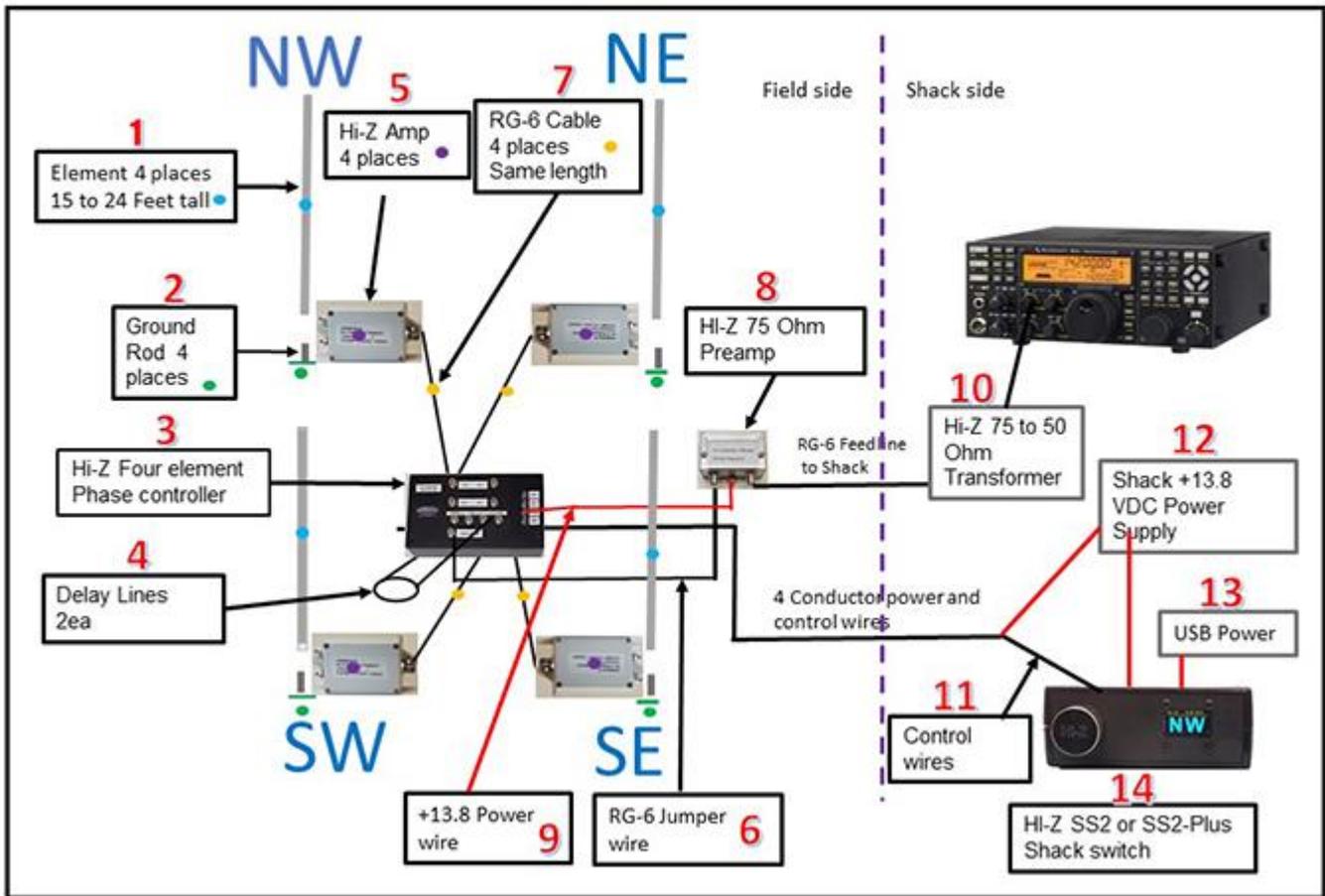




## High Performance Low Band Receiving Array Systems And Components for 160 meters thru 40 meters

### Hi-Z Four Element V2 4-Square Array Purchasing and Assembly

R3



Hi-Z 4 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 4A 4 element array looking toward due West

The 4A phase controller has since been placed in a 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 4 element **Kit** Combinations at DX Engineering with **Dark Red** SKU's

