steppIR COMMUNICATION SYSTEMS

UrbanBeam Yagi Instruction Manual

Manual REV 2.32 **August 2nd, 2024**

ANTENNA SPECIFICATIONS

UrbanBeam Yagi Specifications

Specifications	UrbanBeam Yagi
Boom length	4.0 ft / 1.22 m
Boom outside diameter	1.75 in / 4.45 cm
Longest element	30.5 ft / 9.3 m
Turning radius	15.5 ft / 4.72 m
Weight	45 lb / 20.5 kg
***Projected area**	6.44 sq ft / 0.60 sq m
Wind rating	100 mph
Adjustable elements	2
Power Rating	3000 watts continuous
Feed points	1
Frequency coverage	6.95 MHz—54 MHz
Control cable	12 conductor shielded, 22AWG

Frequency	Gain dBi	Front to Back dB	Front to Rear dB
40m	1.6[1]		9.55 (F/S)
30m	1.77[2]		9.63 (F/S)
20m	6.50	16.5	12.0
17m	6.6	21	12.6
15m	6.6	24.6	14.0
12m	6.7	18.5	15.7
10m	6.65	14.8	14.8
6m	6.15	4.0	4.0

[1] A full size dipole is referenced at 2.1dBi
[2] Measured SWR is 2.3:1 for this model on 30m

*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.

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Pascal Villeneuve, VA2PV has done an excellent series on YouTube showing the unboxing and assembly of the Urban Beam Yagi antenna. While there has been some design changes it is still beneficial to watch these to get a good idea of how to build the antenna. He also did a comprehensive review of the product including the OptimizIR controller. Below are links that we HIGHLY recommend you review thoroughly before unboxing and assembling your Urban Beam Yagi:

Unboxing: https://www.youtube.com/watch?v=4KlkyR3S9v8

Assembly: https://www.youtube.com/watch?v=HKLnPsXhUYE

Review: https://www.youtube.com/watch?v=InKqrViwrxk

If typing these links in are laborious, simply go to www.youtube.com and then type in Pascal Villeneuve, Urban Beam, and the three links will appear.

Special thanks to Pascal Villeneuve VA2PV for the time he spent making these incredible 4K HD Videos!

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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

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PREAMBLE

OK - - - NOW WHAT?

(Sage advice from Jim Streible, K4DLI, SK)

You have ordered you 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 it 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.

WORD OF CAUTION

Be careful to avoid making contact with power lines or other potential hazards when constructing, moving and installing the antenna, as you could be seriously injured or even killed if a metal object comes in contact with high voltage.

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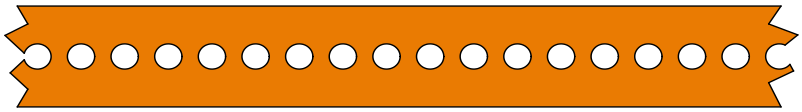
STEPPIR DESIGN

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.

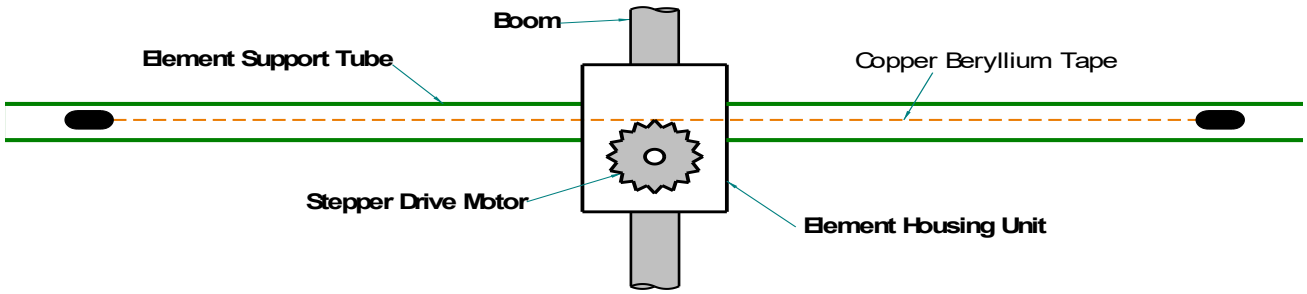


Copper-Beryllium Tape

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).



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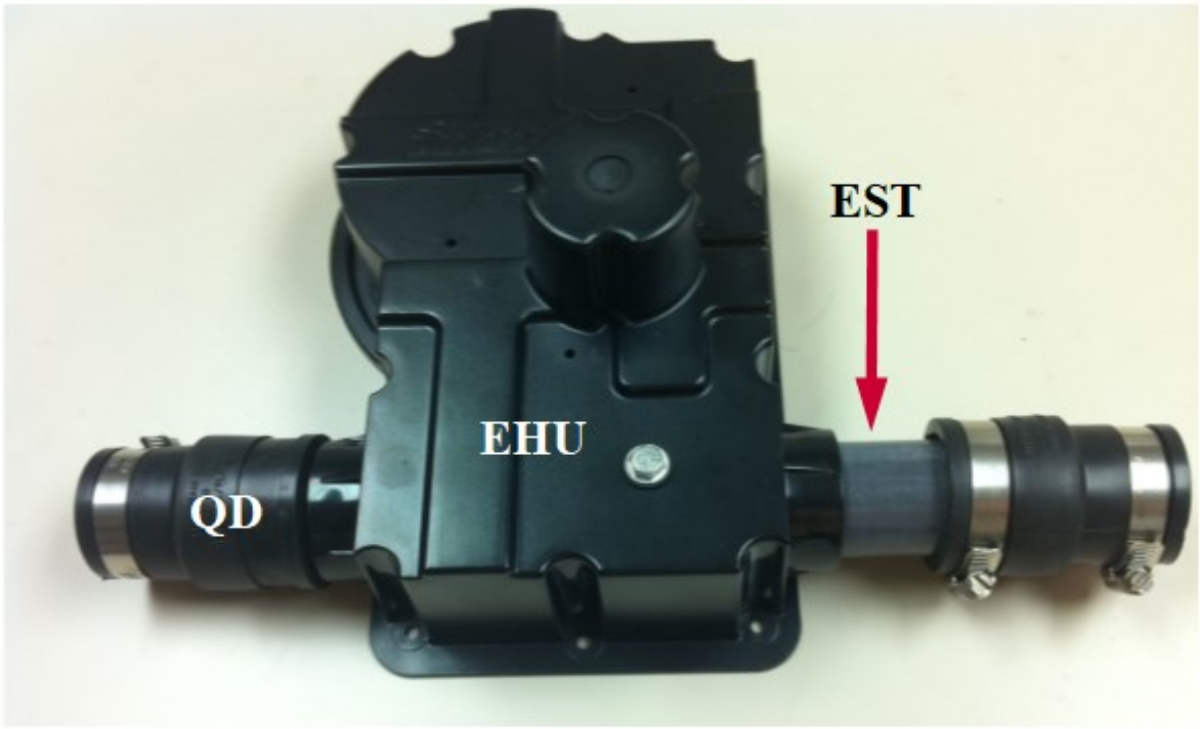
ABBREVIATIONS

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



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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.

What Comes in the Antenna Box

✓	QTY	PART #	DESCRIPTION
	4	10-1013-02	Telescoping Pole, 18 foot 4 section
	1	10-1018-11	Aluminum tube, 1-3/4" (4' Boom)
	1	10-1021-43	Boom to Mast plate, 8", HIGH WIND..with saddle holding holes
	8	10-1059-01	Polyolefin Heat Shrink 1-1/2" x 6"
	4	10-1059-21	Heat Shrink (new size) 1.1" x 6"
	4	10-1701-01	Metal Loop Strut
	4	10-1703-01	Poly Sweep Tubes, 1"OD x 18" (100psi)
	8	10-1059-21	Heat Shrink (new size) 1.1" x 6"
	8	10-1511-01	Sweep Diverters
	1	21-6040	Splitter, 6" 3-1/2mm, Stereo Male to Two RCA Female
	4	60-1006-22	QUICK DISCONNECT, 1-1/2" to 1-1/4", Fernco, (1056-150-125)
	2	70-2025-13	CPVC tube, 49" x 3/4", with coupler
	2	70-2025-23	CPVC tube, 39-7/8" x 3/4", w/o coupler
	2	70-2030-21	DB Mounting Plate w/ Reinforcement Wings and Foam Mounting Guide
	2	10-1609-11	DB Mounting Plate Upper Reinforcement Bracket
	1	70-2034	Connector Junction Box, 2E and 3E
	1	70-3000-01	33 Volt supply with cord
	1	70-3403-01	EHU, 40m Driven
	1	70-3420-01	EHU, 20m Passive
	1	70-6010-01	Adapter, 25pin Dsub Field Splice
	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)
	1	72-0041-21	Kit, UrbanBeam Glue, Tape, and Anti-Seize
	1	72-0060-01	Kit, UrbanBeam Loop Hardware
	1	72-0061-01	Kit, UrbanBeam Mast Plate Hardware
	1	72-0062-02	Kit, UrbanBeam Element Hardware (New reinforced DB plate style)
			QR Code Sheet - Instruction Manuals

PARTS CHECKLIST

72-0041-21

Kit, UrbanBeam Glue, Tape, & Anti-Seize

✓	QTY	PART #	DESCRIPTION
	1	72-0009-03	Glue kit
	1	09-0001	66’ PVC electrical tape
	1	10-1028-01	Anti-Seize Stick
	2	10-1509-02	Diverter cone

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

72-0060-01

Kit, UrbanBeam Loop Hardware

✓	QTY	PART #	DESCRIPTION
	6	09-0013-CUT	3M Grip tape 2.3” x 1”
	53	60-0014	6-32 Nylock nut
	53	60-0186	Screw, 6-32 x 2”, 18-8 SS Socket Head
	53	60-0016	6-32 Flat Washer
	16 halves	10-1155-01	Sweep Clamp half
	1	09-1025	3/4” conical grinding stone (pole tip preparation)
	2	10-1702-01	Loop Splice (5 inch)
	6	60-6000-50	Type “M” (.312) #10 SS Hose Clamp .312” Wide
	1	60-9000	Allen Key

72-0061-01

Kit, UrbanBeam Mast Plate Hardware

✓	QTY	PART #	DESCRIPTION
	4	10-1601-03	1.75” x .75” Aluminum Saddle Half
	4	10-1601-22	2.00” x .75” Aluminum Saddle Half
	4	60-0065	5/16” x 3.5” Hex head bolt, SS
	4	60-0114	5/16” x 3.75” Hex head bolt, SS
	8	60-0046	5/16” -18 SS Nylock nut
	5	60-0112	10-32 x 1/4” SS Set Screw cup point
	3	60-0113	10-32 x 5/8”, Panhead screw, SS

PARTS CHECKLIST

72-0062-02

Kit, UrbanBeam Element Hardware

✓	QTY	PART #	DESCRIPTION
	2	72-0054-21	EHU Lid Hardware Kit
	8	60-0046	5/16” Nylock nuts
	8	60-0065	5/16” X 3-1/2” Hex head bolt, SS
	8	10-1601-03	1.75” x .75” Aluminum Saddle Half
	5	60-0112	10-32 x 1/4” SS Set Screw cup point
	4	60-7019-11	Resin Clamp, 1.5" (set)
	4	10-1612-01	Resin Clamp Spacer
	10	60-0041	Washer, 1/4", Flat (5c)
	10	60-0030	Nut, 1/4"-20, Nylock, S/S (5c)
	10	60-0100	Bolt, 1/4 -20 X 3-1/2", hex head, S/S
	19	60-0033	Washer, 5/16", Flat, S/S
	2	10-1609-21	EHU Shell Flange Reinforcement Bracket, Side
	2	10-1609-31	EHU Shell Flange Reinforcement Bracket, Top

72-0054-01

Kit, EHU Lid Hardware (included in 72-0062-01 or -02)

✓	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)

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!

