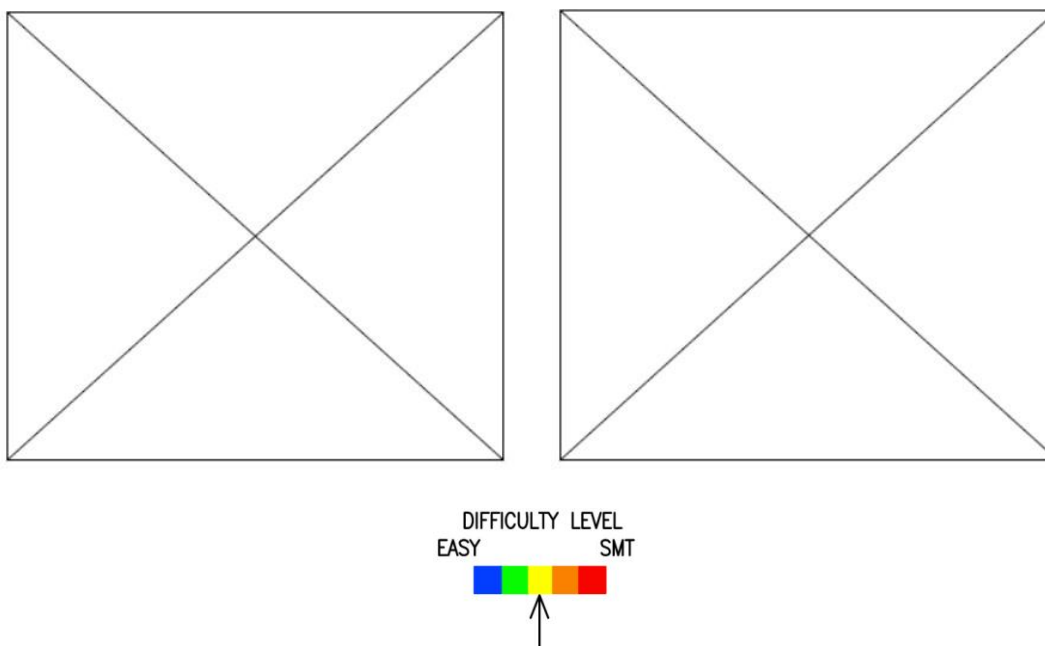




QRPBuilder Multi-Z Tuner Assembly Manual

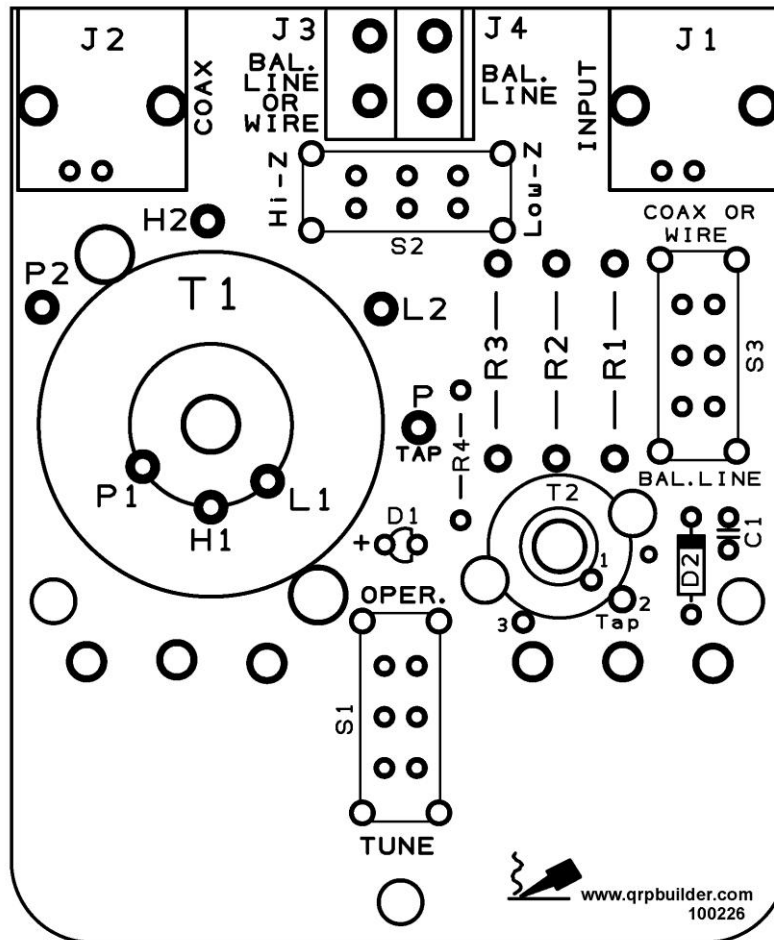


First, familiarize yourself with the parts and check for all the components. If a part is missing, please contact us and we will send one. To request a part, please use grpbuilder@gmail.com.

