



# Dipole Assembly Manual



REV 2.0 04/17/2020

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## STEPPIR—WHY COMPROMISE?

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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.

Yagis 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 yagis. 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**



## PREPARING FOR ASSEMBLY

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- Before beginning assembly of this antenna, please read the manual in its entirety to familiarize yourself with the task at hand. Doing so will eliminate potential confusion.
- Be sure to do an inventory of your parts as soon as possible after receipt of the antenna, and well before your intended installation date — this way we can get you the parts required before it's too late.
- Be sure to check the insides of the aluminum tubing and the telescoping poles when unpacking your boxes. In certain situations we put items inside these pieces to reduce the amount of boxes used for shipping, which in turn reduces your shipping costs.
- A large, cleared flat area is recommended for assembly of the antenna. Typically, an area 40 ft x 25 ft would be ideal. We recommend using sawhorses or sturdy tables when installing the boom. By having the boom elevated, it is easier to ensure that the elements are level.
- Be sure to refer to the antenna configuration drawing so that you can fully understand how the antenna operates. In addition, the configuration drawing identifies EHU placement, which is important as you progress in your installation of the antenna.
- Use of a level for adjusting the Element Housing Units (EHU's) is highly recommended. This is a surprisingly accurate and consistent method. When all the EHU's are level, secure the boom to the sawhorses so that it cannot shift—this will help considerably when you are leveling the mast plate.

### IMPORTANT NOTES!

**Be sure to use the anti-seize compound supplied to prevent the galling of the stainless steel fasteners. If you do not use the anti-seize, count on issues with the stainless steel hardware galling. Heat is one of the primary causes of galling, so if you use a ratchet, steady speed as you tighten will help minimize galling. We have found that when the anti-seize is applied to the bolt portion of the hardware, it will eliminate any galling issues. Rubber or nitrile gloves are recommended when applying the anti -seize to the stainless steel fasteners or the aluminum boom sections.**

**Never attempt to wire or change wiring on the antenna when the controller is connected to the control cable, even if it is turned off! This is the number one cause of installation failures for our products. Even with power off, damage can occur. When the power is “off” on your controller, there is still a very small amount of power feeding to the stepper motors, to effectively “lock” them in place. This leads to less need for calibration of the antenna.**

# ANTENNA SPECIFICATIONS

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## Dipole

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Boom length	N/A
Boom outside diameter	N/A
Longest element	33ft / 10.05m
Turning radius	18ft / 5.48m
Weight	15lb / 6.8kg
Wind load - EIA-222-F/G	1.9sq-ft / 0.17 sq-m
Wind load - EIA-222-C	-
Wind rating	100mph / 160kph
Adjustable elements	1
Power rating	3KW
Feed points	1
Frequency coverage	13.8MHz—54MHz
Control cable	4 Conductor, 22GA, Shielded

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## PARTS CHECKLIST

Use the following parts list to take an inventory of your parts to ensure that everything is accounted for. The items in [blue](#) represent available options — you will need to check these items off only if you purchased them.

✓	QTY	PART #	DESCRIPTION
	2	10-1013-02	Telescoping Pole, 18 foot 4 section
	6	10-1059-01	Polyolefin Heat Shrink 1-1/2"
	1	20-6208-01	25 Pin male connector
	1	20-6209-01	25 Pin Sub Back Shell
	2	60-1006-22	Quick Disconnect Boot, 1-1/2" to 1-1/4", Fernco
	1	70-1007-01	Foam plug assembly
	1	70-2030-11	DB style mounting plate
	1	70-3000-01	33 Volt supply with cord.
	1	70-3402-01	EHU, Dipole Assembly
	1	72-0054-21	Kit, EHU DB Plate Hardware
	1	72-2015-21	Kit, 20m Dipole Hardware
	1	<a href="#">70-6010-01</a>	<a href="#">DB25 Field Splice</a>
	1	<a href="#">70-4005-01</a>	<a href="#">Controller Assy, OptimizIR</a>
	1	-	<a href="#">Manual, OptimizIR Controller</a>
	1	<a href="#">70-4001-01</a>	<a href="#">Controller Assy, SDA 100</a>
	1	-	<a href="#">Manual, SDA 100 Controller</a>
	-	21-5001-01	Control cable, 4 Conductor

