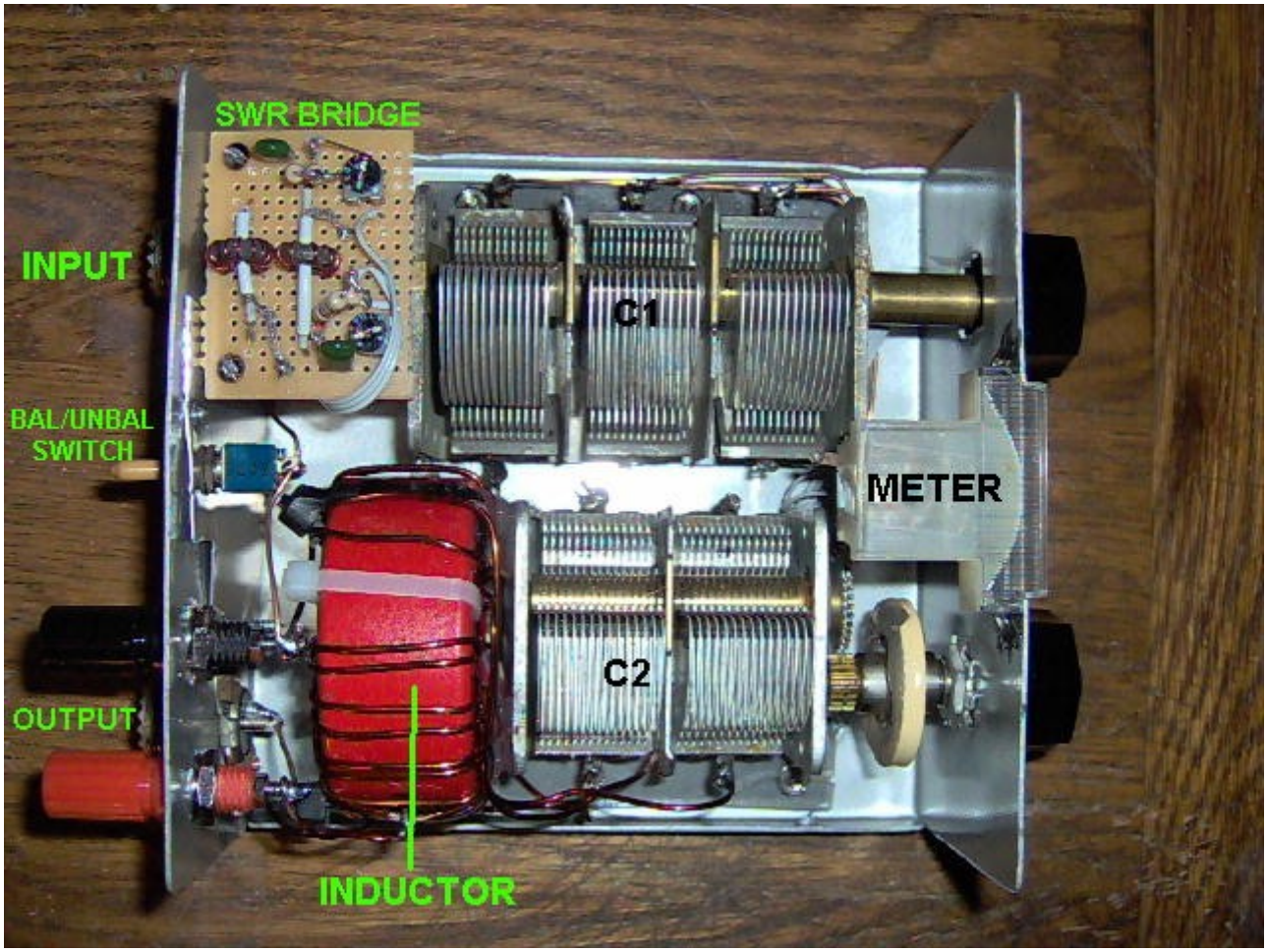
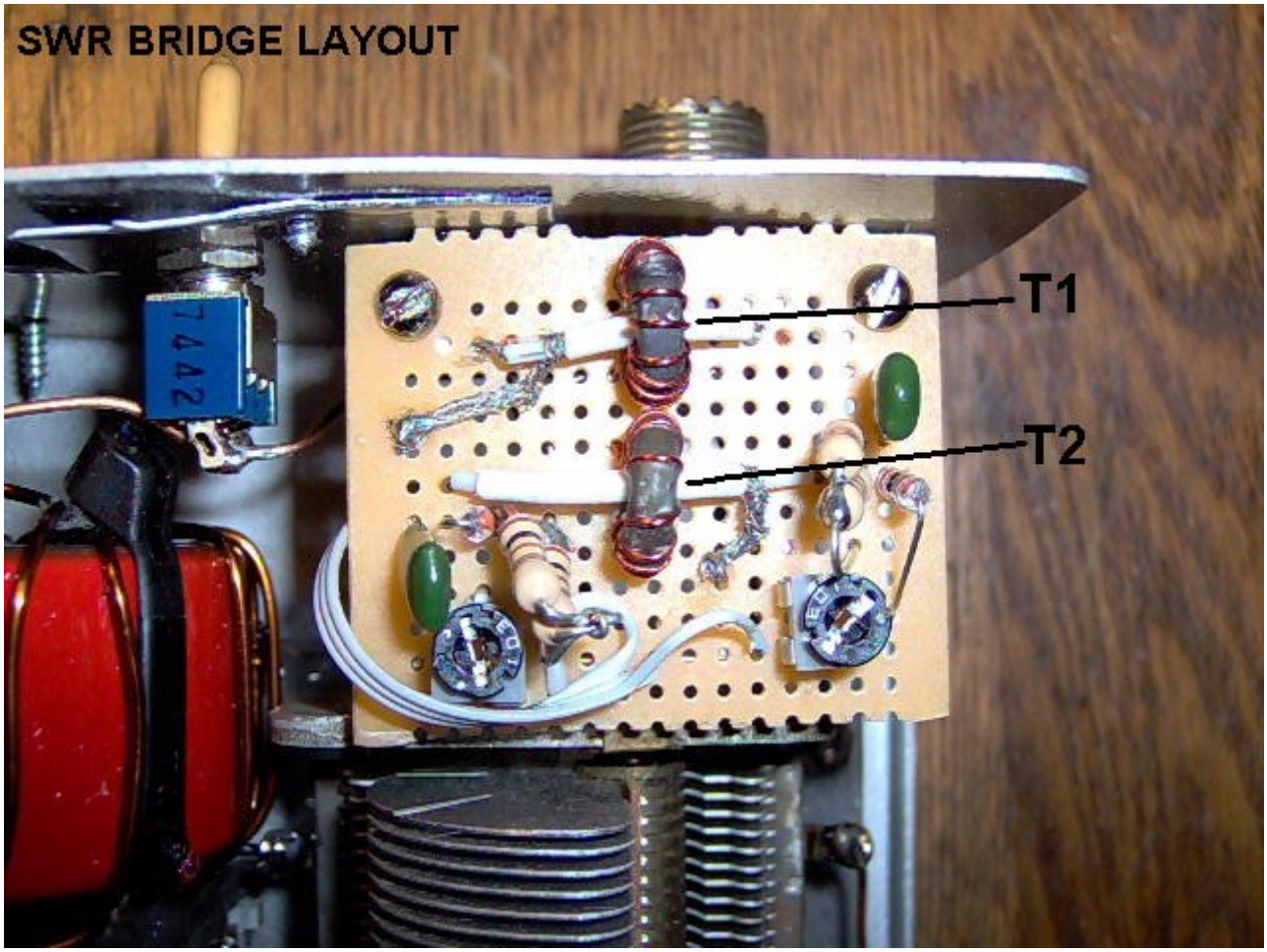
QRP TO 50 WATT Z-MATCH TUNER
A Z-MATCH TUNER FOR 10 THRU 80 METERS

THIS TUNER ONLY HAS 2 CONTROLS AND WILL TUNE ALMOST ANYTHING !

