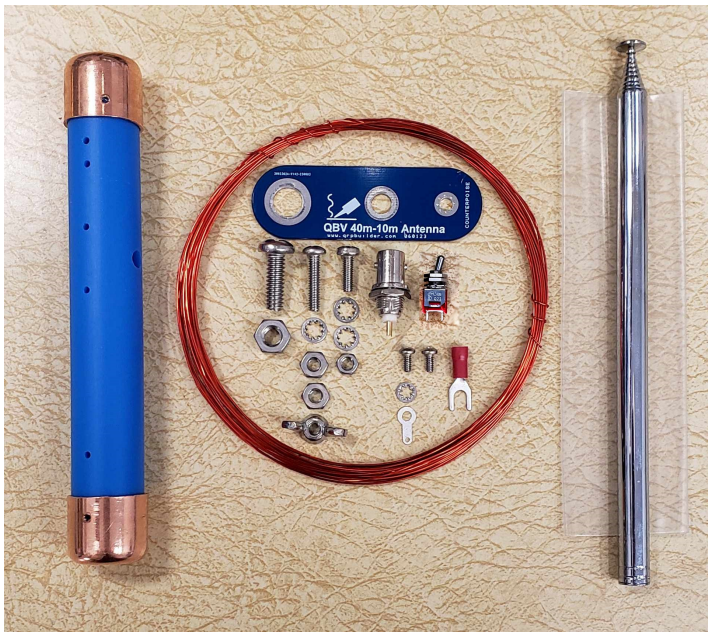
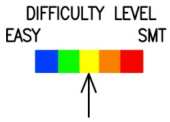
QRPBuilder QBV 40m/20m-10m Portable Antenna Kit





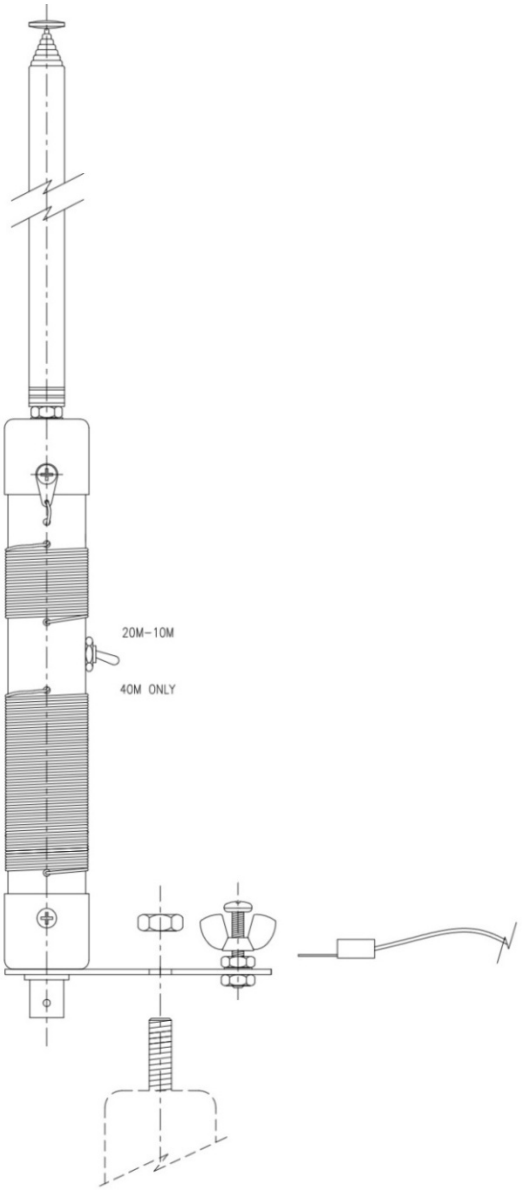
First, familiarize yourself with the parts and check for all the components. If a part is missing, please contact us and we will send one. Email grpbuilder@gmail.com to request a part, or for any questions.

