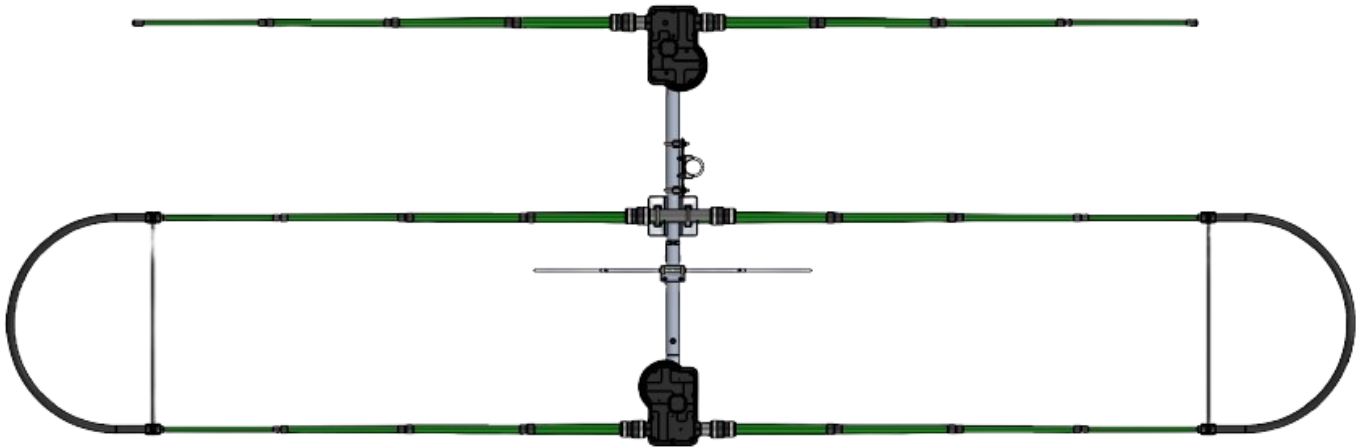
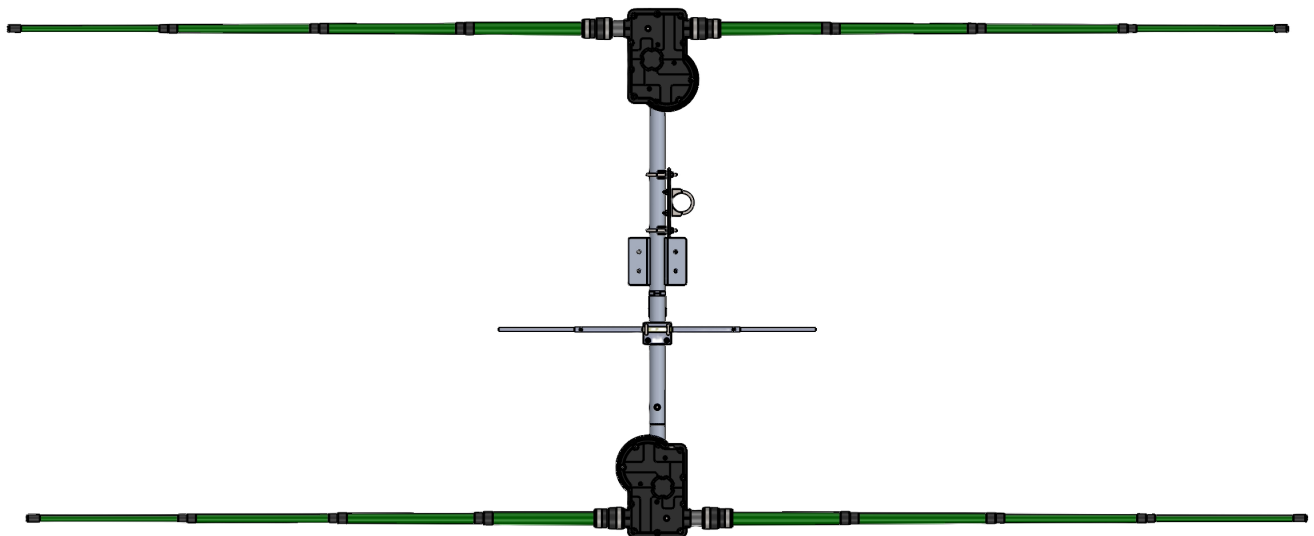


2 Element Yagi Instruction Manual



*2 Element Yagi with 40/30m Dipole
(not to scale)*



*2 Element Yagi 20-6m
(not to scale)*

ANTENNA SPECIFICATIONS

| Specification | 2 Element Yagi | 2 Element Yagi + 40/30 Loop |
|------------------------------|-----------------------------|-----------------------------|
| Boom length | 60" (61.5" overall length) | 60" (61.5" overall length) |
| Boom outside diameter | 1-3/4" | 1-3/4" |
| Longest element | 36 ft | 39 ft |
| Turning radius | 18.94 ft | 20.4 ft |
| Weight | 30 lb | 37 lb |
| Projected Area* | 7.27 sq ft / 0.66 sq m | 10 sq ft / 1.01 sq m |
| Wind rating | 100 mph | 100 mph |
| Adjustable elements | 2 | 2 |
| Power rating | 3 kW continuous | 3 kW continuous |
| Feed points | 1 | 1 |
| Frequency coverage | 13.85 MHz - 54 MHz | 6.95 MHz - 54 MHz |
| Tuning rate | 1.3 ft/s | 1.3 ft/s |
| Control cable | 12 conductor 22awg shielded | 12 conductor 22awg shielded |

| Frequency | 2E Gain dBi | 2E Front to rear dB | 40/30 loop gain dBi | 40/30 loop front to rear dB |
|----------------------|-------------|---------------------|---------------------|-----------------------------|
| 40m | N/A | N/A | 1.8 | N/A |
| 30m | N/A | N/A | 2.1 | N/A |
| 20m | 6.6 | 21 | N/A | N/A |
| 17m | 6.6 | 16 | N/A | N/A |
| 15m | 6.5 | 13 | N/A | N/A |
| 12m | 6.4 | 11 | N/A | N/A |
| 10m | 6.2 | 9 | N/A | N/A |
| 6m | 5.0 | 2 | N/A | N/A |
| 6m w/ passive | 8.3 | 20 | N/A | N/A |

*Projected area is the total perpendicular surface area measured in square feet/square meters, that is exposed to wind. To calculate wind load you always take the largest projected area whether that is from the perspective perpendicular to the boom or perpendicular to the elements. In the case of SteppIR Yagi's, the maximum projected area will always be the sum of the surface area's perpendicular to the Yagi elements. This calculation is a constant number and will not change regardless of EIA specification changes. Do not mistake this projected area calculation as anything more than a datapoint to present to your structural engineer, tower manufacturer or rotator manufacturer so that they can determine what is necessary for your application.

When sizing an antenna to a tower, many factors need to be taken into consideration including, but not limited to: projected area of antenna in square feet or square meters, weight of the antenna and other items on tower, turning radius, element lengths, antenna height, location exposure category, locations three-second gust wind-speed, locations maximum radial ice loading.

Improper specification of an antenna or rotator to a tower can result in product failure, injury or death. SteppIR is not an expert on tower or rotator sizing and for this reason will never offer any recommendation – this specification process is meant for industry professionals such as a structural engineer, tower manufacturer or rotator manufacturer. Please do not attempt to self-specify our products – the information provided by SteppIR is to be utilized by industry professionals only and we will not accept any liability for improperly specified antenna/tower/rotator applications.

TABLE OF CONTENTS

| | |
|---|-------|
| SteppIR - Why Compromise? | 4 |
| Preamble by Jim Streible | 5-6 |
| SteppIR Design | 7 |
| Abbreviations | 8 |
| Parts Checklist | 9-12 |
| Stainless Steel Fastener Information | 13 |
| Antenna Direction Configuration | 14 |
| Antenna Overview and Diagram | 15 |
| Section 1: 2 Element Yagi Boom Assembly | 16 |
| Section 2: Connecting the Mast Plate and Return Tube to the Boom | 17-21 |
| Section 3: Control Cable, Connector Junction Box, and EHU Wiring | 22-27 |
| Section 4: EHU Wiring Tests | 28-29 |
| Section 5: Attaching the EHUs to the Element Brackets | 30-31 |
| Section 6: Telescoping Poles, Sweeps, and Foam Plug Assemblies | 32-37 |
| Section 7: CPVC Guide Tubes and Diverter Cones, Attaching Fiberglass Poles, and Trusses | 38-45 |
| Section 8: 6 Meter Passive Element (Included) | 46 |
| PTT Lockout Tuning Relay (Included) | 47 |
| Voltage/Surge Suppressor (Optional) | 48 |
| Grounding the Controller | 49 |
| How to Tune Your Yagi (Mandatory) | 50-52 |
| SteppIR Options | 53 |
| Product Warranty Claim | 54 |

STEPPIR — WHY COMPROMISE?

The SteppIR antenna was originally conceived to solve the problem of covering the six ham bands (20m, 17m, 15m, 12m, 10m and 6m) on one tower without the performance sacrifices caused by interaction between all of the required antennas.

Yagi's are available that cover 20 meters through 10 meters by using interlaced elements or traps, but do so at the expense of significant performance reduction in gain and front to back ratios. With the addition of the WARC bands on 17m and 12m, the use of interlaced elements and traps has clearly been an exercise in diminishing returns.

Obviously, an antenna that is precisely adjustable in length while in the air would solve the frequency problem, and in addition would have vastly improved performance over existing fixed length yagi's. The ability to tune the antenna to a specific frequency, without regard for bandwidth, results in excellent gain and front to back at every frequency.

The SteppIR design was made possible by the convergence of determination and high tech materials. The availability of new lightweight glass fiber composites, Teflon blended thermoplastics, high conductivity copper-beryllium and extremely reliable stepper motors has allowed the SteppIR to be a commercially feasible product.

The current and future SteppIR products should produce the most potent single tower antenna systems ever seen in Amateur Radio! We thank you for using our SteppIR antenna for your ham radio endeavors.

Warm Regards,

John Mertel

*John Mertel - WA7IR
President/CEO*



PREAMBLE

OK - - - NOW WHAT?
(Sage advice from Jim Streible, K4DLI, SK)

You have ordered your SteppIR Antenna and are waiting for delivery. What do you do in the meantime?

1. Go to the SteppIR web site at www.consumer.steppir.com and download the latest manual for your antenna, and also the Operators Manual for the controller.
2. Read the manuals from cover-to-cover ---TWICE! Don't just read them --Study them, so you are familiar the terminology used about the antennas and have a good idea of how the antenna is assembled and where the various parts go.
3. As you go through the manuals make notes of any instructions you may not clearly understand, then call or email for clarifications. It is better to have it all sorted out before you start assembly. We don't mind answering your questions beforehand.
4. Now, wait for notification your antenna is being shipped.

Your antenna has arrived!
What is the first thing to do?

1. If the antenna is to arrive on Wednesday----DO NOT plan an antenna party for Saturday!
2. Even if you plan to install the antenna weeks later, the first thing to do is to unpack the antenna and do a complete inspection. Make sure nothing is missing or has been damaged in shipment.
3. Do a complete inventory of every part, nut and bolt. Yes it takes time, but it also allows you to notify SteppIR if anything is missing and allow time to get it to you before you start assembly of the antenna. There is nothing more frustrating than realizing that something is missing, just hours before you want to install the antenna.
4. Go back to the SteppIR website and download the latest manual. SteppIR constantly is improving and adding to the manual, so even though your version of the instruction manual is going to have all the data you need, it makes sense to check for the latest updates online. This is especially true if you purchased the antenna and a period of time has passed between arrival and install dates.
5. Take the controller and power supply out of their wrappings and connect them. The controller does not have to be connected to the antenna in order to familiarize yourself with it. In fact, it is best to get familiar with the controller when it is not connected to the antenna. Turn on the controller and read through the Operators Manual again while operating the controller in all its modes. Go through the menus so you know what each does and how to navigate through the various menus and functions.
6. When you are familiarizing yourself with the controller be sure to verify that the controller is set for your antenna type, or your antenna will not work properly on 40m and 30m, if it's capable. If you are installing the 6m passive element, be sure to enable that as well.

PREAMBLE

OK - - - NOW WHAT?

(Sage advice from Jim Streible, K4DLI, SK)

**Your Antenna Has Arrived!
What is the first thing to do?
(continued)**

7. When you have finished working with the controller be sure the display indicates “Elements Home” and the controller has been turned OFF. When the controller is connected to the antenna and the controller is turned back on the next time, it will think the antenna is in whatever position the controller was left in last time you were using it, so you want to be sure that position is HOME.
8. Once the antenna is completely assembled and ready to mount on the antenna tower, use an antenna analyzer, if you have one, to test resonance of the antenna. If you don't have an analyzer, try to borrow one or purchase one, they are inexpensive and readily available (The NanoVNA is a great example). It will save you a lot of time and worry. Check the antenna on each band for some sign of resonance within the frequency range. Leave the antenna on the default frequency and scan the ham band (you may need to open up the span to be outside of the band) with the analyzer to see where the dip occurs. It will be somewhere below the lower band edge on each band with the antenna 3 or 4 feet above the ground on sawhorses. Also, don't expect to see a 1:1 SWR here (on lower frequencies you may see up to a 2.5 or 3:1), just look for a good indication of resonance.

Once it has been determined this part of the antenna is working correctly do the following: Select the lowest band and establish the dip condition by tuning the analyzer. Do not touch the analyzer again. Retract the elements and then reselect the same band. The antenna should come back to very near the same setting. Do this 2 or 3 times on each band. Also, try going from the band being tested to any other band and back again and observe that the antenna comes back to the same resonant point. Now you know the antenna is tuning correctly from band to band and is consistent.

9. Once the antenna is installed on the tower, be sure to properly tune the antenna using an antenna analyzer as the manual outlines before applying any RF power. Every install height and environment is different and will affect the antenna's SWR and resonant point. You don't want to damage the antenna due to high power being applied with a large mismatch.
10. Enjoy the antenna!

73

Jim Streible—K4DLI

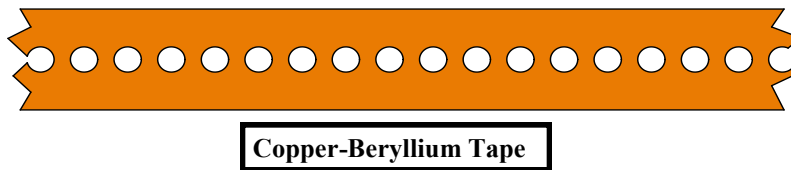
Jim passed away in early 2016, but his advice has enduring value.

STEPPIR DESIGN

Currently, most multi-band antennas use traps, log cells or interlaced elements as a means to cover several frequency bands. All of these methods have one thing in common—they significantly compromise performance. The SteppIR™ antenna system is our answer to the problem. Resonant antennas must be made a specific length to operate optimally on a given frequency.

So, instead of trying to “trick” the antenna into thinking it is a different length, or simply adding more elements that may destructively interact, why not just change the antenna length? Optimal performance is then possible on all frequencies with a lightweight, compact antenna. Also, since the SteppIR can control the element lengths, a long boom is not needed to achieve near optimum gain and front to back ratios on 20 - 10 meters.

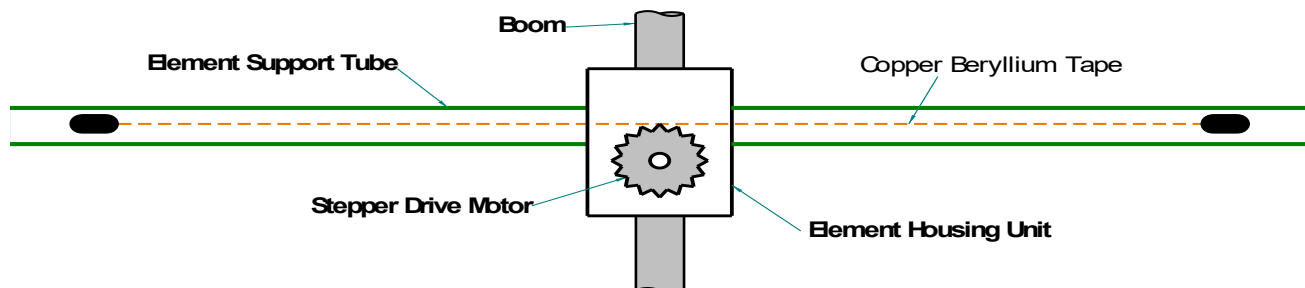
Each antenna element consists of two spools of flat copper-beryllium tape conductor (.54" Wide x .008" Thick) mounted in the element housing unit. The copper-beryllium tape is perforated to allow a stepper motor to drive them simultaneously with sprockets. Stepper motors are well known for their ability to index very accurately, thus giving very precise control of each element length. In addition, the motors are brushless and provide extremely long service life.



The copper-beryllium tape is driven out into a hollow fiberglass elements support tube (see below), forming an element of any desired length up to the limit of each specific antenna model (a vertical uses only one side). The fiberglass elements support tubes (poles) are telescoping, lightweight and very durable. When fully collapsed, each one measures approximately 59" in length. Depending on the model, there may be additional extensions added to increase the overall element length.

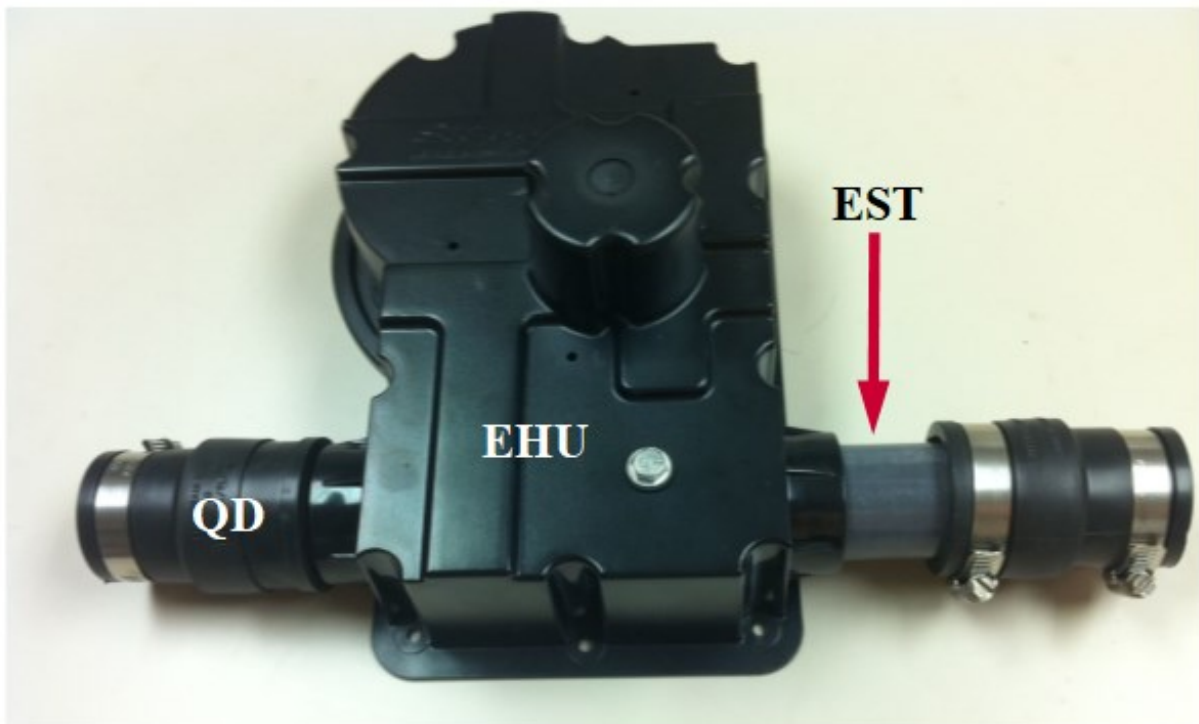
The ability to completely retract the copper-beryllium antenna elements, coupled with the collapsible fiberglass poles makes the entire system easy to disassemble and transport.

The antenna is connected to a microprocessor-based controller (via 22 gauge conductor cable) that offers numerous functions including dedicated buttons for each ham band, continuous frequency selection from 40m to 6m (depending on the model). There are also 17 ham and 6 non-ham band memories and you can select 180° direction reversal* or bi-directional* mode and it will adjust in just about 3 seconds (*Yagi only).



ABBREVIATIONS

| | |
|-----|--------------------------------|
| EST | Element Support Tube |
| EHU | Element Housing Unit |
| QD | Quick Disconnect Boot (rubber) |



PARTS CHECKLIST

It is important that you do an inventory of the items that were shipped to you. We do our very best to ensure that you receive everything needed for construction of your antenna, but better to be safe than sorry—inventory your parts well in advance of your installation. The items in **blue** represent hardware for the 40/30 loop—you will **not** need to check these off if your antenna does not include the 40/30 loop.

