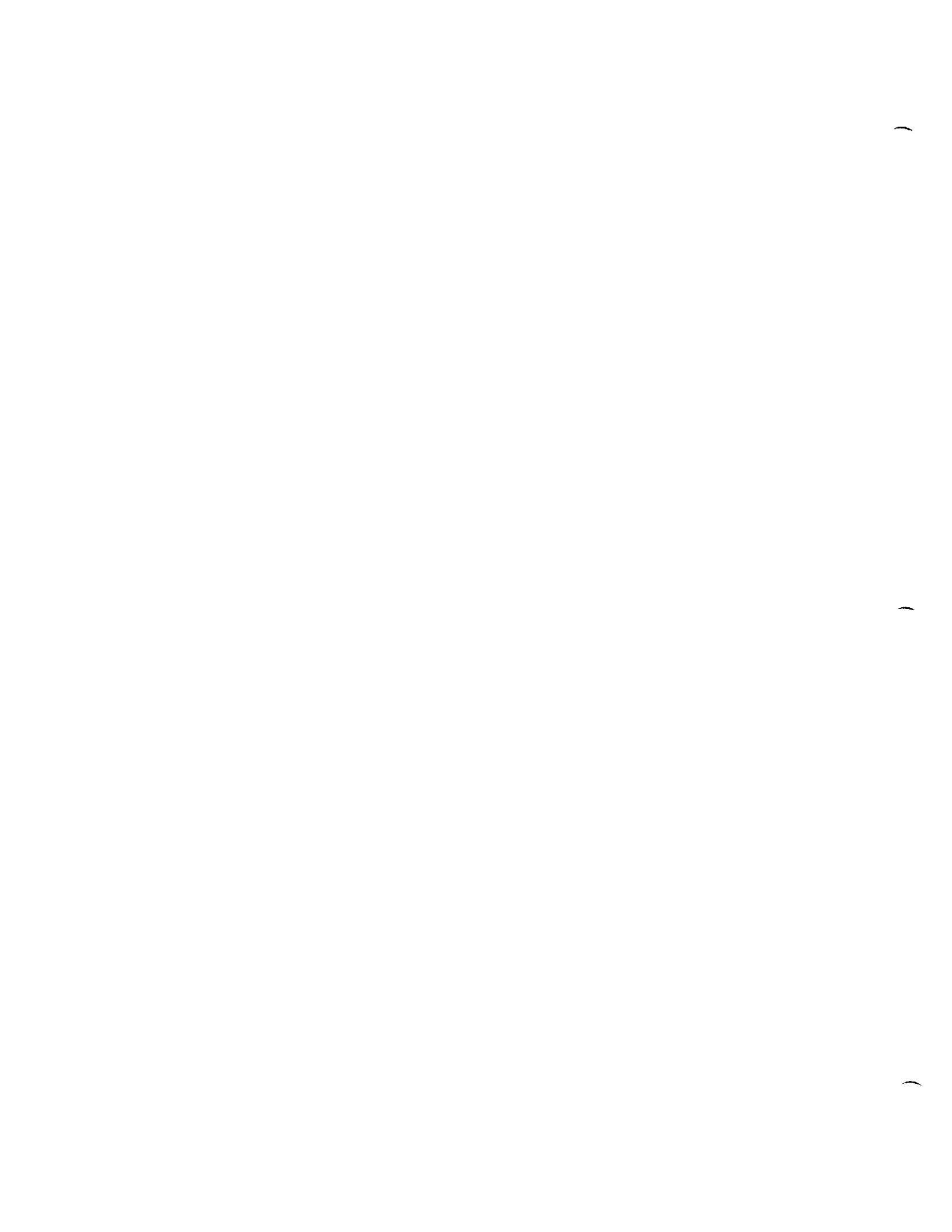


**EXHIBIT 3 CFR 47, Part 2.1033, c(3)**

**THE INSTALLATION AND OPERATING INSTRUCTIONS**

A copy of the installation and operating instructions is attached.

---



## Chapter 2. Installation

### 2.1 Introduction

The SPECTRUM II microwave radio system is designed for ease of installation and operation. The Outdoor Unit (ODU) is designed to either be mounted directly to antenna on an antenna mount assembly, or be mounted remotely from the antenna. The antenna mount assembly is designed for a round pipe mounting. The pipe mounting can be a right-hand or left-hand orientation, which is explained in sections 2.4.3 and 2.4.4.

The Indoor Unit (IDU) is designed to be mounted in a standard 19-inch EIA relay rack in a sheltered environment. Site survey considerations, unpacking, checking equipment, installation instructions and procedures for systems configured for both non-protected and protected operation, and envelope drawings are provided in this chapter.

### 2.2 Site Survey Prior to Equipment Installation

Prior to the installation of a microwave system, the installation site must be surveyed. Refer to Table 2-1 for a list of typical site considerations. Table 2-1 is not intended to replace or to be used in lieu of a site survey. It is intended to be used as a reference for the installing engineer.

**NOTE**

*If a question should arise as to the appropriateness or adequacy of the installation site, path analysis, or any other questions regarding the installation site, contact the local Digital Microwave Corporation representative.*

**Table 2-1. Site Survey Considerations - Reference Only**

Consideration	Description
<b>Signal Path</b>	The distance between radio terminals, referred to as the link, is dependent upon several factors. Refer to a detailed path analysis for the geographic area considerations. The signal path must be unobstructed line-of-sight. Even partial obstructions such as power lines will reduce the effective range of the radio link or hop. The system is compact enough to be installed at an inside location. See the "Through-Glass Operation" section below.
<b>Weather</b>	Climatic conditions in the signal path can affect the effective range of the link.
<b>Interference and Frequency Selection</b>	The SPECTRUM II operating frequency can be easily changed to the licensed frequency, within the operating frequency band and receive filter tuning range of the system, during system installation. The licensed transmitting and receiving frequencies of the radios in a link are chosen so that interference from/to other installations is kept to a minimum. Refer to Appendix B for instructions on using the LMT to select standard or custom channels.
<b>Antenna Polarization</b>	A typical SPECTRUM II System installation uses vertical polarization of the signal at the antenna. In those rare instances when a horizontally polarized signal is required, due to the probability of interference from other signals, an optional radiation polarization assembly may be installed with the antenna when the antenna is installed. Refer to the installation procedures included with the antenna for installing the polarization rotator kit (ordered separately).
<b>Mounting Provisions</b>	The antenna mount, where the antenna and ODU are attached, is designed for a round-pipe type mounting with a diameter of 7.3 cm (2.875 in.) through 11.4 cm (4.5 in.). The mount is designed so that it can be mounted to the pipe with a RH or LH offset, as viewed when facing the waveguide port of the antenna. The IDU is designed for a standard 19 in. (48.26 cm) EIA relay rack.
<b>Optional Antenna Mounting</b>	Digital Microwave Corporation offers optional wall and remote pipe mounting configurations. Contact the nearest Digital Microwave Corporation representative for more information.
<b>System Power Requirements</b>	±19.2 to ±57.6 volts DC.

Table 2-1. Site Survey Considerations - Reference Only (Continued)

Consideration	Description
<b>Through-Glass Operation</b>	The SPECTRUM II System is designed as a compact, easily portable system and can be installed in an inside (office) location. If the system is installed in an inside office and the signal is to be radiated or received through a glass pane, the glass should be free of lead or other metallic material and should have no metallic covering or film installed on the glass. Metallic material in the glass or on the glass as a film will severely attenuate the signal strength, both transmit and receive, and may cause errors in both data and voice transmissions. Consult the building manager for specifications of the window glass, and for the use of RF in the proposed installation.
<b>Grounding of Equipment</b>	Grounding of equipment is to be in accordance with all applicable local ordinances and guidelines. Digital Microwave Corporation recommends connecting a ground wire from the ground studs located on the front panel of the IDU and the housing of the ODU, to a suitable earth or station ground point.

## 2.3 Equipment Preparation Prior to Equipment Installation

### 2.3.1 Unpacking Equipment

The system units and installation kits are packaged for easy handling and unpacking. When opening the shipping boxes or crates, care should be taken so as not to nick or otherwise mark the equipment. The tools required for unpacking the system equipment are as follows:

- Utility knife
- Flat blade screwdriver
- Clean, flat working surface

Open the shipping containers, carefully remove the equipment and place on a clean, flat working surface. Save the shipping and packing material for the unlikely event that the equipment will have to be returned.

### **2.3.2 Checking Equipment**

Once the equipment and installation kits are removed from the shipping containers, check the equipment and installation kits against the packing list enclosed with the equipment to ensure that the equipment part numbers, parts, and ancillary equipment included in the shipment match the part number and quantity specified on the packing list. In the unlikely event that a discrepancy should exist between the packing list and the equipment and/or parts shipped, contact the nearest Digital Microwave Corporation representative.

With the equipment placed on a clean flat surface, visually inspect the equipment for any type of shipping damage. If damage is observed, contact your nearest Digital Microwave Corporation representative for repair or replacement instructions.

### **2.4 System Installation - General**

Refer to Table 2-2 for a list of equipment, parts, and materials in the installation kit that is shipped with each system. The contents of the installation kit will vary depending upon the configuration of the system. Refer to the packing list enclosed with the shipment for a complete list of equipment, parts, and materials.

Refer to Table 2-3 for a listing of optional parts and material that may be ordered from DMC. Refer to Table 2-4 for a listing of additional tools and equipment that you will need to provide for the installation.

Table 2-2. Installation Kit Contents

Part Number	Description	Where Used
007-500977-015	Site configuration label	Configuration label installed on the IDU or IDU PIU.
006-301470-001	Washer, M10, split-lock, SS (4ea)	Used with screw 006-303470-025M to secure the ODU to the antenna mount.
006-310470-001	Washer, M10, flat, SS (4ea)	Used with screw 006-303470-025M to secure the ODU to the antenna mount.
006-303470-025M	Screw, M10X25MM, SS, hex head (4ea)	Used to secure the ODU to the antenna mount.
006-390000-014	Pin, quick release, 3/16x2, 6 in. lg. (1ea)	Inserted into the housing of the ODU when the cover is open to prevent the cover from closing inadvertently and causing injury or equipment damage.
011-300000-001	Silicone grease, 1 oz., DC-4 (1ea)	Used on the O-rings on the slip-fit connectors on the antenna and the ODU.
035-390000-005	Vapor-wrap (1ea)	Additional weatherproof protection for TNC connector(s) on the ODU.
033-321412-001	Receptacle, 1x4, 200SP, C/E (1ea)	Connector for primary power to the IDU.
037-501930-001 (See Note)	Protection Cable	Connects the PROTECTION ports of two 1U IDUs when two 1U IDUs are configured for protected operation.
037-502017-050 (See Note)	DMC Net Bridging Cable	Connects between the O & M ports of two 1U IDUs when two 1U IDUs are configured for protected operation.
037-501961-001 037-502059-020 037-502020-001 037-502042-001 037-502139-001 076-330400-001 (See Note)	DB-25 "Y" Cable BNC "Y" Cable LEMO "Y" Cable BT-43 "Y" Cable DS1 "Y" Cable DS3 "Y" Cable	Connects between the IN or OUT ports of the two 1U IDU protected configuration. Connects to user termination equipment.  Only one of the listed cables is supplied depending on the data rate configuration of the system. The exception is the 1xDS3+1xDS1 which uses two "Y" cables.
039-361312-001	TNC male crimp connector, Belden 9248	Used for connection of coax cable between the ODU and IDU.

Note: Supplied with systems configured for protected operation with two 1U IDUs.

**Table 2-3. Optional Installation Materials  
 (Ordered Separately)**

Part Number	Description	Where Used
<b>182-620023-001</b> (RG-6) or <b>182-620023-002</b> (RG-11)	Installation Tool Kit	Used to install the SPECTRUM II microwave radio system. Includes: <ul style="list-style-type: none"> <li>• Crimp tool (RG-6 or RG-11) (1ea)</li> <li>• Test cord, BNC-Banana (for connection between the RSSI connector on the ODU and a voltmeter to check RSSI or AGC voltage of the terminal) (1ea)</li> <li>• Washers (M10, split-lock, SS) (25ea)</li> <li>• Washers (M10, flat, SS) (25ea)</li> <li>• Screws (M10X25MM, SS, hex head) (25ea)</li> <li>• TNC male crimp connectors (RG-6 or RG-11) (8ea)</li> <li>• Vapor-lock connector protection (4ea)</li> <li>• 1X4 receptacles (4ea)</li> </ul>
<b>037-501956-001</b>	Cable Assembly, EOW, SP2 (optional)	Used for connection between the EOW connector of one link to the EOW connector of another link, daisy-chaining the links. This cable for use on systems configured with a 1U IDU or 4U IDU.
<b>037-501957-001</b>	Cable Assembly, Alarm, SP2 (optional)	Used for connection between the ALARM connector of the IDU and user equipment. This cable for use on systems configured with a 1U or 4U IDU.
<b>037-501954-001</b>	Cable Assembly, EOW Protected (optional)	Used for connection between the connectors of two 1U IDUs and to the EOW connector of another link, daisy-chaining the links. This cable for use on systems configured with two 1U IDUs.
<b>037-501955-001</b>	Cable Assembly, Alarm Protected (optional)	Connects between the ALARM ports of two 1U IDUs when two 1U IDUs are configured for protected operation. Connects to user termination equipment.
<b>039-341312-003</b>	BNC male crimp connector, Belden 9248, 75 ohm (optional)	Used for the optional BNC coax cable connection from the ODU to the IDU or with IDUs configured with BNC IN and OUT tributary connectors.
<b>186-161006-001</b> <b>186-161006-002</b> <b>186-161006-003</b>	Lightning Arrestor Kits: IDU, RG-6 Cable IDU, RG-11 Cable ODU, Generic	Protects equipment against voltage surges due to lightning strikes. Both an IDU and ODU kit are recommended for maximum system protection.



Table 2-4. Installation Tools and Test Equipment  
(Supplied by Users)

Item	Description
1	11 mm (or 7/16-in.) end wrench or nut driver
2	14 mm (or 9/16-in.) end wrench or box wrench
3	19 mm (or 3/4-in.) end wrench or box wrench
4	Torque wrench, 27 Newton-meters (20 foot-pounds)
5	14 mm (or 9/16-in.) crow-foot wrench adapter or socket for torque wrench
6	3/32-in. hex (Allen-head) driver
7	Screwdriver, No. 2 Phillips
8	Screwdriver, No. 2 flat blade (common)
9	Volt-ohm meter for measuring RSSI (receive signal strength indicator) voltage during antenna alignment and checking for a short between the conductor and shield when making cables.
10	Portable IBM personal computer (PC) or compatible computer, 386 or higher with at least 4 MB of RAM, Microsoft Windows 3.1 <sup>®</sup> or higher installed, VGA graphics, one free COM port, keyboard interface, and keyboard. Mouse is recommended.
11	Local Maintenance Terminal (LMT) Software and Cable Kit (P/N 182-620019-001).
12	Telephone with FCC Class B electronic ringer, cable and RJ-11 modular telephone connectors at each end. Used for communicating over the engineering order wire (EOW) only if voice EOW is to be used.
13	Pattern generator/checker (optional)

### 2.4.1 Operational Switch Settings Prior to IDU Installation - Unbalanced Input (75Ω) Configuration Only

Operational switches are installed in ITU-T systems configured for 75Ω unbalanced tributary inputs. The switches are used to match the grounding of the tributary connectors in the IDU to the grounding of the tributaries in the user's equipment. The operational switches on the 1U IDU or 4U IDU are shipped from the factory in the OFF or ungrounded (AC ground) position. You need to determine whether your equipment is AC or DC grounded and change the SPECTRUM II operational switches if necessary. If the grounding of your equipment is unknown, use a voltmeter to check for a voltage potential between the terminal grounds of the SPECTRUM II and your equipment. If a potential exists, the settings of the operational switches should be changed to DC grounded.

Grounding of one side of the 75Ω unbalanced inputs is accomplished by setting the appropriate operational switches to the ON or grounded position (DC ground). Refer to Table 2-5 for a 1U IDU and 4U IDU Operational Switch/Input Channel Correspondence. Refer to Figure 2-1 for the location of the operational switches. The following paragraphs describe how to access and set the operational switches for the 1U IDU and the 4U IDU Assembly.

**Table 2-5. IDU Operational Switch/ Input Channel Correspondence**

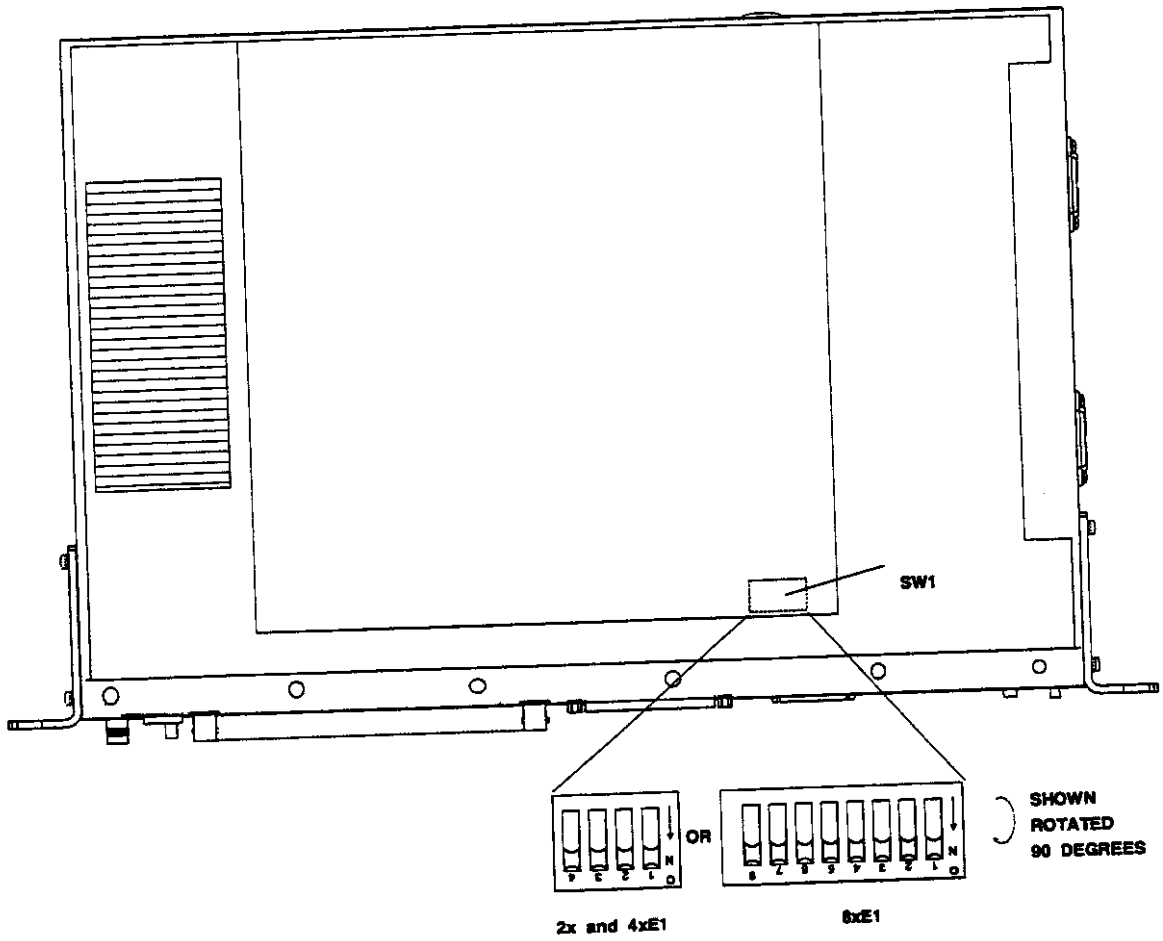
IDU	Configuration	Switch/ Input Channel Correspondence
1U	2xE1	SW1-3 = input channel 1; SW1-4 = input channel 2
1U	4xE1	SW1-1 through SW1-4 correspond to input Channels 1 through 4
1U	8xE1	SW1-1 through SW1-8 correspond to input Channels 1 through 8
4U	16xE1	SW2-1 through SW2-8 correspond to input channels 1 through 8; SW3-1 through SW3-8 correspond to input channels 9 through 16

#### 2.4.1.1 Operational Switch Access and Setting, 1U IDU

To access and set the Operational Switch (SW1) on the 1U IDU, refer to Figure 2-1, Part A, and perform the following steps:

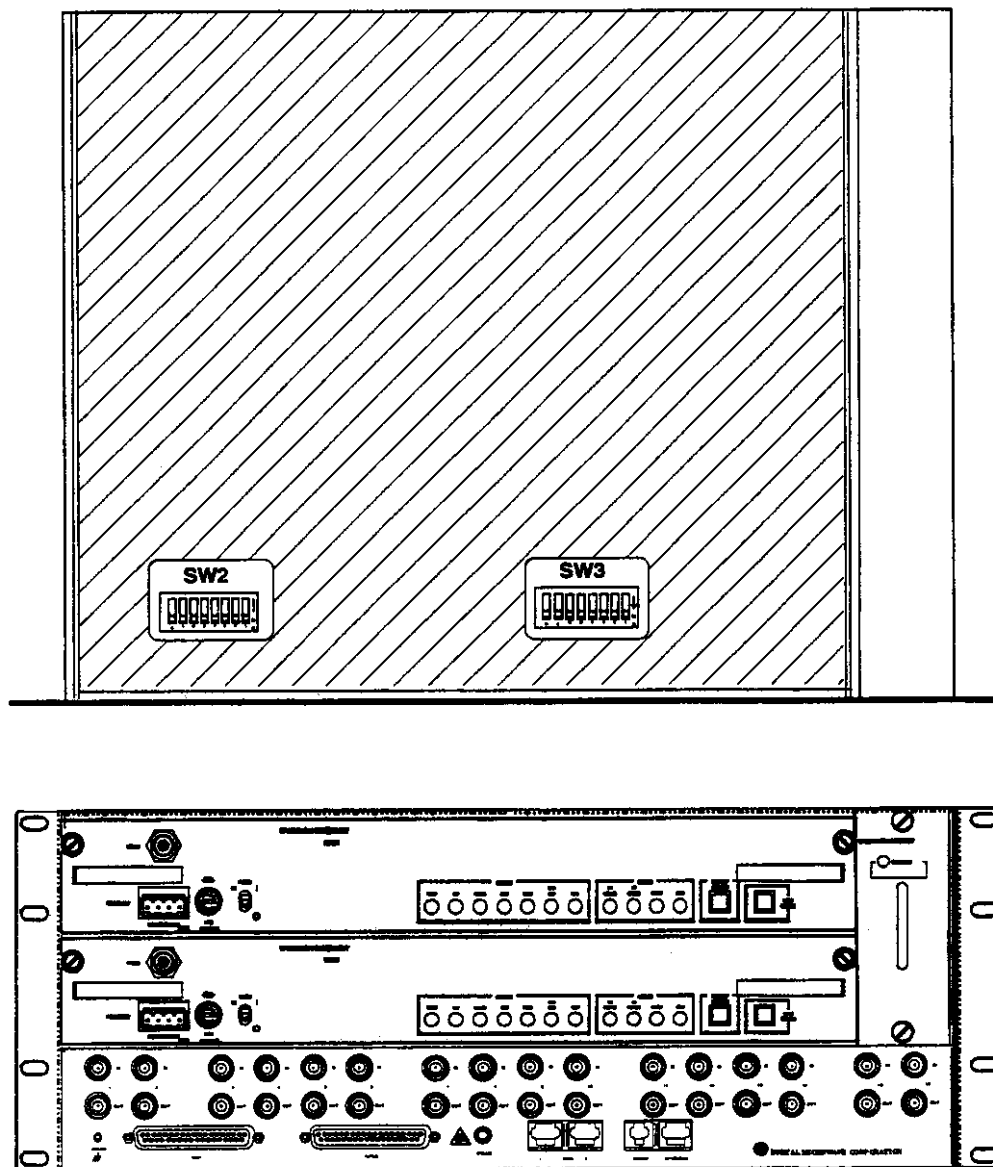
**CAUTION** *Proper ESD (electrostatic discharge) procedures must be followed whenever the cover of the 1U IDU is removed to avoid damage to internal circuitry due to an inadvertent static discharge.*

1. Power-off the system if it has been powered-on.
2. With a Phillips head screw driver remove and save the screws securing the top cover to the unit.
3. Remove the top cover from the unit by lifting the cover straight up.
4. Locate the Operational Switch, SW1.
5. Refer to Table 2-5 for switch position to channel correspondence for the input channels.
6. With an "orange stick," or other non-conductive material, set the switch positions to the appropriate position.
7. Install cover removed previously.
8. Install and tighten screws removed previously.



**Part A - 1U IDU Operational Switch Location**

**Figure 2-1. IDU Operational Switch Locations  
(Sheet 1 of 2)**



*Notes:*

1. Access to SW2 and SW3 is through the front panel opening of the IDU assembly when the two IDUs are removed.
2. Though one type of tributary (customer input/output) connector is shown here, four types are available. See Figure 1-3, Parts F through I in Chapter 1 for illustrations of various connectors.

**Part B - 4U IDU Assembly Operational Switch Locations**

**Figure 2-1. IDU Operational Switch Locations  
(Sheet 2 of 2)**

### 2.4.1.2 Operational Switch Access and Setting, 4U IDU Assembly

To access and set the Operational Switches (SW2 and SW3) on the 4U IDU Assembly, refer to Figure 2-1 Part B and perform the following steps:

1. Power-off the system if it has been powered-on.
2. Loosen the captive screws on either side of IDU PIU "A" (top PIU) until completely disengaged.
3. Locate the ejector levers located on either side of the PIU.
4. With a smooth even pressure, lift the ejector levers to the eject position, approximately perpendicular with the front panel of the PIU.
5. Pull the PIU straight out and place on a clean dry surface.
6. Perform the above listed steps to remove IDU PIU "B" (bottom PIU) if the system is configured with two PIUs for protected operation.

If you have a non-protected system, a blank panel will be in the PIU "B" position. Loosen the two captive screws on either side of the panel and remove it.

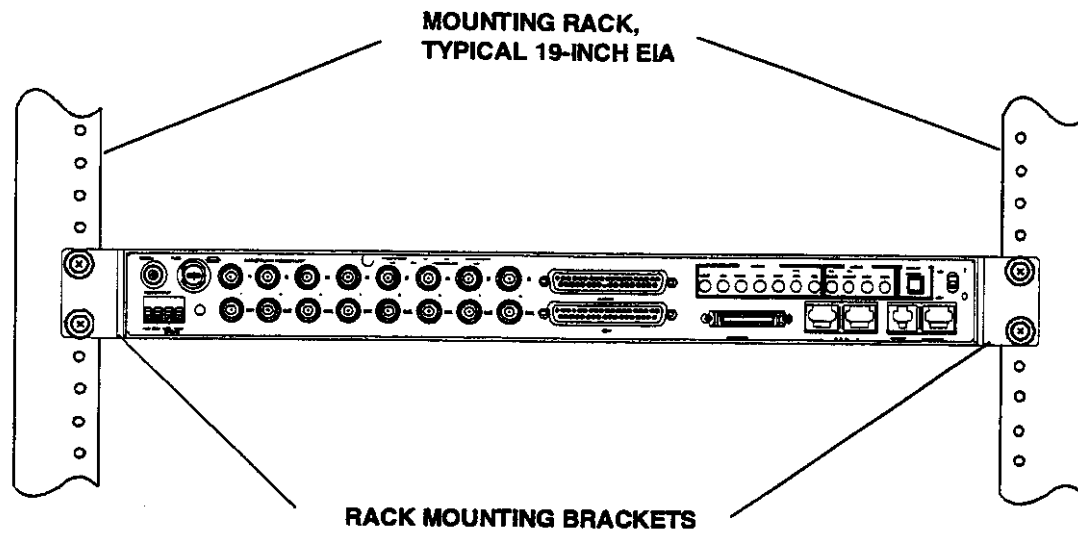
7. With an "orange stick," or other non-conductive type of material, set the switches to the appropriate position.
8. Install the PIUs, or PIU and blank panel, removed previously and tighten the thumb screws.

