INSTALLATION MANUAL

TYPICAL ANTENNA

September 2023

DOCUMENT NO. AYU5000

REVISION A

SIGNATURE PAGE

Originator:_____	Approval:_____
	Documentation Approval:_____

RECORD OF REVISIONS

Revision	Issue Date	By	ECR

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

INTRODUCTION

This manual was created to be used as an installation aid for the operator.

For more detailed information about the hardware overview presented here, it is suggested that the user refer to the equipment manuals.

Advisories

WARNING

READ THIS ENTIRE MANUAL BEFORE BEGINNING ANY ACTIONS.

TO REDUCE THE RISK OF ELECTRICAL SHOCK, WATCH OUT FOR OVERHEAD POWER LINES. CHECK THE DISTANCE TO THE POWER LINES BEFORE STARTING THE INSTALLATION. STAY BACK A MINIMUM OF 6 METERS (20 FEET) FROM ALL POWER LINES.

DO NOT USE METAL LADDERS.

PERFORM AS MANY FUNCTIONS AS POSSIBLE ON THE GROUND.

IF YOU START TO DROP AN ANTENNA OR LOAD FRAME ASSEMBLY, GET AWAY FROM IT AND LET IT FALL.

IF ANY PART OF THE ANTENNA OR MAST ASSEMBLY COMES IN CONTACT WITH A POWER LINE, CALL YOUR LOCAL POWER COMPANY. DO NOT TRY TO REMOVE IT YOURSELF! THEY WILL REMOVE IT SAFELY.

MAKE SURE THAT THE LOAD FRAME IS PROPERLY GROUNDED.

Assembling dish antennas on windy days can be dangerous. Because of the antenna surface, even slight winds create strong forces. For example, a 1-meter antenna facing a wind of 32 km/h (20 mph) can undergo forces of 60 lbs. Be prepared to safely handle these forces at unexpected moments.

IMPORTANT SAFEGUARDS

Antennas improperly installed or installed to an inadequate structure are very susceptible to wind damage. The installer assumes full responsibility that the installation is structurally sound to support all loads (e.g., weight, wind, and ice) and properly sealed against leaks.

All non-penetrating roof mounts must have calculated wind load characteristics performed to ensure proper application. No site is to be installed without verifying that this process and associated information has been incorporated.

1 SCOPE

This manual provides a systematic methodology for typical antenna installations.

It covers 1.2 and 1.8-meter reflectors attached to a modular AZ/EL housing assembly optimized for fixed positioning on geostationary satellites. The elevation adjustment is continuous from 0 to 75 degrees. The azimuth adjustment is capable of a full 360-degree rotation.

The AZ/EL housing is designed to fit over and clamp tightly to a 3" outer diameter pipe or mast when the reflector is 1.2-meters and a 4.5" outer diameter pipe when the reflector is 1.8-meters. The pipe or mast is attached to a hot-dipped galvanized steel mount assembly constructed of steel components assembled into a non-penetrating load frame designed to support and spread the ballast weights and counter wind loading effects.

The frame is required to be constructed over a protection and friction enhancing substrate due to the functional design requirements of the load frame. The substrate, usually rubber, lies between the load surface that the system is being erected on and the mount components that will be in contact with that surface. In some applications, it may be necessary to ground mount the antenna or install using a wall mount. The former being a pipe embedded in a concrete foundation, and the latter being a pipe and bracket assembly affixed to a relatively vertical structure.

The antenna is comprised of two functional sub-components: the reflector (which is of a surface design to be aimed and consequently reflect signals to a predetermined focus), and a feed mechanism (which collects the reflected signals). The reflector employed here is an offset antenna of a transmit compatible, type-accepted manufacture. The fielded feed mechanism is dual port, receive-only universal wideband design. The feed support assembly is comprised of a three-leg strut system attached to the perimeter of the reflector and extending out to the offset focal point. The feed and ancillary components are attached to this vertex plate.

2 APPLICABLE DOCUMENTS

Feed Cover Installation Procedure (Form Number F023).
Site Survey Manual (Document Number SUP345).
Missing Materials Worksheet (Form Number F047).
RMA Process Sheet (Form Number F057).
Ground Pole Installation Worksheet (Form Number F089).

3 PRE-INSTALLATION INFORMATION

This chapter details information that will be needed by the engineer before installing the outdoor equipment.

3.1 Site Selection

A site survey will need to be completed in advance. The site survey is covered in the Field Services Site Survey Manual (Document Number SUP345). In general, the site selected will provide an unobstructed southward view of the satellite(s) of interest. Occasionally, a considerable amount of time will elapse between the survey and the commencement of the equipment installation. In those cases, it will be necessary to ascertain whether or not the view has been obstructed due to unforeseen changes. Additionally, some radio or terrestrial interference may be present that could adversely impact the installation. Due to the transient nature of interference, it would be wise to keep the possible existence of it in mind when working on-site.