### Kit: 72-0054-21 EHU DB Plate Hardware

✓	QTY	PART #	DESCRIPTION
	11	60-0017	Screw, 10-32 x 3/4", Panhead
	11	60-0018	Washer, 10-32, Flat
	11	60-0019	Nut, 10-32, Nylock

### Kit: 72-2015-21 EHU DB Plate Hardware

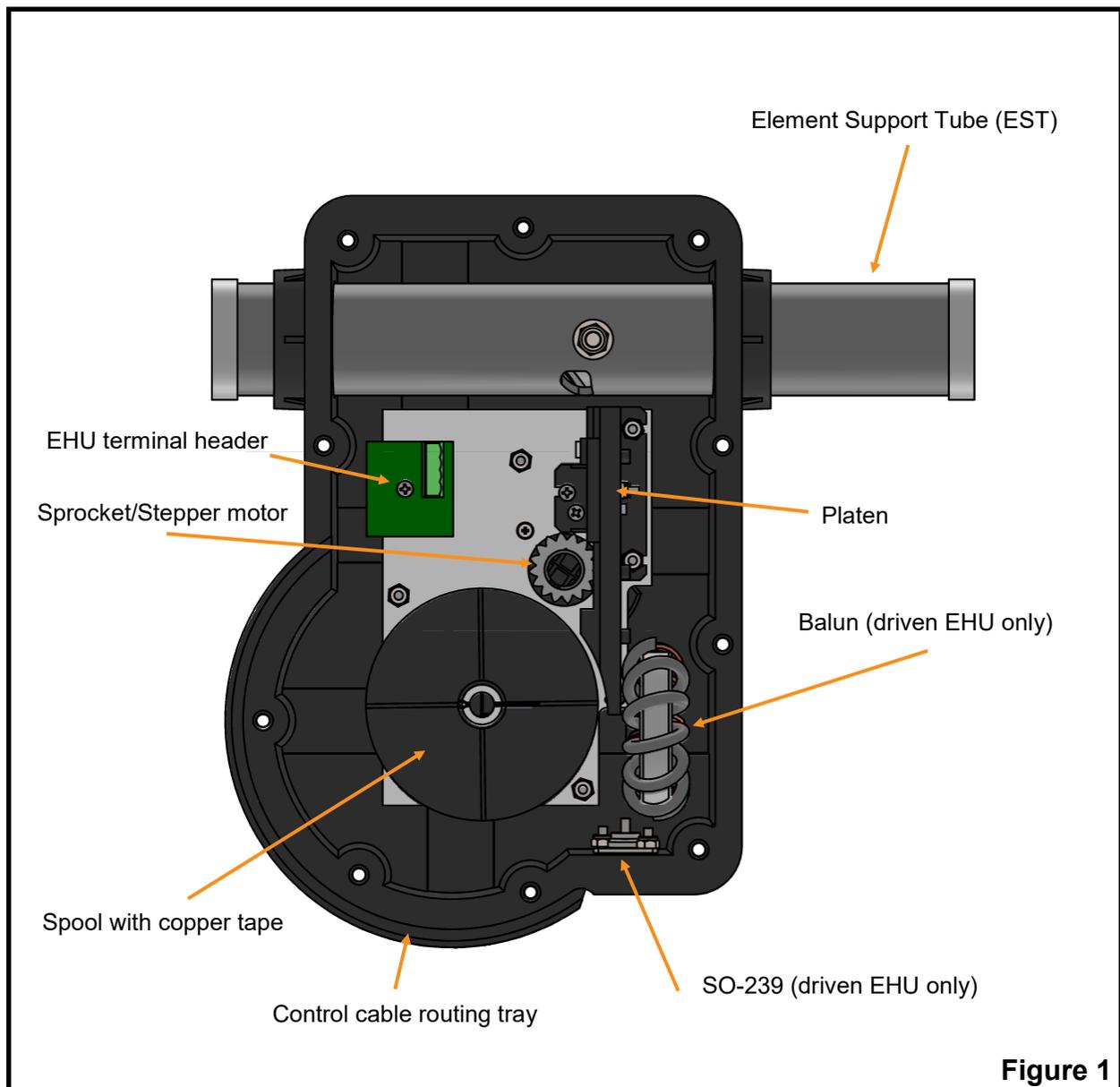
✓	QTY	PART #	DESCRIPTION
	8"	09-1022	Coax Seal, 12' x 1/2".
	4	10-1601-03	Saddle, 1-3/4" x 3/4"
	4	60-0046	Nut, 5/16" -18, Nylock
	4	60-0075	Bolt, 5/16" X 3-1/4", S/S
	2	60-0112	Set Screw, 10-32 x 1/4", Cup Point, S/S

