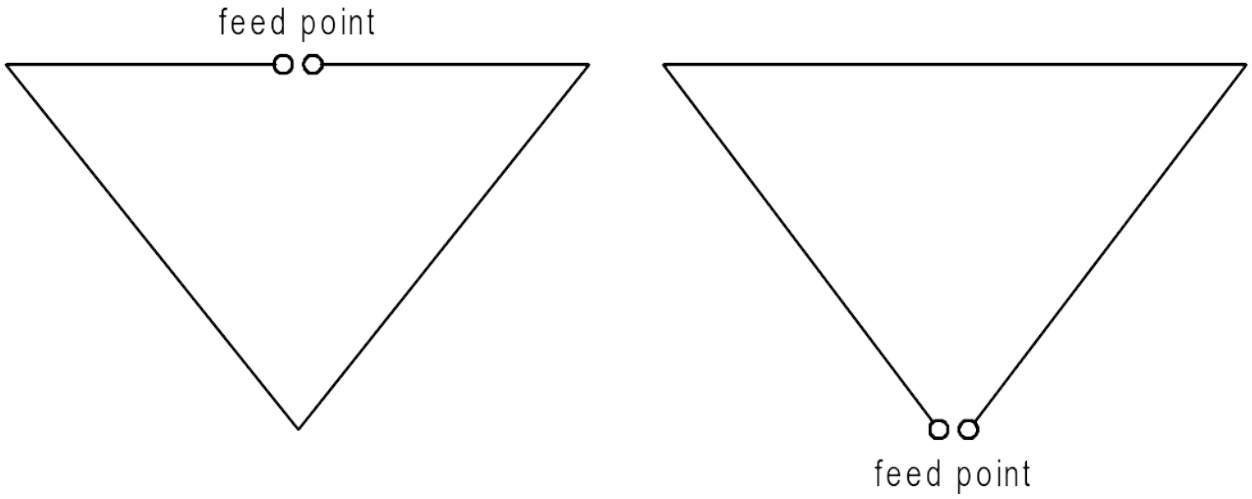
Delta Loop for 70MHz

A single element delta loop is an antenna with a bi-directional radiation pattern. It has a gain over a dipole because it effectively stacks two half wave elements one above the other. The feed impedance at a corner of the triangle is approximately 100 ohms. The polarisation depends on the location of the feed point on the triangle. For **horizontal polarisation** the two possible arrangements are:



The **second** option is used in this project as it puts the antenna higher and attaching the feeder is simpler when using plastic plumbing fittings.

This is a LOW COST, value for money antenna and the parts required are:-

1. Length of white 40mm PVC solvent weld waste pipe
2. length of white 21.5mm PVC overflow pipe
3. two straight white 40 mm couplings
4. 440 cm of stranded copper wire
5. N-type socket (or other coaxial socket)
6. 70 cm of RG59, 75 ohm coax (or gamma matching rod and capacitor)
7. various fixing hardware and waterproofing tape etc.

The N-type socket can be an in-line type on the end of a short length of RG213 or a chassis mounting type fixed to a copper strap around the coupling (as used in this project).

The upper 40 mm straight coupler has to have two 21.5 mm holes cut in it. These are diametrically opposite. An appropriate ‘cone-cutter’ or hole punch can be used for doing this job.

Matching and Feed Arrangements

With an open circuit feed point as shown in the diagrams above, we can use a quarter wave matching section of 75 ohm coax connected to the loop. This will give a good match into 50 ohms. This is the arrangement chosen for this project.

Alternatively, a quarter wave line transformer using an open section and a coaxial balun to connect to 50 ohm coax can be used. This arrangement also delivers a balanced feed to the loop for what is a balanced antenna by nature.

Finally, if the loop is a closed circuit its length is marginally longer at 1.02λ and a better feed arangement in this case would be a gamma match which will produce a 50 ohm feed. This allows the maximum current point to lie where there is **no** break in the conductor.

Construction (using ¼ wave coax matching)

1. Cut the 21.5 mm overflow pipe to a length of 145 cm
2. Tidy the cut ends with a penknife or a file
3. Mark two drilling spots 180° apart on one of the 40mm couplings. These should be 19 mm in from the end.
4. Drill these as two pilot holes with a 2mm drill bit.
5. Enlarge these holes with a 10mm drill.
6. Use a 21mm diameter hole cutter to enlarge the holes to 21 mm.
7. Use a round file to tidy the holes so that they give a tight fit for the 21.5 mm overflow pipe.
8. Mark the centre of the 145 cm pipe with a permanent marker pen.
9. Push the overflow pipe half way into the 40mm coupler.

Construction of the Loop and Feed Arrangements.

