

IPmux-1, IPmux-1 E

TDMoIP Gateways

Installation and Operation Manual

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Telecommunication Safety

The safety status of each of the ports on IPmux-1/1E is declared according to EN 41003 and is detailed in the table below:

| Safety Status | Ports |
|---------------|---------------------------------|
| SELV | LAN, Unbalanced E1, E&M, ISDN-S |
| TNV-1 | Balanced E1, T1 |
| TNV-2 | FXS |
| TNV-3 | FXO |

SELV = Safety Extra-Low Voltage

TNV-1 = Telecommunications Network Voltage within the limits of SELV and subject to overvoltages

TNV-2 = Telecommunications Network Voltage not subject to overvoltages

TNV-3 = Telecommunications Network Voltage subject to overvoltages

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Manufacturer's Name: RAD Data Communications Ltd.

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conforms to the following standard(s) or other normative document(s):

EMC: EN 55022 (1998) Information technology equipment – Radio disturbance characteristics – Limits and methods of measurement.
EN 50024 (1998) Information technology equipment –Immunity characteristics – Limits and methods of measurement.

Safety: EN 60950/A4 (1996) Safety of information technology equipment, including electrical business equipment.

Supplementary Information:

The product herewith complies with the requirements of the EMC Directive 89/336/EEC and the Low Voltage Directive 73/23/EEC. The product was tested in a typical configuration.

Tel Aviv, March 18th, 2001



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Chapter 1

Introduction

1.1 Overview

IPmux-1/1E offers a solution for extending traditional E1/T1, ISDN, or POTS TDM services transparently over the widely deployed IP networks. The device converts the data stream coming from its user ports into configurable sized IP packets that are extended over the Fast Ethernet port and vice versa. IPmux-1/1E offers end-to-end synchronization for voice applications. IPmux-1/1E also offers large buffers to compensate for the delay variation inserted by the network. The device can be used to extend E1/T1 or ISDN/POTS circuits over IP networks for Metropolitan Area Network applications. IPmux-1/1E also features a Fast Ethernet user port for data (Ethernet) connectivity to the IP/Ethernet network. Management is performed locally by a terminal, or remotely via Telnet or SNMP.

IPmux-1 has a single E1/T1 port.

IPmux-1E offers one of the following options:

- 4 BRI – a card with 4 ISDN standard S-interfaces
- 4 FXS – a card with 4 FXS ports
- Optional user Ethernet port.

The IPmux family implements TDMoIP technology to carry TDM transport over IP. IPmux-1E BRI channels are transported as TDM timeslots, while the Analog FXS channels are digitized and carried as fractional E1/T1 with CAS.

Versions

- **IPmux-1 with E1 interface**
 - Balanced line with an RJ-45 connector
 - Unbalanced line with a mini-coaxial connector (TBNC)
- **IPmux-1 with T1 interface** – Balanced with an RJ-45 connector
- **IPmux-1E with ISDN BRI interface** – 4 ISDN 'S' RJ-45 connectors
- **IPmux-1E with FXS interface** – 4 Analog 'FXS' RJ-11 connectors

An external clock port is optional for IPmux-1.

A user Ethernet interface is optional for IPmux-1/1E (Ordering options).

Applications

Typical IPmux-1/1E applications are shown with E1/T1, ISDN, and FXS interfaces.

Figure 1-1 illustrates Multiplexing Voice and Data over an Ethernet Trunk.

Figure 1-2 shows an E1/T1 circuit extension over an IP based Network.

Figure 1-3 illustrates mixed BRI and POTS support application of V5.1 concentration of BRI remote terminals.

Figure 1-4 shows mixed BRI and POTS support application of S/U interface concentration.

Figure 1-5 illustrates extending BRI ports and LAN of a Small Office.

Figure 1-6 shows Ethernet-based multi-tenant with voice and data integrated access.

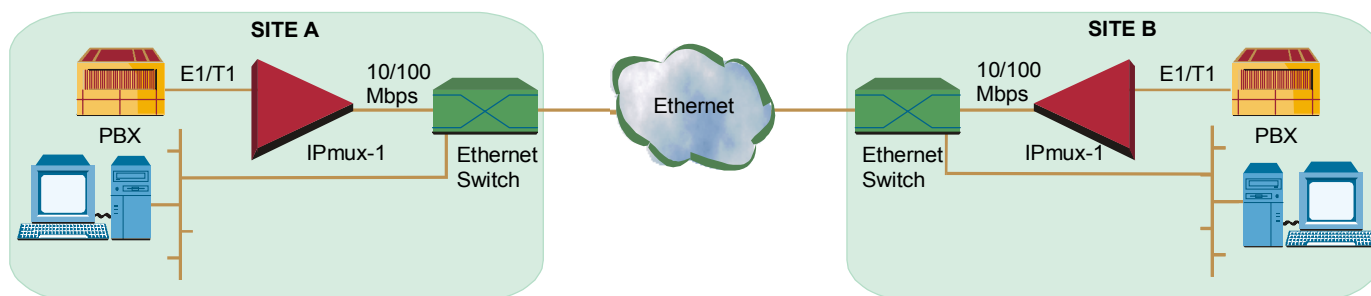


Figure 1-1. Multiplexing Voice and Data over an Ethernet Trunk

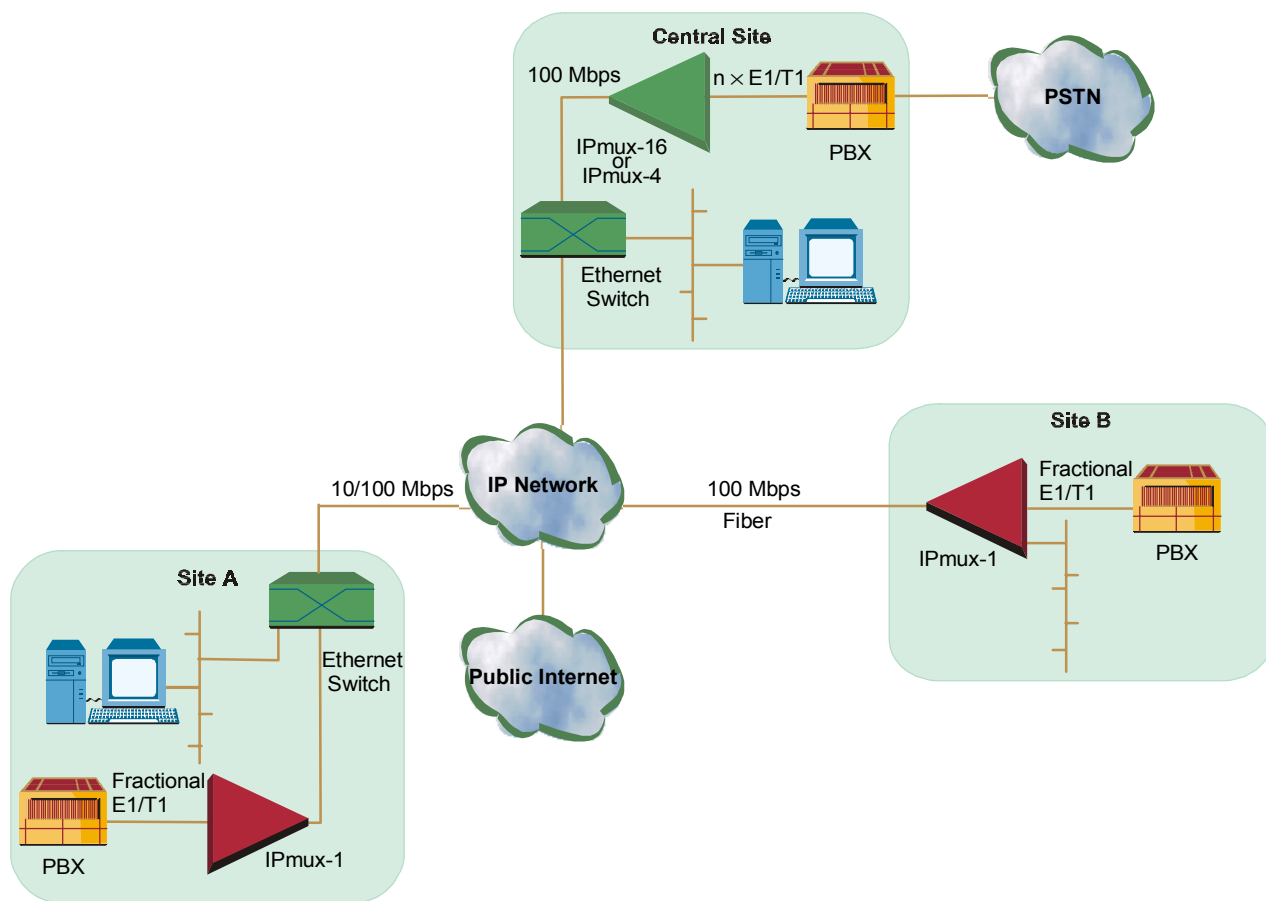


Figure 1-2. E1/T1 Circuit Extension over an IP Based Network

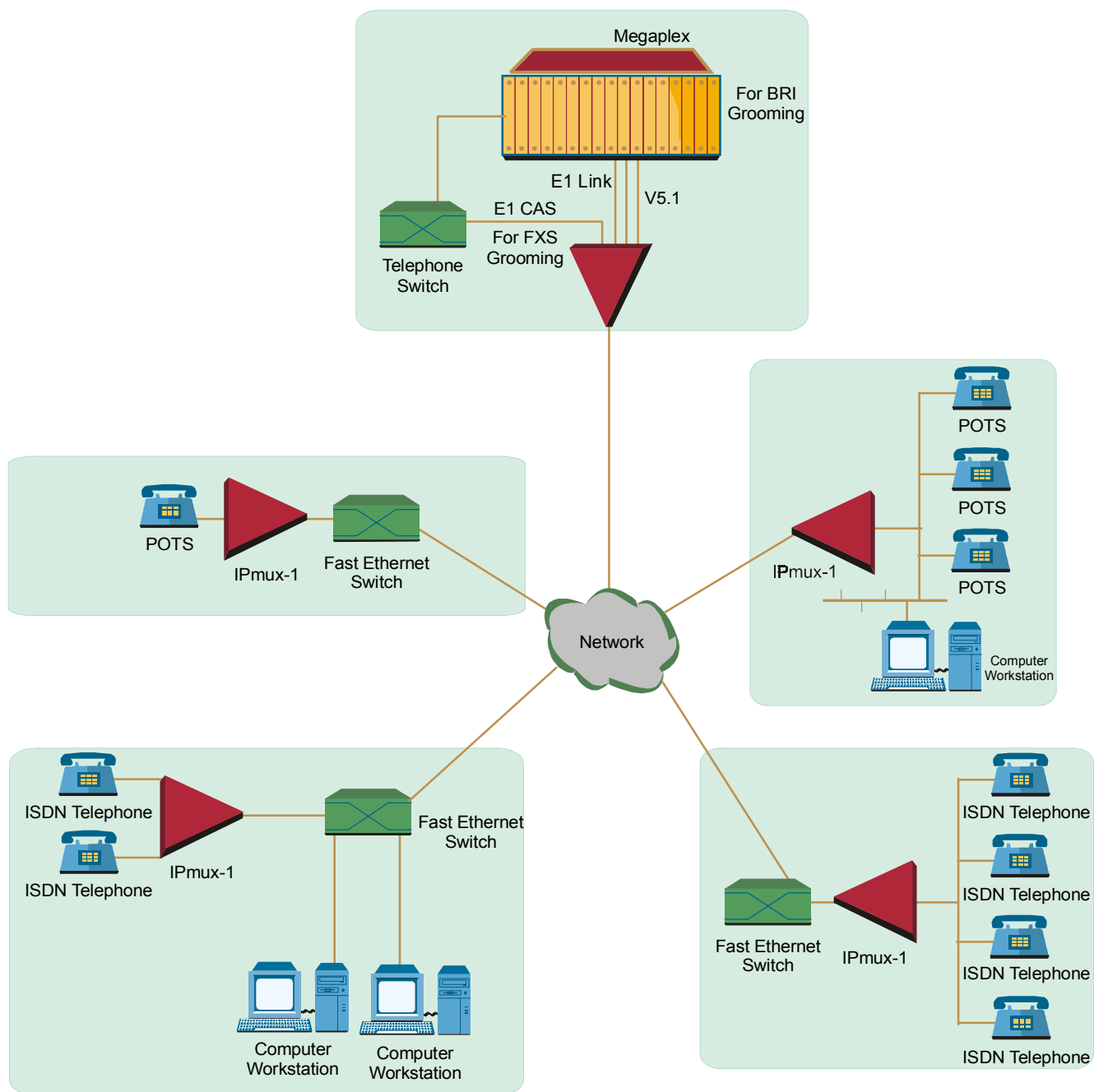


Figure 1-3. Mixed BRI and POTS Support Application (V5.1 Concentration of BRI Remote Terminals)

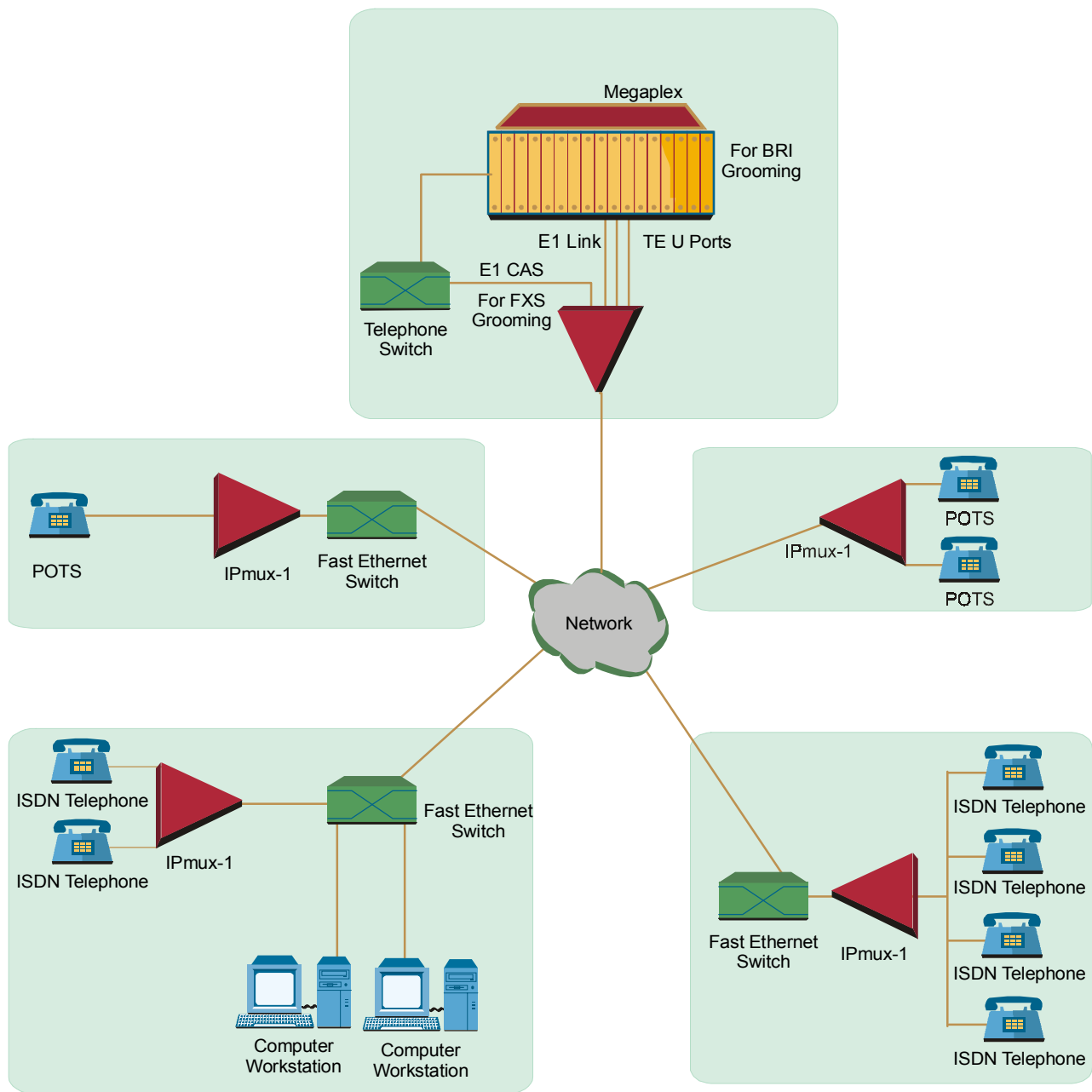


Figure 1-4. U Interface Concentration

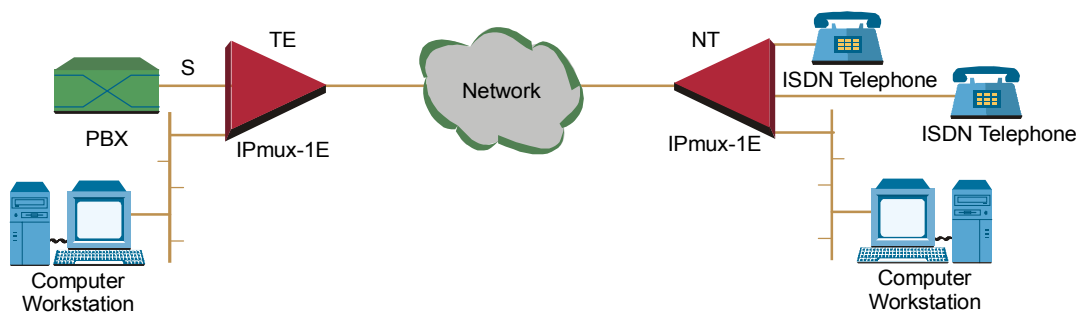


Figure 1-5. Extending BRI Ports of a Small Office

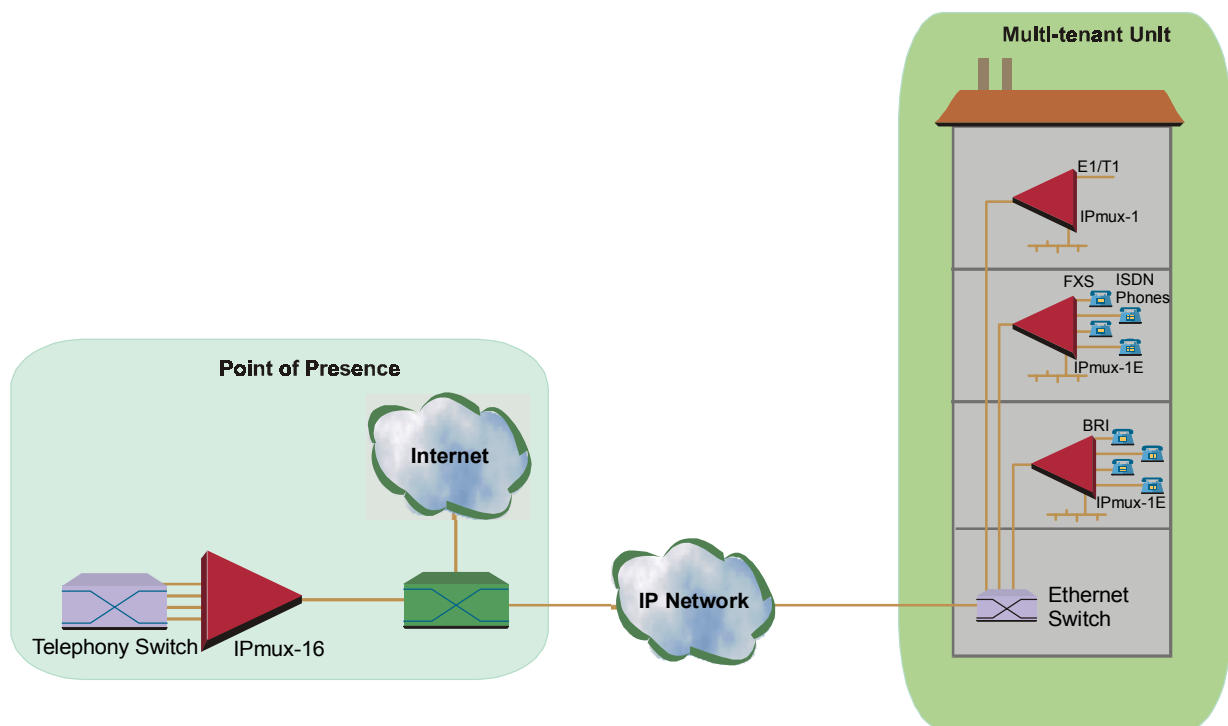


Figure 1-6. Ethernet-based Multi-tenant Application with Voice and Data Integrated Access

Features

IPmux-1/1E is a 1U high, easy-to-install standalone unit. A rack mount installation option is available.

IPmux-1 can be ordered with AC or DC power supply. IPmux-1E is only available with AC power supply.

Management

IPmux-1/1E can be managed locally by connecting an ASCII terminal to the RS-232 port on the front panel or remotely via Telnet or SNMP. The SNMP management capability enables fully graphical, user-friendly management using the RADview network management stations offered by RAD, as well as management by other SNMP-based management systems.

T1

The T1 port and framers comply with ANSI T1.403 standards. T1 jitter performance is according to G.704, G.824, TR-62411. The T1 framers support pass-through, SF, ESF and CAS framing. The T1 port supports long haul and short haul input signals and can be monitored for alarms and error statistics. FDL and transmit PRM for T1/ESF are also supported.

E1

The E1 port complies with G.703, G.704, and G.823 standards. E1 framers comply with G.704. The E1 framers support pass-through, framed, CRC4 MF and CAS MF framing. The E1 port supports long haul and short haul input signals and can be monitored for alarms and error statistics.

ISDN BRI

IPmux-1E has 4-ports, S-interface only. Each port can be configured as either NT or TE (Network/User) by jumper and software; NT or TE is configured per device.

IPmux-1E can be configured to 1, 2, 3 or 4 active ports.

IPmux-1E works in transparent mode (no termination/compression of D channels). It operates opposite IPmux with E1/T1 and a Megaplex unit as a concentrator in transparent mode or opposite another IPmux-1E with ISDN BRI ports.

FXS

IPmux-1E has 4 FXS interface ports for POTS connection. A central IPmux unit with an E1/T1 CAS interface can groom FXS channels from the remote site.

IP

The data stream coming from the E1 or T1 port is converted into IP packets that are transported over the Fast Ethernet port, and vice versa.

TDM bytes are encapsulated in a UDP frame that runs over IP and over Ethernet.

The number of TDM bytes in an IP frame is configurable for throughput/delay tradeoff.

Each device has a single IP address (Host IP). A configurable destination IP address is assigned to the IP packets. IP ToS field support can be configured for IP Level Priority.

Ethernet User Port

IPmux-1E has an optional user port for user LAN connectivity/access as well as TDM services connectivity. A transparent bridging mode is supported (user/network Ethernet port) and a second mode which enables user port rate limiting.

Ethernet Physical Port

IPmux-1/1E is available with Ethernet ports (user or network port). The Ethernet network port can be either UTP or fiber. The Ethernet user port is UTP only.

- **UTP option** – A standard 10/100BaseT half/full duplex port with auto-negotiation support. If auto-negotiation is disabled, IPmux-1 capabilities can be configured to 100BaseT – full duplex, 100BaseT – half duplex, 10BaseT – full duplex, or 10BaseT – half-duplex. Half-duplex operation in IPmux-1 network port is not recommended, because collisions and backoffs cause large delay variation and may exceed the delay variation buffer tolerance at the receiving end, causing buffer underflows and errors to occur.
- **Fiber option** – standard 100BaseF full duplex port (see *Table 1-1*).

Table 1-1. Fiber Options

| Interface Type | Wavelength (nm) | Optical Power (dBm) | | Receive Sensitivity (dBm) | Optical Budget (dB)* | Loss (dB/km) | |
|----------------|-----------------|---------------------|-----|---------------------------|----------------------|--------------|-----|
| | | Min | Max | | | Min | Max |
| SC Multimode | 1300 | -20 | -14 | -31 | 8* | 1 | 4 |
| SC Single mode | 1300 | -20 | -14 | -31 | 8* | 0.5 | 0.8 |
| LC Multimode | 1300 | -19 | -14 | -32 | 10* | 1 | 4 |
| LC Single mode | 1300 | -15 | -8 | -32 | 14* | 0.5 | 0.8 |

- Permitted fiber optic cable length differs according to fiber characteristics, splices, and connectors.

Note When a user port option (only UTP) is chosen, the network fiber option is LC. If there is no user port, the network fiber option is SC.

➤ **To calculate Optical Budget:**

Optical Budget [dB] =
| Receive Sensitivity | - | Optical Power | - 3 (Aging) - Connectors/Patch Panels Loss

➤ **To calculate Distance:**

Distance = Optical Budget/Maximum Loss

Mode of Operation

IPmux-1 can operate in three different modes:

- Unframed E1/T1 over UDP over IP over Ethernet
- Fractional E1/T1 over UDP over IP over Ethernet
- Fractional E1/T1 with CAS over UDP over IP over Ethernet.

IPmux-1E with BRI can operate in two modes:

- NT mode
- TE mode.

IPmux-1E with FXS can operate in three modes:

- E1 mode
- T1 mode D4 mode
- T1 ESF mode.

Note *IPmux E1/T1 working opposite IPmux-1E with BRI ports should work in Fractional E1/T1 mode (no CAS). When working opposite IPmux-1E with FXS, use E1/T1 CAS mode.*

QoS

QoS support:

- Labeling IP level priority (ToS) for TDMoIP packets
- VLAN tagging and priority labeling according to IEEE 802.1p&q for TDMoIP packets.

The user can configure the ToS (Type of Service) of the outgoing TDMoIP packets. This allows an en-route Layer 3 router or switch, which supports ToS, to give higher priority to IPmux-1/1E TDMoIP traffic for delay-sensitive and secure applications. IPmux-1 allows you to configure the **WHOLE** ToS byte field, since different vendors may use different bits to tag packets for traffic prioritization. This also enables you to work according to various RFC definitions (for example RFC 2474, RFC 791). The user can also configure VLAN priority bits for Level 2 Priority.

Timing

IPmux-1 maintains synchronization between TDM devices by deploying advanced clock distribution mechanisms.

Available timing modes are:

- Loopback
- Adaptive
- Internal Clock
- External Clock.

Note *For more details see Timing Modes in Section 1.3.*

Standards

G.703, G.704, G.706, G.823, ANSI T1.403, AT&T TR-62411, G.824, IEEE 802.3, I.430, IEEE 802.3D, IEEE 802.1p&q, EMC Class B compliance – EN55022 Class B

1.2 Physical Description

IPmux-1 is a 1U high 19-in (IPmux-1E is a 1U high ½ 19-in), easy-to-install standalone unit. A rack mounting kit option is available (ordered separately).

Figure 1-7 shows a 3-dimensional view of IPmux-1; Figure 1-8 shows a 3-dimensional view of IPmux-1E.

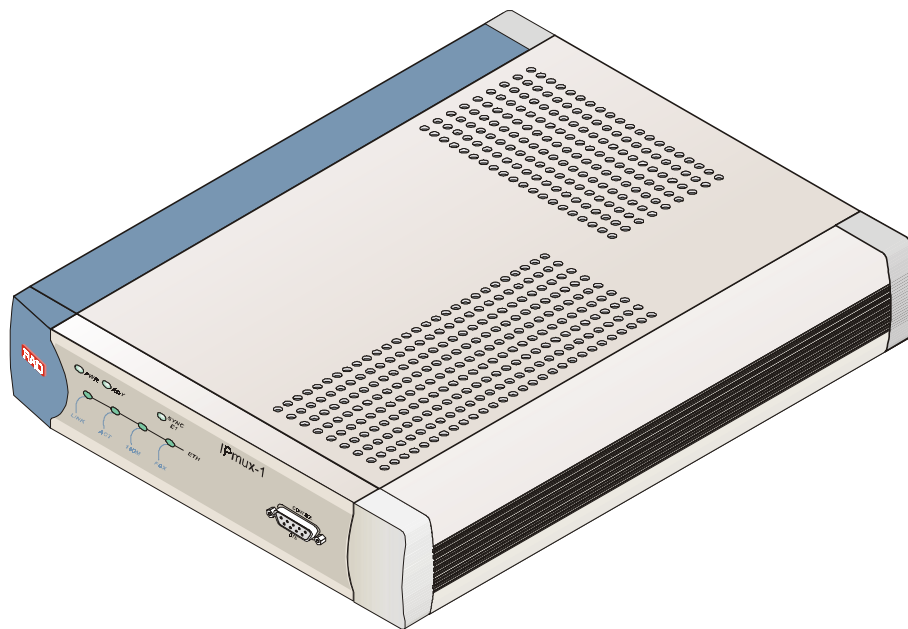


Figure 1-7. IPmux-1 3-D View



Figure 1-8. IPmux-1E 3-D View

Front Panel

The control interface and indicator LEDs are located on the front panel of IPmux-1/1E. For further details see *Chapter 2*.

Rear Panel

User and network ports and power supply are located on the rear panel of IPmux-1/1E. For further details see *Chapter 2*.

1.3 Functional Description

IPmux-1 supports a single E1 or T1 TDM interface; it provides TDM connectivity across the IP network. A single bundle (group of timeslots) can be transmitted to a predefined far-end bundle. IPmux-1 supports ICMP (ping), and generates ARP in case of unknown next hop MAC addresses, answers ARP requests, and supports 802.3 Ethernet format.

IPmux-1E supports 4 BRI or 4 FXS ports for transparent connectivity over the IP network.

Both IPmux-1 and IPmux-1E support Ethernet user port for user LAN connectivity.

Configuration and management are provided via the IPmux-1/1E local terminal, Telnet or RADview management tool (SNMP).

Figure 1-9 shows a typical application for IPmux-1.

