NC ARES Meeting April 11th

60 Meter NVI Antenna, Some Shop Tricks and a Soldering Course

A 60 Meter Antenna

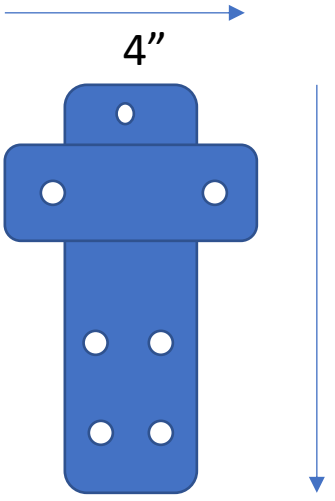
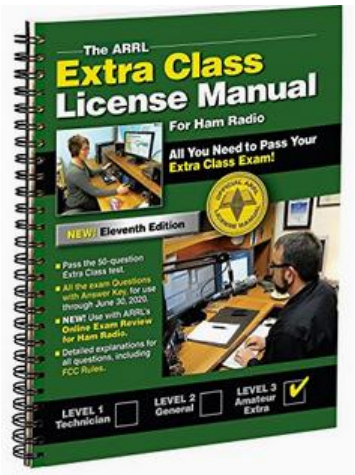


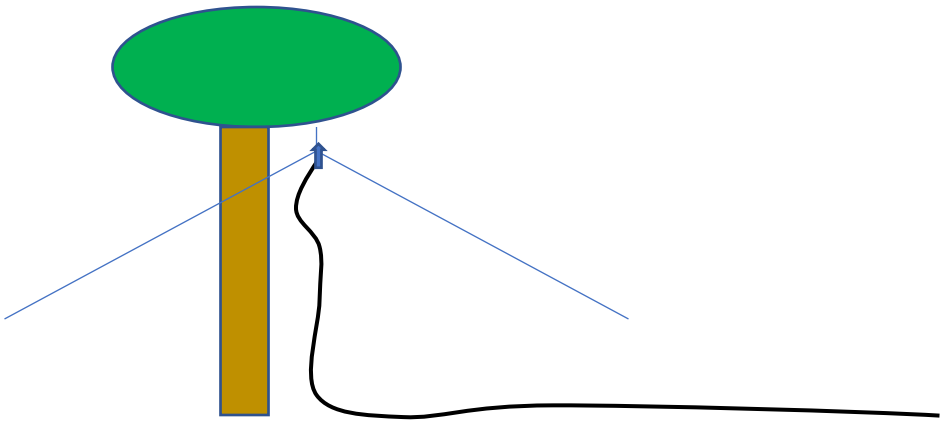
Figure 1
Center Support

- Antenna Wire
  - #12 to #18 Copper clad steel or aluminum
  - For Center Frequency 5373 KHz (dial USB 5371.5)
  - 2 pieces 46 feet, You are going to trim 3 to 9 inches off of each side.
- Coax any length of RG 8x, RG 58 or RG59
- Center Support (plastic shaped something like Figure 1.
- Build.
  - Cut out center support and drill holes as indicated.
  - Crimp one copper terminals to each antenna wire
  - Strip 4 inches of coax to separate center insulated wire and ground shield.
  - Crimp one copper terminal to center and ground of coax
  - Bolt antenna wire and coax terminal to each side of the center support.



60 Meter Antenna

- Put it Up
  - Tie fishing line or weed whacker line to the top of the center support.
  - Tie fishing line or weed whacker line to the antenna wire 12 to 18 inches from the end without the terminal. (you are going to trim a few inches of this lose end off to tune the antenna.
  - Attach the coax to the support with wire or cable ties (has to support the weight of the coax.
  - Toss the center support line over a tree limb or edge of a house. Need to be 20-30 feet up if possible.
  - Spread out the two antenna wires so that they run as close to north – south as you can. They antenna wires should be 6-8 feet off of the ground. Higher is ok but we want the whole antenna relatively close to the ground so that the radiation is nearly vertical (NVI – Near Vertical Incidence).
  - Check SWR with antenna analyzer of swr meter.
    - Trim off 1.5 inches from each end and recheck SWR.
    - Repeat as needed (you will likely trim off 3 to 6 inches so go slow.
  - STOP when you get close to 1:1.3 or so…. You don't have any extra to add back on if you