3.2 Unpacking and Inspection

Inspect each crate and packed unit for visible damage. Note any visible crate damage on the freight bill or receipt, and have it signed by the carrier's agent. Failure to adequately describe such external evidence of loss or damage may result in the carrier refusing to honor a damage claim. Request a damage claim ticket from the carrier and fill it out.

In the event of a damaged unpacked unit, make a written request for inspection by the carrier's agent within 15 days of the delivery date. File a claim with the carrier since such damage is the carrier's responsibility.

The packing slip is to be used as confirmation of materials received and should be cross-checked between the specific installation needs and the materials shipped. The packing slip should be faxed back to Technical Support at the earliest possible moment.

Should any parts be damaged, mismatched, or missing, send the bad parts along with the appropriate forms to Technical Support. Technical Support has forms specifically for reporting missing equipment and for returning bad equipment.

Finally, all waste materials must be properly disposed of after all installation work has been completed.

4 INSTALLATION INFORMATION

This chapter details information that will be needed by the engineer to install the outdoor equipment.

4.1 Non-penetrating Roof Mount Assembly (For 1.2-Meter Antennas)

The Mount Assembly can be used for the entire domestic satellite arc and does not require orientation on the center of the satellite arc. However, to ensure proper calculated wind loading characteristics, the mount should be oriented at an azimuth angle that will accommodate viewing the satellite of interest. The Mount Assembly is shown in Figure 1.

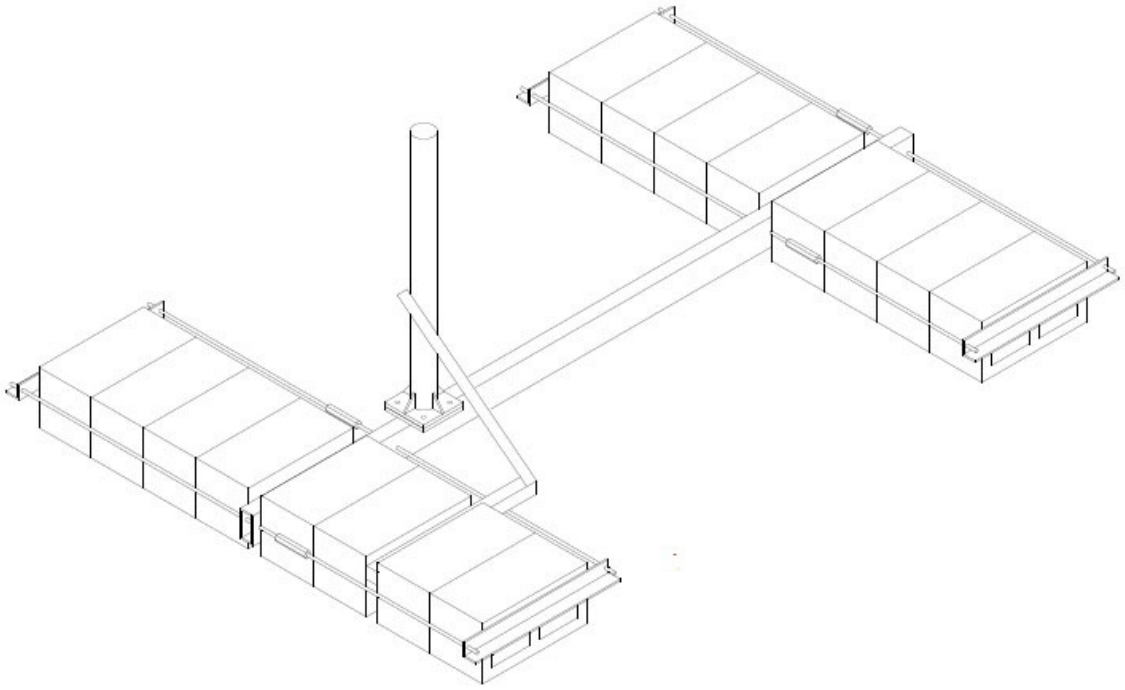

Figure 1: Mount Assembly

4.1.1 Mount Assembly Work Area

The work area should provide plenty of space for pre-assembly and assembly activity. Before beginning, clear the area of debris, rock, ballast, dust, sand, and standing water. Sweep the area with a broom to remove any loose materials.

Using the typical mount size footprints as a guide, place the provided substrate textured side down on the previously cleared installation area. Be sure the layout is oriented as appropriate for the satellite of interest.

4.1.2 Mount Assembly Installation Tools and Equipment

This section lists all tools and equipment necessary for the Mount Assembly installation. Table 1 lists the tools that the Field Service Engineer should have on hand. Table 2 lists the equipment that should be included in the delivered installation package.

