Knowledge Domain: Electrical Simple
Unit: Connections
Skill: Building and Using a Continuity Tester

Tools and Parts Required:

1) **Soldering iron**
2) **Solder**
3) **Stranded wire**
4) **Solid-core wire**
5) **Needle-nose pliers**
6) **Wire cutters**
7) **Wire strippers**
8) **Heat shrink tubing**
9) **Epoxy**
10) **5mm super red diffused LED** (digikey: 67-1648-ND)
11) **200 ohm resistor** (digikey: P200BACT-ND)
12) **Perfboard or PCB** (digikey: 3405K-ND)
13) **2 Alligator Clips** (digikey: 314-1033-ND)
14) **Battery holder (for 2 AAA batteries)** (digikey: BC 2AAAW-ND)
15) **2 AAA batteries**
16) **Sandpaper (optional)**

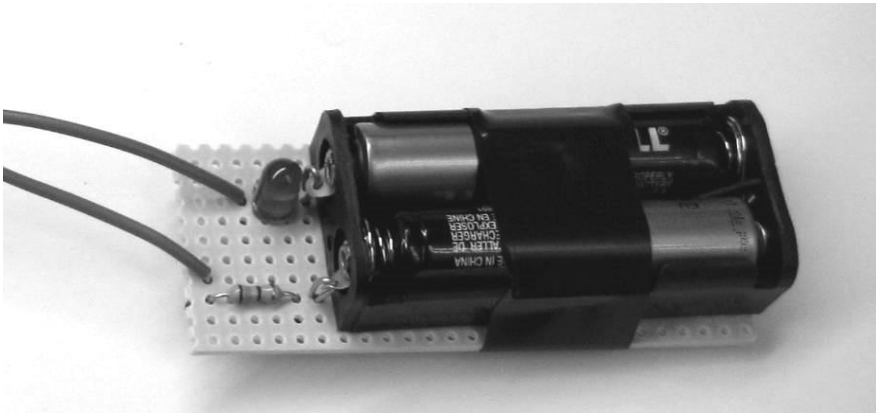
Introduction

This skill is an introduction to basic circuit theory. First, you must understand that electricity only flows in a closed circuit. A closed circuit is a loop of materials that will conduct electricity. An open circuit is a loop that will not conduct electricity.

A continuity tester helps to determine if a circuit is closed or open. Testing circuits is an essential skill for troubleshooting. A functioning continuity tester indicates continuity, sometimes called connectivity. The LED on the continuity tester will light when the test leads are connected to two points that are connected electrically. The LED will not light if the two points are not connected electrically.

Example

Below is a picture of a simple continuity tester. The circuit includes a battery, a light emitting diode (also called an LED), and a resistor in series.

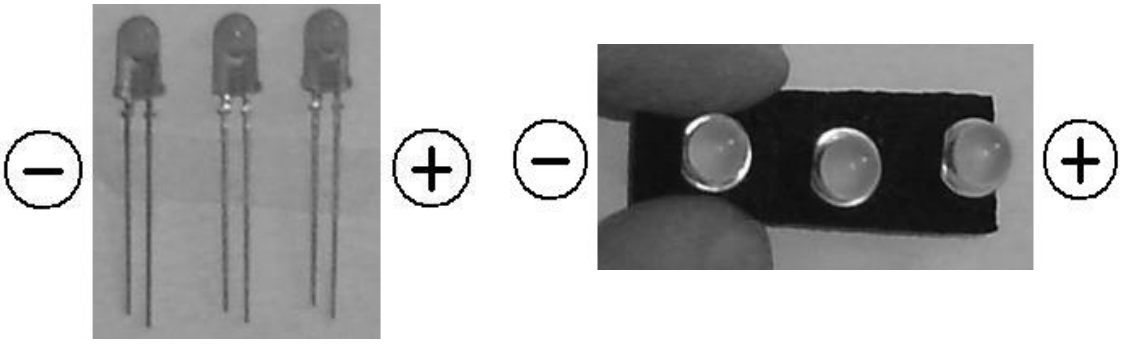


Identification and Diagnosis

Before Assembling the Continuity Tester

Be aware of the following items as you build your continuity tester

- Polarity. Some electrical components are polarized. Polarized components have a negative end and a positive end. Polarized components will only function when placed in the circuit in the correct direction. In the continuity tester, the batteries and the LED are both polarized. The resistor is not polarized.
    - The battery holder has markings that indicate the positive end (+) and the negative end (-). Verify the direction of the battery holder when making connections. Follow the directions on the markings when you place batteries in the battery holder.
    - LEDs are also polarized. LEDs have a negative and positive leads. If the LED is new, notice that the negative lead is shorter than the positive lead. If the LED has been used, look at the LED bulb. The LED bulb is not round. The slightly flattened side is the negative terminal.

