C-100 SERIES MICRO EARTH STATION

INSTALLATION MANUAL

03-0050-02

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REVISION HISTORY

1.0	Initial Release	September 1985
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Section 1.0
INTRODUCTION

EQUATORIAL Communications Company markets satellite-based data communications networks for point-to-multipoint distribution applications. These satellite networks offer a cost-effective alternative to the traditional telephone networks.

The EQUATORIAL satellite data communication network incorporates a 36-foot (11-meter) Master Earth Station located in Mountain View, California; a geostationary satellite; and a number of Micro Earth Stations installed at remote user locations. EQUATORIAL manufactures, operates, and markets the Master Earth Station, uses its own satellite transponders on WESTAR IV and GALAXY III as authorized by the Federal Communications Commission, and manufactures and markets the low-cost C-100 Series receive- only Micro Earth Stations.

After receiving customer data from telephone lines or a satellite feed, the master station transmits the data to the satellite transponder in orbit above the earth. The satellite relays the data to each micro station which forwards it to nearby peripheral equipment. Figure 1-1 shows the integral parts of this data communication network.

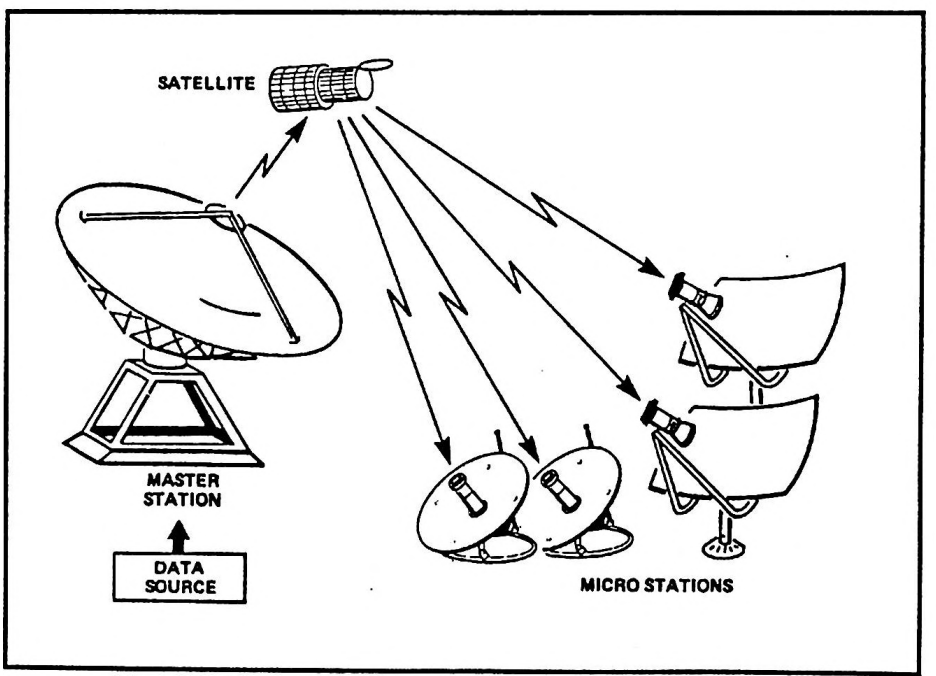


Figure 1-1. Point-to-Multipoint Network

EQUATORIAL's patented spread-spectrum technology is used to provide reliable data transmission in the presence of strong satellite or terrestrial interference. This technology uses a frequency bandwidth which is greater than conventional signals transmitting at comparable data rates, resulting in micro earth stations with antennas as small as 0.6 meter (24 inches) in diameter.

The Equatorial Data Distribution Network is ideally suited for the following types of network applications:

- General and sports news distribution
- Commodity and financial news distribution
- Weather data distribution
- Data-base distribution.

The C-100 Series Micro Earth Station equipment consists of the antenna and the low noise converter (LNC) assembly, and the controller. The small size and weight, low power requirements, and interference-resistant design of the receiver allow for easy installation.

This manual provides the step-by-step instructions for installation of the C-100 Series receive-only Micro Earth Stations. Organized in five sections, the document contains the following:

Section 1.0: Introduction.

Section 2.0: System Description

A brief overview of the Micro Earth Station system operation.

Section 3.0: Preparation for Installation

Instructions for unpacking of equipment, controller connections and checkout, and site selection.

Section 4.0: 0.6 and 0.7 Meter Antenna Installation

Details on assembly and installation of the 0.6 and 0.75-meter (24- or 30-inch) antenna system.

Section 5.0: 1.4 Meter Elliptical Antenna Installation

Details on assembly and installation of the 1.4-meter (4 by 6-foot) offset-fed elliptical antenna system.

The Appendices contain additional information which may be needed to facilitate antenna installation or controller check-out.

Section 2.0
SYSTEM DESCRIPTION

The C-100 Series receive-only Micro Earth Station consists of two major subsystems; the antenna assembly and the controller (see Figure 2-1). The antenna assembly consists of a reflector, low noise converter, and waveguide/feedhorn. It receives, amplifies, and downconverts the 4-GHz satellite signal to a 69.25-MHz intermediate frequency (IF). The controller demodulates the intermediate frequency (IF) signal, performs data processing functions, and transmits data to user's peripheral equipment. The antenna is connected to the controller by up to 500 feet (152 m) of high-quality RG-59/U coaxial cable.

The C-100 Series is available with several antenna and controller I/O options that permit it to be tailored to meet user location and application requirements.

Antenna Options

- The 0.6 meter (24-inch) antenna is installed at locations where the satellite-radiated power is maximum, i.e., in the center of the satellite beam.
- The 0.75 meter (30-inch) antenna is installed at locations with a slightly lower received signal.
- The 1.4 meter (1.8 x 1.1 meter, or 72 x 42-inch) offset-fed elliptical antenna (with an effective aperature of a 1.4 meter dish) may be required where the received signal is lower.

Each antenna has a low noise converter (LNC) assembly that contains bandpass filters, a low-noise preamplifier, and downconverter.

Controller I/O Options

- Asynchronous/synchronous mode which supports 1 or 4 ports with RS232 or 20 ma current loop interface.
- Asynchronous/synchronous/SDLC mode which supports 4 ports with RS232 or RS422 interface.
- Intelligent mode (for applications requiring programmable interface) which supports 2 ports with RS232 or RS422 interface.

Any controller option works with any of the three antenna options (see Table 2-1).

Figure 2-1. C-100 Micro Earth Station

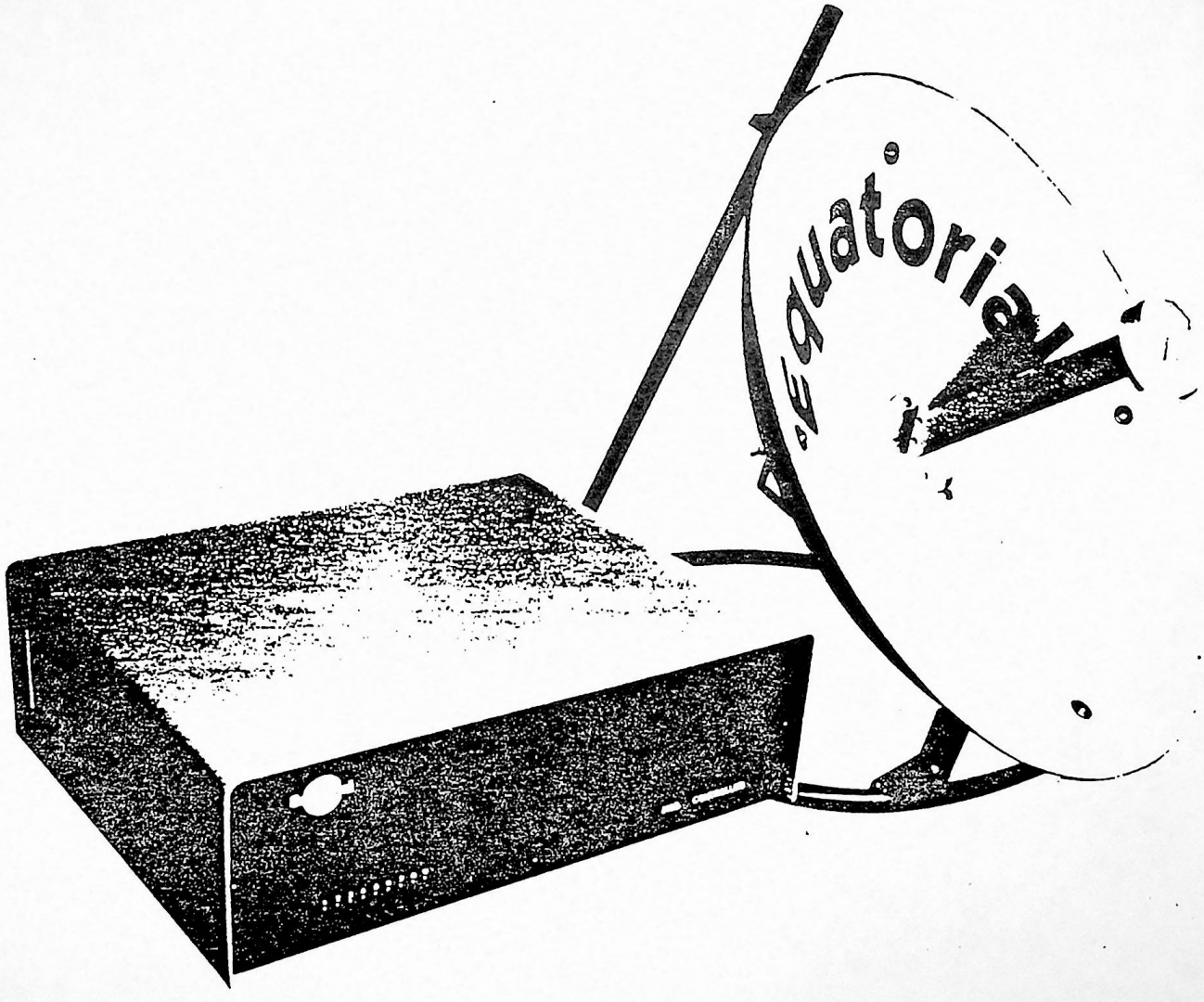


Table 2-1. Antenna/Controller Configuration Guide

I/O Version		Antenna Size		
Model		**0.6m**	**0.75m**	**1.4m**
Async/Sync				
C-101	(1 port)	X		
C-102	(4 port)	X		
C-104	(1 port)		X	
C-105	(4 port)		X	
C-108A	(4 port)			X
C-131	(1 port)		RHC	
C-132	(4 port)		RHC	
C-133A	(1 port)			RHC
C-134A	(4 port)			RHC
C-135	(1 port)		LHC	
C-136	(4 port)		LHC	
C-137A	(1 port)			LHC
C-138A	(4-port)			LHC
Async/Sync/SDLC				
C-112	(4 port)	X		
C-115	(4 port)		X	
C-118A	(4 port)			X
Intelligent				
C-122	(2 port)	X		
C-125	(2 port)		X	
C-128A	(2 port)			X

X = For Linearly Polarized Signals
RHC = For Right Hand Circular Polarization
LHC = For Left Hand Circular Polarization

Table 2-2 lists the physical and environmental specifications for the controller and the three antenna sizes.

Table 2-2. C-100 Physical and Environmental Specifications

Antenna Assembly:

ANTENNA SIZE	0.6 m	0.75 m	1.4 m
Reflector Dimensions:	24.8 in.	30.9 in.	72" x 42"
(metric)	(630 mm)	(785 mm)	(1.1 x 1.8 m)
Waveguide Length:	10.1 in.	11.9 in.	N/A
(metric)	(257 mm)	(302 mm)	N/A
Mounting Ring Frame Depth (front to back):	21.5 in.	29.5 in.	N/A
(metric)	(546 mm)	(749 mm)	N/A
Assembly Weight:	20.0 lb.	25.0 lb.	150 lb.
(metric)	(9.1 kg)	(11.4 kg)	(68.2 kg)
Operating Temperature:	-40° to 140°F (-40° to 60°C)		

Controller:

Height:	6.75 inches	(171 mm)
Depth:	13.5 inches	(343 mm)
Width:	17.5 inches	(445 mm)

Weight:
19 lb. (8.6 kg)

Operating Temperature:
32° to 122°F (0° to 50°C)

Power Requirements:
100 to 127 VAC, 60 Hz, 60 watts (U.S.)
220 to 240 VAC, 50 Hz, 60 watts (International)

Section 3.0
PREPARATION FOR INSTALLATION

3.1 UNPACKING AND INSPECTING EQUIPMENT

The C-100 Series Micro Earth Station, in either the 0.6 or 0.75-meter version, is packed in three cartons. Five cartons are required for systems with the 1.4-meter antenna. An additional shipping carton is used for the base mount (if ordered).

1. Examine the exterior of each carton for damage before unpacking the Micro Earth Station equipment. If the carton is damaged, note the location and extent of the damage.

> **NOTE**
>
> **The person accepting delivery should inspect the exterior of the cartons in the presence of the delivery person. If the cartons are damaged, note extent of damage on the Bill of Lading before signing for shipment.**

2. Open the cartons and carefully unpack each item. Refer to the shipping documents and ensure that each carton contains the items listed.

3. Inspect each item for damage. If an item is damaged or missing, note the discrepancy and contact the supplier directly.

3.2 CONTROLLER CHECKOUT

Before proceeding further with the installation, it is best to run a preliminary check on the C-100 Controller to verify its operation. This also gives you an opportunity to verify the Controller Input/Output (I/O) configuration and to build or otherwise acquire the proper I/O cable. This section consists of three separate Controller checkout procedures, one procedure for each type of I/O configuration. In order to select the proper Controller checkout procedure, you must identify the I/O configuration.

Locate the configuration label on the rear of your C-100 Controller. This label is illustrated in Figure 3-1. The third item down is the I/O configuration. This will be one of the numbers listed below and will indicate the type of I/O controller installed.

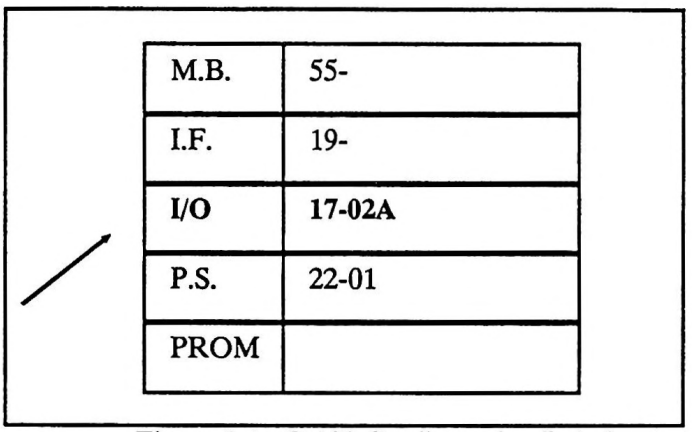


Figure 3-1. C-100 Configuration Label

Label	See	
17-nn	Sec 3.3	Async/Sync I/O Checkout
18-nn	Sec 3.3	Async/Sync I/O Checkout
56-nn	Sec 3.4	MPSC I/O Checkout
122-nn	Sec 3.5	Intelligent I/O Checkout

3.3 ASYNC/SYNC I/O CHECKOUT

Check the operation of Controllers with the 17-nn and 18-nn I/O controllers by performing the following steps:

1. Fabricate one custom cable to connect the controller output to the peripheral equipment input. Refer to Table 3-1 for the proper cable connections at the controller end of the cable. Consult the peripheral equipment manual for the specific connections required for the peripheral equipment.

   Required Materials:

   - One 25-pin male connector (DB-25P) (for controller)
   - One data cable (12 conductors, maximum)
   - Mating connector for peripheral equipment

Table 3-1. Asynchronous/Synchronous I/O Connections

Pin	Special Interface Function	Remarks
1	Ground (chassis)	
2	Transmitted Data	
4	Receive Data	
7	Ground (logic)	
8	RS-232 Control Out	
9	Bipolar Current Loop Transmit (active only)	
10	TTL Transmit	Reserved
13	Unipolar (+) Current Loop Tx (active only)	20 mA
15	RS-232 Clock (for synchronous operation)	Optional
19	Alignment Clock (signal-strength meter)	Only Port 1
25	Unipolar (-) Current Loop Return	

NOTE: Pins not listed are reserved and should not be used without consulting EQUATORIAL Communications Company.

2. Connect the Controller end of the custom cable to Port 1 on the rear of the controller. Connect the other end of the cable to the peripheral equipment.

3. Connect the power cable to the controller AC LINE receptacle (rear panel) and plug the cable into the 120-volt AC wall outlet. Ensure that the outlet is properly grounded.

4. Energize the peripheral equipment and verify its proper operation. The equipment should be set for 300 bps data with 8 data bits, no parity, and 1-stop bit.

5. Set the controller AC POWER switch (rear panel) to the ON position and check for the following lamp indications:

   - Front panel LEDs 1 through 8 flash 'ON' as a lamp test. After one second LEDs 1-8 go 'OFF'.
   - Then LED 9 comes 'ON', indicating that the unit has passed its power-up self-diagnostics.
   - When LED 1 comes 'ON' for approximately 5 seconds, a logon message is sent to all controller ports. Concurrent with LED 1 'ON', the rear panel output port LEDs flash for several seconds as the data is sent.
   - - In the C-10X Series units, the LEDs remain steadily on when idle, and flash off as data is being passed.

6. Check for a display on peripheral equipment. The display will appear on asynchronous peripheral equipment only when configured to the correct data rate and format, as in Step 4. The following, or similar test pattern may be used:

```
EQUATORIAL Communications Company
Module 5102, Controller Number 00003796
Firmware Number 94-0022-01 Rev A
Copyright(c) 1983
```

This completes the Async/Sync I/O controller check-out procedure.

3.4 MPSC I/O CHECKOUT

Check the operation of the Multi Protocol Synchronous Controllers (MPSC) by performing the following steps:

1. Fabricate one custom cable to connect the controller output to the peripheral equipment input. Refer to Table 3-2 for the proper cable connections at the controller end of the cable. Consult the peripheral equipment manual for the specific connections required for the peripheral equipment.

Required Materials:

- One 25-pin male connector (DB-25P) (for controller)
- One data cable (12 conductors, maximum)
- One mating connector for peripheral equipment

Table 3-2. Multi-Protocol Synchronous Control (MPSC) I/O Connections

A. RS232C MPSC DCE

Pin	Special Interface Function	Remarks	
1	Ground (chassis)		
2	Transmitted Data		
3	Received Data		
4	Control In		
7	Ground (logic)		
8	Control Out		
17	Receive Clock		Optional
19	Alignment Clock (signal-strength meter)	Only Port 1	

B. RS422 MPSC DCE

Pin	Special Interface Function	Remarks
1	Ground (chassis)	
6	Receive Data (+)	
7	Ground (logic)	
9	Control In (+)	
10	Control Out (+)	
11	Transmit Clock (+)	
12	Transmit Data (+)	
18	Receive Data (-)	
19	Alignment Clock (signal-strength meter)	Only Port 1
21	Control In (-)	
22	Control Out (-)	
23	Transmit Clock (-)	
24	Transmit Data (-)	

2. Connect one end of the custom cable to Port 1 on the rear of the controller. Connect the other end of the cable to the peripheral equipment. (Consult a peripheral equipment manual or a local equipment distributor for specific connector configurations.

3. Connect the power cable to the controller AC LINE receptacle (rear panel) and plug the cable into the 120-volt AC wall outlet. Ensure that the outlet is properly grounded.

4. Energize the peripheral equipment and verify its proper operation. The equipment should be set for 300 bps data with 8 data bits, no parity, and 1-stop bit.

5. Set the controller AC POWER switch (rear panel) to the ON position and check for the following lamp indications:

   - Front panel LEDs 1 through 8 flash 'ON' as a lamp test. After one second LEDs 1-8 go 'OFF'.
   - Then LED 9 comes 'ON', indicating that the unit has passed its power-up self-diagnostics.
   - When LED 1 comes 'ON' for approximately 5 seconds, a logon message is sent to all controller ports. Concurrent with LED 1 'ON', the rear panel output port LEDs flash for several seconds as the data is sent.
   - - The C-11X Controllers test the port status by turning 'ON' each of the output port LEDs in sequence.