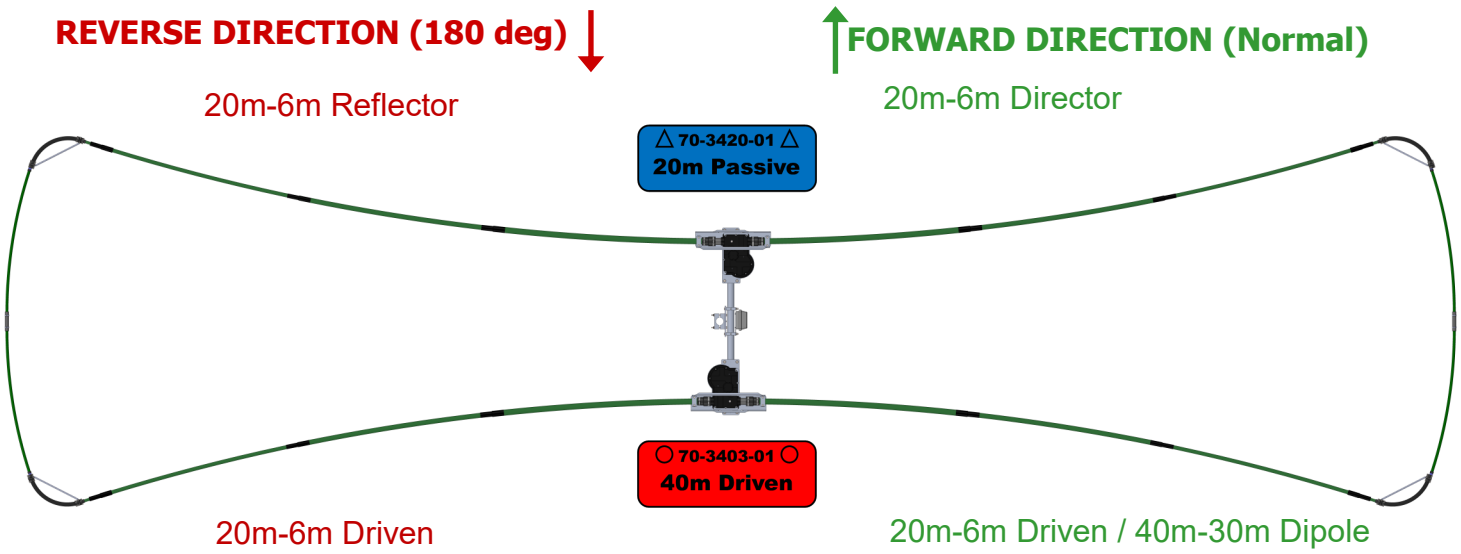
Turn-of-nut tightening of nuts to bolts is recommended where torque values are not named, with metal to metal connections. Turn the wrench/socket until it is flush with the material it will seat against and snug-tightened, and then turn approximately 2/3 of a rotation past that point. When in doubt use 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

Figure 1.01



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ANTENNA OVERVIEW AND DIAGRAM

Figure 1.02

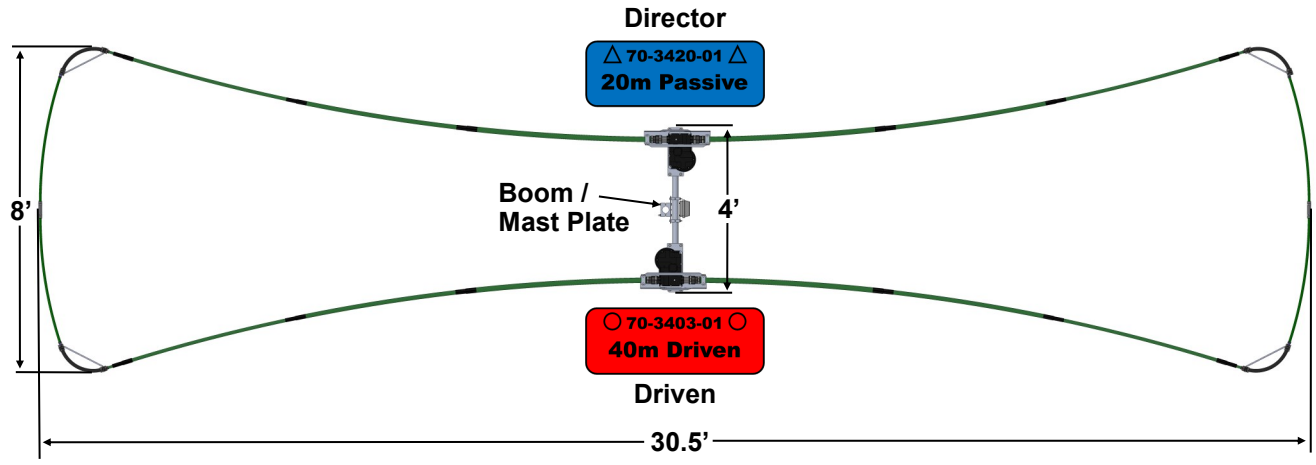
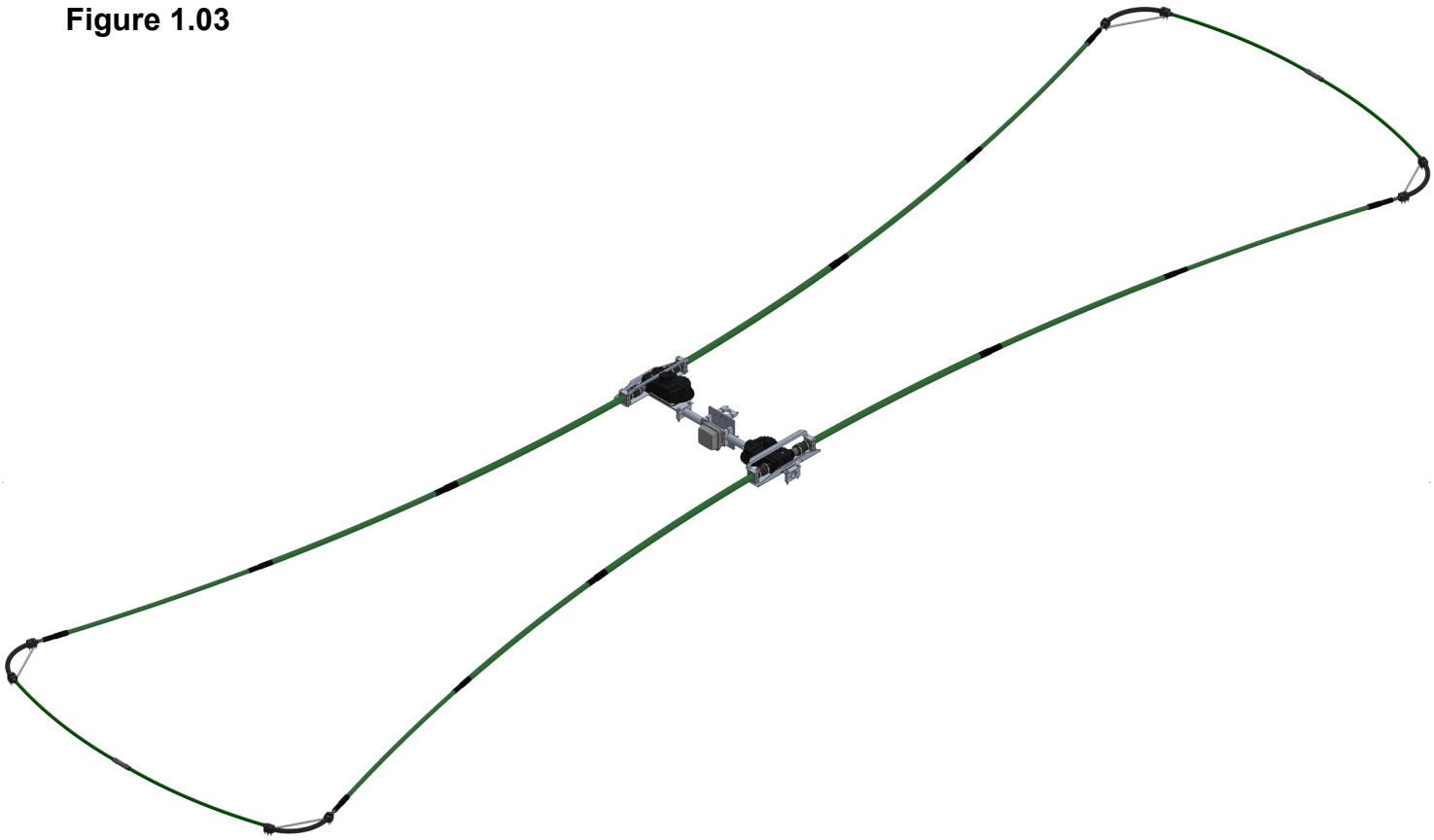


Figure 1.03



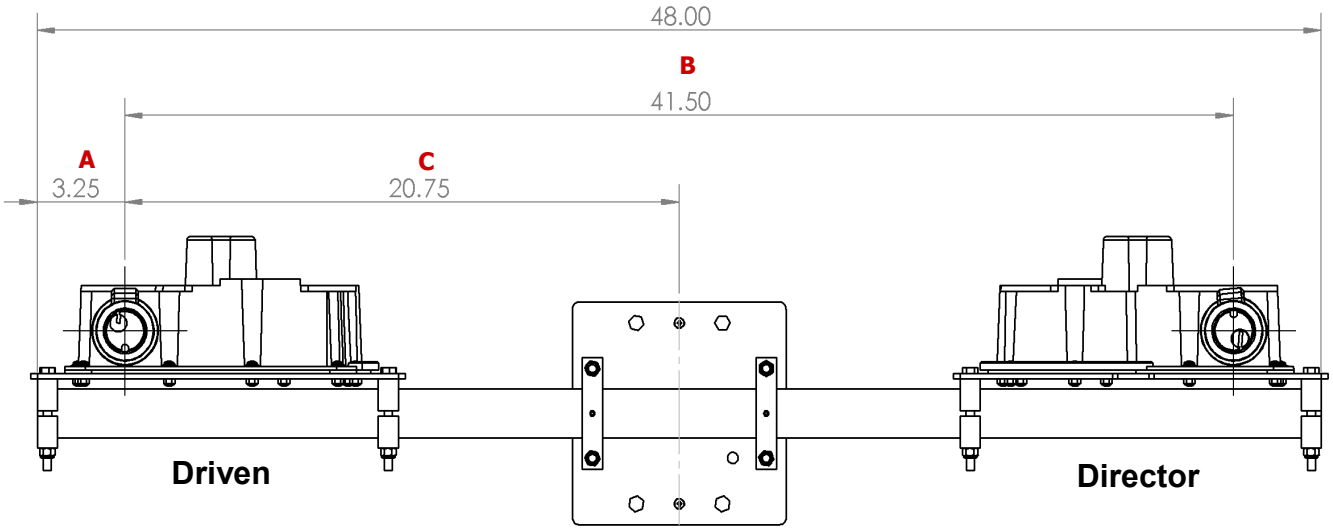
Section 1.1: EHU and Mast Plate Measurements

It is critically important that the center-to-center spacing is correct when assembling your SteppIR Yagi. Use **Figure 1.11** for placement of each of the elements. Start from the left edge of the boom and measure from there.
As you assemble each of the element housing units (EHU), refer to this drawing. We recommend this sequence:

1. Secure the driven and director element mounting plates to the boom using the correct saddles and fasteners **(be sure to use anti-seize on all stainless steel fasteners).** Level the mounting plates to each other and firmly tighten.
2. Install the connector junction box and mast plate perpendicular to the element mounting plates.
3. Wire the EHUs and secure them to the element mounting plates (don't forget the gasket!). The mounting plate itself acts as the lid for the EHUs.
4. Measure the center-to-center lengths and correct if needed. Take your time; get it right.

All of this is covered in greater detail in this manual, but it's important to understand the proper flow BEFORE you start—it will save a lot of time.

Figure 1.11



KEY	Start measurement at center-point of:	Finish measurement at center-point of:	Measurement distance between points
A	Boom edge	Driven EHU	3.25 inches
B	Driven EHU	Director EHU	41.50 inches
C	Driven EHU	Center of Mast Plate	20.75 inches

Use anti-seize on all stainless hardware!

