

Chapter 4

Installation and Alignment

This Chapter describes the following:

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- Installing the Hub ODU, page 47
- Installing the Hub IDU, page 57
- Installing the Remote ODU, page 67
- Installing the Remote IDU, page 68
- Remote Antenna Alignment, page 69

Perform the installation in the sequence presented in this Chapter. Refer to the site survey and the Grounding chapter of this manual for supporting information.

Preparation

Communications

Two-way radio communications are recommended between personnel:

- hub ODU to hub IDU
- remote ODU to remote IDU
- remote antenna alignment

Wiring Closet Recommendations

Installation of the Wavtrace system covers most wiring closet concerns. Wavtrace recommends checking the following items:

- Ground the racks properly. The racks provide a secondary ground for the system.
- The connection terminals for field wiring of the –48 Vdc must be suitable for the wire gauges commonly used in the USA and Canada. Current-carrying conductors are required to be rated at least 125% of the equipment rating.
- Ensure that the wiring closet meets all state, local and country building and wiring codes.
- Ensure that all wiring closet doors have locks to prevent unauthorized access.
- Ensure that the wiring closet floor is concrete. If distribution racks are used, bolt racks to the floor to prevent them from tipping over.
- Ensure that ventilation in the wiring closet is adequate to maintain a temperature below 40 degrees centigrade (104 degrees Fahrenheit).
- Guard against ventilation shutdown while the PTM 1000 system remains powered up. Otherwise, the equipment might shut down due to overheating.

All of the following requirements must be met, where applicable:

- Connect the equipment directly to the dc supply system protective earth electrode conductor. It can also be connected to a bonded jumper from a protective earth terminal bar or bus if it is connected to the dc supply system protective earth electrode.

- Locate the equipment in the same immediate area (e.g., adjacent cabinets) as any other equipment that has a connection between the protective earthed conductor of the same dc supply circuit and the protective earth conductor, and also the point of protective earth of the dc system. Do not earth-ground the dc system elsewhere.
- Locate the dc supply source within the same premises as this equipment.
- Do not use switching or disconnecting devices in the protective earthed circuit conductor between the dc source and the point of connection of the protective earth electrode conductor.

Rack Requirements

Rack Grounding

Properly ground the rack to ensure that voltages induced into wiring by lightning or other disturbances are directed to ground.

Rack Space Requirement

Allow a minimum of 76 cm (30 in.) between the rack and any wall behind or in front of it. This space in front of and behind the system allows room for servicing.

Rack Specifications

- In the USA, use EIA Standard RS-310D: Racks, Panels, and Associated Equipment.
- In countries other than the USA, use IEC Standard 297: Dimensions of Panels and Racks.
- Use a rack that has the universal mounting rail hold pattern identified in IEC Standard 297.
- Use a rack that is made of steel.
- Use a rack that can be used as electrical grounding.

Tools

Table 2: Required Installation Tools

Required tools	Hub ODU	Hub IDU	Remote ODU	Remote IDU
Open-end wrench set, 9/16"–3/4"	X	X	X	X
Hex key set, 1/4"–3/8"	X			
Flush cutters	X	X	X	
ODF alignment bracket	X			
Inclinometer	X			
GPS testing device	X			
#2 Philips screwdriver		X		X
Std crimps for fuse holder		X		

Weatherproofing

Weatherize all connectors exposed to the elements. You will need the following materials:

- Butyl tape
- ¾" Electrician's tape
- Cable ties (6")

Installing the Hub ODU

Inspect and Verify the Equipment

- 1 Verify that the equipment and hardware matches the packing list.
- 2 Inspect the equipment for shipping damage.

Install the ODF Mounting Bracket to the Tower Mast

Install the bracket on the pipe in the general area of the azimuth.

- 1 Place the outward side of the bracket toward the azimuth.

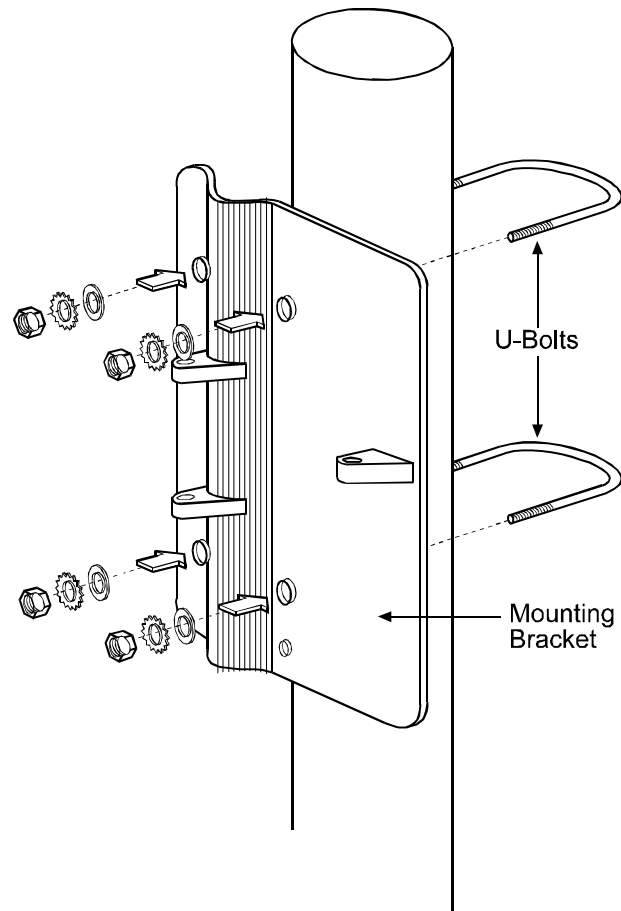


Figure 16 ODF Mounting Bracket

- 2 Wrap two U-bolts around the antenna mast and thread through the appropriate mounting bracket holes.
- 3 Fasten with ½" nuts, flat washers and lock washers supplied.

Warning



When installing a hub ODU on a mast or tower, ensure that the unit is properly secured prior to lifting. If hoisting is required, use a tag line to maintain control of the ODF. To avoid injury, ensure that all personnel are clear of the area below the ODF.

Note

Do not completely tighten the ½" nuts. Secure snugly to hold in place.

