

Array Solutions 2 Element Array User's Guide



Array Solutions Array Steering Controller

Congratulations.

You have selected one of the finest phased array steering systems made. We have under-rated the power capability of this system to assure the user high reliability under heavy use such as in a 48 hour radio contest. Please contact us if you have any questions about the product and please send a picture and description of your station showing the control system installed and in use.

The two element array system has two components: a relay box that will be mounted midway between the two verticals or dipoles, and a control box that is connected with a 5-wire control cable inside the operating room. With this system you will be able to beam in 2 directions with a Cardioid and also in a broadside.

Wiring the system:

Take the cover off the switch box and unwrap the circuit board. Wire the control cable before mounting the board to the box.

You will need a cable with 3 wires. Small gauge wires are fine and will fit inside the boxes better than large rotor cable. For runs of less than 500 feet #18 or larger gauge stranded wires will be adequate. The relays draw only 120 ma at 12V DC. Try to use a supply that has a 13.8V DC output.

You will also need a small two-wire 12V DC line for power. A 13.8VDC 1/2 amp power supply should be ample. But please use a reliable power source, since wall wart transformers have a habit of falling out of plugs and going bad in the middle of a contest.

The silk-screen on the PCB indicates where to wire the +12 V DC (+13.8V DC) supply and its RETURN or GND wire to the Power Supply.

Wire the control switch PCB to the relay box per the following Table 1.

Control Switch PCB Terminal Strip	Relay Box Terminal strip
1 - No wire Default end fire position direction A	No connection and no terminal 1 in this box
2 - Direction B	2
3 - Broadside pattern	3
4 - No wire Default end fire position direction A	
5 - wire to terminal 2 above	
6 - wire to terminal 3 above	
+12V - wire to your 13.8 V DC supply	
GND - Ground return to your DC supply	GND return wire back to control switch

Table 1

Please use a connector on a short piece of cable so you may disconnect the control unit from the control cable when not in use, or when a thunderstorm arrives. We also recommend the use of a surge protector at the station end for the control cable and RF cables, such as the model 348 and 303U products we sell. A little money spent now can save valuable radios later. We have MOV protection inside the relay box.

Place the control switch PCB inside the control switch and secure the PCB in place with the rotary switch hardware. The LEDs should just protrude through the holes provided for them.

Use the tie wraps supplied as a strain relief when the control cable is fed through the grommet hole. Snug the tie wrap next to the hole in the back of the box to prevent the wire from being pulled and stressing the PCB.

Do the same with the 12V-power wires you will supply through the other grommet hole.

Relay Box

Route the control cable through the rubber grommet hole in the relay box tray. Use a Ty-wrap™ as a strain relief. The relay box terminal strip is marked to indicate the connection to terminals. See the above **table 1** for the proper connections. There is no terminal 1 since it is the no power default position. The relays are bypassed with MOVs, capacitors, and diodes for RF and lightning suppression. See **Fig. 2** which is a picture of the inside of the phasing box.

Figure 2 description

Feedline RF connector is where your 50 ohm feedline connects.

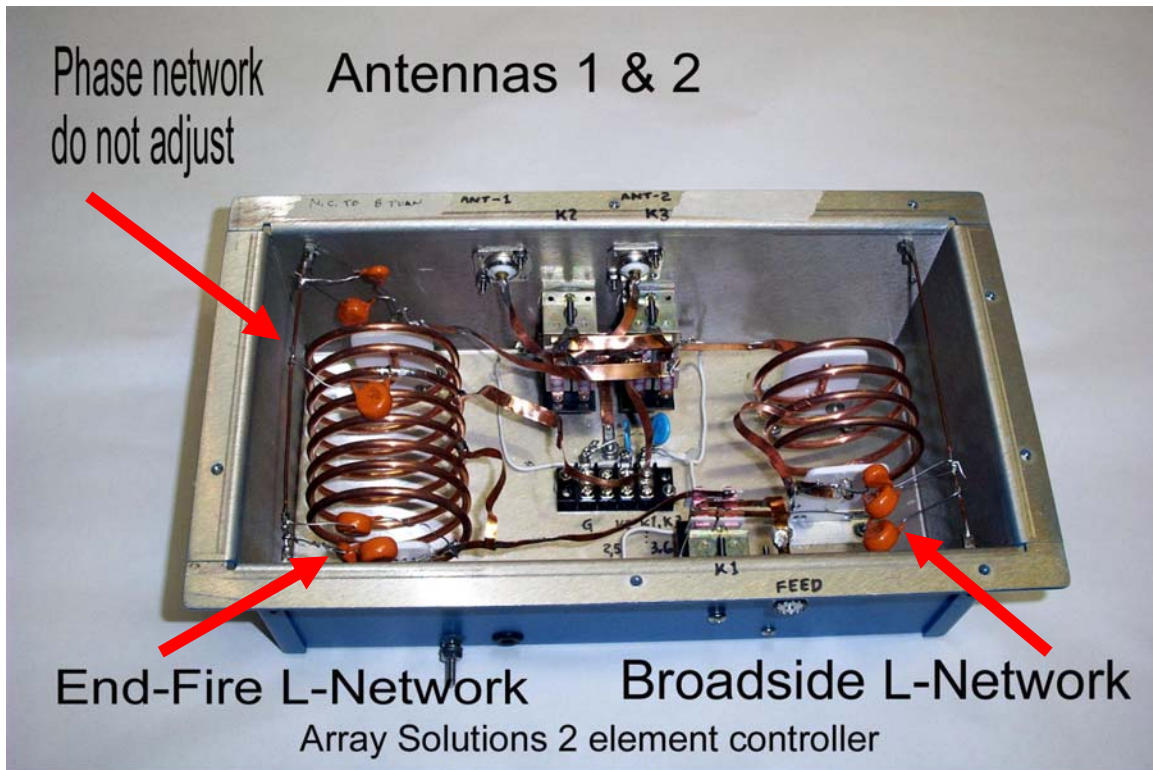
The areas marked **L-Network** is for placement of HV RF capacitors. These are the input L networks used to match the system to a perfect 1:1 VSWR. We have set it up using dummy loads but you may be required to adjust the network for the characteristics of your antennas by adding or removing capacitors or moving the tap on the coil, once you hook up all of the antennas.

Antenna Ports 1 & 2 these are the output connectors to the two antennas. Each one should have a ¼ wavelength (or odd multiples) feedline connected to it. We use ¼ wavelengths to take advantage of the current forcing properties of this length of line. Array Solutions can supply these feedlines to you if you do not want to cut them yourself.

90 degree phase shifter is the LC circuit that will cause a 90 degree phase delay with equal magnitude currents to each antenna. It is factory set and should not require any adjustment.

Control Terminals - attach the control cable to this terminal strip.

Figure 2



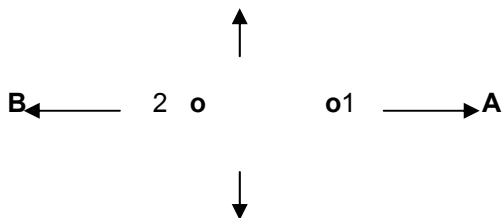
Setting up the system

The very best book on the subject of setting up a 2 element antenna array is a book by John Devoldere, ON4UN titled "Low-Band DXing". If you do not already have this book we recommend you obtain a copy of it to learn all about these types of systems. It is available from us.

Place the controller relay box in the center of the array. Use the U-bolt provided to mount the box on a ground rod, pipe, or tower leg. Feed each vertical with $\frac{1}{4}$ wavelength of 50 ohm feedline. You may use 75 ohm feedline as well but it is of no real benefit. We will match the system SWR to a perfect match in a latter step.

Weather proof the connectors. There is a ground lug on the side of the box, use it to secure a good ground connection to a ground rod and tie it all into the radial system of your verticals.

You have set up your verticals in a line such as below



The above diagram indicates verticals (o), Antenna number (1-2), and Direction (A-B, and broadside to the array)

Drive the antennas from the antenna output ports that coincide with the above diagram.

Switching the array pattern is done with the control switch. Position one is the default position. It is not supplying any voltage to the array. Drive your antennas such that this is your most important direction. IE in North America you probably will want to have this position be your NE direction toward Europe and direction A in the diagram above.

Position two is the opposite End-Fire direction.

Position three is Broadside

Position four repeats position one

Position five repeats position two

Position repeats position three

VSWR and Matching

Tuning the two L-networks for best VSWR is a fairly simple procedure and can be done by first adjusting the taps of the coil and then adjusting the capacitor for minimum SWR. We have set up starting values which will be very close to your real antennas. Apply a small amount of power to the input, and with the SWR meter of your rig or an external meter adjust the L-Networks as follows.

1. Select position 1 (End-Fire direction A) This is the End-Fire L network (fig 2). Try adding a capacitor by touching it from the input connector side of the coil to ground. If the SWR goes higher you know you must remove capacitance. If the SWR goes lower, you of course will need to add capacitance. You can unsolder the coil tap and also move it slightly to achieve best SWR. Repeat this procedure until you have a perfect match to your system We have pre-adjusted the system for a SWR of less than 1.1:1 at the desired frequency using dummy loads at the factory to give you a good starting point.
2. Select position two (End-Fire opposite direction) and the SWR should be exactly as seen above in step 1.
3. Select position 3 (Broadside) and adjust the Broadside L-Network as in 1 above.

Please contact us for help in tuning your array or if you have any other questions.

Specifications

Construction	Aluminum Box, weather seals, Amphenol connectors, RF sealed
Power	5 KW CW / 8 KW PEP
VSWR	Adjustable for 1:1 perfect match – No dump load
Gain	3 dB over single vertical 6.1 dB (optimized)
Directions	2 directions and broadside
Electronic phasing	LC network
Phasing Options	90 degree End-Fire, and 0 degree Broadside
Capacitors in networks	True temperature stable high current RF capacitors
Weight and size	9 lbs 13" x 6" X 5" relay box, 6"x3"x3" controller box

Thank you for purchasing this fine phasing system, we feel it is the best system on the market and will bring you many pleasurable years of reliable service.



Please visit our website at www.arrayolutions.com