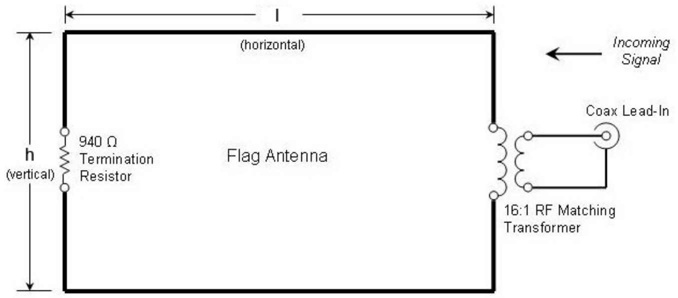
Schematic and parts used for reversing direction of a Flag-antenna.

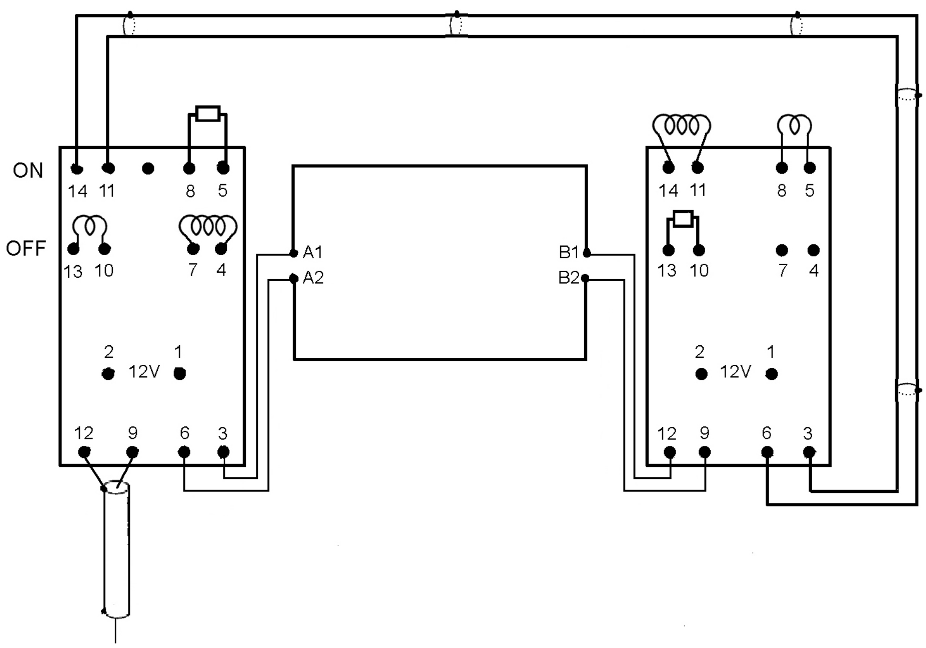
During several months I have planned to erect a second Flag antenna perpendicular to the first one and also rebuild the existing antenna with high quality relays instead of the very cheap relays used. The intention was also to bury 20 mm flexible tubes in the ground for housing the coaxial and 12 V DC supply cables. Digging, pulling the cables into the plastic tubes and soldering the parts for the two Flag antennas took a lot more hours than expected to complete.

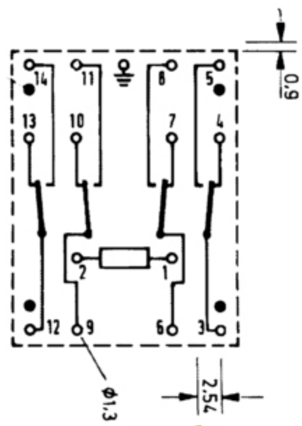
The final design is presented below with the schematic for control of the relays and also some photos showing the parts in the plastic boxes each side of the antennas.