Install the ODF

- 1 Install the frame turnbuckle on the mounting bracket using $\frac{1}{4}$ " socket nut and $\frac{1}{4}$ " hex key wrench.
- 2 Set the turnbuckle for mid range to allow fine adjustments in either direction.
- 3 Install the ODF on the bracket using swivel nuts provided. (Do not tighten completely.)
- 4 Install the final frame turnbuckle assembly to the ODF using $\frac{1}{4}$ " socket nut and $\frac{1}{4}$ " key wrench.
- 5 If more than one frame is required to be installed on the antenna mast, an additional 31" of surface area must be provided on the mast per ODU assembly. Perform a quadrant alignment.

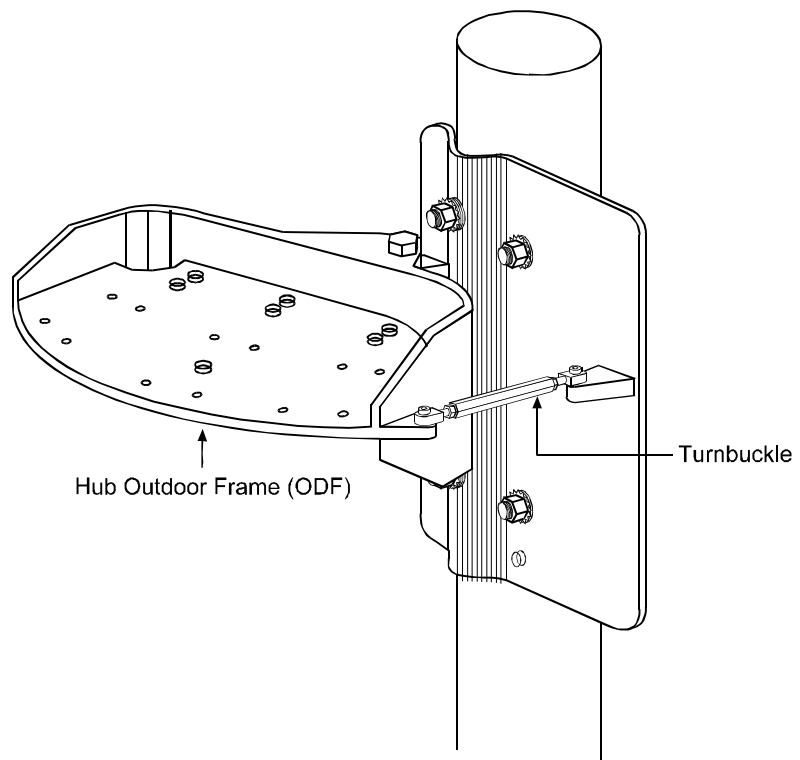


Figure 17 ODF and Turnbuckle Assembly

Perform a Quadrant Alignment

Use the azimuth aiming bracket (from Wavtrace) to align the ODF.

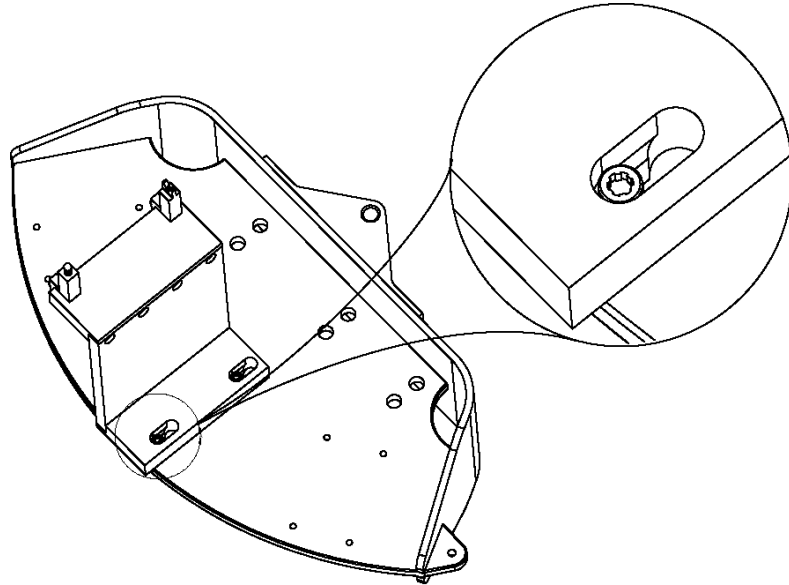


Figure 18 Azimuth Aiming Bracket on ODF

- 1 Install two socket head cap screws into the desired position on the ODF.
- 2 Place the azimuth aiming bracket keyhole over screws in the ODF, then slide the bracket against the narrow end of the keyhole.
- 3 Using a digital compass, align sights to the azimuth bracket.
- 4 Once the sights have been targeted, adjust the ODF turnbuckle until ODF is aligned respectively at 45°, 135°, 225°, and 315°.
- 5 Tighten the cap screws with an allen wrench and tighten the turnbuckle to secure.

Quadrant Alignment Requirements

When installing a PTM 1000, the TRA must be mounted so that the line-of-sight is clear of neighboring buildings, trees, power lines, and other obstructions. If you are mounting it on a roof, you are recommended to mount it at least five feet above the roof line. If you are mounting it on the wall of a building, you must ensure that the TRA is high enough to achieve a line-of-sight as defined in the following paragraphs.

Line-of-sight can be defined as:

- No obstacles in the direct path between the two antennas.
- No obstacles within a defined zone around the antenna beam.

As a general rule, line-of-sight can be achieved more easily if the ODF and TRA are mounted as high as possible, above potential obstructions such as trees and other buildings. An acceptable height is between five and ten feet above the roof line.

Generally, large reflecting surfaces in parallel or partly perpendicular to the beam will cause reflections of the radio signal. Examples are metallized glass buildings, crowded parking lots, water, moist earth, moist vegetation, and above-ground telephone lines.

When positioning an ODF, each sector must have a line-of-sight to the remote unit antenna at the distant end of the link. Final TRA alignment can only be accomplished with remote system installation. Two-way communication is required between the hub and remote installers during installation and alignment.

The hub IDU can be used to optimize the performance of the directional TRA. However, before it can be used, the remote at the other end of the link must also be installed and connected. The hub IDU allows you to verify the communications path between the two ends of the link. It ensures that:

- the wireless device and antenna at each end of the link function correctly,
- the antenna orientation is optimal, and
- stations are within operating range of each other.

