

Using a Multimeter

Jeffrey La Favre

These instructions use the Extech model MN35 as an example of a multimeter. This is the meter you will use in our meetings unless you bring your own. It is very important to understand the proper methods for making measurements with a multimeter because it is easy to damage the meter by improper use.

The measurements we usually want to make with the meter are resistance, voltage and current. The MN35 meter is capable of measuring DC voltage up to 600 volts, AC voltage up to 600 volts, resistance up to 20 mega ohms and DC current up to 10 amps. The meter cannot be used to measure AC current.

The meter has a dial (Figure 1) which must be set to the proper position for the type of measurement you desire (in the photo the dial is set to the OFF position). The upper left quadrant of the dial contains the settings for DC voltage. For



Figure 1 dial of MN35 multimeter

example, if the dial is pointing to this , the meter is set to measure a maximum of 20 volts DC. The straight lines above the number (solid and dashed) are the symbol used on this meter to represent DC (direct current). Do not confuse this setting with a setting to measure direct current. This setting is for measuring **VOLTAGE** of a direct current source (for example, a battery).

We won't have much need to measure AC voltage but I will cover the setting here briefly. There are two

settings for measuring AC voltage (200 and 600 volts). The meter should be set to this  to measure a maximum of 200 volts AC. Notice the curved line symbol above the number, which represents AC. We will never work with voltages above 20 as these have the potential to cause you harm by electric shock. You should never attempt to measure voltages higher than 20 volts, even though the meter is capable of measuring higher voltages.

In your first lesson (light bulbs) you will be using the meter to measure voltage drops across mini light bulbs. A voltage drop is a measure of the amount of voltage consumed by an electrical or electronic

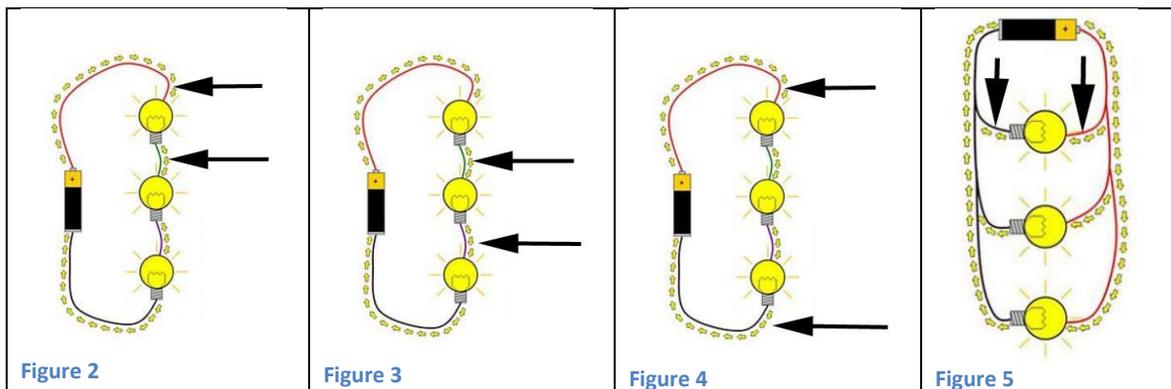
component. If all light bulbs in a circuit are in parallel, or if there is only one light bulb in the circuit, then the voltage drop across the bulb(s) will be the same as the voltage supplied by the battery. If the light bulbs are in series, then each bulb will consume a fraction of the voltage supplied by the battery.

To make a DC voltage measurement:

1. Make sure current is flowing through the circuit you are measuring
2. Connect the test leads to the meter, red wire to the jack labeled **V·Ω·mA** and black wire to jack labeled **COM** (see Figure 1).
3. Set the dial to the proper voltage setting (in our light bulb experiment that would be 20 volts



4. Touch one meter probe tip to one side of the component (bulb) and the other meter probe tip to the other side. The arrows in Figure 2 mark the locations where the probes should be placed to measure the voltage drop across the top bulb, Figure 3 for middle bulb, Figure 4 for voltage drop across all three bulbs and Figure 5, voltage drop across bulbs in parallel. The voltage drop across each bulb in the parallel circuit of Figure 5 is the same. For the parallel circuit, the probes can be placed anywhere in the circuit as long as one probe is on the negative side and the other on the positive side.

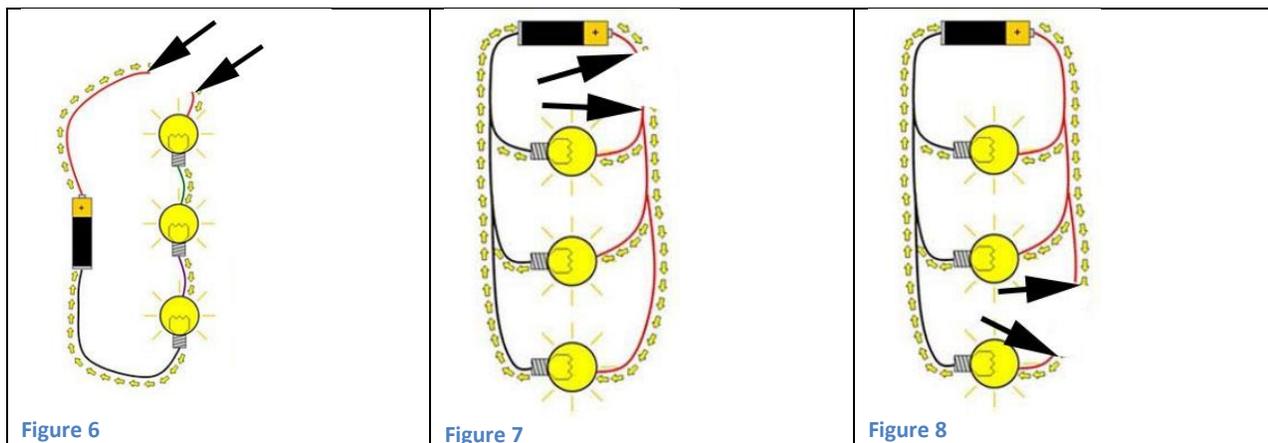


To make a DC current measurement:

1. Make sure current is flowing in the circuit you are measuring.
2. You must open the circuit in the position where you want to measure current
3. Connect the probes to the meter as follows: black wire to COM jack and red wire to jack labeled 10A. This will allow measurements up to 10 amps (if you are measuring high current you must make the measurement quickly, 15 seconds or less, and only one measurement every 15 minutes). In our case we will measure much less than one amp and won't need to follow these time limits.



4. Set the meter dial to the  position (10 amps DC).
5. Connect one meter probe to one end of the open circuit and the other probe to the other end. Figure 6 arrows show where to connect the probes in a series circuit. Actually, the circuit can be opened in any location since the current is the same anywhere in the circuit. Figure 7 shows the location for the probes in a parallel circuit for measurement of total current. Figure 8 shows the location for the probes in a parallel circuit for measuring current of just one light bulb (adjust the position appropriately to measure each light bulb).



To make a resistance measurement:

1. Unlike measurements for voltage and current, measurement of resistance must be done **WITHOUT** current flowing through the circuit. If current is flowing through the circuit, **THE METER MAY BE DAMAGED**.
2. Connect the meter leads to the meter: black wire to the **COM** socket and red wire to the socket labeled **V·Ω·mA**.
3. Set the meter dial to the appropriate level of resistance. For measuring the light bulbs, use the lowest resistance setting: , which is used to measure resistances up to 200 ohms.
4. Touch one probe to one end of the component to be measured and the other probe to the other end. It is important that one end of the component is open for proper measurement (in other words, at least one end of the component should be connected to a meter probe and nothing else).