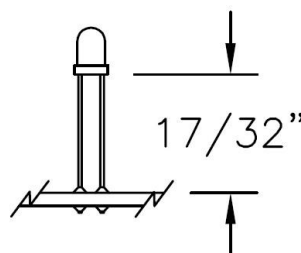
Parts List

- 1 – Multi-Tuner base PCB
- 1 – Multi-Tuner top PCB
- 1 – S1 - Slide switch - DPDT, w/longer operating lever
- 2 – S2, S3 - Slide switch – DPDT, w/shorter operating lever
- 1 – C1 - .1uF mono capacitor, marked 104
- 2 – C2, C3 - Polyvaricon, w/shaft and hardware
- 1 – D1 - Red LED w/clear lens
- 1 – D2 - 1N4148 signal diode, sm. glass, w/black band on one end
- 3 – R1, R2, R3 - 51 ohm 2W power resistor (green-brown-black-gold)
- 1 – R4 - 470 ohm resistor (yellow-violet-brown-gold)
- 1 – L1, FT37-43 toroid core (black)
- 1 – T1, T106-2 toroid core (red)
- 1 – 24" of 26AWG magnet wire
- 1 – 6' of 22AWG magnet wire
- 2 – ø20mm control knob
- 2 - BNC PCB horizontal connector
- 1 – 2 position, pushbutton terminal block
- 3 – M3 x 15mm hex standoff
- 6 - M3x8mm long. S.S. Phillips screw
- 4 – Round self-adhesive rubber foot
- 4 – 1/8" plastic cable ties

Refer to the graphic below and the silk screening for the placement of the components.

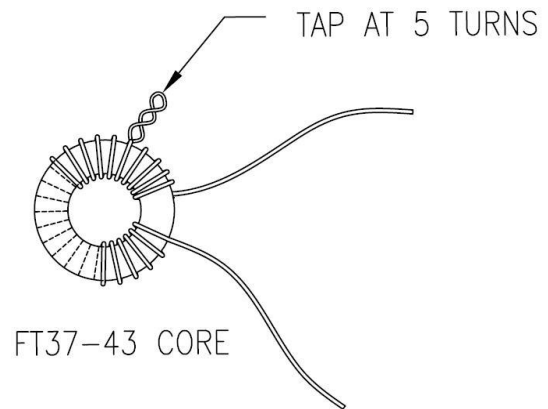
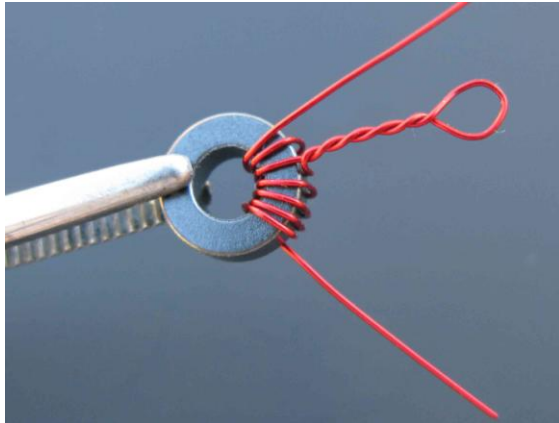


- [] Install C1, .1uF mono capacitor, marked 104.
- [] Install D2, 1N4148 signal diode, observing the black polarity band (cathode) matching the Silkscreen band.
- [] Install R4, 470 ohm resistor (yellow-violet-brown-gold)
- [] Install R1 – R3, 51 ohm, 2W, power resistors (green-brown-black-gold), or value is printed on the component.
- [] Install the clear lens LED to the dimension shown below from the top of the board to the bottom of the led. The long lead is positive and must be installed with the correct polarity.