Install the TRA

- 1 Log the TRA label and Electronic Serial Number for programming reference. Refer to the “Site Survey” for additional specific information.
- 2 Secure the TRA in position on the ODF. Set the downtilt/uptilt parameters according to specifications in the Site Survey.

Note Verify proper antenna assembly is being installed, i.e., 30° high- or low-gain vertical/horizontal polarity.

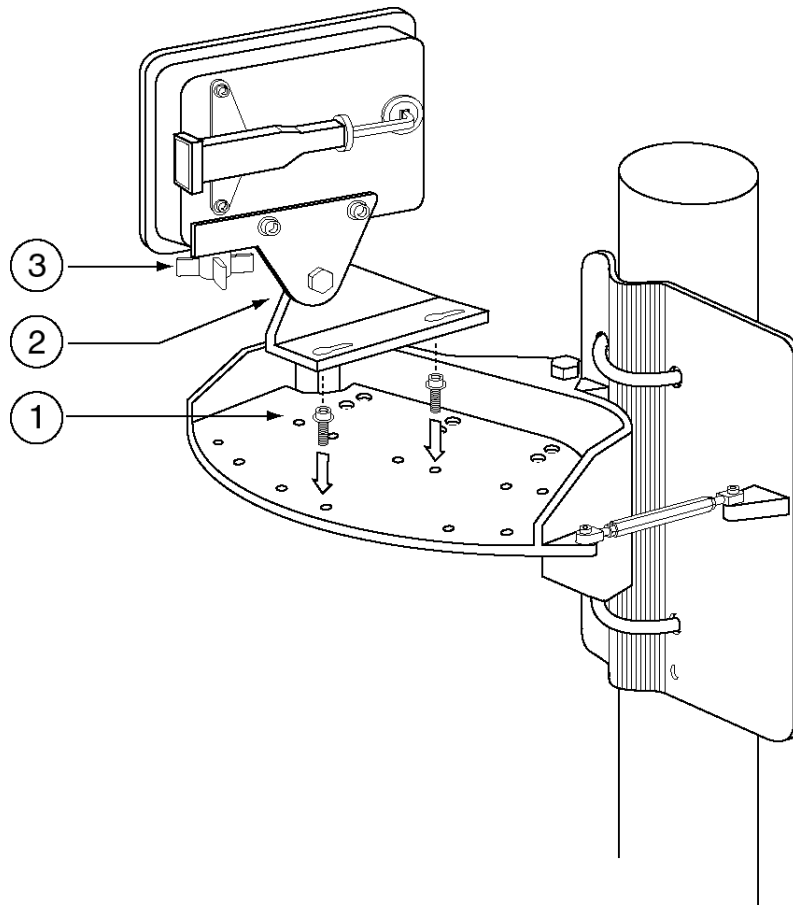


Figure 19 ODF TRA Mounting

- 3 Loosen the socket head on the TRA, then adjust the coarse elevation. Tighten the socket when coarse aiming is complete.

Note Each tooth on TRA mounting bracket represents five degrees of tilt axis. A TRA can be adjusted for 35 degrees of uptilt/downtilt elevation.

- 4 For fine elevation adjustments (less than five degrees), loosen the upper socket head screws, then turn the adjustment knob to dial in the angle. Tighten both socket head screws when elevation adjustment is complete.
-

Example If the Site Survey defines the desired RF coverage at 26 degrees north, the TRA would be installed in Quadrant 1, slot #2.

- 5 Position an inclinometer on top of the TRA. Adjust elevation until coarse adjustment is complete.
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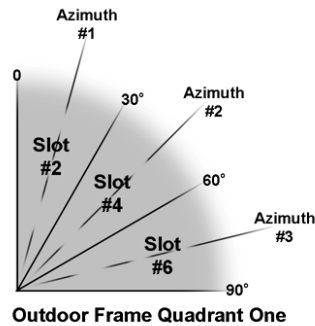


Figure 20 Hub ODF Quadrant One

Note The azimuth for each slot shown in Figure 20 is based on the center of the 30° beam.

Install the ODB

- 1 Wrap the two U-bolts around the antenna mast and thread through the matching holes in the back of the ODB.
- 2 Fasten with four flange serrated hex nuts and four star washers.

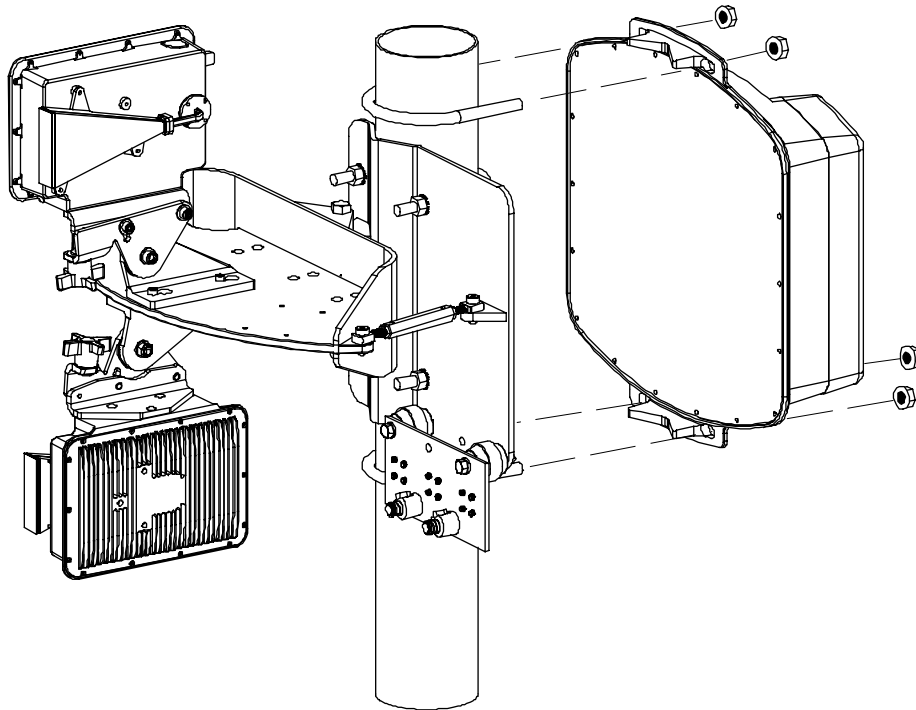


Figure 21 ODB Mounting

Connect the TRA cables to the ODB

Specific TRAs are designated for specific remotes. TRAs have already been placed in their appropriate slots. Connect the TRA cables to the ODB using a TRA labeling scheme in numerical sequence.