What Comes in the Antenna Box

| ✓ | QTY | PART # | DESCRIPTION |
|---|----------------|---|--|
| | 1 | 09-0001 | Electrical tape 3/4" PVC MERCO 307 |
| | 1 | 09-1025 | Conical Grinding Stone, 3/4" |
| | 4 OR 6 | 10-1013-02 | Telescoping Pole, 18 foot 4 section |
| | 1 | 10-1028-21 | TM-1 Thread Magic Anti-seize sticks |
| | 1 | 10-1054-02 | Truss support, 30m/40m, 36" |
| | 8 OR 12 | 10-1059-01 | Polyolefin Heat Shrink 1-1/2" x 6" |
| | 4 OR 6 | 10-1059-21 | Polyolefin Heat Shrink 1.1" x 6" |
| | 2 | 10-1501-23 | Cover for Black EHU, With countersunk drain hole |
| | 2 | 10-1509-02 | Diverter Cone |
| | 1 | 21-6040 | Splitter, 6" 3-1/2mm, Stereo Male to Two RCA Female |
| | 4 OR 6 | 60-1006-22 | QUICK DISCONNECT, 1.75" to 1.5", Fernco (STANDARD) |
| | 4 OR 2 | 70-1007-01 | Foam plug assembly consisting of plastic cap and foam plug |
| | 1 | 70-1508-02 | Boom assembly, 2 Element |
| | 2 | 70-2025-13 | CPVC tube, 49" x 3/4", with coupler |
| | 2 | 70-2025-23 | CPVC tube, 39-7/8" x 3/4", without coupler |
| | 1 | 70-2034 | Connector Junction Box, 2E and 3E |
| | 1 | 70-3000-01 | 33 Volt supply with cord |
| | 1 | 70-3401-01 OR 70-3403-01 | EHU, 20m Driven OR 40m Driven |
| | 1 | 70-3420-01 | EHU, 20m Passive |
| | 1 | 70-6010-01 | Adapter, 25pin Dsub Field Splice |
| | 1 | 72-0009-03 | Kit, Glue |
| | 1 | 72-0010-01 or -02 | Kit, UrbanBeam/2E EHU Cable Assemblies and 16" Coax Seal (72-0010-02 is preassembled, 72-0010-01 is bare cable only) |
| | 2 | 72-0054-01 | Kit, EHU Lid Hardware - 1 for Driven and 1 for Passive |
| | 1 | 70-6002-01 | 2E 6m Passive element |
| | 1 | 72-0014-01 | Kit, 2E/3E 6m hardware |
| | 1 | 09607 | High Wind Mast Kit; 2 or 3 element Yagi |
| | 1 | - | QR Code Sheet - Instruction Manuals |

PARTS CHECKLIST

What Comes in the Sweep Box

| ✓ | QTY | PART # | DESCRIPTION |
|---|-----|------------|---|
| | 2 | 10-1153-01 | Poly Sweeps (100psi) |
| | 4 | 10-1511-01 | Sweep diverter |
| | 4 | 10-1059-21 | Polyolefin Heat Shrink 1.1" x 6" |
| | 2 | 10-1503-21 | Fiberglass rod, 3/8" x 31-3/4" long, black |
| | 1 | 72-0008-11 | Kit, 2E/3E 40/30m Return Hardware |
| | 1 | 72-0018-31 | Kit, 39' Element Truss, 2E, 3E, DB18/18E/36/42 end elements |
| | 1 | 72-0027-03 | EST Return Tube, 1-3/4" x 12", Fiberglass, with reinforcing rings |
| | 1 | 72-0030-61 | Kit, Sweep hardware |

72-0009-03

Kit, Glue

| ✓ | QTY | PART # | DESCRIPTION |
|---|-----|------------|--|
| | 1 | 09-1020-10 | Weldon 10259 Multi-Purpose Cement, 6mL |
| | 1 | 09-1013 | Glass vial, 6mL |
| | 4 | 09-1011 | Cotton tip applicator, 3" |

72-0010-01

Kit, 10' 4 Conductor Cable and Coax Seal

| ✓ | QTY | PART # | DESCRIPTION |
|---|-------|------------|---|
| | 10 ft | 21-5001-01 | Control cable, 4 conductor, 22awg, shielded |
| | 8 in | 09-1022 | Coax seal, 1/2" width |

OR, IF YOU HAVE THE PREASSEMBLED CABLE

72-0010-02

Kit, UrbanBeam/2E EHU Cable Assemblies and 16" Coax Seal

| ✓ | QTY | PART # | DESCRIPTION |
|---|-------|------------|--|
| | 2 ft | 21-5001-01 | Control cable, 4 conductor EHU Cable Assembly, 13' |
| | 16 in | 09-1022 | Coax seal, 1/2" width |

PARTS CHECKLIST

09607

High Wind Mast Kit

| ✓ | QTY | PART # | DESCRIPTION |
|---|-----|------------|---|
| | 2 | 10-1021-43 | Boom to Mast plate, 8", HIGH WIND with saddle holding holes |
| | 4 | 10-1601-22 | Saddle, 2" x 3/4" |
| | 4 | 10-1601-03 | Saddle, 1-3/4" x 3/4" |
| | 4 | 60-0065 | Bolt, 5/16" x 3-1/2", S/S (1c) |
| | 4 | 60-0066 | Bolt, 5/16" x 4", S/S |
| | 9 | 60-0046 | Nut, 5/16" -18, Nylock, S/S |
| | 1 | 60-0037-21 | Eyebolt, 5/16" x 4", S/S |
| | 1 | 60-0085 | Bolt, 3/8" x 4", Hex Head, full thread, S/S |
| | 2 | 60-0050 | Nut, 3/8", S/S, Nylock |
| | 4 | 60-0034 | Washer, 3/8", Flat, S/S |
| | 1 | 60-0049 | Nut, 3/8", S/S |
| | 1 | 60-0051 | Lockwasher, 3/8", Split, S/S |
| | 3 | 60-0062 | Bolt, 1/4" -20 2-3/4", S/S |
| | 3 | 60-0030 | Nut, 1/4"-20, Nylock, S/S |
| | 15 | 60-0041 | Washer, 1/4", Flat |
| | 4 | 60-0112 | Set Screw, 10-32 x 1/4", Cup Point, S/S |
| | 2 | 60-0017 | Screw, 10-32 x 3/4", Panhead, S/S |
| | 1 | 10-1028-01 | Anti-seize single packets, TMP-1 |
| | 1 | 09-1026 | 5/16" Drill Bit |

72-0008-11

Kit, 30/40m Return Hardware

| ✓ | QTY | PART # | DESCRIPTION |
|---|-----|---------|-----------------------------|
| | 2 | 60-0003 | U-Bolt & Saddle, 1-3/4" |
| | 4 | 60-0046 | Nut, 5/16" -18, Nylock, S/S |

72-0054-01

Kit, EHU Lid Hardware

| ✓ | QTY | PART # | DESCRIPTION |
|---|-----|------------|---|
| | 11 | 60-0019 | Nut, 10-32, Nylock, S/S |
| | 2 | 60-0017-10 | Screw, 10-32 x 7/8", Flathead, Phillips |
| | 9 | 60-0061 | Screw, 10-32 7/8", Panhead, S/S |
| | 11 | 60-0018 | Washer, 10-32, Flat, S/S (5c) |

PARTS CHECKLIST

72-0018-31

Kit, 39' Element Truss, 2E, 3E, DB18/18E/36/42 end Elements

| ✓ | QTY | PART # | DESCRIPTION |
|---|------|------------|---|
| | 4 | 10-1510-21 | Element Truss Coupler (sets) |
| | 75ft | 21-7001-01 | Dacron double braided poly rope, 1/8" |
| | 2 | 10-1601-03 | Saddle, 1-3/4" x 3/4" |
| | 2 | 60-0083 | Turnbuckle, 1/4" x 4", Eye to Eye, S/S |
| | 1 | 60-0110 | Bolt, 1/4"-20 x 1-1/4", S/S |
| | 1 | 60-0030 | Nut, 1/4"-20, Nylock, S/S |
| | 2 | 60-0065 | Bolt, 5/16" x 3-1/2", S/S |
| | 2 | 60-0046 | Nut, 5/16" -18, Nylock, S/S |
| | 2 | 60-0033 | Washer, 5/16", Flat, S/S |
| | 16 | 60-0014 | Nut, 6-32 Nylock |
| | 16 | 60-0014-01 | Screw, 6-32 X 7/8", Panhead |
| | 2 | 60-0158 | Thimble, 1/8", Heavy galvanized |
| | 4 | 60-0157 | Wire Clips, 1/8", galvanized |
| | 1 | 10-1028-01 | Anti-seize single packets, TMP-1 |
| | 1 | 09-0001 | Electrical tape 3/4" PVC MERCO 307 |
| | 1 | 60-0112 | Set Screw, 10-32 x 1/4", Cup Point, S/S |

72-0030-61

Kit, Sweep Hardware

| ✓ | QTY | PART # | DESCRIPTION |
|---|-----|------------|--|
| | 28 | 60-0014 | Nut, 6-32 Nylock |
| | 20 | 60-0016 | Washer, 6-32, Flat |
| | 28 | 60-0186 | Screw, 6-32 x 2", 18-8 SS, Button Socket CS |
| | 8 | 10-1155-01 | Sweep Clamp, SCH-160 Clamp, half a set (need 2 to make a single set) |
| | 1 | 60-9000 | Allen Key, 5/64" |

72-0014-01

Kit, 2E/3E 6m Hardware

| ✓ | QTY | PART # | DESCRIPTION |
|---|-----|---------|-----------------------------|
| | 1 | 60-0003 | U-BOLT & SADDLE, 1-3/4" |
| | 2 | 60-0011 | Screw, 6-32 x 3/4", Panhead |
| | 2 | 60-0014 | Nut, 6-32 Nylock |
| | 2 | 60-0046 | Nut, 5/16" -18, Nylock, S/S |

STAINLESS STEEL FASTENER INFORMATION

From time to time, we get complaints from customers regarding galling of stainless steel fasteners.

Here is an excerpt from the Industrial Fastener Institute's Standards Book: *Thread galling seems to be the most prevalent with fasteners made of stainless steel, aluminum, titanium and other alloys which self-generate an oxide surface film for corrosion protection. During fastener tightening, as pressure builds between the contacting and sliding thread surfaces, protective oxides are broken, possibly wiped off and interface metal high points shear or lock together. This cumulative clogging-shearing-locking action causes increasing adhesion. In the extreme, galling leads to seizing - the actual freezing together of the threads. If tightening is continued, the fastener can be twisted off or its threads ripped out.*

During minor galling, the fastener can still be removed, but in severe cases of galling, a strong bond between the bolt and nut can prevent removal of fasteners. Here are two ways to minimize this effect: *Decreasing installation RPM speed will cause less friction and decrease heat generation. Lubrication used prior to assembly can dramatically reduce or eliminate galling. Recommended lubricants should contain higher amounts of molybdenum disulfide, such as graphite which is very commonly used as a solid lubricant or special anti-galling lubricants sold by chemical companies.*

We provide an anti-seize compound stick called "Thread Magic" with all of our antennas and **strongly encourage** you to use it to reduce the aggravation of galling. Nylock nuts are no exception—apply the anti-seize on fasteners that use Nylock nuts as well. The Thread Magic stick is fantastic and is good for all metal fastener use—and, you can get plenty of anti-seize on the fastener without getting it on your hands!

Turn-of-nut tightening of nuts to bolts is recommended where torque values are not named, with metal to metal connections. Turn the wrench/socket until it is flush with the material it will seat against and snug-tightened, and then turn approximately 2/3 of a rotation past that point. When in doubt use common sense to ensure the fastener is not too loose, or not too tight—both positions can cause issues. On all connections, check the tightness 30 minutes or more later to ensure no creeping has taken effect.

Contrary to popular belief, galling of stainless steel is not a symptom of a "cheap" fastener - it is prevalent in all types of stainless steel, aluminum, and titanium fasteners. You can be assured that the stainless steel fasteners we provide with our products are manufactured of very high quality.

Save yourself a lot of grief and always use a thread lubricant when working with stainless steel fasteners.



ANTENNA DIRECTION CONFIGURATION

**REVERSE DIRECTION
(180 deg)**



FORWARD DIRECTION (Normal)

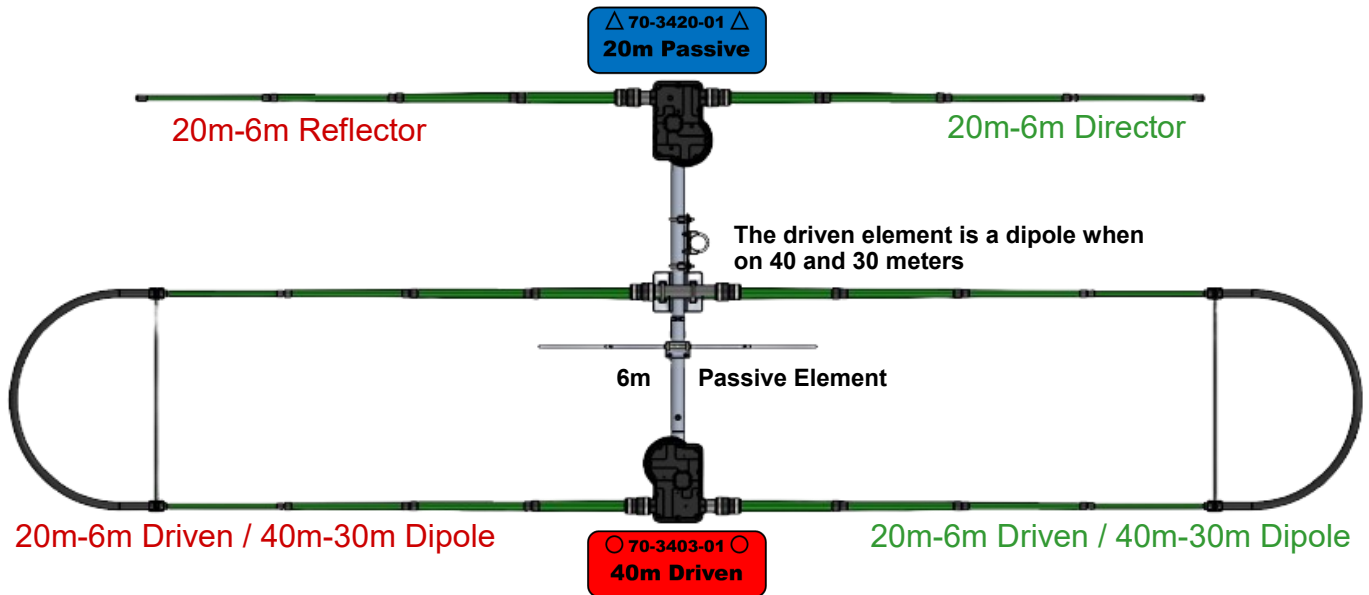


Figure 1.01: 2 Element Yagi with 40/30m Dipole

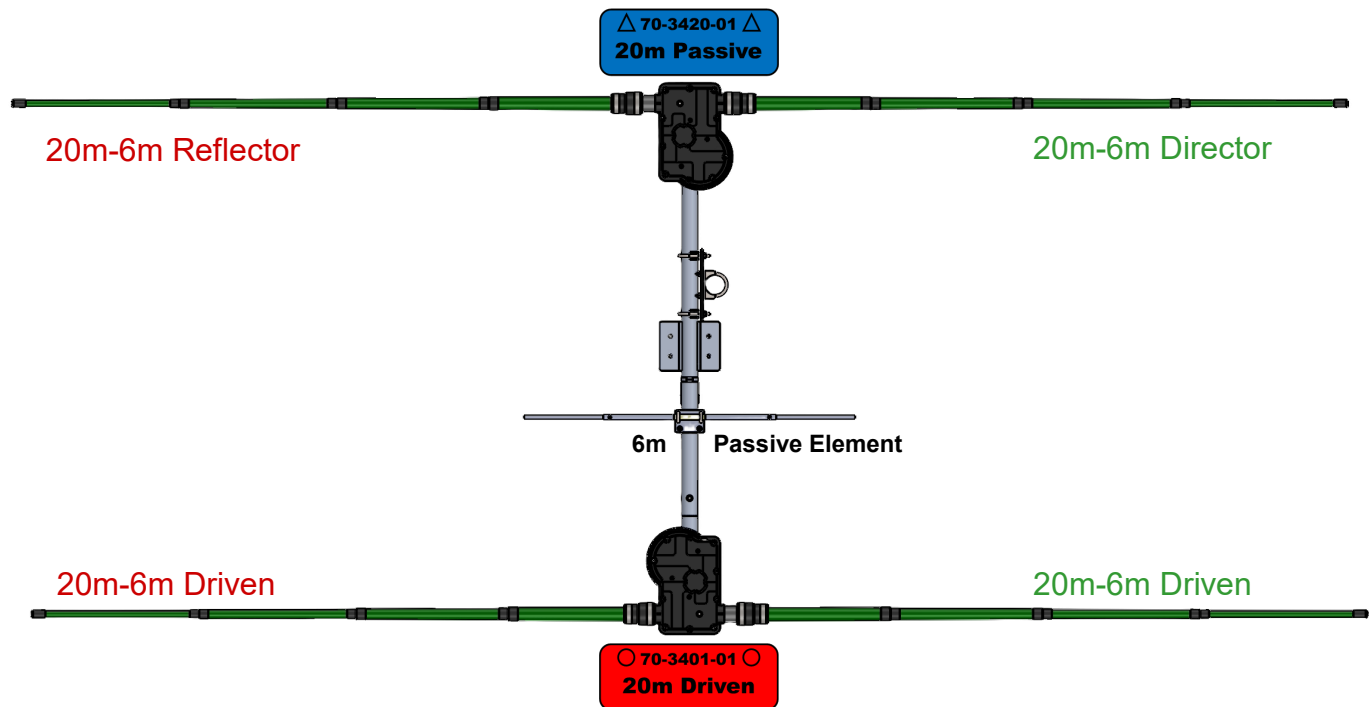
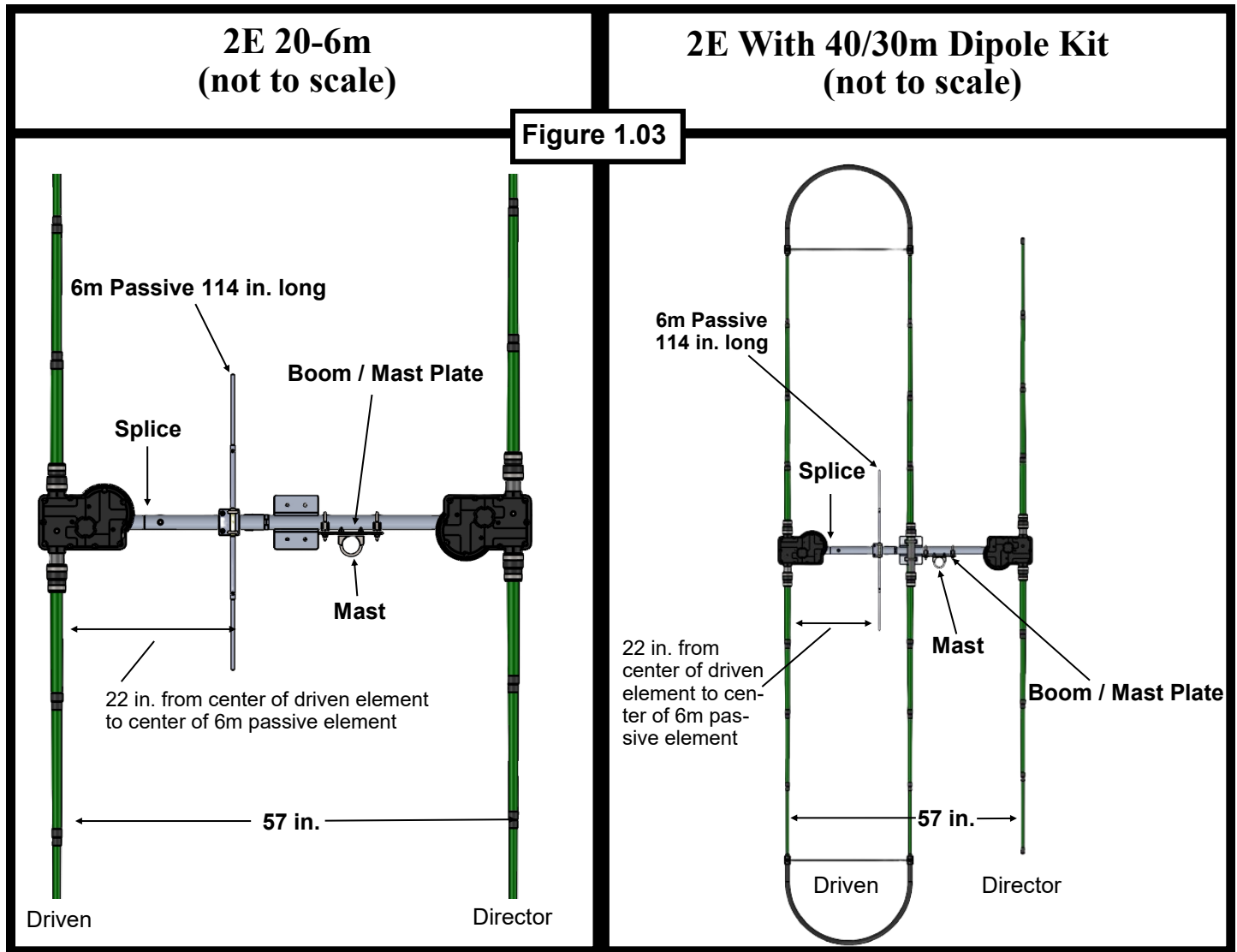


Figure 1.02: 2 Element Yagi 20-6m

ANTENNA OVERVIEW AND DIAGRAM



2 ELEMENT YAGI BOOM ASSEMBLY

Section 1.1: Assemble the Boom

The 2 element SteppIR Yagi boom consists of two sections of aluminum tubing that are 60 inches long x 1-3/4" OD x 1/8" wall, along with two aluminum antenna housing brackets as shown in **Figure 1.11**. The element housing brackets are pre-installed at the factory. To assemble your antenna, you will need a 1/2" (13 mm) and 7/16" (11 mm) wrench and / or socket drive. We double check the fasteners for proper tightness before shipping but it is always a good idea to check them yourself before installing the antenna. Put anti-seize grease on all bolts, especially on the U-bolts because it greatly increases their gripping power. Anti-seize grease (molybdenum based) is available at most auto part stores and is included in the package.