- [] For T2, use the FT37-43 (black) core and the 24" of the thinner supplied magnet wire. You are winding a total of **25** turns, with a tap at **5** turns from the beginning of winding. Remember, every time the wire goes through the center of the core, it counts as one turn. The picture and figure below shows the beginning of winding and the twisted technique for the tap. The total of 25 turns will completely fill the toroid. Don't wind it loose, a #4 screw must go through the center for securing.

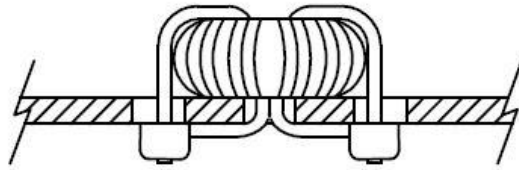
Note: Now is a good time to mention a good way for counting the turns on small toroids. Many times on toroids with a lot of turns, you lose track going around. A good trick is to take a digital picture of it and blow it up on your computer screen. Counting is clearly a lot easier. Never cut until you verify the turn count. Too many turns is easy to fix, too few leaves only one option..



- [] Bend the leads as shown below, trim to 1/2" long, and tin the leads prior to soldering them to the backside of the board. The magnet wire supplied is Thermaleze® brand and will tin easily with a soldering iron. Always tin the leads before trying to solder them in place and you will greatly eliminate any continuity problems. When installing do not pull the wires past where you have tinned them.



- [] Solder L1 where indicated on the PCB, and centered on the silkscreen. You will notice the tap hole is indicated, and is slightly larger in diameter to accept the double twisted wire. Install the toroid flush with the top of the board. **Do not elevate it off the board.** You will be securing it with two tyrapas as shown below.

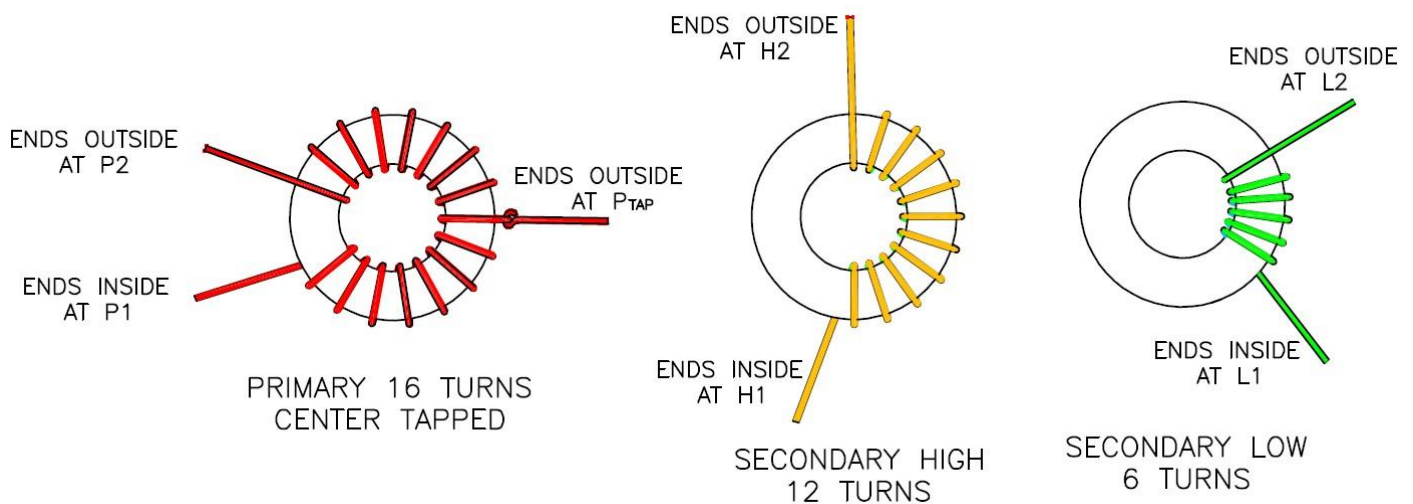


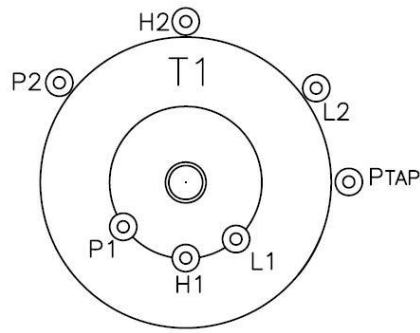
- [] Install the two BNC connectors flush with the top of the board, and solder the two locating pins and two electrical connections.
- [] Install S1, DPDT switch with the **long** operating lever.
- [] Install S2,3, DPDT switches with the shorter operating lever where indicated, soldering all four corners and the electrical pins.

