Objectives:
The purpose of this laboratory is to learn the basic skills of soldering electronic components and wires.

Equipment to be drawn out:
1 - Goggles
1 - Soldiering Iron
1 – Solder (available in Lab 3010)
1 – Wet Sponge
1 – Cutter for excess wires

Components:
1 – EL-K-Back and forth LED flasher kit

Background:
Soldering is a technique that is used in making and repairing jewelry whereby two pieces of metal are joined by applying a molten metal which has a lower melting point than the two metals being joined. Soldering is a must have skill in electronics construction. It is also a skill that must be taught correctly and developed with practice. This description attempts to explain soldering through a few simple steps.

Procedure:
Note: The following steps must be followed carefully.
1. Soldering requires the following equipment: solder, a soldering iron, and a wet sponge.

Solder is the paste of 10 or 14 karat gold that is placed between two pieces of gold and heat is applied to melt the solder, permanently joining the two pieces of metal.

A Soldering iron is usually rod-shaped metal with a pointed or wedge-shaped tip that is used as a heat source to melt solder and then soldering metallic parts. Irons of the 15W to 30W range are good for most electronics/printed circuit board work. Using anything higher in wattage will risk damage to the component or the pc board. Using the correct type of solder is also important. Never use acid core solder. Acid core solder will corrode component leads, board traces and form conductive paths between components. The best solder for electronics work is a thin rosin core solder, which is the only type that is provided by the EECS shop.

2. A clean surface is very important for a strong, low resistance joint. Ensure all surfaces to be soldered are free of contaminates. Don't neglect to clean component leads, as they may have a buildup of glue from the packaging.
3. After ensuring the component and board (from EL-K-Back and forth LED flasher kit) are clean, you are ready to **place the component** on the board. Bend the leads as necessary and insert the component through the proper holes on the board as shown in the document that came with the Kit. To hold the part in place while you are soldering, you may want to bend the leads on the bottom of the board at a slight angle.

4. **Clean** any oxidation from the **soldering iron tip** using a wet sponge. Apply a very small amount of solder to the tip of the iron to ‘tin’ the tip, and then wipe off the excess. This helps in conducting the heat to the component and board, but it is not the actual solder that will make up the joint. **Lay the iron tip** so that it rests against both the component lead and the pad of the board. Normally, it takes only a second to heat the component up enough to solder, but larger components and larger soldering pads on the board can increase this time.

5. Once the component lead and solder pad has heated up, you are ready to **apply solder**. Touch the tip of the strand of solder to the component lead and solder pad. The solder should flow freely around the lead and pad. Once the surface of the pad is completely coated, stop adding solder. To prevent splashing and ‘bridging’ (an electrical short), do not use excessive amounts of solder. Once the correct amount of solder is applied, remove the soldering iron. Don't move the joint for a few seconds to allow the solder to cool. If the joint is moved, a "cold joint" could be formed. Cold joints occur when the component lead or solder pad moves before the solder is completely cooled.

As a result the solder does not make good contact with the component lead or pc board pad. Cold joints make an improper electrical connection and can provide a high or intermittent resistance. Cold joints can be recognized by a characteristic grainy, dull gray color, and can be easily fixed. This is done by first removing the old solder with a de-soldering pump. Once the old solder is removed, you can re-solder the joint, making sure to keep the component still, as it cools.

Note: Remember that when soldering, the rosin in the solder releases fumes. These fumes are harmful to your eyes and lungs. Therefore, always work in a well-ventilated area. Solder contains lead, which is toxic if ingested. Hot solder splashes present a danger to the naked eye. Eye protection is required and mandatory!

6. Inspection of the solder joint and verifying proper workmanship is the final step in the soldering process. This step may seem redundant, but identifying a short caused by splashes/bridging or an open circuit on the trace from excessive heat, can save time in troubleshooting as well as personal frustration. Most board malfunctions experienced for this class/project are caused by workmanship errors. You need to turn in the soldered devices to your instructor who will verify your work and give you a grade based on the quality of your work.

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