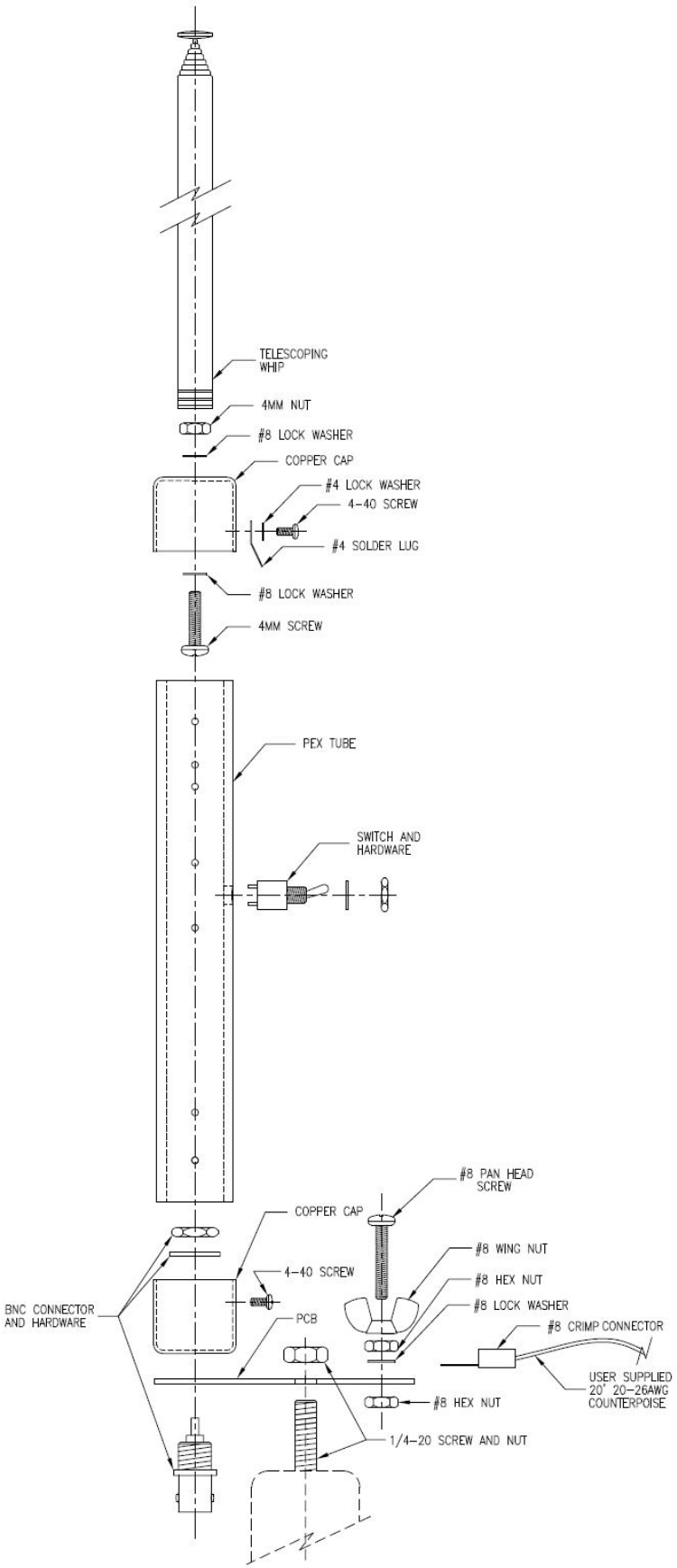
Parts List

1 – QBV 40m/20m-10m Antenna PCB
1 – PEX tubing, drilled and tapped with copper end caps
1 – Telescoping antenna whip
1 – BNC female bulkhead connector
1 – SPST toggle switch
2 – 4-40 x 1/4” SS pan head screw
1 - #4 internal tooth lock washer
1 - #4 solder lug
1 – M4 x 12mm SS pan head screw, (do not confuse with the longer 8-32 screw)
1 – M4 SS nut, (do not confuse with 8-32 nut)
1 – 8-32 x 3/4” SS pan head screw, (do not confuse with the shorter M4 screw)
2 – 8-32 SS nut, (do not confuse with M4 nut)
3 - #8 internal tooth SS lock washer
1 – 8-32 SS wing nut
1 - #8 spade crimp connector
1 –1” dia. x 5 1/2” long clear heat shrink tubing
1 – 22awg magnet wire
1 – 1/4-20 x 3/4” SS pan head screw
1 - 1/4-20 SS nut

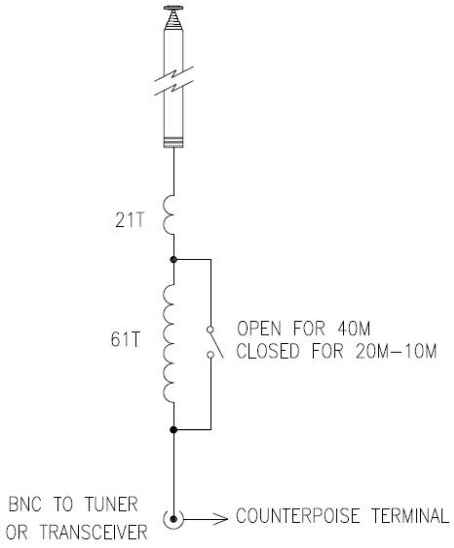
The tools required are: Phillips screwdriver, forceps, or small needle nosed pliers, wire cutters, soldering iron, some rosin core solder. The instructions below will insure a successful outcome. Please read them all carefully before proceeding. Open the parts bag carefully; small parts are difficult to find in the carpet.

The graphic below shows the scope of this project.





It is important that the coil be wound and switch wired as described or the antenna will not work as designed. Read and follow the instructions carefully. The design of the antenna is such that it is resonant on 20m with only the short coil in the circuit and resonant on 40m when both coils are in series. For 20m, the switch shorts out the larger coil. Opening the switch puts the 21 turn and the 61 turn coil in series for 40m operation. Frequencies 17m to 10m use only the 21 turn coil and require a tuner.