T1 assembly

The next item to make and install is T1. This T106-2 toroid has a 16 turn center tapped primary, a 12 turn secondary, and another 6 turn secondary. We have supplied a 6 foot length of 20awg magnet wire for this purpose. Proper winding of the transformer will result in the three different windings ending up at the correct positions on the PCB. The two secondary windings are on top of the primary winding. The graphic below shows the separate windings and how they are positioned on the T160-2 toroid. Please study the following figures and understand the process before you try winding the transformer.

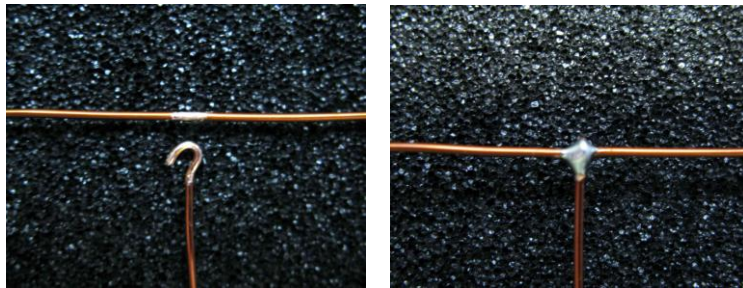
If a winding does not end up as shown below or is not wound in the same direction as shown below, the tuner will not work properly. Note that the ends of the windings must be over or under the core as shown below.



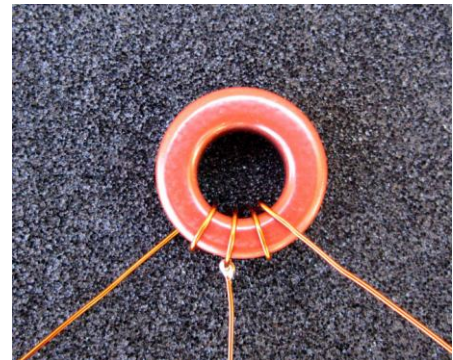
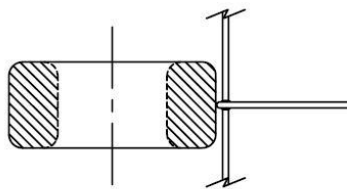
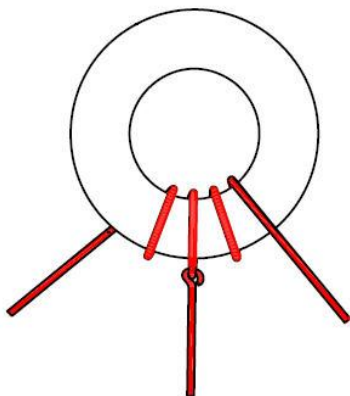


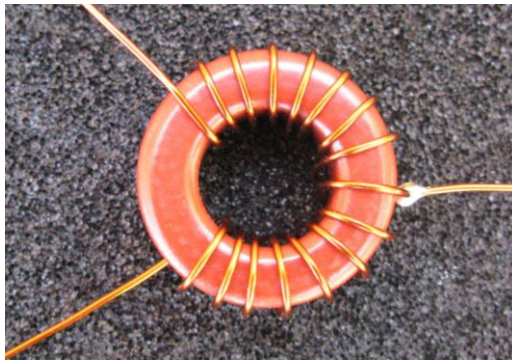
The seven pad positions for T1

- [] Prepare the primary wire as shown in the figure below. Cut 30" of the supplied **RED** 22awg wire and a 2" piece. Strip the insulation off of the 2" piece for 1/4" and make a small loop that will attach to the center of the 30" long section. On the 30" piece measure to the center (15") and strip off the enamel insulation for 1/8" inch and solder the loop to the center. See photos below.