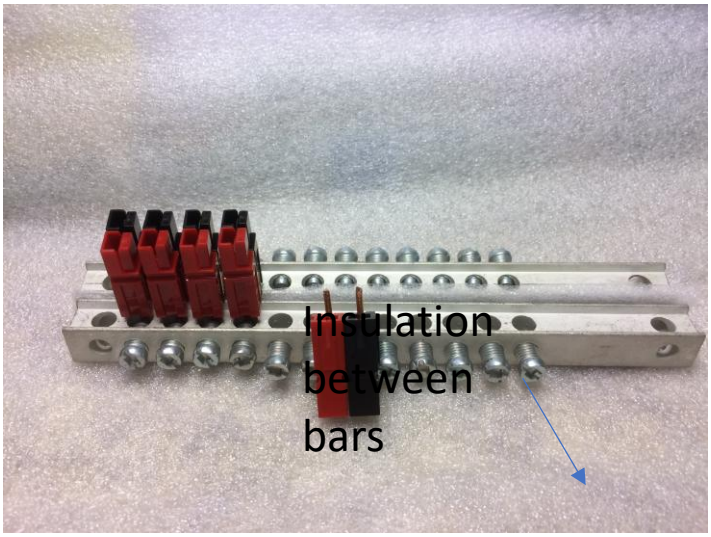


Shack Tip -
Threading PL259 connectors onto LMR-400

- Trim the insulation and center conductor to length.
- Put in center conductor through the 259 center pin.
- Start threading the connector over the shield braid….
- USE THE OUTSIDE SLEVE OF A SECOND CONNECTOR AS A WRENCH TO TIGHTEN DOWN.
- Remove the tool shell and finish installation of 259.

Shack Tip-
El Cheapo Power Pole Distribution

- A 12 power pole distribution device costs $100 plus.
- The “El Cheapo” approach: use a pair of “Neutral Bus Bars” purchased at Home Depot.
  - About $4.00 each.
  - Solder 1.25” #18 solid wire into terminals and solder
  - Insulate between bars
  - Put into bus bar holes and tighten screws.\
  - Don’t forget a fuse.



A quick solder course for circuit boards

- **Tools**
  - 15 to 40 watt soldering iron
  - Small sponge
  - 1/32” solder Lead / Tin 60/40
  - Diagonal cutters – small!
  - Needle nose pliers – small!
  - Steel or brass wool
  - Magnifying glass or loupe
  - Optional – liquid flux and dropper.
  - Solder sucker or braid

ADAFRUIT pictures and summary

- https://learn.adafruit.com/adafruit-guide-excellent-soldering/preparation

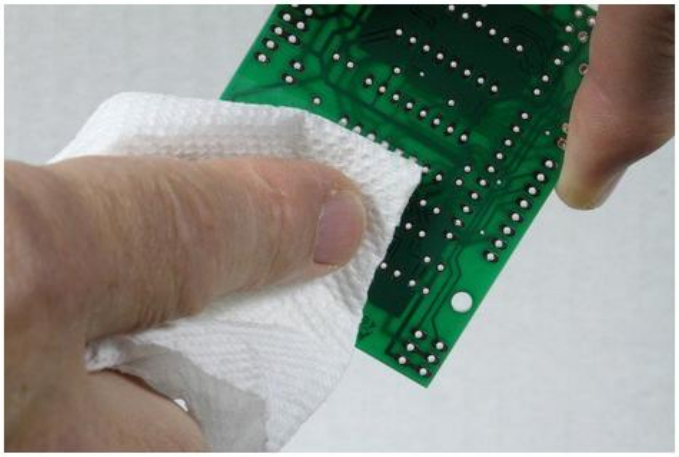
- ADAFRUIT supplies tools, circuits, experiments, Raspberry Pi boards and components.
- I want to acknowledge sucking out a number of their pictures and text for this presentation. I recommend you take a look at the web site

Solder Prep

Tin the Tip

Apply a small amount of solder to the tip and wipe again to tin the tip. You should have a thin, shiny layer of molten solder on the tip of your iron.

