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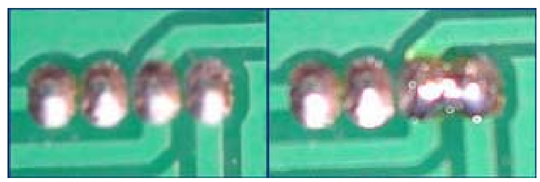
QRV? Finishing Your Cub-40

Over the past couple of columns, we've been building a MFJ Cub-40 (40 meter CW transceiver). If you've been following along, you should by now have the basic construction of your Cub complete--you may already have it on the air—if so, great! Maybe you've even been the fox one night this summer (one day I'm gonna catch that slippery fox!).

Before You Apply Power!

It has been said that the number one cause of failed construction projects is the old nemesis, the solder bridge. What *exactly* is a solder bridge? Simply put, a solder bridge occurs when a glob of solder causes a short between two solder points *that are not supposed to be shorted*. One of the hardest things for me, for a long time, was figuring out if two points were supposed to be shorted or not. The best thing to do is identify the solder points on the schematic (almost always supplied with the construction manual). Sometimes the kit will have the trace pattern supplied as well—this usually makes it much easier to find whether the two points are actually connected or not.



Normal solder junction on left, solder bridge on right

Another useful tool in identifying solder bridges is a magnifying lens. I use a lighted magnifying lens on my bench (cost, about $10)—it also helps to add extra light to the area where I'm working on my construction project.

Using solder wick to get rid of a bridge

To get rid of a solder bridge, just use solder wick to absorb the extra bit of solder between the two bridged circuit points. Don't be ashamed to use solder wick! I use a lot of it! It is truly amazing stuff—the wicking action just sucks the solder right up. Usually, I trim the wick back to bare copper before using. But save that solder impregnated wick—it's useful for lots of things—for example, I use pieces of old solder wick to ground circuit boards to their enclosures.

Before doing any testing (unless otherwise instructed in the manual), be sure to examine the entire circuit board in detail looking for solder bridges, unsoldered connections, etc.

There's No Such Thing as a Failed Test

My personal philosophy is that any test that finds a problem is a successful test. I've also found that you usually allocate more time for construction than for testing, when often it ends up working the other way around! So if you're planning to have that next project on the air in enough time for you're favorite contest, be sure to allocate enough time for testing.

A shameless plug for Elecraft right here—having built both the K1 and the K2, I firmly believe that while these are both great pieces of equipment, the truly great thing about these projects is how much testing is integrated right into the construction process. You can't build a piece of Elecraft gear without testing it in the process! While this doesn't guarantee success, it sure does reduce the number of problems in the end.

Fire!

One of the first tests in most projects is the *smoke test*. Apply power to the circuit. If there's smoke, there's obviously a problem. Usually this can be traced back to either a solder bridge, or a component installed either incorrectly or in the wrong place. No smoke doesn't guarantee no problems with the circuit, but it's at least a good start.

Simple, but useful test equipment

Most kitted projects do not require complicated testing equipment. Usually, all that's required is some kind of VOM (Volt-Ohm Meter) and a radio (to tell if you're generating RF or not). I've found that some other simple test gear to be very helpful:

MFJ Antenna Analyzer (MFJ-259) – other than the VOM, this may be the most useful piece of test equipment I have in my shack. It is very useful for its intended purpose (antenna SWR/resonance measurements). However, I've also used it as a signal generator, a sweep generator (for example, to measure the response of a filter), and as a grid dip meter (for finding the resonant frequency of a tuned circuit). There are tons of uses for this device!

MFJ Frequency Counter (MFJ-886) – the basic building block of all RF equipment (receivers, transmitters, transverters, etc.) is the oscillator. It's often useful to find exactly (within the error limits of your test equipment) what frequency your oscillator is generating. For a long time, I simply used a radio, but I've found that a frequency counter really does help.

RF Power Meter – it is often useful to determine how much power you are generating. Page 146 of *Solid State Design for the Radio Amateur*, has a very simple diode detector for RF power measurements. Again, I've found this circuit to be incredibly useful.

While it doesn't give exact measurements, it definitely does the trick for most of my construction projects.

Audio Signal Generator – recently I found a neat little audio signal generator kit from Velleman (PMK1051). It generates a 1KHz tone (sine, square, sawtooth waves)—this can be very useful in tracing a problem in the audio chain.

Finding the Problem

Ok, so you applied power to your circuit and it didn't smoke, now what? The MFJ Cub instruction manual has a good set of testing and alignment procedures. In general, this involves setting the BFO frequency, calibrating the VFO, tweeking the bandpass filters, setting the transmit offset and measuring the power output.

Everything seemed to be going well when I built my MFJ Cub 40. I had audio coming out (even could receive signals when hooked up to an antenna). But in the process of calibrating the VFO, I noticed that I only had one or two KHz of VFO swing. Hmm, what could be wrong? This is where learning to read a circuit schematic becomes very useful.

From the schematic, it looks like R3, R4, R5, R6, D2, L3, C6, C7, C8, C9 and C10 are all involved in setting the VFO frequency (the VFO is the internal oscillator in U2, a NE602 an integrated mixer, oscillator and RF amplifier IC). In normal operation, R4 is used to tune the VFO, by varying the reverse bias voltage to D2 (in this case D2 is acting as a varactor diode, who's capacitance changes with change in its reverse bias voltage).

Re-examining the completed circuit board, I discovered that I had installed R14 (a 500K pot) where R4 (a 10K pot) goes and vice versa. No wonder I had no VFO swing! The real trick was unsoldering the pots! All I can say is that I used a whole lot of solder wick getting those guys out! (A solder sucker would have come in really handy right then!)

Putting the pots where they were supposed to go, and voila!—the VFO worked just like it was advertised. All that was left was to mount the circuit board inside the MFJ Cub 40 enclosure, and I was QRV!

72 de Mike, KO4WX