

# Constructing My VK5JST Aerial (Antenna) Analyser Kit

July 2009 (ver. 22)

By Andrew Cornwall / VE1COR

## HAPPY ENDING FOR MY MISPLACED ANTENNA ANALYZER

My wife and I are Snowbirds, which means we head south for the winter instead of staying in Nova Scotia and enduring the very cold Canadian Winter. We spend the winter camping on the various deserts of Arizona and California in our travel trailer. In spring we return home to the amazement of local wildlife with our ability to find our way back to the very same spot we left five months previously. Due to the high cost of gasoline in recent years we have stored the travel trailer in Arizona for the summer, and journeyed home staying in motels along the way.

A complication of living in two places during the year is keeping track of the gear needing to be (literally) trucked back and forth so we have use of it year-round. I happen to have an MFJ 259B antenna analyzer, which usually comes with me in all seasons. Last winter I used the device extensively to 'perfect' my home-brewed 'Mini Missile' portable, "multiband", HF antenna for ham radio operation from the trailer. When I returned home this spring I found that I left the MFJ 259B behind in the stored travel trailer. This appeared to be a very real setback to my plan of erecting a 33 ft. vertical antenna on my Nova Scotia property. Since the antenna and unum would be 'home brew' I needed an antenna analyzer to measure its characteristics and make (endless) adjustments.

Not to be stymied I looked for an economical alternative to the MFJ 259B, and my search lead me to the VK5JST 'Aerial Analyser' Kit, costing \$150 (AUD), about \$110 (US), produced by the South Coast Amateur Radio Club in Australia (<http://www.scarc.org.au/>). The ratings of the kit on E-ham (<http://www.eham.net/reviews/detail/5779>) were very complimentary. I made kits years ago, assembling Heathkit, Eico, and Dynaco products. Since then I have home-brewed a lot of 'electronic stuff', some of which actually worked as intended. With only a little hesitation I ordered my VK5JST kit on-line. Very shortly afterward, Graham, VK5GCT, notified me that he was burning the PICAXE 28X chips, and would ship the next batch of kits in a few days. Thereafter Graham notified me the kits had been shipped airmail. In about a week and half I received the VK5JST Aerial Analyser kit in my mailbox. The package was sturdy but of modest size. All of the parts of the kit were packed inside a black, 9 x15 x5 cms, bare plastic box which would be the Aerial Analyser's case.

The parts were good quality and all there. The box was not yet milled, and some cutting and drilling would be required. But the instructions were less than the bulky, step-by-step manuals I was used to with a Heathkit, etc. The VK5JST kit comes with 10 pages of instructions covering theory, assembly, testing, and calibration. How to put the kit together is described in only about one page of text and an annotated circuit board parts layout. Despite their brevity these instructions were well written, to the point, and entirely adequate. Further, there is a lot of additional information on Jim Tregellas' /VK5JST website (<http://users.on.net/~endsodds/analrs.htm>).

After working on the kit for a couple of evenings I started taking pictures of my progress. At that point I was feeling pretty good about the project and thought there was a reasonable chance of its being a success. Below are a series of pictures showing how I put together my VK5JST Aerial Analyser. In three instances I deviated from the instructions. One is using stand-off screws instead of spacer tubes to mount the circuit board to the front panel. I thought the stand-off screws would provide a degree of adjustment, but no

adjustment was necessary. Another is the way I wired the LCD panel to the circuit board. The LCD wiring my way seemed to be easier and allowed for better access if a repair is required. The third is putting the battery holders in a separate box instead of inside the Analyser's case. This way changing batteries is easier, but having to carry a battery case is not as convenient. As it turns out the VK5JST draws only about 80 ma, so battery life is quite long. Finally I goofed when drilling the first hole for the fine-tune potentiometer. The hole was too near the top on the side of the box creating a conflict between the potentiometer and the circuit board. The ugly solution was to drill a second hole lower down.

I've been using my completed VK5JST Aerial Analyser for a couple of weeks. The 33 ft. vertical is erected and operational. The first time I used the antenna, in the afternoon with PSK31 on 30 meters, I made an instant contact not far away in the state of New Hampshire. At the same time a spotter station in the state of Illinois heard my signal. That evening I had easy contacts in the Province of Ontario and the state of Texas, and a spotter station in the state of California picked up my signal. Wow, the vertical puts my G5RV to shame. So, am I done the VK5JST Aerial Analyser? "Naw ... there is still a lot of tinkering to do". Maybe I will leave the MFJ 259B in the trailer full-time and use the VK5JST when at home.

As you can see from the following pictures I am not a craftsman kit builder. But this is OK. If I can build a VK5JST Aerial Analyser, so can you – and likely do it better.

