

Basic Electronics Assembly Tips

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Assembled below are a list of tips and tricks to help newbies (and maybe even some oldies) solder circuit boards and wiring. We hope they are helpful. Feel free to contact us with comments.

1. CHECK and CONFIRM polarity of capacitors. Markings vary: (+) signs, (-) signs, arrows pointing to the minus (-), or a dot on the plus (+). Check with the capacitor manufacturer to be sure.

Hint: Mouser, Digi-Key and many other parts suppliers often provide the manufacturer's spec sheet as a PDF on their websites. These white-papers are invaluable (i.e, free).

2. CHECK and CONFIRM the polarity of diodes and LEDs. For diodes, a silver or black band indicates the cathode or (-) connection. You should look up the method for LED polarity denotation because it varies with manufacturer.
3. Use grounded, or preferably "ESD safe", soldering irons whenever working with integrated circuits or FETs. A grounded iron has a three-prong plug. Ungrounded irons generate very large magnetic fields that will invisibly destroy your components, sort of like radiation or communism circa 1950.
4. CHECK and CONFIRM polarity of switches, battery holders, AC line connectors and transformers. For AC mains wire and sockets, the small blade is the HOT (black wire), the large blade is NEUTRAL (white wire) and the pin is safety GROUND (green wire). Check poling markings or denotations with the transformer manufacturer; no standard is currently in effect, unlike the 1970s. Hooray for deregulation and global competition.
5. Use a multimeter to CHECK and CONFIRM the value and function of all components you can measure. Re-check them on the board using adjacent solder pads so you can check both the components' condition post-soldering and the efficacy of your joint (note that some components cannot have their values checked while mounted on the board; you can still check connectivity, though).
6. PREPARE a printed circuit board (PCB) for soldering by lightly buffing copper solder pads with very fine sandpaper or a sanding sponge. This will remove any oxidation from the copper so the solder adheres well. The copper should be shiny, bright and clean. If your board is pre-tinned, don't sand it, just clean it.. A pre-tinned board will have circular, silver solder pads. Do not touch the pads and traces with your fingers; skin oil is bad for solder bonds. If you must rub skin oil on something, use the fretboard of

your guitar. (Cleaning is further discussed in #8 and #17 below).

7. A good solder joint starts with a good mechanical joint. Make sure components, leads and/or hook-up wires are tight and snug and everything is positioned exactly as you want it. While a good solder joint is strong and somewhat ductile, you don't want to wiggle and bend it much if you can avoid it.

8. Before making a solder joint, make sure to wipe the leads and the board clean with alcohol or another electronic cleaning product. This is in addition to prepping the board since skin oil and other contaminants can get on the components during mechanical assembly.

Hint: CAIG Labs products are very popular and highly effective, but not cheap. You can make them go further by first using high-grade isopropyl to get the bulk of the mess off. Many techs attribute miraculous properties to CAI-KLEEN, some of which may seemingly defy physics but are nonetheless substantiated by experience.

9. After every joint, CLEAN the soldering iron tip using a dampened sponge. Some say to use distilled water on your sponge to keep your tip free of mineral contaminants. Why not? A jug of water is handy near the bench anyway for burns or for thirst.

10. APPLY the soldering iron's heat to the component leads THEN feed solder onto the work, not onto the iron's tip. This is absolutely vital for proper filling (flowing) of the joint. It's usually best to feed the solder onto the work right up against the tip of the iron, into the little notch formed by the intersection of the iron's tip and the component's or wire's lead. The solder will flow like a liquid into every crevice when enough heat is correctly distributed. Remove the iron the instant this happens. The whole process should take 2-4 seconds.

To reduce the time that heat is applied to the component, dab a little paste flux onto the area to be joined. This isn't always strictly necessary because electronic solder has the flux built into its core, but it can be very helpful on highly heat-sensitive components or hard-to-solder joints.

Hint: Practice on old boards salvaged from thrown-away computers, stereo components bought from infomercials, obsolete East German weapon systems, etc. As a bonus, you can practice de-soldering first.

11. USE a soldering heat-sink on all components or you'll risk ruining them. Some say using a heat-sink is for beginners to build up confidence. This is silly machismo, like mountain biking without a helmet. Wicking braid and an alligator clip make an excellent heat-sink. The principal enemies of solid state electronics are water, heat and time. If you can minimize the most intense heat in their service life with a heat-sink, why not do it?

12. Use the MINIMUM heat and time to make the joint; work fast, work accurate, work clean. This will work miracles. If your solder is flowing poorly, clean your work better or use a little more flux before you try turning up the heat.
13. AVOID “solder bridges” (solder dripped or pulled via capillary action from one trace to an adjacent trace) between traces. Work slowly and carefully. This is faster than troubleshooting later.
14. AVOID cold, under-filled or over-filled solder joints. A perfect joint has a connecting web of solder but not a big blob. Cold joints are dull, flat silver. Good joints gleam brightly like chrome.
15. Check your work for #9 and #10 by examining it with a magnifying glass. A magnifying lamp is recommended, especially for aging eyes.
16. Temperature regulated soldering irons are highly recommended.
17. Keep the board clean using a foam or cotton swab with alcohol on it. If you can, use proper solvent grade alcohol, not the 70% pure drug-store rubbing alcohol because it contains water, lanolin, fragrance and other non-electronically desirable things. Clean the board before and after soldering it.

What is Tinning?

Tinning refers to an application of a thin coating of solder onto the work at hand before you begin soldering. For example, when preparing stranded hook-up wire for attachment, tin the wire’s end first, making it both easier to insert into a solder lug and easier to join.

Tinning is simple. Smear on a little paste flux then heat the component’s lead, wire or trace and coat it lightly with solder, using the tips above. A new soldering iron tip should also be tinned.

De-Soldering

If you’re reading this guide, you can bet you will be de-soldering something at some point. Even if you’re an expert, bad and/or aging components will need to be pulled or modifications made.

If you’re de-soldering components from a board, you must accept the fact that the part you’re removing (resistor, cap, pot, etc.) is almost certainly going to get fried. De-soldering fast enough to leave everything else in the circuit intact means brief, intense heat. And it’s hard to get a good heat sink on parts with the leads cut off.

De-soldering requires two tools: a suction wand and copper wicking braid.

- Suction tools are good for removing the bulk of solder from a joint. Their use is self-explanatory. You'll soon get a feel for what you can actually pull from a joint. Get one that's anti-static to protect the circuit and which has a heat-resistant tip so it can withstand being shoved up against the iron. The better ones have replaceable tips.
- Wicking braid is best for "sucking" solder from a pc board pad holes or other small surface too fine to make good contact with the crude tip of the suction tool. It can also sometimes reach where the suction tool can't. Press some flux into the braid, then hold the braid to the area to be soldered by pushing the tip into the braid as it lies against the area to be de-soldered. Solder will flow into the braid. Make sure you remove the braid and tip at the same time, otherwise the solder will cool, connecting the braid to the work!
- With stubbornly-filled PC board holes you can press the iron's tip against one side while using the suction tool on the other side. This is tricky and usually requires a board clamp or vise. When doing this, be especially aware of over-heating near-by components.