### 2.4.2 IDU Installation

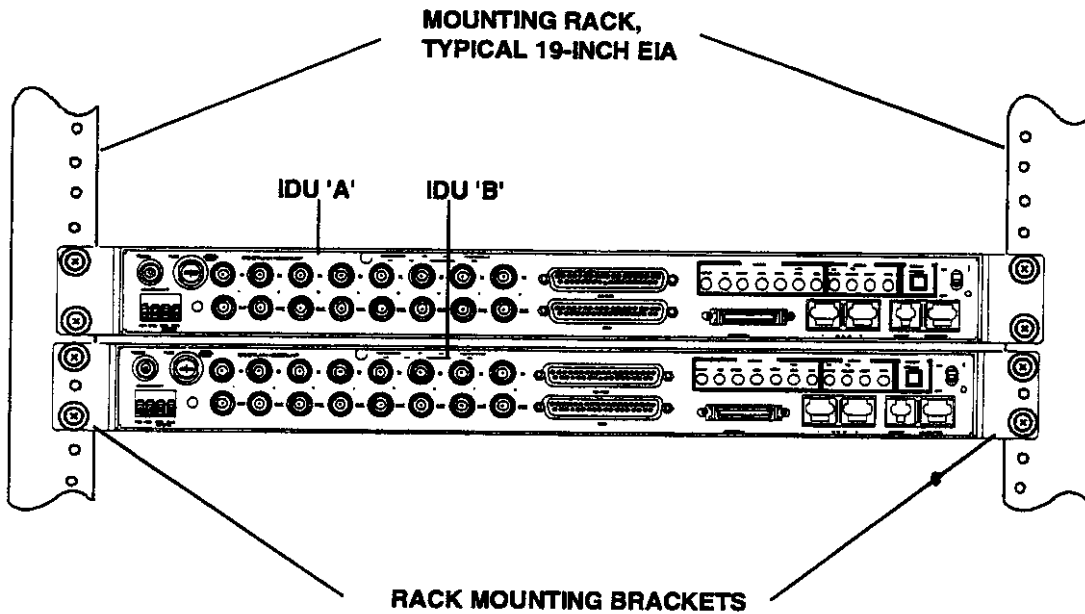
To install the IDU refer to Figure 2-2 and perform the following:

**NOTE** *If the system configuration is to be set in the IDU prior to system installation, refer to Setting System Configuration in Chapter 3 of this manual and perform the steps listed. If the system configuration is to be set after system installation proceed with the steps listed below.*

1. Locate the rack mounting screws and cup washers (not supplied by DMC).
2. Position the unit, or units if the system is configured with two 1U IDUs, in the rack and install the mounting screws and washers (not supplied by DMC).



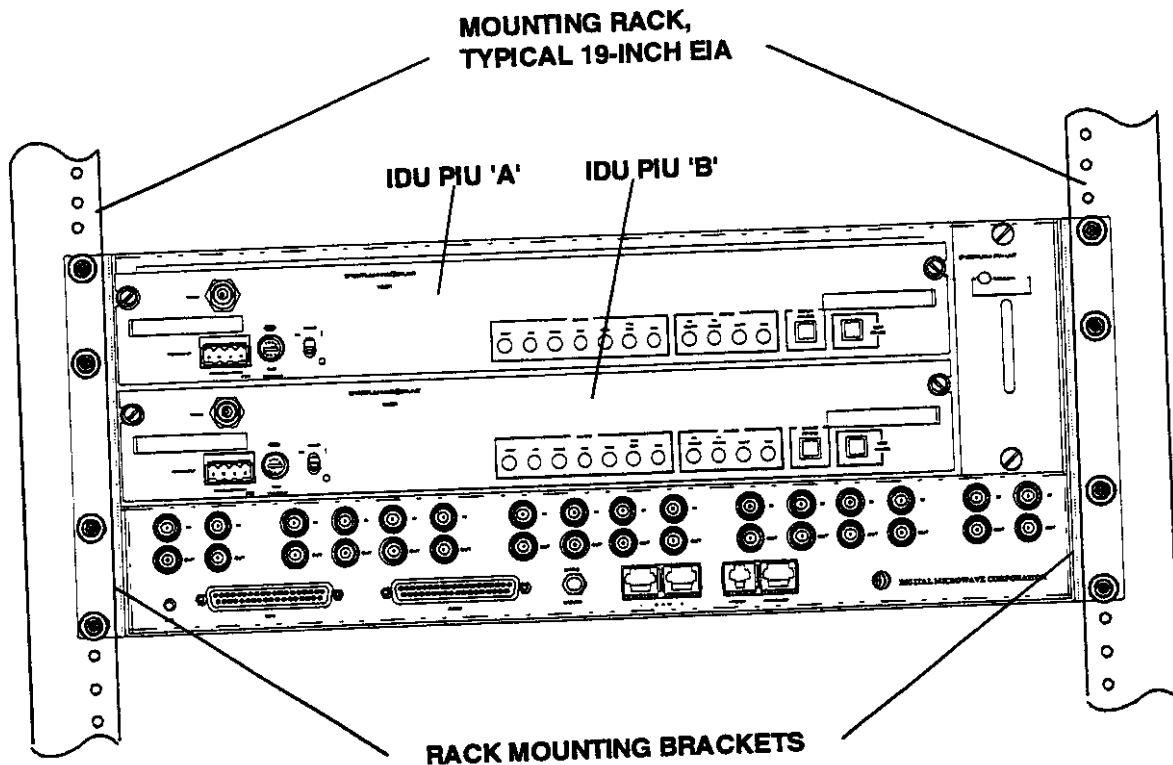
**Part A - 1U IDU Installation**



*Note: Though one type of tributary (customer input/output) connector is shown here, five types are available. See Figure 1-3, Parts A through E in Chapter 1 for illustrations of various connectors.*

**Part B - Two 1U IDUs, Configured for Protected Operation, Installation**

**Figure 2-2. IDU Installation (Typical)**  
(Sheet 1 of 2)



*Note: Though one type of tributary (customer input/output) connector is shown here, four types are available. See Figure 1-3, Parts F through I in Chapter 1 for illustrations of various connectors.*

### Part C - 4U IDU Installation

**Figure 2-2. IDU Installation (Typical)**  
(Sheet 2 of 2)

### 2.4.3 Antenna and Antenna Mount Installation

To install the antenna and antenna mount, perform the following:

1. Determine if the mount is to be installed with an RH (right-hand) or LH (left-hand) offset. The offset refers to the antenna being mounted to the right or left of the mounting pole, as viewed when facing the waveguide port of the antenna. See Figure 2-3.
2. Refer to the manufacturer's installation instructions included with the antenna and mount assembly and install the mount and antenna. The SPECTRUM II system may be configured with different manufacturers' antennas and mounts; as such the installation instructions included with the antenna and antenna mount may differ from one manufacturer to another.

### 2.4.4 Outdoor Unit Installation Procedures

There are two options for mounting the ODU: directly to the antenna, and independent (remote) from the antenna. The direct mount can be an RH or LH offset as discussed in the antenna mount section above. Direct or remote mounting requires different RF connectors for the antenna interface. These options apply to both protected and non-protected configurations.

- **Direct Mount** – The ODU mounts directly to the antenna on the mounting plate using the mounting ears on the side of the housing. See Figure 2-4 Part A. This can be an LH or RH offset mounting. See Figure 2-3. A slip-fit waveguide connector (supplied with the particular antenna selected) is used for the RF antenna interface. See Figure 2-5. The installation procedures are different for LH and RH mounting. The ODU comes from the factory configured for an RH installation. An LH installation requires relocation of connector locations and cable routing.
- **Remote Mount** – The ODU is mounted independent from the antenna on a pipe or to a wall. See Figure 2-4 Part B.

Mounting to a pipe can be accomplished by two methods:

- 1) Mounting the ODU to the same pipe as the antenna is mounted, or
- 2) Installing a separate pipe mounting kit specifically designed for the ODU remote mount.

Mounting the ODU to a wall can also be accomplished by two methods:

- 1) Fastening the pipe mounting kit to a wall using lag bolts or other suitable fasteners that can withstand the applied forces, or
- 2) The plates in the pipe mounting kit can be fastened directly to the wall with lag bolts or other suitable fasteners.

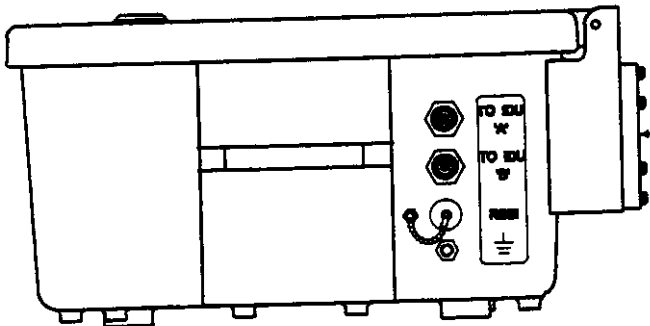
With either wall-mount method, the plates attach to the ODU by the four threaded holes in the rear surface.

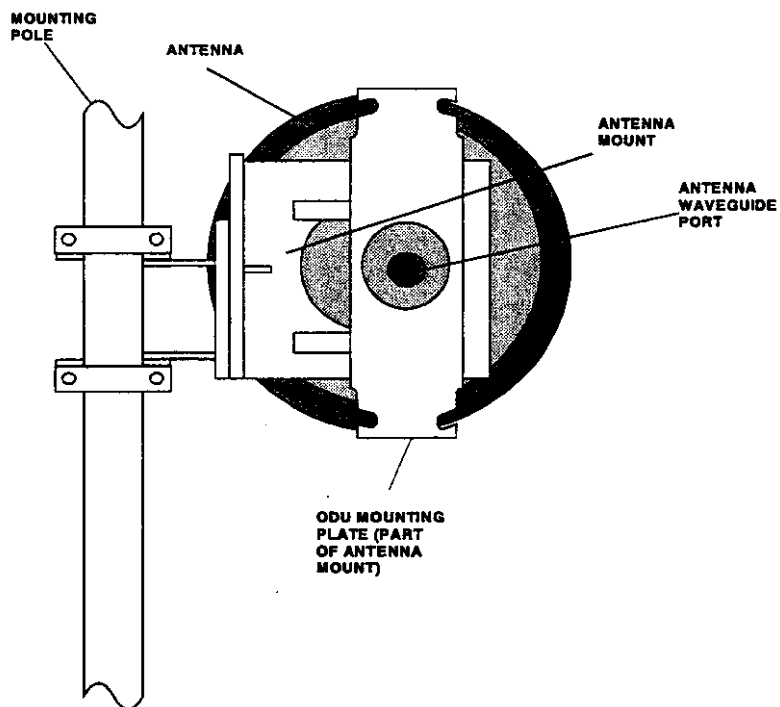


Flexible waveguide is used for the RF antenna interface with all remote mounting methods. See Figure 2-5. Flexible waveguide is available in 24", 30" and 36" (60.7cm, 76.2cm and 91.4cm) lengths.

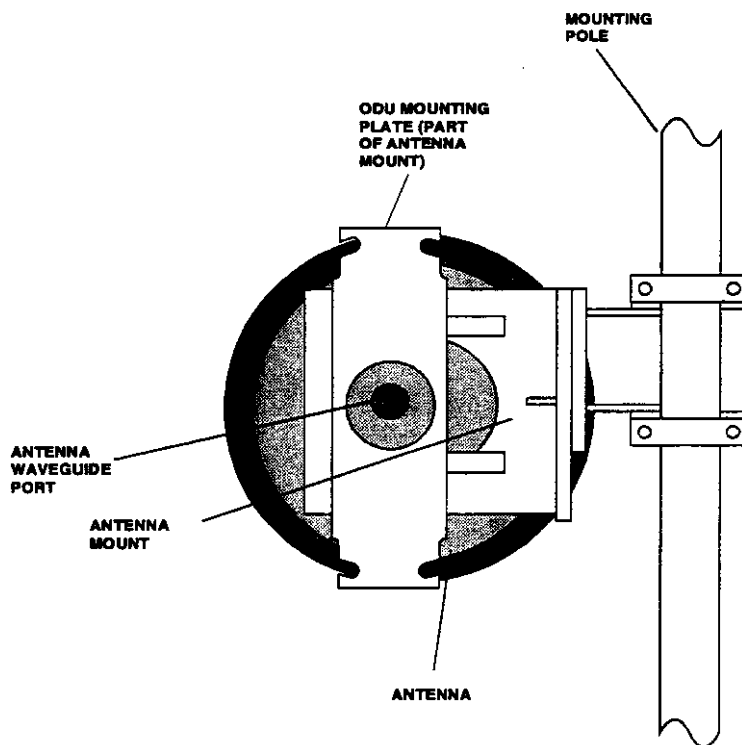
The following sub-sections provide instructions for the direct and remote mounting options. External electrical and RF connections to the ODU are described in Table 2-6.

Table 2-6. Outdoor Unit Connections

Connector Type	Description
TNC	Outdoor to Indoor Unit cable connector. Labeled "TO IDU 'A'" and "TO IDU 'B'" (protected configuration).
BNC	Connector provided for monitoring RSSI voltage during system set-up or system maintenance (provided in installation tool kit). Labeled "RSSI."
Waveguide Flange	Antenna to ODU interface. Waveguide types, and their flanges and screw sizes, vary with the frequency band of the radio. Contact the nearest DMC representative for details
Ground Lug	Connection to earth or station ground on tower or other mounting structure. Labeled $\equiv$ .
 <p style="text-align: right; margin-right: 50px;">WAVEGUIDE FLANGE</p> <p style="text-align: center;"><i>(Protected ODU shown)</i></p>	

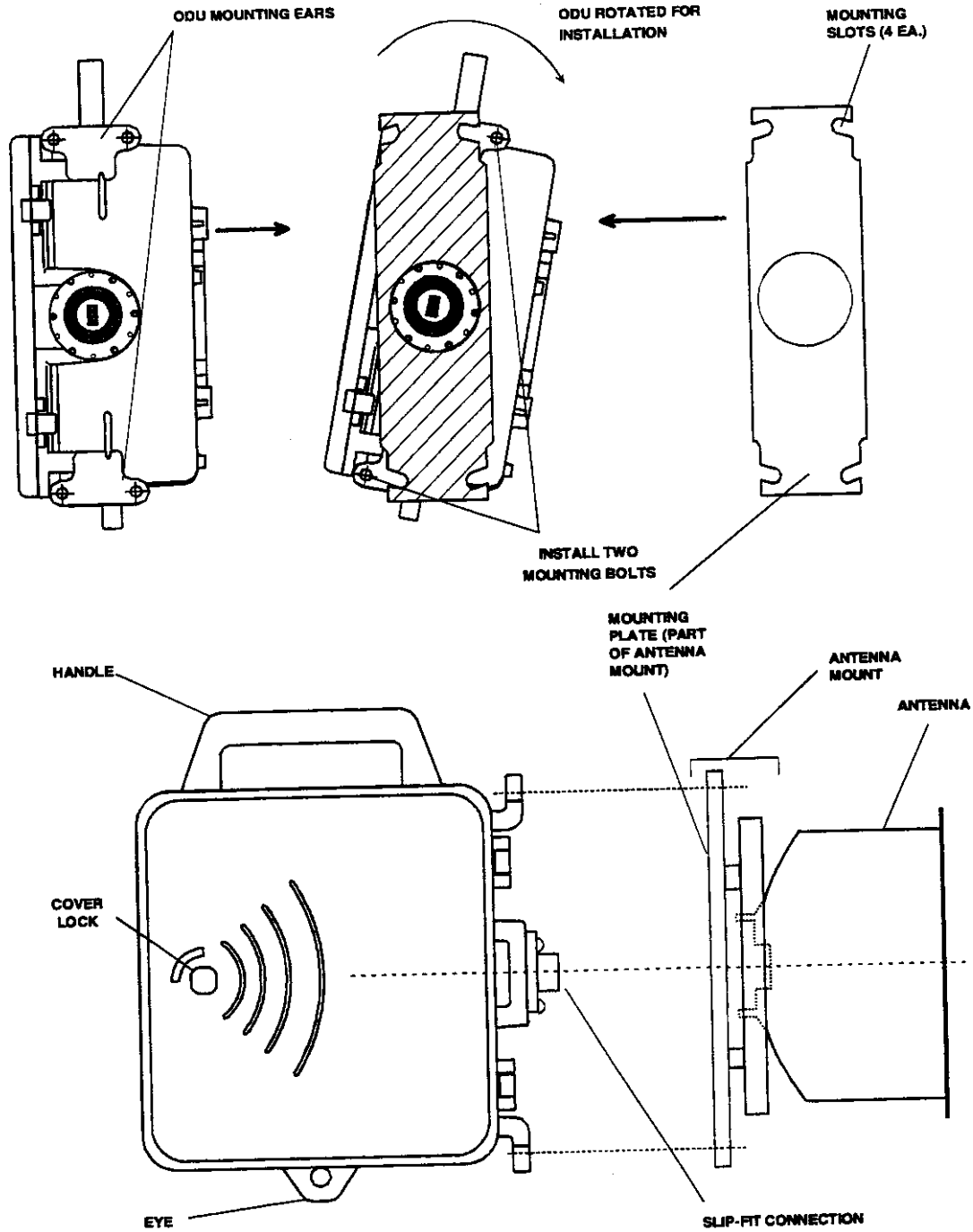


Part A. RH Offset



Part B. LH Offset

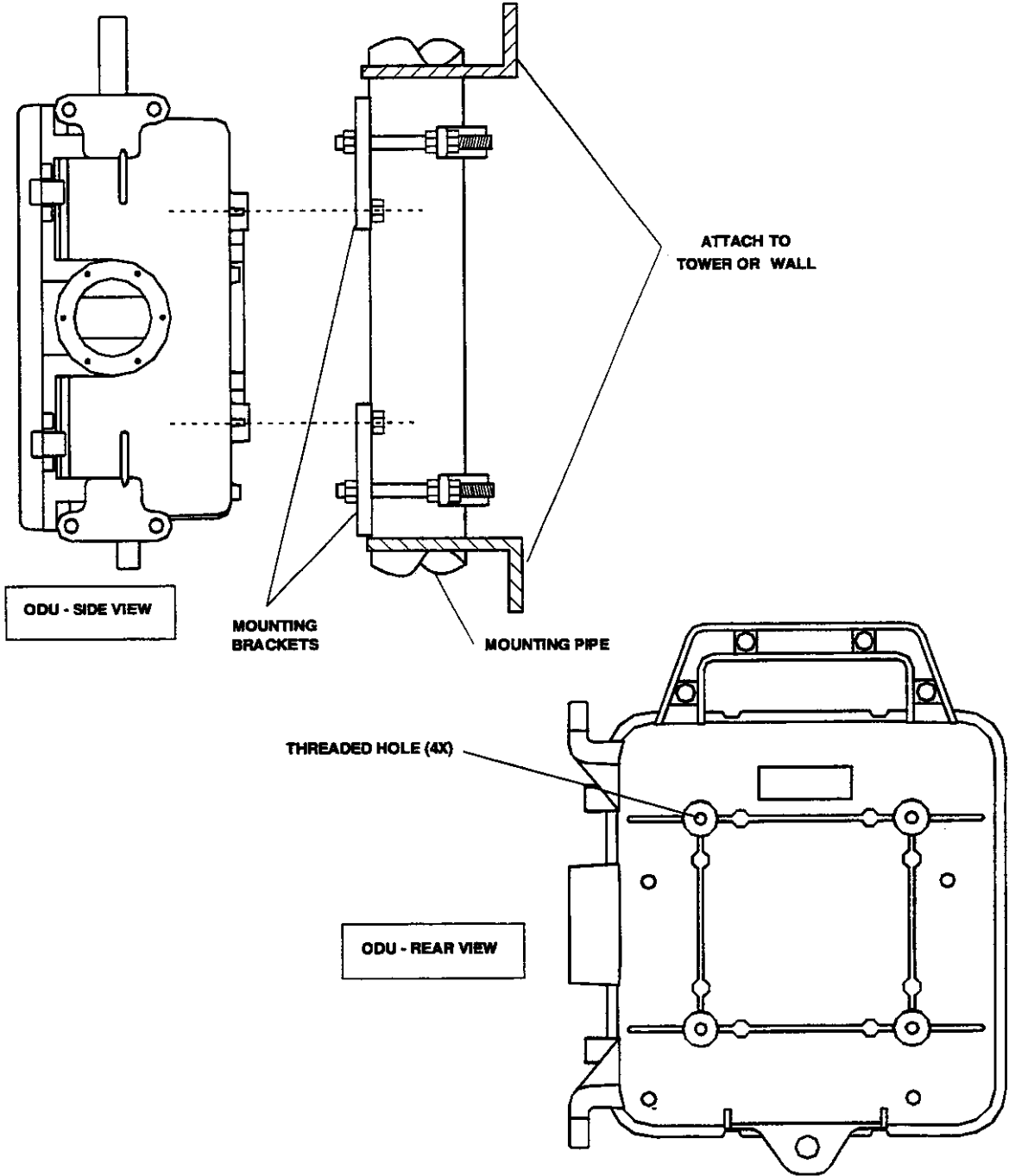
Figure 2-3. Antenna Mount, RH and LH Offset



*Non-protected ODU shown as example. Protected ODU installation is similar.*

**Part A - Direct Mount**

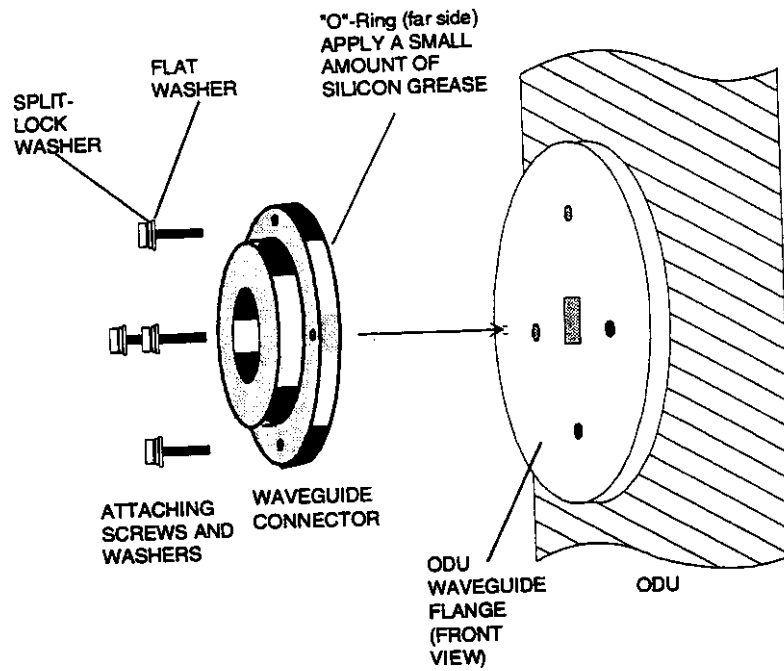
**Figure 2-4. ODU Installation**  
(Sheet 1 of 2)



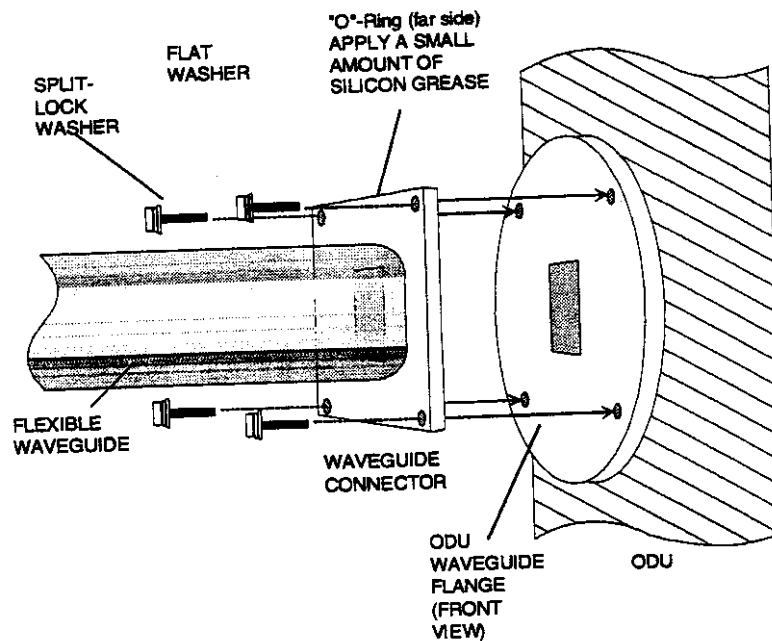
*Non-protected ODU shown as example. Protected ODU installation is similar.*

**Part B – Remote Mount**

**Figure 2-4. ODU Installation**  
(Sheet 2 of 2)



**Part A - Slip-Fit Connector**



*The screws securing the waveguide are different sizes depending on the frequency band of the radio.*

**Part B - Flexible Waveguide Connection**

**Figure 2-5. Waveguide Connector Installation**

### 2.4.4.1 Direct Mount – RH Offset

To install a protected or non-protected ODU with an RH offset mount, perform the following:

1. Install the slip-fit waveguide connector. Refer to Figure 2-5, Part A, and perform the following:
  - a) Locate the female slip-fit waveguide connector supplied with the antenna installation kit.
  - b) Remove the O-ring from the groove of the waveguide connector and apply a small amount of silicone grease to the O-ring. Reinstall the O-ring in the groove.
  - c) Place the connector on the waveguide flange of the ODU and align the mounting holes.
  - d) Install the stainless-steel (SS) socket-head machine screws (SHMS) and SS split and flat washers supplied in the kit.

**CAUTION:** *To avoid damage to the connector and to compress the O-ring properly, tighten the screws as stated in the following step.*

- e) Tighten the connector mounting screws in a cross, "X," pattern 1/4 turn at a time until all four screws are securely tightened.

**NOTE:** *Refer to Figure 2-4 Part A while performing the following steps.*

2. Screw an M10-by-25 mm SS hex bolt about 2 to 3 threads into the top-right and bottom-left threaded holes on the mounting ears.

**WARNING:** *If mounting the ODU on a mast or tower, ensure that the unit is properly secured when lifting. If hoisting the ODU, use a tag line to maintain control while it is being hoisted. To avoid injury, ensure that all personnel are clear of the area directly below the ODU being hoisted.*

3. If the unit is to be hoisted using a hoisting cable, attach the cable to the handle on the ODU housing. To maintain control during hoisting, attach a tag line to the eyelet on the bottom of the housing.
4. Hoist the ODU up to the antenna. Guide and stabilize the ODU with a tag line while hoisting.
5. Inspect the male slip-fit waveguide connector on the antenna. Apply a thin film of silicone grease to the O-ring and install on the connector. If the O-ring is already installed, remove the O-ring, apply a thin film of silicone grease and re-install.

**CAUTION** *The performance of the system will be degraded if the outer O-ring is not installed on the male slip-fit waveguide connector.*

6. Align the slip-fit waveguide connector on the ODU with the slip-fit waveguide connector on the antenna.
7. Rotate the ODU counterclockwise so that the two bolts installed in the ODU are offset from the slots in the antenna mounting plate.
8. With smooth even pressure, push the ODU towards the antenna until the mounting ears of the ODU are flush with the mating surface of the antenna mounting plate.
9. Rotate the ODU clockwise as far as possible. The two mounting bolts should be seated in the slots in the antenna mounting plate.
10. Tighten the two installed mounting bolts finger tight.
11. Install two M10-by-25 mm SS hex bolts with SS flat and split-lock washers through the two unused (upper-left and lower-right) ODU mounting slots in the antenna mounting plate and tighten hand tight.
12. Remove the two mounting bolts that were installed without washers. Install split-lock and flat washers on the bolts.
13. Install the bolts into the ODU mounting holes from where they were just removed.
14. Tighten the four ODU mounting bolts.
15. Disconnect the hoisting cable and tag line, if used.

#### 2.4.4.2 Direct Mount - LH Offset

When installing the ODU as an LH offset mount, it is necessary to orient the unit with the handle pointing down. The unit is mounted in this orientation so the cover can be opened without interference with the antenna mount. Due to this orientation, it is necessary to change the location of the TO IDU TNC connector on the housing. A spare hole, plugged with a nut, bolt and O-ring is provided for this purpose.

To install a protected or non-protected ODU with an LH offset mount, perform the following:

1. Install the slip-fit waveguide connector. Refer to Figure 2-5, Part A, and perform the following:
  - a) Locate the female slip-fit waveguide connector supplied with the antenna installation kit.
  - b) Apply a small amount of silicone grease to the O-ring and install in the groove of the waveguide connector.
  - c) Place the connector on the waveguide flange of the ODU and align the mounting holes.
  - d) Install the stainless-steel (SS) socket-head machine screws (SHMS) and SS split and flat washers supplied in the kit.

**CAUTION** *To avoid damage to the connector and to compress the O-ring properly, tighten the screws in a cross, "X," pattern.*

- e) Tighten the connector mounting screws in a cross, "X," pattern, 1/4 turn at a time until all four screws are securely tightened.