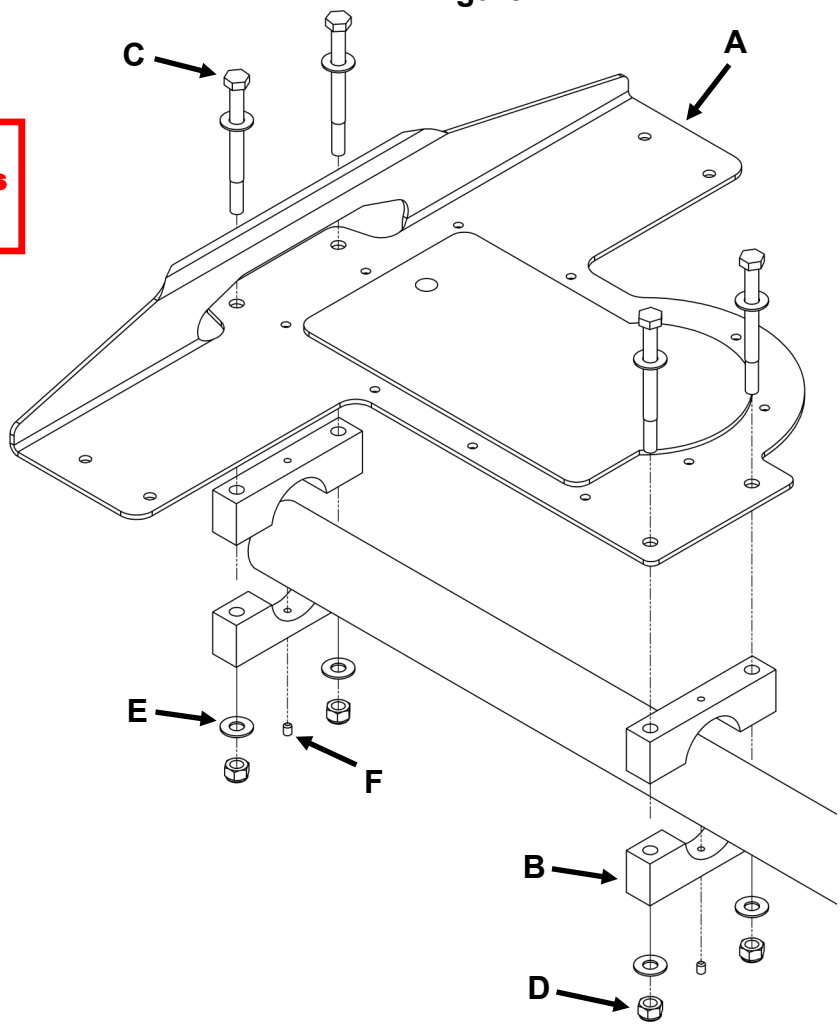
Section 1.2: Install the DB Mounting Plates

- Install both DB mounting plates according to **Figure 1.21** below, on opposite ends of the boom. The bent flange on the plate will be nearest the edge of the boom.
- The aluminum saddles nearest the edge of the boom need to be flush with the edge of the boom.
- Secure both plates so that you can still rotate one of them in order to level them to one another.
- Level the plates to one another then firmly tighten the 5/16” hardware.
- Verify the plates are still level to one another. If they have shifted, fix it.
- Install the set screws and tighten firmly.

KEY	QTY	PART #	DESCRIPTION
A	1	70-2030-21	DB Mounting Plate w/ Reinforcement Wings and Foam Mounting Guide
B	4	10-1601-03	1.75” x .75” Aluminum Saddle Half
C	4	60-0066	Bolt, 5/16-18 X 3-1/2”, hex head, SS
D	4	60-0046	Nut, 5/16”-18, Nylock, SS
E	8	60-0033	Washer, 5/16”, Flat,SS
F	2	60-0112	Set Screw, 10-32 x 1/4”, Cup Point, SS

Figure 1.21

Use anti-seize on all stainless hardware!

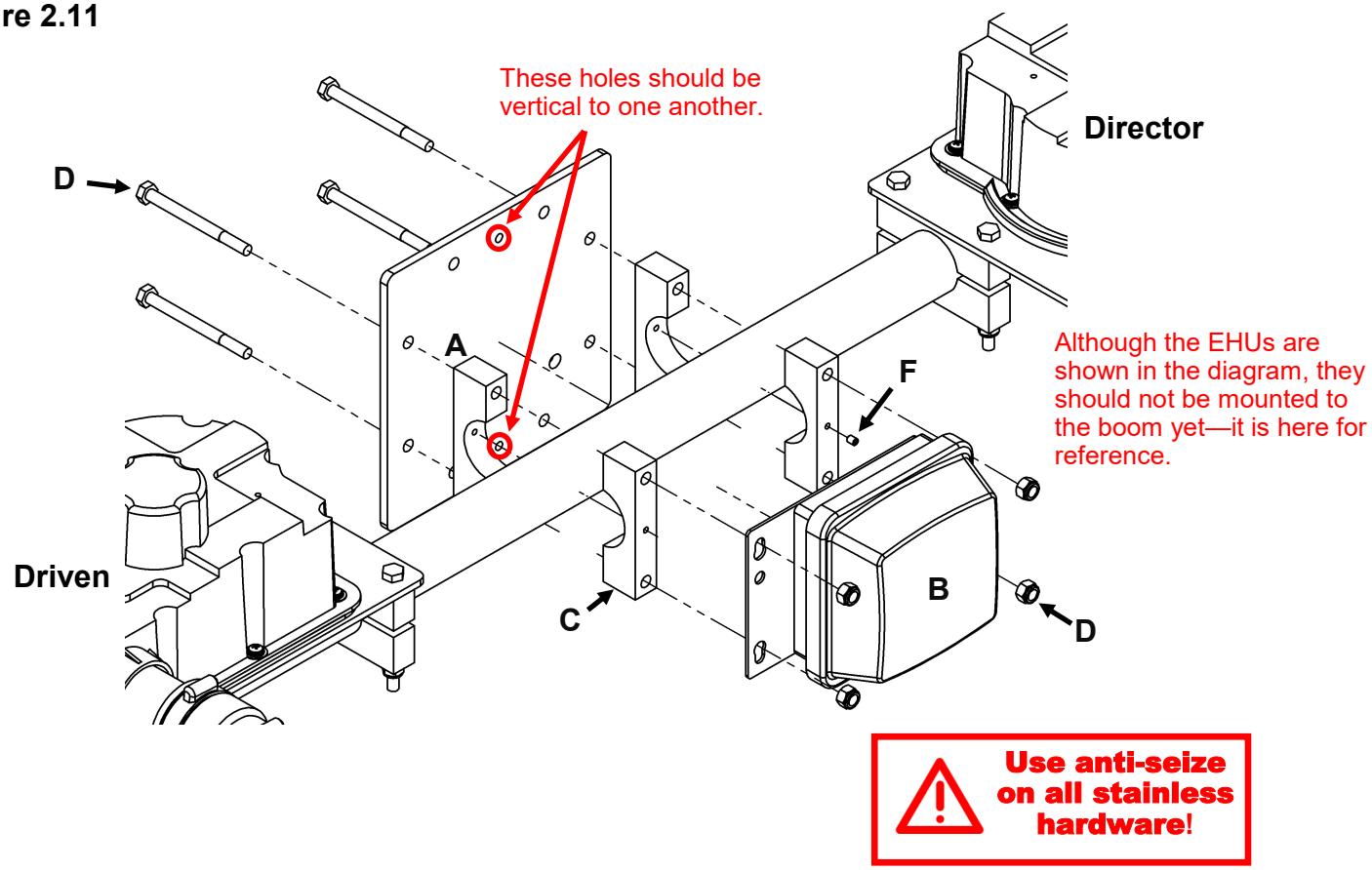


CONNECTING THE MAST PLATE TO THE BOOM

Section 2.1: Install the Mast Plate and Connector Junction Box

- Install the mast plate according to **Figure 2.11** below. Be sure to orient the mast plate such that the saddle holding holes (circled in red) can be used on the saddles for the mast clamps.
- Align the mast plate such that it is centered on the boom as shown **Figure 1.11** and is perpendicular to the DB mounting plates.
- Firmly tighten the 5/16" hardware.
- Verify the plates are still perpendicular to one another. If they have shifted, fix it.
- Install the set screw and tighten firmly. You will only be able to install one set screw due to the connector junction box covering up the other hole.

Figure 2.11



Use anti-seize on all stainless hardware!

KEY	QTY	PART #	DESCRIPTION
A	1	10-1021-43	8" x 8" x 0.250" Aluminum mast plate
B	1	70-2034	Connector junction box, 2E and 3E
		Part of 72-0061-01	**Mast Plate Hardware Kit**
C	4	10-1601-03	1.75" x .75" Aluminum Saddle Half
D	4	60-0065	5/16" x 3.5" Hex head bolt, SS
E	4	60-0046	5/16" -18 SS Nylock nut
F	1	60-0112	10-32 x 1/4" SS Set Screw cup point

Section 2.2: Install the Mast Clamps

- The parts used in this section can be found in the UrbanBeam Mast Plate Hardware Kit (PN 72-0061-01)
- Insert 2qty 10-32 screws (A) through the saddle holding holes (circled in red on **Figure 2.21**) in the mast plate and screw them into the 2” saddles (B) that go on the mast side to hold them in place as shown in **Figure 2.22**.
- Insert the 5/16” bolts (C) through the boom side of the plate through the saddles.
- Place the other two halves of the 2” saddles onto the bolts.
- Loosely screw the 5/16” nuts onto the bolts (be sure to apply anti-seize first). Keep the hardware loose until it is mounted onto the mast.
- Once the antenna is mounted on the mast tighten the 5/16” and 10-32 hardware firmly and insert the set screws (E) onto the exposed side of the saddles and tighten firmly.

KEY	QTY	PART #	DESCRIPTION
A	2	60-0113	10-32 x 5/8”, Panhead Screw, SS
B	4	10-1601-22	2” x .75” Aluminum Saddle Half
C	4	60-0114	5/16” x 3.75” Hex head bolt, SS
D	4	60-0046	5/16” -18 SS Nylock nut
E	2	60-0112	10-32 x 1/4” SS Set Screw cup point

Use anti-seize on all stainless hardware!

Figure 2.21

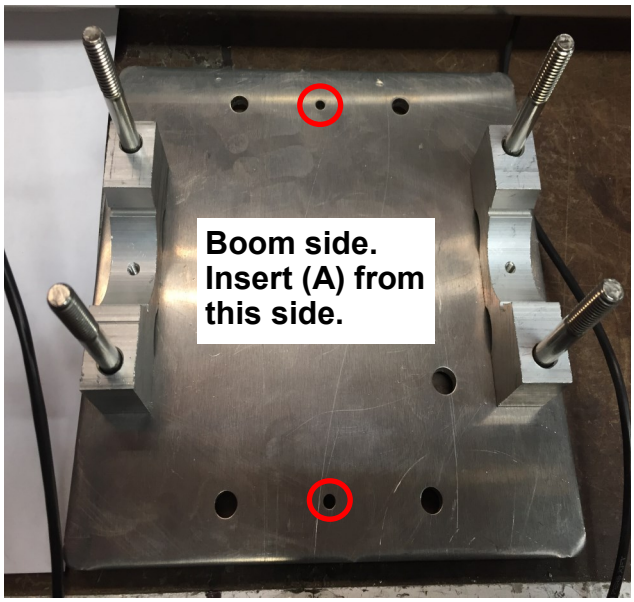
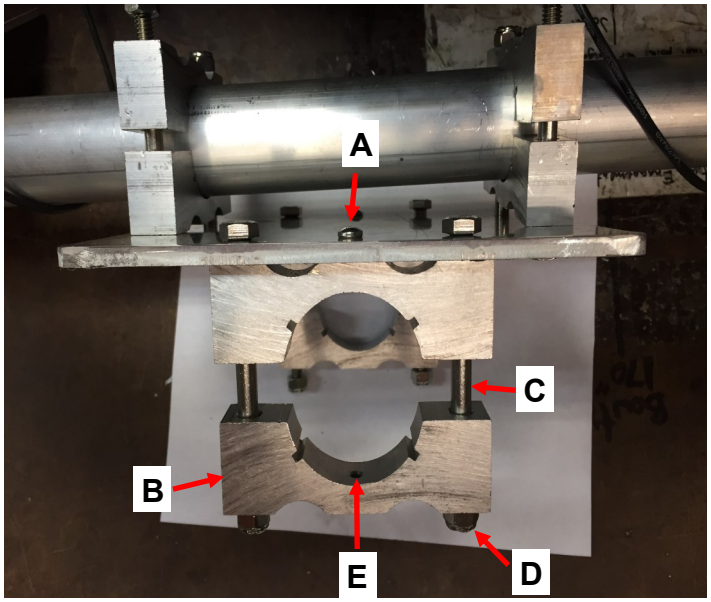


Figure 2.22



WIRING THE CONTROL CABLE TO THE DB25 SPLICE

Section 3.1: Preparing the Control Cable

SKIP TO PAGE 23 IF YOU HAVE A PREWIRED CABLE

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

SKIP TO PAGE 23 IF YOU HAVE A PREWIRED CABLE

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.