Good Luck and Best wishes,

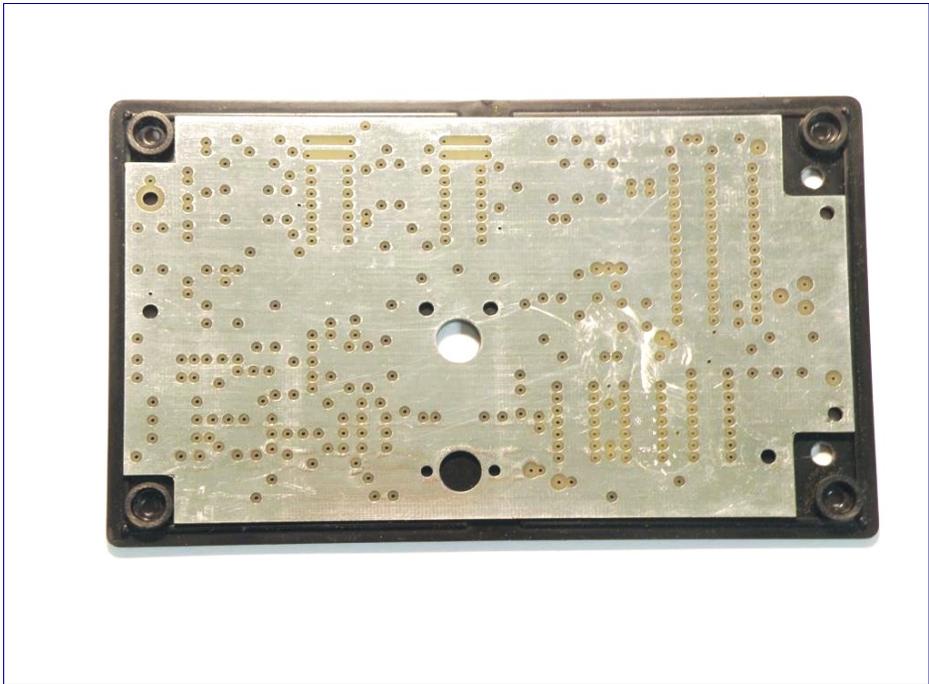
--- Andy / VE1COR

#### **PICTURES AND A FEW COMMENTS:**

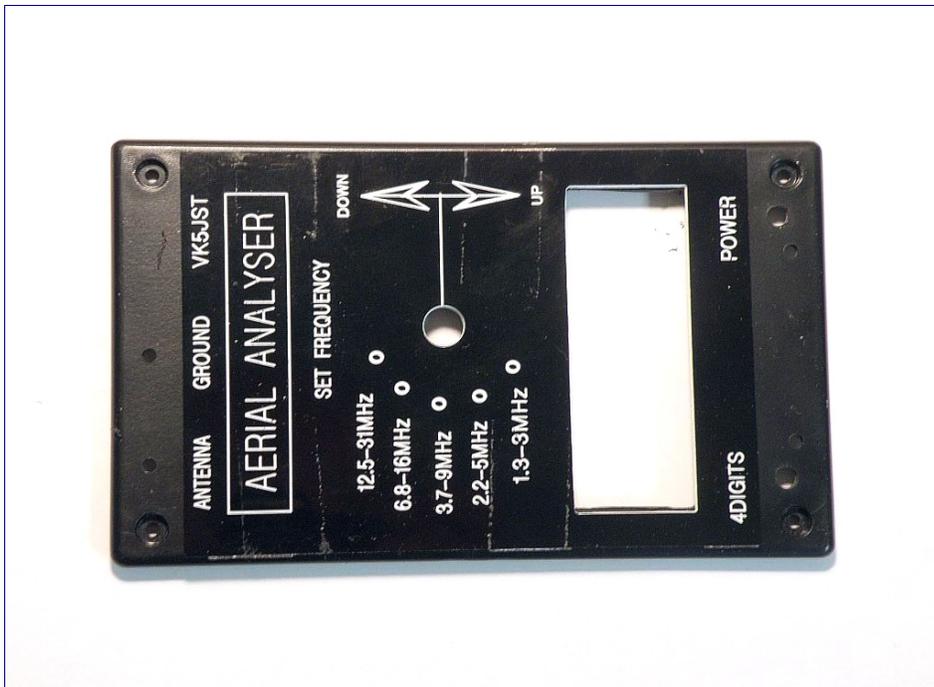
Here are some of the tools I used to prepare the case, including cutting in the top the rectangular hole for the LCD panel, drilling the hole for the frequency selector rotary switch, and drilling holes for mounting the circuit board and pilot holes for the toggle switches and binding posts. This picture and the box preparation ones that follow were taken after the holes were cut and drilled.



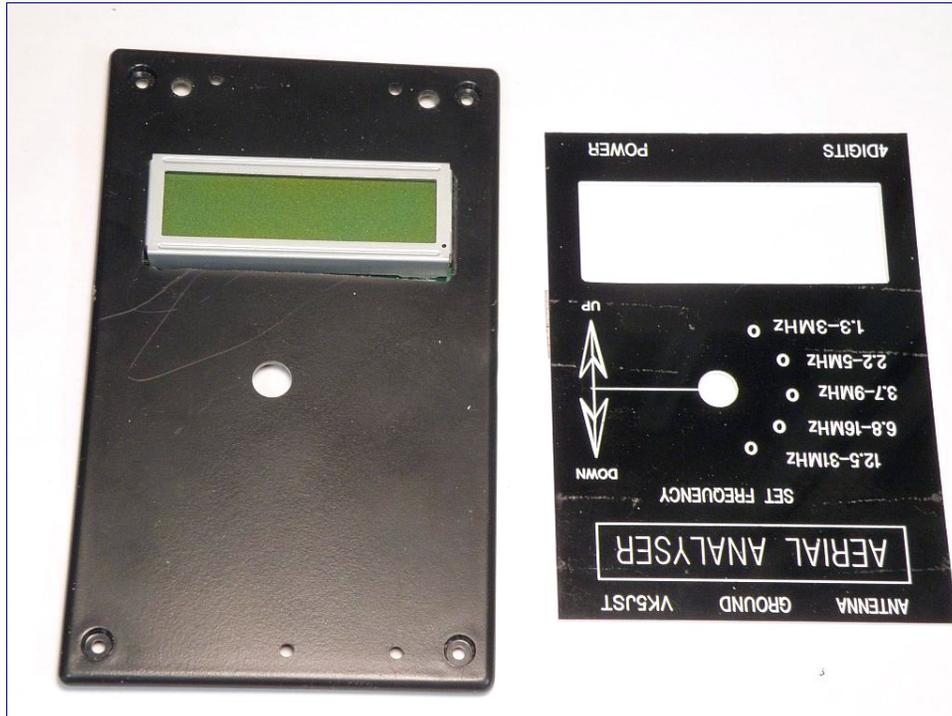
The bare circuit board serves as a template for drilling the frequency rotary switch (center) and the board mounting holes (2 at each end). The mounting holes used by the binding posts (left end) will be made bigger later. There is no template for drilling the switch holes (right end at top and bottom), but now is a good time to locate two places for the switches and drill their holes.



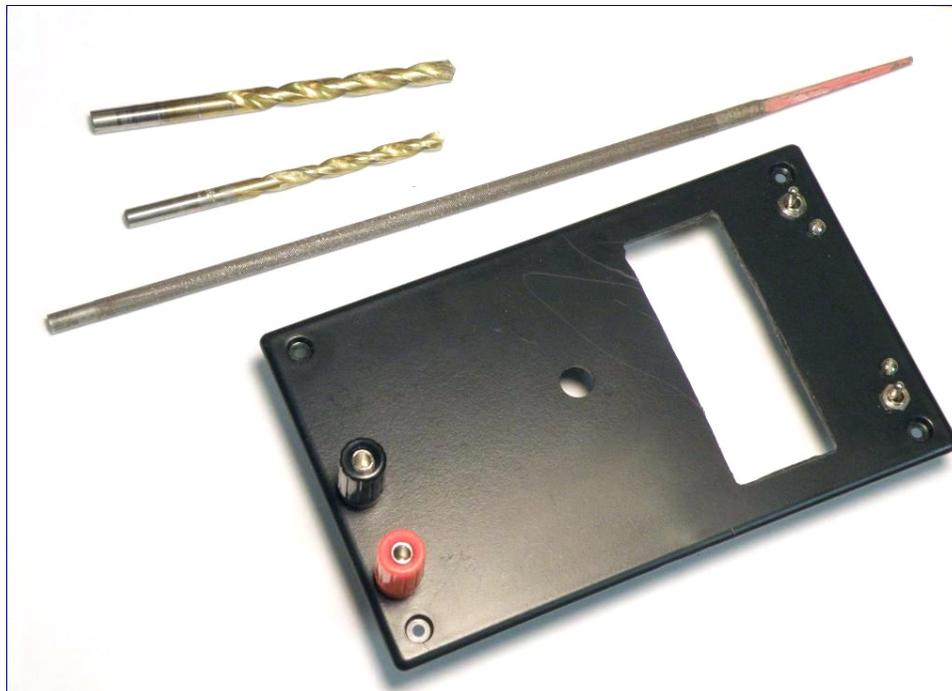
When the drilled hole for the frequency selector exactly matches switch hole in the engraved face plate, the LCD hole in the faceplate becomes a template for scribing the box cover with the shape of the LCD panel hole. (The streaks on the face are tape lines left when the face was attached to the box cover. Later the lines are removed with solvent.)