**HIZ-4A-V2-SS2** Kit order SKU, contents below, Individual part DX Engineering SKU's in **Light Blue**

Includes **HIZ-AMP-V2** (QTY 4ea) Item **5** shown above and described below

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

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

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

**HIZ-4A-V2-SS2P** Kit order SKU, contents below

Includes **HIZ-AMP-V2** (QTY 4ea) Item **5** shown above and described below

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

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

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

**HIZ-4A-V2P-SS2** Kit order SKU, contents below

Includes [HIZ-AMP-PLUS-V2](#) (QTY4 ea. Plus version) item 5 shown above and described below

Includes [HIZ-SS2](#) item 14 shown above and described below

Includes [HIZ-PC-4A](#) item 3 shown above and described below

Includes [HIZ-TRANSFORMER](#) item 10 shown above and described below

**HIZ-4A-V2P-SS2P** Kit order SKU, contents below

Includes [HIZ-AMP-PLUS-V2](#) (QTY4 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-4A](#) item 3 shown above and described below

Includes [HIZ-TRANSFORMER](#) item 10 shown above and described below

**HIZ-DL-4-60-85** Purchased separately

**HIZ-DL-4-80-113** Purchased separately

## 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 4 element arrays in any length from 15 feet to 24 feet in length. These elements should normally be mounted at 6 inches or less 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. [Elements are available at DX Engineering Part Number DXE-AL24](#)

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 mu

st 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. [Ground rods are available at DX Engineering in various lengths.](#)

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 4 element-V2 phase controller is included in all four of the different KITS

The four-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 four-element controller uses one of 2 standard 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-4A](#)

### 4... The Hi-Z 4 element phase controller Delay Cables are purchased separately with two options

**HIZ-DL-4-60-85** Purchased separately for 60 foot per side arrays.

**HIZ-DL-4-80-113** Purchased separately for 80 foot per side arrays.

Part Number. [HIZ-DL-4-60-85](#)

Part Number. [HIZ-DL-4-80-113](#)

The Delay Cables that are required with the Hi-Z 4 element phase controller have information in Appendix C of the manual for custom modification. This allows the user to vary the parameters of the array to suit individual needs. These cable delays are at 1.840 MHz which is the HI-Z standard frequency for measurement. There are two cables for the 60 foot array with one long cable at 60 degrees delay and one short cable with 30 degrees delay. There are also 2 cables for the 80 foot array with one long delay cable at 80 degrees delay and one short cable at 40 degrees delay

Details for the Delay Cables are on [Appendix C of the HIZ-4A 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 pairs very nicely with the 4-element array. 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 optional 75 Ohm preamplifier is also used with the array.**

The RG-6 Jumper cable is just that. A cable to place the optional 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.

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

The four 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.

### **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 four element 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 two wires necessary to control the 4 directions available with this array. Two other wires are used for power and ground. The control truth table is available in the 4A controller manual. These wires only carry around 300 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 to 50 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 300 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 performance 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. It supplies the field located array and is connected to the optically isolated +13.8 VDC enabling switching. 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 applied at the SS2 or SS2-Plus terminal switching connections. This +13.8 VDC terminal 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.

**The model SS2 uses a USB A to Mini USB B cable connection.**

**The model SS2Plus uses a USB A to Micro B cable connection.**

This carries USB signals to the direction control software like PstRotator Az. This software is available at

[https://www.gsl.net/yo3dmu/index\\_Page346.htm](https://www.gsl.net/yo3dmu/index_Page346.htm) It is very stable and works very well with the SS2-PLUS .

**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 4A 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 4A manual.

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

**Appendix C** Provided with the 4A manual.

Appendix C is a guide showing the 4A Delay cable system. This guide should help any customer deciding to experiment with different array delay values.

**Appendix D** Provided with the 4A manual.

Appendix D is a large picture of the PC4A circuit board showing where to move the supplied header pin jumpers for selection of an 80 or 60 foot per side array. The PC4A is

supplied already set for our recommended 60 foot per side array. Customers with already in place systems spaced at 80 feet per side upgrading to the PC4A will need to move the internal header pin jumpers from the supplied 60 foot setting to the 80 foot setting.