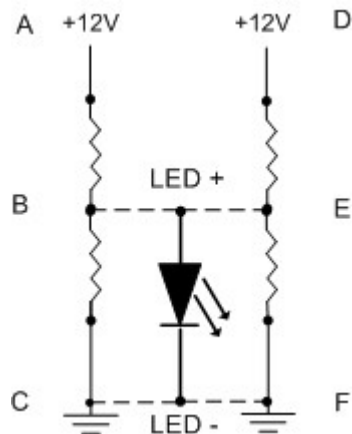


# Electrical Measurement Activity

MVRT  
2010 – 2011 Season

## Introduction

The point of this activity is to show you how to measure resistance, voltage, & current and make some sense of it. Here is the schematic of the device you'll be working on



The wiggly lines are resistors, the funnel shaped thing with arrows is a LED and the triangles mean ground (negative connection).

When you measure between the two resistors you find they divide the voltage. One reason why you might want to do this is if you have a 12V source—like a robot battery—but want to use a 5V device—like a LED—and want to know how to do it.

One other important piece of information about this activity is that it takes about 15 milliamps to light a LED. Remember, resistors limit current: the larger the resistor, the smaller the current. Keep it in mind when you do part C.

## Part A: Measuring Resistance

Do not connect any of the wires.

Set the multimeter to 200 $\Omega$  to start with. If your meter reads 1, then set it to a higher ohm range.

Measure the following:

1. A to C \_\_\_\_\_
2. A to B \_\_\_\_\_
3. B to C \_\_\_\_\_
4. D to F \_\_\_\_\_
5. D to E \_\_\_\_\_
6. E to F \_\_\_\_\_

## Part B: Measuring Voltage

- 1) Set the multimeter to 20 DCV
- 2) Set the power supply to 12 V but do not turn it on yet
- 3) Connect the long red wire from the red power supply terminal to A
- 4) Connect the long black wire from the black power supply terminal to C
- 5) Turn the power supply on

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Measure the following with a multimeter:

1. A to C Is it 12 volts? If not adjust the knob until it reads roughly 12V
2. A to B \_\_\_\_\_
3. B to C \_\_\_\_\_

Make the LED light up.

- 1) Turn off the power supply
- 2) Connect the short red wire from B to LED+
- 3) Connect the short black wire from C to LED-
- 4) Turn the power back on.

Switch sides:

- 1) Now turn the power supply off.
- 2) Connect the long red wire from the red power supply terminal to D
- 3) Connect the long black wire from the black power supply terminal to F

Measure the following with a multimeter:

1. D to F \_\_\_\_\_ Is it still 12V? If not adjust the power supply knob.
2. D to E \_\_\_\_\_
3. E to F \_\_\_\_\_

Test the LED:

- 1) Turn the power supply off.
- 2) Move the short red wire from B to E
- 3) Move the short black wire from C to F.
- 4) Turn the power supply back on.

Does the LED light up? \_\_\_\_\_

## Part C: Measuring Current

To understand what happened with the LED we have to measure current. Unlike resistance & voltage, current must be measured by putting the leads inline with the circuit.

**Warning! It's easy to blow out your multimeter if you're not careful. You can't measure more than 200 mili-amps. A motor is many amps. You have to use a clamp meter or other means to measure motor current.**

- 1) Turn the power supply off.
- 2) Unplug the long black wire from F
- 3) Move the red plug on your multimeter from V/ $\Omega$  to ma (mili-amps).
- 4) Use a clip wire to hook up the black wire to the black multimeter lead.
- 5) Set the multimeter to 20ma & turn the power supply on.
- 6) Touch the red probe to F. What current do you measure? \_\_\_\_\_
- 7) Now turn the power supply off & move the long red wire from D to A.
- 8) Turn the power supply on.
- 9) Touch the red probe to C. What current do you measure? \_\_\_\_\_

## Part D: Evaluate

Explain what happens with the LED?