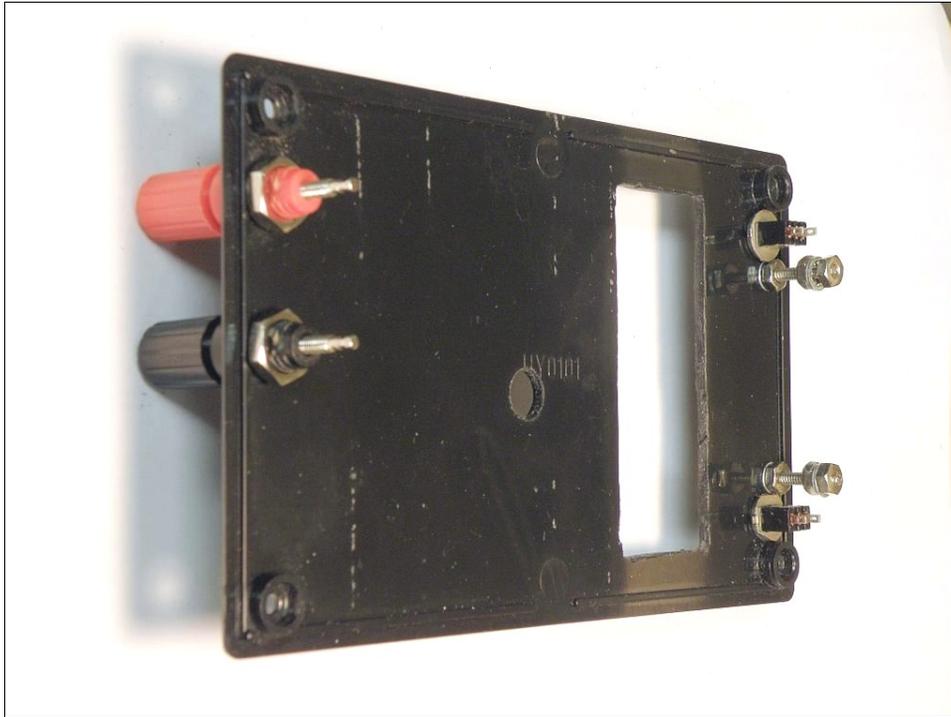
LCD panel is 'tried on for size' in the box cover.



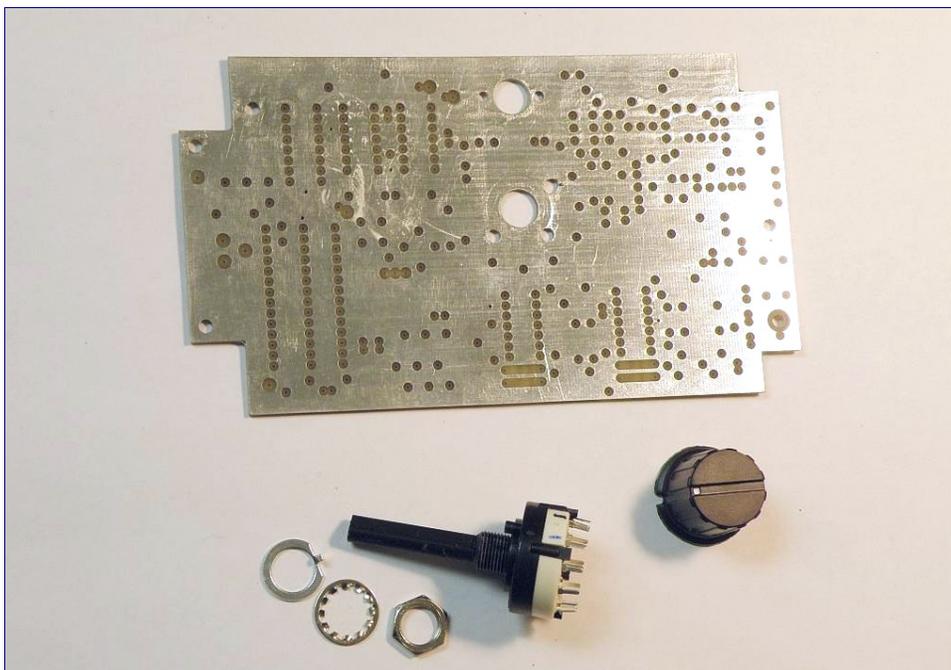
Binding posts are installed at the left end of the box cover, and board mounting screws and switches are mounted on the right end. I used the tools to enlarge the holes for the binding posts and drilling holes for switches.



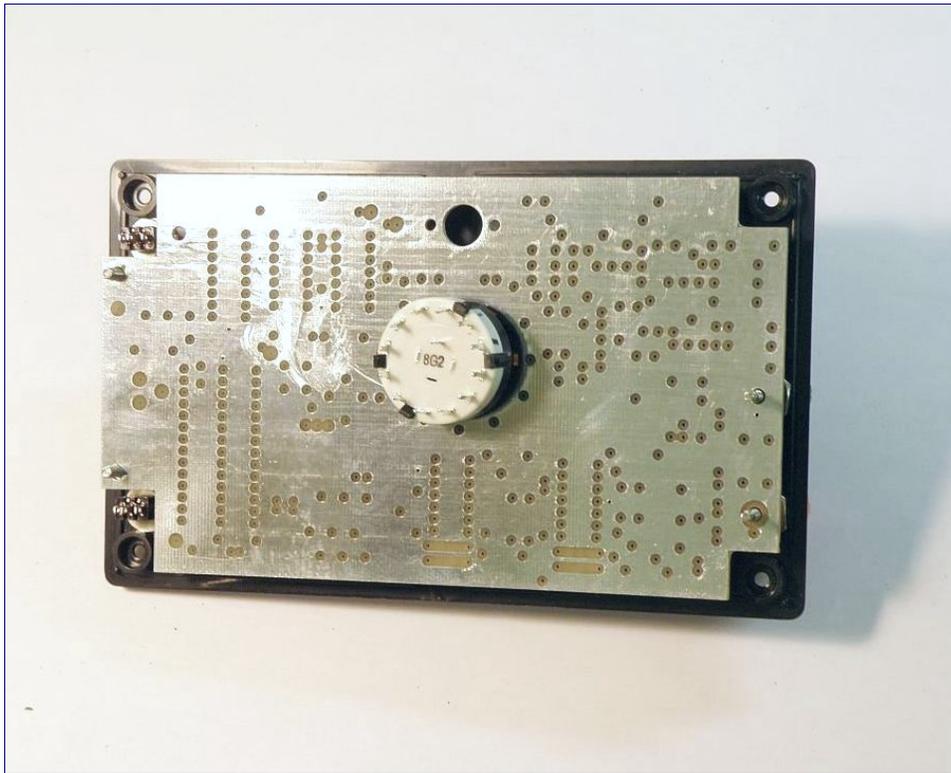
Detail showing circuit board mounting screws and switches. The use of mounting screws / nuts is out of habit. The kit comes with screws / nuts and spacer posts which are as good as my method.



