LED Indicators

A device used to indicate the status of a digital output is the **light-emitting diode** or **LED.** (This is sometimes pronounced as a word ["led"] and sometimes said as separate initials ["ell ee dee"].) The circuit symbol, shown in Figure 2.2, has two terminals, called the anode (positive) and cathode (negative). The arrow coming from the symbol indicates emitted light.

Figure 2.2 LED Showing Anode and Cathode Terminals

The electrical requirements for the LED are simple: current flows through the LED if the anode is more positive than the cathode by more than a specified value (about 1.5 volts). If enough current flows, the LED illuminates. If more current flows, the illumination is brighter. (If too much flows, the LED burns out, so a series resistor is used to keep the current in the required range.) Figure 2.3 shows a circuit in which an LED illuminates when a switch is closed.

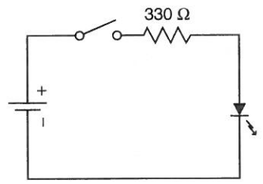

Figure 2.3 LED Turns ON when Switch Closes

The left side of Figure 2.4 shows a NOT gate (inverter) driving an LED. The LED is on when the inverter output is HIGH (~5 volts), since the anode of the LED is more positive than the cathode. This happens when the inverter input A is LOW (~0 volts).

In the diagram on the right side of Figure 2.4, the LED turns on when the inverter output is LOW (~0 volts), again since the anode is more positive than the cathode. This happens when input the inverter input A is HIGH.

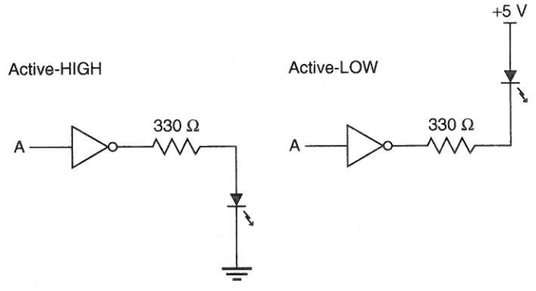

Figure 2.4 Driving an LED with a Logic Gate

Procedure

DIP Switches as Logic Switches

1. DIP (Dual In-Line Package) switches can be combined with resistors packaged as a SIP (Single In-Line Package) to make multiple logic switches on a breadboard. A SIP resistor package is shown in Figure 2.5. If you measure the resistance between pin 1 and any other pin, you should get the value of 1 resistor. Measuring between any two other pins will give the value of two resistors added together.

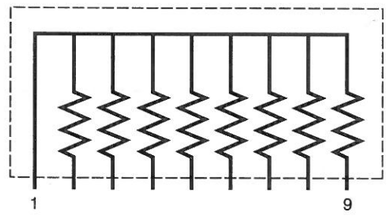

Figure 2.5 SIP Resistor Network (Bussed)

2. Measure the resistance between pins 1 and 2 of the SIP resistor. Resistance: _____
   Measure the resistance between pins 1 and 3. Resistance: _____
   Measure the resistance between pins 2 and 3. Resistance: _____
   Measure the resistance between pins 2 and 4. Resistance: _____

   What do you conclude from these resistance measurements?

   _____

   _____

   _____

3. Connect the components shown in Figure 2.6 to make eight logic switches. Test each one with a logic probe to ensure its correct operation. Demonstrate the circuit to your instructor. ***Do not disconnect the circuit yet. It will be used in the next part of this lab.***

   Instructor's Initials _____