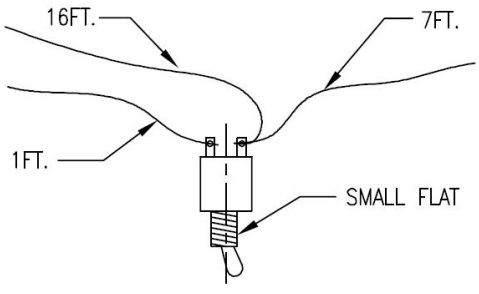


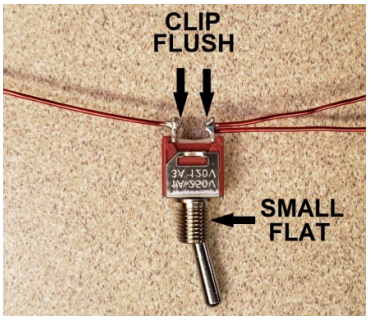
Assembly:

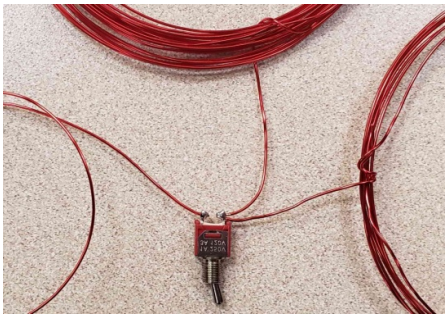
[ ] The tube and caps are all pre-drilled and tapped for assembly. The tube is marked with a “W” on the whip end of the tube. If the “W” gets worn off during the assembly, it is the end of the tube with the two holes close together. The copper cap on the “Whip End” has a small hole in the center, and the copper cap on the “Base End” has the larger hole for the BNC connector. Set aside the two copper caps for later assembly. Clean out the tube if there are any chips remaining from the drilling and tapping.

[ ] Be careful measuring and cutting the magnet wire. There is no extra for errors. Cut the 16ft. wire first, 7ft. wire second, and finally the 1ft. length. Strip (~3/16”) of the enamel off ends of the wires. The magnet wire is Thermalize, so you can use a hot soldering iron to remove the enamel, or scrape it with a craft knife. Remove both nuts and lock washer from the switch. Solder the lengths to the terminals exactly as shown in the graphic. Use care soldering the toggle switch. It can be damaged be excessive heat. Trim the excess close to the switch terminals. Take care that a stripped portion of any of the wires cannot short out to the other side of the SPST switch.

When soldering the wires, note and follow the location of the small flat on the mounting shaft of the switch.