6. Check for a display on peripheral equipment. The display will appear on asynchronous peripheral equipment only when configured to the correct data rate and format, as in Step 4. The following, or similar test pattern may be used:

```
EQUATORIAL Communications Company
Module 5102, Controller Number 00003796
Firmware Number 94-0022-01 Rev A
Copyright(c) 1983
```

This completes the MPSC I/O controller check-out procedure.

3.5 INTELLIGENT I/O CHECKOUT

Check the operation of the C-122 through C129 Controllers by performing the following steps:

1. Fabricate one custom cable to connect the controller output to the peripheral equipment input. Refer to Table 3-3 for the proper cable connections at the controller end of the cable. Consult the peripheral equipment manual for the specific connections required for the peripheral equipment.

Required Materials:

- One 25-pin male connector (DB-25P) (for controller)
- One data cable (12 conductors, maximum)
- One mating connector for peripheral equipment

2. Connect one end of the custom cable to Port 1 on the rear of the controller. Connect the other end of the cable to the peripheral equipment.

3. Connect the power cable to the controller AC LINE receptacle (rear panel) and plug the cable into the 120-volt AC wall outlet. Ensure that the outlet is properly grounded.

4. Energize the peripheral equipment and verify its proper operation. The equipment should be set for 300 bps data with 8 data bits, no parity, and 1-stop bit.

5. Set the controller AC POWER switch (rear panel) to the ON position and check for the following lamp indications:

   - Front panel LEDs 1 through 8 flash 'ON' as a lamp test. After one second LEDs 1-8 go 'OFF'.
   - Then LED 9 comes 'ON', indicating that the unit has passed its power-up self-diagnostics.
   - When LED 1 comes 'ON' for approximately 5 seconds, a logon message is sent to all controller ports. Concurrent with LED 1 'ON', the rear panel output port LEDs flash for several seconds as the data is sent.

Table 3-3. Intelligent I/O Connections

A. RS232C (Intelligent I/O) DCE

Pin	Special Interface Function	Remarks
1	Ground (chassis)	
2	Transmitted Data	
3	Received Data	
4	Request to Send	
5	Clear to Send	
6	Data Set Ready	
7	Ground (logic)	
8	Carrier Detect	
13	+I-Loop	
14	CE Enable	
15	Transmit Clock	
17	Receive Clock	Optional
19	Alignment Clock (signal-strength meter)	Only Port 1
20	Data Terminal Ready	
25	-I-Loop	

B. RS-422 (Intelligent I/O) DCE

Pin	Special Interface Function	Remarks
1	Shield	
2	Send/Receive Common	
3	Carrier Detect	
4	Send Data (+)	
5	Send Timing (+)	
7	Signal Ground	
8	Receive Timing (+)	
9	Clear to Send (+)	
10	Request to Send (+)	
11	Data Set Ready (+)	
12	Terminal Ready (+)	
13	+I-Loop	
14	CE Enable	
15	Carrier Detect (-)	
16	Send Data (-)	
17	Send Timing (-)	
18	Receive Data (-)	
19	Alignment Clock (signal-strength meter)	Only Port 1
21	Clear to Send (-)	
22	Request to Send (-)	
23	Data Set Ready (-)	
24	Terminal Ready (-)	
25	-I-Loop	

NOTE: Pins not listed are reserved and should not be used without consulting EQUATORIAL Communications Company.

6. Check for a display on peripheral equipment. The display will appear on asynchronous peripheral equipment only when configured to the correct data rate and format, as in Step 4. The following, or similar test pattern may be used:

```
EQUATORIAL Communications Company
Module 5102, Controller Number 00003796
Firmware Number 94-0022-01 Rev A
Copyright(c) 1983
```

This completes the Intelligent I/O controller check-out procedure.

3.6 SITE SELECTION REQUIREMENTS

In order to facilitate the installation of the C-100 Micro Earth Station, a site survey should be performed prior to the installation. The site survey aids in the resolution of any potential problems and assures that all installation materials are available.

DANGER

Ensure that the antenna is not mounted near power lines. In addition to being hazardous to personnel and equipment, power lines also create powerful electrical fields which are a source of electromagnetic interference.

The antenna must be mounted within 500 feet (153 meters) of the controller. The selection of a suitable antenna location must ensure a continuously clear path to the satellite. The path must not be obscured by pedestrian or vehicular traffic, winter snow-drifts, or other obstructions. The antenna can be mounted at ground level, on a roof, on a pole or wall, or any similar suitable location. Perform the following steps to ensure that an optimal site is selected for the antenna installation.

NOTE

In order to minimize exposing the reflector to severe winds and other bad weather conditions, low mounting heights are preferable for antenna location. However, the antenna should be mounted high enough to ensure that the signal path is completely free from interference caused by fixed or moving objects such as buildings, trees, hills, and traffic.

1. Determine which satellite will be used by your micro station. Record the orbital location of the satellite (in longitude). Determine the latitude and longitude of your micro station and record the information.

NOTE

The antenna should not be located under rain gutters or drains, near equipment that could cause antenna vibration, or it could be covered by snow drifts.

2. Based on the latitude and longitude of your station, determine the pointing parameters to the satellite. The pointing parameters may be determined by using the basic computer programs listed in the appendices or they may be determined from tables. The three necessary parameters are azimuth, elevation angle, and polarization. Note: For circularly polarized satellites, you need to determine only if the polarization is right-hand circular (Intelsat A-pol) or left-hand circular (Intelsat B-pol).

CAUTION

If the 1.4-meter offset-fed elliptical antenna is to be installed to an existing structure; note that the surface area is approximately 22 square feet and the maximum wind pressure at 100 mph is 30 lbs per square foot. The effective surface area is reduced as the antenna reflector is rotated off vertical by cos(elevation change + 20). Assure that the mounting structure can withstand as a minimum 700 lbs of horizontal load and 1500 ft-lbs of overturning torque when the 19-inch pipe mount is used. When mounting the antenna to any structure, assure that the structure can support a 1000 pound load.

3. Locate the exact position of the planned antenna installation. The maximum coaxial cable length is 500 feet (152 m) between the antenna and the controller. Inspect the antenna location for interfering obstructions as explained below.

CAUTION

To minimize the possibility of lightning strikes, ensure that the antenna is not mounted on the highest point of any structure.

4. Go to the exact point where the antenna will be installed. Visually sight along the signal path as determined in Step 2 to ensure there are no physical obstructions in the signal path.

5. Place the controller and peripherals in their permanent locations, keeping in mind the cable run between the antenna, the controller, and the peripheral equipment. Ensure that the I/O connecting cable is as short as possible, by placing the controller close to the peripheral equipment.

If the installation will be on rented or leased property, owner approval of the installation must be obtained. Local, state, and federal regulations, as well as labor contracts that may effect the installation, must be considered.

This completes the procedures for unpacking, controller checkout, and site selection. You are now ready to begin installation of the 0.6- or 0.75-meter dish antenna (Section 4.0), or the 1.4-meter offset-fed elliptical antenna (Section 5.0).

Section 4.0

0.6- AND 0.75-METER ANTENNA INSTALLATION

The installation of the 0.6 or 0.75-meter (24- or 30-inch) antenna systems, requires a minimum set of tools, materials, and test equipment. The antenna may be mounted on a roof or other flat surface (the preferred method of mounting) on a wall, or a vertical pole. The installation of the 0.6 or 0.75-meter antenna is quite straight forward, and can be accomplished in a couple hours. A standard electronic tool kit which includes the following items should be available before proceeding with the system assembly.

Required Installation Tools:

- 5/32-inch (#10) hex head wrench
- 11/32-inch nut driver
- 6-inch #2 Phillips screwdriver
- Compass (magnetic)
- Large-scale local map (aeronautical or marine chart)
- 3/8-inch drive ratchet and 3/8-inch socket
- Wire strippers
- Wire cutters
- Crimp tool (Gilbert HX 596 or equivalent)
- Inclinometer.

Required Materials:

- Silicon-base sealant (such as Dow #5) or tape (such as Flexite RC-00080N)
- 500-foot coaxial cable, Belden type 8241 (RG-59/U with 96% braid).

Recommended Test Equipment:

- EQUATORIAL signal-strength meter (transmitter, receiver units, and coaxial cables)
- Volt-ohmmeter.

4.1 ASSEMBLY

The antenna and strut are assembled so that the reflector is tilted at an angle of approximately 45 degrees when the entire assembly is positioned on a flat surface. The assembly procedure follows (Refer to Figure 4-1 for details):

1. Remove the protective tape from the strut collar and the strut mount.
2. Loosen the hex-drive cap screw on the strut collar but do not remove. Remove the bolt-washer-nut assembly from the strut mount and set aside. (See Figure 4-1, Detail "A".)

> **NOTE**
>
> **In some models, the strut collar is replaced by a U-bolt. For these units, slide the strut through the U-bolt collar and tighten the U-bolt nuts. Refer to Detail "B" in Figure 4-1.**

3. Ensure that the tubular mounting ring (base) is resting on a flat surface. Hold the base against the flat surface and lift the reflector until it is at an approximate 45-degree angle.
4. Insert the bolt-hole end of the strut into the strut collar. Slide the strut through the collar, aligning the strut bolt hole to the bolt hole on the strut mount.
5. Reinstall the bolt-washer-nut assembly removed in Step 2 and tighten it until the strut is secure.
6. Tighten hex-drive cap screw on strut collar to ensure collar does not slide downward on strut. When assembled, strut collar-to-mount distance is approximately 19 inches.

This completes the antenna assembly procedure.

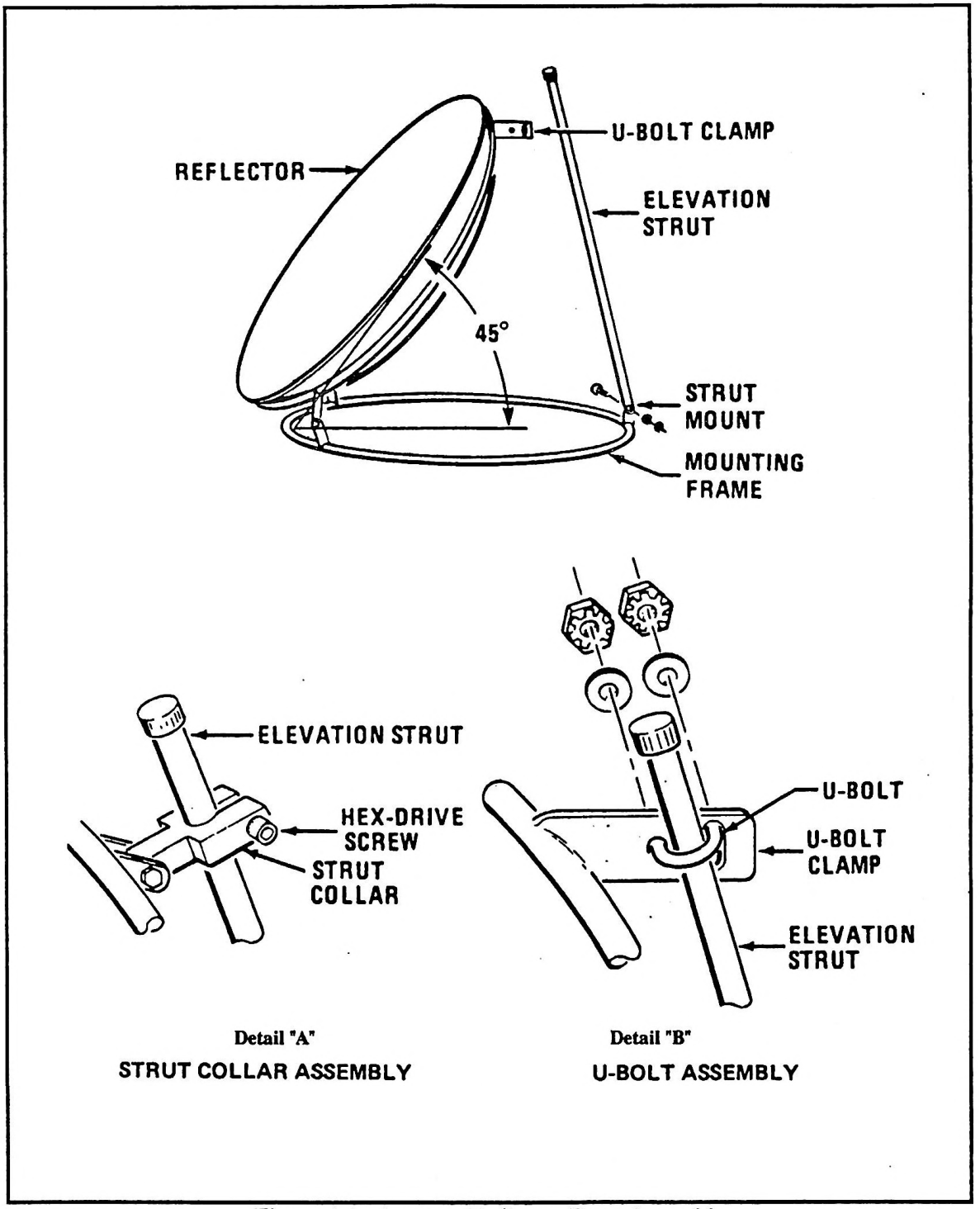


Figure 4-1. Antenna Reflector/Strut Assembly

4.2 MOUNTING

This procedure explains how to mount the antenna reflector and strut assembly on either a horizontal surface, such as a rooftop, or a vertical surface such as a wall or post. The antenna assembly is mounted without the low noise converter/ waveguide assembly, which is installed when the antenna polarization is adjusted. Of the three types of antenna mountings, EQUATORIAL recommends use of the rooftop or other horizontal surface. Wall and pole mounts complicate the polarization, elevation, and azimuth alignment.

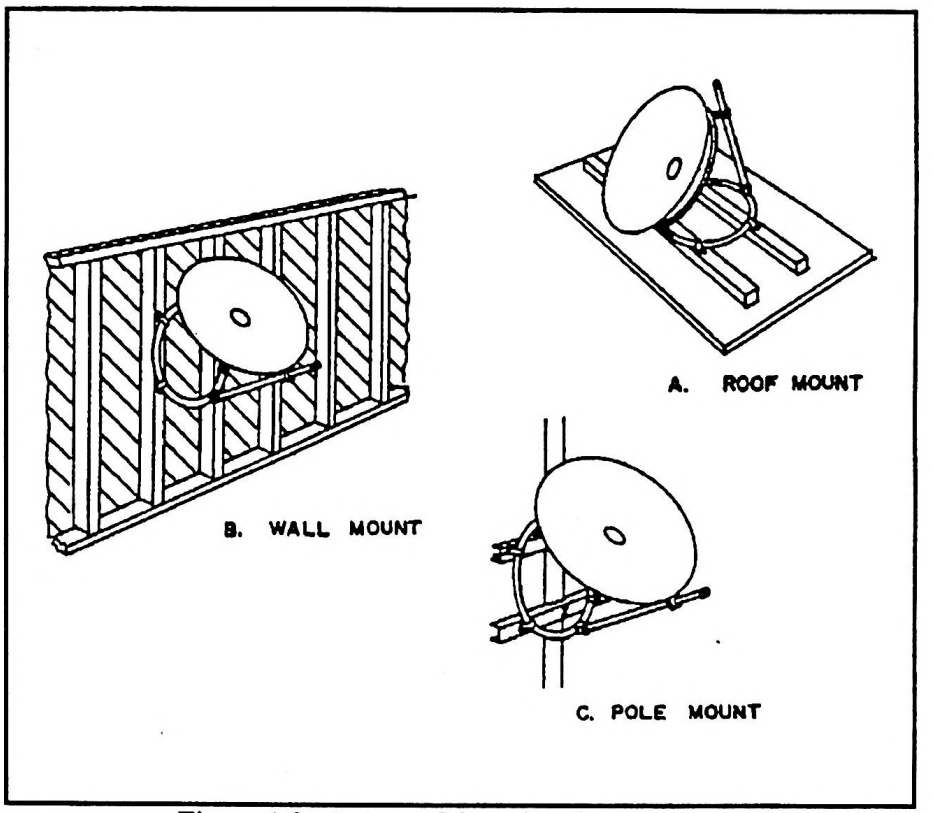


Figure 4-2. Antenna Mounting Arrangements

After the antenna mounting location has been selected (as explained in Section 3), check the mounting surface for strength and rigidity. The surface must possess sufficient strength to support the weight of the antenna assembly (dead weight plus wind load) and should not flex or vibrate during severe weather conditions. See Figure 4-2 for the mounting arrangements the for 24- and 30-inch (0.6- and 0.75-meter) reflectors.

4.2.1 FLAT-ROOF OR HORIZONTAL MOUNTING

The installation procedure for the recommended horizontal mounting is given in Steps 1 through 5, following. Special attention must be given to the NOTES and CAUTIONS!

1. Nail or bolt two 4- x 4- x 36-inch (10 x 10 x 91 cm) battens to roof as shown in Figure 4-3.
2. Set the assembled reflector and mounting ring on the roof battens as shown in Figure 4-3 (or use the frame shown in Figure 4-4).

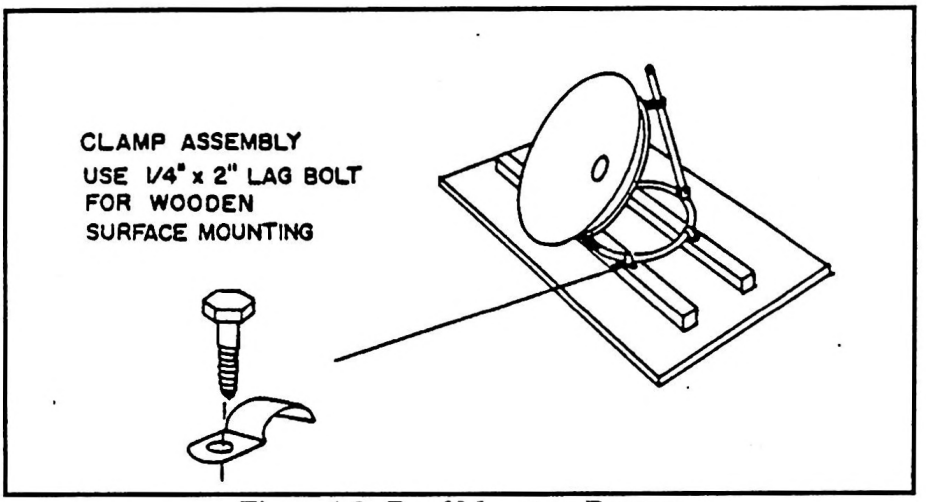


Figure 4-3. Roof Mount on Battens

3. Determine the location of the mounting ring clamps. Try to equally space the clamps, using four clamps. Use the clamps as templates and mark the center of the bolt hole for clamp locations.

CAUTION

Ensure that nails or bolts do not penetrate into the room below the mounting surface. Check with the building superintendent to determine the location of the utility feeder lines so that nails or bolts will not puncture subsurface plumbing and/or electrical cables.

NOTE

If battens cannot be attached to the roof surface, construct a wooden frame as shown in Figure 4-4 or purchase a similar sized commercial antenna mount. Lay two 90-pound bags of cement across the frame members to hold the frame in position.

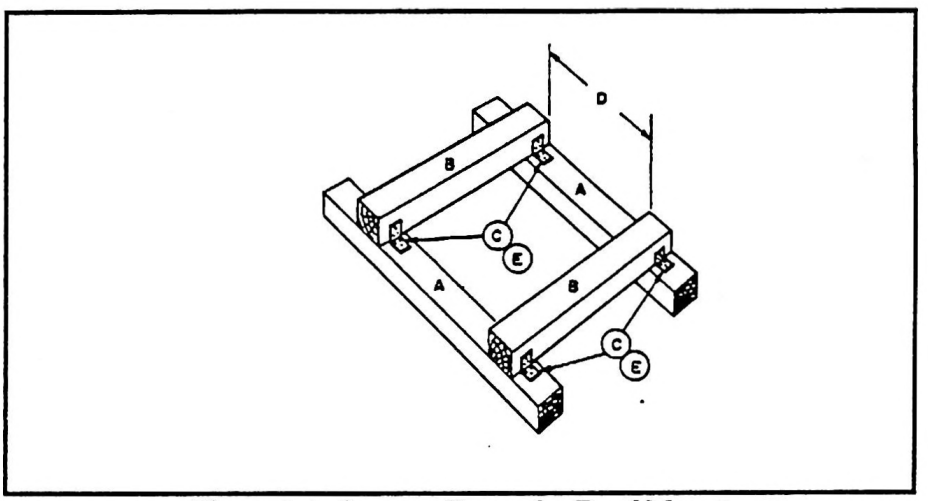


Figure 4-4. Support Frame for Roof Mount

NOTES:

A. 4 x 4 x 36 inches (10 x 10 x 91 cm): 0.6- or 0.75-meter antenna
B. 4 x 4 x 24 inches (10 x 10 x 61 cm): 0.6- or 0.75-meter antenna
C. 2- x 2-inch (5- x 5-cm) corner braces: 4 per cross member
D. Space between cross members:
   13 inches (33 cm): 0.6-meter antenna
   21 inches (53 cm): 0.75-meter antenna
E. Secure cross braces with 2 1/2-inch galvanized common nails.

