No. 56: Some Ideas for Quad Loops in the Field

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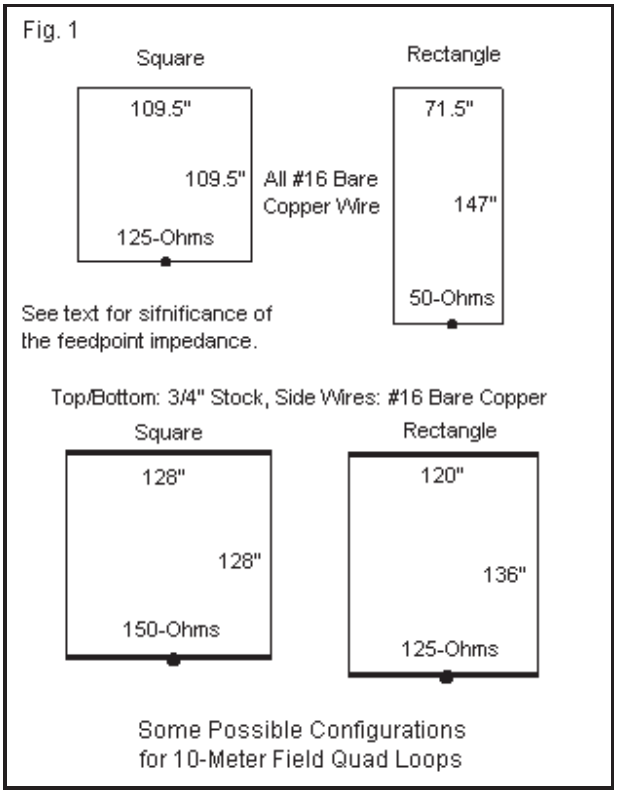
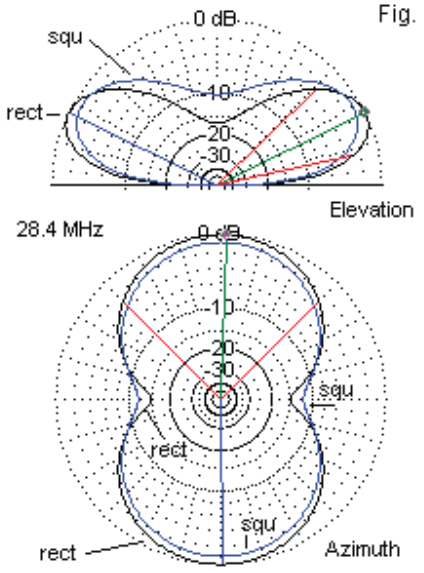
As the sunspots slowly return to improve 10-meter propagation, some operators begin to think of picnics, accompanied by a rig and a portable antenna. In episode 42, we examined a simple 10-meter dipole that consisted of nesting 3' sections of aluminum tubing. With about 20' of mast, the antenna is capable of very good performance, and one can hand-turn it to broadside the desired station. We can do similar things with a simple quad loop with about half the side-to-side spread. As a bonus, we acquire just a little more gain, but not enough normally to make the difference between a go and a no-go contact.

In this episode, we shall look at several configurations of the quad loop, some of which may be more useful to individuals, depending on local materials and construction preferences. **Fig. 1** shows square and rectangular quad loops. The top pair use all-wire elements. I have selected AWG #16 as a compromise size that is quite strong but lighter than house wiring. If you change the wire size, you will have to refigure the loop sizes or experimentally find the length of wire that gives a resonant feedpoint at 28.4 MHz (our design frequency). In general (and unlike the case of dipoles), closed loops require longer wire circumferences as the wire gets fatter and smaller circumferences as the wire gets thinner.