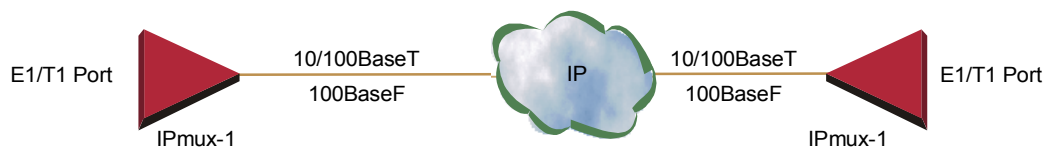


Figure 1-9. IPmux-1 Functional Diagram

IPmux-1/1E works in conjunction with the rest of the IPmux product line (see *Figure 1-10*). The combination of IPmux products provides up to 31 per E1 or 24 per T1 remote bundles, attached to one central IPmux-4/16 (see *Figure 1-10*).

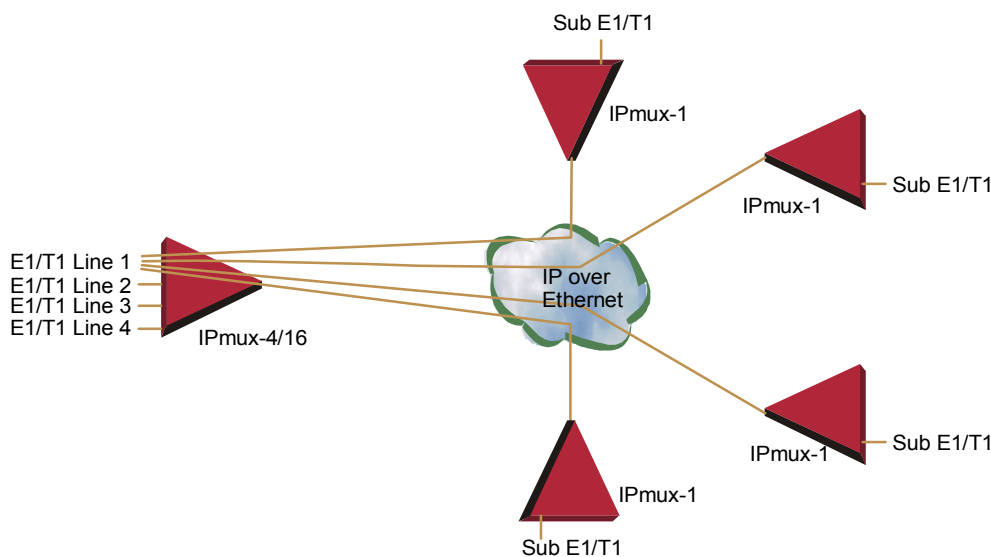


Figure 1-10. Grooming of Timeslots from Remote Sites into a Single E1/T1 Port at Central Site

Other BRI/FXS applications are shown in Figure 1-3, Figure 1-4, and Figure 1-5.

Operation Modes

IPmux-1 E1/T1

IPmux-1 E1/T1 operation modes are:

- Unframed
- Fractional
- Fractional with CAS.

Unframed

In the transparent mode, the incoming bit stream from each channel (regardless of framing) is converted into IP over Ethernet frames. This option provides clear channel end-to-end service (unframed).

Fractional

In the fractional mode, the incoming bit stream is regarded as a sequence of $n \times 64$ kbps channel groups (according to framing). Each predefined group of channels is converted into a structure block. The structure block is packetized into IP frames and transmitted.

This mode allows transmission of several selected timeslots without the whole E1 or T1 frame, as in transparent mode.

Note Use Fractional mode when grooming ISDN BRI channels from a remote IPmux-1E unit.

Fractional with CAS

In the fractional-with-CAS mode, the structure block (as described under Fractional Operation Modes, above) also includes Channel Associated Signaling (CAS). The relevant portion of the signaling channel is packetized and sent to the destination.

Note Use Fractional with CAS mode when grooming FXS channels from a remote IPmux-1E unit.

IPmux-1E ISDN BRI

The IPmux-1E ISDN BRI S interface operation modes are:

- TE mode
- NT mode.

The selected mode applies to all 4 channels. The NT or TE mode is determined by phantom feeding and software setting, which is enabled/disabled by jumpers located on the BRI card (see *Chapter 2*).

TE Mode

All four channels are configured in TE (Terminal Equipment) as defined in I.430.

NT Mode

All four channels are configured in NT (Network Termination) as defined in I.430. TE Deactivation is not used in NT mode, and Layer 1 is in active mode all the time.

Note If phantom feeding is enabled by the jumpers, the TE mode cannot be selected as the IPmux-1E operation mode. If phantom feeding is disabled, both NT and TE are valid options.

IPmux-1E FXS

IPmux-1E FXS operates in:

- E1 mode
- T1-D4 mode
- T1 ESF mode.

The IPmux-1E FXS operation modes allow IPmux to work opposite E1, T1-D4, or T1-ESF. Two parameters are set internally when choosing one of the options:

- A-Law/ μ -Law
 - A-Law when E1 mode is selected
 - μ -Law is used in PCM CODEC when T1 (D4 or ESF) is selected.
- E1, T1-D4, and T1-ESF with CAS are structured differently in the TDM \leftrightarrow IP interworking function. A different structure must be used when working opposite each one.

BRI/FXS TS Assignment in a Bundle

BRI

The TS assignment in a Bundle for IPmux-1E with BRI (when working opposite IPmux with E1/T1 or Megaplex) is assigned as follows:

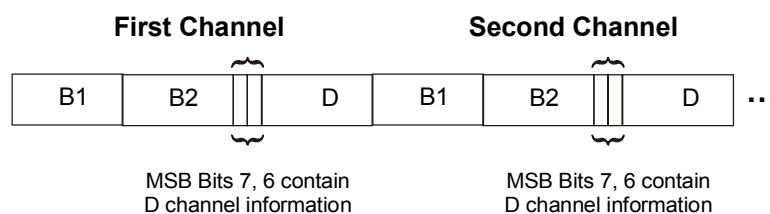


Figure 1-11. TS Assignment in a Bundle for IPmux-1E/BRI

As shown in *Figure 1-11*, the 4 BRI channels consume 12 timeslots in the Bundle. The E1/T1 IPmux should work in framed mode (no CAS).

The three TS groups in the bundle are assigned according to BRI channel numbers; the first group is assigned to the lowest BRI channel that is enabled, etc.

FXS

The TS assignment in a Bundle for IPmux-1E with FXS is straightforward. Each timeslot in a Bundle is assigned to a specific FXS channel. Time slots in the bundle are assigned according to FXS channel numbers; the first timeslot is assigned to the lowest FXS channel that is configured, etc. As shown in *Figure 1-11*, the 4 FXS channels consume 4 timeslots in the Bundle.

The E1/T1 IPmux that works opposite the FXS channels should work in Framed with CAS mode.

Testing

Diagnostic capabilities include E1/T1 or BRI S local and remote loopback tests for rapid localization of faults. The E1/T1 or BRI S channel can be looped locally, toward the line, or toward the remote end (see *Chapter 4* for more information).

Remote Loopback and Tone Injection are available for the FXS port.

Timing Modes

The E1/T1 Tx clock, or ISDN/FXS PCM clock, can operate in several timing modes to provide maximum flexibility for connecting the IPmux-1 E1, T1, ISDN or FXS channels.

Each of the clocks must be configured correctly on both the Receive and Transmit ends to ensure proper operation and prevent pattern slips (see *Figure 1-12*, *Figure 1-14*, and *Figure 1-15*).

E1/T1

The E1/T1 available Tx modes are:

- Loopback Timing – the E1/T1 Tx clock is derived from the E1/T1 receive (Rx) clock.
- Adaptive Timing – in this mode, the E1 or T1 Tx clock is regenerated using the Adaptive method. In this method, the fill level of the buffer receiving packets is monitored. If the buffer begins to overflow, the regenerated Tx clock frequency increases to avoid overflow. If the buffer begins to empty, the Tx clock (toward the TDM device) decreases to avoid underflow.
- Internal Clock Timing – in this mode, the Tx clock is received from an internal oscillator.
- External Clock Timing – in this mode the Tx clock is taken from the external clock input (Ordering option). The External Clock port also outputs the input clock signal to allow connection to other units, if needed.

Note *In Adaptive Timing mode the regenerated clock is subject to network Packet Delay Variation and may not comply with jitter and wander specifications.*

FXS/BRI

The available timing modes for the PCM clock are:

- Loopback Timing – available only when IPmux-1E BRI is configured as TE (not available in BRI NT mode or for FXS interface). In this mode the PCM clock is derived from Channel 1.



Warning

It is recommended not to deactivate Channel 1 while it is in loopback clock so that data will not be damaged. If Channel 1 is disconnected or deactivated (by the NT side), the PCM clock will change to Internal clock and a momentary disruption will occur to the other channels (2,3,4), if they are active.

- Adaptive Mode – the clock is regenerated using the Adaptive method, where the rate of arriving packets is used to regenerate the clock (see E1/T1).
- Internal Mode – the clock is received from an internal oscillator.

Network Timing Schemes

The following paragraphs describe typical timing schemes and the correct timing mode settings for achieving end-to-end synchronization.

External Network Timing

When the edges of the network are synchronized according to an external network clock source, all the IPmux-1 units should be configured to work in loopback timing mode (see *Figure 1-12*). This topology enables any-to-any connectivity.

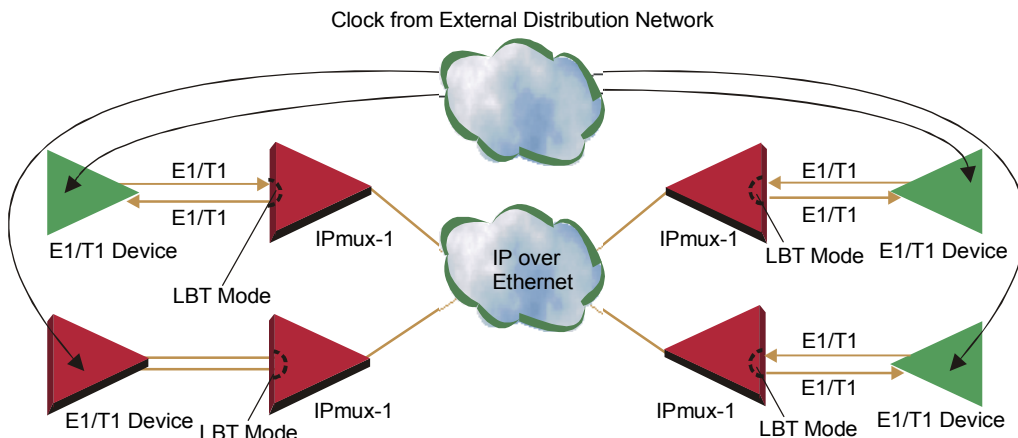


Figure 1-12. IPmux-1 in Loopback Timing Mode

External timing from the network can also be issued to IPmux-1 by External Clock input; in this case, the E1/T1 device will use the LBT mode.

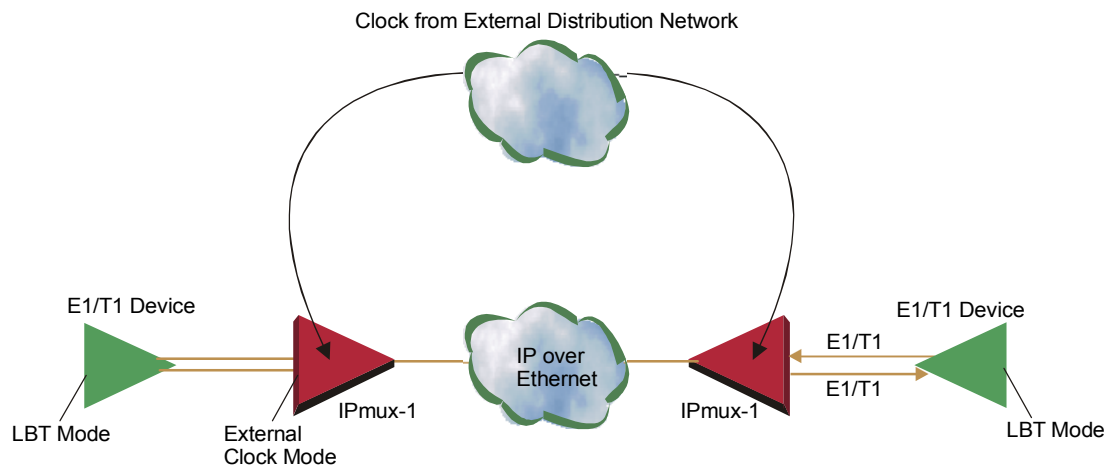


Figure 1-13. IPmux-1 in External Clock Mode

Single Source Clock Network

When a common clock is not available on all the ends of the network one of the IPmux-1 devices is configured to work in Loopback timing mode, while the other IPmux-1 device is configured to work in Adaptive timing mode (see *Figure 1-14*).

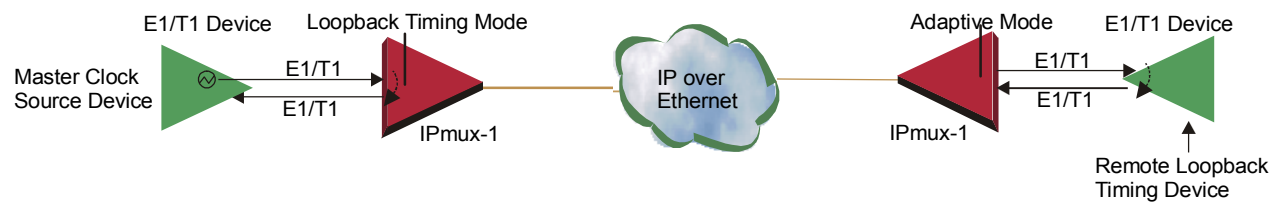


Figure 1-14. IPmux-1 in Adaptive Timing Mode

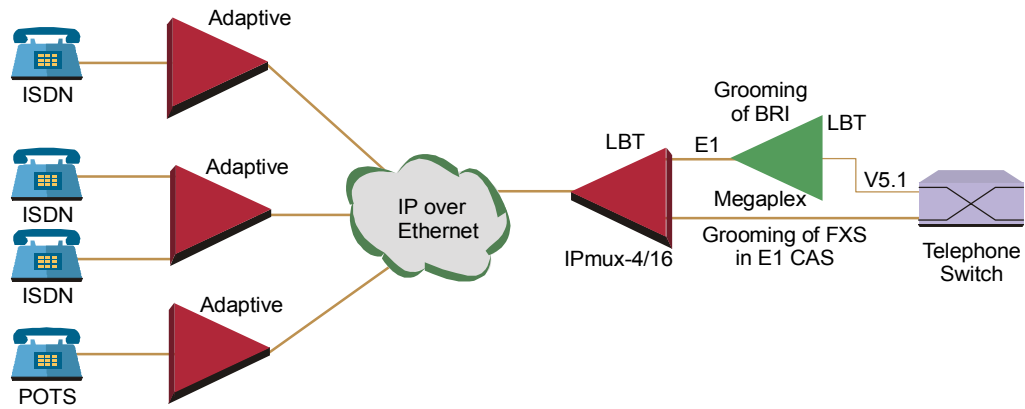


Figure 1-15. IPmux-1E in Adaptive Timing Mode

Frame Format

The Ethernet frame sent by the IPmux-1 is a UDP datagram that transfers E1/T1 payload bytes over IP over Ethernet (UDP payload + UDP header + IP header + Ethernet header).

The UDP payload size is equal to TDM bytes per frame (TDM bytes/frame configuration).

Table 1-2 specifies the structure of the different headers, special fields, and the payload in the Ethernet packet.



Figure 1-16. TDMoIP Frame Structure

Table 1-2. Ethernet Frame Structure

| | Field length (bytes) | Field | |
|------------|----------------------|------------------------------|---|
| MAC Layer | 7 | Preamble | |
| | 1 | SFD | |
| | 6 | Destination MAC Address | |
| | 6 | Source MAC Address | |
| LLC Layer | 2 | Type | ← Note: IEEE 802.1p&q VLAN Tagging (additional 4 bytes if enabled) |
| | 1 | Vers/HLEN | |
| IP Layer | 1 | Service Type | |
| | 2 | Total Length | |
| | 2 | Identification | |
| | 1 | Flags/Fragment Offset (most) | |
| | 1 | Fragment Offset (least) | |
| | 1 | Time to Live | |
| | 1 | Protocol | |
| | 2 | Header Checksum | |
| | 4 | Source IP Address | |
| | 4 | Destination IP Address | |
| | UDP Layer | 2 | UDP Source Port |
| 2 | | UDP Destination Port | |
| 2 | | UDP Message Length | |
| 2 | | UDP Checksum | |
| Data Layer | ... | Payload | |
| MAC Layer | 4 | CRC | |

VLAN Support

VLAN, according to IEEE 802.1p&q, adds four bytes to the MAC layer of the Ethernet frame. The contents of these bytes, MAC layer priority and VLAN ID, can be set by the user. In this mode, only VLAN format frames are sent and received by IPmux-1. Figure 1-17 describes the VLAN tag format.

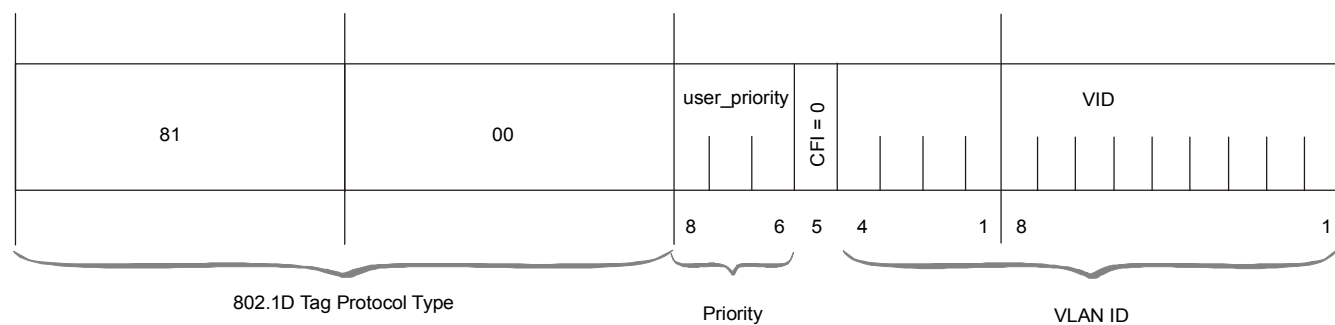


Figure 1-17. VLAN Tag Format (802.1p&q)

UDP Support

Table 1-3. UDP Ports Definition

| Field Length (Bits) | Field Description | Value | Function |
|---------------------|----------------------|---------|------------------------------|
| 2 bytes | UDP Source Port | 2–497d* | Destination timeslots bundle |
| 2 bytes | UDP Destination Port | 2142d | Standard TDMoIP UDP port |

* The MSB of this field can be either 1 or 0 for inband end-to-end proprietary signaling.

Note The UDP Source Port field is used for destination timeslots bundle indication. For example, if the destination is:
 Bundle 1 – 02, Bundle 2 – 03, Bundle 3 – 04, Bundle 4 – 05, etc.

For more information about VLAN tagging, refer to *IEEE Std 802.1p&q*.

Packet Delay Variation

Packets are transmitted at set intervals. Packet Delay Variation is the maximum deviation from the nominal time the packets are expected to arrive at the far end device. IPmux-1 has a buffer that compensates for the deviation from the expected packet arrival time to prevent IPmux-1 buffers from emptying out or overflowing.

Packet Delay Variation is an important network parameter. Large PDV (exceeding the jitter buffer configuration) will cause receive buffer underflows and errors at the E1/T1 level (see *Figure 1-18*).

To compensate for large PDV, configure the PDVT (jitter) buffer to a higher value.

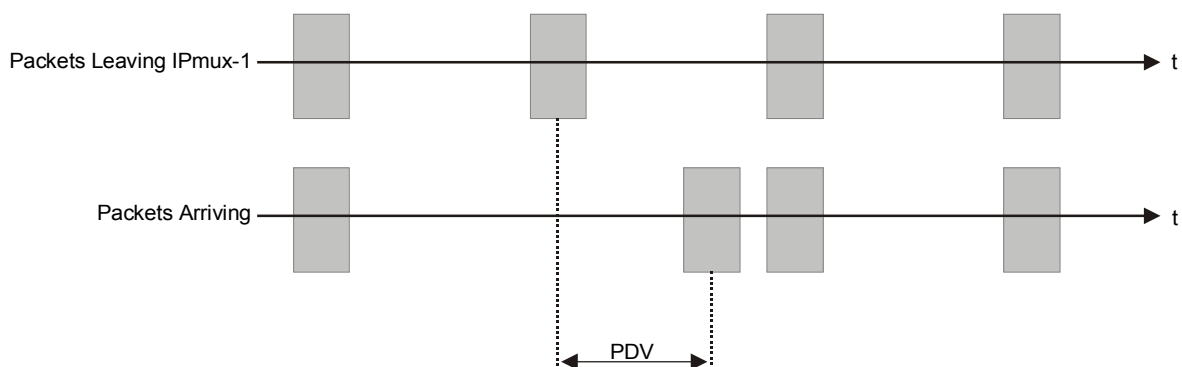


Figure 1-18. Packet Delay Variation

PDVT (Jitter) Buffer

IPmux-1 is equipped with a Packet DVT (Delay Variation Tolerance) buffer. The PDVT buffer or jitter buffer is filled by the incoming IP packets and emptied out to fill the E1/T1 stream. The buffer begins to empty out only after it is half full in order to compensate for packet starvation from the Ethernet side. The time it takes for half of the buffer to empty out is the maximum DVT time. Delay Variation Tolerance is configurable. The PDVT (jitter) buffer is designed to compensate for packet delay variation caused by the network + intrinsic PDV. It supports a delay variation of up to 300 ms for E1 or T1.

➤ To configure jitter buffer depth:

Estimated or Measured PDV introduced by the network + intrinsic PDV (if it exists) introduced by the module as a result of configuring the TDM bytes / frame > 48 (see explanation of calculating intrinsic PDV, below).

Intrinsic PDV

If TDM bytes/frame is greater than 48, there is an intrinsic delay variation (intrinsic PDV). The intrinsic PDV introduced by the module is a function of $n > 1$ in TDM bytes/frame configuration as follows:

$$I.PDV \text{ (ms)} = [(n-1) \times 1000] / (\text{frames per second} \times n)$$

$$\text{where } n = \frac{\text{Configured TDM bytes/frame}}{48} \quad (n = 1 \text{ to } 8).$$

Note For a bundle that contains a few timeslots (i.e. 1–3) the minimal jitter buffer should be 6 ms.

PDVT Buffer Effect on Delay

The PDVT buffer is on the TDM path; it adds to the total end-to-end delay (see delay calculation, below).

Ethernet Throughput

Configuring the TDM bytes per frame (TDM bytes/frame) parameter can reduce Ethernet throughput (bandwidth or traffic travelling through the Ethernet). This parameter controls the number of TDM bytes encapsulated in one frame. The TDM bytes/frame parameter can be configured to $n \times 48$ bytes where n is an

integer between 1 and 8. Configuring TDM bytes/frame to a higher value reduces the IP/Ethernet overhead segment of the total packet and thus can significantly reduce the total Ethernet throughput.

On the other hand, packetization delay and intrinsic packet delay variation (PDVT) are increased; this contributes to a higher end-to-end delay. This effect can be small and negligible when a full E1 (or many timeslots) are transferred but can be very significant when few timeslots are transferred. In this case, the packetization delay and the intrinsic PDV when configuring a large value of TDM bytes/frame can be very large and may exceed the maximum PDVT (jitter) buffer on the receiving end. *Table 1-4* and *Table 1-5* show throughput as a function of the TDM bytes/frame configuration for full E1 and full T1.

Table 1-4. Ethernet Throughput – Unframed E1

| TDM bytes/frame | Frame Length (bytes) | Overhead (bytes) | Overhead (%) | Packets per Second | Throughput (Mbps) |
|------------------------|-----------------------------|-------------------------|---------------------|---------------------------|--------------------------|
| 48 | 94 | 46 | 96 | 5447 | 4.1 |
| 96 | 142 | 46 | 48 | 2724 | 3.1 |
| 144 | 190 | 46 | 32 | 1816 | 2.76 |
| 192 | 238 | 46 | 24 | 1362 | 2.6 |
| 240 | 286 | 46 | 19 | 1089 | 2.5 |
| 288 | 334 | 46 | 16 | 908 | 2.43 |
| 336 | 382 | 46 | 14 | 778 | 2.38 |
| 384 | 430 | 46 | 12 | 681 | 2.34 |

Table 1-5. Ethernet Throughput – Unframed T1

| TDM bytes/frame | Frame length (bytes) | Over head (bytes) | Over head (%) | Packets per Second | Throughput (Mbps) |
|------------------------|-----------------------------|--------------------------|----------------------|---------------------------|--------------------------|
| 48 | 94 | 46 | 96 | 4107 | 3.08 |
| 96 | 142 | 46 | 48 | 2054 | 2.32 |
| 144 | 190 | 46 | 32 | 1369 | 2.07 |
| 192 | 238 | 46 | 24 | 1027 | 1.95 |
| 240 | 286 | 46 | 19 | 821 | 1.87 |
| 288 | 334 | 46 | 16 | 685 | 1.82 |
| 336 | 382 | 46 | 14 | 587 | 1.78 |
| 384 | 430 | 46 | 12 | 513 | 1.76 |

► **To calculate Ethernet throughput and intrinsic PDV as a function of TDM bytes/frame:**

Ethernet load (bps) =
 $[(\text{frame overhead (bytes)} + \text{TDM bytes/frame}) \times 8] \times \text{frames/second}$

Frame overhead = Ethernet overhead + IP overhead = 46 bytes

Note *The frame overhead does not include:*

Preamble field: 7 bytes

SFD field: 1 byte

VLAN field (when used): 4 bytes.

Frame/second =

Unframed: 5447/n for a full E1
 4107/n for a full T1

Framed: $8000 \times k / (46.875 \times n)$
 Where k = number of assigned timeslots

Where $n = \frac{\text{TDM bytes/frame}}{48}$

Round Trip Delay

The voice path round-trip delay, which is a function of all connections and network parameters, is calculated for E1/T1 as follows:

$$(\pm 2 \mu\text{s}) \text{RTDelay}_{(\mu\text{s})} = 2 \times \left(\frac{48 \times n}{\text{NTS}} \times 125 (\mu\text{s}) + \text{PDVT buffer } (\mu\text{s}) + 1000 \mu\text{s} \right) + \text{Network Round Trip Delay}$$

$$\text{where } n = \frac{\text{TDM bytes/frame}}{48}$$

where NTS = number of timeslots assigned
 in unframed E1 interface = 32
 T1 interface = 24

End-to-End Alarm Generation

An end-to-end alarm generation mechanism exists in IPmux-1 to facilitate the following alarms:

Unframed AIS is transmitted toward the near-end PBX in event of:

- Far-end LOS, AIS
- PDVT underflow/overflow.

Framed Timeslot/CAS configurable alarm pattern is transmitted toward the near-end PBX in event of:

- Far-end LOS, LOF, AIS
- PDVT underflow/overflow.

Ethernet User Port

The Ethernet user port allows a user to aggregate both TDMoIP traffic and his private network LAN traffic to a single Ethernet network connection without requiring an access switch. This is a cost effective solution for MTU or small office applications. A rate limiter to restrict user port traffic is supported.

IPmux-1/1E contains an internal switch where one of its ports is connected to a TDMoIP interworking function, another internal switch port is used as the user port, and the third is used as an Ethernet network port.

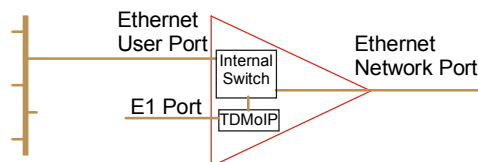


Figure 1-19. IPmux-1/1E with Ethernet User Port

Note Priority is always given to TDMoIP packets inside the internal switch.

Internal Switch Operation Modes

Bridge Mode (no user rate limiter)

In this mode the internal switch performs transparent bridging, ALL internal ports learn, update the internal tables, and make forwarding decisions according to the source MAC only (not MAC + VLAN ID).

VLAN tagged frames are supported, however forwarding decisions are based on MAC only.

Rate Limiter Mode

In this mode a rate limiter is available to limit user port traffic. This feature is valuable when a limited bandwidth DSL modem, for example, is used to extend the Ethernet link (generally when the Ethernet link rate is limited/shaped to a lower rate after IPmux). In this case TDMoIP packets will be dropped in the modem even if it was prioritized at the IPmux internal switch. This is prevented by limiting the user port to actual link rate minus TDMoIP bandwidth. The rate limiter can limit user traffic at 50 kbps steps up to 5M and in 1 Mbps steps from 5M to 100M.

The internal switch (in the rate limiter mode) operates in the following way:

- The network port is in lock mode (no learning takes place). If this port must be connected to a switch (not a hub), this is not a limitation, since all applications involve connection to a backbone on an access switch.
- VLAN tagged frames are not supported (will be dropped)
- Access to the IPmux host for management is possible only from the network port.

Note All of the above exist only in rate limiting mode, and do not exist in bridge mode.

The bridge/rate limiter modes are selected by the rate limiter parameter. When set to 0 the bridge mode is selected, otherwise the rate limiter is selected by the specified rate.