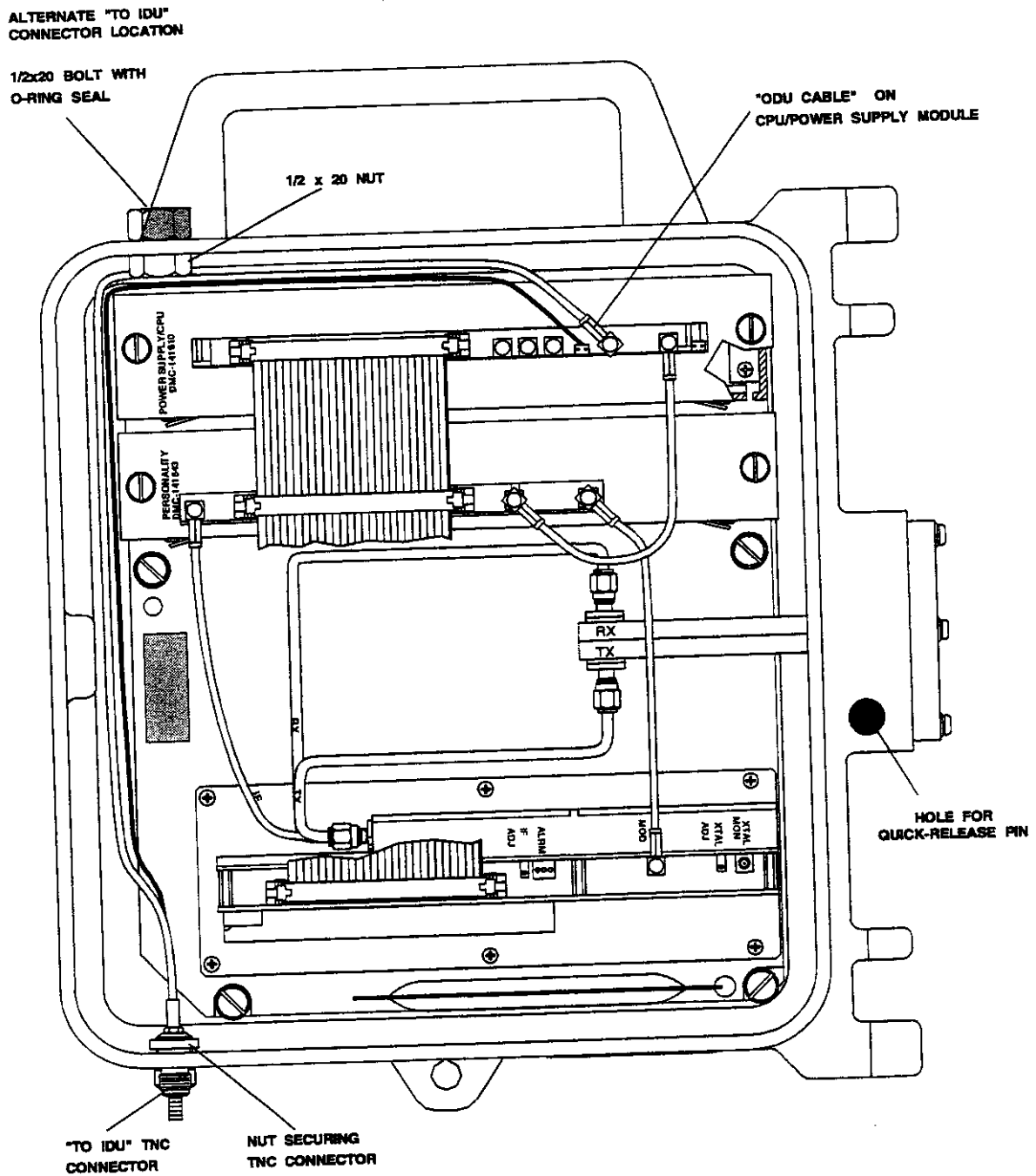
**NOTE:** Refer to Figure 2-6 while performing the following steps.

2. Re-locate the TO IDU connector and cable as follows:
  - b) Release the cover lock and open the cover to the maximum limit (approximately 90 degrees). Insert the quick-release pin into the hole provided in the housing. (ODUs manufactured prior to the date of this manual require a key—provided in the installation kit—to release the cover lock.)
  - c) With an open-end wrench, loosen and remove the 1/2-by-20 bolt and nut that plugs the alternate TO IDU connector location. Save for reinstallation. If the unit is configured for non-protected operation, it has one bolt and nut; if the unit is configured for protected operation, it has two bolts and nuts.
  - d) Locate the ODU CABLE connector on the Power Supply Module and disconnect the SMB connector. If the unit is configured for protected operation, mark the cables appropriately: “A” for the A side cable and “B” for the B side cable.
  - e) Locate the TO IDU connector on the outside of the ODU housing. With an open-end wrench, loosen and remove the nut and washer securing the TNC cable to the housing (two connectors for protected operation). Save for reinstallation.
  - f) Remove the TNC connector, cable and SMB connector from the housing.
  - g) Install the TNC connector into the alternate hole where the 1/2-by-20 bolt was removed.
  - h) Reinstall the nut and washer onto the TNC connector and tighten. Apply a light film of silicon grease if the O-ring is dry. Take care to properly set the seal for water tightness.
  - i) Route the coax cable and install the SMB connector on the ODU CABLE connector on the Power Supply Module.

**CAUTION** After removing the TO IDU TNC connector from its placement, the placement should not be used as an alternative grounding location.

- i) Reinstall the 1/2-by-20 bolt into the hole in the housing where the TNC connector was removed so that the head of the bolt is to the outside of the unit. Apply a light film of silicon grease if the O-ring is dry.
- j) Install the nut on the bolt and tighten.
- k) Remove the quick-release pin holding the cover open and close the cover.
- l) Apply smooth even pressure to the cover of the unit to compress the O-ring and turn the cover lock to secure the cover.





**Part A - Non-Protected ODU - Typical all frequencies**

**Figure 2-6. Reconfiguring ODU for LH Mounting  
(Sheet 1 of 2)**

Digital Microwave Corporation  
SPECTRUM™ II Microwave Radio System

ALTERNATE "TO IDU"  
CONNECTOR LOCATION

1/2x20 BOLT WITH  
O-RING SEAL  
2 EACH

"ODU CABLE" ON  
CPU/POWER SUPPLY MODULE

RF  
BASIC "B"

HOLE FOR  
QUICK-RELEASE  
PIN

RF  
BASIC "A"

NUT SECURING  
TNC CONNECTORS

"A" AND "B" "TO IDU"  
TNC CONNECTOR

Part B - Protected ODU - Typical, all frequencies

Figure 2-6. Reconfiguring ODU for LH Mounting  
(Sheet 2 of 2)

3. The top of the ODU is now defined as that part of the unit where the eyelet is located. Screw an M10-by-25 mm SS hex bolt about 2 to 3 threads into the top-right and bottom-left threaded holes in the mounting ears of the ODU housing, as viewed from the mounting face of the ODU.

**WARNING** *If mounting the ODU on a mast or tower, ensure that the unit is properly secured when lifting to prevent a fall. If hoisting the ODU, use a tag line to maintain control of the ODU while it is being hoisted. Ensure that all personnel are clear of the area directly below the ODU being hoisted to avoid injury.*

4. If the unit is to be hoisted using a hoisting cable, attach the cable to the eyelet in the ODU housing. To help maintain control while hoisting, attach a tag line to the handle.
5. Hoist the ODU up to the antenna. Guide and stabilize the ODU with a tag line while hoisting.
6. Inspect the male slip-fit waveguide connector on the antenna. Apply a thin film of silicone grease to the O-ring and install on the connector. If the O-ring is already installed, remove the O-ring, apply a thin film of silicone grease and re-install.

**CAUTION** *The performance of the system will be degraded if the outer O-ring is not installed on the male slip-fit waveguide connector.*

7. Align the slip-fit waveguide connector on the ODU with the slip-fit waveguide connector on the antenna.
8. Rotate the ODU so that the two bolts installed in the ODU are offset from the slots in the antenna mounting plate.
9. With smooth even pressure, push the ODU towards the antenna until the mounting ears of the ODU are flush with the mating surface of the antenna mounting plate.
10. Rotate the ODU clockwise as far as possible. The mounting bolts should be seated in the slots in the antenna mounting plate.
11. Tighten the two installed mounting bolts finger tight.
12. Install two M10-by-25 mm SS hex bolts with SS flat and split-lock washers through the two unused (upper-left and lower-right) ODU mounting slots in the antenna mounting plate and tighten hand tight.
13. Remove the two mounting bolts that were installed without washers. Install split-lock and flat washers on the bolts.
14. Install the bolts into the ODU mounting holes from where they were just removed.
15. Tighten the four ODU mounting bolts.
16. Disconnect the hoisting cable and tag line, if used.

### 2.4.4.3 Remote Mount

To install the ODU on a remote mount, refer to Figure 2-4 Part B and perform the following:

Digital Microwave Corporation  
SPECTRUM™ II Microwave Radio System

**CAUTION:** *If lubricant is used in the threaded holes in the ODU, avoid applying excessive amounts. An excess of lubricant may create great pressure when compressed by the bolts resulting in damage to the ODU housing.*

1. Install the mounting pipe per manufacturer's instructions.

**WARNING:** *If mounting the ODU on a mast or tower, ensure that the unit is properly secured when lifting. If hoisting the ODU, use a tag line to maintain control while it is being hoisted. To avoid injury, ensure that all personnel are clear of the area directly below the ODU being hoisted.*

2. If the unit is to be hoisted using a cable, attach the cable to the handle on the ODU housing. To maintain control during hoisting, attach a tag line to the eyelet on the bottom of the housing.
3. Hoist the ODU up to the mounting pole. Guide and stabilize the ODU with a tag line while hoisting.
4. Align the threaded holes in the rear face of the ODU with the brackets on the mounting pole. Install and tighten the four M10-by-25 mm SS hex bolts with SS flat and split-lock washers.
5. Install the flexible waveguide. Refer to Figure 2-5 Part B, and perform the following steps:

**CAUTION:** *Be careful when removing the protective cover from the waveguide connector. Dust or other debris that enters the waveguide opening can damage the waveguide or cause signal degradation after installation.*

- a) Remove the protective caps from the ends of the waveguide.
- b) Remove the O-ring from the groove of the waveguide connector and apply a small amount of silicone grease to the O-ring. Reinstall the O-ring in the groove.

**NOTE** *Only one of the flanges on the waveguide has a groove for an O-ring (referred to as the "choke flange"). The choke flange, with O-ring installed, is to be oriented towards the ODU.*

- c) Position the end of the waveguide, with the O-ring installed, up to the waveguide flange on the ODU so that the mounting holes align properly.

**CAUTION** *The mounting holes on the waveguide connector flange may not be symmetrically square. Align the mounting holes carefully when mating the waveguide flange to the ODU or antenna. If the holes are not aligned properly, the attaching screws may cross-thread, damaging the waveguide flange and causing a mismatch at the waveguide coupling, which can cause signal distortion.*

- d) Install the attaching cap screws and washers into the waveguide flange and tighten.

- e) Position the end of the waveguide jumper up to the waveguide flange on the antenna so that the mounting holes align properly.
- f) Install the attaching cap screws and washers into the waveguide flange and tighten.

## 2.4.5 System Coaxial Cable Installation

The coaxial cable(s) connecting the IDU to the ODU carry high-speed digital data, operating DC power, and high-frequency analog signals. The following list summarizes the options and other factors affecting coaxial cables:

- One cable is used for non-protected systems; two cables for protected systems.
- The ODU is configured with a TNC coaxial connector labeled "TO IDU". Two connectors are provided for protected operation.
- The IDU (or IDU PIU) may be configured with either a TNC or BNC connector. One connector is provided for each IDU (or IDU PIU) and is labeled "TO ODU".
  - If the IDU is configured with BNC, BT-43 or DB-25 connectors for the tributary connectors, the unit will have a TNC connector for the TO ODU terminal.
  - If the IDU is configured with LEMO connectors for the tributary connectors, the unit will have a BNC connector for the TO ODU terminal.
- The coaxial cables may be up to 1,000 feet (300 meters) for RG-11 cable, or 440 feet (122 meters) for RG-6 cable. Therefore, it is important that the cables and connectors be of high quality, and that the connectors be properly installed on the cables. The cables should be a low-loss, high quality type cable with a solid copper center conductor. **Do not use cables with a copper-clad steel center conductor.** The cables should be double- or triple-shielded. Refer to Table 2-7 for a list of recommended coaxial cables.
- Table 2-8 lists the acceptable crimp-type TNC and BNC connectors for use with the recommended coaxial cable. Refer to Table 2-9 for a list of the recommended crimping tools to be used with the connectors. The optional Installation Tool Kit (see Table 2-3) also contains the appropriate crimping tool.

**CAUTION:** *Lightning arrestors should be installed on the coaxial cables in areas prone to lightning strikes. See Table 2-3 for ordering information.*

The following sections provide a reference step-by-step procedure for installing TNC and BNC connectors on coaxial cables. It should be noted that the following is intended to be used as a guide only; if a question should arise regarding the procedures contained herein and those procedures of the connector manufacturer, the procedures of the connector manufacturer should be followed.

**Digital Microwave Corporation**  
**SPECTRUM™ II Microwave Radio System**

**CAUTION:** *The list of recommended coax cables must be used if the guaranteed performance specifications are to be achieved.*

**Table 2-7. Recommended Coaxial Cable**

Cable Part No.	Impedance	No. of Shields	Use with Connector Type	Cable Length
Belden 9248 (RG-6/U type) DMC Part No. 036-372100-101	75Ω	Two	TNC	Up to 122 meters (400 ft.)
Belden 9292 (RG-11/U type) DMC Part No. 036-377100-101	75Ω	Duofoil + 61% tinned copper braid	TNC	Up to 300 meters (1,000 ft.)

**Table 2-8. Acceptable Connectors**

Connector Type	Part Number	
	RG-6/U Type Cable	RG-11/U Type Cable
TNC	DMC 039-361312-001 Gilbert G-TNC-6-AHS-322. For use with RG-6/U type cable	DMC 039-361312-002 Gilbert NS-7100-1
BNC	DMC 039-361312-003 Gilbert G-BNC-6-AHS-322. For use with RG-6/U type cable	DMC 039-361312-002 Gilbert NS-7100-1

Table 2-9. Recommended Connector Crimp Tool

Connector Type	Recommended Crimp Tool (Available in Installation Tool Kit)	
	RG6/U Type Cable	RG-11/U Type Cable
TNC	DMC 008-311000-026 Gilbert G-HCT-360	DMC 008-311000-027 Gilbert G-CRT-211
BNC	DMC 008-311000-026 Gilbert G-HCT-360	DMC 008-311000-027 Gilbert G-CRT-211

### 2.4.5.1 Coax Cable Preparation Prior to Connector Installation

**NOTE** *If installing a system configured for protected operation, identify and mark each coaxial cable at both ends of the cable run as A-side or B-side.*

Route the system coaxial cable from the ODU to the IDU. The cable is to be secured along the routing per local regulations and/or guidelines. Prior to installing the cable connector, pass the cable through any pipes, grommets or other openings and into the IDU location. Leave a convenient amount of cable (service loop) at each end of the cable run to accommodate connecting equipment, or in the unlikely event that a new connector needs to be installed. Refer to Figure 2-7.

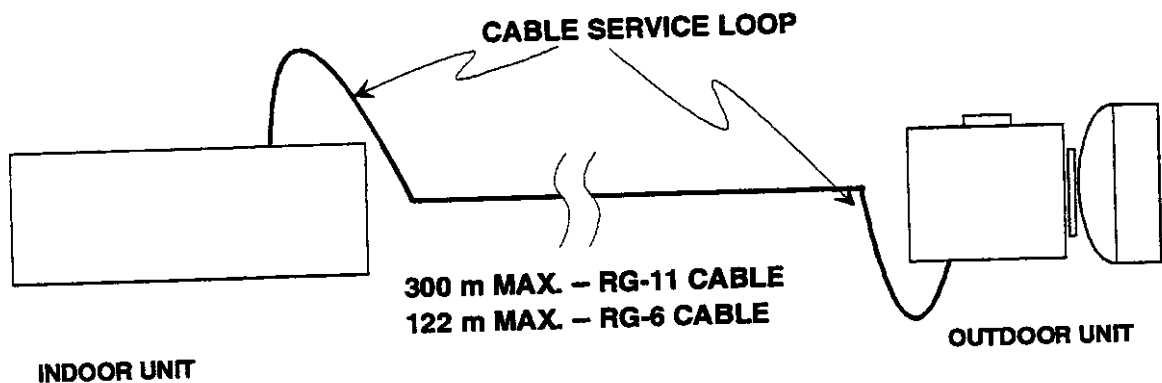
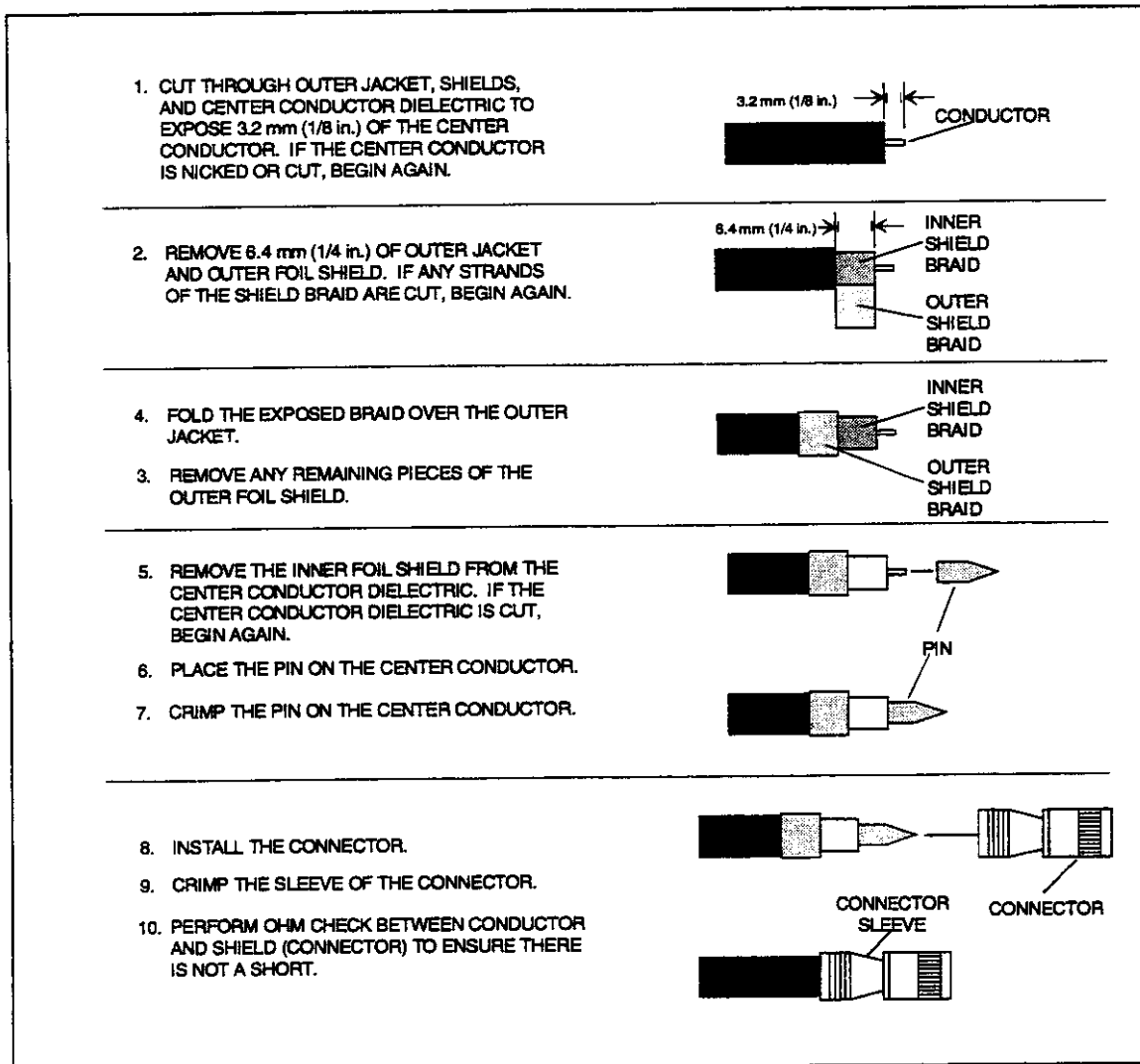


Figure 2-7. System Cabling

### 2.4.5.2 TNC and BNC Connector Installation

Prepare the cable and install the connector as shown in Figure 2-8 using the crimping tool shown in Figure 2-9.



**Figure 2-8. Cable Preparation and Connector Installation**



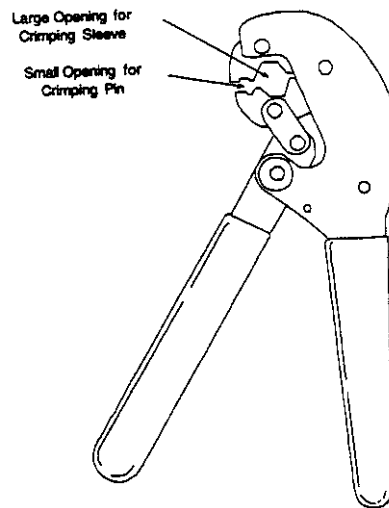


Figure 2-9. Connector Crimping Tool

### 2.4.5.3 Coaxial Cable Connections

Perform the following to connect the coaxial and ground connections:

1. Install the protective cap on the RSSI connector of the ODU.
2. For systems configured for non-protected operation, perform the following:
  - a) At the ODU, connect the coaxial cable to the 'TO IDU' connector.
  - b) Apply the Vapor Wrap from the installation kit to the ODU-end connector, fully covering the connector to add another weather barrier.
  - c) At the IDU, connect the coaxial cable to the 'TO ODU' connector.
1. For systems configured for protected operation, perform the following:
  - c) Verify that the coaxial cables that will be used to connect between the IDUs and the ODU have been identified as A-side and B-side. If the cables are not identified, perform the following steps. Otherwise skip to step b) below:
    - 1) Apply a short between the shield and the center conductor of one cable at ODU location, thereby terminating the cable.
    - 2) With an ohmmeter at the IDU location, measure the resistance of each coaxial cable, shield to center conductor, and identify the terminated cable.
    - 3) Mark the identified cable as A-side at both ends of the cable. Mark the other coaxial cable as B-side at both ends of the cable.
  - a) At the ODU, connect the coaxial cable marked 'A-side' to the 'TO IDU "A"' connector.
  - b) At the ODU, connect the coaxial cable marked 'B-side' to the 'TO IDU "B"' connector.
  - c) Apply the Vapor Wrap protective wrap from the installation kit to the ODU-end connectors.

**NOTE:** *A system configured for protected operation with either two 1U IDUs installed or a 4U IDU with two IDU plug-in units (PIUs), the upper most IDU or IDU PIU as installed, is typically referred to as "IDU A."*

- e) At the IDU location, connect the coaxial cable marked 'A-side' to the 'TO ODU' connector on the 'A' IDU.
- f) At the IDU location, connect the coaxial cable marked 'B-side' to the 'TO ODU' connector on the 'B' IDU.

## 2.4.6 Ground Wire Connection

To install the ground wire connection, perform the following steps:

**CAUTION:** *When connecting the ground wire, use stainless steel hardware only. Plain steel or inferior grade hardware can corrode causing poor grounding and, thereby, compromising the system operation.*

1. Connect the ground wire to the ODU ground stud with a wire lug or SS flat washers (not supplied.) Refer to Table 2-6.
2. Install the outer nut on the ground stud and tighten.
3. Connect the ground wire to the GROUND stud on the front panel of the IDU with a wire lug or SS flat washers.

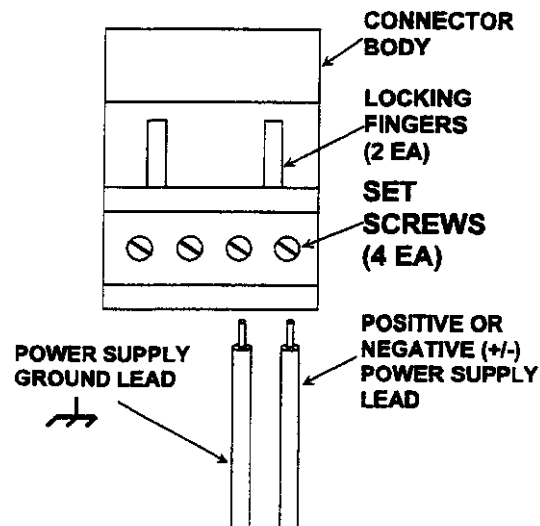
**NOTE** *The ground wire for the IDU and the ODU are to be terminated in accordance with local ordinances and/or regulations.*

4. Terminate the IDU and ODU ground wires to a suitable earth or station ground connection.

## 2.4.7 DC Input Power Connection

The installation kit includes a mating connector (P/N 033-321412-001) for the POWER INPUT receptacle on the IDU. To install the connector on the leads from the primary power source, perform the following:

1. Turn off primary DC power.
2. Locate the primary DC power (power supply) leads.
3. Strip the insulation back approximately 1/4-in. (6.35 mm).
4. With a soldering iron and solder, tin the leads just stripped (recommended if stranded wire is used).
5. Locate the power connector in the installation kit.
6. Loosen the set screws on the connector.



7. Insert the grounded power supply lead into the power connector slot.
8. Insert the positive or negative power supply lead into the connector slot.
9. Tighten the connector set screws securing the inserted leads.
10. Verify that the set screws have been tightened and that the leads are securely installed by holding the connector and pulling on the leads. If the leads are pulled out, reinstall the leads by performing the steps listed above.
11. Insert the power connector into the POWER INPUT receptacle on the front of the IDU.
12. With smooth even pressure, push the connector in until it is fully seated in the receptacle.

### 2.4.8 Other Cable Connections

This section describes other system cables that either come in the installation kit shipped with the radios, or can be ordered as optional parts. The contents of the installation kit vary with the configuration of the radios.

Cables included in the installation kit of a protected radio configured with two 1U IDUs:

- Protection cable
- DMC Net Bridging Cable
- Tributary "Y" cables (short cables to provide a single I/O connection)

Optional system cables available from DMC:

- EOW (Engineering Orderwire) cable (protected or non-protected version)
- Alarm cable (protected or non-protected version)
- LMT/host computer interface cable (provided with LMT software kit)
- DB-25 tributary cable

Refer to Table 2-10 for more information on other system cables. Refer to Table 2-11 through Table 2-18 for the connector pin assignments/cable wire list for the ALARM, EOW, O&M 1 and 2, HANDSET, MAINTENANCE, DB-25, DB-9 and LEMO connectors respectively. Refer to Figure 2-10 for the LEMO connector pin locations. Refer to Figure 2-11 for a pictorial description of the other system cables. Refer to Figure 2-12 for IDU front panel cable connector descriptions. Refer to Figure 2-13 for IDU cable connections.

