



Expanded Troubleshooting Guide: Basics

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1 ---- Basics

Your SteppIR antenna uses adjustable length copper beryllium strips to set each element length to the correct length for the frequency it is on.

Only the copper strips moves, the outer fiberglass shell stays fixed.

The control system for the SteppIR Element is open loop meaning the controller assumes the element is connected and working properly. We did this for two reasons, High power can damage sensors in the antenna. We were concerned sensors in the elements would reduce the overall reliability and increase the complexity when building the antenna.

Trouble shooting the SteppIR can be difficult if you are not methodical about how you do it.

The antenna may get out of calibration if power is removed while the elements are extended, Always home elements before removing power from the controller.

2 ---- UV effects on SteppIR poles

The SteppIR will last many years with the paint that is currently on the poles, it is the best material currently available. But if you want to keep the poles looking new longer we would suggest spraying them with a UV protective coating like <http://www.krylon.com/products/fusion-for-plastic-clear/>.

You can also paint the poles and elements with any high quality automotive paint that is non-metallic. In our experience polyurethane is the best.

3 ---- Using Create modify to trouble shoot

Create modify can be a good tool to determine if the elements are working correctly. There are 2 possible problems you can test for, is the element tuning or is the element out of calibration.



Basics (continued)

In the case of out of calibration which may occur when the element stalls on the way out you can find which element is out of calibration by:

First setting the antenna to 20m then entering create modify mode.

Record the element lengths that are displayed.

Record the current SWR on the 20m band. Use a high=quality SWR meter or antenna analyzer.

Now one at a time set the element to the minimum length then wait for tuning to stop. Now set it back to the original length and wait for tuning to stop. Check the SWR to see if it changed (very small changes like .01 or .02 are normal).

You can also use create modify mode to determine if the motors in the elements are working.

First pick a band like 20m and use Create Modify to record the element lengths.

Next home the elements.

The radio should be quiet on receive.

Use create modify to extend the driven element, the receive noise should come up as you reach the recorded length.

Check the SWR it should be somewhere between 2 and 4:1.

Next as you extend the Reflector the SWR should start to drop as its gets close to the driver length then the SWR should go quite high when both elements are the same length. Set the reflector back to the minimum length.

Next as you extend the Director the SWR should start to drop as it gets close to the driver length then the SWR should go quite high when both elements are the same length. Set the director back to its normal length.

If the antenna has a director 2 repeat the above test for this element. Watch the SWR closely, because it is not going to change much, the SWR should move when the element is close to its original length.

When done just exit without saving (no flashing) and the controller will restore the original lengths.

4 ---- Using 180 mode to test antenna health.

Using the 180 mode can be a good way to assess the SteppIR's health. The reasons for this first is that we designed the antenna to have close to the same SWR in the forward direction as the 180 direction and with most of our antenna designs the Director has more effect on the SWR than the Reflector.

Generally we can say that if there is a big difference in SWR between Normal and 180 modes then there is a problem with the antenna.

Usually if the SWR is better in the Normal mode than the 180 mode the reflector will be the source of the trouble.

And the opposite is true if it is better in the 180 mode.

On the 4 element is hard to tell if DIR 2 is working using this method since it only has a small effect on the SWR.

5 ---- Element names in create modify

The element names in the controller and documentation follow the named element position on the boom and



Basics (continued)

not their function in the mode the controller is set to (normal, 180, Bi-Dir). The Dipole and Vertical use the Driver (DVR), the 2 element use the Driver and Director 1 (DIR) the 3 and 4 element should be obvious. When the controller is in the 180 Mode the Reflector is being used as a Director and vice versa so when you look at the lengths you will see that the REF is the shortest and the DIR is the longest. In Bi-Dir mod there really is no such thing as a Director or Reflector they are just acting like passive element. Unfortunately we did not hide the unused elements for the different antennas. The unused elements will have lengths in them, usually close to the other element lengths but they will have no effect on your antenna.

6 ---- Calibrating the antenna

Since the Antenna control system operates open loop the antenna can get out of calibration if power is lost to the controller or if the control cable is unplugged or has an intermittent connection.