# WIRING

## Section 1: Overview

It is important to know that there are two different types of Element Housing Units (EHU). The two types are Driven and Passive. A Driven EHU acts as the driven element of the antenna and connects to your radio via coax. A Passive EHU does not have a coax connection and functions as the director or reflector element of the antenna. Some EHUs on our antennas have relays which allow them to switch between functioning as a passive or driven element!

**Figure 1** provides an overview of a SteppIR EHU (the specific model shown is a 20m driven).



**Figure 1**

## Section 1.1: Wiring the EHUs

1. Trim approximately 1.5 inches of the outer jacket of the control cable.
2. Remove the shield material, the support thread and cut the ground 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 inches 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 1.10** shows the control cable should look like when you are finished with the trimming.
5. Dip each of the copper wires into connector protector before inserting into the terminal plug. **Figure 1.11** shows what the connector protector will look like.
6. The terminal header assembly consists of the terminal header and the terminal plug as shown in. The plug is shipped loosely attached to the header. Remove this plug when wiring and firmly plug back in when completed.
7. Follow the wire sequence in **figure 1.13** or **figure 1.14** for each EHU. *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 each EHU is also imprinted on the PCB that the terminal header is mounted on (located inside the EHU), as shown in **figure 1.12**. 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 1.12** shows a blue line crossing out the text in question. The orange circle shows the correct wiring sequence.

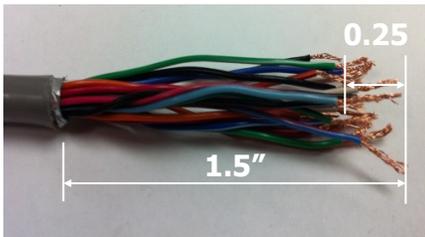


Figure 1.10



Figure 1.11



Figure 1.12

### 6 Pin Header Wiring Sequence

**BLACK** **RED** **GREEN** **WHITE** **BLUE** **BROWN**



Figure 1.13

### 4 Pin Header Wiring Sequence

**BLACK** **RED** **GREEN** **WHITE**

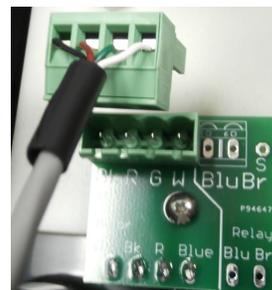


Figure 1.14

8. Check to be sure the terminal plug is firmly inserted into the terminal header.
9. Lay the control cable wire inside the wire tray of the EHU as shown in **figure 1.15**. This trough acts as a strain relief so that the cable will not be pulled out of the EHU. 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 **figure 1.16**.
10. Cut three 1-inch strips of coax seal for each EHU as shown in **figure 1.17**. The remainder can be used to seal the driven element SO239 connector, should you wish to.
11. Apply coax seal on top of the control cable and work it around the cable as shown in **figure 1.18**. This will help keep water from entering into the EHU. Apply the coax seal to the remaining areas of the wire tray as shown in **figure 1.19**.
12. Repeat wiring and coax seal preparation for each EHU. When finished, the EHU's will be secured to the aluminum element mounting plates. This is covered in detail in the next chapter