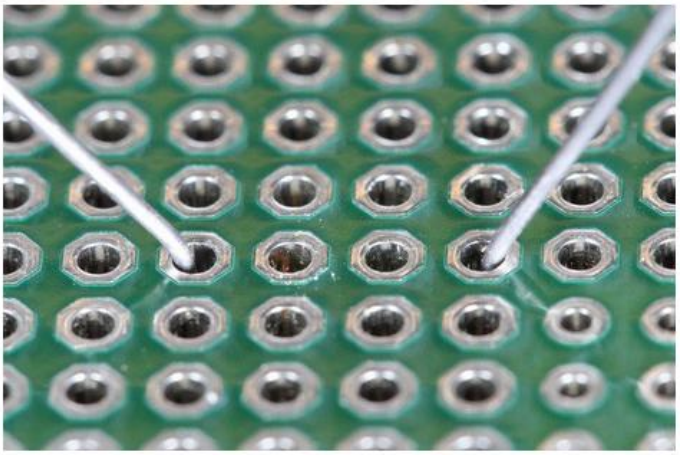
If the tip is badly oxidized and difficult to tin, it can usually be reconditioned with some tip-tinning paste.



Make sure that the joint is clean

Dirt, oxidation and oily fingerprints can prevent the solder from wetting the solder-pad to create a solid joint. All Adafruit boards are plated to prevent oxidation, but if your board appears dirty from storage or handling, wipe it down with a little isopropyl alcohol.

Insert device and immobilize by bending leads

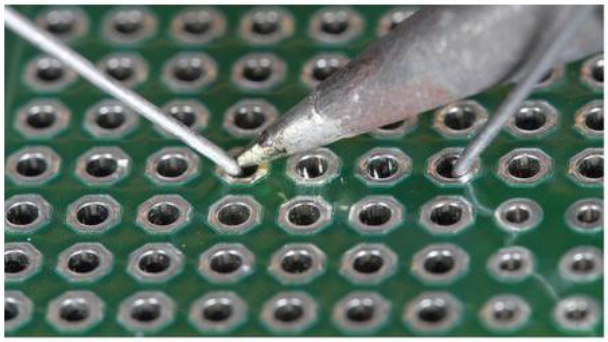


Immobilize the Joint

This is very important! The parts being joined must not move during the soldering process. If there is any movement as the molten solder is solidifying, you will end up with an unreliable 'cold joint'.

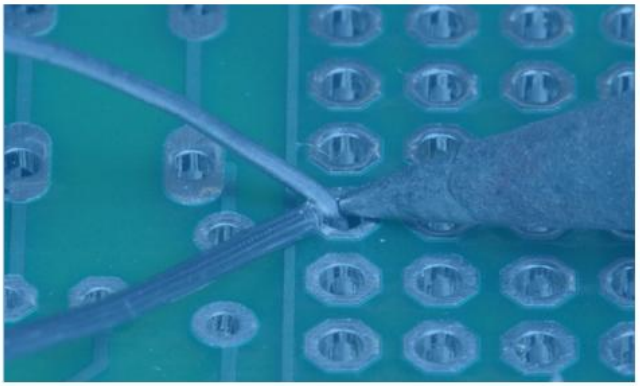
Most through-hole components can be immobilized by simply bending the leads on the solder-side of the hole.

Heat 5 seconds and apply solder



Heat the joint

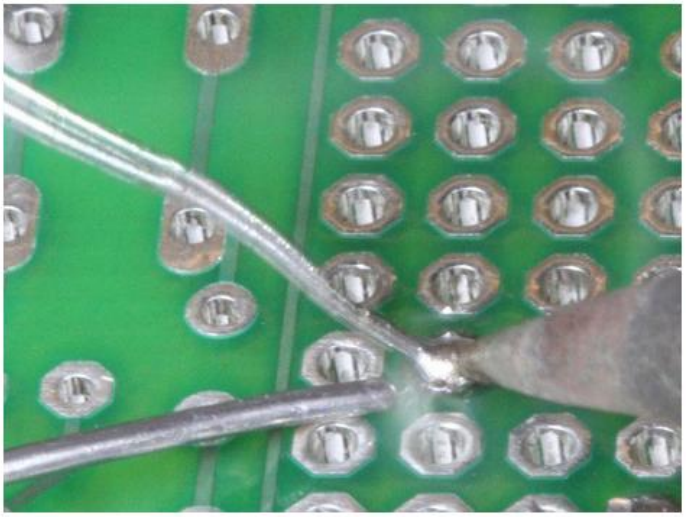
Heat the joint with the tip of the iron. Be sure to heat both the solder pad and the component lead or pin. A small drop of solder on the tip will help to transfer the heat to the joint quickly.



Apply the solder

Touch the end of the solder to the joint so that it contacts both the solder pad and the component lead or pin. It should melt and flow smoothly onto both the pin and the pad. If the solder does not flow, heat the joint for another second or two and try again.

