Keyer Selector Construction Notes

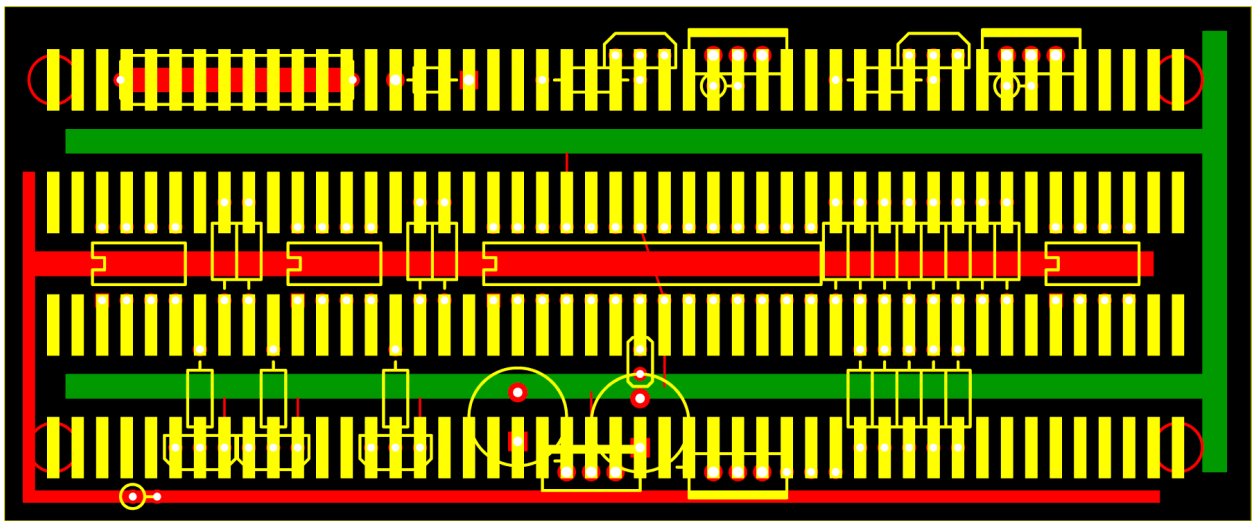
I have built two Keyer Selectors which were used at PJ4A in the 2013 CQ WW CW. This describes the construction of those boxes and some alternatives.

Overall Construction

The Keyer Selectors were built in Ten-Tec TPB-41 enclosures. A larger box might be a better choice but I wanted the units to be small because they had to fit in my baggage. This led to a few compromises:

- I could not label all of the controls as I would have liked. The box it labeled "TX SELECTOR" because a longer word would not have fit. The transmit control says IND and UNL instead of INDEPENDENT and UNLOCKED because full words would not fit. Similarly the labels on the back are not positioned where I would prefer in some cases.
- I used ⅛" stereo jacks for CW and PTT and for the paddle output. These reduced the number of connectors on the rear panel. These are popular because they are used on tablets and it is easy to find ⅛" stereo phone to RCA adapters on amazon.com or eBay. Also the USB Winkey uses a ⅛" stereo phone jack as the paddle input.
- When all of the wires are attached to the board it becomes difficult to work on it. The smaller box is a bit tricky to build and troubleshoot.

Most of the bypass capacitors were mounted on the connectors. The remaining parts were installed on a piece of a Vector 8001 breadboard (Mouser part number 574-8001. I cut the board into several pieces and used two for the two Keyer Selectors. Each piece was slightly different but this is the approximate layout I used:



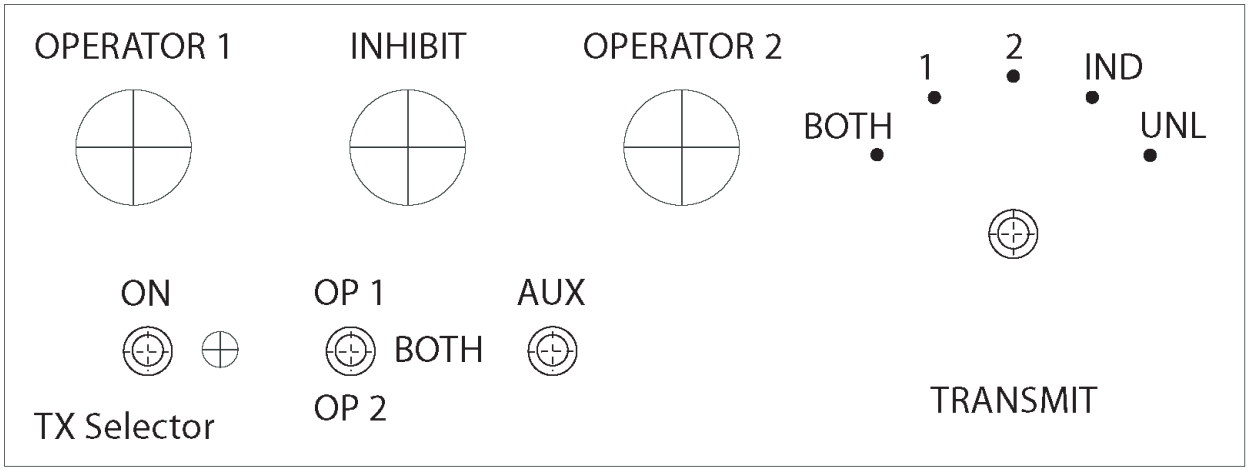
Box Front

This view is from the component side of the board.

There are three rows of parts. A partial list of the top row, from left to right is F1, D1, Q2, Q5, Q3, and Q6. A partial list of the middle row is U3, R9 & R10, U5, R18 & R 19 U2, R1-R4, R16, R11 & R12, and U4. The bottom row is Q7, Q8, Q1, U1, Q4, R5-R8, and R17. R15 is mounted vertically at the bottom left.

The red circles are where holes were drilled. Holes were drilled in corresponding locations in the bottom of the box and 4-40 nuts, bolts, and spacers were used to mount the board. Plastic washers were used to ensure that the nuts, which are on top of the board, do not short anything on the board.

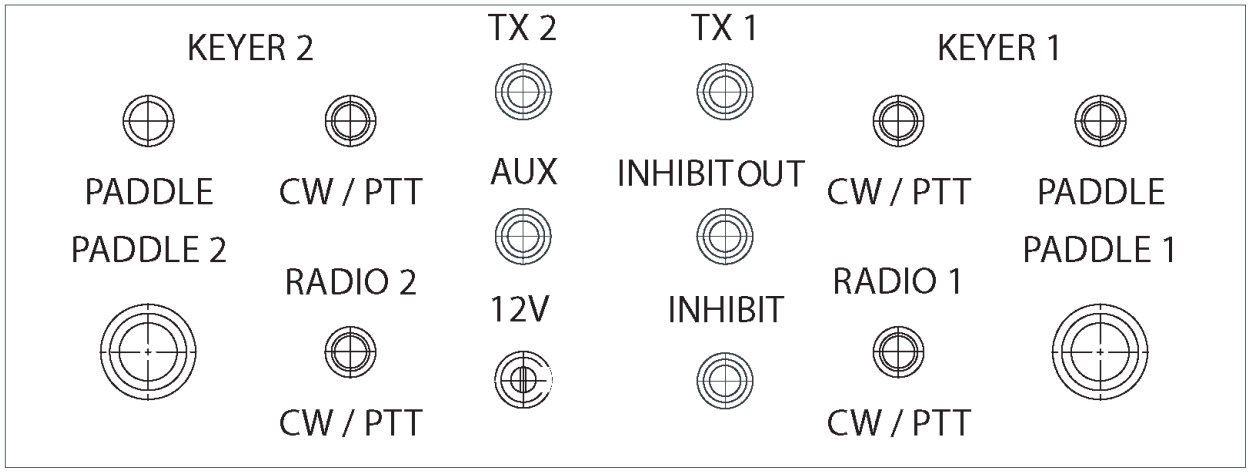
This is the front panel layout:



The three large holes are for the LEDs. The bottom left holes are for the power switch, LED, priority switch, and auxiliary switch. The hole on the right is for the transmit mode switch.