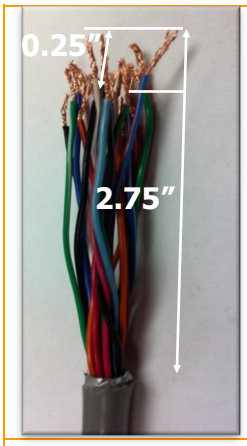


Figure 3.11

Figure 3.21

Figure 3.22

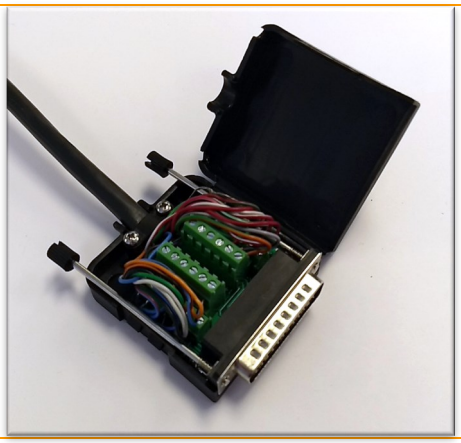
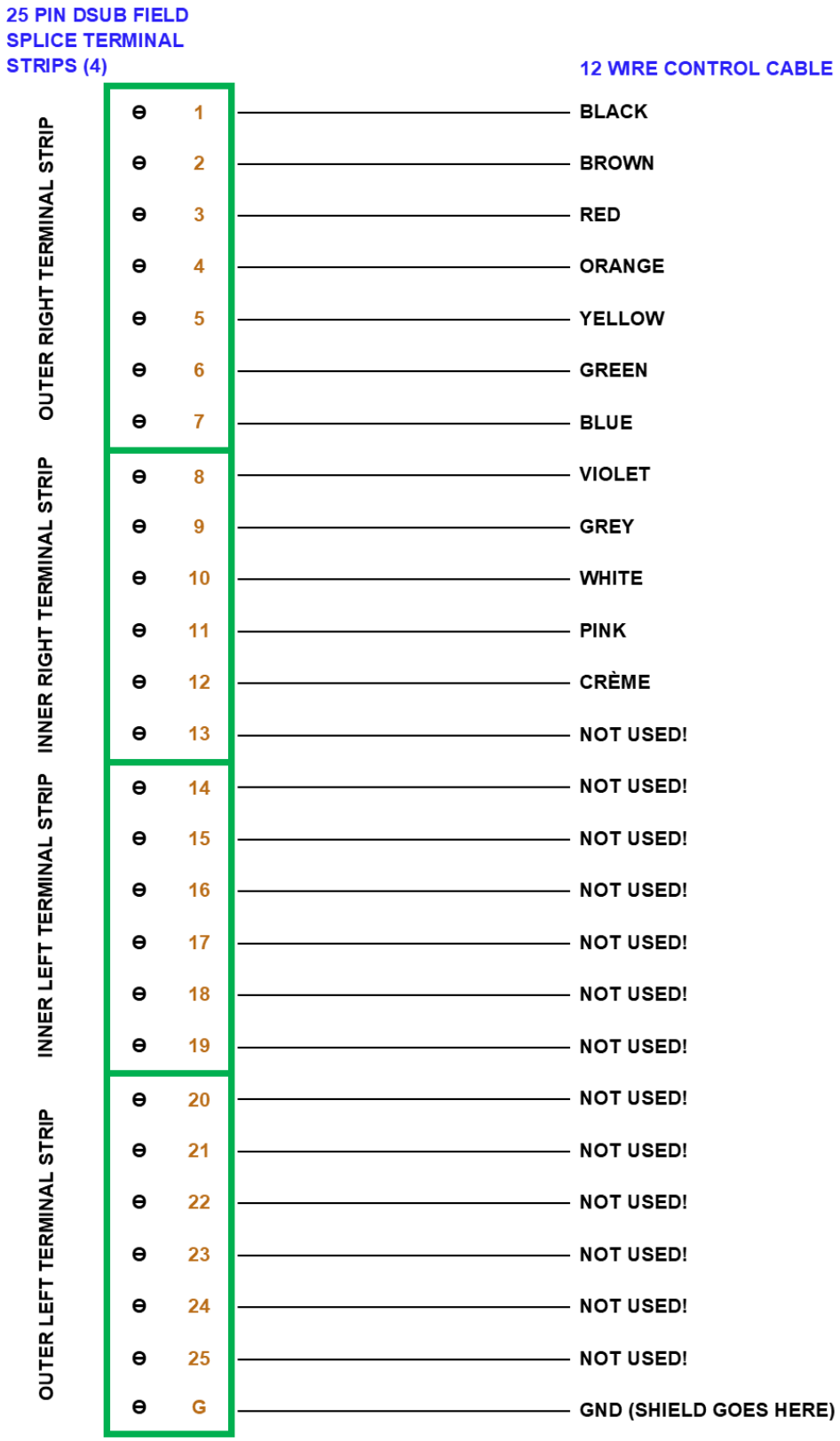


Figure 3.23

SKIP TO PAGE 23 IF YOU HAVE A PREWIRED CABLE

FIGURE 3.24



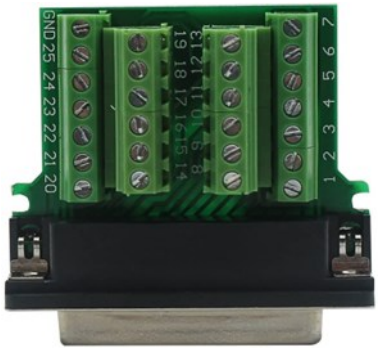


Figure 3.25

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 5ft, and the Director EHU control cable should be about 5ft. Measure your specific set-up just in case (connector junction box locations will vary the lengths)—it's much easier to account for too long of a cable than too short!

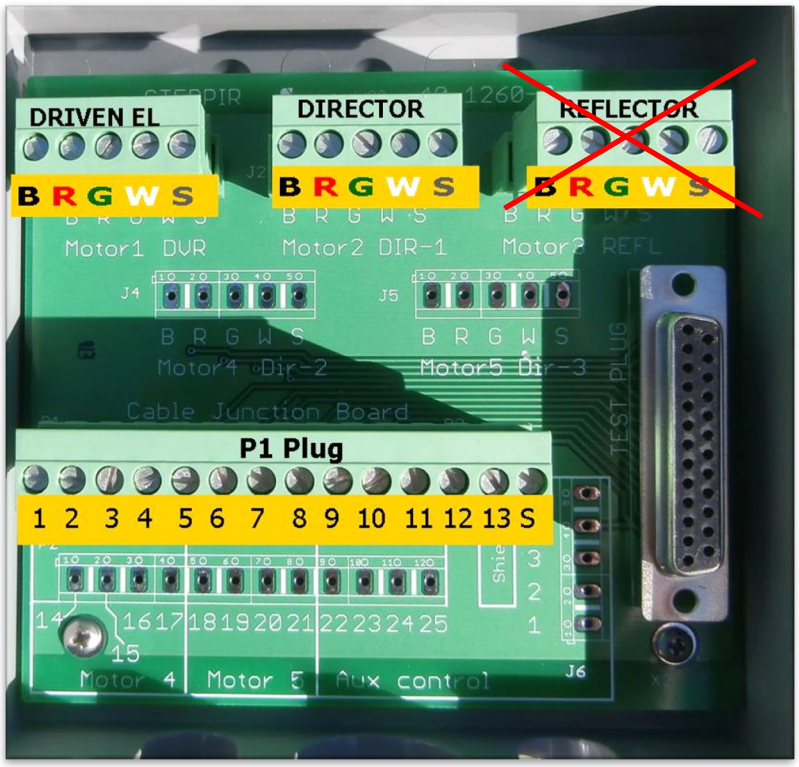


Figure 3.31

Since the UrbanBeam Yagi does not have a reflector, the associated plug in the connector junction box is not

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

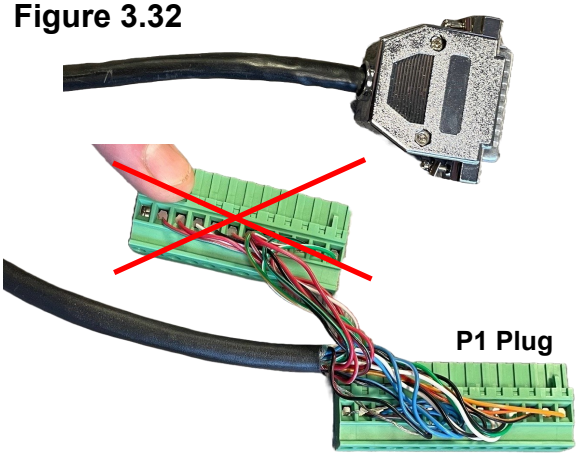


Figure 3.34

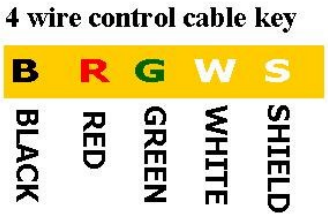


Figure 3.35

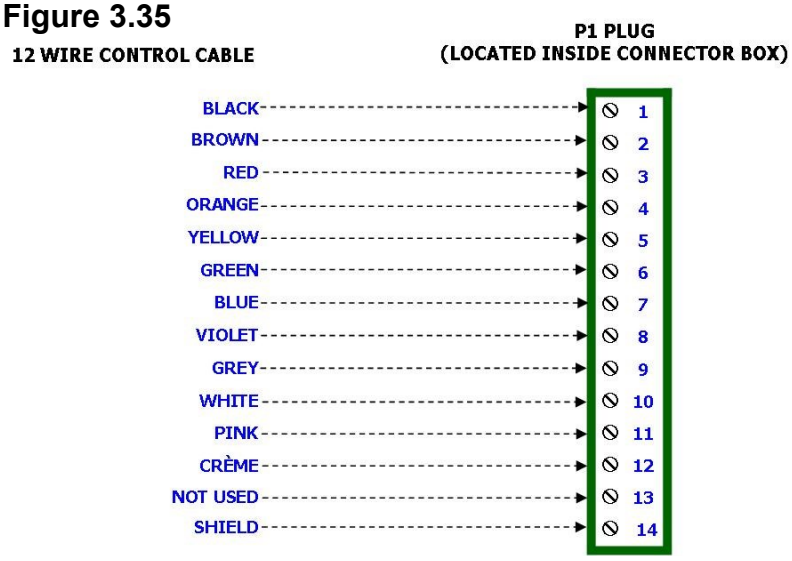


Figure 3.33

Regular electrical tape works perfectly for this.

P1 Plug

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EHU OVERVIEW

SKIP TO PAGE 26 IF YOU HAVE A PREWIRED CABLE

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.

