SubLab: Multimeter

The multimeter is one of the most useful tools for the electronics technician. We will use it to test some common components. Before you start, read over the instructions that came with the multimeter. Also, wipe off the metal ends of the test leads to remove any oxidation layer they may have built up during storage. You can do this with a pen or pencil eraser or another mild abrasive. The first check to do on your meter is to test the test leads themselves.

Continuity:

Digital meters often come with a continuity function. This is a mode where the meter will make a sound whenever there is a short circuit across the test leads. This is good for testing if wires have an open in them that is preventing current flow or signals to pass through. Using the instructions, set up the multimeter for continuity checking. Touch the two ends of the test leads together. You should hear a tone coming from the meter. With the leads still touching, wiggle the connectors and wires slightly to see if it comes and goes. This could be an indication that there is an intermittent open in your setup. This is an easy way to check a meter operation when you first turn it on.

Resistors:

Resistors resist current in both AC and DC circuits. They are a fundamental electronics component. Their value is identified by colored bands printed on the resistor body. See the enclosed card for information on how to read them or go online to the various calculators available. We will read the resistor values of the included resistors.

Set up the multimeter to read resistance in accordance with the enclosed instructions. When you know the value of the resistor, you can set the range on the multimeter accordingly. When you don’t know, you should start on the highest scale (2000k), hook up the resistor to the test leads, and lower the scale until you see a reading on the display. Do this to measure the resistance of the included resistors.

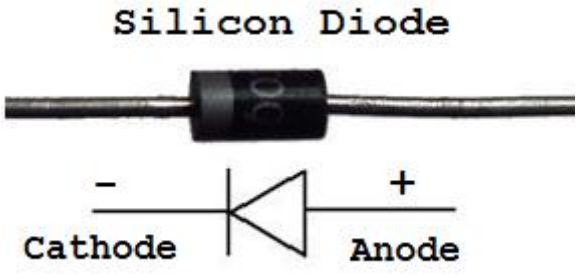
Voltage:

Voltage is the driving force for electrical current. It is a potential difference between two points. Gather up a couple of batteries in your home. You may find some in drawers, remote controls, or toys. Set up the multimeter to read voltage using the included instructions. A digital multimeter has the advantage over a mechanical meter in that if you hook up the polarity wrong, you will still see the correct voltage and it will be displayed with a negative sign. Set the meter to read on the 20V scale and place the test leads across a typical battery like a AA, AAA, 9V, or watch battery. Read the voltage off the display. Again, if you do not know what voltage to expect, start with the highest scale and work down until you see a reading on the display.

Diodes:

Diodes belong to a class of components called semi-conductors. They have the properties of both conductors and insulators. When a voltage is applied one way across a diode, current will flow. When the polarity is switched, current will not flow. These are very useful devices for many different applications. One that most familiar applications is a Light Emitting Diode (LED). These are little indicator lights on our electronic gadgets. When the LED has the right voltage in the right direction, it will light up. Your meter has a special test mode to test diodes. When in the diode test mode, the meter will supply a small voltage to the test leads. When placed on the diode, they will show the voltage drop across the diode when it is set up to conduct (the Red lead on the Positive side of the diode and the Black lead on the negative). When you reverse the leads, the diode will not conduct and you will see an over range indication (a "1" on the display).

Test the silicon diode included with the kit. See below for an illustration.



Note that the stripe on the diode marks the negative (cathode) side. Observe that when you apply the leads to the ends of the diode in one direction, the meter gives no indication and in the other, it shows a small voltage drop across the diode. When you see the voltage drop, you know the leads are in the correct place to cause conduction so the Red is on the positive side (Anode) and the Black is on the negative (Cathode). This is a way to find out the anode and cathode on an unknown diode or one that has no markings. LEDs have a much higher voltage drop and may not register on the meter. However, they are lights and will light up dimly when the leads are in the right orientation.

Current:

Current is the movement of electrons through a circuit. Measuring current is a little more difficult since you must place the meter into the actual current flow you want to measure. For many electronic circuits, you don't have places available where you can do this. However, it is often helpful to look at the current coming from a power supply. Usually you have access to the battery of equipment and can disconnect one of the terminals to place the meter in the circuit at that point. Set up the meter to read current per the enclosed instructions. Set it to the highest scale (200m = 200 milliamps).

Safety Note: *When you set up the meter to read current, you create a very low resistance path between the two test leads. This prevents the meter from impacting the current flow in the*

circuit under test. However, if you set the meter to read current and place the leads across a power supply like a battery, it will try to draw tremendous amount of current and will blow the internal fuse in the meter. ***Never set the meter for current reading and place it across voltage supplies.***

Set up a circuit as shown below:

Figure 1: Basic Circuit

Now, insert the meter in the circuit by connecting it between the battery and the resistor. See below:

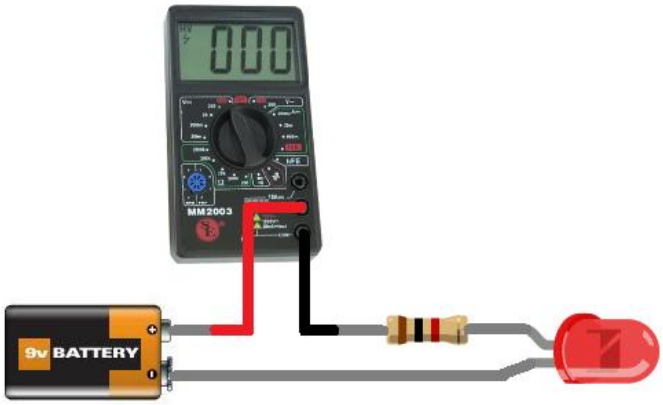


Figure 2: Circuit with Meter

Observe the current reading on the meter. This is the amount of current leaving the battery, traveling through the meter, the resistor, the LED, and then back to the battery.

Multimeters are indispensable to the electronic technician, electrician, and anyone who routinely maintains or services electronic and electrical equipment. Now that tool is in your hands to test batteries, check cables, and do other basic measurements in your home.