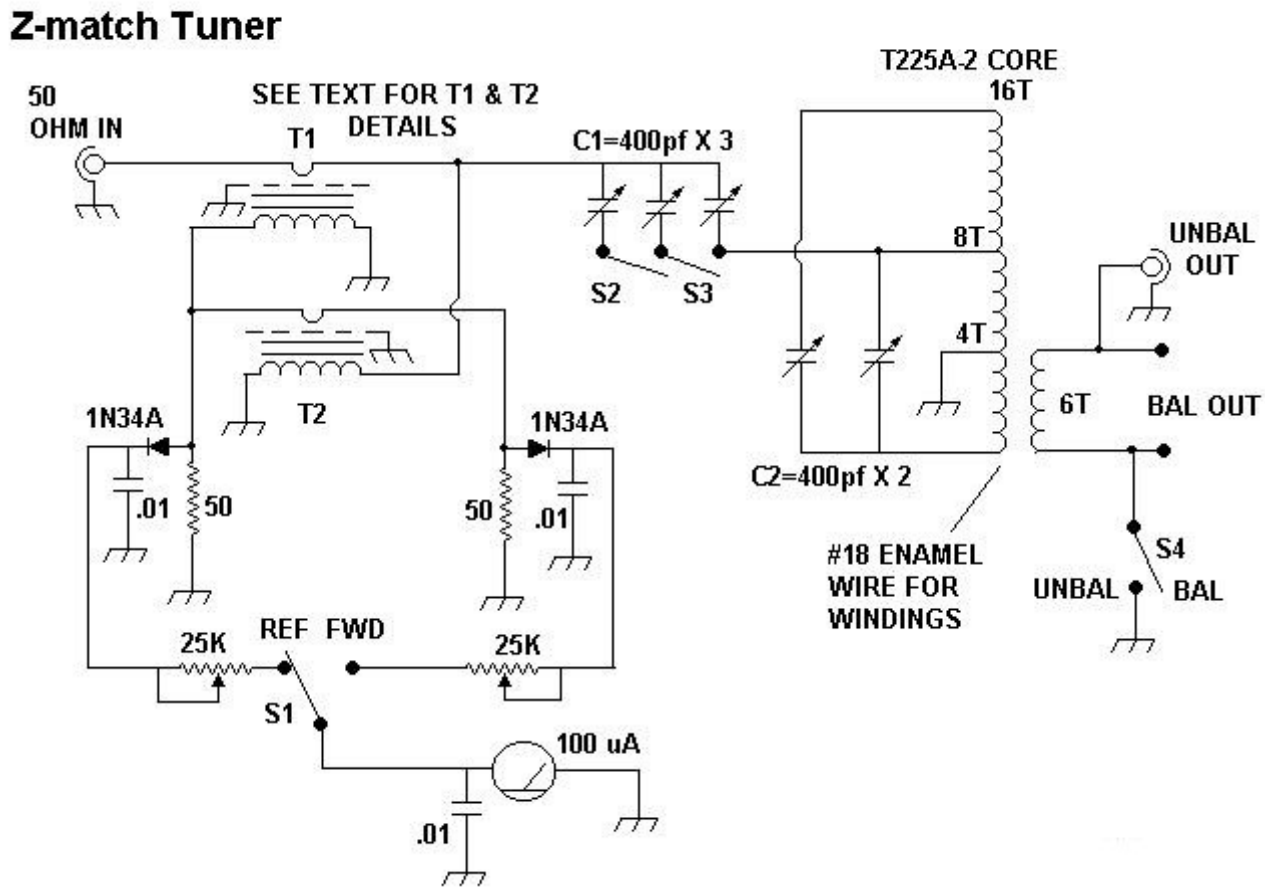
I really didn't need another antenna tuner, but I had the parts in my junkbox and figured I'd build a homebrew Z-match tuner just for something to do. The result was a tuner that will work 10 thru 80 meters and handle up to 100 watts of RF. I originally thought that the variable capacitors that I had would handle 100 watts, but then found out that they will arch over on 80 meters at the 100 watt level. So I backed the power down to 50 watts and it handled it just fine. 50 watts is plenty for my intended purpose though, as the most I plan on putting through it is around 15 watts from my old Yaesu FT-7. The Z-match tuner is designed to handle balanced loads such as a doublet fed with balanced feedline or a loop. Since it is a balanced tuner, it does not need the balun that so many commercial tuners require to feed balanced feedline. I also added a switch to the tuner that shorts one side of the balanced output link to ground, converting it to operate into an unbalanced load such as a coax fed dipole or endfed wire.