- [] Start winding by positioning the tap halfway up the outside of the core and pass the right side winding **up** thru the center of the core and the left side winding **down** thru the center of the core. Wind a couple of turns in each direction and compare it to the graphic and picture below. All three windings will be done with this method. If it doesn't look like this, stop and correct it. Wind a total of 16 turns, eight in each direction. Every time the wire passes through the core, counts as one turn





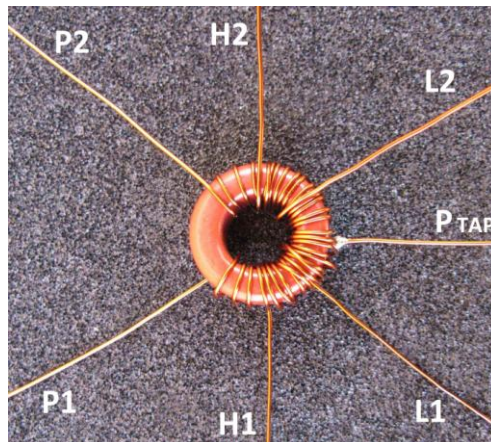
Completed primary winding, 16 turns

- [] Cut a **BLOND** color piece of the 22awg wire 22" long, mark the center at 11" with a marker and start with the center of the wire along one side of the tap, on the outside, and wind 6 turns in each direction. Wind the right side **up** thru the center and the left side **down** thru the center of the core. Space your winding out so that the end up 180° apart centered on the primary tap as shown below.



12 turn secondary added

- [] Cut a **GREEN** color piece of the 22awg wire 13" long, mark the center at 6.5" with a marker and Start with the center of the wire along one side of the tap, on the outside, and wind 3 turns in Each direction for a total of 6 turns. Wind the right side **up** thru the center and the left side **down** thru the center of the core. Space your winding out so that the end up 60° apart centered on the primary tap as shown below.



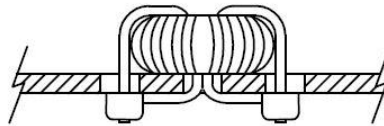
Completed with 6 turn secondary

In the picture above, all the leads (P2, H2, L2) above the center tap should exit the core over the top of the toroid and all the leads (P1, H1, L1) below the center tap should exit under the toroid. When all these leads are bent down, they will line up with the lettered pads on the PCB. P1, P2, and Ptap will be the red wire. H1 and H2 will be the blond wire. L1 and L2 will be the green wire.

- [] When you are satisfied you have followed these instructions you may bend the leads down, strip the enamel, and tin the leads. **P1, H1, and L1** pass through the PCB on the inner diameter of the toroid. **P2, H2, L3, and Ptap** pass through the PCB on the outer diameter of the toroid.

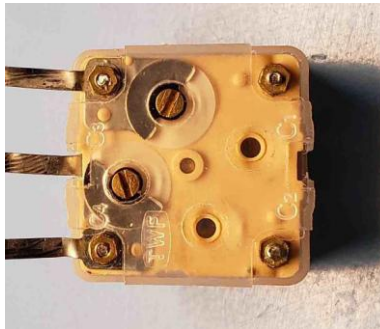
Note: Before soldering, if you lose absolute confidence in the name of the leads, verify their identity with an ohmmeter before proceeding.

- [] Solder the toroid flush with the top of the board, and trim the leads.
- [] Secure toroid to the the pcb two tyrapas as shown below.



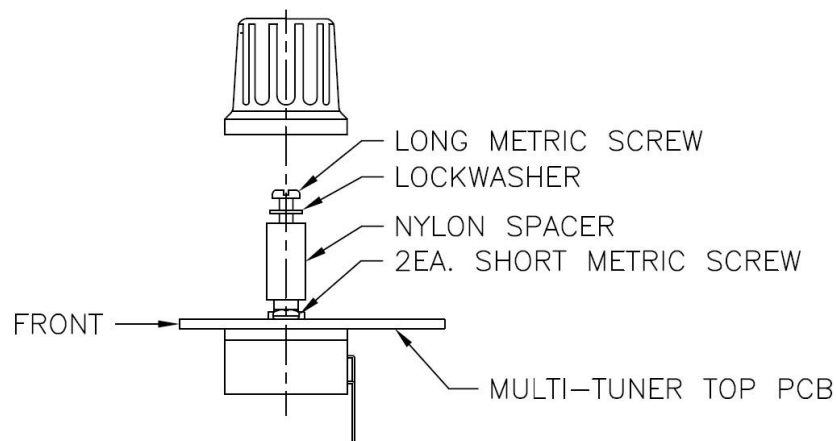
Polyvaricon installation

- [] Adjust the two trimmer caps on the back of each polyvaricon to their *minimum* value as shown below.

