XP4 Series
Microwave Radio System

Reference Manual

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1.0 XP4 System Description

1.1 Overview

The XP4 series of millimeter and microwave products are designed for short-haul, high-reliability, easy-to-install, low-cost point-to-point communication links. Applications include PCS/PCN micro-cell fixed-network infrastructure, last-mile connections for local telephony, cellular back-haul interconnections, and private networks for government, educational institutions, banks and commercial organizations.

The XP4 is designed for data rates up to 16 x 2.048 Mb/s (16E1), 1 x 34 Mb/s (E3), 8 x 1.544 Mb/s (8DS1), or 1 x 45 Mb/s (DS3) in protected and non-protected configurations in frequency bands from 7 GHz to 38 GHz. Outdoor Units (ODUs) are software configurable so that capacity upgrades can be made without climbing towers. Indoor Units (IDUs) support capacities of up to 16E1, E3, 8DS-1, or DS3 and are frequency independent so that they can be used with any ODU.

The features offered by the XP4 are some of the most advanced in the industry, delivering at a reasonable cost.

The major XP4 features include:

- Minimal installation time
- Single coaxial cable connection between Indoor and Outdoor Units
- Dual polarity DC power input (21.6 to 72 VDC)*
- Adjustable transmit output power
- Frequency/channel setting via keypad or laptop PC
- Diagnostic loopbacks accessible via laptop PC
- Capacity to store 25 different channel plans
- 255 different link ID codes
- Selectable data rate
- Alarm summary available via keypad or laptop PC
- Forward-Error-Correction (FEC)
- Low power consumption
- No radio IF frequencies on the cable
- No cable length settings or adjustments required
- Protection Switch Option available
- SNMP (NMI) Option available

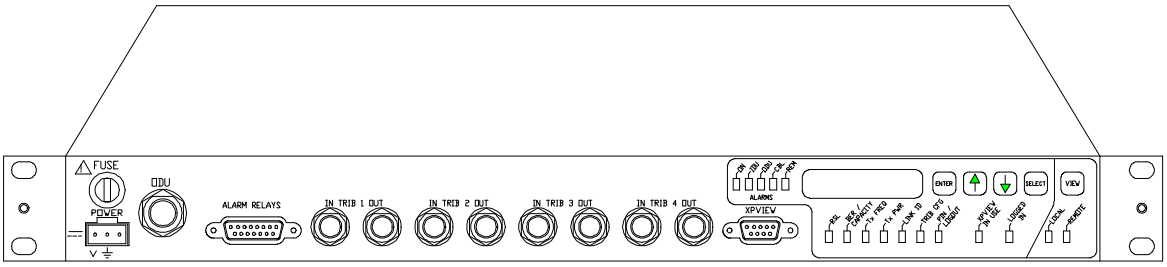


Figure 1-1. Unbalanced 2x/4x IDU

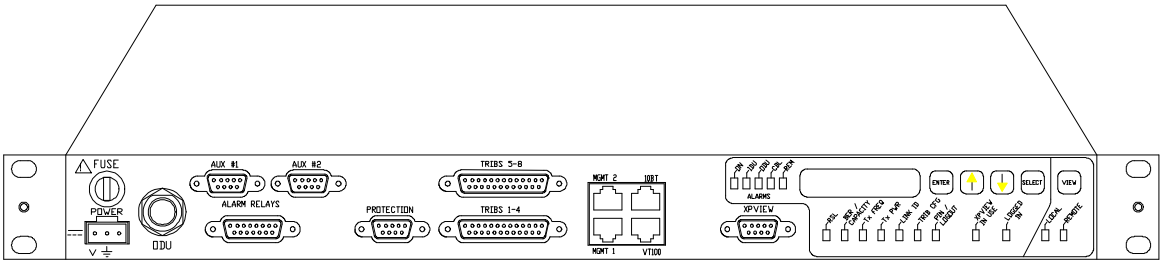


Figure 1-2. Balanced/Unbalanced 4x/8x IDU

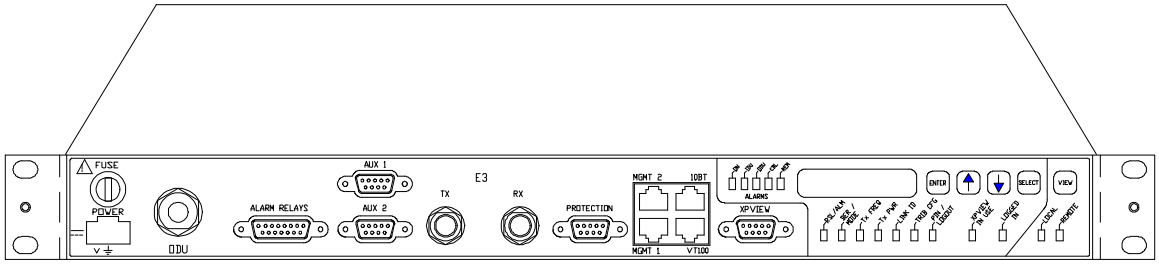


Figure 1-3. Unbalanced E3 or DS3 IDU

XP4 IDU Features

- 1 Rack Unit (RU) high, 19” wide
- 5 alarm relay outputs as standard
- 1 external alarm input sensor as standard
- Front-panel keypad access to control and diagnostics features

  Control:
  - Link Capacity select
  - Frequency/channel of operation
  - Transmitter Power adjustment
  - Link ID (1-255)
  - Tributary status

  Diagnostics:
  - Dynamic RSL indication
  - Current BER
  - Alarm summary status
  - Transmitter Mute

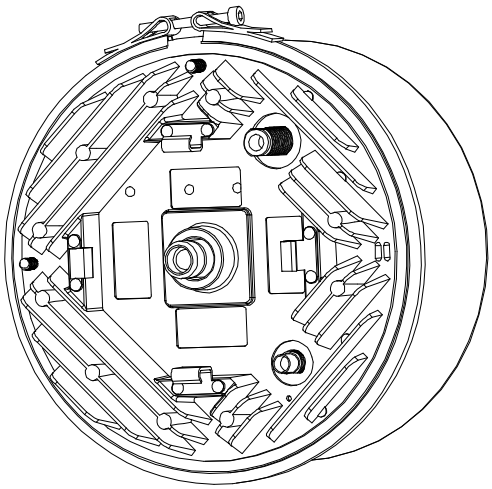


Figure 1-4. XP4 ODU

XP4 ODU Features

- Dual data rate
- Fully tunable over entire RF band from IDU
- Output power controllable from IDU over at least 30 dB of range
- Integrated design incorporating MMIC technology
- Least amount of mounting hardware required in the industry
- Least obtrusive ODU assembly
- DC AGC voltage and audible alignment aid accessed via weatherproofed BNC connection

1.2 Software Controlled Features

The XP4 product range is based on full software control and system configuration, eliminating the need for any hardware switches or factory installed options. Use of the software-based features is through the front panel keypad and display on each IDU, or through XPVIEW. The DB9 connector on the IDU front panel provides an EIA RS232 interface to a standard IBM compatible PC running XPView software. The software functions include all commands to configure a terminal, the alarms and monitor performance. The configuration of both the local and remote terminals can be displayed and changed from one end of the link. In addition to transmit/receive frequencies, software selectable features include transmit power level, link ID code, receive level alarm points, remote and local loopbacks, etc.

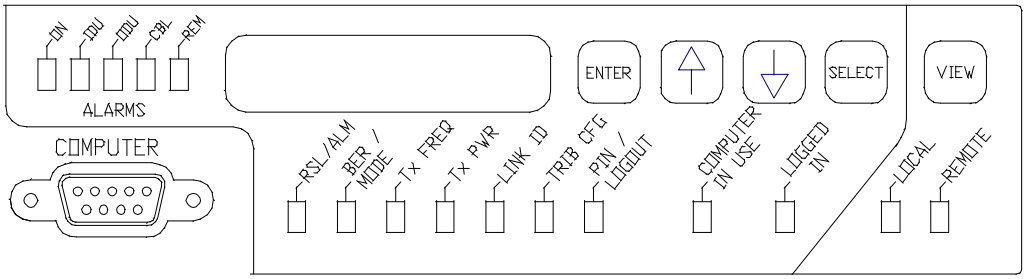


Figure 1-5. IDU Speedkeys and LED Displays

The IDU speedkeys are a unique feature of the software-controlled radio. These front panel keys, shown in Figure 1-5, provide all of the on-site controls required to install, test, and commission a link. This can be

done without any external test equipment, resulting in major time and cost savings. A PC running XPView is not required if the radio has been preset with the customer's standard default parameters either at the factory or at the user's depot.

Digital Microwave's PC based XPView software package is available to control, configure and monitor a XP4 terminal using the RS 232 interface on the IDU. This software program is ideally suited for depot setup and configuration of XP4 terminals prior to delivery to the final site. The XP4 terminal data can be stored in files as records for future reference. The XPView main screen is shown in Figure 1-6.

The XPView software package and Operators Manual are available from your local Digital Microwave representative.

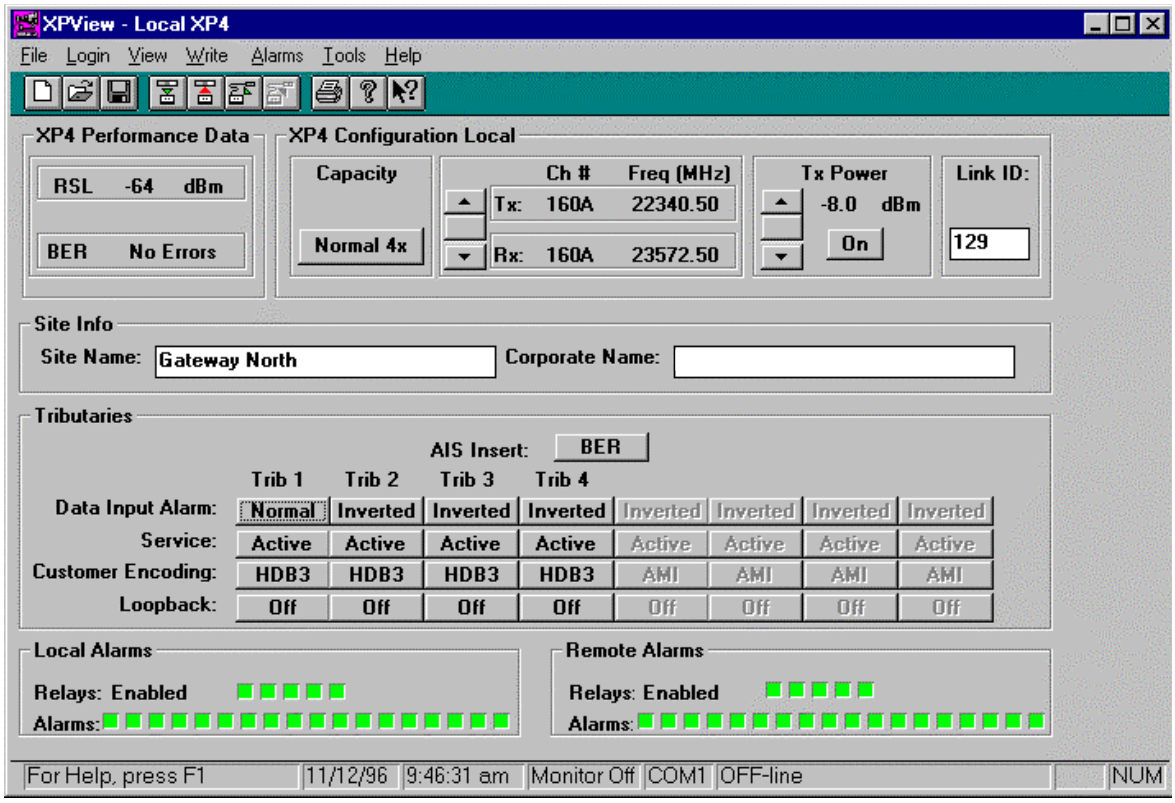


Figure 1-6. XPView Main Screen

1.3 Architecture

A universal radio architecture concept has been implemented for the XP4 product line. A radio terminal consists of three components: IDU, ODU and Antenna. A single coaxial cable is required to interconnect the IDU with the ODU. This single cable feeds DC power to the ODU from the IDU and supports bi-directional traffic, alarm and control signals.

This architecture structure is used for the full frequency range from 7 to 38 GHz to maximize flexibility, commonality of spare parts and interchangeability. This universal radio architecture is illustrated in Figure 1-7. The primary frequency dependent components are the antenna and several modules within the ODU including the transmit hybrid, receive hybrid and diplexer. The IDU is frequency independent and the ODU is capacity independent. The XPView link management system supports all bands. Option cards are available in the IDU to support Network Management, Auxiliary Data Channels (standard on 4x/8x, Front Access 2x/4x, E3, and DS3), 1+1 Protection Interface or other custom interfaces.

A protection switch is required for protected operation. The protection switch dual feeds tributary inputs to each IDU, as well as selecting the tributary outputs from the on line system IDU. The protection switch also controls the ODU transmitter selection in the monitored hot-standby mode.

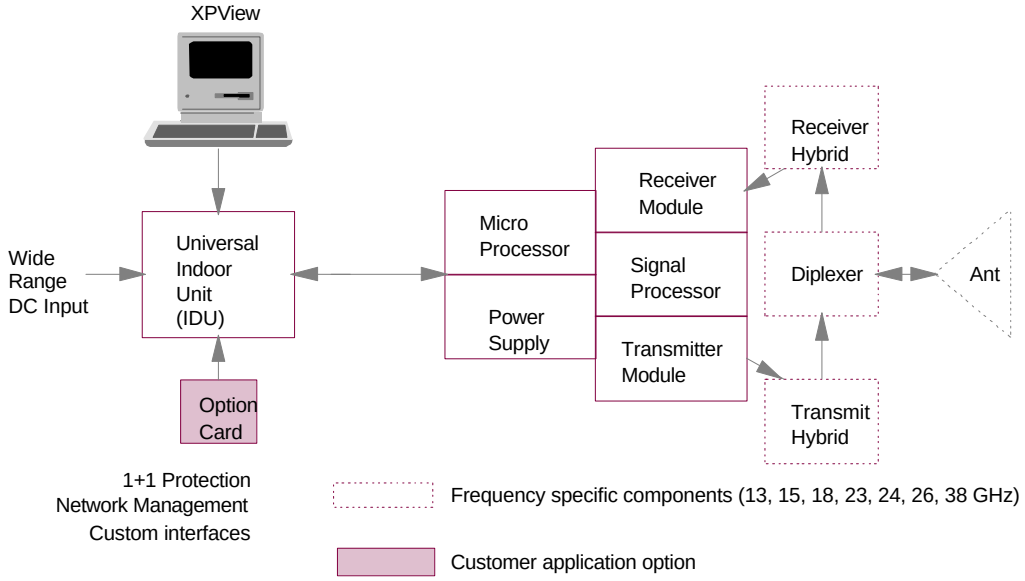


Figure 1-7. XP4 universal radio architecture

1.3.1 XP4 IDU

The XP4 IDU is a 1RU rack-mountable assembly designed for 19-inch rack/cabinet installations.
Each IDU is designed to support one of four capacities: 2x/4x, 4x/8x, E3, or DS3 data rates. E3 is converted to 16E1 by adding an indoor rack-mounted multiplexer (MSU). The IDU is independent of any frequency band thus simplifying maintenance and lowering the overall cost of sparing. All IDUs are compatible with standard 19-inch EIA and ETSI rack mount standards.

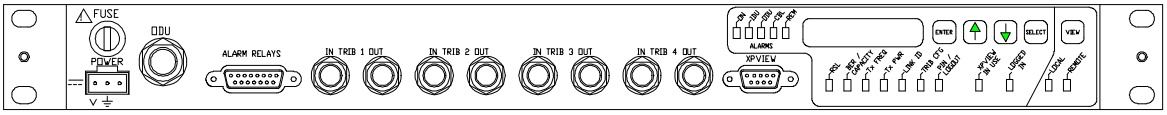


Figure 1-8. Unbalanced 2x/4x IDU Front Panel

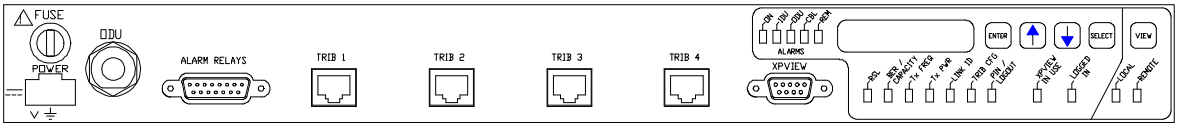


Figure 1-9. Balanced 2x/4x IDU Front Panel

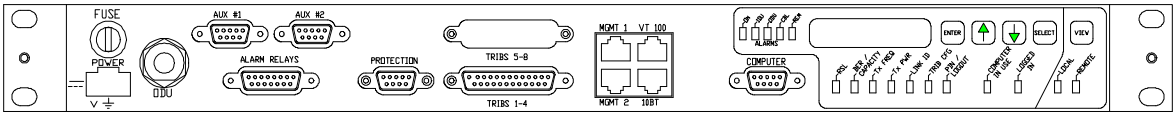


Figure 1-10. Unbalanced/Balanced Front Access 2x/4x IDU Front Panel

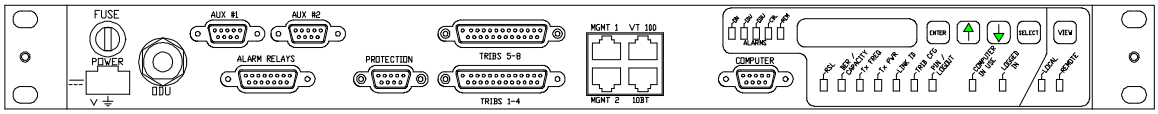


Figure 1-11. Unbalanced/Balanced 4x/8x IDU Front Panel

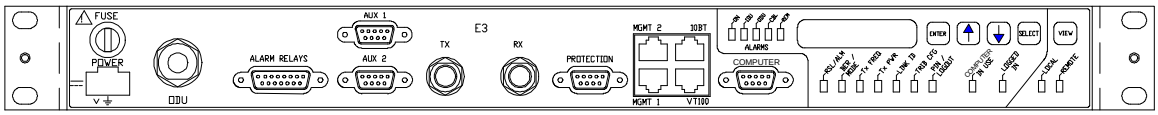


Figure 1-12. Unbalanced E3 or DS3 IDU Front Panel

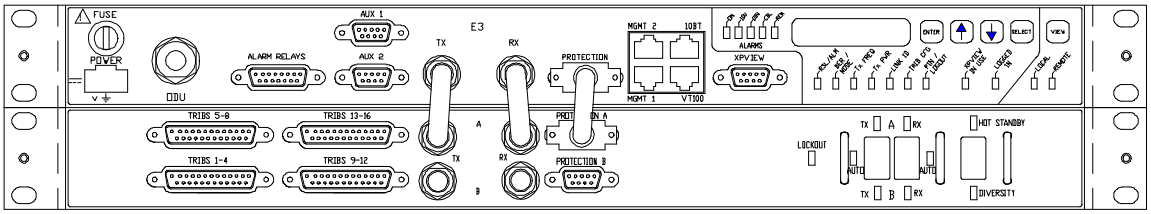


Figure 1-13. Unbalanced/Balanced 16xE1 IDU with MSU

The IDU contains much of the "brains" of the system. The system is fully software controllable through the IDU front-panel keypad or the XPView interface. Functions such as frequency, power output, capacity, link ID, enabling or disabling tributaries, alarm monitoring and RSL indication are all available via the front-panel keypad. The IDU can store up to 25 different frequency plans, which may be edited by the operator as required using XPView. XPView is a software package that serves as a link manager for the system, allowing the user to have enhanced configuration and diagnostic options. A password is required for configuration changes using XPView. Using a password for changes through the front panel keypad is set as default, but not required.

The main functions of the IDU are multiplexing/data interface, reference frequency generation, error correction, scrambling/descrambling, alarm/status monitoring, and site-to-site communications. A block diagram of the IDU is shown in Figure 1-14. All of these functions are integrated onto a single PC Board inside the IDU. In addition, optional plug-in cards are available to support Auxiliary Data Channel (standard on all front access systems), Network Management Interfaces, and 1+1 Protected options. A memory backup holds all relevant data so that if the IDU loses power, the unit will be operational when power is restored. The IDU has five configurable alarm relay outputs ("Form C" dry contacts) and one external alarm input sensor (0V detect).

In the transmit direction, data is input from the front panel connectors. This data is then multiplexed into a composite data rate and passed through scrambling circuitry followed by Forward Error (FEC). The FEC (BCH) circuitry is capable of correcting 2 bits in a 512 bit block. Independent of actual data rate, the data is further multiplexed to a constant bit rate, processed, and sent up the single coaxial cable. Additional overhead for command, control, diagnostics, and site to site communications is also multiplexed in this process.

In the receive direction (from the ODU), the composite signal is demodulated (the AMI data signal is stripped off the 140 MHz carrier signal), de-multiplexed to the appropriate composite bit rate, and then passed through the FEC circuitry and descrambler. The recovered composite data stream is de-multiplexed to the tributary outputs and applicable auxiliary channels.

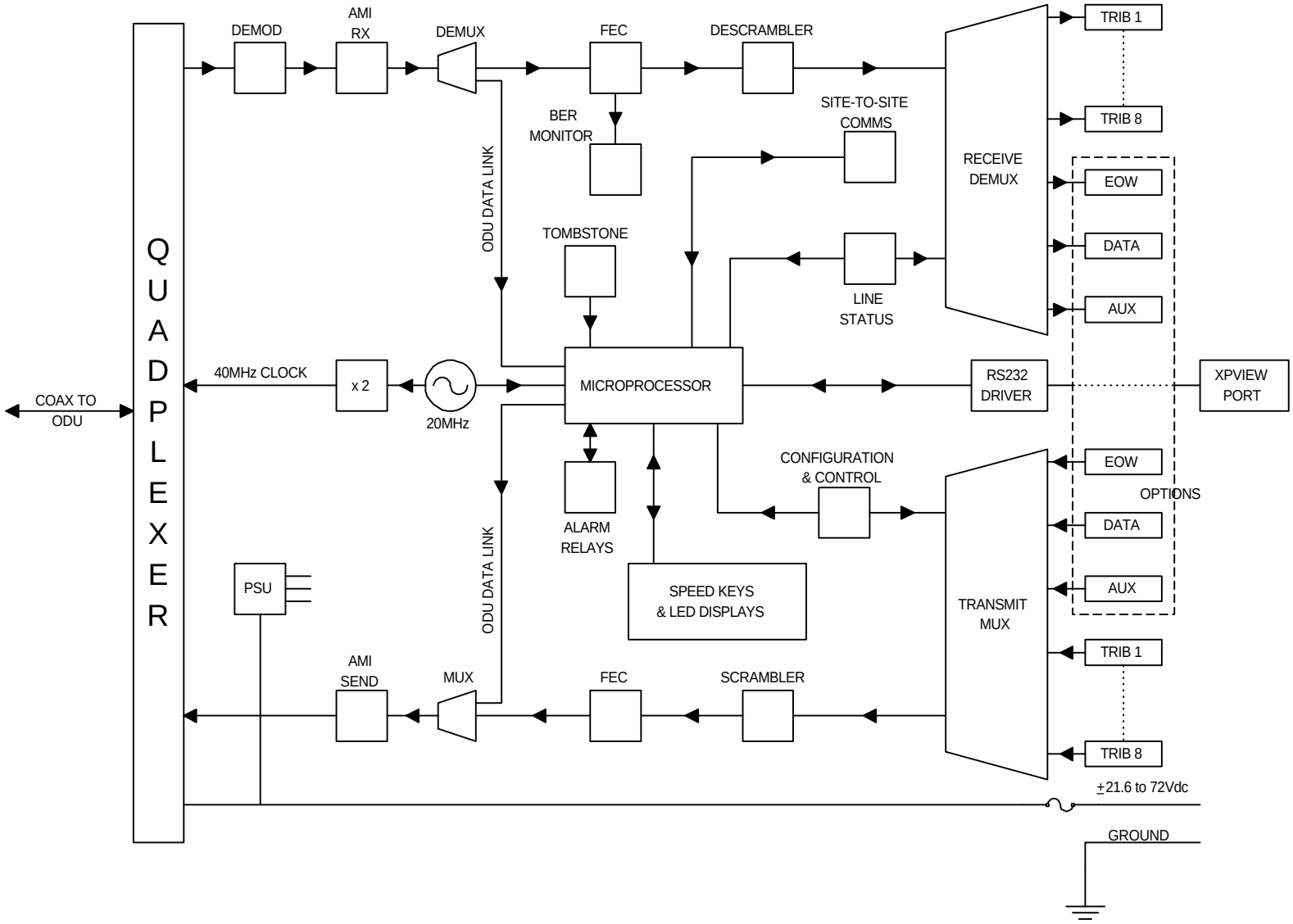


Figure1-14. XP4 IDU Block Diagram

1.3.1 XP4 ODU

The XP4 ODU has a weather-proofed sealed assembly designed to be latched onto an antenna. It can be removed without any tools and without affecting antenna alignment.

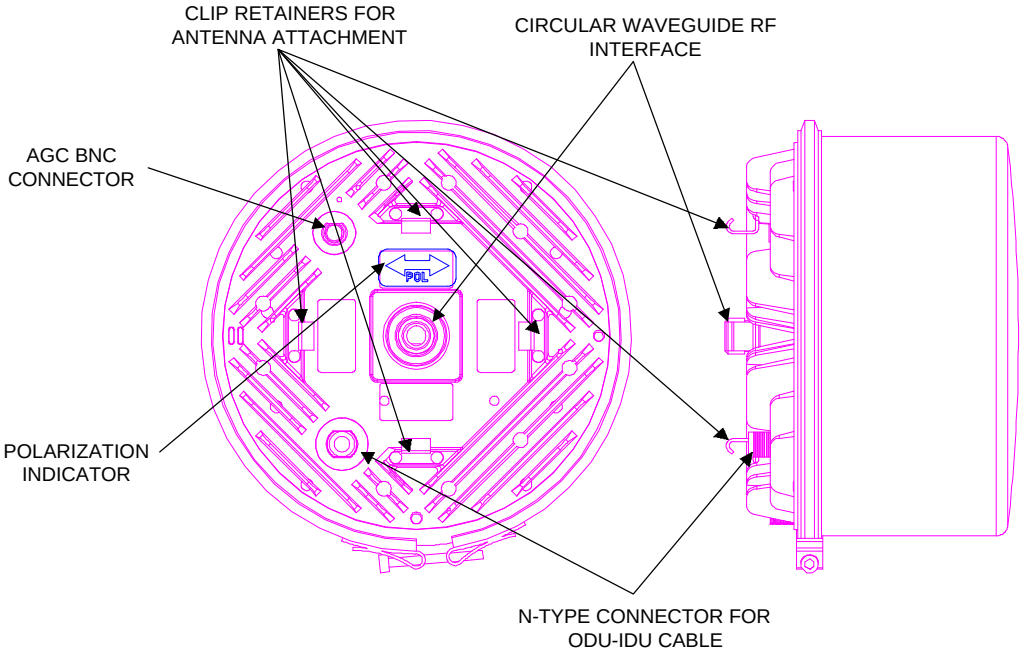


Figure 1-15. XP4 ODU

Each ODU is designed to operate over the entire frequency band of interest:

- 37.0 - 39.5 GHz for a 38 GHz system
- 27.6 to 31.3 GHz for a 28/29/31 GHz system (DS1/DS3 only)
- 24.25 - 26.5 GHz for a 26 GHz system
- 24.25 – 25.25 GHz for a 24 GHz system (DS1/DS3 only)
- 21.2 - 23.6 GHz for a 23 GHz system
- 17.7 - 19.7 GHz for a 18 GHz system
- 14.4 - 15.35 GHz for a 15 GHz system
- 12.75 - 13.25 GHz for a 13 GHz system

ODU diplexers are designed to allow a field tuning range of up to 300 MHz dependent on T-R spacing and Channel Plan requirements. Within the tuning range, any frequency plan can be established and implemented from the IDU. In addition, each ODU will support traffic capacities of either 2x/4x, 4x/8x, 16E1/E3 without any hardware changes. Capacity and transmit power are also selected from the IDU.

No field adjustments, switch settings or other modifications are required to operate an ODU within its designated tuning range regardless of frequency plan, traffic capacity or transmitter output power.

The ODU consists of the following main components (a block diagram is shown in Figure 1-18): Diplexer, receiver hybrid module, transmit hybrid module, signal processor, microprocessor and power supply.

The power supply converts the DC power being sent up the center conductor of the single coaxial cable, and translates the required voltages for the ODU. The raw DC input voltage (±21.6 to 72 Volts, typically) is converted to voltages of +5, -5 and 12 VDC.

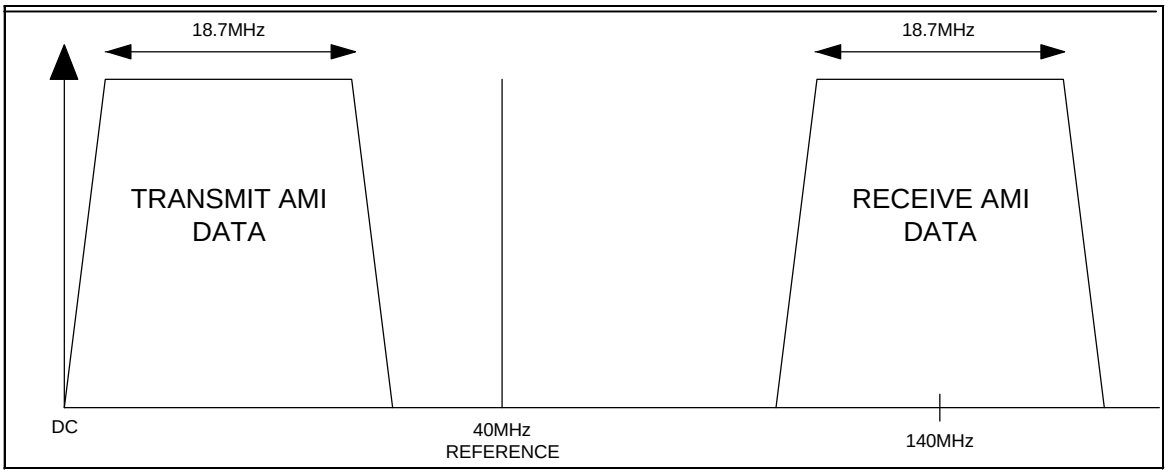


Figure 1-16. XP4 2x/4x/8x Cable Signals

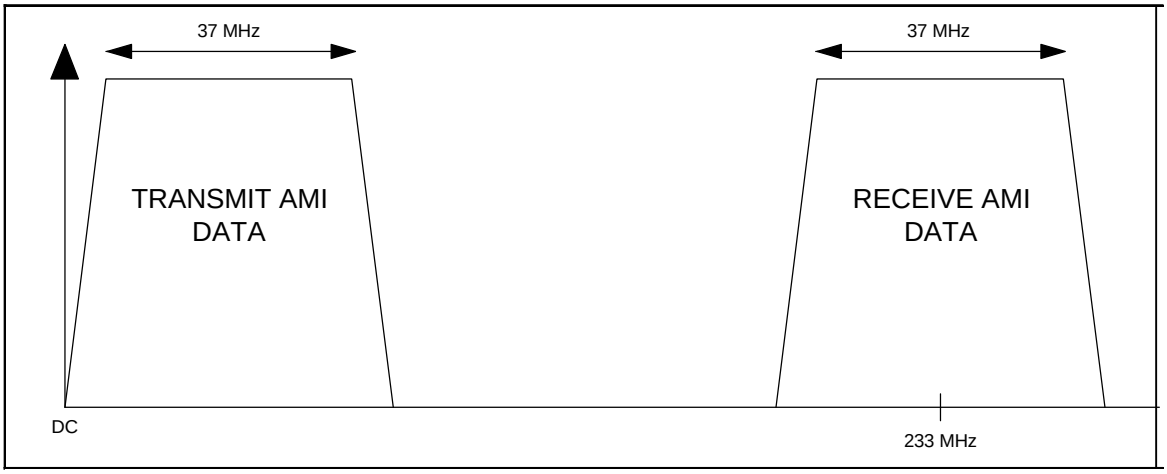


Figure 1-17a. XP4 E3 Cable Signals

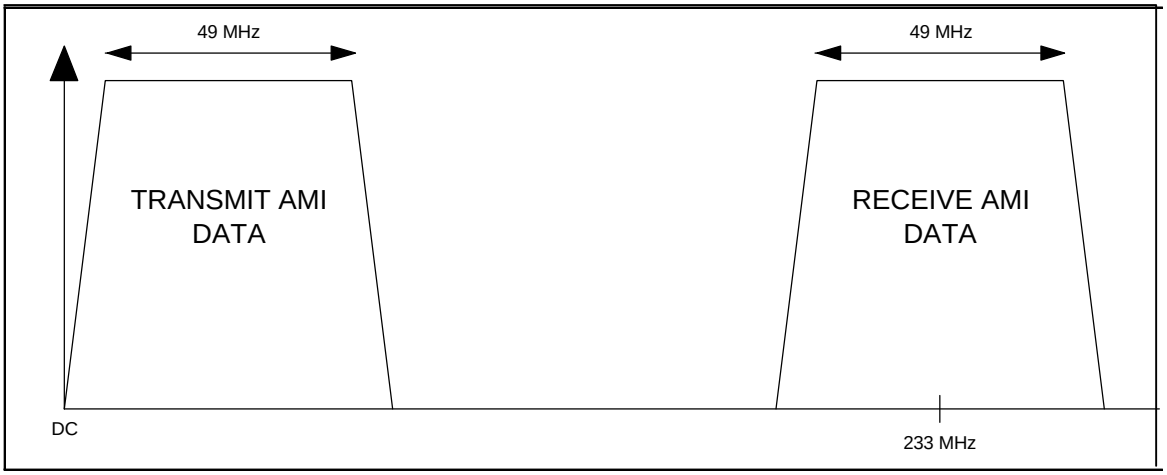


Figure 1-17b. XP4 DS3 Cable Signals

In the transmit direction, a constant multiplexed AMI data stream is sent via the cable to the ODU. For any NxE1 or NxDS-1 system, this includes an aggregate bit rate of 18.7 Mbit/s and 40 MHz reference. For E3 and DS3 systems, the data stream has an aggregate bit rate of 37 Mbit/s and 49 Mbit/s, respectively, at baseband. The data stream contains the transmit data as well as overhead control and status information. The data is sent at a significant level so as to minimize susceptibility to EMI/RFI effects as well as IDU/ODU ground potential differences. Once inside the ODU, this data is received and de-multiplexed accordingly (to the actual bit rate selected) in the signal processor. Overhead information (between ODU and IDU) is passed to the microprocessor. Other embedded overhead accompanies the composite bit rate that is sent for further signal processing. Next, a traditional 4-level FSK modulation scheme is implemented. The signal passes through a 4-level coder, a spectral shaping filter (according to the bit rate selected via software) and transmit modulation circuitry to condition the signal for the proper levels before modulating the voltage controlled oscillator (VCO). The modulation is then fed to the transmit hybrid module where the final modulated signal at the band of interest is derived.

The transmit hybrid module contains a C-band VCO, a solid-state multiplier, an octave band MMIC amplifier (+20 dBm output), followed by a PIN diode variable attenuator/mute switch. Frequency synthesis and control of the transmit (TX) VCO are achieved by state-of-the-art DDS (Direct Digital Synthesis) phase lock circuitry under microprocessor control. The reference is a very stable 20 MHz TCXO located in the IDU, which, in 2/4/8x systems, is doubled to 40 MHz for transmission to the ODU. (40 MHz is used to move the reference away from the baseband 18.7 MHz transmit data stream.) Since the reference is generated in the IDU, it is not subject to the same environmental extremes as the ODU. The synthesizer has a resolution of 0.25 MHz, which will accommodate most frequency plans in use worldwide. The PIN diode attenuator provides at least 0-30 dB of variable attenuation in 0.5 dB steps, as well as mute attenuation of 50 dB. The output of the hybrid is fed to the transmit diplexer, eliminating any unwanted spectral emissions resulting from the modulation and multiplication process, and passed to the antenna feed port.

In the receive direction, the incoming RF signal passes through the receive diplexer, preventing unwanted RF from entering the receiver outside the 300 MHz tuning band. The receive filter also prevents the terminal's own transmit frequency from interfering with the receiver.

Next, the receive signal enters the receiver hybrid module. The receiver hybrid consists of a low-noise amplifier (LNA), which limits the overall system noise figure (to improve threshold performance), and a down-converter. The receive (RX) local oscillator (LO) in this module operates in the same manner as the transmit source (C-band VCO, multiplier, MMIC amplifier), except with a lower output power. The RX LO is synthesized to the same resolution as TX (0.25 MHz) and is locked by DDS. This LO drives an image-reject-mixer, which converts the incoming RF signal to a first IF of 630 MHz. This RX IF frequency is fed to the receiver module where it is down-converted to a second IF of 70 MHz, amplified, and filtered. The highly selective SAW (surface acoustic wave) filters limit the noise bandwidth of the system for better threshold performance and provide superior adjacent-channel performance characteristics. The signal then passes through a multi-stage IF amplifier, providing a linear voltage output over a wide incoming receive signal level (RSL). For example, -80dBm = 1 Volt of AGC and each 1 dB increase in RSL thereafter is equal to 0.1 volt increase in the AGC voltage. RSL is displayed in dBm on the IDU LED display or on the XPView main screen. The signal is then demodulated, baseband filtered, adaptively sliced and multiplexed to a constant bit rate (18.7 Mbit/s). The resulting AMI data stream is double sideband modulated onto a 140 MHz carrier for 2/4/8x systems and a 233 MHz carrier for E3/DS3 systems and sent down the single coaxial cable to the IDU. This signal is very robust with minimum susceptibility to EMI/RFI effects.