The boom is completely assembled and drilled at the factory to assure precision element alignment. Pre-drilled holes are quite snug to align almost perfectly. In some cases you may find it necessary to assist the bolts with a tap of a hammer, or "thread" them in by turning with a wrench. **The bolts, washers, and nuts are shipped in the high wind kit (PN 09607).**

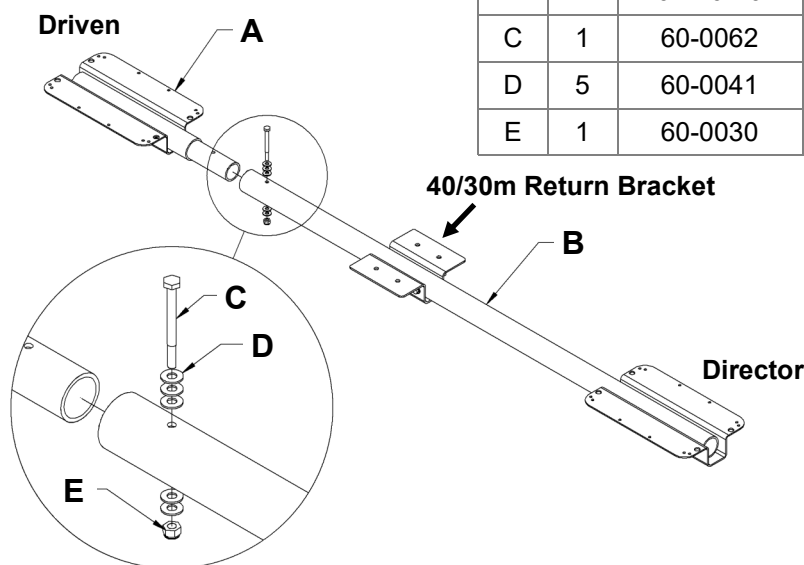
Connect the boom by sliding the two sections together and align the pre-drilled holes. Refer to the diagram below for correct configuration. It is advisable to spray a small amount of WD-40 on the male sleeve before sliding the female section onto it. Do not twist the aluminum excessively, as this can cause binding - the WD-40 will help keep the two pieces lubricated.

Note: The boom bolts need to have a total of "5" flat washers on each bolt to prevent the nut from bottoming out at the end of the threads before it is tight.

Insert the included bolts into the pre-drilled hole, and tighten the Nylock nut securely as seen in the detail view on **Figure 1.11**.

Note: If you are not installing the 40m-30m dipole kit you can remove the return bracket if you want to, but it is not necessary. If you do remove the bracket it is a good idea to mark both the boom and the bracket so that it can be reinstalled correctly later if needed and to re-install the bolts into the boom.

Figure 1.11



| Key | Qty | Part # | Description |
|-----|-----|------------|---|
| A | 1 | 10-1017-22 | Element Bracket, 1-3/4" (already mounted) |
| B | 1 | 10-1201-01 | Aluminum tube, 1.75" OD x 48" Length |
| C | 1 | 60-0062 | Bolt, 1/4"-20 2-3/4", SS |
| D | 5 | 60-0041 | Washer, 1/4", flat |
| E | 1 | 60-0030 | Nut, 1/4"-20, Nylock |



CONNECTING THE MAST PLATE TO THE BOOM

Section 2.1: Install the Mast Clamps (High Wind Kit)

Older antennas attach the mast plate differently. Skip to page 20 if you do NOT have the high wind kit.

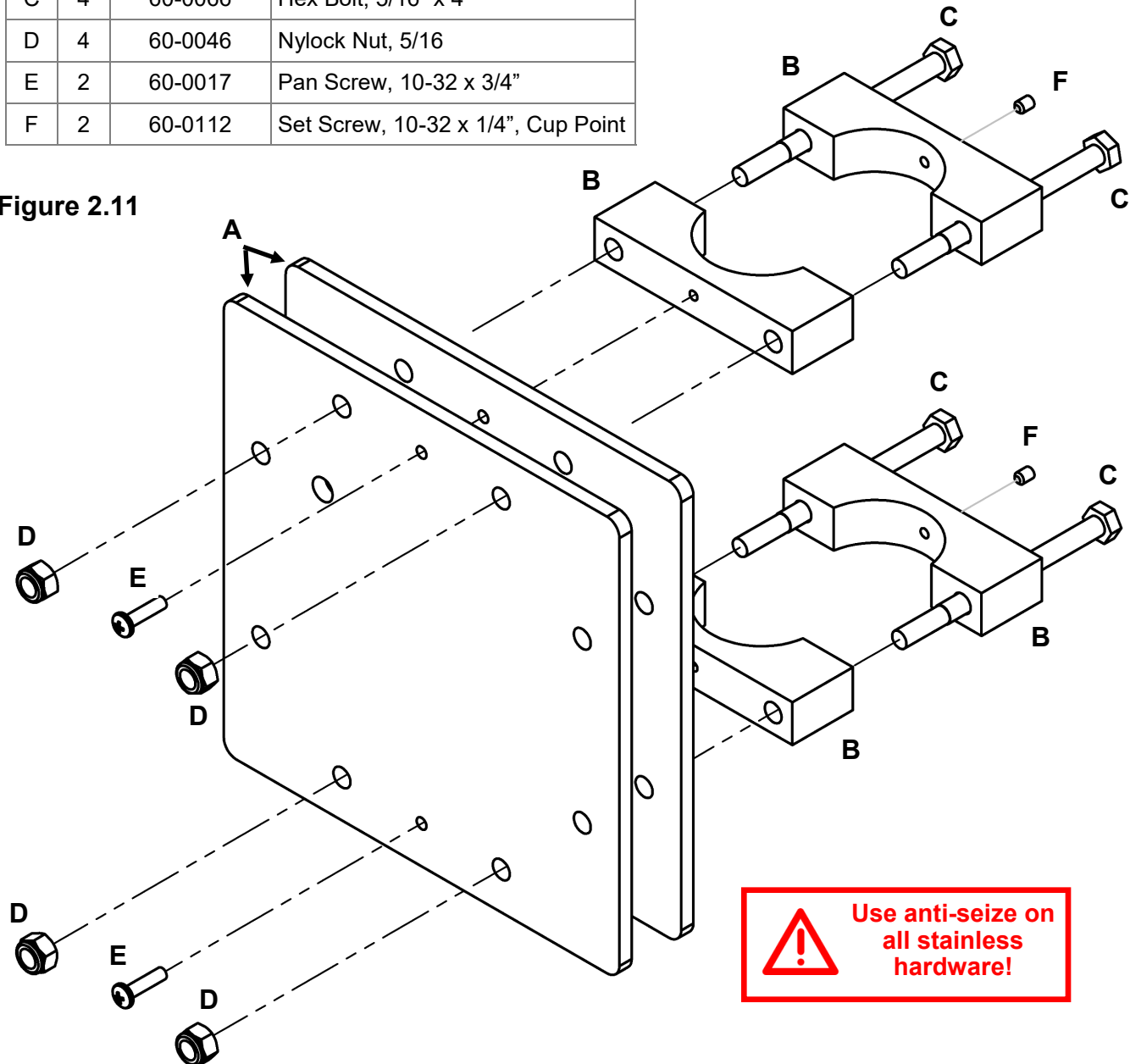
The mast plate is connected to the boom using hardware from the **high wind kit (PN 09607)**. If you haven't already, make sure to do an inventory of the items shipped to you as part of the kit. The checklist for the high wind kit can be found on page 11 of this manual.

Install the mast clamps to the back of the mast plate as shown in **Figure 2.11**. Make sure to apply anti-seize to the threads of each bolt before tightening to minimize unwanted binding.

| Key | Qty | Part # | Description |
|-----|-----|------------|------------------------------------|
| A | 2 | 10-1021-43 | Mast Plate |
| B | 4 | 10-1601-22 | Saddle Clamp, 2" |
| C | 4 | 60-0066 | Hex Bolt, 5/16" x 4" |
| D | 4 | 60-0046 | Nylock Nut, 5/16 |
| E | 2 | 60-0017 | Pan Screw, 10-32 x 3/4" |
| F | 2 | 60-0112 | Set Screw, 10-32 x 1/4", Cup Point |

Do not tighten the set screws (F) or the bolts for the saddle clamps until after the antenna is mounted to the mast.

Figure 2.11



Section 2.2: Install the Fully Threaded Bolt

- Tighten 3/8" nut (C) first.
- When installing the 3/8" Nylock Nut (D), thread it fully with the nylon facing **AWAY** from the mast plate first, then take it off and thread it back onto the bolt with the nylon facing **TO-WARD** the mast plate.
- The flat face of the Nylock nut should be about 1" from the edge of the mast plate as shown in **Figure 2.22**.



| Key | Qty | Part # | Description |
|-----|-----|---------|-------------------------------------|
| A | 1 | 60-0085 | Hex Bolt, 3/8" x 4", Fully Threaded |
| B | 1 | 60-0051 | Lock Washer, 3/8", Split |
| C | 1 | 60-0049 | Nut, 3/8" |
| D | 1 | 60-0050 | Nylock Nut, 3/8" |

Figure 2.21

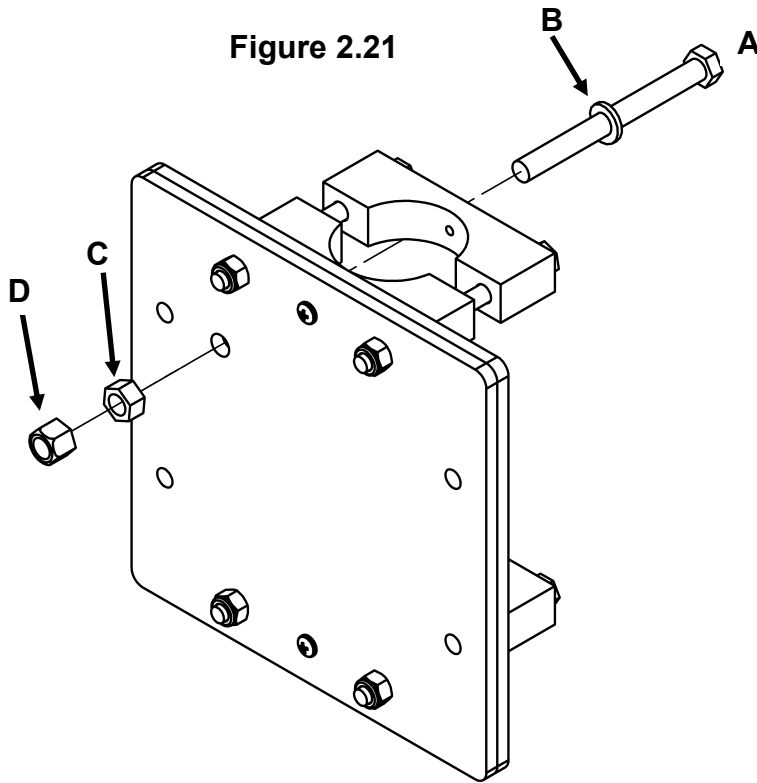
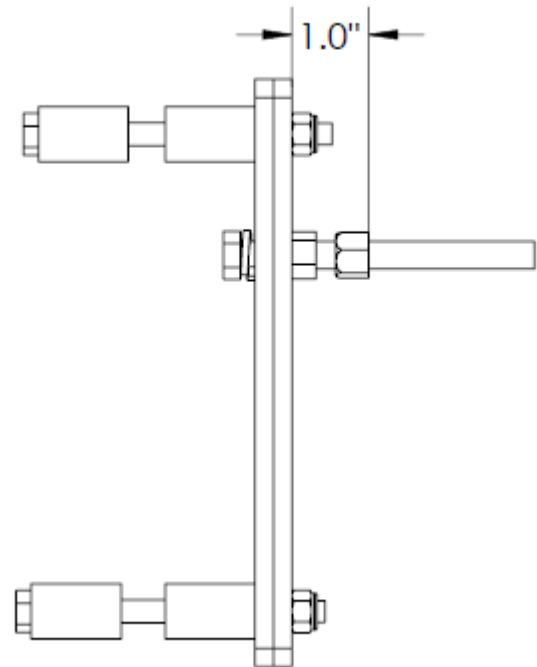


Figure 2.22



Determining the Direction of the Antenna

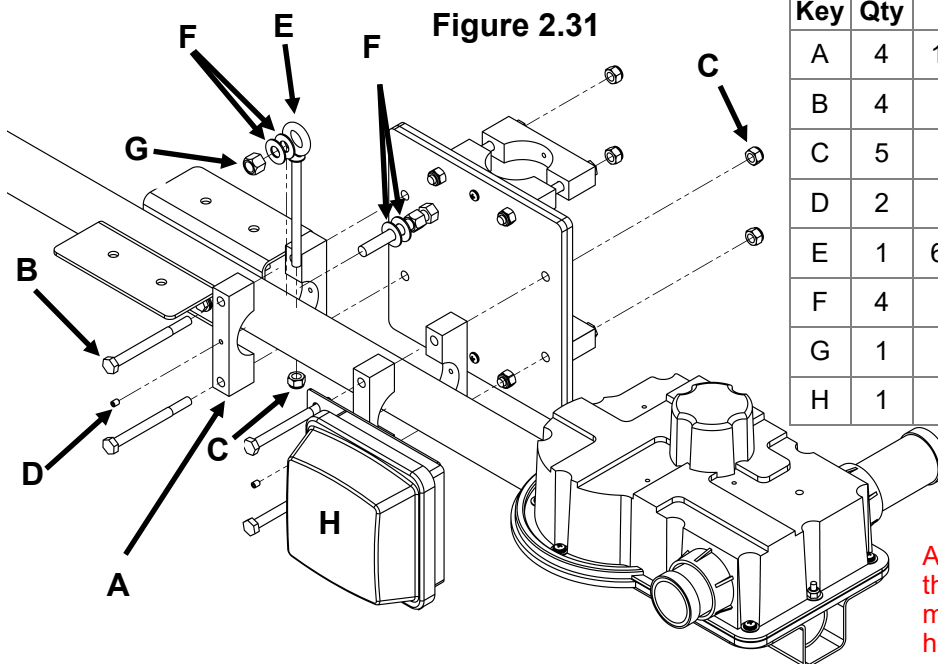
The SteppIR Yagi has three "directions" in which it can be used. Normal, 180 degree and Bi-directional. When the antenna is installed on its mast the passive element should be facing the direction the rotator indicates. Keep this in mind for when you install the antenna onto the mast at the end of the antenna assembly.

- In the **Normal** mode the antenna directs RF energy towards the passive element (the element that does not have the coax attached to it), giving gain in that direction and rejecting signals coming directly at the driven element from the opposite direction.
- In the **180°** mode the gain is now directed from the driven element end and rejected from the passive end.
- In the **Bi-Directional** mode, your antenna is directing RF in both directions.

Section 2.3: Install the High Wind Kit

- Position the high wind kit using the **Figure 2.31** as reference.
- Mark a hole on the top of the boom directly under the eyebolt stud, 24.40" from the bracket of the Director EHU as shown in **Figure 2.32**.
- Place the boom on a flat level surface with the element mounting brackets facing up and leveled.
- Make sure the mark is on the **top center** of the boom.
- Center punch the mark.
- Drill **straight** down through both sides of the boom with the provided 5/16" (.3125") drill bit.
- Use the exploded view drawing below to install the mast plate. Discard the included washer and non-Nylock nut on the Eyebolt, it will not be used.
- Adjust the two Nylock nuts on the EZ-Eye stud to make sure the boom is level (mast plate perpendicular to element plates).
- Tighten the Nylock nuts first, then set screws on the boom saddle clamps and Nylock nuts on the EZ-Eye.

NOTE: The boom can be re-leveled if necessary by loosening the bolts on the boom saddle clamps and then adjusting the two Nylock nuts that position the EZ-Eye. Be sure to tighten all nuts when finished.

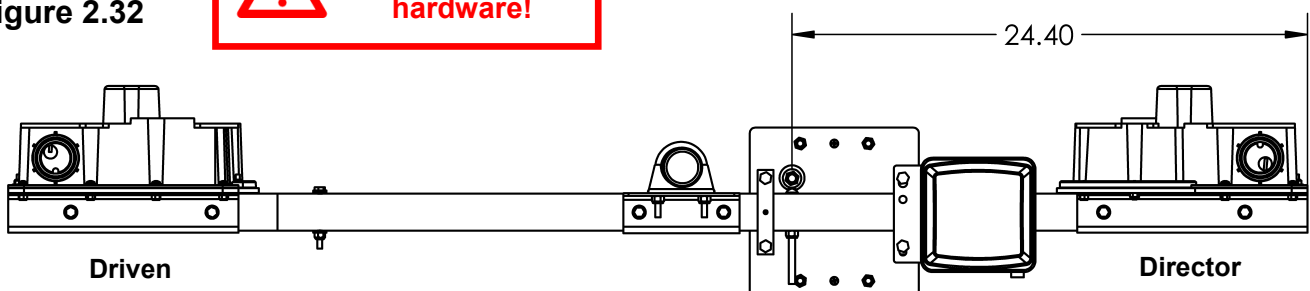


| Key | Qty | Part # | Description |
|-----|-----|------------|--------------------------|
| A | 4 | 10-1601-03 | Saddle, 1-3/4" x 3/4" |
| B | 4 | 60-0065 | Hex Bolt, 5/16" x 3-1/2" |
| C | 5 | 60-0046 | Nylock Nut, 5/16" |
| D | 2 | 60-0112 | Set Screw, 10-32 x 1/4" |
| E | 1 | 60-0037-21 | Eyebolt, 5/16" x 4" |
| F | 4 | 60-0034 | Washer, 3/8" |
| G | 1 | 60-0050 | Nylock Nut, 3/8" |
| H | 1 | 70-2034 | Connector Junction Box |

Although the EHUs are shown in the diagram, they should not be mounted to the boom yet—they are here for reference.

Director

Figure 2.32



Section 2.4: Install the Mast Plate (No High Wind Kit, Old Version)

Skip if you have the high wind kit

The older version of the mast plate has 8 pre-drilled holes. Four holes are used for the 2" stainless steel mast clamps (D) and four more holes are used for the 1-3/4" stainless steel boom clamps (B).

Connect the boom to the mounting plate (**Figure 2.42**), using the 1-3/4" U-bolts, saddles, and nuts. Align the boom so that the element brackets are level (mast plate is perpendicular to element brackets), then tighten securely. Ensure the mounting plate is the correct distance from the director element plate (18.50" from end of bracket) as shown in **Figure 2.41**.

Connect the mast to the mast plate (once antenna is completely assembled) using the included 2" stainless steel U-bolts, with saddles, and Nylock nuts as shown in **Figure 2.42**. Tighten securely.

With this mounting style, it doesn't matter which side of the boom the mast plate goes on—that's up to you.



View orientation changed to more clearly show the assembly!

Figure 2.41

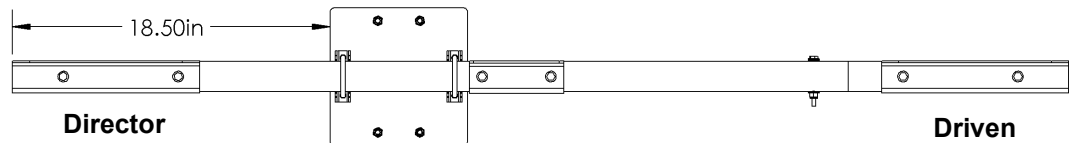
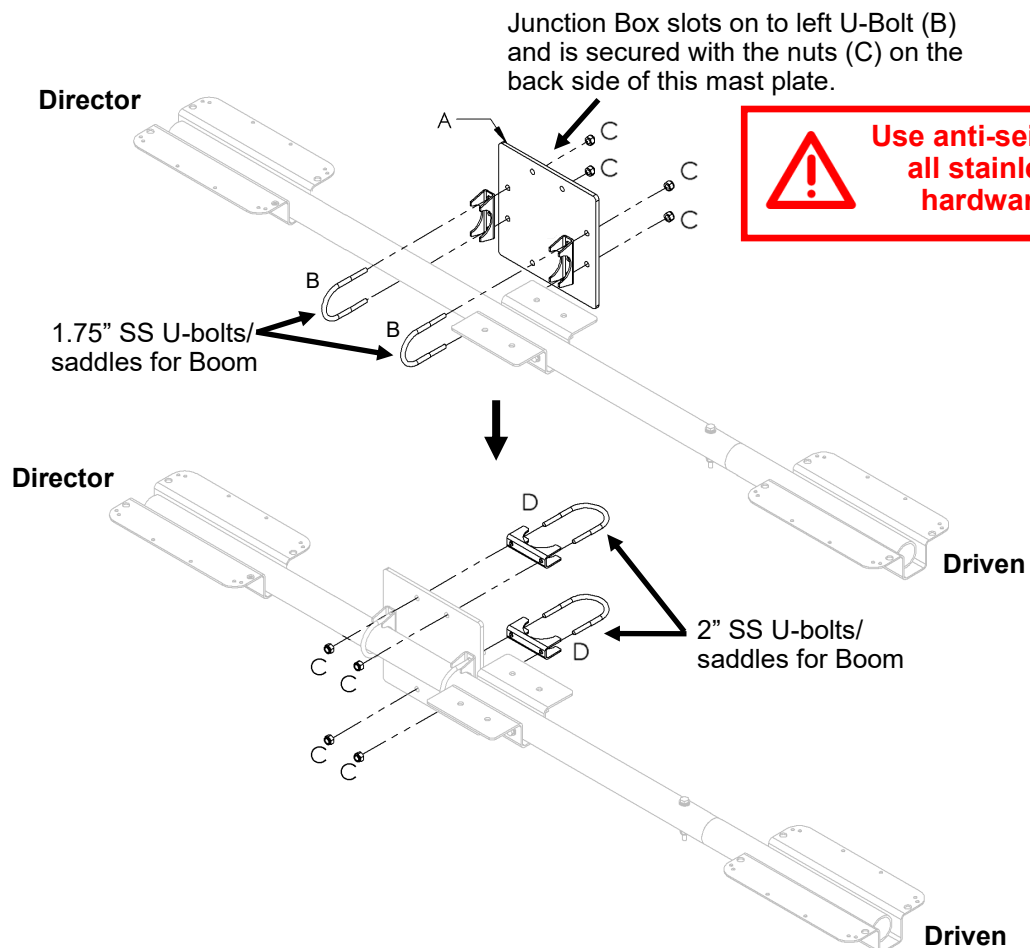


Figure 2.42



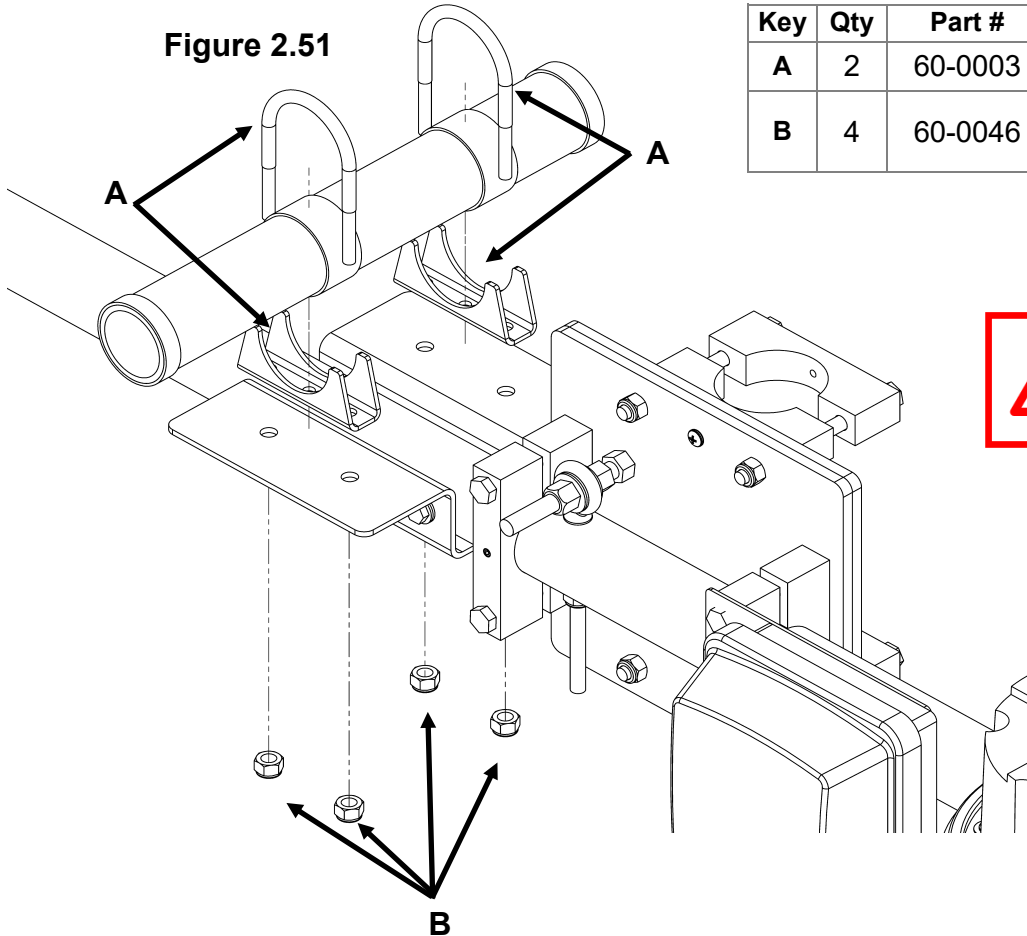
INSTALLING THE RETURN TUBE

Section 2.5: Attach Return Tube to the Boom

Skip if you do not have the 40/30 loop

The return tube is installed next to the mast plate, as shown below using the 2E/3E return hardware kit (PN 72-0008-11). Make sure the U-bolts/saddles are positioned over the reinforced rings on the return tube as shown in **Figure 2.51**, and be careful not to overtighten the nuts on the ends of the U-bolts. Align the return tube so that it lines up with the EST on the Driven EHU, the recommended dimensions are shown in **Figure 2.52**.