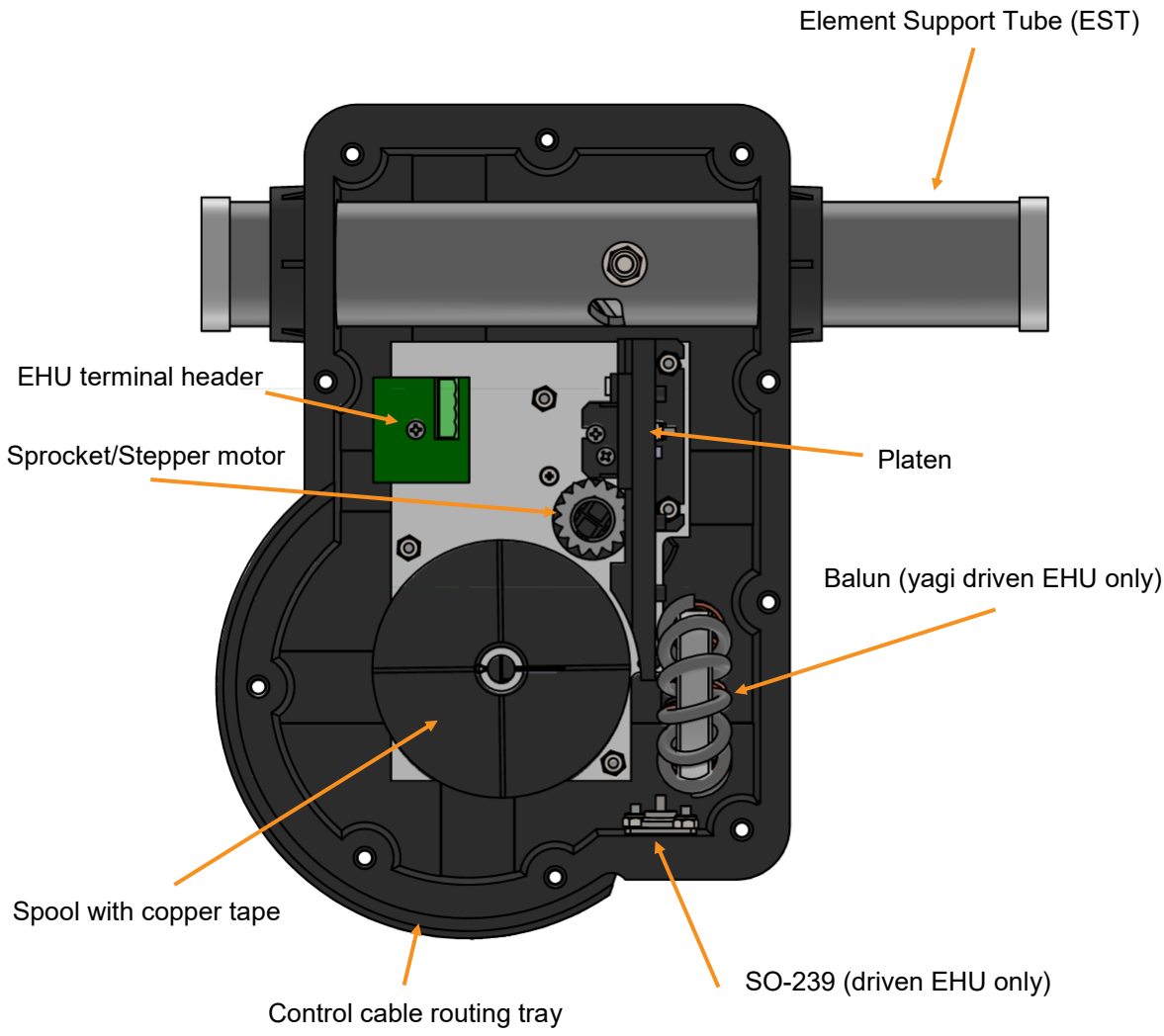


Figure 3.40

Section 3.4: Wiring the EHU

SKIP TO PAGE 26 IF YOU HAVE A PREWIRED 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.

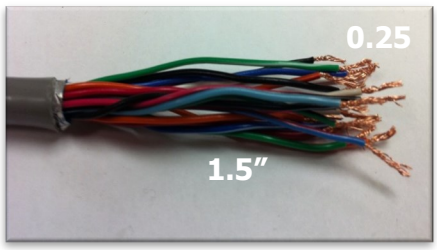


Figure 3.41

Figure 3.42

Figure 3.43

4 Pin Header Wiring Sequence

BLACK	RED	GREEN	WHITE

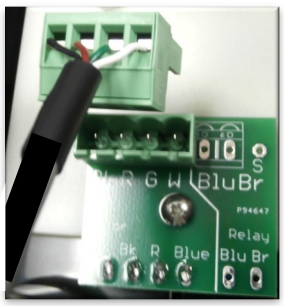


Figure 3.44

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**.

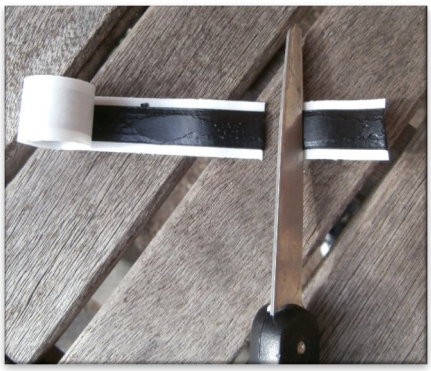


Figure 3.45

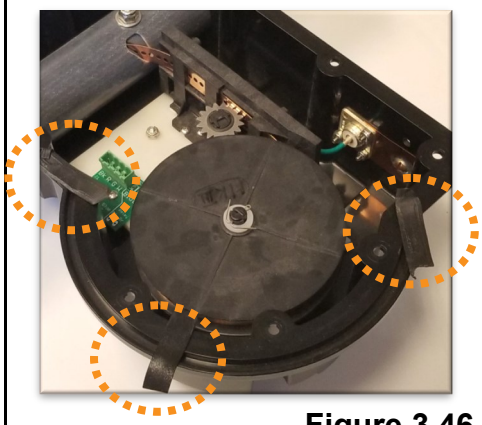


Figure 3.46

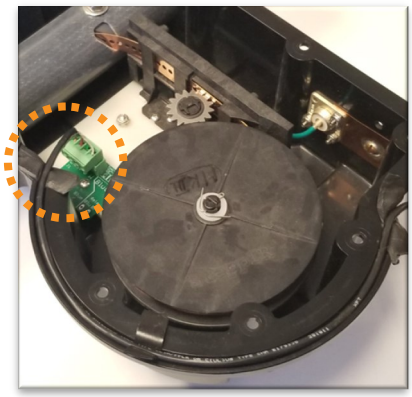


Figure 3.47

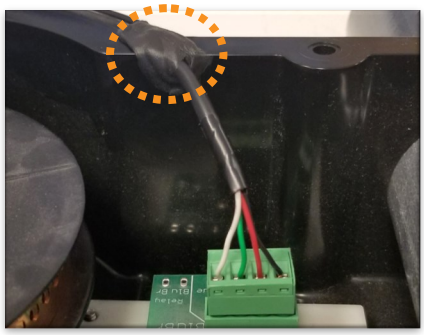


Figure 3.48

Figure 3.49

EHU WIRING TESTS

Section 4.1: Resistance Test (mandatory)

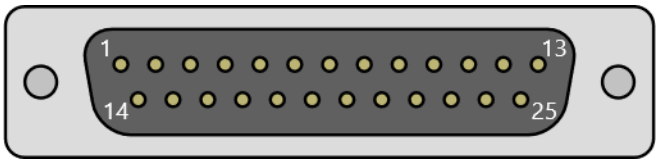


Figure 4.11

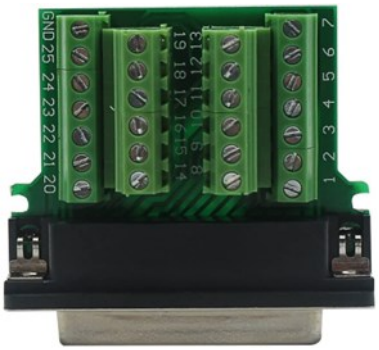


Figure 4.12

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		
Test Pins	*Expected Resistance*	*Results (Ohms or Open Load (OL))*
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.

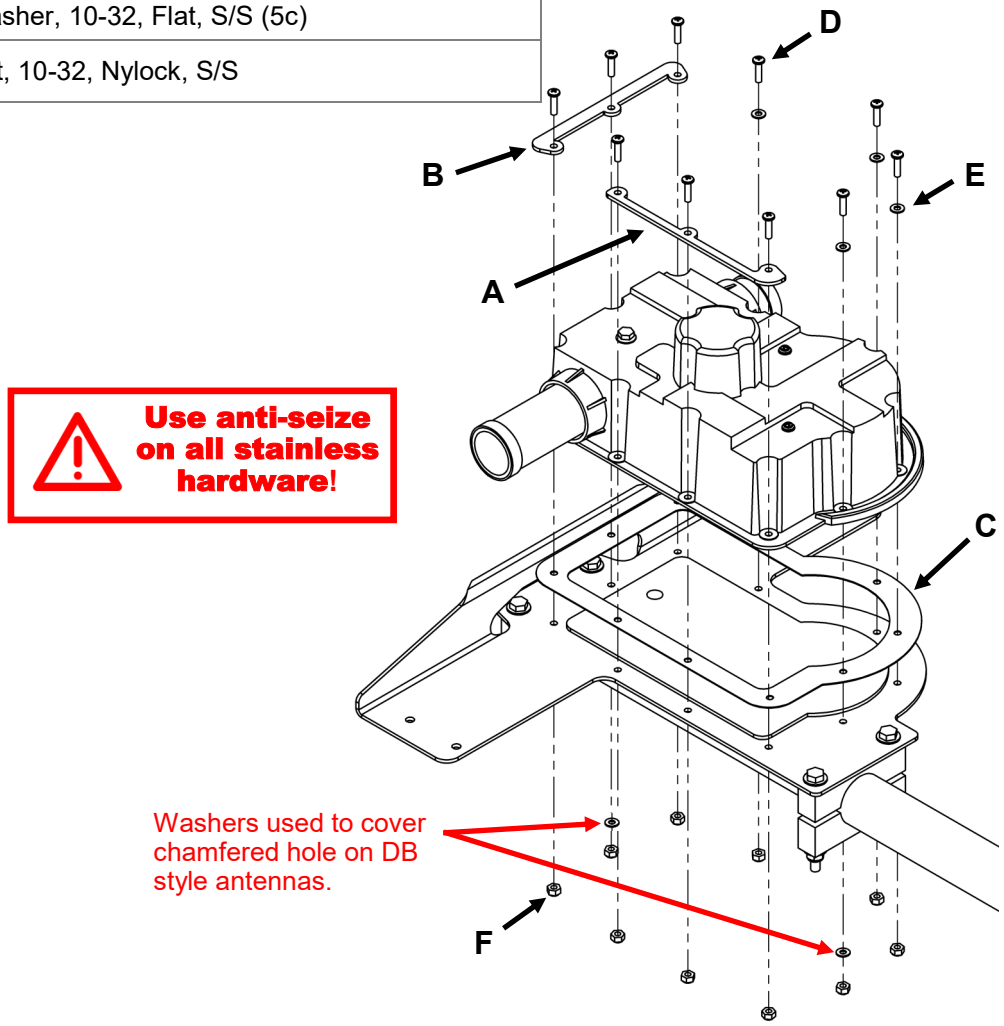
ATTACHING THE EHUS TO THE DB MOUNTING PLATES

Section 5.1: Mounting the EHUs to the Boom

- Refer to the center-to-center measurements in **Figure 1.11 in Section 1.1** when installing each of the EHUs the DB mounting plates. The EHU should already be wired before placing it on the DB mounting plate.
- Place the EHU gasket onto the mounting plate as shown in **Figure 5.11**. Remove all chads from the gasket holes if they are present. Align the gasket with the holes on the mounting plate.
- Place the EHU onto the mounting plate, then the EHU flange reinforcements across the top and side of the EHU.
- Attach the EHU to the DB mounting plate using the #10 x 3/4" machine screws, #10 flat washers #10 Nylock nuts. Note that there are no flat washers on the reinforcement flange. Be sure that the flat washer is between the machine screw head and the EHU housing.
- Tighten the Nylock nuts enough to compress the gasket material but do not over tighten or you can crack the plastic EHU housing. It is best to tighten the nuts twice, with the final tightening being the most aggressive. Let the EHU sit 15 minutes in between tightening.
- Verify that the center-to-center distance from the Director EHU to the Driven EHU is 41.5 inches.

Key	Qty	Part #	Description
A	1	10-1609-21	EHU Shell Flange Reinforcement Bracket, Side
B	1	10-1609-31	EHU Shell Flange Reinforcement Bracket, Top
C	1	10-1502-12	Gasket, for Black Housing EHU Updated spac-ing
D	10	60-0017	Screw, 10-32 x 3/4", Panhead, S/S
E	6	60-0018	Washer, 10-32, Flat, S/S (5c)
F	10	60-0019	Nut, 10-32, Nylock, S/S

Figure 5.11



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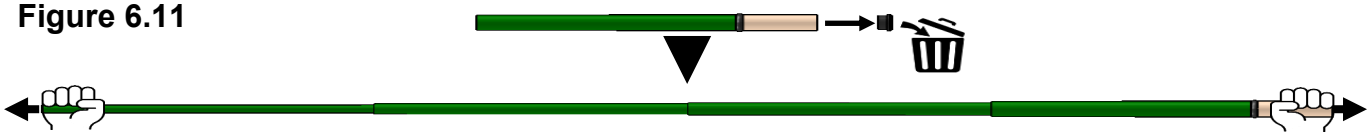
PREPARING THE TELESCOPING POLE

Section 6.1: Preparing the fiberglass pole

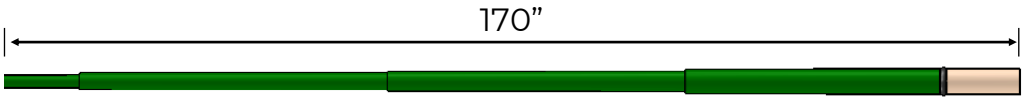
1. Extend the telescoping poles (PN 10-1013-02) to full length by firmly locking each section of the pole in place. A good methodology is to position each half of the joint so that they are several inches apart (while still within each other), and then pull quickly and firmly as shown in **Figure 6.11**. 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



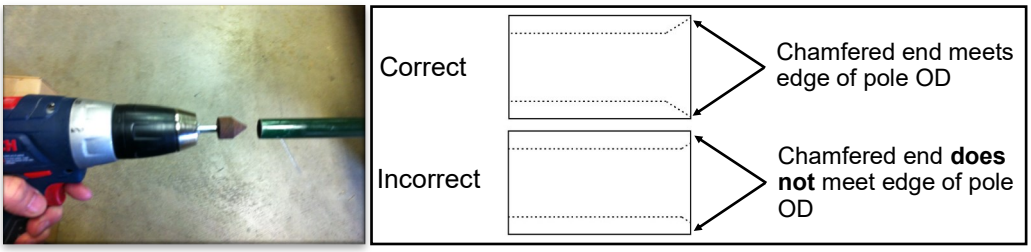
2. With the poles fully extended, trim the end of the tip element of each pole so that the pole is 170" from the tip of the pole to the butt end, as shown in **Figure 6.12**. **Keep the remnant piece, it will be used in a later step!** Use a hack saw, pipe cutter, or similar cutting blade that is suitable 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 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.