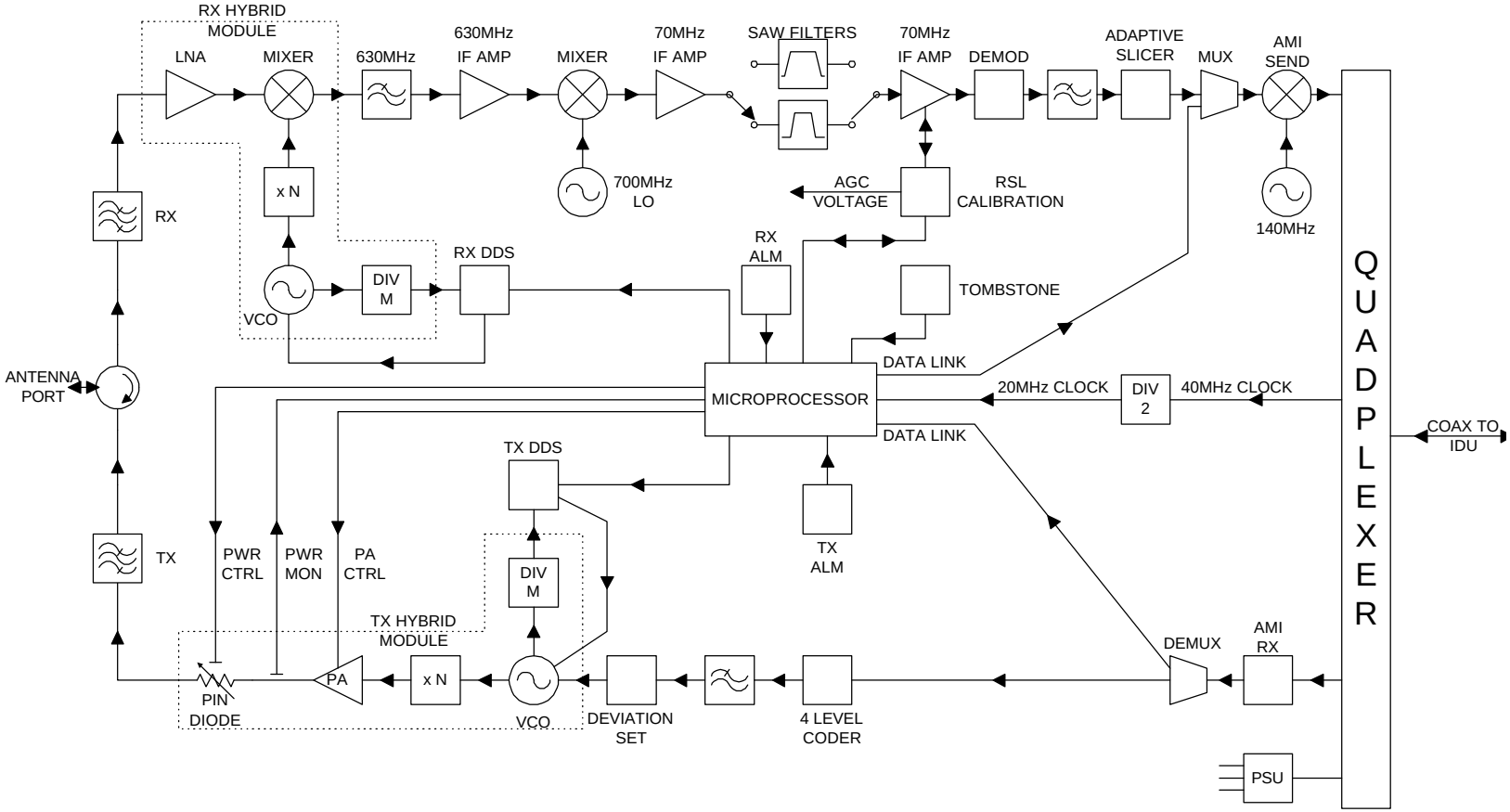


Figure 1-18. XP4 ODU block diagram

2.0 XP4 Options

2.1 XP4 Protection Systems

The XP4 radio link may be operated in protected configuration by the addition of an indoor rack-mounted protection switching shelf (see Figures 2-3 through 2-5) and another standby radio terminal.

The ODU arrangements may use either one antenna with a waveguide coupler or two antennas. See Figures 2-1 and 2-2 for illustrations showing both ODU mounting configurations.

The switching protection shelf may be operated in one of three modes:

1. Hot-Standby
   Only one transmitter is on-line at any one time. Both main and standby terminals are tuned to the same frequency. A fault detected in the on-line radio terminal results in a switch of traffic to the off-line radio terminal.

2. Frequency Diversity
   The main and standby radios are transmitting simultaneously and are tuned to different frequencies to avoid interference. A fault detected in a traffic-carrying radio terminal results in a switch of customer traffic to the standby radio link.

3. Dual Link (4x/8x systems)
   The main and standby radios are transmitting simultaneously and are tuned to different frequencies to avoid interference. Under normal operating conditions, primary radio carries tributaries 1 through 8 traffic and stand-by radio carries tributaries 9 through 16 traffic. Fault detected in traffic of first eight tributaries results in an automatic switch of those tributaries to the stand-by radio, disabling tributaries 9 through 16. Fault detected in traffic of tributaries 9 through 16 will raise alarms but no switching will result.

4. Space Diversity (E3/DS3 systems)
   The main and stand-by radios are set up in Hot Stand-by mode, but are connected to their own antennas. The spatial separation of the antennas, combined with hitless receive switching, provides the Space Diversity function on the receiving end of the link.

For details regarding the installation and operation of the protection system, refer to Section 7.1.

2.2 Network Management

Since all control, configuration and monitoring functions of the radio are already software controlled from the serial EIA RS232 XPView port, the radio is ideally suited to interface with external Network Management Systems.

The standard NMI option offers SNMP compatibility for management of radio systems. With the use of a browser such as “HP Openview” or “SNMPc”, the operator may view and configure any radio terminal in a network from a single point.

The NMI plug-in module, with connections located on the rear of each 2x/4x IDU and on the front panel of each 4x/8x IDU (except for the BNC port), include the following interfaces:

- EIA RS232 VT100 configuration port on a RJ-45 socket,
- 2 x EIA RS232/422/485 SNMP SLIP ports on RJ-45 sockets,
- Ethernet port on RJ-45 or BNC socket.

Options to support other Network Management protocols can also be easily accommodated as the NMI is built on a powerful hardware platform (Motorola 68000 series microprocessor).

For details regarding installation of NMI option, refer to Section 7.2.

For full details on the NMI option, contact your area's Digital Microwave Sales Representative.

2.3 Auxiliary Data Channels

The XP4 Auxiliary Data Channels provide access to two 72 kbit/s overhead channels between XP4 terminals in a link. For 2x/4x systems, the option card needed to implement this feature may be fitted to any 2x/4x XP4 IDU, independent of capacity setting or frequency band. The Auxiliary Data Channel option card must be fitted to the XP4 IDUs at both ends of the link. The option card is not required for Front Access 2x/4x, 4x/8x, E3/16E1, and DS3 systems as the Auxiliary Data Channels are a standard feature in these IDUs.

The XP4 Auxiliary Data Channels feature:
- One balanced data channel (EIA RS422) and one unbalanced (EIA RS232)
- Both data channels may be used simultaneously
- Each data channel includes a clock as well as data signal

For details regarding installation, refer to Section 7.2.

For full details on the Auxiliary Data Channel option, contact your area's Digital Microwave Sales Representative.

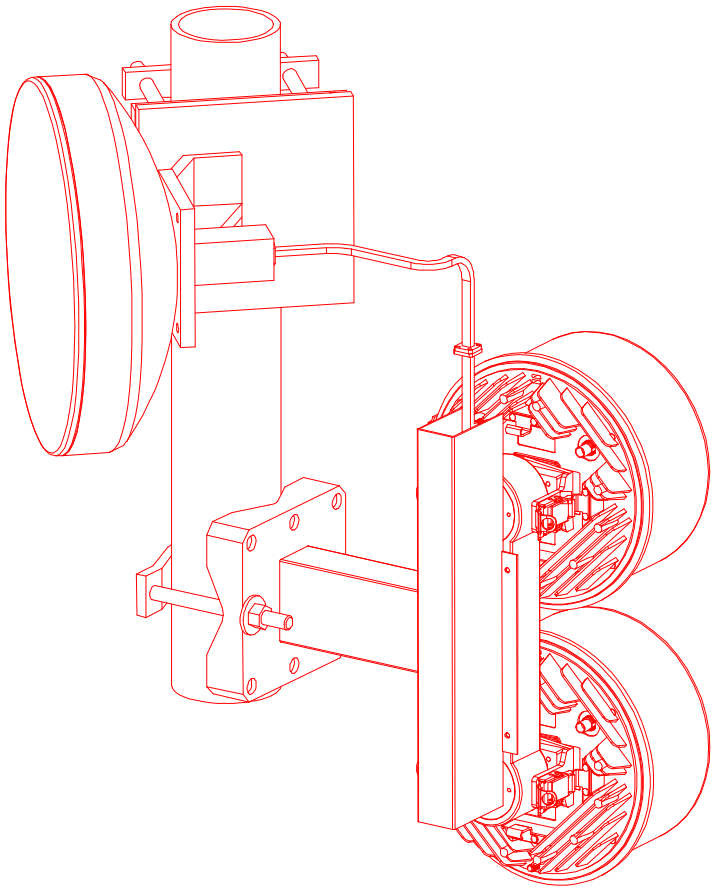


Figure 2-1. ODU Protection Configuration using a Single Antenna.

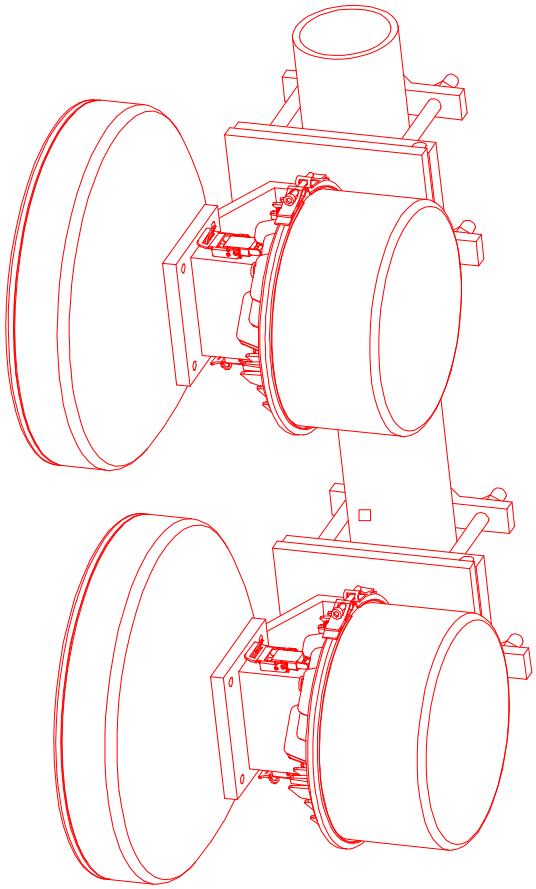


Figure 2-2. ODU Protection Configuration using Dual Antennas.

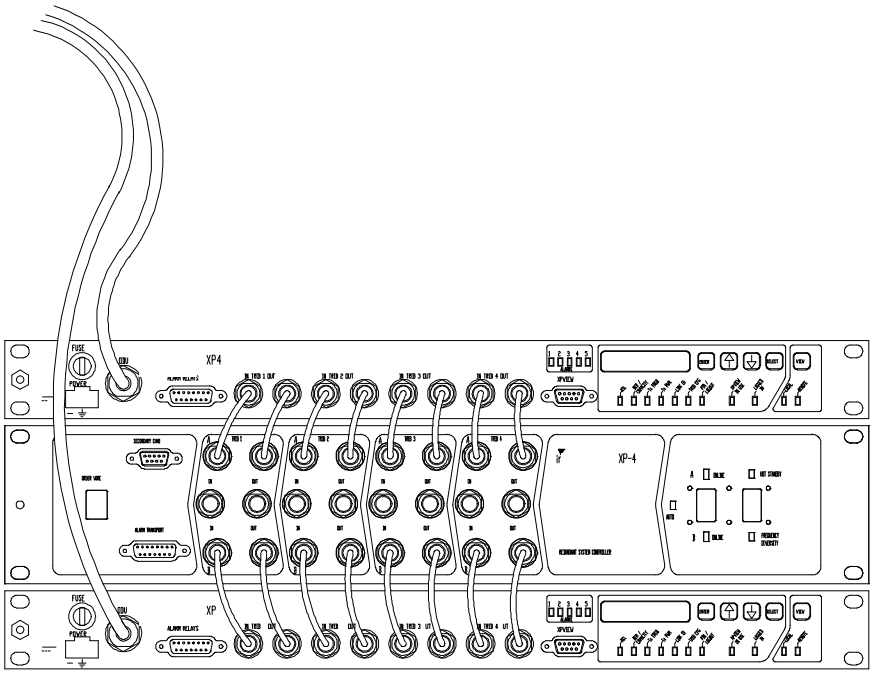


Figure 2-3. Unbalanced 2x/4x IDUs in Protected Configuration.

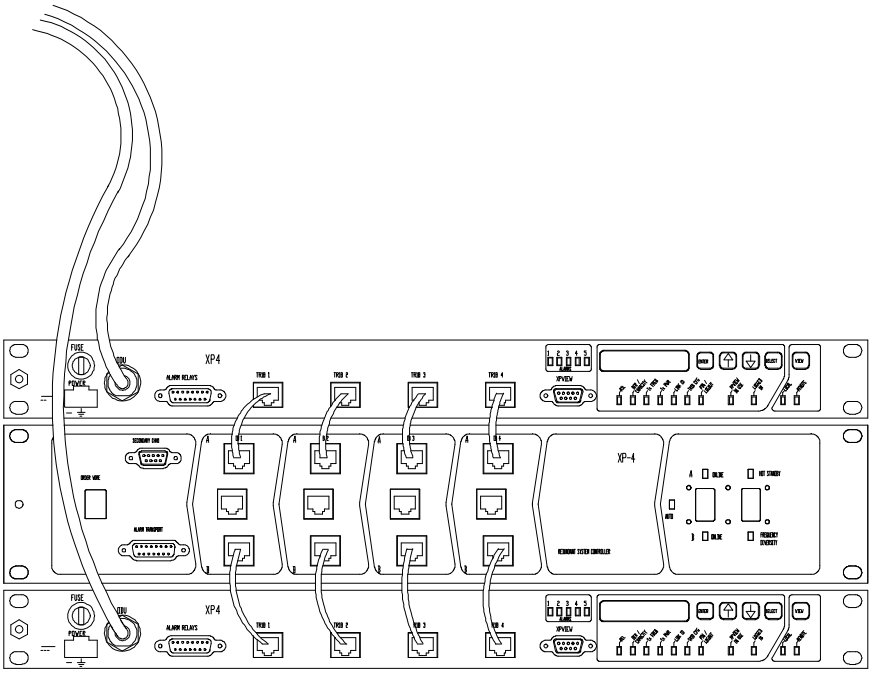


Figure 2-4. Balanced 2x/4x IDUs in Protected Configuration.

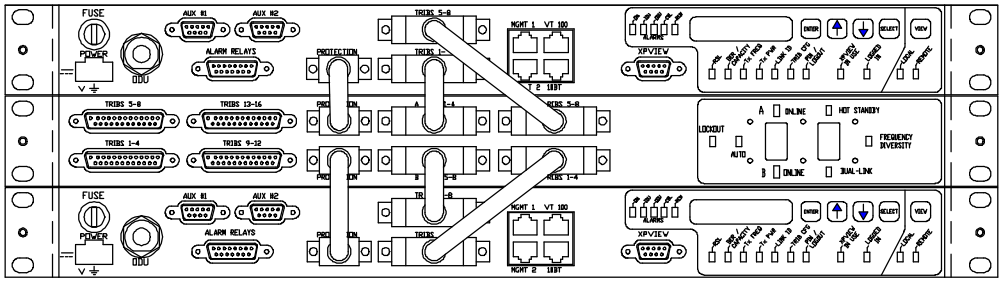


Figure 2-5. Balanced/Unbalanced 4x/8x IDUs in Protected Configuration.

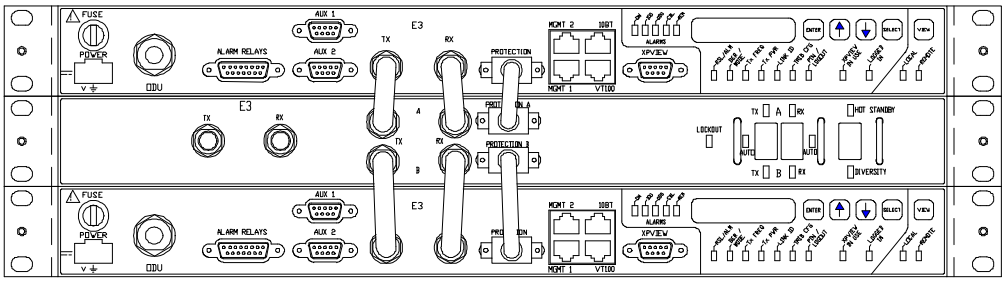


Figure 2.6. Unbalanced E3 or DS3 IDU Protected Configuration

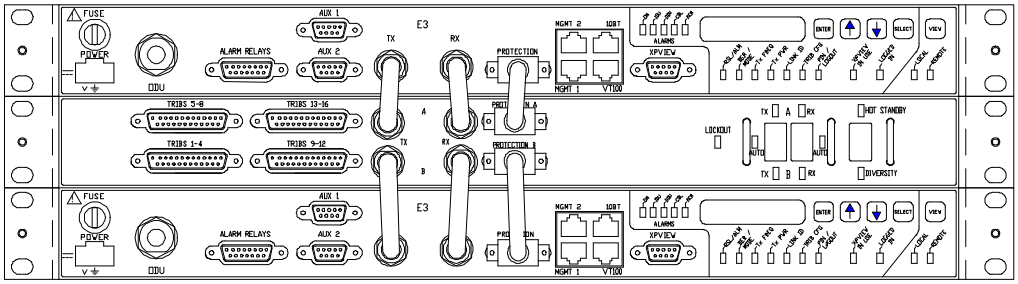


Figure 2.7. Unbalanced/Balanced 16E1 Protected Configuration

3.0 XP4 Installation

3.1 General

Installation Task List:

Section	*Task Description*
3.1	General
3.2	Equipment and Tools Required
3.3	Equipment Inventory
3.4	Cable Installation
3.5	ODU Installation
3.5.1	Co-located ODU Installation
3.5.2	Remote or Separated ODU Installation
3.6	IDU Installation

This Section assumes that pre-planning of the link has occurred; i.e. path budgeting and survey to ensure good line-of-sight between the two link ends and cable run estimations.

3.2 Required Installation Equipment

3.2.1 Tools

The only tools needed to install the radio are:
- Basic electricians toolkit (incl. voltmeter)
- Adjustable wrench (5-20mm)
- Torque wrench (capable of 66 N-m or 50 ft-lb) with a ¾ inch socket
- Crimp tool suitable for attaching N-type connectors to IDU-ODU cable

3.2.2 Equipment

Assuming the installer has the necessary radio equipment and antenna, the only other items needed are:
- RG-223/U or Belden 9913 cable of length to suit installation. See Section 3.4 for advice on which cable to use.
- At least two crimpable N-type connectors suitable for termination of the RG-223/U or Belden 9913 cable.
- Suitable waveguide to connect remote mounted ODU to antenna if Remote Mount option is used.
- To ground the ODU, sufficient earthing cable (at least 25mm^2 conductor recommended) and suitable crimp lugs are also required (the ODU grounding lugs are M6 and ¼-20).
- To ground the IDU, a suitable length of green PVC insulated 14-gauge wire (1.5 mm^2 conductor) minimum is required, plus a suitable crimp lug to attach wire to the IDU ground post (4 mm / 0.064 in. diameter).
- To power the IDU, suitable lengths of different colored PVC insulated 14-gauge wire (1.5mm^2 conductor) are required. Recommend the use of red for 0 V power connection and black for negative power connection.
- To connect alarm relay outputs and external input sensor from IDU to other co-located equipment; a suitable length of 8-pair tin-plated PVC insulated twisted pair copper cable (24 gauge), a male DB15 connector and cover.
- Enough cable ties to secure all cable runs.

3.3 XP4 Radio Equipment Inventory Check

Verify inventory of radio components before beginning installation. Ensure the part description detailed on the outside of each box corresponds to the components required for the installation; i.e. correct ODU frequency band, T-R spacing, capacity, and IDU configuration.

The radio configuration is determined by the Customer Specific Data Sheet (CSDS) that has been agreed upon by the customer. See Appendix 2 for an example showing the factory default settings.

The basic components required are contained in two boxes:

1. **ODU Box:**
   - 1 ODU
   - 1 ODU Installation Kit (refer to Table 3-1)

2. **IDU Box:**
   - 1 IDU
   - 1 IDU Installation Kit (refer to Table 3-2a)

3. **MSU Box (for 16E1):**
   - 1 MSU
   - 1 MSU Installation Kit (refer to Table 3-2b)

A remote mounted ODU requires an additional box:

4. **ODU Remote Mount Box:**
   - 1 Remote ODU mount
   - 1 Remote mount installation kit (refer to Table 3-3)

Additional items that are available through Digital Microwave Corporation:
- 1 Antenna waveguide adapter for antennas using XP-type interface
- 1 Flex waveguide (includes 4-40 screws and allen wrench)

Item	Quantity	Description
1	1	Weatherproof sleeve or tape and instruction set for use on cable connection at ODU (includes 200mm tie wrap for securing)

Table 3-1. ODU Installation Kit Parts List

Item	Quantity	Description
1	1	DC Power Connector for IDU; Weidmuller 3-pin
2	5	Phillips dome-head screw for mounting IDU in rack; No. 12 (12-24)
3	5	3.15A, slow-blow, 20mm spare fuse for IDU
4	1	100mm tie wrap for securing power cables to item 1
5	1	N-type 90° adapter for use with IDU in reduced front access clearance environments
6	1	Installation Guide

Table 3-2a. IDU Installation Kit Parts List

Item	Quantity	Description
1	2	DE-9 male-to-male cables, 7.5” (only 1 cable required for 1+0 16E1)
2	4	BNC to BNC cables
3	5	No.12 Phillips dome-head screws
4	5	Washers
5	1	Installation Guide

Table 3-2b. MSU Installation Kit Parts List

Item	Quantity	Description
1	2	Galvanized custom V-bolt
2	5	½-13 hex nut for attaching item 1 to antenna mounting assembly (incl. 1 spare)
3	5	½” flat washer for item 2 (incl. 1 spare)

Table 3-3. Remote Mount Installation Kit Parts List

3.4 Cable Installation

Only one cable is required to connect the XP4 IDU to the ODU. Both ends of the cable must be terminated with N-type male connectors. The N-type connectors are not supplied with the radio equipment unless requested by the customer as the type required depends upon cable type used for each installation.

Cable length limitations are dependent upon cable type used and power supply voltage as follows:

Cable Type	Nominal* Power Supply Voltage	Cable Length Limitation
RG-223/U	24 Vdc	≤ 50 m (150 ft)
RG-223/U	48 or 60 Vdc	≤ 100 m (300 ft)
Belden 9913	24 Vdc	≤ 150 m (500 ft)
Belden 9913	48 or 60 Vdc	≤ 300 m (1000 ft)

Table 3-4. Cable Length Limitations

* Nominal voltage range definitions:
- 24 Vdc = 21.6 to 28.0 Vdc
- 48 Vdc = 43.0 to 57.6 Vdc
- 60 Vdc = 54.0 to 72.0 Vdc

General notes regarding cable installation:
- When installing the cable between IDU and ODU, avoid excessive bending. Run the cable where it is reasonably well protected and will not rub against sharp edges or overly abrasive surfaces. Recommend use of cable ties at least every 1 meter.
- Use the crimp tool and die specifically designed for the connectors and cable being used. Use of generic crimp tools may result in sub-standard physical and therefore electrical connections.
- Leave a “U-bend” in the cable where it attaches to the ODU. This prevents water from running down the cable onto the ODU connection point and allows slack for antenna re-positioning should it be necessary.
- When connecting the terminated indoor/outdoor cable to the ODU and IDU, the N-type connectors should be tightened by hand. Using a tool such as pliers to tighten the N-type connectors could result in damage to the connectors, the equipment or both.
- The cable connection to the ODU should be weatherproofed using the cable-connector weatherproof sleeve or tape provided in the ODU Installation Kit. Roll the sleeve (or wind tape) onto the cable first, then connect the cable to the ODU. Roll the sleeve (or wind tape) over the connector until it contacts the ODU housing. If necessary, secure the sleeve/tape with a tie wrap to prevent it from rolling back. Detailed instructions on how to fit the sleeve or tape are included in its packing.

Caution:
Power for the ODU is carried on the coaxial cable connecting the IDU and ODU. Ensure that power to the IDU is turned off before connecting or removing the cable from the ODU.

3.5 ODU Installation

The XP4 ODU may be used with a standard antenna that has a customized waveguide interface to accommodate DMC's proprietary circular ODU interface. The ODU generally attaches directly to the antenna. A remote ODU mounting kit is available, if required. A remotely mounted ODU does not require a DMC interface on the antenna. Both installation procedures are described in this section.

3.5.1 Co-located ODU Installation

The ODU mounts directly to the antenna with latches and spring loaded retention clips, as shown in Figure 3-1. The polarization of the transmitted signal is indicated by the polarization indicator on the faceplate of the ODU, as shown in Figure 3-2. The ODU has four mounting clips so that it may be fixed to the antenna according to the desired polarization.

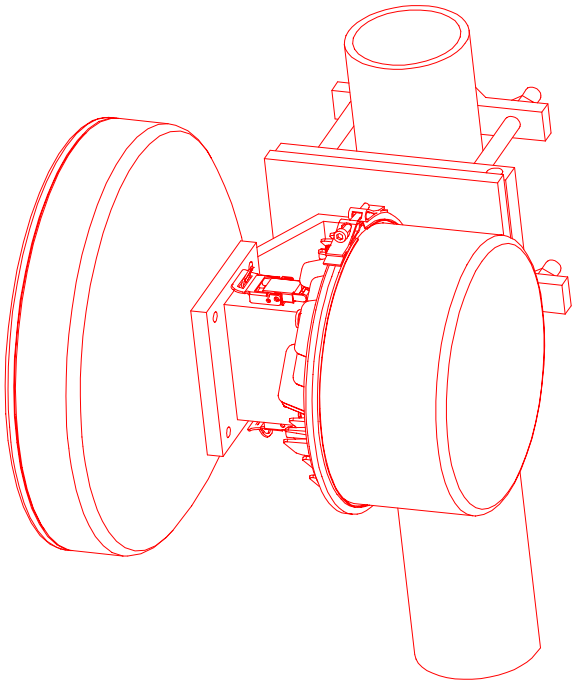


Figure 3-1. Co-located ODU with Antenna

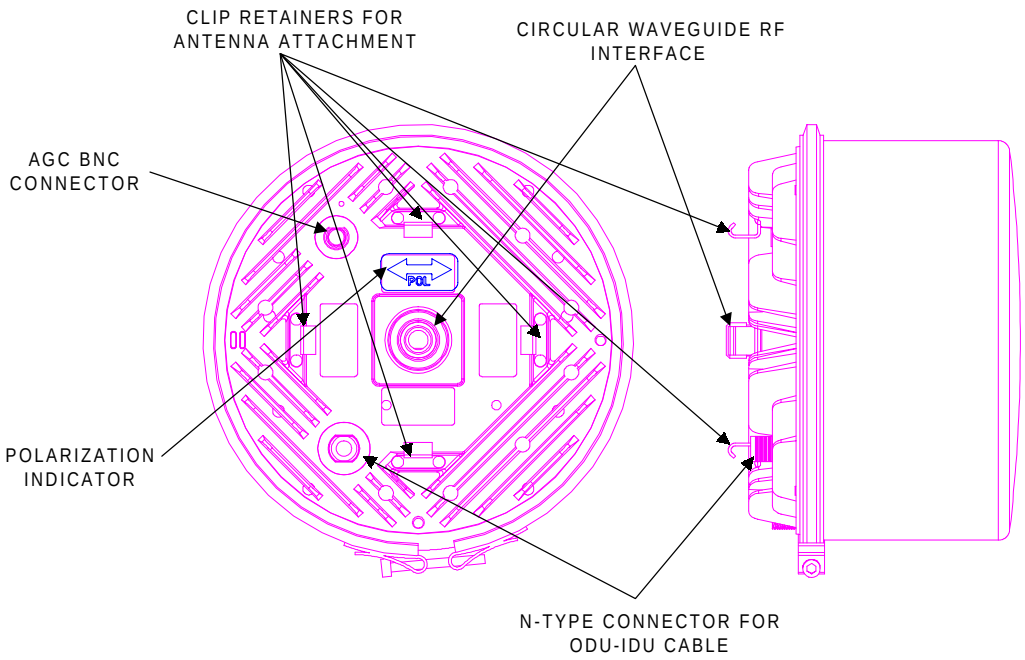


Figure 3-2. ODU in Horizontal Polarization

3.5.1.1 Procedure for Installing ODU

Step 1. Install antenna according to manufacturer's instructions.

Step 2. Attach ODU to antenna using captive spring clips on antenna, ensuring polarization is correct.
Note: For horizontal polarization, mount the ODU to the antenna so that the arrow is horizontal. For vertical polarization, mount the ODU to the antenna so that the arrow is vertical.

Step3. Move ODU/antenna assembly to desired installation location on pole, being careful not to impact either ODU or antenna.

Step4. Attach assembly to pole.
Note: The location and orientation chosen for the assembly should have adequate clearance behind the ODU to allow the installer to be positioned behind it, so both installer and antenna are facing the remote radio terminal.

Step 5. Secure the assembly to the pole.

Step 6. Route, secure with cable ties and terminate ground between ODU and a nearby local ground point. Use jam and lock nuts provided on grounding post to secure ground connection. Tighten nuts using a small adjustable wrench.

Step 7. Locate an attachment point for the ground terminal.

Step 8. Remove any oxidation, zinc coating paint and dirt from a surface over a 13 mm (1/2 in.) area surrounding the ground hole.

Step 9. Apply a coating of conductive grease to the area surrounding the area surrounding the grounding hole.

Step 10. Connect the ground wire to the attachment point with the appropriate hardware.

Step 11. Tighten the bolt. *Note: After tightening the connection remove any excess conductive grease.*

Step 12. Apply a coat of zinc-rich paint.

3.5.2 Remote or Separated ODU

For remote radios or systems that require mounting the ODU separate from the antenna, a length of flex waveguide is used to connect the antenna to the ODU. The remote mount contains a circular-to-rectangular waveguide transition, providing a rectangular waveguide interface with tapped holes. A waveguide adapter is available to mount rectangular waveguide to an antenna with the DMC interface.

The ODU remote mount, shown in Figure 3-3, secures the ODU with latches and spring-loaded retention clips. The mount is designed for attachment to a pole of diameter between 48 mm and 115 mm (1.9 and 4.5 inches) using a V-bolt. The ODU is always attached to the remote mount in vertical polarization mode, i.e. with ODU polarization indicator positioned to point up and down.

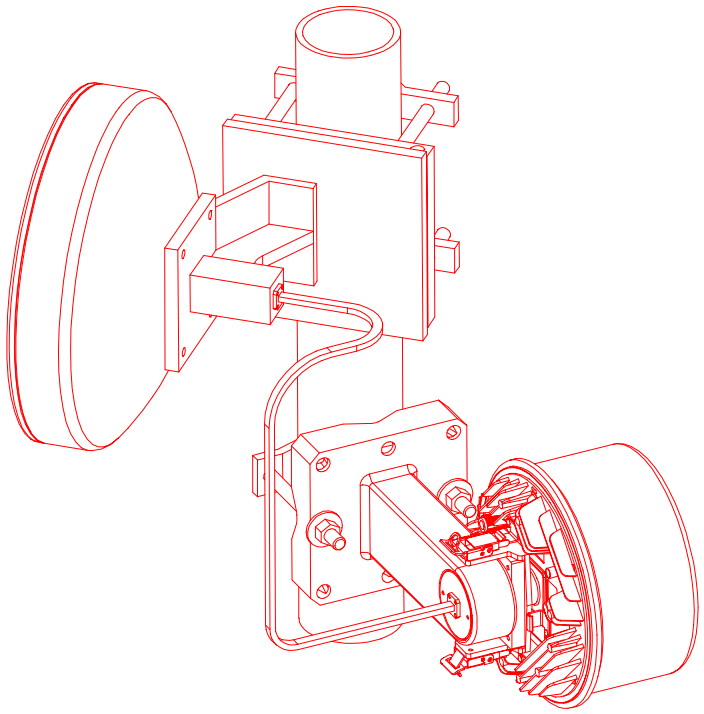


Figure 3-3. Remote Mounted ODU with Antenna

3.5.2.1 Procedure for Installing Remote Mounted ODU

Step 1. Install antenna according to manufacturer's instructions.
Step 2. Remove remote ODU mounting assembly and installation kit from the transport box.
Step 3. Loosely assemble the V-bolt to the remote ODU mount plate using 2-each of the ½-13 hex nuts and ½" flat washers supplied in the Remote Mount installation kit (items 2 and 3). See Figure 3-3 for reference.
Step 4. Attach ODU to remote mount using captive spring clips on plate, ensuring polarization is vertical, i.e. with ODU polarization indicator positioned to point up and down. See Figure 3-2 for reference.

Step 5. If flex waveguide is used between the ODU and antenna, attach one end of the flex waveguide to the Remote Mount ODU waveguide flange using the 4-40 Allen bolts, No.4 lock washers and 3/32 Allen key provided in the installation kit.

Note: The waveguide section should be terminated on one side with a PBR type flange (square, 4-hole, with gasket groove) to be compatible with the UBR flange (square, 4-hole, without gasket groove) on the coupler. The other side of the flex waveguide section should be terminated with either a PBR or UBR flange depending on the antenna flange. All waveguide junctions require a PBR to UBR (gasket to cover) interface.

Ensure the gasket is installed in the flex waveguide PBR flange prior to assembly. Cover the open end of flex waveguide or coupler to prevent entry of foreign matter. Stow flex waveguide for transportation to its point of installation.

Step 6. Move ODU assembly to the desired installation location on the pole, being careful not to impact the ODU or flex waveguide.

Step 7. Attach assembly to pole using V-bolt.

Note: The location and orientation chosen should have enough clearance behind the antenna assembly to allow the installer to be positioned behind it, so both installer and antenna are facing the remote radio terminal.

Step 8. Secure the assembly to the pole.

Step 9. Lay-in, secure with cable ties and terminate ground between ODU and a nearby local earth point. Use jam and lock nuts provided on grounding post to secure ground connection. Tighten nuts using a small adjustable wrench.

3.6 Indoor Unit Installation

The IDU requires only 1RU of vertical rack space and 250 mm rack depth. No space above or below the IDU is required for ventilation purposes. IDUs may be stacked adjacently in racks. For 16E1, 2RU of vertical rack space is required for the IDU and MSU.

3.6.1 IDU Installation Procedure

Step 1. Position the IDU as required in the equipment rack and secure using 4 No.12 Phillips dome-head screws provided in the installation kit.

Step 2. a.) Lay in, secure with cable ties and terminate ground cable (at least 14 gauge wire recommended {1.5mm^2 conductor}) between IDU ground post and a nearby local grounding point. Refer to Figures 3-4, 3-5 and 3-8 for IDU ground post location.
b.) Use nut and captive lock washer provided on grounding post to secure ground connection.
c.) Tighten nut using a small adjustable wrench.

Step 3. Attach 90° N-type adapter to ODU port on IDU front panel if required.

Step 4. Pull terminated IDU/ODU cable into rack, securing with cable ties as necessary and leaving 0.5m service loop at the IDU connection point. Connect cable to 90° N-type adapter (if installed) or ODU port of IDU.

Step 5. Install tributary data signal cables on the IDU "TRIB" connectors. Use 75Ω BNC male connectors for 2x/4x, E3, and DS3 unbalanced systems, RJ-45 plugs for 2x/4x balanced systems, and DB25 connectors for 4x/8x and 16E1 systems. Refer to the Table 3-5 and Figure 3-6 for RJ-45 wiring details and Table 3-6 for DB25 wiring details:

Step 6. If required, install alarm relay wiring to female DB15 connector on IDU front panel. Refer to the Table 3-7 and Figure 3-7 for wiring details. Recommend use of 8-pair, tin-plated, PVC insulated, twisted pair, copper cable (24 gauge).

Step 7. The XP4 requires DC power ($\pm$21.6 to 72 Vdc) via a 3-pin connector. Ensure that the plug provided in the installation kit is wired as detailed in Figure 3-8. Recommend use of 14 gauge wire (1.5mm^2 conductor), ends stripped back by 3mm and secured in 3-pin Weidmuller connector using a small flat-blade screwdriver.