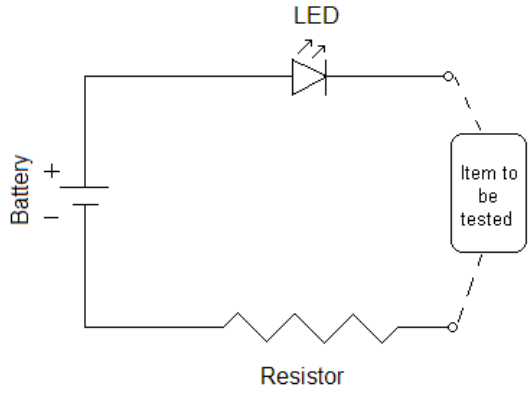


- Use a minimum amount of wire to connect the components. Long wires can be pulled accidentally and can break connections in the circuit.
- Use the techniques for connecting solid-core and stranded wires you practiced in the 'soldering' lab. You must strip wire when making electrical connections.
- Use heat shrink to insulate all connections. Refer to the BTA skill *Electrical-Connections-Heat Shrink Tubing*.

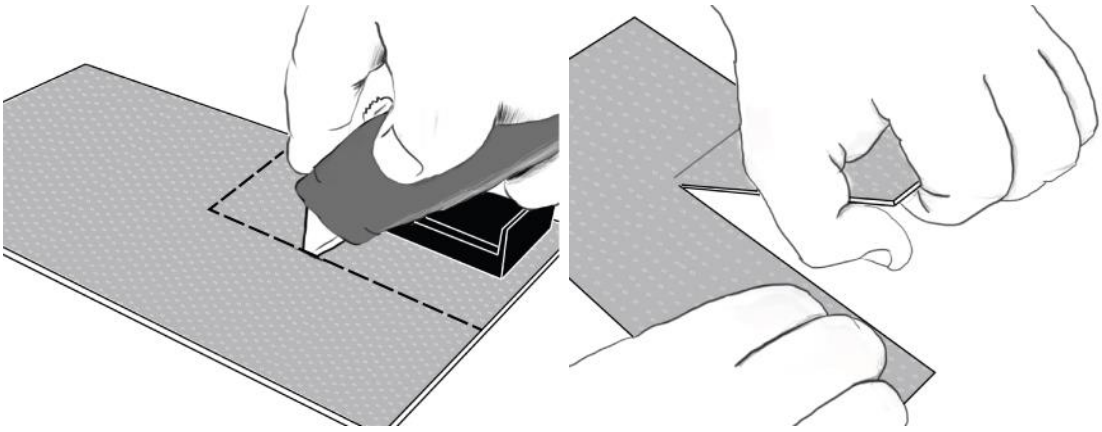
Procedure

1. Collect the materials you need to assemble the continuity tester. Soldering is required; prepare your soldering iron as instructed in previous exercises.

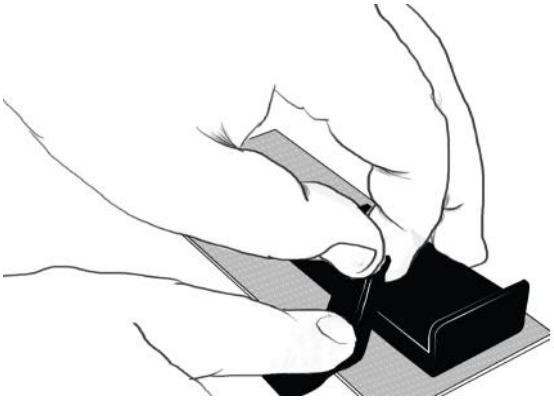
2. Plan the arrangement of your circuit. You will need to attach the battery holder, LED, resistor and test leads to the board. Use the following circuit diagram as a guide. When you use perfboard, place the parts of the circuit (called components) on top and connect wiring underneath. Decide the size of the perfboard.