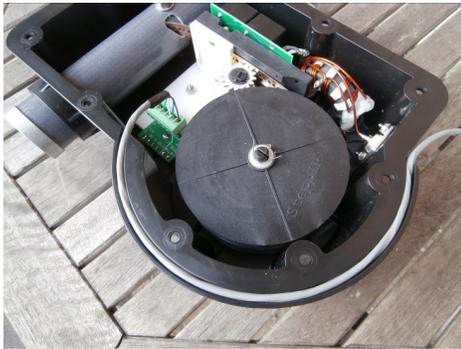


Figure 1.15

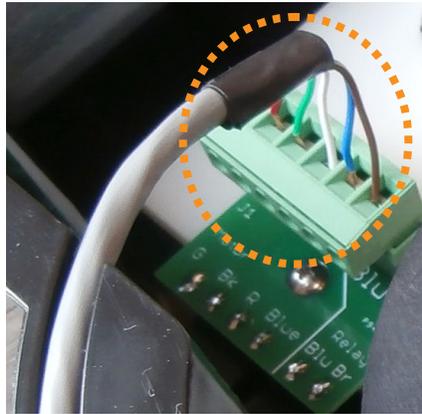


Figure 1.16



Figure 1.17

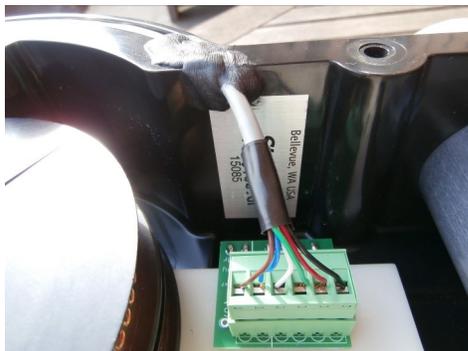


Figure 1.18



Figure 1.19

## Section 1.2: Preparing the control cable

1. Strip the jacket and aluminum shielding off of the control cable as shown in **figure 1.20**, 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.

## Section 1.3: Connecting control cable to the 25 pin connector

/// If you purchased the optional DB25 Field Splice upgrade, skip ahead to the next section.

1. Solder each wire to the appropriate pin of the 25 pin connector. Refer to the table on the following page for the correct wiring sequence.
2. Attach the clamp to the control cable approximately 1" from the connector and secure with the provided hardware as shown in **figure 1.30**.
3. Place the connector between the back-shell halves as shown in **figure 1.31** and secure with the provided hardware.



## Section 1.4: Connecting control cable to the DB25 Field Splice

The optional DB25 Field replaces the standard connector with a convenient solder-less connector. If you purchased this option, follow the steps below to connect it to your control cable.

1. Apply the provided dielectric grease to the exposed copper portion of each wire.

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

2. Connect each wire to the appropriate terminal and tighten using a flat head screwdriver.
3. Consult the table on the next page for the correct wiring sequence.
4. Position the control cable between the cable clamp halves as shown in **figure 1.40**.

