

Cornerstone Electronics Technology and Robotics I Week 19 Soldering Tutorial

- Administration:
 - Prayer
 - Turn in quiz
 - Using fixed resistors design and build a voltage divider divides 5 volts in half. The maximum current permitted through the divider is 10 mA. Measure both the current and voltage in your design.
 - Now use a potentiometer to do the same task.
- Building Robots for Beginners, Section Chapter 21, 22, **Electronic Soldering and Connecting:**
 - Soldering is the process of melting solder onto the desired joints to connect the joint materials together both electrically and physically. Soldered joints are not capable of taking a lot of stress or movement.
 - Show examples
 - A good soldering job requires:
 - Clean conductors, parts, and joints
 - Solder
 - Flux
 - Heat
 - Safety precautions:
 - To avoid burns, always assume the tip is hot.
 - Safety goggles are required when working with a soldering iron.
 - Keep your soldering iron away from all flammable materials.
 - Always return the iron to the soldering iron stand, do not lay it on the workbench.
 - Be sure the hot soldering tip and heater do not come into contact with the electric power cord.
 - Before making any adjustment, such as removing or replacing a tip, make sure the station is unplugged and cool.
 - Do not dip the soldering iron into any liquid.
 - Always work in a well ventilated room.
 - After use, unplug the soldering station and allow the tip to cool before storing.
 - Thoroughly wash your hands with soap and water after each soldering session.
 - Soldering equipment:
 - Solder wire and flux
 - Lead free solder is made of tin and silver.
 - Rosin flux core solder; flux is inside the hollow of the solder
 - Flux is a chemical that dissolves oxides on metals during soldering. Flux suspends oxides in solution and floats it to the top.
 - Never use acid core solder on any electronic circuits. The acid is highly corrosive and will eat through many components.

- Electronic soldering irons:
 - Soldering irons for electronics are low-wattage from 25 to 40 watts.
 - Tip temperature range from 600 to 900 degrees F. Tip temperatures from 700 to 800 degrees F are preferred.
- Soldering guns
- Butane torches
- Soldering sponges:
 - Special sponges with distilled water are used to periodically clean iron tips.
- Helping hands
- Desoldering bulb and tool
- Braided wire
- Heat sinks
- Steps in soldering:
 - Setup equipment at a location with adequate ventilation and away from combustible materials.
 - Moisten sponge with distilled water.
 - Put on personal safety equipment, i.e., goggles.
 - Plug in soldering iron; wait 2 – 5 minutes.
 - Remove all foreign materials from materials to be connected using solvents, sandpaper, or steel wool.
 - Make a good mechanical connection by wrapping wires around each other or around a terminal.
 - Use the soldering iron to heat the joint, not the solder. A small amount of fresh solder on the tip will help conduct heat to the joint faster. The solder should be heated by the joint so it will flow into the connection, resulting in a stronger joint. Do not apply too much solder or move the connection before it cools.
 - The two key factors in quality soldering are time and temperature.
 - Time: The solder should melt within a second for normal PC board connections and within two seconds for most other connections.
 - Temperature: The tip temperature should be about 100 degrees F above the solder melting point. For melting points of different solder alloys, see: <http://www.rfcafe.com/references/electrical/solder.htm>
 - When solder flows freely throughout a connection, it tends to form concave shapes; with insufficient heat solder does not flow freely and forms convex shapes or blobs. See diagrams at: <http://downloads.solarbotics.com/pdf/solderingtutorial.pdf>
 - Do not create a solder bridges. A solder bridge is an undesired connection made by excess solder between two connections.