Here's the inside layout of the Z-match tuner. As you can see, it is a fairly compact tuner that measures 5" wide, 6" deep, and 3" tall. It's not a backpacker, but it is compact enough to take along on trips without taking up much room. The air variable capacitors I used are nothing more than a 2 gang 400PF per section, and a 3 gang 400pf per section variables from old receivers. These were aquired over the years from hamfest junkbox diving. In this picture, you can also see the SWR bridge. It is a Stockton type bridge that I built up on a small piece or Radio Shack perf board and I had to compress the circuit to get it to fit the available space. The inductor is wound on a huge T225A-2 core that I had, and the #18 enamel wire was salvaged from an old transformer. The front panel meter for the SWR bridge was salvaged from an old CB, and I made a new relative reading scale of 1 thru 5 on white peel and stick mailing label to make it easier to see. I may even add an LED and small battery for backlighting for the meter later, the meter has a space in the back for a small bulb in case I decide to do so.



Here you can see the layout of the SWR bridge. It looks pretty much like the schematic. and is really a simple circuit that is easy to build and calibrate. Most Stockton bridges use FT50-61 cores for the transformers, but I used FT37-61 cores to save space. Normal size Stockton bridges use RG58 coax through the cores too, but because I used the smaller cores, I had to use RG174 coax. I basically used smaller parts where I could to get them all to fit in the space I had. To calibrate the bridge, connect a 50 ohm dummy load to the output (do this before connecting the bridge to the input of the tuner) of the bridge. Then with the desired amount of RF applied, set the reflected pot on the board to make the meter read zero. Then set the meter switch to forward power, and set the forward pot to make the meter read full scale. I set mine with a maximum input of 15 watts. My meter has a hand written scale of 1 thru 5, but I'm not worried about accuracy, just using it for an indication of forward and reflected power. If you get the antenna to tune to zero or near zero reflected power, the swr will be low.



And finally, here is the schematic for the Z-match Tuner. For T1 & T2, I used FT37-61 cores and wound them with 12 turns of #24 enamel wire each for the secondary windings. The primary windings simply consist of a short piece of RG174 coax that passes through the center of the core one time, and the shield on them are only grounded at one end to form what is know as a Faraday screen to help eliminate harmonic currents that effect meter accuracy. The two 50 ohm resistors in the circuit are made by using two 100 ohm 1/2 watt resistors in parallel. The main inductor for the Zmatch is wound on a large T225A-2 powdered iron toroid. The main winding consists of 16 turns of #18 enamel wire with a tap at 4 turns and one at 8 turns. The output link consists of 6 turns of #18 enamel wire wound over the ground end of main windings. Notice that C1 & C2, the variable caps, are floated above ground. I did this by mounting both on a 1/8" piece of plexiglas and made some spacers out of the same plexiglas and glued these to the edges of the sheet that the caps are mounted on. Then I just put the assembly in the enclosure and then drilled through the plexiglas sheet and spacers and bolted it to the enclosure with some 4-40 hardware. I have even used 2 or 3 layers of thick double sided mounting tape to mount variable capacitors with when they need to be ungrounded, but since these were big and heavy, I wanted them to be solid. For the input connector and the unbalanced output jack, I used standard SO-239 connectors. For the balanced output connectors, I used ordinary banana type binding posts.

To use the Z match tuner, connect the radio to the 50 ohm input side, and the antenna to the output. A balanced antenna connects to the binding posts with mode switch "S4" in the balanced position, or an unbalanced antenna connected to the output SO-239 and the mode switch "S4" in the unbalance position. Turn the radio on and tune to the desired frequency, and with C1 at its midrange, tune C2 until you hear a peak in receive signal strength. Then with the meter switch "S1" in the reflected position, key the transmitter and while watching the meter, tune C1 for a dip in the meter. Then go back to C2 and tune it for a dip in the meter. You may need to go back and forth several times between C1 & C2 to get it tuned to the lowest possible swr (no reflected power). If you can't get a good match, try adding more capacitance on C1 by turning on S2 & S3 one at a time an then retuning until you get a good match. That's it, you're on the air ! And you don't need a balun to feed that balanced antenna with either !