Caution



If the IDU is already installed and powered, -48 Vdc is present on interconnecting cables. Care should be taken not to short the center conductor to ground. This may cause damage to the equipment.

- It is recommended that weather proofing and grounding not be done until after the system test can be completed.
- System can be dressed and finalized after testing is successful.
- Label all cables connected to the ODB, identifying the connector for each cable.

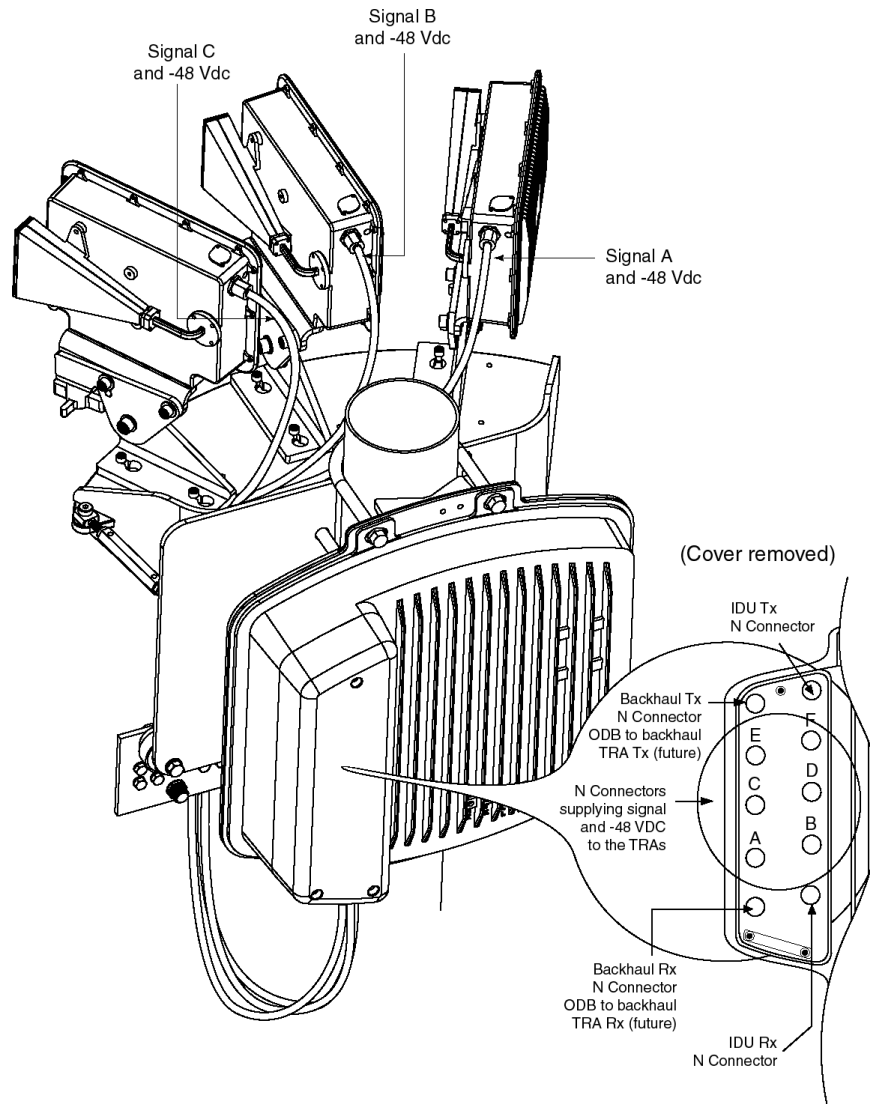


Figure 22 ODF TRA Cable Dressing

Installing the Hub IDU

Inspect and verify the equipment:

- 1 Verify that the equipment and hardware matches the packing list.
- 2 Inspect the equipment for shipping damage.

