Chapter 6

Appendix A: *General Reference Material*

6.1 Digital Multimeter (DMM) Usage

In order to use the Digital Multimeter (DMM), follow these steps:

1. Turn the DMM on. Figure 6.1 shows a view of the DMM with the probes.

2. Plug the black probe into ground or into the common jack. Plug the red probe into the ”A” jack for current measurement or the ”$V\Omega$” jack for voltage or resistance measurement.(Often times, the red probe will be in the ”$V\Omega$” jack).

3. Refer to Figure 6.2 shows a schematic for measuring the voltage and resistance.

Figure 6.1: An example DMM with probes

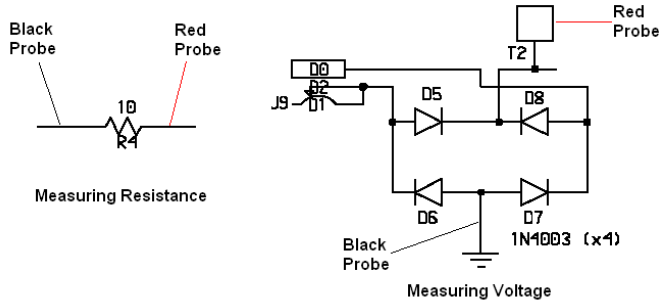


Figure 6.2: Schematic for measuring the voltage and resistance

4. Choose the correct measurement setting, keeping the following in mind:

   (a) We will be taking DC measurements exclusively.

   (b) There is a continuity-check setting. It will test electrical continuity. To see how this works, set it to the speaker setting, and touch the two probes together.

   (c) The Ω setting reads the value of a resistor, if you are unable to read the color code or the color bands.

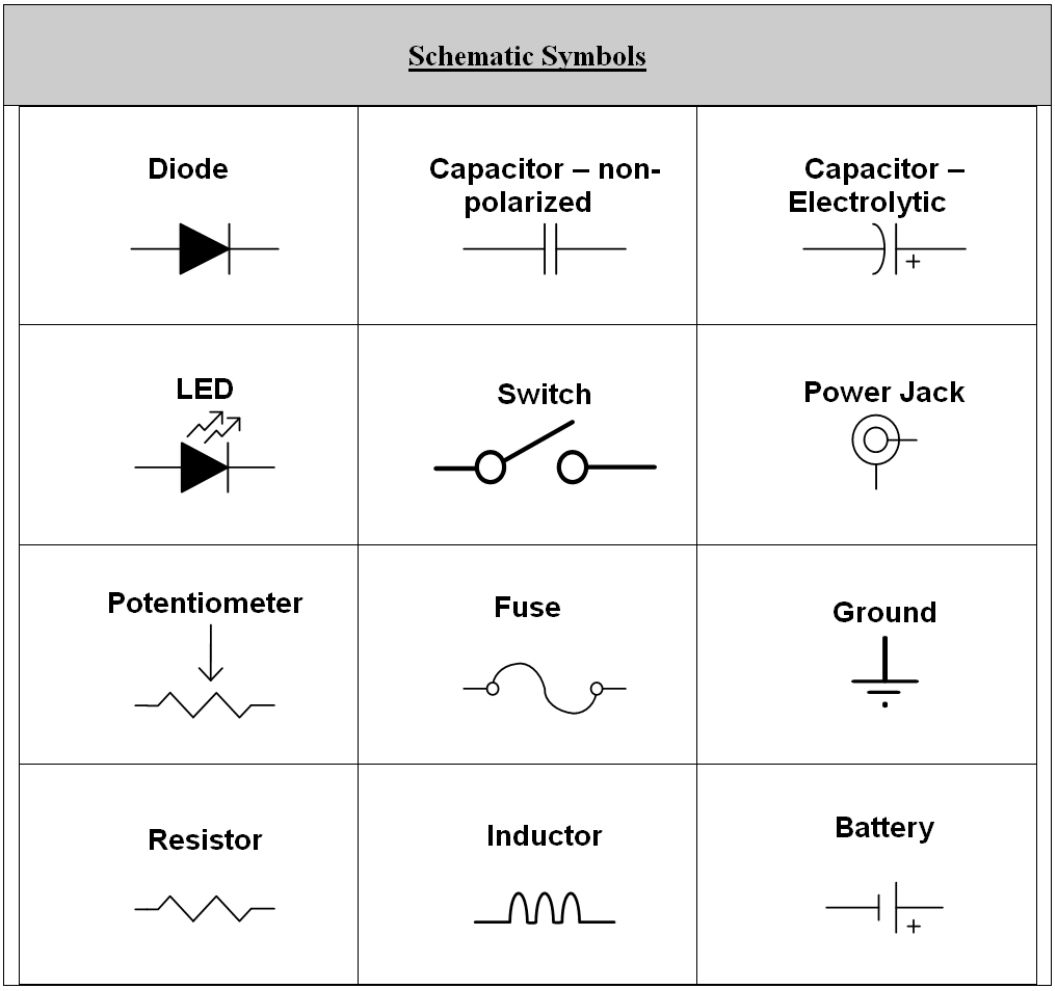
5. Take the Measurements.

6. When finished, turn off your DMM to save battery life.

Never probe a circuit for resistance with the circuit energized.

6.2 Schematic Symbols

The table contains some common schematic symbols you might encounter, when examining a schematic.



6.3 Resistor Color Code Chart

The table below will assist you in identifying resistor color codes. Examples:

- If a 180Ω resistor is needed, what are the color bands?

  $$180 = 18 \times 10^1 = [10 \times (1) + 1 \times (8)] \times 10^1 = [10 \times (brown) + 1 \times (gray)] \times 10^{Brown}$$

  = Brown Gray Brown = 180Ω

- If the bands on the resistor are gold red violet yellow, what is the resistance? First of all the resistor is backwards. Gold is never the first color band: so, the real order is yellow violet red gold.

  $$[10 \times (yellow) + 1 \times (violet)] \times 10^{red} = [10 \times (4) + 1 \times (7)] \times 10^2 = 4,700 = 4.7K\Omega$$

Resistor Color Code Chart				
Color	1st Color Band	2nd Color Band	3rd Color band (Multiplier)	Tolerance
Black	0	0	10^0	
Brown	1	1	10^1	± 1%
Red	2	2	10^2	± 2%
Orange	3	3	10^3	± 3%
Yellow	4	4	10^4	± 4%
Green	5	5	10^5	± .5%
Blue	6	6	10^6	± .25%
Violet	7	7	10^7	± .1%
Gray	8	8	10^8	
White	9	9	10^9	
Gold			10^{-1}	± 5%
Silver			10^{-2}	± 10%
None				± 20%

6.4 Capacitor Code Chart

The table will assist you in identifying capacitor codes.

Use these units of reference:

- **1 milli Farad:** 10^{-3}
- **1 micro Farad:** 10^{-6}
- **1 nano Farad:** 10^{-9}
- **1 pico Farad:** 10^{-12}

Examples:

- If the capacitor says ”104” on it, do the calculation as shown below:
$10 \times 10^4 = 10^5 picoFarad \times \frac{1microFarad}{10^6 picoFarad} = .1microFarad$
- If the capacitor says ”47” on it, then assume the multiplier is 0. The process is then the same as shown above.

Capacitor Code Chart: Digit multipliers	
Third digit	**Multiplier** (this, times the first two digits, gives you the value in Pico-Farads)
0	1
1	10
2	100
3	1,000
4	10,000
5	100,000
8	.01
9	.1

