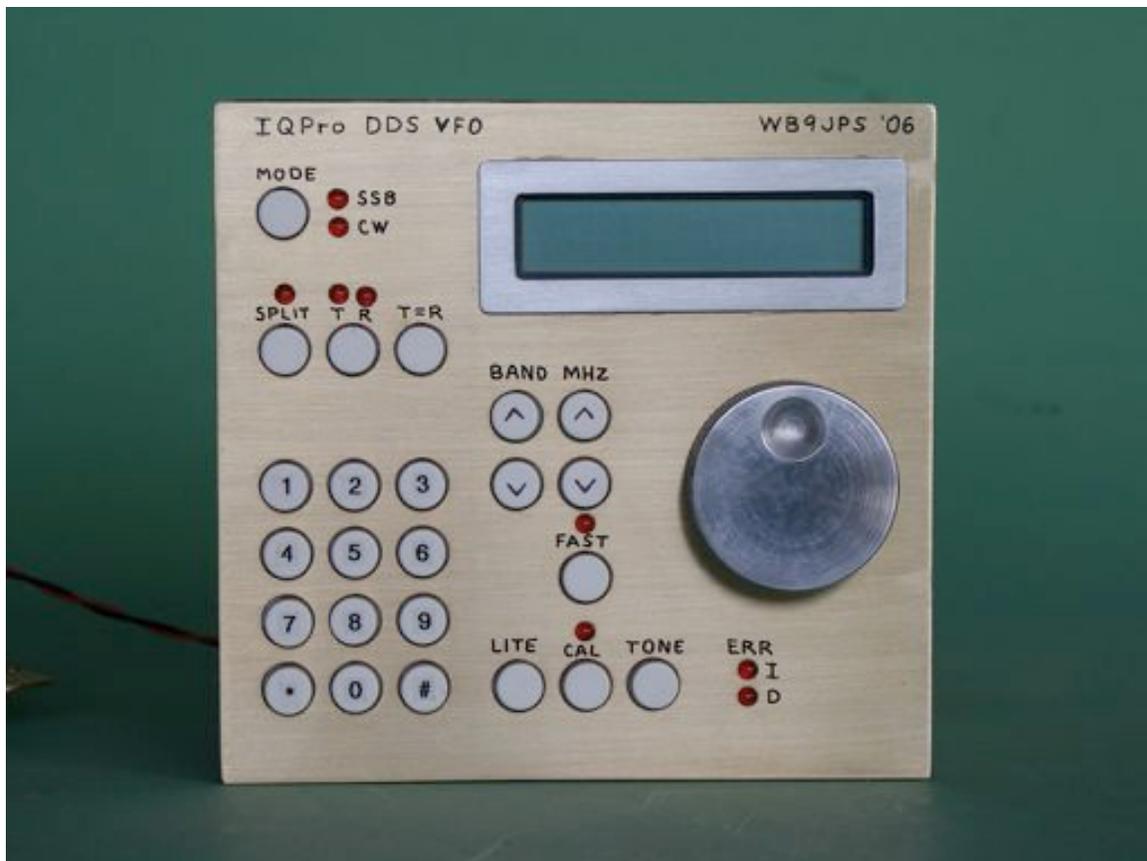


IQPro Construction Notes by Gary Johnson, WB9JPS

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All parts of the enclosure were fabricated from 0.050 brass sheet, folded and soldered, with 0.187-thick brass strips soldered along edges where I needed to drive screws. That's thick enough to tap #2-56. Standoffs for various boards were machined from brass rod. Finishing consisted of wet sanding prior to and after assembly, with some help from a hot ammonia soak to clean up corrosion in dark corners. To keep things shiny, I use Staybrite spray lacquer designed for brass, available from Woodcraft. Hand lettering was done with a Rapidograph #2 pen with ink that is meant for mylar. I also used some clear stick-on labels from one of those cheap label makers.

The front panel was drilled on a vertical mill to obtain a uniform pattern that exactly matches the Vector board that holds the pushbuttons and LEDs. The knob was turned from aluminum; it has a knurl on the side. The display bezel is aluminum. I thought the contrast would be nice against brass. The box is 5.0 inches tall. I use that as a standard dimension for the modules that will make up my R2Pro-derivative receiver that this thing is destined for.