**Table 2-10. Other System Cables**

Cable P/N	Description/ Usage	Cables	IDU Connectors	Cable-to- IDU Connection
037-501930-001 See Note 1	<b>Protection Cable Assembly</b> For systems configured for protected operation using two 1U IDUs.	Figure 2-11 Part A	Figure 2-12 Parts D, E and F	Figure 2-13 Parts D, E and F
037-502017-050 See Note 1	<b>DMC Net Bridging Cable</b> For systems configured for protected operation using two 1U IDUs. See Table 2-13 for pin out.	Figure 2-11 Part B	Figure 2-12 Parts D, E and F	Figure 2-13 Parts D, E and F
037-501954-001 See Note 2	<b>EOW Protected Cable Assembly</b> For systems configured for protected operation using two 1U IDUs. See Table 2-12 for pin out.	Figure 2-11 Part C	Figure 2-12 Parts D, E and F	Figure 2-13 Parts D, E and F
037-501955-001 See Notes 2 and 4	<b>Alarm Protected Cable Assembly</b> For systems configured for protected operation using two 1U IDUs. See Table 2-11 for pin out.	Figure 2-11 Part D	Figure 2-12 Parts D, E and F	Figure 2-13 Parts D, E and F
037-501941-001 See Note 1	<b>BNO 'Y' Cable</b> For protected systems with two 1U IDUs. [This IDU model discontinued]	Figure 2-11 Part E	Figure 2-12 Part D	Figure 2-13 Part D
037-502020-010 See Note 1	<b>LEMO 'Y' Cable</b> For protected systems with two 1U IDUs. Connects to the two IDUs and provides a single I/O connection. See Table 2-18 for pin out.	Figure 2-11 Part F	Figure 2-12 Part D	Figure 2-13 Part D
037-502059-020 See Note 1	<b>BNC 'Y' Cable</b> For protected systems with two 1U IDUs. Connects to the two IDUs and provides a single I/O connection.	Figure 2-11 Part G	Figure 2-12	Figure 2-13 Part D
037-502042-020 See Note 1	<b>BT-43 'Y' Cable</b> For protected systems with two 1U IDUs. Connects to the two IDUs and provides a single I/O connection.	Figure 2-11 Part H	Figure 2-12 Part D	Figure 2-13 Part D
037-501961-xxx -060 = 60 in. -120 = 120 in. -240 = 240 in. See Note 1	<b>DB-25 'Y' Cable</b> For protected systems with two 1U IDUs. Connects to the two IDUs and provides a single I/O connection. See Table 2-16 for pin out.	Figure 2-11 Part I	Figure 2-12 Part E	Figure 2-13 Part E
076-330400-001 See Note 1	<b>DS3 'Y' Cables</b> For protected systems with two 1U IDUs. Connects to the two IDUs and provides a single I/O connection.	Figure 2-11 Part J	Figure 2-12 Part F	Figure 2-13 Part F

Table 2-10. Other System Cables - Continued

Cable P/N	Description/ Usage	Cables	IDU Connectors	Cable-to- IDU Connection
037-502139-001  See Note 1	<b>DS1 "Y" Cables</b> For protected systems with two 1U IDUs. Connects to the two IDUs and provides a single I/O connection. See Table 2-17 for pin out.	Figure 2-11 Part K	Figure 2-12 Part F	Figure 2-13 Part F
037-501956-001  See Note 2	<b>EOW Cable Assembly</b> For systems configured with one 1U IDU for non-protected operation or a 4U IDU configured for either protected or non-protected operation. See Table 2-12 for pin out.	Figure 2-11 Part L	Figure 2-12 Parts A, B, C, G and H	Figure 2-13 Parts A, B, C, G and H
037-501957-001  See Notes 2 and 4	<b>Alarm Cable Assembly</b> For systems configured with one 1U IDU for non-protected operation or a 4U IDU configured for either protected or non-protected operation. See Table 2-11 for pin out.	Figure 2-11 Part M	Figure 2-12 Parts A, B, C, G and H	Figure 2-13 Parts A, B, C, G and H
037-502114-xxx -060 = 60 in. -120 = 120 in. -240 = 240 in. See Note 2	<b>DB-25 Tributary Cable</b> For 1U non-protected, or 4U non-protected and protected systems. DB-25 connector on one end; unterminated on the other end for user-defined termination. See Table 2-16 for pin out.	Figure 2-11 Part N	Figure 2-12 Parts B and H	Figure 2-13 Parts B and H
037-502010-960  See Note 3	<b>LMT/Host Computer Interface Cable</b> Provides the interface between the host computer and terminal for setting terminal configuration and troubleshooting. See Table 2-15 for pin out.	Figure 2-11 Part O	Figure 2-12 Parts A through H	Figure 2-13 Parts A through H

Notes:

1. Supplied in Protected Cable Kits. A separate kit exists for each connector type. The Protection cable and DMC Net Bridging cable are in all kits.
2. Optional cables that may be ordered from Digital Microwave Corporation.
3. Supplied with the LMT Software and Cable Kit.
4. The ALARM connector contains connection for not only alarms and devices, but also for AGC monitoring and auxiliary data channels (0 - 9600 baud) used for EOW data. See Table 2-11.

**Table 2-11. ALARM Connector Pin Assignments/ Cable Wire List  
 (Grouped by wire pairs)**

Pins	Wire Color (1 <sup>st</sup> color = stripe; 2 <sup>nd</sup> color = solid)	Signal Name	Function/Use
1	Blue / White	ALM-RLY1	Normally Closed
20	White / Blue	ALM-RLY1	Common
2	Orange / White	ALM-RLY1	Normally Open
22	White / Orange	ALM-RLY2	Normally Open
3	Green / White	ALM-RLY2	Common
21	White / Green	ALM-RLY2	Normally Closed
4	Brown / White	ALM-RLY3	Normally Closed
23	White / Brown	ALM-RLY3	Common
5	Gray / White	ALM-RLY3	Normally Open
25	White / Gray	ALM-RLY4	Normally Open
6	Blue / Red	ALM-RLY4	Common
24	Red / Blue	ALM-RLY4	Normally Closed
7	Orange / Red	GND	Ground
26	Red / Orange	EXT IN	1
8	Green / Red	EXT IN	2
27	Red / Green	EXT IN	3
9	Brown / Red	EXT IN	4
28	Red / Brown	EXT IN	5
10	Gray / Red	EXT IN	6
29	Red / Gray	EXT IN	7
11	Blue / Black	EXT IN	8
30	Black / Blue	GND	Ground
12	Orange / Black	AGC MON	Out
31	Black / Orange	Reserved	
13	Green / Black	AGC MON	Ground
32	Black / Green	Reserved	
14	Brown / Black	Reserved	
None	Black / Brown		
15	Gray / Black	GND	Ground
None	Black / Gray		
16	Blue / Yellow	AUX DATA TX-	RS-422
34	Yellow / Blue	AUX DATA TX+	RS-422
17	Green / Yellow	AUX TX DATA	RS-232
36	Yellow / Green	AUX RX DATA	RS-232
18	Orange / Yellow	AUX DATA	Ground
35	Yellow / Orange	GND	Ground
19	Brown / Yellow	AUX DATA RX+	RS-422
37	Yellow / Brown	AUX DATA RX-	RS-422

NOTES: 1. All wires are Shielded Twisted Pairs with the shields grounded.  
 2. Wire is 26 AWG solid conductor.

Table 2-12. EOW Connector Pin Assignments/ Cable Wire List  
(Grouped by wire pairs)

Pin	Wire Color (1 <sup>st</sup> color = stripe; 2 <sup>nd</sup> color = solid)	Signal Name	Function/Use
1	Blue / White		Reserved for future use
20	White / Blue		Reserved for future use
2	Orange / White		Reserved for future use
21	White / Orange		Reserved for future use
3	Green / White	GND	Ground
22	White / Green		Reserved for future use
4	Brown / White		Reserved for future use
23	White / Brown		Reserved for future use
5	Gray / White		Reserved for future use
24	White / Gray		Reserved for future use
6	Blue / Red		Reserved for future use
25	Red / Blue		Reserved for future use
7	Orange / Red	GND	Ground
26	Red / Orange		Reserved for future use
8	Green / Red		Reserved for future use
27	Red / Green		Reserved for future use
9	Brown / Red		Reserved for future use
28	Red / Brown		Reserved for future use
10	Gray / Red	GND	Ground
29	Red / Gray		Reserved for future use
11	Blue / Black	GND	Ground
30	Black / Blue		Not Used
12	Orange / Black		Reserved for future use
31	Black / Orange		Reserved for future use
13	Green / Black	GND	Ground
32	Black / Green		Reserved for future use
14	Brown / Black		Reserved for future use
None	Black / Brown		
15	Gray / Black	EOW VF 2B IN	Ch. 2 Overhead Data
33	Black / Gray	EOW VF 2A IN	Ch. 2 Overhead Data
16	Orange / Yellow	EOW VF 2B OUT	Ch. 2 Overhead Data
35	Yellow / Orange	EOW VF 2A OUT	Ch. 2 Overhead Data
17	Green / Yellow	EOW VF 1A IN	Ch. 1 Overhead Data
36	Yellow / Green	EOW VF 1B IN	Ch. 1 Overhead Data
18	Blue / Yellow	GND	Ground
34	Yellow / Blue	GND	Ground
19	Brown / Yellow	EOW VF 1A OUT	Ch. 1 Overhead Data
37	Yellow / Brown	EOW VF 1B OUT	Ch. 1 Overhead Data

- NOTES: 1. All wires are Shielded Twisted Pairs with the shields grounded.  
2. Wire is 26 AWG solid conductor.

**Table 2-13. O&M 1 and 2 Connector Pin Assignments**

<b>Pin</b>	<b>Function/Use</b>
<b>1</b>	GND
<b>2</b>	RX+ RS-422
<b>3</b>	RX- RS-422
<b>4</b>	RXD RS-232
<b>5</b>	TXD RS-232
<b>6</b>	TX- RS-422
<b>7</b>	TX+ RS-422
<b>8</b>	GND

**Table 2-14. HANDSET Connector Pin Assignments**

<b>Pin</b>	<b>Function/Use</b>
<b>1</b>	GND
<b>2</b>	
<b>3</b>	TIP Handset
<b>4</b>	RING Handset
<b>5</b>	
<b>6</b>	GND

**Table 2-15. MAINTENANCE Connector Pin Assignments**

<b>PIN</b>	<b>Function/Use</b>
<b>1</b>	GND
<b>2</b>	
<b>3</b>	
<b>4</b>	TXD RS-232
<b>5</b>	RXD RS-232
<b>6</b>	
<b>7</b>	
<b>8</b>	GND



Table 2-16. DB-25 Tributary Connector Pin Assignments

Pin #	Pair Color	2xE1/DS1	4xE1/DS1	8xE1/DS1	16xE1/DS1
1	WHT/BLU	CH 1 IN TIP	CH 1 IN TIP	CH 1/5 IN TIP	CH 9/13 IN TIP
14	BLU/WHT	CH 1 IN RING	CH 1 IN RING	CH 1/5 IN RING	CH 9/13 IN RING
2	ORN/WHT	GND	GND	GND	GND
16	WHT/ORN	GND	GND	GND	GND
3	GRN/WHT	CH 1 OUT TIP	CH 1 OUT TIP	CH 1/5 OUT TIP	CH 9/13 OUT TIP
15	WHT/GRN	CH 1 OUT RING	CH 1 OUT RING	CH 1/5 OUT RING	CH 9/13 OUT RING
4	BRN/WHT	CH2 IN TIP	CH 2 IN TIP	CH 2/6 IN TIP	CH 10/14 IN TIP
17	WHT/BRN	CH 2 IN RING	CH 2 IN RING	CH 2/6 IN RING	CH 10/14 IN RING
5	GRY/WHT	GND	GND	GND	GND
19	WHT/GRY	GND	GND	GND	GND
6	BLU/RED	CH 2 OUT TIP	CH 2 OUT TIP	CH 2/6 OUT TIP	CH 10/14 OUT TIP
18	RED/BLU	CH 2 OUT RING	CH 2 OUT RING	CH 2/6 OUT RING	CH 10/14 OUT RING
7	ORN/RED	N/A	GND	GND	GND
None	RED/ORN	N/A	GND	GND	GND
8	GRN/RED	N/A	CH 3 IN TIP	CH 3/7 IN TIP	CH 11/15 IN TIP
21	RED/GRN	N/A	CH 3 IN RING	CH 3/7 IN RING	CH 11/15 IN RING
9	BRN/RED	N/A	GND	GND	GND
20	RED/BRN	N/A	GND	GND	GND
10	GRY/RED	N/A	CH 3 OUT TIP	CH 3/7 OUT TIP	CH 11/15 OUT TIP
22	RED/GRY	N/A	CH 3 OUT RING	CH 3/7 OUT RING	CH 11/15 OUT RING
11	BLU/BLK	N/A	CH 4 IN TIP	CH 4/8 IN TIP	CH 12/16 IN TIP
24	BLK/BLU	N/A	CH 4 IN RING	CH 4/8 IN RING	CH 12/16 IN RING
12	ORN/BLK	N/A	GND	GND	GND
23	BLK/ORN	N/A	GND	GND	GND
13	GRN/BLK	N/A	CH 4 OUT TIP	CH 4/8 OUT TIP	CH 12/16 OUT TIP
25	BLK/GRN	N/A	CH 4 OUT RING	CH 4/8 OUT RING	CH 12/16 OUT RING

- NOTES:
1. First color = Stripe; Second color = Solid.
  2. All wires are shielded twisted pairs with sheilds grounded.
  3. Wire is 26 AGW solid conductor.

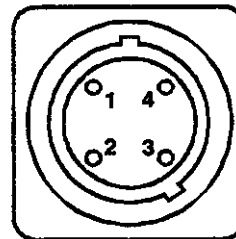
**Table 2-17. DB-9 Tributary Connector Pin Assignments**

Pin Number	Signal
1	Receive Input Tip
6	Receive Input Ring
5	Transmit Output Tip
9	Transmit Output Ring
3	Shielded Ground

**Table 2-18. LEMO Tributary Connector Pin Assignments**

Pin Number	Signal
1	DATA OUT +
2	DATA OUT -
3	DATA IN -
4	DATA IN +

(As viewed in Figure 2-10.)



**Figure 2-10. Pin Locations – LEMO Connector on IDU**  
 (As viewed looking at the front of the IDU.)

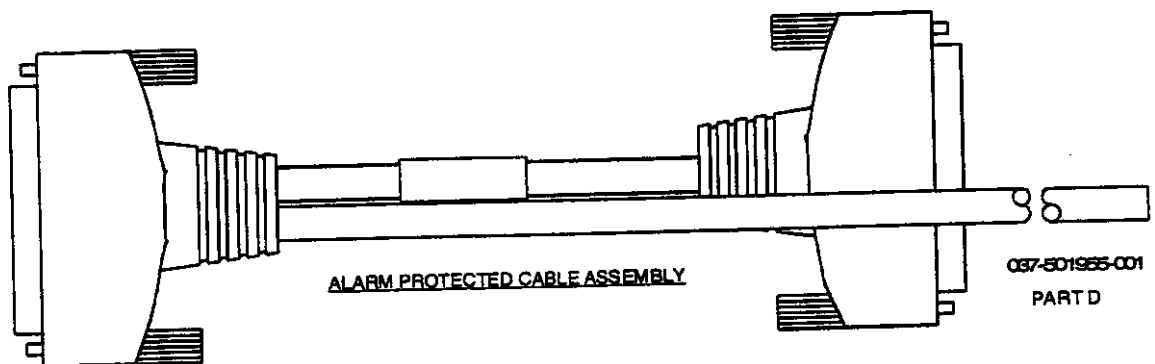
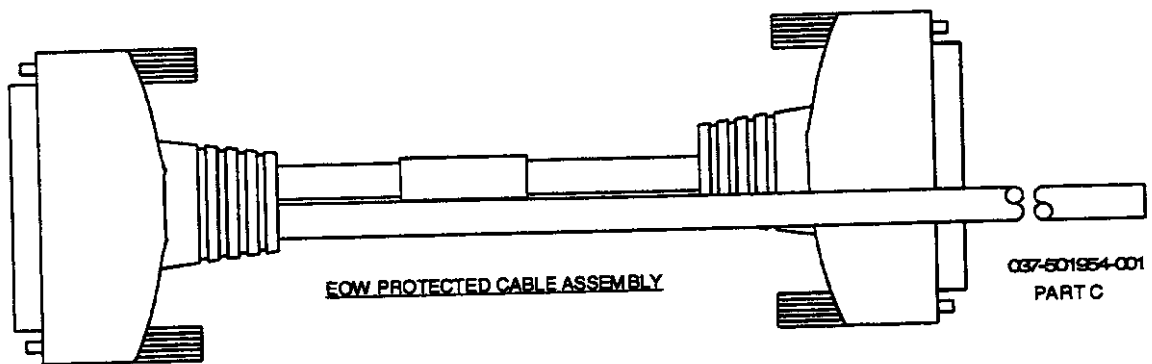
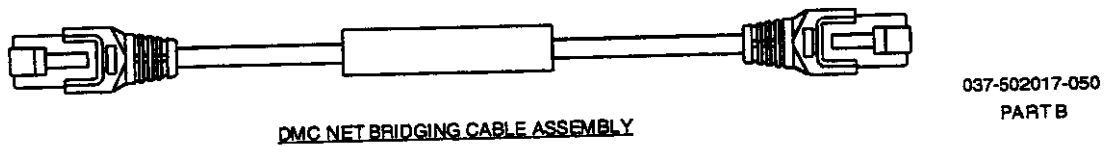
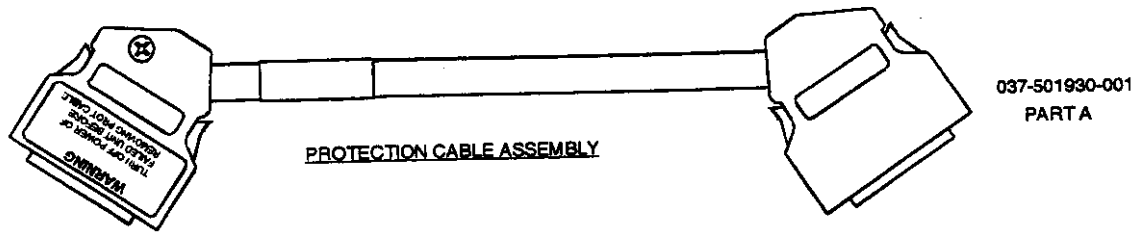
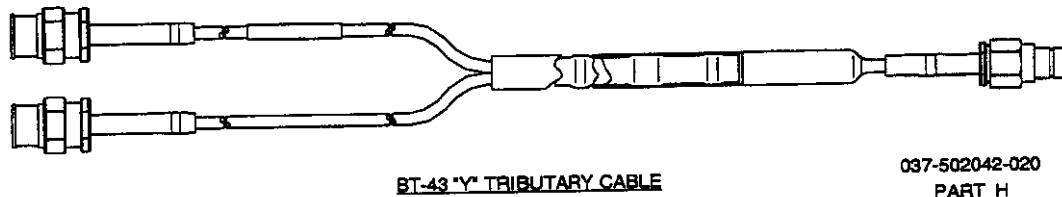
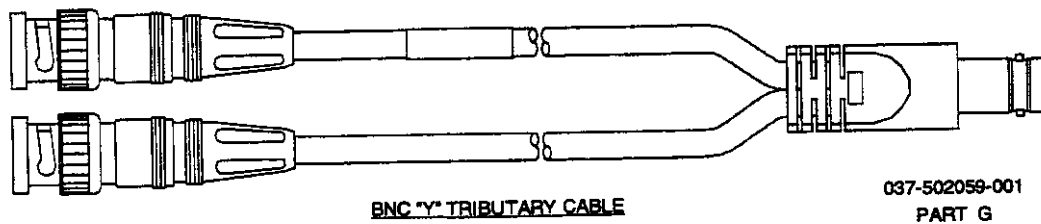
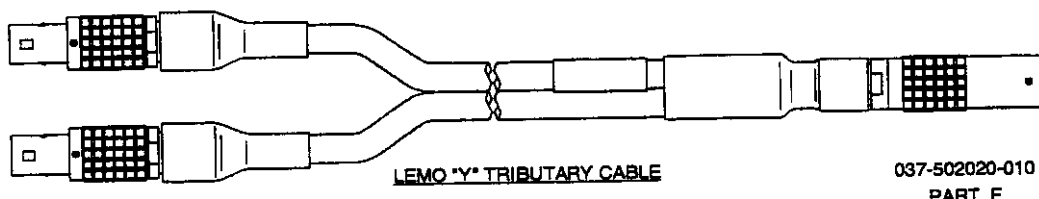
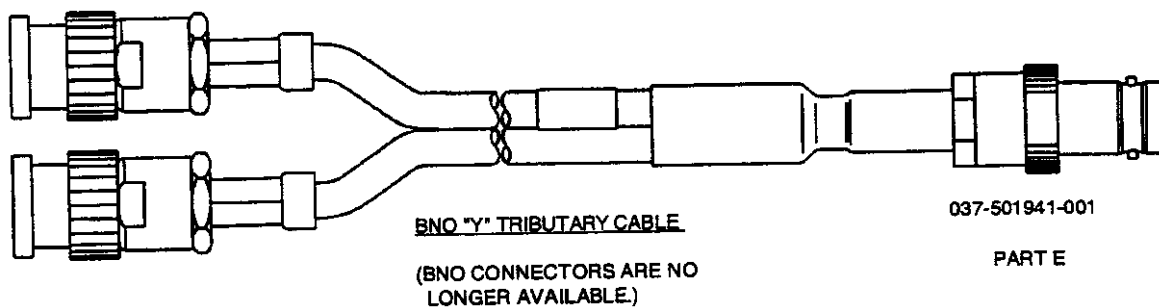


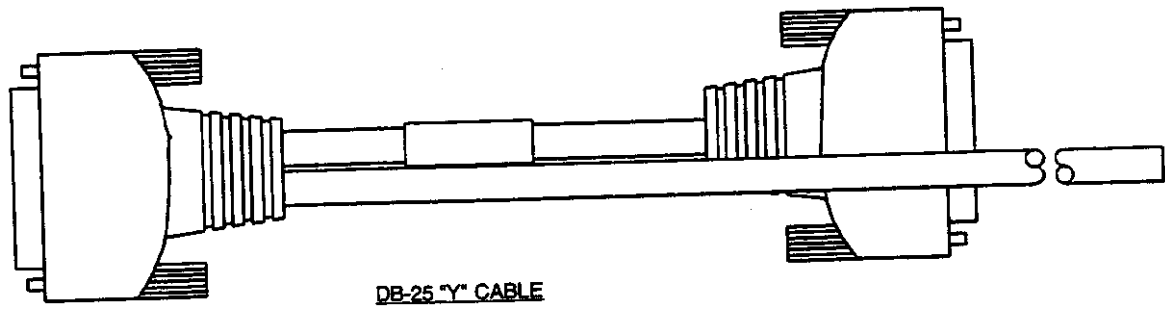
Figure 2-11. Other System Cables  
(Sheet 1 of 4)

Digital Microwave Corporation  
SPECTRUM™ II Microwave Radio System

---

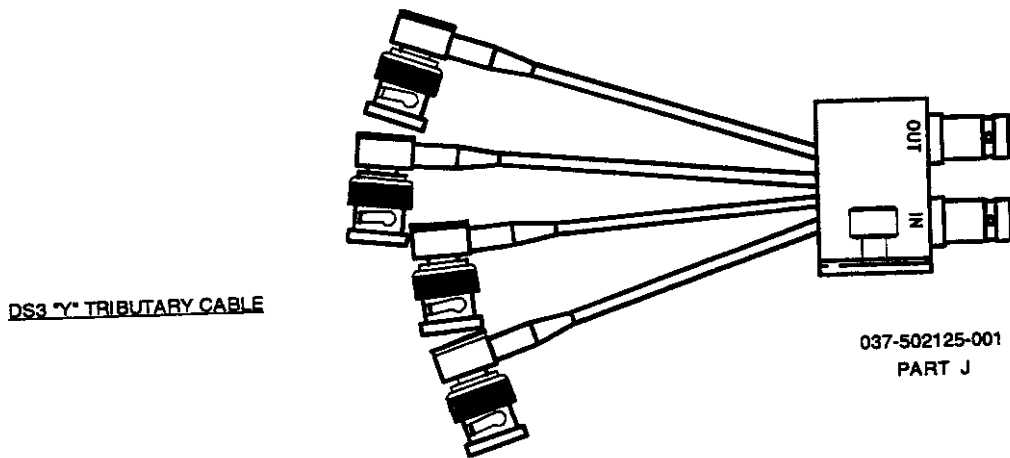


**Figure 2-11. Other System Cables**  
(Sheet 2 of 4)



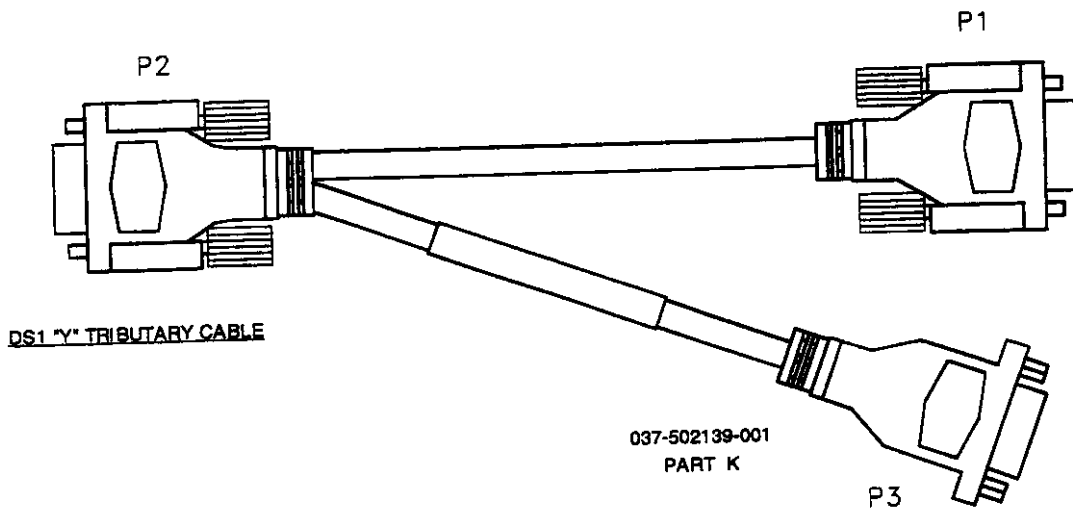
P/N 037-510961-xxx

PART I



037-502125-001

PART J



037-502139-001

PART K

Figure 2-11. Other System Cables  
(Sheet 3 of 4)