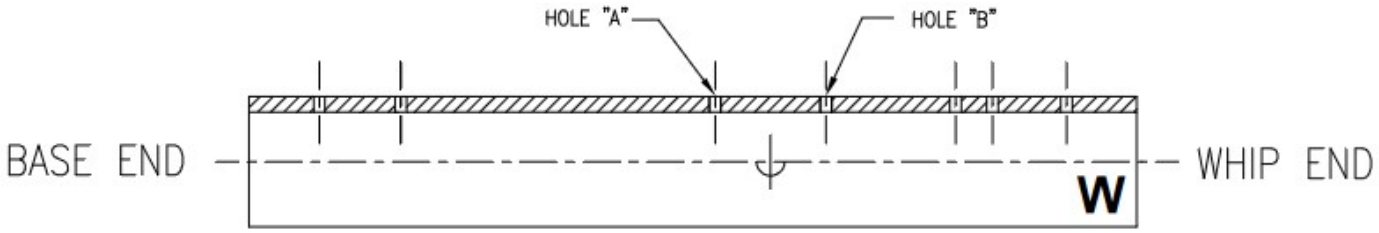




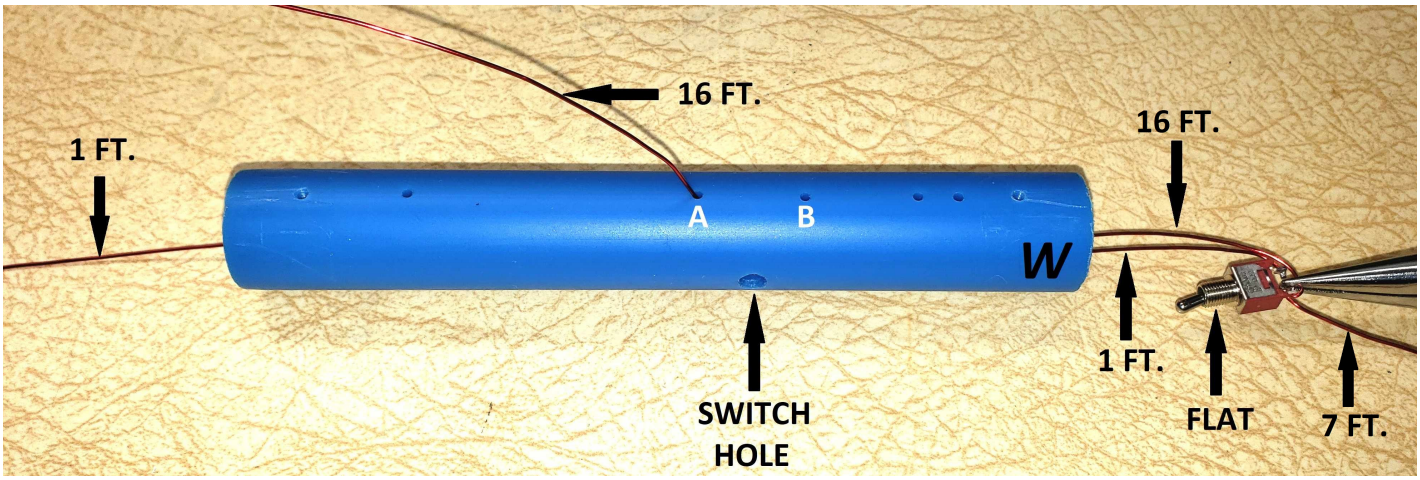


The switch lever must be in this position. Check with your VOM that the two pins are in the switch “closed” condition when the wires are connected to the switch terminals as shown, and that the flat on the mounting diameter is on the side indicated.

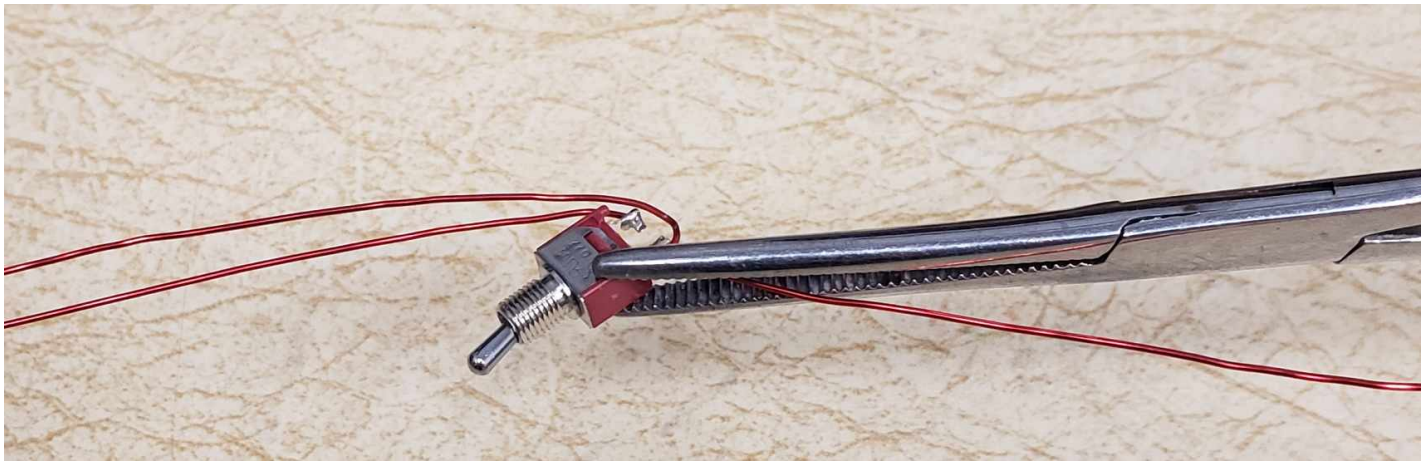
[ ] Insert the 1ft. and 16 ft. wires into the open “Whip End” of the tube. Route the 1ft. wire straight through the tube and exit out the base end. Route the end of the 16ft. wire from the inside, out at hole “A”. Use you forceps or needle nose pliers.



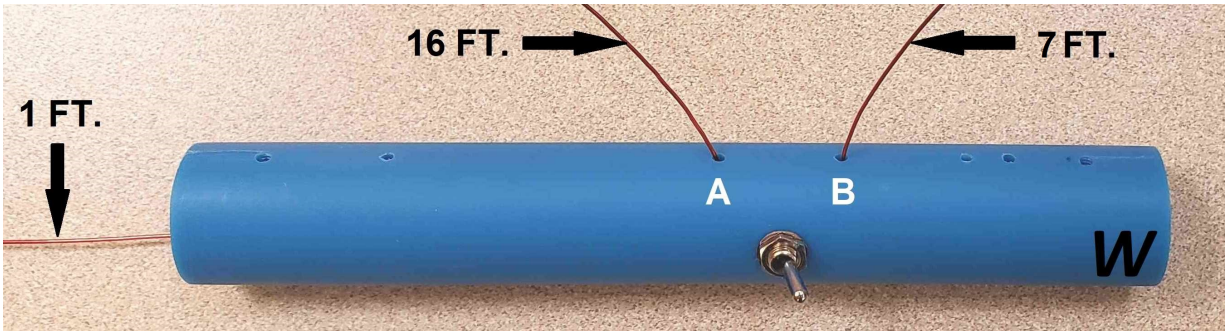
[ ] Bend all three wires as shown below and slide the switch into the “Whip End”, with your forceps, or small needle nose pliers, positioning the switch lever at a downward angle so that the switch lever enters the switch hole. Work the switch in the end of the tube to the switch hole, while gently pulling on the 1ft. and 16ft. wires. Look in the end of the tube to see that the wires are not tangled or kinked, and then secure it with the lock washer and single nut. You may need to put a screwdriver or forceps, inside, to hold the switch from turning while securing the nut. You want the switch to operate vertically with the *flat towards the whip end*.