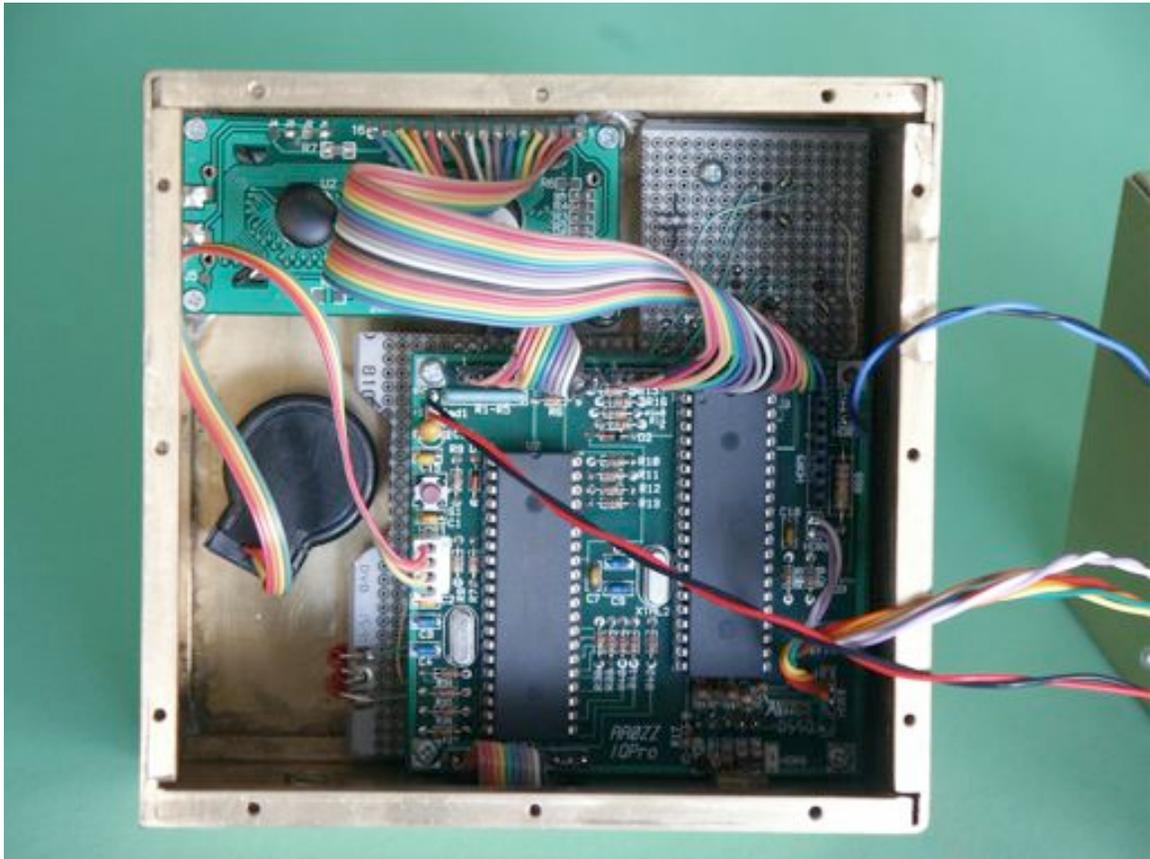


All the power was brought in via feedthroughs. I got most of them from Mouser (Spectrum Control). Band relay digital outputs went to a DB-9 jack. Filtering for those was discussed on the DDS-VFO Yahoo group (msg. no. 2864). I used 220 ohms in series with each lead, and 10 nF to ground. RF signals come out thru SMAs.

Vent holes are drilled on the sides and top. Holes in the top line up with similar holes in the RF section inside.