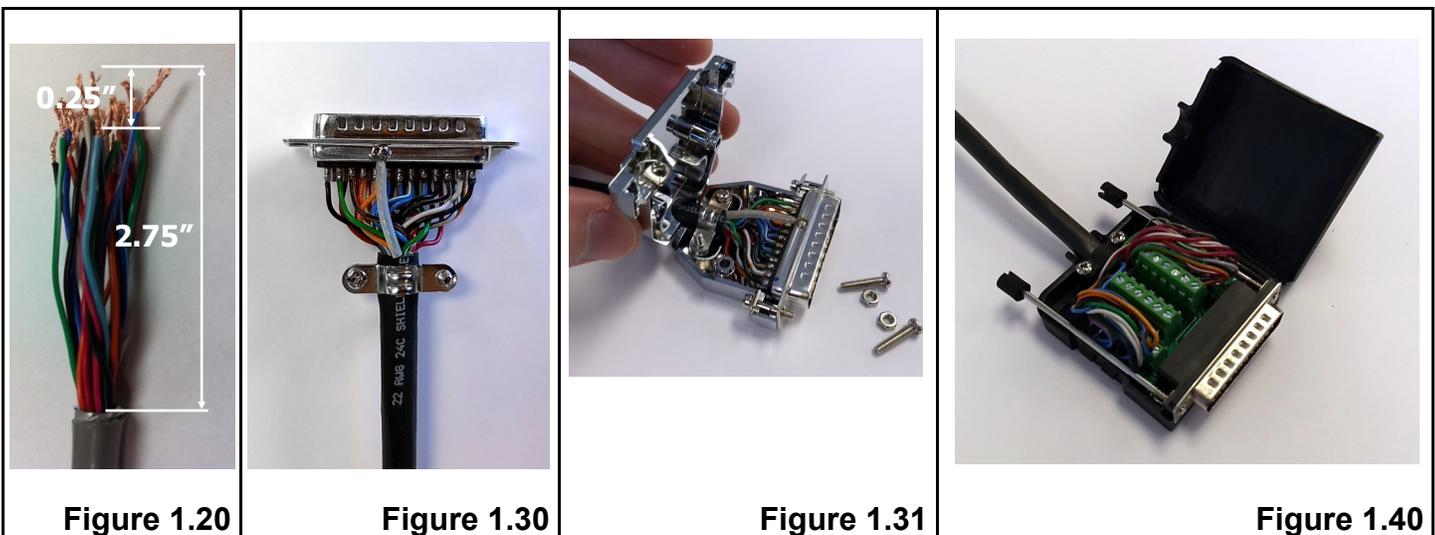


Figure 1.20

Figure 1.30

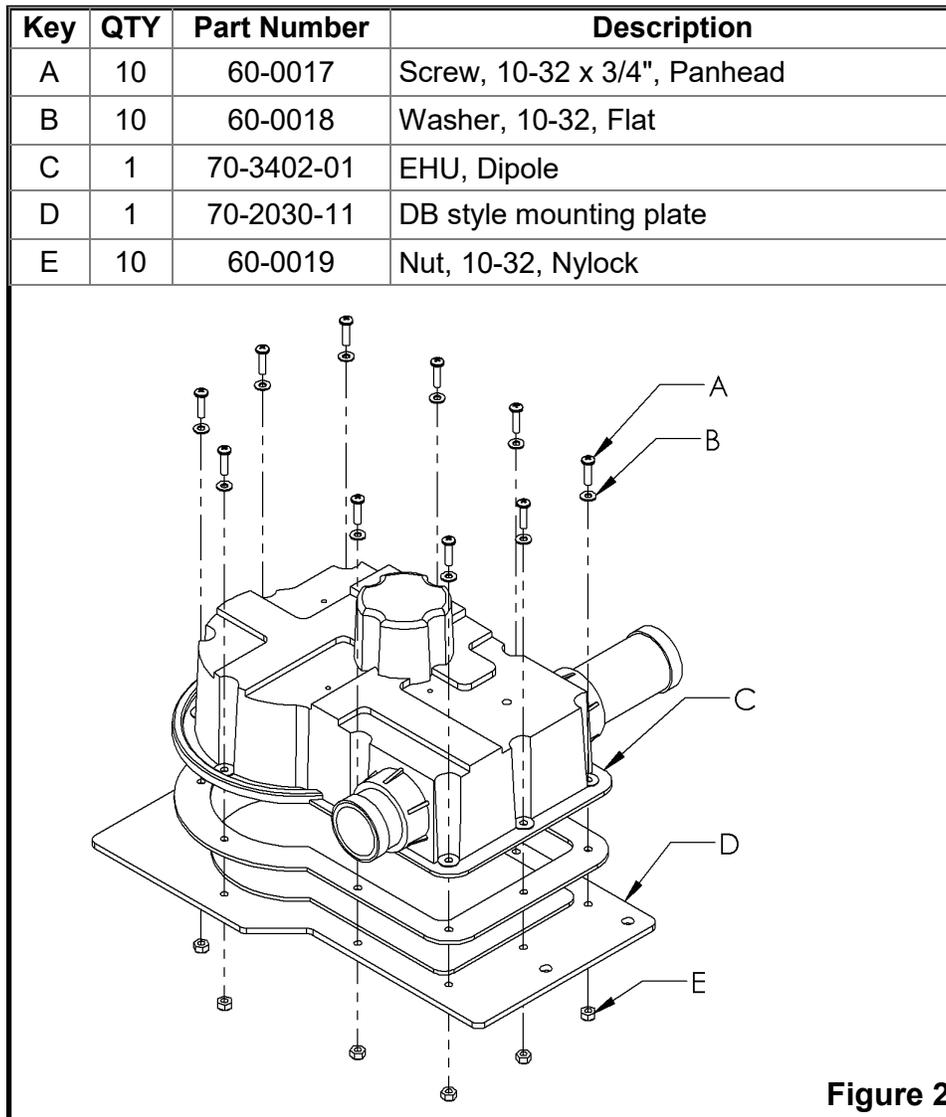
Figure 1.31

Figure 1.40

## INSTALL EHU ON MOUNTING PLATE

⚡ Don't forget to apply anti-seize to all stainless steel hardware to prevent galling!

1. Mount the EHU onto the mounting plate using **figure 2** below as a reference.
2. Tighten the hardware firmly but be careful not to overtighten or you will risk damaging the EHU flange.



## PRELIMINARY WIRING TESTS

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### Section 3: EHU mechanical test

Read the controller operator manual so that you are familiar with its operation. You will need an ohm meter or continuity tester for most of these tests. At this time the controller should NOT be connected to your radio or computer. Also, the coax jumper cables and fiberglass poles should NOT be installed on the antenna.

1. With the control cable NOT CONNECTED to the controller, turn the controller on. It should read “Manual Mode Elements Home”. If not, push the RETRACT button. After the controller is finished tuning it may turn off. If it does, you will need to turn the controller back on. The controller will now read “Manual Mode Elements Home”.
2. **ENSURE THAT ALL THE ELEMENTS ARE CLEAR OF ANY OBSTRUCTIONS.** The copper tape will be extended out from both sides of each EHU for approximately 6 inches.
3. Go into Setup mode by pressing the SETUP button and navigate to the “Create/Modify” menu.
4. Now CONNECT the control cable to the controller.