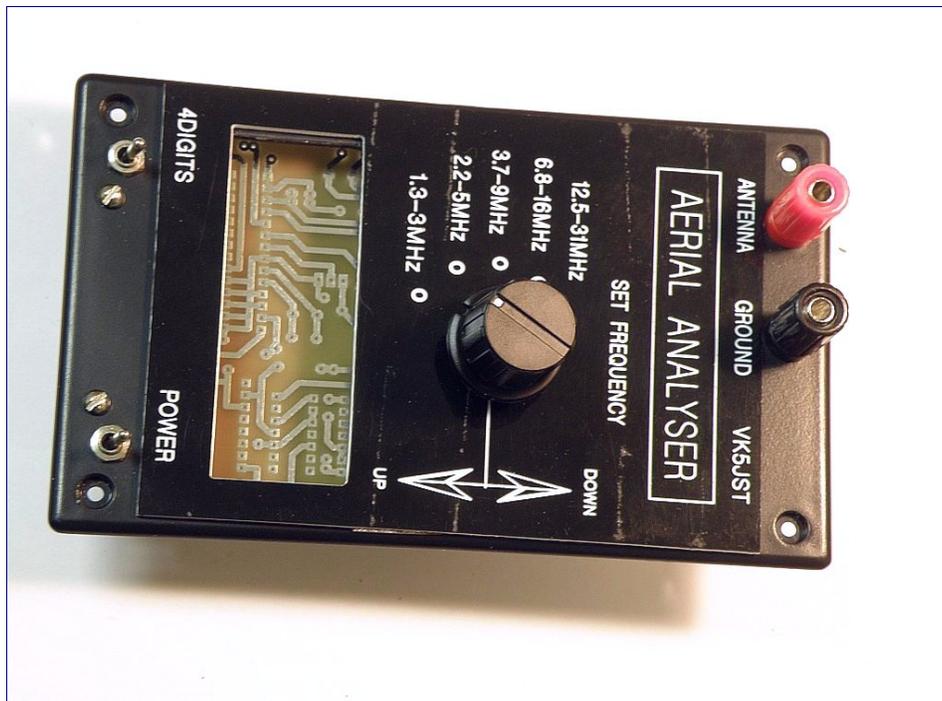
This is the circuit board with frequency range rotary switch assembly. The Kit's instructions warn about the possibility that the the hole in the circuit board may not be right for orienting the particular switch supplied. I drilled three extra holes in the circuit board and tried two locations for the washer with the end stop pin before getting the orientation correct. All this is not hard to due, but took an evening of fiddling. Even then I had to turn the knob around. By the way, I am not a master of the Rubik's cube either.



The frequency range rotary switch temporarily mounted in the circuit board, which is temporarily mounted on the cover of the box, to make sure everything aligns up and fits in the box.



The mock setup looks pretty good. It fits in the box, but the knob's set screw is backwards with respect to the flat side of the rotary switch's shaft.



Turning the knob around:

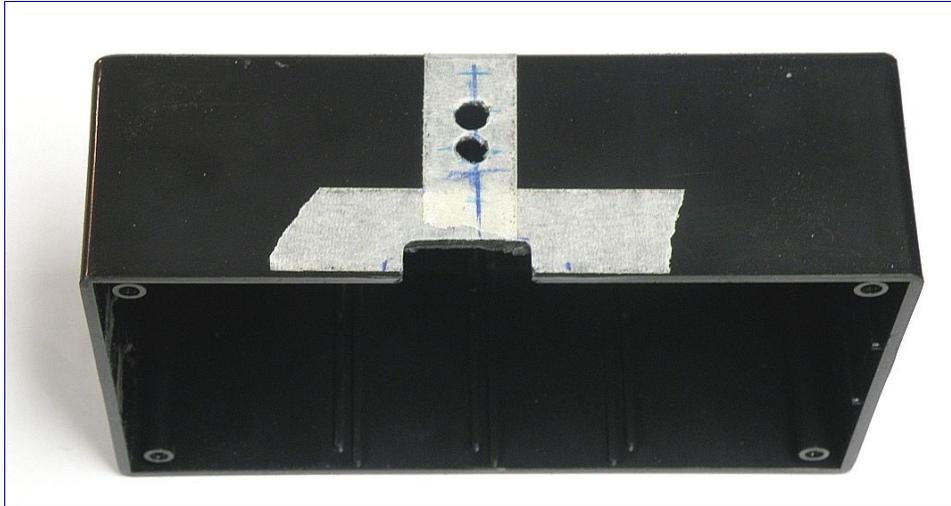
Before.



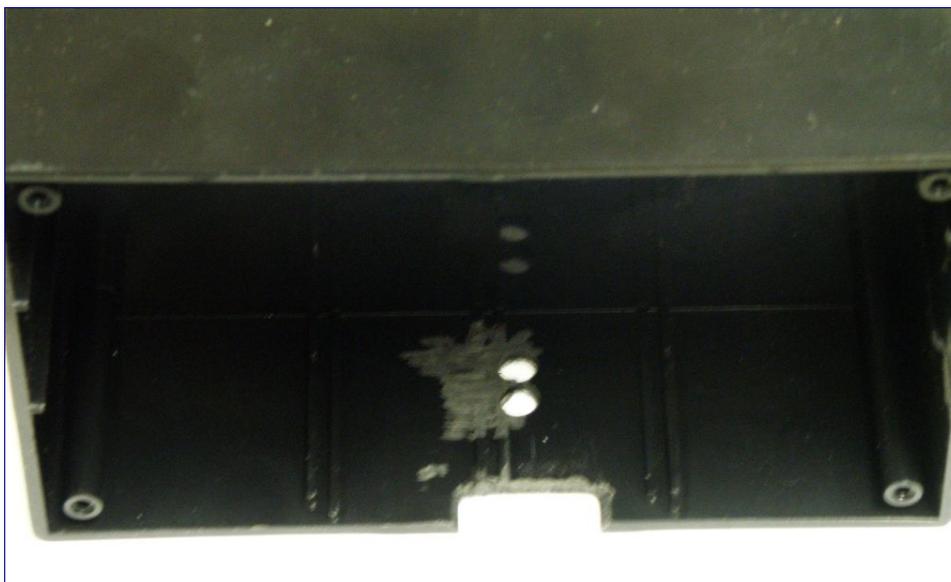
After. With a marker I blackened out the old white spot, drilled a dimple at the other end, and filled it with white paint from a paint pen. I also filed a small notch at the base.