The Mount Assembly is designed to capture and clamp various quantities of 32-pound concrete ballast blocks using angle brackets and threaded rods. The ballast is usually composed of 2 rows of 8 to 16 blocks (each row) depending on the previously calculated site wind load characteristics. Table 3 shows the correlation between threaded rod lengths, number of concrete blocks, and pressure pads.

Table 1: Field Service Tools

Tools	
12" Adjustable Wrench	Level
5/8" Open End Wrench	Felt Marker
2 Qty - 3/4" Open or Box End Wrench	Tape Measure

Table 2: Mount Assembly Installation Equipment

P/N	Qty	Description
19	1	Rectangular Support Tube
18	4	Short Threaded Rods (see Table 3)
17	4	Long Threaded Rods (see Table 3)
16	4	Threaded Rod Couplers
15	4	Clamp Angles .18"x 2" x 2" by 17.08"
14	16	3/8" Coupler Nuts for Clamp Angles
13	8	3/8" Lockwashers for Clamp Angles
12	8 to 16	Concrete Blocks per Row (see Table 3)
11	2	Pressure Pads (see Table 3)
10	1	3.0" Outer Diameter Mast
9	4	1/2" x 1.25" Bolts for Mast
8	4	1/2" Lockwashers for Mast
7	4	1/2" Nuts for Mast
6	1	Lower Mounting Angle 1.75" x 1.75" x 19"
5	1	Brace Angle .12" x 1.5" x 1.5" by 22.3"
4	1	3/8" x 4" Bolt for Brace Angle
3	1	3/8" Flatwasher for Brace Angle
2	2	3/8" Whizlock Nuts for Lower Mounting and Brace Angles
1	1	3/8" x 1.00" Bolt for Lower Mounting and Brace Angles

Table 3: Threaded Rods and Pressure Pads

# of Blocks per Row	Threaded Rods Short & Long	Pressure Pads
8	3/8" x 18" 3/8" x 48"	18" x 68"
10	3/8" x 24" 3/8" x 60"	18" x 81"
12	3/8" x 38" 3/8" x 60"	18" x 98"
14	3/8" x 46" 3/8" x 72"	18" x 112"
16	3/8" x 60" 3/8" x 72"	18" x 83"

4.1.3 Mount Assembly Instructions

This section shows the steps required to assemble the Mount. The part numbers are shown in parentheses.

1. Utilizing the appropriate threaded rods required for the number of blocks, assemble each short length (18) with a long length (17) using the threaded rod coupler (16) to join them (see Figure 2). You should have 4 threaded rod assemblies when done.

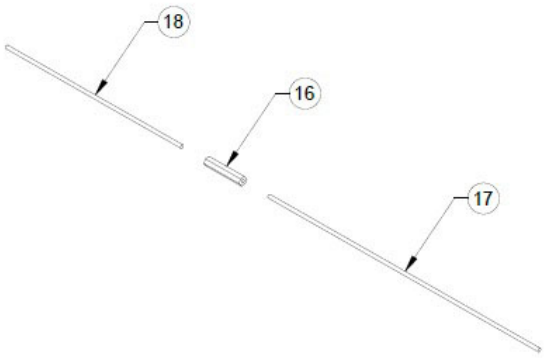

Figure 2: Threaded Rod Assembly

2. Place the rectangular support tube (19) on the ground with the 6" x 6" mast plate facing up (see Figure 3). Orient the support tube in the azimuth heading of the satellite of interest. The mast plate should be facing up and toward the leading edge of the azimuth heading.

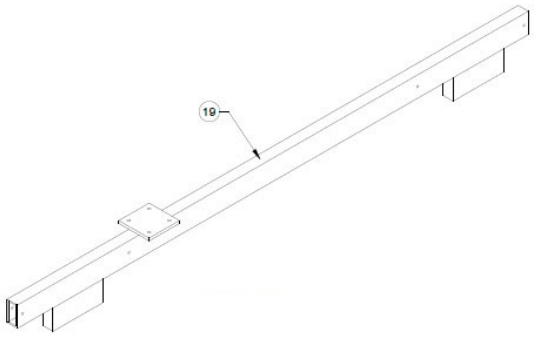

Figure 3: Rectangular Support Tube

3. Insert a threaded rod, long end first (17), through the first pre-drilled hole in the rectangular support tube (see Figure 4). Step across the rectangular support tube and insert another rod, long end first, through the second pre-drilled hole. The idea is to stagger the coupler on opposite sides of the rectangular support tube for stability.