You might use a small flashlight to shine in the correct hole, to help locate where to route the wire.



[ ] After the nut is secured, route the loose 7ft. wire to the inside the “Whip End” of the tube and out at the hole marked “B. Use you forceps or needle nose pliers. Look in the end of the tube and check that the wires do not have any loops or kinks.



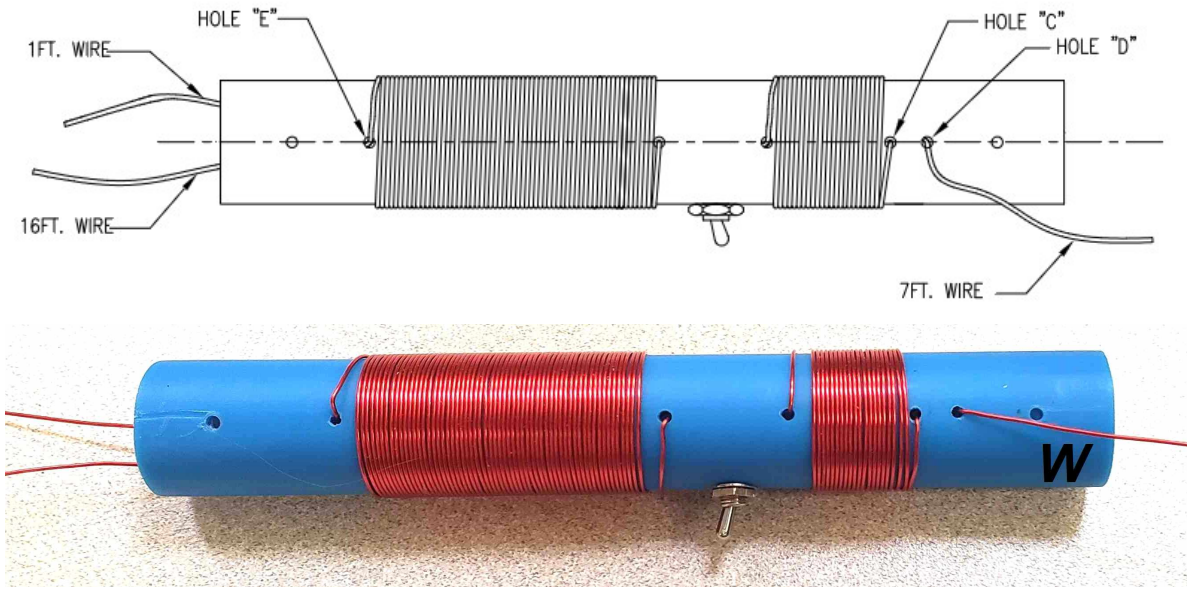
As a switch and wire orientation check, strip the loose ends of the 16ft. and 1ft. wires and test that there is continuity between them when the switch lever is towards the “Whip End”, and no continuity when the switch lever is towards the “Base End”

[ ] Straighten out any kinks or bends you may have in the three loose 22awg wires. We’ll wind the longer coil first to get it out of the way. Wind the 61 turns with the 16ft. wire, close wound, and enter hole ”E” to the inside, and back out at the end “Base End” of the tube.

*****Note that both windings are wound in the same direction.*****

They can be wound in either direction as long as both are the same.

[ ] Now wind the 21 turns with the 7ft. wire, close wound, and enter the tube at hole “C” and out at hole “D”.