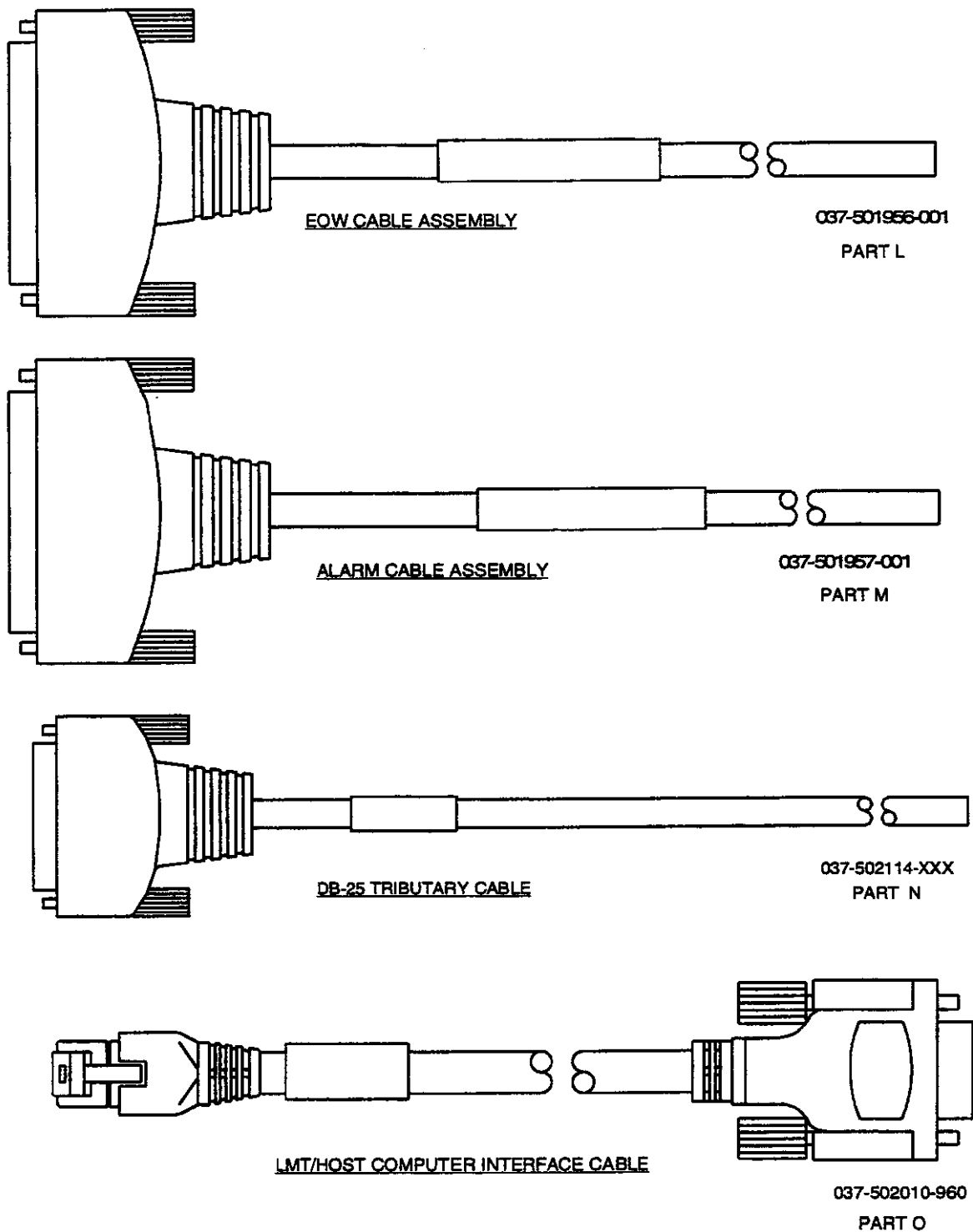
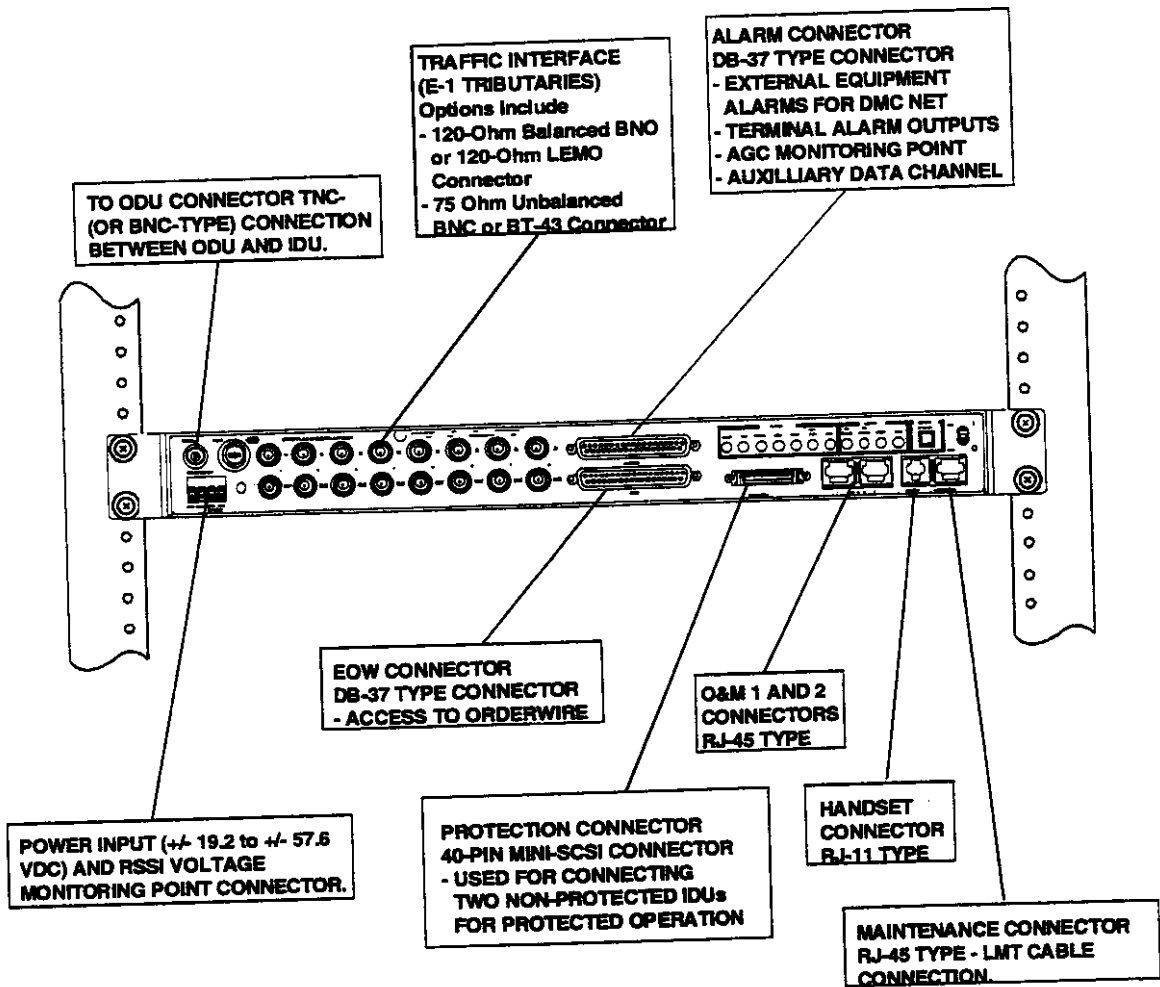
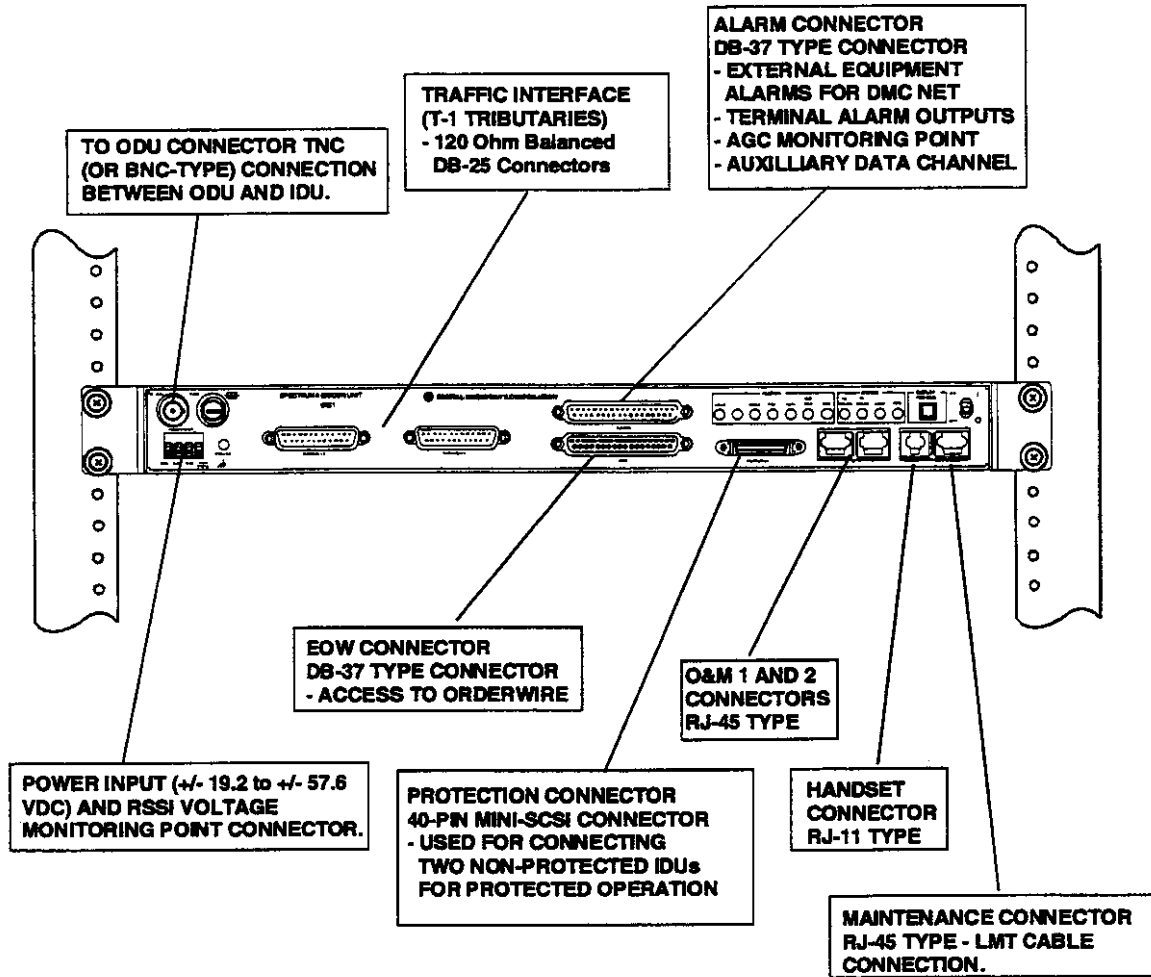


Figure 2-11. Other System Cables  
(Sheet 4 of 4)



Part A - 1U IDU ( ITU-T Version with LEMO, BNC, or BT 43 Tributary Connectors)

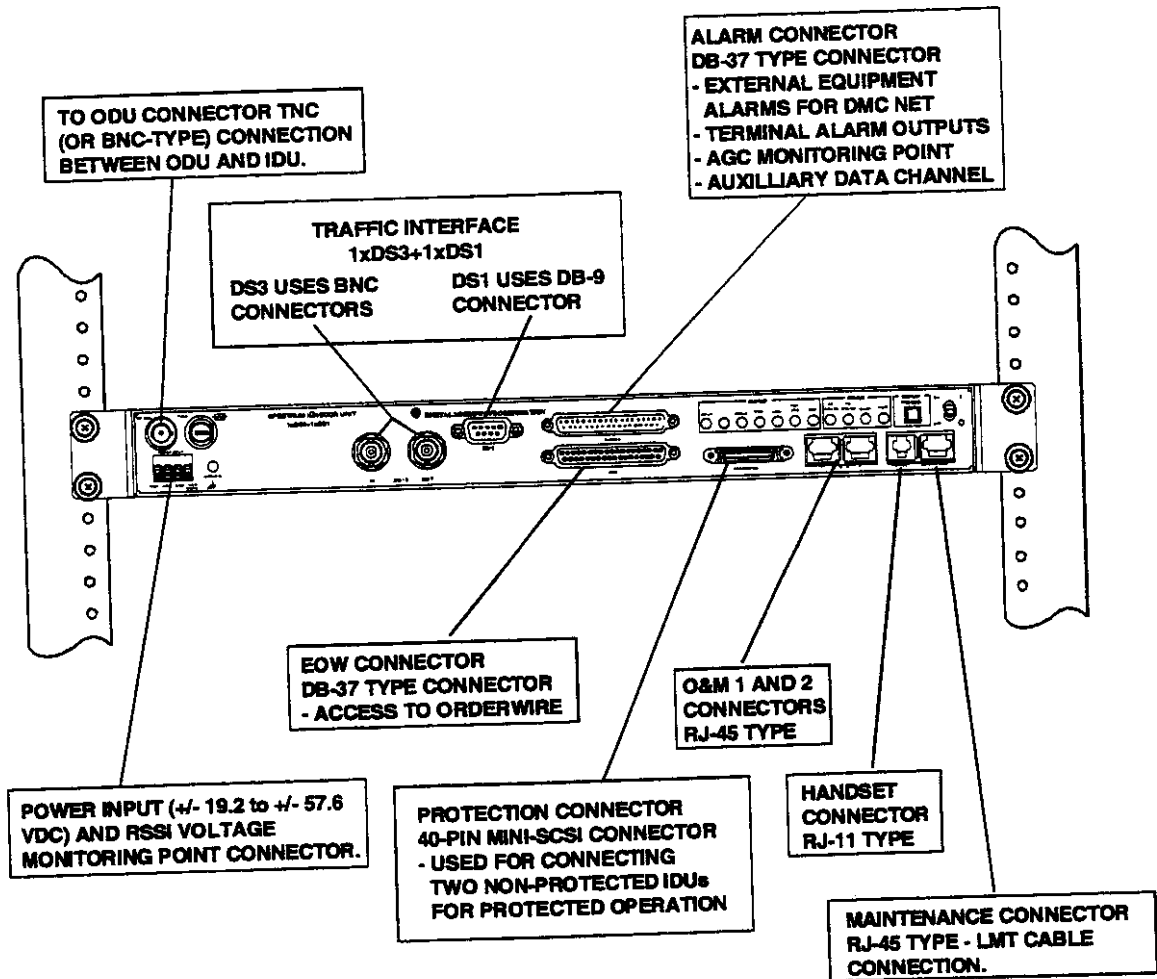
Figure 2-12. IDU Front Panel Connectors  
(Sheet 1 of 8)



**Part B - 1U IDU (ITU-T/DSX Version with DB-25 Tributary Connectors)**

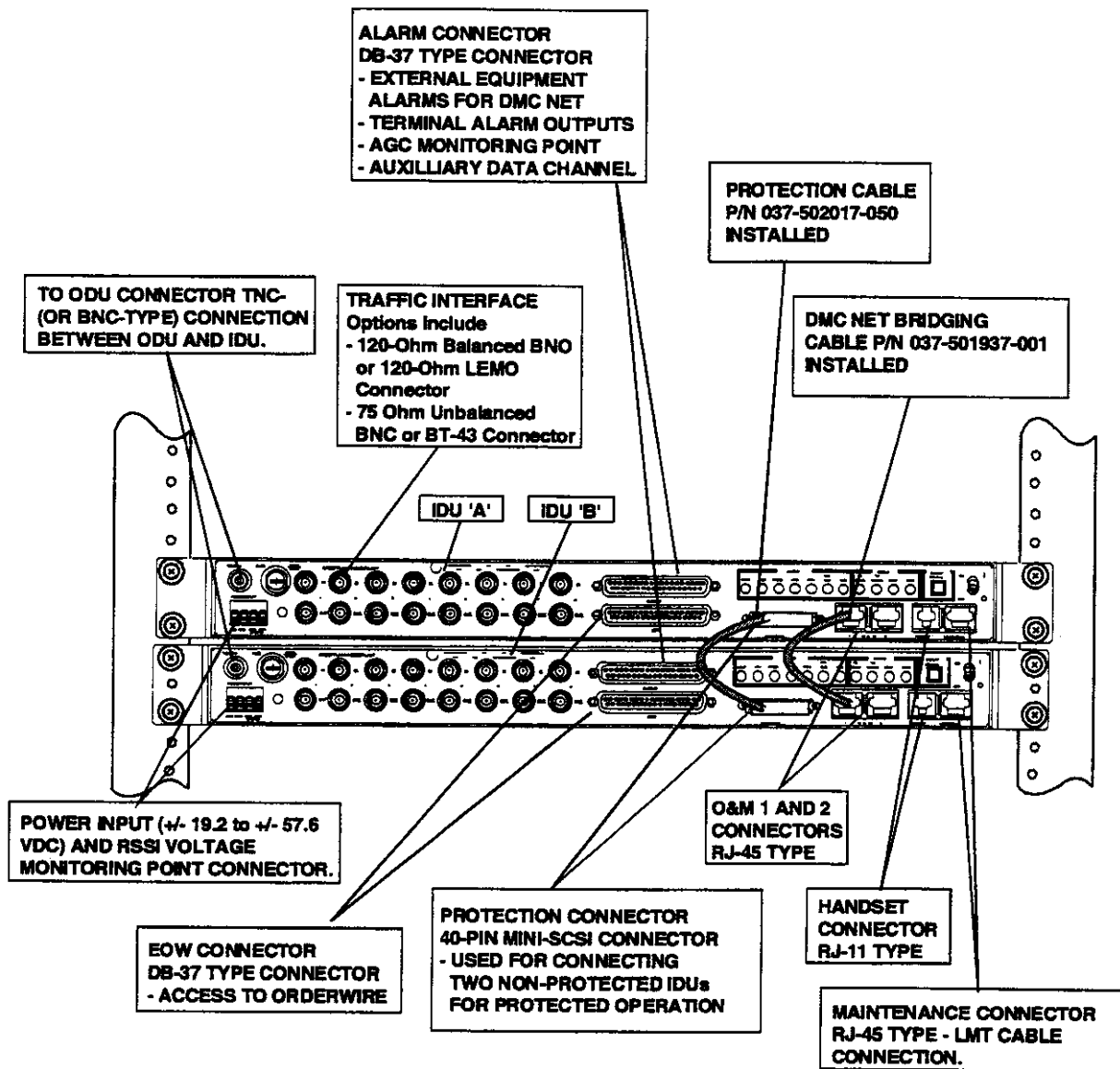
**Figure 2-12. IDU Front Panel Connectors**  
 (Sheet 2 of 8)





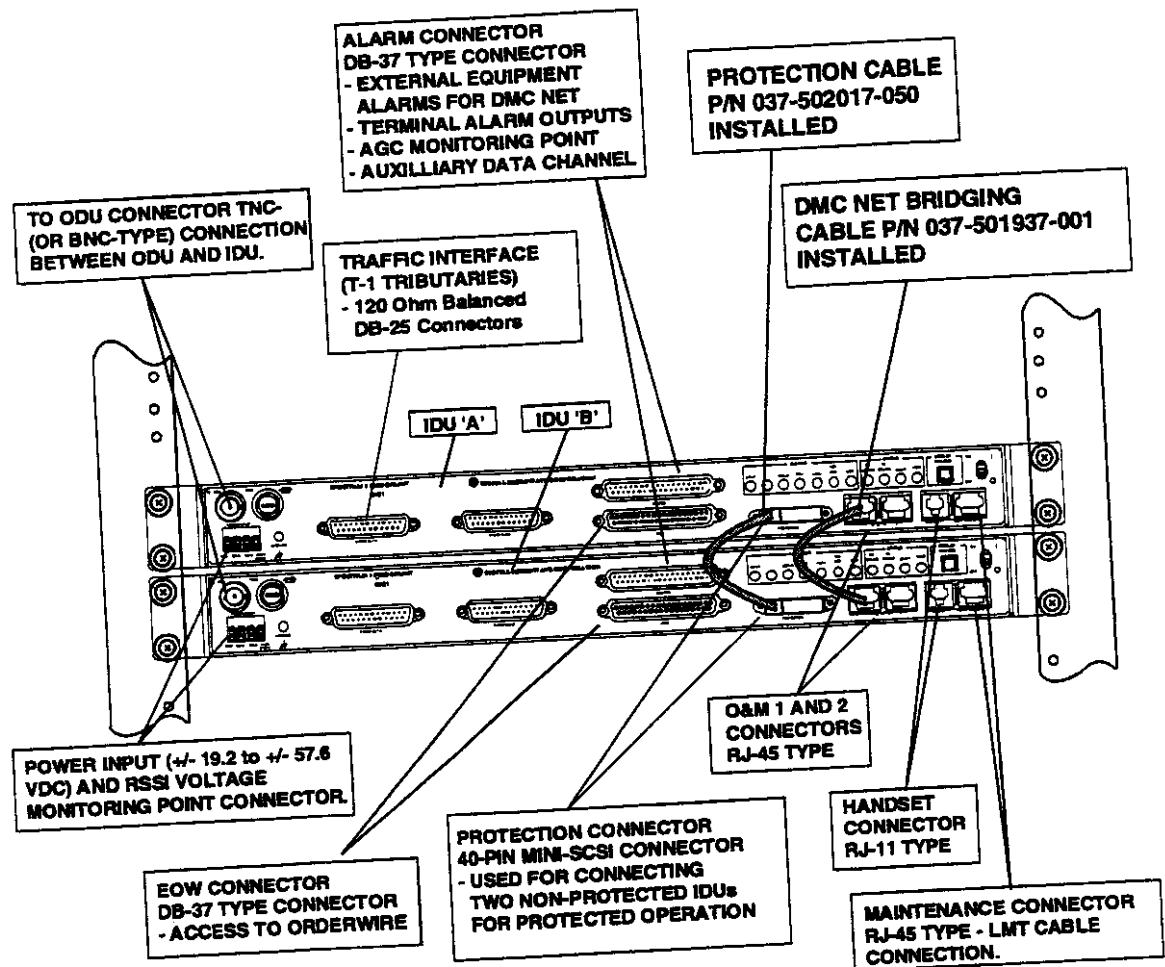
Part C - 1U IDU (DSX Version with BNC and DB-9 Tributary Connectors)

Figure 2-12. IDU Front Panel Connectors  
(Sheet 3 of 8)



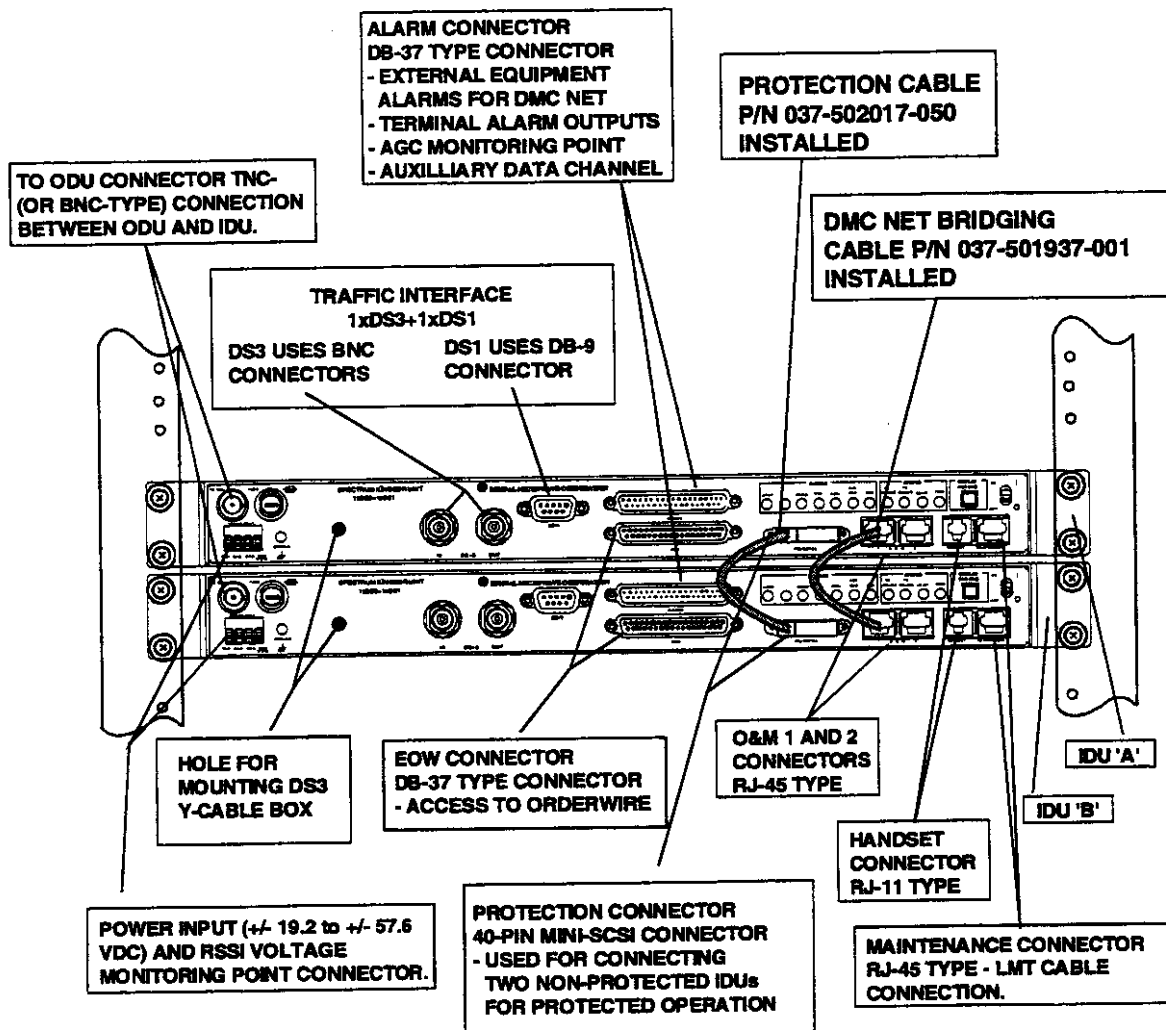
**Part D - Two 1U IDUs Configured for Protected Operation ( ITU-T Version with LEMO, BNC, or BT-43 Tributary Connectors)**

**Figure 2-12. IDU Front Panel Connectors**  
 (Sheet 4 of 8)



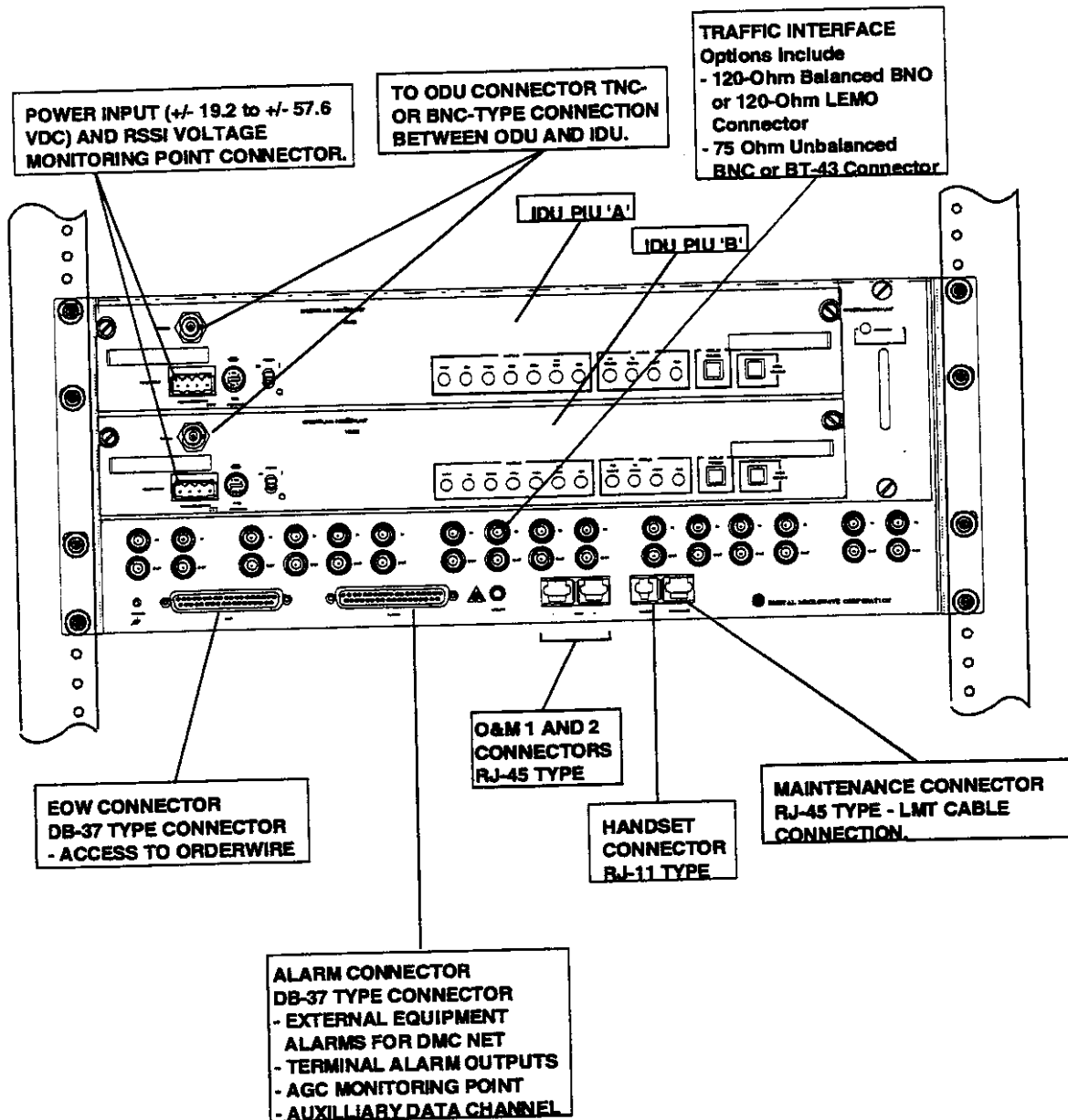
Part E - Two 1U IDUs Configured for Protected Operation (ITU-T/DSX Version with DB-25 Tributary Connectors)

Figure 2-12. IDU Front Panel Connectors  
(Sheet 5 of 8)



**Part F - Two 1U IDUs Configured for Protected Operation (DSX Version with BNC and DB-9 Tributary Connectors)**

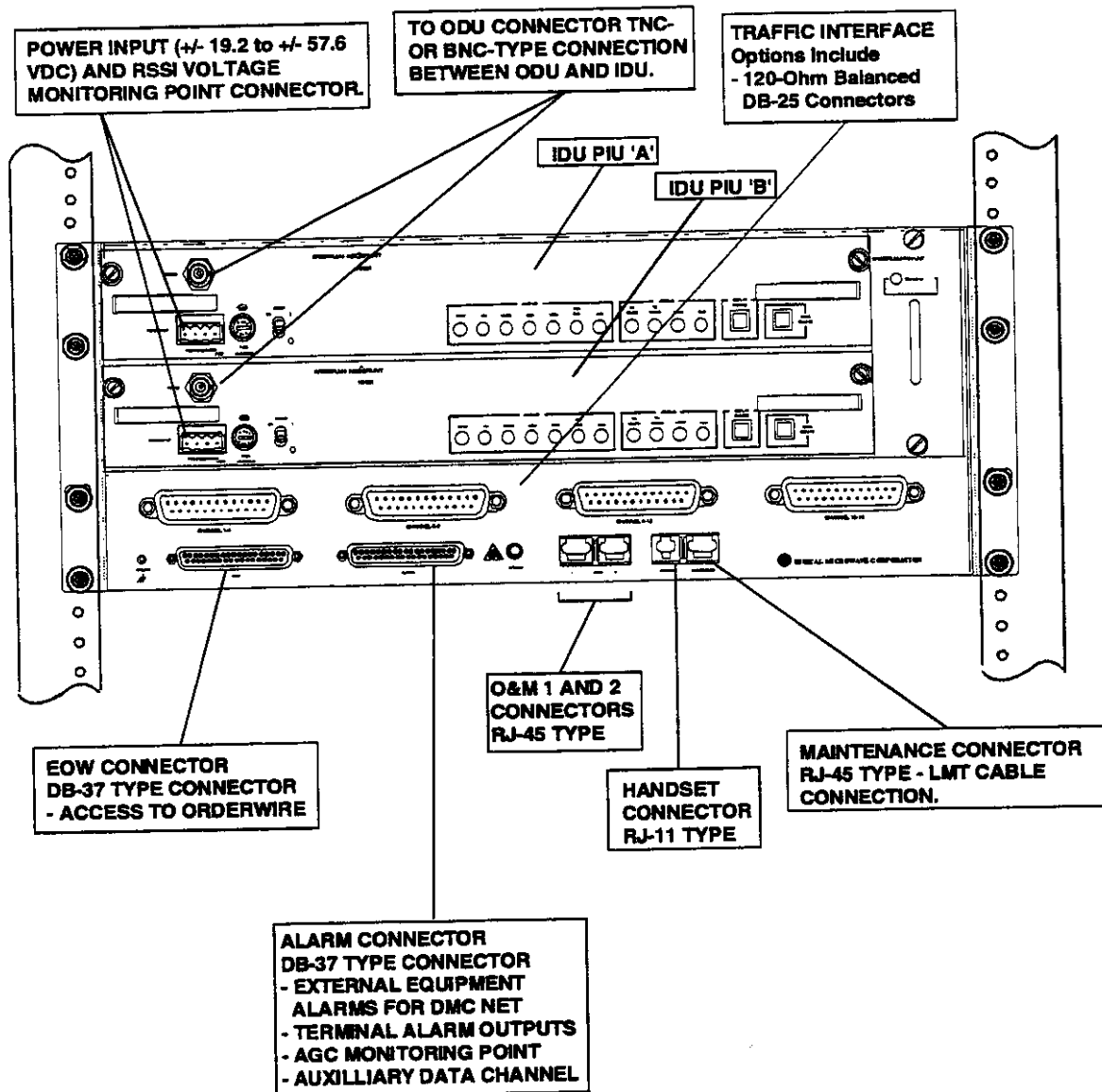
**Figure 2-12. IDU Front Panel Connectors**  
 (Sheet 6 of 8)