Figure 2.51

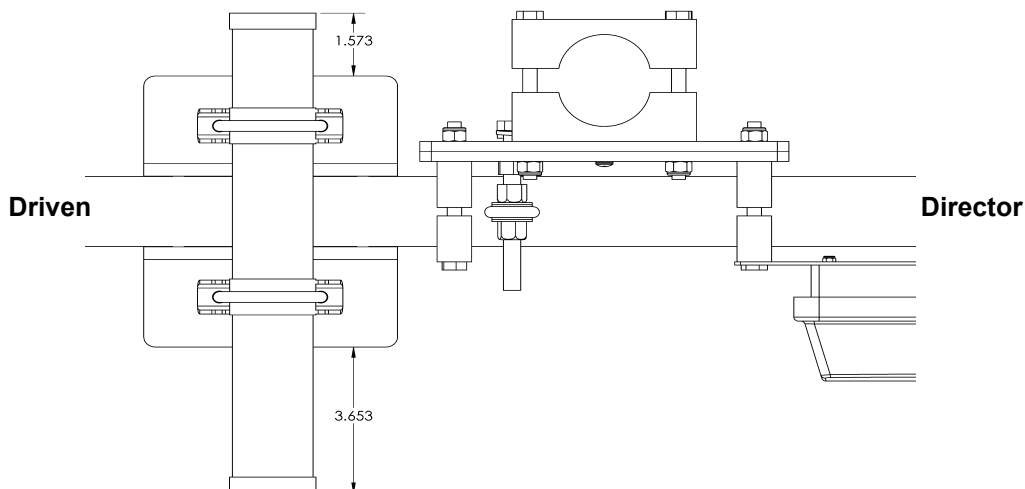


| Key | Qty | Part # | Description |
|-----|-----|---------|-----------------------------|
| A | 2 | 60-0003 | U-Bolt & Saddle, 1-3/4" |
| B | 4 | 60-0046 | Nut, 5/16" -18, Nylock, S/S |



Figure 2.52

Top view



WIRING THE CONTROL CABLE TO THE DB25 SPLICE

Section 3.1: Preparing the Control Cable

(if you have pre-wired cable, skip to page 24)

1. Strip the jacket and aluminum shielding off of the control cable as shown in **Figure 3.11**, approximately 2.75" from end of control cable, being careful not to damage the individual wires.
2. Strip the plastic insulation off of each of the control cable wires, approximately 0.25" in length should be bare wire. Tinning of the copper wire ends with solder is NOT recommended by the connector manufacturer.

Section 3.2: Connecting control cable to the DB25 Field Splice

(if you have pre-wired cable, skip to page 24)

1. Apply the provided dielectric grease to the exposed copper portion of each wire. **Figure 3.22** shows what the connector protector will look like.

The terminals may be closed by default. If so, turn the terminal screw counterclockwise ~10 turns to open it before inserting the wires.

2. Consult **Figure 3.24** on the next page for the correct wiring sequence.
3. Connect each wire to the appropriate terminal and tighten using a flat head screwdriver. **Be sure you are clamping down on bare copper, not the insulation. Verify there is not excessive bare wire sticking out of the terminal or it may short to other pins/wires.**
4. Position the control cable between the cable clamp halves as shown in **Figure 3.23**. Electrical tape can be wrapped around the cables to increase the cable thickness if necessary.
5. Tighten the two pan head screws until the cable is snug, but do not over-tighten.
6. Thread the two thumb screws into the connector face as shown in **Figure 3.23**.
7. Plug the DB25 splice into the back of the controller, ensuring that it is fully seated, and twist the thumb-screws to secure it. For first time setups it is common for this to be only partially installed, resulting in fault codes on the controller.

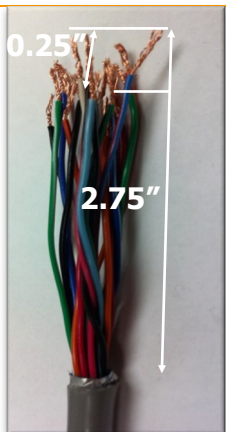


Figure 3.11



Figure 3.21



Figure 3.22

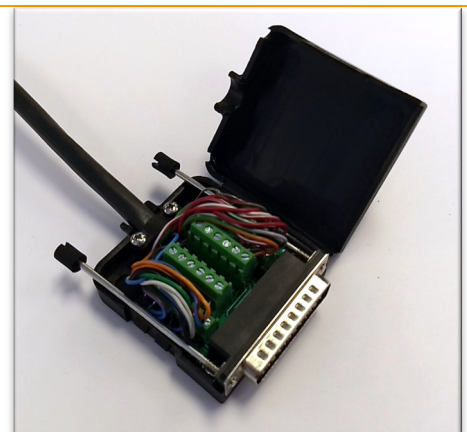


Figure 3.23

SKIP TO NEXT PAGE IF YOU HAVE A PREWIRED CABLE

FIGURE 3.24

25 PIN DSUB FIELD
SPLICE TERMINAL
STRIPS (4)

12 WIRE CONTROL CABLE

| | | | |
|----------------------------|------|---|------------------------|
| OUTER RIGHT TERMINAL STRIP | ⊖ 1 | — | BLACK |
| | ⊖ 2 | — | BROWN |
| | ⊖ 3 | — | RED |
| | ⊖ 4 | — | ORANGE |
| | ⊖ 5 | — | YELLOW |
| | ⊖ 6 | — | GREEN |
| | ⊖ 7 | — | BLUE |
| INNER RIGHT TERMINAL STRIP | ⊖ 8 | — | VIOLET |
| | ⊖ 9 | — | GREY |
| | ⊖ 10 | — | WHITE |
| | ⊖ 11 | — | PINK |
| | ⊖ 12 | — | CRÈME |
| | ⊖ 13 | — | NOT USED! |
| INNER LEFT TERMINAL STRIP | ⊖ 14 | — | NOT USED! |
| | ⊖ 15 | — | NOT USED! |
| | ⊖ 16 | — | NOT USED! |
| | ⊖ 17 | — | NOT USED! |
| | ⊖ 18 | — | NOT USED! |
| | ⊖ 19 | — | NOT USED! |
| OUTER LEFT TERMINAL STRIP | ⊖ 20 | — | NOT USED! |
| | ⊖ 21 | — | NOT USED! |
| | ⊖ 22 | — | NOT USED! |
| | ⊖ 23 | — | NOT USED! |
| | ⊖ 24 | — | NOT USED! |
| | ⊖ 25 | — | NOT USED! |
| | ⊖ G | — | GND (SHIELD GOES HERE) |

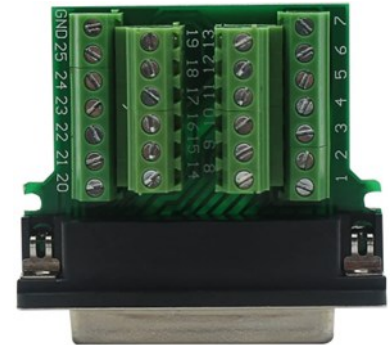


Figure 3.25

CONNECTOR JUNCTION BOX WIRING LAYOUT

Section 3.3: Connecting control cable to the Connector Junction Box

If you have the pre-wired EHU cables, both EHUs will have around 13ft of cable and can just be plugged into the junction box. If you are wiring the EHUs and junction box yourself, you can easily measure along the boom from each EHU bracket to the junction box. The Driven EHU control cable should be about 6ft, and the Director EHU control cable should be about 4ft. Measure your specific set-up just in case (different mast plates and connector junction box locations will vary the lengths)—it's much easier to account for too long of a cable than too short!

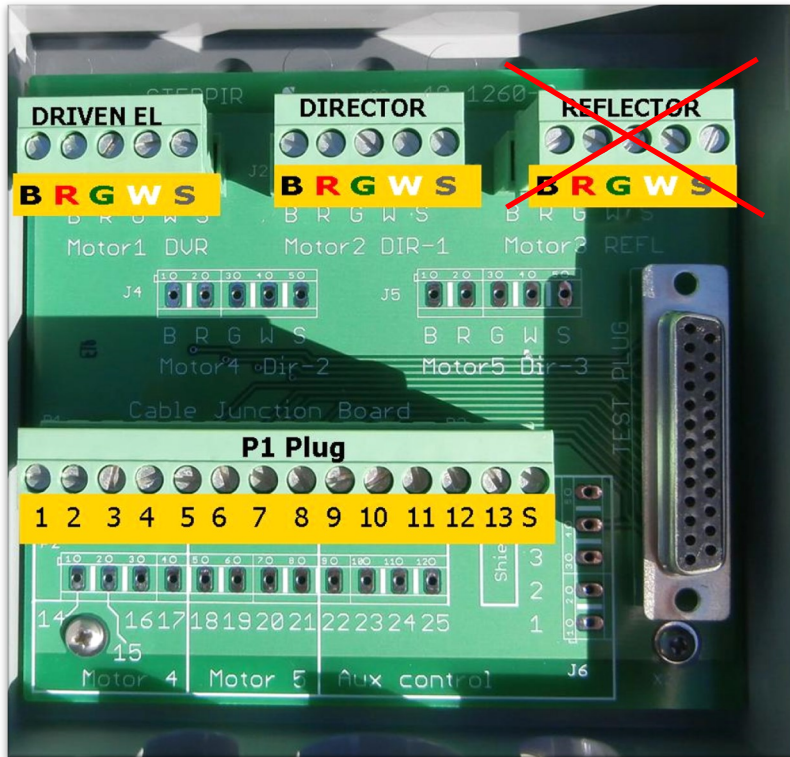


Figure 3.31

Since the 2 element Yagi does not have a reflector, the associated plug in the connector junction box is not used.

FOR PREWIRED CABLE: You'll have to route the control cable from your station to your antenna—unless you have 3" wide conduit to fit the DB25 connector, it will ALWAYS be better to pull the phoenix connectors from your station to the junction box. We recommend taping the wires and connector straight with the cable to make it easier to pull through as shown in **Figure 3.32**. Since the 2 element Yagi only has one phoenix connector, you may ignore the second one in these images.

Figure 3.32

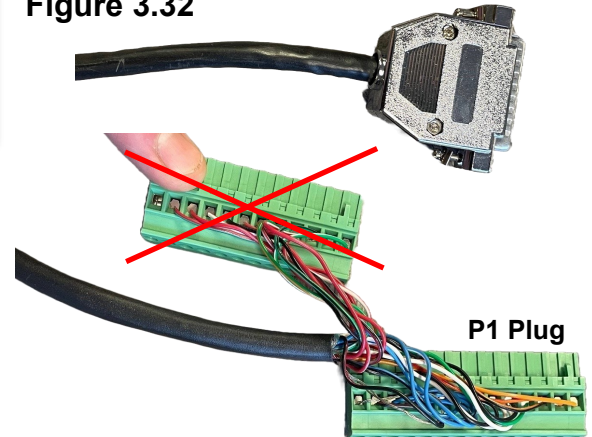


Figure 3.33



Regular electrical tape works perfectly for this.

Figure 3.34 4 wire control cable key

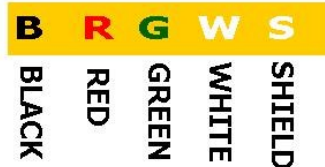


Figure 3.35

12 WIRE CONTROL CABLE

P1 PLUG
(LOCATED INSIDE CONNECTOR BOX)

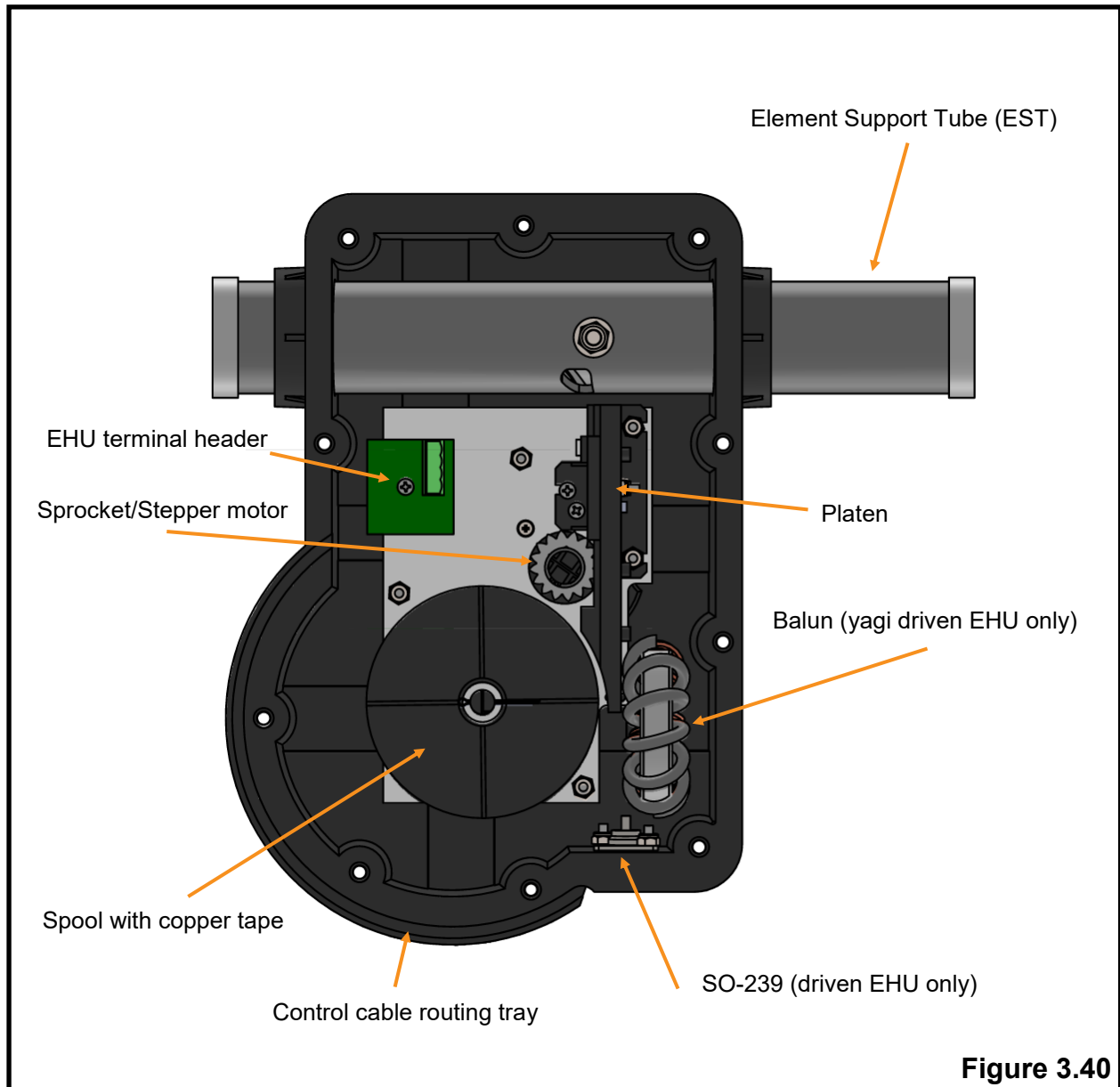
| | | |
|----------|---|----|
| BLACK | → | 1 |
| BROWN | → | 2 |
| RED | → | 3 |
| ORANGE | → | 4 |
| YELLOW | → | 5 |
| GREEN | → | 6 |
| BLUE | → | 7 |
| VIOLET | → | 8 |
| GREY | → | 9 |
| WHITE | → | 10 |
| PINK | → | 11 |
| CRÈME | → | 12 |
| NOT USED | → | 13 |
| SHIELD | → | 14 |

EHU OVERVIEW

If you have a prewired EHU, you may skip to page 27.

Figure 3.40 gives an overview of the inside of a SteppIR EHU. Wiring of each EHU will be covered in detail on the following pages.

NEVER ATTEMPT ANY WIRING WHILE THE ELECTRONIC CONTROLLER IS CONNECTED TO THE CONTROL CABLE. Even if the power is turned off for the controller, damage can occur. This is the number one cause of antenna installation failure, so please be sure to heed the advice.



WIRING THE EHU

Section 3.4: Wiring the EHU (skip to page 27 if you have pre-wired cable)

1. Trim approximately 1.5" of the outer jacket of the control cable.
2. Remove the outer foil shield, the support thread, and cut the shield wire off.
3. Attach electrical tape at the end of the trimmed control cable jacket so that there is no chance for a short.
4. Remove 0.25" of the insulation from each of the individual 22 AWG wires, leaving bare copper. **Tinning of the copper wire ends with solder is NOT recommended by the connector manufacturer. Figure 3.41** shows the control cable should look like when you are finished with the trimming.
5. Apply the provided dielectric grease to the exposed copper portion of each wire. **Figure 3.42** shows what the connector protector will look like.
6. The terminal header assembly consists of the terminal header and the terminal plug. The plug is shipped loosely attached to the header. Remove this plug when wiring and firmly plug back in when completed (**use dielectric grease on this terminal plug to prevent moisture ingress/corrosion**).
7. Follow the wire sequence in **Figure 3.44**. **Be careful to ensure that there are no bare wires protruding out from the terminal clamps, to avoid potential shorts. Also make sure you are clamping down on bare wire, and not the insulation of the wire.** The wiring sequence for the EHU is also imprinted on the PCB that the terminal header is mounted on (located inside the EHU), as shown in **Figure 3.43**. Pay no attention to the second row of imprinted text, these pins are for use in the manufacturing of the board itself and are of no use to you. **Figure 3.43** shows a red line crossing out the text in question. The orange circle shows the correct wiring sequence.

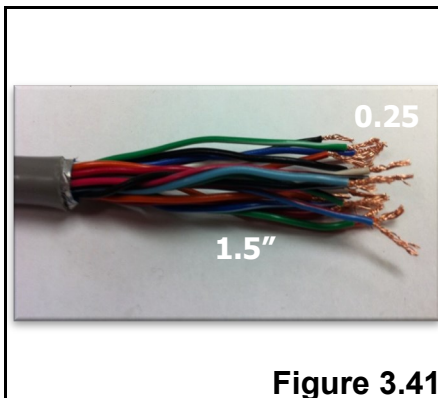


Figure 3.41



Figure 3.42



Figure 3.43

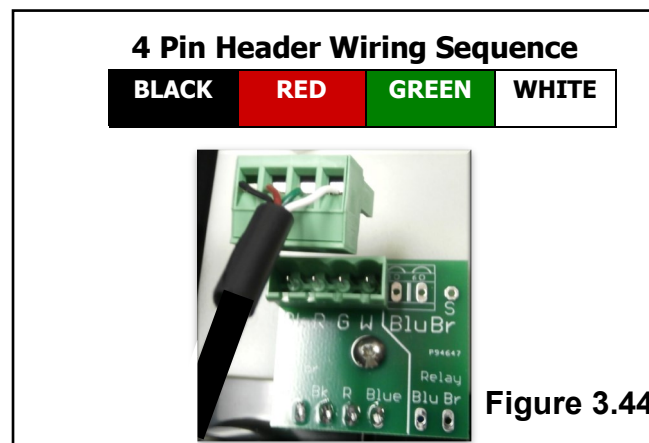


Figure 3.44

8. Check to ensure the terminal plug is firmly inserted into the terminal header.
9. Cut three 1-inch strips of coax seal for each EHU as shown in **Figure 3.45**, and place them at each end of the wire tray of the EHU, as well as one in the center as shown in **Figure 3.46**. This trough acts as a strain relief so that the cable will not be pulled out of the EHU. The remainder can be used to seal the driven element SO239 connector.
10. Lay the control cable wire inside the wire tray of the EHU then firmly press the cable into the trough as shown in **Figure 3.47**. It is a good idea to leave a small amount of slack between the plug and the point which the tray starts as shown in the circled region of **Figure 3.47**. **Be sure that the cable is fully seated in the trough, otherwise you may pinch and damage the cable during assembly.**
11. Wrap the coax seal around the control cable as shown in **Figure 3.48** and squish it flat. This will help keep water from entering into the EHU. Repeat this process to the remaining areas of the wire tray as shown in **Figure 3.49**.
12. When finished, the EHU will be sealed with the gasket and lid, and secured to the EHU brackets on the boom.