Make sure the solder flows into the hole and attached to the lead smoothly



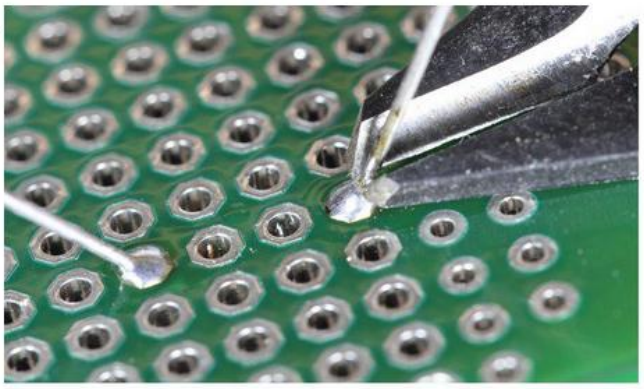
Let It Flow

Keep heating the solder and allow it to flow into the joint. It should fill the hole and flow smoothly onto both the solder pad and the pin or component lead.

Let It Cool

Once enough solder has been added to the joint and it has flowed well onto both the component lead and the solder pad, remove the iron from the joint and allow it to cool undisturbed.

Finish and Inspect EVERY SOLDER JOINT as it is made



Trim the Lead

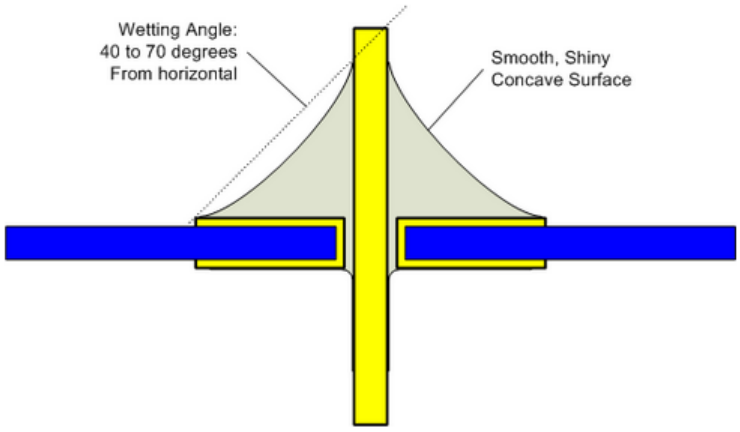
Use your diagonal cutters to trim the lead close to the board.

Note: This step applies only to components with wire leads. It is not necessary to trim the pins on Integrated circuit chips or sockets.