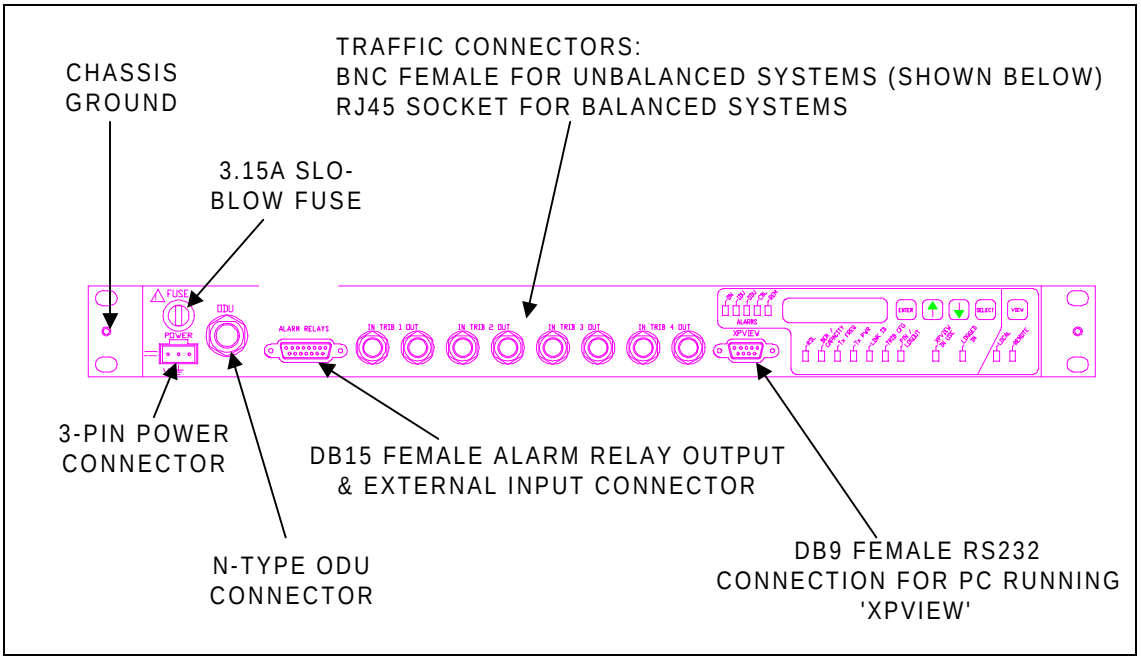


Figure 3-4. XP4 2x/4x IDU Connectors

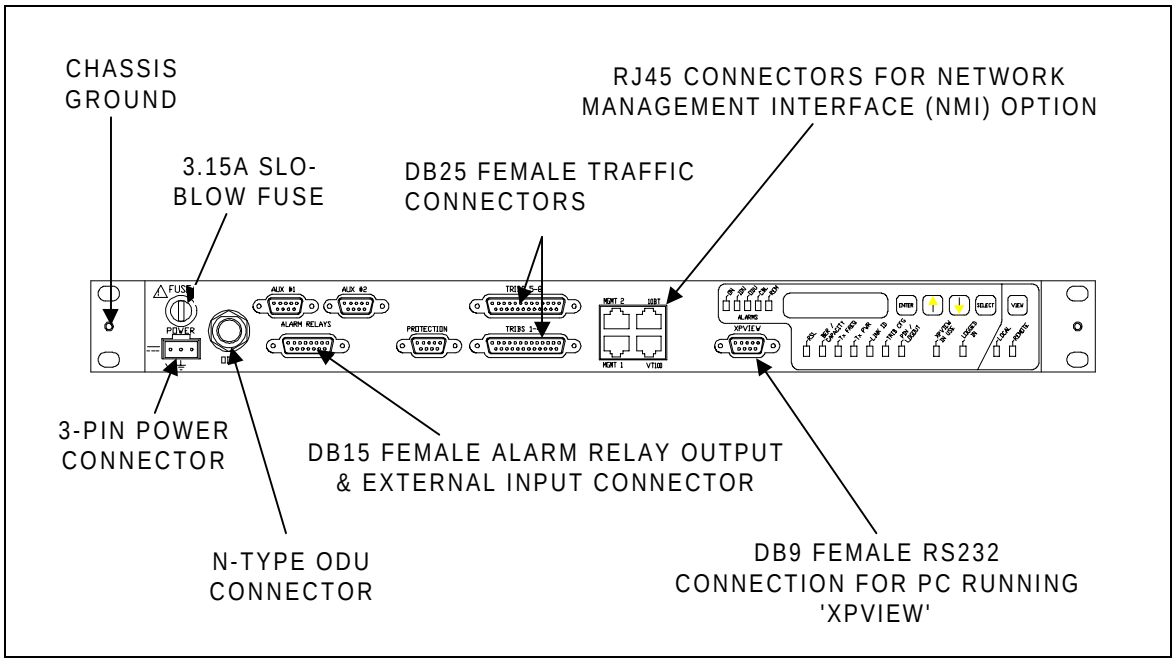


Figure 3-5a. XP4 4x/8x and Front Access 2x/4x IDU Connectors

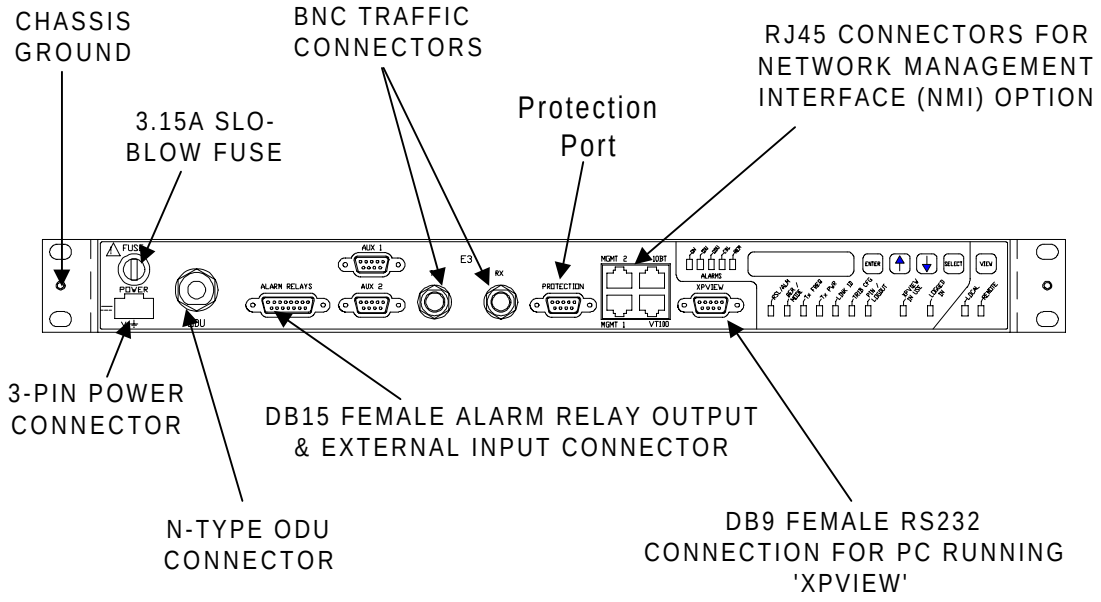


Figure 3-5b. XP4 E3 and DS3 IDU Connectors

3.6.2 MSU Installation Procedure (16E1 only)

Step 1. Position the MSU either directly below or above the E3 IDU in the equipment rack and secure using 4 No.12 Phillips dome-head screws provided in the installation kit.

Step 2. Connect the BNC cables from the MSU to the IDU – Tx A to Tx A, Rx A to Rx A.

Step 3. Connect the DB-9 cable from the MSU to the IDU.

Caution: Verify that IDU is powered OFF before connecting or disconnecting IDU to MSU DB-9 'Protection' cable.

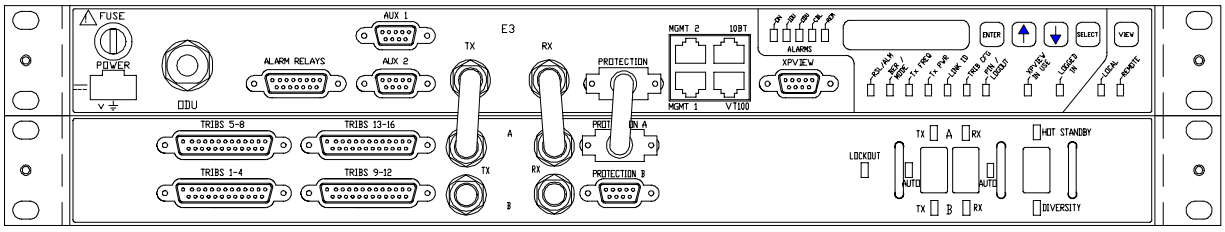


Figure 3-5c. XP4 16E1 Connections

RJ-45 Socket Pin#	Signal Name	Signal Description
1	RXD -	Receive Balanced Data Signal (-)
2	RXD +	Receive Balanced Data Signal (+)
3	RX GND	Receive Shield Connection
4	TXD -	Transmit Balanced Data Signal (-)
5	TXD +	Transmit Balanced Data Signal (+)
6	N/C	Not Connected
7	N/C	Not Connected
8	TX GND	Transmit Shield Connection

Table 3-5. RJ-45 Tributary Socket Pinout

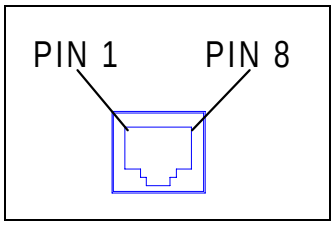


Figure 3-6. RJ-45 Tributary Socket Pin Numbering

DB25 Connector Pin #	Trib	Unbalanced	Balanced
1	N/A	Overall Shield	Overall Shield
2	1/5 In	Shield	Shield
3	1/5 Out	Center	Tip
4	1/5 Out	Shield	Ring
5	2/6 In	Shield	Shield
6	2/6 Out	Center	Tip
7	2/6 Out	Shield	Ring
8	3/7 In	Shield	Shield
9	3/7 Out	Center	Tip
10	3/7 Out	Shield	Ring
11	4/8 In	Shield	Shield
12	4/8 Out	Center	Tip
13	4/8 Out	Shield	Ring
14	1/5 In	Center	Tip
15	1/5 In	Shield	Ring
16	1/5 Out	Shield	Shield
17	2/6 In	Center	Tip
18	2/6 In	Shield	Ring
19	2/6 Out	Shield	Shield
20	3/7 In	Center	Tip
21	3/7 In	Shield	Ring
22	3/7 Out	Shield	Shield
23	4/8 In	Center	Tip
24	4/8 In	Shield	Ring
25	4/8 Out	Shield	Shield

Table 3-6. IDU Tributary DB25 Pinout

IDU "ALARM RELAYS" DB15 Pin No.	Signal Name	Signal Description (Radio is Powered on)
1	Relay #1 NO	Relay #1 normally open output
2	Relay #1 NC	Relay #1 normally closed output
3	Relay #2 NO	Relay #2 normally open output
4	Relay #2 NC	Relay #2 normally closed output
5	Relay #3 NO	Relay #3 normally open output
6	Relay #3 NC	Relay #3 normally closed output
7	Relay #4 NO	Relay #4 normally open output
8	Relay #4 NC	Relay #4 normally closed output
9	Relay #5 NO	Relay #5 normally open output
10	Relay #5 NC	Relay #5 normally closed output
11	Common	Common connection to all relays
12	GND	Station ground output (0V)
13	N/C	Not connected
14	GND	Station ground output (0V)
15	Ext I/P	External alarm input sense (alarm condition = station ground)

Table 3-7. IDU "ALARM RELAYS" DB15 Pinout

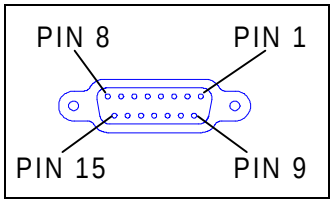


Figure 3-7. "ALARM RELAYS" DB15 Pin Numbering

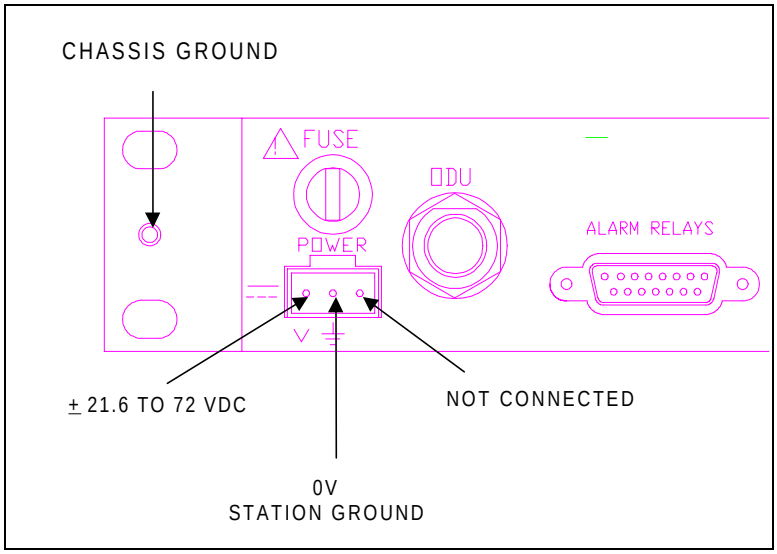


Figure 3-8. IDU Power Connector Detail

The XP4 terminal is now installed. Proceed to Section 4, Commissioning.

4.0 XP4 Commissioning

4.1 General

Commissioning Task List:

Section	*Task Description*
4.1	General
4.2	Equipment and Tools Required
4.3	Connections
4.4	Power On
4.5	Setup Routine (7 simple steps):
4.5.1	Power
4.5.2	Log In
4.5.3	Traffic Capacity
4.5.4	Transmit Frequency
4.5.5	Transmit Power
4.5.6	Link ID Code
4.5.7	Tributary Configuration
4.6	Antenna Alignment/AGC Optimization

This section assumes that the XP4 radio terminal has been successfully installed, following the guidelines outlined in Section 3.

Standalone Terminal Commissioning
A XP4 radio terminal may be set up on the bench, without the remote terminal using the simple steps outlined in Sections 4.3 through 4.5. These steps should take no longer than five (5) minutes due to the software configuration of the XP4.

XP4 Commissioning as Part of a Link
Following installation, verify that antennas at either end are aligned and pointing directly at each other.

4.2 Commissioning Tools Required

The only tools needed to commission the XP4 are:
- Voltmeter (customer supplied)
- BNC cable for connection to ODU AGC monitoring point (customer supplied)
- Appropriate tool for securing the antenna azimuth and elevation adjustment mechanisms (customer supplied)

4.3 Connections

Step 1
Ensure the following connections are made to the IDU before applying power. See Section 3.6 for specific cable preparation procedures. See Figures 4-1 through 4-3 for connection illustration.

Traffic:
- BNC for unbalanced 2x/4x, E3, and DS3 systems
- RJ-45 for balanced 2x/4x systems
- DB25 for unbalanced/balanced 4x/8x and 16E1 systems

IDU chassis ground
ODU cable
MSU to IDU BNC and DE-9 connector cables (16E1)

The following connections, based on customer's requirements, may also be made to the IDU:

- Alarm Relays and External Alarm Input Sensor may be connected to other monitoring equipment at the site
- Protection System (Refer to Section 7.1)
- Auxiliary Data Channels (standard on all front access IDUs))
- Network Management Interface (NMI)

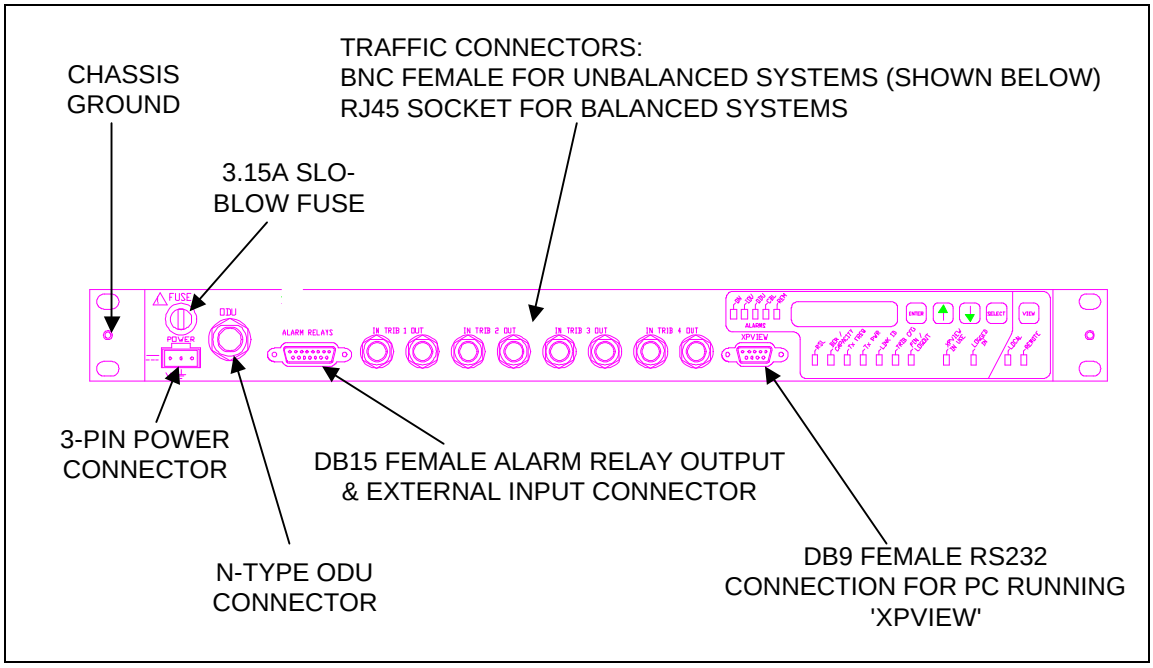


Figure 4-1. 2x/4x IDU Front Panel Connections

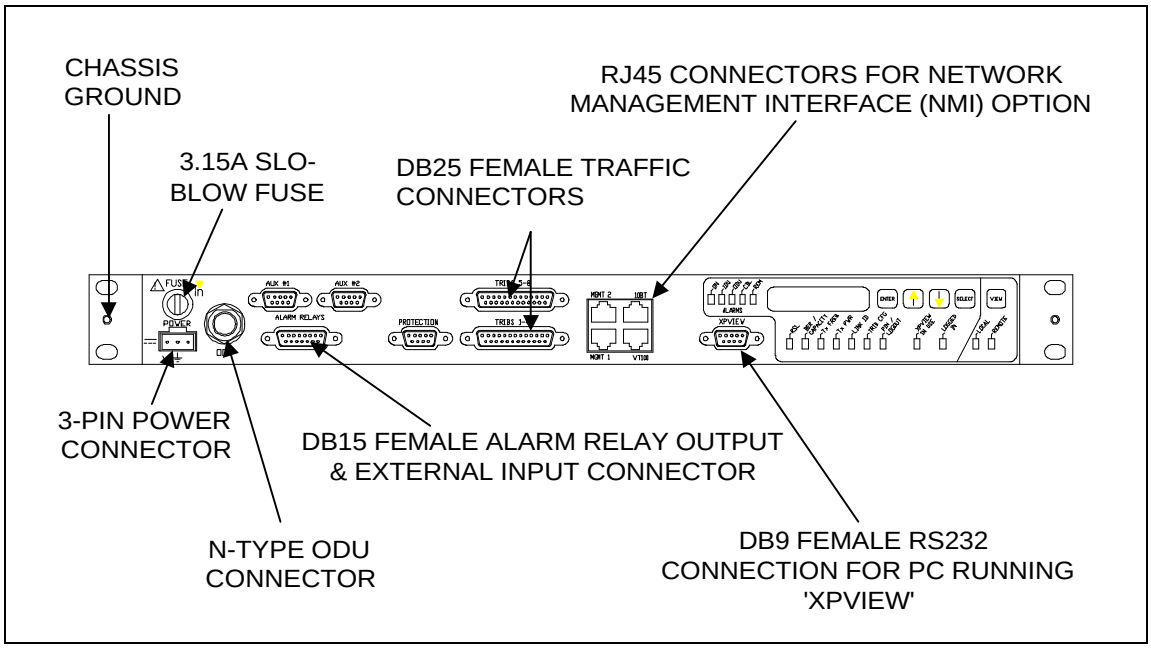


Figure 4-2. 4x/8x and Front Access 2x/4x IDU Front Panel Connections

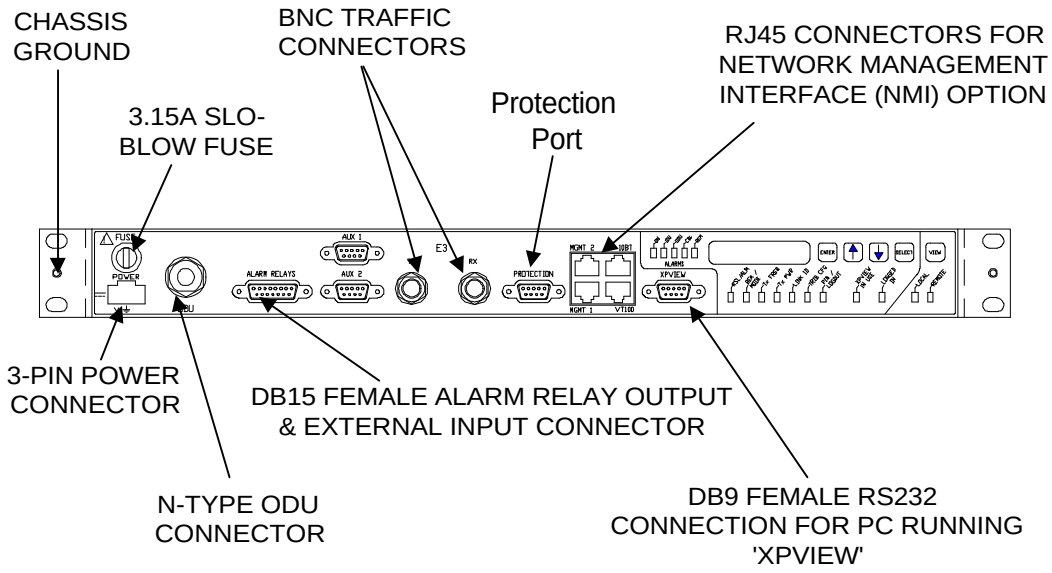


Figure 4-3. E3 and DS3 IDU Front Panel Connections

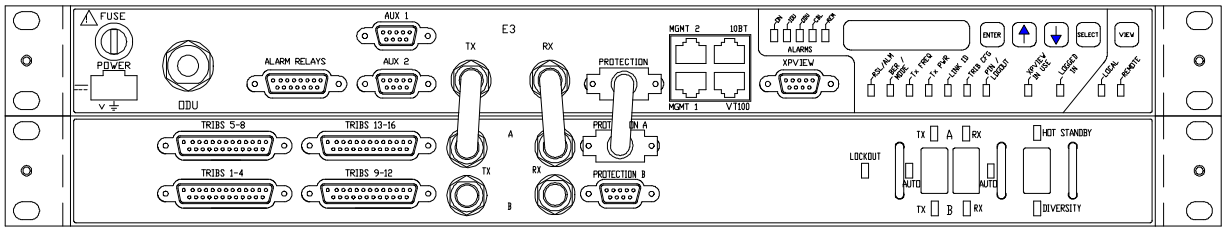


Figure 4-4. 16E1 IDU/MSU Front Panel Connections

Caution:
As a matter of good practice, measure the voltage on the DC power connector before it is connected to the IDU. Figure 4-5 below shows the required power connector pinout.

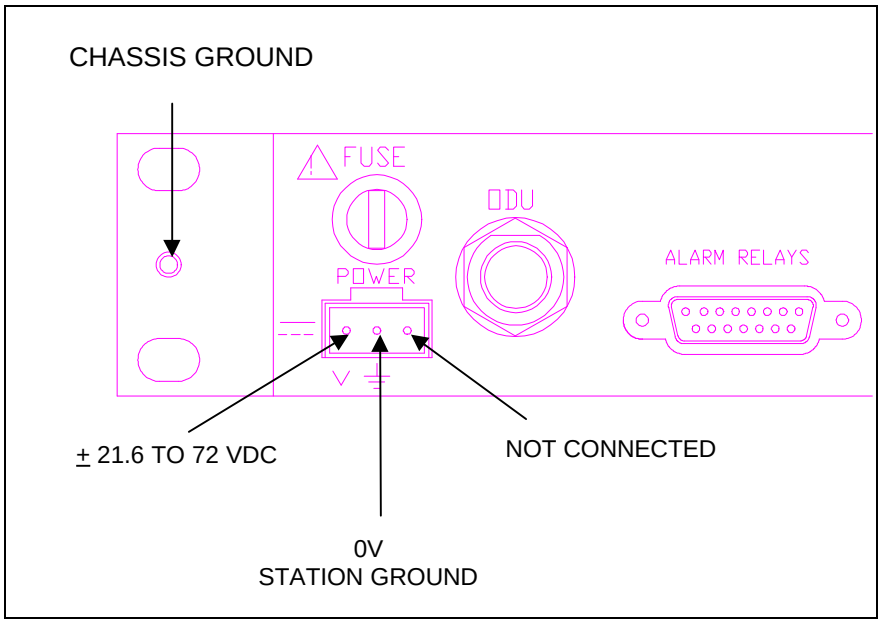


Figure 4-5. IDU Power Connector Detail

Step 2
Once all connections have been made, apply power to the IDU by connecting energized power connector. The XP4 will now begin the start up self-diagnostic sequence. If the XP4 does not appear to power up, check the applied voltage and replace the fuse if necessary with one of the 3.15A 20mm slow-blow fuses provided in the IDU Installation Kit.

4.4 Power On

Danger!
Exposure to stray radio frequency (RF) is harmful to the body, especially the eyes. It can also interfere with other electronic equipment.

For your personal safety when handling, installing, or replacing ODUs, you must observe the following precautions:

- Switch off the IDU and disconnect the IDU/ODU cable from the ODU before removing the ODU.
- Avoid exposure to microwave energy. Refer to IEEE Standard C95.1 (1991): Safety levels with respect to human exposure to radio frequency electromagnetic fields, 3 kHz to 300 GHz..

When an ODU/IDU pair is powered up together, the IDU front panel LED will display "***odu?***" while the system performs its self-diagnostics. If IDU and ODU are properly connected, "***install***" will be displayed. If "***odu?***" remains on the display after a few seconds, verify that the ODU is present and check continuity of the IDU/ODU cable connection.

On subsequent power-ups, a *walking dot* (a dot moving left to right across the display) will appear after the system has completed its self-diagnostics and the "***install***" message will no longer be displayed. The *walking dot* indicates that all self-checks have been performed and that the system is ready to operate.
An ODU/IDU pair will have been tested together at the factory prior to shipment to the customer, or at the pre-installation test depot. In the case that the same pair is installed as a terminal in the field, only the

walking dot display will appear initially, indicating that the system is fully operational (and ready to configure if necessary).

Caution.

Once power has been applied to the IDU, the N-type connector marked "ODU" on the IDU front panel will be energized. Ensure that the power is off before connecting or disconnecting cable to the IDU or ODU.

4.5 7-Step XP4 Setup Routine

This setup routine need only be performed when an IDU/ODU pair is first powered up together. The IDU informs the operator of this occurrence by displaying "***install***" on the front panel LED.

To subsequently alter the XP4 configuration, the operator may simply log in to the XP4 front panel (Section 4.5.2, step 2) and select the desired function directly, skipping functions whose parameters do not require alteration. See Section 5 for a more detailed account of keypad operations and other common post-installation procedures.

4.5.1 Step 1: Power

The XP4 requires DC power via a 3-pin connector. When an IDU/ODU pair is powered up for the first time, the front panel LED will display "***odu?***" while the unit performs a self-check for ODU-IDU compatibility. If the units are correctly installed, "***install***" will display. If "***odu?***" remains displayed after a few seconds, check for one of the following:

- ODU not installed
- Improper cable connection

On subsequent power-ups, the *walking dot* will appear instead of the "***install***" message.
If "Err1" appears, the IDU and ODU have incompatible frequency plans. The appropriate frequency plan must be entered into the IDU via "Radio Frequency Plans" in XPView.

4.5.2 Step 2: Log In

After powering up the XP4, the front panel will display "***install***"

- Press **ENTER**.
  At this point, the **PIN/LOGOUT** LED will illuminate only if a PIN is required. The factory default PIN used unless the customer has requested otherwise is 1234. If no PIN is required, move to Step 3: Traffic Capacity.
- Use the ↑ and ↓ keys on the IDU until the first digit of the PIN is correct, press ENTER to set.
- Set the second, third and fourth PIN digits in the same manner.
- When the fourth digit has been set, press ENTER again. The orange **LOGGED IN** LED will illuminate.

Note: The XP4 logs the operator out of the front panel after a period of inactivity longer than five minutes.

4.5.3 Step 3: Traffic Capacity

- Press **SELECT** until the **BER/CAPACITY** LED illuminates.
  "***---- n4***" on the display indicates "4x" channel mode is selected (i.e. 4 X 2.048 Mbit/s for 4E1).
- Use the ↑ and ↓ keys on the IDU to select the required capacity.
- Press **ENTER** to set the traffic capacity.

- The IDU will beep and display the new setting.

On E3, 16E1, and DS3 systems, **BER/MODE** displays 'E3', '16', or 'DS3' for 1+0 modes. Capacity is not selectable for E3, 16E1, and DS3 systems.

4.5.4 Step 4: Transmit Frequency

- Press **SELECT** until the **Tx FREQ** LED illuminates.
  Depending on whether the customer order was for the XP4 terminals to display the transmit frequency, or a channel number, the display will now show the transmit frequency in MHz (to 2 decimal places) or a channel number, which may be up to four digits.
  The XP4 will not let the operator tune to a frequency outside the terminal's tunable range.
- Use the ↑ and ↓ keys on the IDU to select a different transmit frequency.
- Press **ENTER** to set the transmit frequency.
- The IDU will beep and display the new setting.

Note: The T-R spacing is set in the channel plan installed in the factory so that receiver frequency changes to track the transmitter; therefore, changing frequency on one end of the link automatically changes the frequency at the other end of the link.

4.5.5 Step 5: Transmit Power

- Press **SELECT** until the **Tx PWR** LED illuminates.
  The transmit power level will be displayed as "***off***" (muted).
- Use the ↑ and ↓ keys on the IDU to select a different transmit power setting. Each key press will change the transmitter power display in 0.5 dB increments.
  The XP4 only allows the operator to change power to values within its range of calibration.
- Press **ENTER** to set the transmit power level.
- The IDU will beep and display the new setting.

4.5.6 Step 6: Link ID Code

- Press **SELECT** until the **LINK ID** LED illuminates.
  The default link ID code will be displayed.
- Use the ↑ and ↓ keys on the IDU to select a different link ID code in the range 1-255.
- Press **ENTER** to set the link ID code.
- The IDU will display the new setting.

4.5.7 Step 7: Tributary Configuration

- Press **SELECT** until the **TRIB CFG** LED illuminates.
  The display will read "***trib 1 I***" which means: *tributary #1 is set to invert the LOS (loss-of-signal) alarm that would be normally generated due to lack of input signal*. This feature is used to defeat LOS alarms on unused tributaries.
- Use the ↑ key on the IDU to select whether the tributary LOS alarm is inverted "***trib 1 I***" or normal "***trib 1 n***".
- Press **ENTER** to set tributary #1 configuration.
- The display will now read "***trib 2 I***". Set up as necessary using the ↑ key.
- Press **ENTER** to set tributary #2 configuration.
- Set up the remaining tributaries in the same manner as detailed above.

Note: Applying data to a tributary whose LOS alarm has been set to "invert" WILL cause a tributary LOS alarm; however, the tributary will pass traffic.

NOTE: Tributary configuration is always set to 'normal' for E3 and DS3 systems.

The XP4 terminal is now set up and running. The operator may choose to log out of the keypad or leave it as the XP4 will automatically log out the keypad if no activity has taken place within a five minute period.
Set up the remote XP4 terminal in the same manner as described above.
When the antennas are aligned, the XP4 link will be ready to pass operational traffic.

Antenna Alignment

For antenna installation, follow the instructions provided by the manufacturer; instructions should be packaged with the antenna.

Two alignment aids are available in the ODU:
- AGC voltage measurement via the BNC connector on the ODU, used for fine alignment,
- When the ODU BNC weatherproof cap is removed, the ODU will emit an audible "chirping" to aid antenna alignment. The rate of "chirps" is proportional to the AGC voltage and therefore the receive signal level.

4.6.1 AGC Voltage Optimization

The tools required to fine-align the XP4 terminals using the ODU AGC facility are:
- Appropriate tool to adjust the azimuth and elevation mechanism securings
- Voltmeter
- Cable for connection between ODU monitoring point (BNC) and Voltmeter.

The voltage on the ODU BNC is calibrated such that 1.0 Vdc ≡ -80 dBm and that each additional 0.1 Vdc increase thereafter corresponds to 1 dBm increase in RSL as follows:

BNC (Vdc)	1.0	2.0	3.0	3.5	4.0	4.5	5.0	5.5	6.0
RSL (dBm)	-80	-70	-60	-55	-50	-45	-40	-35	-30

Table 4-1. BNC Voltage and RSL Relationship

1. Remove the ODU BNC weatherproof cap (if not already removed from the previous procedure).
2. Connect the voltmeter set to read DC volts (0-10) to the BNC connector on the ODU.
3. Loosen the azimuth.
4. Adjust azimuth (horizontal) position for maximum BNC voltage. Locate maximum voltage by "peaking" or rotating the antenna in azimuth so as to pass through the maximum voltage. This ensures the antenna is not mistakenly aligned to a side-lobe.
5. Tighten azimuth adjustment securing mechanism, making sure that the voltmeter reading does not drop as the securing mechanism is tightened.
6. Loosen the elevation.
7. Adjust elevation (vertical) position for maximum BNC voltage. Locate maximum voltage by "peaking" or rotating the antenna in elevation so as to pass through the maximum voltage. This ensures the antenna is not mistakenly aligned to a side-lobe.
8. Tighten elevation adjustment securing mechanism, making sure that the voltmeter reading does not drop as the securing mechanism is tightened.

9. Calculate RSL from BNC voltage using the information given above and verify the RSL is within acceptable limits of that predicted for specific path distance, power settings, antenna used, etc. taking into consideration the path conditions on the day of alignment. As a guide, the RSL measured should be within ±4 dB of the predicted value (± 2 dB for transmit, ± 2 dB for receive). For any greater discrepancy, it is recommended to re-align the antennas and if necessary, re-survey the path.
   Note: A discrepancy of 20 dB or greater between the measured and calculated RSL may be the result of either the antennas being aligned on their side lobes or a polarization mismatch. Check polarization and re-align if necessary.
10. After the RSL has been optimized, remove the voltmeter cable.
11. Replace the ODU BNC weatherproof cap.

Caution:
Ensure that the weatherproof cap is replaced on the ODU BNC connector. Failure to do so may result in damage to the ODU.

12. Ensure all the IDU summary alarms are off and the RSL displayed on the IDU is as expected.

The XP4 terminal is now fully aligned and ready to carry operational traffic.
If required, record RSL or BNC voltage in the site maintenance log.

5. Post-Installation XP4 Configuration

5.1 General Use of the Keypad

The keypad and display of the XP4 IDU enable the operator to configure the terminal and diagnose terminal faults by displaying unambiguous alarms and clear real-time system status.

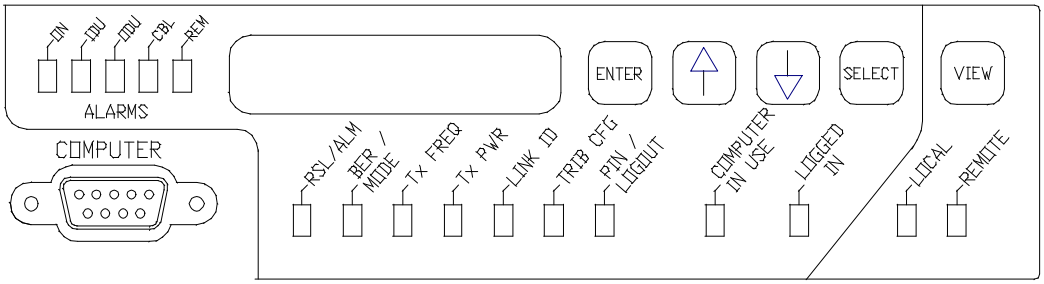


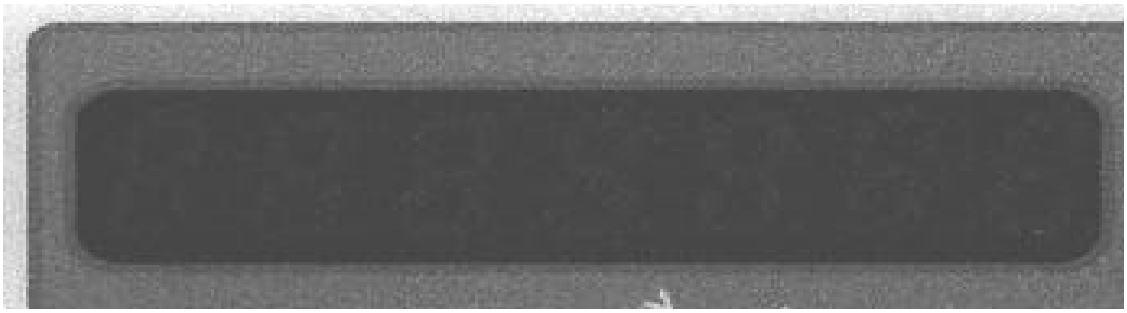
Figure 5-1. XP4 Speedkeys and LEDs

Alarms
The five **Alarm** LEDs, designated as ON, IDU, ODU, CBL and REM, give detailed current system alarms.
The status of the LED gives an indication as to the type of alarm:

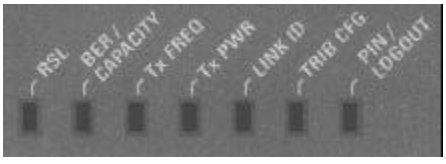
- Green = OK
- Flashing Green/Red = Possible configuration error or minor alarm
- Red = Major alarm

Seven digit, 7-segment (7x7) LED display

This 7x7 display gives information requested by the operator about the XP4 system.