Part G - 4U IDU (ITU-T Version with LEMO, BNC, or BT-43 Tributary Connectors)

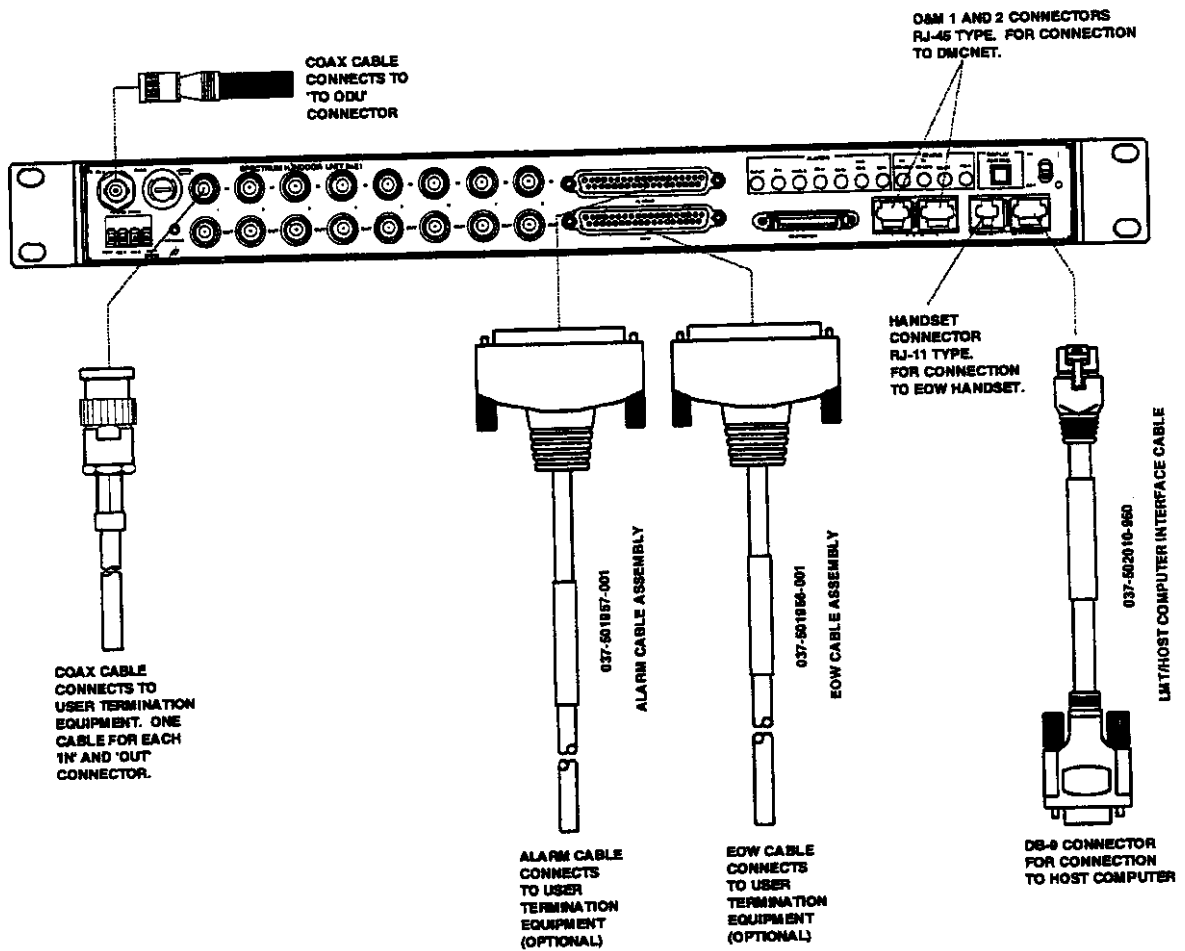
Figure 2-12. IDU Front Panel Connectors  
(Sheet 7 of 8)

Digital Microwave Corporation  
**SPECTRUM™ II Microwave Radio System**



**Part H - 4U IDU (ITU-T/DSX Version with DB-25 Tributary Connectors)**

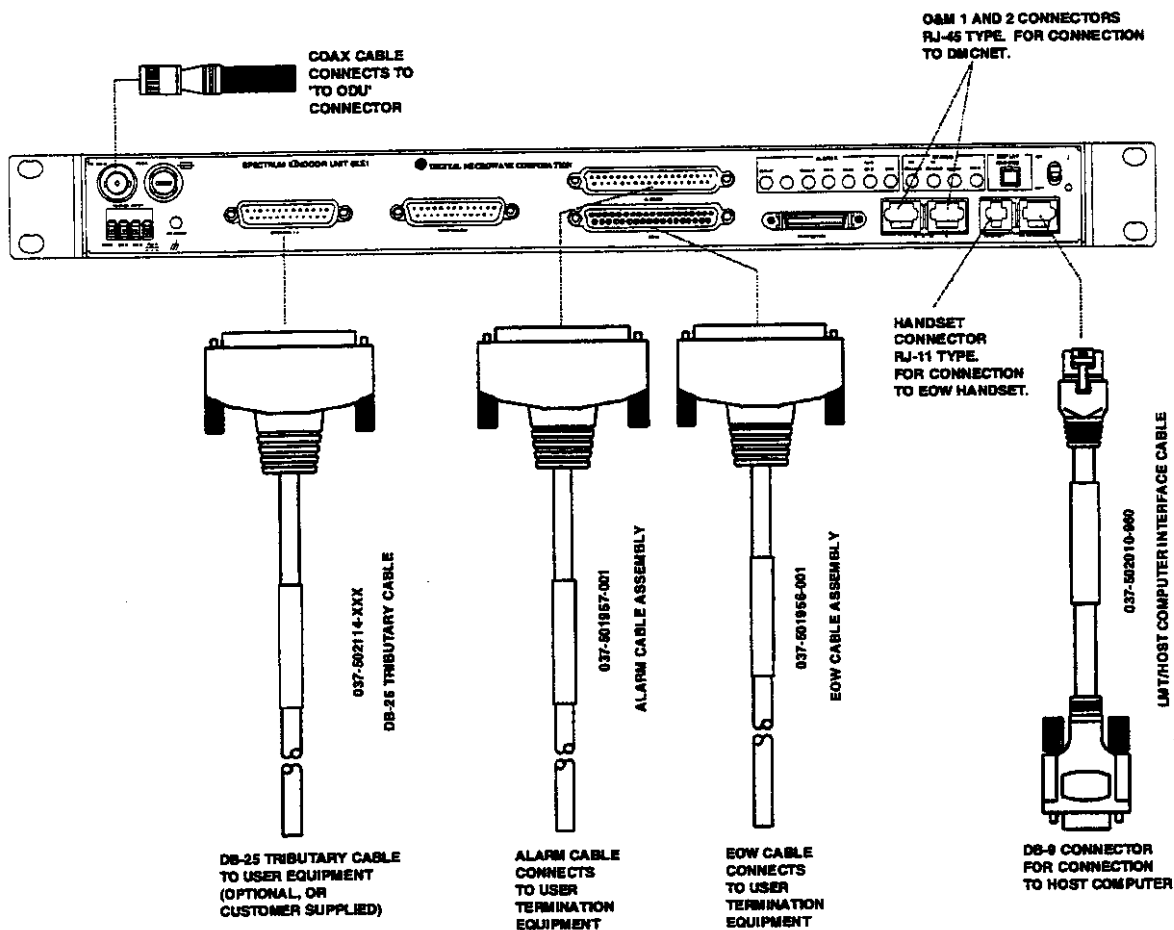
**Figure 2-12. IDU Front Panel Connectors**  
 (Sheet 8 of 8)



Part A - 1U IDU ( FTU-T Version with LEMO, BNC, or BT-43 Tributary Connectors)

Figure 2-13. IDU Front Panel Cable Connections  
(Sheet 1 of 8)

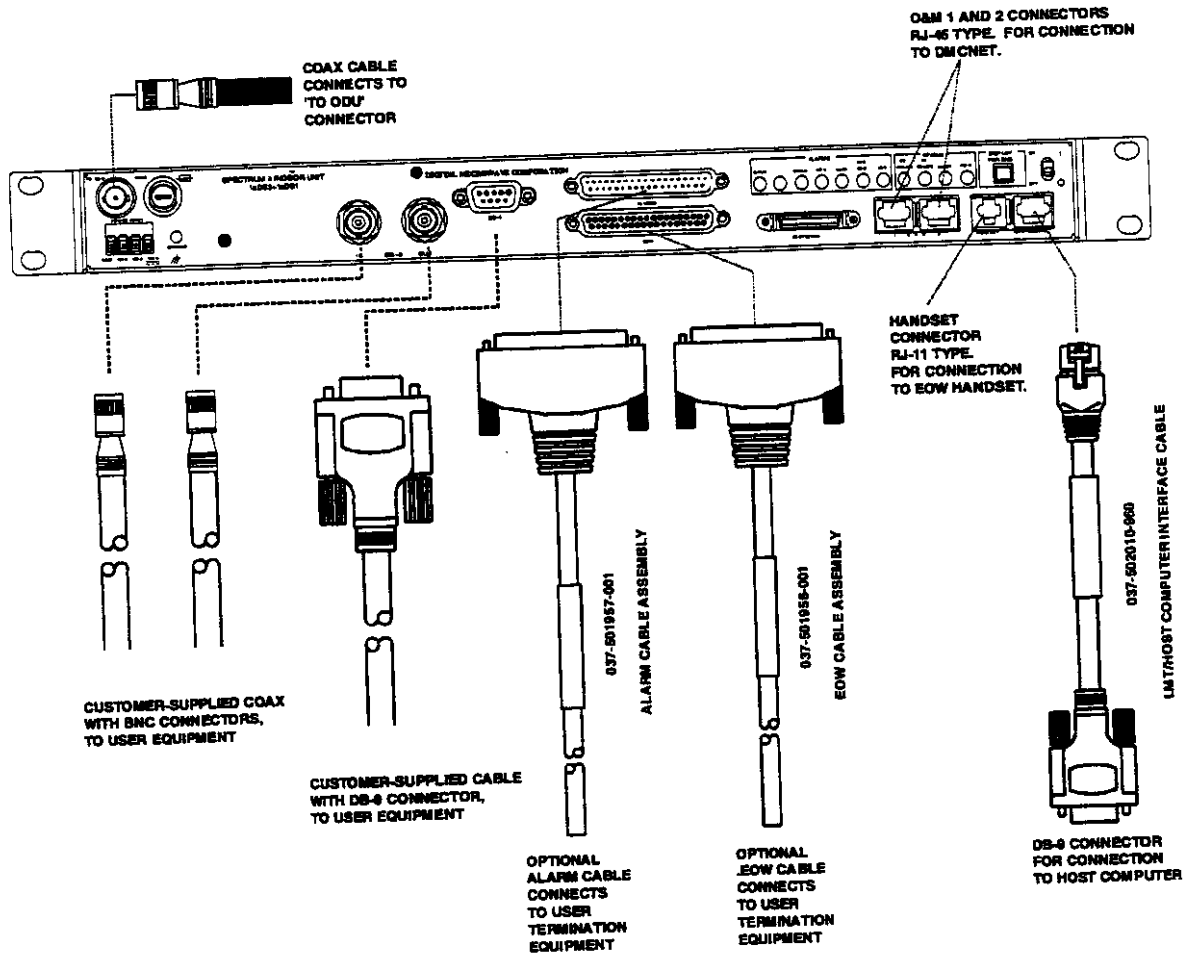
**Digital Microwave Corporation**  
**SPECTRUM™ II Microwave Radio System**



**Part B - 1U IDU (ITU-T/ DSX Version with DB-25 Tributary Connectors)**

**Figure 2-13. IDU Front Panel Cable Connections**  
 (Sheet 2 of 8)

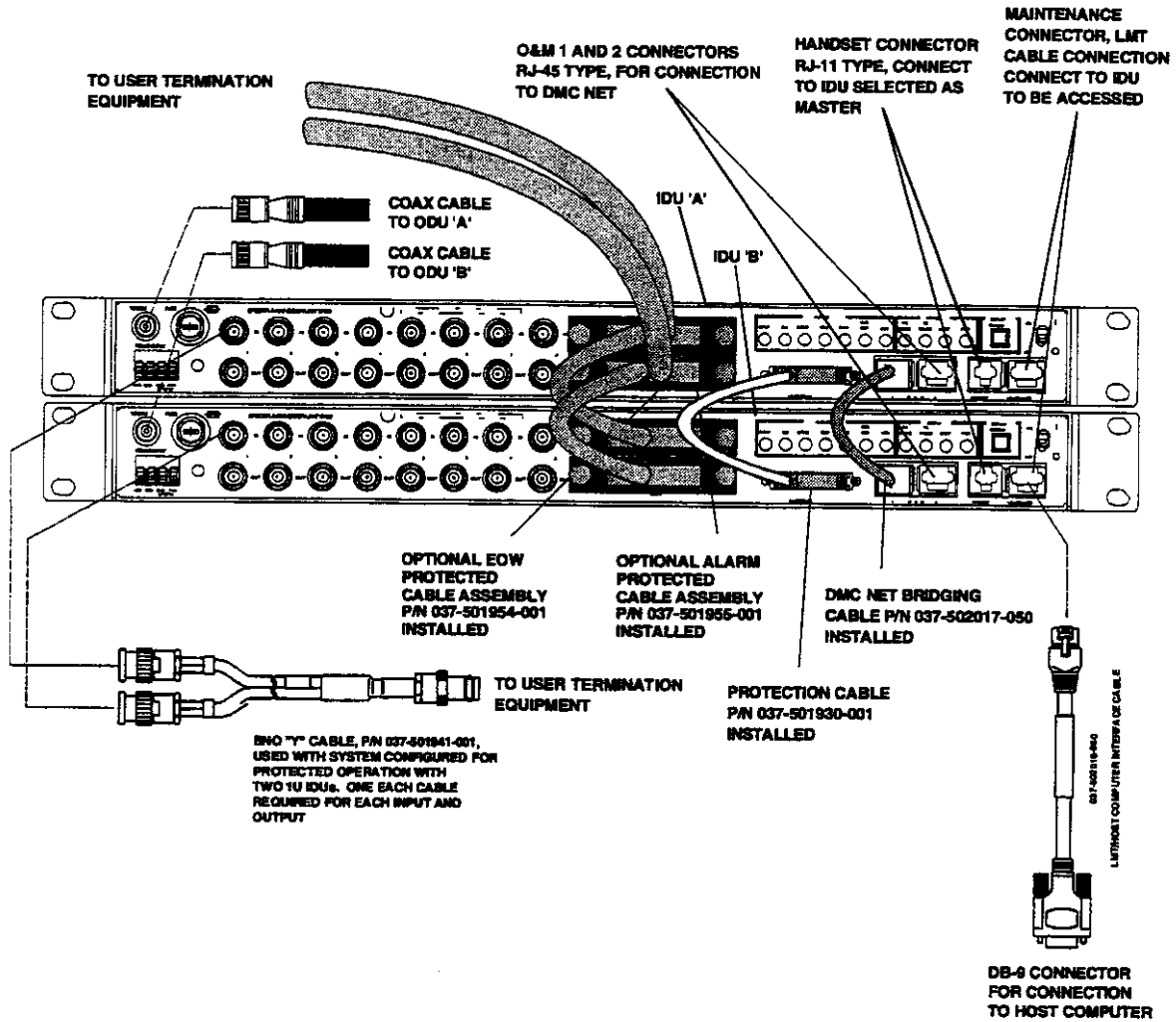




Part C - 1U IDU (DSX Version with DS1 and DS3 Tributary Connectors)

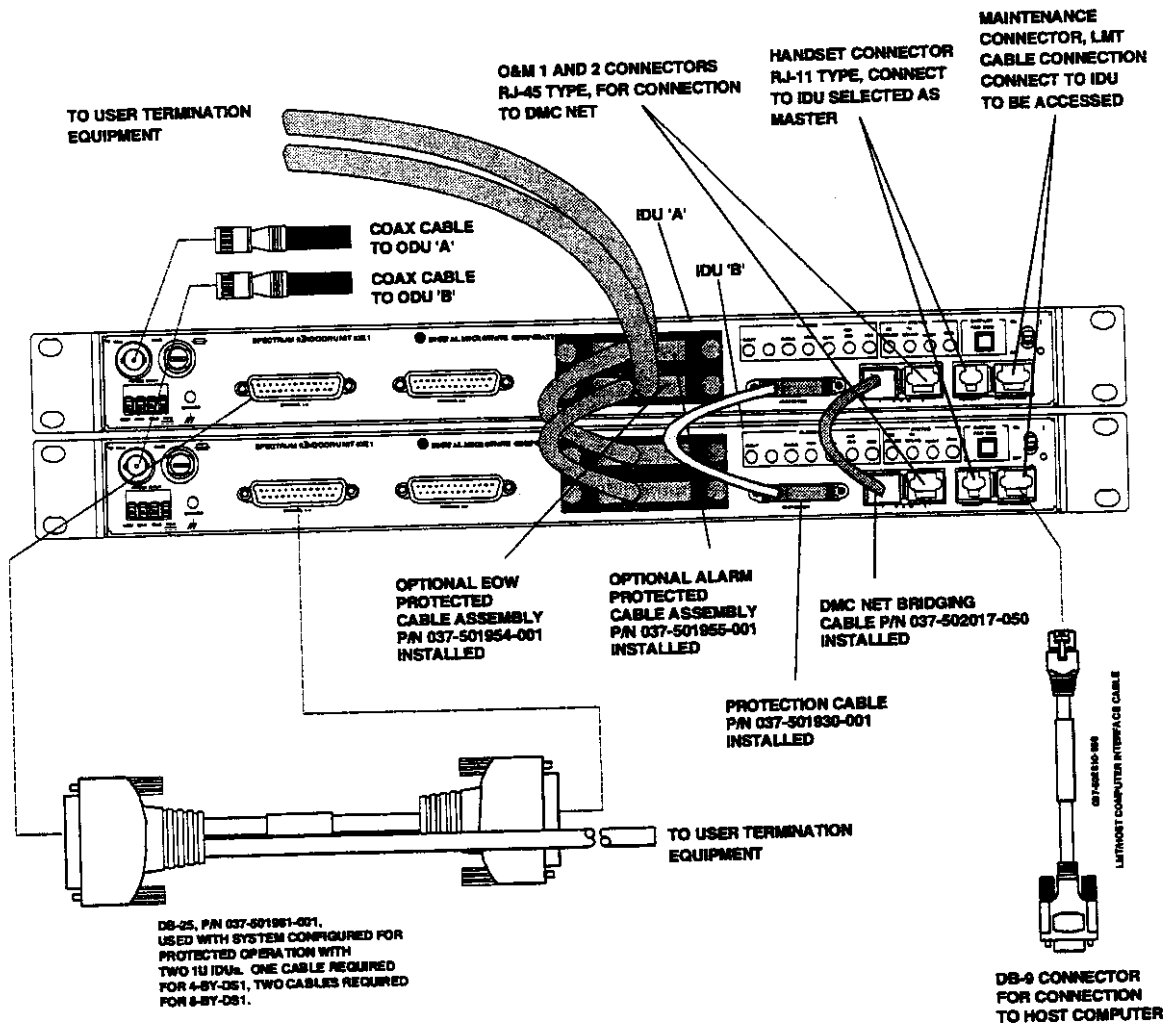
Figure 2-13. IDU Front Panel Cable Connections  
(Sheet 3 of 8)

**Digital Microwave Corporation**  
**SPECTRUM™ II Microwave Radio System**



**Part D - Two 1U IDUs Configured for Protected Operation ( ITU-T Version with LEMO, BNC, or BT-43 Tributary Connectors)**

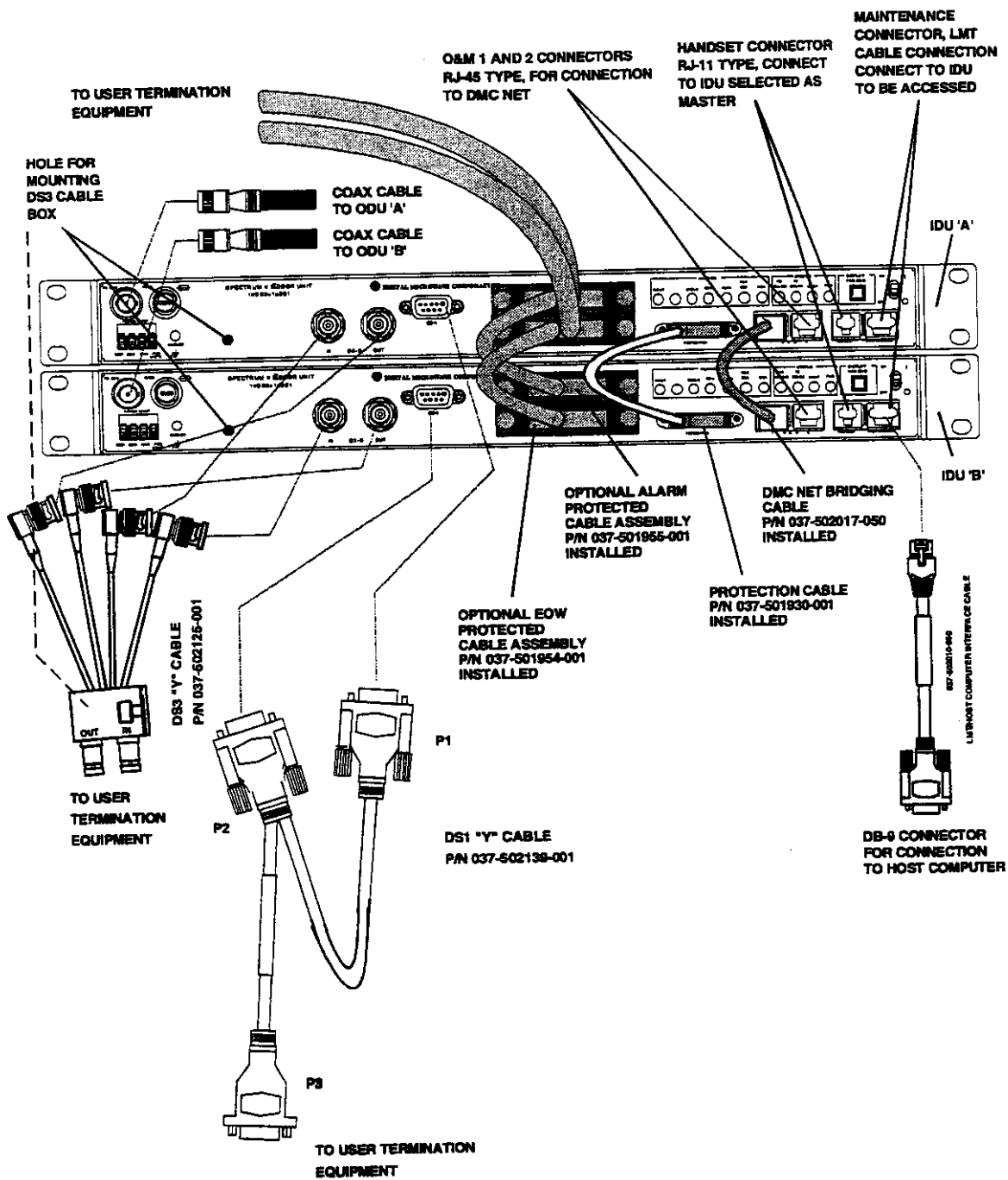
**Figure 2-13. IDU Front Panel Cable Connections (Sheet 4 of 8)**



**Part E - Two 1U IDUs Configured for Protected Operation (ITU-T/ DSX Version with DB-25 Tributary Connectors)**

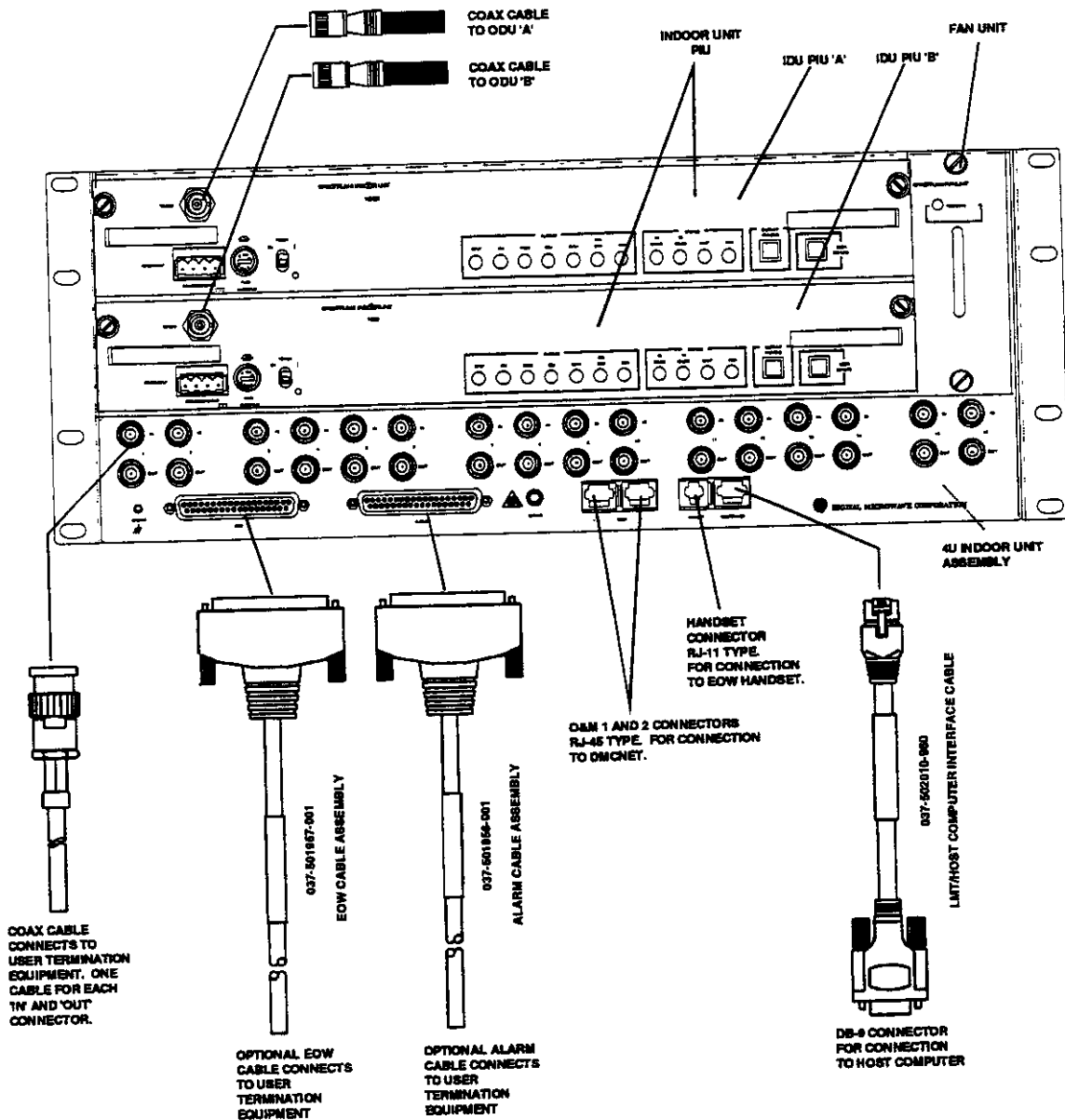
**Figure 2-13. IDU Front Panel Cable Connections (Sheet 5 of 8)**