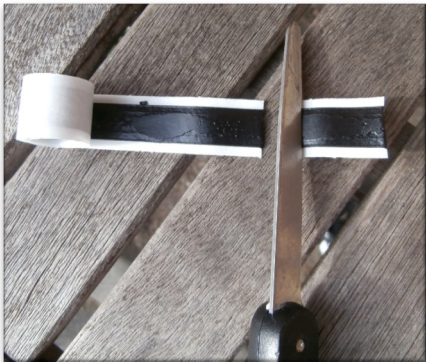


Figure 3.45

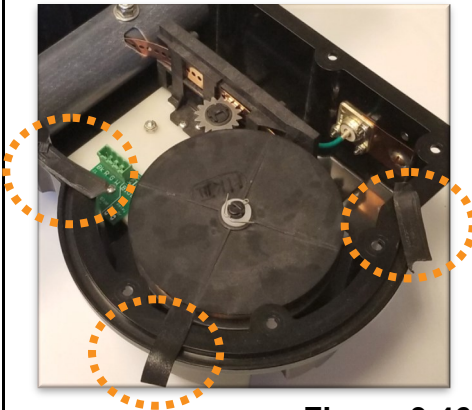


Figure 3.46

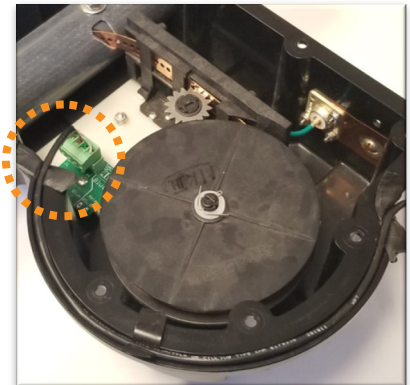


Figure 3.47

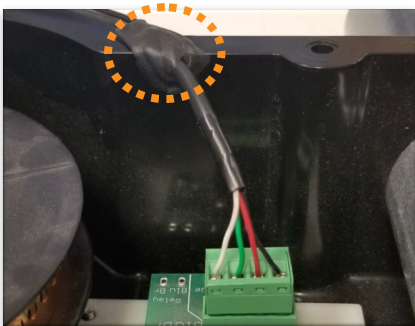


Figure 3.48



Figure 3.49

EHU WIRING TESTS

Section 4.1: Resistance Test (mandatory)

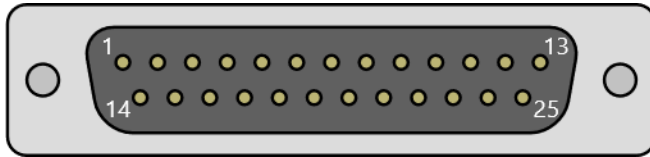


Figure 4.11

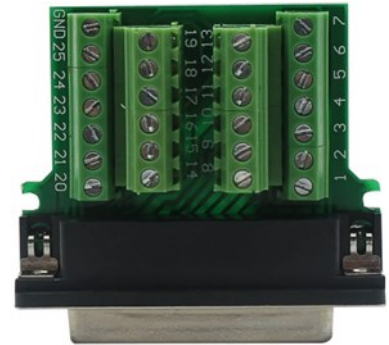


Figure 4.12

The control cable uses 4 wires per motor (one motor in each element housing unit (EHU)). Each motor has two wires for each of its two motor windings. This test assumes the antenna is connected to one end of the control cable and the measurements are taken at the 25-pin connector that mates to the controller (disconnected from controller). You need an ohmmeter capable of measuring 15 – 35 ohms with reasonable resolution or at least one that you can tell the difference between a dead short and 15 ohms.

Step 1: Be sure the 25-pin DSUB control cable connector is disconnected from the controller (your control cable should not be plugged into the controller until the Resistance/Open Circuit test is completed).

Step 2: Hold the DB25 connector so you are looking at the pins with them pointing at you or open the back shell of the DB25 field splice. If prodding the pins directly, orient the connector so the row with 13 pins is on top, now the upper left-hand pin is pin 1. See **Figure 4.11** for reference. If you decide to open the case of the connector, reference the pin number marking on the PCB (**Figure 4.12**).

Step 3: Measure the resistance between the pin pairs indicated. You only need to measure the resistance of wires that correspond to the elements on your antenna. The required pin pairs to measure are shown in the table below. You should read between about 15 ohms to 30 ohms depending on cable length between the pins listed below. Record your results in the “Results” column. (100’ is about 23 ohms).

| Resistance Test Table | | | |
|-----------------------|-----------------|---------------------|----------------|
| Pin Pair | Antenna Element | Expected Resistance | Results (ohms) |
| 1-2 | Driven | ~ 20 Ohms | |
| 3-4 | | ~ 20 Ohms | |
| 5-6 | Director | ~ 20 Ohms | |
| 7-8 | | ~ 20 Ohms | |

Section 4.2: Open Circuit Test (mandatory)

Step 4: Next make sure there is an open circuit between the following pins. Record your results in the “Results” column. (Any reading < 100 K ohms is bad)

| Open Circuit Test Table | | |
|---------------------------------|----------------------------|---|
| <i>Test Pins</i> | <i>Expected Resistance</i> | <i>Results (Ohms or Open Load (OL))</i> |
| Connector metal case to any pin | Open Load (OL) | |
| Pin 1 to any pin except 2 | Open Load (OL) | |
| Pin 3 to any pin except 4 | Open Load (OL) | |
| Pin 5 to any pin except 6 | Open Load (OL) | |
| Pin 7 to any pin except 8 | Open Load (OL) | |

Conclusion

If your antenna passes this test it **does not** mean it is wired correctly. You could have an intermittent short or a short that requires higher current than what the ohmmeter can supply to reveal itself. You may have also swapped two elements or even wired the whole thing backwards (started at the wrong end of the terminal strip) and it will still measure correctly because each connector pair has a motor winding connected to it, but it is the wrong one. This test just takes you to the next step of trying to determine if the antenna is wired correctly and then finally determining if the elements are physically moving. This is an open loop system and the controller has no way of knowing if the elements are really moving when commanded to.

ATTACHING THE EHUS TO THE ELEMENT BRACKETS

Section 5.1: Mounting EHUs to the Boom

Attaching the EHU to the boom is a 2 step process utilizing the **EHU lid hardware kit (PN 72-0054-01)**. The first step involves attaching the lid and gasket with the 3 screws, nuts, and washers shown in **Figure 5.11**. **The flat washer needs to be placed between the screw head or nut and the plastic element housing.** The second step is to attach the EHU to the boom with the remaining 7 screws, as show in **Figure 5.12**. Both of these figures can be found on the following page. **Do not over tighten the bolts/nuts or you risk damaging the EHU shell. Wait 15 minutes then tighten them again.**

WARNING: When assembling the lid to the housing unit and the housing to the boom, make sure the control cable is not being pinched or damaged in any way. This can cause a short and drastically effect the performance of the antenna.

Once the lid is mounted place the flat side of the element housing unit (EHU)/lid assembly on top of the element to boom brackets. The housing **without** the SO-239 coax connector is the director, the one **with** the SO-239 connector is the driven element (the balun is on the inside of this housing). **The driven and director elements should be positioned so the actual fiberglass element are the furthest away from each other.** Fasten each element housing to the element bracket, using seven 10-32 x 7/8" screws, flat washers, Nylock nuts and tighten. **The flat washer needs to be placed between the screw head and the plastic element housing.**

Warning: Tighten the element housing unit screws securely, but not too tight (if you over-tighten the nut, you may split the plastic flange on the element housing). Wait 15minutes then tighten them again.

The dark gray element support tube (EST) on each antenna housing will appear uneven in length - it is actually centered on the inside of the antenna housing.

Note: The driven element and return tube will have the EST (offset tube) lined up so that the short side and long side of the EST/return tube are facing in the same directions. The director element EST configuration will be the opposite. This is normal.

Figure 5.11

Lid Assembly

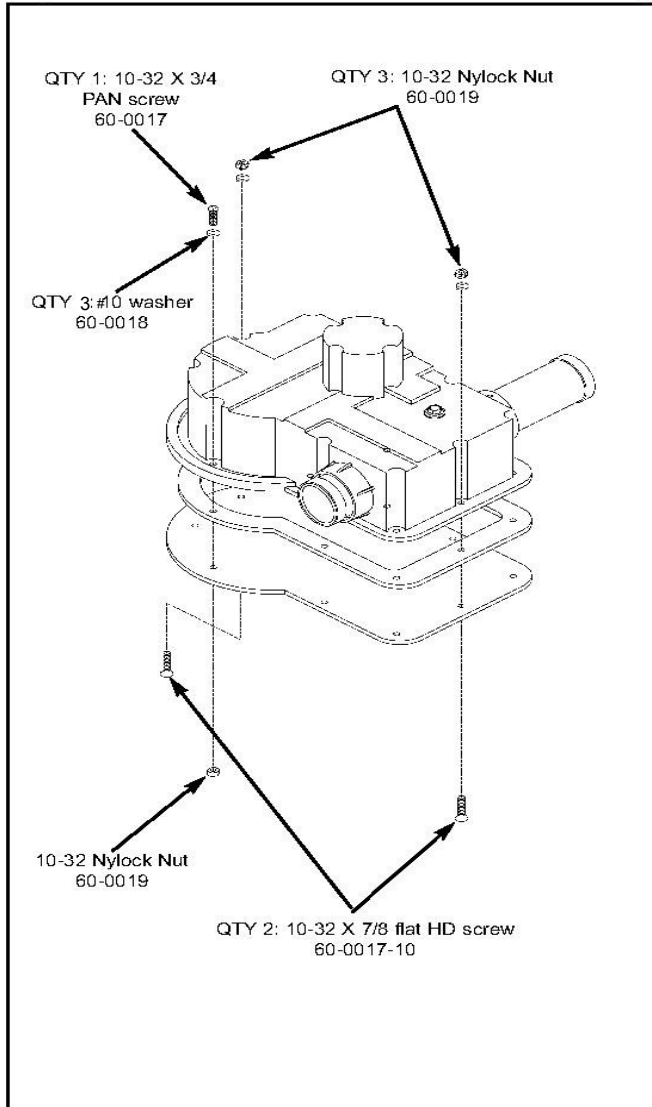
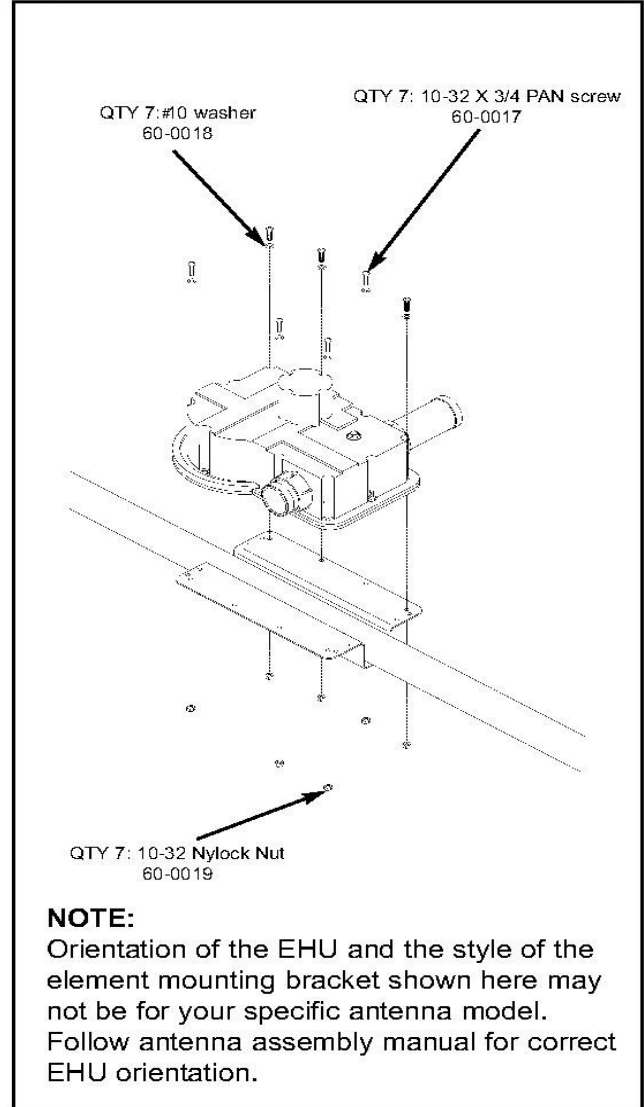


Figure 5.12

EHU Assembly

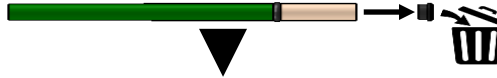


PREPARING THE TELESCOPING POLE

Section 6.1: Preparing the fiberglass pole

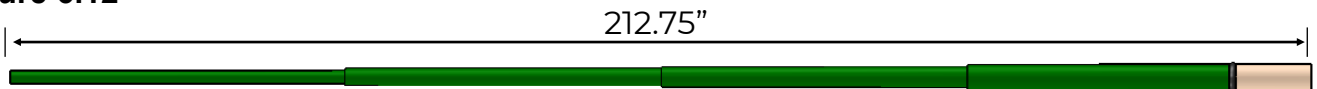
1. Extend the telescoping poles (PN 10-1013-02) to full length by firmly locking each section of the pole in place. A good methodology is to position each half of the joint so that they are several inches apart (while still within each other), and then pull quickly and firmly as shown in **Figure 6.11**. Do this for each pole. There are rubber plugs inside the base section of each telescoping pole. These make it easier for handling, but they **MUST BE REMOVED BEFORE ASSEMBLY**. **VERIFY THE FOAM INSERT IN THE PLUG HAS NOT MADE ITS WAY DOWN THE POLE AND THAT THERE IS NO OTHER FOREIGN DEBRIS INSIDE THE POLE.**

Figure 6.11



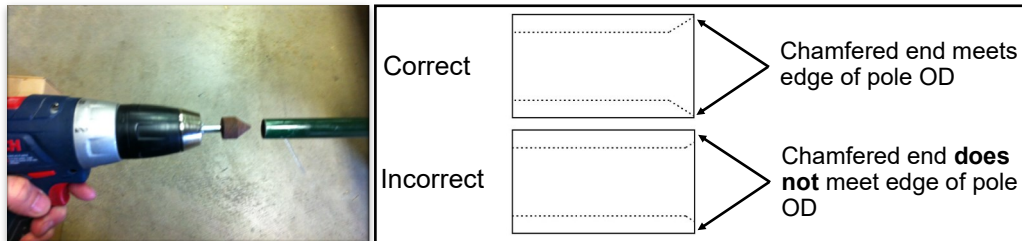
2. With the poles fully extended, trim the end of the tip element of each pole so that the pole is 212.75" from the tip of the pole to the butt end, as shown in **Figure 6.12**. **ONLY trim the poles used for the 40/30 loops**—if your antenna has 20m-6m straight elements, those should not be trimmed (must have a length of at least 213.1"). Use a hack saw, pipe cutter, or similar cutting blade that is suitable for fiberglass. Be sure that you cut the pole perpendicular to the length of the pole so that it is as "square" as possible.

Figure 6.12



3. Using the conical drill bit, chamfer the tips of the 40/30 poles as shown below. The image **Figure 6.13** below shows the proper angle to chamfer to. Clean out the interior of the fiberglass poles after chamfering it.

Figure 6.13



4. Each telescoping pole uses 3 polyolefin heat shrink pieces, one covering each joint after it has been pulled tight. Once finished, the seal is secure and waterproof. This product requires a heat gun for activation of the adhesive.
5. When positioning the heat shrink, place it so that the joint of the telescoping pole is centered in the middle of the heat shrink.
6. Using a heat gun as shown in **Figure 6.14** (hair dryers will NOT work), apply heat evenly around the entire area of heat shrink. Note: there are 4 blue colored lines imprinted on the tubing. The joint is considered done being heated and waterproof when the lines change color to a yellowish green. Each line needs to change color to ensure even adhesion temperatures.
7. The heat shrink will want to slide as it is heated so wear gloves and reposition the heat shrink to keep it centered on the joint as needed. **Caution: The heat shrink will be HOT, wear insulated gloves!**



LOOK INSIDE OF THE TELESCOPING POLE TO VERIFY NOTHING IS BLOCKING IT. YOU SHOULD BE ABLE TO SEE LIGHT AT THE OTHER END IF THE POLE IS KEPT STRAIGHT. DEBRIS INSIDE THE TELESCOPING POLES CAN LEAD TO FAILURE OF THE EHU.



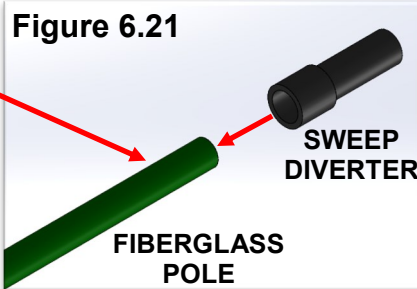
Figure 6.14 1.1" x 6" (PN 10-1059-21) 1.5" x 6" (PN 10-1059-01) 1.5" x 6" (PN 10-1059-01)



Section 6.2: Attaching sweeps and diverters to fiberglass

SKIP TO PAGE 37 IF YOU DO NOT HAVE THE 40/30 LOOP

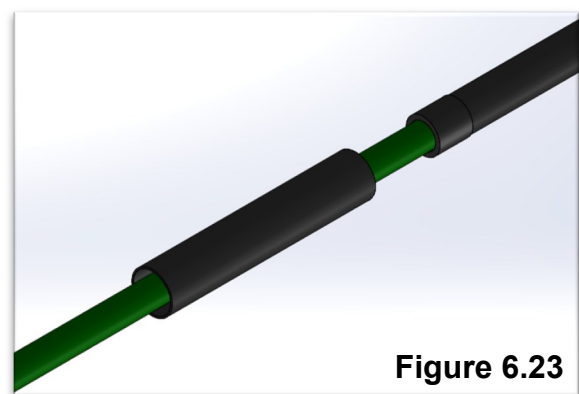
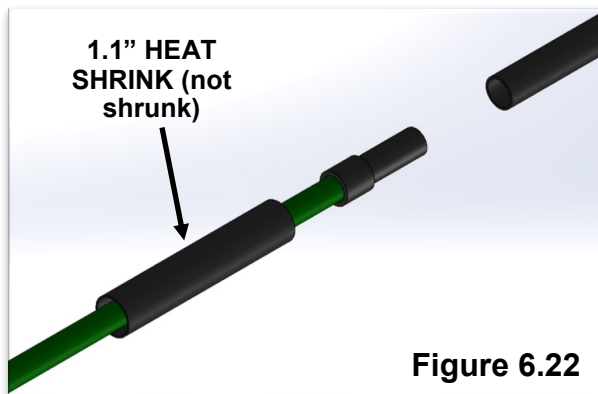
8. Use the **glue kit** (PN 72-0009-03) to attach the **sweep diverters** (PN 10-1511-01) to the tips of the fiberglass telescoping poles as shown in **Figure 6.21**. **ONLY APPLY GLUE TO THE OD OF THE FIBERGLASS**. Slowly rotate the sweep diverter as you slide it onto the pole to let the glue cover the most surface area possible. **MAKE SURE THE SWEEP DIVERTER IS PUSHED AS FAR DOWN ONTO THE FIBERGLASS POLES AS POSSIBLE**. The sweep diverter should be oriented in the same way as shown in the figure below, with the flanged edge towards the rest of the pole. Be sure the glue has dried completely before moving onto the next steps. **The glue is not meant to lock the sweep diverter on the pole, it is only meant to prevent the sweep diverter from moving during the heat shrinking process.**



*Some older versions may have a slightly different sweep diverter—an image of those versions is found at the bottom of the page in **Figure 6.25**. The process is the same, the only change is the thickness of the shoulder on the part.

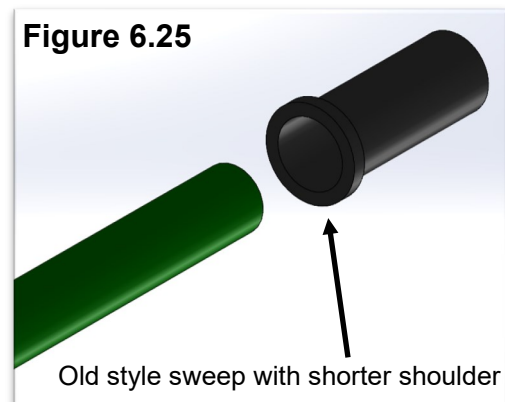
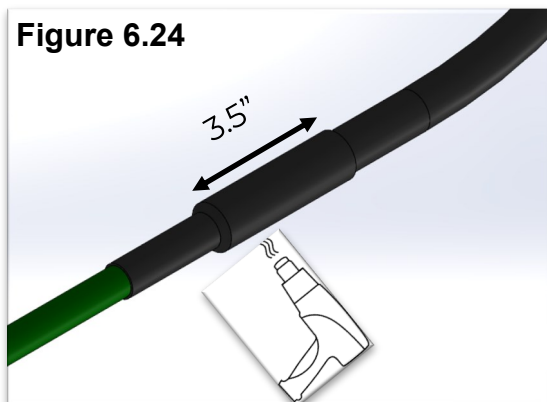
9. Put a piece of **polyolefin heat shrink 1.1" x 6"** (PN 10-1059-21) onto the telescoping pole, leaving the diverter clear. It should be down on the pole far enough that it doesn't interfere with fitting the diverter into the sweep as shown in **Figure 6.22**.