There is only one calibration, you do not need to calibrate each band, and we usually recommend that it be done from some band in the 20m through 6 m range. Calibration can even be done from the home position. You should calibrate the antenna if:

Power is lost to the SteppIR controller and the elements were not home or you were not sure where they were.

If you have work done on the SteppIR controller.

If you have worked on your antenna or control cable and did not home elements first.

If the SWR seems unusually high.

7 ---- The effects of water, rain, on the antenna

Rain can shift the frequency of the SteppIR sometimes shifting it a couple hundred KHz, this is caused by the increase in dielectric loading of the elements and objects around the antenna.

It should also be noted that near field objects like metal roofs and big leaf trees can cause problems in heavy rain.

If your SteppIR shifts more than a 200 KHz in the rain it most likely is something near the antenna effecting the SWR or other problems in the system.

You can use the global frequency offset to correct for the frequency shift or just manually adjust the frequency higher.

If problems persist after the rain has stopped make sure there is nothing that might be causing water to get into the element tubes like tree branches pushing the tubes up in the air.

Also keep in mind that bad or exposed coax connections can also cause the SWR to climb when it rains.

8 ---- Stacking antennas

There are no hard and fast rules about stacking multi-band antennas as far as height goes, it will depend on what you want to get out of the stack.

Just about any two antennas can be stacked and you will get some stack gain but for the best results there are



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some basic guidelines:

Both antennas should have similar gain on the band of interest.

Both driven elements should be over the top of each other, at least as close as practical.

The phase of the driven element must be the same, center conductor to the same side of the element.

With SteppIRs both antennas must be in the same mode, Normal, 180, Bi-Dir.

The antennas must face the same direction, at least no more than +/- 45 degrees from each other.

One of the biggest advantages of stacking is diversity, having more than one signal path.

9 ---- 3 element lengths with 6 m passive.

With the SDA100 it is possible to wipe out the default 6 m Passive element lengths

This is what should be at 50.1 MHz in create modify mode with a 6 m passive element.

REF= 115.4

DVR= 107.9

DIR1= 103.1

10 ---- 6 m problems

6 m is a common band to have trouble with any of our antennas. 6 m uses the same elements as all bands so if the antenna is working on other bands it should work on 6 m, in other words if the antenna quits working just on 6 m it most likely is not the antenna causing the problem.

With most of our antennas it is not possible to get less than 2:1 SWR on 6 m without the optional 6 m passive element Kit.

If you have the 6 m passive element kit the SteppIR controller must have the 6 m Option selected (YES) in the options menu.

The Passive element kit is designed to operate 50 to 50.5 MHz only, outside this range the Passive element(s) have no effect.

If the SWR is a little off on 6 m, this is normal, you should be able to adjust the DVR using create modify to compensate.

Since 6 m (50 MHz) is so far above 10 m it can have many problems that you would not experience on other bands.

A coax that works well up to 10 m may not be adequate on 6 m

Many HF Filters cut off after 10 m effectively filtering out 6 m

Many radios use a different coax connector for 6 m than the lower bands.

Vertical whips mounted on the top of the tower will often interfere with 6 m.

Unbonded tower sections, guy wires, unused wire antennas, linear amps, coax switches have in our experience all at one time or another caused 6 m to have poor performance.

In conclusion if you are having trouble on 6 m make sure everything in the system is up to operating on this band.



Basics (continued)

11---- Typical SWR

The SteppIR has very good SWR (less than 1.4:1 typical) in the normal and 180 modes 20M through 10 m.

If the SWR suddenly changes first try calibrating the antenna from the 10 m band.

If the SWR is greater than 4:1 there is most likely a problem in the feed system or the Driven element

If the SWR is still high try both normal and 180 modes, is it higher in one direction?

If SWR is the same in both directions you have a problem with the antenna feed system or the Driven element.

If high in the Normal mode test the Director

If high in the 180 mode check the Reflector

12 ---- Measuring control voltages

You can check the voltages on the SteppIR control cable but it is important to note than one slip of a probe and a driver chip can be damaged

The most important voltage to test is when the motor is running. Each pin should have 24vac on it with respect to ground when the motor is running. Depending on your meter this can be anywhere from 10 to 28 Vac since the wave form is not true RMS.