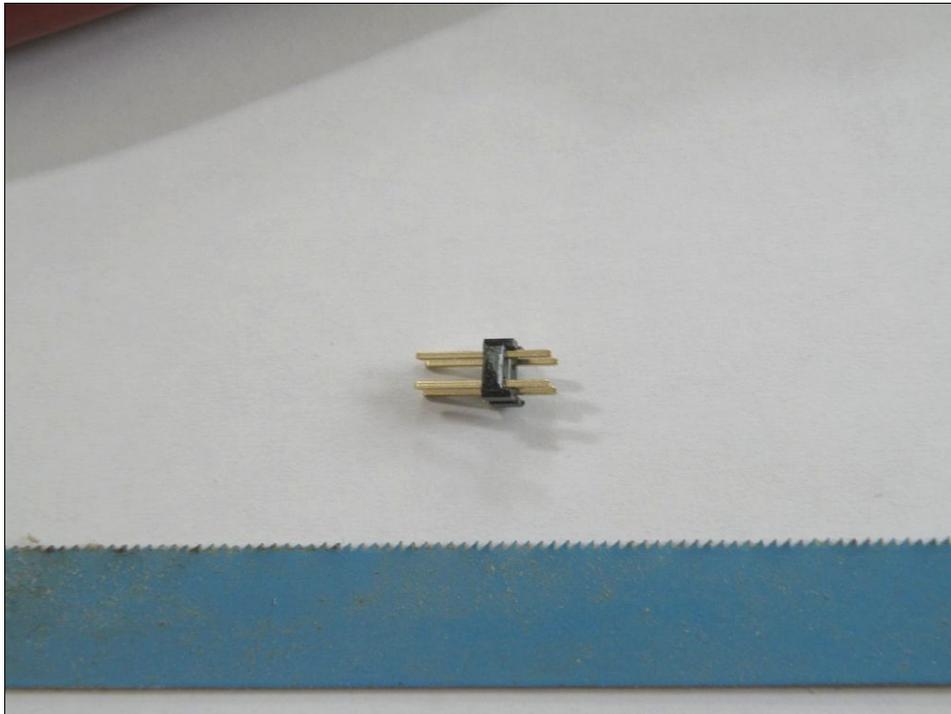
A slot was filed in the box for the knob of the tuning capacitor. (I hastened the job with a bench grinder. )  
OOPS! I goofed and drilled the hole for the fine-tuning potentiometer too high in the box. The hole closer to the bottom is correct (note, the box is upside down in this picture).



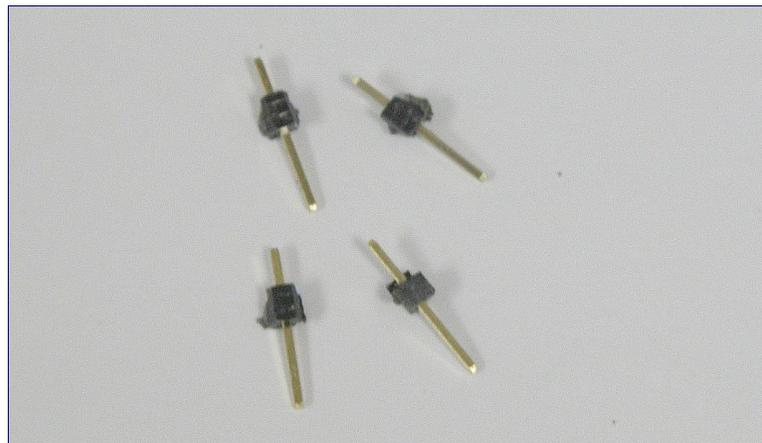
Some of the ribbing in the box at the potentiometer hole needed to be smoothed down so the potentiometer would 'sit' straight. Eventually ribbing at the ends near the top needed to be smoothed down so the cover would fit easily.



I had not encountered a block of test pins like this before and initially wondered what it was. Once I clued in, I separated the four test pins by holding the block with a pair of pliers and cut the pins apart with a hack saw blade.



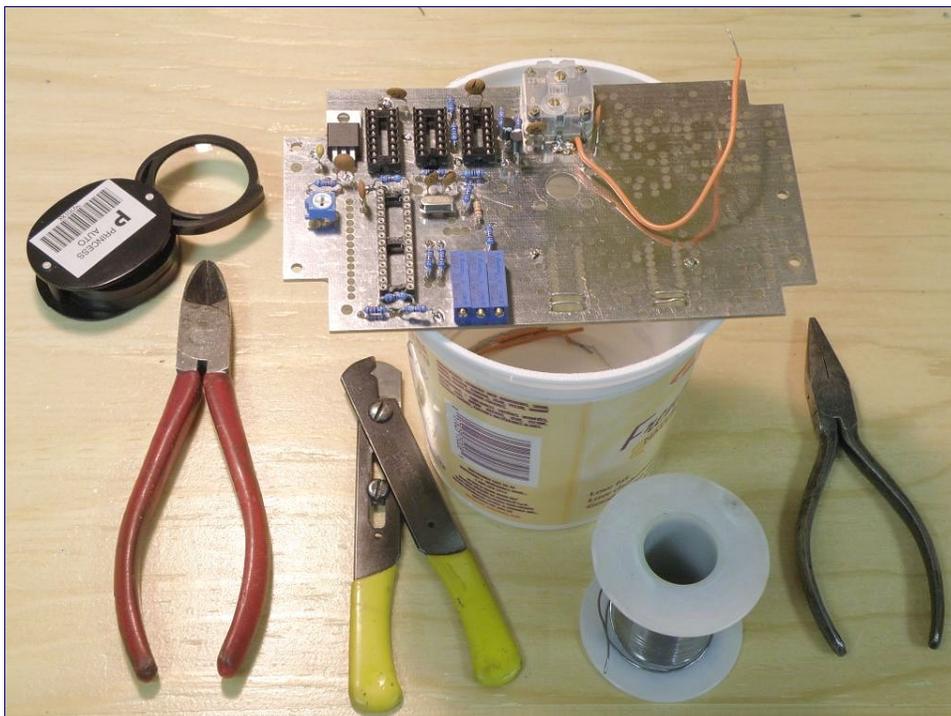
Test pins separated from the block.



