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### Model AS-AYL-4 — 4-way K9AY Loop System



This is the popular K9AY Loop receiving antenna, as described in the September 1997 issue of QST, “The K9AY Terminated Loop-A Compact, Directional Receiving Antenna,” by Gary Breed, K9AY. This system provides a cardioid directional pattern in four different directions. The AS-AYL-4 consists of two units, an indoor control box and an outdoor direction-switching relay box. The control box includes a 15 dB preamplifier with a bandpass filter covering the 160 and 80 meter bands, with excellent rejection of Broadcast Band signals and signals above 5 MHz. The AS-AS-AYL-4 is used with two loops installed using a single support, oriented at right angles to one another. It is intended to be used with either the **AYL-4 Mast/Antenna Kit** which is a mast, hardware and wire package, or with “homebrew” loops constructed by the user.

## Specifications

<i>Antenna type:</i>	Terminated loop
<i>Pattern:</i>	Cardioid, switched in four directions
<i>Peak front-to-back:</i>	Greater than 20 dB, typically 30 dB
<i>Feedpoint impedance:</i>	50 ohms nominal; low-loss transformer matching to the antenna
<i>Frequency range:</i>	Very low frequencies to 30 MHz, using published dimensions. With preamp on, bandpass is limited to 1.8-5 MHz.
<i>Direction change:</i>	Feedpoint/termination switching relays
<i>Direction control:</i>	Connected with a 6-conductor control cable
<i>RF connection (antenna):</i>	SO-239 (UHF) connectors at control box and outdoor relay box.
<i>RF connection (radio):</i>	Phono connector output to receiver external antenna input
<i>Termination Adjustment:</i>	Eight resistances from 340 to 680 ohms, selected by front-panel rotary switch
<i>Power requirements:</i>	+12 to 15 VDC, 400 mA max., (provided by customer, to be fused at 0.5 A)
<i>Preamplifier:</i>	15 dB gain, feedback type, using a silicon NPN transistor
<i>Filter passband:</i>	±2 dB from 1.80 to 4.5 MHz
<i>Filter stopband:</i>	–55 dB at 7 MHz, –50 dB below 1450 kHz (typical)

## Required Area

The AYL-4 K9AY Loop System requires approximately 15 feet in four directions from the center of the antenna, plus additional distance depending on the guying method. The base of the supporting pole and the ground rod are located at the center. With the AYL-M kit, 21 feet in each of the four directions is required. The center support is 25 feet high, and must clear any objects above.

## Installation Instructions

### AYL-4 — 4-way K9AY Loop System

#### Package contents:

AS-AYL-4C control box with filter/preamp  
AS-AYL-4R outdoor relay box  
6-pin control cable connector

**You will also need:**

- The K9AY Loop antenna wire, support and ground system. All materials are included in the AYL-M mast / wire and hardware kit (except ground rod), or you may choose to construct the loop from your own materials using the instructions in “How to Build the K9AY Loop Receiving Antenna” which is enclosed with the AS-AYL-4, and also available in the “application notes” section of our web site — [www.arraysolutions.com](http://www.arraysolutions.com)
- Coax cable to run from the AS-AYL-4C control box to the AYL-4R relay box, which is located at the antenna.
- 6-wire control cable to run from the AS-AYL-4C control box to the AS-AYL-4R relay box, which is located at the antenna. #20 AWG wire is recommended for runs up to 250 ft. Larger wire is recommended for longer runs.

**\*\*\* WARNING \*\*\***

**If you need to enlarge the hole in the relay box for a larger control cable, please use extreme caution when drilling the hole so you do not drill into any of the components on the relay box circuit board. Components damaged in this manner will not be covered under warranty.**

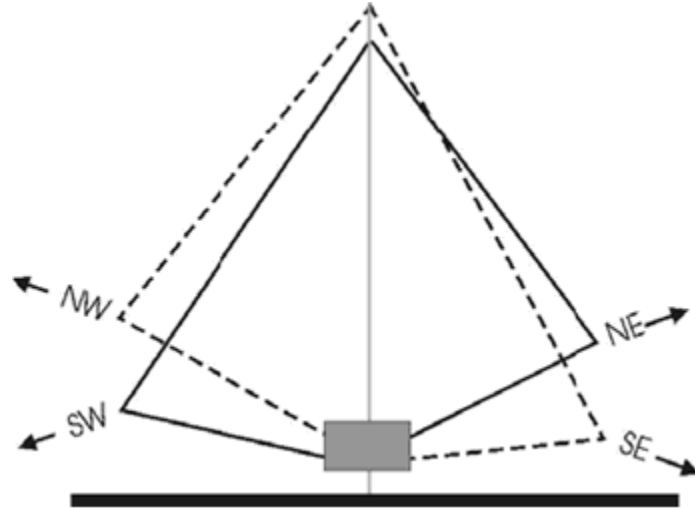
- Source power of 12 - 15 volts DC. Typically, this will be from your station power supply.

## Connections to the Control Box:

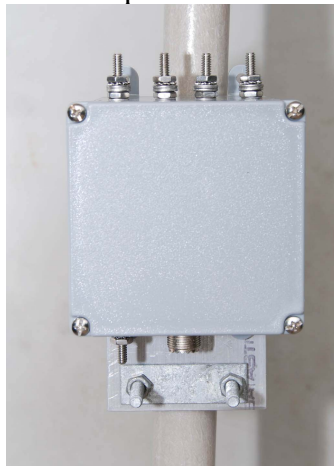


1. Connect the leads of a 6-wire control cable to pins 1 through 6 of the connector provided. This cable plugs in to the back of the control box and will run to the AYL-4R relay box. Write down which wires are connected to each (e.g. Red = 1, Grn = 2, Yel = 3 etc.)
2. Connect 12 – 15 volts DC (typically 13.6 VDC). Positive is connected to center pin.
3. Connect a coaxial cable to the SO239 “ANTENNA” connector. This cable will run to the AYL-4R relay box.
4. Connect a cable from the “RCVR” phono connector to the external antenna input of your receiver.

## Relay box installation:

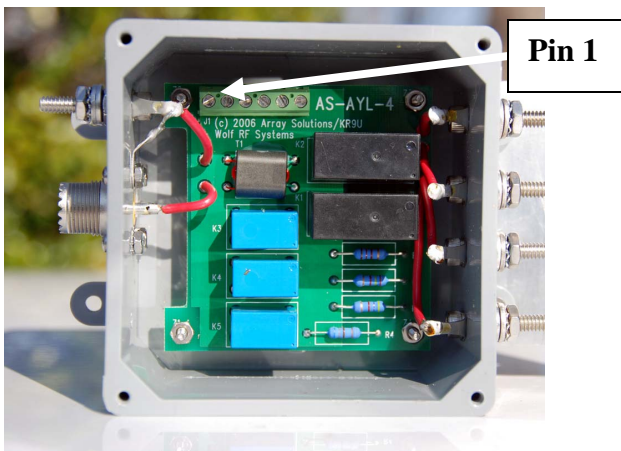


1. Mount the box at the base of the loops as shown. Note that the connections to the loops should face up as shown in the photo below.



2. This is where the ends of the loop wires come together, and where the ground rod is located. The mounting flange has two holes for the supplied U-bolt or a may be used to attach the box to the antenna support or other mount. The four antenna connections will be facing up.
3. Connect the ground (GND) post on the relay box to the ground rod with a short piece of wire. The antenna **MUST** be grounded to operate properly. See illustration for location.

4. Connect the coaxial cable and the 6-wire control cable. Open the Relay Box and connect the control wire to the terminal block on the inside of the box. Terminals 1 through 6 are connected to the same wires that go to pins 1 through 6 on the connector at the control box. Use the supplied tie wrap and tighten it around the control cable on the inside of the relay box where it enters. This will provide the strain relief. If your control cable is larger than the hole, simply open the hole to accommodate your cable. Be careful to protect the relays in the box when drilling as the drill bit will have a tendency to grab the plastic and pull itself into the box. See illustration for connection information.
5. Connect the antenna connectons to the relay box according to the label. For instance, for the loop that is orientated in the NE / SW direction, connect the NE end of the loop to the NE post and the SW end of that same loop to the SW post.





**Quick installation checklist:**

1. Control cable wired correctly: Pins 1 through 6 on the connector go to terminals 1 through 6 at the relay box.
2. The relay box ground post is connected to the antenna ground system (the ground rod, plus any radials – please note that radials will improve the performance of the system!)
3. Each loop is the proper size—25 ft. high, with corners 15 ft. on either side of the center (about 85 ft. of wire)
4. The two loops do not have any electrical connection other than their connection to the relay box. They are not shorted to each other at the top, or to the mast, etc.
5. The two Loops are connected to the relay box correctly.

## OPERATION

Operation of the K9AY Loop receiving antenna system is easy. Once everything is hooked up, simply select the desired direction with the front panel switch. Signals from the opposite direction can be reduced by up to 30 dB or more, depending on the arriving wave angle. For amateur band operation, the preamplifier/filter will greatly reduce AM Broadcast signals, as well as signals above 5 MHz.

Like all small antennas, the K9AY Loop is much less efficient than your transmitting antenna similar to a Beverage receiving antenna. Expect the signal to be approximately 30 dB below your transmit antenna signal. To compensate, the preamplifier provides 15 dB of gain, with a filter that passes approximately 1.8 to 4.5 MHz. When the preamplifier is switched off, the filter is also bypassed, and the antenna may be used on any frequency.

Adjustable Termination—The termination establishes the optimum front-to-back ratio. The best termination value will vary somewhat with the frequency, with the local ground conditions, and with the size and shape of the loop. The resistance is adjustable using the 8-position switch on the control box. The resistance range was designed to cover all expected variations in installation and local ground conditions. The nominal resistance for each position is:

<b>Position</b>	<b>Resistance</b>
1	680 ohms
2	595 ohms
3	530 ohms
4	475 ohms
5	435 ohms
6	400 ohms
7	370 ohms
8	340 ohms

PLEASE NOTE — There are a couple very important things to note about the adjustable termination and grounding of the K9AY Loop system:

1) The termination does not tune the antenna or steer the nulls! The termination only optimizes the front-to-back at the frequency you are listening. The setting will not change unless there is a change in the antenna itself or in the ground (e.g. from very wet to dry soil). Moderate changes in frequency (less than 1 MHz) will rarely require a change in the termination resistance. Since the antenna characteristics depend on the ground conditions, the better the ground, the more consistent the termination will be. In a poor or dry ground area, installing a few radials out from the ground rod can help to minimize ground effect changes and improve the performance. At a minimum, we suggest putting at least one set of radials directly under the loop wires.

2) As an option, you may disconnect the coax ground from the antenna ground system to prevent common mode currents from flowing on the coax shield. If the ground system is good, this is usually not a problem. For those who choose to do so, there is a simple procedure to modify the Relay Box to accommodate the change. Remember that the ground in the control cable back to the control box can also pick up noise and direct it into the control box. So in some cases, this modification could cause a decrease in performance.

The procedure is as follows.

- a. Open the Relay Box. Cut or remove the short connecting wire between the SO-239 solder lug and the ground screw solder lug.
- b. Using a sharp knife or Dremel tool, cut the trace marked “CUT” at the end of the balun between pads PD6 and PD7. Connect a wire from PD6 to the terminal lug on the ground of the SO-239 connector. This will be the only connection to the SO-239 solder lug.

3) Most K9AY Loop users (80% or more) will find that they only need two switch settings - one for 80M, and one that covers 160M and all lower frequencies. To find the best termination setting for your installation, we recommend starting with position #6 for 160M and the AM Broadcast Band, and #5 for 80M.

When you first install your K9AY Loop system, we recommend that you spend plenty of time listening to gain an understanding about how the antenna works and what termination settings work best for your loop and your local ground conditions. Good sources of test signals are WWV at 2.5 MHz and, of course, ham radio signals in the 80 and 160 meter bands. AM radio stations high in the broadcast band (with the preamp off), are also good, but remember that local stations may not show as much front-to-back as distant stations—this is because the null of the K9AY Loop is greatest for skywave signals.

Do your testing at night when the low bands are open to see the greatest performance.

Enjoy your K9AY Loops!