1.4 Technical Specifications

| | | |
|------------------|-------------------------------|---|
| E1 Port | <i>Compliance</i> | ITU-T Rec. G.703, G.706, G.732, G.823 |
| | <i>Connector</i> | Balanced: RJ-45 8-pin Unbalanced: TBNC 75Ω (an external adapter cable from TBNC to BNC is required) |
| | <i>Data Rate</i> | 2.048 Mbps |
| | <i>Line Code</i> | HDB3 |
| | <i>Line Impedance</i> | Balanced: 120Ω; Unbalanced: 75Ω |
| | <i>Signal Levels</i> | Receive: 0 to -32 dB with LTU 0 to -10 dB without LTU Transmit Balanced: ±3V ±10% Transmit Unbalanced: ±2.37V ±10% |
| | <i>Jitter Performance</i> | ITU-T G.823 standard |
| | <i>External Adapter Cable</i> | TBNC to BNC required |
| | E1 Framing | <i>Compliance</i> |
| <i>Framing</i> | | Pass Through, CRC4 MF, CAS MF |
| <i>Signaling</i> | | CAS, CCS (transparent) |
| T1 Port | <i>Compliance</i> | ANSI T1.403, ITU-T Rec. G.703, G.704 |
| | <i>Connector</i> | RJ-45, 8-pin |
| | <i>Data Rate</i> | 1.544 Mbps |
| | <i>Line Code</i> | B8ZS, B7ZS, AMI |
| | <i>Line Impedance</i> | Balanced: 100Ω |
| | <i>Signal Levels</i> | Receive: 0 to -30 dB Transmit: 0 dB, -7.5 dB, -15 dB, -22.5 dB, with CSU ±2.7V ± 10%, adjustable, measured in range 0 to 655 feet, without CSU |
| | <i>Jitter Performance</i> | AT&T TR-62411, G.824 standards |

| | | |
|---|---------------------------------|---|
| T1 Framing | <i>Compliance</i> | ANSI T1.403 |
| | <i>Framing</i> | Pass through, SF, ESF |
| | <i>Signaling</i> | CAS (bit robbing), CCS (transparent) |
| Local Terminal and Control Interface | | DB-9, female |
| | <i>Mode</i> | RS-232/V.24 (DCE) |
| | <i>Baud Rate</i> | 9.6, 19.2, 38.4, 57.6, 115.2 kbps |
| | <i>Connector</i> | DB-9 |
| Ethernet | <i>Compliance</i> | IEEE 802.3, 802.3u, Ethernet, 802.1p&q |
| | <i>Connector</i> | UTP: RJ-45, 8-pin Fiber: SC (without user port), LC (with user port) |
| | <i>Ports</i> | 1 or 2 (if user port is used) |
| | <i>Data Rate</i> | UTP: 10 Mbps or 100 Mbps, full or half duplex Fiber: 100 Mbps full duplex |
| | <i>Range</i> | Up to 100m on UTP Category 5 cables For optical interfaces: see optical budget calculation (<i>Features</i>) |
| Analog Voice | <i>Number of voice channels</i> | 4 |
| | <i>Modulation method</i> | PCM (per ITU-T G.711 and AT&T PUB-43801) μ -Law or A-Law |
| | <i>Interfaces</i> | FXS: Loop start for direct connection to a 2-wire telephone Nominal level: 0 dBm Nominal impedance: 600 Ω Return loss (ERL): Better than 20 dB Frequency response: (Ref: 1020 Hz) <ul style="list-style-type: none"> • ± 0.5 dB, 300 TO 3000 Hz • ± 1.1 dB, 250 to 3400 Hz Signal to total distortion, G.712, G.713 method 2: <ul style="list-style-type: none"> • 0 to -30 dBm0, better than 33 dB • $+3$ to -45 dBm0, better than 22 dB Idle channel noise: Better than -70 dBm0 (+20 dBnc) |

| | | |
|--------------------------|-------------------------|--|
| | | Transformer isolation: 1500 VRMS |
| | | Ringing – 22 Hz, sine wave |
| | <i>Diagnostics</i> | Remote analog loopback towards the remote side, activated from local side |
| | | 1kHz tone injection towards analog side Activity indicators |
| ISDN S0 Interface | <i>Number of ports</i> | 4 |
| | <i>Compliance</i> | ETS 300012, I.430, NTT, 5ESS, DMS-100, NI1 |
| | <i>Bit Rate</i> | 192 kbps |
| | <i>Line Coding</i> | Pseudo-ternary |
| | <i>Line Termination</i> | 100 ± 5% |
| | <i>Connector</i> | RJ-45 |

External Clock

| | | |
|-----------|-------------------------------|--|
| E1 | <i>Compliance</i> | ITU-T Rec. G.703, G.706, G.732, G.823 |
| | <i>Connector</i> | Balanced: RJ-45 8-pin Unbalanced: TBNC 75Ω (an external adapter cable from TBNC to BNC is required) |
| | <i>Data Rate</i> | 2.048 Mbps |
| | <i>Line Code</i> | HDB3 |
| | <i>Line Impedance</i> | Balanced: 120Ω; Unbalanced: 75Ω |
| | <i>Signal Levels</i> | Receive: 0 to -10 dB Transmit Balanced: ±3V ±10% Transmit Unbalanced: ±2.37V ±10% |
| | <i>Jitter Performance</i> | ITU-T G.823 standard |
| | <i>External Adapter Cable</i> | TBNC to BNC required |
| T1 | <i>Compliance</i> | ANSI T1.403, ITU-T Rec. G.703, G.704 |
| | <i>Connector</i> | RJ-45, 8-pin |
| | <i>Data Rate</i> | 1.544 Mbps |
| | <i>Line Code</i> | B8ZS, B7ZS, AMI |
| | <i>Line Impedance</i> | Balanced: 100Ω |

Signal Levels Receive: 0 to -10 dB
 Transmit: $\pm 2.7V \pm 10\%$, adjustable, measured in range
 0 to 133 feet, without CSU

Jitter Performance AT&T TR-62411, G.824 standards

Indicators

General:

PWR ON when power supply is OK
 OFF when a malfunction is detected

RDY ON when self-test is successfully completed
 OFF during self-test
 BLINKS when self-test fails

Ethernet Port:

LINK OFF when line is not active
 ON when line is OK

ACT OFF when no activity
 ON when a frame is being transmitted or
 received on the line

100M OFF when 10 MHz
 ON when 100 MHz

FDX OFF when half duplex
 ON when full duplex

E1/T1 Port:

SYNC ON when the port is synchronized (no alarm)
 OFF when signal loss, LOF or AIS is detected
 (local alarm)
 BLINKS when RDI is detected (remote alarm)

ISDN Port:

SYNC ON when the ISDN BRI frame is
 synchronized (no alarm)
 OFF when signal loss, LOF is detected

FXS Port:

SYNC ON when off-hook
 OFF when on-hook
 BLINKS when ringing

Note: All LEDs are green and ON after power-up.

Power 1 power supply
 100 to 240 VAC, 50 or 60 Hz
 -36 to -72 VDC (-48 VDC nominal)

Note: IPmux-1E only has AC power supply option.

| | |
|--------------------------|--|
| <i>Power consumption</i> | IPmux-1: 4W IPmux-1 (with LAN): 10W IPmux-1E: 25W IPmux-1E (with LAN switch): 32W |
| <i>Physical</i> | |
| <i>IPmux-1</i> | Height 4.4 cm/1.7 in (1U) Width 21.4 cm/8.4 in Depth 24.6 cm/9.7 in Weight 1.2 kg/2.7 lb |
| <i>IPmux-1E</i> | Height 4.4 cm/1.7 in (1U) Width 43.2 cm/17.0 in Depth 24.6 cm/9.7 in Weight 2.3 kg/5.1 lb |
| <i>Environment</i> | Temperature: 0 to 50°C/32 to 122°F |
| <i>Humidity</i> | Up to 90%, non-condensing |

Chapter 2

Installation

This chapter includes:

- Site requirements and prerequisites
- Package contents
- Equipment needed
- Installation and setup

2.1 Introduction

IPmux-1/1E is delivered completely assembled for bench-top installation. The only mechanical installation procedures that may be necessary are optional installation in a 19-in rack. For rack installation instructions refer to the *Rack Mounting Kit for 19-inch Racks* guide that comes with the RM kit.

After installing the unit, configure IPmux-1/1E using an ASCII terminal connected to the IPmux-1/E Control port, or Telnet or RADview TDMoIP management application. The IPmux-1/1E configuration procedures are described in *Chapter 3* and *Appendix E* of this manual. Configuration parameters are explained in *Appendix E*.

If problems are encountered, refer to *Chapter 4* for test and diagnostics instructions.



No internal settings, adjustment, maintenance and repairs may be performed by either the operator or the user; such activities may be performed only by skilled service personnel who are aware of the hazards involved. Always observe standard safety precautions during installation, operation, and maintenance of this product.

2.2 Site Requirements and Prerequisites

Install AC-powered IPmux-1/1E units within 1.5m (5 feet) of an easily-accessible grounded AC outlet capable of furnishing the required supply voltage, in the range of 100 to 240 VAC.

DC-powered IPmux-1 units require a 48 VDC power source. The positive pole can be earthed.

Caution The DC power source must be isolated from the mains supply by double or reinforced insulation. A suitable fuse or a circuit breaker should be integrated in the negative power-supply line.

Allow at least 90 cm (36 inches) of frontal clearance for operator access. Allow at least 10 cm (4 inches) clearance at the rear of the unit for cable connections. Make sure that the ventilation holes are not blocked.

The ambient operating temperature of IPmux-1/1E is 0° to 50° C (32° F to 122° F), at a relative humidity of up to 90%, non-condensing.

2.3 Package Contents

The IPmux-1/1E package contains the following items:

- IPmux-1/1E unit
- Power cord
- Kit containing hardware for mounting the unit in a 19-in rack (optionally supplied)
 - RM-25 for IPmux-1
 - RM-27 for IPmux-1E.

Power Cable

IPmux-1/1E comes equipped with the power cord connected to the AC/DC interface on the rear panel.

2.4 Equipment Needed

IPmux-1/1E needs no special tools for installation. A screwdriver is necessary when mounting IPmux-1/1E in a 19-in rack.

2.5 Installation and Setup

Setting Jumpers

IPmux-1

In general, IPmux-1 internal jumpers and switches do not need to be configured by the user. Therefore, removing the product cover is not required.

IPmux-1E

The IPmux-1E FXS version needs NO user internal jumper configuration.

The IPmux-1E ISDN version contains jumpers for phantom feed (see *Figure 2-1*). Open the case and check the positions of internal jumpers before the IPmux-1E installation.

► **To open the IPmux-1E case:**

1. Disconnect all the cables connected to the IPmux-1E.
2. Release the cover screws at the rear panel (one is near the POWER connector).
3. Slide the IPmux-1E top cover by pulling it straight out.

► **To set the IPmux-1E ISDN-S module jumpers:**

If necessary, change the settings in accordance with the specific requirements of your application:

- ENA – enable phantom feed
- DIS – disable phantom feed

The phantom feed ENA/DIS setting influences the IPmux-1E BRI operation mode. When phantom feed is disabled, the S interface can be configured (through software) to the TE or NT mode. When phantom feed is enabled, only the NT mode is possible.



Warning

Only qualified and authorized service personnel should have access to the inside of the unit.

Disconnect the unit from the power line and from all the cables before removing the cover.

Line voltages are present inside IPmux-1E when it is connected to power. Moreover, under certain external fault conditions, dangerous voltages may appear on the lines connected to IPmux-1E.

Any adjustment, maintenance, and repair of the opened device under voltage should be avoided as much as possible and, when inevitable, should be carried out only by a skilled technician who is aware of the hazards involved. Capacitors inside the device may still be charged even after it has been disconnected from its source of power.

Caution The IPmux-1E contains components sensitive to electrostatic discharge (ESD). To prevent ESD damage, avoid touching the internal components, and before moving jumpers, touch the IPmux-1E rear panel.

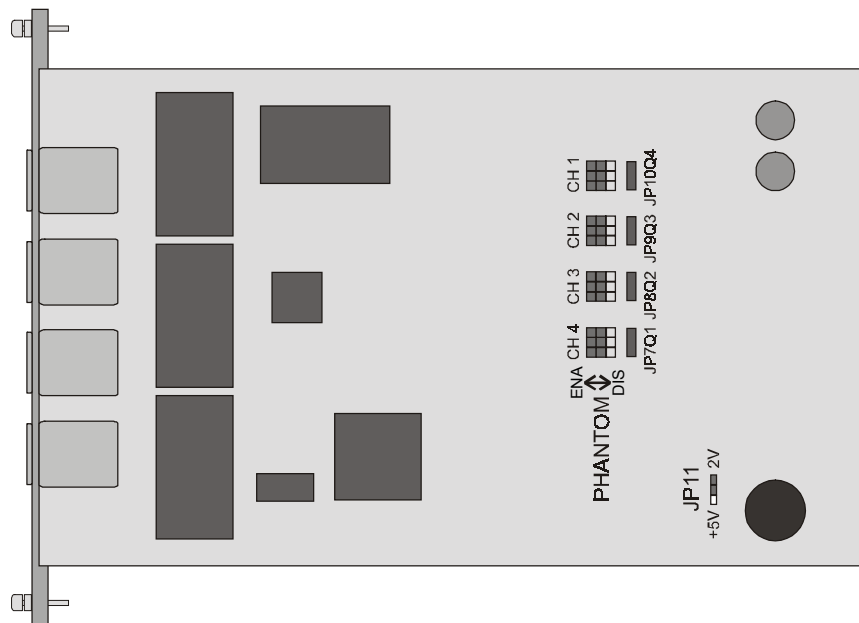


Figure 2-1. The IPmux-1E ISDN-S Jumpers

► **After completing the internal settings, reinstall the top cover as follows:**

1. Position the IPmux-1/1E case on a flat, clean surface.
2. Slide the cover into the slots from the rear panel, and set the cover in place.
3. Fasten the cover to the rear panel with the locking spring screws (one is near the POWER connector).

Connecting Interfaces and Cables

Figure 2-2 through Figure 2-5 illustrate the front and rear panel options available for IPmux-1.

Figure 2-6 through Figure 2-9 illustrate the rear and front panel options available for IPmux-1E.

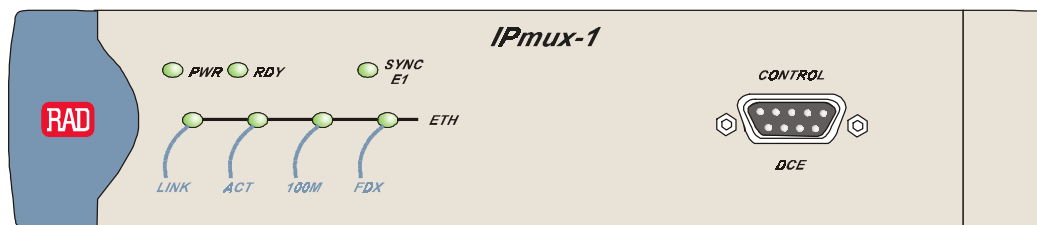


Figure 2-2. IPmux-1 Front Panel

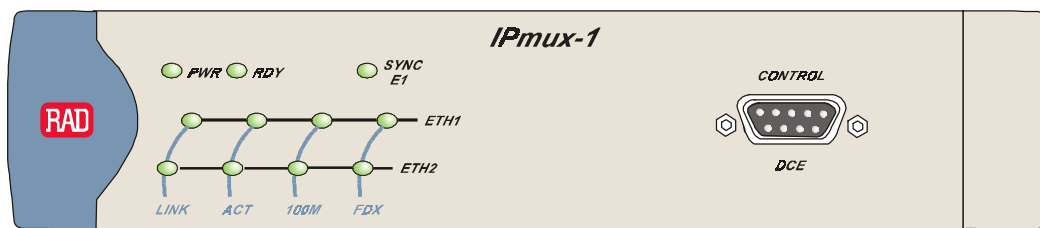


Figure 2-3. IPmux-1 Front Panel for Two Ethernet Ports

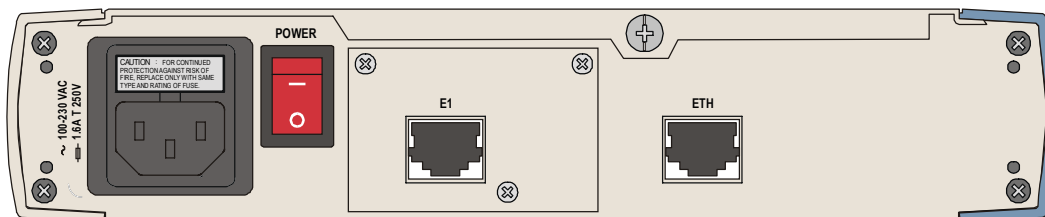


Figure 2-4. IPmux-1 Rear Panel

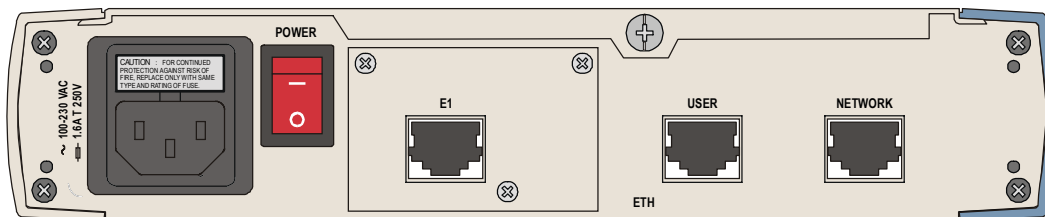


Figure 2-5. IPmux-1 Rear Panel for Two Ethernet Ports

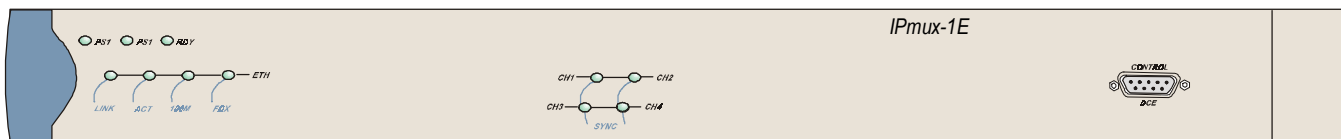


Figure 2-6. IPmux-1E Front Panel

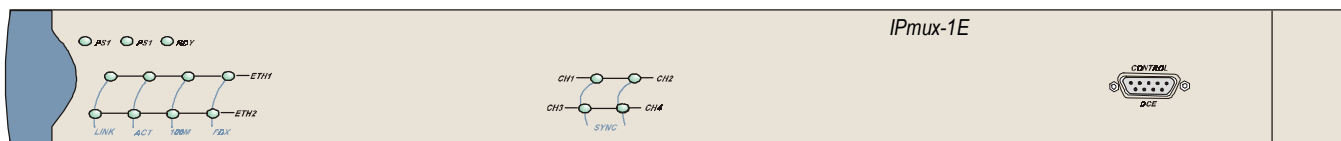


Figure 2-7. IPmux-1E Front Panel for Two Ethernet Ports

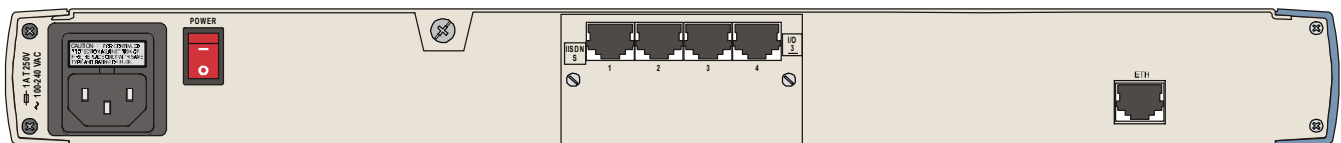


Figure 2-8. IPmux-1E Rear Panel (BRI Option)

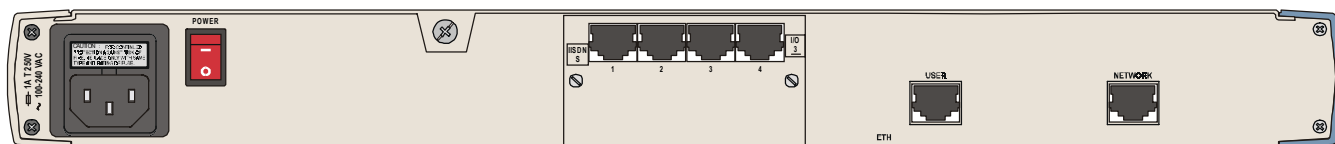


Figure 2-9. IPmux-1E Rear Panel (BRI Option) for Two Ethernet Ports

Grounding

Interrupting the protective grounding conductor (inside or outside the instrument) or disconnecting the protective earth terminal can make this instrument dangerous. Intentional interruption is prohibited.



Warning

Before switching ON this instrument and before connecting any other cable, the protective earth terminals of this instrument must be connected to the protective ground conductor of the power cord.

Fuses

Make sure that only fuses with the required rated current and specified type, as marked on the IPmux-1/1E rear panel, are used for replacement: 1.6A T 250V.

Whenever it is likely that the protection offered by fuses has been impaired, the instrument must be made inoperative and secured to prevent any operation.

Location of Connectors

Interface connections are made from the IPmux-1/1E back panel, as shown in Figure 2-2.

- Table 2-1 lists the E1/T1 port pinout.
- Table 2-2 lists the Ethernet port pinout.
- Table 2-3 lists the Control port pinout.
- Table 2-4 lists the ISDN-S connector pinout.
- Table 2-5 lists the FXS connector pinout for RJ-11.

Table 2-1. E1/T1 Port Connectors Pinout

| Pin | Designation | Direction | Function |
|-----|-------------|-----------|----------------------|
| 1 | RD (R) | Input | Receive data (ring) |
| 2 | RD (T) | Input | Receive data (tip) |
| 3,6 | – | – | FGND |
| 4 | TD (R) | Output | Transmit data (ring) |
| 5 | TD (T) | Output | Transmit data (tip) |
| 7,8 | – | N/A | Not connected |

Table 2-2. Ethernet Port Pinout

| Pin | Pinout |
|-----|--------|
| 1 | Tx+ |
| 2 | Tx– |
| 3 | Rx+ |
| 4 | – |
| 5 | – |
| 6 | Rx– |
| 7 | – |
| 8 | – |

Table 2-3. Control Port Pinout

| Pin | Pinout |
|-----|--------|
| 1 | – |
| 2 | Rx |
| 3 | Tx |
| 4 | – |
| 5 | GND |
| 6 | – |
| 7 | – |
| 8 | – |
| 9 | – |

Table 2-4. ISDN-S Interface Pin Assignments

| Pin Number | Signal Name |
|------------|-------------|
| 3 | Tx+ |
| 4 | Rx+ |
| 5 | Rx- |
| 6 | Tx- |

Table 2-5. FXS Interface Pin Assignments for RJ-11

| Pin Number | Designation | Direction | Function |
|------------|-------------|-----------|-----------------|
| 1,2 | | | Not connected |
| 3 | RING | IN/OUT | 2W input/output |
| 4 | TIP | IN/OUT | 2W input/output |
| 5,6 | | | Not connected |

Connecting the Control Port

The Control port is located on the IPmux-1/1E front panel (Figure 2-2). The External Clock port pinout is shown in Figure 2-10 listed in Table 2-6.

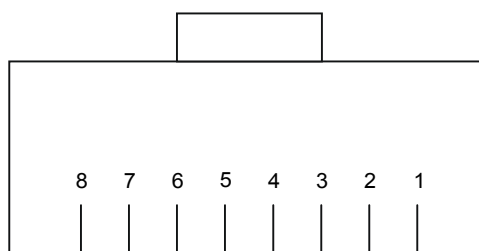


Figure 2-10. External Clock Port Pinout

Table 2-6. External Clock Port Pinout

| Pin Number | Signal Name | Function |
|------------|-------------|-----------------------|
| | RRING | Rx |
| 2 | RTIP | Rx |
| 3 | GND | Usually not connected |
| 4 | TRING | Tx |
| 5 | TTIP | Tx |
| 6 | GND | Usually not connected |
| 7 | | Not connected |
| 8 | | Not connected |

Connecting the Power

To connect power to IPmux-1/1E, refer to the appropriate section below, depending on your version of the unit (AC or DC).

AC Power Connection

AC power is supplied to IPmux-1/1E through the 5-ft (1.5m) standard power cable terminated by a standard 3-prong plug. The cable is supplied with the unit.

► **To connect AC power to IPmux-1/1E:**

1. Verify that the AC outlet is grounded properly. Ensure that the supply voltage is in the range 100 VAC to 240 VAC.
2. Check that both Power switches on the rear panel are set to OFF.
3. Connect the power cable to the rear panel connector first and then to the AC mains outlet.

DC Power Connection

A DC power supply option is available to be ordered for IPmux-1 only (not available for IPmux-1E). For information about connecting the DC power supply refer to the *DC Power Supply Connection Supplement* at the back of this manual.

Chapter 3

Operation

This chapter:

- Provides a detailed description of the front panel controls and indicators and their functions
- Explains power-on and power-off procedures
- Provides instructions for using a terminal connected to the IPmux-1/1E Control port
- Describes how to navigate menus
- Illustrates some menus:
 - Main menu
 - Configuration menu
 - Viewing System Information
 - Monitoring IPmux-1/1E performance.

For a detailed explanation of parameters on the menus, see *Appendix E*.

3.1 Front Panel Controls, Connectors, and Indicators

The unit's LEDs (see *Figure 3-1*, *Figure 3-2*, *Figure 3-3* and *Figure 3-4*) are located on the left side of the front panel. *Table 3-1* and *Table 3-2* list the functions of the IPmux-1 and IPmux-1E system indicators and switches.

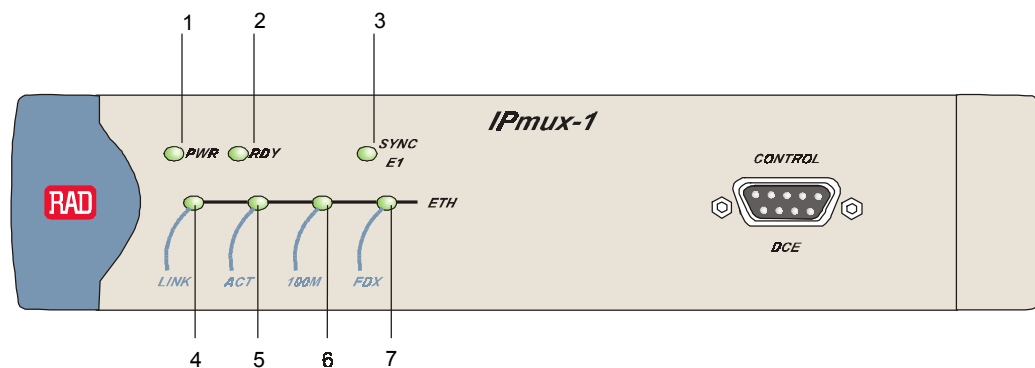


Figure 3-1. IPmux-1 Front Panel LEDs

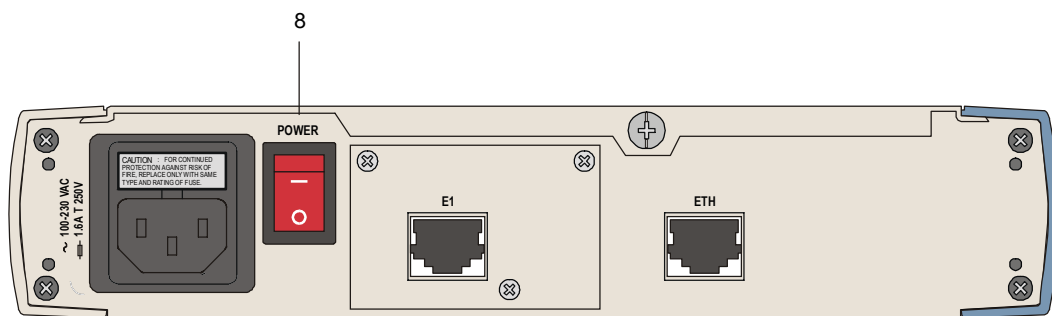


Figure 3-2. IPmux-1 Rear Panel Switch

Table 3-1. IPmux-1 System Indicators and Switches

| No. | Name | Type | Function |
|-----|----------|------|---|
| 1 | PWR | LED | On: Unit powered Off: Unit not powered |
| 2 | RDY | LED | On: Device OK Off: Self-test in progress Blinking: Malfunction detected |
| 3 | SYNC E1 | LED | On: Port synchronized (no alarm) Off: Unframed: Signal loss or AIS detected Framed: Signal loss, loss of frame or AIS detected Blinking: RDI detected (remote alarm) |
| 4 | ETH LINK | LED | On: Line OK Off: Link not active |
| 5 | ETH ACT | LED | On: Frame being transferred on line Off: No activity |
| 6 | ETH 100M | LED | On: 100 Mbps Off: 10 Mbps |

Table 3-1. IPmux-1 System Indicators and Switches (Cont.)

| No. | Name | Type | Function |
|-----|---------|--------|-------------------------------------|
| 7 | ETH FDX | LED | On: Full duplex Off: Half duplex |
| 8 | POWER | Switch | Turns IPmux-1/1E power On and Off |

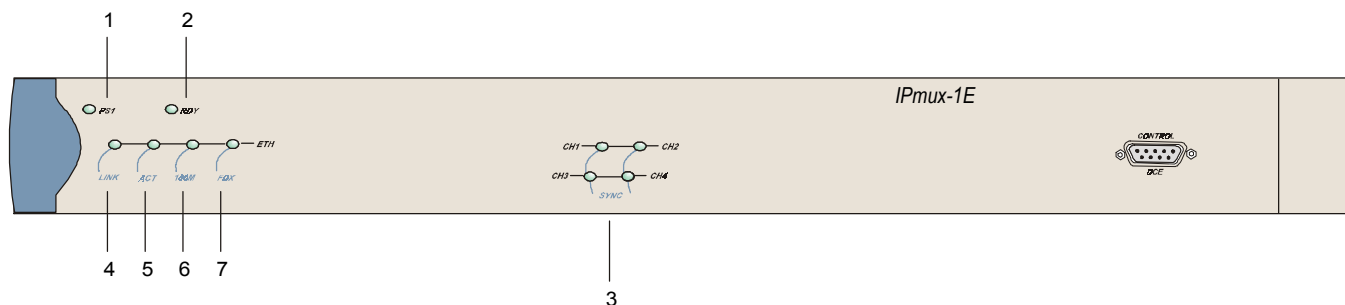


Figure 3-3. IPmux-1E Front Panel Indicators

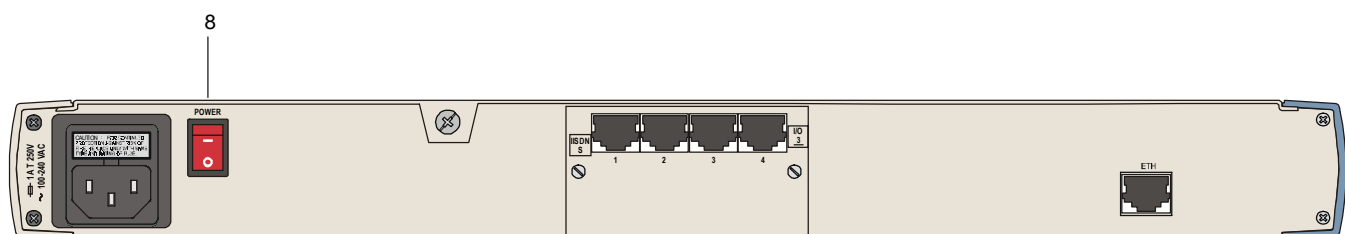


Figure 3-4. IPmux-1E Back Panel Indicators

Table 3-2. IPmux-1E (BRI/FXS) System Indicators and Switches

| No. | Name | Type | Function |
|-----|-----------------|------|--|
| 1 | PS1 | LED | Green On: Unit powered Red On: Power supply failure Off: Unit not powered |
| 2 | RDY | LED | On: Device OK Off: Self-test in progress Blinking: Malfunction detected |
| 3 | SYNC CH1-CH4 | LED | ISDN On: ISDN synchronized Off: ISDN LOF FXS On: OFF hook Off: ON hook Blinking: Ringing |

Table 3-2. IPmux-1E (BRI/FXS) System Indicators and Switches (Cont.)

| No. | Name | Type | Function |
|-----|-------------|--------|---|
| 4 | ETH LINK | LED | On: Line OK Off: Link not active |
| 5 | ETH ACT | LED | On: Frame being transferred on line Off: No activity |
| 6 | ETH 100M | LED | On: 100 Mbps Off: 10 Mbps |
| 7 | ETH FDX | LED | On: Full duplex Off: Half duplex |
| 8 | POWER | Switch | Turns IPmux-1E power ON and OFF |

3.2 Operating Instructions

Turning IPmux-1/1E On

Without Control Terminal

The IPmux-1/1E power switch is located on the back panel, as shown in *Figure 3-2*.