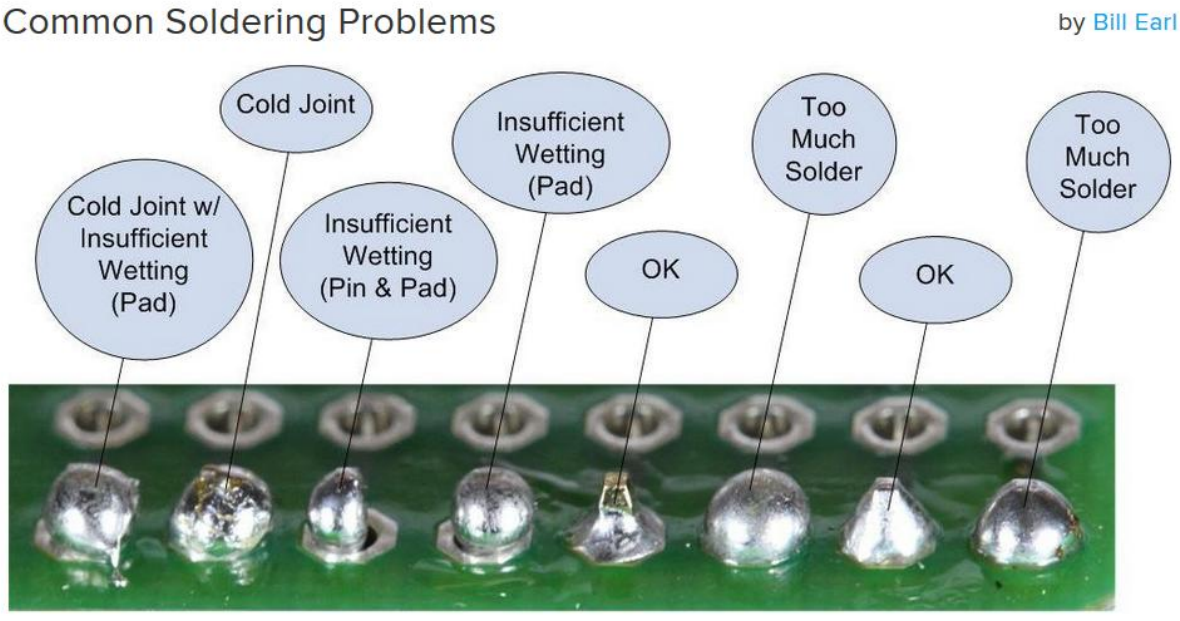
Anatomy of a GOOD solder joint

The Ideal Solder Joint

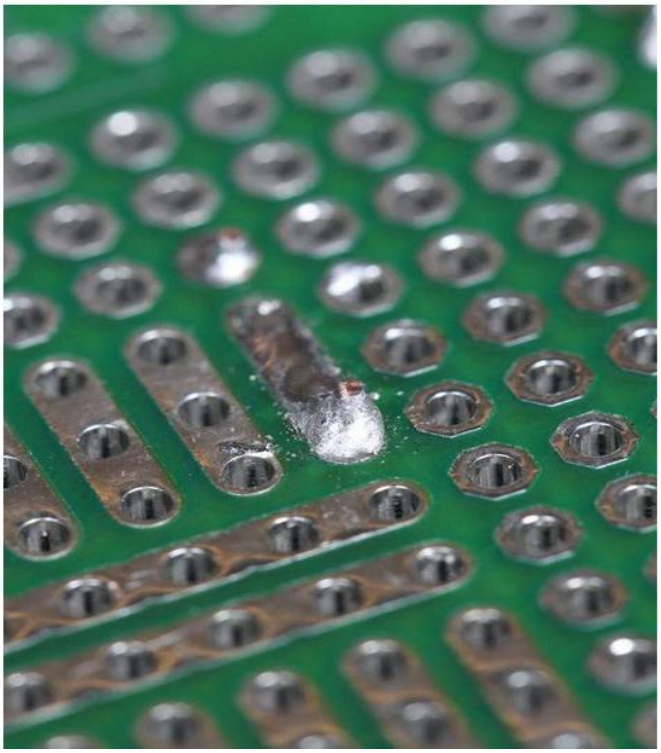
The ideal solder joint for through-hole components should resemble the diagram below.



Common solder problems



Problems



Disturbed Joint

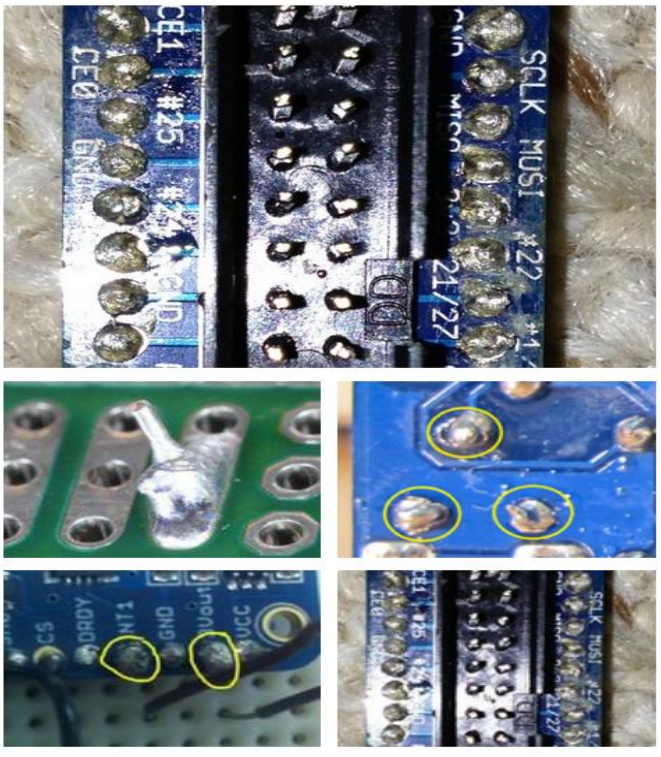
A Disturbed joint is one that has been subjected to movement as the solder was solidifying. The surface of the joint may appear frosted, crystalline or rough.

Often called a 'Cold Joint'. They can look similar to a true cold joint, but the cause is different.