- Keep the iron's tip clean and shiny by wiping off debris on the damp sponge.
 - On electrical and electronic components avoid too much heat. A heat sink can be used to dissipate away from the component.
 - After soldering, remove any remaining flux with a cotton swab dipped in isopropyl or denatured alcohol.
 - Tinning the tool tip: Always apply a generous amount of solder to your tip just before or immediately after you turn the soldering iron off to protect the tip from oxidation.
- Other Soldering "Don'ts:
 - Do not run a soldering iron at high temperatures for a long period of time when not in use.
 - Do not file a nickel or iron clad soldering iron.
- Cold solder joints:
 - This happens when one of the parts is not heated sufficiently for the solder to adhere.
 - Also, do not hold your iron too long on a connection; this will weaken your joint.
 - Do not try to "paint" the solder onto the wire or connection.
- Tinning:
 - When you apply solder to a part before you make a solder connection, you are tinning the part.
 - Example of old Sandwich breadboard PCB.
 - Perform Soldering Tutorial Lab 1 – Tinning a Wire
 - Perform Soldering Tutorial Lab 2 – Soldering Lug-Type Terminal Strips
 - Perform Soldering Tutorial Lab 3 – Soldering Components to a PC Board
- Desoldering:
 - Used when a part must be removed.
 - The pc Board is more important than the component that is being removed. Always, sacrifice a component before risking damage to the pc board. It is much easier and less costly to replace a component than to try to repair or replace a damaged pc board.
 - Perform Soldering Tutorial Lab 4 – Desoldering Components on a PC Board

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Soldering Tutorial LAB 1 – Tinning a Wire

- **Purpose:** The purpose of this lab is to tin the end of a stranded wire.

- **Apparatus and Materials:**
 - 1 – Soldering Iron and Holder with Moistened Sponge
 - 1 – 0.022 Resin-Core Solder
 - 1 – 0.50 Resin-Core Solder
 - 1 – Wire Cutting Pliers
 - 1 – Wire Strippers
 - 1 – Helping Hands
 - 2 – 5 cm #22 Gauge Stranded Wires

- **Procedure:**
 - Follow all safety precautions.
 - Turn on the soldering iron.
 - Moistened the sponge with distilled water.
 - Cut a two pieces of stranded wire about 5 cm long.
 - Stripe 1 cm of insulation from all ends of the wires.
 - Place the ends of one wire into the helping hands. The bare wire should be free of the alligator clip.
 - Clean the soldering iron tip off on the sponge.
 - Hold the soldering iron against the bare wire.
 - Apply a small amount of fresh 0.022 solder between the soldering iron tip and the bare wire to help conduct heat to the wire faster.
 - As the wire heats, apply more solder to the wire away from the tip of the soldering iron.
 - The solder should be heated by the wire so it will flow into the stranded wire.
 - After the bare portion of the wire is soldered, continue to hold the soldering iron against the wire for about a half of a second then pull away.
 - Inspect the tinned wire for:
 - Shiny surface
 - Wire strands – they should be visible
 - Excess insulation damage
 - Tin the other end of the wire of the wire.
 - Tin both ends of the other wire.
 - Tinning the tool tip: Just after turning the soldering iron off, apply a generous amount of 0.050 solder to your soldering iron tip.

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Soldering Tutorial LAB 2 – Soldering Lug-Type Terminal Strips

- **Purpose:** The purpose of this lab is to solder stranded wires to a lug-type terminal strip.

- **Apparatus and Materials:**
 - 1 – Soldering Iron and Holder with Moistened Sponge
 - 1 – 0.022 Resin-Core Solder
 - 1 – 0.50 Resin-Core Solder
 - 1 – Wire Cutting Pliers
 - 1 – Wire Strippers
 - 1 – Helping Hands
 - 2 – 5 cm #22 Gauge Stranded Wires
 - 1 – Lug-Type Terminal Strip

- **Procedure:**
 - Follow all safety precautions.
 - Turn on the soldering iron.
 - Moistened the sponge with distilled water.
 - Clean the component leads and lugs with rubbing alcohol.
 - Tin the end of a wire.
 - Attach the wire to the lug of the terminal strip.
 - Insert the end of the tinned wire through the lug allowing the insulation to be about 1 mm above the lug.
 - Crimp the wire around the lug using the pliers.
 - Cut the end of the wire off even with the top of the lug.
 - Clean the soldering iron tip off on the sponge.
 - Hold the soldering iron against the lug and the wire.
 - Apply a small amount of fresh 0.022 solder between the soldering iron tip and the lug to help conduct heat to the connection faster.
 - As the lug and wire heat, apply more solder directly to the connection but not to the soldering tip.
 - The solder should be heated by the lug so it will flow into the connection.
 - Make sure that the entire eyelet of the lug is filled with solder to keep the connection from failure long term.
 - Don't move the wire or the connection for a few seconds to allow the solder to cool.
 - Practice with other wires and lugs.
 - Tinning the tool tip: Just after turning the soldering iron off, apply a generous amount of 0.050 solder to your soldering iron tip.