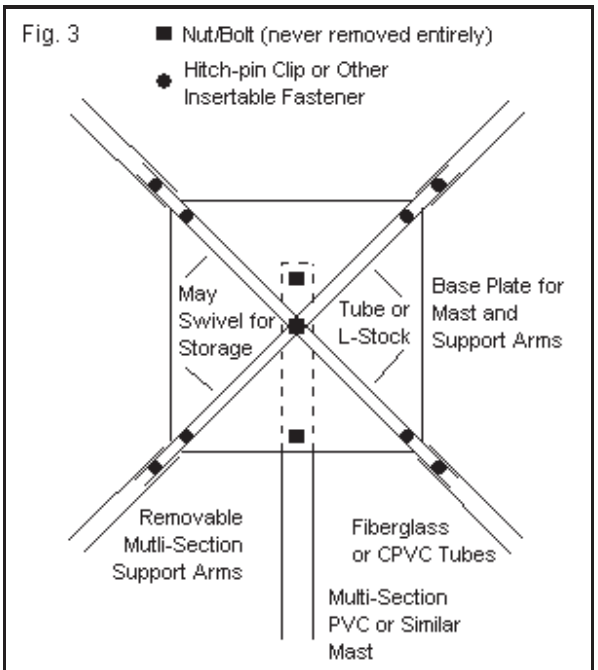
The lower pair use a hybrid construction method, with horizontals consisting of 3/4" aluminum. You may use tubing, but L-stock is easier to manage for field assembly and disassembly. The side wires are AWG #16. All wires in these antennas are designed to be bare. If you use insulated wire, shorten the wires by 2% to 5%. Thicker insulation calls for the greater amount of shortening.

Let's start with the all-wire quad loops. A standard square loop, fed at the center of the bottom wire, will have a resonant feedpoint impedance of about 125 Ohms. To create the simplest match to a 50-Ohm feedline, insert a 1/4 wavelength section of 70-75-Ohm coax. The electrical length will be just under 104". However, you must multiply this length by the velocity factor of the line that you use. Most solid dielectric lines have a velocity factor of 0.67, resulting in a 70" length. Most foam dielectric lines have a velocity factor of about 0.8, resulting in a matching section length of 83". Both the square and the rectangular loops will cover from 28.0 to about 28.7 MHz with under 2:1 SWR. Since the total feedline length will be short compared to the amount used in a home station installation, you can extend the operating span by using an internal or external antenna tuner--with no significant losses.



Comparative Patterns:
Square and Rectangular Quad Loops
Bottom = 10' Above Ground

One reason some loop users prefer the rectangular shape is that it provides a direct 50-Ohm impedance and therefore requires no matching section. As well, if we place the bottom horizontal wire of both antennas at the same height--for example, 10' above ground in the field--we obtain slightly more gain and a slightly lower elevation angle due to the higher top wire. See **Fig. 2**. In most cases, the variables that field operations inevitably involve will wash out the small differences in the performance numbers. So the main reason for using the rectangular shape is to achieve a direct feed that requires no matching section. However, the resulting tall loop can be somewhat ungainly in the breeze.



Basic Ideas for Supporting
an All-Wire Field Quad Loop

Let's consider how to construct both types of all-wire quad loops for field use, using **Fig. 3** as a rough guide. We can start with a support mast. Unlike the dipole mast that had to reach the ultimate height of the antenna element, the quad loop mast only goes to the level between wires plus a little margin. PVC sections in 5' lengths (or whatever length fits the trunk or truck-bed) make a good mast, especially when the ends have threaded couplings cemented in place. Be sure to use some rope and long spikes (tent pegs or garden timber spikes) to set up a guying system. At the top of the uppermost section, we can install a plate with 4 stubs to receive the X-braces or support arms. If we use pressure insert fasteners for the outer pinning devices, we can fold the assembly to reduce its width during transport. The anchor plate can be almost anything from plywood to plastic.

The support arms should be light, flexible, and strong. CPVC is useful and available at home centers. Fiberglass is perhaps better, but it may require mail order to obtain it. Assemble the entire support structure to string the wire initially. Be sure the wire is equally taut on all four sides of the loop, but not so taut that it stresses the support arms. Stress will likely result in a warping of the frame to one side or the other--and the warp may change in a stiff breeze. For permanent installations, I would normally suggest slip tubes at the corners, but for this antenna, I recommend that you fix the corner in place. Use non-conductive cable ties or similar, and add some epoxy after you are satisfied with the structure. The wire will help prevent the arms from sagging. For the square quad loop, the arms should be a minimum of 77.5" from the plate center to the tip. The rectangular loop requires arms that are minimally 82" long. You will have to solder in a coax connector at the center of the bottom wire, and you may wish to use a small plastic plate as a mounting.