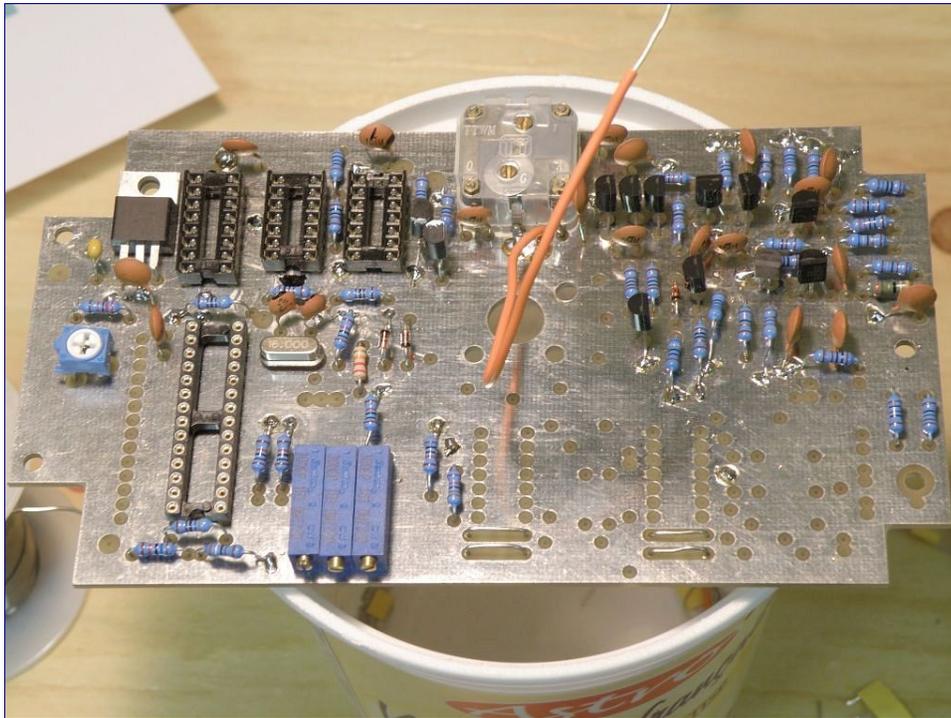
Some tools I used to mount and solder the components on the circuit board. The nice soldering station was a 'just in time' present from my son, KF7CCC. Thank's, Andrew. I may have been able to make the kit with my Weller 25 watt soldering pencil, but I am glad I did not have to try.



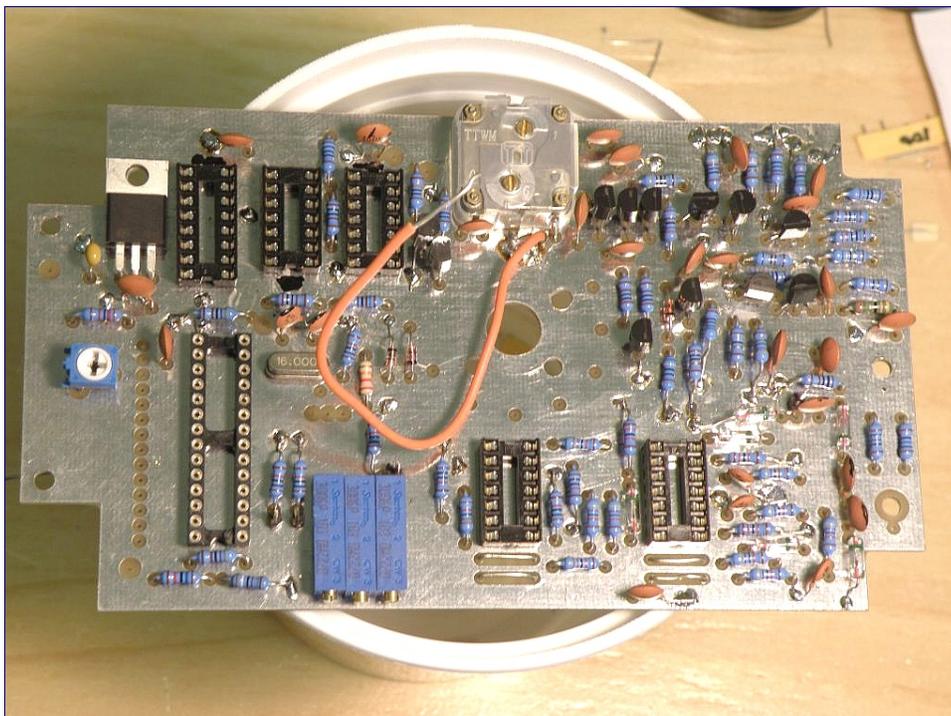
Starting to mount the components. A plastic yogurt container serves as a work stand.



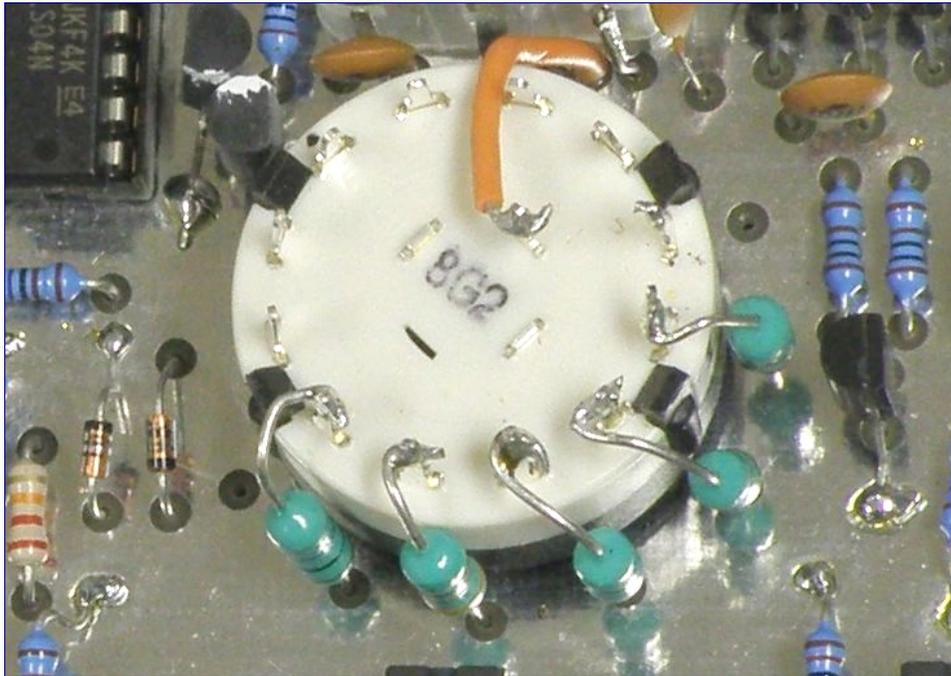
Mounting more components. If you have sharp eyes you can see I put one of the IC sockets in backwards (notch at the wrong end). I marked what should have been the notch end with an ink spot to remind me of the correct position of the IC.