5. Select each element (*REF = reflector, DVR = driven, D1 = director 1, etc.*) and extend them to around 16” as indicated on the controller display. There will be approximately 3 inches of copper strip protruding out of each side of the EHU as shown in **figure 3**. This will allow you to put an ohm meter probe on the copper tapes during the tests.
6. If any of the tapes do not extend, or the individual EHU/element does not correspond to the correct controller description, (I.E.: the antenna Reflector is controlled by the REF position on the controller.) STOP, retract the elements, disconnect the control cable and correct any wiring errors. Then start at the beginning of these instructions.
7. If the tapes extend properly, press the react button to retract the elements and proceed to the next assembly step.



## PREPARE THE TELESCOPING POLES

- Remember to remove the black rubber plug from the base of each telescoping pole and check for debris inside!

### Section 4: Extend the telescoping poles

- 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. 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 installing the poles onto the antenna

### Section 4.1: Secure polyolefin heat shrink to the telescoping pole joints

- Each telescoping pole uses 3 polyolefin heat shrink pieces (PN 10-1059-01). Once finished, the seal is secure and waterproof. This product requires a heat gun for activation of the adhesive.
- When positioning the heat shrink, place it so that the joint of the telescoping pole is centered in the middle of the heat shrink. **Figure 4.10** below shows how this is done.
- Using a heat gun (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.
- We recommend wearing heat-resistant gloves while doing this so that you can reposition the heat-shrink as needed (it will try to slide down the pole).