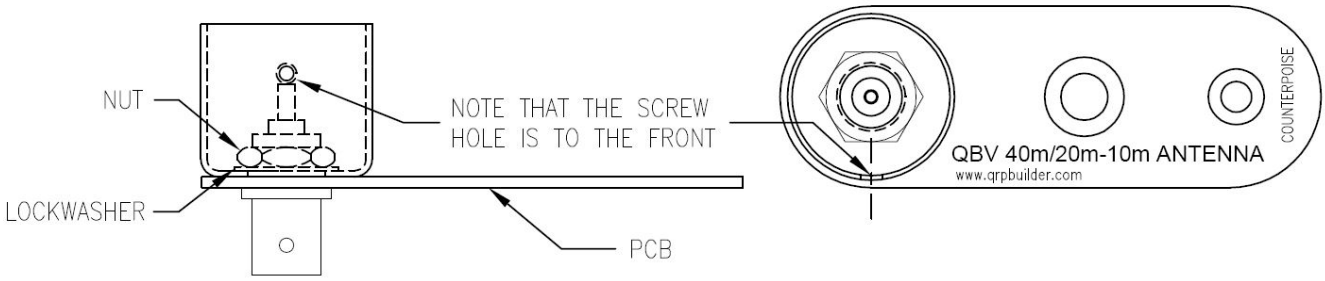


It should now look like this…

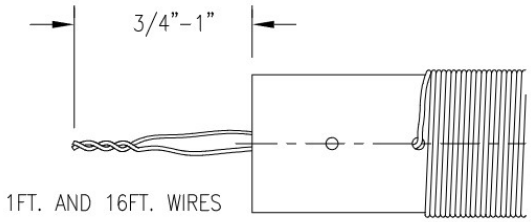
Note: ***Double check your turn count before trimming any wires.***

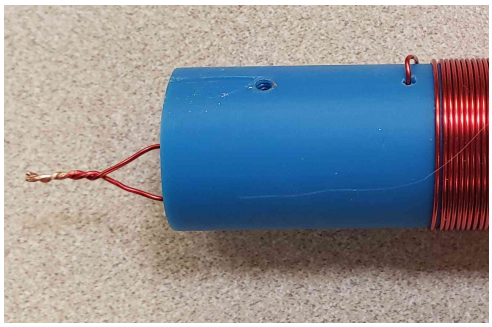
When counting coil turns, it is easy to make a mistake. I find it helpful to take a sharp, close-up picture, and print it. It’s a lot easier to count.

[ ] Prepare the base copper cap by installing the female BNC bulkhead fitting and pcb as shown below with the copper cap screw hole to the front. Use your needle nose pliers or a 1/2” socket if available to tighten the hex and with lock washer securely. *Do not use the solder lug if on the bnc connector.*



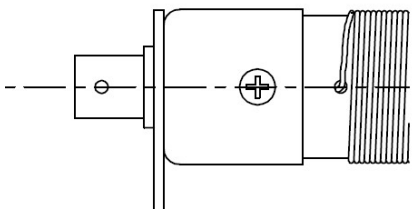
[ ] Trim both the 1ft. and 16ft. wire to 3/4”-1” from the end of the “Base End” of the tube. Scrape 1/4” of the enamel off both wires, twist together, and solder the wires together.



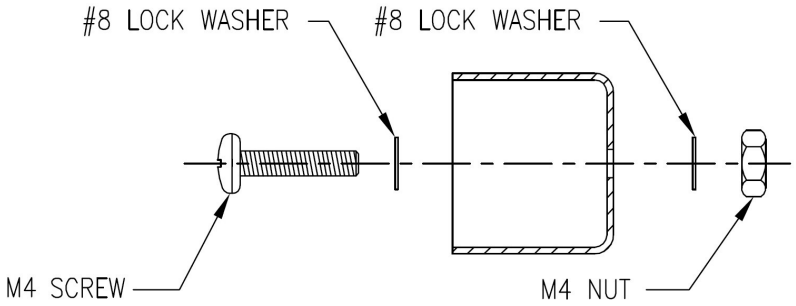


[ ] Solder the twisted pair to the center pin of the BNC connector.

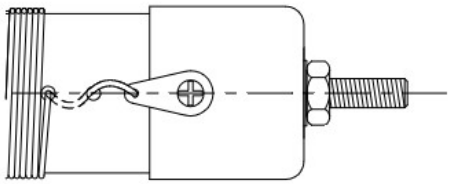
[ ] After soldering, fit the PEX tube into the copper cap so that the 4-40 threaded hole lines up and install the 4-40 pan head screw. *Do not over tighten or you will strip the threads in the thin walled copper cap.*

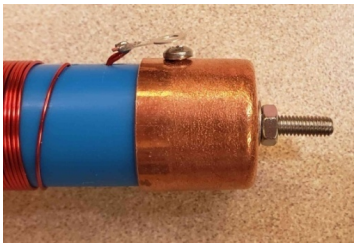


[ ] Prepare the whip copper end cap by installing the M4 x 12mm SS screw, two #8 SS lock washers, and secure the M4 SS nut tightly as shown in the graphic below.

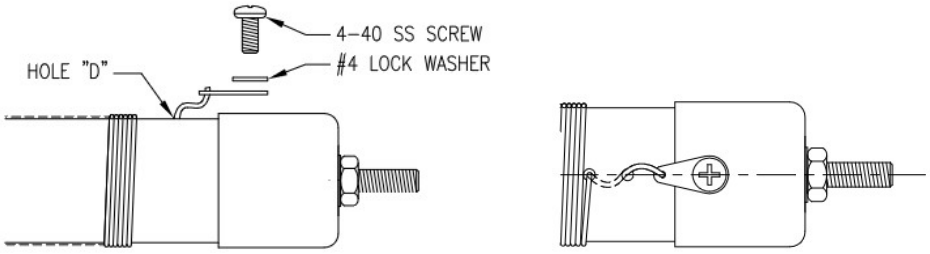


[ ] Install the whip end copper cap onto the PEX tube, align and install the 4-40 pan head screw temporarily. *Do not install the #4 solder lug yet.*