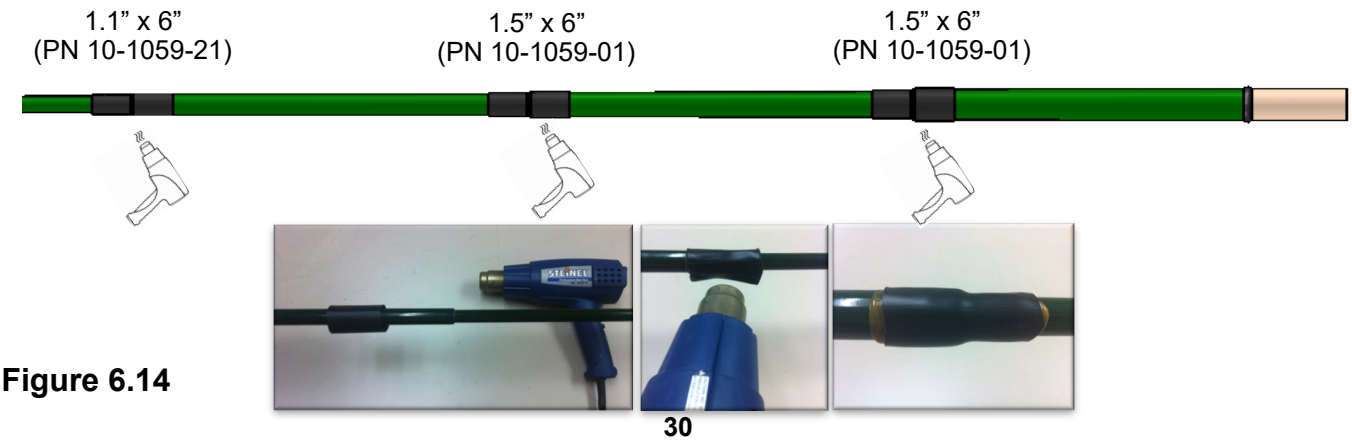
Figure 6.13



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



Section 6.2: Attaching sweeps and diverters to fiberglass

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.**

Only apply glue to the OD of fiberglass pole!

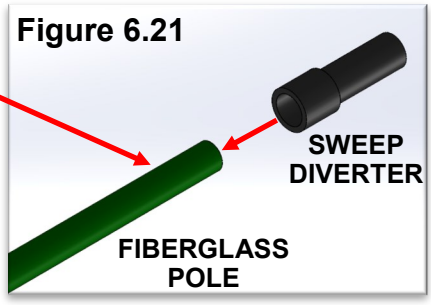


Figure 6.21

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).

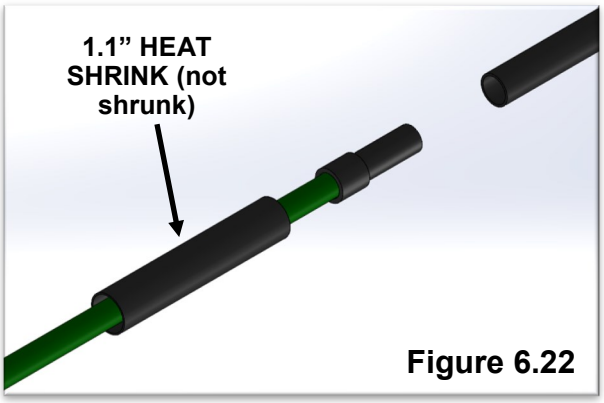


Figure 6.22

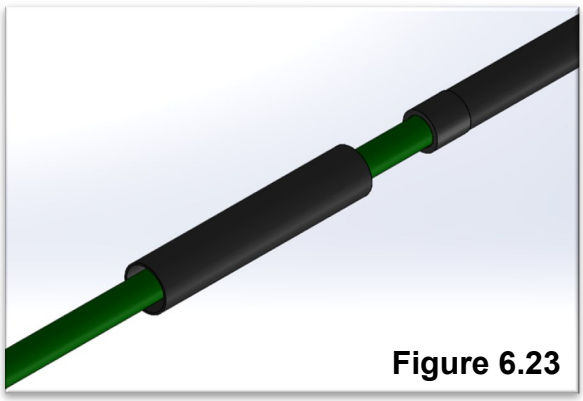


Figure 6.23

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.

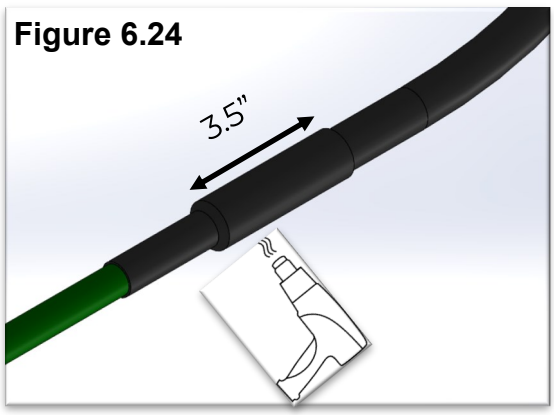


Figure 6.24

Preparing the telescoping pole tips for the loop elements
The remaining piece of cut-off pole tip from the previous step will be used to complete the loop, but first it must be cut to the proper length. The cut that was made to make the telescoping pole measure 170" is called "cut 1." The next cut ("cut 2") must be made on the **opposite end** of the pole remnant as cut 1, leaving the thickest part of the pole remnant intact. The reason is these pole sections are tapered and we want to have the thickest end go into the Sweep Diverter and thinner end in the Loop Splice because it makes a better fit.

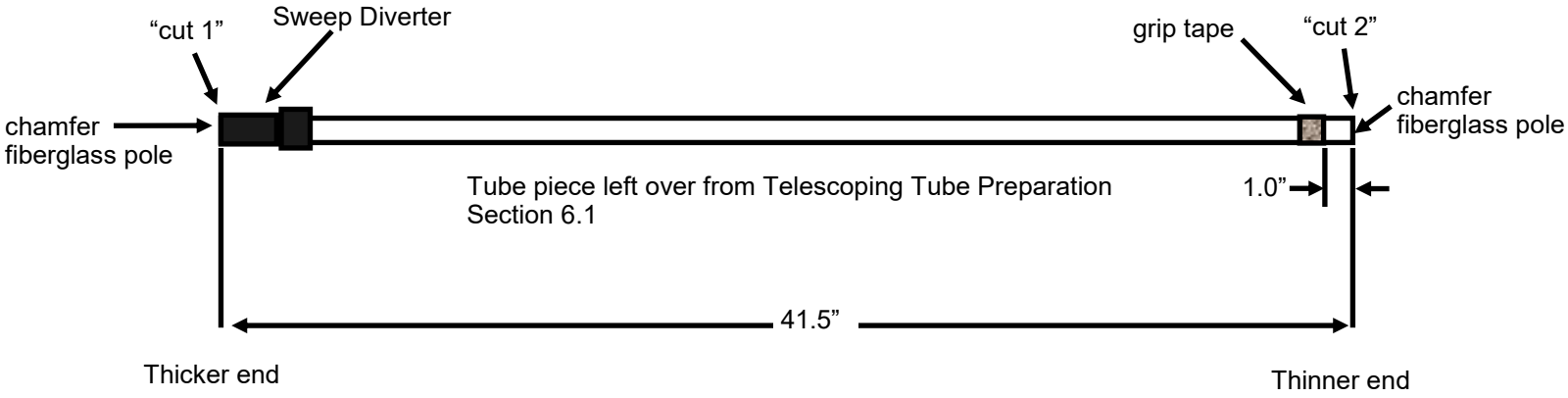
Figure 6.25 is the diagram of the pole tip remnant, showing overall size, differences between the thin and thick end, and preparations of the ends.

Cut the pole remnant to 41.5", cutting off material from the **thinner end**. This is "cut 2". Chamfer both ends of the poles after cutting.

Apply the 3M grip tape 2.3" x 1" (PN 09-0013-CUT) onto the side of the pole where you made "cut 2", it is recommended to clean the pole surface with isopropyl alcohol before applying the grip tape. Before applying the grip tape, be sure that it will not overlap itself when wrapped around the pole. Remove the film off the opposite side of the textured surface to expose the adhesive. Place the grip tape (adhesive side down) 1" inset from the "cut 2" edge and such that the 2.3" side wraps around the pole surface (long side perpendicular to length of the pole).

Glue the sweep diverters (PN 10-1511-01) to the pole remnants in the same way as before. As earlier, slide a piece of heat shrink past the diverter and down the pole, but do not shrink it yet. Then, insert the diverter into the sweep material opposite of the telescoping pole section that was connected to the sweep material in the previous step, slide the piece of heat shrink back up, and shrink it down over the joint. Remember, try to align the heat shrink over the joint so the diverter shoulder has roughly 3.5" of heat shrink on the sweep side of it. Lastly, watch carefully to make sure the heat shrink doesn't slide around on the joint as the glue melts. Wear gloves if it's necessary to reposition as the material will be very hot. Reference **Figure 6.21-6.24** for detailed instructions.

Figure 6.25



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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 UrbanBean Loop hardware kit (PN 72-0060-01).
- 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!

13. 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.
14. 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.
15. 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.
16. Repeat the previous steps on the other side of sweep tube. Be sure that the **sweep couplers are level to one another on both sides of the sweep material** as the metal loop strut will be connecting both sides of the sweeps together. The assembly should look like **Figure 6.29** at this stage. Build 2 assemblies such that they bend to the right and two such that they bend to the left.

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
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

Sweep Clamp Notch

Figure 6.26

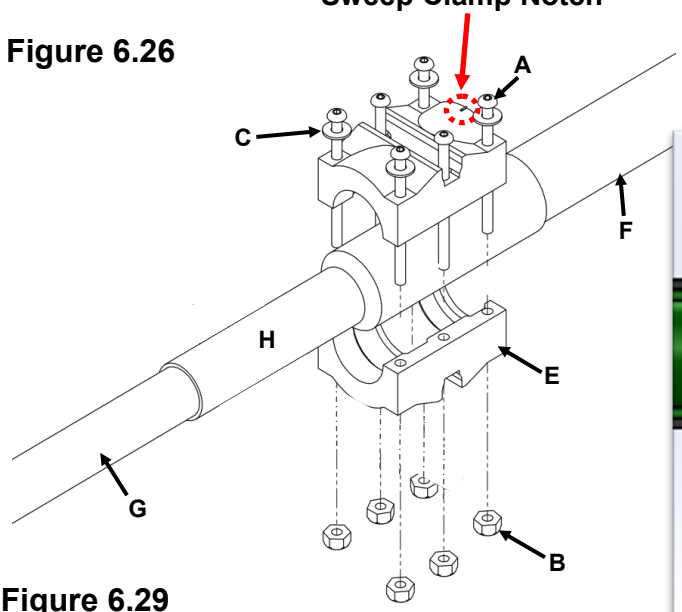


Figure 6.28

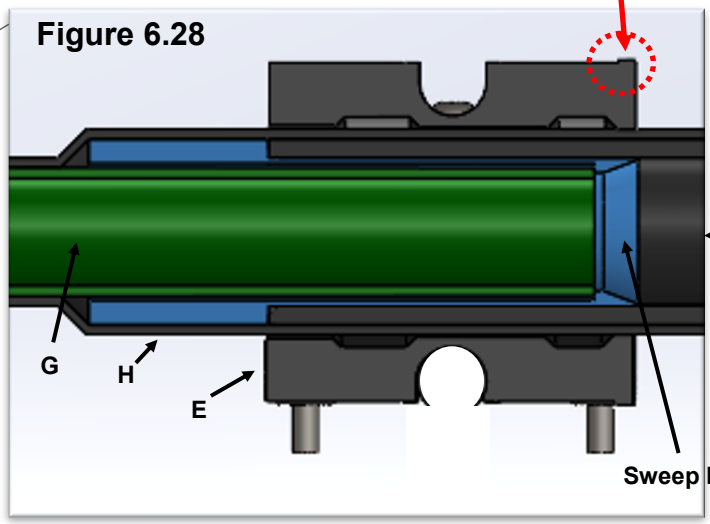


Figure 6.29

Use anti-seize on all stainless hardware!

