Digital Multimeter

A basic multimeter will measure Volts, Amperes, and Ohms. The maximum reading that can be displayed on the scale can be selected with a rotary knob. Many times the off position is on this knob, if not, there is a separate on-off switch. Some meters have an auto off feature to extend the battery life. If the meter turns off, just change the scale and it will wake up. All meters have an input, which are usually banana jacks.

One lead is labeled COM, which is the negative lead, and the black lead is inserted there. The red lead is plugged into the V or Ω jack. On some meters current is also measured at this same input jack. On others, current has 1 or 2 additional input jacks. Most meters have a 10 Ampere current input jack that is separate from the regular current measurement jack and is used for currents higher than 200 mA. The red lead would be moved there to measure current.

To measure voltage, set the scale to an appropriate range for what you are measuring. The highest voltage we use in this text is 15 Volts, so you normally would not need to use a scale higher than 20 Volts. All our measurements will be DC.

To make AC measurements, you need to select the AC voltage range, not the DC range. The AC scale is usually marked with a ~ next to V sign (~V). The DC range will be marked with a V followed by a dash (V–). If you reverse the leads and put the black lead on a positive voltage, and the red lead to ground, then the voltage will read negative, even though it is positive. If you do this, you can mentally make the correction, re-measuring is not required.

You can use the ohmmeter scale to measure resistance of the resistors you use before you put them in the circuit. Once you assemble your circuit, you can use the ohmmeter to check for shorts or opens, but you should be aware that resistance measurements of a particular resistor may not be accurate since other resistive components maybe connected to it in the circuit. Many ohmmeters have *continuity checkers* and when you put the leads across a low impedance, the meter buzzes, like saying “you are buzzing out the circuit”.

A digital multimeter is a device with a numeric LCD. Depending on the precision of the meter, it has 2.5, 3.5, or more digits. The 0.5 digit implies that the first digit is either 1 or absent. No matter what scale is selected the largest number that can be displayed on that scale is 1.99 depending on how many digits the display is. If the meter is set to the 2 volts scale, then the maximum voltage that can be displayed is 1.99 volts, if it goes higher, the meter will over-range and display 1 and no additional digits.

Figue I. A multimeter measuring a battery voltage.

To measure current, the leads of the meter are put in series with the component that the current of which is being measured. So, if you wanted to measure the current through a resistor in your circuit you should lift one lead of the resistor out of the circuit, and connect the meter between the resistor lead and the point where the resistor was plugged in.

Another way to measure current is to place a small valued resistor in series with the connection where the measurement of current is to be made. Before connecting this resistor, measure its resistance. Make the connection, turn on the power and then measure the voltage across it. Then the current is just I-V/R. However, make sure the this resistor is much small than any of the other resistors in the cirucuit.

Some multimeters have extra features, such as the ability to measure capacitance, frequency, transistor check and diode check.