Green LEDs: RSL, BER/CAPACITY, Tx PWR, Tx FREQ, LINK ID, TRIB CFG, PIN/LOGOUT



These LEDs indicate the type of data displayed on the 7x7 display.

ENTER key

This key executes a choice selected via the keypad, shown on the 7x7 display.

↑ and ↓ keys

These keys permit scrolling through various options that are pertinent to the type of data shown on the 7x7 display.

SELECT key

This key is used to select the type of data shown on the 7x7 display.

Orange "XPVIEW IN USE" LED

When lit, this LED indicates that a PC running the XPVIEW software is connected to the XPView port of the IDU.
Note: Keypad operations at both ends of the link are limited to viewing terminal configuration only when this LED is lit.

Orange "LOGGED IN" LED

When lit, this LED indicates that the operator is logged in to the XP4 keypad.
Note: Operators may not be simultaneously logged in to both ends of the link.

VIEW key

This key allows the user to toggle between local and remote terminal information display.

Green "LOCAL" LED

When lit, this LED indicates that the information displayed on the IDU front panel is related to the local XP4.

Orange "REMOTE" LED

When lit, this LED indicates that the information displayed on the IDU front panel is related to the remote XP4.

5.1.1 Diagnostic Features

The diagnostic features below may be viewed without logging into the XP4 keypad (if the keypad has not been previously "locked out" using XPView).

The feature to be viewed is selected using the **SELECT** key.

5.1.1.1 RSL/ALARM

When the green **RSL** LED is lit, the 7x7 display gives a real-time indication of receive signal level in dBm. Current alarm conditions are available by pressing the arrow keys and scrolling through the alarms. If not alarms are present, 'noAl' will be displayed.

Remote XP4 RSL and alarms may be displayed by pressing the **VIEW** key so that the orange **REMOTE** LED is lit.

5.1.1.2 BER/CAPACITY

When the green **BER/CAPACITY** LED is lit, the 7x7 display gives a real-time indication of received BER and the current capacity setting and channel plan being used (alternate or normal). E3, 16E1, and DS3 systems provide **BER/MODE**, shown as 'E3', '16', or 'DS3' for 1+0 systems and 'E3p', '16p', and 'DSp' for 1+1 systems.

BER is displayed on the left side in the format "***0err***" if the BER is less than $1x10^{-7}$. If the BER rises above $1x10^{-7}$, the current BER is displayed in the format "***nE-n***" indicating a BER of n errors in 10^n bits is being received. For example, if a BER of 4 errors in 10^{-6} bits are being received, the display will read "4E-6".

Capacity and current channel plan are displayed on the right side in the format "***n2***", where 2 is the capacity (i.e., 2 x 2.048 Mbit/s for 2E1 configuration) and "n" is the "normal" channel plan. Capacity may be displayed as 2, 4 or 8; meaning 2x, 4x or 8x. The channel plan may be "n" or "A"; meaning "normal" or "alternate". Capacity is not selectable on E3, 16E1, and DS3 systems.

Valid configurations are:

- For a 2x/4x XP4 Series: n2, A2, n4 (2x not available for DS-1 configurations)
- For a 4x/8x XP4 Series: n4, A4, n8

An "alternate" channel plan is used when operating at the lower of the two applicable capacities. The "alternate" channel plan allows the operator to assign a frequency on the channel plan normally associated with the next higher capacity. By assigning channels in this way, there is no need for the operator to obtain new frequencies from their regulatory authority, or change channel when upgrading link capacity.

Assignment of normal and alternate channel plans are pre-programmed defaults in the factory. They may be altered or deleted by the operator if required using the XPView software.

5.1.1.3 Tx FREQ

When the green **Tx FREQ** LED is lit, the 7x7 display gives transmitter frequency currently in use.

Depending on whether the customer order was for the XP4 to display the transmit frequency in MHz or as a channel number, the display shows the transmit frequency in MHz (to 2 decimal places) or a channel number, which may be up to four digits in length.
The for transmit frequency display will be shown on the Default Software Configuration Sheet that accompanied the IDU in it's factory delivered packing (see Section 7.4 for an example).

Remote XP4 transmitter frequency may be displayed by pressing the **VIEW** key so that the orange **REMOTE** LED is lit.

5.1.1.4 Tx PWR

When the green **Tx PWR** LED is lit, the 7x7 display gives transmitter output power currently in use.

XP4 transmitter power is displayed in dBm.
If "***OFF***" is displayed, this indicates the transmitter is muted.

Remote XP4 transmit power may be displayed by pressing the **VIEW** key so that the orange **REMOTE** LED is lit.

5.1.1.5 LINK ID

Unique link codes for each installed link are required to help prevent interference.
When the green **LINK ID** LED is lit, the 7x7 display gives the Link ID currently in use.

Link ID may be set to any value between 1 and 255.

5.1.1.6 TRIB CFG

When the green **TRIB CFG** LED is lit, the 7x7 display gives tributary configuration information. This feature allows the operator to view the LOS (loss-of-signal) detect function for each tributary. The display may read one of two ways depending on the XP4 setup:

- "***trib 1 n***" which means: *tributary #1 is set to "normal" mode, i.e. LOS alarm will occur upon a lack of input signal*. This is the configuration used on traffic carrying tributaries.
- ***"trib 1 I***" which means: *tributary #1 is set to "invert" mode, i.e. the LOS alarm that would be normally generated due to lack of input signal is inverted to defeat LOS alarms on unused tributaries.*

Each Trib Config. setting may be viewed in turn using the **ENTER** key.

Remote XP4 Trib Configs may be displayed by pressing the **VIEW** key so that the orange **REMOTE** LED is lit.

NOTE: Tributary configuration is set to *'normal'* for E3 and DS3 systems.

5.1.2 Control Features

The control features are accessed by inputting a PIN to the keypad. The PIN is detailed on the Customer Specific Data Sheet. The PIN, which can be up to six numeric digits, may be changed using XPView.

PIN input procedure:

- The **SELECT** key is pressed until the **LOG IN** LED is lit. A dot will be displayed on the left side of the 7x7 display.
  *If the 7x7 displays "**locd**", either another operator is logged in to the remote terminal keypad or a PC running XPView is connected to the XPView port at the local or remote terminal. It will not be possible to log in to the local keypad until the other operator logs out.*
- The first digit of the PIN is selected using the ↑ or ↓ keys.
- Input the digit using the **ENTER** key.
- The second digit of the PIN is selected using the ↑ or ↓ keys.
- Input the digit using the **ENTER** key.
- Enter the remaining digits in the same manner
- The **ENTER** key is pressed once more after the last PIN digit is accepted into the XP4. If the PIN is correct, the IDU will beep and light up the orange **LOGGED IN** LED.

The operator may now proceed to setup any or all of the control features detailed below, using the **SELECT** key to select the desired option.

After the operator has finished configuring the XP4, they may logout manually or just leave the keypad for inactive for 5 minutes, when the XP4 will automatically log out.

Manual logout procedure:

- The **SELECT** key is pressed until the **PIN/LOGOUT** LED is lit.
- Press the **ENTER** key to log out of the XP4. The IDU will beep and the orange **LOGGED IN** LED will extinguish.

5.1.2.1 BER/CAPACITY

When the green **BER/CAPACITY** LED is lit and the operator is logged in to the keypad (orange **LOGGED IN** LED is lit), the 7x7 display gives a real-time indication of received BER, the current capacity setting and channel plan being used. E3, 16E1, and DS3 systems provide **BER/MODE**, shown as 'E3', '16', or 'DS3' for 1+0 systems and 'E3p', '16p', and 'DSp' for 1+1 systems.

Capacity and current channel plan are displayed on the right side of the 7x7 display in the format "***n2***", where 2 is the capacity (2 x 2.048 Mbit/s for 2E1 configuration) and "n" is the "normal" channel plan. Capacity may be displayed as 2, 4 or 8; meaning 2x, 4x or 8x. The channel plan may be "n" or "A"; meaning "normal" or "alternate". Capacity is not selectable for E3, 16E1, and DS3 systems.

Valid configurations are:

- For a 2x/4x XP4: n2, A2, n4 (2x not available for DS-1 configurations)
- For a 4x/8x XP4: n4, A4, n8

An "alternate" channel plan is used when the XP4 is operating at the lower of its two capacities. The "alternate" channel plan allows the operator to assign a frequency on the channel plan normally associated with the next higher capacity. By assigning channels in this way, there is no need for the operator to obtain new frequencies from their regulatory authority, or change channels when upgrading link capacity.
Assignment of normal and alternate channel plans are pre-programmed defaults in the factory. They may be altered or deleted by the operator if required using the XPView software.

When the operator is logged in to the XP4 terminal keypad, the capacity and channel plan may be altered using the ↑ or ↓ keys. The choice of capacity and channel plan is accepted/executed by pressing **ENTER** and is implemented simultaneously at both terminals in a working link.

Capacity Change Warning
When upgrading traffic capacity between either "***A2***" to "***n4***" or visa versa, the channel number and frequency is not affected and the link remains operating at the new capacity. This is the only type of capacity change recommended after a link has been installed.
If the capacity is changed between either the "***n2***" to the "***n4***" or visa versa, the new channel number and frequency will not match and therefore both transmitters will be muted. They will also tune automatically to the center channel of the ODU band. In this case the link will not be operating and will need to be re-installed following the initial installation procedure in Section 4.5, unless the operator wishes to un-mute the transmitters on the center frequency of the ODU tuning band. Re-tuning without un-muting the transmitters may require intervention by an operator at both ends of the link.

Note: Changing capacity or channel plan setting WILL cause momentary traffic disruption.

5.1.2.2 Tx FREQ

When the green **Tx FREQ** LED is lit, the 7x7 display gives transmitter frequency currently in use. Depending on whether the customer order was for the XP4 to display the transmit frequency in MHz or as a channel number, the display shows the transmit frequency in MHz (to 2 decimal places) or just a channel number (up to four digits in length).
The customers choice for transmit frequency display is detailed on the Customer Specific Data Sheet.

If the operator is logged in to the XP4 terminal keypad, the frequency/channel setting may be altered using the ↑ or ↓ keys. The change is accepted/executed by pressing **ENTER** and is implemented simultaneously at both terminals in a working link.

The XP4 will not let the operator tune to a frequency outside the ordered/purchased tunable range.

Note: Changing frequency/channel setting WILL cause momentary traffic disruption.

5.1.2.3 Tx PWR

When the green **Tx PWR** LED is lit, the 7x7 display gives transmitter output power currently in use.

XP4 transmitter power is variable in steps of 0.5 dB from the terminal's maximum output power down to 50 dB below the maximum. See Appendix 1, Specifications, for maximum output requirements.

The transmitter can be turned off or muted by selecting the "***OFF***" option on the 7x7 display.

If the operator is logged in to the XP4 terminal keypad, the transmitter power setting may be altered using the ↑ or ↓ keys. The change in level is accepted/executed by pressing **ENTER**.

The XP4 will not let the operator select a value outside of the calibrated range of operation.

Remote XP4 transmit power may be displayed and altered by pressing the **VIEW** key so that the orange **REMOTE** LED is lit.

Note: Changing transmit power setting may cause momentary traffic disruption.

5.1.2.4 LINK ID

When the green **LINK ID** LED is lit, the 7x7 display gives the Link ID currently in use.

Link ID may be set to any value between 1 and 255.

If the operator is logged in to the XP4 terminal keypad, the Link ID setting may be altered using the ↑ or ↓ keys. The change is accepted/executed by pressing **ENTER** and is implemented simultaneously at both terminals in a working link.

Note: Changing Link ID WILL cause momentary traffic disruption.

5.1.2.5 TRIB CFG

When the green **TRIB CFG** LED is lit, the 7x7 display gives current tributary configurations.
This feature allows the operator to view and configure the LOS (loss-of-signal) detect function for each tributary.
The display may read one of two ways depending on XP4 setup:

- "***trib 1 I***" which means: *tributary #1 is set to "invert" mode, i.e. the LOS alarm that would be normally generated due to lack of input signal is inverted to defeat LOS alarms on unused tributaries.*
- "***trib 1 n***" which means: *tributary #1 is set to "normal" mode, i.e. LOS alarm will occur upon a lack of input signal*. This is the configuration used on traffic carrying tributaries.

If the operator is logged in to the XP4 terminal keypad, each Trib Config. setting may be altered using the ↑ key. The arrow key toggles the trib between "inverted" and "normal" modes. The change is accepted/executed by pressing **ENTER**, upon doing so the 7x7 display shows the next tributary's configuration for editing.

Remote XP4 Trib Configs may be displayed and altered by pressing the **VIEW** key so that the orange **REMOTE** LED is lit.

Note: Changing Trib Config. will not disrupt traffic.

Tributary configuration is set to *'normal'* for E3 and DS3 systems.

5.2 Specific Post-Installation XP4 Configuration Procedures

This section provides procedures that use the keypad to configure a working link without the need of a PC or other external control device connected to the IDU.

5.2.1 Traffic Capacity Upgrade

Terminals are capable of either 2x/4x or 4x/8x operation depending upon the original customer order. This upgrade is achieved entirely in software and may be executed from the IDU keypad.
As an example, the process below details how to upgrade a link operating in 2x mode to operate in 4x mode.

1. Log in to the IDU keypad (see Section 5.1.2)
2. Press **SELECT** key until green **BER/CAPACITY** LED is lit
3. LED will display "***0Err n2***" indicating that the link BER is $<1x10^{-7}$ and the channel plan is use is the "normal" 2x channel plan

Caution:
Do not attempt this procedure if the link is running with a BER indicated on the display. If this is the case, fix the BER problem before attempting to upgrade capacity.

4. Use the ↑ key to select "***n4***". This is 4x mode
5. Press the **ENTER** key to accept the configuration change. Both local and remote terminals now switch to working in a 4x mode

6. Press **SELECT** key until green **Tx PWR** LED is lit. Notice that the transmitter was muted (shown as "***off***" on the 7x7 display) when the XP4 link changed from "***n2***" to "***n4***" mode to prevent unwanted emissions
7. Use the ↑ key to select the required transmitter power
8. Press the **ENTER** key to accept the transmitter power. *This action will unmute the transmitters simultaneously at both ends of the XP4 link*
9. Connect traffic to tributaries #3 and #4
10. Check for alarms and configure tributaries #3 and #4 (Section 5.2.5)
11. When finished, press **SELECT** key until green **PIN/LOGOUT** LED is lit and press **ENTER** to logout

If the radio was working in "***A2***" mode before the capacity upgrade to "***n4***" was initiated, there is no need to un-mute the transmitters as the channel plans used in both modes are the same (see Section 5.1.2.1 for further detail).

5.2.2 Transmit Frequency Change

When a XP4 terminal's transmitter frequency is changed in a working link, the remote terminal will track the frequency change.
If the new frequency selected is subject to interference, both XP4 terminals will fall back to their original transmitter frequencies.
To change frequency:
1. Log in to the IDU keypad (see Section 5.1.2)
2. Press **SELECT** key until green **Tx FREQ** LED is lit
3. Use the ↑ and ↓ keys to select the desired frequency
4. Press the **ENTER** key to accept the change
5. The IDU will beep and display the new transmitter frequency
6. When finished, press **SELECT** key until green **PIN/LOGOUT** LED is lit and press **ENTER** to logout

For further details, refer to Section 5.1.2.2.

5.2.3 Transmit Power Change

Either local or remote XP4 transmitter power may be adjusted in a working link from the keypad:
1. Log in to the IDU keypad (see Section 5.1.2)
2. Press **SELECT** key until green **Tx PWR** LED is lit
3. Press **VIEW** key to display either local or remote transmit power setting
4. Use the ↑ and ↓ keys to select the desired transmit power
5. Press the **ENTER** key to accept the change
6. The IDU will beep and display the new transmitter power
7. When finished, press **SELECT** key until green **PIN/LOGOUT** LED is lit and press **ENTER** to logout

For further details, refer to Section 5.1.2.3.

5.2.4 Link ID Code Change

The entire Link ID Code may be changed from either XP4 terminal in a working link from the keypad:
1. Log in to the IDU keypad (see Section 5.1.2)
2. Press **SELECT** key until green **LINK ID** LED is lit
3. Use the ↑ and ↓ keys to select the desired Link ID Code (1-255)
4. Press the **ENTER** key to accept the change
5. The IDU will beep and display the new Link ID Code setting

6. When finished, press **SELECT** key until green **PIN/LOGOUT** LED is lit and press **ENTER** to logout

For further details, refer to Section 5.1.2.4.

5.2.5 Tributary Reconfiguration

During initial installation, if not all the tributaries were used and at some later date the tributaries are put into service, the LOS alarm inverts on the previously unused tributaries must be removed to prevent the alarms that will result.

1. Apply data to unused tributaries. Note resulting alarms. Data throughput over the link is not affected by the tributary LOS alarm configuration.
2. Log in to the IDU keypad (see Section 5.1.2)
3. Press **SELECT** key until green **TRIB CFG** LED is lit
4. Press **ENTER** key until tributary to be configured is displayed: e.g. 7x7 display shows "***trib 3 I***"
5. Use the ↑ key to select "normal" tributary LOS alarm condition, e.g. 7x7 display shows "***trib 3 n***"
6. Press the **ENTER** key to accept the change and move on to configure the next tributary
7. The IDU will beep and display the next tributary configuration setting
8. When finished, press **SELECT** key until green **PIN/LOGOUT** LED is lit and press **ENTER** to logout

For further details, refer to Section 5.1.2.5.

Tributary configuration is not selectable on E3 and DS3 systems.

5.2.6 Alarm Status

When the **RSL/Alarm** mode is selected, the arrow keys are used to scroll through the active alarm indicators. Either local or remote alarms can be viewed by toggling the **VIEW** button. When no alarms are present, the 7x7 display will show only 'no Al'.

5.2.7 Alarm Mapping

LED No.	LED Description	LED Status	
		Off	**Red**
1	Tributary Alarm	Normal	Tributary [1-8] Fault
2	Transmit Alarm (logical OR)	Normal	• Transmit Power Low • Transmit Frequency Lock • Cable Fault
3	Receive Alarm (logical OR)	Normal	• Receive Frequency Lock • Link ID Code Mismatch • Cable Fault
4	RSL Alarm	Normal	Receive Level Low
5	Auxiliary Alarm Input Status	Normal	• Local Aux. Input Alarm • Remote Aux. Input Alarm

Table 5-1. 2x/4x Default LED/Relay Alarm Mapping

LED	LED Description	LED Status		
		Green	**Green/Red Flashing**	**Red**
ON	On-Line	On-Line	• BER early warning • RSL alarm • Loopback	• BER alarm
IDU	IDU Summary (logical OR)	Normal	• Trib alarm • ID code mismatch	• Frame loss • IDU Tx failure
ODU	ODU Summary (logical OR)	Normal	• TX muted • Capacity Mismatch	• TX power • TX PLL • RX PLL
CBL	Cable	Normal		ODU-IDU comms failed
REM	Remote	Normal	Summary of the following alarms detected at remote terminal: • BER early warning • RSL alarm • Trib alarm • ID code mismatch • Capacity mismatch	Summary of the following alarms detected at remote terminal: • BER alarm • Frame loss • IDU Tx Failure • TX power • TX PLL • RX PLL Also, a local terminal frame loss alarm condition will cause this LED to light, indicating remote to local XP4 communications have failed.

Table 5-2. Front Access 2x/4x and 4x/8x LED Alarm Mapping.

LED	LED Description	LED Status		
		Green	**Green/Red Flashing**	**Red**
ON	On-Line	On-Line	• BER early warning • RSL alarm • Loopback	• BER alarm
IDU	IDU Summary (logical OR)	Normal	• Trib alarm • ID code mismatch	• Frame loss • IDU Tx failure
ODU	ODU Summary (logical OR)	Normal	• TX muted • Capacity Mismatch	• TX power • TX PLL • RX PLL
CBL	Cable	Normal		• ODU-IDU comms failed • Downlink Loss
REM	Remote	Normal	Summary of the following alarms detected at remote terminal: • BER early warning • RSL alarm • Trib alarm • ID code mismatch • Capacity mismatch	Summary of the following alarms detected at remote terminal: • BER alarm • Frame loss • IDU Tx Failure • TX power • TX PLL • RX PLL Also, a local terminal frame loss alarm condition will cause this LED to light, indicating remote to local XP4 communications have failed.

Table 5-2. E3 and 16E1 LED Alarm Mapping.

5. Post-Installation XP4 Configuration

5.1 General Use of the Keypad

The keypad and display of the XP4 IDU enable the operator to configure the terminal and diagnose terminal faults by displaying unambiguous alarms and clear real-time system status.

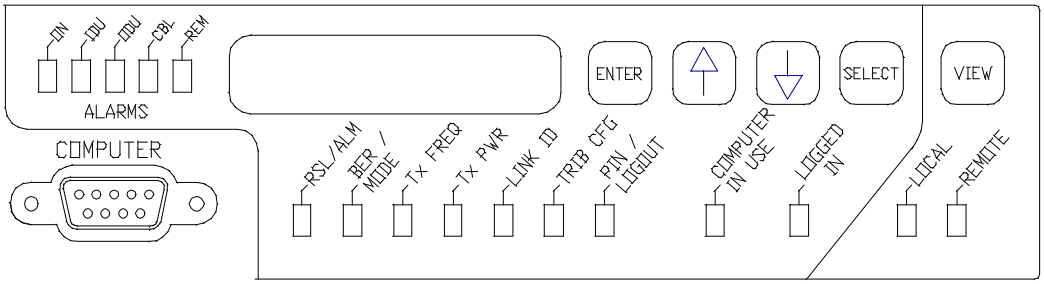


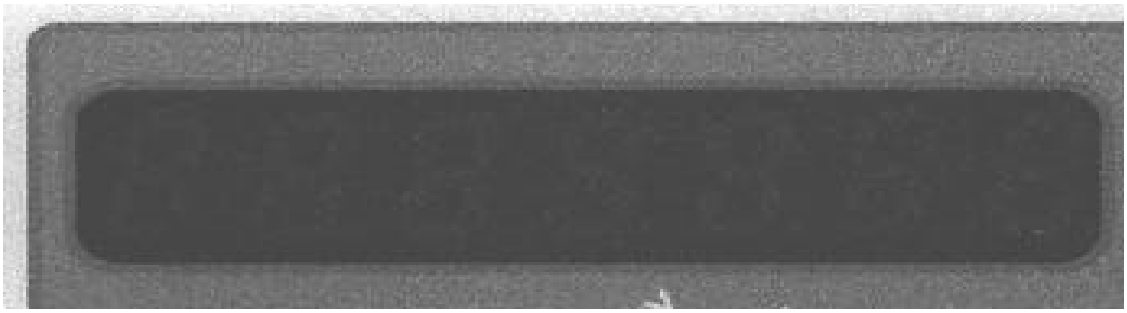
Figure 5-1. XP4 Speedkeys and LEDs

Alarms
The five **Alarm** LEDs, designated as ON, IDU, ODU, CBL and REM, give detailed current system alarms.
The status of the LED gives an indication as to the type of alarm:

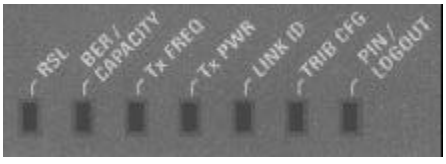
- Green = OK
- Flashing Green/Red = Possible configuration error or minor alarm
- Red = Major alarm

Seven digit, 7-segment (7x7) LED display

This 7x7 display gives information requested by the operator about the XP4 system.



Green LEDs: RSL, BER/CAPACITY, Tx PWR, Tx FREQ, LINK ID, TRIB CFG, PIN/LOGOUT



These LEDs indicate the type of data displayed on the 7x7 display.

ENTER key

This key executes a choice selected via the keypad, shown on the 7x7 display.

↑ and ↓ keys

These keys permit scrolling through various options that are pertinent to the type of data shown on the 7x7 display.

SELECT key

This key is used to select the type of data shown on the 7x7 display.

Orange "XPVIEW IN USE" LED

When lit, this LED indicates that a PC running the XPVIEW software is connected to the XPView port of the IDU.
Note: Keypad operations at both ends of the link are limited to viewing terminal configuration only when this LED is lit.

Orange "LOGGED IN" LED

When lit, this LED indicates that the operator is logged in to the XP4 keypad.
Note: Operators may not be simultaneously logged in to both ends of the link.

VIEW key

This key allows the user to toggle between local and remote terminal information display.

Green "LOCAL" LED

When lit, this LED indicates that the information displayed on the IDU front panel is related to the local XP4.

Orange "REMOTE" LED

When lit, this LED indicates that the information displayed on the IDU front panel is related to the remote XP4.

5.1.1 Diagnostic Features

The diagnostic features below may be viewed without logging into the XP4 keypad (if the keypad has not been previously "locked out" using XPView).

The feature to be viewed is selected using the **SELECT** key.

5.1.1.1 RSL/ALARM

When the green **RSL** LED is lit, the 7x7 display gives a real-time indication of receive signal level in dBm. Current alarm conditions are available by pressing the arrow keys and scrolling through the alarms. If not alarms are present, 'noAl' will be displayed.

Remote XP4 RSL and alarms may be displayed by pressing the **VIEW** key so that the orange **REMOTE** LED is lit.

5.1.1.2 BER/CAPACITY

When the green **BER/CAPACITY** LED is lit, the 7x7 display gives a real-time indication of received BER and the current capacity setting and channel plan being used (alternate or normal). E3, 16E1, and DS3 systems provide **BER/MODE**, shown as 'E3', '16', or 'DS3' for 1+0 systems and 'E3p', '16p', and 'DSp' for 1+1 systems.

BER is displayed on the left side in the format "***0err***" if the BER is less than $1x10^{-7}$. If the BER rises above $1x10^{-7}$, the current BER is displayed in the format "***nE-n***" indicating a BER of n errors in 10^n bits is being received. For example, if a BER of 4 errors in 10^{-6} bits are being received, the display will read "4E-6".

Capacity and current channel plan are displayed on the right side in the format "***n2***", where 2 is the capacity (i.e., 2 x 2.048 Mbit/s for 2E1 configuration) and "n" is the "normal" channel plan. Capacity may be displayed as 2, 4 or 8; meaning 2x, 4x or 8x. The channel plan may be "n" or "A"; meaning "normal" or "alternate". Capacity is not selectable on E3, 16E1, and DS3 systems.

Valid configurations are:

- For a 2x/4x XP4 Series: n2, A2, n4 (2x not available for DS-1 configurations)
- For a 4x/8x XP4 Series: n4, A4, n8

An "alternate" channel plan is used when operating at the lower of the two applicable capacities. The "alternate" channel plan allows the operator to assign a frequency on the channel plan normally associated with the next higher capacity. By assigning channels in this way, there is no need for the operator to obtain new frequencies from their regulatory authority, or change channel when upgrading link capacity.

Assignment of normal and alternate channel plans are pre-programmed defaults in the factory. They may be altered or deleted by the operator if required using the XPView software.

5.1.1.3 Tx FREQ

When the green **Tx FREQ** LED is lit, the 7x7 display gives transmitter frequency currently in use.

Depending on whether the customer order was for the XP4 to display the transmit frequency in MHz or as a channel number, the display shows the transmit frequency in MHz (to 2 decimal places) or a channel number, which may be up to four digits in length.
The for transmit frequency display will be shown on the Default Software Configuration Sheet that accompanied the IDU in it's factory delivered packing (see Section 7.4 for an example).

Remote XP4 transmitter frequency may be displayed by pressing the **VIEW** key so that the orange **REMOTE** LED is lit.

5.1.1.4 Tx PWR

When the green **Tx PWR** LED is lit, the 7x7 display gives transmitter output power currently in use.

XP4 transmitter power is displayed in dBm.
If "***OFF***" is displayed, this indicates the transmitter is muted.

Remote XP4 transmit power may be displayed by pressing the **VIEW** key so that the orange **REMOTE** LED is lit.

5.1.1.5 LINK ID

Unique link codes for each installed link are required to help prevent interference.
When the green **LINK ID** LED is lit, the 7x7 display gives the Link ID currently in use.

Link ID may be set to any value between 1 and 255.

5.1.1.6 TRIB CFG

When the green **TRIB CFG** LED is lit, the 7x7 display gives tributary configuration information. This feature allows the operator to view the LOS (loss-of-signal) detect function for each tributary. The display may read one of two ways depending on the XP4 setup:

- "***trib 1 n***" which means: *tributary #1 is set to "normal" mode, i.e. LOS alarm will occur upon a lack of input signal*. This is the configuration used on traffic carrying tributaries.
- ***"trib 1 I***" which means: *tributary #1 is set to "invert" mode, i.e. the LOS alarm that would be normally generated due to lack of input signal is inverted to defeat LOS alarms on unused tributaries.*

Each Trib Config. setting may be viewed in turn using the **ENTER** key.

Remote XP4 Trib Configs may be displayed by pressing the **VIEW** key so that the orange **REMOTE** LED is lit.

NOTE: Tributary configuration is set to *'normal'* for E3 and DS3 systems.

5.1.2 Control Features

The control features are accessed by inputting a PIN to the keypad. The PIN is detailed on the Customer Specific Data Sheet. The PIN, which can be up to six numeric digits, may be changed using XPView.

PIN input procedure:

- The **SELECT** key is pressed until the **LOG IN** LED is lit. A dot will be displayed on the left side of the 7x7 display.
  *If the 7x7 displays "**locd**", either another operator is logged in to the remote terminal keypad or a PC running XPView is connected to the XPView port at the local or remote terminal. It will not be possible to log in to the local keypad until the other operator logs out.*
- The first digit of the PIN is selected using the ↑ or ↓ keys.
- Input the digit using the **ENTER** key.
- The second digit of the PIN is selected using the ↑ or ↓ keys.
- Input the digit using the **ENTER** key.
- Enter the remaining digits in the same manner
- The **ENTER** key is pressed once more after the last PIN digit is accepted into the XP4. If the PIN is correct, the IDU will beep and light up the orange **LOGGED IN** LED.

The operator may now proceed to setup any or all of the control features detailed below, using the **SELECT** key to select the desired option.

After the operator has finished configuring the XP4, they may logout manually or just leave the keypad for inactive for 5 minutes, when the XP4 will automatically log out.

Manual logout procedure:

- The **SELECT** key is pressed until the **PIN/LOGOUT** LED is lit.
- Press the **ENTER** key to log out of the XP4. The IDU will beep and the orange **LOGGED IN** LED will extinguish.

5.1.2.1 BER/CAPACITY

When the green **BER/CAPACITY** LED is lit and the operator is logged in to the keypad (orange **LOGGED IN** LED is lit), the 7x7 display gives a real-time indication of received BER, the current capacity setting and channel plan being used. E3, 16E1, and DS3 systems provide **BER/MODE**, shown as 'E3', '16', or 'DS3' for 1+0 systems and 'E3p', '16p', and 'DSp' for 1+1 systems.

Capacity and current channel plan are displayed on the right side of the 7x7 display in the format "***n2***", where 2 is the capacity (2 x 2.048 Mbit/s for 2E1 configuration) and "n" is the "normal" channel plan. Capacity may be displayed as 2, 4 or 8; meaning 2x, 4x or 8x. The channel plan may be "n" or "A"; meaning "normal" or "alternate". Capacity is not selectable for E3, 16E1, and DS3 systems.

Valid configurations are:

- For a 2x/4x XP4: n2, A2, n4 (2x not available for DS-1 configurations)
- For a 4x/8x XP4: n4, A4, n8

An "alternate" channel plan is used when the XP4 is operating at the lower of its two capacities. The "alternate" channel plan allows the operator to assign a frequency on the channel plan normally associated with the next higher capacity. By assigning channels in this way, there is no need for the operator to obtain new frequencies from their regulatory authority, or change channels when upgrading link capacity.
Assignment of normal and alternate channel plans are pre-programmed defaults in the factory. They may be altered or deleted by the operator if required using the XPView software.

When the operator is logged in to the XP4 terminal keypad, the capacity and channel plan may be altered using the ↑ or ↓ keys. The choice of capacity and channel plan is accepted/executed by pressing **ENTER** and is implemented simultaneously at both terminals in a working link.

Capacity Change Warning
When upgrading traffic capacity between either "***A2***" to "***n4***" or visa versa, the channel number and frequency is not affected and the link remains operating at the new capacity. This is the only type of capacity change recommended after a link has been installed.
If the capacity is changed between either the "***n2***" to the "***n4***" or visa versa, the new channel number and frequency will not match and therefore both transmitters will be muted. They will also tune automatically to the center channel of the ODU band. In this case the link will not be operating and will need to be re-installed following the initial installation procedure in Section 4.5, unless the operator wishes to un-mute the transmitters on the center frequency of the ODU tuning band. Re-tuning without un-muting the transmitters may require intervention by an operator at both ends of the link.

Note: Changing capacity or channel plan setting WILL cause momentary traffic disruption.

5.1.2.2 Tx FREQ

When the green **Tx FREQ** LED is lit, the 7x7 display gives transmitter frequency currently in use. Depending on whether the customer order was for the XP4 to display the transmit frequency in MHz or as a channel number, the display shows the transmit frequency in MHz (to 2 decimal places) or just a channel number (up to four digits in length).
The customers choice for transmit frequency display is detailed on the Customer Specific Data Sheet.

If the operator is logged in to the XP4 terminal keypad, the frequency/channel setting may be altered using the ↑ or ↓ keys. The change is accepted/executed by pressing **ENTER** and is implemented simultaneously at both terminals in a working link.

The XP4 will not let the operator tune to a frequency outside the ordered/purchased tunable range.

Note: Changing frequency/channel setting WILL cause momentary traffic disruption.

5.1.2.3 Tx PWR

When the green **Tx PWR** LED is lit, the 7x7 display gives transmitter output power currently in use.

XP4 transmitter power is variable in steps of 0.5 dB from the terminal's maximum output power down to 50 dB below the maximum. See Appendix 1, Specifications, for maximum output requirements.

The transmitter can be turned off or muted by selecting the "***OFF***" option on the 7x7 display.

If the operator is logged in to the XP4 terminal keypad, the transmitter power setting may be altered using the ↑ or ↓ keys. The change in level is accepted/executed by pressing **ENTER**.

The XP4 will not let the operator select a value outside of the calibrated range of operation.

Remote XP4 transmit power may be displayed and altered by pressing the **VIEW** key so that the orange **REMOTE** LED is lit.

Note: Changing transmit power setting may cause momentary traffic disruption.

5.1.2.4 LINK ID

When the green **LINK ID** LED is lit, the 7x7 display gives the Link ID currently in use.

Link ID may be set to any value between 1 and 255.

If the operator is logged in to the XP4 terminal keypad, the Link ID setting may be altered using the ↑ or ↓ keys. The change is accepted/executed by pressing **ENTER** and is implemented simultaneously at both terminals in a working link.

Note: Changing Link ID WILL cause momentary traffic disruption.

5.1.2.5 TRIB CFG

When the green **TRIB CFG** LED is lit, the 7x7 display gives current tributary configurations.
This feature allows the operator to view and configure the LOS (loss-of-signal) detect function for each tributary.
The display may read one of two ways depending on XP4 setup:

- "***trib 1 I***" which means: *tributary #1 is set to "invert" mode, i.e. the LOS alarm that would be normally generated due to lack of input signal is inverted to defeat LOS alarms on unused tributaries.*
- "***trib 1 n***" which means: *tributary #1 is set to "normal" mode, i.e. LOS alarm will occur upon a lack of input signal*. This is the configuration used on traffic carrying tributaries.

If the operator is logged in to the XP4 terminal keypad, each Trib Config. setting may be altered using the ↑ key. The arrow key toggles the trib between "inverted" and "normal" modes. The change is accepted/executed by pressing **ENTER**, upon doing so the 7x7 display shows the next tributary's configuration for editing.

Remote XP4 Trib Configs may be displayed and altered by pressing the **VIEW** key so that the orange **REMOTE** LED is lit.

Note: Changing Trib Config. will not disrupt traffic.

Tributary configuration is set to *'normal'* for E3 and DS3 systems.

5.2 Specific Post-Installation XP4 Configuration Procedures

This section provides procedures that use the keypad to configure a working link without the need of a PC or other external control device connected to the IDU.

5.2.1 Traffic Capacity Upgrade

Terminals are capable of either 2x/4x or 4x/8x operation depending upon the original customer order. This upgrade is achieved entirely in software and may be executed from the IDU keypad.
As an example, the process below details how to upgrade a link operating in 2x mode to operate in 4x mode.

1. Log in to the IDU keypad (see Section 5.1.2)
2. Press **SELECT** key until green **BER/CAPACITY** LED is lit
3. LED will display "***0Err n2***" indicating that the link BER is $<1x10^{-7}$ and the channel plan is use is the "normal" 2x channel plan

Caution:
Do not attempt this procedure if the link is running with a BER indicated on the display. If this is the case, fix the BER problem before attempting to upgrade capacity.