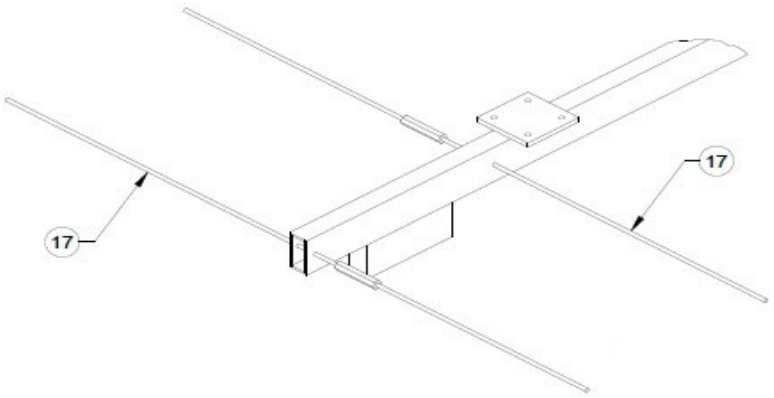

Figure 4: Rectangular Support Assembly

4. Slide an angle clamp (15), face down and outward, on both ends of the rods by aligning the pre-drilled holes with the threaded rods (see Figure 5). Install the angle clamp with a 3/8" lockwasher (13) against the clamp and a 3/8" coupler nut (14), but do not tighten.

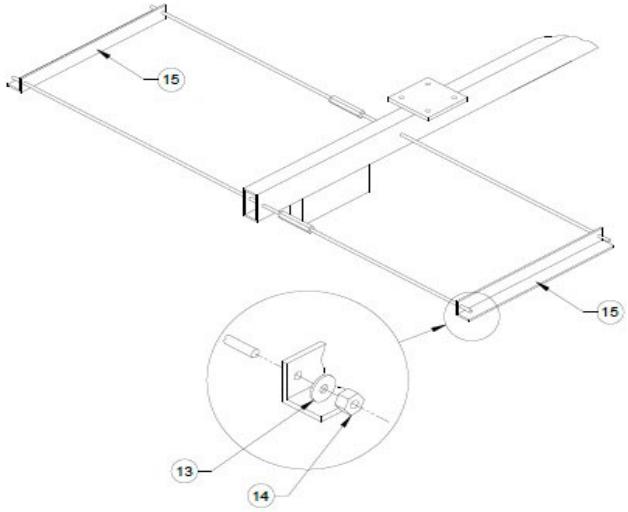

Figure 5: Angle Clamp Assembly

5. Repeat the assembly process for the other side of the rectangular support tube starting with step 3.
6. Place the pressure pads (11) on the ground under the angle clamp assemblies. Center the pads using the threaded rods and clamp angles as guides.
7. Place the appropriate number of concrete blocks (12) between all threaded rods and clamps. The long axes of the blocks should be perpendicular to the threaded rods (see Figure 6). Square up the assembly, but do not tighten the coupler nuts. Repeat the process on the other side of the rectangular support tube.

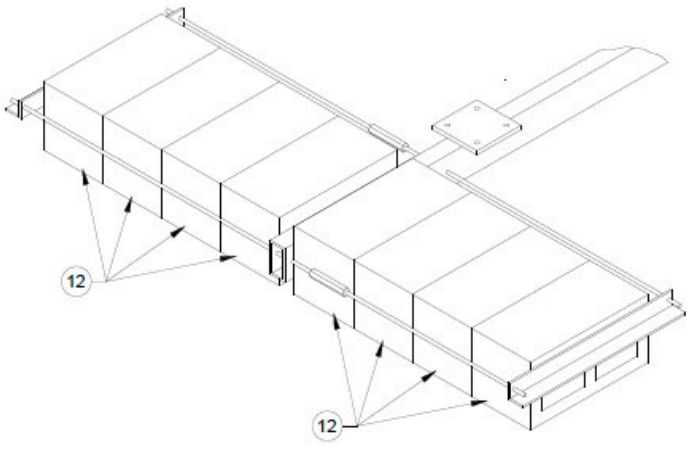

Figure 6: Block Assembly

8. Attach the mast (10) using the four supplied 1/2" x 1.25" bolts (9), 1/2" nuts (7), and 1/2" lockwashers (8). Insert the bolts from the bottom up placing the lockwasher

between the nut and the top of the mast plate (see Figure 7). Tighten the mast bolts until the lockwasher is fully collapsed and is properly tightened.