10. Insert the fiberglass pole, with the sweep diverter on it, into the sweep as far as possible as shown in **Figure 6.23**. **DO NOT GLUE THE SWEEP DIVERTER INTO THE SWEEP**. Reposition the heat shrink to cover the joint.



11. Shrink the polyolefin heat shrink over the joint as described on step 6 on the previous page; **LEAVE AT LEAST 3.5" OF HEAT SHRINK ON THE SWEEP SIDE OF THE JOINT** as shown in **Figure 6.24**. **Be EXTREMELY careful not to overheat the poly sweep, you will deform or kink the material if too much heat is applied** (if this occurs you will need to undo your work and replace the poly sweep).

12. Remember, the heat shrink will want to slide as it's heated. Reposition it as it cools to make sure the joint is fully covered. **The heat shrink will be hot; wear insulated gloves.**

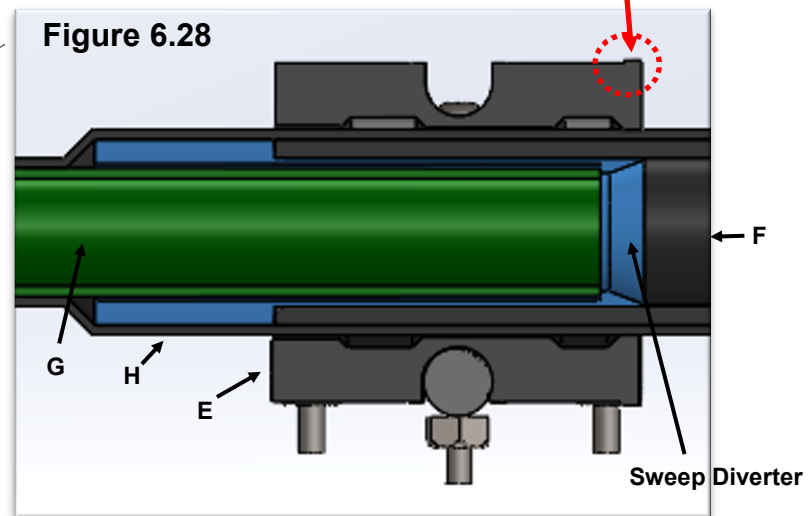
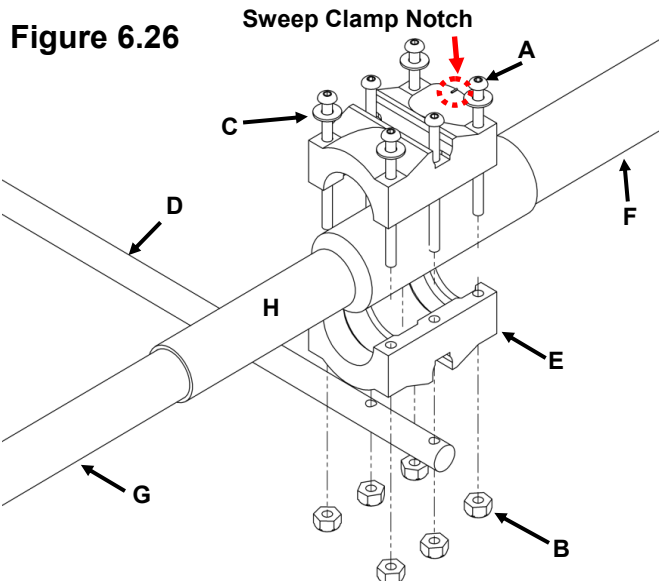


ASSEMBLING THE SWEEPS

- Refer to **Figure 6.26** during the following steps for an overview of the assembly process. You will be using the hardware from the **sweep hardware kit (PN 72-0030-61)**
 - Each of the sweep coupler halves (E) will have a notch in the mold on one side marked with silver sharpie. **IT IS CRITICAL THAT THESE NOTCHES ARE POINTING TOWARDS THE SWEEPS OR THEY WILL NOT WORK PROPERLY.** See **Figure 6.27** for the location of the mark. Be certain that each half of the coupler has the mark facing the sweep tube!
- Place the coupler halves over the heat shrink on the sweep side of the joint. The flange on the diverter should still be visible through the heat shrink, as well as the edge of the sweep material. The non-marked side of the coupler should be placed as close to the edge of the sweep material as possible, without overhanging, as shown in the cutaway in **Figure 6.28** where the sweep diverter is highlighted in blue. **The sweep clamp must ONLY clamp the edge of the sweep material, not the shoulder of the sweep diverter.**
 - Insert four of the 6-32 x 2" socket head screw (A) with washer (C). Place the screws so that the threaded portion of the screw is facing downward. **BE SURE THAT THE DRAIN HOLES FOR THE PLASTIC SWEEP TUBE ARE POINTING DOWNWARD BEFORE INSTALLING THE COUPLERS.**
 - Apply anti-seize to the threads and screw the Nylock nuts on. Tighten using a 5/16" wrench/socket to **turn the nut** and the provided 5/64" **Allen Key to hold the screw**. Tighten enough so that the clamp is held in place on the sweep/heat shrink. Final tightening will happen once the fiberglass spreader is installed.
 - Repeat the previous steps on the other side of sweep tube.

| Key | Qty | Part # | Description |
|-----|-----|------------|--|
| A | 6 | 60-0186 | Screw, 6-32 x 2", 18-8 Button Socket CS |
| B | 6 | 60-0014 | Nut, 6-32 Nylock |
| C | 4 | 60-0016 | Washer, 6-32, Flat |
| D | 1 | 10-1503-21 | Fiberglass Rod, 3/8" x 31-3/4" long, black |
| E | 2 | 10-1155-01 | Sweep Clamp, SCH-160 Clamp Half |
| F | 1 | 10-1153-01 | Poly Sweeps (100psi) |
| G | 1 | 10-1013-02 | Telescoping Pole, 18 foot 4 section |
| H | 1 | 10-1059-21 | 1.1" x 6" polyolefin heat shrink |

Figure 6.27



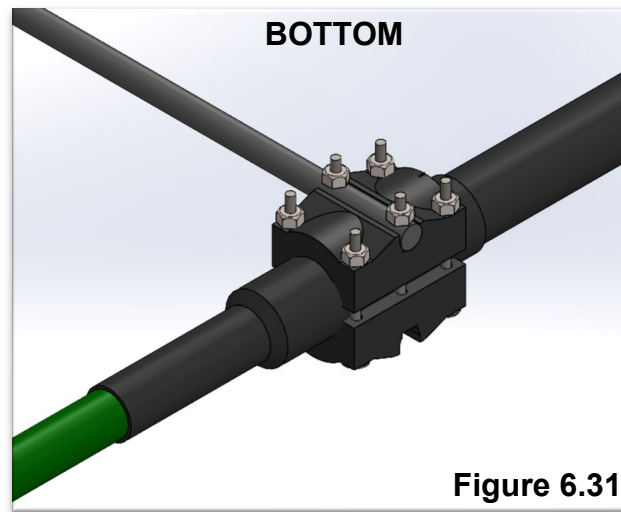
Use anti-seize on all stainless hardware!



Only turn the NUT when tightening!

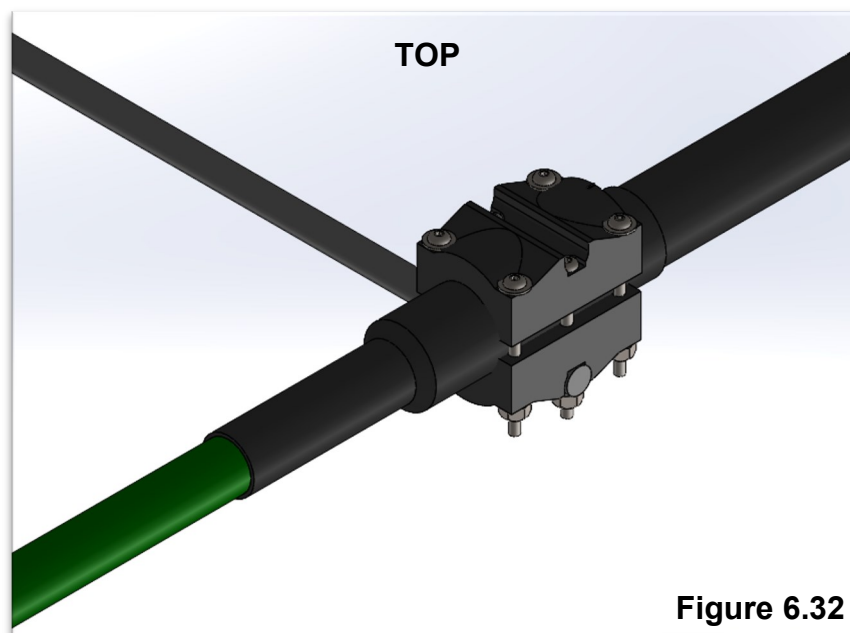
Section 6.3: Mounting the fiberglass spreaders

17. Mount the black fiberglass sweep spreaders (PN 10-1503-21) to the sweep couplers. There is a concave mounting area on each side of the plastic couplers. Position the fiberglass spreader so that the holes align with the clam shell couplers as shown in **Figure 6.31**. When installing the fiberglass spreader, you will want the spreader to be underneath the plastic coupler as shown in **Figure 6.32**. The spreaders will be longer than the couplers on each side of the loop. This is done on purpose to ensure plenty of fiberglass material is on each side of the screw.
18. Insert 2qty 6-32 x 2" socket head screw (PN 60-0186) through each of the coupler halves and the fiberglass rod. This screw must be placed so that the Nylock nut (PN 60-0014) is resting on the fiberglass material and the screw head are resting inside the concave groove on the top of the sweep coupler. Refer to **Figures 6.31** and **6.32** for detail. The screws are longer than necessary so that you can get the nut on in the initial stages.
19. Tighten the Nylock nuts firmly. Be sure to use anti-seize on these screws or they will likely gall and have to be replaced.
20. Repeat the previous steps on the other side of sweep tube.



 Use anti-seize on all stainless hardware!

 Only turn the NUT when tightening!



Section 6.4: Final tightening

21. Finish tightening the four screws on the outside corners of the plastic coupler. Tighten evenly, in an automobile X type pattern as shown in **Figure 6.41**. If you do not tighten evenly, you may break the fastener. Once the outsides are firmly tight, tighten the two screws that hold the fiberglass spreader in place. **Figure 6.42** shows the suggested method for tightening the screws.
22. When completely tightened, **the sweep coupler halves should have gap of about $5/16"$ – $3/8"$** , as shown in **Figure 6.43**. This gap is not critical as the coupler is mostly to keep the spreader in place properly. **It is best to let the screws sit for a while (15-30min) and tighten in intervals in order to allow the plastic clamp material to re-form.** This also will reduce the chance of snapping a screw.
23. **Figure 6.44** shows the completed sweep—repeat the process for each sweep.

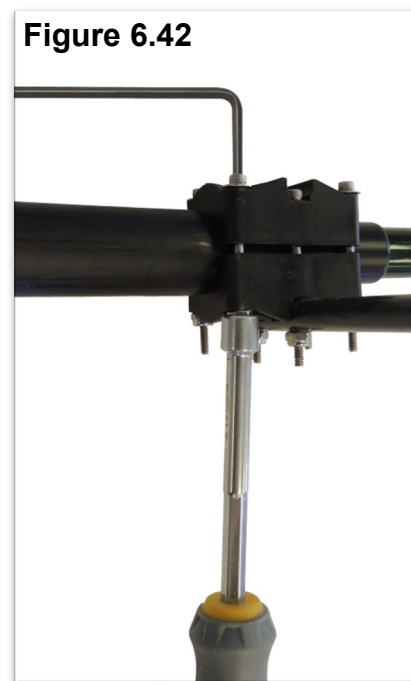
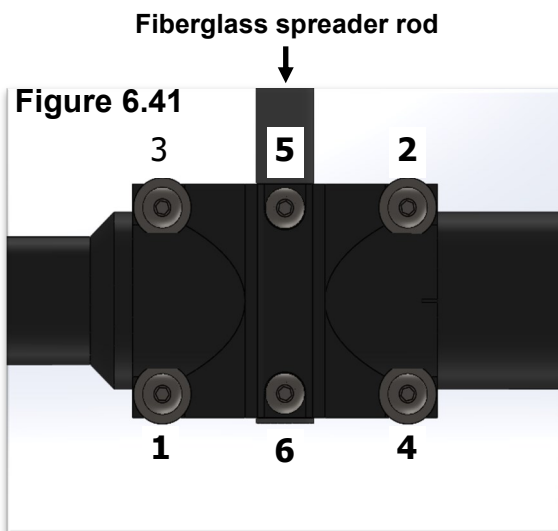
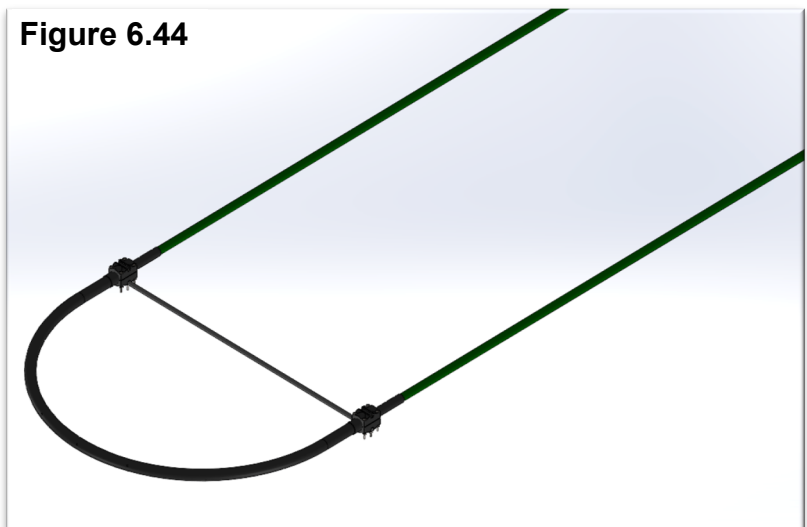


Figure 6.43



Figure 6.44



ATTACHING FOAM PLUG ASSEMBLY TO TELESCOPING POLE

Section 6.5: Adding Foam Plug Assembly to the Telescoping Poles

Each 20m-6m telescoping pole tip requires a breathable foam plug to allow for venting of the EHU. The **foam plug assembly (PN 70-1007-01)** in **Figure 6.51** consists of a special UV resistant foam plug material, a SS screen, and a vinyl cap.

The foam plug and SS screen is installed inside the vinyl cap at the factory.

The fit of the vinyl cap on the pole tip is purposely very tight, so that the foam plug assembly will stay in place. Before attaching the foam plug assembly, spread a small amount of dish soap around the inside edge of the vinyl cap as shown in **Figure 6.52**. This helps the housing slide on easily, and the soap will eventually evaporate, leaving you with a firm interference fit.

Insert the foam plug assembly onto the telescoping pole tip as shown in **Figure 6.53**. Be sure that the plastic housing bottoms out on the pole tip.

Repeat for the other telescoping pole tip.

Figure 6.51



Figure 6.52



Figure 6.53



ATTACHING ELEMENTS TO THE EHUS

Section 7.1: Prepare the CPVC Inner Guide Tube & Diverter Cone

SKIP TO THE NEXT PAGE IF YOU DO NOT HAVE THE 40/30 LOOP

The 40/30 loop on the 2 Element Yagi uses a plastic tube and a diverter cone located inside the telescoping pole, to guide the copper strip out of the EHU. Note that the straight elements do not use this inner tube, only the 40/30 loops. The plastic tube is off-white and is made of CPVC. There are 3 pieces that make up the guide tube assembly: The **diverter cone** (PN 10-1509-02), the **39-7/8" CPVC tube with no coupler** (PN 70-2025-23) and the **49" CPVC tube with coupler** (PN 70-2025-13). This guide tube is only required for 40/30 loop elements. The guide tube is not needed on the return side of the loop. **Figure 7.11** shows the three pieces in the assembly.

The smaller diameter end of the diverter cone is glued to one end of the 39-7/8" CPVC tube as shown in **Figure 7.12** utilizing the **glue kit** (PN 72-0009-03). Use the supplied glue and applicator as shown in **Figure 7.13**. Apply the glue evenly around the outside diameter of the tube as shown in **Figure 7.13**. Be sure you get even coverage all the way around the tube. Cover about 3/4" of an inch deep as shown in **Figure 7.13**. Firmly push and twist the 39-7/8" CPVC tube into the diverter cone end as shown in **Figure 7.14**. Let the glue dry at least 20 minutes before moving it.

Apply glue evenly around the outside diameter of the 39-7/8" CPVC tube as shown in **Figure 7.15**. Apply approximately 3/4" deep as per prior step. Locate the 49" CPVC tube with coupler, as shown in **Figure 7.16**. Push the 39-7/8" tube firmly into the coupler as shown in **Figure 7.17**.

Repeat above instructions for remaining guide tube assemblies (two per 40m driven EHU).

WARNING: Do not apply glue to the inner "female" portion of either the diverter cone or coupler. The glue applied to the outside of the tube is sufficient to bond the two pieces, and will prevent potential for damaging obstructions being formed by dried glue.

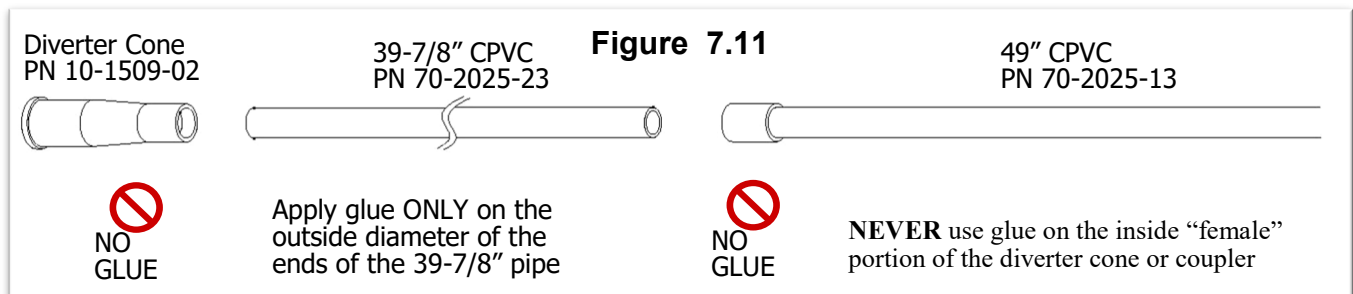


Figure 7.12



Figure 7.13



Figure 7.14



Figure 7.15



Figure 7.16

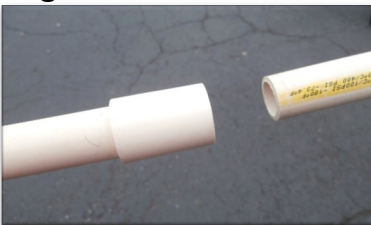


Figure 7.17



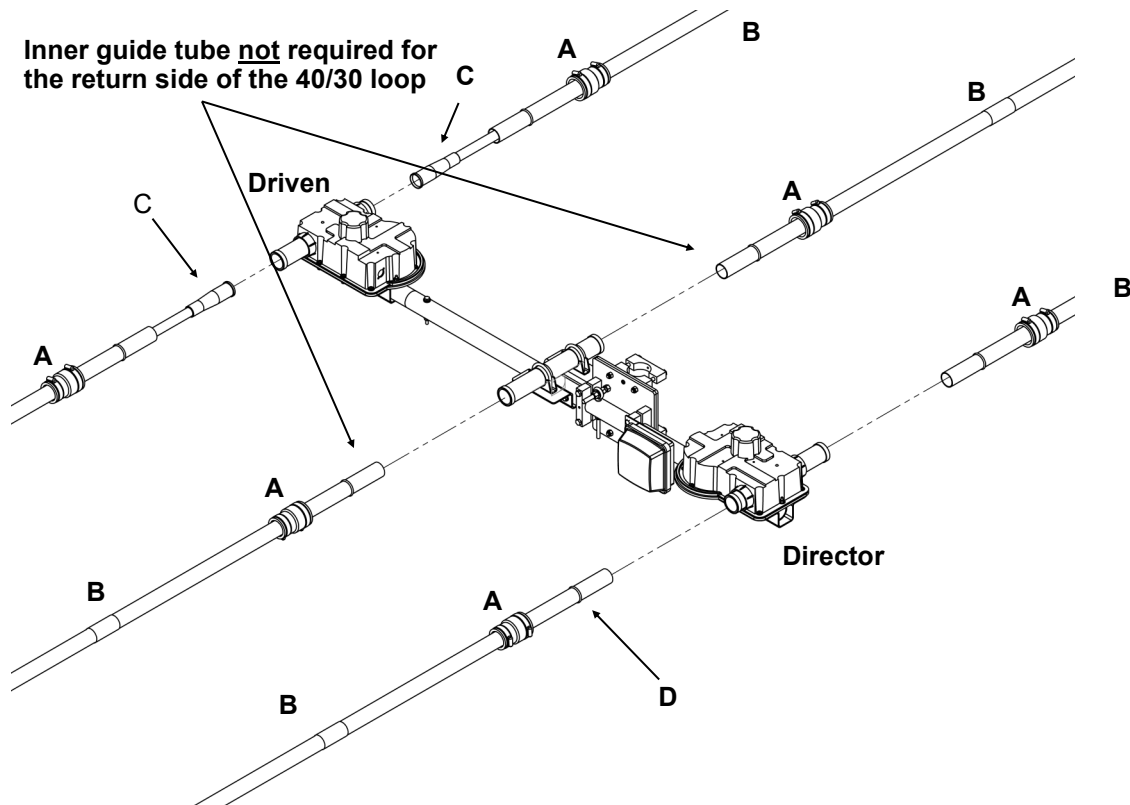
Section 7.2: Securing the Telescoping Poles to the EHUs

When the CPVC inner guide tubes are completed, they will need to be inserted into the telescoping poles and secured to each EHU. **Figure 7.21** below gives an overview of this procedure, with detailed instructions following on the next page.