Space Requirements

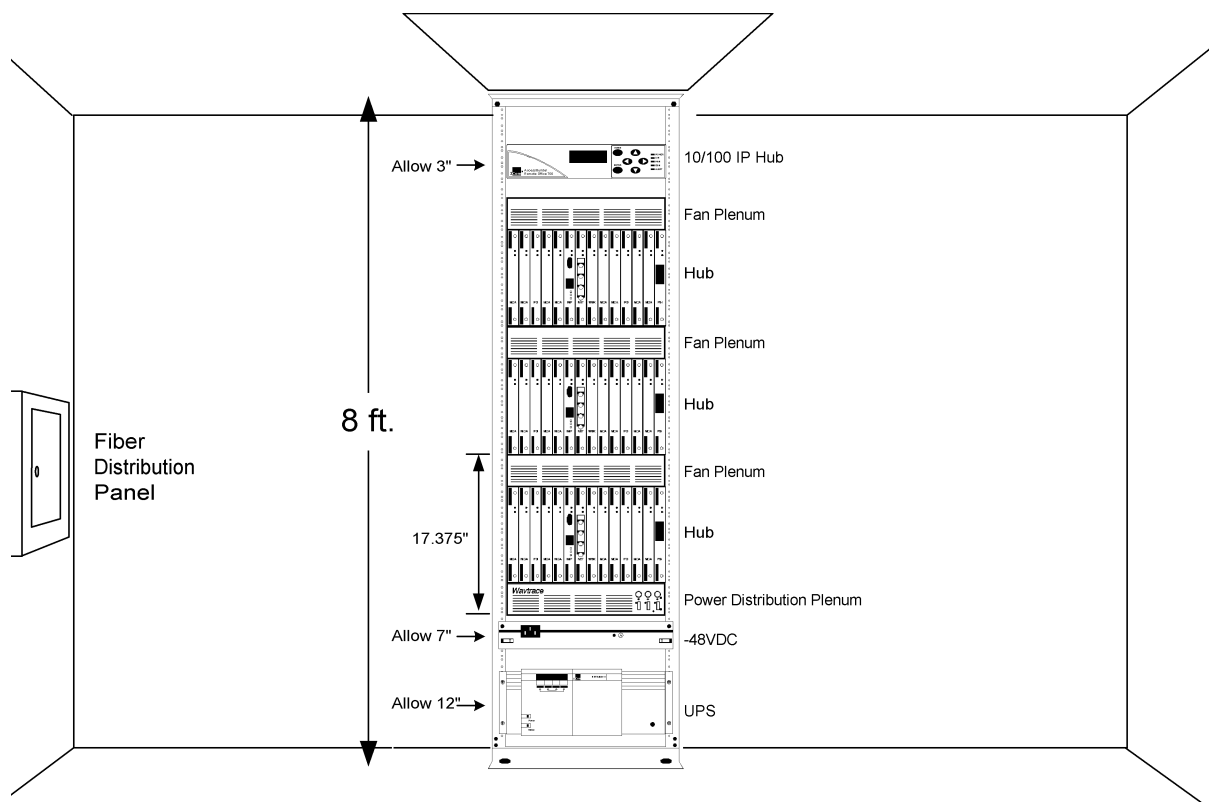


Figure 23 *Space Requirements for PTM 1000 System Expansion*

Install the IDU

Install the IDU in a 19" or 23" rack using the screws and brackets shown in Figure 24. The rack needs to conform to EIA-310-D standards. Screw hole spacing in particular, is important.

Mount the IDU components in the following order:

- 1 The power supply plenum
- 2 The hub chassis
- 3 The fan assembly plenum

Ensure that during installation there is enough room left for future growth.

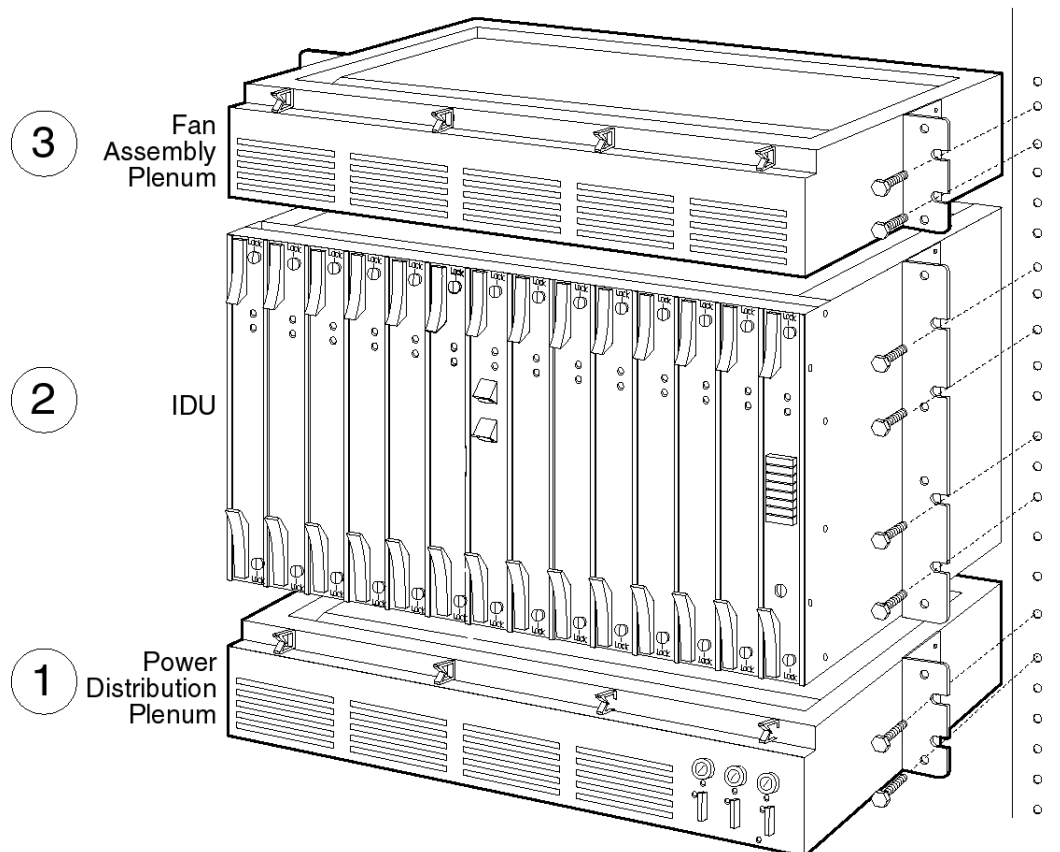


Figure 24 IDU Installation

PCA Installation

When removing a PCA:

- 1 Turn the top locking screw *clockwise*.
- 2 Turn the bottom locking screw *counter clockwise*.
- 3 Pull the levers up and pull the PCA out.

Install a PCA in reverse order.