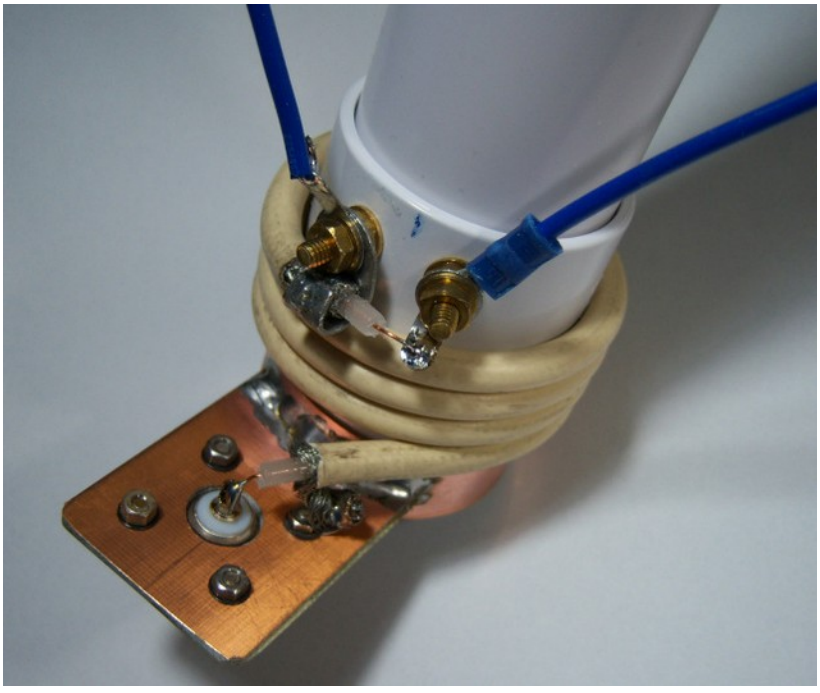
10. Strip 15mm of the insulation off one the end of the wire.
11. Solder a 4mm tag or crimp a 4mm ring to this end, doubling the wire over to increase its thickness.
12. Slip two rubber sleeves and two short lengths of heatshrink on to the other end of the wire.
13. Repeat steps 10 and 11 at the other end such that the total length from tag or ring centre at one end to tag or ring centre at the other is 435 cm.
14. One rubber sleeve and one piece of heatshrink can be secured at **ONE** end of the wire. At the other end leave this until the antenna is tested in case a small adjustment needs to be made in the length of the loop (note later adjustment is more difficult if a crimped ring has been used). Feed the wire through the 21.5 mm pipe till the middle third is in the pipe.
15. Fit the other 40 mm coupling to the other end of the 40 mm pipe
16. Drill two 4.2mm diameter holes through both the coupling and the pipe. These should be positioned such that the centre and braid of the coax can be attached to tags on the two 4mm diameter brass bolts that go through the holes. The brass bolts also secure the pipe into the coupling.
17. Secure the coupling to the pipe with the brass screws by putting the screw heads inside the pipe. On the outside of the pipe is a washer and nut, followed by two washers and another nut.

Preparing the Matching Section and Connector

18. Cut a strip of copper (or similar thin, solderable material) strap 23cm long and run it round the circumference of the coupling leaving two overlapping ‘tails’ that are equal in length. Bend the ‘tails’ up at 90°.
19. Grip the ‘tails’ in a vice so that they match up. Drill two 2mm pilot holes in the straight tails and then drill these out to 4.2mm.
20. Insert two brass 4mm bolts into the holes, attach nuts and tighten these until tails are pulled tightly together.
21. Solder the nuts on to the copper to secure them. A large soldering iron may be required for this but avoid melting the coupling!
22. Prepare a piece of double sided PCB large enough to take a coax socket and shape the edge to the same profile as the copper strap.
23. Using metal punch or ‘cone-cuttter’, make a hole in the PCB for the coax socket.
24. Drill four 3.2mm holes to take mounting screws for the socket (if required).
25. Mount socket securely onto the PCB.

26. Solder PCB/socket unit to the copper strap, correctly aligning the curved profile.
27. Cut the quarter wavelength of matching coax allowing enough for the ends to be stripped and the braid and inner separated. To allow for small adjustments this can be cut a little long at the start and trimmed later. (The velocity factor of the coax is relevant here!)
28. Attach one end of this coax to the tags on the brass bolts or to the terminal block.
29. Coil the coax neatly round the plastic tube, terminating at the lower terminal block or at the coax socket.

The antenna is now ready for testing.



Testing

This can be carried out with an antenna analyser and a short piece of 50 ohm coax. A length of 40mm waste pipe can be inserted into the lower pipe coupler and used as a short mast. Keep the antenna away from nearby objects while conducting the tests.

Alternatively, a 4m transceiver and a 50 ohm SWR bridge suitable for 70 MHz can be used to check the matching and resonance.

Small adjustments may have to be made in the length of the loop and/or the length of the matching section to achieve the best results.

If the antenna is to be used outdoors when there is any possibilty of rain then consideration should be given to waterprrofing the matching section and the connections.

Details and guidance for this 4m delta loop project were provided by Graham GM4OBD.

The completed antenna is shown below.