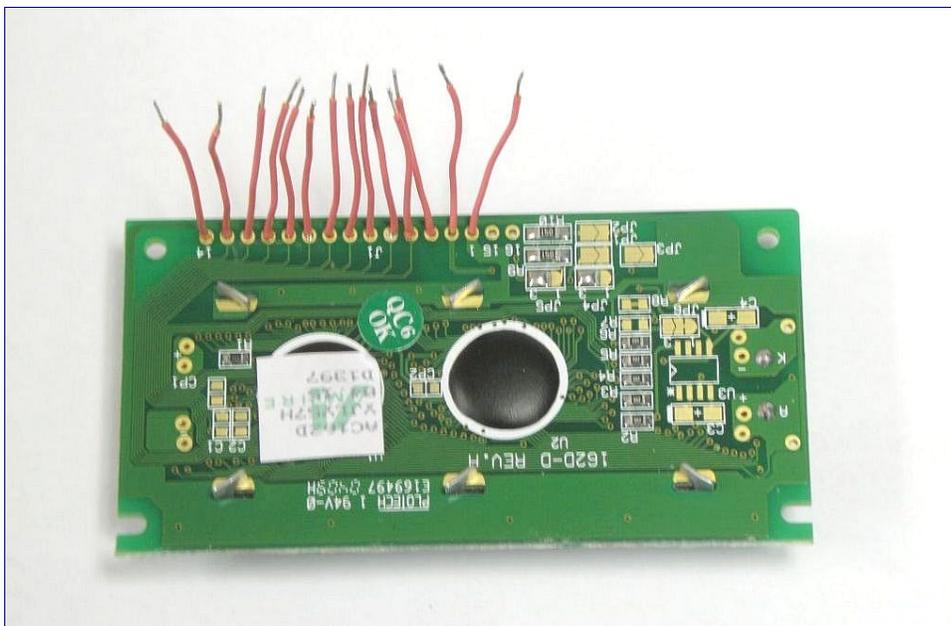
More parts mounted.



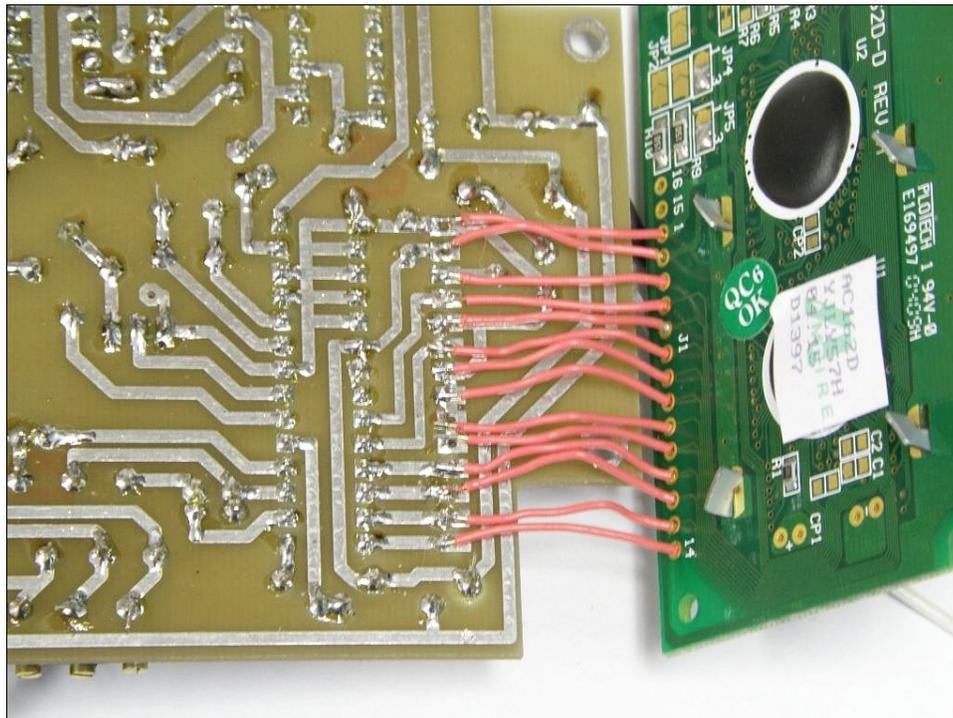
Finally, the frequency rotary switch was mounted and inductors soldered to it.



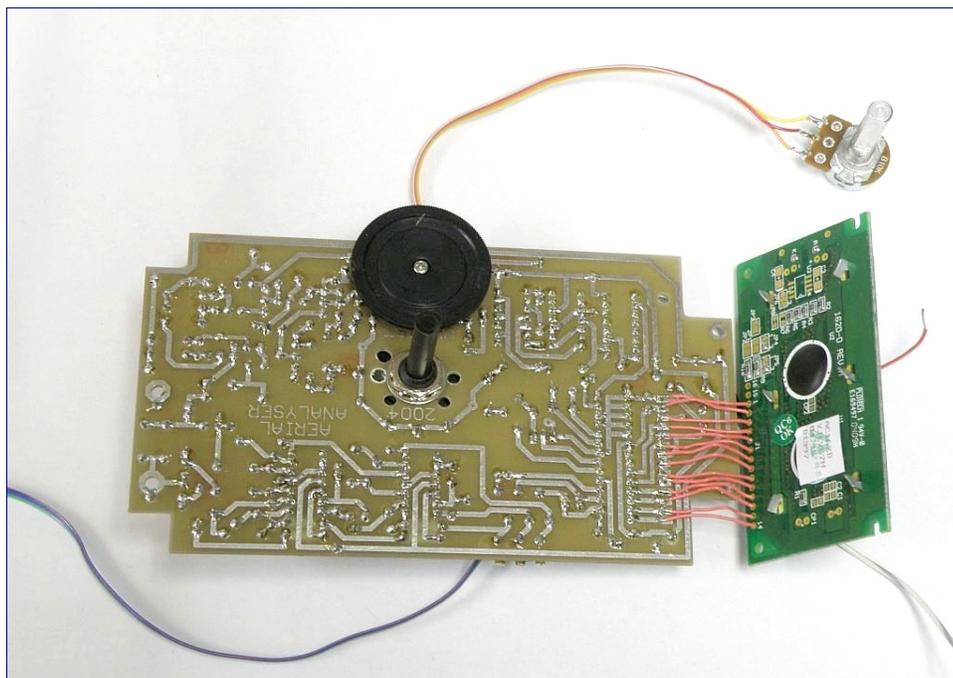
Soldering the connecting wires to the LCD panel. Each wire was cut to about 3.6 cms long. Less than  $\frac{1}{2}$  cm of insulation was removed from each end. An ample coil of wire came with the kit. The instructions envision a different way of placing the wires between the LCD panel and circuit board, and the wires that way would likely be shorter.