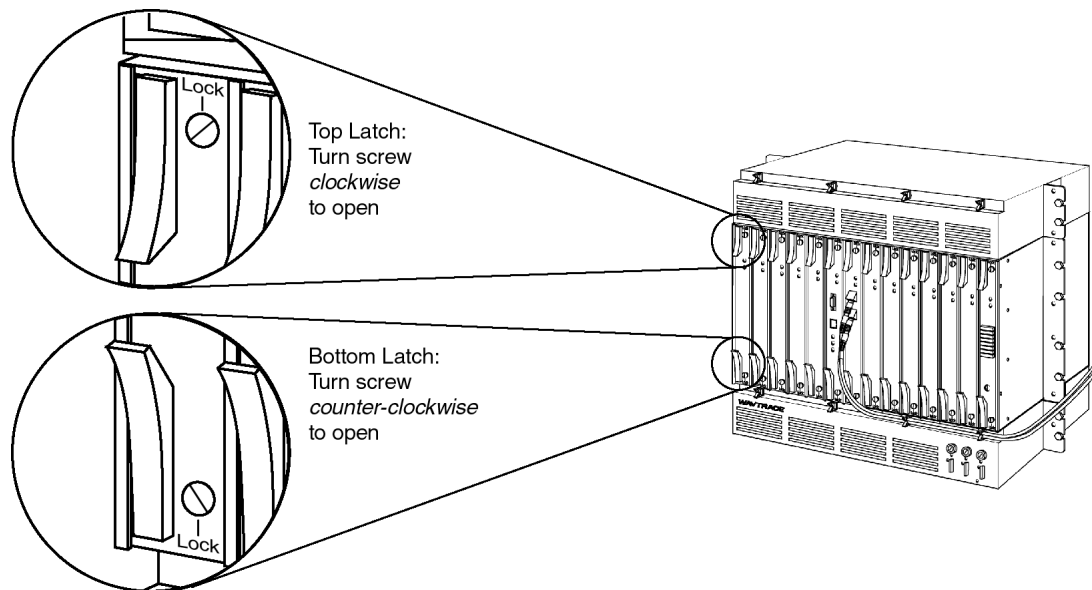


Figure 25 PCA Installation

Ground the Hub IDU

There are two methods for grounding the hub IDU.

When the rack is grounded, the hub IDU ground is through the mounting brackets to the rack.

When stand-alone, or if the rack is not grounded, use the following procedure:

- 1 Attach a lug to one end of a 6AWG green stranded wire and secure it to back of the hub IDU at the stud located at the top right of hub IDU (see Figure 26).
- 2 Gauge the green wire length by running wire to the hub indoor ground bar.
- 3 Secure the green wire to the hub indoor ground bar.

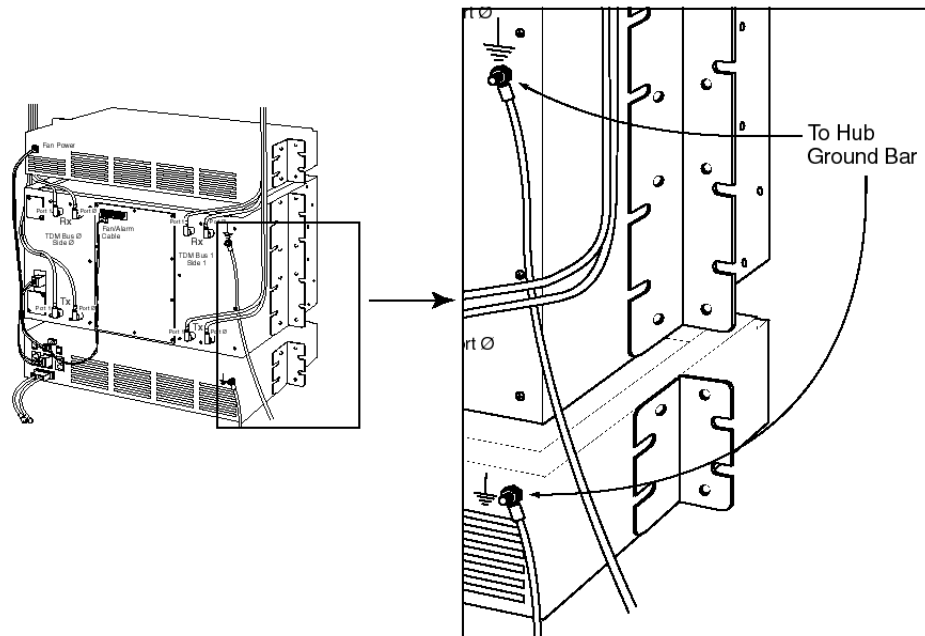


Figure 26 Hub IDU Grounding

Verify the Rack Power

- 1** Locate the red and black leads on the back of the IDU. Verify that the leads are separated and not touching a grounded location.
- 2** Connect meter leads using alligator clips or a device that allows you to separate the leads without shorting them together or holding them with your hands.
- 3** Apply power to the IDU.
- 4** Verify $-48\text{ Vdc} \pm 10\%$ on the battery or power supply.

Connect Power to the Hub IDU

Caution



Verify power is off to the power supply before connecting to the power distribution plenum.

- 1 Remove the Shelf 2 fuse from the Power Distribution Plenum.
- 2 Connect red and black leads from power supply after verifying that there is -48Vdc . If you need to extend lead lengths, use 12AWG red and black wire respectively.

Dress the excess cable length to eliminate any chance of a possible short in the future or at power-up sequence.

- 3 Reinstall the Shelf 2 fuse.