According to Mark Connelly at http://www.qsl.net/wa1ion/flag/flag_antenna.htm the K6SE article on Pennants and Flags suggests a horizontal dimension of 8.84 m / 29 ft. and a vertical (side) dimension of 4.27 m / 14 ft. The VE6WZ web site has data suggesting that, as long as the horizontal-to-vertical (H/V) ratio is kept the same, performance in nulling will be comparable with antennas of different sizes. Signal capture, of course, is greater as the area enclosed by the antenna is increased. The K6SE ratio of 29/14 or 2.07 was arrived-at by EZNEC analysis. Ken Alexander had good results with a Pennant measuring 16.45 m horizontally by 5 m vertically for a ratio of 3.29. It would seem that there's a certain amount of "budge room" in the H/V ratio.



In one of the garden borders, between two trees separated by 12 m, I erected the first Flag-antenna two years ago. The second was erected a few months ago in the garden border hedge at right angle to the other. The same size, 2 x 4 m, were used for both antennas. It seems that this size, although not optimal, seems to give decent nulling of the backlobes. At least there is a big difference in reception when switching between the four antenna directions.



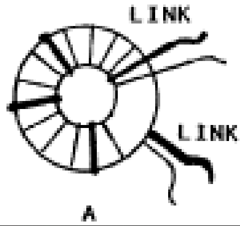


Flag antenna: l x h = 12 x 4 m, lowest horizontal wire 0,5 m above ground

Relay 4-pole:	Matsushita NF4EB-12V DC	Elfa part no 37-052-66
Toroid:	Epcos N30 36x23x15 mm	Elfa part no 58-614-14
Resistor:	940 ohm ½ W (2x470 ohm in series)	
Coaxial cable:	RG58/U, 50 ohm	Elfa part no 55-904-01
12 V feed cable:	LIYY 4x0,14 mm^2	Elfa part no 55-721-28

Cable for toroid windings:	6 x10 m EKUX	Elfa part no 55-288-07
Experimental board 100x160	2,54 mm spacing	Elfa part no48-202-70
Printed circuit screw termination blocks:	8-pol. 2,54 mm spacing	Elfa part no48-354-68
Plastic box:	10x10x5 cm	Bauhaus
Wooden impregnated pole:	50 mm dia, l = 1,8 m	Bauhaus
Fir rod:	27 mm dia, l = 3,4 m	Bauhaus
Flexible tube:	20 mm black PVC, 25 m per reel	Jula

The toroid is wound with 35 turns for the 900 ohm winding and 8 turns for the 50 ohm winding. Note that both windings must be wound in the same direction. The primary winding must be carefully spread around the entire toroid and then the much smaller secondary winding must be carefully wound atop the primary winding and equally spaced around the toroid.
The EpcosNE30 toroid has a A_L value of 5600 and with the above number of windings reception will be almost flat from 0,1 to at least 15 mHz.



Picture showing the two plastic boxes (10x10 cm) with relay and toroid attached to a small plywood board.

Interior view of the 10x10 cm boxes on the right antenna side. The left box contain the relay and termination blocks on the curcuit board, the right box contain the balun.

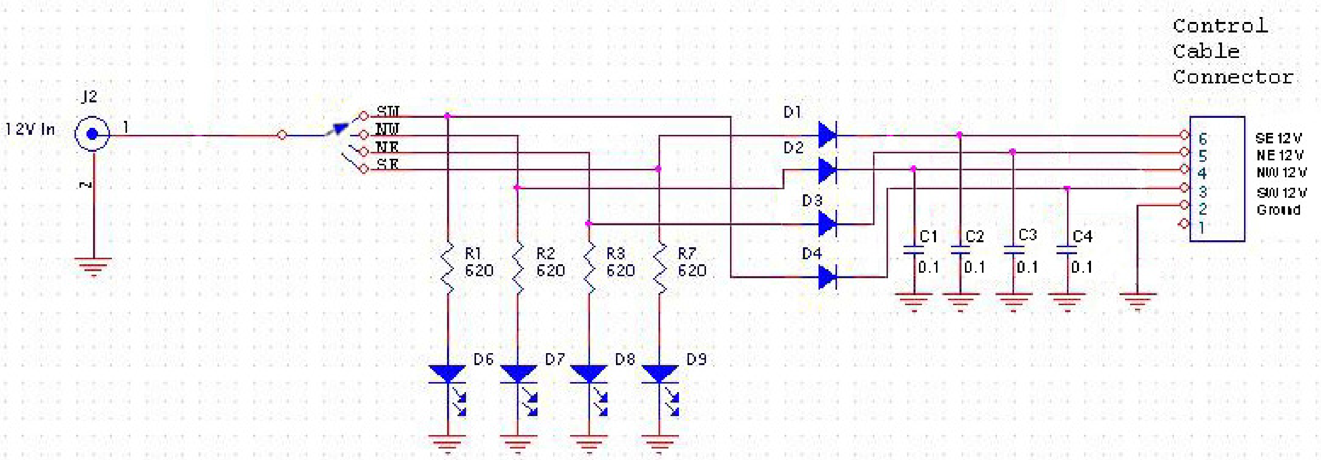
Picture showing the 1,8 m impregnated pole with a 3,4 m fir rod (27 mm) attached with long, wooden screws in the top. In the middle the 20x10 cm plywood board with the two boxes attached with wooden screws.
At the bottom the two 20 mm plastic tubes with coaxial and 12 V supply cable come up from the ground and are secured to the pole with plastic strips.
All cables are buried in the ground in black flexible plastic tubes.
The bottom horisontal antenna wire is about 50 cm above ground.