This drawing shows the EHU placement for the driven and director element. The parts required in the table below are shown for the 40m-6m version of this antenna.

If you have the 20m-6m version of the antenna with no 40/30 loop, the Driven side will match the Director. The guide tube assemblies, labeled C in **Figure 7.21** below, will not be present.

Figure 7.21



| Key | QTY | Part # | Description |
|-----|-----|------------|---|
| A | 6 | 10-1006-22 | Quick disconnect boot |
| B | 6 | 10-1013-02 | Telescoping pole |
| C | 2 | NA | Inner guide tube assembly consisting of diverter cone , 39-7/8" and 49" CPVC Plastic tube, glued together. They are only used on the EHU side of the 40/30 loop |
| D | 4 | NA | Quick disconnect boot locking ring (these are molded into the base section of each telescoping pole and are used to keep the pole from sliding out of the quick disconnect boots in high wind situations) |

When attaching the telescoping fiberglass poles to each of the EHU's, special care must be taken to ensure that the rubber plugs that are in the base section of each pole are removed before placing the telescoping poles onto the EHU. **Failure to remove these plugs will result in catastrophic failure of the EHU.** Figure 7.22 shows how the plug is in place for shipping purposes.

Depending on when you purchased your antenna and what options you chose, it may have a 40/30 loop for use on 40m and 30m. These loops were prepared earlier on pages 33-36 and should look like the one shown in Figure 7.23. Be sure to put your quick disconnect boot (PN 10-1006-22) onto the pole before inserting into the EHU.

The CPVC inner guide tube is inserted into the EHU side of the loop assembly as shown circled in red in Figure 7.24. The guide tube is not required for the non-EHU side of the loop. The non-EHU side of the loop is commonly referred to as the "return side". Insert the guide tube so that the edge of the diverter cone is flush with the base of the telescoping pole as shown circled in red in Figure 7.25. Slide the pole base and guide tube into the EHU tube until it bottoms out firmly as shown in Figure 7.26. There may be a small portion of unpainted pole protruding. This is OK as it is shielded from the sun by the quick disconnect boot.

Align the telescoping pole on the return tube side of the loop. Insert the end firmly into the return tube as shown in Figure 7.27. There is a raised area called a locking ring that is molded onto the base section of each of the telescoping poles. These are there so that the quick disconnect boot cannot "slide" off in the event of high winds. This raised portion of the base section will rest up against the return tube as shown in Figure 7.27.

Before tightening the quick disconnect boots, twist the base sections of the telescoping poles until the loop portion of the element is as level as possible, as shown in Figure 7.28. Tighten the quick disconnect boots firmly. **Wait 20 minutes and tighten again—the flexible material will tend to cold flow initially.** It is also a good idea to do a final tightening of all the quick disconnect boots and all fasteners as a last step before mounting the antenna onto the mast. Repeat above steps for the other half of the loop.

The installation pictures below may represent a different antenna, the overall process is the same.

For the straight elements you only need to follow the steps concerning the telescoping pole and quick disconnect boot, there is no CPVC inner guide tube.

Figure 7.22



Figure 7.23



Figure 7.24



Figure 7.25



Figure 7.26



Figure 7.27

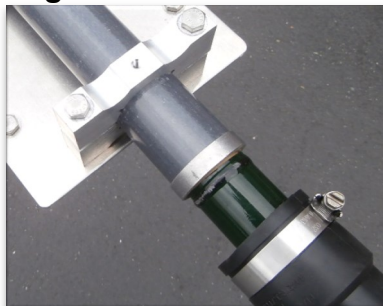


Figure 7.28



ELEMENT TRUSS OVERVIEW

SKIP TO PAGE 46 IF YOU DO NOT HAVE THE 40/30 LOOP

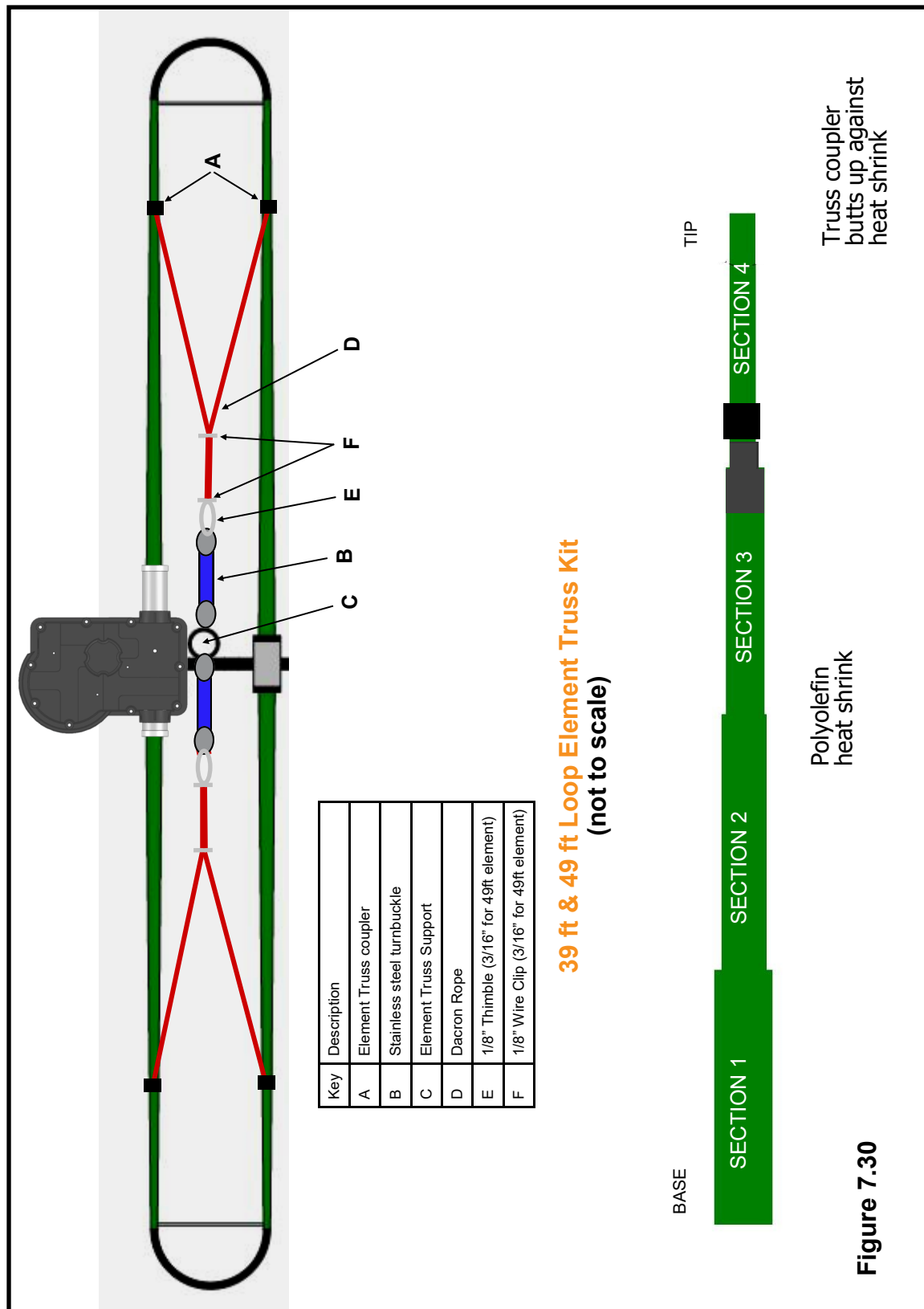


Figure 7.30

40/30 ELEMENT TRUSS KIT

Section 7.3: Installing the Truss Support Mast

SKIP TO PAGE 46 IF YOU DO NOT HAVE THE 40/30 LOOP

The great advantage of telescoping fiberglass poles are that they are both flexible and extremely strong. This is a significant advantage for such adverse weather situations as high winds, icing, or snow accumulation. The only negative to this, is because of the flexibility, there is a slight natural "droop" at the element ends. This droop has no impact whatsoever on performance, but some people do not care for the look. For primarily aesthetics purposes, we offer the 40/30 loop end truss kit which allows for the leveling of the loop elements to the same level as the straight elements. This makes for a better overall profile of the Yagi. The hardware below will be found in the [39' element truss kit \(PN 72-0018-31\)](#).

The truss mast needs to be mounted so that it is centered on the halfway point between the EHU's EST center-point and the return tube center-point. The overall length between the two center-points is 30 inches, so the halfway point is 15 inches. Make a mark on the boom 15 inches between the two center-points as shown in **Figure 7.33**. Locate the truss support (E) and two 1-3/4" aluminum saddle halves (F). Place the saddles so that the edge of the saddle is on the edge of the mark as shown in **Figure 7.34** (be sure this is the same edge as the one on the truss support that the turnbuckles bolt to). This will ensure that the support is indeed on the center point. Insert two of the 5/16" x 3-1/2" hex head bolts (I) and secure with 5/16" Nylock nuts (G). **Remember to use anti-seize on the stainless steel fasteners.** Level the support (perpendicular to the element brackets) before tightening as shown in **Figure 7.35**. After tightening, insert a set screw (K) into the exposed saddle and tighten.

Attach each of the 4" stainless steel turnbuckles (C) using the 1/4" x 1-1/4" hex head bolt (D), two of the 5/16" stainless steel flat washers (B) and 1/4" Nylock nuts (A) as shown in **Figure 7.31**. The keys below are used for both drawings, they are not separated by top or side view drawings.

| Key | Qty | Part # | Description |
|-----|-----|------------|---------------------------|
| A | 1 | 60-0030 | 1/4" SS Nylock nut |
| B | 2 | 60-0033 | 5/16" SS washer |
| C | 2 | 60-0083 | 4" SS turnbuckle |
| D | 1 | 60-0110 | 1/4" X 1-1/4" SS hex bolt |
| E | 1 | 10-1054-02 | 30m / 40m truss support |

| Key | Qty | Part # | Description |
|-----|-----|------------|----------------------------|
| F | 2 | 10-1601-03 | 1-3/4" Aluminum saddle |
| G | 2 | 60-0046 | 5/16" SS Nylock nut |
| I | 2 | 60-0065 | 5/16" X 3-1/2" SS hex bolt |
| J | 1 | N/A | Antenna Boom |
| K | 1 | 60-0112 | 10-32 x 1/4" SS Set Screw |

Figure 7.31—Top View

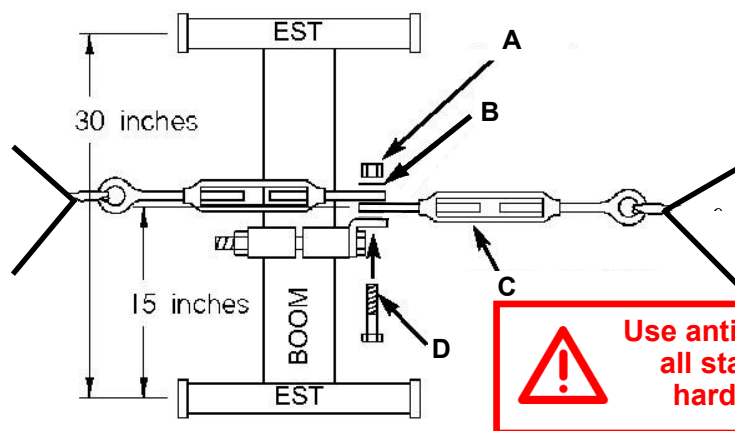


Figure 7.32—Side View

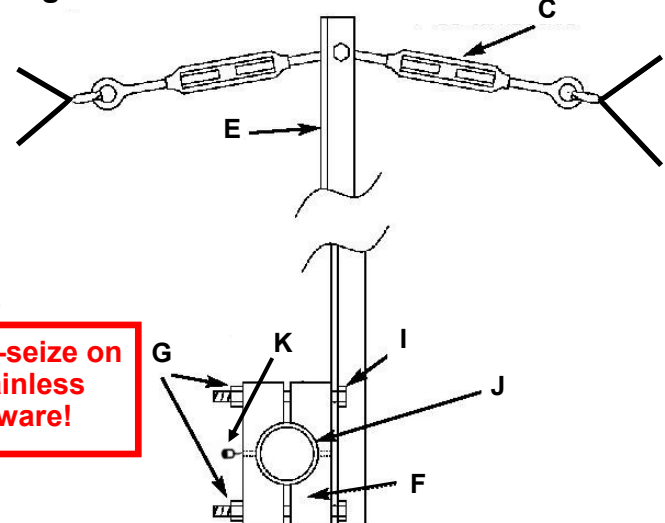


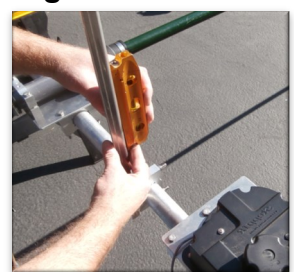
Figure 7.33



Figure 7.34



Figure 7.35



Section 7.4: Attach the Truss Couplers

SKIP TO PAGE 46 IF YOU DO NOT HAVE THE 40/30 LOOP

There are two pieces to the **element truss couplers** (PN 10-1510-21) as shown in **Figure 7.41**. The couplers are mounted on each side of the loop, located at the outer joint of the telescoping poles as shown in **Figure 7.42**. The truss coupler butts up against the edge of the polyolefin heat shrink.

There are nut trays molded on one side of the truss coupler, recessed so the nut can rest inside, as shown in **Figure 7.43**. These are handy for holding the **6-32 Nylock nut** (PN 60-0014) when tightening, but you will need to position your finger over the nut to keep it from spinning when you thread on each of the **6-32 x 7/8" pan-head machine screw** (PN 60-0014-01). Align the truss coupler so that the Dacron rope hole axis is parallel with the ground (coupler is perpendicular to ground) as shown in **Figure 7.44**. Do not over tighten the screws. The coupler halves do not need to bottom out against themselves, a small gap is fine.

The Dacron truss cord is provided in a single piece and will need to be trimmed as you progress with the installation of the end trusses. Thread the Dacron cord through the truss coupler, leaving approximately ten inches of truss cord sticking out of the hole. Tie four half-hitches and leave approximately four inches of spare rope after the knots are tied. **Figure 7.45** shows the proper way to tie a half-hitch. When finished, melt the end of the Dacron rope with a lighter so that it does not fray and apply electrical tape so that the leader of the Dacron rope is secured to the truss line. **Figure 7.46** shows a tied truss line before electrical tape is applied.



Figure 7.41



Figure 7.42



Figure 7.43



Figure 7.44



Figure 7.45

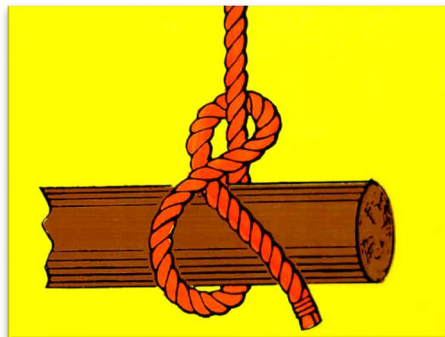


Figure 7.46



Section 7.5: Routing the Dacron Truss Cord

SKIP TO PAGE 46 IF YOU DO NOT HAVE THE 40/30 LOOP

Before inserting the cord through the eyebolt of the 4" turnbuckle, unthread each eye so that there is approximately 3/8" thread remaining in the frame of the turnbuckle portion, as shown in **Figure 7.51**. Locate the **1/8" thimble (PN 60-0158)**. Spread the thimble apart enough to slide it on to the eye of the turnbuckle. When the thimble is through the eyebolt, bend the tips of the thimble back as close to each other as possible, as shown in **Figure 7.52**.

Thread the Dacron truss cord through the eye of the turnbuckle and around the 1/8" thimble as shown in **Figure 7.53**. Pull the truss cord back down to the truss coupler on the opposite side of the loop. Insert the Dacron cord through the truss coupler (refer to prior page for instructions), pulling the cord tight so that there is no slack on either side of the cord. The procedure for securing the Dacron truss cord on this end of the loop is exactly the same as the truss coupler you prepared initially.

At this point of the installation of the 40/30 loop element truss, it is important to assemble the truss couplers and Dacron truss cord on the other side of the EHU. Because of the significant torque generated by leveling of the elements, there **needs to be equal force applied on each side** as shown in **Figure 7.54**.

When the 40/30 loops on each side of EHU have both been prepared, attach two **1/8" galvanized wire clips (PN 60-0157)** on each side as shown in **Figure 7.55**. Position the first wire clip as close as possible to the tip of the thimble. Position the second wire clip an inch behind the first. Be certain that the rope is "stacked" one on top of the other as shown in **Figure 7.56**. Tighten the wire clips firmly.

Figure 7.51



Figure 7.52



Figure 7.53

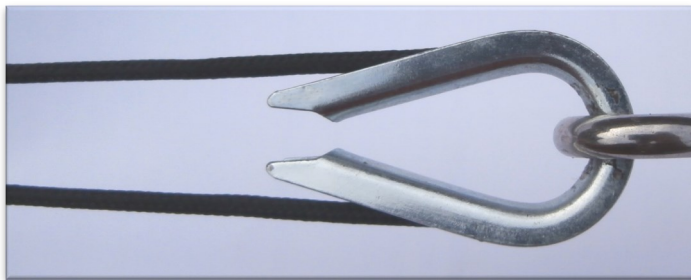


Figure 7.54

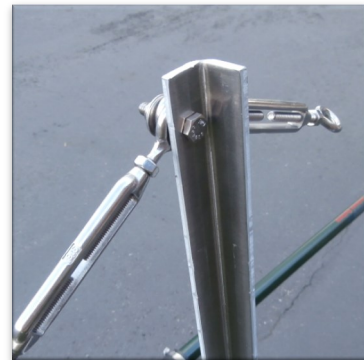


Figure 7.55

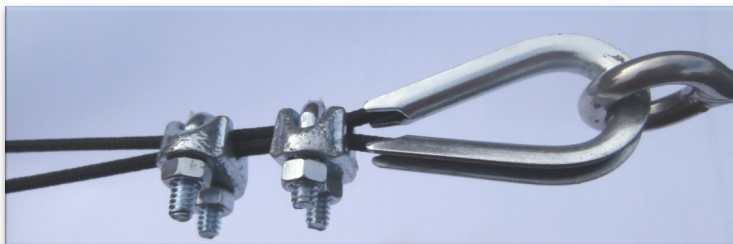


Figure 7.56



Section 7.6: Leveling the elements

SKIP TO NEXT PAGE IF YOU DO NOT HAVE THE 40/30 LOOP

When leveling the elements, use two adjustable wrenches as shown in **Figure 7.61**. **Be sure to apply anti-seize to the threads of the eyebolts in the turnbuckle otherwise they may seize!** The wrench that is placed on the thimble is held stationary, while the wrench that is on the frame of the turnbuckle is rotated. Adjust each turnbuckle a few turns at a time until the elements are level.

Be careful not to raise the elements so that the loops are above the profile of the straight elements—some droop is necessary so that water will not accumulate in the poles. When the elements are at the desired position, tighten the lock nuts on each end of the turnbuckle frame as shown in **Figure 7.62**. Be sure to do this with ALL turnbuckles, as this will prevent the turnbuckle from unwinding. As a secondary measure, we recommend looping insulated copper wire or SS safety lock wire through the eye and frame of the turnbuckle as shown in **Figure 7.63**.

In addition to the leveling of the elements, it is also important to ensure that the fiberglass spreader on the loops are parallel to the boom. The best method for this is to loosen the quick disconnect boots on the telescoping poles and twist the base of the pole until the loops are parallel to the boom. **Figure 7.64** shows a loop that is not parallel. **Figure 7.65** shows the loop being adjusted. **Figure 7.66** shows the level and parallel half of the 40/30 element.



**Use anti-seize on
all stainless
hardware!**

Figure 7.61

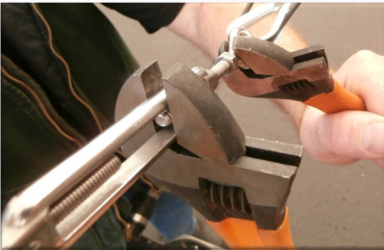


Figure 7.62



Figure 7.63



Figure 7.64



Figure 7.65



Figure 7.66



6 METER PASSIVE ELEMENT (INCLUDED)

Section 8: Installing the 6m Passive Element

The 6 meter passive element comes in 3 pieces. The main body with a 1/2" x 58" element section attached to it, and two 3/8" element sections as shown in **Figure 8.01**. The overall length of the element is approximately 114" for the 2 element when assembled.

The required fasteners will be in the **2E/3E 6m hardware kit (PN 72-0014-01)**. Use a small amount of the connector protector that was included with the connector junction box when connecting the two sections of tubing. Slide in the short ends of the 3/8" tubing (the end that has the least amount of distance from the edge of the tubing to the drilled hole) and line up the holes in the two sections. Insert the 6-32 x 3/4" screws (C) and fasten securely with the 6-32 Nylock nuts (D) as shown in the detail view on **Figure 8.01**. The 6m passive element mounts to the boom using a 1-3/4" U-bolt and Saddle (A) and 5/16"-18 Nylock nuts (B) as shown in **Figure 8.02**. The center of the 6m element should be 22" from the center of the driven element, as shown in **Figure 8.03**. Fasten securely to the boom using the U-bolt, saddle and hardware supplied. Make certain that you have the 6 meter passive element mounted on the top side of the boom and level (parallel) with the other elements.

Warning: When attaching the 6m passive to the boom be careful not to trap the element control cable under the U-bolts.

Note: You will need to verify that the 6m passive in the controller is enabled. Reference your controllers operators manual under "Setup" - "Options Menu" - "6m Passive Selection".

When you are using the 6 meter band, keep the antenna in the forward direction and rotate accordingly. Optimum performance will be from 50.000 MHz to 50.500 MHz. The 180 degree mode is exactly the same as the forward mode since we now have a fixed length aluminum passive element, however, the Bi-Directional works to the same degree by directly reducing the front to back ratio.