4. Drill one 5/32-inch hole for each bolt-hole mark.

5. Secure the mounting ring/reflector assembly to the battens with clamps and lag bolts. Do not completely the tighten clamps as the ring must be adjusted later for azimuth.

This completes the horizontal mounting procedure. If this procedure was selected, proceed to Section 4.3, Low-Noise Converter Installation, by-passing the alternate mounting procedures which follow.

4.2.2 WALL MOUNTING

Vertical mounting of antennas on walls complicates the polarization, elevation, and azimuth heading. If possible, the antenna should be mounted to a horizontal surface. If this cannot be done, proceed with Steps 1 through 4 below.

1. Refer to Figure 4-5. Place the antenna mounting ring/reflector

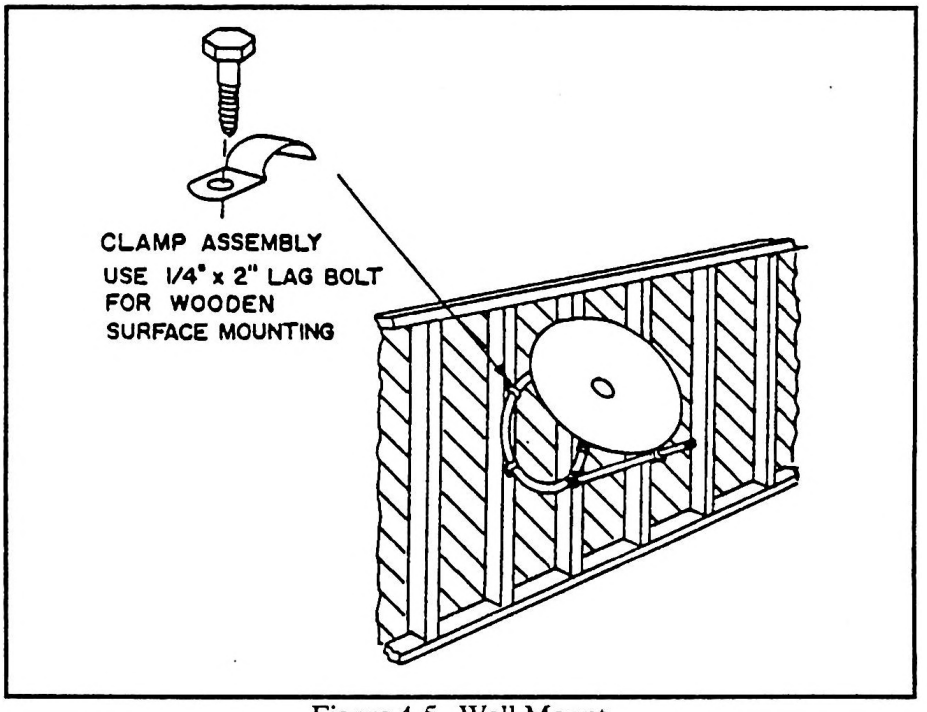


Figure 4-5. Wall Mount

assembly against the wall studs and hold in position. The wall should not slope more than 20 degrees from the vertical plane.

2. Determine the locations of the mounting ring clamps. Try to equally space the clamps. Use the clamps as templates and mark the center of the bolt hole for each clamp location.

3. Drill one 5/32-inch hole at each marked location.

4. Secure the mounting ring/reflector assembly to the wall studs with the clamps and lag bolts (Figure 4-5). Do not completely tighten the clamps as the ring must be adjusted later. Proceed to Section 4.3, Low-Noise Converter Installation, by-passing Subsection 4.2.3.

4.2.3 POLE MOUNTING

Vertical pole mounting of antennas complicates the polarization, elevation, and azimuth heading. If possible, use a horizontal surface to mount the antenna. If this cannot be done, proceed with steps 1 through 3.

1. Verify that the pole and mount meet the following specifications:

1)	Pole height:	4 feet (minimum)
2)	Pole angle:	Vertical (maximum slope: 20 degrees)
3)	Pole material:	Iron, steel, wood
4)	Shape	Round/square/angle/I-beam
5)	Tubing	3-inch w/ 1/8-inch wall
6)	Angle iron:	3-inch width (minimum)
7)	Steel/iron I-beam:	3-inch width (minimum)
8)	Number of X-members:	Two
9)	Cross-member length:	24 inches (minimum)
10)	Cross-member spacing:	13 inches (minimum)

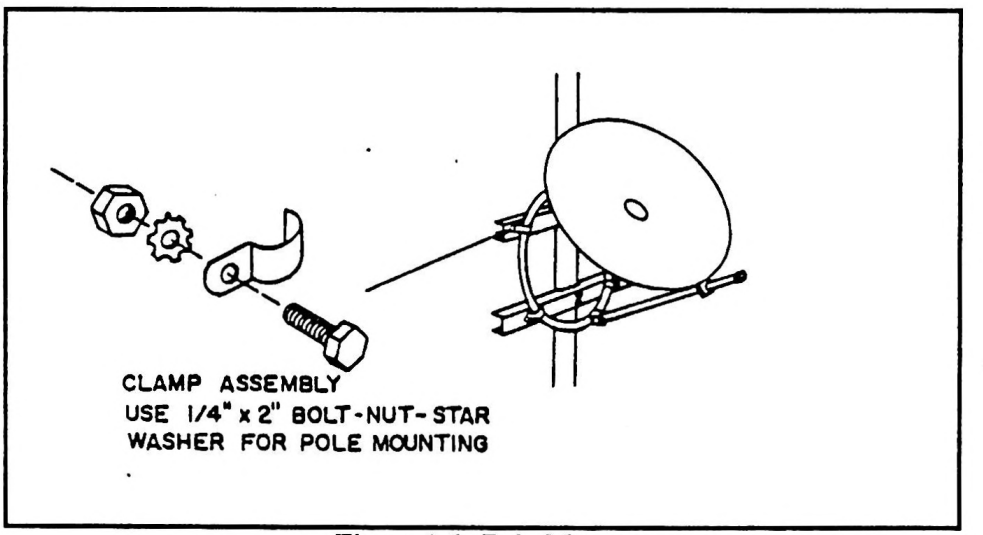


Figure 4-6. Pole Mount

2. Refer to Figure 4-6. Drill four holes in the pole cross members as shown. Drill two holes per member, 8 inches from the center of the pole.

   - Wooden cross members:

     Drill 5/32-inch holes for 1/4 x 2 lag screws

   - All other cross

     Drill 1/4-inch holes for members: 1/4 x 2 hex cap screws

3. Secure the mounting ring/reflector assembly to the cross members with clamps and bolts (Figure 4-6). Do not completely tighten the clamps as the ring must be adjusted later.

Notes:

A = Pole Cross Members
X = Clamp Mounting Holes: 8 inches (20 cm) from center of mounting pole.

4.3 LOW NOISE CONVERTER INSTALLATION

This procedure explains how to install the low noise converter on a reflector assembly that has been secured to a mounting surface. Part of the procedure involves connecting the waveguide and low noise converter to the reflector. The waveguide is then set to a preliminary position prior to making the elevation angle adjustment.

1. Determine type of low noise converter being installed.
   - Type B is equipped with a trapezoidal shaped feedhorn and a nondetachable waveguide.
   - Type C uses a circular-shaped feedhorn and a detachable waveguide.
2. Study Figure 4-7 (Type B converter) or Figure 4-8 (Type C converter) for assembly details of low noise converter and waveguide with respect to antenna reflector.

> **NOTE**
>
> **The Type B low noise converter has the feedhorn already attached and has a trapezoidal feedhorn cap. The feedhorn cannot be detached from the converter.**
>
> **The Type C low noise converter has a separate feedhorn assembly with a circular feedhorn cap. The Type C feedhorn must be attached to the LNC before continuing with the assembly instructions.**

For the Type C Low Noise Converter:

3. Remove the plastic insert from the waveguide apertures on both the low noise converter and on the waveguide.
4. Install the waveguide assembly to the LNC so that the waveguide aperture is aligned with the low noise converter waveguide aperture. Secure the waveguide to the low noise converter with six Phillips-head screws and tighten the screws. See Figure 4-7.

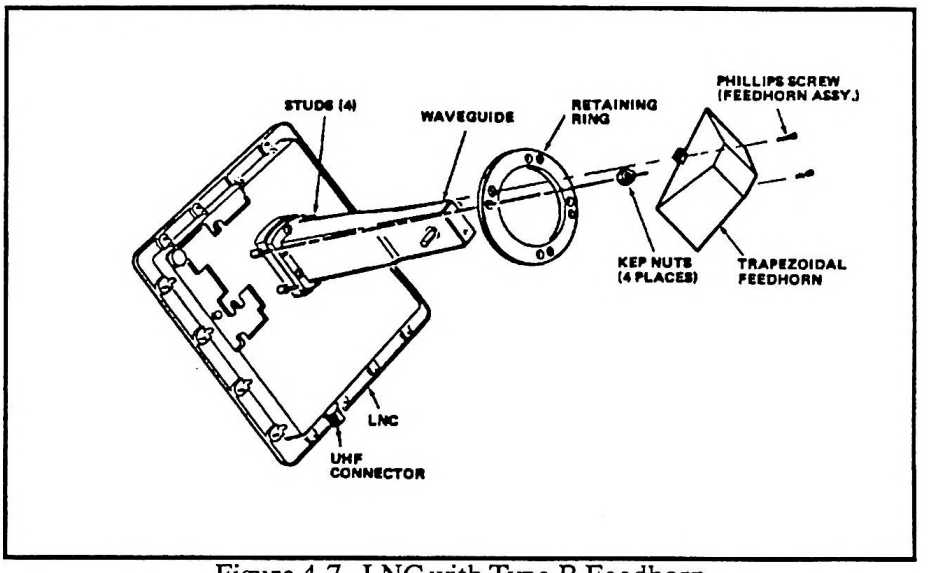


Figure 4-7. LNC with Type B Feedhorn

For all Low Noise Converters:

5. Remove the feedhorn cap (secured by two Phillips screws) from the waveguide.

6. On the rear of the antenna, install the low noise converter and secure (finger tight) with the retainer ring and nuts. Ensure that the UHF Series RF connector points downward and is perpendicular to the ground. (See Figure 4-9.) If correctly installed, the narrow side of the waveguide is parallel to the ground.

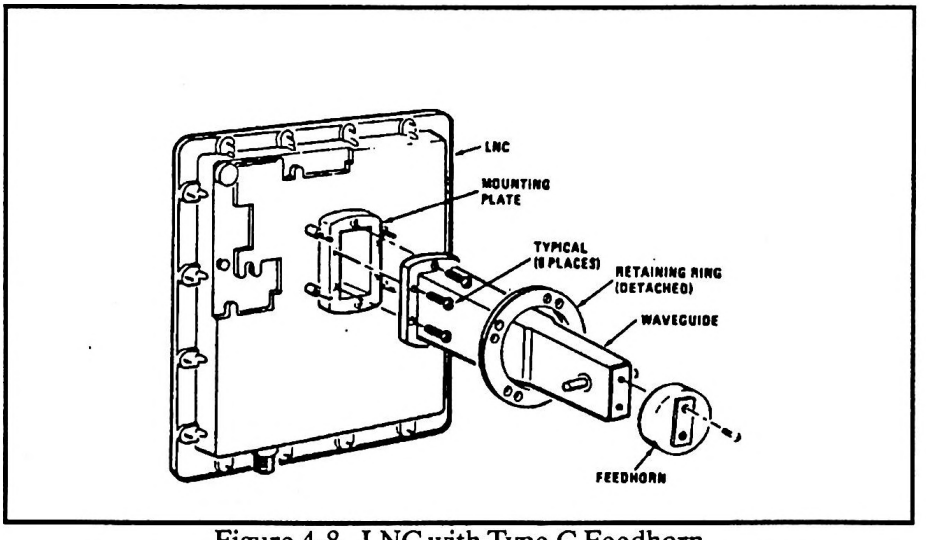


Figure 4-8. LNC with Type C Feedhorn

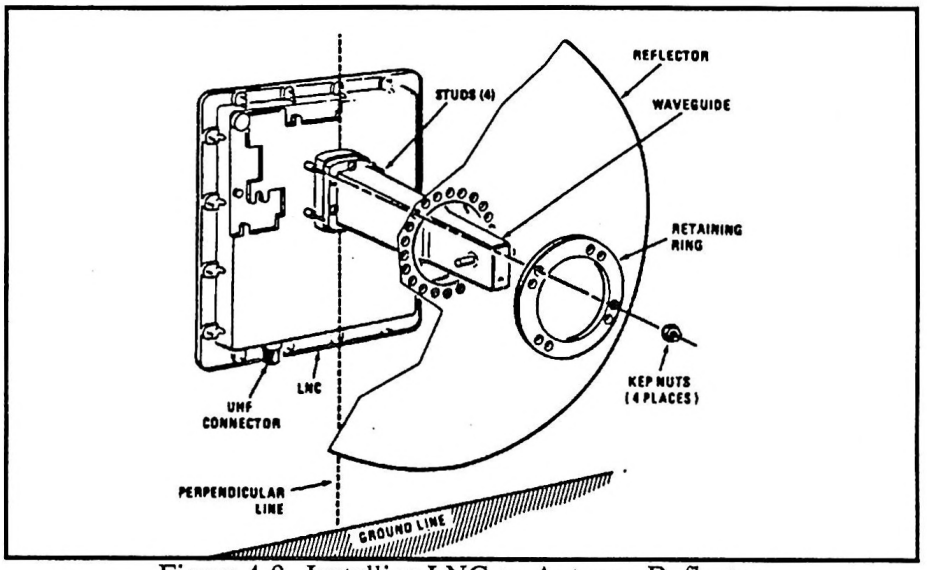


Figure 4-9. Installing LNC on Antenna Reflector

7. Set the inclinometer across the narrow side of the waveguide and verify that it is parallel to the ground (0- to 5-degree reading). See Figure 4-10. If the inclinometer indicates that the waveguide/LNC is tilted left or right, remove the waveguide/LNC and rotate it one hole clockwise or counterclockwise, depending on the original inclinometer indication, and reinstall. Check the reassembled waveguide position with the inclinometer. Repeat this procedure, as necessary, until the waveguide/LNC assembly is installed as near parallel to ground as possible.

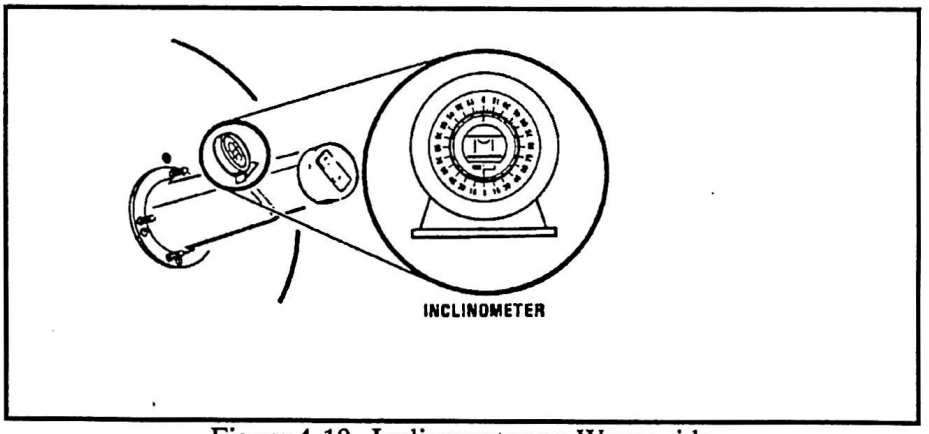


Figure 4-10. Inclinometer on Waveguide

8. Reinstall the feedhorn cap removed in Step 5.

4.4 ELEVATION ADJUSTMENT

The elevation angle adjustment is performed after the low noise converter is installed. The elevation angle is determined using the procedures in Appendix D.

1. Refer to Appendix D and determine the azimuth, elevation, and polarization angles from your micro earth station location to the correct satellite. Record these numbers for easy reference.

2. Refer to Figure 4-11 and use the inclinometer to measure the elevation angle. (Elevation angle is measured from the horizontal plane. The example in Figure 4-11 shows the inclinometer setup for measuring a 22-degree elevation.)

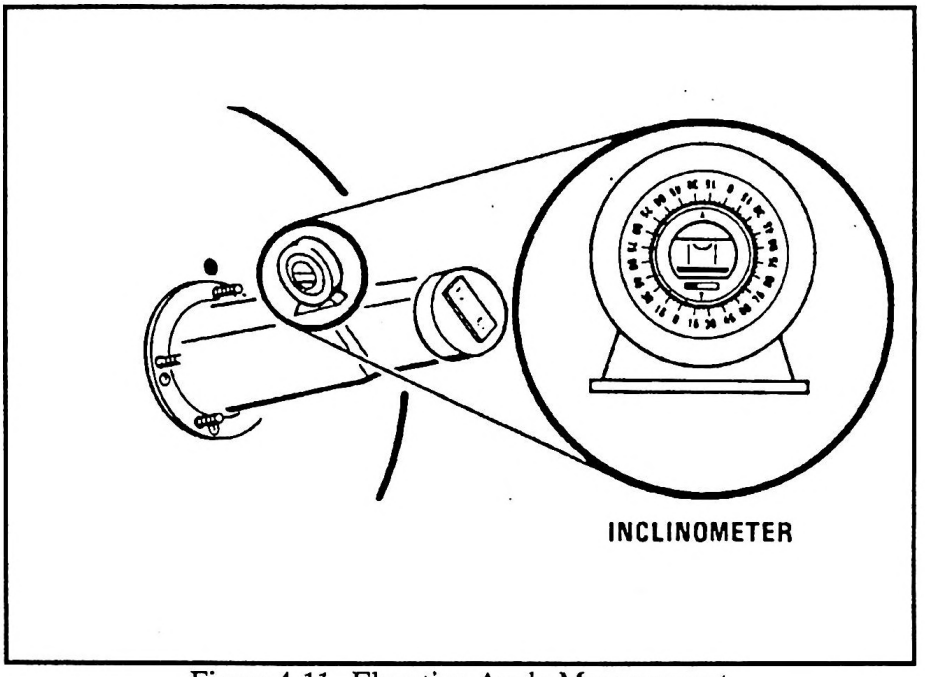


Figure 4-11. Elevation Angle Measurement

CAUTION

Ensure that the elevation adjustment is performed as accurately as possible to minimize problems with adjustment of the antenna azimuth heading in a later procedure.

3. Adjust elevation angle, as follows (Figure 4-12):

   a) Loosen the hex-drive lockscrew on the strut collar and adjust the collar-height on the strut until the specified elevation angle is read on the inclinometer. (Raise the strut collar to decrease the elevation angle. Lower the collar to increase the angle.)
   b) Tighten hex-drive lockscrew.

This completes the elevation adjustment.