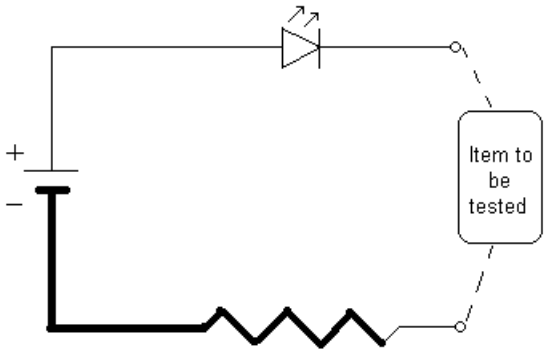
3. Score the board by making cuts along a line of holes with a knife. You will not be able to cut completely through the board. Break the board along the scored lines.

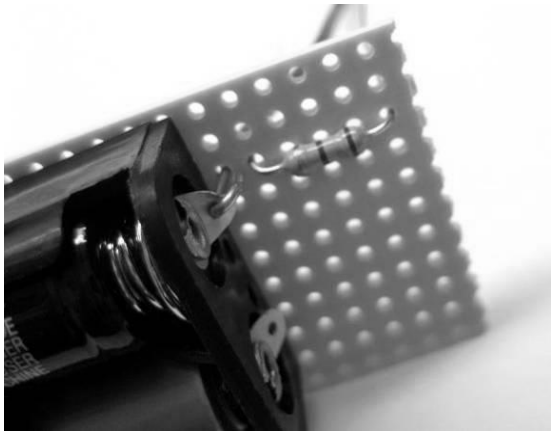


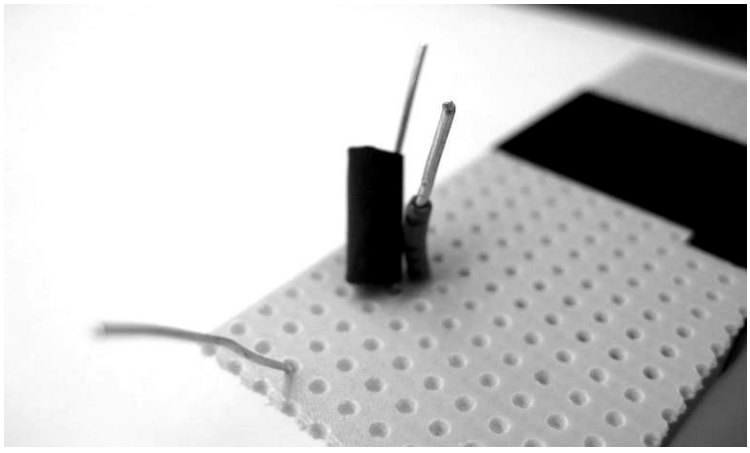
4. Use sandpaper to roughen the perfboard where you will place the battery holder. A rough surface helps epoxy stick. Use electrical tape to temporarily hold the battery holder.



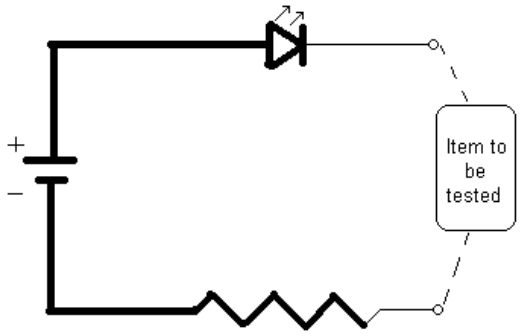
5. Using solid core wire, solder the negative lead on the battery holder to the resistor.

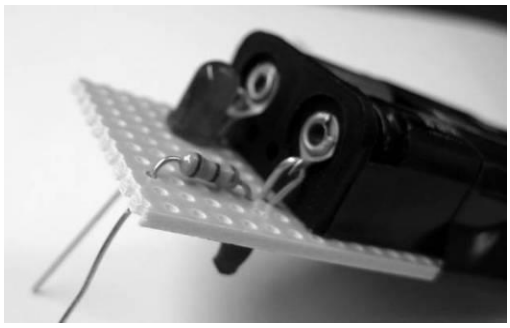


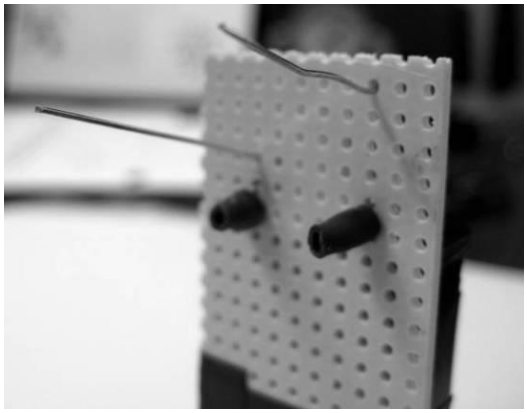




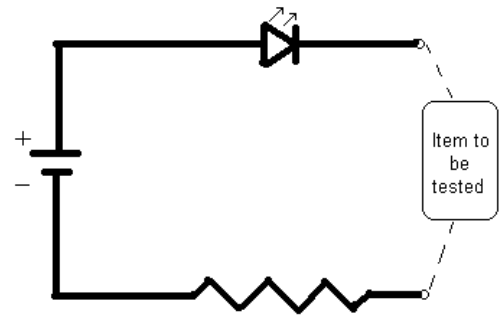
6. Using solid core wire, solder the positive end of the LED to the positive lead of the battery holder. Remember, the positive end of the LED is the long lead.