**Digital Microwave Corporation**  
**SPECTRUM™ II Microwave Radio System**



**Part F - Two 1U IDUs Configured for Protected Operation (DSX Version with DS1 and DS3 Tributary Connectors)**

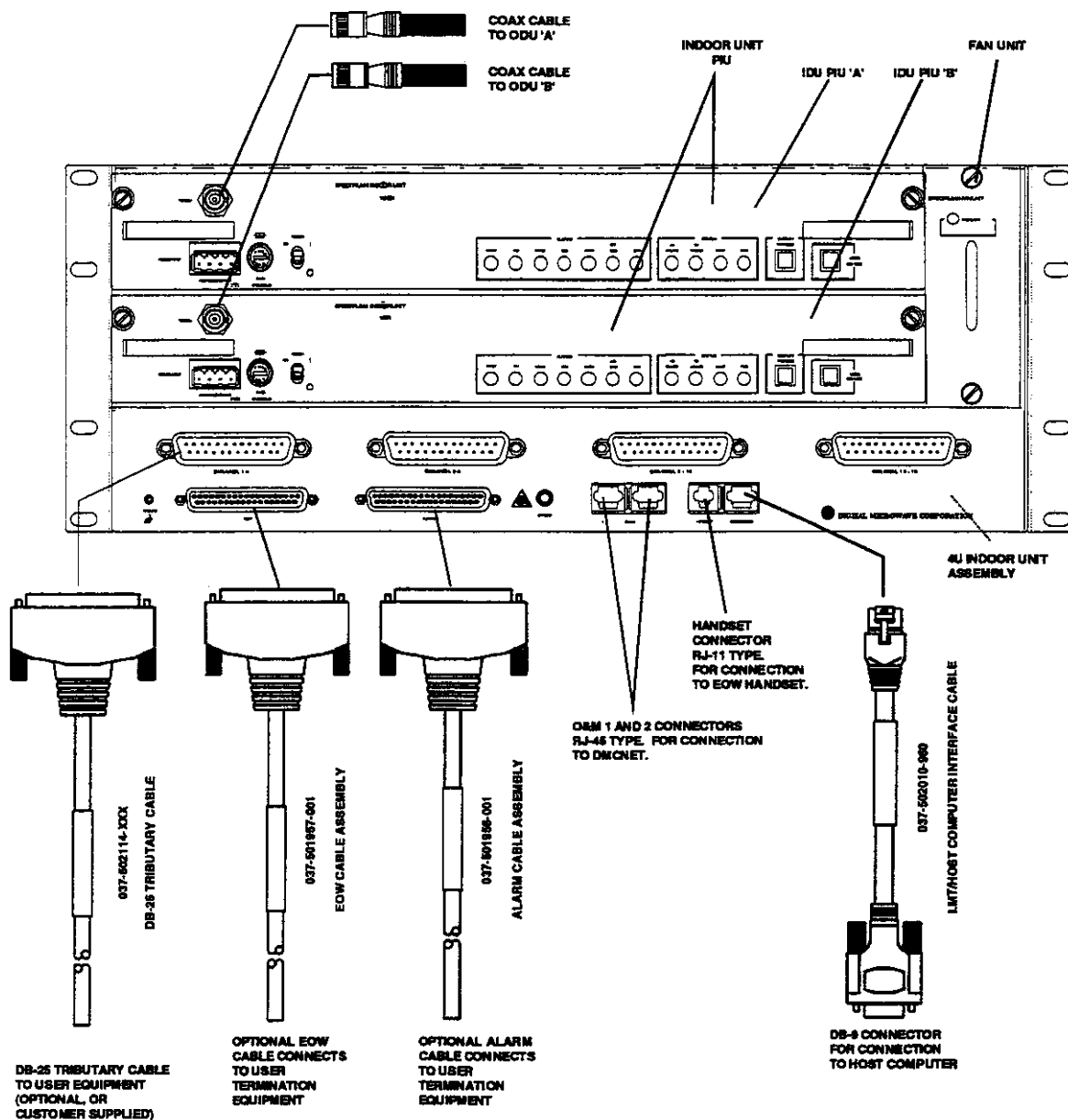
**Figure 2-13. IDU Front Panel Cable Connections**  
 (Sheet 6 of 8)



Part G - 4U IDU ( ITU-T Version with LEMO, BNC, or BT-43 Tributary Connectors)

Figure 2-13. IDU Front Panel Cable Connections  
(Sheet 7 of 8)

**Digital Microwave Corporation**  
**SPECTRUM™ II Microwave Radio System**



**Part H - 4U IDU (ITU-T/ DSX Version with DB-25 Tributary Connectors)**

**Figure 2-13. IDU Front Panel Cable Connections**  
 (Sheet 8 of 8)

### 2.4.8.1 Cable Connections for One 1U or 4U IDU Configuration

If the system is configured for non-protected operation with one 1U IDU, or has a 4U IDU configured for either protected or non-protected operation, perform the following steps:

1. Locate the optional EOW and Alarm cables in the shipping cartons if they were ordered. Refer to Table 2-10 and Figure 2-11, Figure 2-12 and Figure 2-13.
2. Install the EOW cable connector into the EOW IDU mating front panel connector and secure by tightening the two securing thumb screws at each end of the connector.
3. Install the Alarm cable connector into the ALARM IDU mating front panel connector and secure by tightening the two securing thumb screws at each end of the connector.
4. Terminate the non-terminated ends of the EOW and Alarm cables for installation into user equipment using approved termination methods and procedures.
5. Install the terminated ends of the EOW and Alarm cables into user equipment using approved installation methods and procedures. Refer to Table 2-11 and Table 2-12 for connector pin assignments for the Alarm and EOW connectors.
6. Refer to Figure 2-12 and Table 2-13, Table 2-14 and Table 2-15 for pin assignments and signal nomenclature for the O&M 1 and 2, HANDSET, and MAINTENANCE connectors.
7. Connect the traffic interface cables to the IN and OUT connectors on the IDU front panel. See Figure 2-12.

### 2.4.8.2 Cable Connections for Two 1U IDU Configuration

If the system is configured for protected operation with two 1U IDUs, perform the following steps:

1. Locate the optional Protected EOW and Alarm cables in the shipping cartons if they were ordered. Refer to Table 2-10 and Figure 2-11, Figure 2-12 and Figure 2-13.
2. Install the Protected EOW cable connectors into the EOW IDU mating front panel connector on each IDU and secure by tightening the two securing thumb screws at each end of the connector.
3. Install the Protected Alarm cable connector into the ALARM IDU mating front panel connector on each IDU and secure by tightening the two securing thumb screws at each end of the connector.
4. Terminate the non-terminated ends of the Protected EOW and Alarm cables for installation into user equipment using approved termination methods and procedures.
5. Install the terminated ends of the Protected EOW and Alarm cables into user equipment using approved installation methods and procedures. Refer to

Table 2-11 and Table 2-12 for connector pin assignments for the Alarm and EOW connectors.

6. Locate the Protection cable in the installation kit. Refer to Table 2-10 and Figure 2-11.
7. Install the Protection cable into the PROTECTION connectors of the two 1U IDUs. See Figure 2-12.
8. Locate the DMC Net Bridging cable in the installation kit. Refer to Table 2-10 and Figure 2-11.
9. Install bridging cable between one of the two O&M connectors on each of the IDUs. See Figure 2-12.
10. Refer to Figure 2-12 and Table 2-13, Table 2-14, and Table 2-15 for the pin assignments and signal nomenclature for the O&M 1 and 2, HANDSET, and MAINTENANCE connectors.
11. Locate the tributary "Y" cables and connect them to the IN and OUT connectors on the IDU front panel.
12. Connect the traffic interface cables to the "Y" cables. See Figure 2-13.

### **2.4.8.3 Alarm Relay Connection for Two 1U IDU Configuration**

When a SPECTRUM II is configured for protected operation using two 1U IDUs, a special condition exists in regards to the ALARM connector. To receive alarm signals from the SPECTRUM II, users connect their equipment to the ALARM connector through a "Y" cable. Since the "Y" cable makes the two IDUs electrically parallel, the open or closed status of the alarm relays are affected in regards to the output signal.

If users attach their equipment to a wire in the "Y" cable that is connected to a normally-closed relay, they are actually connected to two normally-closed relays in parallel. Therefore, if one relay opens, a path still exists through the other closed relay and no change of state will be sensed by the users' equipment.

DMC recommends users connect to normally-open relays when working with two 1U IDU configured radios. If this is not feasible, the non-protected alarm cable assembly for the one 1U IDU and the 4U IDU configurations can be used. See Table 2-10 and Table 2-11 for reference.

## **2.5 Bridging DMC Net Data**

The SPECTRUM II System is designed to operate as a single link or as part of a multiple link network. As such, the system may be connected (bridged) to links in a network. DMC Net data and signals are passed from one link to another through bridging cables. Refer to Table 2-19 for a list of DMC Net bridging cables that can be used with the SPECTRUM II System to bridge to other Digital Microwave Corporation microwave radio systems.

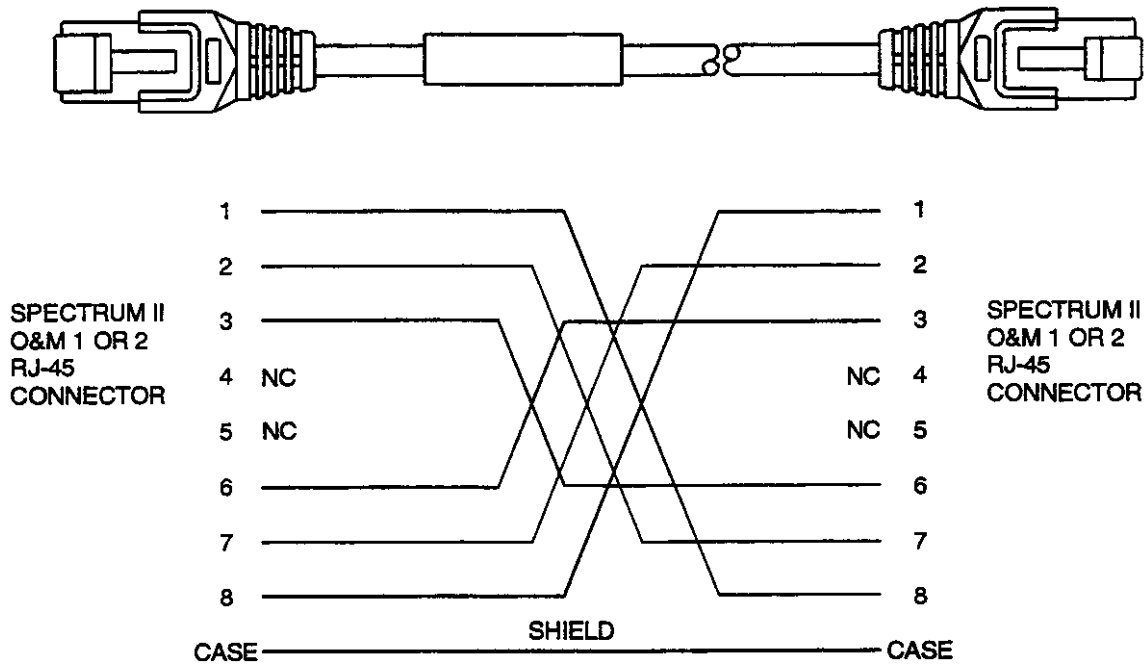


Table 2-19. DMC Net Bridging Cables

Cable P/N	Description/Usage	Reference
037-502017-xxx	<p><b>SPECTRUM II to SPECTRUM II</b></p> <p>For bridging DMC Net data between two SPECTRUM II links.</p>	Figure 2-14 Part A
037-502018-xxx	<p><b>SPECTRUM II to other Digital Microwave Corporation radio systems.</b></p> <p>For bridging DMC Net data between a SPECTRUM II link and a link configured with M series, LC series or QUANTUM radios, DMC NET 1 port.</p>	Figure 2-14 Part B
037-502035-xxx	<p><b>SPECTRUM II to other Digital Microwave Corporation radio systems.</b></p> <p>For bridging DMC Net data between a SPECTRUM II link and a link configured with M series, LC series or QUANTUM radios, DMC NET 2 port.</p>	Figure 2-14 Part C
037-502019-xxx	<p><b>SPECTRUM II to Sun SPARCstation™.</b></p> <p>For bridging DMC Net data between a SPECTRUM II link and the Sun SPARCstation that hosts DMC Net.</p>	Figure 2-14 Part D

**NOTE:** See Figure 2-14 for available lengths of bridging cables.

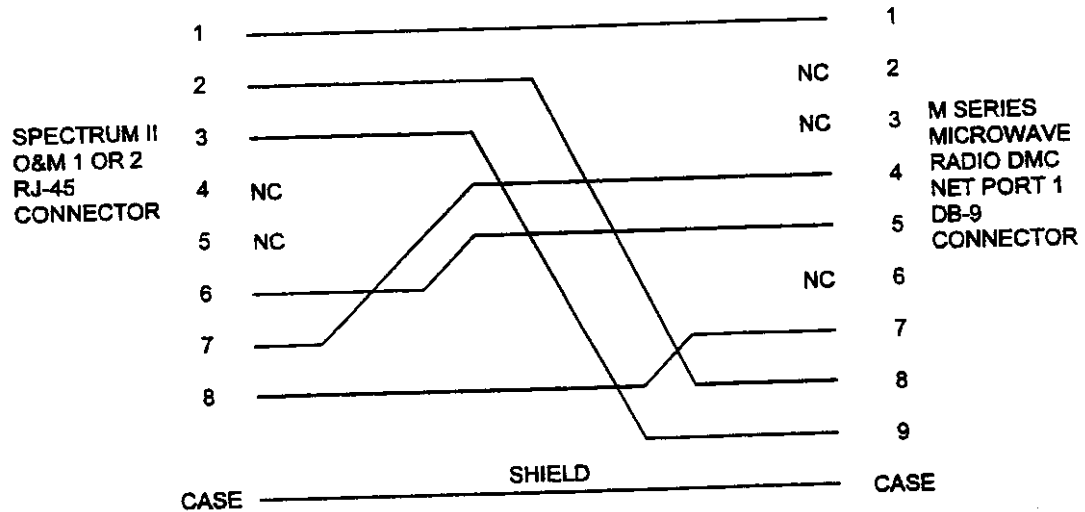
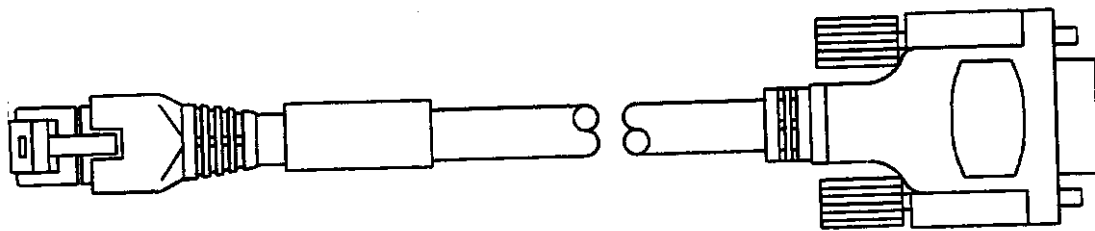
**Digital Microwave Corporation**  
**SPECTRUM™ II Microwave Radio System**



Part Number 037-502017-xxx Where -xxx =	Corresponding Lengths
-050	5 inches
-120	12 inches
-240	24 inches
-480	48 inches
-720	72 inches
-960	96 inches
-3000	300 inches
-6000	600 inches

**Part A - SPECTRUM II to SPECTRUM II Bridging Cable**

**Figure 2-14. SPECTRUM II DMC Net Bridging Cables**  
 (Sheet 1 of 4)

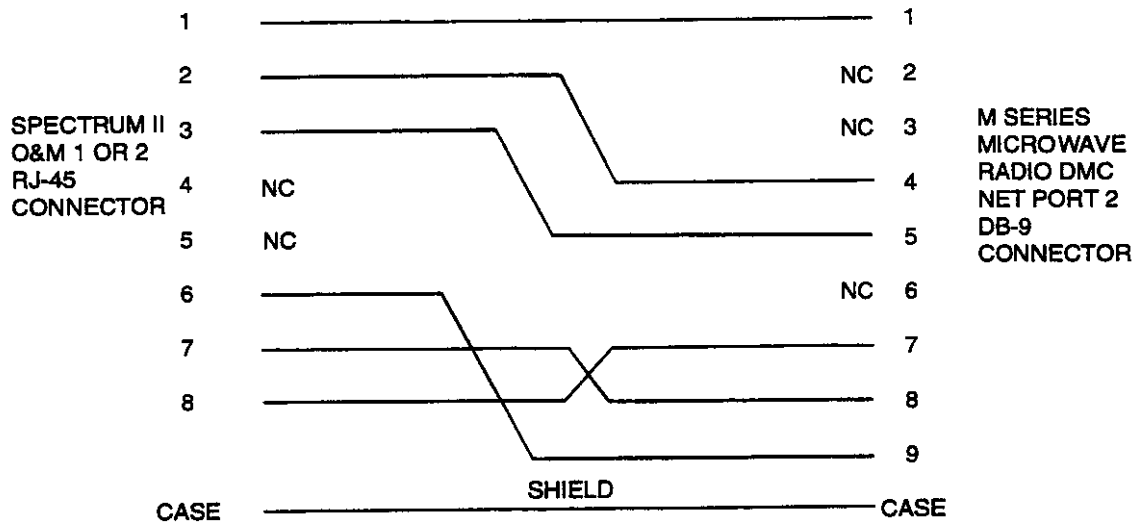
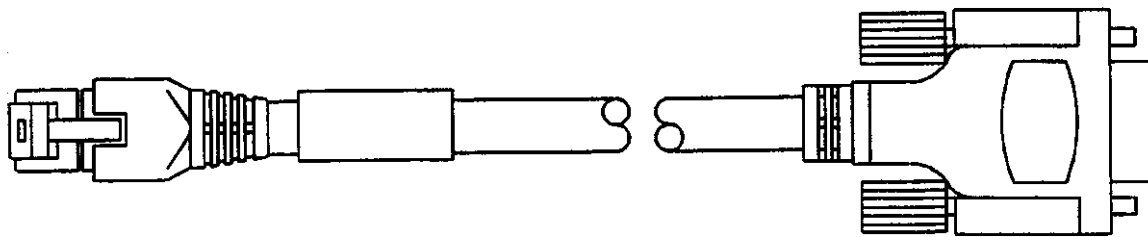


Part Number 037-502018-xxx Where -xxx =	Corresponding Lengths
-120	12 inches
-240	24 inches
-960	96 inches
-3000	300 inches
-480	480 inches
-6000	600 inches

**Part B - SPECTRUM II to Digital Microwave Corporation M Series Port 1  
Microwave Radio Systems Bridging Cable**

**Figure 2-14. SPECTRUM II DMC Net Bridging Cables  
(Sheet 2 of 4)**

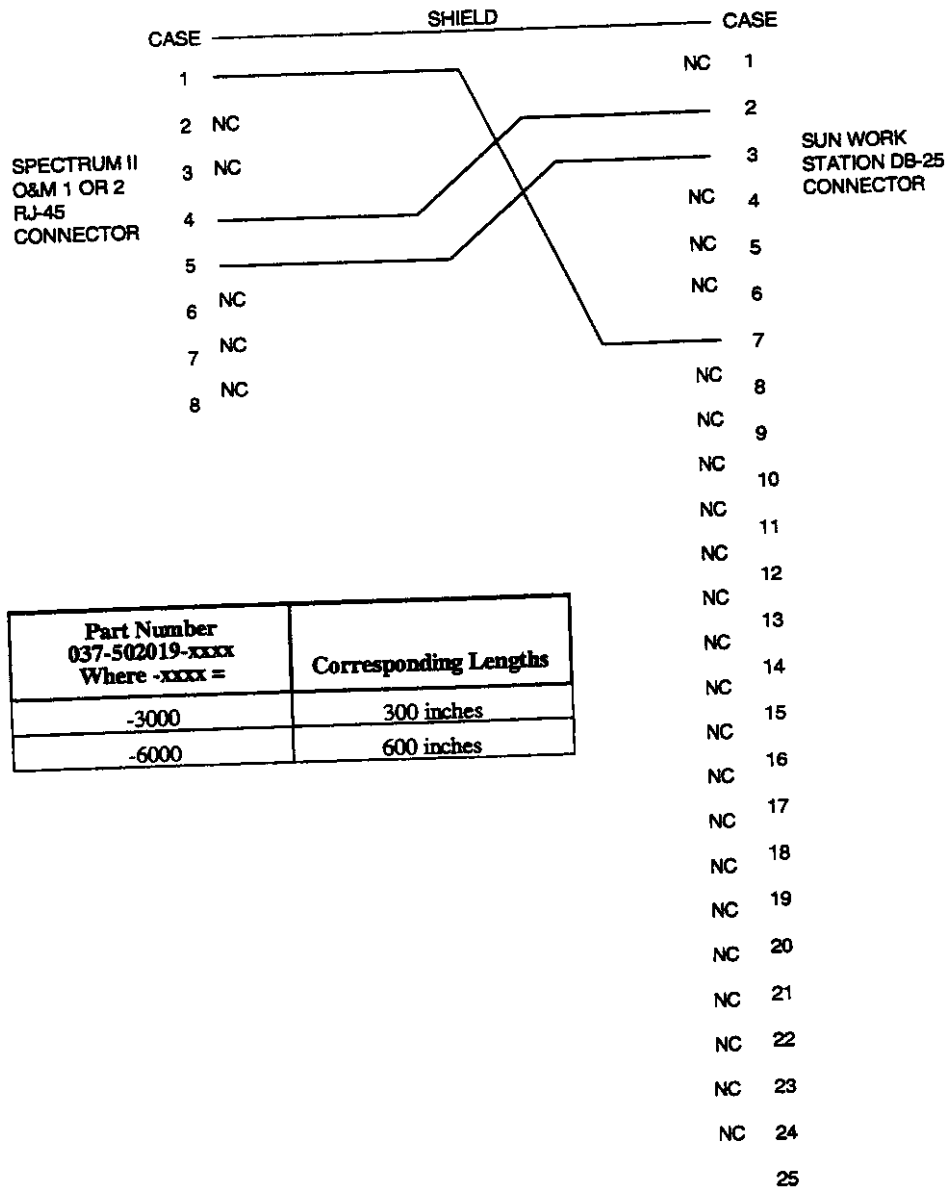
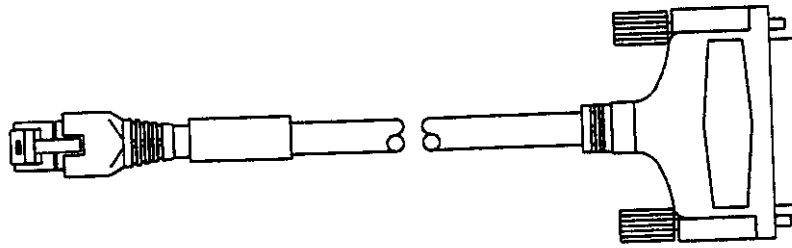
**Digital Microwave Corporation**  
**SPECTRUM™ II Microwave Radio System**



Part Number 037-502035-xxx Where -xxx =	Corresponding Lengths
-120	12 inches
-240	24 inches
-960	96 inches
-3000	300 inches
-480	480 inches
-6000	600 inches

**Part C - SPECTRUM II to Digital Microwave Corporation M Series Port 2  
 Microwave Radio Systems Bridging Cable**

**Figure 2-14. SPECTRUM II DMC Net Bridging Cables  
 (Sheet 3 of 4)**



**Part D - SPECTRUM II to Sun SPARCstation Bridging Cable**

**Figure 2-14. SPECTRUM II DMC Net Bridging Cables  
(Sheet 4 of 4)**

### **2.5.1 SPECTRUM II to SPECTRUM II**

A SPECTRUM II Microwave Radio System link can be bridged or connected to another SPECTRUM II Microwave Radio System link for DMC Net communication. Install the Bridging cable between either the O&M 1 or 2 front panel connector on the IDU of each link. Refer to Figure 2-14, Part A, for a description of the bridging cable.

### **2.5.2 SPECTRUM II to Other DMC Systems**

A SPECTRUM II radio link can be bridged (connected) to M series, LC series or QUANTUM radios at a hub. This is accomplished by installing a bridging cable between the O&M 1 or 2 front panel connector on the SPECTRUM II IDU and the DMC Net 1 or 2 connector on the other Digital Microwave Corporation radio system. Refer to the instruction manual for the connector location of the system being bridged to. Refer Figure 2-14, Parts B and C, for a description of the cable.

### **2.5.3 SPECTRUM II to Sun SPARCstation**

A SPECTRUM II Microwave Radio System link can be connected to a Sun SPARCstation for DMC Net communication. Install the connecting or bridging cable between the O&M 1 or 2 front panel connector on the IDU and the appropriate DB-25 connector on the Sun SPARCstation. Refer to the Sun SPARCstation manual for the location of the connector. Refer to Figure 2-14, Part D, for a description of the cable.

## **2.6 Bridging EOW Signals**

The need may arise to bridge (daisy chain) EOW signals of the SPECTRUM II to other SPECTRUM II radios, or other types of radio systems, together at a hub. The SPECTRUM II can be bridged to other SPECTRUM IIs, or to other Digital Microwave Corporation radios such as QUANTUM and M/LC Series radios. The optional EOW cable is used for this connection, and a separate EOW cable is required for each terminal to be bridged. Optional EOW cables must be ordered from Digital Microwave Corporation to accomplish daisy chain connections. Cable part numbers are 037-501954-001 for the protected cable used with two 1U IDUs, and 037-501956-001 for the non-protected cable used with one 1U IDU and all 4U IDUs. Contact your nearest Digital Microwave Customer Service Center for more information.

The SPECTRUM II EOW connector has two VF channels. Each is a 4-wire analog channel (400 - 3400 Hz) interface with a 600 ohm balanced impedance and a clip level of +7 dBm. See Table 2-20 for attenuation levels and Table 2-12 for the pin out of the EOW connector. The two channels allow one or two other radios to be bridged from one SPECTRUM II terminal. See Figure 2-15 for a schematic of the VF channels in the EOW connector. To daisy chain SPECTRUM II to other Digital Microwave Corporation radios, such as QUANTUM and M/LC Series, the SPECTRUM II's analog signals must

be bridged to compatible analog orderwires. For proper operation and optimum performance, attention should be given to these inter-radio connections.

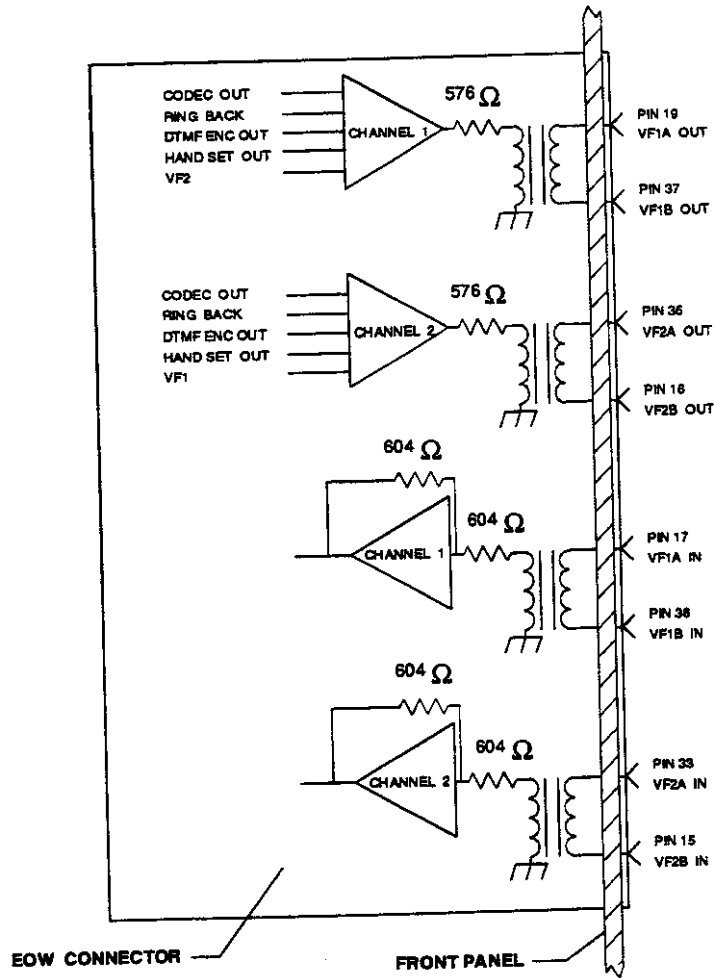


Figure 2-15. Overhead Channels in EOW Connector

**Table 2-20. EOW Channels Attenuation Matrix**

	VF1 In	VF2 In	From Head Set	DTMF Generator	Ringback Generator	Codec Input
VF1 Out	-----	0dB	0dB	-18.3 dBm (typical low tones) -15.7 dBm (typical high tones)	-19.2 dBm	0 dBm
VF2 Out	0dB	-----	0dB	same as VF1	-19.2 dBm	0dB
To Head Set	-6 dB	-6 dB	-----	-26 dBm (typical)	-27 dBm	-8 dBm
Ringback Generator	-----	-----	-----	-----	-----	-27 dBm
Codec Output	0dB	0dB	-----	-----	-----	-----

**CAUTION:** *There is a limit to the number of radios that can be daisy chained together due to quantizing noise accumulation. Noise is inherent in analog voice channels, and can be increased by A-to-D converters and improper grounding. Noise problems may be discernible beginning at three to five terminals bridged in series. See the following paragraph for details.*

In a typical radio, the orderwire uses an analog-to-digital (A-to-D) conversion producing a digital connection at the front panel. These A-to-D conversions add noise in addition to the noise level inherent in analog signals. Improper grounding can also increase the noise level in a channel. If a series of radio links have to be daisy chained, the induced noise will quantitatively accumulate to a level that interferes with the signal. In these situations, Digital Microwave Corporation recommends the use of external digital bridging equipment (party line telephone) to connect the radios.

