Appendix C

How To Solder

Even if you already have experience soldering components to a printed circuit board, this Appendix contains useful information to help you avoid disaster in wiring your SK68K computer trainer.

Using a printed circuit board for a project eliminates most worries about connecting components to the wrong place, but it introduces new problems, especially if the board contains many components and very small wiring, as the SK68K computer board does. Bad construction technique can result in short circuits, bad connections, or even a ruined pc board. If you have never soldered on a printed circuit board before, find an expert technician or repairman and ask him or her to show you how it's done. Even your local TV repairman may be a good source of expertise. This Appendix describes some of the hints and tricks, but there is no substitute for on-the-job training. You just don't want to train on the SK68K computer pc board!

Good soldering requires (a) a steady hand and some patience, (b) good eyesight, (c) the right equipment, and (d) the right technique. Most of us can manage the steady hand, resting our hand on a thick book or the table edge if need be, and the patience we can't help you with. In the absence of good eyesight, we recommend one of the magnifiers which slips over the head. It is available at many stationery stores and also from Heathkit. It slips over the head and puts a magnifying lens in front of each eye. Highly recommended.

On to the equipment. First, you need the right solder. NEVER USE ACID CORE SOLDER because it corrodes the connections. The proper solder for electronic use is called rosin core. Solder is made of a combination of lead and tin; the best solder is 60% tin and 40% lead, although so-called 50-50 solder will also work. But beware - some solders are labelled 60-40 to make you think they are better, but are in fact worse than 50-50 because they contain more lead rather than more tin. The composition of solder is

important because the correct 60- 40 solder melts at the lowest temperature and is thus easiest to use.

Next, you need the right soldering iron. A pencil type iron rated 35 watts or so is good; a *temperature controlled low-voltage soldering station*, made by Weller, Ungar, and others, is a more expensive but ideal choice. The cheaper non-temperature controlled irons sometimes tend to run too cool (which results in inadequate joints) or too hot (which may burn the board.)

Do not get anything over 45 watts, and definitely do not use a solder gun. It is almost certainly going to run too hot. Aside from possibly burning the board, a hot tip corrodes much faster and gets much dirtier in use. Speaking of tips, the slightly more expensive iron-clad tips last much longer than pure copper tips, and also stay cleaner.

Cleanliness is important. Use a wet sponge to clean off the iron tip every few minutes or so. We use a sponge in a holder on the solder stand, and wipe the iron on it just before using it. This avoids the problem that any dirt on the soldering iron's tip (which is usually corroded solder and rosin flux) will flow onto the soldered joint and contaminate it. Dirt also prevents good contact between the iron and the joint, which is needed to quickly melt the solder without overheating the joint.

Once wiped clean, the iron sometimes needs three or four seconds to heat up again, and also needs just a bit of solder to 'wet' the tip with solder and make it shiny.

Most soldering instructions claim that you should put the iron on one side of a joint, hold solder against the other side of the joint, and wait for it to melt and flow on the joint. We find this doesn't always work. When a clean iron tip touches the joint to be soldered, it often touches at just a single tiny point; the result is that not enough heat gets transferred to the joint to melt any solder. You can try to get around this by placing the flat part of the iron against a flat part of the joint, but heat transfer is still sometimes too low. Our solution is to hold the thin strand of solder between the joint and the iron until it melts, and then move the solder to the opposite side. The tiny bit of solder which melts on the iron's side of the joint forms a layer of metal which transfers heat very quickly to the joint, so that by the time we get the rest of the solder to the other side, the joint is hot and ready to melt more solder. In this way we can solder a connection on a pc board in just a second or two.

Speed is important too. Applied too long, the soldering iron can burn the board or loosen a trace so it comes off; both of these are unsightly and can be difficult to fix. Some companies sell heat sinks - small clips which are supposed to remove extra heat from connections - and many people suggest putting a rubber band around the handles of a pair of needle-nose pliers so they stay closed, and then clipping them on the lead being soldered. But these do not really solve the basic problem; if anything, they make it worse because they keep the temperature too low for good soldering. The best solution is to keep the iron clean and hot so that the connection can be made fast - if a single printed circuit board connection takes you more than a second or two, you are doing something wrong.

When finished, the connection should be smooth, bright and shiny, with no rough edges. Don't use too much solder - the right amount will just cover the joint. In fact, it is not even essential to cover all of the joint, as long as

there is enough solder to form a bridge between the two metals to be joined. Many technicians believe that it is better to have too little solder than too much.

Note that both sides of the board are covered with what looks like a layer of thin green paint. This is called the solder mask. The entire side of the board is masked except right around each hole; the purpose of the solder mask is to keep the solder on a joint from spreading to adjacent joints. Since many of the solder pads are very tiny, the solder mask helps prevent solder bridges from shorting to nearby pads. All exposed areas of copper are plated with a stable, shiny coating which does not corrode. Unlike plain copper boards, which slowly oxidize and have to be washed or cleaned just before soldering for best connections, this board does not need such treatment. Do not wash or clean the board prior to soldering.

Final words - don't rely on the above. If you have never soldered to a printed circuit board before, find someone who has and ask them to show you.