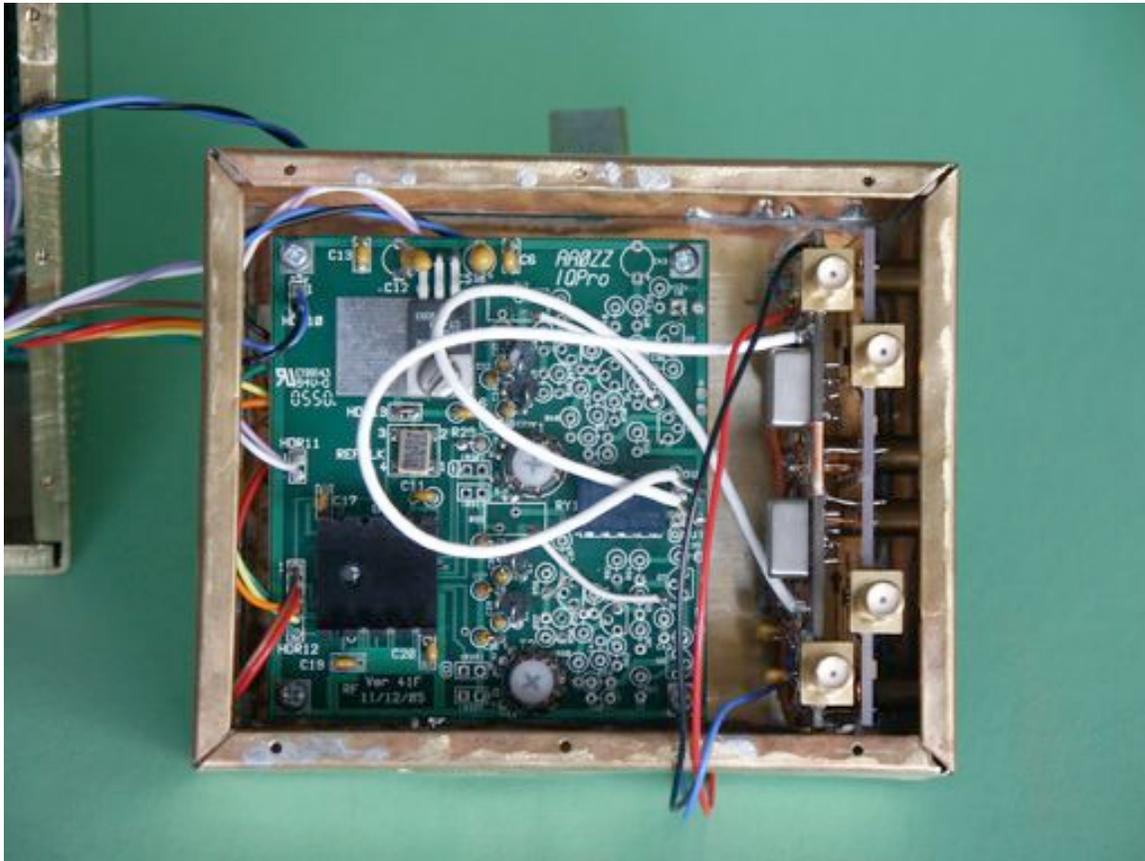


Looking inside the main box from the back, you can see that the IQPro CPU board is floating above the switch/LED board on standoffs. Standoffs for the switch/LED board and the LCD display are soldered to the inside of the front panel so there are no visible fasteners. To align them, I made sheet metal templates with holes that match those in the boards. Then everything is clamped in place while soldering. The front panel was completed before soldering it to the sides. After the enclosure was all soldered, I mounted it on the mill table and took a final cut on the back to give the rear panel a nice flat mating surface. I suppose I could have gone haywire and added RF gasketing, but this is only for the HF bands.



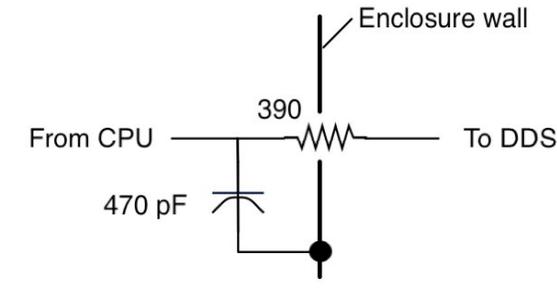
A sub-enclosure houses the RF section, and it bolts onto the rear panel. You can see the SMA connectors that feed through the rear panel. Everyone who uses these DDS chips knows how hot they get. I glued on a small heatsink with a metal-loaded epoxy. That made a big difference, and it's even more important with the very limited convection cooling in this enclosure (there are holes along the top and bottom).

You can see the IQPro RF board, mounted on standoffs. Its outputs go through subminiature Teflon coax that I had lying around. The first board it reaches contains a pair of 3 dB hybrid splitters and some voltage regulators. One side off each splitter routes the signal to an output for a transmitter (0 dBm out), and the other goes to the booster amps that drive the receiver's mixers. Those amplifiers are LMH6703s on their evaluation boards, and they deliver +13 dBm. Power is ± 6 V from a pair of regulators located on the power splitter board. Prime power is ± 15 V for the amplifiers, and 5 V for everything else.



To get the SPI bus digital control signals into the RF section while rejecting some RF leakage, I used an RC filter. There was a thread on the DDS-VFO group called *Driving DDS with Feedthru Caps*, if you want to read all about it. Here's the deal: The IQPro has CMOS digital outputs, and we need the transitions to be relatively fast and clean, otherwise the DDS chip will not understand the bit stream. And the CPU swings 5 V while the DDS can only handle 3.3, so there is a voltage divider on each pin. By reducing the default resistor values from 5.6K and 3.3K to 560 and 330 ohms, we can supply enough current to drive perhaps 1 nF of bypass capacitance. That could be a feedthrough capacitor.

But there's an additional problem. Depending on how long the wires are and how they are routed, you can end up with crosstalk. Or, the resulting risetime may be marginal for your particular DDS chip. In my case, I found that it was impossible to get reliable operation with 1 nF feedthrus. By the way, the tolerance on many feedthrus is awful. My 1 nF units were more like 1.8 nF. So the solution I came up looks like this:



I chose 470 pF because it was as large as I could go with reliable operation. The resistor increases the source impedance looking into the RF box, which gives us a more favorable voltage divider at several MHz, thus enhancing the suppression of RF leakage. Meanwhile, the resistor doesn't slow the risetime much more because the input capacitance of the DDS chip is very low. Also, the resistor makes a nice insulated feedthrough terminal. I use 1/2 watt carbon in a tight-fitting hole. A dab of epoxy makes it permanent. Since the panel is rather heavy, I added #4-40 brass screws at each feedthrough location and used them as solder lugs for the bypasses.



Total power consumption is about 380 mA from 5 V with the backlight on. Current on the ± 15 V supplies is something like 60 mA. It works great. Thanks to Craig for a nifty kit. It's been a great ride.

There, a tidy package. I sure do like working in brass. Some day I'll post something about the whole receiver when it's done. Hint: It will *all* be brass.

73,
Gary