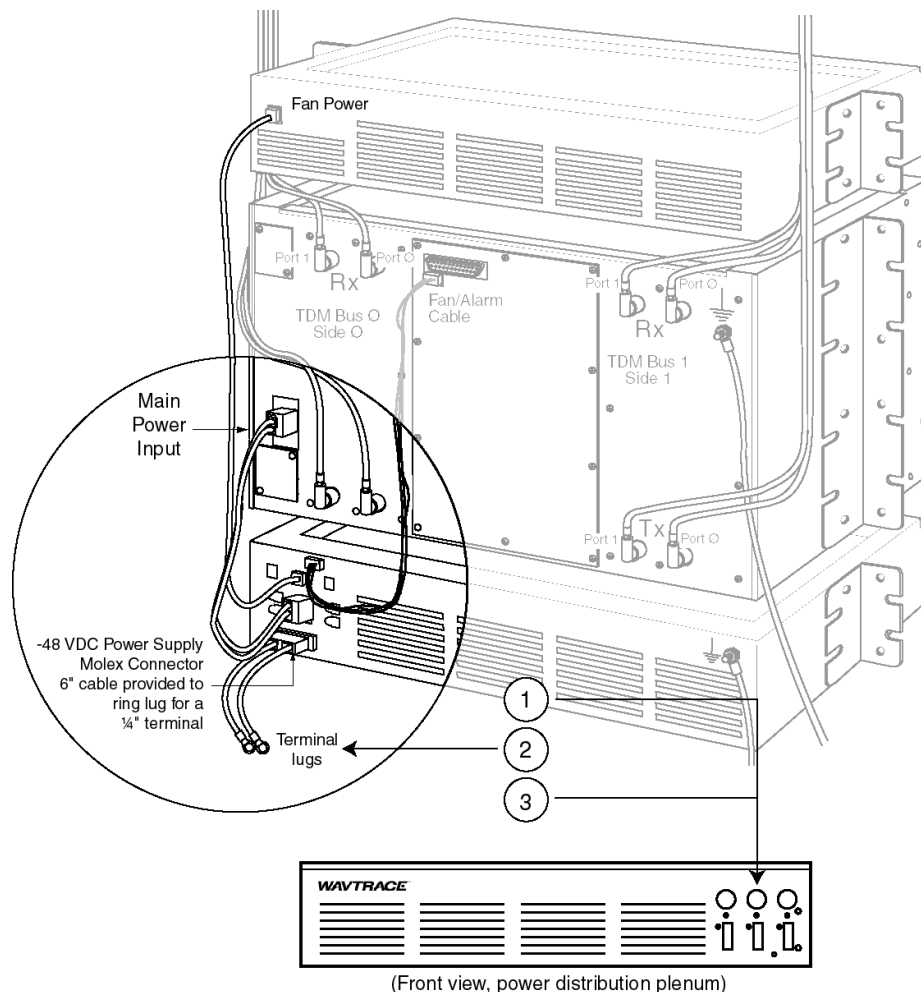


Figure 27 IDU Power Connections

Connect the Hub IDU Cabling

- 1 Connect the Rx cable to far-left side, top Rx connection.
- 2 Connect the other end of the jumper to a surge protector on the internal ground bar.
- 3 Connect cabling to the other end of the surge protector to ground on the ODF.
- 4 Connect cabling from the surge protector to the ODB Rx connector.
- 5 Repeat the preceding steps for the Tx line.
- 6 Connect cabling from the ODB output ports (labelled A–F) to the input of each TRA.

Each IDU has four Tx cables and four Rx cables, supporting a full system with four ODBs.

Each ODB supports six TRAs. There is one Tx and one Rx cable per ODB.

Caution

If the power supply or –48 Vdc is applied to the hub assembly, then the cables have –48 Vdc applied to them. Care should be taken when connecting cables to not ground the system and blow fuses in the hub assembly. See Figure 29.

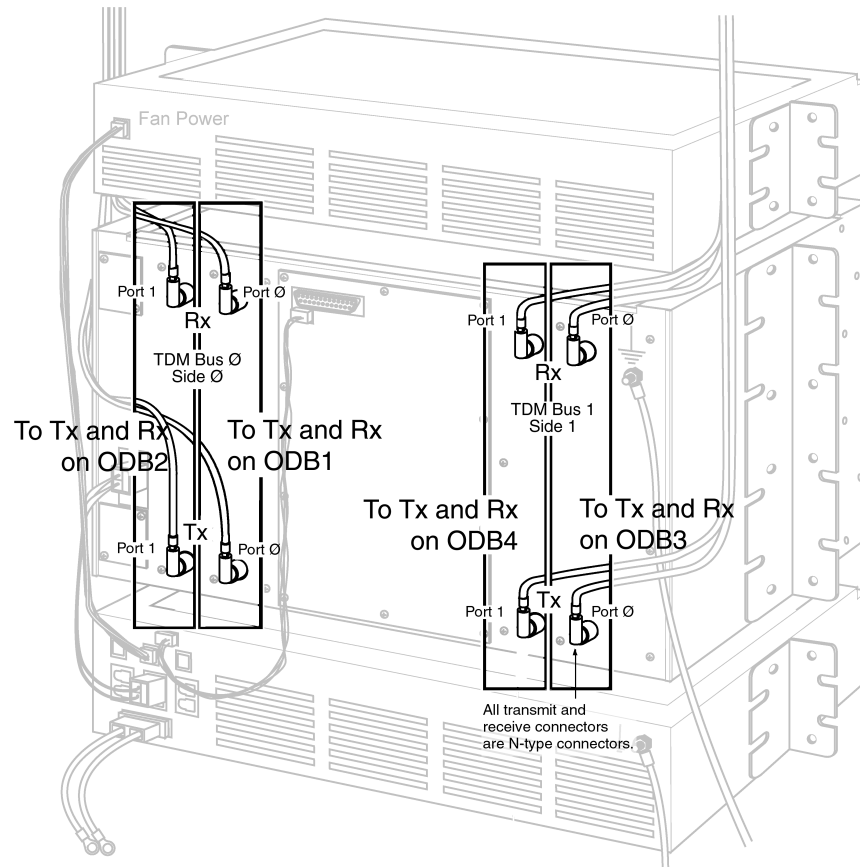


Figure 28 IDU Signal Connections

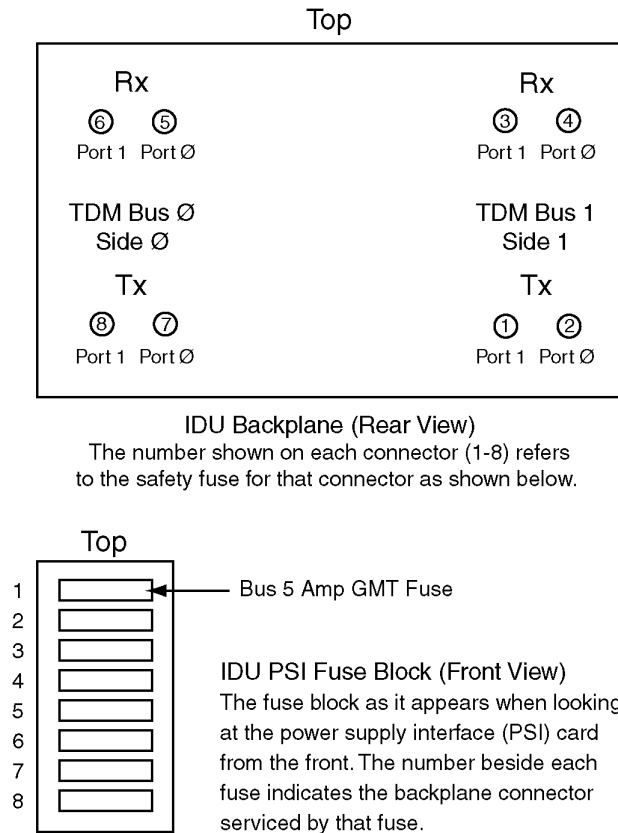


Figure 29 PTM 1000 IDU Fuse Diagram

Power On Self Test (POST)

Apply power to the IDU and verify the condition of the lights on the PCAs in sequence during the POST:

- 1** Initial power on:
 - MCA PCA – red and green
 - IMP PCA – red and green
 - Net PCA – red and green
 - PSI PCA – red only
 - IFD PCA – no lights
 - All the alarm lights
- 2** The alarm lights extinguish.
- 3** All red lights extinguish, and all the green lights stay on, including the IFD and PSI PCAs. The POST is complete.