Figure 8.01

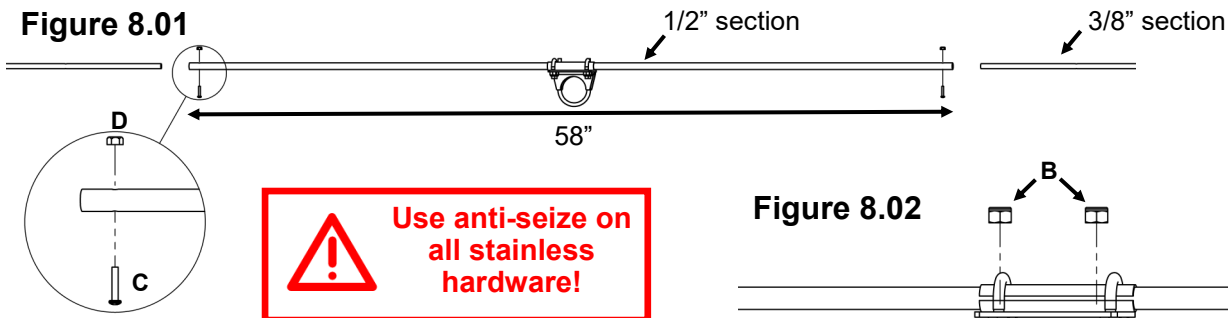
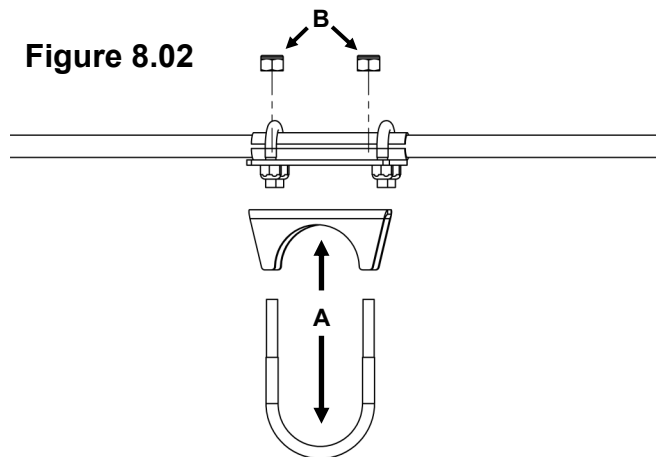
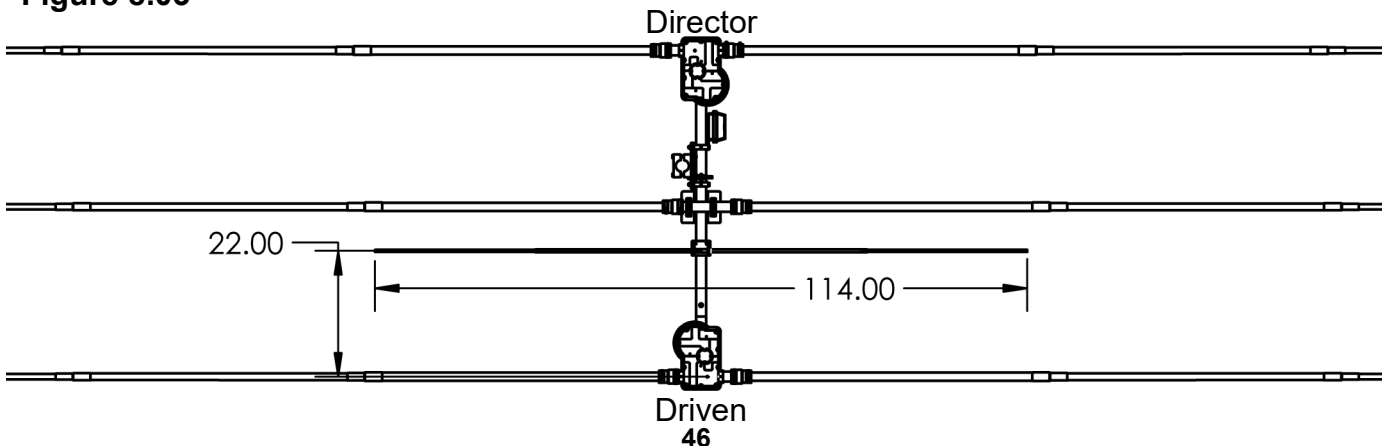


Figure 8.02



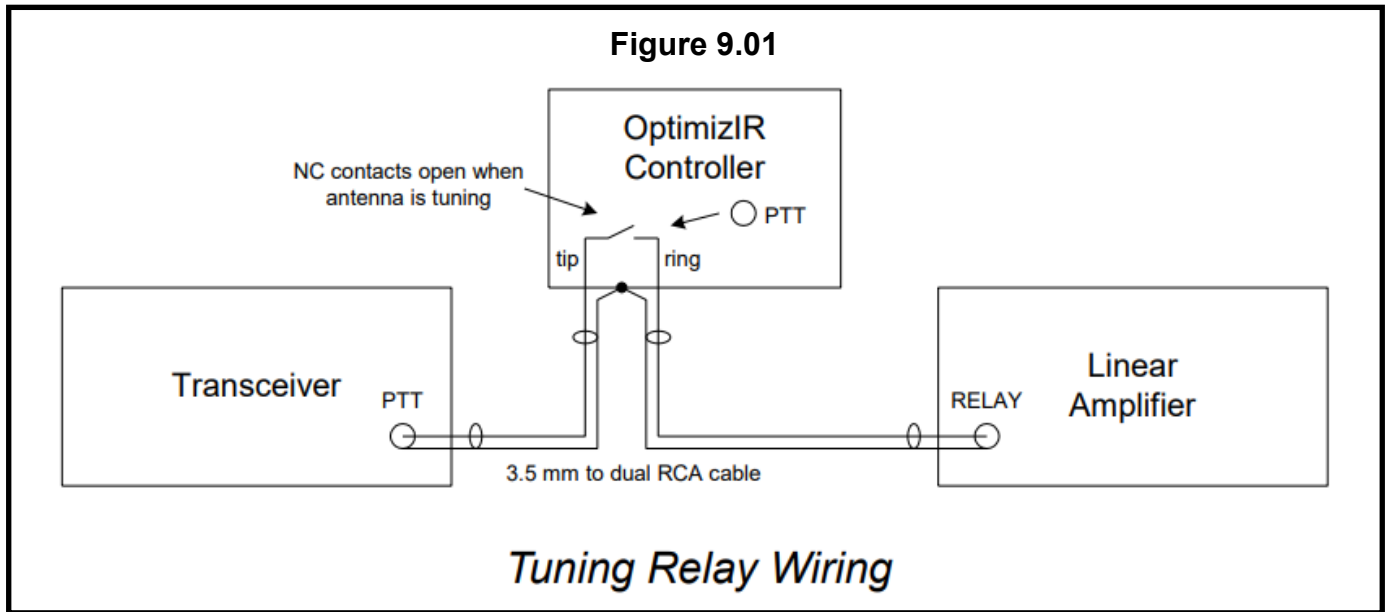
| Key | Qty | Part # | Description |
|-----|-----|---------|-----------------------------|
| A | 1 | 60-0003 | U-Bolt & Saddle, 1-3/4" |
| B | 2 | 60-0046 | Nut, 5/16" -18, Nylock, S/S |
| C | 2 | 60-0011 | Screw, 6-32 x 3/4", Panhead |
| D | 2 | 60-0014 | Nut, 6-32 Nylock |

Figure 8.03



PTT LOCKOUT TUNING RELAY (INCLUDED)

To prevent application of unintended, excessive RF power while the SteppIR antenna is tuning, the SDA 100 and OptimizIR controller provides an isolated pair of contacts from a 3.5 mm stereo jack to interrupt the PTT relay signal to a linear amplifier. The cable is provided, but any standard 3.5 mm stereo plug to two RCA plug cable sold for audio applications works well in most cases. Some more modern amplifier relay control schemes are different and may not accommodate an RCA plug. Older amplifiers may use high voltage in their PTT circuit which may be a problem for some transceivers. Please read your amplifier and transceiver manuals carefully. The 3.5 mm plug tip and ring connect to isolated relay contacts inside the controller that interrupt the PTT circuit. The sleeve connection serves as a ground/shield. **Figure 9.01**



VOLTAGE/SURGE SUPPRESSOR (OPTIONAL)

- The Voltage/Surge Suppressor is can be installed at the base of the tower, or on a well grounded structure (ground rod or ground bus bar). It is recommended to mount this outside of the radio room.
- You will need to cut the control cable in order to install the Voltage/Surge Suppressor. **MAKE SURE THAT THE POWER IS TURNED OFF AND UNPLUGGED ON THE CONTROLLER AS WELL AS THE CONTROL CABLE UNPLUGGED.**
- The Voltage/Surge Suppressor **DOES NOT GO IN SERIES WITH THE CONTROL CABLE.** If you wire it this way, your control box **WILL NOT OPERATE.** The Surge Suppressor is a **SHUNT DEVICE.** To visualize the connection, think of a "T". The control cable is the top of the "T" and the Surge Suppressor is the "leg" of the "T".

Mounting the Voltage/Surge Suppressor:

1. Remove the two Galvanized U-Bolts from the mounting bracket.
2. Install the U-Bolts around the tower leg to suite your installation. If mounting to a ground post or ground bus bar then you may use the holes for the U-bolts as mounting holes to the post/bus bar.
3. Install the Voltage/Surge Suppressor, square washer plates and nuts.
4. Tighten the nuts. Over-tightening of the U-Bolts may result in bending of the aluminum bracket.
5. Visit your local hardware store or home center and pick up some Forked Crimp Style Lugs that will fit the #8 stud. You may either use crimp style lugs that need NO soldering or soldered lugs AND because they are fork style, you don't need to remove the nut to install them (Very handy when working on the tower!). It's a good idea to give the lug a tug to confirm it's crimped properly. **Soldered lugs are preferred if you have the capability to do so.**

The 8 Wire Surge Suppressor will require 16 Lugs. The 12 Wire Surge Suppressor will require 24 Lugs. The 16 Wire Surge Suppressor will require 32 Lugs.

6. If you match the colors of the leads on your control cables per stud, you should have no issues as shown in **Figure 9.02**. The Voltage/Surge Suppressor was checked at the factory for defects prior to shipment.

7. Make sure that you secure the control cable with tape or cable ties (aka Zip Ties) to the tower or ground rod as shown in **Figure 9.03**.

8. We recommend sealing up the connections by either using silicone tape or electrical tape to wrap the entire Voltage/Surge Suppressor and cable connections so that they do not corrode from moisture.

Figure 9.02

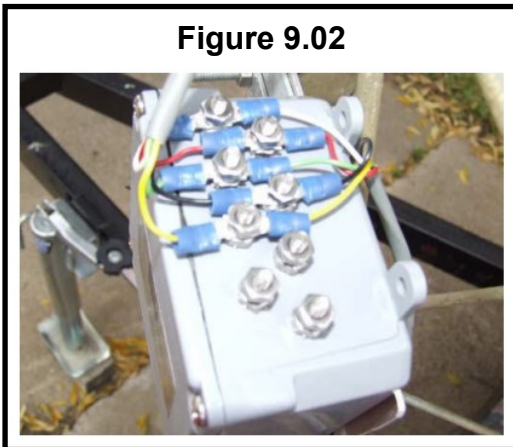
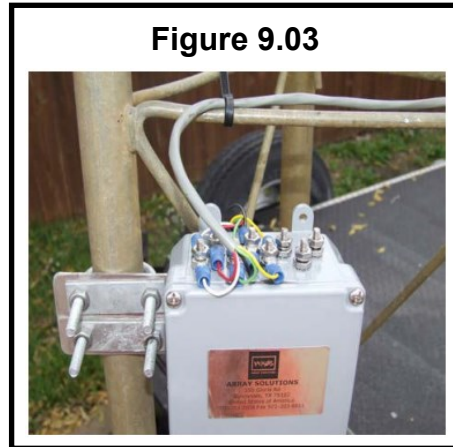


Figure 9.03



GROUNDING THE CONTROLLER

Make sure the controller is grounded! The ground lug locations are different for different controllers—the locations of the lugs for each type of controller are shown in the photos below.

To ground the controller, remove the yellow cap on the lug and take off the first nut and star washer. Attach a ring lug to the grounding wire and secure it to the ground lug by placing the ring lug, then star washer, then screwing the nut back on. Tighten with a wrench or socket. The other end of the wire should connect to any suitable ground point, typically a ground bus bar used for station ground.

Figure 9.04: Lug location for SDA100, OptimizIR, and OptimizIR 2.0 (early models)



Figure 9.05: Lug location for OptimizIR 2.0 (stainless steel chassis)



HOW TO TUNE YOUR YAGI (MANDATORY)

A Yagi antenna's resonant frequency is determined by the length of its driven element, reflectors, and directors, as well as a variety of other factors. Since every installation is different, the factory default lengths in the controller for each band/frequency are almost guaranteed to need adjustment for your particular installation. Because of this, **it is mandatory to tune the length of the elements on all frequencies of operation before application of high power.**

This is done by pressing "Setup" and selecting the "Create/Modify" menu. In this menu, the operator can scale the antenna up or down in frequency by using the "Band Correction Factor" or adjust the length of the driven element (DVR/DE) until the minimum SWR dip is at least below 1.4-1.3. An antenna analyzer (Vector Network Analyzer) is extremely helpful for this task as it allows the user to plot SWR over a frequency range, at which you can match the SWR dip in the antenna with the frequency which you are tuning in the create/modify menu. **If you are unable to make a good match by scaling the antenna or adjusting the length of the driven element, you most likely have an issue with your connections or wiring.**

SteppIR antenna tunes are broken up into "segments" which we use to create an ideal antenna at a specific frequency. Each segment consists of a frequency, element lengths, and some miscellaneous display settings like gain, F/R, and beam width. To get the element lengths at frequencies in between segments, the controller utilizes an algorithm to calculate them with the given segment information. The controller can only "store" lengths at the start of each segment, and it calculates the lengths in between. **What this means for the end user is that the antenna can only be tuned once in between each segment.**

Important notes:

- Start tuning by first calibrating the antenna.
- You will want to tune starting at the highest frequency and work your way down to lower frequencies.
- Send the antenna to the recommended tune frequency, scan a large span (the SWR dip may be outside of the ham band) with your antenna analyzer and find the minimum SWR. If it is below 1.4:1, but the minimum SWR frequency does not match your controller frequency, then use the band correction factor to scale the antenna up or down in frequency. The band correction factor should only be used as a tool to find the correct element lengths. Once you have found a correction factor that lines up the minimum SWR to the controller frequency, record the element lengths for each element. Set the correction factor back to 0.0% and input the previously recorded lengths into each element. The SWR dip should be back to where it was when you found the correction factor that works for that segment.
- If the SWR dip minimum is above 1.4:1 you will want to change the length of the active driven element (not always DVR on antenna's that have relay switching, reference the manual for the correct active driven element). Lengthen/shorten the active driven element until you have a SWR minimum below 1.4:1. You will then want to use the band correction factor to scale the antenna as described above.
- In order to save a setting in the Create/Modify menu, you can simply exit from the screen by pressing "Setup" again, and when the controller prompts you whether you want to save your changes make sure you select "Yes" to save your changes.

On the next pages are lists of the segments, segment frequencies, and recommended tune frequencies for the 2 Element Yagi on the OptimizIR and SDA100 controllers.

OptimizIR / OptimizIR 2.0 recommended tuning frequencies

| Segment # | Start | End | Tune Frequency | Ham Band |
|-----------|-------|-------|----------------|---------------------|
| 17 | 51.00 | 65.00 | 52.5 | 6m (50-54) |
| 16 | 49.50 | 51.00 | 50.5 | |
| 15 | 41.00 | 49.50 | 45.25 | - |
| 14 | 34.50 | 41.00 | 37.75 | - |
| 13 | 29.00 | 34.50 | 29.35 | 10m (28.0-29.7) |
| 12 | 27.50 | 29.00 | 28.5 | |
| 11 | 24.60 | 27.50 | 24.94 | 12m (24.89-24.99) |
| 10 | 20.80 | 24.60 | 21.225 | 15m (21.0-21.45) |
| 9 | 17.85 | 20.80 | 18.118 | 17m (18.068-18.168) |
| 8 | 15.80 | 17.85 | 16.825 | - |
| 7 | 13.85 | 15.80 | 14.175 | 20m (14.0-14.35) |
| 6 | 12.50 | 13.85 | 13.175 | - |
| 5 | 11.30 | 12.50 | 11.9 | - |
| 4 | 10.00 | 11.30 | 10.125 | 30m (10.10-10.15) |
| 3 | 8.85 | 10.00 | 9.425 | - |
| 2 | 7.85 | 8.85 | 8.35 | - |
| 1 | 6.95 | 7.85 | 7.15 | 40m (7.0-7.3) |

If tuning a 2E 20-6m (no 40/30m dipole) then segment 7 will be the last segment you tune.

Please refer to the create/modify section of the controller manual and our Tech Support Video section on our website for more information on tuning.

OptimizIR Manual:

https://consumer.steppir.com/wp-content/uploads/2018/05/SDA-2000-OptimizIR-Manual-Version-1_4-April-17-2018.pdf

Tech Support Videos:

<https://consumer.steppir.com/support/tech-support-videos/>

SDA100 recommended tuning frequencies

| Segment # | Start | End | Tune Frequency | Ham Band |
|-----------|-------|--------|----------------|---------------------|
| 17 | 51.00 | 65.525 | 52.5 | 6m (50-54) |
| 16 | 49.50 | 51.00 | 50.5 | |
| 15 | 41.00 | 49.50 | 45.25 | - |
| 14 | 34.50 | 41.00 | 37.75 | - |
| 13 | 29.00 | 34.50 | 29.35 | 10m (28.0-29.7) |
| 12 | 27.50 | 29.00 | 28.5 | |
| 11 | 24.60 | 27.50 | 24.94 | 12m (24.89-24.99) |
| 10 | 20.80 | 24.60 | 21.225 | 15m (21.0-21.45) |
| 9 | 17.85 | 20.80 | 18.118 | 17m (18.068-18.168) |
| 8 | 15.80 | 17.85 | 16.825 | - |
| 7 | 13.85 | 15.80 | 14.175 | 20m (14.0-14.35) |
| 6 | 12.50 | 13.85 | 13.175 | - |
| 5 | 11.30 | 12.50 | 11.9 | - |
| 4 | 10.00 | 11.30 | 10.125 | 30m (10.10-10.15) |
| 3 | 8.85 | 10.00 | 9.425 | - |
| 2 | 7.85 | 8.85 | 8.35 | - |
| 1 | 6.95 | 7.85 | 7.15 | 40m (7.0-7.3) |

If tuning a 2E 20-6m (no 40/30m dipole) then segment 7 will be the last segment you tune.

Please refer to the create/modify section of the controller manual and our Tech Support Video section on our website for more information on tuning.

SDA100 Manuals:

Mustang Firmware:

<https://consumer.steppir.com/wp-content/uploads/2020/10/SDA100-Operators-Guide-MUSTANG.pdf>

Pinto Firmware:

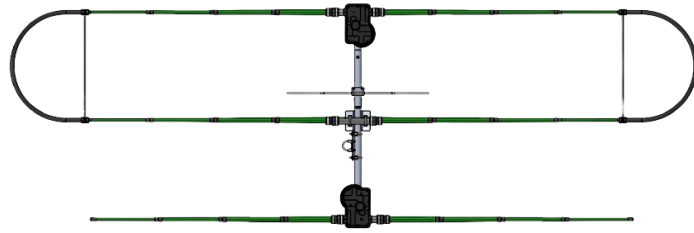
<https://consumer.steppir.com/wp-content/uploads/2011/10/operations-manual-SDA-100-rev-2-dec-12.pdf>

Tech Support Videos:

<https://consumer.steppir.com/support/tech-support-videos/>

STEPPIR OPTIONS

- 40m - 30m Dipole Retrofit



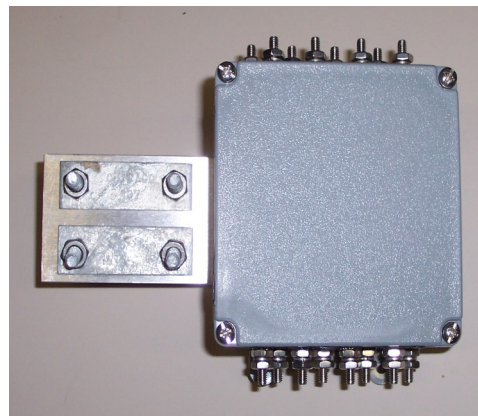
- “Y” Cable



- Transceiver Interface (Rig Specific)



Voltage suppressor (12 conductor)



- Element Expansion Kit

| | | |
|-----------|----|-----------|
| Dipole | to | 2 Element |
| 2 Element | to | 3 Element |

STEPPIR COMMUNICATION SYSTEMS 5 YEAR LIMITED PRODUCT WARRANTY

(as of May 22, 2023; Prior to that date warranty is 2 years)

Our products have a limited warranty against manufacturers defects in materials or construction for five (5) years from date of shipment. Do not modify this product or change physical construction without the written consent of Fluidmotion Inc, dba SteppIR Communication Systems.

This limited warranty is automatically void if the following occurs: improper installation, unauthorized modification and physical abuse, customer misuse or damage from weather events or natural disasters that are outside of the stated survivability of the product. For wind damage, proof of winds beyond 100 mph must be presented. Lightning or near-lightning events are not covered under this warranty. Driver chip module replacement is not covered under this warranty. This warranty is not transferrable.

SteppIR Communication System's responsibility is strictly limited to repair or replacement of defective components, at SteppIR's discretion. SteppIR will not be held responsible for any installation or removal costs, costs of any ancillary equipment damage or any other costs incurred as a result of the failure of our products.

In the event of a product failure, a return authorization is required for warranty repairs. This can be obtained at www.steppir.com. Shipping instructions will be issued to the buyer for defective components, and shipping charges to the factory will be paid for by the buyer. SteppIR will pay for standard shipping back to the buyer. The manufacturer assumes no further liability beyond repair or replacement of the product.

Modification of this product is not authorized and may cause product failure, injury or death.