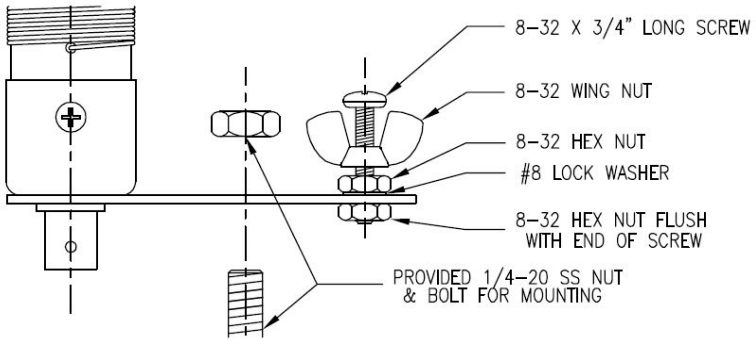




[ ] Use the screw head as a guide. Position, trim, tin and solder the 7ft. magnet wire from hole "D" to the #4 solder lug when loose. Remove the 4-40 screw and secure the #4 solder lug using the #4 internal tooth lock washer and 4-40 pan head screw. *Do not over tighten or you will strip the threads in the thin walled copper cap. If you try to solder the lug screwed to the copper cap, you will sink the heat away, resulting in a bad solder joint.*



[ ] Assemble the counterpoise hardware as shown in the sequence below, and the wing nut will never be lost. The remaining 1/4-20 nut is for securing the antenna to a user supplied 1/4-20 stud or using the supplied 1/4-20 screw, via the center hole in the board. The #8 spade crimp connector is for securing a user supplied ~20ft. counterpoise under the 8-32 SS wing nut.



Test the antenna *outdoors* before installing the heat shrink tubing, as testing indoors will skew any results due to interaction of house wiring etc. Try to test using the mounting technique you feel you will use in the field. To check the operation of the antenna, mount it on a tripod or a temporary bracket, *install the counterpoise*, and extend the whip close to the dimensions noted below, depending on frequency. It should be resonant on 20m with the switch in the up position, and resonant on 40m with the switch in the down position. Some whip length adjustments are necessary to accommodate any variables in construction or environment. **Remember, 17m-10m require a tuner.** *If you are not getting a good swr reading you may have feedline radiation on your test coax. Look at the note at the beginning of page 10.*

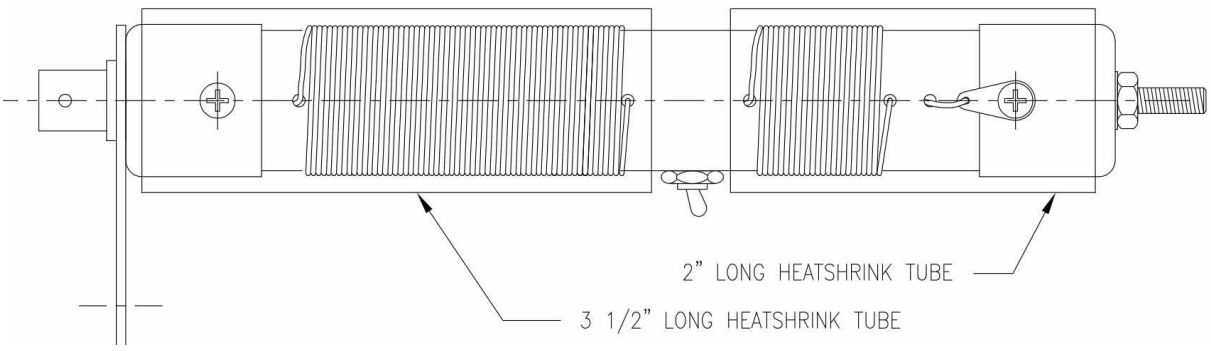
The table below shows how to use the length of the whip to fine tune for your conditions and construction variations. In this particular situation, I used a 30 ft. feed line of RG-174 with a clamp on ferrite to eliminate any feedline radiation (four turns through a mix 31 ferrite), a 20 ft. counterpoise, and no tuner, making small adjustments to the whip (~1/2" increments). It was mounted outdoors about two feet off the ground. The whip length is measured from the top of the whip end copper cap to the tip of the whip end.

These results were measured with my NanoVNA. Your results may have whip lengths different due to construction and environment variables:

Sw. Pos.	Freq.		Whip Length	VSWR
DOWN	40m	7.060 MHz	46 1/8"	1.03
DOWN		7.200 MHz	43 1/2"	1.02
UP	20m	14.060 MHz	46 1/2"	1.01
UP		14.300 MHz	44 3/8"	1.01

[ ] The final step after a successful test is to cut two pieces of the Ø1" heat shrink tubing, 2" and 3 1/4" long and install as shown below. This will help protect and stabilize the windings. **Install and shrink the 3 1/4" piece first.** Remove the switch nut and lock washer to let the switch retract into the tubing slightly to allow the heat shrink pass over the switch lever, and re-attach after heat shrinking. It's a little snug, but it will go. Re-attach the nut and lock washer to the switch. Make sure the switch operates vertically and the flat is still towards the whip end. Then, shrink the 2" piece.