Repair: This joint can be repaired by reheating and allowing it to cool undisturbed.

Prevention: Proper preparation, including immobilizing the joint and stabilizing the work in a vise can prevent disturbed joints.

Cold Joint



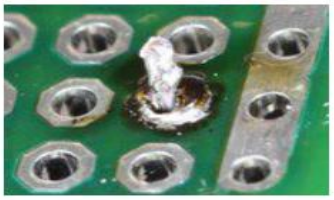
Cold Joint

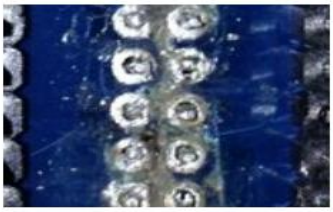
A 'Cold Joint' is one where the solder did not melt completely. It is often characterized by a rough or lumpy surface. Cold joints are unreliable. The solder bond will be poor and the cracks may develop in the joint over time.

Repair: Cold joints can usually be repaired by simply re-heating the joint with a hot iron until the solder flows. Many cold joints (such as the one pictured) also suffer from too much solder. The excess solder can usually be drawn-off with the tip of the iron.

Prevention: A properly pre-heated soldering iron with sufficient power will help prevent cold joints.

Overheated board/lead





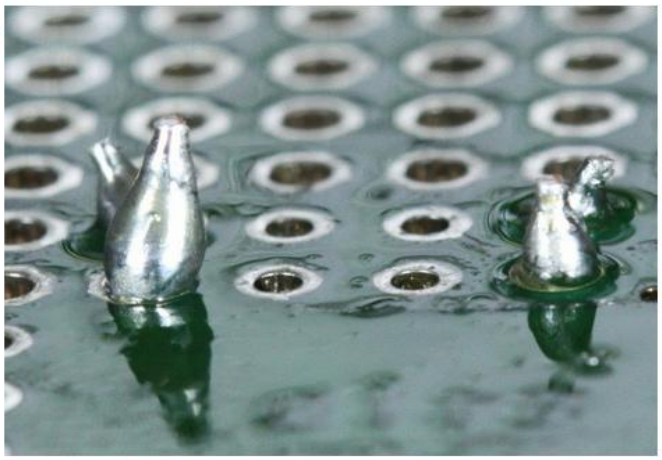
Overheated Joint

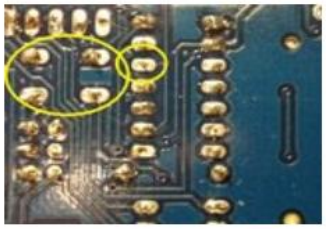
At the other extreme, we have the overheated joint. The solder has not yet flowed well and the residue of burnt flux will make fixing this joint difficult.

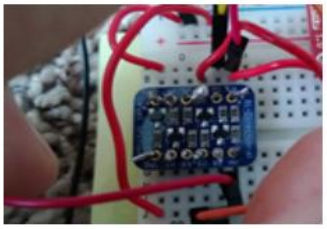
Repair: An overheated joint can usually be repaired after cleaning. Careful scraping with the tip of a knife, or little isopropyl alcohol & a toothbrush will remove the burnt flux.

Prevention: A clean, hot soldering iron, proper preparation and cleaning of the joint will help prevent overheated joints.

Board not heated just wire







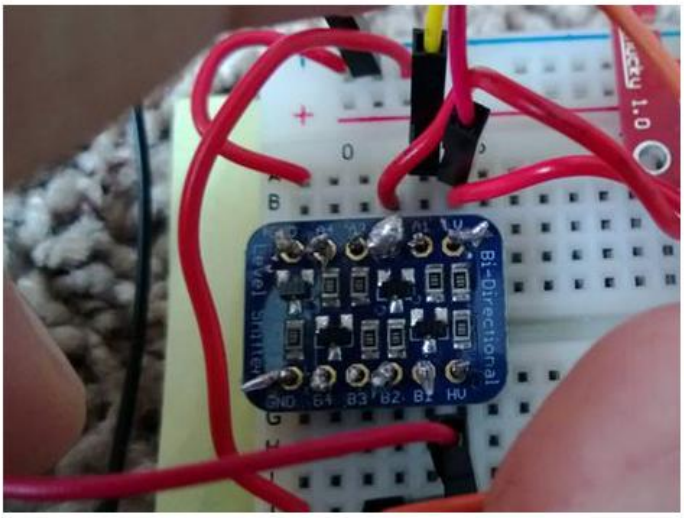
Insufficient Wetting (Pad)