4. Use the ↑ key to select "***n4***". This is 4x mode
5. Press the **ENTER** key to accept the configuration change. Both local and remote terminals now switch to working in a 4x mode

6. Press **SELECT** key until green **Tx PWR** LED is lit. Notice that the transmitter was muted (shown as "***off***" on the 7x7 display) when the XP4 link changed from "***n2***" to "***n4***" mode to prevent unwanted emissions
7. Use the ↑ key to select the required transmitter power
8. Press the **ENTER** key to accept the transmitter power. *This action will unmute the transmitters simultaneously at both ends of the XP4 link*
9. Connect traffic to tributaries #3 and #4
10. Check for alarms and configure tributaries #3 and #4 (Section 5.2.5)
11. When finished, press **SELECT** key until green **PIN/LOGOUT** LED is lit and press **ENTER** to logout

If the radio was working in "***A2***" mode before the capacity upgrade to "***n4***" was initiated, there is no need to un-mute the transmitters as the channel plans used in both modes are the same (see Section 5.1.2.1 for further detail).

5.2.2 Transmit Frequency Change

When a XP4 terminal's transmitter frequency is changed in a working link, the remote terminal will track the frequency change.
If the new frequency selected is subject to interference, both XP4 terminals will fall back to their original transmitter frequencies.
To change frequency:
1. Log in to the IDU keypad (see Section 5.1.2)
2. Press **SELECT** key until green **Tx FREQ** LED is lit
3. Use the ↑ and ↓ keys to select the desired frequency
4. Press the **ENTER** key to accept the change
5. The IDU will beep and display the new transmitter frequency
6. When finished, press **SELECT** key until green **PIN/LOGOUT** LED is lit and press **ENTER** to logout

For further details, refer to Section 5.1.2.2.

5.2.3 Transmit Power Change

Either local or remote XP4 transmitter power may be adjusted in a working link from the keypad:
1. Log in to the IDU keypad (see Section 5.1.2)
2. Press **SELECT** key until green **Tx PWR** LED is lit
3. Press **VIEW** key to display either local or remote transmit power setting
4. Use the ↑ and ↓ keys to select the desired transmit power
5. Press the **ENTER** key to accept the change
6. The IDU will beep and display the new transmitter power
7. When finished, press **SELECT** key until green **PIN/LOGOUT** LED is lit and press **ENTER** to logout

For further details, refer to Section 5.1.2.3.

5.2.4 Link ID Code Change

The entire Link ID Code may be changed from either XP4 terminal in a working link from the keypad:
1. Log in to the IDU keypad (see Section 5.1.2)
2. Press **SELECT** key until green **LINK ID** LED is lit
3. Use the ↑ and ↓ keys to select the desired Link ID Code (1-255)
4. Press the **ENTER** key to accept the change
5. The IDU will beep and display the new Link ID Code setting

6. When finished, press **SELECT** key until green **PIN/LOGOUT** LED is lit and press **ENTER** to logout

For further details, refer to Section 5.1.2.4.

5.2.5 Tributary Reconfiguration

During initial installation, if not all the tributaries were used and at some later date the tributaries are put into service, the LOS alarm inverts on the previously unused tributaries must be removed to prevent the alarms that will result.

1. Apply data to unused tributaries. Note resulting alarms. Data throughput over the link is not affected by the tributary LOS alarm configuration.
2. Log in to the IDU keypad (see Section 5.1.2)
3. Press **SELECT** key until green **TRIB CFG** LED is lit
4. Press **ENTER** key until tributary to be configured is displayed: e.g. 7x7 display shows "***trib 3 I***"
5. Use the ↑ key to select "normal" tributary LOS alarm condition, e.g. 7x7 display shows "***trib 3 n***"
6. Press the **ENTER** key to accept the change and move on to configure the next tributary
7. The IDU will beep and display the next tributary configuration setting
8. When finished, press **SELECT** key until green **PIN/LOGOUT** LED is lit and press **ENTER** to logout

For further details, refer to Section 5.1.2.5.

Tributary configuration is not selectable on E3 and DS3 systems.

5.2.6 Alarm Status

When the **RSL/Alarm** mode is selected, the arrow keys are used to scroll through the active alarm indicators. Either local or remote alarms can be viewed by toggling the **VIEW** button. When no alarms are present, the 7x7 display will show only 'no Al'.

5.2.7 Alarm Mapping

LED No.	LED Description	LED Status	
		Off	**Red**
1	Tributary Alarm	Normal	Tributary [1-8] Fault
2	Transmit Alarm (logical OR)	Normal	• Transmit Power Low • Transmit Frequency Lock • Cable Fault
3	Receive Alarm (logical OR)	Normal	• Receive Frequency Lock • Link ID Code Mismatch • Cable Fault
4	RSL Alarm	Normal	Receive Level Low
5	Auxiliary Alarm Input Status	Normal	• Local Aux. Input Alarm • Remote Aux. Input Alarm

Table 5-1. 2x/4x Default LED/Relay Alarm Mapping

LED	LED Description	LED Status		
		Green	**Green/Red Flashing**	**Red**
ON	On-Line	On-Line	• BER early warning • RSL alarm • Loopback	• BER alarm
IDU	IDU Summary (logical OR)	Normal	• Trib alarm • ID code mismatch	• Frame loss • IDU Tx failure
ODU	ODU Summary (logical OR)	Normal	• TX muted • Capacity Mismatch	• TX power • TX PLL • RX PLL
CBL	Cable	Normal		ODU-IDU comms failed
REM	Remote	Normal	Summary of the following alarms detected at remote terminal: • BER early warning • RSL alarm • Trib alarm • ID code mismatch • Capacity mismatch	Summary of the following alarms detected at remote terminal: • BER alarm • Frame loss • IDU Tx Failure • TX power • TX PLL • RX PLL Also, a local terminal frame loss alarm condition will cause this LED to light, indicating remote to local XP4 communications have failed.

Table 5-2. Front Access 2x/4x and 4x/8x LED Alarm Mapping.

LED	LED Description	LED Status		
		Green	**Green/Red Flashing**	**Red**
ON	On-Line	On-Line	• BER early warning • RSL alarm • Loopback	• BER alarm
IDU	IDU Summary (logical OR)	Normal	• Trib alarm • ID code mismatch	• Frame loss • IDU Tx failure
ODU	ODU Summary (logical OR)	Normal	• TX muted • Capacity Mismatch	• TX power • TX PLL • RX PLL
CBL	Cable	Normal		• ODU-IDU comms failed • Downlink Loss
REM	Remote	Normal	Summary of the following alarms detected at remote terminal: • BER early warning • RSL alarm • Trib alarm • ID code mismatch • Capacity mismatch	Summary of the following alarms detected at remote terminal: • BER alarm • Frame loss • IDU Tx Failure • TX power • TX PLL • RX PLL Also, a local terminal frame loss alarm condition will cause this LED to light, indicating remote to local XP4 communications have failed.

Table 5-2. E3 and 16E1 LED Alarm Mapping.

6. 0 XP4 Troubleshooting

6.1 General

This section describes the features available to assist the operator in tracking and correcting XP4 radio problems. These features include a series of discrete alarm functions that will assist in tracking both configuration errors and radio failure conditions using the front panel controls at one end of a working radio link. The five multi-function LED alarm indicators on the front panel can be mapped to five alarm relays for connecting to external alarm reporting systems. The factory default mapping of the relays is shown in Table 6-1

The XP4 has six loopback configurations to provide in-depth troubleshooting capability. These loopback paths are described in Section 6.6.

2x/4x/8x Alarm Relay Configuration							
Relay	**1**	**2**	**3**	**4**	**5**	**Threshold**	**Options**
Relay Name	Tribs	Tx	Rx	RSL	Aux. I/P		
Transmit Power	☐	☒	☐	☐	☐		
Transmit Freq (PLL)	☐	☒	☐	☐	☐		
Receive Level	☐	☐	☐	☒	☐	-70 dBm	-60 to -80 dBm
Receive Freq (PLL)	☐	☐	☒	☐	☐		
Link ID Code	☐	☐	☒	☐	☐		
Trib 1 Fault	☒	☐	☐	☐	☐		
Trib 2 Fault	☒	☐	☐	☐	☐		
Trib 3 Fault	☒	☐	☐	☐	☐		
Trib 4 Fault	☒	☐	☐	☐	☐		
Trib 5 Fault	☒	☐	☐	☐	☐		
Trib 6 Fault	☒	☐	☐	☐	☐		
Trib 7 Fault	☒	☐	☐	☐	☐		
Trib 8 Fault	☒	☐	☐	☐	☐		
BER Early Warning	☐	☐	☐	☐	☐	1×10^{-6}	3,4,5,or 6
BER Alarm	☐	☐	☐	☐	☐	1×10^{-3}	3,4,5,or 6
Cable Fault	☐	☒	☒	☐	☐		
Local Aux Input	☐	☐	☐	☐	☒		
Remote Aux Input	☐	☐	☐	☐	☒		

Table 6-1a. 2x/4x/8x Default Alarm Relay Mapping

Alarm Relay Configuration							
Relay	**1**	**2**	**3**	**4**	**5**	**Threshold**	**Options**
Default Relay Name	Tribs	Transmit	Receive	RSL	Aux.		
Customer Relay Name							
Transmit Power	☐	☒	☐	☐	☐		
Transmit Freq	☐	☒	☐	☐	☐		
Receive Level	☐	☐	☐	☒	☐	-70 dBm	-60 to -80 dBm
Receive Freq	☐	☐	☒	☐	☐		
Link ID Code	☐	☐	☒	☐	☐		
Trib Fault	☒	☐	☐	☐	☐		
Downlink	☐	☒	☐	☐	☐		
Frame Loss	☐	☐	☒	☐	☐		
E3 LOS A	☒	☐	☐	☐	☐		
E3 LOS B	☒	☐	☐	☐	☐		
E3 FRAME AL	☒	☐	☐	☐	☐		
AIS TO CUST	☒	☐	☐	☐	☐		
BER Early Warning	☐	☐	☒	☐	☐	1 x 10- (6)	3,4,5,or 6
BER Alarm	☐	☐	☒	☐	☐	1 x 10- (3)	3,4,5,or 6
Cable Fault	☐	☒	☐	☐	☐		
Local Aux Input	☐	☐	☐	☐	☒		
Remote Aux Input	☐	☐	☐	☐	☒		

Table 6-1b. E3/16E1 Default Alarm Relay Mapping

6.2 Discrete Alarm Descriptions

The discrete alarm functions are described below together with suggested corrective action.

Transmit power
Alarm condition indicates low power output from final stage of microwave power amplifier.
If this alarm occurs, replace the ODU.

Transmit PLL
Alarm condition indicates the transmitter phase-locked-loop has lost lock.
If this alarm occurs on its own, replace the ODU.
If this alarm occurs in conjunction with the *Receive PLL*, replace the IDU (reference source failure).

Receive Level
Alarm condition indicates the receive RF level is below the preset threshold (refer to Table 6-1).
If alarm occurs on its own, verify RSL, RF path between XP4 terminals, antenna alignment and remote terminal transmitter power output setting.
If alarm occurs in conjunction with others, the action required to resolve the fault will depend upon the activated alarm. Use of the loopbacks in XPView is recommended to locate the problem (see Section 6.6).
Note. The most common reason for this alarm occurrence will be due to a link fade, such as that occurring during excessive rainfall.

Receive PLL
Alarm condition indicates the receiver phase-locked-loop has lost lock.
If this alarm occurs on its own, replace the ODU.
If this alarm occurs in conjunction with the *Transmit PLL*, replace the IDU (reference source failure).

Link ID Code
Alarm condition indicates the signal being received has an unexpected Link ID Code.
If alarm occurs, there will be no traffic throughput on the link. Either remote XP4 terminal's Link ID Code is incorrect or the RF propagation path to the remote XP4 has disappeared (due to, e.g. rain fade) and another XP4 terminal in the vicinity has been detected (check for interference).

Trib [1-8] Fault
Alarm condition indicates LOS (loss-of-signal) condition detected on the tributary input.
If alarm occurs, check continuity of data connections to XP4 IDU.
Note. For 2x/4x/8x and 16E1 systems, this alarm will occur if data is applied to a previously unused tributary whose tributary alarm configuration has been inverted. To remove alarm, set tributary configuration to "normal" as detailed in Section 5.2.5

BER Early Warning
Alarm condition indicates the received BER has exceeded the preset *Early Warning* threshold (refer to Table 6-3). If alarm occurs on its own, suspect link interference or a faulty IDU (local or remote). Use loopback features of XPView to confirm problem. If alarm occurs in conjunction with others, the action required to resolve the fault will depend upon the alarms appearing. Recommend use of loopback features in XPView to locate the problem.
Note. The most common reason for this alarm occurrence will be due to a link fade, such as that occurring during excessive rainfall.

BER Alarm
Alarm condition indicates the received BER has exceeded the preset *Alarm* threshold (refer to Table 6-3).
The action required to resolve the fault will depend upon all the accompanying alarms. Recommend use of loopback features in XPView to locate the problem.
Note. The most common reason for this alarm occurrence will be due to a link fade, such as that occurring during excessive rainfall.

Cable Fault
Alarm condition indicates microprocessor communications between the IDU and ODU have failed.
The fault is most probably with the cable connection, it may be either open or shorted. Use of a multi-meter to measure DC cable resistance will determine if the cable is open or shorted:
1. Disconnect power to the XP4 IDU
2. Remove the N-type ODU connector from the IDU
3. Measure the DC resistance between the centre pin and the outer of the N-type connector terminating the cable;

If resistance is between 1 MΩ and 10MΩ:
- This is correct
- Suspect IDU or ODU circuitry
- Replace IDU
- If alarm persists, swap replacement IDU for original and replace ODU.

If resistance is less than 1MΩ:
- Check cable thoroughly over whole length and at both ends for damage or reasons that would cause low cable resistance.
- If in doubt re-terminate both ends of cable with new N-type connectors.
- Re-measure cable resistance (with it disconnected at both ends), resistance should be unmeasurable or open circuit.
- If cable resistance is unchanged, replace entire cable run, terminating with new N-type connectors.

If resistance is unmeasurable:
- Cable is open circuit
- Check cable thoroughly over whole length and at both ends for damage or reasons that would cause an open circuit condition (e.g. connector not terminated correctly and/or badly corroded or cable cut)
- If in doubt re-terminate both ends of cable with new N-type connectors.

- Re-measure cable resistance (with it disconnected at both ends), resistance should be unmeasurable or open circuit.
- If cable resistance is unchanged, replace cable, terminating with new N-type connectors.
- If cable is cut, replace entire cable run, terminating with new N-type connectors.

Capacity Mismatch
The alarm condition indicates a capacity mismatch between the local and remote IDUs. If this alarm occurs, verify that both local and remote IDUs are set to the same channel capacity.

IDU Transmit Failure
The alarm condition indicates a failure in the AMI output signal and/or the 40 MHz reference. If this alarm occurs, replace the IDU.

Local Auxiliary Input
The alarm condition indicates that an external alarm has been detected at the local XP4 IDU.
The alarm input is located on pin 15 of the local IDU DB15 *ALARM RELAYS* connector (see Table 6-4).
An alarm condition is caused by applying 0 Vdc to the pin.

Remote Auxiliary Input
The alarm condition indicates that one or more external alarms have been detected at the remote XP4 IDU.
The alarm input is located on pin 15 of the remote IDU DB15 *ALARM RELAYS* connector (see Table 6-4). An alarm condition is caused by applying 0 Vdc to the pin.
Additional alarms for 16E1 systems include:

Downlink Loss (E3 and 16E1)
An alarm condition generated by the MSU indicating a loss of signal on the downlink cable.

E3 LOS A (16E1 only)
An alarm condition generated by the MSU indicating a loss of E3 input to the MSU from IDU A.

E3 LOS B (16E1 only)
An alarm condition generated by the MSU indicating a loss of E3 input to the MSU from IDU B.

E3 FRAME (16E1 only)
An alarm condition generated by the MSU indicating a loss of frame synchronization on the E3 input to the MSU from the IDU.

AIS TO CUST (16E1 only)
An alarm condition generated by the MSU indicating that AIS has been detected on the E3 input to the MSU from the IDU.

6.3 Troubleshooting Using the Front Panel

6.3.1 Summary LED Alarm Display

For 2x/4x systems, a series of five LEDs are presented on the XP4 IDU front panel adjacent to the LED display and speed keys. These LEDs can be used to identify unit failures and terminal configuration errors based on the following LED alarm philosophy. Mapping of specific alarms to these LEDs is configurable by the customer through XPView. Default alarm mapping for 2x/4x systems is shown in Table 6-2a. For Front Access 2x/4x, 4x/8x, E3, and DS3 IDUs, the alarms are not mapped through XPView as the LEDs are specially configured for debugging per Tables 6-2b and 6-2c.

LED off (2x/4x systems)
Normal, no fault condition.

Green (Front Access systems)
Normal, no fault condition.

Red
Steady state red represents a non-functioning radio link or unit failure. This may be the result of a radio path problem or an installation problem such as both ends of the link not set to the same RF channel.

Flashing Red/Green (Front Access systems)
Flashing green/red represents a possible configuration error, not a unit failure. This condition may be recoverable from the front panel keypad providing the XP4 radio defaults have been properly set. Specific alarm mapping for 4x/8x and E3/16E1 systems are shown in Tables 6-2 and 6-3, respectively.

The LED alarms require communications over the link and therefore will only give meaningful information once a link has been established using the initial installation procedure described in Section 4.

COMMON ALARM SITUATIONS AND THE RESULTING LED STATUS ARE DETAILED IN SECTION 6.4, WHICH MAY BE USED AS A QUICK REFERENCE GUIDE TO EVALUATE SUCH SITUATIONS.

A series of five LEDs are presented on the XP4 IDU front panel adjacent to the LED display and speed keys. These LEDs can be used to identify unit failures and terminal configuration errors based on the following LED alarm philosophy.

The LED alarms require communications over the link and therefore will only give meaningful information once a link has been established using the installation procedures described in Section 4.

2x/4x Systems:
- Off = OK
- Red = Alarm

LED No.	LED Description	LED Status	
		Off	**Red**
1	Tributary Alarm	Normal	Tributary [1-8] Fault
2	Transmit Alarm (logical OR)	Normal	• Transmit Power Low • Transmit Frequency Lock • Cable Fault
3	Receive Alarm (logical OR)	Normal	• Receive Frequency Lock • Link ID Code Mismatch • Cable Fault
4	RSL Alarm	Normal	Receive Level Low
5	Auxiliary Alarm Input Status	Normal	• Local Aux. Input Alarm • Remote Aux. Input Alarm

Table 6-2a. 2x/4x Default LED/Relay Alarm Mapping

Note: This is the standard default alarm mapping. Mapping of alarms for any terminal may be changed by the end-user using XPView.

Front Access Systems:

- Green = OK (Front Access systems)
- Flashing Green/Red = Possible configuration error or minor alarm (Front Access systems)
- Red = Major alarm

LED	LED Description	LED Status		
		Green	**Green/Red Flashing**	**Red**
ON	On-Line	On-Line	• BER early warning • RSL alarm • Loopback	• BER alarm
IDU	IDU Summary (logical OR)	Normal	• Trib alarm • ID code mismatch	• Frame loss • IDU Tx Failure
ODU	ODU Summary (logical OR)	Normal	• TX muted • Capacity Mismatch	• TX power • TX PLL • RX PLL
CBL	Cable	Normal		• ODU-IDU comms failed • Downlink Loss (E3)
REM	Remote	Normal	Summary of the following alarms detected at remote terminal: • BER early warning • RSL alarm • Trib alarm • ID code mismatch • Capacity mismatch	Summary of the following alarms detected at remote terminal: • BER alarm • Frame loss • IDU Tx Failure • TX power • TX PLL • RX PLL • Downlink Loss Also, a local terminal frame loss alarm condition will cause this LED to light, indicating remote to local XP4 communications have failed.

Table 6-2. LED Alarm Mapping.

6.3.2 Alarm Summary on LED Display

When the **RSL/Alarm** mode is selected, press the arrow keys to scroll through the active alarm indicators. Either local or remote alarms can be viewed by toggling the **VIEW** button.

The alarms and display codes are as follows:

No Alarms	no Al
Transmit Power	AL tP
Transmit Frequency	AL TF
Receive Level	AL rSL
Receive Lock	AL rLoC
Link ID Code	AL id
BER Warning	AL bErL
BER Alarm	AL bErH
Cable Fault	AL Cbl
Local Aux. Input	AL LAu
Remote Aux. Input	AL rAu
Frame Loss	Al Fr
Trib 1 Fault	Al Tr 1
Trib 2 Fault	Al Tr 2
Trib 3 Fault	Al Tr 3
Trib 4 Fault	Al Tr 4
Trib 5 Fault	Al Tr 5
Trib 6 Fault	A1Tr 6
Trib 7 Fault	A1Tr 7
Trib 8 Fault	A1Tr 8

E3/16E1:	
Trib Fault	Al Tr
Downlink Loss	Al dnl

16E1 only:	
E3 LOS A	E3 A
E3 LOS B	E3 B
AIS TO CUST	AIS
E3 FRAME	E3Fr

6. 4 Troubleshooting Quick Reference Guide

6. 4.1 IDU LED Status for 2x/4x Systems with Default Alarm Mapping Configuration

Key to LED status:
- R = Red
- - = Off

	IDU LED STATUS					
	1	**2**	**3**	**4**	**5**	
	Tribs	**Tx**	**Rx**	**RSL**	**Aux I/P**	
Condition						**Corrective Action**
Normal operation	-	-	-	-	-	
Cable shorted or open circuit	-	R	R	-	-	Check cable connection IDU-ODU (section 6.2)
Link fade: • RSL is below RSL alarm threshold. • Remote XP4 not recognized.	-	-	-	R	-	• Check local conditions for rainfall. • Check link path for obstructions. • Check antenna alignment. • Check remote transmitter output power. • Check for interference from another link in the vicinity. • Check both XP4 terminals are set to the same frequency.
Tributary input LOS.	R	-	-	-	-	• Configure new tributary (section 5.1.2.5). • Check existing tributary connections.
Link ID code mismatch OR ODU receiver failure	-	-	R	-	-	• Check both XP4 terminal link ID codes and set to the same value if they were different. • If the above does not work, replace ODU.
ODU output failure	-	R	-	-	-	Replace ODU
Auxiliary Input alarm Detected	-	-	-	-	R	Check external equipment monitored by XP4 auxiliary input alarm detector (at both local and remote sites).

Table 6-3a. Troubleshooting Quick Reference Guide for 2x/4x

6. 4.1 IDU LED Status for Front Access 2x/4x and 4x/8x Systems

Key to LED status:
- G = green,
- R = red,
- G/R = alternating between green & red.

	IDU LED STATUS					
	ON	**IDU**	**ODU**	**CBL**	**REM**	
	On-Line	**IDU**	**ODU**	**Cable**	**Remote**	
Condition						**Corrective Action**
No DC power to IDU	Off	Off	Off	Off	Off	Restore power to IDU
Normal operation	G	G	G	G	G	
Cable shorted or open circuit	R	R	R	R	R	Check cable connection IDU-ODU
Minor link fade: • RSL is below RSL alarm threshold Major link fade: • RSL is below RSL alarm threshold, • BER Early Warning threshold has been exceeded.	G/R	G	G	G	G/R or G	• Check local conditions for rainfall • Check link path for obstructions • Check antenna alignment • Check remote transmitter output power • Check for interference from another link in vicinity
Total link loss: • RSL is below RSL alarm threshold, • Received BER exceeds BER alarm threshold, • Received frame synchronization may be intermittent.	R	R	G	G	R	• Check local conditions for excessive rainfall • Check link path for obstructions • Check antenna alignment • Check remote transmitter output power • Check for interference from another link in vicinity • Check both XP4 terminals are set to the same frequency
Tributary input LOS	G	G/R	G	G	G	• Configure new tributary • Check existing tributary connections
Local XP4 transmitter muted	G	G	G/R	G	R	Unmute transmitter
Link ID code mismatch	G	G/R	G	G	G/R	Set both XP4 terminal link ID codes the same
ODU output failure	G	G	R	G	R	Replace ODU
IDU transmit failure	G	R	G	G	R	Replace IDU
Capacity mismatch	R	R	G/R	G	R	Set both XP4 terminal capacities to the same
Loopback	G/R	G	G	G	G	Release loopback

Table 6-3b. Troubleshooting Quick Reference Guide for Front Access 2x/4x and 4x/8x

6. 4.1 IDU LED Status for Front Access E3/16E1 Systems

Key to LED status:
- G = green,
- R = red,
- G/R = alternating between green & red.

	IDU LED STATUS					
	ON	**IDU**	**ODU**	**CBL**	**REM**	
	On-Line	**IDU**	**ODU**	**Cable**	**Remote**	
Condition						**Corrective Action**
No DC power to IDU	Off	Off	Off	Off	Off	Restore power to IDU
Normal operation	G	G	G	G	G	
Cable shorted or open circuit	R	R	R	R	R	Check cable connection IDU-ODU
Minor link fade: • RSL is below RSL alarm threshold Major link fade: • RSL is below RSL alarm threshold, • BER Early Warning threshold has been exceeded.	G/R	G	G	G	G/R or G	• Check local conditions for rainfall • Check link path for obstructions • Check antenna alignment • Check remote transmitter output power • Check for interference from another link in vicinity
Total link loss: • RSL is below RSL alarm threshold, • Received BER exceeds BER alarm threshold, • Received frame synchronization may be intermittent.	R	R	G	G	R	• Check local conditions for excessive rainfall • Check link path for obstructions • Check antenna alignment • Check remote transmitter output power • Check for interference from another link in vicinity • Check both XP4 terminals are set to the same frequency
Loss of outgoing customer data (16E1 only)	G	G	G	G	G	Verify MSU operation by scrolling through alarms on IDU RSL/ALM display for E3Fr, E3 A, E3 B, or AIS.
Tributary input LOS	G	G/R	G	G	G	• Configure new tributary • Check existing tributary connections
Local XP4 transmitter muted	G	G	G/R	G	R	Unmute transmitter
Link ID code mismatch	G	G/R	G	G	G/R	Set both XP4 terminal link ID codes the same
ODU output failure	G	G	R	G	R	Replace ODU
IDU transmit failure	G	R	G	G	R	Replace IDU
Capacity mismatch	R	R	G/R	G	R	Set both XP4 terminal capacities to the same
Loopback	G/R	G	G	G	G	Release loopback

Table 6-3b. Troubleshooting Quick Reference Guide for E3/16E1

6.5 Alarm Relays

The alarm relays are presented on the front panel of the IDU.

- "Form C" relay outputs are presented on the XP4 IDU front panel *ALARM RELAYS* DB15 connector.
- Each relay output is mapped to provide an alarm summary of discrete alarm conditions within the XP4 terminal.
- The relays are intended for use with a customer's existing external alarm collection and monitoring system (e.g. SCADA) when the NMI feature is not used.

The pinout of the *ALARM RELAYS* connector is as detailed below:

IDU "ALARM RELAYS" DB15 Pin No.	Signal Name	Signal Description
1	Relay #1 NO	Relay #1 normally open output
2	Relay #1 NC	Relay #1 normally closed output
3	Relay #2 NO	Relay #2 normally open output
4	Relay #2 NC	Relay #2 normally closed output
5	Relay #3 NO	Relay #3 normally open output
6	Relay #3 NC	Relay #3 normally closed output
7	Relay #4 NO	Relay #4 normally open output
8	Relay #4 NC	Relay #4 normally closed output
9	Relay #5 NO	Relay #5 normally open output
10	Relay #5 NC	Relay #5 normally closed output
11	Common	Common connection to all relays
12	GND	Station ground output (0V)
13	N/C	Not connected
14	GND	Station ground output (0V)
15	Ext I/P	External alarm input sense (alarm condition = station ground)

Table 6-4. IDU "ALARM RELAYS" DB15 connector pinout

6.6 Loopback Configurations

For additional troubleshooting, six loopback paths can be configured from XPView.

6.6.1 XP4 IDU Loopbacks

6.6.1.1 Local Tributary Loopback

This loopback is used for locating faults in equipment and cable connections to the local XP4 by routing each tributary input (data from customer) directly to the corresponding tributary output (data to customer). Any combination of tributaries may be configured for loopback. Figure 6-1 shows the loopback path for tributary 1. The incoming data stream from the remote terminal for the tributaries configured in loopback will be affected.

6.6.1.2 IDU Local Loopback

This loopback, shown in Figure 6-2, routes the outgoing data stream to the incoming, bypassing the AMI conversion. The incoming data stream from the remote terminal will be affected.

6.6.1.3 Remote Tributary Loopback

This loopback is used for locating faults in equipment and cable connections to the remote XP4 by connecting the receive data stream directly to the transmit data stream. Any combination of tributaries may be configured for loopback. Figure 6-3 shows the loopback path for tributary 1at the remote IDU. For the tributary channel(s) in loopback, the incoming data stream will be affected.

6.6.2 XP4 ODU Loopbacks

6.6.2.1 RF Loopback

This loopback, shown in Figure 6-4, provides an unambiguous check of all active circuitry in a XP4 terminal. RF leakage through the ODU diplexer assembly allows the receiver to synchronize with the transmitter. Unwanted emissions are suppressed by the transmit diplexer. The transmitter of the remote ODU is muted to prevent interference.

6.6.2.2 ODU Analog Loopback

In the local ODU, the composite data stream at the output of the 2-4 level converter is routed directly to the demodulator output, bypassing the transmit and receive RF modules. This loopback, shown in Figure 6-5, includes the entire baseband path.

6.6.2.3 ODU Digital Loopback

In the local ODU, the composite digital data stream prior to the digital-to-analog converter is routed directly to the multiplexer input, bypassing the RF and analog modules. This loopback, shown in Figure 6-6, includes the tributaries, transmit and receive multiplexers, scrambler and FEC circuitry.

