What is soldering?

Soldering is a method of connecting two or more pieces of metal using a relatively low-melting point filler metal called solder (pronounced, “sah-der”). The many applications of soldering include plumbing, stained glass making, and (of course) electronics. Most soldering is basically a two-step process: 1) heat metal, and 2) apply solder. Sounds simple enough, right? Well, like most skills getting good at it requires a bit of practice and patience. Before we go any further, however, let’s cover some safety tips.

Safety

As you will learn later (or may already know) most solder contains lead (Pb), which is well known to be a toxin. If you are PREGNANT or think you may be so, do NOT solder! In fact, stay away from the area where people are soldering to avoid breathing any of the fumes given off in the process. For those of you who are not pregnant, WEAR SAFETY GLASSES! Solder does splatter occasionally, and you do not want a molten mixture of lead and tin in your eye (it will ruin your week…not to mention your eye). Do not hunch over the piece you are soldering or breathe the smoke generated while soldering. You will get a mega headache if you breathe too much of it. While soldering, you will find many awkward ways to hold your soldering iron while trying to make connections. If (and when) you drop your iron, do NOT try to catch it…trust me, let it fall. When you are finished soldering, WASH YOUR HANDS. Use your common sense and if you see a dangerous situation arise, please inform the lab TA.

Soldering irons

The lab will provide soldering irons and solder for use in the lab, however, students are encouraged to purchase their own soldering irons for home use. They are one of many tools of the trade and come in very handy when repairing equipment or prototyping circuits. Several inexpensive units are available; for example the Weller WLC100 soldering iron, which is a 40-Watt soldering station (includes iron, stand, and sponge) for under $50. The business end of a soldering iron is the metal tip, which can reach temperatures in excess of 700 deg F (remember do not try to catch it if it falls). These tips come in many different styles such as conical, chisel, screwdriver, etc. for many different applications. As a courtesy to your fellow students and lab TAs, please acknowledge the following guidelines for iron tip care.

1) An iron is used to heat the metal. The solder is then applied to the heated joint. We do not solder by loading the tip with solder and delivering it to a cold connection, this ruins the tip very quickly and makes for lousy joints.
2) A good joint should not require much solder. Excessive solder makes the iron tip crusty and hard to clean. It also makes your connection look like a hack job.
3) Wipe the tip clean after every connection. Yea, it may require getting up and putting the sponge under the sink but you will be doing everybody a huge favor by simply wiping the excess solder off the tip after every use.
4) Only set your iron down in an iron stand. Really though, this one shouldn’t even have to be written down but it irks me every time I see a burn mark on the lab tables.

5) When finished clean then tin the tip of the iron. Tinning is when you put a light coat of solder on something. This will protect the tip from oxidation.

Solder

In the lab we will use primarily 60-40 rosin core solder (usually yellow packaging). This is made up of 60 percent tin (Sn) and 40 percent lead (Pb). Note: if you kept your MatE 25 book, look up the Pb-Sn phase diagram. Do you notice anything about the 60 percent tin composition? The rosin core of the solder contains an inorganic acid, which cleans (a little bit) the metal you are soldering as it melts. You may notice after making a solder connection that there are yellow pools of the rosin on you work. These can be cleaned off with flux remover, which is an awful smelling solvent but it makes your work look much better. If using an organic solder, (usually red packaging) you do not need to use flux remover, however, you will need to wash all solder connections with water when finished (just don't plug your circuit in 'till it dries).

Desoldering

Desoldering is a skill that is conveniently developed while learning how to solder. The two most useful desoldering tools are desoldering braids (or wick) and a solder sucker. A desoldering braid is made of woven copper, which is placed ON the undesirable solder joint. When heated with the soldering iron, the solder flows into the copper braid. Note: you must remove the braid quickly after the solder joint is clean or the braid will stick to your work. A solder sucker is just a handheld suction pump that quickly removes unwanted solder from bad joints. Desoldering can be a time consuming practice, so it is strongly advised that you try to make good solder joints instead of counting on the desoldering tools to clean up messy connections.

For more information on soldering beyond the tutorial below, check out:

http://www.kpsec.freeuk.com/solder.htm

http://www.epemag.wimborne.co.uk/solderfaq.htm

http://www.kingbass.com/soldering101.html

http://www.elecraft.com/TechNotes/N0SS_SolderNotes/N0SS_SolderNotesV6.pdf

http://www.bdmicro.com/smt/ (some tips on soldering surface mount chips)

http://www2.silabs.com/public/documents/tpub_doc/anote/Microcontrollers/en/an114.pdf (more on soldering fine-pitched QFP devices)

Soldering Tutorial continued on the next page

Good vs. Poor Soldering Practice

Picture 1.

Picture 1 shows improper soldering practice. Not only is this poor slob neglecting to wear eye protection, but he is also going to be inhaling a lot of vaporized lead. Will someone please help him!