► **To power up IPmux-1/1E without a Control terminal:**

1. Turn the power supply switch, located on the rear panel, to ON.
2. Check the unit LED indicators, located on the left side of the front panel, and the module indicators for proper operation (see *Figure 3-1*, *Figure 3-2*, *Figure 3-3*, *Figure 3-4*, *Table 3-1*, and *Table 3-2*).

With Control Terminal

► **To power up IPmux-1/1E with a Control terminal:**

1. Make sure all IPmux-1/1E cables and connectors are properly connected.
2. Connect IPmux-1/1E to a PC equipped with an ASCII terminal-emulation application (for example, Windows 95 Hyper Terminal or Procomm).
3. Turn on the control-terminal PC and set its default port parameters to 19,200 baud, 8 bits/character, 1 stop bit, No Parity. Set the terminal emulator to ANSI VT100 emulation (for optimal view of system menus).
4. Switch ON the POWER supply switch, located on the rear panel.
5. When the initialization and self-test are over, a menu appears displaying initialization and self-test results. If the self-test is successful, the RDY LED (*Figure 3-1* and *Figure 3-3*) on the left side of the front panel lights. If problems are encountered, refer to *Chapter 4* for instructions.

6. Press <Esc> to open the configuration software.
7. Enter your User Name according to your assigned system privileges (either Supervisor (**su**) or **User** and then your Password when prompted (the factory-set password is **xxxxxxxx**).

The Main Menu is displayed (Figure 3-8).

Note *If the password is invalid in three consecutive attempts, the system becomes inaccessible for 15 minutes.*

Login

User Name and Password

➤ **To enter as a superuser:**

1. Enter **su** for User Name.
2. Enter **xxxxxxxx** for Password.

This allows you to configure all the parameters of Ipmux-1/1E, and to change the *su* and *user* passwords.

➤ **To view the unit's configuration:**

1. Enter **user** for User Name.
2. Enter **xxxxxxxx** for Password.

This does not allow you to make configuration changes.

➤ **To set all passwords to the default value (xxxxxxxx):**

- Delete the unit's configuration through the Configuration screens.

Note *Deleting the unit's configuration using <Cntrl+A> and choosing **4** in the Boot Menu does not set the password to the default value.*

➤ **If you forget your password:**

- Consult Technical Support at RAD for further assistance (send email to support@rad.co.il).

Turning IPmux-1/1E Off

➤ **To power off the unit:**

- Switch PWR to OFF.

3.3 Getting Started

After installation, there are no special operating procedures for IPmux-1/1E. Once it is powered up, the unit operates automatically. The front panel LED indicators (*Figure 3-1* and *Figure 3-3*) indicate proper operation. The unit operational status can be monitored constantly.

If required, IPmux-1/1E can be reconfigured. Both the IPmux-1/1E configuration and monitoring operations are performed locally from an ASCII terminal connected to the Control port. Detailed configuration procedures are given in *Overview of Menu Operations* and *Appendix E*.

The following functions are supported (see menu trees in *Figure 3-5*, *Figure 3-6*, and *Figure 3-7*):

- Viewing system information
- Modifying configuration and mode of operation, including setting system default values
- Viewing statistics and status
- Performing diagnostics.

3.4 Overview of Menu Operations

Navigating

Navigate the IPmux-1/1E terminal menus to set and view configuration parameters:

- *Figure 3-5* maps the IPmux-1 terminal menus
- *Figure 3-6* maps the IPmux-1E ISDN-S terminal menus
- *Figure 3-7* maps the IPmux-1E FXS terminal menus.

Use these menu trees as a reference aid while performing configuration and control functions. *Appendix E* illustrates menus, explains parameters, and lists default values. Refer to *Appendix E* to find specific parameters.

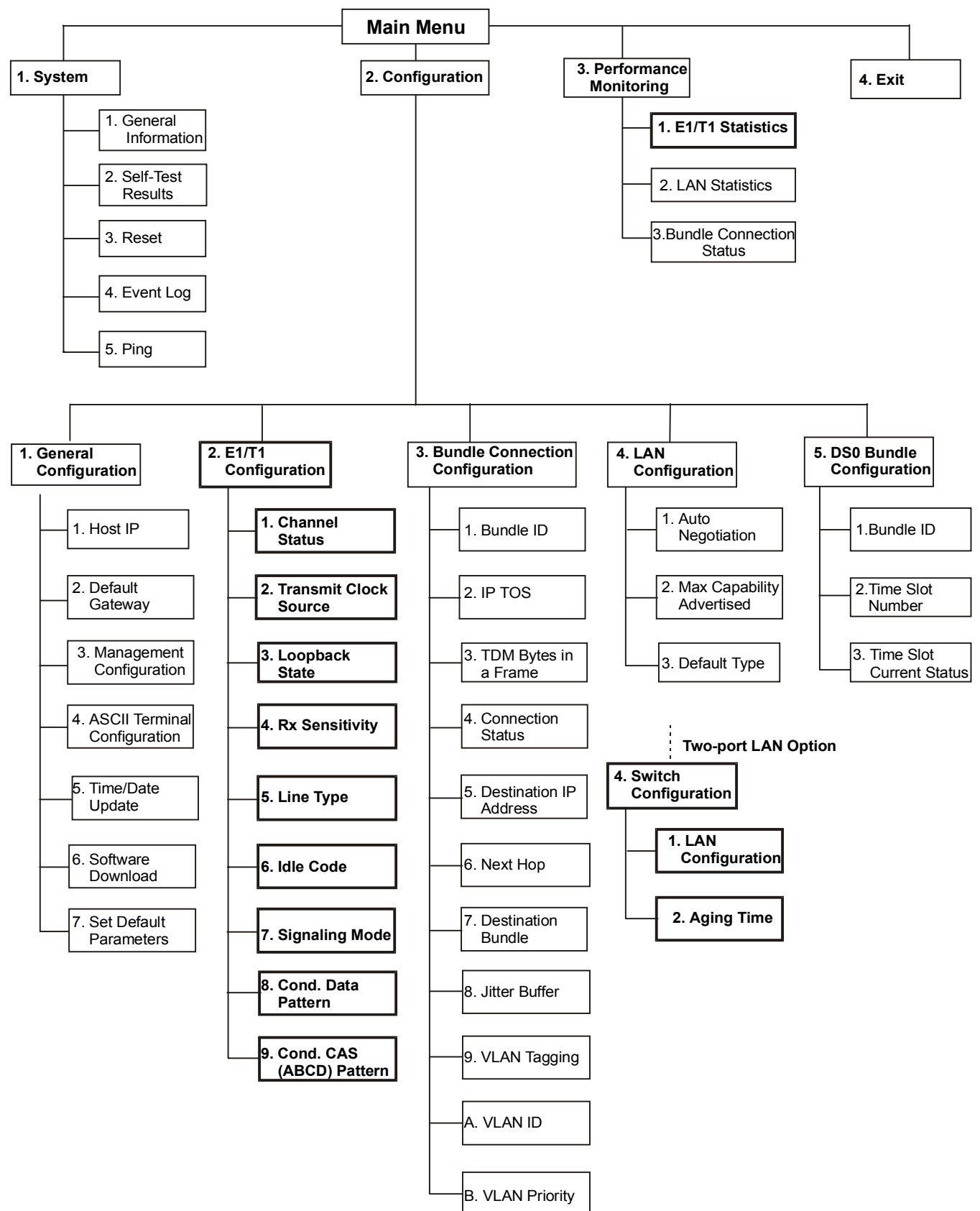


Figure 3-5. IPmux-1 (E1/T1) Terminal Menu Tree

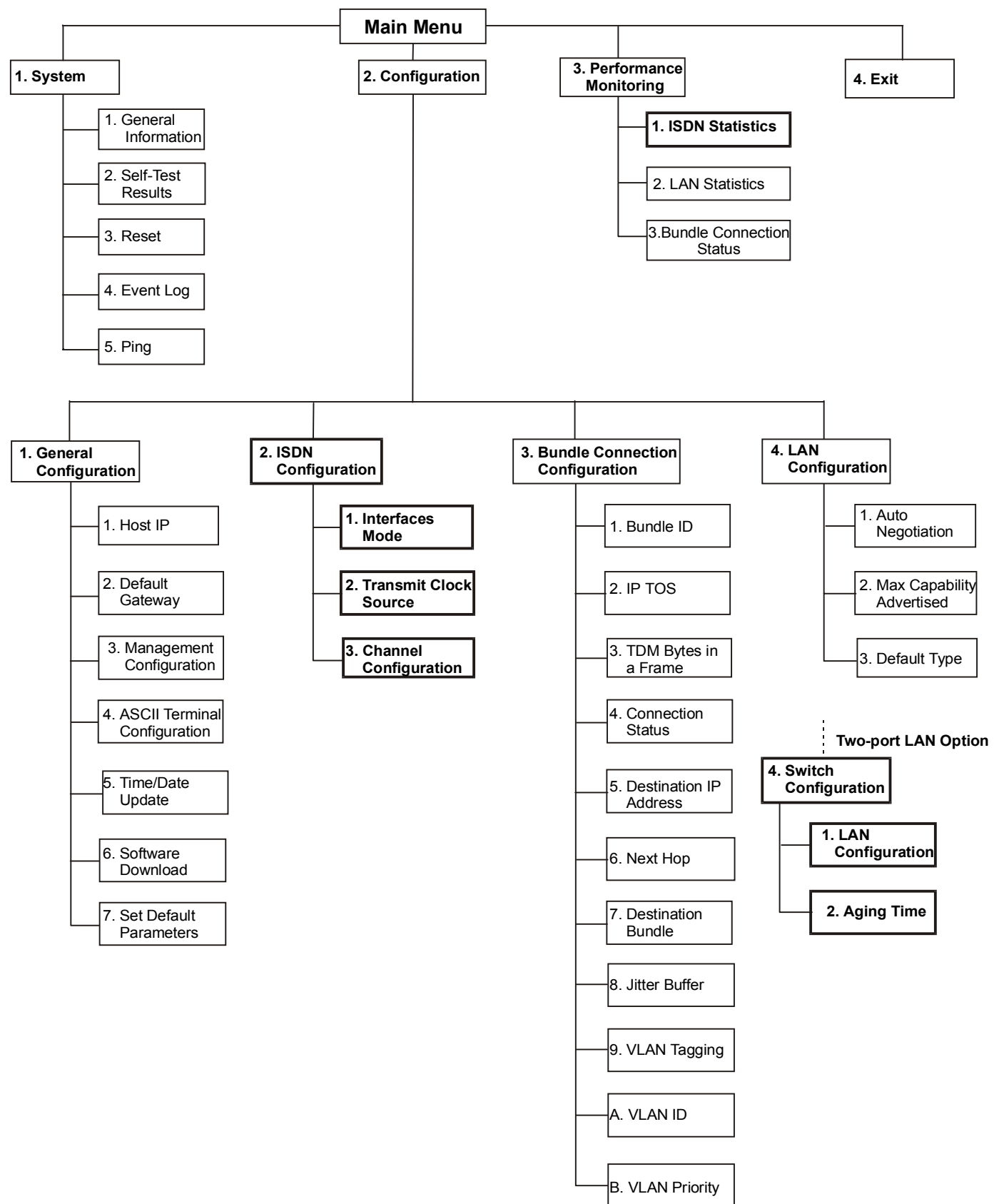


Figure 3-6. IPmux-1E ISDN-S Terminal Menu Tree

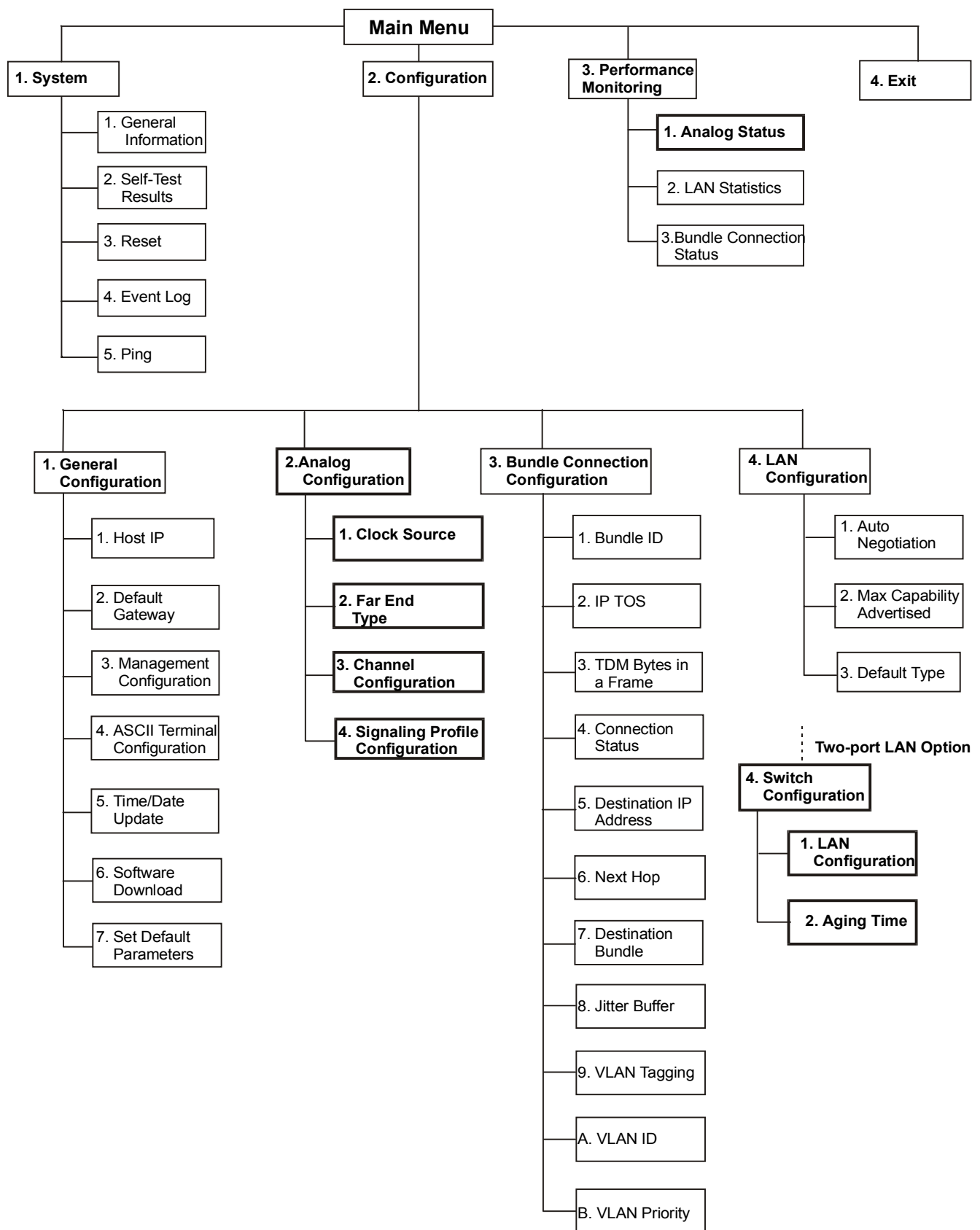


Figure 3-7. IPmux-1E FXS Terminal Menu Tree

Main Menu

Figure 3-8 shows the IPmux-1/1E Main Menu. Access all system configuration and control functions via this menu.

At any point and from any screen, you can press **<Esc>** repeatedly, backing up until you reach the main menu.

You exit the program only from this menu. In order to prevent unauthorized access, it is recommended that when you finish a session, you return to the Main Menu and type **4** to exit the program. A password is then required for reentry.

```

                                MAIN MENU
1.System                          >
2.Configuration                    >
3.Performance Monitoring           >
4.Exit
Select item from the menu:        -
Use keys <1> to <4>

```

Figure 3-8. IPmux-1/1E Main Menu

The Main Menu options are:

- | | |
|----------------------------------|-----------------------------------|
| 1. System | View and modify system parameters |
| 2. Configuration | Define system configuration |
| 3. Performance Monitoring | Monitor system performance |
| 4. Exit | Exit the control software |

System Menu

Main Menu
↓
1. System

► **To access the System menu:**

- Type **1** (System) in the **Main Menu**.

From the System menu you can view and configure the following options:

- | | |
|-------------------------------|---|
| 1. General Information | View IPmux-1/1E general information. |
| 2. Self-Test Results | Review self-test results obtained during system power-up. |
| 3. Reset | Reset IPmux-1/1E. |
| 4. Event Log | View a list of IPmux-1/1E events. |
| 5. Ping | Ping other network devices. |

These options are explained in full detail in *Appendix E*.


```

                                SYSTEM
1. General Information
2. Self-Test Results
3. Reset
4. Event Log >
5. Ping

ESC. Exit

Select item from the menu.

```

Figure 3-9. System Menu

Setting IPmux-1/1E Configuration Options

► To access the Configuration menu:

- Type **2** (Configuration) in the **Main Menu**.

Main Menu



2. Configuration

The IPmux-1/1E Configuration menu is shown in *Figure 3-10*.

The IPmux-1E ISDN-S Configuration menu is shown in *Figure 3-11*.

The IPmux-1E FXS Configuration menu is shown in *Figure 3-12*.

```

                                CONFIGURATION
1. General Configuration
2. E1/T1 Configuration
3. Bundle Connection Configuration
4. LAN Configuration
5. DS0 Bundle Configuration

ESC. Exit

Select item from the menu: _

```

Figure 3-10. IPmux-1/1E Configuration Menu

```

                                CONFIGURATION
1. General Configuration
2. ISDN Configuration
3. Bundle Connection Configuration
4. LAN Configuration

ESC. Exit

Select item from the menu: _

```

Figure 3-11. IPmux-1E ISDN-S Configuration Menu

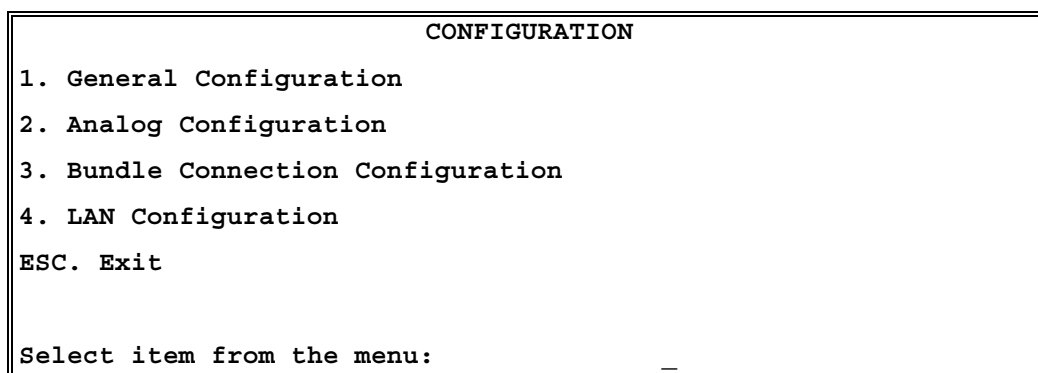


Figure 3-12. IPmux-1E FXS Configuration Menu

From the Configuration menu you can view and configure the following options:

- | | |
|---|--|
| 1. General Configuration | Configure Host IP, Default Gateway, ASCII Terminal Configuration, Time/Date update, and Default parameters, and download software updates. |
| 2. E1/T1/ISDN/FXS Configuration | E1/T1, ISDN, or FXS physical layer configuration. |
| 3. Bundle Connection Configuration | Configure Connection parameters: Configure IP ToS, TDM bytes/frame and VLAN tagging. |
| 4. LAN Configuration | Ethernet physical layer configuration. |
| 5. DS0 Bundle Configuration | Configure TS assignment to the bundle (only for IPmux-1). |

Specific parameters are explained in *Appendix E*.

Note *DS0 Bundle Configuration is only available in IPmux-1.*

Performance Monitoring

- **To view Performance Statistics:**
 - Type 3 (Performance Monitoring) in the **Main** menu.

Typical menus are shown in *Figure 3-13*, *Figure 3-14*, and *Figure 3-15*.

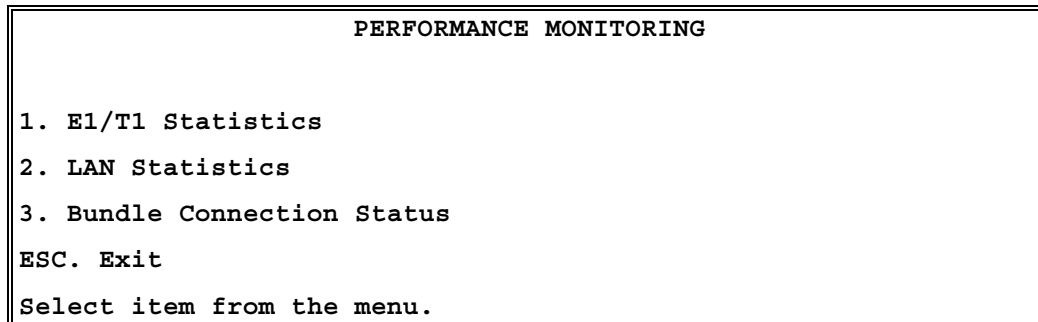


Figure 3-13. Performance Monitoring Menu for IPmux-1

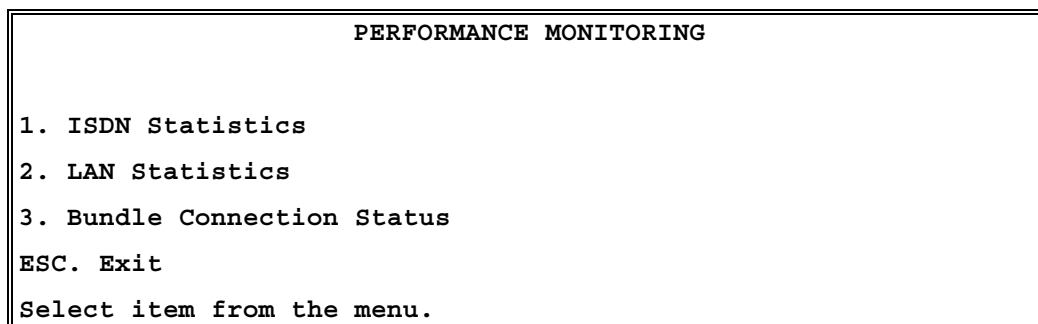


Figure 3-14. Performance Monitoring Menu for IPmux-1E ISDN-S

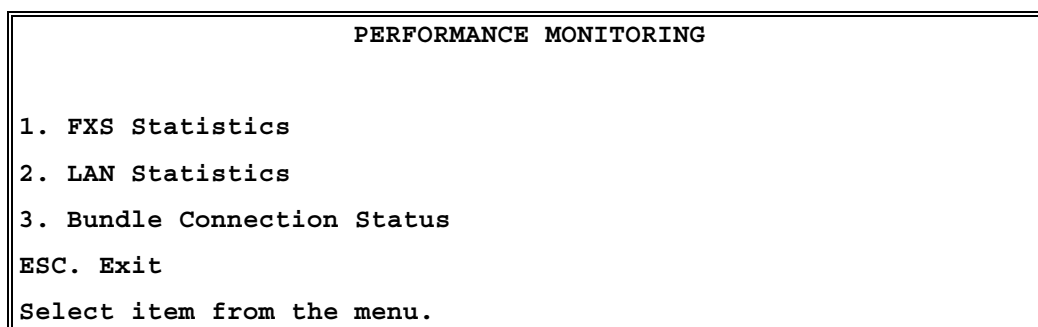


Figure 3-15. Performance Monitoring Menu for IPmux-1E FXS

From the Performance Monitoring menu you can view:

- 1. E1/T1/ ISDN/ Analog Statistics** Statistics for E1/T1, ISDN, or FXS.
- 2. LAN Statistics**
- 3. Bundle Connection Status**

Further details for specific parameters are explained in *Appendix E*.

Chapter 4

Troubleshooting and Diagnostics

This chapter describes how to:

- Detect errors
- Troubleshoot problems
- Perform diagnostic tests.

4.1 Error Detection

Using Front Panel LEDs

LED indicators on the front panel IPmux-1/1E indicate the operating status of the module. The LED indicators are described in *Chapter 3* of this manual.

Working with the Alarm Buffer

IPmux-1/1E maintains an Event Log File. All events are time-stamped. The user can view the contents of the Event Log File via an ASCII terminal or a Telnet Session. The user can also clear the contents of the Log File.

Table 4-1 presents the event types that appear on the Event Log File alphabetically, as well as the actions required to correct the event (alarm) indication.

To correct the reported problem, perform corrective actions in the given order until the problem is corrected. If the problem cannot be fixed by carrying out the listed actions, IPmux-1/1E **MUST** be checked by the **authorized** technical support personnel.

Table 4-1. Event Types

| Event | Description | Corrective Action |
|-------------------|--|---|
| COLD_START | The IPmux-1/1E has been powered up | None |
| PWR_ACTIVE | IPmux-1/1E power supply unit is powered on | None |
| FATAL_ERR | IPmux-1/1E has encountered an internal fatal error | The IPmux-1 requires servicing |
| SYS_USER_RESET | IPmux-1/1E was reset by the user | None |
| LOS_START | IPmux-1 has a LOS (loss of signal) state on its E1/T1 port | 1. Check the port cable connection 2. Check input signal |
| LOS_END | The LOS state detected has ended | |
| LOF_START | IPmux-1 has a LOF (Loss of frame synchronization) state on its E1/T1 port | 1. Check port cable connection 2. Check input signal |
| LOF_END | The LOF state detected has ended | None |
| LINE_AIS_START | IPmux-1 has AIS (alarm indicator signal) state on its E1/T1 port | Check for a fault at the PDH network, on the receive direction |
| LINE_AIS_END | The line AIS state detected has ended | None |
| LINE_RDI_START | IPmux-1 has LINE RDI (remote defect indicator) state on its E1/T1 port | Check for a fault at the E1/T1 connectivity on the transmit direction |
| LINE_RDI_END | The LINE RDI state detected has ended | None |
| LINE_FEBE_START | IPmux-1 has LINE FEBE state on its E1/T1 port | Check for errors in the E1/T1 connection on the transmit direction |
| LINE_FEBE_END | The LINE FEBE state detected has ended | None |
| REMOTE_FAIL_START | Ethernet frames are not received by the remote IPmux-1 on the specified connection | Check Eth/IP path |
| REMOTE_FAIL_END | Remote fail state has ended | None |
| LOCAL_FAIL_START | Ethernet frames are not received by the local IPmux-1 on the specified connection | Check Eth/IP path |
| LOCAL_FAIL_END | Local fail state has ended | None |

4.2 Troubleshooting

Table 4-2 presents the event types as they appear on the Event Log File and lists the actions required to correct the event (alarm) indication.

Table 4-2. IPmux-1 Troubleshooting Chart

| Fault | Probable Cause | Remedial Action |
|---|--|---|
| E1/T1 equipment connected to IPmux-1 is not synchronized with IPmux-1/1E. | Configuration problems Physical layer problems | <ol style="list-style-type: none"> 1. Check cables and physical connectivity. 2. Check IPmux-1 E1/T1 configuration and, if necessary, other IPmux-1 parameters. 3. Check E1/T1 physical connection (use loopbacks). |
| Slips and errors in E1/T1/BRI/FXS equipment | <ul style="list-style-type: none"> • Ethernet port in switch and IPmux-1 are not in the same rate or duplex mode • Ethernet port is set to work in half duplex mode (may cause extreme PDV because of collisions and backoffs) • Timing configuration is not properly set (periodic buffer under/overflows shown on IP channel status menu) • Deactivation employed by NT when IPmux is TE and in loopback timing mode • Network PDV or lost frames | <ol style="list-style-type: none"> 1. Check E1/T1 physical connection (use loopbacks). 2. Check timing settings according to explanation in this manual. 3. Check switch and IPmux-1 port configuration (negotiation, rate, duplex mode) 4. Check PDV introduced by the network, and, if necessary, increase PDVT jitter buffer setting. 5. Check NT deactivation (BRI). |
| Echo in voice | High delay in voice path | <ol style="list-style-type: none"> 1. Check network delay and try to decrease it. 2. Try to decrease PDVT (jitter) buffer. |

4.3 Diagnostic Tests

Maintenance capabilities include external and internal loopbacks.