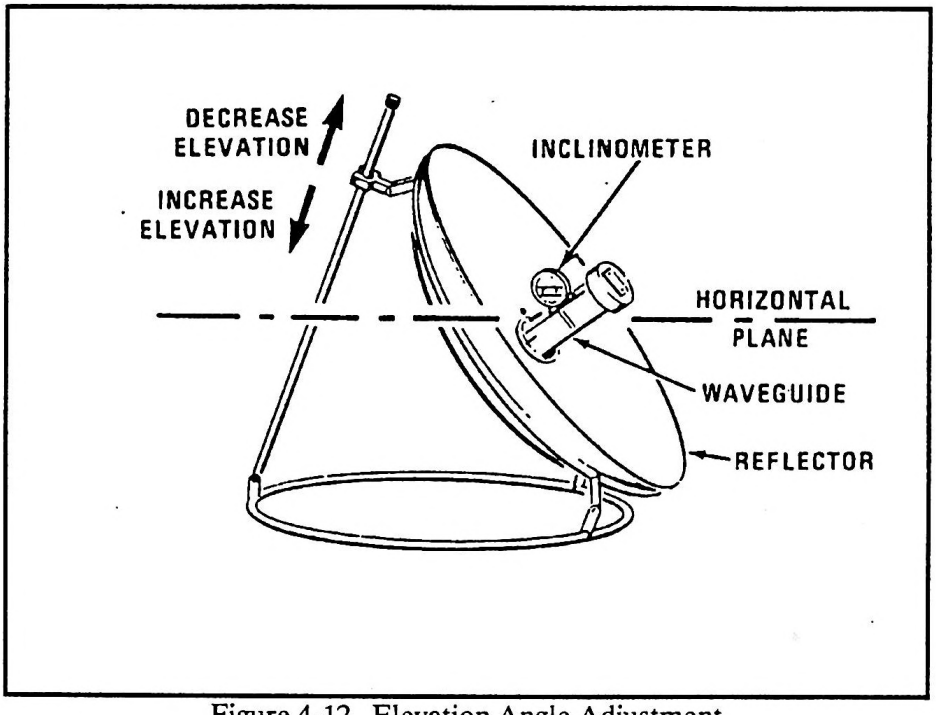


Figure 4-12. Elevation Angle Adjustment

4.5 POLARIZATION ADJUSTMENT

This procedure is performed after the low noise converter/waveguide assembly has been installed on the reflector and the elevation angle is adjusted. After the polarization adjustment is completed, the entire antenna assembly will be exactly adjusted for maximum signal strength in the next procedure.

1. Refer to the appropriate satellite pointing parameter reference (as determined in Section 4.4, Step 1). Determine the polarization angle.

2. Refer to Figure 4-13 and locate the upper right-hand mounting stud and the reflector mounting hole for the stud. Use an indelible pen to mark "0" degrees on the reflector, adjacent to the stud.

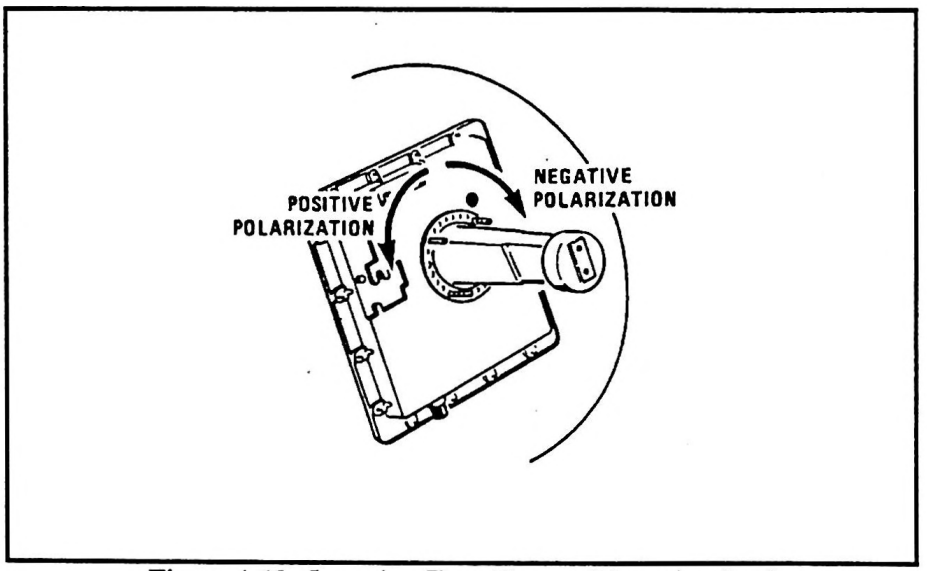


Figure 4-13. Locating Zero Degree Mounting Stud

3. Count the mounting holes from the 0-degree reference on the reflector to the hole nearest the polarization angle determined in Step 1. For negative angles, count clockwise from the 0-degree reference. For positive angles, count counterclockwise from 0 degrees. The holes are spaced at 10-degree intervals (See Figure 4-14).

4. Use an indelible pen to mark the polarization angle adjacent to the reflector mounting hole as shown in Figure 4-13.

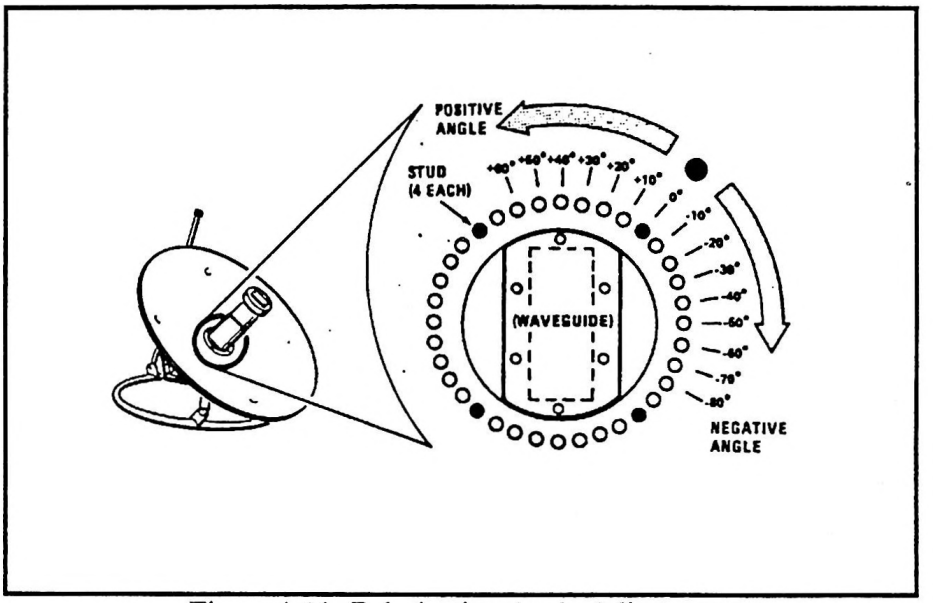


Figure 4-14. Polarization Angle Adjustment

5. Rotate the low noise converter until the marked stud is aligned with the newly marked mounting hole on the reflector.

6. Insert the low noise converter studs into the reflector mounting holes. Install the retainer ring over the studs and secure it with the nuts.

This completes the polarization adjustment.

4.6 PRELIMINARY AZIMUTH ADJUSTMENT

Perform this procedure only after completing adjustments of the elevation and polarization angles. The azimuth heading adjustment is a preliminary procedure that must be completed before the antenna assembly is finally oriented for maximum receive signal strength.

1. Refer to the satellite parameters (as determined in Section 4.4, Step 1) and determine the azimuth to the satellite.
2. Ensure that the antenna feedhorn is pointing in the approximate direction of the satellite.
3. Stand directly behind the antenna. Refer to Figure 4-15 and perform the following instructions:
   a) Locate magnetic north with the compass.
   b) Determine the approximate azimuth heading with a compass (example in Figure 4-16).
   c) Compare the azimuth heading with the direction in which the feedhorn is pointing. If necessary, loosen the mounting ring clamps and rotate the entire antenna assembly until the feedhorn is aligned on the azimuth heading. Retighten the clamps after aligning the feedhorn.

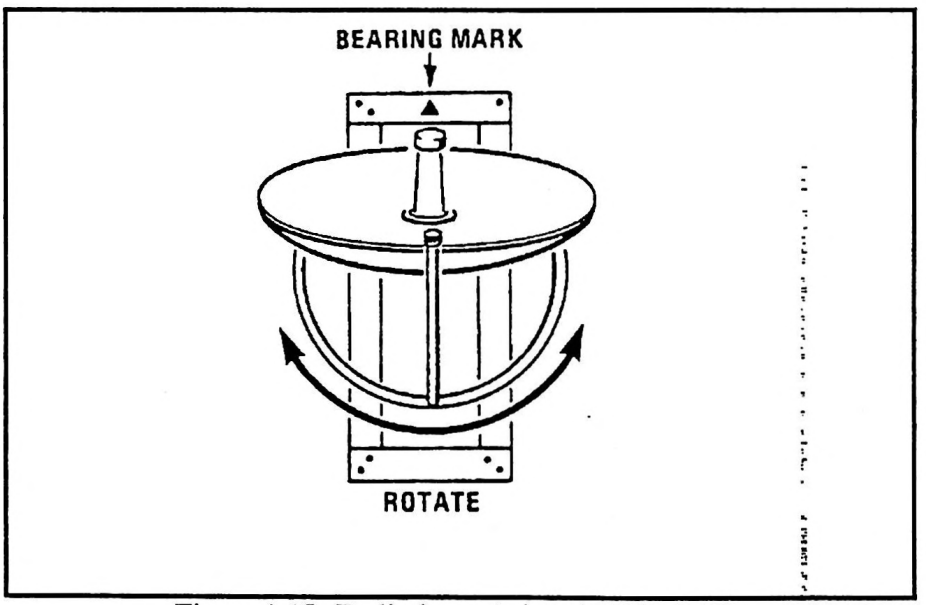


Figure 4-15. Preliminary Azimuth Adjustment

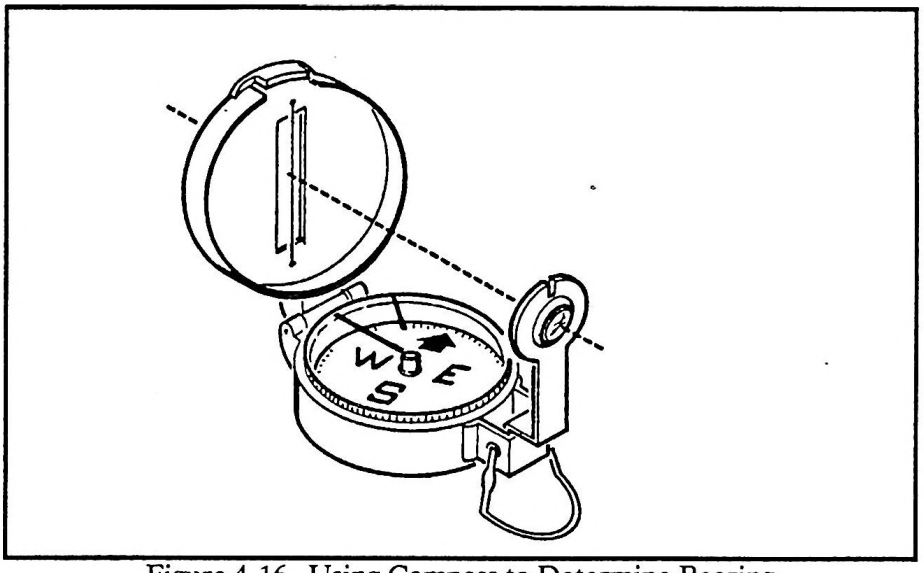


Figure 4-16. Using Compass to Determine Bearing

NOTE

False compass readings can be obtained if a compass is used in the vicinity of strong electromagnetic fields or large metal surfaces.

4. An alternate method of pointing the antenna is to use a local aeronautical or marine chart (map) and determine the bearing relative to true North and align the feedhorn on a distant object; such as a water tower, a building, or other landmark. At this time it is important to point the antenna within an accuracy of +/- 5 degrees.

NOTE

Wall mount and pole mount antennas: Large changes in azimuth may affect polarization and elevation angles of the feedhorn. If the azimuth is varied more than 20 degrees, recheck polarization and elevation angles before

5. Tighten all nut and bolt assemblies on the antenna.

This completes the preliminary azimuth adjustment.

4.7 COAXIAL CABLE CONNECTION

The RF connectors for the coaxial cable which links the antenna low noise converter to the controller must be fitted to the cable at the time of installations. It is recommended that the coaxial cable be routed from the antenna to the controller location prior to fitting the connectors. Gather the materials listed below, and then proceed with Step 1.

Required Materials:

- One solderless UHF Series PL-259 connector (supplied with installation kit)
- One solderless F-type connector (supplied with installation kit)
- Belden-type 8241 (RG-59/U coaxial cable, 96-percent or better braid).

1. Route one end of the RF-59/U cable to the vicinity of the low noise converter. Ensure that the cable has sufficient slack so that it can be connected to the low noise converter without making sharp bends or kinks.

2. Refer to Figure 4-17 and install the PL-259 connector on the end of the RG-59/U cable according to the following instructions:

   a) Trim the cable sheath and dielectric to the dimensions shown in Figure 4-17A. Take care to ensure that the center conductor is not nicked. Trim the braid to a length slightly longer than the dielectric.

   b) Using a clockwise twisting action, twist the braid to expose at least 1/32 inch of the dielectric.

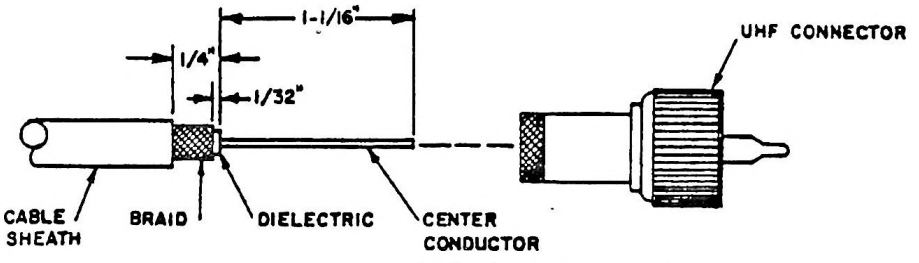
   c) Slide the PL-259 connector over the cable end and twist onto the cable, as shown in Figure 4-17B. Grasp the connector by the knurled shoulder, twist clockwise, and thread over the outer sheath until it is hand-tight. If correctly installed, the braid is not visible and the connector cannot easily rotate on the cable. Approximately 1/8 inch of the cable center conductor should protrude from the tip of the connector.

   d) Crimp the tip of the PL-259 connector using the Gilbert HX596 crimp tool, as shown in Figure 4-17C.

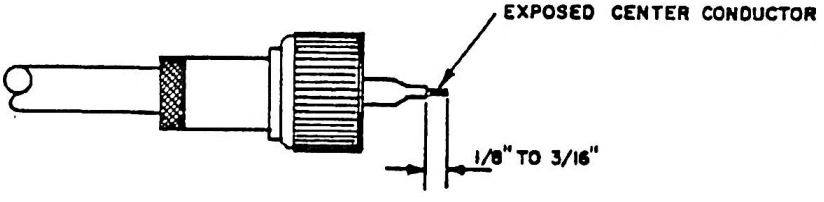
      NOTE: Do not solder the center conductor to the PL-259 connector. Only crimp-type connectors are used on the coaxial cable.

   e) Cut off the exposed portion of the center conductor shown in Figure 4-12B.

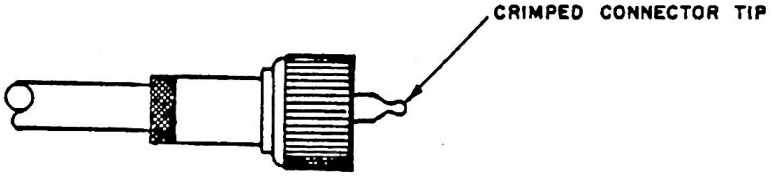
   f) Use ohmmeter to check the continuity between the fixed part of the connector sleeve and the cable center conductor. The meter should read infinite (open) resistance on the highest meter range. If the meter reads other than infinite resistance, cut off the connector and start the connector installation again with a new PL-259 connector. (Do not connect this end of the cable at this time.)



4-17A. Cable Preparation



4-17B. Attaching PL-259 Connector to Cable



4-17C. Installed PL-259 Connector

Figure 4-17. PL-259 Installation

3. Go to the controller end of the cable. Refer to Figure 4-18 and install the F-type connector on the controller end of the cable by performing the following instructions:

   a) Trim the cable sheath, braid, and dielectric material as shown in Figure 4-18A. Ensure that the braid is cut the same length as the dielectric material. Use care to avoid nicking the center conductor during cable preparation.
   b) Refer to Figure 4-18B; slide the ferrule over the cable outer sheath.
   c) Refer to Figure 4-1bB. Fan the braid approximately 3/16 inch over the outer sheath for ease of assembly.
   d) Refer to Figures 4-18B and 4-18C. Slide the F-type connector over the end of the cable until it butts the outer sheath, ensuring that the connector covers the dielectric and slides under the braid. Check that the dielectric is flush with the center hole and the threaded end of the connector. The center conductor should protrude at least 1/8 inch beyond the end of the connector.
   e) Trim the excess braid around the outer circumference of the connector shoulder where it butts against the outer sheath.
   f) Slide the ferrule forward until it touches the shoulder of the connector as shown in Figure 4-18C. Gently crimp the ferrule with crimp tool.
      CAUTION Over crimping the ferrule can cause the braid and center conductor to short circuit the coaxial cable. Crimp the ferrule only enough to hold the connector in the installed position.
   g) Trim the center conductor so that it protrudes 1/8 inch from the end of the connector.
   h) Use an ohmmeter to check the continuity between the connector sleeve and the cable center conductor. The meter should read infinite (open) resistance on high meter range. If the meter reads other than infinite resistance, cut off the connector and start again with a new F-type connector.
   i) Verify that the controller AC POWER is off.
   j) Connect the F-type connector to the RF input jack on the rear of the controller.

This completes the connector installation.

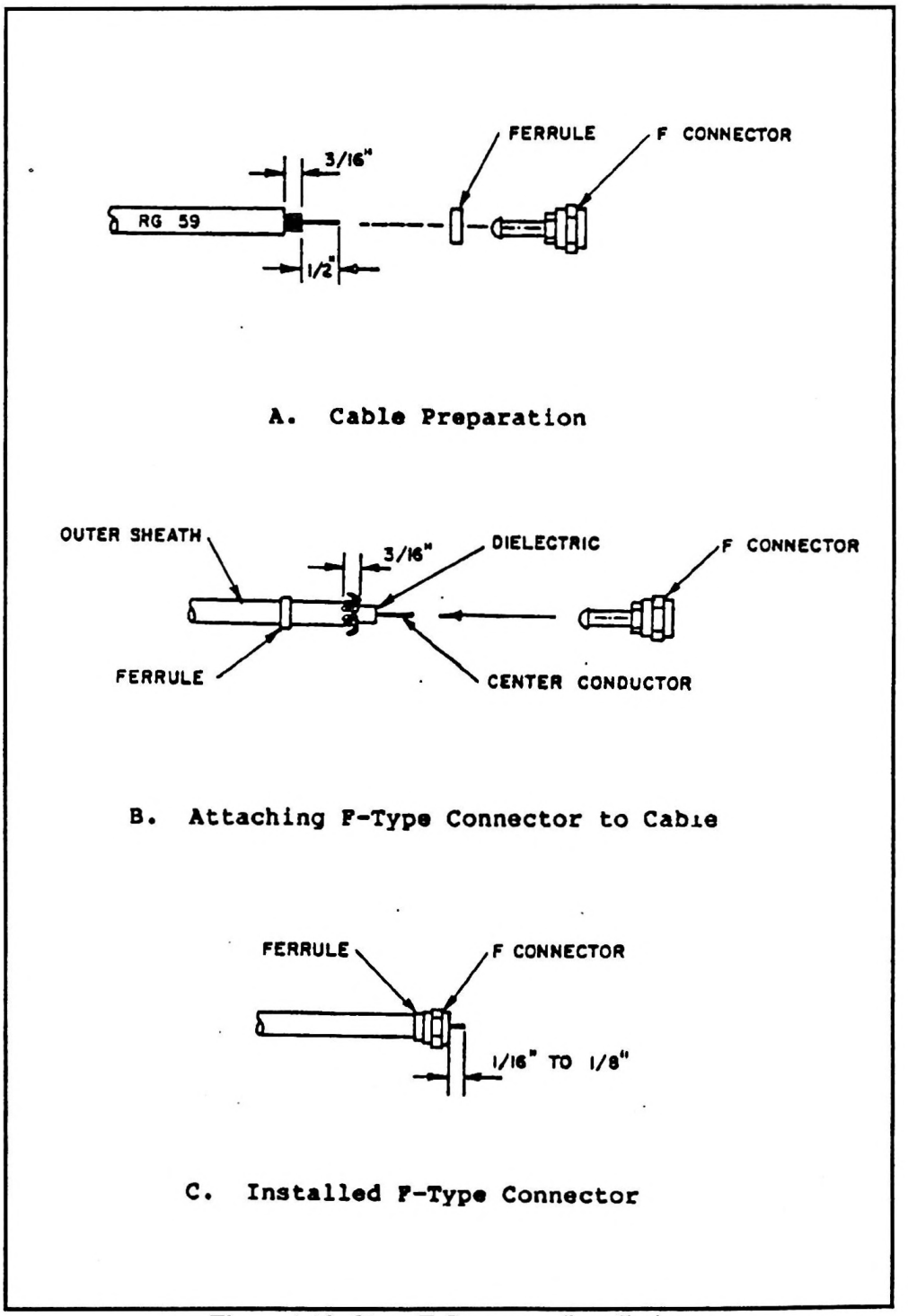


Figure 4-18. Type-F Connector Installation

4.8 ACQUIRING THE SIGNAL

This procedure will verify the connections to the C-100 controller, apply power to the controller and preliminarily acquire the signal from the satellite.

