

Figure 1: xkcd/227

Part 2 - The Potentiometer

Experiment with the potentiometer I give you. Measure the extreme values of the resistance and several values in between. Set up the leads of the DMM such that the resistance read is a minimum when the potentiometer knob is set to its counterclockwise limit and a maximum when the potentiometer is at its clockwise limit.

Part 3 - Ohm's Law

Another way to determine the resistance, R, of a resistor is to measure the voltage drop, V across and the current, I, through the resistor. The resistance is then calculated using Ohm's Law,

$$R = \frac{V}{I}.$$

This is, in fact, what the DMM does in ohmmeter mode.

To do the measurement yourself, you need to apply a voltage across the resistor, measure the voltage across the resistor, and at the same time measure the current through the resistor. A simple way to accomplish this is to use a powered protoboard. You will connect your resistors to the protoboard and apply a voltage using the power from the board while measuring the voltage and current. I will show you how to use the protoboard.

IMPORTANT USAGE NOTE:

Do not connect an external power supply to the power terminals of a powered protoboard. Those are output terminals. They have internal components which are designed to have voltage differences of only one sign across them. Even when the power is off, you can damage the power supplies by connecting power to them.

Data Sheet for Electronics Lab 1 - Resistors

Name_____

Date_____

Part 1 - Resistors

Have your instructor initial the table after filling in the first four columns but **before** using the ohmmeter to complete the last two columns.

Label	R value by code	Tolerance	Range of expected values	II*	Ohmmeter Value	Within Tolerance?
Example	*1250 Ω*	*10 %*	*1125-1375 Ω*	*𝓜𝓖*	*1326.5 Ω*	*yes*

*Instructor initials

Part 2 - The Potentiometer

1. Draw a picture of the potentiometer and a schematic diagram of a potentiometer.

2. What are the maximum and minimum values of resistance on your potentiometer?

3. Write a description of the working of the potentiometer. Be sure to discuss the resistance values between the left-to-center and the right-to-center connection at any given value.

Part 3 - Ohm's Law

Label	V ( )	I ( )	R ( )	Difference from Ohmmeter	% Difference
Example	*7.500 V*	*5.660 mA*	*1325 Ω*	*1.5 Ω*	*0.11 %*