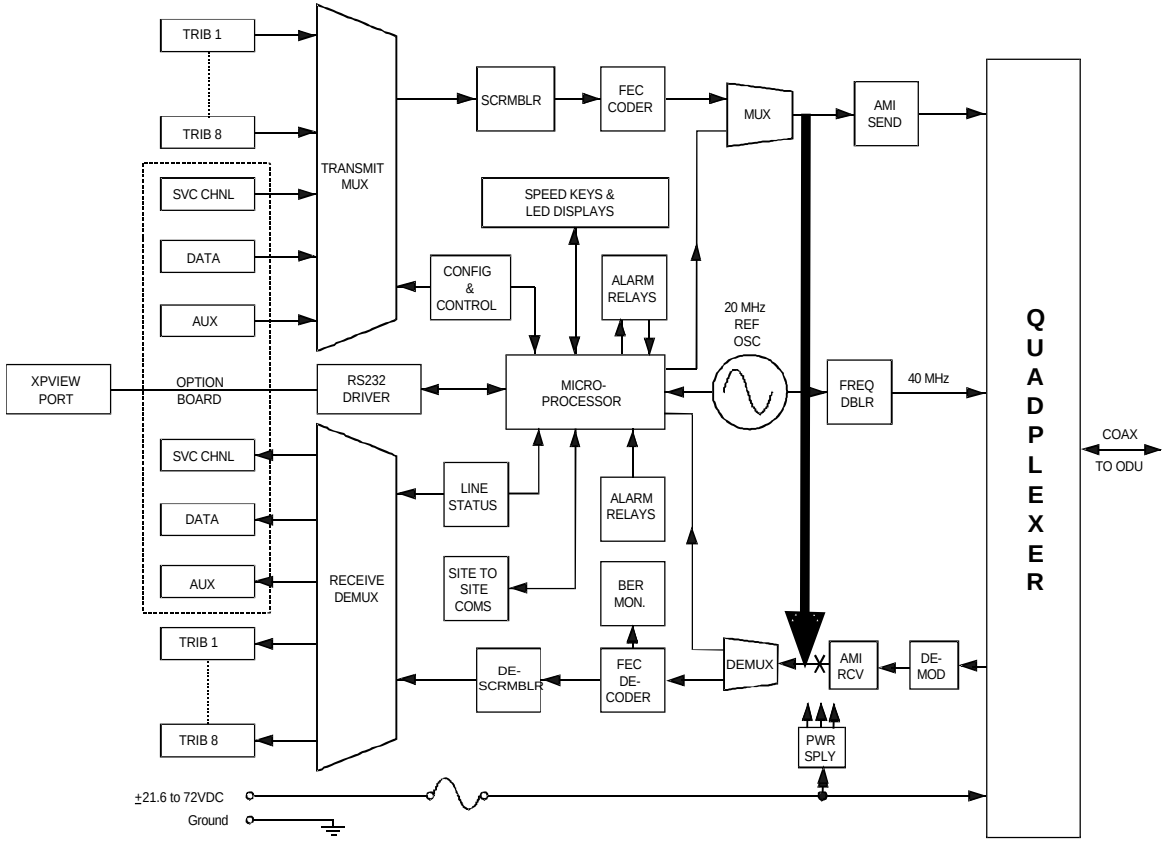


Figure 6-1. IDU Local Loopback

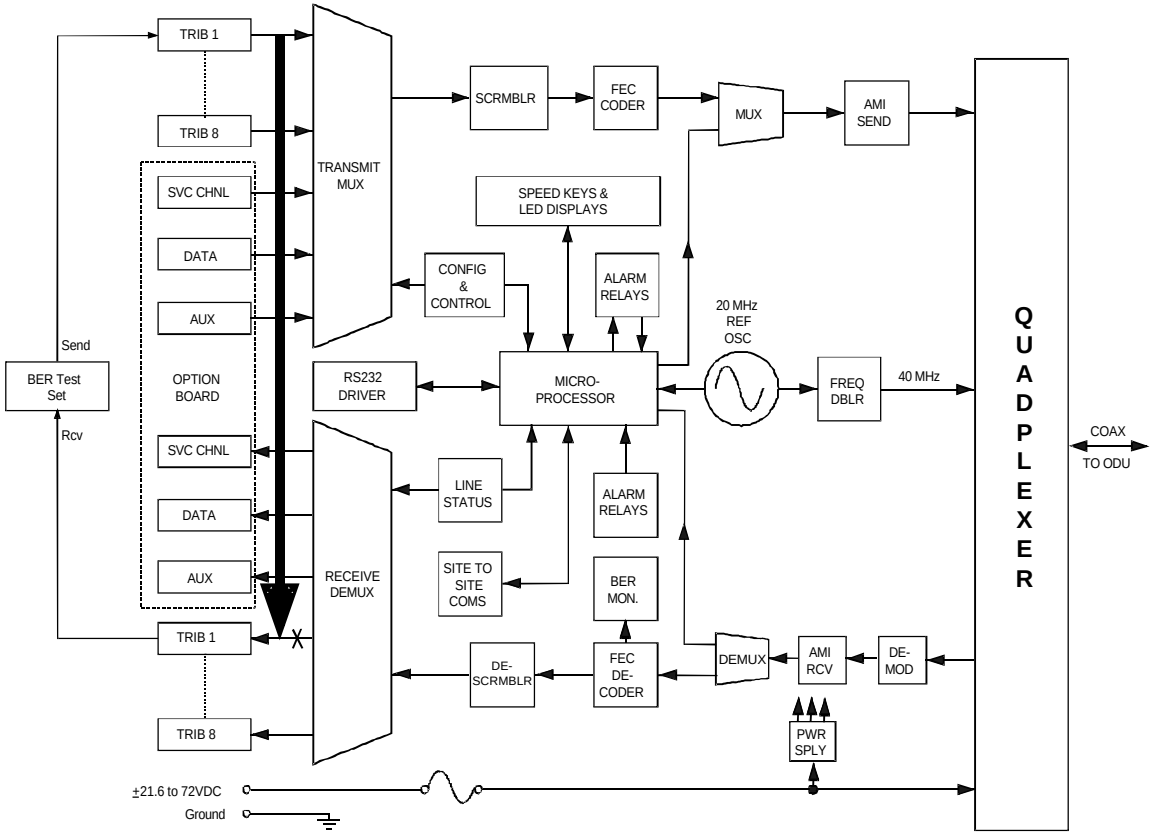


Figure 6-2. Local Tributary Loopback

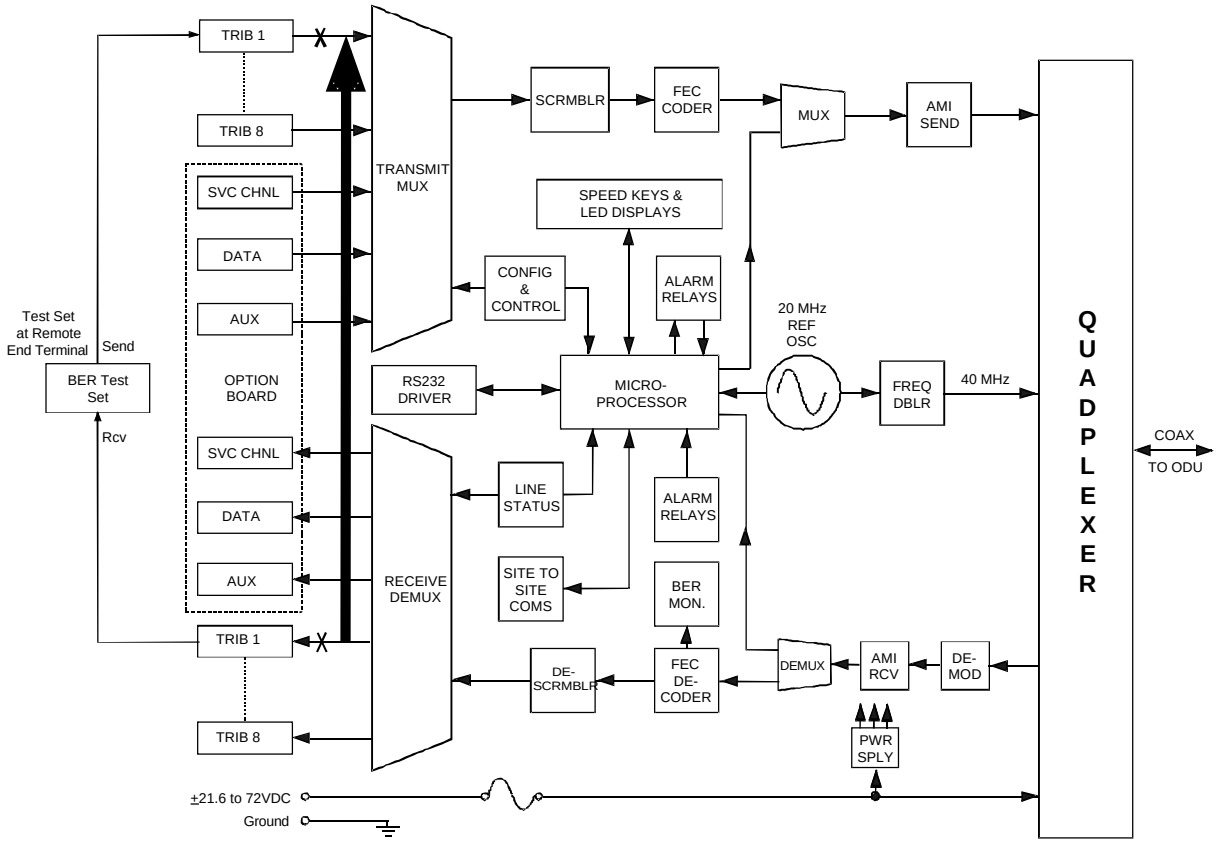


Figure 6-3. Remote Tributary Loopback

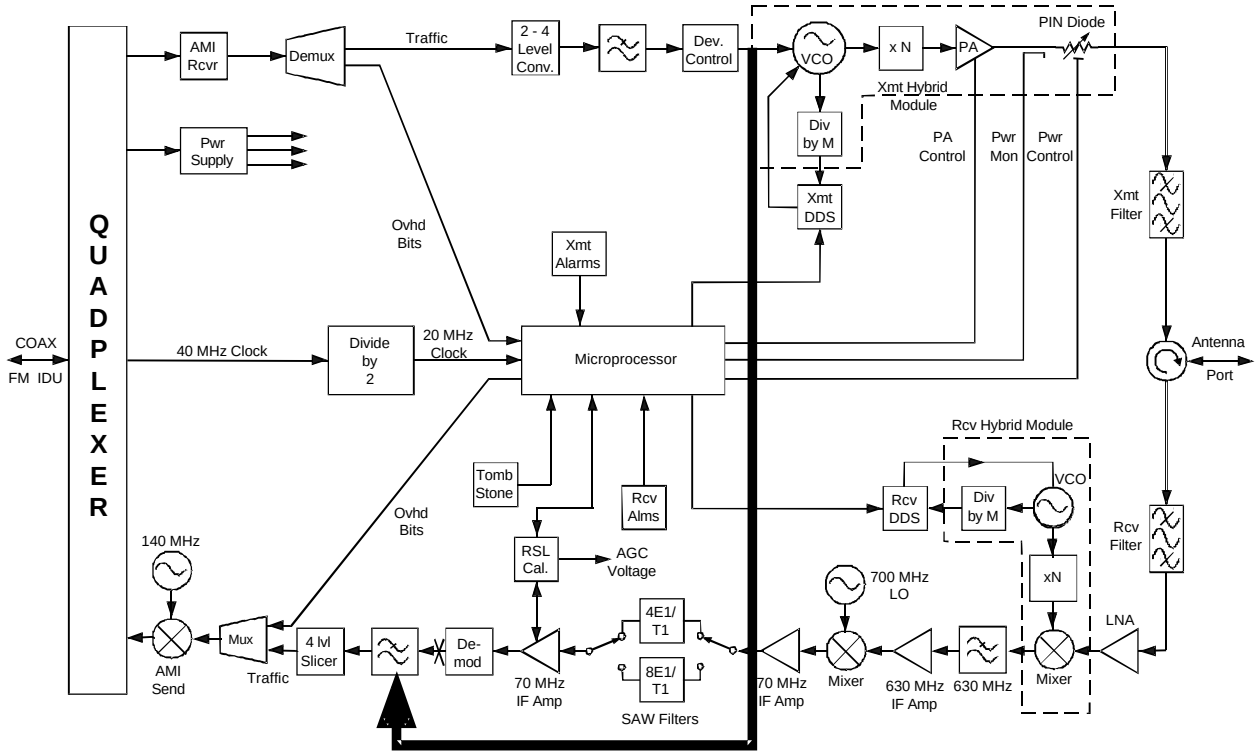


Figure 6-4. ODU Analog Loopback

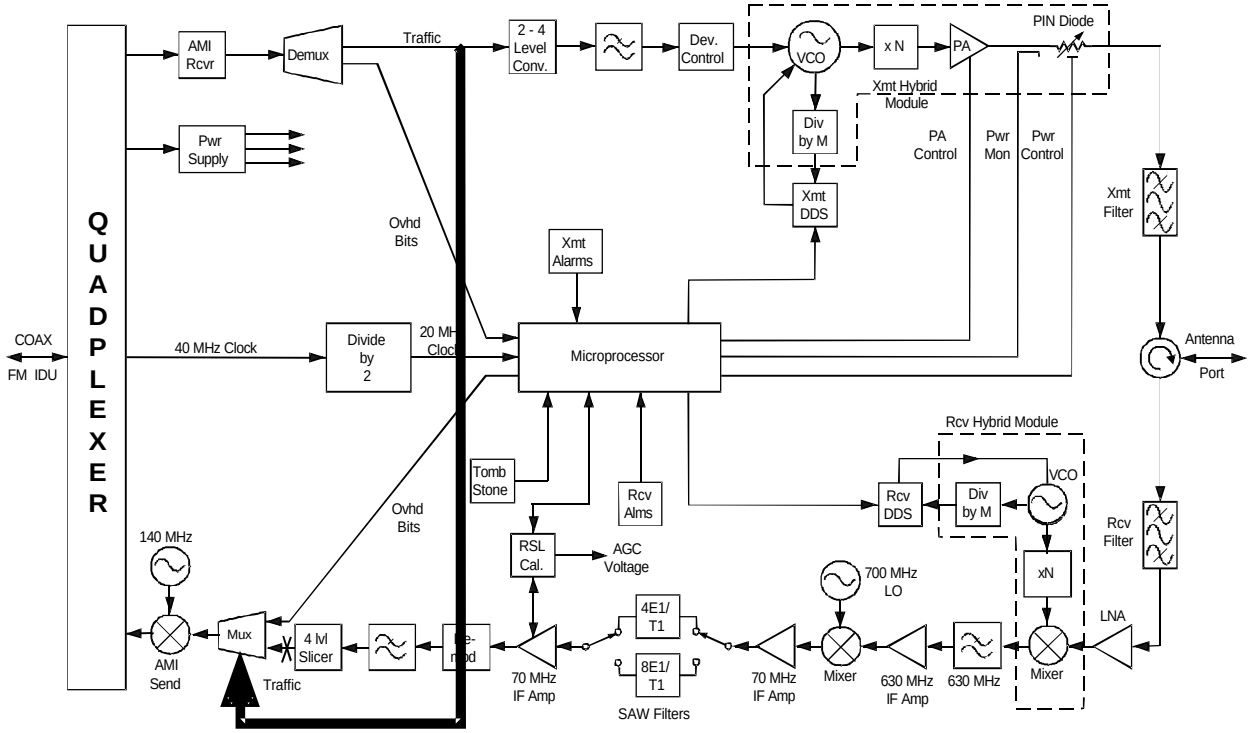


Figure 6-5. ODU Local Loopback

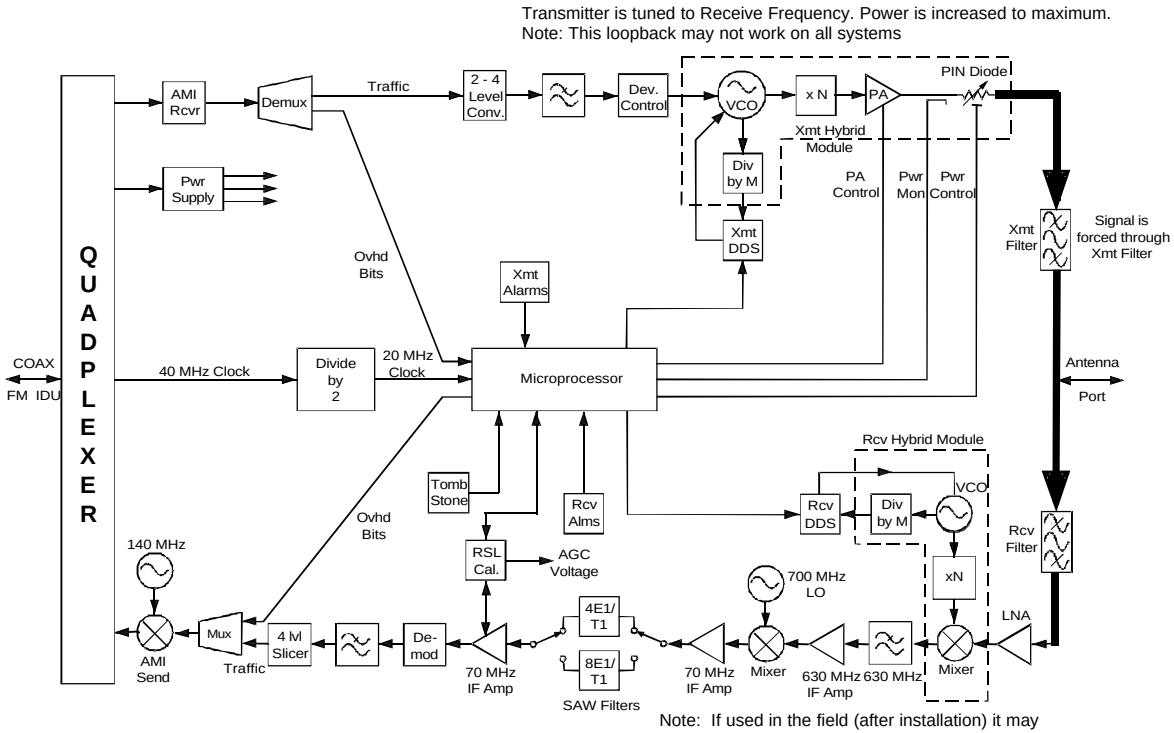


Figure 6-6. RF Loopback

Note: If used in the field (after installation) it may be necessary to mute the remote transmitter or even disconnect the local ODU from the antenna to eliminate interference.

6.7 Technical Support

Digital Microwave Corporation provides 24-hour, 365 day-a-year technical support over the telephone through our Customer Service department:

For customers serviced by DMC's UK office
Within/Outside UK: +44 1203-863838

For customers serviced by DMC's USA Narrowband office
Within USA: 1 800 974 2250
Outside USA: +1 206 243 5468

On-site technical support can be arranged if necessary by contacting Customer Service at one of the above numbers.

6.8 Faulty Equipment

Should any XP4 equipment be found faulty, refer to the purchasing agreement for equipment return policy. Contact Customer Service at one of the numbers given above.

Note: The equipment warranty is void if the warranty seals on the IDU or ODU are tampered with.

6.9 Maintenance

No regular maintenance of the XP4 installation is necessary. If a fault occurs, the system is sufficiently well alarmed and has diagnostics to allow the operator to rapidly and precisely locate the source of the fault condition.

7.0 Options

7.1 XP4 Protection Systems

7.1.1 General

Protection Systems are used to improve link reliability and availability. The XP4 Protection System may operate in one of the following modes, depending on customer requirements:

1. Frequency Diversity.
   Both terminals' transmitters are powered on, but use different frequencies to avoid interference.
2. Hot Standby.
   Both terminals are set to the same frequency, but one terminal's transmitter is muted to prevent interference.
3. Dual Link (4x/8x systems)
   Both terminals are fully functioning, using different frequencies to provide 16 tributaries under normal operation (no fault). A fault detected in traffic of tributaries 1 through 8 results in an automatic switch of those tributaries to the stand-by radio, disabling tributaries 9 through 16. A fault detected in tributaries 9 through 16 generates an alarm, but no switching will occur, as the first eight tributaries are considered primary.
4. Space Diversity (E3, 16E1, and DS3 systems)
   The main and stand-by radios are set up in Hot Stand-by mode, but are connected to their own antennas. The spatial separation of the antennas, combined with hitless receive switching, provides the Space Diversity function on the receiving end of the link.

The IDU arrangement is similar for all four protection modes. The protection switch provides connection between two IDUs, each of which connects to an ODU. See Figures 7-11 through 7-13.

The ODU arrangements may use either one antenna with a waveguide coupler or two antennas. See Figures 7-9 and 7-10 for illustrations showing both ODU mounting configurations.

7.1.2 Operation

Switching Conditions for 2x/4x/8x Protected Systems

The protected system provides link continuity in the event that a fault occurs in the primary radio. The switch is activated by an alarm condition in the primary link. Refer to Section 6.0 for detailed alarm descriptions. The following alarm conditions will trigger a switch from primary to secondary IDU:

1. Loss of lock on transmit signal
2. Loss of transmit power
3. Frame loss (Receive)
4. BER alarm
5. Loss of IDU transmit signal
6. DC power loss
7. Cable fault
8. Loss of tributary input to primary IDU (when set to 'normal')

Additionally, while in Hot Stand-by mode, the protection switch will not switch to an off-line link that has a different link ID or different capacity than that of the primary link.

Switching Conditions for E3, 16E1, and DS3 Systems

The E3, 16E1, and DS3 protected systems have separate transmit and receive switches, which are triggered by different alarms. The receive switch is hitless for RSL and BER alarms (path fade, etc).

Alarm	Switching Function Activated
1. Loss of lock on transmit signal	Transmit
2. Loss of transmit power	Transmit
3. Frame loss (Receive)	Receive
4. BER alarm	Receive (hitless)
5. Loss of IDU transmit signal	Transmit
6. DC power loss	Transmit and Receive
7. Cable fault	Transmit and Receive
8. Loss of tributary input to primary IDU	Transmit
9. Loss of downlink signal from ODU to IDU (E3, 16E1, DS3 systems)	Receive
10. RSL alarm (E3, 16E1, DS3 systems)	Receive (hitless)
11. Loss of E3 data from IDU (16E1 systems)	Receive

Protection Switch LED Summary

The LEDs on the protection switch provide the following information:

Hot Stand-by/Frequency Diversity/Dual Link/Diversity Mode:
Green = Active
OFF = Not Active

Tx/Rx A, B, or Auto:
Green = On-line and no alarms
Flashing Green = Off-line and no alarms
Red = Off-line and alarmed
Flashing Red = Loss of communications signal from IDU
Orange = Forced on-line and alarmed

7.1.3 The XP4 Protection Switch

The key component to protected system operation is the Protection Switch. The switch is available with balanced (RJ-45) or unbalanced (BNC) traffic interfaces for 2x/4x systems and balanced or unbalanced DB25 interfaces for 2x/4x/8x systems. E3 and DS3 systems connect to a Switching Unit (SU), which uses a BNC traffic interface. 16E1 systems, which have a DB25 traffic interface, use a multiplexer/switching unit (MSU) that provides E3 to 16E1 conversion as well as the switching function. Traffic connections between the protection shelf and IDUs are made on the front panel.

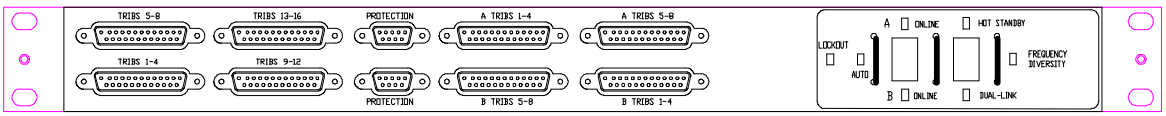


Figure 7-1. Balanced/Unbalanced Front Access 2x/4x/8x XP4 Redundant System Controller

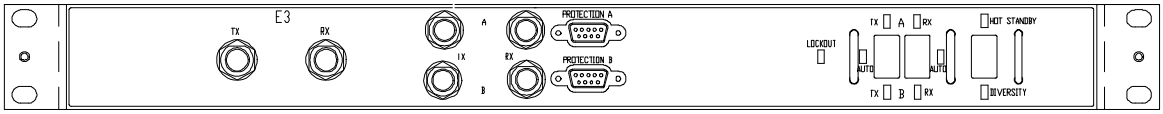


Figure 7-2. Unbalanced E3 or DS3 XP4 Protection Switch

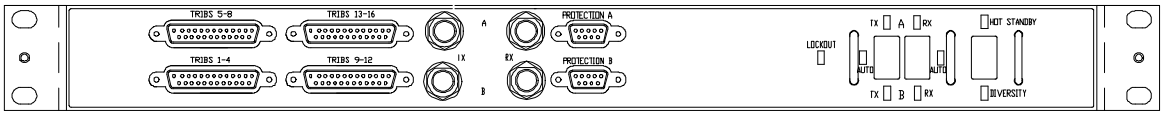


Figure 7-3. Balanced/Unbalanced MSU

The protection switch monitors both co-located XP4 terminals and, upon an alarm status change in either terminal, makes a decision as to which of the two XP4 terminals should be on-line (carrying traffic). For 2x/4x systems, alarm, status, and power connections to the controller from both IDUs are made at the rear of each unit. For Front Access 2x/4x, 4x/8x, E3, 16E1, and DS3 systems, the connections are on the IDU front panel.

For BNC/RJ45 versions of the 2x/4x systems, the choice of operation in Hot Standby or Frequency Diversity protection mode is set by the front panel mounted rocker switch on the redundant system controller. 4x/8x systems include an additional position for Dual Link mode. E3, 16E1, and DS3 provide a choice between Hot Stand-by/Space Diversity and Diversity modes using a two-position rocker switch. LEDs clearly indicate the switch setting.

Either XP4 terminal may be forced on-line for maintenance purposes using a three-position front panel mounted rocker switch. LEDs clearly indicate which XP4 terminal is on-line and whether the redundant system controller is in auto or manual switch mode. Both controller switches are prevented from accidental operation by “guard rails” fixed on either side of them.

7.1.4 Protected Configuration Options

A protected configuration typically consists of redundant IDUs and ODUs and a waveguide coupler to connect the two ODUs to a single antenna port. If desired a second antenna may be used instead of the waveguide coupler, providing protection against an antenna falling out of alignment. The dual ODU/dual antenna configuration is required for Space Diversity E3, 16E1, and DS3 systems. The following descriptions assume all protected systems are configured with a single antenna and a waveguide coupler.

7.1.4.1 ODU Configuration

7.1.4.1.1 Electrical Configuration

The waveguide assembly combines the outputs and inputs of two standard XP4 ODUs to an antenna using either a 6 dB waveguide coupler or 3 dB splitter. The insertion loss through the primary path is typically 1.5 dB for the coupler plus losses due to any flexible waveguide and circular-to-rectangular waveguide transitions used to connect the ODU assembly and the remotely mounted antenna.

Frequency	Waveguide	Primary Path Insertion Loss	Standby Path Insertion Loss
13/15 GHz	WR62	1.6 dB	6.5 dB
18/23/26 GHz	WR42	1.8 dB	6.5 dB
28/38 GHz	WR28	2.0 dB	6.5 dB

Table 7-1a. Dual ODU/Single Antenna Path Losses with 6 dB Couple, Typical

Frequency	Waveguide	Primary Path Insertion Loss	Standby Path Insertion Loss
13/15 GHz	WR62	3.5 dB	3.5 dB
18/23/26 GHz	WR42	3.5 dB	3.5 dB
28/38 GHz	WR28	3.5 dB	3.5 dB

Table 7-1b. Dual ODU/Single Antenna Path Losses with 3 dB Splitter, Typical

7.1.4.1.2 Mechanical Configuration

The mechanical configurations for a typical installation are shown in Figures 7-9 and 7-10. For the dual ODU/single antenna configuration in Figure 7-9, the XP4 ODUs attach to the dual ODU pole mount using the same drawlatches that mount an ODU to an antenna. The dual ODU/dual antenna configuration, Figure 7-10, employs two of the single ODU/single antenna arrangements typically used in an unprotected system.

Dual ODU/Single Antenna Configuration

The flexible waveguide needed to connect between the ODU assembly and the remotely mounted antenna is not included in the assembly kit and is dependent upon the user's installation arrangement. Fixed lengths of flexible waveguide can be purchased from many sources or can be supplied by DMC once the lengths are specified.

The splitter/coupler, associated rigid waveguide plumbing and necessary circular-to-rectangular transitions are supplied as part of the Dual ODU Remote Mount Kit.

Dual ODU/Dual Antenna Configuration

Two single ODU/single antenna configurations, each connected to its respective IDU, are used to provide the primary and secondary paths. This configuration is required for Space Diversity protection systems.

7.1.4.2. Protected Mode Options

7.1.4.2.1 Hot Standby Protection Mode

The main and standby radios are tuned the same frequency. Transmitters of the off-line radio are muted. When a fault is detected, the on-line terminal is muted, the standby terminal is unmuted, and traffic is switched to the newly unmuted terminal.

7.1.4.2.2 Frequency Diversity Protection Mode

The main and standby radios are typically set up at least two channels apart to avoid interference. Both radios are unmuted and ready to pass data. When a fault is detected on the active radio, the traffic is switched to the stand-by radio.

7.1.4.2.3 Dual Link Mode (4x/8x only)

The main and standby radios are transmitting simultaneously and are tuned to different frequencies to avoid interference. Under normal operating conditions, primary radio carries tributaries 1 through 8 traffic and stand-by radio carries tributaries 9 through 16 traffic. A fault detected in traffic of the first eight tributaries results in an automatic switch of those tributaries to the stand-by radio, disabling tributaries 9 through 16. A fault detected in traffic of tributaries 9 through 16 will raise alarms but no switching will result.

7.1.4.2.4 Space Diversity Mode (E3, 16E1, and DS3 only)

The main and stand-by radios are set up in Hot Stand-by mode, but are connected to their own antennas. Both antennas, separated by a specific distance, are receiving the signal transmitted from the on-line radio at the other end of the link. If a fault occurs in the receiving end of the link, the traffic is switched to the stand-by radio without causing errors (hitless receive switching). As in Hot Stand-by mode, a fault detected in the on-line transmitter causes that transmitter to mute and the stand-by radio to un-mute.

7.1.5 System Installation

7.1.5.1 General

This section covers only procedures unique to installing a protection system. Where necessary, references to Section 3 (Installation) are made for specific guidelines on how to install cables, ODUs and IDUs.

7.1.5.2 Installation Equipment Required

7.1.5.2.1 Tools

Same as for unprotected installation. Refer to section 3.2.1.

7.1.5.2.2 Equipment

Twice the amount required for unprotected installation plus the protection switch and dual ODU remote mount. Refer to section 3.2.2.

7.1.5.3 XP4 Radio Equipment Inventory

An inventory of radio components to be installed should be performed before installation begins. Ensure the part description detailed on the outside of each box corresponds to the components required for the installation (i.e. ODU frequency band, sub-band and capacity, IDU configuration). If there are any discrepancies, first contact should be with the Digital Microwave's customer service department. The equipment warranty is void if the warranty seals on the IDU or ODU are tampered with.

For Hot Standby protected system:

- Protection Switch Installation Kit. Refer to Tables 7-2 and 7-3 for 2x/4x and 4x/8x configurations, respectively.
- Dual ODU / Single Antenna Installation Kit, Table 7-4, or two of the single ODU/single antenna kits (Section 3).

For Frequency Diversity protected system:

- Protection Switch Installation Kit. Refer to Tables 7-2, 7-3a, and 7.3b for 2x/4x, 4x/8x, and Front Access 2x/4x configurations, respectively.
- Dual ODU / Single Antenna Installation Kit, Table 7-4, or two of the single ODU/single antenna kits (Section 3).

For Dual Link Systems (4x/8x only):

- Protection Switch Installation Kit. Refer to Table 7-3a for 4x/8x configuration.
- Dual ODU / Single Antenna Installation Kit, Table 7-4, or two of the single ODU/single antenna kits (Section 3).

For E3 or DS3 Hot Stand-by or Frequency Diversity protected systems:

- Protection Switch Installation Kit. Refer to Tables 7-3c for E3 and DS3 configurations, respectively.

- Dual ODU / Single Antenna Installation Kit, Table 7-4, or two of the single ODU/single antenna kits (Section 3).

For Space Diversity protected systems:

- Protection Switch Installation Kit. Refer to Tables 7-3c and 7.3d for E3/DS3 and 16E1 configurations, respectively.
- Two ODUs and two antennas are required.

For 16E1 Hot Stand-by or Frequency Diversity protected systems:

- Protection Switch Installation Kit. Refer to Table 7-3d for 16E1 configuration.
- Dual ODU / Single Antenna Installation Kit, Table 7-4, or two of the single ODU/single antenna kits (Section 3).

Item	Quantity	Description
1	1	2RU Redundant System Controller (in unbalanced or balanced configuration, per original Purchase Order).
2	4	Phillips dome-head screw for mounting IDU in rack; No.12 (12-24).
3	2	DB37-DB37 cable for alarm and power connections to IDUs.
4	2	Protection Option Card for each IDU.
5	16 or 8	Short BNC to BNC traffic cable for connection to unbalanced IDU, Or Short RJ-45 to RJ-45 traffic cable for connection to balanced IDU. (Dependent on item 1).

Table 7-2. 2x/4x Redundant System Controller Installation Kit Parts List

Item	Quantity	Description
1	1	1RU Protection Switch (in unbalanced or balanced configuration, per original Purchase Order).
2	5	Phillips dome-head screw for mounting IDU in rack, No.12 (12-24).
3	5	Washers
4	2	DB-9 male-to-male cables, 7.5”
5	4	DB-25 male-to-male cables, 7.5”

Table 7-3a. 4x/8x Protection Switch Installation Kit Parts List

Item	Quantity	Description
1	1	1RU Protection Switch (in unbalanced or balanced configuration, per original Purchase Order).
2	5	Phillips dome-head screw for mounting IDU in rack, No.12 (12-24).
3	5	Washers
4	2	DB-9 male-to-male cables, 7.5”
5	2	DB-25 male-to-male cables, 7.5”

Table 7-3b. Front Access 2x/4x Protection Switch Installation Kit Parts List

Item	Quantity	Description
1	1	1RU Switching Unit
2	5	Phillips dome-head screw for mounting IDU in rack, No.12 (12-24).
3	5	Washers
4	2	DB-9 male-to-male cables, 7.5”
5	4	BNC-to-BNC cables

Table 7-3c. E3 and DS3 Switching Unit Installation Kit Parts List

Item	Quantity	Description
1	1	1RU Mux/Switching Unit (MSU)
2	5	Phillips dome-head screw for mounting IDU in rack, No.12 (12-24).
3	5	Washers
4	2	DB-9 male-to-male cables, 7.5”
5	4	BNC-to-BNC cables

Table 7-3d. 16E1Mux/Switching Unit Installation Kit Parts List

Item	Quantity	Description
1	1	Dual ODU mounting bracket, incl. coupler and protective cover pre-assembled.
2	1	Galvanized custom V-bolt.
3	3	½-13 hex nut for attaching item 2 to antenna mounting assembly (incl. 1 spare).
4	3	½” flat washer for item 3 (incl. 1 spare).

Table 7-4. Dual ODU / Single Antenna Installation Kit Parts List

7.1.5.4 Cable Installation

Two cable runs are all that is required to connect ODUs to IDUs in XP4 protected systems. Run the cables per the guidelines given in section 3.4.

7.1.5.5 Protected ODU Installation

Protected XP4 ODUs may use standard antennas. If redundant antennas are required (two antennas at each site), the antennas must be fitted with the XP-type circular interface for each antenna to mount its own ODU. If a single antenna is used with the waveguide coupler, the antenna interface must be fitted with a gasketed UBR flange (square, 4-hole). Each waveguide junction must have a gasket to cover interface to prevent moisture from entering waveguide.

For the dual ODU/single antenna configuration, use the following procedure to install the waveguide coupler ODU mounting assembly and ODUs.

Step 1. Remove dual ODU pole mount and installation kit from the transport box.

Step 2. Loosely assemble the V-bolt to the dual ODU pole mount using 2-each of the ½-13 hex nuts and ½" flat washers supplied in the installation kit (items 3 and 4). See Figure 7-4 for reference.

Step 3. Attach both ODUs to the dual ODU pole mount using captive spring clips on the assembly, ensuring ODU polarization is vertical, i.e. with ODU polarization indicator positioned relative to the orientation of the rectangular waveguide and coupler.

Step 4. If flex waveguide is used between the ODUs and antenna, attach one end of the flex waveguide to the coupler using the 4-40 Allen bolts, No.4 lock washers and 3/32 Allen key provided in the installation kit.

Note: The waveguide section should be terminated on one side with a gasketed UBR flange (square, 4-hole) to be compatible with the un-gasketed (cover) UBR flange on the coupler. The other side of the flex waveguide section should be terminated with either a gasketed or cover UBR flange depending on antenna interface flange. All waveguide junctions require a gasket to cover UBR interface.

Ensure the gasket is installed in the flex waveguide UBR flange prior to assembly. Cover the open end of flex waveguide or coupler to prevent entry of foreign matter. Stow flex waveguide for transport to its point of installation.

Step 5. Move ODU assembly to the desired installation location on the pole, being careful not to impact the ODUs or coupler/flex waveguide.

Step 6. Attach assembly to pole using the V-bolt. See Figure 7-4 for reference.

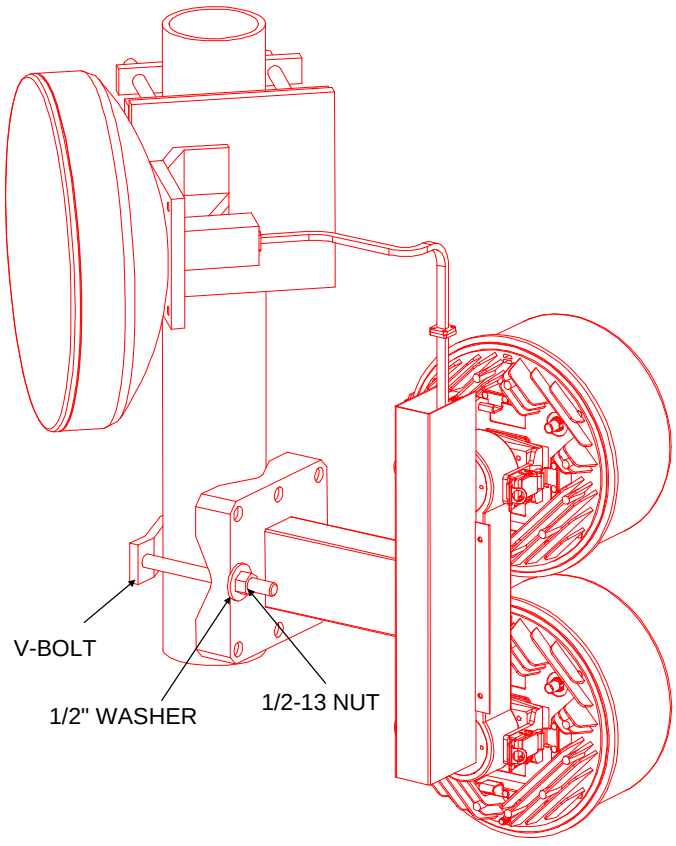


Figure 7-4. ODU Mounting Bracket Assembly

Step 7. Torque the ½-13 V-bolt hex nuts to 66 N-m (50 ft-lb) to secure the assembly to the pole.

Step 8. Lay-in, secure with cable ties and terminate grounds between both ODUs and a nearby local earth point. Use jam and lock nuts provided on ODU grounding posts to secure ground connection. Tighten nuts using a small adjustable wrench.

Connect the coupler output to the antenna:

Step 9. If the ODUs are to be mounted close to the antenna, use flex waveguide to connect the coupler to the antenna. Attach the free end of the waveguide installed in Step 4 to the antenna using the 4-40 Allen bolts, No.4 lock washers and 3/32 Allen key provided in the installation kit.

Step 10. If the ODUs are to be mounted further away from the antenna, install elliptical type waveguide between the two locations, terminating one side with a gasketed UBR or PBR flange. Attach flange to coupler using the 4-40 Allen bolts, No.4 lock washers and 3/32 Allen key provided in the installation kit. The other side should be terminated with an UBR-type flange. Ensure gaskets are installed in all gasket grooves prior to assembly.

Step 11. If necessary, weatherproof, ground and pressurize the waveguide connections at the ODU and antenna ends of the waveguide run according to local engineering practices.

7.1.5.6 IDU and Protection Switch Installation

The protected XP4 IDUs and protection switches require only 300mm rack depth and 4RU of vertical rack space for 2x/4x systems, 3RU space for all front access systems. No space above, below or between the units is required for ventilation purposes as the whole system dissipates less than 35 W (approximately 11 W per shelf). Protection systems may be stacked adjacently in racks.

Note: The 2x/4x 2RU switch is referred to as a 'Redundant System Controller'.

7.1.5.6.1 2x/4x Installation Procedure

- If the IDU is not fitted with a Protection Option Card, shown in Figure 7-5, install the Protection Option Card into each IDU by removing the rectangular plate secured to the rear of each IDU with four small Phillips dome-head screws and insert the option card in its place. Secure card using the four Phillips dome-head screws.
- Connect one end of each DB37-DB37 cable assembly to the Protection Option Cards installed in each IDU. Secure connectors using a small flatblade screwdriver and the captive screws provided with the connectors.
- Install each IDU in a rack with a 2RU space between them. Follow the guidelines given in Section 3.6.1, Steps 1-4.
- Position the redundant system controller in between the IDUs.
- Connect the DB37-DB37 cable from the upper IDU to the port marked "A" on the rear of the protection shelf. Secure connector with the captive screws provided using a small flatblade screwdriver, as shown in Figure 7-6.

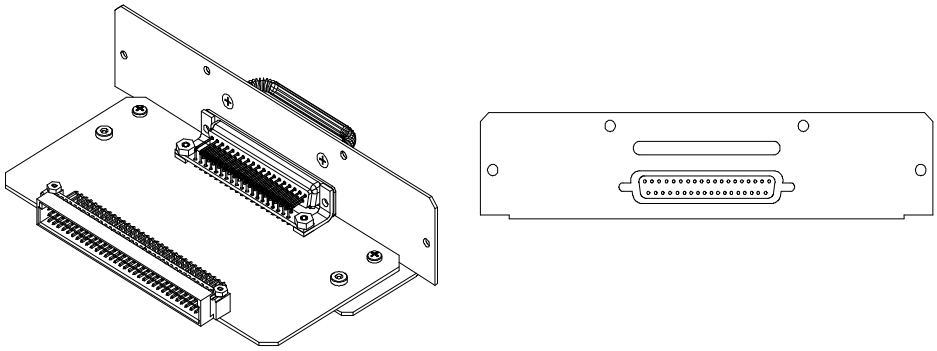


Figure 7-5. 2x/4x IDU Protection Option Card

- Connect the DB37-DB37 cable from the lower IDU to the port marked “B” on the rear of the system controller. Secure connector with the captive screws provided using a small flatblade screwdriver, as shown in Figure 7-6.

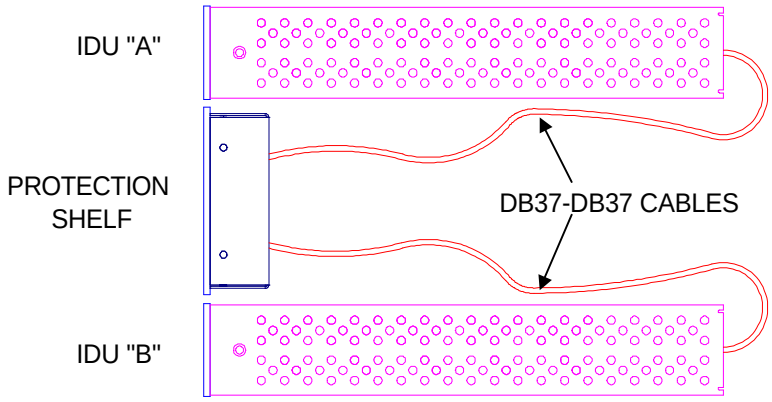


Figure 7-6. DB37-DB37 Connections Between IDUs and Redundant System Controller.