1. Verify that the UHF series connector is firmly connected to the downconverter at the antenna.
2. Verify that the Type-F connector is connected to te RF INPUT jack on the rear of the C-100 controller.
3. Before connecting AC power, verify the voltage requirement of the C-100. The voltage requirement is indicated on the rear panel just below the power input connector. The controller will require either 110 VAC or 220 VAC power.
4. Connect the AC power cord between the C-100 power connector and the appropriate electrical supply.
5. Turn on the AC POWER switch on the rear of the C-100 and observe the indicator lamps on the front of the unit. Lamps 3, 8, and 9 will come ON.
6. If the unit is operating properly, the front panel lamps will light in the following sequence:

   A. Lamp 7 flashes and stays ON within 30 seconds.

   B. Within two seconds Lamps 2, 5, and 6 come ON solidly.

   C. Lamp 4 may be ON or OFF.

If the above sequence does not occur, verify the coaxial cable and connections, and then the antenna pointing angles. If problems persist, continue to Section 4.9.2; Method 2: Controller Panel Lights.

4.9 FINAL ANTENNA ADJUSTMENT

The object of this adjustment procedure is to obtain maximum signal strength from the signal that is transmitted from the satellite to the C-100 Series system. This adjustment requires precise orientation of the 24- or 30-inch antenna to a specified azimuth heading. The procedure can only be performed after the feedhorn elevation and polarization angles have been adjusted and the coaxial cable is installed between the low noise converter and the controller.

Two methods are provided to adjust the antenna for receiving the maximum signal level. Method 1 (Subsection 4.9.1) is recommended for precise adjustment of the antenna. This method requires an EQUATORIAL Communication Company signal-strength meter (see Appendix A for a description of the signal-strength meter).

The alternate method of antenna adjustment, METHOD 2, (Section 4.9.2) is performed while monitoring the front panel lamps on the controller. The alternate method requires that the installer exercise extreme care to ensure that the antenna is EXACTLY adjusted according to the instructions in the procedure.

4.9.1 METHOD 1: SIGNAL-STRENGTH METER

Required Test Equipment:

- EQUATORIAL signal-strength meter transmitter unit
- EQUATORIAL signal-strength meter receiver unit (REV. A or later)
- One 4-foot RG-59/U cable fitted with a PL-259 and a F-type connectors (supplied with the signal-strength meter)
- One 4-foot RG-59/U cable fitted with F-type connectors (supplied with the signal-strength meter)
- One 4-foot signal cable fitted with a 4-pin MOLEX connector and 25-pin male subminiature D (DB-25P) connector (supplied with the signal-strength meter).

1. Verify that the AC POWER switch is set to the OFF position on the controller.
2. Find a convenient fixed reference point on the antenna mounting ring, such as a strut, screw hole, or support bracket, preferably in the area behind the antenna dish. Refer to Figure 4-19 and mark a reference point (1) with a piece of tape.

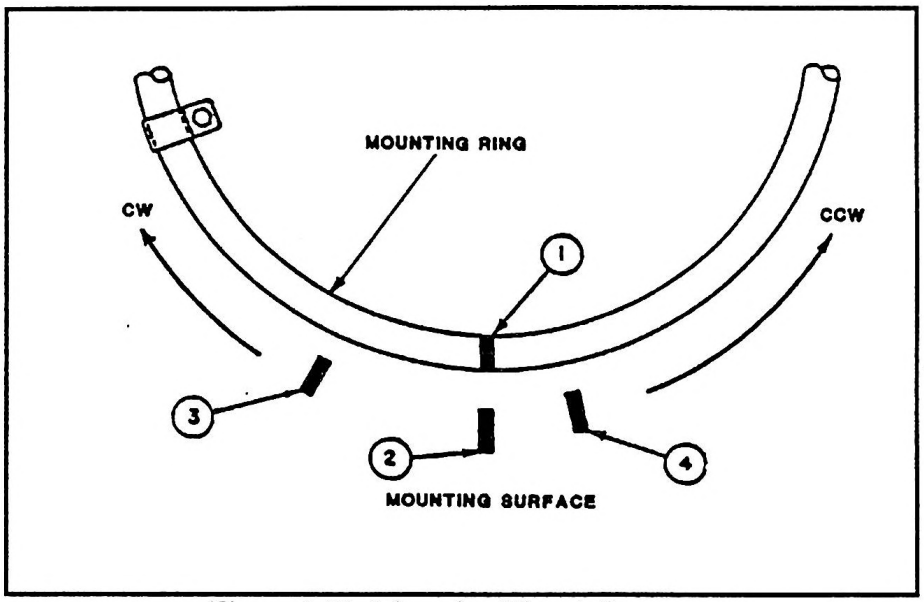


Figure 4-19. Mounting Ring Adjustment

3. Verify the azimuth heading for pointing the antenna (determined in Section 4.4, Step 1). If necessary, loosen the antenna mounting ring clamps and rotate the antenna base until the feedhorn points to the specified heading.

4. Refer to Figure 4-20 and 4-21 and connect the signal-strength meter as follows:

   a) Turn controller power off, then disconnect the antenna cable from the jack labeled R.F. INPUT, and connect it to the jack labeled ANT. on the signal-strength transmitter unit.
   b) On the signal-strength transmitter, connect one end of the 4-foot RF test cable (with F-type connectors) to the jack labeled CTLR. On the controller, connect other end of RF cable to the jack labeled R.F. INPUT.
   c) On the transmitter, connect one end of the signal cable (with 4-pin MOLEX connector) to the jack labeled DATA INPUT. Connect the other end of the cable (with 25-pin connector) to Port 1 on the controller.
   d) Go to antenna location. Connect the same cable to the UHF Series (SO-239) jack labeled CTLR on signal-strength receiver module.
   e) On the receiver module, connect one end of the 4-foot RF test cable (with F-type connector) to the jack labeled ANTENNA. Connect the other end of the test cable (with PL-259 connector) to UHF Series SO-239 jack on the low noise converter.
   f) Go to location of the controller and set AC POWER switch to ON position.

5. Checkout initial reading of signal-strength meter. Indicator should register between 0 and 0.2.

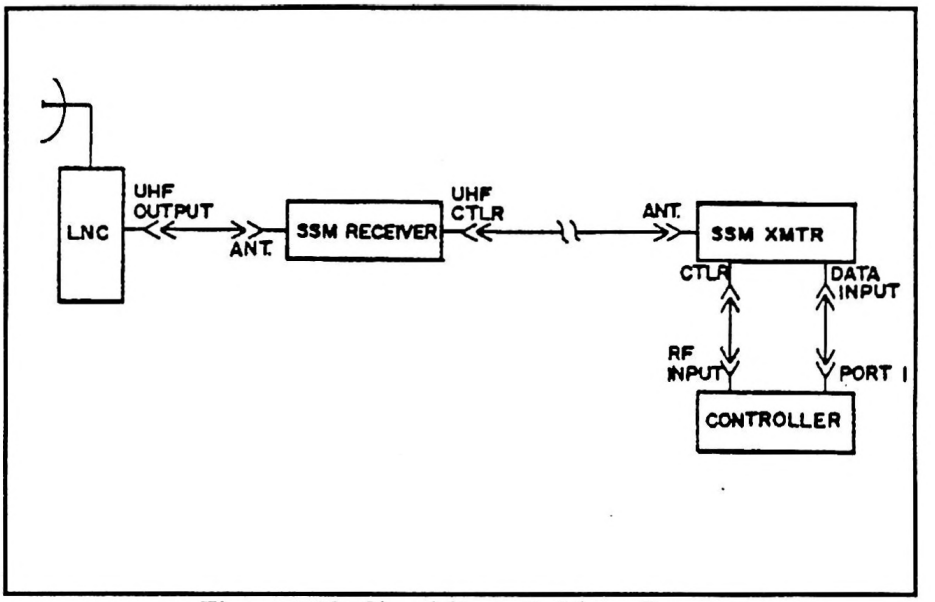


Figure 4-20. Signal Strength Meter Set-up

If the antenna is pointed properly, the meter indicator will eventually deflect to a higher reading several times, returning to a low-scale reading each time. Be patient, it may take up to 5 or 10 minutes before the initial deflections occur (typically it will take much less time). After several repetitions, the indicator will deflect to a fixed high reading (indicating an antenna lock-on to the satellite signal).

If a fixed high reading is not obtained, recheck elevation angle, polarization angle, and azimuth heading. If readjustment is required for any angle, push RESET button on signal-strength meter and wait for deflections once again. If a fixed high reading is not obtained, rotate the mounting ring in 1/2-inch increments through a 10-inch arc (5 inches on each side of the original starting point). After each 1/2-inch movement, push the RESET button and wait for deflections once again. If fixed high reading still cannot be obtained, call your micro station supplier for assistance. Proceed to Step 6 ONLY if the meter provides a fixed high reading.

6. Locate the reference mark made with tape on the mounting ring, Step 2. Refer to Figure 4-19 and, with another piece of tape, mark the mounting surface (2), opposite reference mark (1).

7. Observe and note the signal-strength meter reading. Slowly rotate the mounting ring clockwise 1/2 inch. Wait several seconds. Check the meter to determine if the indicator now registers higher or lower. If higher, proceed with Step a), below. If lower, by-pass Step a) and proceed to Step b).

a) **Higher Reading:**

1) Continue to rotate the ring clockwise in 1/2-inch increments, waiting several seconds after each move to read the meter. Continue until a peak reading is reached. (The highest reading should be greater than 0.2.)
2) Refer to Figure 4-14 and mark the mounting surface (3) at the point of the highest reading.
3) Align the mounting ring reference (1) with point (3) and secure the mounting ring clamps.
4) Note the highest reading for your site records and go to Step 8.

b) **Lower reading:**

1) Refer to Figure 4-19 and return the rotating ring to the starting point (2), opposite the reference mark (1).
2) Rotate the ring counterclockwise in 1/2-inch increments, waiting several seconds after each move to read the meter. Continue this rotation until a peak reading is reached. (The highest reading should be greater than 0.2.)
3) Refer to Figure 4-19 and mark the mounting surface (4) at the point of the highest reading.
4) Align the mounting ring reference (1) with point (4) and secure the mounting ring clamps.
5) Note the highest reading for your site records and go to Step 8.

8. Turn the controller POWER to the OFF position.

9. Disconnect the signal-strength-meter receiver and transmitter units and the test cables from the system.

10. Reconnect the system coaxial cable to the controller and connect the other end of the cable to the low noise converter. Ensure that the coaxial cable connected to the low noise converter provides a 3-inch drip loop (Figure 4-18).

11. Weatherproof the coaxial connector on the low noise converter with a silicon-based sealant or tape such as Flexite RC-00080N.

This completes the procedure for Final Antenna Adjustment, using the recommended signal-strength meter method. If you have employed this method, you may proceed to Section 4.10, DOWNLINE LOADING CONTROLLER.

4.9.2 METHOD 2: CONTROLLER PANEL LIGHTS

Required Materials:

- Coaxial test cable; 4 to 6 feet, RG-59/U, fitted with F-type and PL-259 connectors (not supplied).
- Electrical extension cord; 100 feet (not supplied).

1. Move the controller to the site of the antenna installation. Do not operate the controller when the temperature is below 32° Fahrenheit (0° Celsius).
2. Connect the power cable to the controller and set the rear panel AC POWER switch to the ON position.
3. Disconnect the PL-259 cable connector (part of the permanent cabling installation) from the low noise converter.
4. Connect the PL-259 connector on the short RG-59/U test cable to the low noise converter. On the rear of the controller, connect the other end of the cable (F-type connector) to the RF INPUT jack.
5. Verify the azimuth heading for pointing the antenna. (Refer to the azimuth heading determined in Section 4.4, Step 1.) If necessary, loosen the antenna mounting ring clamps and rotate the antenna base until the feedhorn points to the specified heading.
6. Set the controller AC POWER switch to the ON position and wait 1 minute or until Lamps 8 and 9 light (see Appendix C for description of lamps). If the feedhorn is pointed on or near the specified heading, the controller front panel lamps will light as indicated below:
   - Lamp 7 flashes for up to 75 seconds, then lights solidly.
   - Lamps 2, 5, and 6 light solidly after Lamp 7 lights. Be patient, it may take 5 to 10 minutes before Lamp 7 begins to flash (Typically it will take much less time). Lamp 4 may or may not be lighted.

If Lamps 2, 5, 6, and 7 light, go to Step 7. If Lamps 2, 5, 6, and 7 do not light, the antenna feedhorn is not aligned on the specified heading. Carefully check the antenna alignment and readjust if necessary (Section 4.4, 4.5, or 4.6). Then reset the AC POWER on the controller and begin Step 6 again.

- After the antenna alignment has been rechecked, if Lamps 2, 5, 6, and 7 still do not light and Lamp 8 has flashed OFF and then ON again, rotate the mounting ring in 1/2-inch increments through a 10-inch arc (5 inches each side of the original starting point). After each 1/2-inch movement, reset the AC POWER and Lamp 7 will flash once again.
- If the lamps still do not light, contact your micro station supplier for assistance.

7. Rotate the antenna mounting ring slowly clockwise in 1/2-inch increments, waiting 25 seconds between each move, until Lamp 4 lights (unless already on).
8. Continue rotating the ring clockwise in 1/2-inch increments, waiting 25 seconds between moves, until Lamp 4 goes dark.
9. Mark the first point on the mounting surface, adjacent the mounting ring reference (determined in Section 4.8, Step 2), where Lamp 4 goes dark.
10. Rotate the antenna mounting ring slowly counter-clockwise in 1/2-inch increments, waiting 25 seconds between each move, until Lamp 4 lights again.
11. Continue rotating the ring clockwise in 1/2-inch increments, waiting 25 seconds between moves, until Lamp 4 goes dark.
12. Mark the second point on the mounting surface, adjacent the mounting ring reference, where Lamp 4 goes dark.
13. Determine the exact midpoint between the two marks on the mounting surface where Lamp 4 went dark. Mark this midpoint location.
14. Adjust the antenna mounting ring until the mounting ring reference point is aligned with the midpoint mark. Lamp 4 should light solidly.
15. Prepare the system for operation by performing the following steps:
    a) Set the controller POWER switch to the OFF position and disconnect the coaxial cable from the RF INPUT jack.
    b) Disconnect the test cable from the low noise converter and connect the system cable PL-259 connector.
    c) Move the controller to the location where the system cable has been routed.
    d) Connect the system coaxial cable to the RF INPUT jack on the controller.
    e) Connect the controller power cord and set the AC POWER switch to the ON position.

This completes the alternate procedure for Final Antenna Adjustment. Proceed to Section 4.10, DOWNLINE LOADING CONTROLLER.

4.10 DOWNLINE LOADING CONTROLLER

Before starting this procedure, ensure that the AC power switch on the controller is set to the ON position and Lamps 2, 4, 5, 6, 7, 8, and 9 are steadily lighted. (Lamps 1 and 3 may or may not be lighted.) To downline load the controller, the micro station supplier (not EQUATORIAL) must be called and a request must be made to downline load the controller (Administrative Download). After the downline load procedure is completed, the C-100 system should be ready to receive customer data. Perform the following steps to downline load the system.

1. Call the micro station supplier, request a downline load, and provide the supplier with the following information:
   - Customer name
   - Location of installation (city, state)
   - Controller serial number
   - Low-noise-converter serial number
   - Type of service and/or channel number.
2. On the controller, verify that Lamp 3 lights after the downline load is performed.
3. Verify that the user peripheral is configured according to specifications provided by the micro station supplier.
4. Connect the user peripheral to the controller output port identified by the micro station supplier.
5. Verify that the transmitted packetized data is received by the controller and sent to the peripheral as follows:
   a) Lamp 1 on front of the controller: ON
   b) Port LED on rear of the controller:
   - C-10X-Series units (standard single/quad I/O board: ON
   - C-11X-Series units (MPSC I/O board): ON during data transmission, OFF during data transmission
   - C-12X-Series units (Intelligent I/O board): ON during data transmission, OFF during data transmission.
6. Notify the users that the C-100 Micro Earth Station network is ready for service.

This completes the installation procedure.

Section 5.0
1.4-METER ELLIPTICAL ANTENNA INSTALLATION

The 1.4-meter elliptical antenna extends the EQUATORIAL Network beyond the borders of the contiguous United States to Canada, Alaska, Puerto Rico, and the Virgin Islands, with Hawaii coverage on certain data carriers on Westar IV. It is also used in international service when satellite signal strength is not sufficient for the 0.6- or 0.75-meter antennas.

The 1.4-meter offset-fed elliptical antenna is available in two configurations:

- Linear polarized version for use with domestic satellites
- Circular polarized version for use with Intelsat satellites.

These installation instructions are written to cover both types of installation. Please note the sections that apply to only one or the other type of installation.

The installation of the 1.4-meter elliptical antenna system requires a minimum set of tools, materials, and test equipment.

5.1 RECOMMENDED TOOLS AND EQUIPMENT

The tools required to install a C-200 Micro Earth Station are listed in this section. This tool kit is sufficient to resolve most installations. For any individual installation, all these tools may not be required. In addition, the test equipment and miscellaneous items which may be needed during the installation and adjustment of a C-200 Micro Earth Station are listed. Table 5-1 lists the recommended tools.

Table 5-1. Recommended Tools

ITEM	DESCRIPTION
Pliers:	
01	Pliers, Chain, 10-inch
02	Pliers, Diagonal Cutters, 5-inch
03	Pliers, Diagonal Cutters, 7-inch
04	Pliers, Groove Joint, 9-inch
05	Pliers, Locking, 7-inch
06	Pliers, Long Nose, w/side cutters, 5-1/2-inch
Saws:	
07	Saw, Wood, 20-inch
08	Saw, Hacksaw
Screwdrivers:	
09	Screwdriver, Common slot, 3/16 x 6-inch
10	Screwdriver, Common slot, 1/4 x 4-inch
11	Screwdriver, Common slot, 5/16 x 6-inch
12	Screwdriver, Phillips, #0 x 2-inch
13	Screwdriver, Phillips, #0 x 3-inch
14	Screwdriver, Phillips, #1 x 3-inch
15	Screwdriver, Phillips, #2 x 4-inch
Tool Sets:	
16	Set, Hex wrench (Allen 'L' Key, ball end)
17	Set, Drill, 1/16-inch to 3/8-inch
18	Set, Knife, X-acto Precision Knife set
Sockets:	
19	Socket Drive, Rachet, 3/8-inch
20	Socket, Extension, 3/8-inch x 3-inch
21	Socket, Deep, 3/8-inch
22	Socket, Deep, 1/2-inch
23	Socket, 9/16-inch
24	Socket, Deep, 5/8-inch
25	Socket, 11/16-inch (or nut driver)
26	Socket, Deep, 3/4-inch
Wrenches:	
27	Wrench, Adjustable, 6-inch
28	Wrench, Chain
29	Wrench, Combination, Set

30 Wrench, Open End, 9/16-inch
31 Wrench, Pipe, 14-inch

Power Tools:

32 Cord, Extension, 100-foot (on reel)
33 Drill, Electric, 3/8-inch
34 Soldering Iron, 25-Watt

Misc. Tools:

35 Bit, Drill, Masonry, 5/8-inch
36 Cutter, Tubing
37 Crimper/Stripper/Bolt cutter
38 File, Half Round, 6-inch
39 Hammer, Claw
40 Level, Spirit
41 Light, Flashlight w/Batteries
42 Light, Trouble light
43 Punch, Automatic, heavy duty
44 Reamer, T-handle
45 Staple Gun
46 Tape Measure, 6-foot
47 Vise, Base, Panavise
48 Vise, Head, Panavise

Special Tools:

49 Compass
50 Inclinometer (Angle Finder)
51 Protractor
52 Local Map

Expendable Items:

53 Flux B/O
54 Solder
55 Staples, Box of
56 Tape, Wrapping, Flexite TGL

Containers:

57 Tool Box
58 Parts Box

5.2 UNPACK AND INSPECT EQUIPMENT

Immediately upon receipt, the packages should be inspected for external damage. Any obvious damage should be noted on the shipper when the shipment is received and acknowledged. When the equipment is unpacked, it should again be carefully inspected for damage. Any damage should be reported to the carrier in accordance with their instructions.