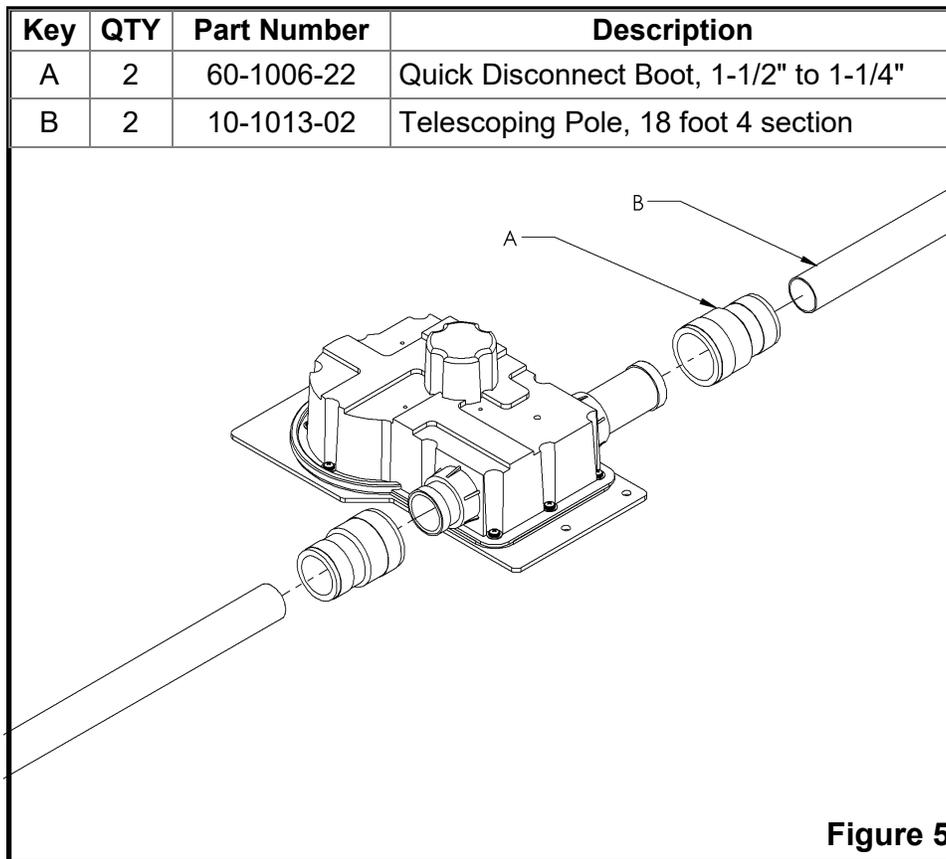
## Section 4.2: Install the foam plugs

- Each telescoping pole tip requires a breathable foam plug to allow for venting of the EHU. The foam plug assembly (PN 70-1007-01) consists of a special UV resistant foam plug material, and a plastic housing as shown in **figure 4.20**.
- The fit of the plastic housing on the pole tip is purposely very tight, so that the foam plug assembly will stay in place. Before attaching the plastic housing, spread a small amount of dish soap around the inside edge of the plastic housing as shown in **figure 4.20**. This helps the housing slide on easily, and the soap will eventually evaporate, leaving you with a firm interference fit.
- Insert the plastic housing onto the telescoping pole tip as shown in **figure 4.20**. Be sure that the plastic housing bottoms out on the pole tip.
- Repeat for the other telescoping pole tip.



