Soldering Tutorial

The audible and measured performance of your project depends upon many elements. CAE projects have been designed to incorporate the finest circuitry, components, grounding techniques, and power supply technology which can provide the finest audible performance and long term reliability.

However, one element outside of our control is the care the builder will exercise during assembly. And in that area the most important is the quality of the individual soldering connections. This includes both those made at the component lead pc board interface and those associated with the interconnecting wiring. Good connection are essential for long term reliability and world class audible performance. If you follow the techniques outlined here you can rest assured. On the other hand shortcuts will negate the significant investments you have made elsewhere from components to esoteric tubes and the like.

A quality solder joint uses minimal solder - just enough to "fill" the area between the elements. You shouldn't need to cover the connection with a ball of solder. A quality connection will appear smooth and shiny as opposed to dull as the solder flows into the gaps.

Your soldering iron should appear bright right before it is used. To prepare it (I recommend using a soldering station with a chrome plated tip) clean it with a damp sponge immediately before use.

Before we begin, let's talk about the tools you should have. And let me emphasize - it is imperative that you invest in quality tools. We have authored a separate tech note on the essential tools and their sources. It discusses the essential tools you will need plus some convenience tools as well. For convenience we'll repeat the list of tools associated with the soldering process. I've also listed the part numbers from MCM Electronics (800-543-4330, www.mcmelectronics.com). They provide high quality products and great service at reasonable prices.

DESCRIPTION	MFG	MCM P/N	PRICE
Soldering Station	Weller #WLC100	21-3475	51.50
Solder Tips	Weller # ST-3 Chrome Plated	96-315	5.39/ea
Solder, Rosin	Multicore - Nonresidue	21-1570	19.95
Solder Vacuum	Tenma	21-590	6.79
Solder Wick	Solder Wick	21-2180	3.99
Mini Needle Nose	Xcelite	22-590	4.79
Shear Cutter	Crescent	22-1050	5.39

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Soldering Tutorial

OK - Now we're ready.

Soldering is actually quite simple if you observe a few rules:

1. Keep the solder tip clean (hopefully you have purchased a chrome plated tip). "Tin" it by wiping it clean with a wet sponge and then applying a small bit of solder so it just looks shiny. Immediately before you use it wipe it clean. After use place it in the holder - the solder from the soldering operation should keep the tip tinned.
2. It is also imperative that the elements being soldered be relatively clean. (You should be getting the idea by now that cleanliness is a good thing.) Rosin based solder has powerful chemicals that when heated do a pretty good job of cutting through component and pc board oxides. But this takes time and heat. And the longer you are required to heat the junction to dissolve oxides the more the risk that you will physically damage the pc board foil or melt the insulation on the wire. (BTW if you use teflon insulation this latter problem is eliminated.) So to simply minimize these problems, I recommend a simple cleaning step with the leads of components. This involves using your mini long nose pliers (should have serrated tips) to scrape off the thin layer of oxide. Place the component lead at the body of the part in the jaws of your mini long nose pliers and with a little force pull the pliers away from the component body. (with a little practice this will become second nature). Do this two or three times to cover the circumference the lead.
3. Place the items being soldered in a relatively stable position such that once competed there is no possibility of jarring or relative movement between the soldered elements
4. Now, for eyelet connections using your needle nose pliers make a good mechanical connection. For PC boards, simply bend the leads with a slight radius and inset it into the board.
5. Hold the component in place so it remains undisturbed. Apply heat to the junction with the bright shiny tip of the iron.
6. After a few second the junction temperature will rise and you can then apply solder to the other side of the junction (not the solder iron). It should melt immediately and flow smoothly into the junction. You will note that the solder seems to fuse with the two elements.
7. Allow this to cool undisturbed.
8. Examine the junction - it should appear clean and shiny - not dull or pitted.

OK, that's it. Actually much simpler that it sounds.

If you are new to this, take the time to practice on some scrap pc boards and terminals until you feel confident.

On PC boards especially neat high density IC's it is very common to form a solder bridge. This is when a connection of solder forms between to adjacent pins. Many hours have been dedicated to troubleshooting and many components destroyed as well as a result of this "minor" error. I would suggest that at the end of each component connection (or certainly at the completion of one board) you stop to visually inspect each connection. Look for both cold solder connection and bridges. And don't be shy about using a magnifying glass to examine each connection in detail. This is a valuable investment with playback in both trouble free start up and long term reliability.

Soldering Tutorial

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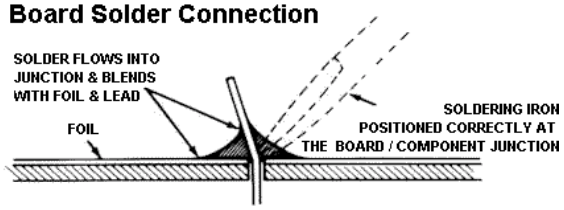
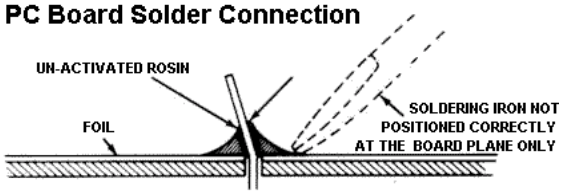
Heat the component lead and foil at the same time. Apply solder a few seconds later to the heated junction on the other side. It should flow easily into the junction and fill the gaps between the foil and component lead.

An Example of a Quality PC Board Solder Connection



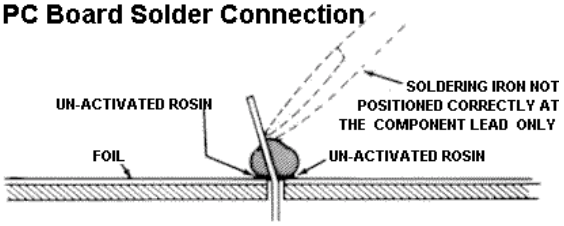
This defect occurs when the temperature of the component lead has not reached the melting temperature of the solder. This type of defect is difficult to spot. Usually you will notice the lead is loose. If this happens, use some solder wick to remove the solder and try again. Be careful not to apply too much heat to the foil.

An Example of a Defective PC Board Solder Connection



Another defective solder joint. Here the temperature of the foil has not reached the solder melting temperature. This one is very easy to spot as it is characterized by a “ball” appearance of the solder and of course the component will be able to move in the direction of the component lead. Once again use some solder wick to clean up and try again.

An Example of a Defective PC Board Solder Connection



An example of a pc board showing a solder bridge. The left photo is correct - no defect whereas the right photo shows the same position on the pc board but with a solder bridge defect in place. Bridges are more likely in high density areas such as IC leads. I recommend you use a magnifying glass to visually examine each connection carefully after each component especially the high density types.

SAME AS RIGHT BUT WITHOUT BRIDGE DEFECT

SAME AS LEFT BUT W/ SOLDER BRIDGE DEFECT