The Micro Earth Station is shipped in one crate and four cartons which contain the equipment listed below. Check each container against the packing list to be sure correct models and all parts have been received.

Box	Contents	CONTAINER SIZE (INCHES) H x W x D	SHIPPING WEIGHT POUNDS
1.	Antenna 1.4-m reflector only	75"x50"x12"	88
2.	Structure Kit, includes cables and all hardware to mount the antenna (minus base)	56"x27"x8"	88
3.	Controller	26 x 22 x 12	52
4.	Downconverter, includes receiver electronics and two N-Type connectors	14"x12"x4"	7
5.	Feedhorn	20"x10"x10"	17

Notes:

1. For special installations requiring Teflon cables, the cables and connectors will be shipped separately.

Table 5-2 lists all the components used in the antenna reflector assembly as illustrated in Figure 5-4, and Table 5-3 lists the antenna feed components as illustrated in Figure 5-5.

Table 5-2. Reflector Assembly Components

Item	Qty	Part Number	Description
1	2	60-0057-17	Bolt; Hex, 3/8-16 X 3.00
2	4	61-0029-07	Washer; Flat, 3/8, 0.625
3	2	62-0011-06	Nut; Kep, 3/8-16,R,ST
4	2	60-	Bolt; Hex, 3/8-16 X 1.75
5	2	61-0029-07	Washer; Flat, 3/8, 0.625
6	2	62-0011-06	Nut; Kep, 3/8-16,R,ST
7	2	50-0334-01	Bracket; Pillow Block
8	1		U-Bolt
9	2		Washers
10	2		Nut
11	1	54-0057-01	Tee; Welded, w/Adj Strut
12	-	n/a	Vert Pipe (part of base)
13	1	99-0146-01	Assy; Reflector, Offset
14	1	54-0061-01	Anchor; Elevation Adjust

15	2		Nut
16	1		Washer
17	1		Nut
18	1	54-0062-01	Rod; Anchor Adjust
19	1	60-	Bolt; Hex, 1/2-16 X 3.50
20	2	61-	Washer; Flat, 1/2, 0.625
21	1	62-	Nut; Kep, 1/2-16,R,ST
22	6	60-0057-17	Bolt; Hex, 3/8-16 X 3.00
23	12	61-0029-07	Washer; Flat, 3/8, 0.625
24	6	62-0011-06	Nut; Kep, 3/8-16,R,ST
25	2	50-0362-01	Support Boom; Triangular

Table 5-3. Antenna Feed Assembly

Item	Qty	Part Number	Description
1	1	-	Polarizer Assembly
2	1	-	Clamp, Right Hand
3	1	-	Mounting Plate
4	4	-	Bolt
5	4	-	Washer
6	4	-	Nut
7	1	-	Down Converter
8	1	-	Clanmp, Left Hand
9	6	-	Bolt
10	12	-	Washer
11	6	-	Nut
12	2	-	Bolt
13	4	-	Washer
14	2	-	Nut

Table 5-4. Supplied Cables and Connectors

1.	Cable, Coaxial, Belden 9258	300 feet
2.	Cable, Coaxial, Belden 8219 (RG-58)	300 feet
3.	Connector, N-type	2 each
4.	Connector, UHF (PL 259)	1 each
5.	Connector, TNC	1 each
6.	Connector, DB-25P, male 25-pin	1 each

5.3 ANTENNA MOUNT INSTALLATION

The location and type of antenna mounting should have been determined during the site survey. The site survey form will provide the antenna pointing angles, the antenna mounting type, and proposed location. Inspect the proposed antenna mounting location and ensure all preparations have been made for the installation.

> **NOTE**
>
> **Again, check to be sure the antenna can be oriented to the required azimuth with an unobstructed path to the satellite.**

The antenna may be installed in either of two orientations, boom high or boom low. Before starting the antenna installation, determine which type will be used:

BOOM LOW

BOOM LOW is the standard installation method. If the satellite elevation angle is between 17 degrees and 50 degrees, the antenna should be installed as BOOM LOW, which provides a low silhouette and makes the installation and alignment easier.

BOOM HIGH

If the satellite elevation is below 17 degrees, or above 50 degrees, the antenna should be installed BOOM HIGH. The BOOM HIGH orientation is required below 17 degrees satellite elevation because the mount interferes with the reflector at elevations below 17 degrees. BOOM HIGH is required above 50 degrees satellite elevation to reduce the accumulation of rain on the reflector.

> **NOTE**
>
> **In most cases, the illustrations and instructions in this manual reflect the normal BOOM LOW configuration. In some instances the illustrations will not show the alternative BOOM HIGH configuration. In these instances, the BOOM HIGH configuration will not change the alignment procedures.**

5.3.1 ANTENNA MOUNTS

Construct, or arrange to have constructed, the appropriate antenna mount. The primary mounting method uses the aluminum base for flat roof mounts. Special circumstances may require other installation methods, such as the wall or extended pipe mount. Contact your network provider if special mounting techniques are required.

The Aluminum Base

The aluminum base is constructed of three platform beams assembled in such a way to form a solid three-legged base to support the antenna and associated hardware. The three-legged base is illustrated in Figure 5-1. If installed on a flat roof, the base may be mounted without bolting it to the roof. To ensure this deadweight platform will not move in high winds, thirty 12"x12"x2" patio bricks should be distributed along, and strapped to, the aluminum base. The dead weight should total approximately 220 pounds on each of the legs. The weights should be strapped using 1/2-inch steel banding.

The Wall Mount

The wall mount base is designed and constructed to hold an antenna off the side of a wall and has no need for any additional support from the ground. Its primary function is to enable an installation to be made off the ground, such as high-rise buildings, or other structures where the antenna does not have a sufficient clearance to provide a clear look angle to the satellite unless it is elevated.

Prior to installing this mount, the physical composition of the wall must be considered. This design exerts a large amount of downward loading on the surface to which it is attached. Wood walls should be avoided unless they are supported by large beams and even then the mount should be bolted to a steel backing plate to avoid excessive pressure on the primary surface. When installing this mount on a concrete or brick wall, make use of lead anchors for all mounting holes. The standard wall mount is illustrated in Figure 5-2.

The Pole Mount

Pole mounts are installed where a roof mount is either not practical or not desired. This mount offers a practical solution to the problem of snow accumulation on the antenna. It is also somewhat faster to install than the conventional roof mount.

The pipe that is used should be three and one-half inches outside diameter, and three inches inside diameter. The pipe should be galvanized or black iron, or schedule 40 tubular steel. It is sold in varying lengths up to 21 feet (in the United States). These lengths can be coupled together to form longer lengths as desired. The standard pole mount is illustrated in Figure 5-3.

5.3.2 ALUMINUM BASE ASSEMBLY

1. Locate each of the three base struts labeled 1, 2, and 3. Place the struts as shown in Figure 5-1.
2. Attach the three sgruts together using the corner brackets as shown in Figure 5-1. Secure the corner brackets to the struts using six 3/8-16 x 4" carriage bolts, flat washers, and 3/8" kep nuts.
3. Attach the antenna mounting base to the center of the flat roof mount using six 3/8-16 x 4" carriage bolts, flat washers, and 3/8" kep nuts. Note that only two base holes per strut are used. Tighten all hardware.
4. Attach the base plate pads to each of the three base struts using two 3/8-16 x 4" carriage bolts, flat washers, and 3/8" kep nuts. Tighten all hardware.
5. Rotate the entire roof mount in either a clockwise or counterclockwise direction until the base is stable and is as level as possible. Place the three smaller roof guard pads under each of the three base plate pads and the larger single roof guard pad under the center of the base.
6. The last step is to add the dead weight to each of the legs. This should total 660 lbs, or be approximately 220 lbs per leg. To ensure no movement of this weight, it must be strapped down with 1/2" steel banding that is supplied with the mounting kit.

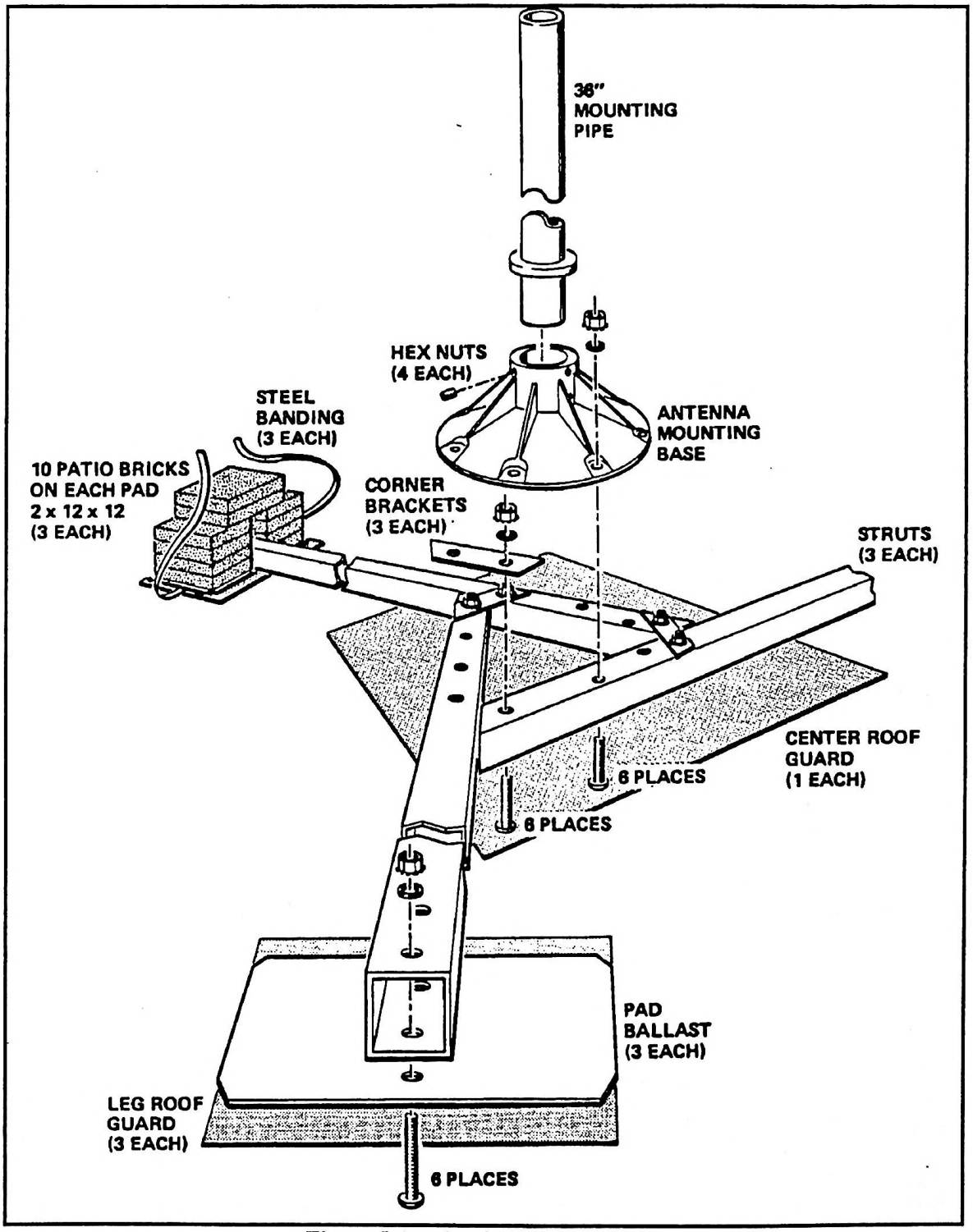


Figure 5-1. Aluminum Base Mount

5.3.3 WALL MOUNT ASSEMBLY

1. All the pieces and hardware of the wall mount kit should be laid out and a check made to insure the kit is complete.
2. Locate one of the four wall frame mounts (Item 002) and place it in position and mark all five bolt hole locations on the wall. Use this as a reference for the other three wall frame mounts. Refer to Figure 5-2. These frames must be 12 inches apart horizontally and separated 36 inches vertically.
3. Drill the necessary holes at this time. Insert the lead mollies to the wall and secure the four frame mounts to the wall. Refer to Figure 3-2 to show their proper orientation.
4. Install the eight sjpport angles to form four triangular sections off of the four wall frames. DO NOT TIGHTEN the hardware down at this time.
5. Install Items 003 and 004 as shown in Figure 5-2 and tighten all the hardware on the wall mount assembly.
6. Position the 3.5" pipe into place and install the two "U" bolts, Item 005, to hold the pipe and tighten down firmly.

This completes the wall mount assembly.

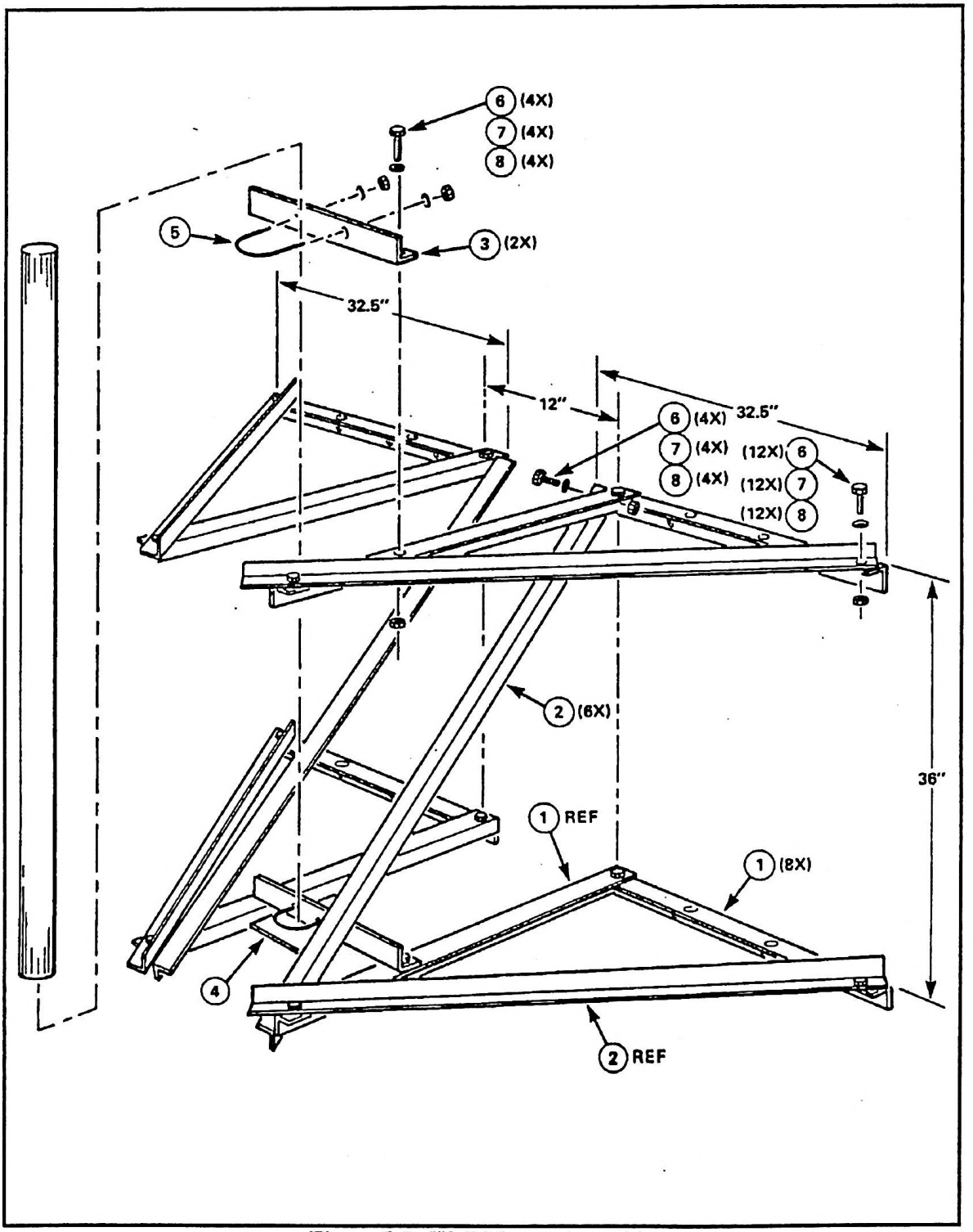


Figure 5-2. Wall Mount Assembly

5.3.4 POLE MOUNT ASSEMBLY

1. All the pieces and hardware of the pole mount kit should be laid out and a check made to insure the kit is complete.

2. The length of the pole required is calculated as follows; three feet in the ground plus the height of the wall, plus three feet on top.

3. After the pipe has been cut to the correct length, drill two 3/8-inch holes through the bottom of the pipe as shown in Figure 5-3. The two holes should be offset 90 degrees and at least a foot apart. The lower one should be about six inches or more from the bottom of the pipe.

4. A piece of threaded rod should be placed through each hole. The rod should extend six inches either side of the pipe. Secure the rod in place with lockwashers and nuts. The purpose is to insure that the pole mount will not move or rotate in the concrete that is used to fill the hole.

5. Position the support angle (Item 005) on the wall where it is to be installed. Mark the five locations where the bolt holes are and drill the holes for the mollie bolts. After the mollie bolts are installed, firmly bolt the support angle to the wall.

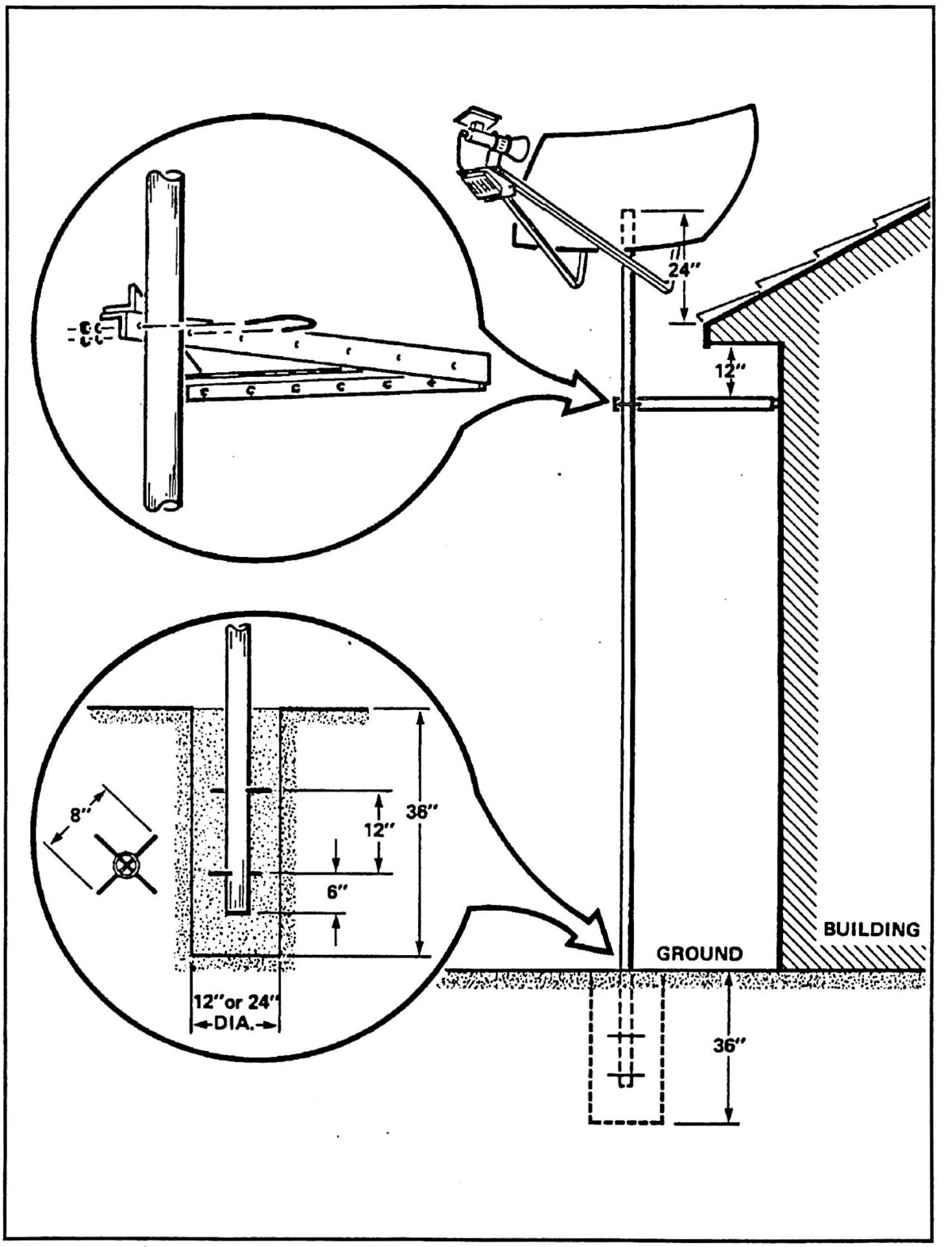
6. Once the wall attachment is secured in place, the two support arms can be added. The arm that attaches to the pole is bolted on the left side of the wall attachement. The support arm which measures 47.5 inches is bolted to the right side using the holes provided for this purpose. Move the loose ends of the arms together and bolt them together to form a triangular form.