Picture 2.

Picture 2 shows much better form. Notice the safety glasses and upright posture. Nice job.

Sample connections

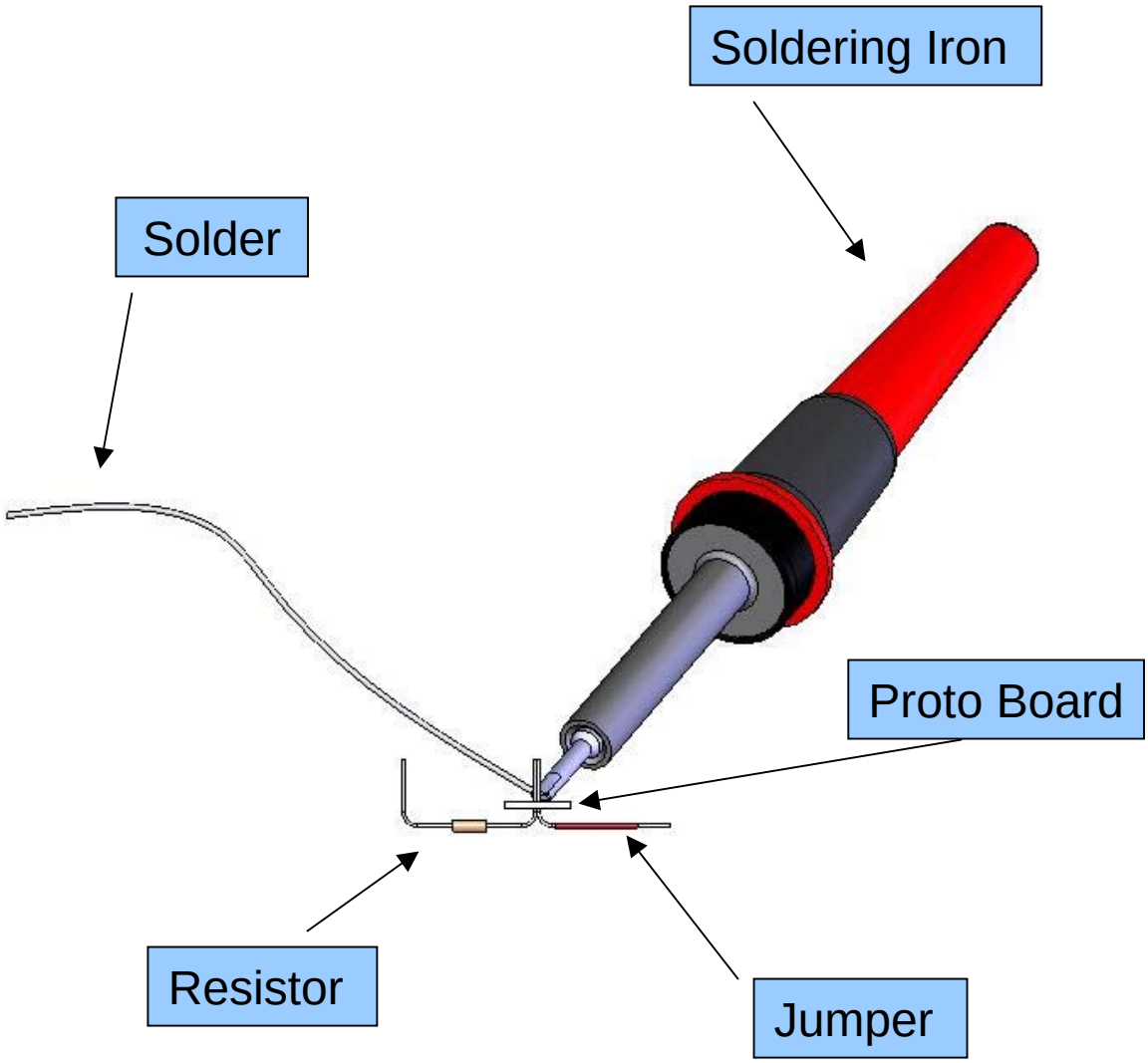


Figure 1.

Two components, a resistor and a jumper wire are connected together and to a thru hole proto board. This is a common connection that will be made in the lab.