Connect the External Equipment

Once the IDU self-tests are complete, remove power and connect the following:

- 1** Connect the Ethernet cable to the indoor module processor (IMP) PCA.
- 2** Connect the OC-3 cable to the network interface (NET) PCA.
- 3** Connect the customer signal and alarm equipment.

Installing the Remote ODU

Indoor use

The remote ODU can be mounted indoors with the antenna aimed through a window. The glass will attenuate the signal. The amount of attenuation depends on the type of glass.

- Double pane glass, uncoated: 10 dB
- Low emission glass: 20 dB

The range of the remote unit is reduced when used indoors. If the office glass is low emission glass, the reduction in range may be significant.

Inspect and verify the equipment:

- 1 Verify that the equipment and hardware matches the packing list.
- 2 Inspect the equipment for shipping damage.

Install the Remote ODU

- 1 Place a U-bolt around the pole through holes in the ODU assembly.
- 2 Place flat washers on the U-bolt.
- 3 Loosely tighten nuts on the U-bolt.
- 4 Repeat with the other U-bolt.

Installing the Remote IDU

Inspect and verify the equipment:

- 1 Verify that the equipment and hardware matches the packing list.
- 2 Inspect the equipment for shipping damage.

Install the Remote IDU

- 1 If rack mounted, install with the brackets and screws provided; otherwise, set on a shelf or desk. Refer to the Site Survey for specific mounting characteristics.
- 2 Ground the IDU by connecting 12AWG (THHN, green) wire to the mounting brackets.

Connect the Remote IDU Cabling

- 1 Connect the AC power cord to the plug inlet on the back of the IDU.
- 2 Gauge the cable length for the power/signal cable by running it up to the ODB.
- 3 Connect the power/signal cable to the TRA on the ODB.

Remote Antenna Alignment

Both the remote IDU and ODU are part of the alignment procedure.

At the Remote IDU

- 1 Verify that the hub is configured.
- 2 Connect the laptop console to the MCA DB-9 connector on the front panel of the IDU.
- 3 Start a HyperTerminal session with the following settings:
 - baud rate 38,000
 - 8 data bits
 - no parity
 - 1 stop bit
 - no flow control
- 4 Type `doReg`.
- 5 Type `doBchan`.
- 6 Type `lockNode`. These commands enable the messaging for statistics. Statistics enable the operator to monitor airlink performance.
- 7 Type `alignRemoteAntenna`.

At the Remote ODU

- 1 Remove the cover from the TRA data port.
- 2 Connect a DMM and a serial cable to the antenna alignment box (Wavtrace). Set the DMM to the 9.9Vdc range.
- 3 Connect the other end of the serial cable to the TRA data port.
- 4 Check that the fine azimuth adjustment knob is set approximately at midpoint.
- 5 Loosen the coarse azimuth adjustment screws and move until reaching the peak RSSI voltage on the DMM.

When the voltage exceeds +5Vdc, the DMM should show a sudden drop in voltage. Continue to align the antenna until the voltage peaks at approximately +2 to +3Vdc.

If the +5Vdc voltage drops off slowly, the antenna is out of azimuth.

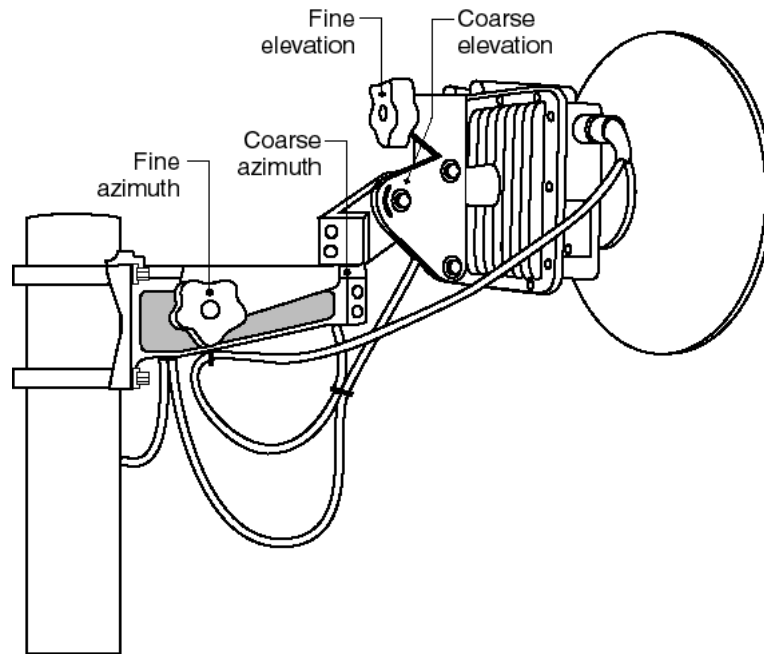


Figure 30 Remote ODU Adjustment Screws

- 6 Tighten the azimuth screws, loosen the coarse elevation screw and move until reaching the peak RSSI voltage on the DMM.
- 7 Loosen the top elevation screw and adjust the fine elevation knob until reaching the peak RSSI voltage on the DMM.

Back at the Remote IDU

- 1 Type `alignRemoteAntennaDone`.
- 2 Verify that the airlink reactivates by checking statistics. The operator will see the following text: **syncOK=100**.
- 3 Check the RSSI and readjust the alignment if necessary.
- 4 Verify that the airlink is still active by checking the CTN and RSSI values.
- 5 Remove the console connector from the DB-9 connector.
- 6 Disconnect the DMM at the remote ODU, and reinstall the TRA data port cover.

Caution



Be sure that the rubber gasket is intact and placed properly before reinstalling the TRA data port cover. Water may enter the TRA data port if the gasket is compromised.

Connect External Equipment

- 10Base-T on front panel RJ45 connector.
- T-1 connections on the front panel DS1 RJ45 connectors.

Chapter 5

Testing

This chapter to be added at a later date.