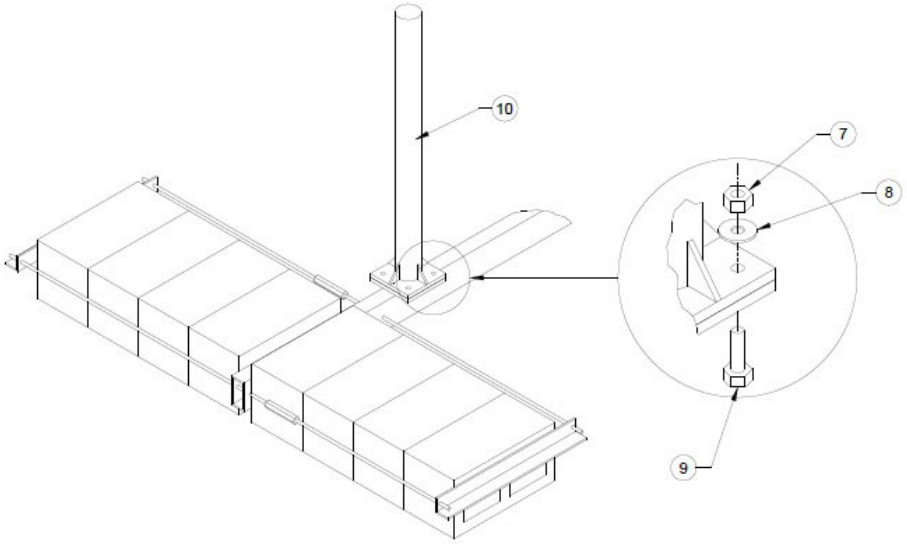

Figure 7: Mast Assembly

9. Facing the concrete blocks closest to the mast, insert the lower mount angle (6) between the second and third blocks from the support tube on the right side (see Figure 8).

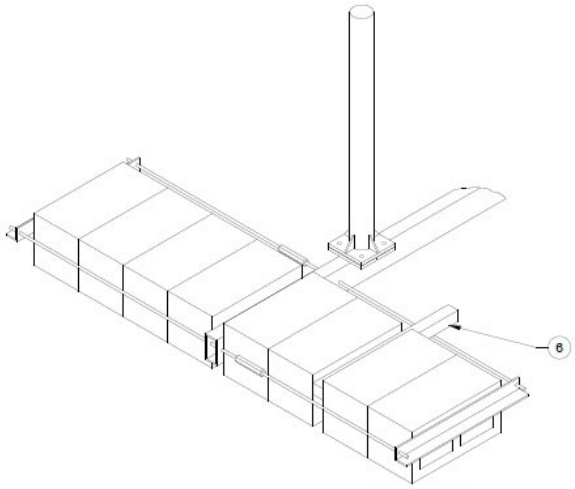

Figure 8: Lower Mount Angle Assembly

10. Attach the brace angle (5) to the mast using the supplied 3/8" x 4" bolt (4), 3/8" flat-washer (3), and 3/8" whizlock nut (2), but do not tighten. Dry fit the brace angle to the lower mount angle (6), but do not bolt together (see Figure 9).

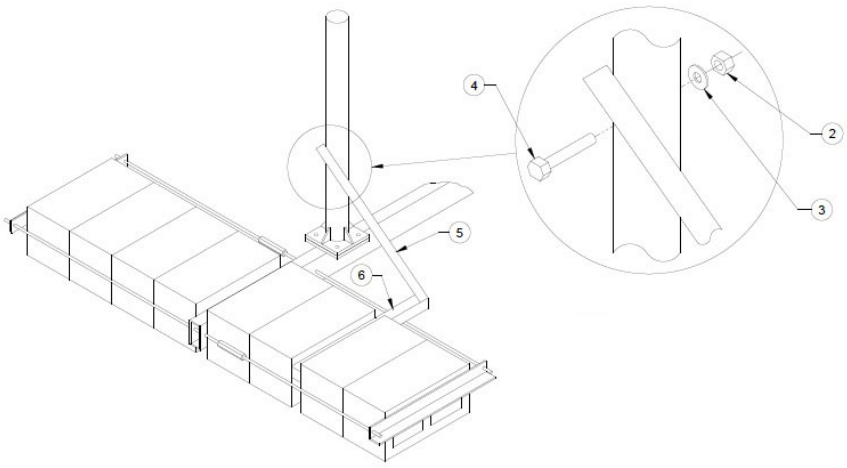

Figure 9: Brace Angle and Lower Mount Angle Assembly

11. Secure the block assembly by tightening the coupler nuts (14) on the clamp angles starting with the coupler nut closest to the threaded rod coupler (see Figure 10). Tighten and torque to 25 ft/lbs. Tighten the remaining coupler nuts in the entire assembly by working in a diagonal pattern for each side. If the rod turns, use the double nut method (shown in the circle) to keep the rod from spinning. Eight extra 3/8" coupler nuts were provided in the installation kit for the double nut method.