It would be better to label the center position of the priority switch FIRST instead of BOTH.

This is the rear panel layout:



Note that the keyer 2 connections are on the left and keyer 1 connections are on the right.

Even using stereo jacks for CW and PTT, there are 14 jacks on the rear panel.

The top left ⅛" stereo jacks below KEYER 2 connect to the keyer. The PADDLE connection goes to the keyer's paddle input and the CW/PTT goes to the keyer's CW and PTT outputs. Below that, the ¼" stereo PADDLE 1 jack is connected to the operator's paddle and the RADIO 2 PTT connection goes to the radio 2 CW and PTT jacks.

The KEYER 1, PADDLE 1, and RADIO 1 jacks on the right work the same as their corresponding jacks on the left.

In the center section, the RCA connectors provide +12V when transmitting or inhibited.

Power is applied to the 12V connector.

The completed unit looks like this:

There is nothing sacred about this layout or box. About the only things to consider are making sure that the leads between the microprocessor and the bypass capacitors and the voltage regulator are short.

Modifications and Component Substitutions

All of the parts used were in stock at Mouser Electronics when I needed them. Some parts can easily be substituted.

- The 2N7000 is convenient but could be replaced by almost any N channel FET which turns on with 5 volts on the gate. They could also be replaced by NPN bipolar transistors such as the 2N3907.
- The SPP08P06PH was chosen because it was inexpensive. It is definitely overkill. Almost any P channel FET would work if it will turn on with -12 volts on the gate. A PNP bipolar could also be used if a resistor is added in series with the base.
- Optoisolators were used for the keyer and radio outputs. This reduces the possibility of grounding issues. If the station does not have the possibility of ground loops these could be replaced with FET or bipolar transistors.
- The Operator and Inhibit LEDs, D2, D3, and D4, were chosen because they are large and visible from a wide angle. Experience with another inhibit box which had a small LED showed that these should be made very visible. The LEDs used are 12 volt units with a built-in resistor. Any LED could be used with a series resistor. If the LED does not draw too much current (most don't) it and the series resistor could be connected between the microprocessor pin and ground, eliminating Q7 and Q8 and their associated resistors.
- The circuit can be easily adapted to a different microprocessor. The one used is overkill but it wasn't worth the time for me to find one which would be suitable and the cost savings would have been pennies.
- Some of the parts were selected because they were the cheapest that Mouser had. For example, the 5V regulator was the least expensive 7805 that was available, as was the 1N4004. Just about any 5V regulator and small power diode will work.
- The ¼" and ⅛" stereo phone jacks are of types which do not connect the ground to the chassis. You can use any type of connector you like, but if it grounds one pin to the chassis you will eliminate the benefits of the optoisolators.
- The Auxiliary switch and output may not be needed for your application. Feel free to leave them out.
- The TX1, TX2, and INHIBIT OUT outputs may not be needed for your application. If so, they can be left out, along with the driver transistors for them.
- Most of the parts values are not at all critical. Anything in your junkbox will probably work.

Programming the Microprocessor

The microprocessor must be programmed using an external programmer. I used an AVRISP programmer. An Internet search for ATMega328P programmer will turn up many inexpensive programmers, including the USBASP and clones. The .HEX file on the website is all you will need.

Set the microprocessor for Calibrated Internal RC Oscillator with 14CK + 65 ms extra delay, no CKDIV8 clock division, no boot area.

Additional

If you run into trouble or have questions send me e-mail and I'll try to help.