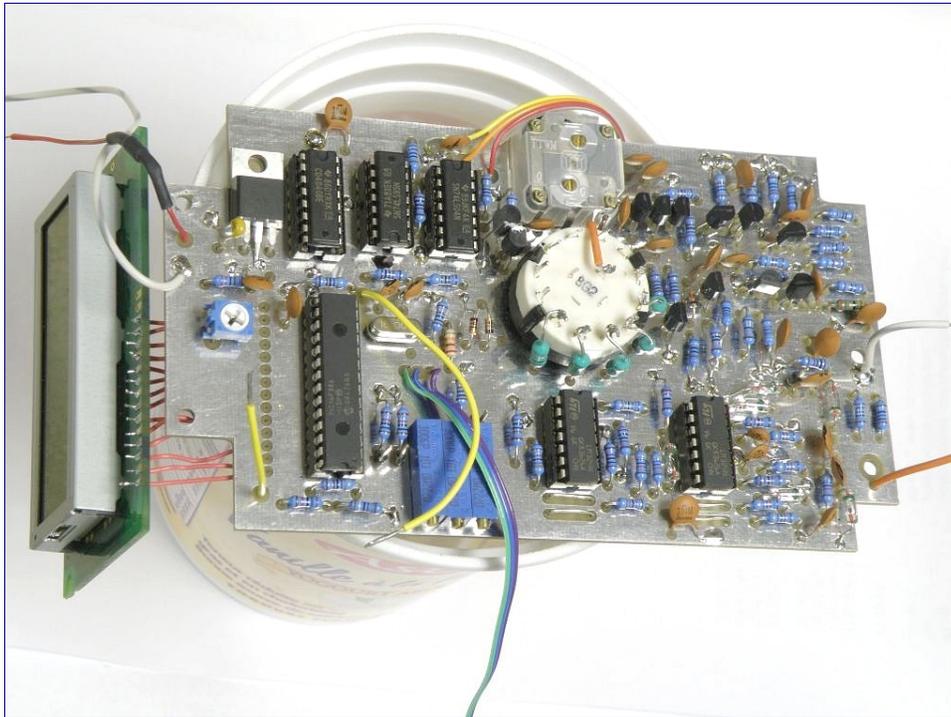
I tack soldered the LCD panel's connecting wires to the circuit board. This is not how the instructions recommended I do it.



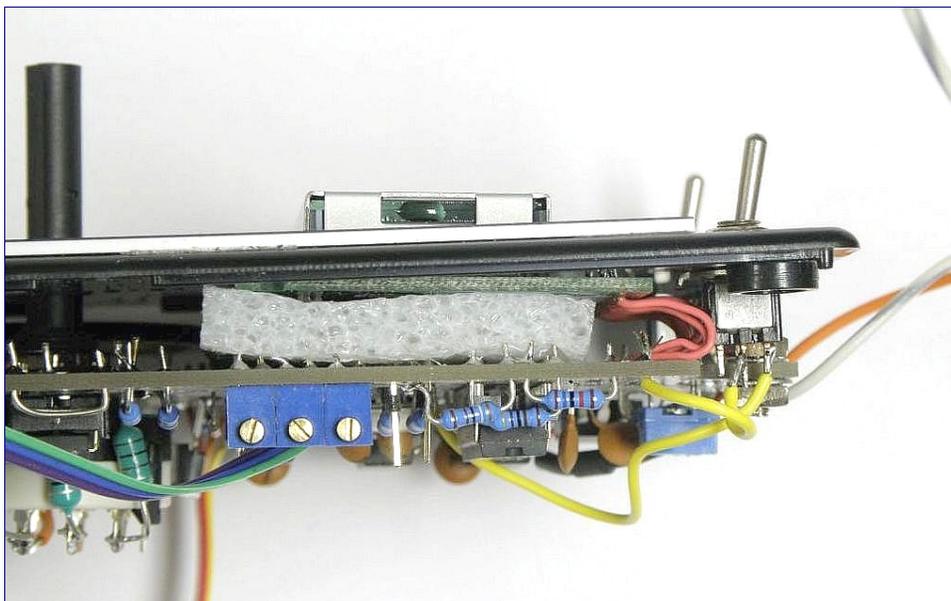
Adding the potentiometer, frequency control knob, and wire for a future RS232 connection if I ever want to reprogram the PICAXE 28 microprocessor.



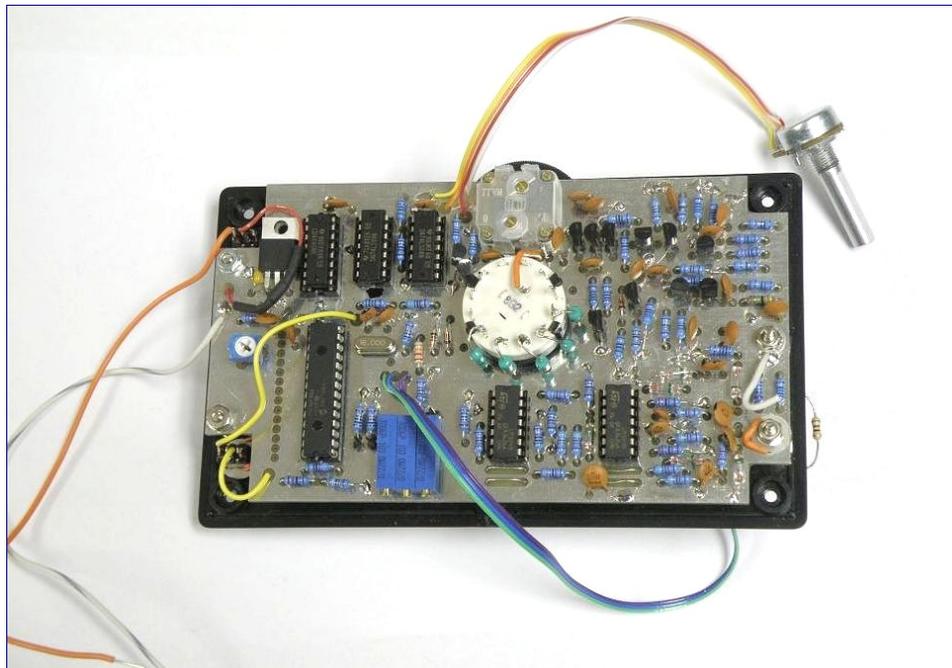
I checked the component placement thoroughly. Even though I took my time while mounting parts I found two resistors were mixed up (47R and 4K7), and an IC pin not soldered. After carefully inserting the ICs, and making final wiring connections to the circuit board for the switches and binding posts, the VK5JST Aerial Analyser was ready for the smoke test. I followed the testing procedure in the instructions, and my kit worked beautifully.



I gently bent over the LCD panel wires and put it in place. The plastic spongy buffering material came from my scrap box.



The completed circuit board was mounted to the cover of the box and wires from the circuit board were connected to the switches and binding posts. Someday an RS232 socket may be added to the green-blue-purple wires for reprogramming the PICAXE 28. The next step was to trim the shafts of the frequency rotary switch and the potentiometer so the knobs would not stick awkwardly too far out. To do this I held each of the shafts in a vice slowly trimmed away just the right amount with a hack saw.



The completed unit with its companion external battery pack. I put a power plug connector in the side of the box. The instructions call for placing the battery holders inside the box, which would make for easier use. Note the large washer covering the mistakenly located hole.



To transport my VK5JST Aerial Analyser and carry it into the field I made a case out of a plastic CD box from Wal-Mart. There is a removable shelf with a wood handle. The battery pack and other bits and pieces are stored under the shelf.



The VK5JST is a neat piece of gear and it seems to work very well. Thank you South Coast Amateur Radio Club.