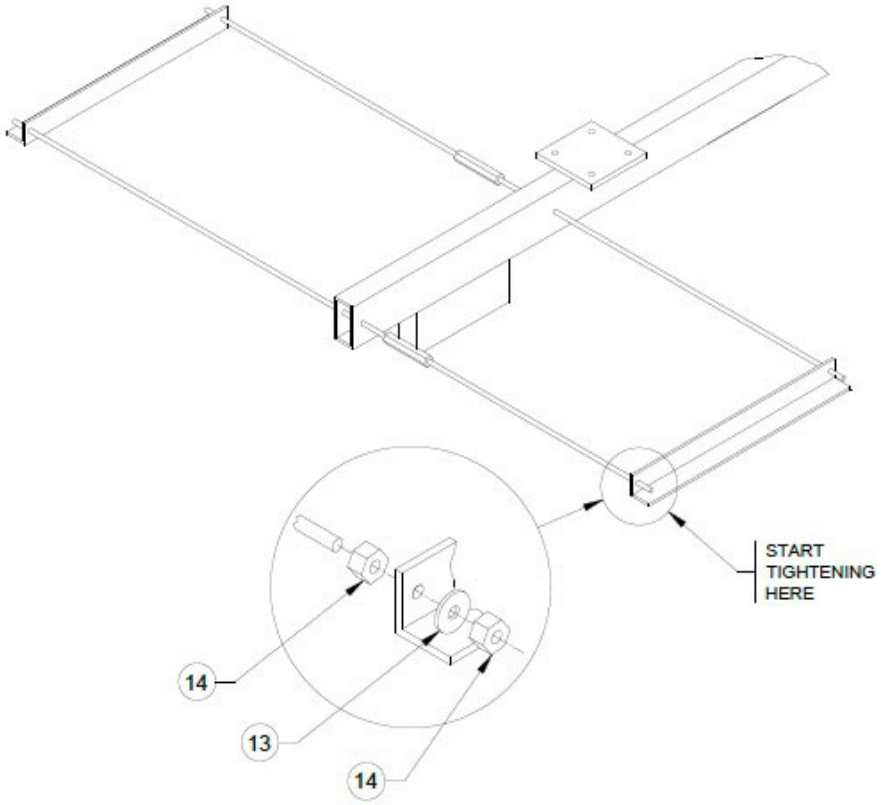

Figure 10: Securing the Block Assembly

12. Firmly attach the brace angle (5) to the lower mount angle (6) using the 3/8" x 1.00" bolt (1) and 3/8" whizlock nut (2). Tighten the brace angle at the mast (see Figure 11).

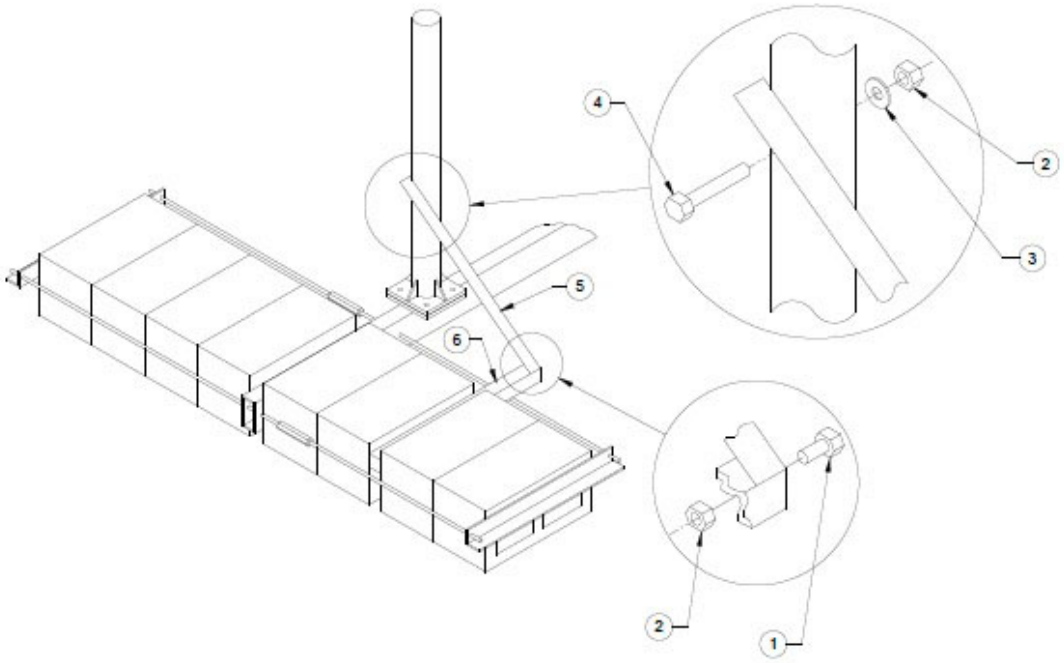

Figure 11: Brace Angel Assembly

4.2 Antenna Pointing and Peaking

This section details the procedures required to align the antenna with the satellite of interest.

Alignment with the satellite is obtained by setting the polarization, elevation, and azimuth. The elevation and azimuth values are calculated based on the site latitude, longitude, and orbital slot. The information needed to complete the calculations is included in the project documentation.