Please refer to your manual to figure out what pins on the 25 pin connector go to the motors but here is the basics, each element has 4 wires (2 for each winding) the wires starting from pin 1 go to the Driven, Director1, Reflector, skips pin 13 (GND), Director 2 and last Director 3.

There is also a holding voltage that is always present when the power supply is connected. Make sure you unplug the controller before working on the control cable, it is easy do damage a driver chip if you do not.

This voltage must be measured between pin pairs for each winding (1-2, 3-4...). Depending on controller and driver this voltage could be between 1.5 and 3.8 volts.

13 ---- Unstable SWR, not the same each time returned to the same band.

Generally you should be able to tune from one band to another and back and have the SWR be the same, at least very close to the same. There will be slight changes in SWR around 0.1:1 or less do to how the tape lays in the element tubes.

Random changes in SWR could be objects near the antenna, the Wind blowing the antenna around and weather (Rain, Snow and Ice).

If the SWR get progressively worse until the antenna needs to be calibrated or until elements are retracted then there is an element problem of some sort or power is being removed from the antenna with the elements extended.

Flickering SWR could be loose coax connections or bad switches in the feed system.



Basics (continued)

14 ---- Tuning noise from SteppIR controller

The SteppIR controller uses current mode drives to run the element motors. These drivers can make RF noise if the ground system does not have a good RF path to ground.

When operating stations that are a long ways from ground it can be difficult to have a good RF ground so care must be taken to make sure that all shields have a good path back to the noise source.

With the SteppIR controller it is important that the control cable shield is connected to the 25 pin connector shell and that the internal components connecting the shield to DC ground are in good order. You can measure to make sure there is 47 ohms between the controller chassis and the DC ground system.

Connecting the control cable shield to ground in more than one location can cause RF noise but on the other hand it can help dissipate ESD so if you have more than one connection to the shield you may need to remove them to see if they are part of the problem.

Also cable routing can have a large effect of RFI, as a rule control cables, power cables and coaxes should be kept separate.

15 ---- RFI, noise on neighbors' radio or TV

Radio interference in TV and radio equipment is not a new problem. There are so many different types now of varying quality it is impossible to keep track of it all.

The first line of defense is to have all of your equipment grounded, with a RF ground system.

Make sure all your cabling is kept clear of the Coax and linear.

Keep the covers secured on your equipment.

Use baluns or good quality chokes on the coax to keep RF at the antenna end.

Keep your SWR as low as possible.

And get your antenna as high as possible.

But still if you are beaming directly towards your neighbor's house or you have a ground mount vertical there may be not much you can do from your end.

It may come down to fixing the problem with the neighbors' equipment. Any broad band radio receiver will be overloaded by a close high power transmitter.

16 ---- Desense or low receive signals

We must point out that this is not a uniquely SteppIR problem in fact it is quite common. This can make it difficult to find to source sense any connection or switch in the feed system can cause the problem.

This problem is where the receive signal is almost nonexistent and transmitting with a small amount of power causes the problem to clear.

It is usually a bad connection somewhere in the feed system this includes the antenna itself.

The most common reason is a bad connection at a PL259.

It is always best to check the easy stuff first by testing as many connections as possible first to make sure the problem is not on the ground.



Basics (continued)

Since the SteppIR Balun/ UnUn looks like a short across the coax a easy test is to measure for a short from the center conductor to the shield of the feed line. If it is less than 4 ohms when the desense problem is present then the connections should be OK.

Next thing to try would be to tune the SteppIR to several different bands to see if the problem can be cleared. If the coax resistance is good and the problem clears by tuning the Antenna there could be a problem with the Driven element.

If the problem can only be cleared by transmitting the problem could be somewhere else in the system and an effort to connect a different radio directly to the SteppIR should be made before assuming the antenna is faulty.

17. Crackle noise while tuning.

We have not proven the reason for this problem but our best informed guess is that it is caused by the antenna rectifying RF signals from nearby transmission sources.

The problem only occurs while the antenna is tuning and most who have reported it have nearby radio transmitters.

It seems to be seasonal so ground conditions have some effect.

It may be possible to effect the severity by bonding the tower ground and boom.

Unproven but treating the conductor with something like silicone or a electrical copper treatment may also help.