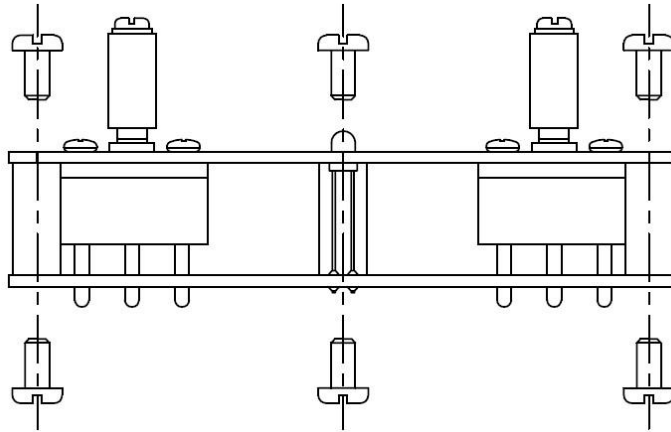


Set for minimum engagement

- [] Install the two polyvaricon capacitors to the Multi-Tuner top pcb using the hard shown below. The leads of the polyvaricon will install to the rear of the pcb.



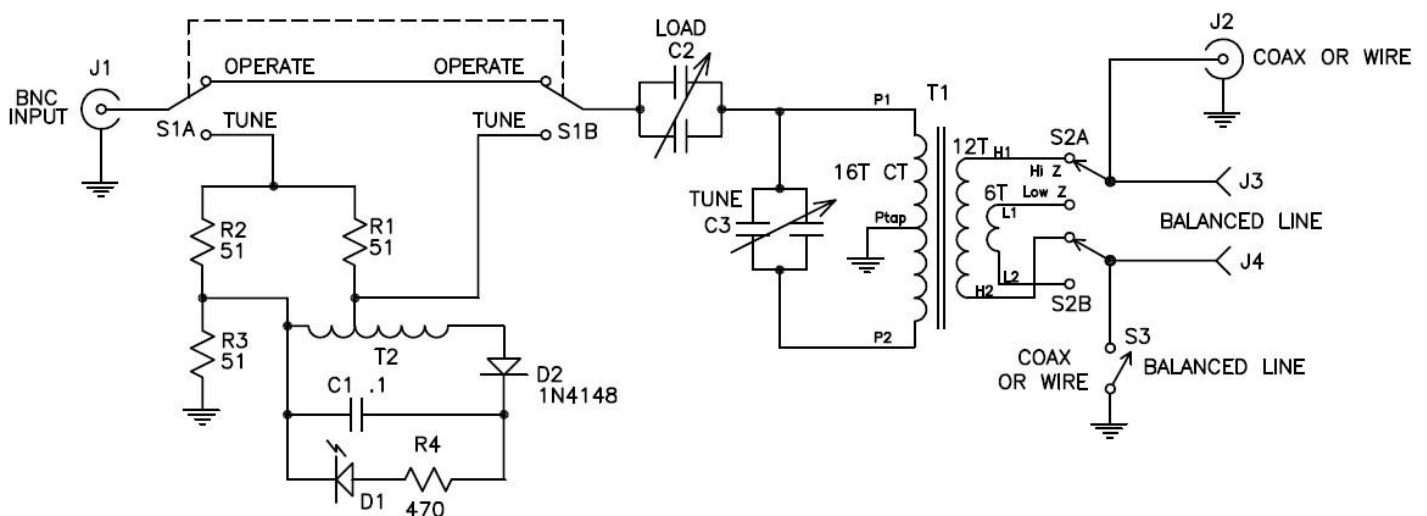
- [] Refer to the graphic below and install the three M3x15mm long plastic standoffs to the base pcb using three of the M3x8mm screws,
- [] Install the top board/polyvaricon assembly onto the three standoffs. Route the polyvaricon leads through the base board, and align the led to protrude through the top board. Secure with the three remaining M3x8mm screws.



- [] Solder the six polyvaricon leads and trim flush with the bottom of the base pcb.
- [] Install the instrument knobs.
- [] Apply the self adhesive rubber feet to the bottom of the tuner at the four places indicated by the silk screened circles on the bottom.

This completes the assembly.