- Secure the system controller into the rack using 4-off No.12 Phillips dome-head screws provided in the Protection Shelf Installation Kit.
- Connect cable from ODU nearest coupler flange to the lower IDU and cable from ODU farthest from coupler flange to the upper IDU. This provides the least amount of insertion loss to the primary side.
- Connect the traffic cables (item 5 of Redundant System Controller Installation Kit) from each tributary of each IDU to the same tributary port of the protection shelf. No cables should be crossed and the middle row of connectors on the protection shelf should be unconnected. Refer to Figures 7-7 and 7-8.
- Install customers data signal cables on the middle row of system controller tributary connectors using 75Ω BNC male connectors for unbalanced systems and RJ-45 plugs for balanced systems. Refer to Table 3-5 and Figure 3-5 for RJ-45 wiring details.
- If required, install alarm relay wiring to female DB15 “ALARM TRANSPORT” connector on redundant system controller front panel. Refer to Table 7-5 and Figure 7-9 for wiring details. Recommend use of 8-pair, tin-plated, PVC insulated, twisted pair, copper cable (24 gauge).
- Install DC power to both IDUs ($\pm$21.6 to 72 V) via the 3-pin connectors. Ensure that the plugs provided in the IDU installation kits are wired as detailed in Figure 3-7. 14 gauge wire (2.5mm^2 conductor) is recommended. Strip ends back by 3mm and secure in connector using a small flatblade screwdriver.

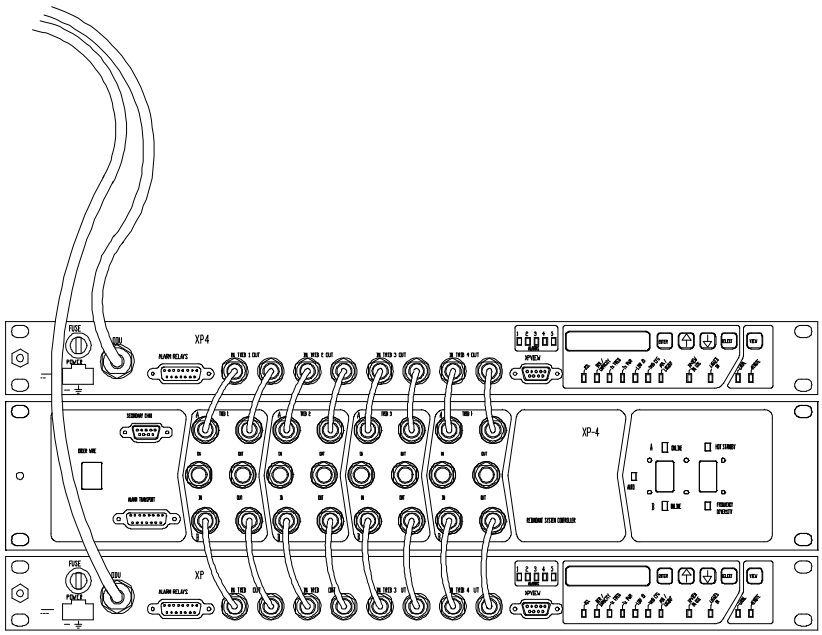


Figure 7-7. Unbalanced 2x/4x Protected Configuration.

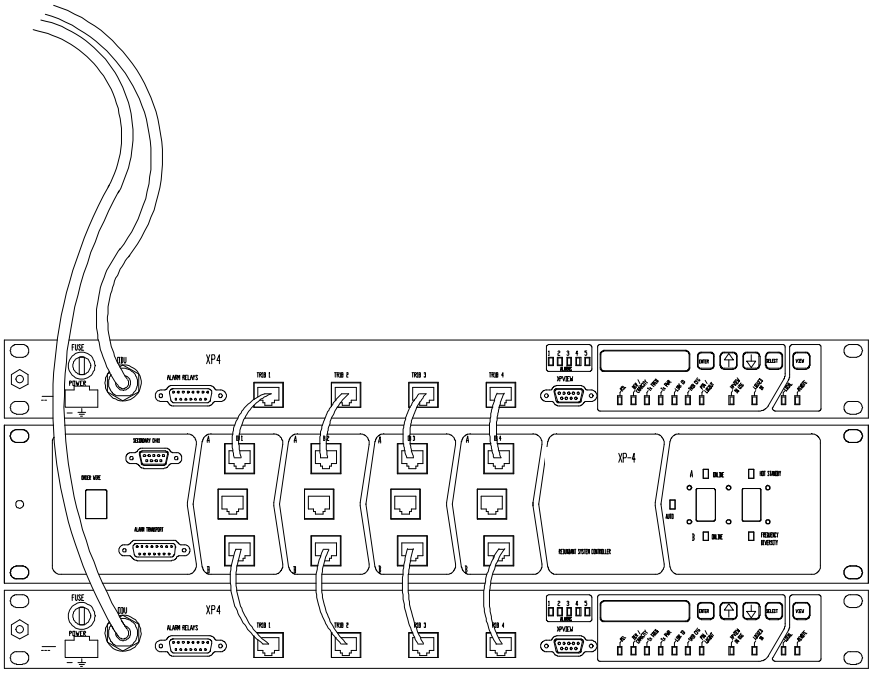


Figure 7-8. Balanced 2x/4x Protected Configuration.

Redundant Controller "ALARM TRANSPORT" DB15 Pin No.	Name	Signal Description (Radio is Powered on)
1	ATI 1	Alarm Transport Input
2	ATI 2	Alarm Transport Input
3	ATI 3	Alarm Transport Input
4	ATI 4	Alarm Transport Input
5	GND	
6	NCOUT 1	Alarm Transport Ckt. #1 N.C.
7	NOOUT 1	Alarm Transport Ckt. #1 N.O.
8	NCOUT 2	Alarm Transport Ckt. #2 N.C.
9	NOOUT 2	Alarm Transport Ckt. #2 N.O.
10	NCOUT 3	Alarm Transport Ckt. #3 N.C.
11	NOOUT 3	Alarm Transport Ckt. #3 N.O.
12	NCOUT 4	Alarm Transport Ckt. #4 N.C.
13	NOOUT 4	Alarm Transport Ckt. #4 N.O.
14	RELCOM	Common Relay Armatures
15	Spare	

Table 7-5. Redundant System Controller "ALARM TRANSPORT" DB15 Pinout

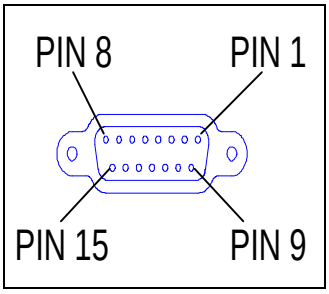


Figure 7-9. "ALARM TRANSPORT" DB15 Pin Numbering

7.1.5.6.2 Front Access Protection Systems Installation Procedure

- Install each IDU in a rack with a 1RU space between them. Follow the guidelines given in Section 3.6.1, Steps 1-4. Secure the lower IDU to rack, leaving the upper loose enough to adjust horizontally.
- Position the protection switch in between the IDUs.
- Install the cables as shown in Figures 7-10 and 7-11.
- Secure the protection switch and IDU into the rack using 4-off No.12 Phillips dome-head screws provided in the Protection Switch Installation Kit.
- Connect cable from ODU nearest coupler flange to the lower IDU and cable from ODU farthest from coupler flange to the upper IDU. This provides the least amount of insertion loss to the primary side.
- Install customer's data signal cables to the tributary connectors on the protection switch using DB25 connectors for Front Access 2x/4x, 4x/8x, and 16E1 systems and BNC connectors on E3 and DS3 systems. Refer to Table 3-5 for wiring details of the DB25 tributary connector.
- Install DC power to both IDUs ($\pm$21.6 to 72 V) via the 3-pin connectors. Ensure that the plugs provided in the IDU installation kits are wired as detailed in Figure 3-7. 14 gauge wire (2.5mm^2 conductor) is recommended. Strip ends back by 3mm and secure in connector using a small flatblade screwdriver.

Note: The protection switch has code download capability through the "B" protection connector. This enables code to be downloaded to the controller without disturbing traffic on "A".

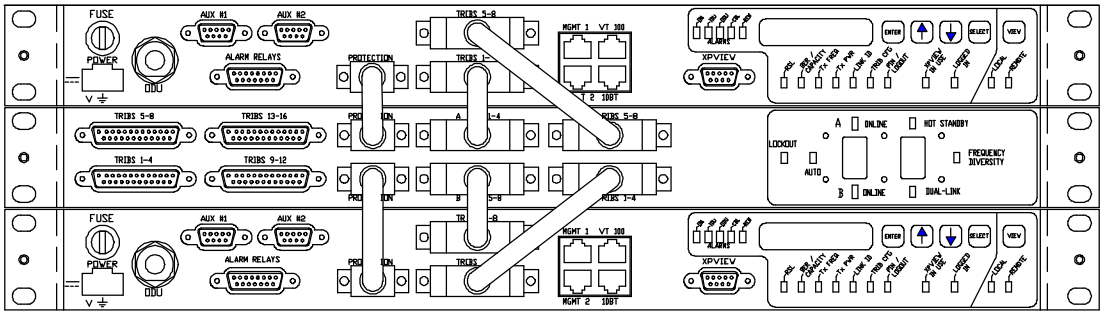


Figure 7-10. Cable Connections for Front Access 2x/4x and 4x/8x Protected Systems

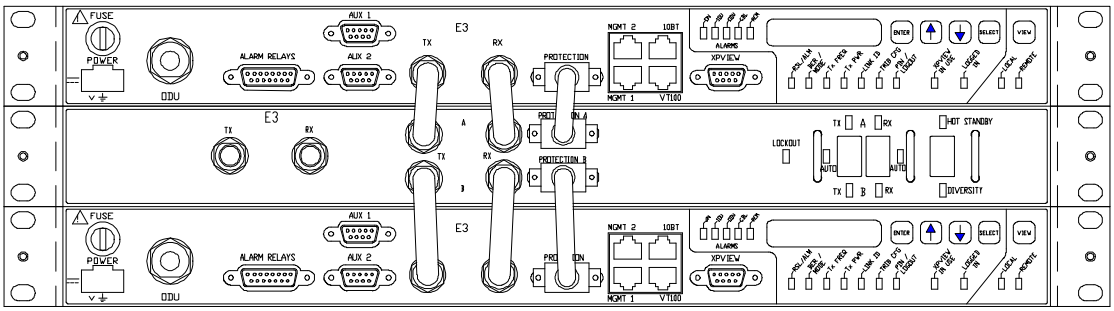


Figure 7-11a. Cable Connections for E3 and DS3 Protected Systems

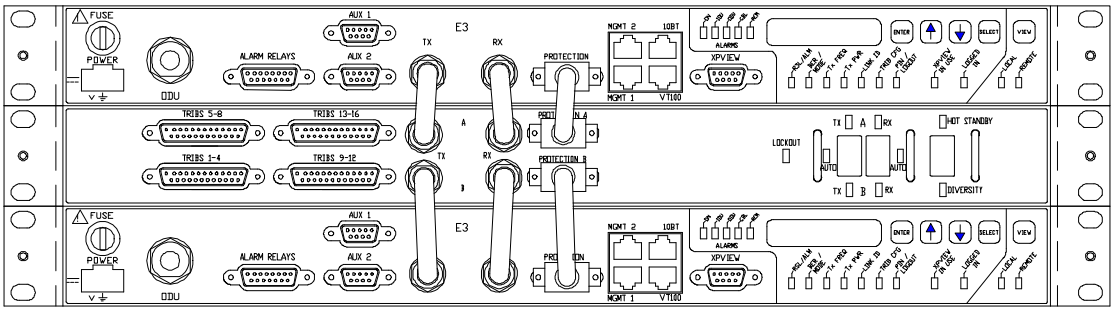


Figure 7-11b. Cable Connections for 16E1 Protected System

The XP4 Protection System is now installed. Proceed to section 7.1.6, Commissioning.

7.1.6 Commissioning The Protection System

Before applying power to the system, select the relevant protection mode of operation for the installation on the redundant system controller front panel using the two-position rocker switch located on the right side of the shelf. Select "A" on-line using the three-position rocker switch located on the protection switch front panel.

NOTE: Both Tx and Rx switches on E3, 16E1, and DS3 systems must be switched into either A, B, or Auto.

7.1.6.1 Hot Standby Protection Mode

Use Section 4 as a general guide, but read the following instructions first:

- Verify that **all** interconnect cables are installed.
- Power up both IDUs.
- Set upper IDU Traffic Capacity, Frequency, Transmit Power, Link ID Code and Tributary Configuration per section 4.5.
- Select "B" on-line using the three position rocker switch located on the protection switch front panel.
- Set lower IDU Traffic Capacity, Frequency, Transmit Power, Link ID Code and Tributary Configuration per section 4.5.
  Note: The setup of the both upper and lower XP4's must be identical for correct system operation.
- Align the antenna using the guidelines given in Section 4.6.
- Select "A" then "AUTO" function on the switch using the three position rocker switch located on the front panel.
- LEDs for upper IDU should be solid green. LEDs for lower IDU should be green, except for green/red flashing on ODU, indicating that it is functional and standing by.

The Hot Standby Protection System is now ready to carry traffic.

7.1.6.2 Frequency Diversity Mode

Use Section 4 as a general guide, but read the following instructions first:

- Verify that **all** interconnect cables are installed.
- Power up the upper IDU only.
- Set upper IDU Traffic Capacity, Frequency, Transmit Power, Link ID Code and Tributary Configuration per Section 4.5.
- Power up the lower IDU and select "B" on-line using the three position rocker switch located on the protection switch front panel.
- Set lower IDU Traffic Capacity, Frequency, Transmit Power, Link ID Code and Tributary Configuration per Section 4.5.
  Note: The setup of the lower XP4 must be identical to the upper except for frequency. Frequencies used on "A" and "B" terminals must be different for system to operate. Frequencies will have been assigned by the customer's frequency planning department.
- Align one antenna system at a time using the guidelines given in Section 4.6.
- Select "A" then "AUTO" function on the controller using the three position rocker switch located on the front panel.
- LEDs for upper IDU should be solid green. LEDs for lower IDU should be green, except for green/red flashing on ODU, indicating that it is functional and standing by.

The Frequency Diversity Protection System is now ready to carry traffic.

7.1.6.3 Dual Link Protection Mode (4x/8x only)

Use Section 4 as a general guide, but read the following instructions first:

- Verify that **all** interconnect cables are installed.
- Power up the upper IDU only.
- Set upper IDU Traffic Capacity, Frequency, Transmit Power, Link ID Code and Tributary Configuration as per Section 4.5 for channels 1 through 8.
- Power up the lower IDU.

- Set lower IDU Traffic Capacity, Frequency, Transmit Power, Link ID Code and Tributary Configuration as per Section 4.5 for channels 9 through 16.
  Note: The setup of the lower XP4 must be identical to the upper except for frequency. Frequencies used on "A" and "B" terminals must be different for system to operate. Frequencies will have been assigned by the customer's frequency planning department.
- Align one antenna system at a time using the guidelines given in Section 4.6.
- Select "AUTO" function on the system controller using the three position rocker switch located on the front panel.
- Both upper and lower IDU LEDs should be solid green, indicating both links are active and transmitting traffic.

The Dual Link System is now ready to carry traffic.

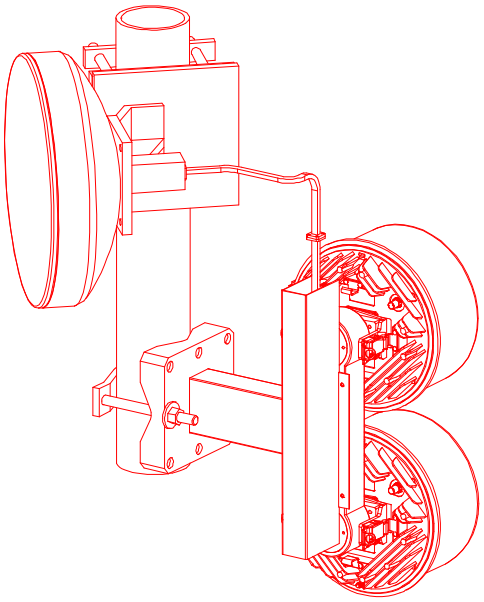


Figure 7-9. ODU Protection Configuration using a Single Antenna

7.1.6.4 Space Diversity Mode

Space Diversity requires the dual ODU/dual antenna configuration (Figure 7-10).

Use Section 4 as a general guide, but read the following instructions first:

- Verify that **all** interconnect cables are installed.
- Power up the upper IDU only.
- Set upper IDU Traffic Capacity, Frequency, Transmit Power, Link ID Code and Tributary Configuration per Section 4.5.
- Power up the lower IDU and select "B" on-line using the three position rocker switch located on the protection switch front panel.
- Set lower IDU Traffic Capacity, Frequency, Transmit Power, Link ID Code and Tributary Configuration per Section 4.5.
  Note: The setup of the lower XP4 must be identical to the upper except for frequency. Frequencies used on "A" and "B" terminals must be different for system to operate. Frequencies will have been assigned by the customer's frequency planning department.
- Align one antenna system at a time using the guidelines given in Section 4.6.
- Select "A" then "AUTO" function on the controller using the three position rocker switch located on the front panel.

- LEDs for upper IDU should be solid green. LEDs for lower IDU should be green, except for green/red flashing on ODU, indicating that it is functional and standing by.

The Space Diversity Protection System is now ready to carry traffic.

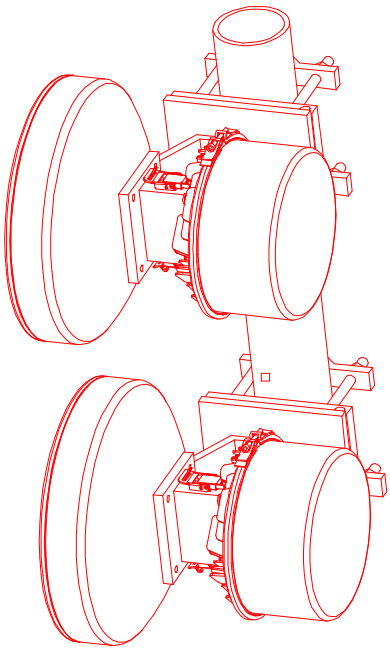


Figure 7-10. ODU Protection Configuration using Dual Antenna

7.2 Network Management Systems (SNMP)

7.2.1 General

Since all control, configuration and monitoring functions of the radio are already software controlled from the serial EIA RS232 XPView port, the radio is ideally suited to interface with external Network Management Systems.

The standard SNMP option offers compatibility for management of radio systems. With the use of a browser such as “HP Openview”, “XPSurf”, or “SNMPc”, the operator may view and configure any radio terminal in a network from a single point.

The SNMP option plug-in module, with connections presented on the rear of each 2x/4x IDU or on the front panel of each 4x/8x IDU (except for BNC port), has the following interfaces:

- EIA RS232 VT100 configuration port on a RJ-45 socket,
- 2 x EIA RS232/422/485 SNMP SLIP ports on RJ-45 sockets,
- Ethernet port on RJ-45 or BNC socket.

Options to support other Network Management protocols can also be easily accommodated as the SNMP is built on a powerful hardware platform (Motorola 68000 series microprocessor).

For full details on the SNMP option, contact your area’s DMC Sales Representative.

7.2.2 SNMP Installation

7.2.2.1 Installation Equipment Required

7.2.2.1.1 Tools

Tools required for SNMP installation:
- Phillips type screwdriver
- Straight RS-232 cable (VT100)

7.2.2.1.2 Equipment

Items included with SNMP:
- 2x/4x Configuration: SNMP card only
- 4x/8x Configuration: SNMP card, Y ribbon cable

7.2.2.2 Installation Procedure

CAUTION: Do not install the SNMP card until all power to the unit is OFF.

Step One:

(For use with a 2x/4x IDU):

Insert the SNMP card into the available slot at the rear of the IDU.

To insert the SNMP card into the IDU, the small panel held by two small screws at the rear of the IDU must be removed. Once this panel is removed, the interface card should make connection with the 96 pin connector on the IDU circuit board.

(For use with a 4x/8x IDU):

Power down the IDU.

To insert the SNMP option card into the IDU, remove the small panel at the left rear of the IDU. Disconnect the cable attached to the panel and plug into the SNMP card. Insert the SNMP card into the access port, ensuring proper engagement of 96-pin connector. Replace the two screws used to tighten the interface card to the IDU.

Step Two: Power the IDU.

Power the IDU with either 24 v DC or 48 v DC (+ or -).

Step Three: Connect the SNMP card to a VT100 terminal for initialization.

Connect the TERM port to an available COM port on a VT100 terminal or a PC equipped with VT100 emulation software via a straight RS-232 cable. (Refer to the cable diagrams). The initial configuration of the SNMP ports must be done using the VT100 TERM port.

Step Four: Startup the VT100 terminal or PC running a VT100 emulation software to begin SNMP configuration.

Any VT100 terminal or PC running a VT100 emulation software may be used. If using a VT100 terminal, hit the Return (↵) key to begin SNMP configuration. If using a PC, first configure the emulation software to use the chosen COM port and the following COM port communication settings and then hit the Return (↵) key to begin SNMP configuration.

Baud Rate	9600 bits/sec
Data Bits	8
Stop Bits	1
Parity	None
Flow Control	None
Initial Modem Commands	None

Table 7-6. COM Port Communications Settings

NOTE: Microsoft Windows 3.1 is equipped with a VT100 emulation program called Terminal. Windows 95 equipped with Hyperterminal for VT100 emulation.

Step Five: Configure all applicable ports.

The initial Login screen should currently be displayed; if it is not hit the Return (↵) key. The first time the system is started there will be no user accounts configured and the user will be logged on as a ‘Super user’ with ‘modify’ access.

From the Main Menu, select option 5) Network Port Configuration. To select an option, enter the number corresponding to a menu item; the screen will scroll and the selected sub-menu will be displayed. Select the option number of the port to configure. Refer to the Tables 7-10 through 7-12 below for a listing of the parameters associated with each port. After configuring each port, save all modifications (choose ‘S’, Save Modifications option).

From the Main Menu, select option 6) System Configuration. Using the System Configuration Menu Options, the system name, time and date can be set along with other system parameters such as automatic logout time and reset status.

Step Six: Reset the SNMP card.

Reset the SNMP card by using the reset function provided in the VT100 program.

NOTE: BY RESETTING THE SNMP, YOU ARE SAVING ALL OF THE CONFIGURATIONS YOU HAVE JUST ENTERED. IF YOU DO NOT RESET THE SNMP, THE CONFIGURATIONS WILL BE LOST.

Step Seven: Disconnect the VT100 connection.

Step Eight: Connect all network connections. The cable pinout diagrams for the cables to be used with each port are defined below in Section 7.2.2.3.

7.2.2.3 SNMP Connection

The SNMP board for the 2x/4x configuration is equipped with the SNMP interface ports on the front of the SNMP board. The SNMP board for the 4x/8x configuration is equipped with only the Ethernet BNC connector; the remaining ports are located on the front panel of the IDU.

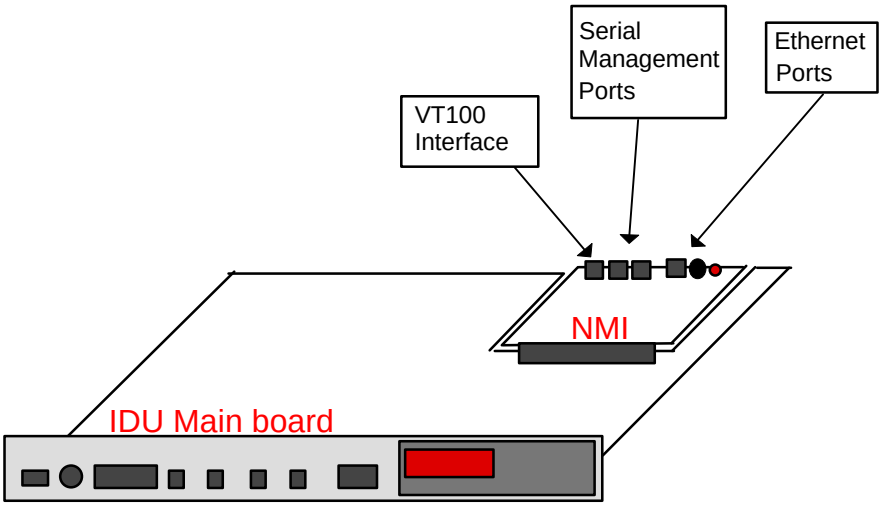


Figure 7-14. SNMP Connection for 2x/4x IDUs

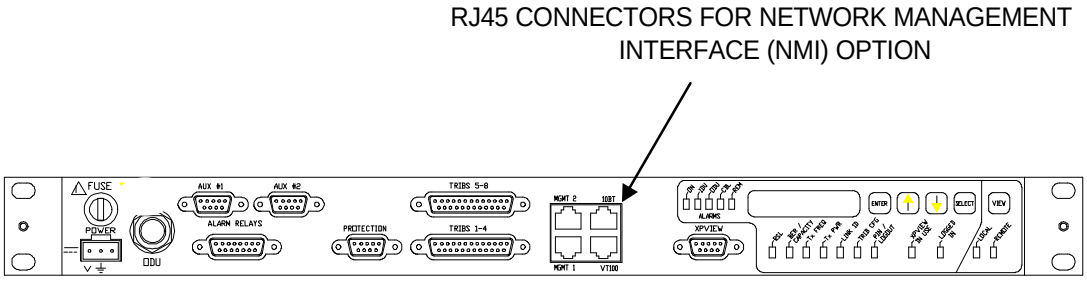


Figure 7-15. SNMP Connection for 4x/8x IDUs

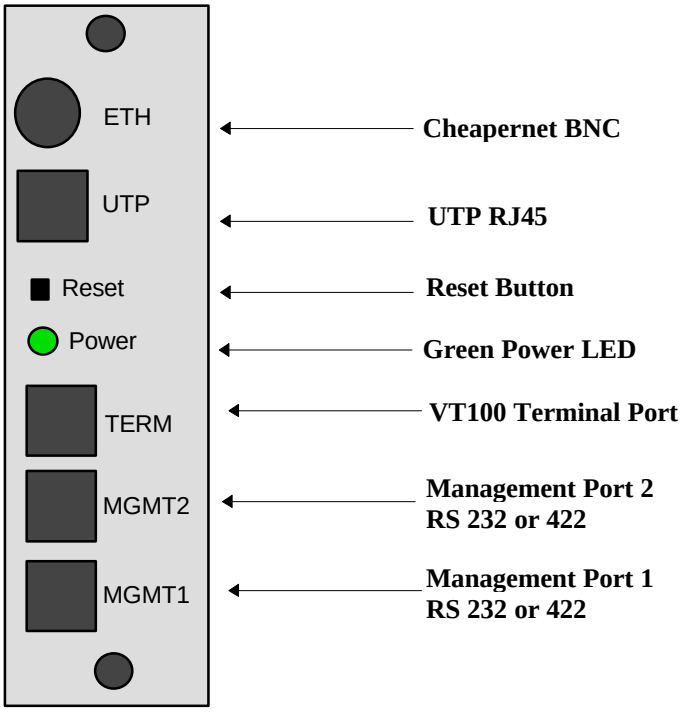


Figure 7-16. SNMP Front Panel for 2x/4x Systems

7.2.2.4 SNMP Interface Cables

7.2.2.4.1 VT100 Interface Cable (DB-25 Female)

This cable is used for connecting the VT100 Terminal or PC serial port (DB-25-Female) to the SNMP TERM Port.

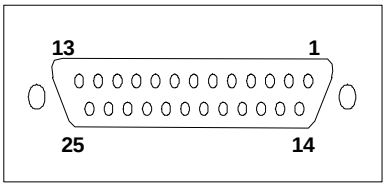


Figure 7-17. VT100 Interface DB-25 Female Connector

DB-25-Female	Pin	Direction	RJ45	Pin	Direction
RxD	3	Input	RxD	2	output
TxD	2	Output	TxD	3	input
RTS	4	Output	RTS	7	input
CTS	5	Input	CTS	8	output
DSR	6	Input	DSR	6	output
GND	7	-	GND	5	-
DCD	8	Input	DCD	1	output
DTR	20	Output	DTR	4	input

Table 7-7. VT100 Interface DB-25 Female Connector

7.2.2.4.2 VT100 Interface Cable (DB-9 Female)

This cable is used for connecting the VT100 Terminal or PC serial port (DB-9-Female) to the SNMP TERM Port.

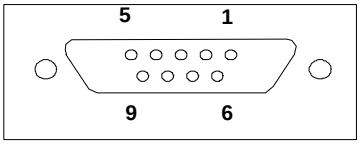


Figure 7-18. VT100 Interface DB-9 Female Connector

DB-9-Female	Pin	Direction	RJ45	Pin	Direction
RxD	2	input	RxD	2	output
TxD	3	output	TxD	3	input
RTS	7	output	RTS	7	input
CTS	8	input	CTS	8	output
DSR	6	input	DSR	6	output
GND	5	-	GND	5	-
DCD	1	input	DCD	1	output
DTR	4	output	DTR	4	input

Table 7-8. VT100 Interface DB-9 Female Connector

7.2.2.4.3 Ethernet Port

The SNMP is equipped with only one ethernet port. However, the one ethernet port is selectable as a UTP RJ-45 connection or a coaxial BNC 10 Base T connection.

1) Ethernet Address	This address is the address associated with the ethernet chip on the circuit board. This address is programmed at the factory and should not be changed.
2) Default Ethernet Address	
3) Default Router IP Address	IP Address of the network node which is the default router for the ethernet port. The network address must correspond to that of the SNMPs other network ports for the route to be valid.
4) Default Router Subnet Mask	The subnet mask for the default router.
5) IP Address	The IP address for the ethernet port.
6) Subnet Mask	The subnet mask for the ethernet port.
7) Trap Destination IP Address	The IP address to which traps being sent out of the ethernet port will be sent.
8) Trap Generation	Enables/Disables trap generation via the ethernet port.
9) Ethernet Connector Type	Configures the ethernet port to operate using the BNC or Twisted Pair connection.
A) Booted Indicator	Indicates whether or not the ethernet port is initialized or not. A port is not initialized until it is “booted”.

Table 7-9. Ethernet Port (UTP RJ-45 or 10BT ETH)

7.2.2.4.4 Serial Management Ports (MGMT1 and MGMT2)

1) Default Router IP Address	IP Address of the network node which is the default router for the serial port. The network address must correspond to that of the SNMPs other network ports for the route to be valid.
2) Default Router Subnet Mask	The subnet mask for the default router.
3) IP Address	The IP address for the serial management port selected.
4) Subnet Mask	The subnet mask for the IP address.
5) Trap Destination IP Address	The IP address to which traps being sent out of the serial management port selected will be sent.
6) Trap Generation	Enables/Disables trap generation via the serial management port selected.
7) Other Serial Management Parameters	
1) Baud Rate	The baud rate at which the serial management port selected will operate.
2) Interface Type	Configures the serial management port selected as an RS-232 or RS-422 connection.
3) Booted Indicator	Indicates whether or not the selected serial management port is initialized or not. A port is not initialized until it is "booted".
4) Protocol	Configures the protocol used over the serial management port selected as SLIP or PPP.
5) Modem Type	Determines the type of user string (if any) is sent out of the serial management port selected upon initialization of the port.

Table 7-10. Serial Management Ports 1 and 2 (MGMT1 and MGMT2)

7.2.2.4.5 XP4 Management Port

Default Router IP Address	The IP address of the network node which is the default router for the XP4 port. The network address must correspond to that of the SNMPs other network ports for the route to be valid.
Default Router Subnet Mask	The subnet mask for the default router.
IP Address	The IP address for the XP4 port.
Subnet Mask	The subnet mask for the XP4 port.
Trap Destination IP Address	The IP address to which traps being sent out of the XP4 port shall be sent.
Trap Generation	Enables/Disables trap generation via the XP4 port.
Booted Indicator	Indicates whether or not the XP4 port is initialized or not. A port is not initialized until it is "booted".

Table 7-11. XP4 Management Port

7.2.2.4.6 RS-232 SLIP/PPP Interface Cable (DB-25 Female)

This cable is used for connecting the SNMP management system or PC serial port (DB-25-Female) to the SNMP Serial MGMT1/MGMT2 (RJ-45) ports.

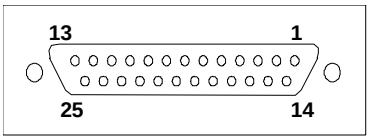


Figure 7-19. RS232 SLIP/PPP DB-25 Female Connector

DB-25-Female	Pin	Direction	RJ45	Pin	Direction
RxD	3	Output	RxD	2	input
TxD	2	Input	TxD	3	output
RTS	4	Input	RTS	7	output
CTS	5	Output	CTS	8	input
DSR	6	Output	DSR	6	input
GND	7	-	GND	5	-
DCD	8	-	DCD	1	-
DTR	20	input	DTR	4	output

Table 7-12. RS232 SLIP/PPP DB-25 Female Connector

7.2.2.4.7 RS-232 SLIP/PPP Interface Cable (DB-9 Female)

This cable is used for connecting the SNMP management system or PC serial port (DB-9-Female) to the SNMP Serial MGMT1/MGMT2 (RJ-45) ports.

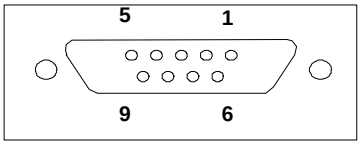


Figure 7-20. RS232 SLIP/PPP DB-9 Female Connector

DB-9-Female	Pin	Direction	RJ45	Pin	Direction
RxD	2	output	RxD	2	input
TxD	3	input	TxD	3	output
RTS	7	input	RTS	7	output
CTS	8	output	CTS	8	input
DSR	6	output	DSR	6	input
GND	5	-	GND	5	-
DCD	1	-	DCD	1	-
DTR	4	input	DTR	4	output

Table 7-13. RS232 SLIP/PPP DB-9 Female Connector

7.2.2.4.8 RJ-45 Ethernet Unshielded Twisted Pair Interface Cables

This cable is used for connecting the SNMP Twisted Pair (UTP) Ethernet Port to an Ethernet hub.

RJ-45	Pin	Direction	RJ-45	Pin	Direction
TPTX+	2	Output	TPRX +	2	input
TPTX-	3	Output	TPRX -	3	input
TPRX+	7	Input	TPTX +	7	output
TPRX-	8	Input	TPTX -	8	output

Table 7-14. RJ-45 Ethernet Cable Pinout

7.3 Auxiliary Data Channels

7.3.1 General

The XP4 Auxiliary Data Channels provide access to two 72 kbit/s overhead channels between XP4 terminals in a link. For 2x/4x systems, the option card needed to implement this feature may be fitted to any 2x/4x XP4 IDU, independent of capacity setting or frequency band. The option card is not required for all other systems as the Auxiliary Data Channels are a standard feature in all Front Access IDUs. The data channel connections for a 2x/4x system are located on the option card at the rear of the IDU. For Front Access 2x/4x, 4x/8x, E3, 16E1, and DS3 systems, the data channel connections are on the IDU front panel. Refer to Figures 7-21 and 7-22 for 2x/4x and Front Access connector locations.

The XP4 Auxiliary Data Channels feature:
- One balanced data channel (EIA RS422) and one unbalanced (EIA RS232)
- Both data channels may be used simultaneously
- Each data channel includes a clock as well as data signal

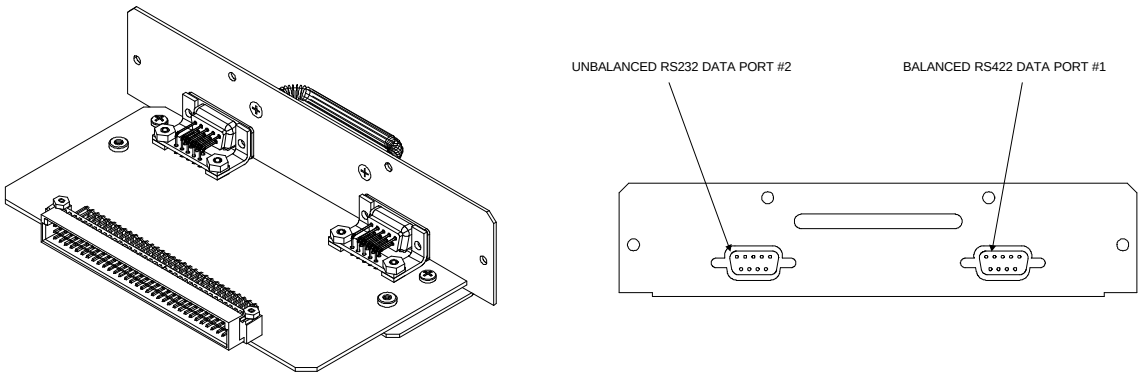


Figure 7-21. IDU Auxiliary Data Channel Option Card for 2x/4x Configuration

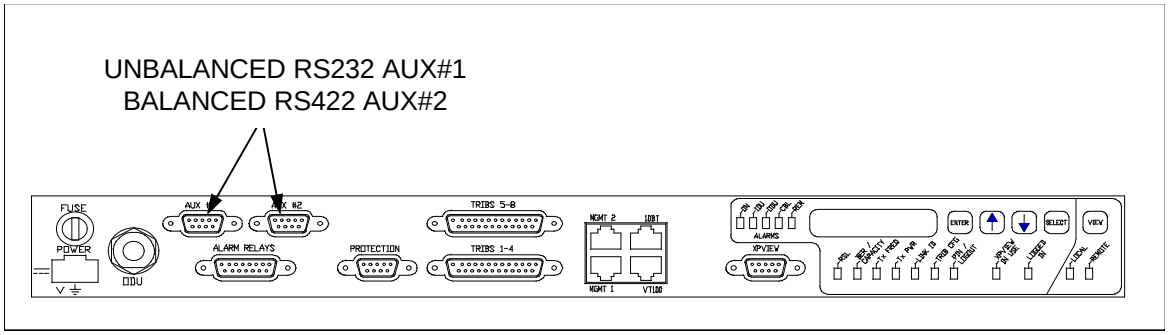


Figure 7-22. IDU Auxiliary Data Channel Connectors on 4x/8x IDU

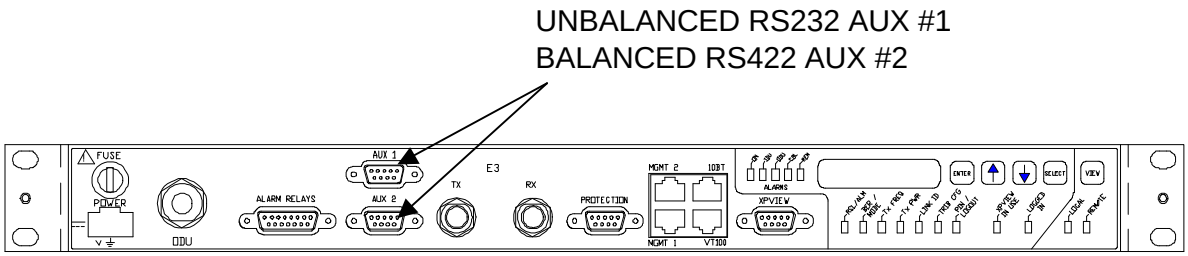


Figure 7-23. IDU Auxiliary Data Channel Connectors on E3 or DS3 IDU

The pinouts of the data channels are detailed below:

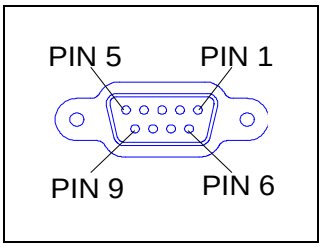


Figure 7-23. Data Ports #1 & #2 DB-9 Pin Numbering

Pin No.	Signal Name	Signal Description
1	TXC	Transmit Clock Signal (O/P)
2	TXD	Transmit Data Signal (O/P)
3	RXD	Receive Data Signal (I/P)
4	RXC	Receive Clock Signal (O/P)
5	GND	Ground
6	N/C	Not Connected
7	N/C	Not Connected
8	N/C	Not Connected
9	N/C	Not Connected

Table 7-15. Unbalanced Data Port DB-9 Pinout

Pin No.	Signal Name	Signal Description
1	RXC+	Receive Clock Signal + (O/P)
2	RXD-	Receive Data Signal - (I/P)
3	TXD+	Transmit Data Signal + (O/P)
4	TXC+	Transmit Clock Signal + (O/P)
5	GND	Ground
6	RXC-	Receive Clock Signal - (O/P)
7	RXD+	Receive Data Signal + (I/P)
8	TXD-	Transmit Data Signal - (O/P)
9	TXC-	Transmit Clock Signal - (O/P)

Table 7-16. Balanced Data Port DB-9 Pinout

7.3.2 Installation

7.3.2.1 Installation Equipment Required

7.3.2.1.1 Tools

A basic electrician's toolkit.