E1/T1

External Loop

IPmux-1 can be set to an external loop to test the connection between the E1/T1 port and the PBX (refer to *Chapter 3*). In this mode, data coming from the PBX is both looped back to the PBX and transmitted forward to the IP network (see *Figure 4-1*).

This mode can also be achieved by a T1 FDL line loopback command.

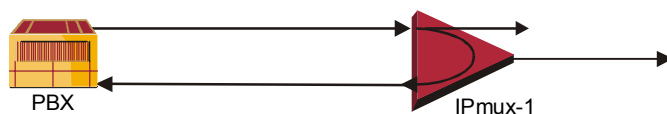


Figure 4-1. IPmux-1 External Loop

Internal Loop

The E1/T1 module can be set to an internal loop to test the connection between the E1/T1 port and the IP network (refer to *Chapter 3*). In this mode (E1/T1 only), data coming from the IP network is both looped back to the IP network and an AIS pattern is transmitted forward to the PBX connected to the E1/T1 port (see *Figure 4-2*).

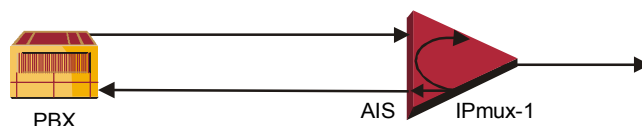


Figure 4-2. IPmux-1 Internal Loop

► To run a loopback test:

- Press the **<Spacebar>** on your keyboard to toggle between the values: **Internal/External /Disable**.
 - Internal: Data received from the IP network side is looped back to the network transmit line. An unframed all '1' code (AIS) is transmitted in the E1 Tx path toward the PBX. Incoming data from the PBX is ignored.
 - External: Data received from the PBX at the receive E1 line is looped back to the E1 Tx path (toward the same PBX), and continues its way to the IP network. Data coming from the IP network is ignored.
 - Disable: No loopback. Regular operation.

Default value: **Disable**

Main Menu
↓
2. Configuration
↓
2. E1/T1
Configuration
↓
**3. Loopback
State**

BRI

External Loop

An external loop on IPmux-1E can be set to test the ISDN "S" line (*Figure 4-3*). The test is performed on B channels only.

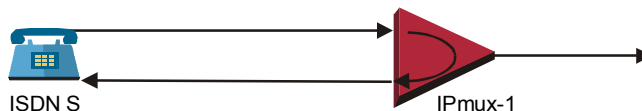


Figure 4-3. IPmux-1E/BRI External Loop

Internal Loop

An internal loop on IPmux-1E can be set to test the ISDN "S" line (*Figure 4-4*). The test is performed on B channels only.

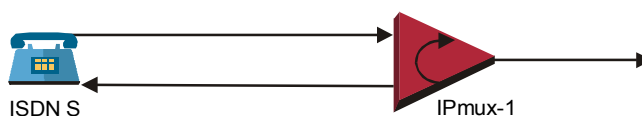


Figure 4-4. IPmux-1E/BRI Internal Loop

Main Menu
 ↓
 2. Configuration
 ↓
 2. ISDN Configuration
 ↓
 3. Channel Configuration
 ↓
 1. Choose Channel
 ↓
3. Loopback State

➤ **To run a loopback test:**

- Press the <Spacebar> on your keyboard to toggle between the values: **Internal/External /Disable**.
 - Internal: Data received from the IP network side is looped back to the network transmit line.
 - External: Data received from the PBX at the receive ISDN S line is looped back to the ISDN S Tx path (toward the same PBX). Data coming from the IP network is ignored.
 - Disable: No loopback. Regular operation.

Default value: **Disable**

FXS

Main Menu
 ↓
 2. Configuration
 ↓
 2. ISDN Configuration
 ↓
 3. Channel Configuration
 ↓
 1. Choose Channel
 ↓
5. Testing

Remote Loopback

You can set a remote loopback analog signal, per port, in IPmux-1E with FXS interface. The analog signal is looped back towards the IP network.

Tone Injection

A 1 kHz tone, per port, is injected towards the local telephone set.

➤ **To run a test:**

- Press the <Spacebar> on your keyboard to toggle between the values: **Remote Loopback/Tone Injection/Disable**.

Default value: **Disable**

Chapter 5

Application Configuration Procedures

This appendix provides detailed instructions for setting up a test application using IPmux-1 and IPmux-4. The application can be used as an optional test setup for an IPmux unit, or can be used as a quick reference guide for basic configuration of an IPmux unit.

5.1 Overview

Application

The section provides detailed instructions for configuring an IPmux-1 unit opposite an IPmux-4 unit in a point-to-multipoint application including configuration via a supervisory terminal (see *Figure 5-1*).

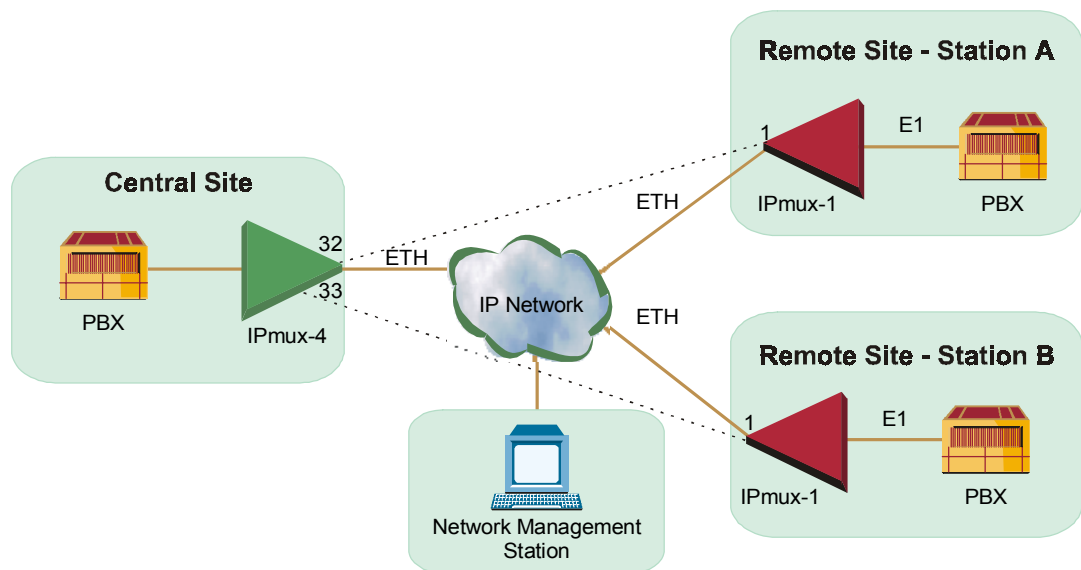


Figure 5-1. IPmux-1 Operating Opposite IPmux-4

Guidelines

Certain guidelines/assumptions for configuring IPmux-1 working opposite IPmux-4 that are relevant to this application are explained below.

IP Configuration

- The IP network can consist of either switches or routers. The minimum requirement is 10M full duplex. Hubs or any half-duplex environments should not be used.
- Each IPmux should be given an IP Address and a Default Gateway (if a routed network is used).

E1/T1 Configuration

- TDM traffic will be sent between the central IPmux-4 and the two remote IPmux-1 units at Station A and Station B over the IP network.
- The TDM traffic can either be generated by a BER tester connected to the IPmux units or by a PABX. If a BER tester is connected to IPmux-4, a physical loop can be inserted in the remote IPmux-1 E1 port to avoid using more BER testers.
- The TDM equipment connected to the central IPmux-4 should be the clock source for the whole application (i.e. it will operate in internal mode). The two other TDM devices connected to IPmux-1 receive the clock from the Tx path of the IPmux-1 units.
- Set the TDM device's E1 parameters in accordance with the E1 parameters of the IPmux units connected to them. For details, see *Table 5-1* and *Table 5-2*, and the E1/T1 Configuration on the following pages.
- On the IPmux-4, only E1 port 2 will be used to connect to the remote IPmux-1 units.

Creating Bundles and Connections

- After IP addresses and E1 parameters have been configured, create bundles on each IPmux, followed by connections between the bundles.
- A bundle is a group of timeslots, encapsulated in UDP over IP over ETH frames, which is sent over the IP network between the IPmux units. A bundle can include between 1 and 31 timeslots for E1, and 1 to 24 for T1. IPmux-1 can only be configured for 1 bundle. IPmux-4 can be configured to have up to $31 \times 4 = 124$ bundles for E1 or $4 \times 24 = 96$ for T1. Each configured bundle is given a Bundle Number that indicates to which E1 channel it belongs, according to *Table 5-1*.

Table 5-1. Bundle Configuration

| E1 Channel | Bundle Number for E1 | Bundle Number for T1 |
|------------|----------------------|----------------------|
| 1 | 1-31 | 1-24 |
| 2 | 32-62 | 25-48 |
| 3 | 63-93 | 49-72 |
| 4 | 94-124 | 73-96 |

- A bundle containing 10 timeslots will be created on each IPmux-1 unit. Two bundles, each containing 10 timeslots, will be created on IPmux-4.
- Bundle 1 on IPmux-1/Station A will be connected to Bundle 32 on IPmux-4. Bundle 1 on IPmux-1/Station B will be connected to Bundle 33 on the central IPmux-4.

Configuration Summary Table

Table 5-2. Configuration Summary

| Device | E1 Parameters | Bundle Creation | Bundle Connection |
|-----------|---|---|------------------------------|
| IPmux-1/A | Clock: Adaptive CRC: Disabled CAS: Disabled | Bundle No. 1 Timeslots in Bundle: 1-10 | 1→IPmux-4/32 |
| IPmux-1/B | Clock: Adaptive CRC: Disabled CAS: Disabled | Bundle No. 1 Timeslots in Bundle: 1-10 | 1→IPmux-4/33 |
| IPmux-4 | Clock: Loopback CRC: Disabled CAS: Disabled | Bundle No. 32 Timeslots in Bundle: 1-10 Bundle No. 33 Timeslots in Bundle: 11-20 | 32→IPmux-1/A 33→IPmux-1/B |

Perform initial configuration of IPmux-1 and IPmux-4 via a standard ASCII terminal connected to the IPmux-1 control port. However, after performing the initial configuration (Host IP Address and Default Gateway), you can manage IPmux-1 and IPmux-4 using any of the following options:

- Use the terminal as a supervisory terminal, for performing all the management activities supported by IPmux-1/4
- Manage IPmux-1/4 from any IP host using the Telnet protocol. After establishing a Telnet session with IPmux-1, the Telnet protocol offers the same functionality as the supervisory terminal, and in addition enables remote access over IP networks.

- Manage IPmux-1/4 by means of SNMP-based network management stations, e.g., the RADview network management station offered by RAD.

Changing Parameters

- Use the <Spacebar> on your keyboard to toggle between options in the menus, and then save.
- Press <Enter> after entering a new parameter, such as the IP address, and then save by pressing **S**.
- At any point and from any screen, you can press <Esc> repeatedly, backing up until you reach the Main menu.

Checking Connectivity

After the configuration has been completed, several tests should be performed in order to verify proper connectivity. For testing procedures see *Section 5.5*.

5.2 IPmux-1

Powering-up

➤ **To turn on IPmux-1:**

1. Make sure all IPmux-1 cables and connectors are properly connected.
2. Connect IPmux-1 to a PC equipped with an ASCII terminal-emulation application (for example, Windows 95 Hyper Terminal or Procomm).
3. Turn on the control-terminal PC and set its default port parameters to **19,200 baud, 8 bits/character, No Parity, 1 stop bit**.
4. Set the terminal emulator to **ANSI VT100** emulation (for optimal view of system menus).
5. Switch ON the POWER supply switch, located on the rear panel.

When the initialization and self-test are over, a menu appears displaying initialization and self-test results. If the self-test is successful, the **RDY LED** on the left side of the front panel lights up.

➤ **To logon:**

1. Press <Esc> to open the configuration software.
2. Enter your User Name as Supervisor (**su**) and press <Enter>.
3. Enter your Password (the factory-set password is **xxxxxxxxxx**).

Note *If the password is invalid in three consecutive attempts, the system becomes inaccessible for 15 minutes.*

Configuring IPmux-1 – Station A

Procedure for Modifying Parameters

➤ **To modify parameters:**

1. Choose the number of the parameter to be changed.
2. Press the **<Spacebar>** to toggle through the possible values.
3. Select the desired value by pressing **<Enter>**.
4. When you have finished modifying all the parameters on a menu, press **<S>** to save the configuration.
5. To return to a previous menu, press **<Esc>**.

Host IP Address

Note *Frames will not leave the device until IP and Mask addresses are defined.*

Main Menu
↓
2. Configuration
↓
1. General Configuration
↓
1. Host IP

➤ **To configure the Host IP Address:**

1. From the **Main** menu, select **2 Configuration**.
2. From the Configuration menu select **1 General Configuration**.
3. From the **General Configuration** menu, press **1 Host IP** (see *Figure 5-2*).
4. Enter the Host IP Address and Mask.
5. Press **<Esc>** a few times back to the **General Configuration** menu.

Note *Remember to press **<Enter>** after modifying each parameter. Press **<S>** to save all changes on the menu.*

| HOST IP | |
|----------------------------|----------------|
| 1. IP Address | 192.168.100.11 |
| 2. IP Mask | 255.255.255.0 |
| ESC. Exit | S.Save |
| Select item from the menu. | |

Figure 5-2. Host IP Menu

E1/T1 Configuration

► To configure E1/T1:

Main Menu
↓
2. Configuration
↓
2. E1/T1
Configuration

1. From the **Main** menu, select **2 Configuration**.
2. From the **Configuration** menu select **2 E1/T1 Configuration** (see *Figure 5-3*).
3. Select Transmit Clock and choose Adaptive.
4. Select Line Type and choose CRC4 Disable.
5. Select Signaling Mode and choose CAS Disable.
6. Press <S> to save the configuration.
7. Press <Esc> a number of times to return to the **Configuration** screen.

Note

Remember to press <Enter> after modifying each parameter. Press <S> to save all changes on the menu.

```

                                E1/T1 CONFIGURATION
1. Channel Status                Enable
2. Transmit Clock Source         Adaptive
3. Loopback State                Disable
4. Rx. Sensitivity               -10dB
5. Line Type                     CRC4 Disable
6. Idle Code                     7E
7. Signaling Mode                CAS Disable
8. Cond. Data pattern            FF
9. Cond. Cas <ABCD> pattern      01

ESC. Exit
Select item from the menu.

```

Figure 5-3. E1/T1 Configuration Menu

DS0 Bundle Configuration

► To create the bundles:

Main Menu
↓
2. Configuration
↓
5. DS0 Bundle
Configuration

1. From the **Configuration** menu select **5 DS0 Bundle Configuration** (see *Figure 5-4*).
2. Select Time slot number and enter 1 – 10.
3. Select Time slot Current Status and choose Set.
4. Press <S> to Save.
5. Press <Esc> to return to the **Configuration** screen.

Note Remember to press <Enter> after modifying each parameter. Press <S> to save all changes on the menu.

```

                                DS0 BUNDLE CONFIGURATION
1. Bundle ID                      1
2. Time Slot Number                1-10
3. Time Slot Current Status        Set

ESC. Exit

ACTIVE TIME SLOTS IN THIS BUNDLE:  1-10
FREE TIME SLOTS:                   11,12,13,14,15,
                                    16,17,18,19,20,21,22,23,24,25,26,27,28,29,30,31
Select item from the menu.

```

Figure 5-4. DS0 Bundle Configuration Menu

Bundle Connection Configuration

► To link the bundles to IPmux-4:

Main Menu
↓
2. Configuration
↓
**3. Bundle
Connection
Configuration**

1. From the **Configuration** menu select **3 Bundle Connection Configuration** (see Figure 5-5).
2. Select Connection Status and choose Enable.
3. Select **Destination IP Address** and enter the IP Address of IPmux-4.
4. Select **Next Hop** and enter the next hop router IP address (this parameter is only necessary if the Destination IP Address is not in the same subnet as this IPmux. In such cases the Ethernet frame will be sent to the next hop IP address).
5. Select **Destination Bundle** and enter **32** (which is the destination bundle on IPmux-4).
6. Press <Esc> a few times to return to the **Main** menu.

Note Remember to press <Enter> after modifying each parameter. Press <S> to save all changes on the menu.

| BUNDLE CONNECTION CONFIGURATION | |
|--|----------------|
| 1. Bundle ID | 1 |
| 2. IP TOS | Empty! |
| 3. TDM Bytes in Frame | 48 |
| 4. Connection Status | Empty! |
| 5. Destination IP Address | 192.168.200.10 |
| 6. Next Hop | Empty! |
| 7. Destination Bundle | Empty! |
| 8. Jitter Buffer<x10 μsec> rounded up 1000 μsec steps! | 3 ms |
| 9. VLAN Tagging | Empty! |
| 10. VLAN ID | Empty! |
| 11. VLAN Priority | Empty! |
| ESC. Exit | |
| Select item from the menu. | |

Figure 5-5. Bundle Connection Configuration

Note *TDM Bytes in Frame* and *Jitter Buffer* are automatically set to default values: 48 for TDM Bytes, 3 ms for Jitter Buffer.

Configuring IPmux-1 – Station B

Power-up in the same manner as for IPmux-1 Station A.

Host IP Address

Note *Frames will not leave the device until IP and Mask addresses are defined.*

Main Menu
↓
2. Configuration
↓
1. General Configuration
↓
1. Host IP

➤ **To configure the Host IP Address:**

1. From the **Main** menu, select **2 Configuration**.
2. From the **Configuration** menu select **1 General Configuration**.
3. From the **General Configuration** menu, press **1 Host IP** (refer to *Figure 5-2*).
4. Enter the **Host IP Address** and **Mask**.
5. Press <Esc> a few times back to the **General Configuration** menu.

Note Remember to press <Enter> after modifying each parameter. Press <S> to save all changes on the menu.

E1/T1 Configuration

Main Menu
↓
2. Configuration
↓
**2. E1/T1
Configuration**

► To configure E1/T1:

1. From the **Main** menu, select **2 Configuration**.
2. From the **Configuration** menu select **2 E1/T1 Configuration** (refer to Figure 5-3).
3. Select Transmit Clock and choose Adaptive.
4. Select Line Type and choose CRC4 Disable.
5. Select Signaling Mode and choose CAS Disable.
6. Press <S> to save the configuration.
7. Press <Esc> a number of times to return to the **Configuration** screen.

Note Remember to press <Enter> after modifying each parameter. Press <S> to save all changes on the menu.

DS0 Bundle Configuration

Main Menu
↓
2. Configuration
↓
**5. DS0 Bundle
Configuration**

► To create the bundles:

1. From the Configuration menu select **5 DS0 Bundle Configuration** (refer to Figure 5-4).
2. Select Time slot number and enter 1 – 10.
3. Select Time slot Current Status and choose Set.
4. Press <S> to Save.
5. Press <Esc> to return to the **Configuration** screen.

Note Remember to press <Enter> after modifying each parameter. Press <S> to save all changes on the menu.

Bundle Connection Configuration

Main Menu
↓
2. Configuration
↓
**3. Bundle
Connection
Configuration**

► To link the bundles to IPmux-4:

1. From the Configuration menu select **3 Bundle Connection Configuration** (refer to Figure 5-5).
2. Select Connection Status and choose Enable.
3. Select **Destination IP Address** and enter the IP Address of IPmux-4.

4. Select **Next Hop** and enter the next hop router IP address (this parameter is only necessary if the Destination IP Address is not in the same subnet as this IPmux. In such cases the Ethernet frame will be sent to the next hop IP address).
5. Select **Destination Bundle** and enter **33** (which is the destination bundle on IPmux-4).
6. Press <Esc> to return to the **Bundle Connection Configuration** screen.
7. Press <Esc> to return to the **Main** screen.

Note Remember to press <Enter> after modifying each parameter. Press <S> to save all changes on the menu.

5.3 IPmux-4

Powering-up

➤ **To turn on IPmux-4:**

1. Make sure all IPmux-4 cables and connectors are properly connected.
2. Connect IPmux-4 to a PC equipped with an ASCII terminal-emulation application (for example, Windows 95 Hyper Terminal or Procomm).
3. Turn on the control-terminal PC and set its default port parameters to **19,200 baud, 8 bits/character, No Parity, 1 stop bit**.
4. Set the terminal emulator to **ANSI VT100** emulation (for optimal view of system menus).
5. Switch ON the POWER supply switch, located on the rear panel.
6. When the initialization and self-test are over, a menu appears displaying initialization and self-test results. If the self-test is successful, the **RDY LED** on the left side of the front panel lights up.

➤ **To logon:**

1. Press <Esc> to open the configuration software.
2. Enter your User Name as Supervisor (**su**) and press <Enter>.
3. Enter your Password (the factory-set password is **xxxxxxxxxx**).

Note If you enter an invalid password in three consecutive attempts the system becomes inaccessible for 15 minutes.

Configuration

Host IP Address

Note *Frames will not leave the device until IP and Mask addresses are defined.*

- | | |
|---|--|
| Main Menu ↓ 2. Configuration ↓ 1. General Configuration ↓ 1. Host IP | <p>➤ To configure Host IP Address:</p> <ol style="list-style-type: none"> 1. From the Main menu, select 2 Configuration. 2. From the Configuration menu select 1 General Configuration (refer to <i>Figure 5-2</i>). 3. From the General Configuration menu, press 1. 4. Enter the Host IP Address and Mask. 5. Press <Esc> a few times back to the General Configuration menu. |
|---|--|

Note *Remember to press <Enter> after modifying each parameter. Press <S> to save all changes on the menu.*

E1/T1 Configuration

- | | |
|--|---|
| Main Menu ↓ 2. Configuration ↓ 3. E1/T1 Configuration ↓ 2. Channel Number Configuration ↓ 1. Physical Layer Configuration | <p>➤ To configure E1/T1:</p> <ol style="list-style-type: none"> 1. From the Configuration menu select 3 E1/T1 Configuration. 2. The Channel Number Configuration menu appears, press 2 (to choose Channel Number 2). 3. The E1/T1 Configuration menu appears, press 1 Physical Layer Configuration (see <i>Figure 5-6</i>). 4. Select Transmit Clock Source and chose Loopback. 5. Select Channel Type and choose CRC4 Disable. 6. Select Signaling Mode and choose CAS Disable. 7. Press <Save>. 8. Press <Esc> to exit the Physical Layer Configuration menu and return to the E1/T1 Configuration menu. |
|--|---|

Note *Remember to press <Enter> after modifying each parameter. Press <S> to save all changes on the menu.*

| PHYSICAL LAYER CONFIGURATION | |
|---|--------------|
| 1. Channel Status | Enable |
| 2. Transmit Clock Source | Loopback |
| 3. Loopback State | Disable |
| 4. Rx. Sensitivity | -10dB |
| 5. Channel Type | CRC4 Disable |
| 6. Idle Code | 7E |
| 7. Signaling Mode | CAS Disable |
| 8. Cond. Data pattern | FF |
| 9. Cond. CAS (ABCD) pattern | 01 |
| ESC. Exit | |
| Current port is the USER PORT, Channel #2 | |
| Select item from the menu. | |

Figure 5-6. Physical Layer Configuration Menu

DS0 Bundle Configuration

► To configure DS0 Bundles for Station A:

Main Menu
↓
2. Configuration
↓
2. DS0 Bundle Configuration

1. From the **Configuration** menu select **2 DS0 Bundle Configuration** (refer to *Figure 5-4*).
2. From the **DS0 Bundle Configuration** menu, press **1**.
3. Select **Bundle ID** and type **32**.
4. Select Time slot number type 1–10.
5. Select Time slot Current Status and choose SET.
6. Press <S> to Save.

Note Remember to press <Enter> after modifying each parameter. Press <S> to save all changes on the menu.

► To configure DS0 Bundles for Station B:

1. From the **DS0 Bundle Configuration** menu, press **1** (refer to *Figure 5-4*).
2. Select **Bundle ID** and type **33**.
3. Select Time slot number type 11–20.
4. Select Time slot Current Status and choose SET.
5. Press <S> to Save.
6. Press <Esc> to return to the **Configuration** menu.

Note Remember to press <**Enter**> after modifying each parameter. Press <**S**> to save all changes on the menu.

Bundle Connection Configuration

Main Menu
↓
2. Configuration
↓
**5. Bundle
Connection
Configuration**

► To link the bundles to IPmux-1 Station A:

1. From the **Configuration** menu select **5 Bundle Connection Configuration** (see Figure 5-7).
2. Select **Bundle ID** and enter **32**.
3. Select Connection Status and choose Enable.
4. Select **Destination IP Address** and enter the IP Address of IPmux-1 Station A.
5. Select **Next Hop** and enter the next hop router IP address (this parameter is only necessary if the Destination IP Address is not in the same subnet as this IPmux. In such cases the Ethernet frame will be sent to the next hop IP address).
6. Select **Destination Bundle** and enter **1** (which is the destination bundle on IPmux-1 Station A).
7. Press <**S**> to save the configuration.
8. Press <**Esc**> to return to the **Bundle Connection Configuration** screen.

Note

1. Remember to press <**Enter**> after modifying each parameter. Press <**S**> to save all changes on the menu.
2. **TDM Bytes in Frame** and **Jitter Buffer** are automatically set to default values: 48 for TDM Bytes, 3 ms for Jitter Buffer.

Main Menu
↓
2. Configuration
↓
**5. Bundle
Connection
Configuration**

► To link the bundles to IPmux-1 Station B:

1. From the **Configuration** menu select **5 Bundle Connection Configuration** (see Figure 5-7).
2. Select **Bundle ID** and enter **33**.
3. Select Connection Status and choose **Enable**.
4. Select **Destination IP Address** and enter the IP Address of IPmux-1 Station B.
5. Select **Next Hop** and enter the next hop router IP address (this parameter is only necessary if the Destination IP Address is not in the same subnet as this IPmux. In such cases the Ethernet frame will be sent to the next hop IP address).
6. Select **Destination Bundle** and enter **1** (which is the destination bundle on IPmux-1 Station B).
7. Press <**S**> to save the configuration.

8. Press <Esc> a few times to return to the **Main** menu.

Note

1. Remember to press <Enter> after modifying each parameter. Press <S> to save all changes on the menu.
2. **TDM Bytes in Frame** and **Jitter Buffer** have been automatically set to default values: 48 for TDM Bytes, 3 ms for Jitter Buffer.

| BUNDLE CONNECTION CONFIGURATION | | |
|---------------------------------|--------------|-----------------------|
| 1. Bundle ID | 32 | |
| 2. Connection State | Enable | |
| 3. Destination IP Address | 192.168.10.1 | |
| 4. Next Hop | 0.0.0.0 | |
| 5. Destination Bundle | 1 | |
| 6. Jitter Buffer(x10usec) | 300 | |
| ESC. Exit | D. Delete | N. Next |
| Select item from the menu. | | Total used bundles: 1 |

Figure 5-7. Bundle Connection Configuration in IPmux-4

5.4 Configuring the Management Option

To configure this application for RADview or an SNMP management station perform the following steps on each station of IPmux-1 and IPmux-4.

Authentication/Community

➤ **To configure Authentication/Community:**

1. From the **Management Configuration** menu, press **1 Authentication/Community** menu (see Figure 5-8).
2. Select Authentication Failure Trap and choose On.
3. Select **Trap** and choose **Public**.
4. Select **Read** and choose **Public**.
5. Select **Write** and choose **Public**.
6. Press <S> to save the configuration.
7. Press <Esc> to return to the **Management Configuration** menu.

Main Menu
↓
2. Configuration
↓
1. General Configuration
↓
3. Management Configuration
↓
1. Authentication/Community

Note Remember to press **<Enter>** after modifying each parameter. Press **<S>** to save all changes on the menu.

| AUTHENTICATION/COMMUNITY MENU | |
|--------------------------------|--------|
| 1. Authentication Failure Trap | On |
| 2. Trap | Public |
| 3. Read | Public |
| 4. Write | Public |
| ESC> Exit | |
| Select item from the menu: | |

Figure 5-8. Authentication/Community Menu

Note Verify that your **Read** and **Write** communities on the NMS match the ones on IPmux-1/4.

Manager List

► To configure the Manager in IPmux-1/4:

Main Menu
↓
2. Configuration
↓
1. General Configuration
↓
3. Management Configuration
↓
2. Manager List

1. From the Management Configuration menu, press **2 Manager List** (see Figure 5-9).
2. Enter the **Manager IP Address** (the Manager IP Address in Figure 5-9 is used as an example. Choose the Manager IP Address of your application).
3. Select **Status Change Trap** according to your application requirements (for details refer to *Manager List* in the *IPmux-4 manual*).
4. Select **Alarm Trap** according to your application requirements (for details refer to *Manager List* in the *IPmux-4 manual*).
5. Select **System Trap** according to your application requirements (for details refer to *Manager List* in the *IPmux-4 manual*).
6. Press **<S>** to save the configuration.
7. Press **<Esc>** a few times to return to the **Main** menu.

Note Remember to press **<Enter>** after modifying each parameter. Press **<S>** to save all changes on the menu.

| MANAGER LIST | | |
|----------------------------|---------|--------------|
| 1. Manager IP Address | | 192.114.35.1 |
| 2. Status Change Trap | | On |
| 3. Alarm Trap | | On |
| 3. System Trap | | Off |
| ESC. Exit | S. Save | N. Next |
| Select item from the menu. | | |

Figure 5-9. Manager List Menu

Note

If you set **Alarm Trap** to **Off** no Alarm Trap will be sent, regardless of the mask defined in the Alarm Trap Mask screen. For further details refer to Manager List in the IPmux-4 or IPmux-1 manual.

Main Menu
↓
2. Configuration
↓
1. General Configuration
↓
3. Management Configuration
↓
3. Alarms Trap Mask

Alarms Trap Mask**► To configure the Alarms Trap Mask:**

1. From the **Management Configuration** menu, press **3 Alarms Trap Mask** (see Figure 5-10).
2. Select **Trap Status** and choose a value according to your application requirements (for details refer to *Alarms Trap Mask* in the *IPmux-4 manual*).

| ALARMS TRAP MASK | | |
|---------------------|---------|--------|
| 1. Alarm ID | | 1 |
| 2. Trap Status | | Active |
| ESC. Exit | S. Save | |
| ACTIVE ALARM TRAPS: | | |

Figure 5-10. Alarms Trap Mask Menu

Default Gateway

If the Manager is not on the same subnet as IPmux-4, configure the Default Gateway.