Schematic:



Tuner usage

The tuner is rated at 5W CW, 10 watts PEP max. and incorporates the N7VE LED absorption bridge circuit for sensing SWR. In the TUNE position, you cannot damage your transmitter caused by a high SWR. The worst your transmitter is looking at is a maximum of 2:1 SWR in the TUNE position. The LED is only showing reflected power. At full brilliance your SWR is 4:1 or greater, at half brilliance your SWR is approximately 2:1, and the LED will completely extinguish at 1:1. *Tip from Dan...If your led does not completely go out at 1:1 there may be a little too much gain on L1, the indicator transformer. Just reduce the turns on the side of the tap with the most turns, one or two turns.*

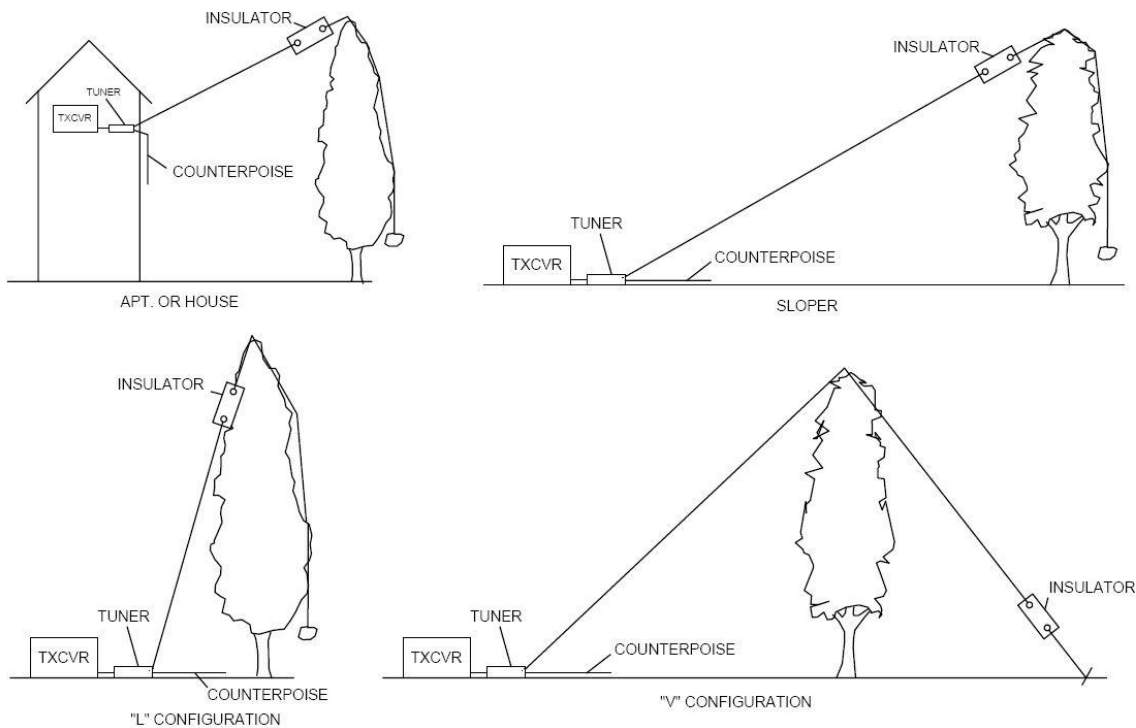
Adjusting for a wire antenna match

With your transmitter and antenna connected to the tuner, set the tune/operate to the tune position. Set the adjustment knobs to the center position. Note: Tune mode, maximum continuous power Input – 5W.

Place the HI/Low impedance switch in the Hi position. The Hi impedance setting provides the most efficient coupling and operation. Briefly key your transmitter and attempt to adjust the knobs to dim the LED. Continue adjusting back and forth until the LED is out or is as dim as possible. If the adjustments do not produce adequate dimming of the LED switch to the Low impedance position and repeat the adjustment process. Note: Under some conditions of match adjustment the LED will not go completely out. Your antenna will be tuned for proper operation even if the LED does not dim completely out. Switch the tune/operate switch to the operate position.

Use all the normal cautions throwing wires up in the air near power lines.

If you use a counterpoise wire, connect it to J4 (ground), with S2 in the “WIRE” position and lay it out in a straight line, 180° from the antenna wire when possible. Any length that is non-resonant to your frequency is best. I use 10ft. or 20ft.



Additionally, after the antenna is tuned up, keeping the bridge in the circuit (Tune position) will reduce the power by a factor of four to a matched antenna. This can occasionally be useful when trying to bring a 3w QRP transmitter to under the 1w level for certain sub-one watt contest multipliers.

[illegible]