7.3.2.1.2 Equipment

Assuming the installer has two Auxiliary Data Channel Option Cards (one per terminal), the only other items needed are:

- To connect data channels from IDU to other co-located equipment; a suitable length of 5-pair tin-plated PVC insulated twisted pair copper cable (24 gauge), a male DB9 connector & cover.
- Enough cable ties to secure cable run.

7.3.2.2 Option Card Installation Procedure

To install the option card into a 2x/4x system, use the following procedure:

- Power down the IDU.
- Lay in & secure the cable run between rear of XP4 IDU & the terminal equipment to be connected.
- Terminate XP4 end of cable run with male DB9 connector & cover.
- Terminate other end of cable as necessary.
- Install the Auxiliary Data Channel Option Card into each IDU by removing the rectangular plate secured to the rear of each IDU with four small Phillips dome-head screws & insert the option card in its place. Secure card using the four Phillips dome-head screws.
- Power up the IDU.

The XP4 Auxiliary Data Channels are now installed and ready for use

Specifications

E1 Format

General	7GHz	13GHz	15GHz	18GHz	23GHz	26GHz	38GHz
Frequency Range	7.10 to 8.50 GHz	12.75 - 13.25 GHz	14.4 - 15.35 GHz	17.7 - 19.7 GHz	21.2 - 23.6 GHz	24.25 - 26.5 GHz	37.0 - 39.5 GHz
Tuning Range	*	98 MHz	*	300 MHz for 1010 T-R *	300 MHz*	300 MHz	300 MHz
Link ID Codes	255	255	255	255	255	255	255
T-R Spacing (MHz)	Numerous - ITU-T.385-6	266	315,420,490,728	340, 1010	1008, 1200, 1232	1008	1260
* Tuning Range is dependent on T-R spacing & Channel Plan required. Contact your local Innova Representative for further details.							

Transmitter	7GHz	13GHz	15GHz	18GHz	23GHz	26GHz	38GHz
Power Output (Std)	+25 dBm	+19 dBm	+19 dBm	+18 dBm	+17 dBm	+17 dBm	+16 dBm
Power Control Range	Max to –8dBm	Max to –8dBm	Max to –8dBm	Max to –8dBm	Max to –8dBm	Max to –8dBm	Max to –8dBm
Power Output Control	0.5dB steps	0.5dB steps	0.5dB steps	0.5dB steps	0.5dB steps	0.5dB steps	0.5dB steps
Power Output Level Stability	+/-2dB	+/-2dB	+/-2dB	+/-2dB	+/-2dB	+/-2dB	+/-2dB
Transmitter Mute Level	Less than -30 dBm	Less than -30 dBm	Less than -30 dBm	Less than -30 dBm	Less than -30 dBm	Less than -30 dBm	Less than -30 dBm
Frequency Accuracy	±10 ppm	±10 ppm	±10 ppm	±10 ppm	±10 ppm	±10 ppm	±10 ppm
Channel Selection	Digital Synthesizer	Digital Synthesizer	Digital Synthesizer	Digital Synthesizer	Digital Synthesizer	Digital Synthesizer	Digital Synthesizer
Frequency Synthesis	Direct Digital Synthesis	Direct Digital Synthesis	Direct Digital Synthesis	Direct Digital Synthesis	Direct Digital Synthesis	Direct Digital Synthesis	Direct Digital Synthesis
Synthesizer Resolution	0.25 MHz	0.25 MHz	0.25 MHz	0.25 MHz	0.25 MHz	0.25 MHz	0.25 MHz
Modulation	4 FSK	4 FSK	4 FSK	4 FSK	4 FSK	4 FSK	4 FSK
Emission Bandwidth							
2E1	3.5 MHz	3.5 MHz	3.5 MHz	3.5 MHz	3.5 MHz	3.5 MHz	3.5 MHz
4E1	7 MHz	7 MHz	7 MHz	7 MHz	7 MHz	7 MHz	7 MHz
8E1	14 MHz	14 MHz	14 MHz	14 MHz	14 MHz	14 MHz	14 MHz
16E1 / E3	28 MHz	28 MHz	28 MHz	28 MHz	28 MHz	28 MHz	28 MHz

Receiver	7GHz	13GHz	15GHz	18GHz	23GHz	26GHz		38GHz
BER 10^{-6} Threshold						Grade A	Grade B	
2E1	-84 dBm	-83 dBm	-83 dBm	-82 dBm	-80 dBm	-79 dBm	-82 dBm	-77 dBm
4E1	-82 dBm	-81 dBm	-81 dBm	-80 dBm	-77 dBm	-76 dBm	-79 dBm	-75 dBm
8E1	-79 dBm	-78 dBm	-78 dBm	-77 dBm	-74 dBm	-73 dBm	-76 dBm	-72 dBm
16E1 / E3	-76 dBm	-75 dBm	-75 dBm	-74 dBm	-71 dBm	-70 dBm	-73 dBm	-69 dBm
BER 10^{-3} Threshold								
2E1	-87 dBm	-86 dBm	-86 dBm	-85 dBm	-85 dBm	-84 dBm	-87 dBm	-82 dBm
4E1	-85 dBm	-84 dBm	-84 dBm	-83 dBm	-82 dBm	-81 dBm	-84 dBm	-80 dBm
8E1	-82 dBm	-81 dBm	-81 dBm	-80 dBm	-79 dBm	-78 dBm	-81 dBm	-76 dBm
16E1 / E3	-80 dBm	-78 dBm	-78 dBm	-77 dBm	-76 dBm	-75 dBm	-78 dBm	-72 dBm

Residual Bit Error Rate	
2E1, 4E1, 8E1	RBER ≤ 10^{-10} when RSL is between 15 & 40 dB above BER 10^{-3} threshold with FEC enabled
16E1, E3	RBER ≤ 10^{-11} when RSL is between 15 & 40 dB above BER 10^{-3} threshold with FEC enabled

Co & Adjacent Channel Performance	
Performance Degradation Criteria	1 dB degradation in BER 10^{-6} threshold
Co-Channel C/I (all capacities)	23 dB
Adjacent Channel C/I (all capacities)	-3 dB

RSL Monitoring	
Calibrated RSL Range	-40 to -80 dBm
RSL Accuracy Over Calibrated Range	±3 dB max
Voltage at ODU BNC Monitoring Point	+0.1 Vdc per +1 dB (reference: -80 dBm ≡ 1.0 Vdc)

Data Interfaces

Traffic	**Electrical**	**Physical**	**Line Code**
2x/4x Balanced (120Ω)	ITU-R G.703	RJ-45	HDB3
2x/4x, E3 Unbalanced (75Ω)	ITU-R G.703	BNC	HDB3
4x/8x/16x Unbal/Balanced	ITU-R G.703	DB25	HDB3

AGC Monitor	**Electrical**	**Physical**
	0 to 5Vdc	BNC on ODU

Aux Data Channel Option	**Electrical**	**Physical**	**Rate**	
Balanced Data Port #1	EIA RS422*	DB9 Female	72 kbit/s synchronous	*Data and Clock only,
Unbalanced Data Port #2	EIA RS232*	DB9 Female	72 kbit/s synchronous	flow control not supported

Relay Alarm Outputs	**Electrical**	**Physical**
5 Relays	Floating Form ‘C’ Relay	DB15

External Input	**Electrical**	**Physical**
1 input	TTL 0V detector	DB15

XPView Interface	**Electrical**	**Physical**	**Rate**
XPVIEW Port	EIA RS232*	DB9 Female	9600 bit/s

SNMP Network Management Option	**Electrical**	**Physical**
VT100 Config. Port	EIA RS232*	RJ-45
Management SLIP Port 1	EIA RS232/422*	RJ-45
Management SLIP Port 2	EIA RS232/422*	RJ-45
Coaxial Ethernet Port	Ethernet	BNC
Thinwire Ethernet Port	Ethernet	RJ-45

IDU to ODU Cable

Number of Cables	One	
Cable Type	**Primary Power**	**Distance**
RG-223/U Cable	21.6 to 72 Vdc	≤ 50 m (150 ft)
RG-223/U Cable	43 to 72 Vdc	≤ 100 m (300 ft)
Belden 9913 Cable	21.6 to 72 Vdc	≤ 150 m (500 ft)
Belden 9913 Cable	43 to 72 Vdc	≤ 300 m (1000 ft)

Primary Power		
Protection Circuit	3.15 A Slow-Blow Fuse	
Voltage	21.6-72Vdc	Battery Supplies
Polarity	Positive or Negative	
ODU Dissipation	38 W	
IDU (2x/4x, 4x/8x, E3)	12 W	without option boards
1+1 Protection Switch (2x/4x, 4x/8x)	10 W	
1+1 Protection Switch/16x Mux (MSU)	8 W	
SNMP Option Board	3 W	

Weight	
ODU (2x/4x, 4x/8x, E3)	3.4 kg (7.4 lb)
IDU (2x/4x, 4x/8x, E3)	3.4 kg (7.4 lb)
MSU (16xE1)	3.2 kg (7.0 lb)
1+1 Protection Switch (2x/4x, 4x/8x)	2.0 kg (4.5 lb)

Dimensions			
ODU (2x/4x, 4x/8x, E3)	Dia.: 225 mm (8.87”)	Depth: 158mm (6.2”)	(13 GHz ODU Depth: 176mm (6.9”))
IDU (2x/4x, 4x/8x, E3, MSU)	Width: 480 mm (19”)	Depth: 250 mm (9.8”)	Height: 45mm (1.75”)
1+1 Protection Switch	Width: 480 mm (19”)	Depth: 145 mm (5.7”)	Height: 45mm (1.75”)

IDU Configuration Rack Units Reqd.	
1+0 Non Protected (2x/4x, 4x/8x)	1 RU
1+0 Non Protected (16xE1)	2 RU
1+1 Protected (2x/4x, 4x/8x, 16x)	3 RU

Environmental	**ODU**	**IDU**
ODU	-30 to +55°C	-10 to +50°C
EMC	ETS 300 385, EN50082-2	ETS 300 385, EN50082-2
Environmental conditions		
Operation	ETS 300 019 Class 4.1 IEC Class 4M3	ETS 300 019 Class 3.2
Storage	ETS 300 019 Class 1.2	ETS 300 019 Class 1.2
Transport	ETS 300 019 Class 2.3	ETS 300 019 Class 2.3

Reliability

Terminal MTBF	10 years
Y2K Compliant	Yes

Monitor & Control Features
From IDU Speedkeys (Local or Remote XP4)
RSL Monitor

	BER Monitor
	Capacity Monitor & Set
	Transmit Frequency Monitor & Set
	Transmit Power Monitor & Set
	Link ID Monitor & Set
	Tributary Configuration Monitor & Set
	Comprehensive Alarm Monitoring via Relay Outputs & LEDs
From XPVIEW Software (Local or Remote XP4)	
	RSL Monitor
	BER Monitor
	Capacity Monitor & Set
	Transmit Frequency Monitor & Set
	Transmit Power Monitor & Set
	Link ID Monitor & Set
	Tributary Configuration Monitor & Set
	Tributary Use Inhibition
	Set BER Alarm Thresholds
	Set RSL Low Level Alarm
	Comprehensive Alarm Monitoring via Relay Outputs & LEDs
	Loopback Setting: RF, ODU Analogue, ODU Digital, IDU & Tributaries (RF loopback not available for 15,18 GHz)
	Alarm Relay Mapping Changes
	Password Administration
	Code Downloads (both IDU & ODU)
	Frequency Plan Addition, Deletion & Editing
XP4 Terminal Alarms Monitored	
	Transmitter Power Fail
	Transmitter Frequency Unlocked
	Receive Level Low
	Receiver Frequency Unlocked
	Link ID Code Mismatch
	Tributary [1-8] Fault
	BER Early Warning
	BER Alarm
	Cable Fault
	Local Auxiliary Input Alarm
	Remote Auxiliary Input Alarm
	Loopback Active Alarm

DS-1 Format

General	15GHz	18GHz	23GHz	24GHz	38GHz
Frequency Range	14.4 - 15.35 GHz	17.7 - 19.7 GHz	21.2 - 23.6 GHz	24.5 – 25.25 GHz	37.0 - 39.5 GHz
Tuning Range	*	300 MHz for 1010 T-R *	300 MHz	300 MHz	300 MHz
Link ID Codes	255	255	255	255	255
T-R Spacing (MHz)	475	340,1560	1200	800	700

Transmitter	15GHz	18GHz	23GHz	24GHz	38GHz
Power Output (Std)	+19 dBm	+18 dBm	+17 dBm	+17 dBm	+16 dBm
Power Control Range	Max to –8 dBm	Max to –8 dBm	Max to –8 dBm	Max to –8 dBm	Max to –8 dBm
Power Control Accuracy	+/- 3 dB	+/- 3 dB	+/- 3 dB	+/- 3 dB	+/- 3 dB
Transmitter Mute Level	Less than -30 dBm	Less than -30 dBm	Less than -30 dBm	Less than -30 dBm	Less than -30 dBm
Frequency Accuracy	±10 ppm	±10 ppm	±10 ppm	±10 ppm	±10 ppm
Channel Selection	Digital Synthesizer	Digital Synthesizer	Digital Synthesizer	Digital Synthesizer	Digital Synthesizer
Frequency Synthesis	Phase Lock Loop	Phase Lock Loop	Phase Lock Loop	Phase Lock Loop	Phase Lock Loop
Synthesizer Resolution	0.25 MHz	0.25 MHz	0.25 MHz	0.25 MHz	0.25 MHz
Modulation	4 FSK	4 FSK	4 FSK	4 FSK	4 FSK
Emission Bandwidth					
4DS-1	5 MHz	5 MHz	5 MHz	5 MHz	5 MHz
8DS-1	10 MHz	10 MHz	10 MHz	10 MHz	10 MHz
DS3	25 MHz	25 MHz	25 MHz	25 MHz	25 MHz

Receiver	15GHz	18GHz	23GHz	24GHz	38GHz
BER 10^{-6} Threshold					
4DS-1	-81 dBm	-80 dBm	-77 dBm	-77 dBm	-75 dBm
8DS-1	-78 dBm	-77 dBm	-74 dBm	-74 dBm	-72 dBm
DS3	-75 dBm	-74 dBm	-71 dBm	-71 dBm	-69 dBm
BER 10^{-3} Threshold					
4DS-1	-84 dBm	-83 dBm	-82 dBm	-82 dBm	-80 dBm
8DS-1	-81 dBm	-80 dBm	-79 dBm	-79 dBm	-76 dBm
DS3	-78 dBm	-77 dBm	-76 dBm	-76 dBm	-72 dBm

Residual Bit Error Rate	
4DS-1, 8DS-1	RBER $\leq 10^{-10}$ when RSL is 15 to 40 dB above BER 10^{-3} threshold with FEC enabled
DS3	RBER $\leq 10^{-11}$ when RSL is 15 to 40 dB above BER 10^{-3} threshold with FEC enabled

Co & Adjacent Channel Performance

Performance Degradation Criteria	1 dB degradation in BER 10^{-6} threshold
Co-Channel C/I (all capacities)	23 dB
Adjacent Channel C/I (all capacities)	-3 dB

RSL Monitoring

Calibrated RSL Range	-40 to -80 dBm
RSL Accuracy Over Calibrated Range	±2 dB typical, ± 3 dB max
Voltage at ODU BNC Monitoring Point	+0.1 Vdc per +1 dB (reference: -80 dBm ≡ 1.0 Vdc)

Data Interfaces

Traffic	**Electrical**	**Physical**	**Line Code**
2x/4x Balanced (120Ω)	ITU-R G.703	RJ-45	AMI/B8ZS
4x/8x Balanced	ITU-R G.703	BNC	AMI/B8ZS

AGC Monitor	**Electrical**	**Physical**
	0 to 10Vdc	BNC on ODU

Auxiliary Data Channel Option	**Electrical**	**Physical**	**Rate**
Balanced Data Port #1	EIA RS422	DB9 Female	72 kbit/s
Unbalanced Data Port #2	EIA RS232	DB9 Female	72 kbit/s

Relay Alarm Outputs	**Electrical**	**Physical**
5 Relays	Floating Form ‘C’ Relay	DB15

External Input	**Electrical**	**Physical**
1 input	TTL 0V detector	DB15

XPView Interface	**Electrical**	**Physical**	**Rate**
XPVIEW Port	EIA RS232	DB9 Female	9600 bit/s

SNMP Network Management Option	**Electrical**	**Physical**
VT100 Config. Port	EIA RS232	RJ-45
Management SLIP Port 1	EIA RS232/422	RJ-45
Management SLIP Port 2	EIA RS232/422	RJ-45
Coaxial Ethernet Port	Ethernet	BNC
Thinwire Ethernet Port	Ethernet	RJ-45

IDU to ODU Cable

Number of Cables	One

Cable Type	Voltage Range	Distance
RG-223/U Cable	21.6 to 72 Vdc	≤ 50 m (150 ft)
RG-223/U Cable	43 to 72 Vdc	≤ 100 m (300 ft)
Belden 9913 Cable	21.6 to 72 Vdc	≤ 150 m (500 ft)
Belden 9913 Cable	43 to 72 Vdc	≤ 300 m (1000 ft)

Primary Power

Protection Circuit	3.15 A Slow-Blow Fuse	
Voltage	24V, 48V or 60V	Battery Supplies
Polarity	Positive Ground Only	
Voltage Tolerance	+20% to -10%	
ODU Dissipation	34 W	
IDU (2x/4x, 4x/8x, 16x)	11 W	without option boards
IDU (16xDS-1 Mux)	11 W	without option boards
1+1 Protection Switch	10 W	
SNMP NMI Option Board	3 W	

Weight

ODU	2.8 kg (6 lb)
IDU (2x/4x, 4x/8x, 16x)	3.2 kg (7 lb)
IDU (16xDS-1 Mux)	1.8 kg (4 lb)
1+1 Protection Switch	1.4 kg (3 lb)

Dimensions

ODU	Radius: 225 mm (8.87”)	Depth: 122 mm (4.8”)	
IDU (2x/4x, 4x/8x, 16x)	Width: 480 mm (19”)	Depth: 250 mm (9.8”)	Height: 45mm (1.75”)
IDU (16xDS-1 Mux)	Width: 480 mm (19”)	Depth: 250 mm (9.8”)	Height: 45mm (1.75”)
1+1 Protection Switch	Width: 480 mm (19”)	Depth: 250 mm (9.8”)	Height: 45mm (1.75”)

IDU Configuration Rack Units Reqd.

Non Protected (2x/4x, 4x/8x)	1 RU
1+1 Protected (2x/4x, 4x/8x)	3 RU
1+1 Protected (16xDS-1)	3 RU

Operating Environment

ODU	-30 to +55°C
IDU Units	-10 to +50°C

Reliability

Terminal MTBF	10 years

Monitor & Control Features

From IDU Speedkeys (Local or Remote XP4)	
	RSL Monitor
	BER Monitor
	Capacity Monitor & Set
	Transmit Frequency Monitor & Set
	Transmit Power Monitor & Set
	Link ID Monitor & Set
	Tributary Configuration Monitor & Set
	Comprehensive Alarming Monitoring via Relay Outputs & LEDs

From XPVIEW Software (Local or Remote XP4)	
	RSL Monitor
	BER Monitor
	Capacity Monitor & Set
	Transmit Frequency Monitor & Set
	Transmit Power Monitor & Set
	Link ID Monitor & Set
	Tributary Configuration Monitor & Set
	Tributary Use Inhibition
	Set BER Alarm Thresholds
	Set RSL Low Level Alarm
	Comprehensive Alarming Monitoring via Relay Outputs & LEDs
	Loopback Setting: RF, ODU Analogue, ODU Digital, IDU & Tributaries
	Alarm Relay Mapping Changes
	Password Administration
	Code Downloads (both IDU & ODU)
	Frequency Plan Addition, Deletion & Editing
	Terminal Configuration Saving to Disk & Loading From Disk

XP4 Terminal Alarms Monitored	
	Transmitter Power Fail
	Transmitter Frequency Unlocked
	Receive Level Low
	Receiver Frequency Unlocked
	Link ID Code Mismatch
	Tributary [1-8] Fault
	BER Early Warning
	BER Alarm
	Cable Fault
	Local Auxiliary Input Alarm
	Remote Auxiliary Input Alarm
	Loopback Active Alarm

Default Software Configuration-E1
Configuration 530-000002-001 Rev 07

Parameter	Options	Std Default	Customer Default
Link ID Code Number	1 thru 255	l	
Corporate Name	18 characters	Blank	
Site Name	18 Characters	Blank	
Transmitter Muted	Yes or No	Yes	
Transmit Frequency	Frequency or Channel No.	Frequency	
Channel No.	Letter or (‘)	(‘)	
FEC Enabled	Yes or No	Yes	
AIS Insert Mode	OFF, Frame, BER	Frame	
Traffic Capacity	2X, 4X , 8X	4X	
Trib 1 Alarm	Normal or Inverted	Inverted	
Trib 2 Alarm	Normal or Inverted	Inverted	
Trib 3 Alarm	Normal or Inverted	Inverted	
Trib 4 Alarm	Normal or Inverted	Inverted	
Trib 5 Alarm	Normal or Inverted	Inverted	
Trib 6 Alarm	Normal or Inverted	Inverted	
Trib 7 Alarm	Normal or Inverted	Inverted	
Trib 8 Alarm	Normal or Inverted	Inverted	
Trib Activation	Activated or Not Activated	Activated	
Line Encoding	HDB3 (E1)	HDB3	
Front Panel Access PIN	PIN required, No PIN required or Locked	PIN required PIN: 1234	
Alarm Relays	Armed or Disarmed	Armed	

Alarm Relay Configuration

Relay	1	2	3	4	5	Threshold	Options
Default Relay Name	Tribs	Tx	Receive	RSL	Aux.		
Customer Relay Name							
Transmit Power	☐	☒	☐	☐	☐		
Transmit Freq	☐	☒	☐	☐	☐		
Receive Level	☐	☐	☐	☒	☐	-70 dBm	-60 to -80 dBm
Receive Freq	☐	☐	☒	☐	☐		
Link ID Code	☐	☐	☒	☐	☐		
Trib 1 Fault	☒	☐	☐	☐	☐		
Trib 2 Fault	☒	☐	☐	☐	☐		
Trib 3 Fault	☒	☐	☐	☐	☐		
Trib 4 Fault	☒	☐	☐	☐	☐		
Trib 5 Fault		☐	☐	☐	☐		
Trib 6 Fault		☐	☐	☐	☐		
Trib 7 Fault		☐	☐	☐	☐		
Trib 8 Fault		☐	☐	☐	☐		
BER Early Warning	☐	☐	☐	☐	☐	1 x 10- (6)	3,4,5,or 6
BER Alarm	☐	☐	☐	☐	☐	1 x 10- (3)	3,4,5,or 6
Cable Fault	☐	☒	☒	☐	☐		
Local Aux Input	☐	☐	☐	☐	☒		
Remote Aux Input	☐	☐	☐	☐	☒		

Frequency Plans

Band	Capacity	T-R Spacing	Tx Start	Tx Stop	T-T Spacing
13	2x	266	12752.75	13239.25	3.5
13	4x	266	12754.5	13237.5	7.0
15	2x	315	14632.25	15223.75	3.5
15	2x	420	14502.75	15325.25	3.5
15	2x	490	14404.75	15339.25	3.5
15	2x	644	14502.75	15255.25	3.5
15	2x	728	14504.5	15341	3.5
15	4x	315	14634	15222	7.0
15	4x	420	14504.5	15323.5	7.0
15	4x	490	14406.5	15337.5	7.0
15	4x	644	14504.5	15253.5	7.0
15	4x	728	14504.5	15337.5	7.0
18	2x	340	18590	19260	5.0
18	2x	1010	17727.5	19672.5	5.0
18	4x	340	18590	19260	10.0
18	4x	1010	17732.5	19672.5	7.5
23	2x	1008	22004.5	23597.0	3.5
23	2x	1232	21225.75	23574.25	3.5
23	4x	1008	22004.5	23593.5	7.0
23	4x	1232	21227.50	23572.50	7.0
26	2x	1008	24550.75	26,451.25	3.5
26	4x	1008	24552.50	26,449.50	7.0
38	2x	1260	37059.75	39436.25	3.5
38	4x	1260	37061.50	39434.50	7.0

Default Software Configuration E1/8X
Configuration 530-000014-001 Rev 06

Parameter	Options	Std Default	Customer Default
Link ID Code Number	1 thru 255	l	
Corporate Name	18 characters	Blank	
Site Name	18 Characters	Blank	
Transmitter Muted	Yes or No	Yes	
Transmit Frequency	Frequency or Channel No.	Frequency	
Channel No.	Letter or (‘)	(‘)	
FEC Enabled	Yes or No	Yes	
AIS Insert Mode	OFF, Frame, BER	Frame	
Traffic Capacity	2X, 4X , 8X	8X	
Trib 1 Alarm	Normal or Inverted	Inverted	
Trib 2 Alarm	Normal or Inverted	Inverted	
Trib 3 Alarm	Normal or Inverted	Inverted	
Trib 4 Alarm	Normal or Inverted	Inverted	
Trib 5 Alarm	Normal or Inverted	Inverted	
Trib 6 Alarm	Normal or Inverted	Inverted	
Trib 7 Alarm	Normal or Inverted	Inverted	
Trib 8 Alarm	Normal or Inverted	Inverted	
Trib Activation	Activated or Not Activated	Activated	
Line Encoding	HDB3 (E1)	HDB3	
Front Panel Access PIN	PIN required, No PIN required or Locked	PIN required PIN: 1234	
Alarm Relays	Armed or Disarmed	Armed	

Alarm Relay Configuration

Default Relay Name	Tribs	Tx	Receive	RSL	Aux.	Threshold	Options
Customer Relay Name							
Transmit Power	☐	☒	☐	☐	☐		
Transmit Freq	☐	☒	☐	☐	☐		
Receive Level	☐	☐	☐	☒	☐		
Receive Freq	☐	☐	☒	☐	☐	-70 dBm	-60 to -80 dBm
Link ID Code	☐	☐	☒	☐	☐		
Trib 1 Fault	☒	☐	☐	☐	☐		
Trib 2 Fault	☒	☐	☐	☐	☐		
Trib 3 Fault	☒	☐	☐	☐	☐		
Trib 4 Fault	☒	☐	☐	☐	☐		
Trib 5 Fault	☒	☐	☐	☐	☐		
Trib 6 Fault	☒	☐	☐	☐	☐		
Trib 7 Fault	☒	☐	☐	☐	☐		
Trib 8 Fault	☒	☐	☐	☐	☐		
BER Early Warning	☐	☐	☐	☐	☐		
BER Alarm	☐	☐	☐	☐	☐	1 x 10- (6)	3,4,5,or 6
Cable Fault	☐	☒	☒	☐	☐	1 x 10- (3)	3,4,5,or 6
Local Aux Input	☐	☐	☐	☐	☒		
Remote Aux Input	☐	☐	☐	☐	☒		

Frequency Plans

Band	Capacity	T-R Spacing	Tx Start	Tx Stop	T-T Spacing
13	4X	266	12754.5	13237.5	7.0
13	8X	266	12758.0	13234.0	14.0
15	4X	420	14504.5	15323.5	7.0
15	8X	420	14515.0	15341.0	14.0
15	4X	490	14406.5	15337.5	7.0
15	8X	490	14417.0	15341.0	14.0
18	4X	340	18580	19260	10.0
18	4X	1010	17732.5	19672.5	7.50
18	4X	1560	17713.75	19686.25	13.75
18	8X	340	18575	19265	10.0
18	8X	1010	17727.5	19672.5	13.75
18	8X	1560	17713.75	19686.25	13.75
23	4X	1008	22004.5	23593.5	7.0
23	8X	1008	22008.0	23590.0	14.0
23	4X	1200	21225	23575	50
23	8X	1200	21225	23575	50
23	4X	1232	21227.50	23572.50	7.0
23	8X	1232	21231.0	23569.0	14.0
26	4X	1008	24552.50	26,449.50	7.0
26	8X	1008	24556.0	26446.0	14.0
38	4X	1260	37061.50	39434.50	7.0
38	8X	1260	37065.0	39431.0	14.0

Default Software Configuration E3/16x
Configuration 530-000026-001 Rev 01

Parameter	Options	Std Default	Customer Default
Link ID Code Number	1 thru 255	1	
Corporate Name	18 characters	Blank	
Site Name	18 Characters	Blank	
Transmitter Muted	Yes or No	Yes	
Transmit Frequency	Frequency or Channel No.	Frequency	
Channel No.	Letter or Prime (‘)	Prime (‘)	
FEC Enabled	Yes or No	Yes	
AIS Insert Mode	OFF, Frame, BER	Frame	
Trib Alarm	Normal or Inverted	Inverted	
Trib Activation	Activated or Not Activated	Activated	
Line Encoding	HDB3		
Front Panel Access PIN	PIN required, No PIN required or Locked	PIN required PIN: 1234	
Alarm Relays	Armed or Disarmed	Armed	
Alarm Relay Configuration*	Standard or Custom	Standard	
XPView Port Configuration*	Null or Thru	Null	

***Hardware Jumper Settings

Alarm Relay Configuration

Relay	1	2	3	4	5	Threshold	Options
Default Relay Name	Tribs	Transmit	Receive	RSL	Aux.		
Customer Relay Name							
Transmit Power	☐	☒	☐	☐	☐		
Transmit Freq	☐	☒	☐	☐	☐		
Receive Level	☐	☐	☐	☒	☐	-70 dBm	-60 to -80 dBm
Receive Freq	☐	☐	☒	☐	☐		
Link ID Code	☐	☐	☒	☐	☐		
Trib Fault	☒	☐	☐	☐	☐		
Downlink	☐	☒	☐	☐	☐		
Frame Loss	☐	☐	☒	☐	☐		
E3 LOS A	☒	☐	☐	☐	☐		
E3 LOS B	☒	☐	☐	☐	☐		
E3 FRAME AL	☒	☐	☐	☐	☐		
AIS TO CUST	☒	☐	☐	☐	☐		
BER Early Warning	☐	☐	☒	☐	☐	1 x 10- (6)	3,4,5,or 6
BER Alarm	☐	☐	☒	☐	☐	1 x 10- (3)	3,4,5,or 6
Cable Fault	☐	☒	☐	☐	☐		
Local Aux Input	☐	☐	☐	☐	☒		
Remote Aux Input	☐	☐	☐	☐	☒		

Frequency Plans

Band	Capacity	T-R Spacing	Tx Start	Tx Stop	T-T Spacing
13	16x	266	12765.0	13227.0	28.0
15	16x	315	14662.0	15201.0	28.0
15	16x	420	14515.0	15327.0	28.0
15	16x	490	14417.0	15327.0	28.0
15	16x	644	14515.0	15327.0	28.0
15	16x	728	14515.0	15327.0	28.0
15*	16x	728	14529.0	15341.0	28.0
18	16x	1010	17727.5	19672.5	27.5
18	16x	1560	17727.5	19672.5	27.5
23	16x	1008	22022.0	23562.0	28.0
23	16x	1200	21225.0	23575.0	50.0
23	16x	1232	21238.0	23562.0	28.0
26	16x	1008	24563.0	26439.0	28.0
38	16x	1260	37072.0	39424.0	28.0
*Alternate 15 GHz T-R 728 Plan					

Default Software Configuration DS-1/8X
Configuration #530-000015-001 Rev 05

Parameter	Options	Std Default	Customer Default
Link ID Code Number	1 thru 255	l	
Corporate Name	18 characters	Blank	
Site Name	18 Characters	Blank	
Transmitter Muted	Yes or No	Yes	
Transmit Frequency	Frequency or Channel No.	Frequency	
Channel No.	Letter or (‘)	(‘)	
FEC Enabled	Yes or No	Yes	
AIS Insert Mode	OFF, Frame, BER	Frame	
Traffic Capacity	2X, 4X , 8X	8X	
Trib 1 Alarm	Normal or Inverted	Inverted	
Trib 2 Alarm	Normal or Inverted	Inverted	
Trib 3 Alarm	Normal or Inverted	Inverted	
Trib 4 Alarm	Normal or Inverted	Inverted	
Trib 5 Alarm	Normal or Inverted	Inverted	
Trib 6 Alarm	Normal or Inverted	Inverted	
Trib 7 Alarm	Normal or Inverted	Inverted	
Trib 8 Alarm	Normal or Inverted	Inverted	
Trib Activation	Activated or Not Activated	Activated	
Line Encoding	B8ZS or AMI	B8ZS	
Front Panel Access PIN	PIN required, No PIN required or Locked	PIN required PIN: 1234	
Alarm Relays	Armed or Disarmed	Armed	

Alarm Relay Configuration

Relay	1	2	3	4	5	Threshold	Options
Default Relay Name	Tribs	Tx	Receive	RSL	Aux.		
Customer Relay Name							
Transmit Power	☐	☒	☐	☐	☐		
Transmit Freq	☐	☒	☐	☐	☐		
Receive Level	☐	☐	☐	☒	☐	-70 dBm	-60 to -80 dBm
Receive Freq	☐	☐	☒	☐	☐		
Link ID Code	☐	☐	☒	☐	☐		
Trib 1 Fault	☒	☐	☐	☐	☐		
Trib 2 Fault	☒	☐	☐	☐	☐		
Trib 3 Fault	☒	☐	☐	☐	☐		
Trib 4 Fault	☒	☐	☐	☐	☐		
Trib 5 Fault	☒	☐	☐	☐	☐		
Trib 6 Fault	☒	☐	☐	☐	☐		
Trib 7 Fault	☒	☐	☐	☐	☐		
Trib 8 Fault	☒	☐	☐	☐	☐		
BER Early Warning	☐	☐	☐	☐	☐	1 x 10- (6)	3,4,5,or 6
BER Alarm	☐	☐	☐	☐	☐	1 x 10- (3)	3,4,5,or 6
Cable Fault	☐	☒	☒	☐	☐		
Local Aux Input	☐	☐	☐	☐	☒		
Remote Aux Input	☐	☐	☐	☐	☒		

Frequency Plans

Band	Capacity	T-R Spacing	Tx Start	Tx Stop	T-T Spacing
18	4X	340	18585	19255	5.0
18	8X	340	18585	19255	10.00
18	4X	1560	17705.0	19695.0	10.00
18	8X	1560	17705.0	19695.0	10.00
23	4X	1200	21202.50	23597.50	5.00
23	8X	1200	21205.00	23595.00	10.00
24	4X	800	24252.50	25247.50	5.00
24	8X	800	24255.00	25245.00	10.00
28	4X	410	27697.5	28342.5	5.00
28	8X	410	27700.0	28340.0	10.00
28	4X	1975	29102.5	31222.5	5.00
28	8X	1975	29105	31220	10.00
28	4X	225	31002.5	31297.5	5.00
28	8X	225	31005	31295	10.00
38	4X	700	38602.50	39997.50	5.00
38	8X	700	38605.00	39995.00	10.00