## ATTACH THE FIBERGLASS POLES TO THE EHU

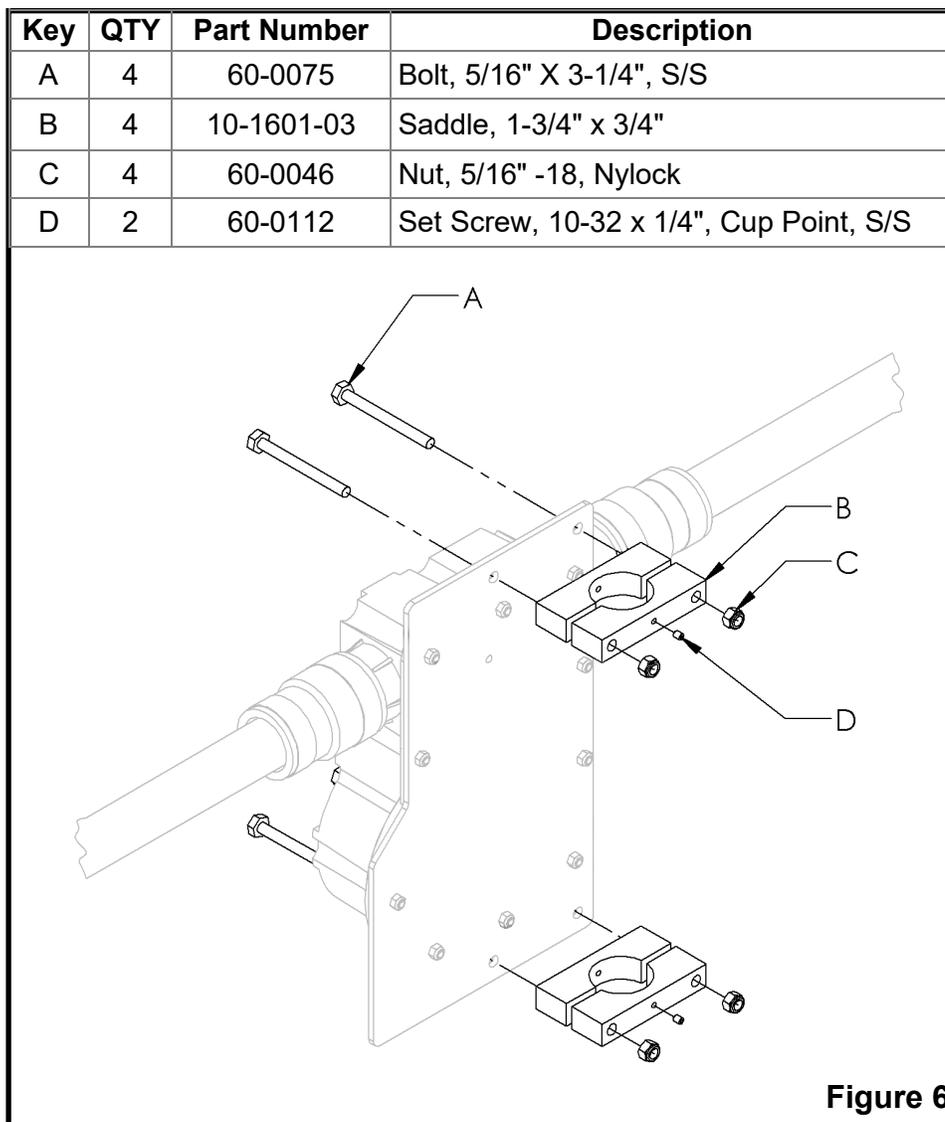
- Slide the rubber quick-disconnect boots (PN 60-1006-22) onto the telescoping fiberglass poles, smaller side first following **figure 5** below.
- Insert the telescoping poles into the element housing tube (EHT) until the pole butts up against the diverter.
- Slide the quick disconnect boot down the pole until it butts up against the edge of the element housing tube.
- Tighten both hose clamps on 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.



# INSTALL MAST CLAMPS

**⚡ Don't forget to apply anti-seize to all stainless steel hardware to prevent galling!**

- Install the clamps on the EHU mounting plate following **figure 6** below. The default clamps allow for mounting onto a 1-3/4" mast.
- You are now ready to mount the antenna onto your tower!
- Once installed, tighten the set screws to prevent the antenna from twisting on the mast in heavy winds.



**Figure 6**

## FINAL NOTES

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### Dipole SWR Considerations

The impedance of a half wave horizontal dipole depends on it's height above ground. In the frequency range of 14 to 28 MHz, the typical height of an amateur radio antenna is between 1/2 and 1 wavelength above ground. At these heights the impedance of a horizontal 1/2 wave dipole is in the vicinity of 70 to 80 ohms. When the antenna is mounted at heights greater than 1/2 wavelength, it should exhibit an SWR of less than 1.5 to one. At lower heights, the SWR may be higher.



## STEPPIR COMMUNICATION SYSTEMS

# LIMITED PRODUCT WARRANTY

Our products have a limited warranty against manufacturers defects in materials or construction for two (2) 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, or damage from severe weather that is beyond the product design specifications.

**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](http://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.

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