Main Menu
↓
2. Configuration
↓
1. General Configuration
↓
2. Default Gateway

► To configure the Default Gateway:

1. From the **General Configuration** menu, press **2 Default Gateway** (see Figure 5-11).
2. Enter the Gateway IP Address.

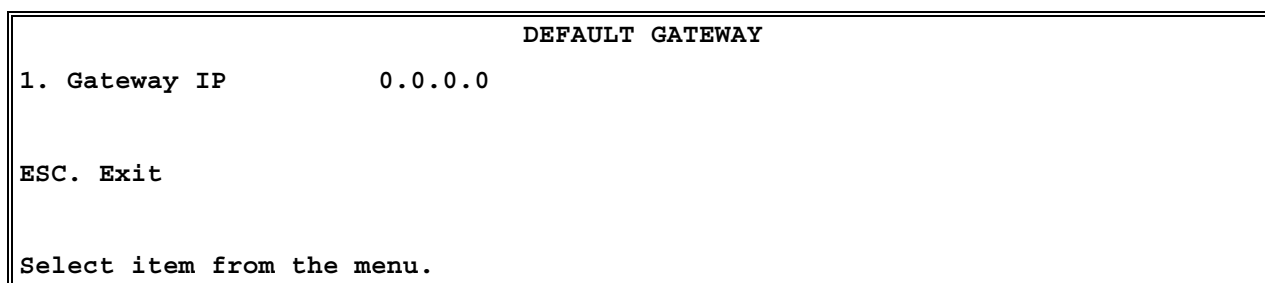


Figure 5-11. Default Gateway Menu

5.5 Checking the Application

Once you have finished configuring all the IPmux units, there are several levels on which to check the application:

1. Use the IPmux Statistics
2. Check the TDM equipment statistics and functionality.

Using IPmux Statistics – Step 1

► **To check the application using IPmux Statistics:**

1. Select the **Performance Monitoring** menu in IPmux-4.
2. Select the **Bundle Connection Status** menu and verify that the connectivity status is OK, and that you don't have any sequence errors, underflows or overflows rising. Verify this for both Bundle 32 and Bundle 33.
3. If the connectivity status is not OK (either local or remote failure):
 - Check that all cables and physical connections on the IP side are OK.
 - Check that the Bundle Connection configuration was properly made.
 - Check that the IP Addresses and Default Gateways are configured correctly.
4. If you have sequence errors and underflows:
 - Check under **LAN Statistics** that your Ethernet connection is full duplex. If it is detected as half duplex, this could indicate that a problem exists in the Auto-negotiation mechanism between IPmux and the switch/router. In this case, set both devices to Auto-negotiation Disable, default type on IPmux to full duplex, and either 10M or 100M, according to the switch/router capability.
 - Check under LAN Statistics that only the correct frames and correct octets are received and transmitted. If other counters are rising, check the physical connection of the IP side (cables, switch/router port, etc.).
5. If you have underflows or overflows at set intervals of time:
 - Check that all IPmux units are configured to the correct clock modes.
 - Check that the TDM device is configured to the correct clock mode.

6. If you have underflows or overflows at non-set intervals of time:
 - Try to gradually increase the jitter buffer size.
 - Check that there are no E1alarms (such as LOS or LOF), through the IPmux E1/T1 Statistics. If problems do exist on the E1/T1 level, check both physical connections (cables and E1 ports) and E1/T1 parameter configuration compatibility between the TDM equipment and the IPmux units (such as CRC and CAS Enable/Disable).
 - Check that the Bundle connection configuration was made correctly.

For further information, see the IPmux *Troubleshooting and Diagnostics* chapter.

Using TDM Equipment Statistics and Functionality – Step 2

After you have verified all the issues in *Step 1*, make the following checks.

1. Check that there are no alarms or BER on the TDM equipment.
2. If you are using a PABX check voice quality. IF echo exists, verify that you haven't configured the jitter buffer size to be too large (remember that the initial configuration should be 3 ms, unless it is required to be larger due to problems seen under the *Bundle Connection Status*).

Appendix A

Boot Sequence for Downloading Software

A.1 General

This chapter provides a description of the IPmux-1/1E boot procedure via an ASCII terminal for downloading software.

The IPmux-1/1E software is stored in flash memory in two sections, in the boot sector and in the file system. The boot sector holds a boot program that calls up the rest of the program from the file system.

The file system can hold two compressed copies of the IPmux-1/1E code. One copy is called the operating file, and the other is called the backup file. The operating file is the default-executable IPmux-1/1E code. The backup file is used whenever the operating file is absent or corrupted.

A.2 Booting IPmux-1/1E

General

IPmux-1/1E boots up automatically. After powering up, no user intervention is required, except when the user wants to access the file system to modify or update the software or the IPmux-1/1E configuration.

Boot Sequence

The following is a description of the boot sequence. If the system is working normally, the entire process is completed within 30 seconds. Refer to *Figure A-1*.

```
BOOT Program V 1.21 7-1-2001 08:35
Flash : size 3e0000h, FileSys sectors 62
BOOT Program is running !!!
Checking File System.....-> exists.
Backup file EXIST
Operating file EXIST
Press Cntl-A within 3 seconds to get File-System Menu !!!
FileName: ipmux1.bin
#clcod code: V 2.00 8-9-2000 11:58
got start addr : 100000
Decompression-process.....
Decompression Ended !!!
Jumping to Application, addr = 100008.
```

Figure A-1. Boot Screen

1. The boot program searches for the operating file in the file system.
 - If the file exists, a message appears on the screen and the program continues.
 - If the file does not exist, the boot program searches for the backup file, renames the file to **Operating** file (a message appears on the screen) and continues.
 - If there is no backup file, you must download a file via the out-of-band interface (XMODEM protocol). The received file is saved as the operating file in the file system.
2. Files in the file system are compressed and automatically decompressed into the RAM memory before execution begins. A message appears on the screen.
3. After decompression, the IPmux-1/1E software starts to execute and the user can begin working.

Accessing the File System

The file system menu is an option that allows the user to perform basic file transfer operations. These operations are all optional.

If an operating file exists in the file system, there is a three-second delay.

➤ **To access the file system;**

- Press <Cntl-A> within this delay interval

The File System menu is displayed (see *Figure A-2*). .

Note *If you do not press <Cntl-A> within three seconds, booting continues normally.*

```
IPmux-1/1E BOOT MENU

The device can store two software files in its File System.
One is called Operating file and the Second is called Backup file.
Operating file           EXIST
Backup file              EXIST
Configuration file       EXIST

0. Exit
1. File swap: Operating↔Backup
2. Download NEW Operating file
  (existing Operating file will be saved as Backup)
3. Delete Operating file
  (existing Backup file will be saved as Operating)
4. Delete Configuration file
9. Delete ALL FileSystem (Software and Configuration files)
Type in one of the above option numbers (or <ESC> to exit) :
```

Figure A-2. File System Menu

From the File System menu, you can:

- Exchange the operating and backup files.
- Download a new operating file; the previous operating file is saved as the backup file.
- Delete the operating file; the backup file becomes the operating file.
- Delete the configuration file.
- Delete all the software and configuration files.

If you choose to exchange or delete a file, you are prompted for confirmation.

Appendix B

Telnet

B.1 General

Telnet, which stands for Telecommunications Network, is a protocol that gives you the ability to connect to a remote machine, by giving commands and instructions interactively to that machine, thus creating an interactive connection. In such a case, the local system becomes transparent to the user, simulating a direct connection to the remote computer. The commands typed by the user are transmitted directly to the remote machine and the response from the remote machine is displayed on the user's monitor screen. It is possible to manage the IPmux-1/1E inband via remote ASCII Terminal using the Telnet IP protocol.

B.2 Using Telnet to Manage the IPmux-1/1E

Starting a Telnet Session

IPmux-1/1E is normally controlled by an ASCII terminal emulation application running on an OS. To control IPmux-1/1E using Telnet, you must first open a Telnet application on a local PC.

See *Figure B-1* for an example of a Telnet logon dialog box. The Telnet application present on the user's computer may vary in appearance, but will have similar fields.

► **To open a Telnet application:**

1. In the **Host Name** field, type the IP number of the IPmux-1/1E.
2. In the **Port** field, choose the Telnet option.
3. In the **TermType** field, choose the ANSI option.
4. Click **Connect**.
5. When prompted, type a valid username and password. The Telnet session is now active.

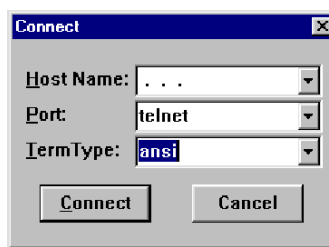


Figure B-1. Telnet Logon Dialog

Telnet Operation

Telnet and ASCII terminal cannot be active at the same time.

If a terminal is active, a Telnet session cannot be established.

► **To establish a Telnet session:**

- Exit the terminal by selecting Exit in the Main menu.

If the auto-disconnect is ON, the terminal will be disconnected automatically after 15–30 minutes if no characters were sent (see the ASCII terminal Configuration Menu – Appendix E).

Terminal management has priority over Telnet, if a Telnet session is active and a user logs on to the terminal, the Telnet session will be disconnected and the terminal will be the active form of management.

Parameters set to default values via Telnet will not erase the Host and Default Gateway parameters, to prevent a loss of connectivity.

Note

When configured to default values from the terminal, Host and Default Gateway parameters will be optionally erased. The user can configure to default parameters and then decide to keep/erase the Host and Default Gateway.

System Security

A user name and password is required to log on and initiate a Telnet session.

- The Terminal session exits to the password screen and the Telnet session disconnects after 15 to 30 minutes of inactivity.

Note

The inactivity time-out feature may be deactivated via the ASCII Terminal Configuration window.

Main Menu ⇒ Configuration ⇒ General Configuration ⇒ ASCII Terminal Configurations, menu line 4: 15 Minute Timeout)

Appendix C

SNMP Management

Appendix C provides specific information for IPmux-1/1E management by SNMP (Simple Network Management Protocol).

The SNMP management functions of IPmux-1/1E are provided by an internal SNMP agent. The SNMP management communication uses UDP (User Datagram Protocol), which is a connectionless-mode transport protocol, part of the IP (Internet Protocol) protocol suite.

This appendix covers the information related to the SNMP environment.

C.1 SNMP Environment

SNMP Principles

The SNMP management protocol is an asynchronous command-response polling protocol. All management traffic is initiated by the SNMP-based network-management station, which addresses the managed entities in its management domain. Only the addressed managed entity answers the polling of the management station (except for trap messages).

The managed entities include a function called an SNMP agent, which is responsible for interpretation and handling of the management station requests to the managed entity, and the generation of properly formatted responses to the management station.

SNMP Operations

The SNMP protocol includes four types of operations:

- **getRequest:** Command for retrieving specific management information from the managed entity. The managed entity responds with a **getResponse** message.
- **getNextRequest:** Command for retrieving sequentially specific management information from the managed entity. The managed entity responds with a **getResponse** message.
- **setRequest:** Command for manipulating specific management information within the managed entity. The managed entity responds with a **getResponse** message.
- **trap:** Management message carrying unsolicited information on extraordinary events, which are events that occurred not in response to a management operation reported by the managed entity.

Management Information Base (MIB)

The MIB includes a collection of managed objects. A managed object is defined as a parameter that can be managed, such as a performance statistics value. The MIB includes the definitions of relevant managed objects. Various MIBs can be defined for various management purposes or types of equipment.

An object definition includes the range of values (also called instances) and the following access rights:

- **Read-only:** Instances of that object can be read, but cannot be set.
- **Read-write:** Instances of that object can be read or set.
- **Write-only:** Instances of that object can be set, but cannot be read.
- **Not accessible:** Instances of that object cannot be read, or set.

MIB Structure

The MIB has an inverted tree-like structure, with each definition of a managed object forming one leaf, located at the end of a branch of that tree.

Each leaf in the MIB is reached by a unique path. Thus, by numbering the branching points starting with the top, each leaf can be uniquely defined by a sequence of numbers.

The formal description of the managed objects and the MIB structure is provided in a special standardized format, called ASN.1 (Abstract Syntax Notation 1). Since the general collection of MIBs can also be organized in a similar structure, under IAB (Internet Activities Board) supervision, any parameter included in a MIB that is recognized by the IAB is uniquely defined.

To provide the flexibility necessary in a global structure, MIBs are classified in various classes (branches). One is the experimental branch and another the group of private (enterprise-specific) branch.

Under the private enterprise-specific branch of MIBs, each enterprise (manufacturer) can be assigned a number, which is its enterprise number. The assigned number designates the top of an enterprise-specific sub-tree of non-standard MIBs. Within this context, RAD has been assigned the enterprise number **164**. Therefore, enterprise MIBs published by RAD can be found under **1.3.6.1.4.1.164**.

MIBs of general interest are published by the IAB in the form of a Request for Comment (RFC) document. In addition, MIBs are also often assigned informal names that reflect their primary purpose. Enterprise-specific MIBs are published and distributed by their originator, who is responsible for their contents.

MIBs Supported by the IPmux-1/1E SNMP Agent

The interpretation of the relevant MIBs is a function of the SNMP agent of each managed entity. The general MIBs supported by the IPmux-1/1E SNMP agent are:

- rfc1213.mib (except the interfaces view which is supported via RFC 2233)
- ianaiftype.mib (defines the ifType)

- rfc2233.mib (IF-MIB)
- rfc1493.mib
- rfc2665.mib
- rfc1907.mib
- rfc2493.mib
- ces.mib
- rfc2127 (ISDN-MIB)
- rfc2495.mib (except Far End objects and RW configuration objects which are different for each configuration) - replaces RFC 1406; which is now obsolete.
- rfc2494.mib
- rfc2239.mib
- IP-MUX RAD private mib

The IPmux-1 object id is

iso (1).org(3).dod(6).internet(1).private(4).enterprises(1).rad(164).radGen(6).systems(1).radSysIPMux(3).IPmux1(82)

The IPmux-1E object id is

iso (1).org(3).dod(6).internet(1).private(4).enterprises(1).rad(164).radGen(6).systems(1).radSysIPMux(3).IPmux1E(84)

Enterprise-specific MIBs supported by RAD equipment, including IPmux-1/1E6, are available in ASN.1 format from the RAD Technical Support Department.

Management Domains under SNMP

In principle, SNMP allows each management station that recognizes the MIBs supported by a device to perform all the management operations available on that device. However, this is not desirable in actual practice, it is necessary to provide a means to delimit management domains.

SNMP Communities

SNMP delimits management domains by defining communities. Each community is identified by a name, which is an alphanumeric string of up to 255 characters defined by the user.

The IPmux-1/1E SNMP agent defines strings of up to 10 characters (case sensitive, numeric and alphabetical).

Any SNMP entity (both managed entities and management stations) is assigned a community name by its user. In parallel, the user defines a list of the communities for each SNMP entity that are authorized to communicate with the entity, and the access rights associated with each community (this is the SNMP community name table of the entity).

In general, SNMP agents support two types of access rights:

Read-Only: The SNMP agent accepts and processes only SNMP **getRequest** and **getNextRequest** commands from management stations which have a Read-Only community name.

Read-Write: The SNMP agent accepts and processes all the SNMP commands received from a management station with a Read-Write community name.

Authentication

In accordance with SNMP protocol, the SNMP community of the originating entity is sent in each message.

When an SNMP message is received by the addressed entity, it first checks the originator's community. Messages with community names not included in the SNMP community names table of the recipient are discarded. SNMP agents of managed entities usually report this event by means of an authentication failure trap.

The SNMP agents of managed entities evaluate messages originated by communities appearing in the agent's SNMP community names table in accordance with the access rights, as previously explained. Thus, a **setRequest** for a MIB object with read-write access rights will nevertheless be rejected if it comes from a management station whose community has read-only rights with respect to that particular agent.

Network Management Stations

The IPmux-1/1E SNMP agent stores the IP address of the Network Management Station (NMS) that is intended to manage it.

Appendix D

TFTP Download Procedures

D.1 Inband TFTP Download Procedure

General

New IPmux-1/1E software version can be downloaded to the IPmux-1/1E using TFTP. There are three possible procedures:

- Users who access IPmux using Telnet can perform software download and configuration upload/download using the configuration screens. For details, see Download/Upload using TFTP (see *Appendix E*).
- Users who have access to the RADview Network Management – for more details refer to *RADview-HPOV Network Management System for IP Applications*.
- Users who access a MIB browser – the TFTP downloading procedure is illustrated in *Figure D-1*.

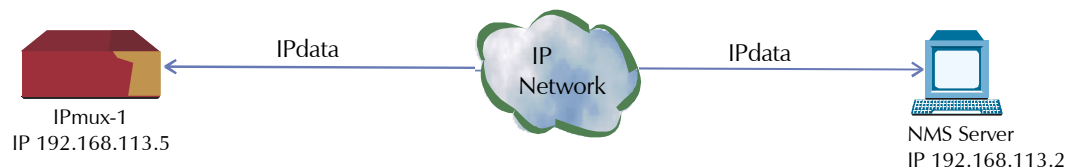


Figure D-1. TFTP Downloading Procedure



Warning

The IPmux-1 manager station must be equipped with a TFTP server and the new software.

The procedures in this chapter should be performed only by a UNIX expert.

► To start download:

1. Set the appropriate IPmux-1/1E MIB parameter. IPmux-1/1E then sends requests to the TFTP server (where the new software resides) and receives packets of data.
2. If there is no TFTP server available to the main manager, assign a station where there is a TFTP server installed. This server becomes a secondary manager. In this case, the main manager only initiates the download process (by setting the MIB parameter), which is then performed between IPmux-1/1E and the TFTP server.

Preliminary Procedure

► Before performing TFTP download:

1. Ping IPmux-1/1E from the station running the TFTP server to ensure that IPmux-1/1E has communication with the machine.
2. Log in as **SUPERUSER (su)**.
3. Edit the file named **inetd.conf** found at the **/etc** directory, as follows:
 - Search for the line starting with a **#** sign followed by **tftp**, for example, **# tftp** and delete the **#** sign.
 - At the end of that line, there is **-S <directory name>**.
In **<directory name>** specify only the path to the file that is to be downloaded to the IPmux-1; for example, **/export/home/demo/tftp**.
4. Save modified file **inetd.conf** and **INIT** the Unix machine; for example, in Solaris type **init 0** (not the same for SunOS or IRIX or HP-Unix).
5. After the Station reboots, type **ovw &** to open **HPOV**.
6. Open the MIB Browser under **MISC → SNMP MIB BROWSER**.
7. Type **iso.org.dod.internet.private.enterprises.rad.radGen.agnt.filetranster**; The Browse MIB window showing the Agent IP and Server IP addresses is displayed.

The fields in are:

- **fileServerIP**: Specify the IP address of the TFTP server where the software file resides.
- **fileName**: Specify the file name containing the new software version, including any path to the file. This name must be under the root directory where the TFTP server was initiated. The name can be up to 12 characters in length; for example, **anteappl.cmp**.
- **fileTransCmd**: Set this parameter to **sw download** (Entry Number 1) to start software download.
- **tftpRetryTimeOut**: Specify the desired time interval, in seconds, between retries (default = 15).
- **tftpTotalOut**: Specify the retry duration, in seconds (default = 60).
- Set the MIB Instance field to **0** (zero).

Downloading should take between 60 to 120 seconds.

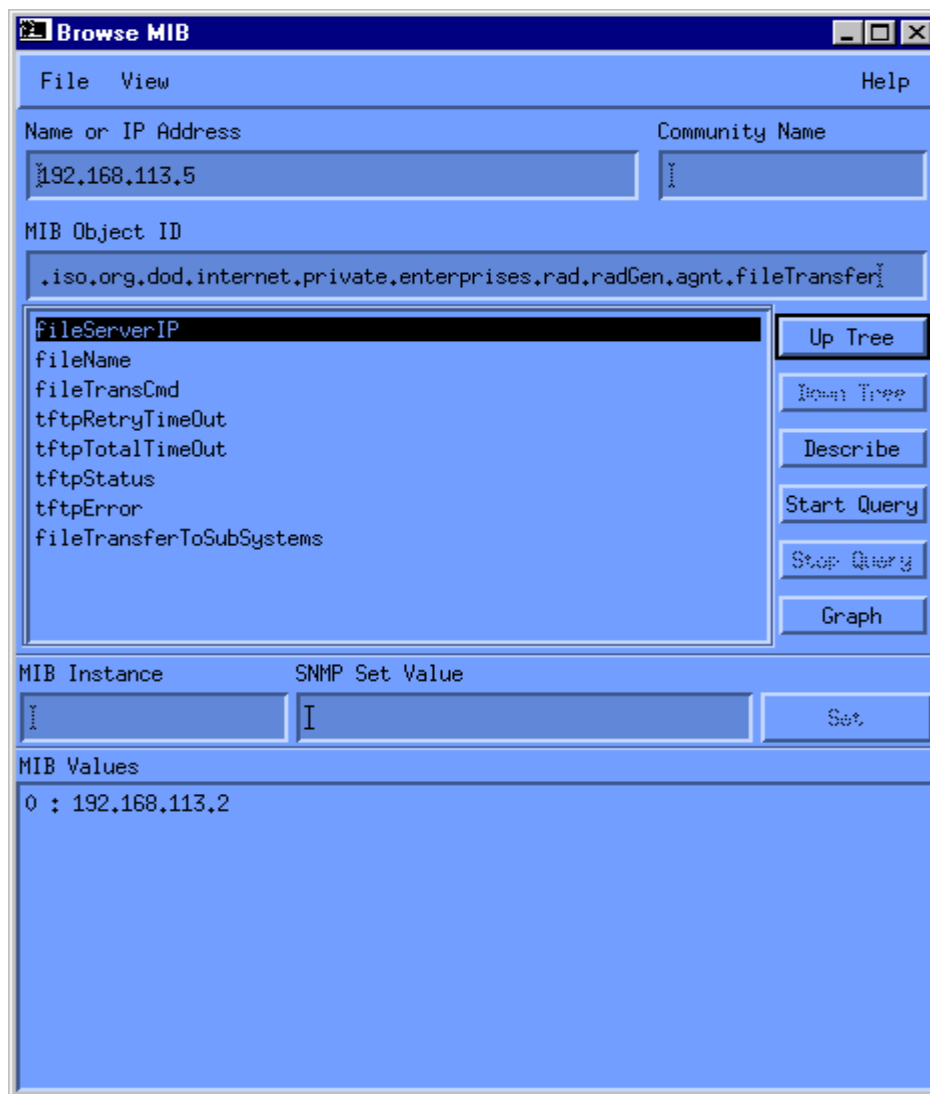


Figure D-2. Agent and Server IP Addresses

Checking the Download

► **To check the download:**

1. Log on the MIB Browser again, as follows: iso.org.dod.internet.mgmt.mib-2.system.sysDescr; the MIB Browser window showing the system description is displayed (see *Figure D-3*).
2. Press <**Start Query**>.
3. Scroll right to check that the application version you have just loaded is the correct one.

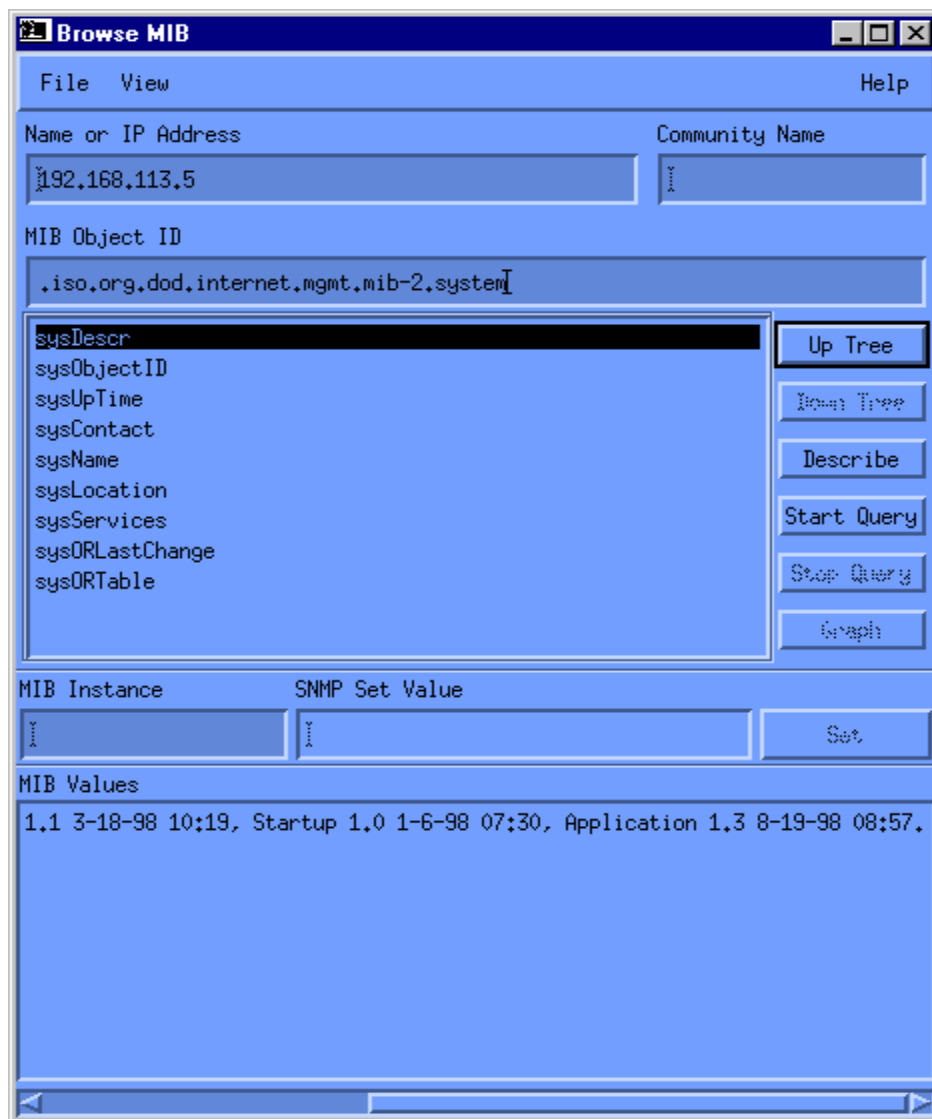


Figure D-3. System Description

Appendix E

Parameters and Screens

This appendix illustrates the IPmux-1/1E screens and explains the parameters for:

- Main Menu in *Section E.1*
- Viewing the IPmux-1/1E System in *Section E.2*
 - General Information
 - Self-Test Results
 - Reset
 - Logfile Events
 - Ping
- General Configuration in *Section E.3*
 - Host IP
 - Default Gateway
 - Authentication/Community
 - Manager List
 - Alarm Traps Mask
 - ASCII Terminal Configuration
 - Time/Date Update
 - Download/Upload Using Xmodem
 - TFTP
 - Set Default Parameters
- IPmux-1 E1/T1 Configuration in *Section E.4*
 - E1 Configuration
 - T1 Configuration
- IPmux-1E ISDN Configuration in *Section E.5*
 - ISDN Channel Configuration
- IPmux-1E Analog Configuration in *Section E.5*
 - FXS Channel Configuration
- Signaling Profile Configuration in *Section E.6*
- Bundle Connection Configuration in *Section E.7*
- LAN Configuration (no User port) in *Section E.8*

- DSO Bundle Configuration in *Section E.9*
- Performance Monitoring in *Section E.10*
 - E1/T1 Statistics
 - ISDN Statistics in IPmux-1E with ISDN
 - FXS Statistics in IPmux-1E with FXS
 - LAN Statistics
 - Bundle Connection Statistics
- Ethernet Menus – two ports in *Section E.11*
 - General Information
 - LAN Configuration
 - Aging Time
 - LAN Statistics

E.1 Main Menu

The Main Menu options are:

- | | |
|----------------------------------|-----------------------------------|
| 1. System | View and modify system parameters |
| 2. Configuration | Define system configuration |
| 3. Performance Monitoring | Monitor system performance |
| 4. Exit | Exit the control software |

The following sections in this appendix explain the parameters in each of the menu options.

```
                                MAIN MENU
1.System                        >
2.Configuration                 >
3.Performance Monitoring       >
4.Exit
Select item from the menu: _
Use keys <1> to <4>
```

Figure E-1. IPmux-1/1E Main Menu

E.2 Viewing the IPmux-1/1E System

General Information

Main Menu



1. System

Menu



**1. General
Information**

This screen displays information including software and hardware versions and module descriptions.