The sub-sections below describe the most direct way to accomplish bridging SPECTRUM II radios to other Digital Microwave Corporation radios.

### **2.6.1 SPECTRUM II to SPECTRUM II**

This is a direct connection between the EOW connectors of the two radios. The VF1 Out or VF2 Out (TX) of the terminal at one end of the bridge is wired to the VF1 In or VF2 In (RX) of the terminal at the other end of the bridge.

Since the SPECTRUM II outputs an analog signal without A-to-D conversion, quantizing noise can accumulate when bridging SPECTRUM IIs in series. Because of the analog-to-analog connection, external bridging equipment is not recommended.



## 2.6.2 SPECTRUM II to QUANTUM

The QUANTUM has analog service channels fixed at +7 dBm or -16 dBm, as opposed to SPECTRUM II's 0 dBm EOW lines. A direct connection between SPECTRUM II and QUANTUM is not possible, a PLT (party line telephone) module should be used. Connect the QUANTUM digital service channels to the PLT, and connect the SPECTRUM II EOW lines to the PLT's analog ports. Refer to the QUANTUM Installation and Operation Manual for pin out detail of the DIGITAL SVC CHANS connector. Contact your nearest Digital Microwave Corporation representative for details on recommended PLT modules.

## 2.6.3 SPECTRUM II to M/LC Series

An M/LC Series radio may have the orderwire port configured with a 703D EOW 4-wire plug-in, or a 703E EOW 2-wire plug-in. Both plug-ins are A-to-D converters.

### 703D EOW Plug-in

The 703D provides a 4-wire, 600 ohm balanced, analog interface, so the SPECTRUM II can be directly connected. See the inset chart for pin out information.

M/LC Series 703D Plug-in		SPECTRUM II EOW Connector	
Pin 1	Ring In	Pin 19	EOW 1A Out
Pin 2	Tip In	Pin 37	EOW 1B Out
Pin 4	Ring Out	Pin 17	EOW 1A In
Pin 5	Tip Out	Pin 36	EOW 1B In
Pin 3	GND	Pin 18	GND

If noise problems arise with this interconnection, a PLT should be used for the interface. The orderwire port can be fitted with an orderwire bypass card in place of the 703D for this application.

### 703E EOW Plug-in

The 703E provides a 2-wire, 600 ohm unbalanced, analog interface. To interconnect to the SPECTRUM II, either a matching transformer or a resistive network is required. Contact your nearest Digital Microwave Corporation representative for recommendations on a resistive network for your specific application.

Regardless of the specific resistive network used, the 2-wire to 4-wire connection is technically more complex and the EOWs will be susceptible to noise. The use of shielded cables for the interconnections will help minimize the induction of noise. If the noise level is excessive, a 703D plug-in and/or a PLT can be used as described above.

## **2.7 Optional Equipment Installation**

Refer to Chapter 1 for a list of the available system options, the location of the technical description and installation procedures for each system option. Refer to Table 2-3 for a listing of optional materials to augment system installations.

## **2.8 Envelope Drawings**

Envelope drawings are provided to show not only the envelope of the equipment but also the dimensions necessary for the opening and closing of covers on the equipment. Refer to Figure 2-16 for an envelope drawing of the IDU. Refer to Figure 2-17 for an envelope drawing of the ODU.

## Chapter 5. Operation

### 5.1 System Operation Overview

The SPECTRUM II microwave radio system has been designed for minimum operator involvement after system installation. However, due to the versatility of the system, the system options available, and specific user requirements, it is recommended that the user develop specific operating procedures to meet the operational requirements of the installed system.

### 5.2 Determining Master IDU and On-Line IDU

In a protected configuration, one of the IDUs (or IDU PIUs) is designated as the master. Also, one IDU is on-line either by automatic control or by manual locking. The status of which IDU is master and which IDU is on-line are not related—the master IDU does not have to be the on-line IDU. The paragraphs below explain these functions.

#### 5.2.1 Master IDU

Both IDUs in a protected configuration contain the protection control circuitry. But, to function properly, only one IDU can actually exercise the control functions. That IDU is referred to as the "master." The master IDU controls the following:

- Switching between A and B sides based on alarm information.
- Establishing communication across the link for the Engineering Orderwire. The handset must be connected to the master IDU.
- Reporting alarm status to DMC Net. The DMC Net bridging cable must be connected to the master IDU.
- Sending alarm signals to user equipment. Users access alarm signals through the ALARM connector (4U IDU) or the Alarm Protected Cable Assembly (two 1U IDUs). The master IDU controls the output signal.

Which IDU becomes the master is determined by the power-up sequence. The first IDU powered-up becomes the master and remains the master until it is powered-down. Even when the master IDU is not on-line, it retains control of the master functions through the backplane which connects the IDU PIUs in the 4U configuration, or the protection cable that connects the IDUs in the two 1U IDU configuration.

To determine which IDU is the master, press the DISPLAY FAR END button on one of the IDUs and observe the LEDs. If the LEDs flash green, that IDU is the master. If the LEDs flash amber, the other IDU is the master.

### **5.2.2 On-Line Status**

You can determine which side (A or B) of a protected radio is on-line by observing the RX ONLINE and TX ONLINE LEDs on the IDUs' front panels. A green illuminated LED indicates that IDU, and its corresponding side of the ODU, are on-line in the automatic mode. If the LED is illuminated amber, that side is manually locked on-line. (A red or flashing LED indicates a fault. See Table 5-1.)

Either A or B side can be locked on-line through the LMT. See Appendix B. On radios configured with the 4U IDU, either side can also be locked on-line with the LOCK ONLINE push buttons on the front panel.

### **5.3 Controls and Indicators**

The system controls and indicators are described in the tables and figures contained in this chapter. Table 5-1 describes the controls and indicators on the IDU, and Figure 5-1 provides graphical illustrations. Table 5-2 and Figure 5-2 do the same for the ODU. For ease of reference, figures are located at the end of the chapter.

Table 5-1. Indoor Unit Front Panel Controls and Indicators

Control/Indicator	Color When Illuminated	Description (When illuminated)
<b>Fuse</b>		
Fuse	--	8A Slo Blo
<b>Indicators (LEDs)</b>		
<b>ALARMS</b>		
<p><i>NOTE Alarms and contributing conditions will be reported on the ALARM screen of the Local Maintenance Terminal (LMT), see Appendix B for details.</i></p>		
INPUT	Red	Indicates that an E1/DS1 input has been placed in the <b>ENABLED</b> state by the LMT but no input traffic is sensed by the system.
	Amber	<b>Unexpected Input Alarm.</b> Indicates that traffic is sensed on an E1/DS1 input that has been <b>DISABLED</b> by the LMT.
IDU	Red	Alarm indication. Immediate action required.
	Amber	Warning indication. An alarm indication may be imminent. Action required.
	Amber (Flashing)	Configuration mismatch.
CABLE	Red	Alarm indication. Indicates the coax cable between the Indoor and Outdoor Units is either shorted or open or that the 300 baud link from the ODU to the IDU is not functioning. Immediate action required.
ODU	Red (Flashing)	Alarm indication. Indicates an IDU and ODU configuration mismatch. Immediate action required.

**Table 5-1. Indoor Unit Front Panel Controls and Indicators - Continued**

<b>Control/Indicator</b>	<b>Color When Illuminated</b>	<b>Description (When illuminated)</b>
<b>PATH</b>	--	Not currently used. For future use.
<b>FAR END</b>	Red	Alarm indication. Indicates that an alarm condition exists at the opposite end of the link.
	Amber	Alarm indication. Indicates an alarm in the overhead channel (private link).
	Flashing Red	Alarm indicates the link or part of the link between the local and remote terminals has failed.  NOTE: The far-end alarm will appear amber when the terminal has been placed in local loopback, indicating that the private link at the far-end is disconnected. The alarm will appear approximately 15 seconds after loopback is activated.
<b>BER</b>	Amber	Indicates that the system is experiencing an error(s) in the aggregate data stream.  <i>NOTE: High and Low BER thresholds are set by the user through the LMT. Refer to Appendix B for details.</i>
	Red	Alarm indication. Indicates that the low bit-error rate (BER) threshold set in the system configuration has been exceeded.  Alarm indication. Indicates that the high BER threshold set in the system configuration has been exceeded.
<b>FAN ALARM (4U Indoor Unit Only)</b>	Red	Indicates that the fan or the fan circuit has failed.

Table 5-1. Indoor Unit Front Panel Controls and Indicators - Continued

Control/Indicator	Color When Illuminated	Description (When illuminated)
<b>STATUS</b>		
<b>RX ONLINE</b>	<b>Non-Protected Configuration</b>	
	Not illuminated	No indication. Does not illuminate for systems configured for non-protected operation.
	<b>Protected Configuration</b>	<i>NOTE: For systems configured for protected operation, the RX ONLINE indicator provides five states of indication as follows:</i>
		1. Not illuminated
		2. Green
		3. Amber
		4. Red
	5. Flashing	
	Not illuminated	Indicates RX is OFF-LINE.
	Green	Indicates that RX is ONLINE and in the AUTOMATIC mode.
	Amber	Indicates that RX is ONLINE and LOCKED with no active alarms.
	Red	Indicates that RX is ONLINE and an active alarm exists on the RX.
	Flashing	Indicates that the protection link between near- and far-end IDU is disconnected. The RX ONLINE indicator will flash in the color it was when the protection link was disconnected, i.e., if the RX ONLINE was in the automatic mode, it will flash green.

Table 5-1. Indoor Unit Front Panel Controls and Indicators - Continued

Control/Indicator	Color When Illuminated	Description (When illuminated)
TX ONLINE	Non-Protected Configuration	
	Not illuminated	No indication. Does not illuminate for systems configured for non-protected operation.
	Protected Configuration	<p><i>NOTE: For systems configured for protected operation, the TX ONLINE indicator provides five states of indication as follows:</i></p> <ol style="list-style-type: none"> <li>1. Not illuminated</li> <li>2. Green</li> <li>3. Amber</li> <li>4. Red</li> <li>5. Flashing</li> </ol>
	Not illuminated	Indicates TX is OFF-LINE.
	Green	Indicates that TX is ONLINE and in the AUTOMATIC mode.
	Amber	Indicates that TX is ONLINE and LOCKED with no active alarms.
	Red	Indicates that TX is ONLINE and an active alarm exists on the TX.
Flashing	Indicates that the protection link between near- and far-end IDU is disconnected. The TX ONLINE indicator will flash in the color it was when the protection link was disconnected, i.e., if the TX ONLINE was in the locked mode, it will flash amber.	

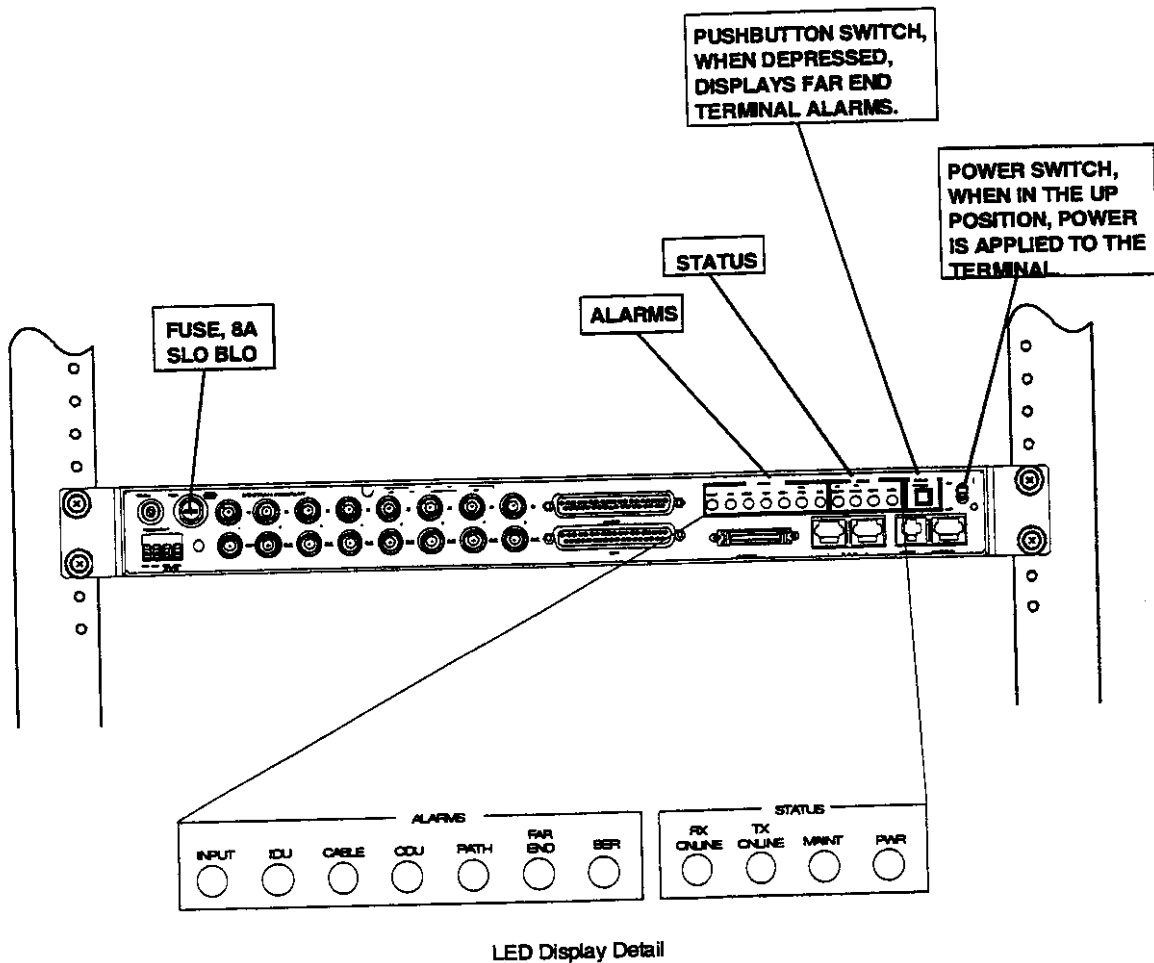


**Table 5-1. Indoor Unit Front Panel Controls and Indicators - Continued**

<b>Control/Indicator</b>	<b>Color When Illuminated</b>	<b>Description (When illuminated)</b>
<b>MAINT</b>	Not illuminated	Indicates that no maintenance condition exists.
	Amber (Flashing)	Indicates that the LMT is communicating with the IDU. No action necessary.
	Amber (Steady)	Alarm indication. Indicates that the system is operating with some type of maintenance condition present, e.g. a loopback test is in progress. Further action may be necessary.
	Red (Flashing)	Alarm indication. Indicates that the IDU is in the boot mode, which is a condition used to download new software using the LMT and IDU firmware.
<b>PWR</b>	Green	Indicates power is on to the system.
<b>Controls</b>		
<b>ON/ OFF (I/ O)</b>		Toggle switch. Controls system power.
<b>DISPLAY FAR END</b>		Push-button switch. When depressed will cause two types of LED displays. First, all of the IDU front panel LEDs will be lit for approximately 500 ms to indicate if IDU is master, green indicates master, amber indicates not master. Second, after approximately 500 ms the far end alarms and status are displayed on the IDU LEDs.
<b>LOCK ON LINE (4U Indoor Unit PIU only)</b>		Push-button switch. When depressed locks the associated RF Basic assembly on line, both TX and RX. For use with systems configured for protected operation only.

Table 5-2. Outdoor Unit Indicators

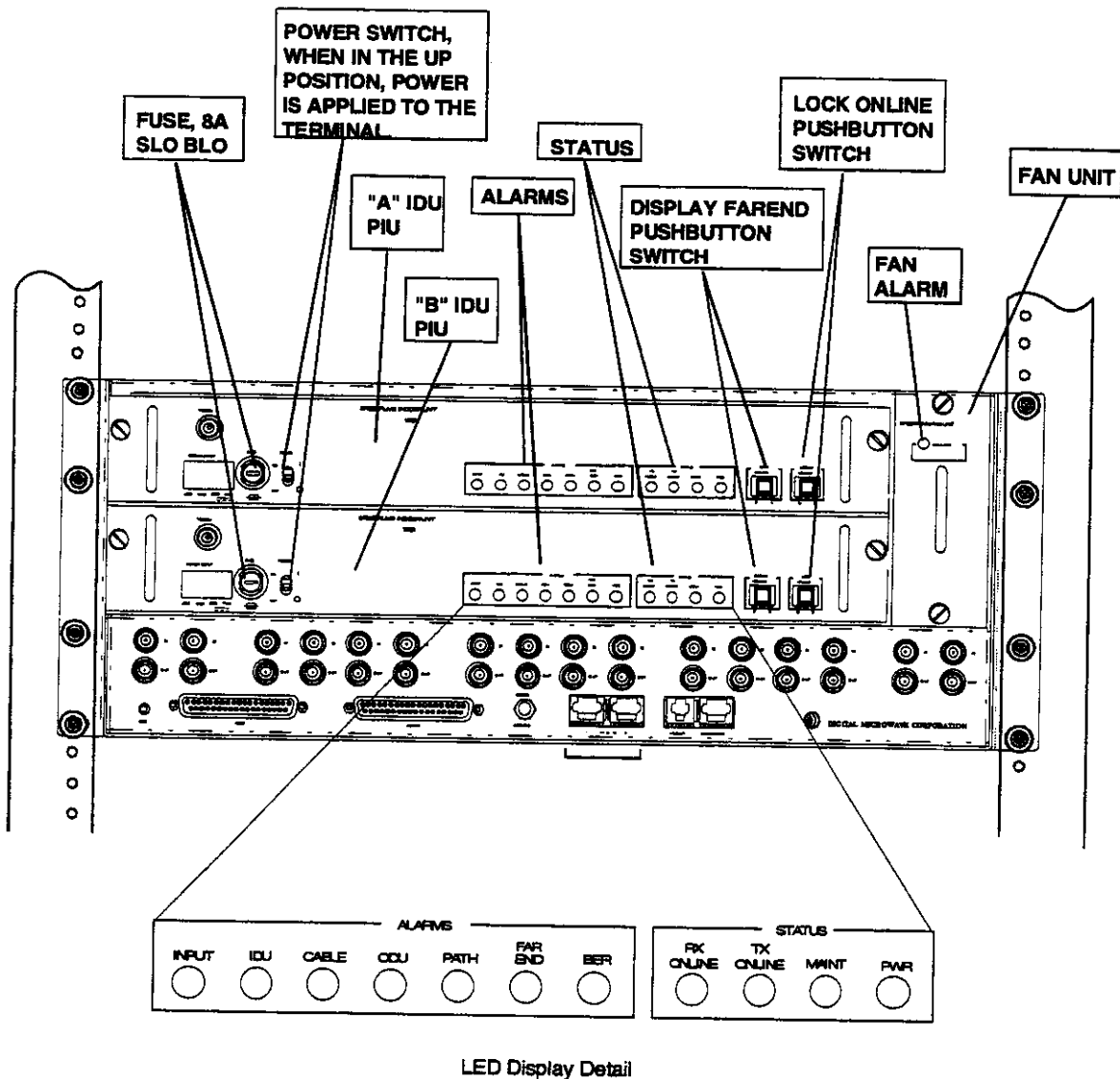
Indicator	Color When Illuminated	Description (When illuminated)
<b>Power Supply/CPU Module:</b>		
<b>DS1- Non-Protected Configuration</b>	Green	When illuminated, indicates TX is active.
<b>DS1 - Protected Configuration</b>	Green	When illuminated, indicates which TX is online, 'A' or 'B'.
<b>DS2</b>	Green	When flashing, indicates 300 baud modem is operational. Used for factory test. Will be flashing during normal system operation.
<b>POWER</b>	Green	Indicates power is on to the Outdoor Unit.



*Note: Though one type of tributary (customer input/output) connector is shown here, five types are available. See Figure 1-3, Parts A through E in Chapter 1 for illustrations of various connectors.*

**Part A - 1U IDU Controls and Indicators (Typical)**

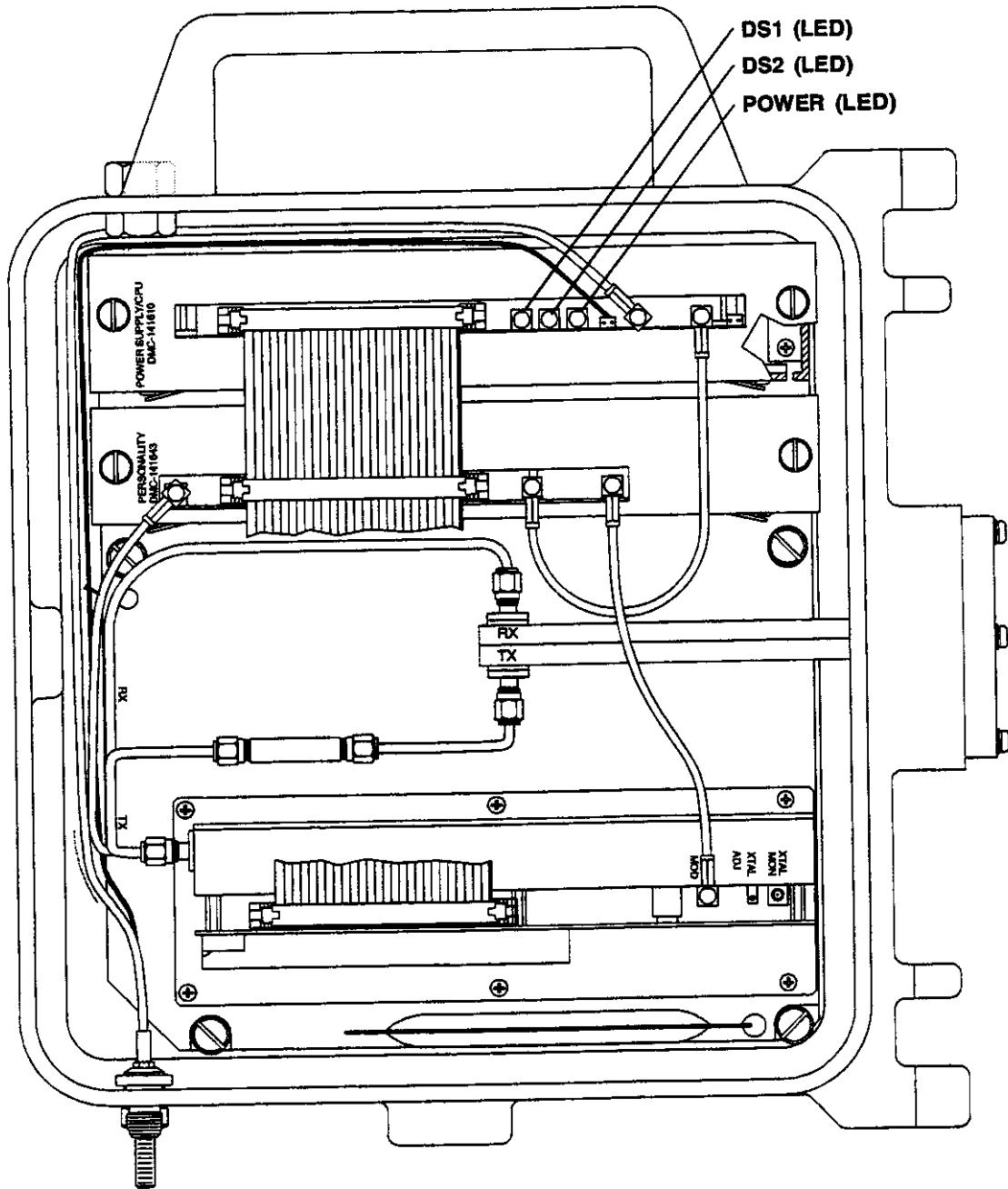
**Figure 5-1. Indoor Unit Controls and Indicators  
(Sheet 1 of 2)**



*Note: Though one type of tributary (customer input/output) connector is shown here, five types are available. See Figure 1-3, Parts F through I in Chapter 1 for illustrations of various connectors.*

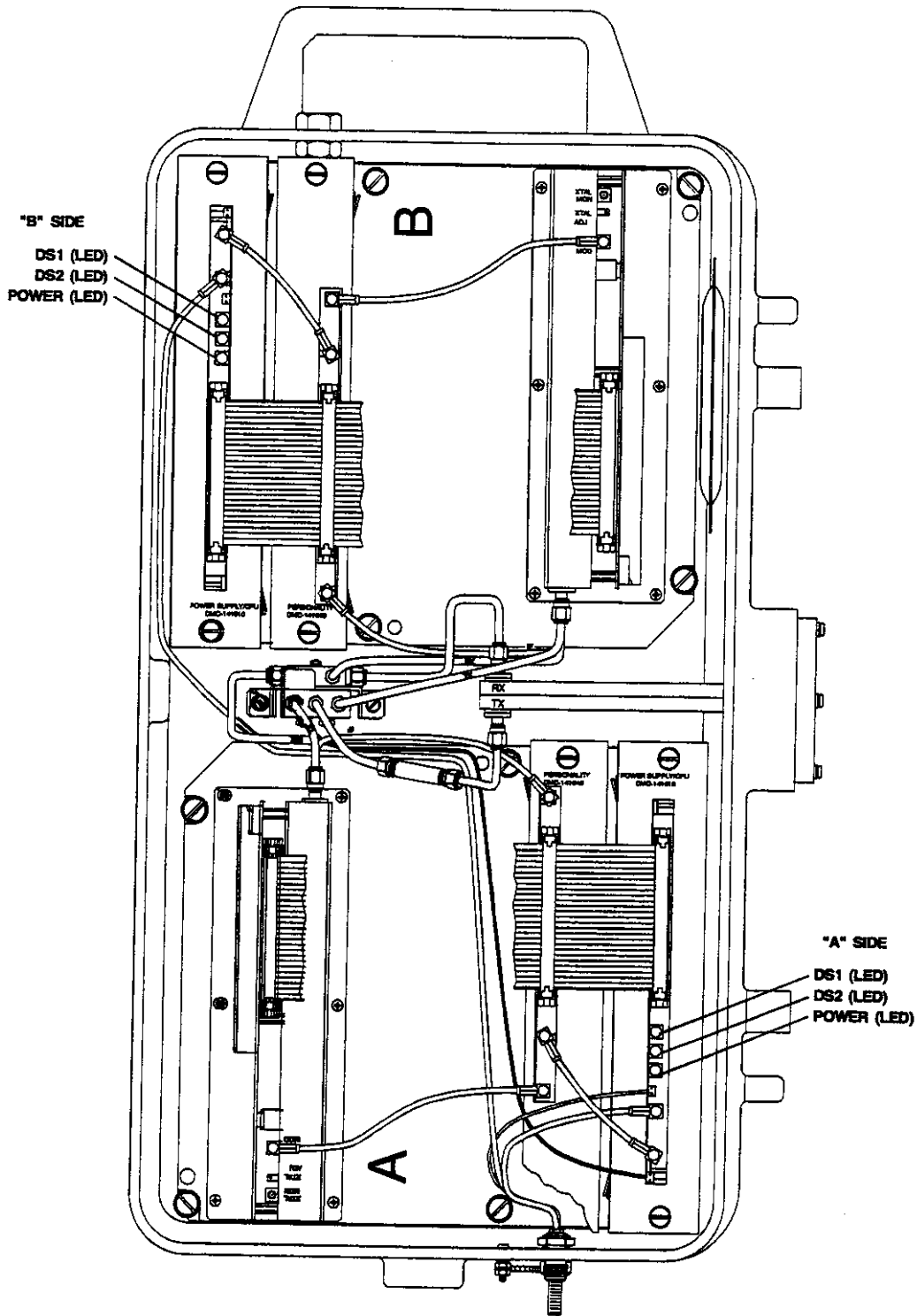
**Part B - 4U IDU Controls and Indicators**

**Figure 5-1. Indoor Unit Controls and Indicators  
 (Sheet 2 of 2)**



Part A - Non-Protected Outdoor Unit (Typical)

Figure 5-2. Outdoor Unit  
(Sheet 1 of 2)



Part B - Protected Outdoor Unit (Typical)

Figure 5-2. Outdoor Unit  
(Sheet 2 of 2)