7. Place the "U" bolt in position through the two outter holes in the left support arm. Using a plumbob or similar device, hang it from the "U" bolt to the ground. This is where the hole should be dug for the pipe mount.

8. Dig a hole 2.5 feet deep and two feet wide. When the hole is complete, place the pole in the hole and secure it in place with the "U" bolt that was previously installed.

9. With the pole in place, fill the hole with quick drying concrete. When the concrete is set, the installation may be continued.

This completes the pole mount assembly.


24"
12"
8"
12"
38"
6"
12"or 24"
←DIA.→
GROUND
BUILDING
36"

5.4 ANTENNA ASSEMBLY

5.4.1 REFLECTOR ASSEMBLY

After the base has been completed, assemble the antenna according to the following instructions. Instructions vary according to the type of mounting required. For example, a pipe "L" and braces are required for wall mounting, but are not required for horizontal concrete base or wooden platform mounting.

Figure 5-4 is an exploded view of the antenna reflector assembly with booms. The components for the mount and the hardware required to mount the antenna are listed in Table 5-1.

1. Mount the base plate. If mounting on a concrete base, place the base plate on the anchor bolts that are embedded in the mounting surface. Secure the base plate with the 3/8-inch flat washers, lock washers and 3/8-16 nuts.

   If mounting on an aluminum base, locate the base plate on the mounting surface or frame as required. Secure the base plate with 3/8-inch lag bolts; or use carriage bolts, flat washers, lock washers, and nuts if mounting into a wooden surface.

2. Install vertical pipe. When the base plate has been secured, place one end of the vertical pipe (item #6) into the base plate. Firmly secure the pipe with the four 1/2-13 x 1/2-inch setscrews (#29) provided.

3. Install "T" Mount. Place the "T" mount (Item 002) over the vertical pipe and hand tighten using the U-bolt and associated hardware as shown in Figure 5-4.

4. Remove the frame/reflector bolts labeled (A) in Figure 5-4.

5. Using the two bolts removed in step (4) above, secure the lower side of each pillow block (Item 003) to the frame/reflector. Then secure the uppeer side of each pillow block to the same frame using 3/8-inch bolts, wahsers, and nuts.

6. Secure the reflector (ITEM 004) to the "T" mount by sliding the pillow blocks over the horizontal posts that form the mount. The Equatorial logo should be upside down and at the bottom in the BOOM LOW configuration. For the BOOM HIGH configuration, the Equatorial logo should be right-side up and at the top.

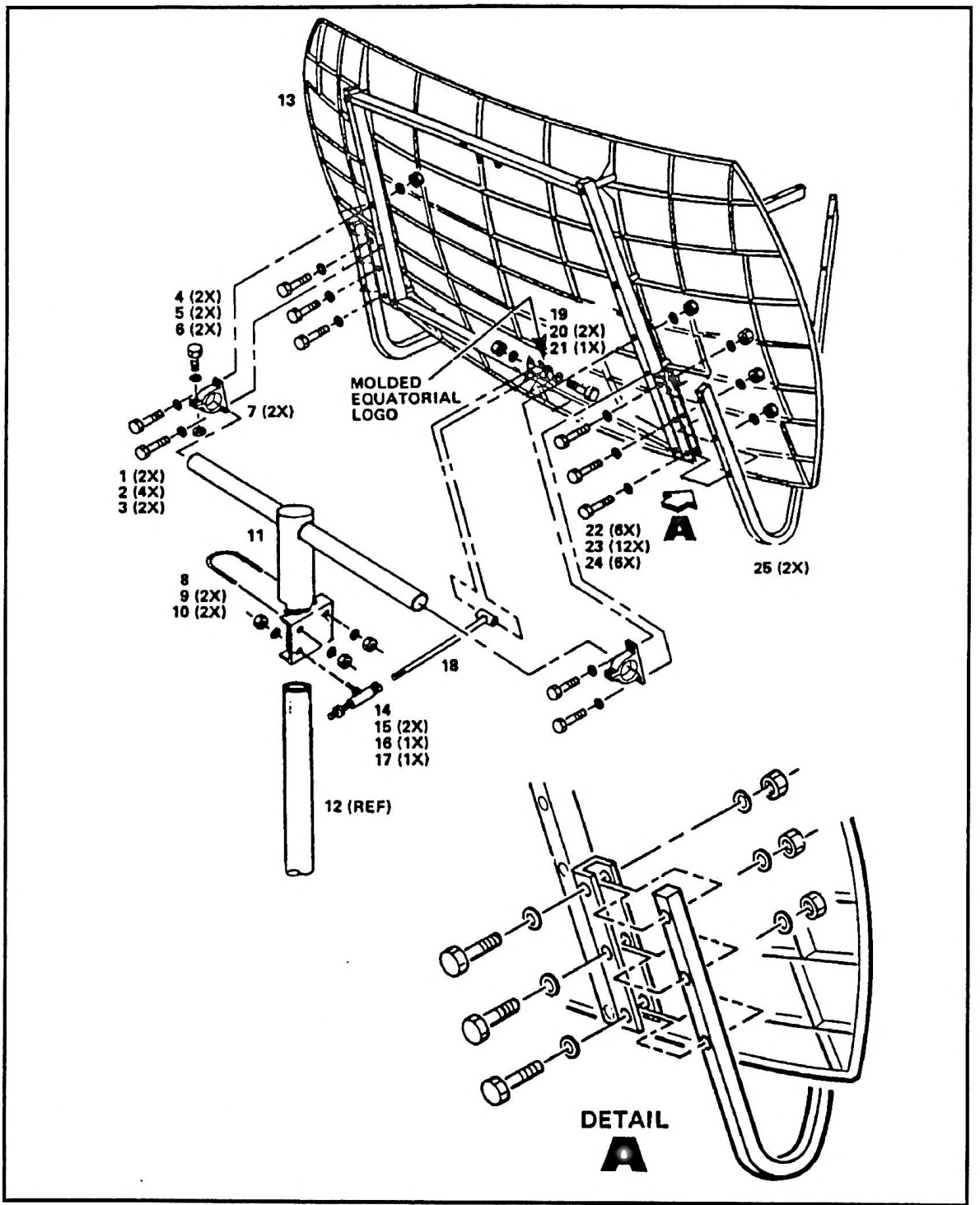


Figure 5-4. Reflector Assembly, Exploded View

7. Mount the left and right booms (items #15 and #16) to the boom support flanges on the reflector and secure using the 3/8-inch hardware supplied. Verify that the reflector is oriented properly with the logo upside-down and low for BOOM LOW and right-side up and high for BOOM HIGH installations.

5.4.2 Downconverter/Feedhorn Assembly

1. Mount the feed mounting plate, as shown in Figure 5-4, using 3/8-inch bolts. Before tightening the bolts, be sure the feed mounting plate is symetrical on the booms.

2. Assemble the feedhorn/downconverter assembly. Place the weatherproof gasket properly on the downconverter, then attach the feedhorn to the downconverter (as shown in Figure 5-5) using six 6-32 x 1/2-inch SS cap screws (#30). Be sure the weatherproof gasket is properly positioned between the feedhorn and the downconverter before tightening the screws.

3. Attach the feedhorn mounting bracket (#5) to the throat of the feedhorn assembly by removing the clamps (#4) and re-assembling around the feedhorn. Tighten the clamp bolts only finger-tight. Attach the entire assembly to the feed mounting plate as shown in Figure 5-5. Push the feedhorn back away from the reflector as far as possible before tightening the hardware. Make sure the bottom of the feed mount bracket is flush across the entire top of the feed mounting plate.

4. Take the threaded support strut (Item 12) and run a 3/4-inch nut up the bar about ten inches. Insert the support strut into the guide ring on the left-hand side of the "T" bar, then run a second 3/4-inch nut with a lockwasher up the wsupport strut to the guide ring so the strut can be locked in place. Do not tighten until the exact antenna elevation has been set.

5. Elevate the antenna sufficiently to permit the attachment of the strut to the back of the reflector. Set the elevation by using the two nuts on either side of the guide ring.

This completes the initial antenna assembly. After the controller is installed and cables are run between the units, then initial adjustments will be made to the feedhorn and downconverter assembly.

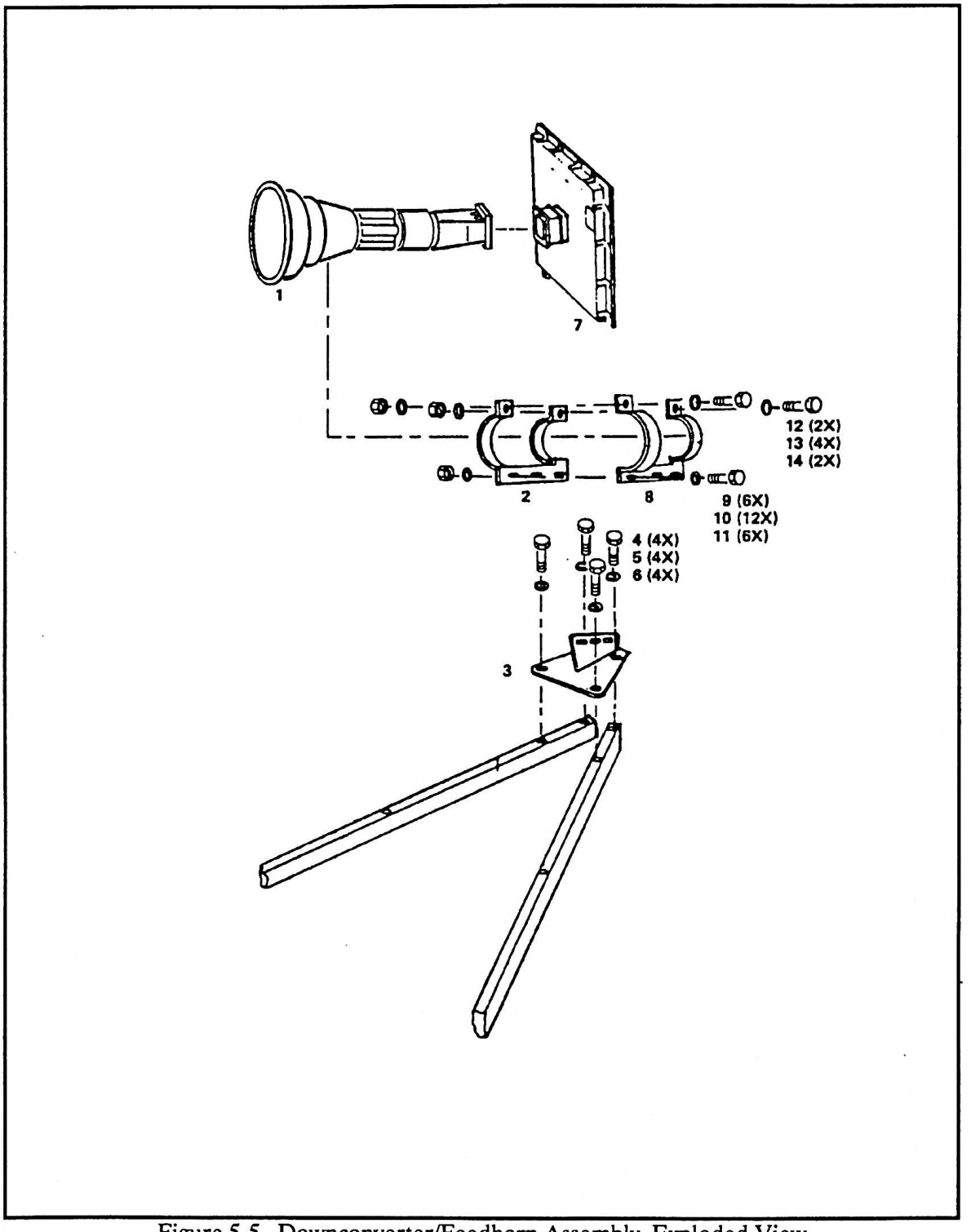


Figure 5-5. Downconverter/Feedhorn Assembly, Exploded View

5.5 PRELIMINARY ADJUSTMENTS

5.5.1 Azimuth

Initially set the antenna azimuth by performing the following steps:

1. Verify that the antenna mounting base is securely mounted to the mounting platform.
2. Verify that the bottom (unthreaded end) of the pipe base is secured by the four 1/2-inch setscrews.
3. With the aide of a local map and landmarks, and/or a compass, set the assembly as close as possible (+5o or less) to the required true azimuth. See Appendix D and Section 4.6 for detail on azimuth adjustment.

> **CAUTION**
>
> **Compass readings are affected by two phenomena. The first is a natural phenomenon called magnetic declination or variation, which can cause errors in the contiguous 48 states in excess of 25 degrees.**
>
> **The second is deviation, which is caused by magnetic materials such as steel in proximity to the compass adding significantly to compass errors. Check the azimuth against a local map and visible landmarks.**

4. Tighten the U-bolt that holds the T-bar on the vertical pipe.

5.5.2 Polarization

Polarization adjustment is required to align the antenna waveguide with the waveguide on the satellite. The C-100 is delivered in two forms; linear feed and circular feed. Look into the front of the feedhorn to determine the type of feed. If the front of the feedhorn is clear, you have a linear feed. If the front face of the horn is orange and has a 'meander line' pattern, the feed is circular.

5.5.2.1 Linear Polarization Adjustment

1. Note the correct polarization for your location from the information in Appendix D.
2. The hex bolts on the pillow block clamps should be friction tight to hold the antenna in any position it is set. Swing the antenna forward until the booms are horizontal (making sure the azimuth is set to within 5° of the satellite).
3. Place an inclinometer on the straight portion of the feedhorn (with the inclinometer perpendicular to the reflector) and adjust the elevation of the antenna until the inclinometer indicates the feedhorn is level.

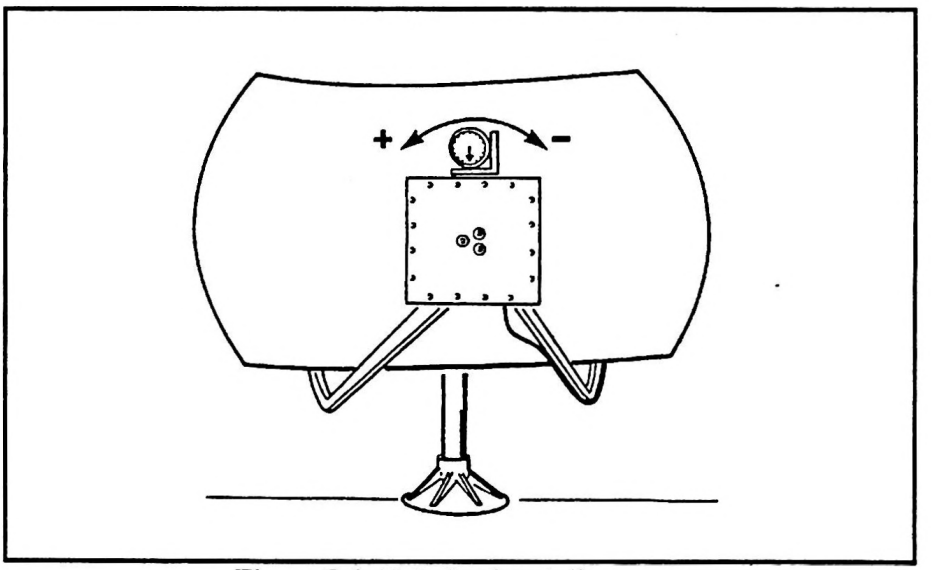


Figure 5-6. Polarization Adjustment

4. Place the inclinometer on the top edge of the downconverter as shown in Figure 5-6. Loosen the feed mounting bracket slightly.

NOTICE

The antenna polarization adjustment is critical and must be set to within 1° accuracy relative to local vertical. The preferred method will compensate for any deviation from vertical of the mounting pipe.

You should be able to rotate the downconverter, but it should be held in position by the clamp friction.

5. As you face the reflector and the rear of the downconverter, rotate the downconverter as follows:

   For Positive Polarity rotate counter-clockwise (to the left)

   For Negative Polarity rotate clockwise (to the right)

Rotate the downconverter to set the proper polarization.

6. When the proper polarization is set, tighten the feed mounting bracket hardware.

This completes the linear polarization adjustment.

5.5.2.2 Circular Polarization

Circularly polarized feed assemblies are factory set for the correct polarization. The polarization can be checked by looking at the junction of the feedhorn waveguide and the horn. The waveguide is connected to the horn by eight Phillips-head screws. The horn has the words "RIGHT" or "A-POL" and "LEFT" or "B-POL" molded in two locations. The waveguide has an arrow that must align with either word, selecting the polarization; right- or left-hand circular.

CAUTION: The waveguide/feedhorn junction is environmentally sealed at the factory. If you remove the screws and change the polarization, you will break the environmental seal. If this is necessary, you must again seal the junction after re-assembling the unit.

The feedhorn/downconverter assembly should be rotated in the mounting bracket until the downconverter UHF-series connector is perpendicular to the ground (pointing straight down).

This completes the circular polarization adjustment.

Connect the RG-58 cable (with the UHF connector) to the downconverter.

5.5.3 Elevation

Set the initial elevation angle by following these steps:

1. Using the information in Appendix D, determine the required elevation angle.
2. Set the inclinometer on the top of the boom, position it parallel to the satellite azimuth. (This orientation will not be parallel with the individual booms.)
3. The boom angle is not the same as the antenna elevation angle. The boom is offset by 15 degrees. If the installation is:

   BOOM LOW, then subtract 15 degrees from the calculated angle

   BOOM HIGH, then add 15 degrees to the calculated angle.
4. Swing the boom to the required angle and alternately tighten the hex bolts in pillow joint clamp. Figures 5-7 and 5-8 illustrate the method for setting the elevation adjustments for BOOM LOW and BOOM HIGH, respectively.