Only turn the NUT when tightening!

Section 6.3: Connect the metal loop strut to the sweep couplers

- Once the sweep couplers have been attached to the sweep material then it's time to attach the metal loop strut (PN 10-1701-01) in the orientation shown in **Figure 6.31**. Start off by attaching the metal loop strut to the 170" pole assembly. Insert two of the 6-32 x 2" socket head screw (PN 60-0186) (no washer) through the top of the sweep clamp and place the metal loop strut on the bottom clamp in the recess center of the clamp. Place the screws so that the threaded portion of the screw is facing downward as shown in **Figure 6.32** (The sweep has been turned upside down to better portray this step). **Apply anti-seize to the threads** and screw the nylock nuts on. Tighten using a 5/16" wrench/socket to tighten the nut and a 5/64" Allen Key to hold the screw. Tighten until the nylock nuts are fully engaged and contacting the metal loop strut.
- Once you have the metal loop strut attached to the sweep couplers on the 170" pole assembly side, you will need to bend the sweep material/remnant pole assembly until the metal loop strut holes line up with the holes on the sweep clamp on the remnant pole side as shown in **Figure 6.33**. **Do this step slowly, if you bend the poly sweep material too much you will kink it!** Repeat the previous step to attach the metal loop strut to the other sweep clamp set.
- 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 6.34**. If you do not tighten evenly, you may break the fastener. Once the outside screws are firmly tight, tighten the two screws that hold the metal loop strut in place. **Figure 6.35** shows the suggested method for tightening the screws.
- When completely tightened, THE SWEEP COUPLER HALVES SHOULD HAVE GAP OF ABOUT 5/16" – 3/8", as shown in **Figure 6.36**. This gap is not critical as the coupler is mostly to keep the bracket 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.
- **Figure 6.37** shows the completed sweep—repeat the process for each sweep.

Use anti-seize on all stainless hardware!

Figure 6.31

Figure 6.32

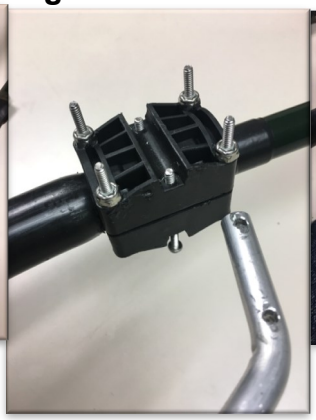


Figure 6.33

Figure 6.34

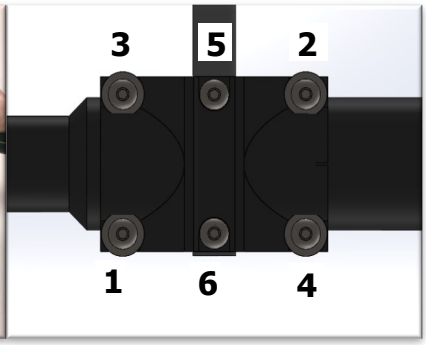


Figure 6.35

Figure 6.36

Figure 6.37

Section 6.4: Joining the loop halves together

Select two loop halves that sweep in opposite directions as shown in **Figure 6.41** and connect them together using the parts shown in **Figure 6.42** (these parts are in the Loop Hardware Kit 72-0060-01). Slide the 5" Loop Splice tube (10-1702-01) onto one of the remnant pole tips with the 0.25" drain hole on the splice facing down to where the ground will be until the pole tip is at the edge of the 0.25" drain hole as shown in **Figure 6.43**. Now position the edge of a hose clamp 3/4" from the edge of the Loop Splice and tighten it. Slide the remaining two hose clamps onto the splice, the outer one will be positioned and tightened first with the middle one left loose as shown in **Figure 6.54**. It is recommended that you put a #2 Philips screwdriver (the shaft should be 0.25" diameter) into the drain hole and slide the other pole tip into the Splice until it hits the screwdriver shaft, keep pressure on the loose pole tip while you position and tighten the other outside hose clamp as you did on the other side of the splice. Be careful not to damage the 3M Grip tape already in place on the pole tips. If necessary spread the slit in the Loop Splice slightly if the fit is so tight it won't slide onto the pole tip. Don't spread it too aggressively, or it could break! The last step is to position the third hose clamp so it covers the .25" drain hole and tighten it as shown in **Figure 6.45**. Make sure you position the hose clamp so the slots in the metal band of the clamp acts as a screen that allows water out, but no bugs in! Now check that each of the three clamps are tight. Be careful, small hose clamps can easily be tightened to the point that they strip, use common sense to get them snug but don't overdo it. You should not be able to cause the splice to spin or pull out with your hands. The completed loop is shown in **Figure 6.46**. Repeat this procedure for the other Loop Half.

Figure 6.41

Figure 6.42

Figure 6.43

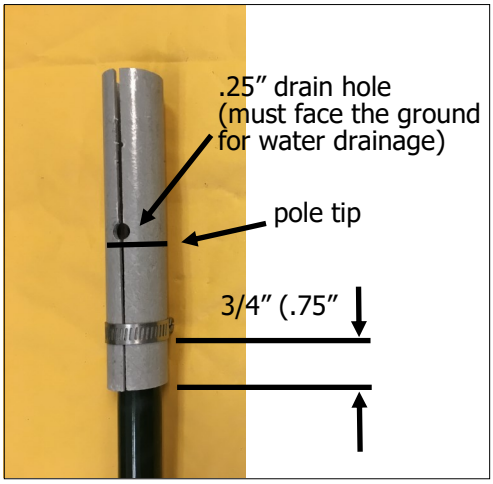


Figure 6.44

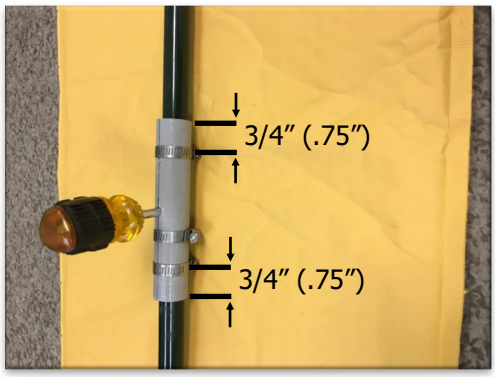
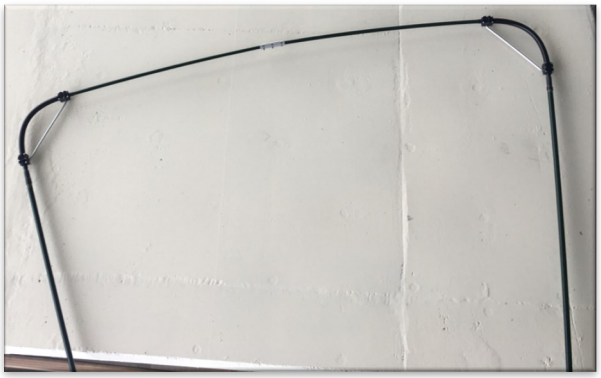


Figure 6.45

Figure 6.46



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ATTACHING ELEMENTS TO THE EHUS

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

The Driven EHU on the UrbanBeam 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 Director EHU does not use this inner tube, only the Driven. 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). **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 7.11

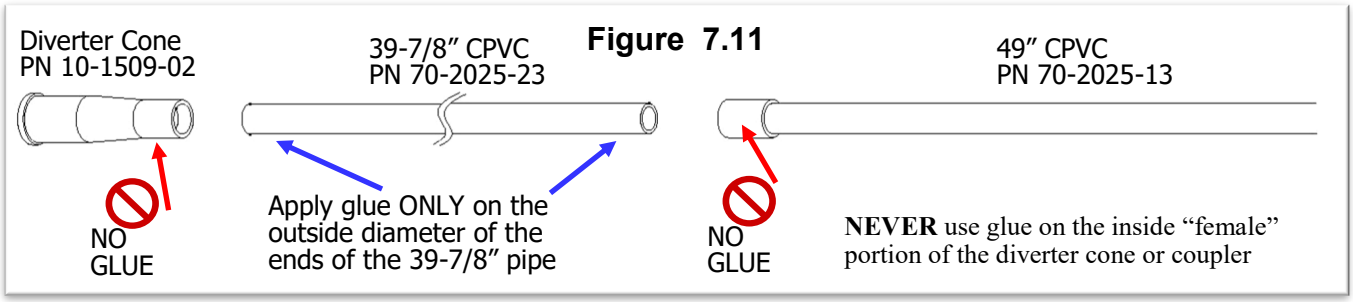


Figure 7.12

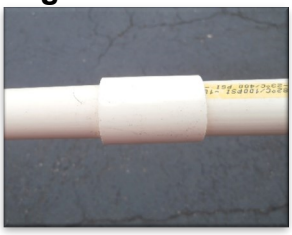
Figure 7.13

Figure 7.14

Figure 7.15

Figure 7.16

Figure 7.17

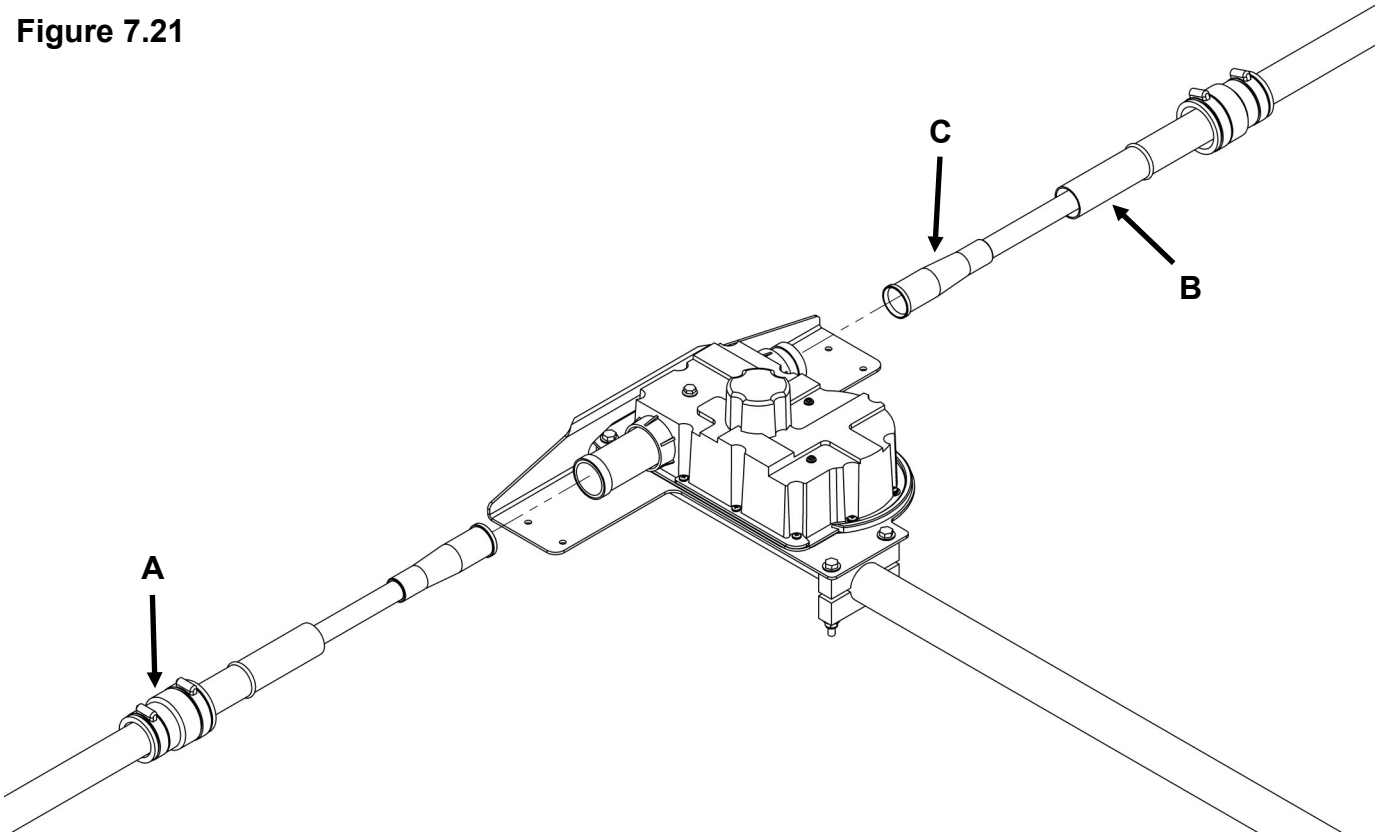


Section 7.2: Securing the Telescoping Poles to the EHU's

When the CPVC inner guide tubes are completed, they will need to be inserted into the telescoping poles and secured to the Driven 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 element, the procedure is the same for the Director element, ***except the Director does NOT have the guide tubes***. The parts required for the Driven EHU Assembly are shown in the table below.