A typical General Information window is shown:

- IPmux-1 E1/T1 in *Figure E-2*
- IPmux-1E ISDN-S in *Figure E-3*
- IPmux-1E FXS in *Figure E-4*.

| GENERAL INFORMATION | | |
|--------------------------------|------------------|---------------|
| Software Version | Hardware Version | Inventory No. |
| Boot: 1.21 7-1-2001 08:35 | HW:0.0 | 236946 |
| Application: 2.00 9-4-01 12:02 | | |
| Backup: 2.00 9-4-01 12:02 | | |
| Interface Description | | |
| E1 over UTP | | |
| ETHERNET over UTP | | |
| Press ESC to exit | | |

Figure E-2. General Information Window

| GENERAL INFORMATION | | |
|--------------------------------|------------------|---------------|
| Software Version | Hardware Version | Inventory No. |
| Boot: 1.21 7-1-2001 08:35 | HW:0.0 | 314153 |
| Application: 2.00 9-4-01 12:02 | | |
| Backup: 2.00 9-4-01 12:02 | | |
| Interface Description | | |
| ISDN-S over UTP | | |
| ETHERNET over UTP | | |
| Press ESC to exit | | |

Figure E-3. General Information Window – ISDN

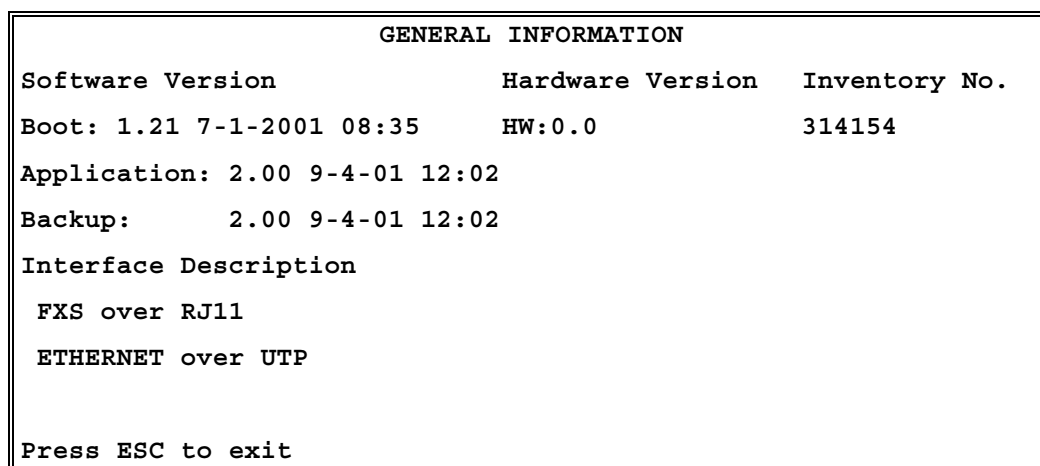


Figure E-4. General Information Window – FXS

Self-Test Results

Main Menu
↓
1. System Menu
↓
2. Self-Test Results

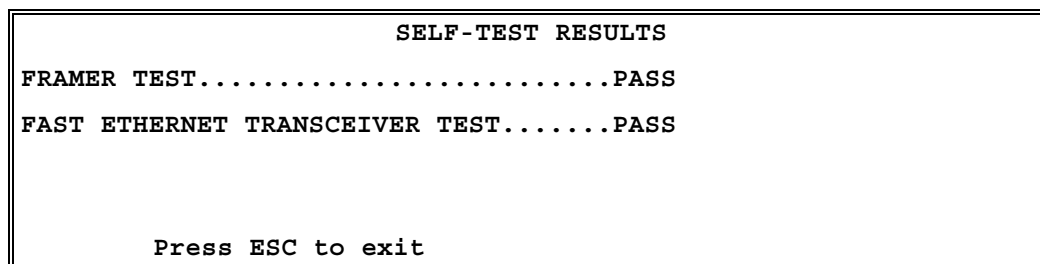


Figure E-5. Last Self-Test Results Window

► **For details:**

- Type **M**. If a problem is encountered refer to *Chapter 4*.

Table E-1. Last Self-Test Results Parameters

| Parameter | Possible Values | Remarks |
|--------------------------------|-----------------|---------|
| Framer Test | Pass, Fail | |
| Fast Ethernet Transceiver Test | Pass, Fail | |

Reset

Main Menu
↓
1. System Menu
↓
3. Reset

► **To reset the IPmux-1/1E configuration:**

1. Type **3** (Reset) in the **System Menu**.
A confirmation message appears.
2. Press **Y** to confirm System Reset for IPmux-1/1E.

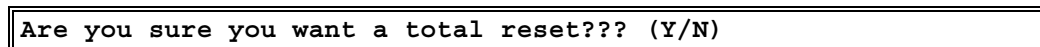


Figure E-6. Reset Confirmation Message

Logfile Events

Main Menu
↓
1. System Menu
↓
4. Event Log
↓
1. Read Logfile

| LOGFILE EVENTS | | | |
|------------------------|----------|------------|----------|
| 2053-08-07 | 00:01:20 | LOS START | TDM SLOT |
| 2053-08-07 | 00:01:20 | COLD START | |
| 2053-08-07 | 00:01:20 | LOS START | TDM SLOT |
| 2053-08-07 | 00:01:20 | COLD START | |
| 2053-08-07 | 00:01:20 | LOS START | TDM SLOT |
| 2053-08-07 | 00:01:20 | COLD START | |
| 2053-08-07 | 00:01:20 | LOS START | TDM SLOT |
| 2053-08-07 | 00:01:20 | COLD START | |
| ESC. Exit N. Next | | | |

Figure E-7. Logfile Events – Sample Menu

For the full Events List see *Chapter 4*.

Ping

Main Menu
↓
1. System Menu
↓
5. Ping

This option enables the user to ping other network devices for diagnostic purposes.

1. Enter the destination IP address and press **<Enter>**.
2. To determine the number of ping repetitions, use the **<Space bar>** and then press **<Enter>** to start pinging.

```

                                PING

Enter Destination IP And Press Enter.
Destination IP: 1.1.1.2
Use Space Bar to Choose Ping Repetitions
Ping Repetitions: Endless Repeats
Pinging.
-----
| Ping Result:Host 1.1.1.2 Request Timed Out |
| Ping Result:Host 1.1.1.2 Request Timed Out |
| Ping Result:Host 1.1.1.2 Request Timed Out |
| Ping Result:Host 1.1.1.2 Request Timed Out |
| Ping Result:Host 1.1.1.2 Request Timed Out |
| Ping Result:Host 1.1.1.2 Request Timed Out |
| Ping Result:Host 1.1.1.2 Request Timed Out |
| Ping Result:Host 1.1.1.2 Request Timed Out |
| Ping Result:Host 1.1.1.2 Request Timed Out |
| Ping Result:Host 1.1.1.2 Request Timed Out |
| Ping Result:Host 1.1.1.2 Request Timed Out |
| Ping Result:Host 1.1.1.2 Request Timed Out |
-----

Scrolling Up

ESC. Stop Pings

```

Figure E-8. Ping Dialog Box

E.3 General Configuration

Host IP

Main Menu
 ↓
 2. Configuration
 ↓
 1. General Configuration
 ↓
 1. Host IP

► To configure the Host IP address and IP Mask:

1. Type the IP Address.
2. Type the IP Mask.

```

                                HOST IP

1. IP Address 192.168.217.12
2. IP Mask    255.255.255.0

ESC. Exit
Select item from the menu:_

```

Figure E-9. Host IP Menu

► To change a configured Host IP:

- Set the device to the default settings.

Note

Frames are not sent until IP and Mask addresses are defined.

Default Gateway

- Main Menu
- ↓
- 2. Configuration
- ↓
- 1. General Configuration
- ↓
- 2. Default Gateway**

Default gateway defines the management *next hop*. When next hop is not defined for the bundle connection the default gateway address will be used.

- **To configure the default gateway:**
1. Type **2** (Default Gateway) in the **General Configuration** menu.
 2. Enter the **Default Gateway IP address**.

Note *The Default Gateway must be in the same subnet as the Host.*

Authentication/Community

- Main Menu
- ↓
- 2. Configuration
- ↓
- 1. General Configuration
- ↓
- 3. Management Configuration
- ↓
- 1. Authentication/Community**

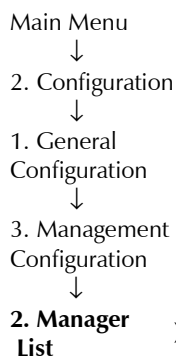
| AUTHENTICATION/COMMUNITY | |
|----------------------------------|--------|
| 1. Authentication Failure Trap | Off |
| 2. Trap | public |
| 3. Read | public |
| 4. Write | public |
| Select item from the menu. | |
| Use <Esc> key or keys <1> to <4> | |

Figure E-10. Authentication/Community Menu

Table E-2. Authentication/Community Parameters

| Parameter | Possible Values | Remarks |
|-----------------------------|----------------------------------|--|
| Authentication Failure Trap | On Off | On – an authentication-failure trap is generated when a system manager attempts to set a parameter within IPmux-1/1E with an incorrect community value |
| Trap | Up to 10 alphanumeric characters | The entry is case-sensitive |
| Read | Up to 10 alphanumeric characters | The entry is case-sensitive |
| Write | Up to 10 alphanumeric characters | The entry is case-sensitive |

Manager List



The Manager List window parameters are used when IPmux-1 inband management capability is used. The parameters define the parameters for up to eight managers. These parameters are:

- Manager IP address
- Host index

In addition, the Manager List window parameters configure the traps to be received by a manager. The default value for all traps is **Off**.

➤ **To access additional manager-list parameters:**

- Press <N> to go to the next Manager List window.

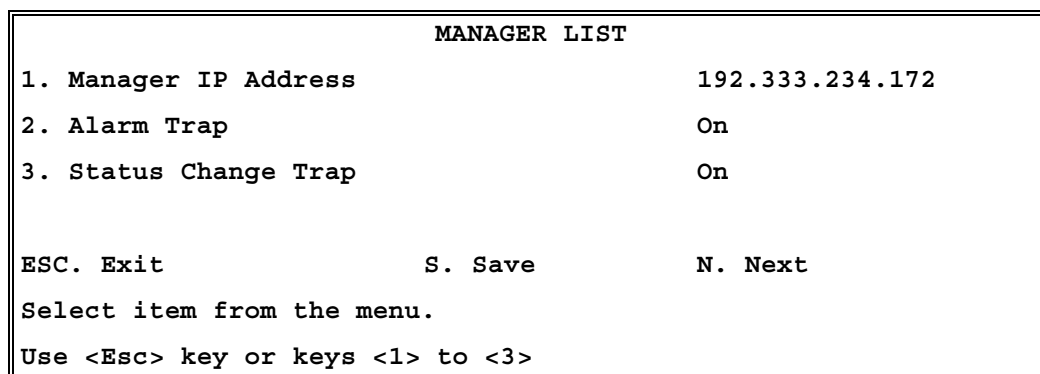


Figure E-11. Manager List Menu

Table E-3. Manager List Parameters

| Parameter | Possible Values | Function |
|--------------------|-----------------------------|--|
| Manage IP Address | 0.0.0.0. to 255.255.255.255 | Set the manager IP address |
| Alarm Trap | On | The alarm trap informs the manager of the occurrence of any alarm enabled in the Alarms Trap Mask screen. It informs the manager of both entry and exit from an alarm state. |
| | Off | No Alarm Trap will be sent regardless of the Mask defined in the Alarm Trap Mask screen |
| Status Change Trap | On | The status-change trap informs the manager that a LED indicator on the front panel has changed its indication. |
| | Off | No Status Change Trap will be sent |

Alarm Traps Mask

- Main Menu
- ↓
- 2. Configuration
- ↓
- 1. General Configuration
- ↓
- 3. Management Configuration
- ↓
- 3. Alarm Traps Mask**

Each of the IPmux-1/1E alarms can activate a trap toward the NMS. It is possible to enable/disable the trap operation for each one of the alarms, using the Alarm Trap Mask screen.

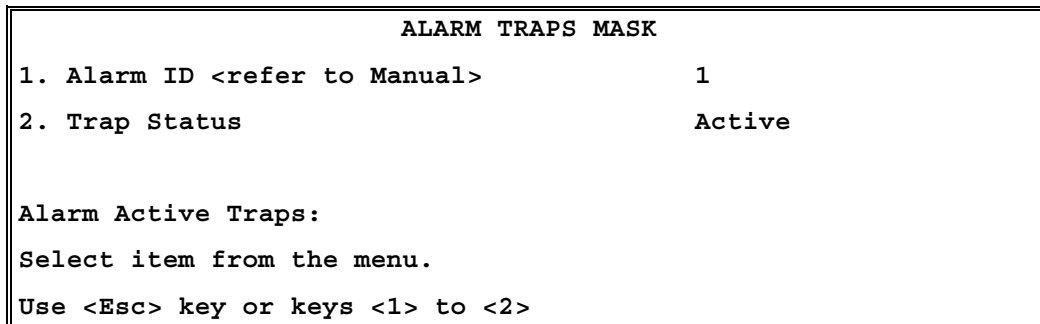


Figure E-12. Alarm Traps Mask Menu

Table E-4. Alarm Traps Mask Parameters

| Parameter | Possible Values | Remarks |
|-------------|------------------------|--------------------------------------|
| Alarm ID | 1, 2, 6, 8, 21, 26, 27 | IPmux-1/1E alarm |
| Trap Status | Active | Generates an alarm |
| | Masked | Does not send an alarm |
| | | Default for all traps: Masked |

Table E-5. IPmux-1/1E Alarms

| Alarm ID | Alarm Description | Trap Sent to NMS |
|----------|---|---|
| 1 | Loss of Signal (LOS Physical Layer) | Alarm LOS 1.3.6.1.4.1.164.6.1.3.0.7 |
| 2 | Loss of Frame (LOF Physical Layer) | Alarm LOF 1.3.6.1.4.1.164.6.1.3.0.8 |
| 6 | Alarm Indication Signal Received (AIS Line Physical Layer) | Alarm AIS 1.3.6.1.4.1.164.6.1.3.0.10 |
| 8 | Remote Defect Indication Received (RDI Line Physical Layer) | Alarm RDI 1.3.6.1.4.1.164.6.1.3.0.11 |
| 21 | Far End Block Error (FEBE Line Layer) | Alarm FEBE 1.3.6.1.4.1.164.6.1.3.0.12 |
| 26 | Local Connectivity Fail | Local Conn Status Trap 1.3.6.1.4.1.164.6.1.3.0.13 |
| 27 | Remote Connectivity Fail | Remote Conn Status Trap 1.3.6.1.4.1.164.6.1.3.0.14 |

Note The other alarms are not used.

ASCII Terminal Configuration

Main Menu
↓
2. Configuration
↓
1. General Configuration
↓
4. ASCII Terminal Config

ASCII TERMINAL CONFIGURATION

1. Display Mode Color
2. Baud Rate (bps) 19200
3. Change Password
4. 15 Min. Timeout On

ESC. Exit

NOTICE: Change the Baud Rate of the ASCII terminal after changing and saving of new Baud Rate data !

Select item from the menu: _
Use <Esc> key or keys <1> to <4>

Figure E-13. ASCII Terminal Configuration Menu

Table E-6. ASCII Terminal Configuration Parameters

| Name | Possible Values | Remarks |
|-----------------|--|--|
| Display Mode | Color MonoChrome 3 color MonoChrome 2 color | |
| Baud Rate | 9600, 19200, 38400, 57600, 115200 – in units of bps | Default: 19200 bps |
| Change Password | | Choose this option to enter a menu that allows the user to change the current password |
| 15 Min. Timeout | On, Off | On – terminal/Telnet exits to the password screen if no characters are sent by the terminal for 15 minutes |

Time/Date Update

Main Menu
↓
2. Configuration
↓
1. General Configuration
↓
5. Time/Date

TIME/DATE UPDATE

1. Set Time (hh:mm:ss) 16:09:12

2. Set Date (yyyy-mm-dd) 2001-04-17

ESC. Exit

Select item from the menu: _

Use <Esc> key or keys <1> to <2>

Figure E-14. Time/Date Update Menu

Table E-7. Time/Date Update Parameters

| Parameter | Possible Values | Remarks |
|-----------|-------------------------|----------------------------|
| Set Time | 00:00:00 – 23:59:59 | Time setting in the device |
| Set Date | 1970/01/01 – 2099/01/01 | Date setting in the device |

Download/Upload Using Xmodem

Main Menu
↓
2. Configuration
↓
1. General Configuration
↓
6. Software Download
↓
1. Download/Upload by X-Modem

Only configuration files can be uploaded. If you enter a software file, the **U. Upload** option is not displayed.

► **To Download/Upload using Xmodem:**

- On the Software Download menu, select **1** (Download/Upload Using Xmodem).
A confirmation message appears.
- Select **Y**.
Upon confirmation, the download or upload procedure begins.

DOWNLOAD/UPLOAD USING XMODEM

1. File Application code

ESC. Exit D. Download

Select item from the menu.

Use <Esc> key or keys <1> to <1>

Figure E-15. Download/Upload Using X-Modem Window

Table E-8. Download/Upload Using X-Modem Parameters

| Parameter | Possible Values | Remarks |
|-----------------|--|--|
| File | Application code, Configuration code, Boot code | |
| Download/Upload | D U | Download a software or configuration file Upload a configuration file |

TFTP

Main Menu
↓
2. Configuration
↓
1. General Configuration
↓
6. Software Download
↓
2. Download/Upload by TFTP

| DOWNLOAD/UPLOAD USING TFTP | |
|-----------------------------------|--------------|
| 1. File name | |
| 2. Command | No Operation |
| 3. Server IP | 0.0.0.0 |
| 4. Retry timeout | 15 |
| 5. Total timeout | 60 |
| 6. View transfer status | |
| ESC. Exit | |
| Select item from the menu. | |
| Use <Esc> key or keys <1> to <6>. | |

Figure E-16. Download/Upload Using TFTP Window

Table E-9. Download/Upload Using TFTP Parameters

| Parameter | Possible Values | Remarks |
|----------------------|--|--|
| File name | | |
| Command | No Operation, Software Download, Configuration Download, Configuration Upload | |
| Server IP | | IP address of the server from which the file is loaded |
| Retry Timeout | | Selected retry timeout period (in seconds) |
| Total Timeout | | Selected total timeout period (in seconds), which is the maximum time allowed for attempted transmission |
| View Transfer Status | | View the transfer status in real-time. It is updated every second. The screen is read-only. |

➤ **To save the parameters and start the transmission process:**

- Enter **S**.

If all parameters are correct, you will be asked for confirmation. After confirmation, the TFTP session begins. You can view the Transfer Status (see *Figure E-17*).

The View Transfer Status values are listed in listed in *Table E-10*.

Note

Boot code download is not possible using TFTP.

Note

Reboot the system after you have completed TFTP download via X-Modem screens.

```

VIEW TRANSFER STATUS
Status  Transferring Data
Error   No Error
Use <Esc> key to Exit

```

Figure E-17. View Transfer Status Window

Table E-10. View Transfer Status Parameters

| Parameter | Values | Remarks |
|-------------------|---|---------|
| Status Indication | No Operation, Connecting, Transferring Data, Ended on Time Out, Ended OK, Error | |
| Error Message | Unavailable (no host IP), No Error, File Not Found, Illegal TFTP Operation, Unknown Transfer ID, Illegal PDU Size, Illegal File Mode, No Empty Connection, No Empty UDP Port, Server Overflow | |

Set Default Parameters

Main Menu
↓
2. Configuration
↓
1. General Configuration
↓
7. Set Default Parameters

Setting Default Parameters reconfigures the device according to default parameters. Before overwriting the system, the warning in *Figure E-18* appears asking you to confirm your selection.

```

Configuration will be overwritten and system will RESET.
Continue ? (Y/N)

```

Figure E-18. Reset Default Warning

➤ **To overwrite the system and reconfigure it according to default settings:**

- Type **Y**.

IPmux-1 is reconfigured according to default settings. Following this, IPmux-1 performs an automatic Reset.

OR

- Type **N** to exit and return to the General Configuration menu.

Note

1. Setting default parameters from an ASCII terminal erases all the configurations and optionally asks if you want to erase Host IP and Default Gateway Configuration.
2. Setting default parameters from Telnet or NMS does not erase the Host IP or Default Gateway Configuration.

E.4 IPmux-1 E1/T1 Configuration

E1 Configuration

Main Menu
↓
2. Configuration
↓
2. E1/T1
Configuration

| E1 CONFIGURATION | |
|----------------------------------|-------------|
| 1. Channel Status | Enable |
| 2. Transmit Clock Source | Adaptive |
| 3. Loopback State | Disable |
| 4. Rx. Sensitivity | -10dB |
| 5. Line Type | CRC4 enable |
| 6. Idle Code | 7E |
| 7. Signaling Mode | CAS enable |
| 8. Cond. Data pattern | FF |
| 9. Cond. CAS (ABCD)pattern | 01 |
| ESC. Exit | |
| Select item from the menu. | |
| Use <Esc> key or keys <1> to <9> | |

Figure E-19. E1 Physical Layer Configuration Menu

Note

When “unframed” mode is selected, the Idle Code, Signaling Mode, Cond Data Pattern and Cond CAS Pattern fields are not present.
When CAS Disabled is selected, the Cond CAS Pattern field is not present.

Table E-11. E1 Physical Layer Configuration Parameters

| Parameter | Possible Values | Remarks |
|------------------------------------|----------------------|--|
| Channel Status | Enable | Detection of LOS alarm |
| | Disable | No detection of LOS alarm |
| Default value: Enable | | |
| Transmit Clock Source | Adaptive | Adaptive clock regeneration |
| | Loopback | The E1 recovered receive clock is used as the transmit clock. A local clock source is used. |
| | Internal | Default value: Adaptive |
| Loopback State | Internal | Data received from the IP network side will be looped back to the network transmit line. An unframed all '1' code (AIS) will be transmitted in the E1 Tx path toward the PBX. Incoming data from the PBX will be ignored. |
| | External | Data received from the PBX at the receive E1 line will be looped back to the E1 Tx path (toward the same PBX), and will continue its way to the IP network. Data coming from the IP network will be ignored. |
| | Disable | No loopback; regular operation |
| Default value: Disable | | |
| Rx Sensitivity | -10 dB,-32 dB | Maximum attenuation of the receive signal that can be compensated for by the interface receive path Default value: E1: -10 dB |
| Line Type | | Framing mode and operation mode for each configuration |
| | Unframed | Framer will be configured to pass through mode and the operation mode will be set to Transparent (see <i>Chapter 1</i>) |
| | CRC4 Enable | Framer will be configured to CRC4 MF mode. Operation mode will be set by Signaling Mode field #6 to either Fractional or Fractional with CAS (see <i>Chapter 1</i>). |
| | CRC4 Disable | CRC4 MF mode is disabled. Operation mode will be set by Signaling Mode field #6 to either Fractional or Fractional with CAS (see <i>Chapter 1</i>). <i>Note: Changing the Line Type setting disables the Line.</i> |
| Default value: CRC4 enabled | | |
| Idle Code | 00 to FF | Determines the idle code inserted into unused timeslots by IPmux-1 at the transmit path towards E1 equipment. <i>Note: This field will not appear if "unframed" is selected in the Line Type field.</i> Default value: 7E |

Table E-11. E1 Physical Layer Configuration Parameters (Cont.)

| Parameter | Possible Values | Remarks |
|----------------|---|--|
| Signaling mode | CAS enable CAS disable | <p>The E1 framer is set to CAS MF mode and the operation mode to fractional with CAS mode.</p> <p>CAS MF will not be set in the E1 framer and the operation mode will be configured to fractional mode.</p> <p>Note: This field will not appear if “unframed” is selected in the Line Type field.</p> <p>Default value: CAS Enable</p> |
| Byte Code | 00 to FF | <p>Conditioning pattern can be applied to timeslots toward the IP path when loss of signal, loss of frame or AIS is detected at the E1 line. Conditioning pattern can also be applied to timeslots toward the E1 line when packet receive buffer overrun or under-run occurs. In Unframed mode, conditioning state will result in AIS transmission. This will be applied when a LOS is detected at E1 line, or when packet receive buffer overrun or under run occurs.</p> <p>Note: This field will not appear if “unframed” is selected in the Channel Type field.</p> <p>Default Value: FF</p> |
| 4 bit code | 1 to F | <p>The ABCD conditioning pattern can be applied toward the IP path when loss of signal, loss of frame, or AIS is detected at the E1 line. Conditioning pattern can also be applied toward the E1 line when packet receive buffer overrun or underrun occur.</p> <p>Note: This field will not appear if “Unframed” is selected in the Channel Type field.</p> <p>Default Value: 1</p> |

T1 Configuration

Main Menu



2. Configuration



2. E1/T1
Configuration

| T1 CONFIGURATION | |
|---|------------|
| 1. Channel Status | Enable |
| 2. Transmit Clock Source | Adaptive |
| 3. Loopback State | Disable |
| 4. Line Type | T1-ESF |
| 5. Line Code | B8ZS |
| 6. Line Mode | DSU |
| 7. Line Length/Tx Gain | 0-133 |
| 8. Restore Time | 1 second |
| 9. Idle Code | 7E |
| A. Signaling Mode | CAS enable |
| B. Cond. Data pattern | 7F |
| C. Cond. CAS (AB/ABCD) pattern | 01 |
| D. Cond. CAS first 2.5 sec pattern (FF=NULL) FF | |
| ESC. Exit | |
| Select item from the menu. | |

Figure E-20. T1 Physical Layer Configuration Menu

Note

When "unframed" mode is selected, the Restore Time, Idle Code, Signaling Mode, Cond Data Pattern, Cond CAS (AB/ABCD) Pattern and Cond. CAS first 2.5 sec pattern (FF=NULL) fields are not present.

When CAS Disabled is selected, the Cond CAS Pattern and Cond. CAS first 2.5 sec pattern (FF=NULL) fields are not present.

Table E-12. T1 Configuration Parameters

| Parameter | Possible Values | Remarks |
|--------------------------------|---|---|
| Channel Status | Enable | Detection of LOS alarm |
| | Disable | No detection of LOS alarm |
| Default value: Enable | | |
| Transmit Clock Source | Adaptive | Adaptive clock regeneration |
| | Loopback | T1 recovered receive clock is used as the transmit clock. |
| | Internal | Local clock source is used. |
| Default value: Adaptive | | |
| Loopback State | Internal | Data received from the IP network side will be looped back to the network transmit line. An unframed all '1' code (AIS) will be transmitted in the T1 Tx path toward the PBX. Incoming data from the PBX will be ignored. |
| | External | Data received from the PBX at the receive T1 line will be looped back to the T1 Tx path (toward the same PBX), and will continue its way to the IP network. Data coming from the IP network will be ignored. |
| | Disable | No loopback. Regular operation. |
| Default value: Disable | | |
| Line Type | | Framing mode and operation mode for each configuration: |
| | T1-D4 | Framer will be configured to T1-D4 mode. Operation mode will be set by Signaling mode field #6 to either Fractional or Fractional with CAS (see <i>Chapter 1</i>). |
| | T1-ESF | Framer will be configured to T1-ESF mode. Operation mode will be set by signaling mode field #6 to either Fractional or Fractional with CAS (see <i>Chapter 1</i>). |
| | Unframed | Framer will be configured to pass through mode and the operation mode will be set to unframed (see <i>Chapter 1</i>). |
| Default value: T1-ESF | | |
| Line Code | B7ZS, B8ZS, AMI | Default value: B8ZS |
| Line Mode | DSU, CSU | Default value: DSU |
| Line Length / Tx Gain | DSU: 0-133, 134-266, 267-399, 400-533, 534-655 | Default value: 0-133 ft |
| | CSU: 0 dB, -7.5 dB, -15 dB, -22.5 dB | |
| Default value: 0 dB | | |

Table E-12. T1 Configuration Parameters (Cont.)

| Parameter | Possible Values | Remarks |
|-------------------------|---|---|
| Restore Time | 1 second, 10 seconds | Selects the T1 red alarm recovery time Default value: 1 second |
| Idle Code | 00 to FF | Inserted into unused timeslots by IPmux-1 at the transmit path towards T1 equipment <i>Note: This field will not appear if "unframed" is selected in the Line Type field.</i> Default value: 7E |
| Signaling Mode | CAS enable CAS disable | T1 framer is set to CAS mode and the operation mode to Fractional with CAS mode CAS mode will not be set in the T1 framer and the operation mode will be configured to Fractional mode <i>Note: This field will not appear if "Unframed" is selected in the Line Type field.</i> Default value: CAS Enable |
| Cond. data pattern | 00 to FF | Byte Code applied to timeslots when fault conditions occur Conditioning pattern can be applied to timeslots toward the IP path when loss of signal, loss of frame or AIS detected at the T1 line. Conditioning pattern can also be applied to timeslots toward the T1 line when packet receive buffer overrun or under-run occurs. In Unframed mode, conditioning state results in AIS transmission. This is applied when a LOS is detected at T1 line, or when packet receive buffer overrun or under run occurs. <i>Note: This field will not appear if "Unframed" is selected in the Channel Type field.</i> Default value: 7F |
| Cond CAS (ABCD) pattern | 1 to F | 2 or 4 Bit Code applied to AB(D4) or ABCD (ESF) bits when fault conditions occur The ABCD conditioning pattern can be applied toward the IP path when loss of signal, loss of frame or AIS detected at the T1 line. Conditioning pattern can also be applied toward the T1 line when packet receive buffer overrun or under run occur. <i>Note: This field will not appear if "Unframed" is selected in the Channel Type field.</i> Default value: 1 |

Table E-12. T1 Configuration Parameters (Cont.)

| Parameter | Possible Values | Remarks |
|---------------------------------|--|--|
| Cond. CAS first 2.5 sec pattern | 0 to F (ESF) 0 to 3 (D4) FF | 2 or 4 Bit Code applied (during the first 2.5 seconds) to AB(D4) or ABCD (ESF) bits (relevant in CAS mode only) when fault conditions occur. After the first 2.5 seconds the code specified in 'Cond. CAS (ABCD) pattern' is applied. ABCD conditioning pattern can be applied toward the IP path when loss of signal, loss of frame or AIS detected at the T1 line. Conditioning pattern can also be applied toward the T1 line when packet receive buffer overrun or underrun occurs. When configuring FF to this function, this parameter is ignored and the CAS pattern applied in the first 2.5 seconds is the same as defined in ' Cond. CAS (ABCD) pattern'. <i>Note: This field does not appear if "unframed" is selected in the Line Type field or if CAS Disable is selected.</i> Default value: FF |

E.5 IPmux-1E ISDN Configuration

Main Menu
↓
2. Configuration
↓
2. ISDN Configuration

| ISDN CONFIGURATION | |
|----------------------------|----------|
| 1. Interfaces Mode | Terminal |
| 2. Transmit Clock Source | Adaptive |
| 3. Channel Configuration | > |
| ESC. Exit | |
| Select item from the menu. | |

Figure E-21. ISDN Configuration Menu

E.6 Analog Configuration

Main Menu



2. Configuration

2. FXS
Configuration

| ANALOG CONFIGURATION | |
|---|----------|
| 1. Clock Source | Adaptive |
| 2. Far End Type | E1 |
| 3. Channel Configuration | > |
| 4. Signaling Profile Configuration | > |
| ESC. Exit | |
| +-----+ | |
| NOTICE: The connection must be disabled | |
| before any changes! | |
| +-----+ | |
| Select item from the menu. | |

Figure E-23. Analog Configuration Menu

Table E-15. Analog Configuration

| Parameter | Possible Values | Remarks |
|---------------------------------|-----------------|--|
| Clock Source | Internal | Local clock source is used |
| | Adaptive | Adaptive clock regeneration |
| Far End Type | E1 | Sets A-Law/ μ -Law and TDMoIP encapsulation mode |
| | T1-ESF, T1-D4 | |
| Channel Configuration | | Next screen |
| Signaling Profile Configuration | | Next screen |

Channel Configuration

Main Menu



2. Configuration

2. FXS
Configuration3. Channel
Configuration

| CHANNEL CONFIGURATION | |
|----------------------------|---------|
| 1. Channel Number | 1 |
| 2. Channel Status | Enable |
| 3. Rx Gain | -4dBm |
| 4. Tx Gain | 0dBm |
| 5. Testing | Disable |
| ESC. Exit | |
| Select item from the menu. | |

Figure E-24. Channel Configuration Menu

Table E-16. Analog Configuration

| Parameter | Possible Values | Remarks |
|----------------|---|---|
| Channel Number | 1,2,3,4 | Selects channel to be configured |
| Channel Status | Enable | Channel is enabled |
| | Disable | Channel is disabled |
| Rx Gain | -10, -8, -6, -4, -2, 0, 1, 2, 3, 4, 5 (dBm) | Sets the gain towards the phone |
| Tx Gain | -10, -8, -6, -4, -2, 0, 1, 2, 3, 4, 5 (dBm) | Sets the analog gain as transmitted from the phone to configure the analog receiver dynamic range |
| Testing | Tone Injection | 1 kHz tone is injected towards the local phone |
| | Remote Loopback | A remote loopback analog signal is set for IPmux-1E FXS |
| | Disable | |

Signaling Profile Configuration

Main Menu
↓
2. Configuration
↓
2. Analog Configuration
↓
4. Signaling Profile Configuration

SIGNALING PROFILE CONFIGURATION

| | | | |
|----|-----------|----------|------------|
| 1. | Rx | A | A |
| 2. | Rx | B | N/C |
| 3. | Rx | C | N/C |
| 4. | Rx | D | N/C |
| 5. | Tx | A | A |
| 6. | Tx | A | 1 |
| 7. | Tx | A | 0 |
| 8. | Tx | A | 1 |

ESC. Exit

```

+-----+
|  Rx: From Network  |
|  Tx: To Network    |
+-----+

```

Select item from the menu.