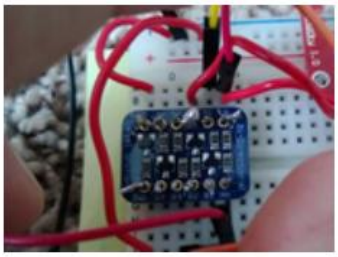
These two joints both show signs of insufficient wetting of the solder pad. The solder has wetted the leads nicely, but it has not formed a good bond with the pad. This can be caused by a dirty circuit board, or by failing to apply heat to the pad as well as the pin.

Repair: This condition can usually be repaired by placing the tip of the hot iron at the base of the joint until the solder flows to cover the pad.

Prevention: Cleaning the board and even heating of both the pad and the pin will prevent this problem.

Solder did not flow into joint



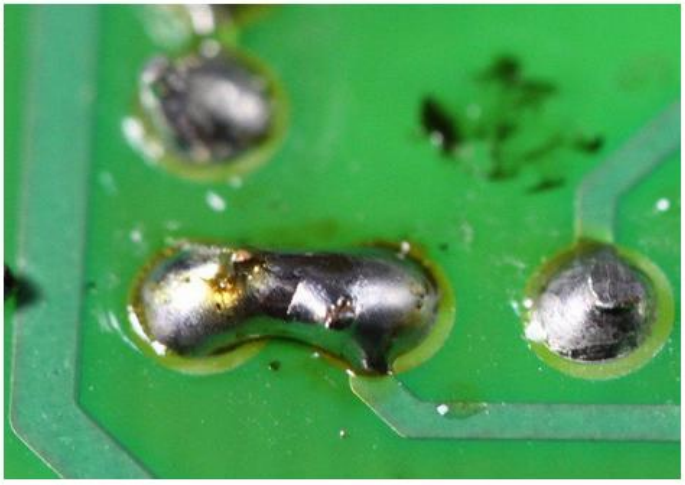


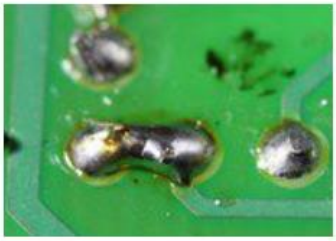
Insufficient Wetting (Pin)

This solder in this joint has not wetted the pin at all and has only partially wetted the pad. In this case, heat was not applied to the pin and the solder was not given adequate time to flow.

Repair: This joint can be repaired by re-heating and applying more solder. Be sure that the tip of the hot iron is touching both the pin and the pad.

Prevention: Even heating of both the pin and the pad will prevent this problem.





Solder Bridge

The left two solder joints have melted together, forming an unintended connection between the two.

Repair: Sometimes the excess solder can be drawn off by dragging the tip of a hot iron between the two solder joints. If there is too much solder, a solder sucker or solder wick can help get rid of the excess.

Prevention: Solder bridges most often happen between joints with too much solder to begin with. Use only enough solder to make a good joint.

Lifted Pad

Lifted Pad

This photo shows a solder pad that has become detached from the surface of the circuit board. This most often occurs when trying to de-solder components from the board. But it can result simply from overworking the joint to the point where the adhesive bond between copper and the board is destroyed.

Lifted pads are especially common on boards with thin copper layers and/or no through-plating on the holes.

Repairing a Lifted Pad

It may not be pretty, but a lifted pad can usually be repaired. The simplest repair is to fold the lead over to a still-attached copper trace and solder it as shown to the left. If your board has a solder-mask, you will need to carefully scrape off enough to expose the bare copper.

Other alternatives are to follow the trace to the next via and run a jumper to there. Or, in the worst case, follow the trace to the nearest component and solder your jumper to the leg of that. Not exactly pretty, but functional.

Hands On

- Get Soldering pen, sponge, 4-5” solder, circuit board, and 14pin socket.
- Insert the socket into the center of the small circuit board.
- Bend one pin on each side of the socket to secure it to the board.
- Solder all 14 pins to the pads but don’t trim the ends yet.
- Take the board over to the scope in inspect the joints
- Fix any bad solder joints.
- Get Bud, Bill B., Eric or Dwayne to take a look at the joints.

- Take this board home, we are going to be building a code practice generator on this board in a later class.