Given the antenna latitude, longitude, and satellite longitude (over the equator), the following calculations can be made (north of the equator):

$AZ = 180° + \arctan(\tan\theta / \sin\infty)$

$EL = 90° - T - R$

Where

AZ = True Azimuth to view satellite, in degrees east (CW) of True North.
∞ = Antenna latitude in degrees
θ = Satellite longitude minus antenna longitude in degrees

Where

EL = True elevation angle to view satellite in degrees
$R = \arccos(\cos\theta \cos\infty)$
$T = \arctan[\sin R / (6.6166 - \cos R)]$

Note: Longitude values are positive for antenna sites or satellite positions west of GMT and negative east of GMT.

Preliminary Setup

It is very important that you perform the following steps to align the mount squarely on the mast to prevent tilting during alignment. Failure to do this will make peaking the elevation and azimuth very difficult

1. Loosen all four azimuth locking bolts.
2. Simultaneously snug-tighten both top bolts to an equal depth, then 1/8 turn, centering the cap on pole.
3. Repeat Step 2 for bottom bolts.

Polarization of the Feed

Polarization of the feed is obtained by using a 10mm nut driver to loosen the two clamp bolts and then turning the feed. Align the alignment mark on the half junction clamp (28) with the "0" (zero) mark on the feed horn scale (see Figure 12). Turn the feed assembly clockwise or counter clockwise to obtain the correct polarization setting for your location. Make sure the half junction clamp is installed with the arrow pointed toward the antenna as shown in Figure 12. Torque the bolts securing the half junction clamp to the junction block to 4 ft-lbs. maximum.

Note: The Vertical Downlink Polarity is the long dimension of the rectangular port on the LNB when the transition is in a vertical position. Horizontal Downlink Polarity is the long dimension of the rectangular port on the LNB when the transition is in a horizontal position.

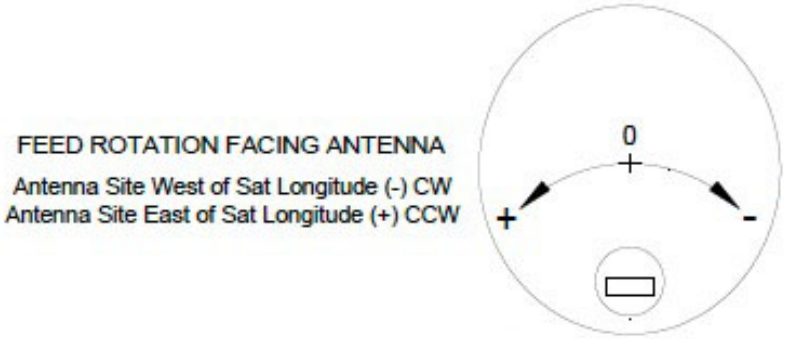

Figure 12: Polarization of the Feed

Elevation

Loosen the elevation locking bolt/nut and elevation pivot bolt/nut 1/4 turn (see Figure 13). Turn the elevation adjustment bolt clockwise to decrease elevation or counterclockwise to increase elevation. Align the pointer with appropriate mark at the desired elevation reading. This will be an approximate coarse setting. The optimum setting will be achieved when fine-tuning.

Note: It is important to note that the degree values shown on the elevation scale are Beam, i.e., when the antenna face is vertical, the mechanical elevation is 0°, but the Beam Elevation (signal) is 22.6°.