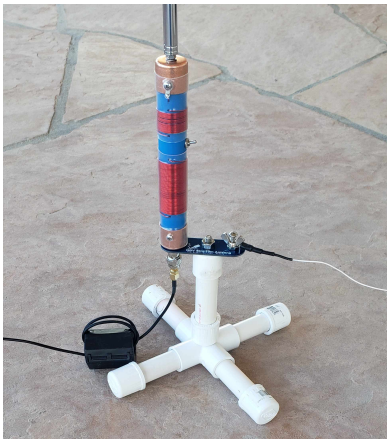
Tip from a user: *If you have trouble sliding the clear tubing, the shrink tubing has a lot of friction on the inside, just put a daub of vegetable oil on the inside of the tube with your finger and it will slide easier. It only takes a thin film only.*



This completes the assembly.

Setup and usage:

Be sure to use a counterpoise wire. Best to use is 20 feet of 20-24awg stranded wire. Shown below are some of the ways you can easily set up the antenna. The antenna is light enough for just about any mounting technique. The simplest, least expensive is just a piece of 1/4-20 threaded rod pushed into the ground, or just about any bracket or clamp with a 1/4" hole will work. Any hard surface can be accommodated with a few pvc fittings, as shown on the right.



Another option is a Husky Portable Light Tripod part# 1001 863 391 from Home Depot. Make an adapter with a 4" long piece of 1/2" PVC pipe with a cap and 1/4-20 screw in the end. The adapter will just go into the tripod tube and rest on the cap. Attach the QBV antenna mount with the 1/4-20 nut we supply.

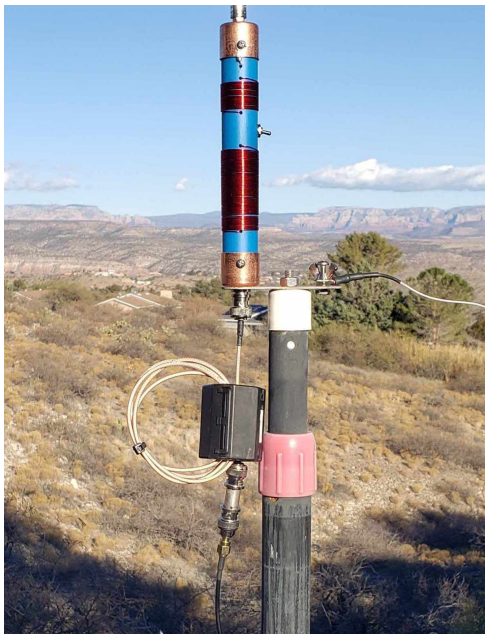
Also, you can usually find a lightweight camera tripod at garage sales. Most come with a 1/4-20 threaded screw for attaching to a camera bottom. Our board will easily mount using the supplied 1/4-20 SS nut.

Remember, with the switch lever in the down position, both coils are in play and the antenna is resonant only on 40m. With the switch lever in the up position, the 61 turn inductor is out of the circuit and the antenna is resonant only on 20m. Also, with the switch in the up position, 17-10 meters require a tuner.

Note: One point I would like to emphasize, even at QRP levels, anytime you are getting strange SWR readings, make sure you aren't getting feedline radiation. It can interfere greatly with resonance, SWR readings, and performance. A clamp-on ferrite, like shown below, right at the antenna to coax connection usually solves this problem. I use RG174 with a few turns through a good sized clamp-on ferrite, mix 31, right at the antenna feedline just for this purpose on all my small portable antennas. In my experience the Amidon #2X316451P2 works well. Mouser suitable part# 623-0431164181, 623-0431176451 should also.

Also from the antenna gurus:

Feed line radiation refers to the phenomenon where the transmission line connected to an antenna radiates energy, which can cause interference and affect the performance of the antenna system. This radiation can occur when the feed line becomes part of the radiating system. It is important to minimize feed line radiation to ensure efficient transmission and reception. Techniques such as using a 1:1 balun or feed line choke can help minimize this effect.



Troubleshooting:

Disconnect the antenna from your transceiver, and checking from the female BNC connector center to the BNC outer shield (ground) there should be no continuity in either switch position. Checking from the BNC connector center, to the whip mounting stud there should be continuity in both switch positions.

Double check the turn count on the coils, even one turn can make a difference. It is easy to miss or add an extra turn. Take a sharp close-up picture and print it. It's a lot easier to count.

Make sure you use a counterpoise wire and do not have any feedline radiation from your coax.

One of the beta builder's, Joe (K0NEB), completed antenna in his go-box.

Steve Galchutt (WG0AT) mounting his with a Harbour Freight clamp for railing, tree branch, or picnic table.

Notes: