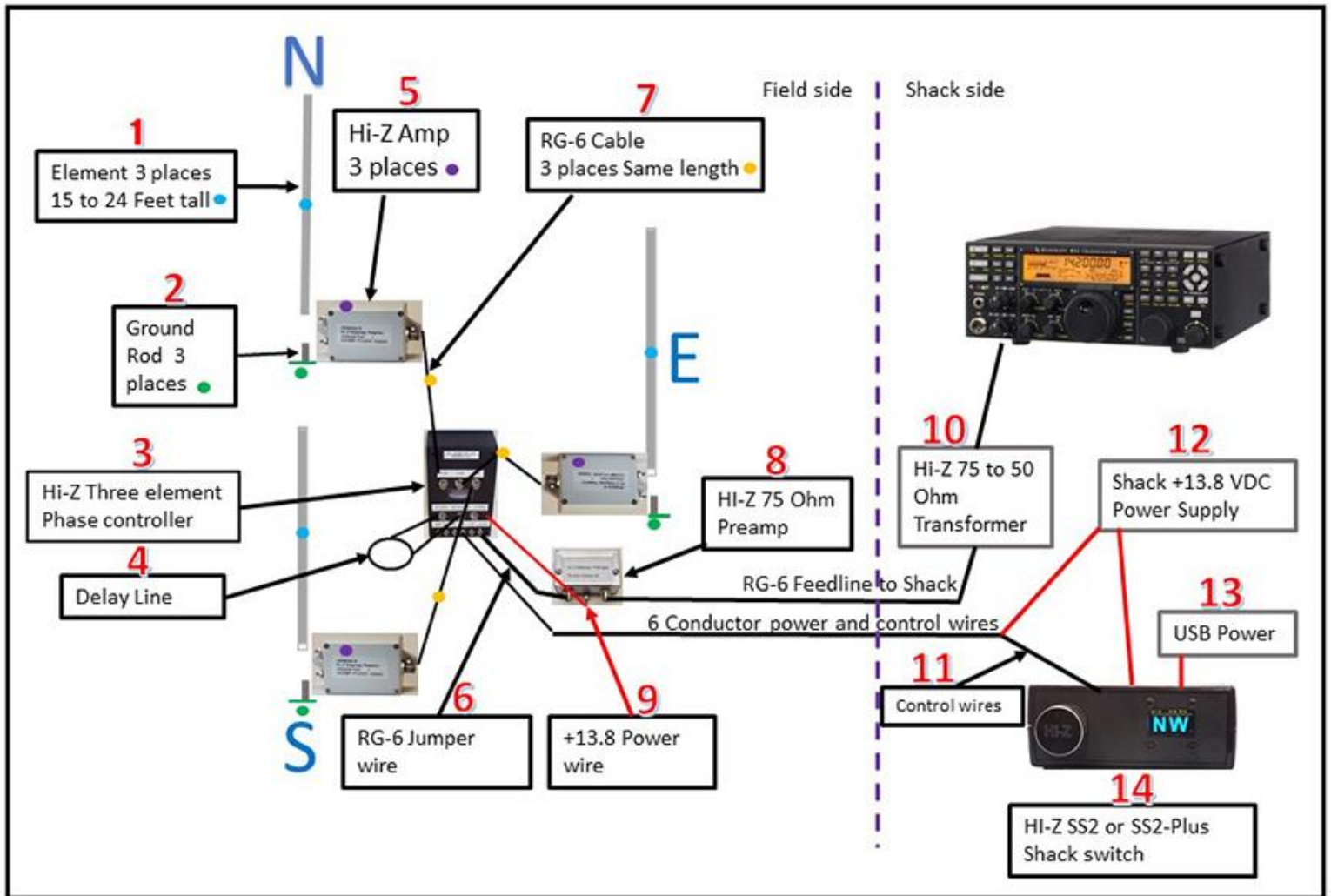




High Performance Low Band Receiving Array Systems And Components for 160 meters thru 30 meters

Hi-Z Three Element V2 Triangular Array Purchasing and Assembly

R5



Hi-Z 3 Element Receiving System V2 Block Diagram

The Red numbers (1 thru 14 above) in the block diagram refer to the following same numbered paragraphs below.



The Hi-Z 3A 3 element array looking toward a little South of due East

Normally these elements should be straight up and down however this picture was taken shortly after a heavy burst of wind. The 3A phase controller is in the plastic box near the middle of the element layout. These element mounts are the same ones used at K7TJR since 2002. These are 19 feet 9 inches tall. There are many ways to construct or simply purchase elements as you will see in the following pages.

Hi-Z 3 element **Kit** Combinations at DX Engineering with **Dark Red** SKU's

HIZ-3A-V2-SS2 Kit order SKU, contents below, Individual part DX Engineering SKU's in **Light Blue**

Includes **HIZ-AMP-V2** (QTY 3ea) Item **5** shown above and described below

Includes **HIZ-SS2** item **14** shown above and described below

Includes **HIZ-PC-3A** item **3** shown above and described below

Includes **HIZ-DL-3A** item **4** shown above and described below

Includes **HIZ-TRANSFORMER** item **10** shown above and described below

HIZ-3A-V2-SS2P Kit order SKU, contents below

Includes **HIZ-AMP-V2** (QTY 3ea) Item **5** shown above and described below

Includes **HIZ-SS2-PLUS** (with USB) item **14** shown above and described below

Includes **HIZ-PC-3A** item **3** shown above and described below

Includes **HIZ-DL-3A** item **4** shown above and described below

Includes **HIZ-TRANSFORMER** item **10** shown above and described below

HIZ-3A-V2P-SS2 Kit order SKU, contents below

Includes HIZ-AMP-PLUS-V2 (QTY3 ea. Plus version) item 5 shown above and described below

Includes HIZ-SS2 item 14 shown above and described below

Includes HIZ-PC-3A item 3 shown above and described below

Includes HIZ-DL3A item 4 shown above and described below

Includes HIZ-TRANSFORMER item 10 shown above and described below

HIZ-3A-V2P-SS2P Kit order SKU, contents below

Includes HIZ-AMP-PLUS-V2 (QTY3 ea. Plus version) item 5 shown above and described below

Includes HIZ-SS2-PLUS (with USB) item 14 shown above and described below

Includes HIZ-PC-3A item 3 shown above and described below

Includes HIZ-DL-3A item 4 shown above and described below

Includes HIZ-TRANSFORMER item 10 shown above and described below

1... The Elements and their mounting arrangements. Customer supplied or purchased separately.

The elements themselves can be constructed in a variety of ways or bought as a complete element. First a few words about these arrays. You can use element lengths for these 3 element arrays in any length from 15 feet to 24 feet in length. These elements should be mounted normal at 6 inches above the ground level with 12 inches being absolute maximum. Any greater distance above ground and the ground wire length becomes part of the antenna and disrupts the receiving pattern.

The elements can be mounted on sloping ground to a point. The vertical elevation distance from one side of the array to the other should not exceed 1/3 the length of the element. When an array is operated with an elevation difference, the lowest signal arrival angles simply follow the slope of the ground when the difference is 1/3 the length of the element or less. This is not to say the array wont work with more uneven ground but only that it will not be correct.

The length of the element determines the level of the signal received and the accuracy of amplitude and phasing of the received signal. Therefore, all elements must be made and installed the same. The diameter of the element also affects the amplitude and phasing but not as seriously as the length. If the array is located in a very quiet location 15 feet in length

should suffice. Twenty to 24 feet is a much better choice for all areas. Going beyond 24 feet in length is not recommended as the signal pickup from broadcast AM stations can be strong enough to overload the electronics in the system. Using wire for the elements is possible and has been successfully done. Keeping wire elements in the 24-foot length area is highly recommended. Successful arrays have been constructed with long (16 feet) fishing poles with wire slightly wrapped around the pole so the wire is held in place.

All elements must be insulated from ground because of the very high impedances realized by the very small portion of a wavelength used with elements. Not only must they be high resistance but the insulating arrangement must not have a significantly high capacitance to ground. High capacitance to ground shunts desired signal away from the Hi-Z amplifier.

Layout guides and element construction information is available in [Appendix A](#) at the end of this document

2... The Ground Rods are Customer supplied or purchased separately.

The ground quality needed by the high impedance system is much less than the average transmit vertical antenna. The ground can be derived in several ways for the elements. The amount of grounding effort will depend some on the make-up of the soil around the element. If the soil is deep and farm type soil the ground needed is minimal. Some element mounting brackets can be made with a 3 foot section of water pipe or aluminum angle. Two feet of this pipe or angle stock should suffice for a ground in moist farm type soil.

In areas where the dirt is always dry, sandy, and appears non-conductive one or two regular power system ground rods can be driven into the soil and connected to the water pipe or angle stock. making the mount ground much better. Even a short 3 to 4 feet length of a ground rod will improve the system in dry areas.

In areas that are mostly rock or gravel soil the ground system in addition to the element mount can be improved with a few short radials. About 8 radials the length of the element itself can be arranged equally around the element. The need for these radials is generally noticed on the lower band of 160 meters. It manifests itself by better performance on 80 meters but not so great on 160. Adding these few radials to a very poor ground system will generally restore the array to excellent performance. You must arrange the radials the same around each element if possible. Straight out away from the ground post if possible.

Lowes, Home Depot, or your local electrical supply house will have ground rods that will work for these purposes. They can easily be cut to a user's desired length. The wires to connect the Ground rod to the Hi-Z amp and from the ground rod to the Hi-Z amp are also customer supplied.

3... The Hi-Z 3 element-V2 phase controller is included in all four of the different KITS

The three-element phase controller is an all new design for enhanced performance.

This controller comes with its own manual which is chock full of different ways to get the performance each customer desires. The three-element controller comes with a standard segmented delay cable allowing users to tailor the system to their desires. Or one can simply use the suggested Hi-Z configuration.

Part Number. [HIZ-PC-3A](#)

4... The Hi-Z 3 element phase controller Delay Cable is included in all four of the different KITS

Part Number. [HIZ-DL-3A](#)

The Delay Cable that comes with the Hi-Z 3 element phase controller is segmented so the user can vary the parameters of the array to suit individual needs. The cable is based on a longer cable that produces an 18 Degree phase delay which is usable for some configurations of the array. These delays are at 1.840 MHz which is the HI-Z standard frequency for measurement. There are 3 more lengths of cable that add 2 degrees each and when all 3 more are added to the 18 degree cable the total delay available is 24 degrees. Any user can get a very wide range of array performance with these values. In addition using the lengths provided to scale additional customer supplied cables allows even more flexibility.

[Details for the Delay Cables are on Appendix C in the HIZ-3A Manual](#)

5... The Hi-Z amplifiers V2 versions are included in two of the KITS and the V2P versions are in the other two KITS

The Hi-Z amplifiers are available in two versions. The lower cost HIZ-AMP-V2 and The HIZ-AMP-PLUS-V2. The Plus version has 6 dB more gain than the straight HIZ-AMP-V2. Each Amp comes with its own manual with pertinent data.

The regular AMP has slightly higher IMD capability than the Plus version. The PLUS version would not normally be needed with the three-element array unless the user is in a very quiet location or likes to have the array signal level on par with a TX antenna level. These new amplifiers are in a new smaller size water resistant enclosure. These amplifiers are sealed except for the RG-6 connector. They also are suggested to be mounted with the RG-6 connector pointed down away from rain or moisture. Or ideally could have some simple rain cover added by the customer. These amps breathe through the RG-6 connector so use silicon grease or "STUF" in each cable connection. [The part numbers are HIZ-AMP-V2 and HIZ-AMP-PLUS-V2](#)

6... The RG-6 jumper cable is Customer Supplied and is used if the 75 Ohm preamplifier is also used with the array.

The RG-6 Jumper cable is just that. A cable to place the Hi-Z 75 Ohm V2 Preamp at any convenient customer location near the phase controller. This cable is not needed if the Preamp is not used. [P/N HIZ-PREAMP-75-V2](#)

7... The RG-6 Element interconnecting Cables are Customer Supplied.

The three each element to phase controller cables are customer supplied . They all should be made from the same roll of cable and each one must be the same length. The length is not critical and can be any length as needed but all the same length. Do not cut yourself short with these, add an extra two feet or more at least so the cable can go over bumps and other turns as needed. You may want to extend the array to the larger footprint later so make them extra-long. It does not matter that there is excess cable for these as long as they are all the same length and from the same roll of cable.