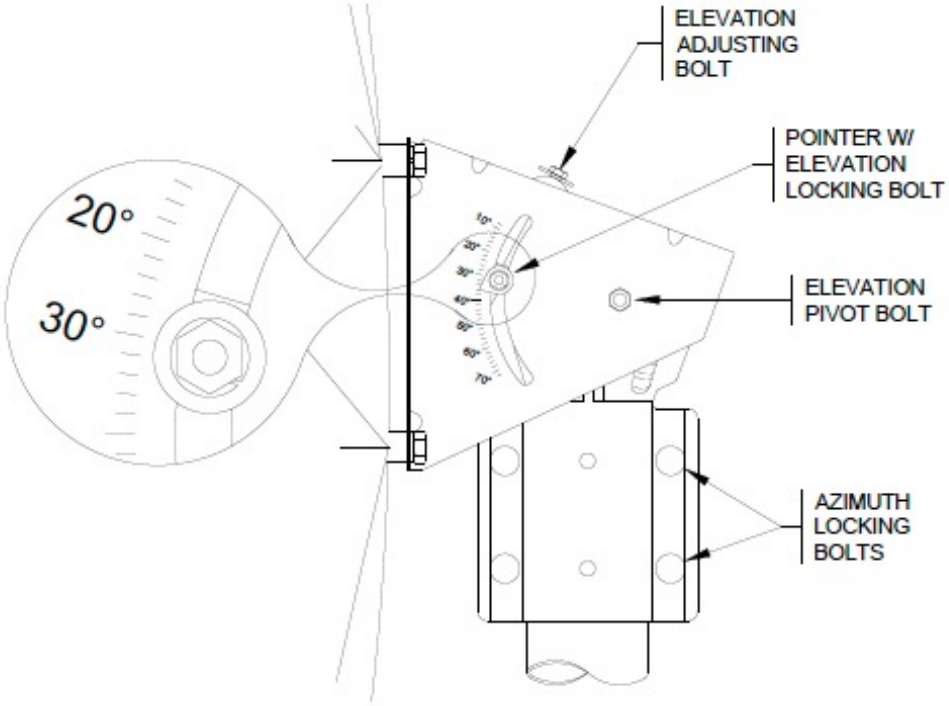

Figure 13: Elevation Adjustment

Azimuth

This section gives a relatively easy method of adjusting the four azimuth locking bolts without tilting the AZ/EL housing/backframe assembly on the mast tube (see Figure 14). Tilting makes the azimuth and elevation adjustments difficult. Also, be cautious not to over tighten bolts at any time prior to lockdown because scarring the mast tube will make the fine tune adjustment process difficult.

Begin by loosening the top and bottom azimuth locking bolts 1/8 turn. Minimum loosening will allow azimuth rotation on the pole without tilting. Next, rotate the antenna and AZ/EL housing/backframe assembly to the correct compass reading for your location and satellite. Slowly sweep the antenna from left to right until the signal is found. If the desired signal is not found, increase or decrease the elevation setting and repeat the azimuth sweep.

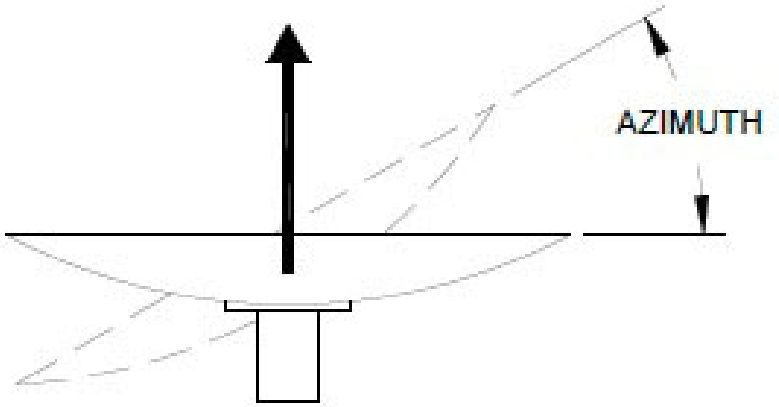

Figure 14: Azimuth Adjustment

Fine Tuning

Use a spectrum analyzer for final adjustments to obtain the maximum antenna performance. Alternate between elevation and azimuth to fine-tune the adjustments until signal improvement can no longer be detected. Once peaked, tighten all hardware.

Final Lock Down

Tighten progressively (1/8 turn each) all four azimuth locking bolts. Repeat until 85-95 ft-lbs. torque is reached. Tighten all remaining hardware. The torque for M8 round head square neck bolts is 11 ft-lbs.

Figure 13 depicts a typical mechanical pointing system frequently found on many ChannelMaster Antennas. When pointing any antenna, accuracy is best achieved using an inclinometer or pointing tool

4.3 Grounding

This section details the procedures required for grounding the antenna.

The load frame, antenna mount assembly, and feed cables must be grounded in accordance with current National Electric Code and local electric codes to protect the equipment from surges due to nearby lightning strikes. Figure 15 illustrates our typical method of providing a means for the client to connect the ground. The clamp provided affords a solid connection to facilitate this.

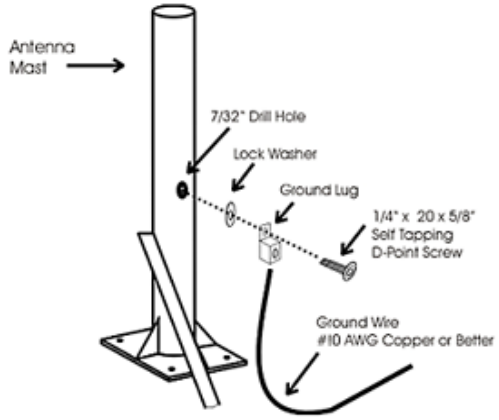

Figure 15: Typical Antenna Ground

For additional protection, Gas Tube Arrestors (GTA) may be placed inline with the coaxial cable. A ground block lug may also be added onto the arrestor. When GTA's are mounted outdoors, all connections must be protected and sealed as per standards for outdoor protection. Figure 16 shows a typical GTA installation.

Figure 16: Gas Tube Arrestors