Figure 7.21



Key	QTY	Part #	Description
A	2	10-1006-22	Quick disconnect boot
B	2	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. **(NOT USED FOR THE DIRECTOR)**

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.

The two elements join together to form one large loop. These elements were prepared earlier in Section 4 and should look like the ones shown in **Figure 7.24**. Be sure to put your quick disconnect boot onto the pole before inserting it into the EHU.

The CPVC inner guide tube is inserted into the Driven EHU side of the loop assembly as shown in **Figure 7.23**. Insert the guide tube so that the edge of the diverter cone is flush with the base of the telescoping pole as shown in **Figure 7.25**. Position a loop to be installed and orient it so the drain hole in the Loop Splice will be facing down to the ground when the antenna is installed. Slide either telescoping pole into the appropriate EHU (remember that only the poles going into the Driven EHU have the CPVC guide tubes inside of them) until it bottoms out firmly (in very rare cases the pole butt may need sanding to allow it to slide freely). There may be a small portion of unpainted fiberglass pole protruding as shown in **Figure 7.26**, this is normal, just make sure it is bottoming out on the diverter that is inside the EST tube. The unpainted part of the pole will be protected from the sun by the quick disconnect boot. Put a quick disconnect boot on the other loop pole and place the pole on top of the EHU so that it hits the round protrusion (it will stay there pretty well but you may want someone to hold it as you perform the next step) then take a rope or cord and pull the two poles together until the butt ends of each are fairly close to parallel, then tie it off. This allows easy insertion of the remaining pole into the appropriate EHU. Once both poles are properly inserted you can remove the rope.

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. 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.

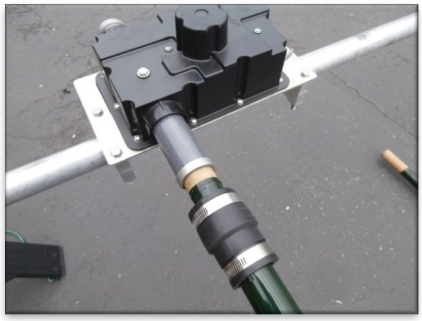
Figure 7.22

Figure 7.23

Figure 7.24

Figure 7.25

Figure 7.26



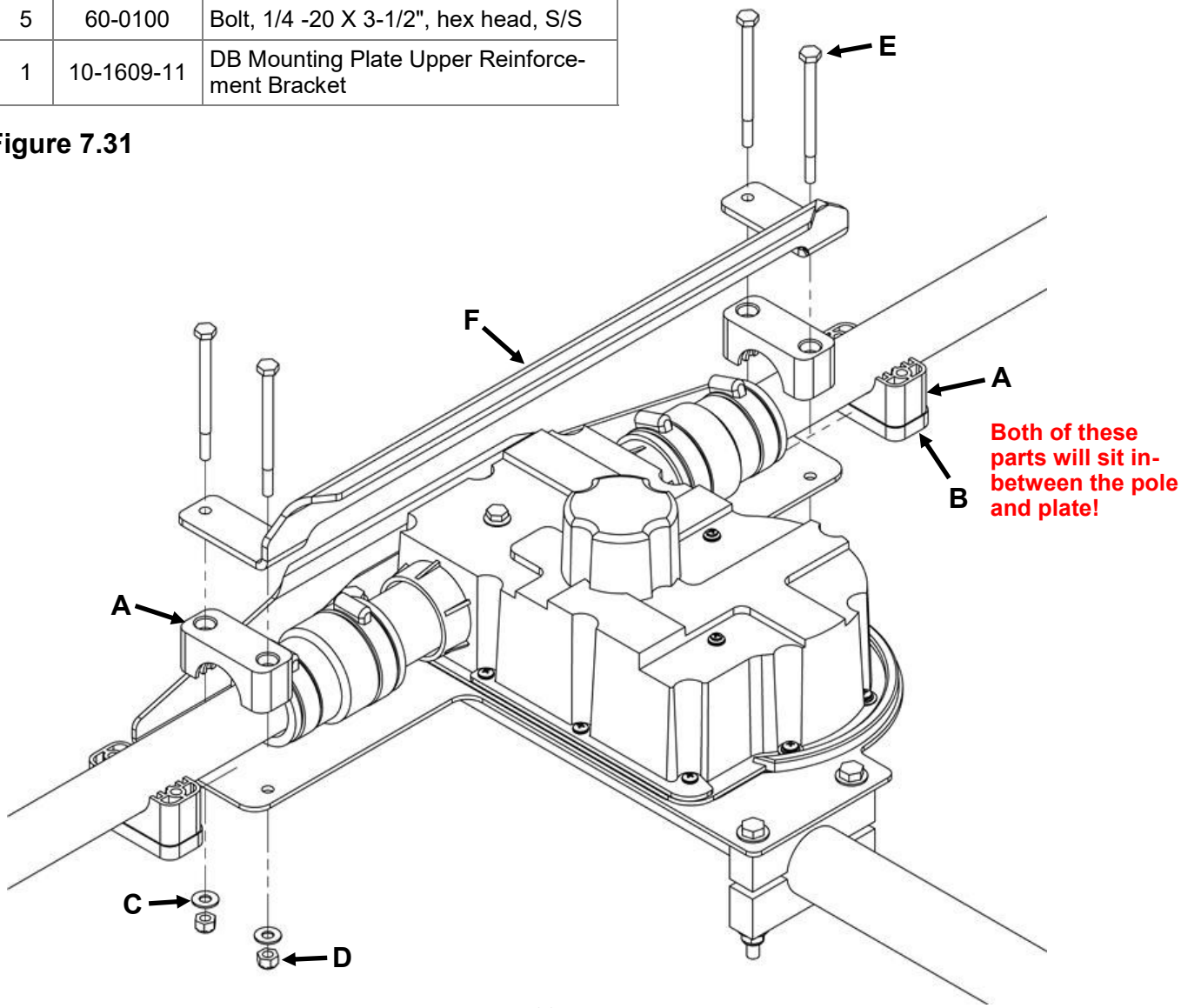
Section 7.3: Attaching the DB Mounting Plate Upper Reinforcement Bracket

- Install the DB mounting plate upper reinforcement bracket on all EHU's according to **Figure 7.21** below.
- First slide the resin clamp spacer (B) and resin clamp half (A) under the telescoping pole together. **This might be a tight fit so flex the plate down slightly to allow the spacer and clamp to slide under the pole.** Align the spacer and clamp with the holes in the plate.
- Place the other half of the resin clamp on top of the telescoping pole and align with the lower resin clamp.
- Place the DB mounting plate upper reinforcement bracket across the EHU and insert the 1/4"-bolts through the assembly. You may need to use a skinny screwdriver to get all the holes in the assembly to align properly. Place the 1/4" washer onto the bolt on the bottom side of the plate and thread on the 1/4" Nylock nuts. Tighten firmly.

Key	Qty	Part #	Description
A	2	60-7019-11	Resin Clamp, 1.5" (set)
B	2	10-1612-01	Resin Clamp Spacer
C	5	60-0041	Washer, 1/4", Flat
D	5	60-00-30	Nut, 1/4"-20, Nylock, S/S
E	5	60-0100	Bolt, 1/4 -20 X 3-1/2", hex head, S/S
F	1	10-1609-11	DB Mounting Plate Upper Reinforcement Bracket

Use anti-seize on all stainless hardware!

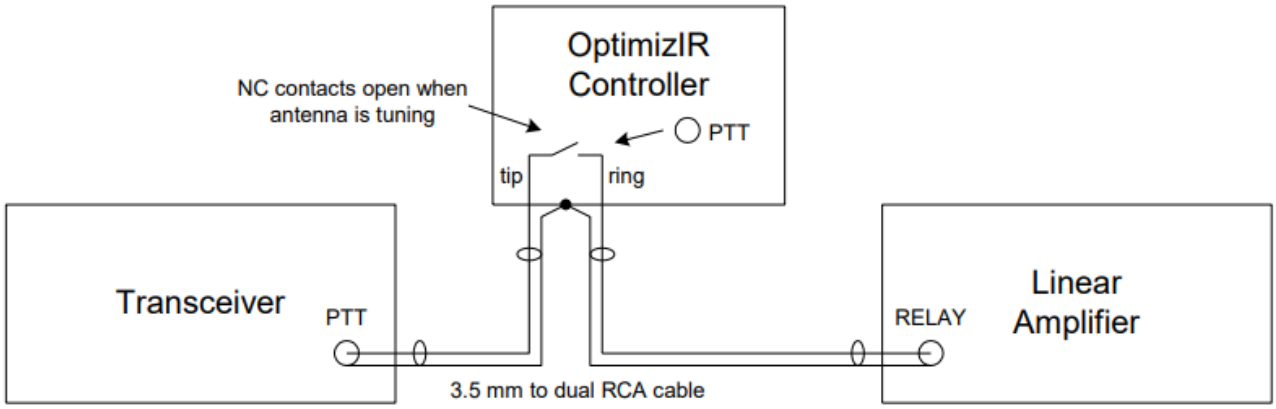
Figure 7.31



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 8.01**

Figure 8.01



Tuning Relay Wiring

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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 8.02.** 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 8.03**.

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 8.02

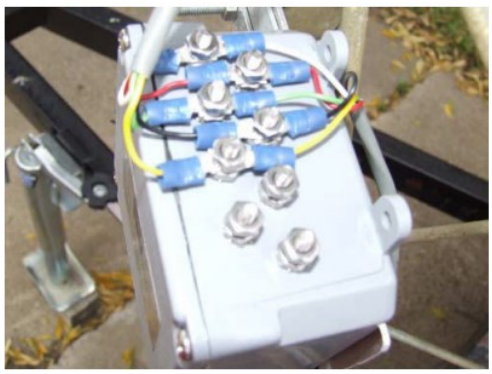

Figure 8.03

GROUNDING THE CONTROLLER (MANDATORY)

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 8.04: *Lug location for SDA100, OptimizIR, and OptimizIR 2.0 (early models)*

Figure 8.05: 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 UrbanBeam 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)

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)
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8	15.80	17.85	16.825	-
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6	12.50	13.85	13.175	-
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2	7.85	8.85	8.35	-
1	6.95	7.85	7.15	40m (7.0-7.3)

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

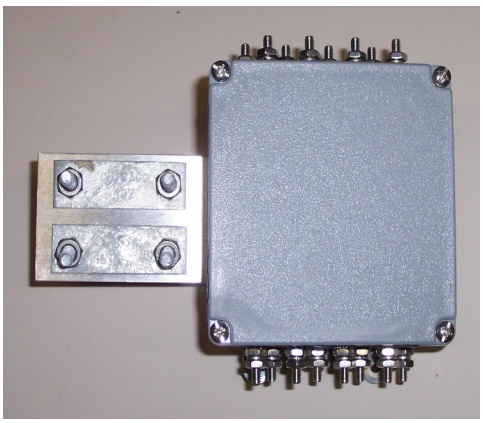
Tech Support Videos:
https://consumer.steppir.com/support/tech-support-videos/

STEPPIR OPTIONS

- **“Y” Cable**

- **Transceiver Interface (Rig Specific)**

Voltage suppressor (12 conductor)



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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.

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