Using the lower quad configurations involves having thick horizontal element sections and wire vertical sections. •À½" L-stock makes a good horizontal element section. Note in **Fig. 1** that the combination of thick and thin materials raises the impedance of a truly square loop to a very inconvenient value. A 150-Ohm impedance is somewhat low for a 4:1 balun, but too high for a 75-Ohm matching section. Therefore, if you prefer this configuration, try a slightly rectangular shape, as shown in **Fig. 1**, to obtain 125 Ohms. Then you can use a 75-Ohm matching line to good effect.

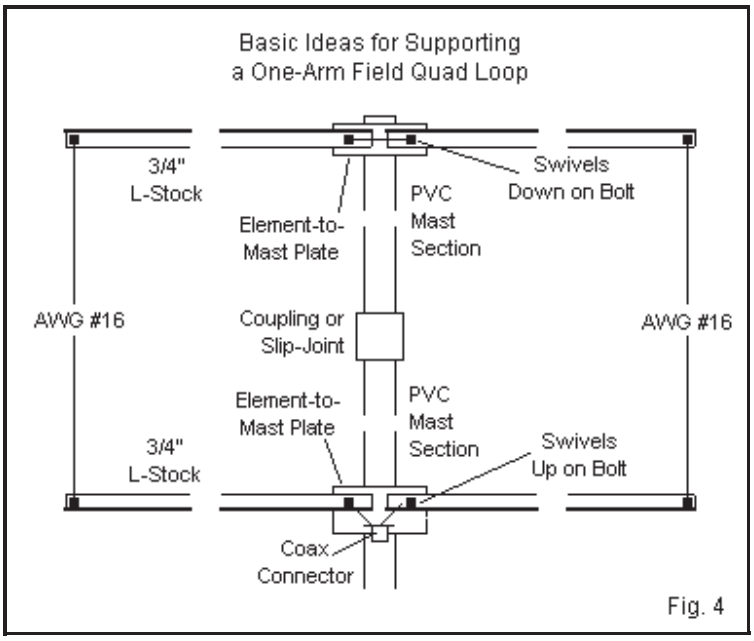


Fig. 4 shows why some field operators prefer the thicker horizontal element sections. If we carry

the mast up to the top element, we no longer need the 4 X-brace support arms. The horizontal L-stock supports the side wires with ease. Since the loop is over 9' tall, the central mast above the lowest element section should be in 2 sections. To each section, we can attach a small plywood or plastic plate to pin down the L-stock. I recommend that you use nuts and bolts near the centerline, but removable fasteners (such as hitch pin clips) near the outer edge. When not in use, you can fold the bottom elements up and the top elements down for easy transport. Be sure to add a bridge wire at the top to connect the two side of the horizontal element. At the bottom, add a coax connector and mounting plate and fasten it to the element support plate.

For either type of quad, you can likely work out the wire and support structure in a way that allows you to store and transport that part of the system as a unit. The more items in the structure that you can fold, bend, and wrap-around for storage, the more quickly you can assemble and disassemble the unit in the field. As well, you create a smaller unit for transport.

These notes do not aim to give you complete construction details of a portable or field quad loop. Instead, they simply provide some ideas and then rely on your own ingenuity for making a complete unit. Over the years, I have built and used several 10-meter quad loops. My personal favorite is the modest rectangle that uses •À½" L-stock and side wires. My versions allowed me to loosen the L-stock and fold the element sections next to the half-mast section. Without removing the side wires, I laid the two half-mast sections side by side and then used the side wires to wrap the entire antenna into a loosely secure bundle. The stored antenna was a little over 4' long (not including the mast sections and the guys below the part shown in **Fig. 4**). The only loose part was the bridge wire across the middle of the upper element, and I kept one end attached to one side of that element. In one version, I mounted the coax connector directly to one of the lower pieces of L-stock, with a bridge wire to the other section.

The number of construction variations that are possible is as endless as the materials that we can find at a home center. In fact, the variations on field quad loops are almost as great as the pleasure of operating 10 meters from a hilltop or open field (on a sunny day with warm temperatures, a fine picnic lunch, and someone special with whom to share the fun).