Don't try to use 16 mm flexible tube. It's almost impossible to pull the coaxial cable through this small diameter.
Use 20 mm flexible tube instead for both coaxial and 12 V supply cable.

View of 10x10 cm boxes on the left antenna side. One of the two pairs of coaxial cable and 12 supply cable controls the relay on the right antenna side. The other pair goes to the shack in the house.

The 12 V control unit for the two Flag antenna relays is quite straightforward consisting of a a power switch, a switch for choosing between two receivers and a 3 pole 4 position rotary switch.
LED indicators show Power on and the actual Flag antenna direction.

The schematic below shows a principal layout which can be used to control four separate relays. Of course you also have to switch the two antenna inputs accordingly. In my case only SW & SE are connected to 12 V to activate the relays. For NW & NE directions no supply voltage is applied because the relays are inactivated in those positions.



Three recordings with 20 seconds in each direction can be found at my web-site http://homepage.sverige.net/~a-0901/ .

- Flag Ant reversal 1566 kHz, 2010-06-09, direction 210/300/30/120
- Flag Ant reversal 1566 kHz, 2010-06-08, direction 300/120
- Flag Ant reversal 1566 kHz, 2008-09-18, direction 30/210

Some hints found on Array Solutions website regarding K9AY antennas also equally valid for Flag-antennas.

Can I make the loop larger, smaller or a different shape?
The short answer is yes — many hams have limited space or want to use existing supports such as trees. Here are the general rules about loop size and shape:

1) The current in the loop (and thus, signal voltage across the feedpoint terminals) is proportional to the area enclosed by the loop. — A smaller loop will capture less signal, which will require more preamplifier gain to give the receiver a proper signal level. The loop is too small when the quiet band signal level falls below the noise floor of the receiving systen (preamp/feedline/receiver).

A larger loop will capture more signal, but at some point its mode of operation changes. A loop is too large when it starts to act like a "delta loop" or "quad loop" instead of a "small loop." A loop is too large when the overall wire length is about 0.3 wavelength; approx. 0.1 wavelength across the diameter or longest diagonal dimension. The published dimensions (25 ft. height, +/- 15 ft. across) are right at the upper limit for operation in the 80 meter band. Also, as the size approaches the upper limit, the optimum terminating impedance will change, and the maximum front-to-back will start to degrade.

2) The shape of the loop determines the vertical angle of the null. — The semi-delta loop shape was chosen for two reasons -- it is practical for a single tall support, and it places the null at an elevation of 35-45 degrees above the horizon, which is ideal for rejecting the strong signals coming from one-hop skip distance.

A square or rectangular shape with vertical ends will place the null at a lower angle, which may be better for local noise rejection. A diamond or a tall rectangle that is higher than its width will place the null at a higher angle, which may be useful for rejection of very short skip (NVIS) signals.

(From http://www.arraysolutions.com/Products/lowbandFAQ.htm)