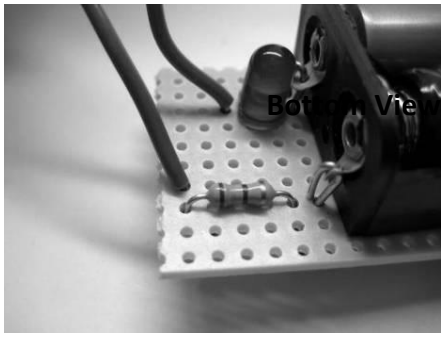


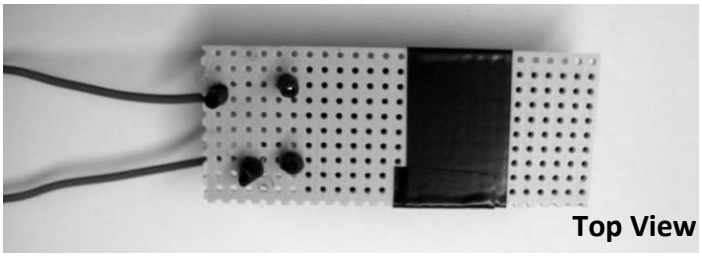




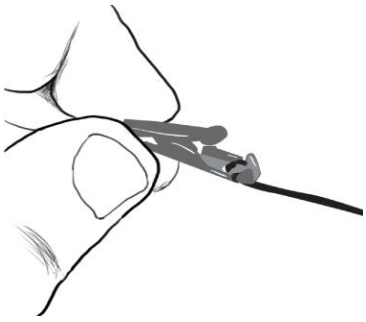
7. Prepare two lengths of stranded wire for the test leads. Cut two stranded wires at least 15cm long. Solder one wire to the negative end of the LED. This is the positive lead. Solder the other wire to the free end of the resistor. This is the negative lead.



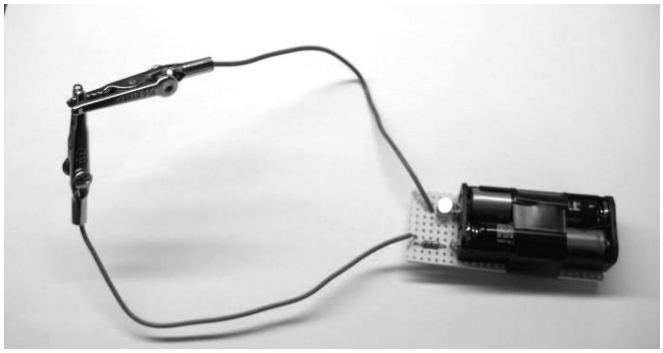




8. You should now have two wires extending from the perfboard. Strip the ends of the wires. Solder an alligator clip to each wire. The clips are terminals that connect to the connections you will test.



9. Clip the test leads together. This creates a closed circuit. The LED should light if the continuity tester is assembled correctly. If the LED does not light, check your connections.



10. You may use electrical tape or heat shrink tubing to insulate the alligator clips. Shrink any remaining heat shrink tubing to cover the connections. Use epoxy to attach the battery holder to the perfboard.

Exercise

Use the instructions in the procedure to build your continuity tester.

Test various electrical connections for continuity. Test the joints you soldered in the "Soldering" exercise. Your instructor will provide you with an open circuit. Notice how the continuity tester does not illuminate when placed across an open circuit.

Preventative Maintenance and Calibration

Always use safe operating procedures when you handle electrical connections. Disconnect all power sources before you test a circuit.

Do not use the continuity tester on delicate circuits. The voltage from the batteries can damage sensitive components.

To test the continuity tester periodically, connect the test leads to each other. If the LED does not light, you need to replace the batteries. After you install new batteries, if the LED does not light up, check the electrical connections and the LED. Sometimes the LED burns out after excessive use. To fix broken electrical connections, resolder the connections.