Always use quality RG-6 compression type connectors such as Thomas & Betts Snap and Seal with these arrays. It will pay off in the long run. Also use silicon grease or "STUF" in all coax cable connections which will also pay off in the long run.

8... The HIZ-PREAMP-75-V2 is a brand new universal 75 Ohm Preamp available through DX Engineering. This is an optional item.

The 75 Ohm Preamp is a 17 dB signal booster that is very useful during very quiet times like early in the AM and days when band noise is very low. This preamp is switchable as its power can be removed which will cause its internal relay to self-bypass the amp. This amp is also quite useful when the array is used for listening to the higher bands like 20, 15, and 10 meters.

The part number is [HIZ-PREAMP-75-V2](#)

9... The +13.8 VDC Power wire is Customer Supplied to jumper power from the Phase Controller to the 75-ohm Preamp.

The simplest way to power the Preamp is to use a wire jumper from the preamp +13.8 power terminal connected to the +13.8 terminal on the Phase Controller. The Phase controller receives its power from the shack on a power wire. The preamp power can also be supplied separately by a remote controlled relay or switch allowing customer Preamp control. Please use soldered wire terminals for excellent connections.

10... The Hi-Z 75 to 50 ohm transformer is included in all four different packaged kits.

The entire array is based on using 75 Ohm cable so cost can be kept to a minimum. It is then necessary to convert the array signal from 75 ohms to the 50 ohms as used by most transceiver manufacturers. The array needs to have the 50 ohm receivers converted to the 75 ohm feedline cable so that the Triangular Controller is properly terminated and can properly phase the incoming signals.

The part number for this transformer is [HIZ-TRANSFORMER](#)

11... The array control wires are customer supplied.

There are four wires necessary to control the 6 directions available with this array. The control truth table is available in the 3A controller manual. These wires only carry around 20 ma. each when switched so the wire size can be something like Cat 5 or 6 stripped cable doubled up. The power that is sent to the array needs a larger cable because the Hi-Z amps are 40 ma each and the relays are say 30 ma max. Also if the Preamp is used there is 50 ma more. This makes the array power draw close to 200 ma total. So, the power wire must be sized to keep the array voltage at the Phase controller between 11 and 14 VDC. Keeping the array at 13.8 VDC by increasing the supply voltage at the Shack will also assist in keeping the array voltage up. Best IMD performance will be realized at or near +13.8 VDC. Using Power wire resistance and total current draw you can estimate the wire size needed for any extended run length to a distant located array.

12... The Shack +13.8 VDC power supply is customer supplied.

The shack power supply for the array can be any well filtered supply. If it becomes necessary to increase the voltage at the shack end to keep the array voltage up then a separate supply should be used for the +13.8 VDC for the SS2 or SS2-Plus directional controller. This SS2 or SS2-Plus connection should not be over voltaged. Do not use a +13.8 VDC switching supply for this array unless it is well known to be very RF quiet.

13... The USB power connection on the SS2 or SS2-Plus is customer supplied...

This power connection can be any computer USB connection or even a wall connected USB power source. It is used to run all the digital internals on the SS2's. This USB supply connection is optically isolated from the +13.8 VDC and control line connections at the SS2's Terminal strip.

14... The Hi-Z SS2 is included in two of the packaged KITS and the SS2-Plus is included in another two of the packaged KITS.

The SS2's are the very new digital controllers for use with any Hi-Z array. They feature many different modes which adds to the available control operations of the array. The SS2's each have their own manual which describes their operation in detail. Both the SS2 and the SS2-PLUS require a USB supply in addition to a +13.8 VDC power that shares a ground connection with the array power supply.

The part numbers are: [HIZ-SS2](#) and [HIZ-SS2-PLUS](#)

Appendix A Provided with the 3A manual

Appendix A Information here describes the operation of and shows various construction methods for Hi-Z elements. They can be constructed by the user or they can be purchased at DX Engineering ready to use. <https://www.dxengineering.com/parts/dxe-al24>

The AL24 customer will need to supply a ground pipe to mount this element slightly above ground.

Appendix B Provided with the 3A manual

Appendix B Is the guide needed to do a physical layout for triangular placement of the Antenna Elements.

Appendix C Provided with the 3A manual

Appendix C is a picture guide showing the 3A Delay cable system and its ability to have sections connected together to provide the desired delay value.