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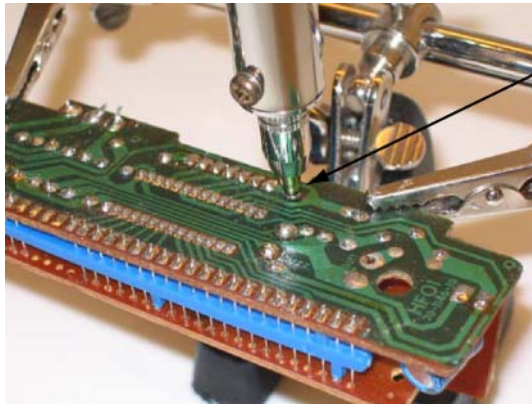
Soldering Tutorial LAB 3 – Soldering Components to a PC Board

- **Purpose:** The purpose of this lab is to solder components to a PC board.
- **Apparatus and Materials:**
 - 1 – Soldering Iron and Holder with Moistened Sponge
 - 1 – 0.022 Resin-Core Solder
 - 1 – 0.50 Resin-Core Solder
 - 1 – Wire Cutting Pliers
 - 1 – Wire Strippers
 - 1 – Helping Hands
 - 2 – 5 cm #22 Gauge Stranded Wires
 - 2 – 5 cm #22 Gauge Solid Wires
 - 5 – Resistors
 - 1 – PC Board
- **Procedure:**
 - Follow all safety precautions.
 - Turn on the soldering iron.
 - Moistened the sponge with distilled water.
 - Clean the component leads with rubbing alcohol and the PC board with steel wool.
 - If needed, tin the component leads.
 - Insert the component leads through the holes of the PC board.
 - To hold the component in place while you are soldering, you may want to bend the leads on the bottom of the board at about a 45 degree angle.
 - Place the PC board into the helping hands.
 - Bring the soldering iron tip so that it rests against both the component lead and the board.
 - Apply a small amount of fresh 0.022 solder between the soldering iron tip and the component lead and solder pad to help conduct heat to the connection faster.
 - Allow the component lead and solder pad to heat up for about one second.
 - Feed the 0.022 solder to the component lead and solder pad, but not the tip of the iron.
 - Once the surface of the pad is completely coated, stop adding solder and remove the soldering iron. The soldered connection should look like a miniature Hershey kiss, not a rounded ball.
 - Don't move the wire or the connection for a few seconds to allow the solder to cool.
 - If the connection looks like a rounded ball, remove the solder by following the instructions in Lab 4 and resolder.
 - Cutoff the excess wire on the leads.
 - Inspect the PC board for:
 - Cold solder joints
 - Solder bridging across the conductive pathways, or traces.

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Soldering Tutorial LAB 4 – Desoldering Components on a PC Board

- **Purpose:** The purpose of this lab is to remove solder from a soldered connection on a PC board.
- **Apparatus and Materials:**
 - 1 – Soldering Iron and Holder with Moistened Sponge
 - 1 – Electric Desoldering Tool (Electronix Express # 060848)
http://www.elexp.com/sdr_0848.htm
 - 1 – 0.022 Resin-Core Solder
 - 1 – 0.50 Resin-Core Solder
 - 1 – Helping Hands
 - 1 – PC Board from Lab 3
- **Procedure:**
 - Follow all safety precautions.
 - Plug in the electric desoldering tool.
 - Place the PC board from Lab 3 into the helping hands.
 - Insert the tip of the desoldering tool over the lead to be desoldered.



Insert the electric desoldering tool directly over the lead.

- Heat the lead and release the pump.
- Resolder the lead.
- Tinning the tool tip: Just after turning the soldering iron off, apply a generous amount of 0.050 solder to your soldering iron tip.