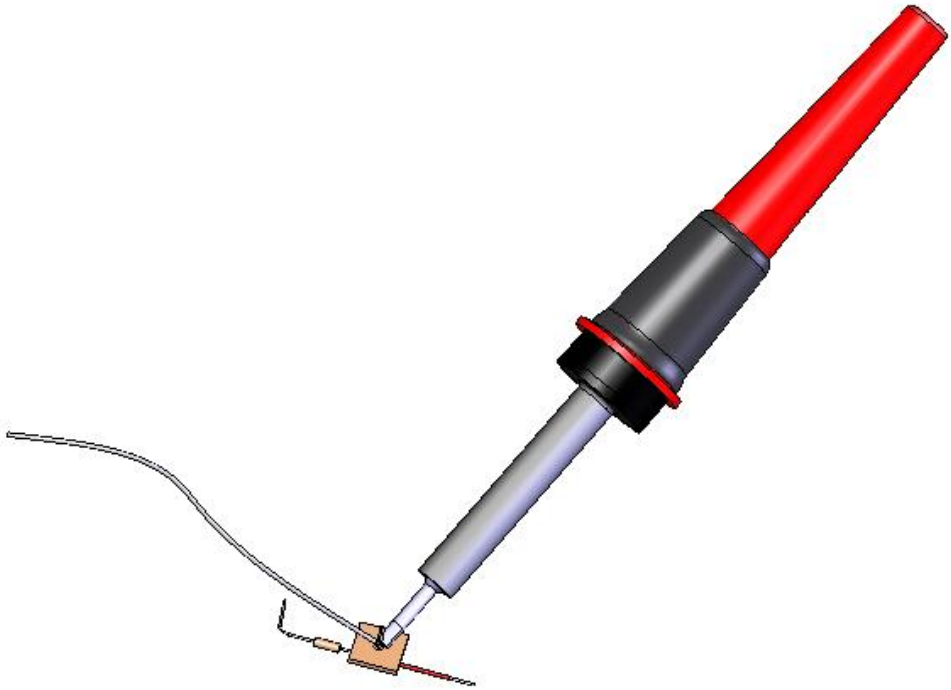


Figure 2.
This shows another view of Figure 1. The component leads are pushed thru the hole in the proto board. They are then soldered to each other and to the copper terminal on the proto board.

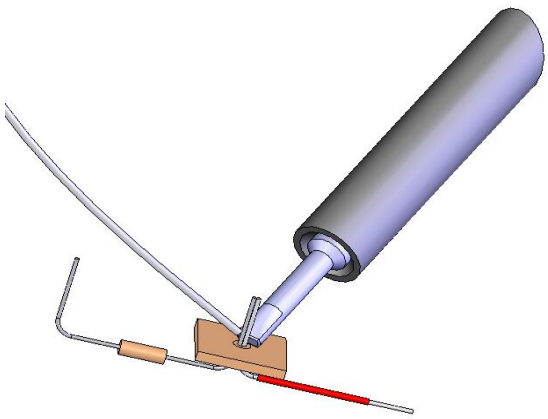


Figure 3.
Here is a close up view of Figure 2. When the terminal and the leads are sufficiently hot, apply solder to the joint.

Finished Connection

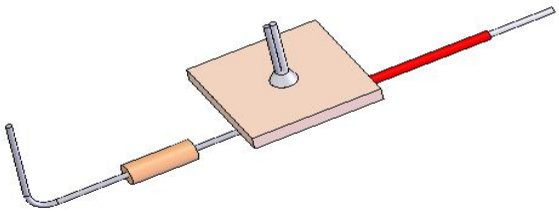
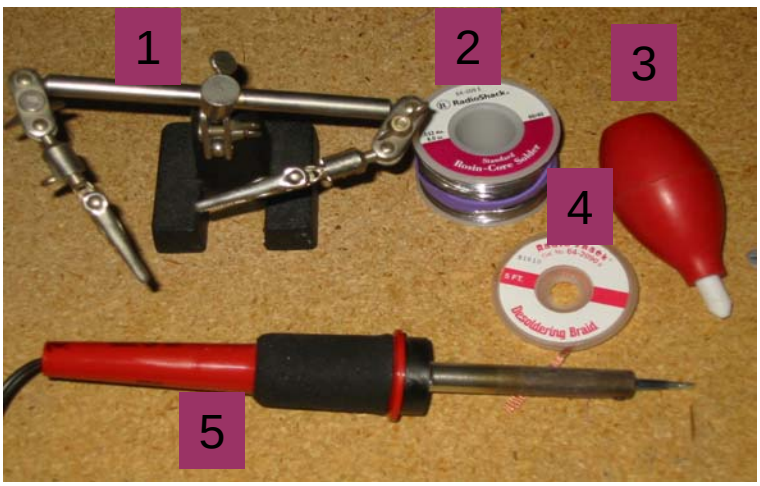


Figure 4.
Now we see the final connection. The solder should firmly connect the copper terminal and the wire leads. There need not be excessive solder for a strong joint, the solder should have a shiny appearance to it. If you see a whitish haze form over your connection then it may be that all of the metal did not get hot enough or that one of the leads moved while the joint was cooling. In that case you may want to rework the connection. Otherwise, clip the leads close to the joint and you are done.



Picture 3.
Some of the tools needed for soldering.
1) Helping Hands
2) Solder
3) De-soldering Pump
4) De-soldering Braid
5) Soldering Iron