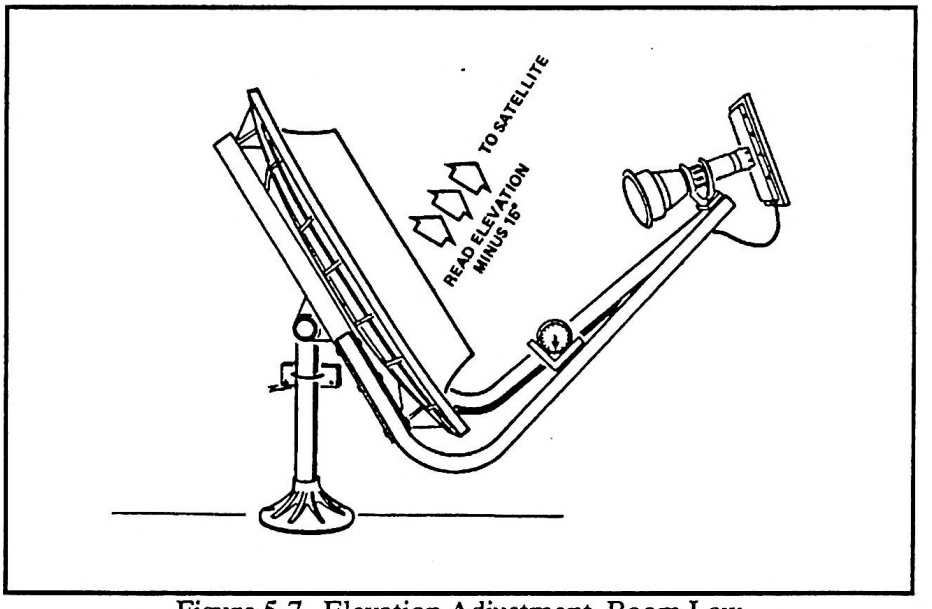


Figure 5-7. Elevation Adjustment, Boom Low

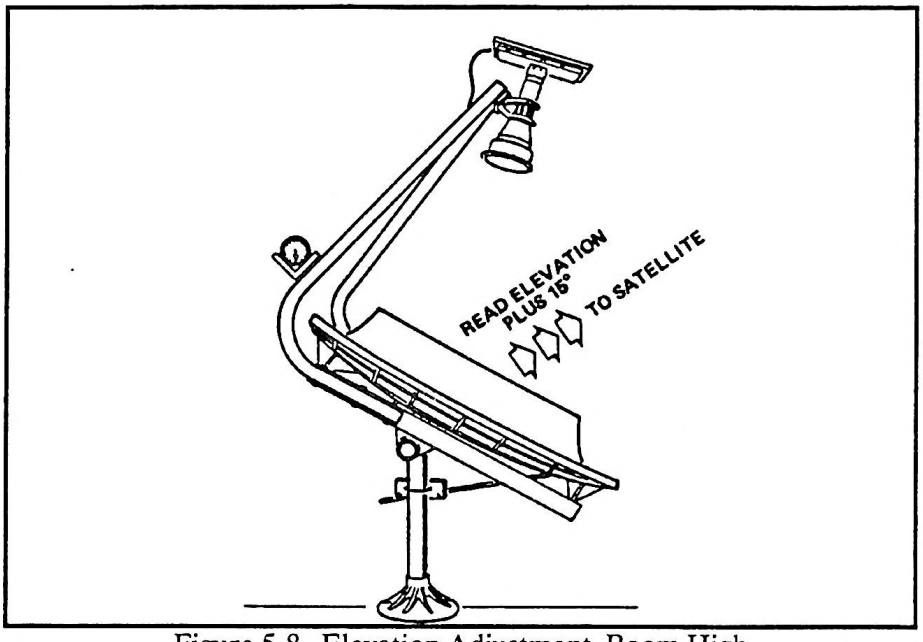


Figure 5-8. Elevation Adjustment, Boom High

This completes the initial antenna adjustments.

5.6 ACQUIRING THE SIGNAL

Refer to Section 4.7 for information on coaxial cable connections, and Section 4.8 for information on acquiring the satellite signal. After these sections have been completed, you may continue to Section 5.7, Final Adjustments.

5.7 FINAL ADJUSTMENTS

5.7.1 Final Azimuth Adjustment

The offset antenna adjustments are critical and movements should be made in increments of 1/8-inch or less. Greater movements may result in signal loss; resulting in time consuming re-cycling of the controller to re-acquire the signal.

> **NOTE**
>
> **Power must be continuously applied to the unit for a minimum of 20 minutes prior to making any final adjustments. This allows sufficient time for the oscillators to stabilize.**

1. Adjust the azimuth. The azimuth must be set to an accuracy of +0.5°. Loosen the U-bolt that locks the "T"-bar clamp on the vertical pipe.
2. With an observer watching the C-100 #4 lamp, adjust the azimuth in a westerly direction until the #4 lamp goes "OFF". Mark the position of the "T"-bar on the vertical pipe.
3. Repeat the adjustment in the easterly direction and note the position of the "T"-bar on the vertical pipe.
4. Set the antenna azimuth exactly half way between the two readings and lock it in position with the T-bar U-bolt.

This completes the azimuth adjustment.

5.7.2 FINAL ELEVATION ADJUSTMENT

The elevation must also be set to an accuracy of +0.5°.

1. Loosen the outer pillow blocks to allow vertical movement of the antenna assembly.
2. Set the inclinometer on the antenna boom to measure elevation angle. See Figures 5-7 and 5-8. Adjust the elevation to the proper satellite elevation angle.

3. Slowly increase the elevation until the C-100 #4 indicator goes out. The elevation is adjusted easily using the threaded rod. Note the inclinometer reading.

4. Slowly decrease the elevation until the #4 lamp comes on and again goes out. Note the inclinometer reading.

5. Set the elevation to a point half way between the two "LAMP OFF" points, lock the elevation rod with the two nuts, and tighten the pillow blocks to lock the antenna assembly in position.

Wrap the connector at the antenna with weatherproof self-vulcanizing tape as shown in Figure 5-9. Alternately, the connectors may be wrapped with black electrical tape and then liberally covered with a weatherproof sealing compound.

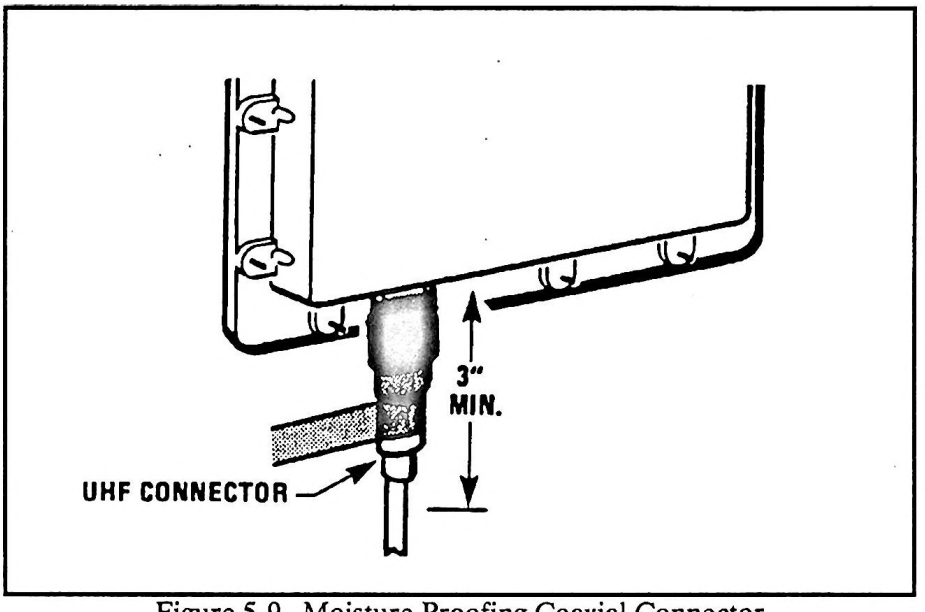


Figure 5-9. Moisture Proofing Coaxial Connector

5.8 VERIFY OPERATION

5.8.1 I/O INTERFACE

The station can now be connected to the customer equipment and tested in the network.

1. If only one I/O cable is required, connect it to Port 1 at the rear of the controller. If multiple ports are used, connect the proper cables between the additonal ports and the peripheral equipment.

2. Have operations download the unit.

Insure peripheral equipment is operating.

As data is passed to peripheral, the appropriate LED on the rear of the controller should flash.

5.8.2 FINAL OPERATIONS

Prior to finishing the installation, confirm the following:

1. Antenna base, pillow block, and tee-joint clamps are properly tightened.
2. All hex bolts are properly tightened.
3. All cable connectors are properly weatherproofed.

Having completed the installation, make sure the following items are handled properly:

1. Be sure to dispose of all packing and other debris.
2. Inform the customer that the installation is completed.
3. Make sure you have the name of the installation contact person. The name should be given to Network Operations for their records.
4. Give the contact person the names and phone numbers of Network Operations and Technical Support. These numbers are given in Section 4 of this manual.

Appendix A
SIGNAL-STRENGTH METER

The signal-strength meter is an electronic test set that allows the installer to quickly and accurately adjust the antenna elevation angle and azimuth heading for maximum receive signal level from the satellite. The test set consists of a receiver unit and a transmitter unit. The units are compact and factory calibrated for sensitive and accurate detection of the satellite signal. Each signal-strength meter kit includes interconnecting test cables fitted with the correct connectors for interfacing the test set to the C-100 Series receive-only Micro Earth Station.

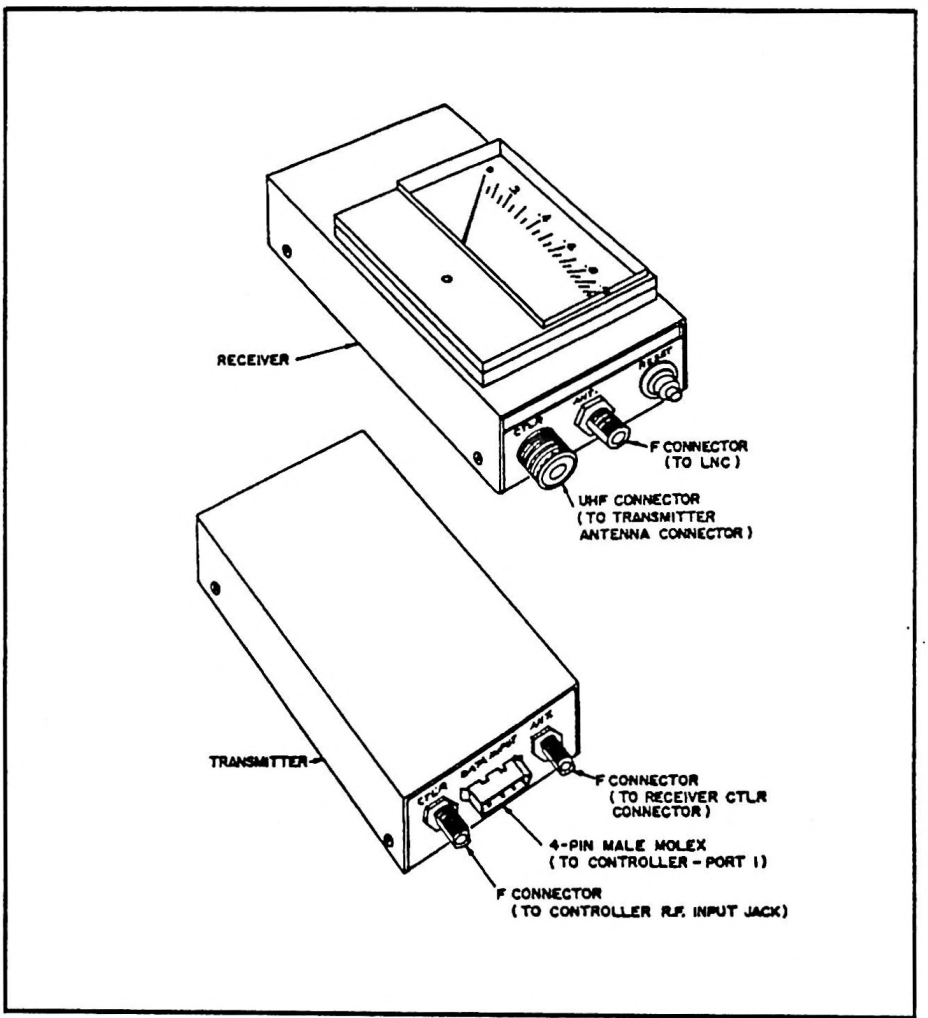


Figure A-1. Signal Strength Meter

A.1 RECEIVER UNIT

The receiver unit performs three functions:

- Surrogate controller for the low noise converter.
- Demodulation of the clock alignment signal from the transmitter unit and display of the relative strength of the satellite signal.
- Partial provision of the RF signal and the powerline path between the controller and the low noise converter.

The receiver unit is connected in series between the low noise converter and the transmitter unit. The receiver is equipped with a meter, reset switch, and two connectors (Figure A-1). These components perform the following functions:

- Meter Switch: Indicates relative strength of the satellite signal.
- Reset Switch: Resets the receiver unit internal circuits during alignment of the antenna.
- Controller Connector: Provides UHF connector interface to the transmitter unit.
- Antenna Connector: Provides F-connector interface to the low noise converter.

A.2 TRANSMITTER UNIT

The transmitter unit performs the following functions:

- Receives the clock alignment signal from the controller which modulates the 200 KHz signal sent to the receiver unit.
- Provides part of the path for sending power from the controller to the low noise converter.

The transmitter unit is connected in series between the controller and the receiver unit. The transmitter is equipped with three connectors (Figure A-1) that perform the following functions:

- Data Input Connector:A four-pin male MOLEX connector provides interface to Port 1 on the controller for the clock alignment signal.
- Antenna Connector:F-Type connector provides signal and power line interface to the CTLR connector on the receiver unit.
- Controller Connector: An F-type connector provides the signal and power line interface to the RF input jack on the controller.

Appendix B
CONTROLLER FRONT-PANEL LAMPS

B.1 POWER-UP DIAGNOSTICS

When the power is applied to the controller, built-in diagnostics are executed. If the diagnostics are successfully executed without errors and the system is completely aligned, all lamps will be solidly lighted, except for Lamp 1 which will light only during data transmission to the controller ports). If the controller fails a diagnostic test during power-up, refer to Table B-1 for interpretation of the failure(s). A failure during diagnostics is indicated when Lamp 9 alternately flashes with one or more of the other front panel lamps. In such a situation, contact the micro station supplier.

Table B-1. Controller Power-up Diagnostics Failures

LAMP		FUNCTION
1	ON	Pseudo-random Noise (PN) RAM error. Test pattern loaded in PN RAM failed comparison test
6	ON	Non-volatile memory checksum error. Checksum executed by non-volatile memory failed comparison test against value calculated after last ADMIN load.
7	ON	System RAM failure.
8	ON	System PROM checksum error. System PROM checksum result failed comparison test against value stored in controller firmware.

B.2 NORMAL OPERATING MODE

After the controller has successfully completed power-up diagnostics, the system is aligned and permissioned for normal operation. During normal operation, the front panel lamp definitions change. The normal operating mode is defined when Lamp 9 is solidly lighted. Lamps 9 through 1 provide an indication of the C-100 series system operation.

Table B-2 describes the normal operating conditions for the lamps in descending order, since this is the normal sequence in which the lamps are lighted when the system becomes operational.

B.3 NORMAL OPERATION

The controller is equipped with a "watchdog timer" (WDT) to monitor specific types of failures. Lamp 9 and one or more lamps (1 through 8) will flash alternately for 15 seconds when a failure occurs during normal operation. However, at the end of 15 seconds the WDT executes a hardware reset. During the reset, Lamp 9 and all other failure lamps do not flash. After the reset is completed, the lamps resume flashing for another 15 seconds until the WDT again attempts to reset the system. See Table B-3 for definitions of failures.

NOTE: Failure indications during normal operation should not be confused with failures that occur during power-up diagnostics. Lamp failure definitions are different for the two conditions.

Table B-2. Normal Front-Panel Lamp Operation

LAMP		FUNCTION
9	ON	System passed power-up diagnostic tests. System in operational mode.
	FLASHING	Failed diagnostic test during power-up procedure. Another lamp should be alternately flashing with Lamp 9 (see Table B-1).
8	ON	Basic in-band system noise being received, indicating antenna, LNC, and controller are connected and power applied.
	OFF	Controller processor cannot sufficiently adjust automatic gain control (AGC).
7	ON	Automatic frequency control (AFC) circuit operational and bandpass for receiver circuit established.
6	ON	Timelock achieved by system.
5	ON	Phaselock (Costas) loop operating within required range and locked onto signal.
4	ON	Receive signal strength from satellite meets or exceeds minimum specification.
	FLASHING	Marginal receive signal level.
	OFF	Signal level less than minimum requirement.
3	ON	Indicates downline load satisfactorily executed.
	OFF	Downline load not executed.
2	ON	Data packets received.
	FLASHING or OFF	High bit-error-rate (BER) or phaselock loop out of lock.
1	ON	Data being sent to one or more ports.
	OFF	Data not sent to output buffers.

B.4 OPERATIONAL FAILURE INDICATIONS

Table B-3. Lamp Indications, Operational Failure

LAMP		INDICATION
9	FLASHING	Failure--check for another flashing lamp on front panel to pinpoint type of failure.
8	FLASHING	No application.
7	FLASHING	No application.
6	FLASHING	Overrun of data in output buffer. Data being loaded to buffer faster than transmission rate to output port.
5	FLASHING	Incoming data overrun in "space" data buffer. Incoming data rate too fast for CPU.
4	FLASHING	No application.
3	FLASHING	No application.
2	FLASHING	No application.
1	FLASHING	No application.

Appendix C
DETERMINING SATELLITE POINTING ANGLES

Accurate satellite antenna pointing angles can be calculated by using the Basic computer program listed in this section. The program is written for Microsoft Basic; however it should run on nearly any micro computer system. The program provides a table of pointing parameters that cover any area defined by latitude and longitude boundaries. If the boundaries selected are too great to list properly, the program will ask for a smaller area.

The computed azimuth is relative to true north. Magnetic north differs from true north by as much as 20 degrees. If a magnetic compass is used to determine azimuth instead of taking bearings from an accurate map, be sure to compensate for magnetic declination. Consult a nearby airport or marina for further information on magnetic variations. Aviation and marine charts (maps) indicate both true and magnetic headings.

Table C-1. Antenna Pointing Program in Basic

```
10 REM PROGRAM "AIMLIST4" 3/6/86
20 REM MODIFIED TO PERMIT 0.25 DEG POS
30 DIM EL(30),AZ(30),P(30)
40 Q=180/3.1415926#:KS=1/6.6125
50 START:
60 INPUT "SATELLITE POSITION (WEST=NEG)";LS
70 RESTART:
80 INPUT "WESTERN EDGE";WEST
90 INPUT "EASTERN EDGE";EAST
100 INPUT "LONG STEPSIZE";KSTEP
110 KSTEP=ABS(KSTEP):NL=ABS(EAST-WEST)/KSTEP
120 FOR NL20 THEN GOTO 460
130 INPUT "NORTH EDGE";NORTH
140 INPUT "SOUTH EDGE";SOUTH
150 INPUT "LAT STEP";JSTEP
160 JSTEP=ABS(JSTEP)
170 LPRINT "FOR SATELLITE LONGITUDE ";LS;"DEG:"
180 REM PRINT TWO HEADER LINES
190 LPRINT "LONG"
200 FOR K=WEST TO EAST STEP 2*KSTEP
```

```
210 LPRINT USING "####.##";K;
220 NEXT K:LPRINT:LPRINT"    ";
230 FOR K=WEST+KSTEP TO EAST STEP 2*KSTEP
240 LPRINT USING "####.##";K;NEXT K:LPRINT
250 FOR J=NORTH TO SOUTH STEP -ABS(JSTEP)
260 LT=J/Q:N=0
270 FOR K=WEST TO EAST STEP KSTEP
280 N=N+1: LL=(LS-K)/Q
290 AZ(N)=INT(Q*ATN(TAN(LL)/SIN(ABS(LT)))+.5)
300 IF LT0 THEN AZ(N)=180-AZ(N)
310 IF AZ(N) THEN AZ(N)=AZ(N)+360
320 CL=COS(LL):CT=COS(CT)
330 SQ=SQR(1-CL*CT*CT)
340 EL(N)=INT(Q*ATN((CL*CT-KS)/SQ)+0.5)
350 P(N)=-INT(Q*ATN(SIN(LL)/TAN(LT))+.5)
360 NEXT K:NN=N:LPRINT
370 LPRINT USING "LAT=####.##:";INT(J*100+.05)/100
380 LPRINT "ELEV";
390 FOR K=1 TO NN:LPRINT USING "####";EL(K);
400 NEXT K:LPRINT:LPRINT "AZIM";
410 FOR K=1 TO NN:LPRINT USING "####";EL(K);
420 NEXT K:LPRINT:LPRINT "POL";
430 FOR K=1 TO NN:LPRINT USING "####";P(K);
440 NEXT K:LPRINT
450 NEXT J:STOP
460 PRINT (NL-20);"TOO MANY LONGITUDE COLUMNS"
470 GOTO RESTART
```