Figure E-25. Signaling Profile Configuration Parameters

Table E-17. Signaling Profile Configuration

| Parameter | Possible Values | Remarks |
|-----------|---------------------------|--|
| Rx A | A, A Inverse, N/C | Specifies which ABCD Signaling Bit (only one), and its polarity, carries the on hook/off hook information from the far-end device |
| Rx B | B, B Inverse, N/C | Specifies which ABCD Signaling Bit (only one), and its polarity, carries the on hook/off hook information from the far-end device |
| Rx C | C, C Inverse, N/C | Specifies which ABCD Signaling Bit (only one), and its polarity, carries the on hook/off hook information from the far-end device |
| Rx D | D, D Inverse, N/C | Specifies which ABCD Signaling Bit (only one), and its polarity, carries the on hook/off hook information from the far-end device |
| Tx A | A, A Inverse, 0, 1 | Specifies which ABCD Signaling Bit carries the on hook/off hook information to the far-end device. One or more can be configured to carry the off-hook/on-hook information (or inverse information), while the other bits should be set to '1' or '0'. |

Table E-17. Signaling Profile Configuration (Cont.)

| Parameter | Possible Values | Remarks |
|-----------|---------------------------|---|
| Tx B | B, B Inverse, 0, 1 | Specifies which ABCD Signaling Bit carries the on hook/off hook information to the far-end device. One or more can be configured to carry the off-hook/on-hook information, while the other bits should be set to '1' or '0'. |
| Tx C | C, C Inverse, 0, 1 | Specifies which ABCD Signaling Bit carries the on hook/off hook information to the far-end device. One or more can be configured to carry the off-hook/on-hook information, while the other bits should be set to '1' or '0'. |
| Tx D | D, D Inverse, 0, 1 | Specifies which ABCD Signaling Bit carries the on hook/off hook information to the far-end device. One or more can be configured to carry the off-hook/on-hook information, while the other bits should be set to '1' or '0'. |

Note For example, if Rx = A, then all other Rx must be NC. If Rx = A Inverse, then all other Rx must be NC. Tx can be A, B, 0, 1.

E.7 Bundle Connection Configuration

Main Menu
↓
2. Configuration
↓
3. Bundle Connection Configuration

| BUNDLE CONNECTION CONFIGURATION | |
|--|----------------------|
| 1. Bundle ID | 1 |
| 2. IP TOS | 1 |
| 3. TDM Bytes in Frame | 48 |
| 4. Connection Status | Disable |
| 5. Destination IP Address | 0.0.0.0 |
| 6. Next Hop | 0.0.0.0 |
| 7. Destination Bundle | 1 |
| 8. Jitter Buffer (x10 μsec) rounded up | 1000 μsec steps! 300 |
| 9. VLAN Tagging | YES |
| A. VLAN Id | EE |
| B. VLAN Priority | 00 |
| ESC. Exit | |
| Select item from the menu. | |

VLAN ID and VLAN Priority are configurable only if VLAN Tagging is set to Yes.

Figure E-26. Bundle Connection Configuration

Parameters must be configured for each connection. To configure all parameters, first select the bundle ID and then proceed with the parameter configuration.

Note *First define the bundle.*

Table E-18. Bundle Connection Parameters

| Parameter | Possible Values | Remarks |
|------------------------|--------------------------------------|---|
| Bundle ID | 1 | IPmux-1 has a single bundle, with the number set at 1 |
| IP ToS | 0 to 255 | Type of Service – sets the IP ToS field in the IP frames transmitted by the device. ToS configuration configures the WHOLE byte, since different vendors may use different bits to tag packets for traffic prioritization. ToS assignment applies to all TDM packets leaving IPmux-1. Default configuration: 0 |
| TDM Bytes in Frame | 48, 96, 144, 192, 240, 288, 336, 384 | Allows you to set the UDP payload length – this parameter enables reduction of Ethernet throughput (detailed explanation in <i>Chapter 1</i>). Default payload: single payload (48) |
| Connection Status | Enable Disable | Connection enabled Frames will not be sent from this connection |
| Destination IP Address | | IP address of the destination device |
| Next Hop | | Use the next hop parameter when the Destination IP address is not in the device subnet. In such cases the Ethernet frame is sent to the <i>next hop</i> IP. If it is not configured, the default gateway is used. Default value: 0.0.0.0 (not configured) Note: <i>The next hop IP must be in the device subnet.</i> |
| Destination Bundle | E1: 1 to 496 T1: 1 to 384 | Bundle number in the destination device |
| Jitter Buffer | 3 to 300 milliseconds (ms) | Desired depth of the jitter buffer (PDVT buffer). Default value: 300 (10 x μ s), i.e. 3 msec |
| VLAN Tagging | Yes No | You must set options 9 and A in the Bundle Connection Configuration menu Note: <i>For an explanation of VLAN tagging see Chapter 1.</i> |
| VLAN ID | 0 to 4095 | Default value: 0 . |
| VLAN Priority | 0 to 7 | |

E.8 LAN Configuration (no User port)

Note For LAN configuration for two LANs, see Ethernet Configuration/Statistics Menus.

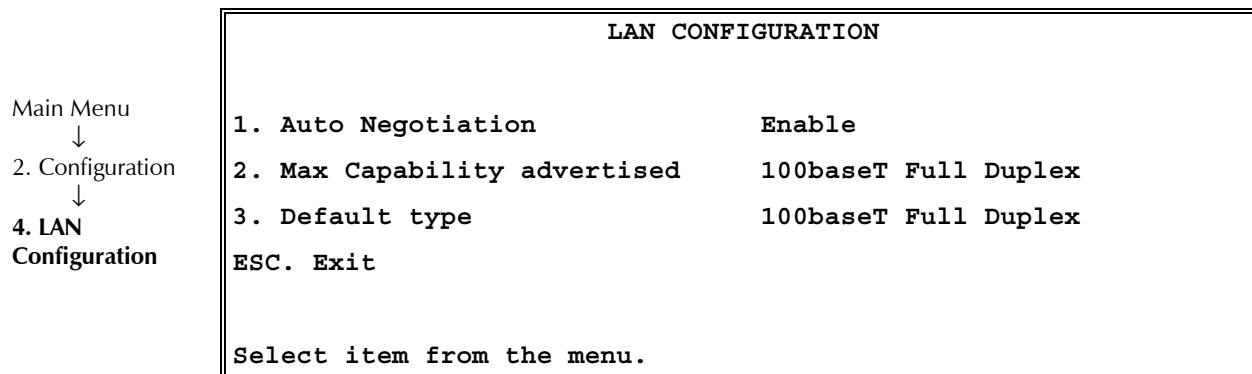


Figure E-27. LAN Configuration Menu

Table E-19. LAN Configuration Parameters

| Parameter | Possible Values | Remarks |
|---------------------------------|---|---|
| Auto Negotiation | Enable, Disable | Auto Negotiation mode is according to RFC 2239 Default: Enable |
| Maximum Capabilities Advertised | | Maximum Capabilities of the port for the Auto Negotiation process (can be lower than the actual capabilities) Default: 100baseT Full Duplex |
| Default Type | 10BaseT Half Duplex, 10BaseT Full Duplex, 100BaseT Half Duplex, 100BaseT Full Duplex | Default: 100baseT Full Duplex Note: This parameter is valid only when the Auto Negotiation mode is disabled (RFC 2239). |

Note If Auto Negotiation is set to Enable and you experience some incompatibility in the Auto Negotiation process, set Auto Negotiation to Disable and set Default type to the desired mode.
When the physical port is fiber, the operation mode is:
Auto Negotiation Off//full duplex/100 Mbps. This is the only possible setting.

E.9 DS0 Bundle Configuration

This configuration selects the timeslots to be transferred end-to-end for E1/T1 when the operation mode is Fractional or Fractional with CAS. One bundle of timeslots can be configured in the IPmux-1 TDMoIP link.

Main Menu
↓
2. Configuration
↓
5. DS0 Bundle Configuration

```

                                DS0 BUNDLE CONFIGURATION
1. Bundle ID                      1
2. Timeslot number                 1-1
3. Timeslot Current Status        SET
ESC. Exit

ACTIVE TIMESLOTS IN THIS BUNDLE: 1
FREE TIMESLOTS: 2,3,4,5,6,7,8,9,10,11,12,13,14,15,17,
                    18,19,20,21,22,23,24,25,26,27,28,29,30,31

Select item from the menu.
Use <Esc> key or keys <1> to <3>

```

Figure E-28. DS0 Bundle Configuration Menu

Table E-20. DS0 Bundle Configuration Parameters

| Parameter | Possible Values | Remarks |
|---------------------------------|---|------------------------------------|
| Bundle ID | 1 | This is the only valid option |
| Timeslot Number | E1: Timeslot 0 is always invalid and timeslot 16 is not valid for Fractional with CAS data format. T1: Valid timeslots are 1 to 24 | |
| Timeslot Current Status | Free | Frees the timeslot from the bundle |
| | Set | Adds the timeslot to the bundle |
| Active timeslots in this Bundle | | Assigned timeslots – read-only |
| Free Timeslots | | Unassigned timeslots – read-only |

► **To save the change:**

- Type <S>.

IPmux-1 will associate the new timeslot with the bundle.

E.10 Performance Monitoring

E1/T1 Statistics

Main Menu
↓
3. Performance Monitoring
↓
1. E1/T1 Statistics

E1 models only
↑

```

E1 STATISTICS
E1 over UTP
LOS:                0
LOF (Red):         0
LCV:                0
RAI (Yellow):     0
AIS:                0
FEBE:              0
BES:                0
DM:                 0
ES:                 0
SES:                0
UAS:                0
LOMF:              0
Time Since:        sec  7-----Valid Intervals      12-----
1. Interval                    0
ESC. Exit  N. Next Inv:
                    
```

Figure E-29. E1/T1 Statistics Menu

The following statistics are valid (and visible) for **ESF and E1-CRC4 modes only**:
BES, DM.

The following parameters are saved in the **event log**: LOS, LOF, Rcv.Yellow alarm, Rcv. AIS and FEBE.

Compliance to Standards

E1: G.703, G.704, G.804, G.706, G.732, G.823

T1: ANSI T1.403, AT&T TR62411, G.703, G.704, G.804

The alarms and statistics are described in *Table E-21*.

Table E-21. E1/T1 Statistics Parameters

| Alarm | Failure | Comments |
|------------------------|--|--|
| LOS | Loss of Signal | <p>Sync LED Off</p> <ul style="list-style-type: none"> For T1: A second during which 192 contiguous pulse positions have no pulse of either positive or negative polarity (signal is more than 30 dB below nominal amplitude). For E1: A second during which 255 contiguous pulse positions have no pulse of either positive or negative polarity. |
| LOF | Loss of Frame | <p>Sync LED Off</p> <ul style="list-style-type: none"> For E1/T1: A second during which an OOF (see below) error persists for 2.5 seconds and no AIS error (see below) is detected. |
| LCV | Line Code Violation | <p>Line Code Violation</p> <ul style="list-style-type: none"> For T1: A second during which BPV (Bipolar Violation) or EXZ errors have occurred. For E1: A second during which two consecutive BPVs of the same polarity are received. <p>BPV is the occurrence of a pulse with the same polarity as the previous pulse.</p> <p>EXZ is the occurrence of a zero string greater than 15 for AMI or 7 for B8ZS.</p> <p>Complies with ITU-TI.431, 0.161, G.775 and G.821 standards.</p> |
| Rcv RAI (Yellow Alarm) | Remote Alarm Indication | <p>Sync LED flashes</p> <ul style="list-style-type: none"> For E1/T1, a second during which tan RAI pattern is received from the far end when the far-end framer enters a RED state (Loss of Frame). |
| AIS | Alarm Indication Signal–Received from User | <p>Sync LED is Off</p> <ul style="list-style-type: none"> For T1: A second during which an unframed “all 1” signal is received for 3 milliseconds. For E1: A second during which a string of 512 bits contains fewer than three zero (0) bits. |
| FEBE | Far End Block Error | <p>Number of seconds in which the FEBE indication is received from the remote E1 device.</p> <ul style="list-style-type: none"> For E1 MF-CRC4 only |
| BES | Bursty Errored Seconds (Errored Second type B) | <p>Number of seconds with from two to 319 CRC error events with no AIS nor SEF (Framing Bit Errors) error detection</p> <p>Complies with AT&T TR-62411 and TR-54016 standards.</p> <p>Not applicable if Line Type is set to Unframed</p> <p>T1-ESF or E1-CRC4 modes</p> |

Table E-21. E1/T1 Statistics (Cont.)

| Alarm | Failure | Comments |
|-------|--|--|
| DM | Degraded Minutes | A Degraded Minute is calculated by collecting all of the available seconds, subtracting any SESs and sorting the result in 60 second groups. A Degraded Minute is a 60 second group in which the cumulative errors during the 60-second interval exceed 1×10^{-6} . T1-ESF or E1-CRC4 modes |
| ES | Errored Second (If any error occurs during one second) | For E1/T1: Any second containing the following error events: <ul style="list-style-type: none"> • CRC • SEF (OOF) • AIS (T1 only). If SES is also active (see below) ES runs for 10 seconds and then stops. |
| SES | Severely Errored Seconds | Any second containing the following errored events is counted as severely errored seconds: For E1/T1: <ul style="list-style-type: none"> • If 320 or more CRC error events • One or more SEF (OOF) events • One or more AIS events occurred (for T1 only). |
| UAS | Unavailable Seconds | Activated when there are 10 consecutive SES occurrences and Deactivated as a result of 10 consecutive seconds without SES. |
| LOMF | Loss of Framing | Loss Of Framing sequence in Timeslot 16. E1 CAS mode only |

The following parameters can be monitored from the Link Status menu:

Valid Intervals – number of 15-minute intervals stored in the system since power-up.

Time Since – elapsed time since the beginning of the current interval (interval 0).
This is displayed only when the current interval is monitored.

Interval Number – number of the interval to be displayed.
Interval number 0 (zero) is the current interval.
The current interval display is continuously updated.
The elapsed time since the beginning of the interval is displayed.

Start Time – time and date when the monitored interval started. This is displayed only when viewing previous intervals.

Prev – displays the previous interval. From the first interval (current interval = 0)
Prev is not visible.

Next – displays the next interval.
The number of valid intervals is displayed.
From the last valid interval Next is not visible.

Analog Status – IPmux-1E with FXS

| | |
|--|--|
| Main Menu ↓ 3. Performance Monitoring ↓ 1. Analog Status | ANALOG STATUS Channel 1: ON HOOK Channel 2: ON HOOK Channel 3: ON HOOK Channel 4: ON HOOK ESC. Exit |
|--|--|

Figure E-31. Analog Status

The options for each channel are: **On-hook, Off-hook, Ringing.**

LAN Statistics (no User port)

| | |
|---|---|
| Main Menu ↓ 3. Performance Monitoring ↓ 2. LAN Statistics | LAN STATISTICS Mac Address 00-20-D2-16-3B-3D Mode Half duplex Rate (Mbps) 10 Status Not connected Frames received from the user Correct frames: 0 Correct Octets: 0 Alignment Err: 0 FCS Errors: 0 Frames transmitted to the user Correct frames: 0 Correct Octets: 0 Sngl Collision: 0 Mlty Collision: 0 Deferred transm: 0 Late Collision: 0 Carrier Sense: 0 Esc. Exit R. Reset Counters |
|---|---|

Figure E-32. LAN Statistics Menu

LAN statistics are not collected in intervals.

► **To reset counters:**

Type **R**.

Table E-23. LAN Statistics

| Statistics | Values | Description |
|--|---|---|
| MAC Address | Hard Coded | Port local MAC address |
| Mode | Half duplex, Full duplex | Port mode is set by either the default mode or via auto negotiation results |
| Rate | 10Mbps, 100Mbps | Port rate is set by either the default mode or via auto negotiation results |
| Status | Not connected, Connected | Not connected: Link loss Connected: Normal operation |
| Frames received from the user | | |
| Correct frames | | Total number of correct frames received |
| Correct Octets received | | Total number of correct octets received |
| Alignment Errors | | Counter of frames received that are not an integral number of octets in length (RFC 1643) |
| FCS Error | | Counter of frames received that do not pass the FCS check (RFC 1643) |
| Frames transmitted to the network | | |
| Correct Frames | | Total number of frames successfully transmitted |
| Correct Octets | | Total number of octets successfully transmitted |
| Single Collision | Valid only in half duplex mode (RFC 1643) | Counter of successfully transmitted frames for which transmission is inhibited by exactly one collision |
| Multiple Collision | Valid only in half duplex mode (RFC 1643) | Counter of successfully transmitted frames for which transmission is inhibited by more than one collision |
| Deferred Transmission | Valid only in half duplex mode (RFC 1643) | Counter of frames for which the first transmission attempt is delayed because the medium is busy |
| Late Collision | Valid only in half duplex mode (RFC 1643) | Number of times that a collision is detected on a particular interface later than 512 bit-times into the transmission of a packet |
| Carrier Sense Error | Valid only in half duplex mode (RFC 1643) | Number of times that the carrier sense condition was lost or never asserted when attempting to transmit a frame |

Bundle Connection Statistics

| | |
|---|--|
| Main Menu ↓ 3. Performance Monitoring ↓ 3. Bundle Connection Statistics | BUNDLE CONNECTION STATUS |
| | Destination IP Address: 192.192.192.1 Next Hop MAC Address: 00-00-00-00-00-00 Connectivity Status: LOCAL FAIL Sequence Errors: 0 Jitter Buffer Underflows: 1 Jitter Buffer Overflows: 0 |
| | Esc. Exit R. Reset Counters |

Figure E-33. Bundle Connection Status Menu

► **To reset counters:**

- Type **R**.

Table E-24. Bundle Connection Status Parameters

| Parameter | Possible Values | Remarks |
|-------------------------|---|---|
| Destination IP Address | | Destination IP address of the bundle configured under Bundle Connection Configuration |
| Destination Mac Address | | In this screen Destination Mac Address displayed is in fact the resulting Mac Address of the ARP process for the destination IP address. |
| Connectivity Status | Disabled OK Local Failure Remote Failure | Channel is disabled Connection is Ok. Frames are received by the remote and the local IPmux Frames are not received by the local IPmux Frames are not received by the remote IPmux |
| Sequence Errors | | The number of times a frame was dropped because frames were received from the network with SN fields not equal to the last SN+1 (or 2) |

Table E-24. Bundle Connection Statistics Parameters (Cont.)

| Parameter | Possible Values | Remarks |
|--------------------------|-----------------|---|
| Jitter Buffer Underflows | | <p>The number of times frames were dropped because the receive buffer was in an underrun state. The buffer enters underflow state when:</p> <ul style="list-style-type: none"> • Sequence errors occur • Flow underrun takes place due to PDV expiration • An overflow condition occurs. |
| Jitter Buffer Overflows | | Number of times that frames were dropped because the receive buffer exceeded the maximum allowed depth |

E.11 Ethernet Configuration/Statistics Menus

User port is present

This section illustrates and describes the menus for IPmux-1/1E when the Ethernet port is present.

General Information

Main Menu
↓
1. System
Menu
↓
**1. General
Information**

| GENERAL INFORMATION | | |
|-------------------------------------|------------------|---------------|
| Software Version | Hardware Version | Inventory No. |
| Boot: 1.21 7-1-2001 08:35 | HW:1.0/0.0 | 232635 |
| Application: 3.00-D1 9-2-2001 16:55 | | |
| Backup: 3.00-D1 9-2-2001 16:55 | | |
| Interface Description | | |
| E1 over UTP | | |
| ETHERNET over UTP | | |
| Press ESC to exit | | |

Figure E-34. General Information Window – Two Ethernet Ports

Aging Time

Main Menu
 ↓
 2. Configuration
 ↓
 4. Switch Configuration
 ↓
2. Aging Time

```

                SWITCH CONFIGURATION
    1. LAN Configuration                >
    2. Aging Time <seconds>            120

    ESC. Exit
    Select item from the menu.
    
```

Figure E-35. Switch Configuration – Two Ethernet Ports

Select Aging Time from 10 to 450 seconds.

LAN Configuration

Main Menu
 ↓
 2. Configuration
 ↓
 4. Switch Configuration
 ↓
1. LAN Configuration

```

                LAN CONFIGURATION
    1. Channel                          Network
    2. Channel Status                   Enable
    3. Auto Negotiation                 Enable
    4. Max Capability advertised         100BaseT Full Duplex
    5. Default type                     100BaseT Full Duplex
    6. Rate limit <kbps> <0-Disable>    0

    ESC. Exit                          N. Next
    Select item from the menu.
    
```

Figure E-36. LAN Configuration – Two Ethernet Ports

Table E-25. LAN Configuration – Two Ethernet Ports

| Parameter | Values | Remarks |
|---------------------------|--|--|
| Channel | Network, User | Selects port to be configured |
| Channel Status | Enable, Disable | When disabled, Ethernet LOS Events will not be sent to the Logfile |
| Auto Negotiation | Enable, Disable | |
| Max Capability advertised | 10BaseT Full Duplex, 10BaseT Half Duplex, 100BaseT Full Duplex, 100BaseT Half Duplex | Default: 100baseT Full Duplex <i>Note: This parameter is valid only when the Auto Negotiation mode is enabled (RFC 2239).</i> |
| Default type | 10BaseT Full Duplex, 10BaseT Half Duplex, 100BaseT Full Duplex, 100BaseT Half Duplex | Default: 100baseT Full Duplex <i>Note: This parameter is valid only when the Auto Negotiation mode is enabled (RFC 2239).</i> |

Table E-25. LAN Configuration – Two Ethernet Ports (Cont.)

| Parameter | Values | Remarks |
|----------------------------------|-------------------|-------------------------------|
| Rate limit <kbps> <0-Disable> | 0..100,000 | Only relevant to Network port |

Note The Rate Limiter restricts the user port bandwidth:

- In steps of 50K, up to 5M
- From 5M–100M in steps of 1M.

A more detailed explanation is found in Rate Limiter Mode in Chapter 1.

LAN Statistics

Three ports are connected to the internal switch:

- Network
- User
- Internal (TDMoIP/Host).

For further details, see *Ethernet User Port* in Chapter 1.

Main Menu
↓
3. Performance
Monitoring
↓
2. LAN Statistics

| LAN STATISTICS | |
|------------------------------|--------------------------|
| Mac Address | 00-20-D2-16-3B-3D |
| Mode | Half duplex |
| Rate (Mbps) | 10 |
| Status | Not connected |
| Frames received | |
| Total Frames: | 0 |
| Total Octets: | 0 |
| Oversize Frames: | 0 |
| Fragments: | 0 |
| Jabber: | 0 |
| Dropped Frames: | 0 |
| CRC Errors: | 0 |
| Frames transmitted | |
| Correct frames: | 0 |
| Correct Octets: | 0 |
| Collision: | 0 |
| Channel: Network/User | |
| Esc. Exit | R. Reset Counters |
| | N. Next Channel |

Figure E-37. LAN Statistics Menu – Two Ethernet Ports (Network or User)

LAN statistics are not collected in intervals.

➤ **To view statistics for next channel:**

- Press **N**.

| LAN STATISTICS | |
|--------------------|-------------------|
| Mac Address | 00-20-D2-16-3B-3D |
| Mode | Half duplex |
| Rate (Mbps) | 10 |
| Status | Not connected |
| Frames received | |
| Total Frames: | 0 |
| Total Octets: | 0 |
| Frames transmitted | |
| Correct frames: | 0 |
| Correct Octets: | 0 |
| Channel: Internal | |
| Esc. Exit | R. Reset Counters |
| | N. Next Channel |

Figure E-38. LAN Statistics Menu – Two Ethernet Ports (Internal)

➤ **To reset counters:**

Type **R**.

Table E-26. LAN Statistics – Two Ethernet Ports

| Statistics | Values | Description |
|---------------------------|---------------------------------|--|
| MAC Address | Hard Coded | Port local MAC address |
| Mode | Half duplex, Full duplex | Port mode is set by either the default mode or via auto negotiation results |
| Rate | 10Mbps, 100Mbps | Port rate is set by either the default mode or via auto negotiation results |
| Status | Not connected, Connected | Not connected: Link loss Connected: Normal operation |
| Frames received | | |
| Total Frames | | Total number of correct frames received |
| Total Octets | | Total number of correct octets received |
| Oversize Frames | | Number of frames that are too long, and CRC is valid |
| Fragments | | Number of frames that are shorter than 64 bytes and have an invalid CRC |
| Jabber | | Number of frames that are too long and have an invalid CRC |
| Dropped Frames | | Number of dropped frames due to delivery problems |
| CRC Errors | | The number of good frames with invalid CRC |
| Frames transmitted | | |
| Correct Frames | | Total number of frames successfully transmitted |
| Correct Octets | | Total number of octets successfully transmitted |
| Collision | | A counter of successfully transmitted frames for which transmission is inhibited by collision event, valid only in half duplex mode. |
| Channel1 | Network, User, Internal | |

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RAD

SUPPLEMENT

DC Power Supply Connection – Terminal Block Connector

Note: Ignore this supplement if the unit is AC-powered.

DC-powered units are equipped with a plastic 3-pin VDC-IN power input connector, located on the unit rear panel. Supplied with such a unit, is a mating Terminal Block (TB) type connector plug for attaching to your power supply cable.

Connect the wires of your power supply cable to the TB plug, according to the voltage polarity and assembly instructions provided below.

Caution: Prepare the connections to the TB plug *before* inserting it into the VDC-IN connector.

Preparing and Connecting the TB Plug

Refer to Figure 1 for assistance.

1. Strip the insulation of your power supply cable wires according to the dimensions shown.
2. Place each wire lead into the appropriate TB plug terminal according to the voltage polarity mapping shown in Figure 2. (If the terminal is not already open, loosen its terminal screw.)
3. Tighten the three terminal screws.
4. Pull a nylon cable tie (supplied) around the power supply cable to secure it firmly to the TB plug grip (pass the tie through the holes on the grip).
5. Isolate the exposed terminal screws / wire leads using a plastic sleeve or insulating tape, to prevent the possibility of short-circuit.
6. Connect the assembled power supply cable to the unit by inserting the TB plug into the unit's VDC-IN connector, until it snaps into place.

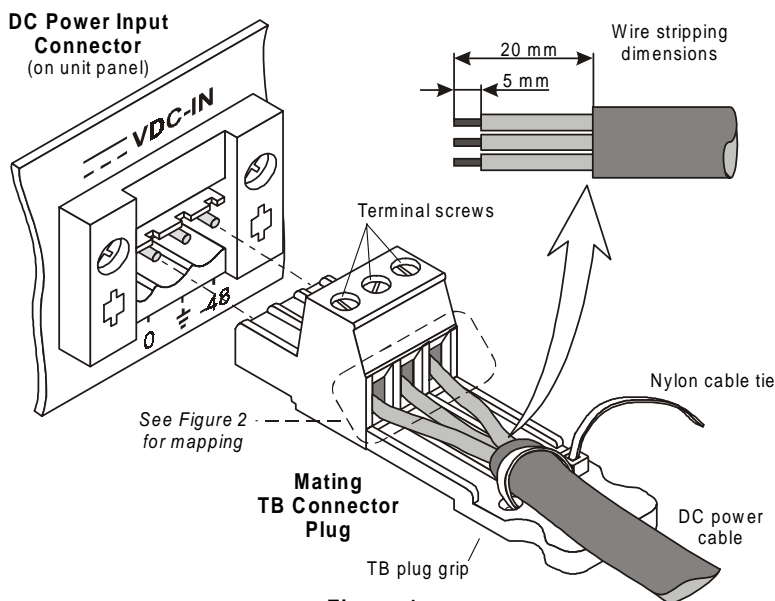


Figure 1

DC Power Supply Wire Voltage Polarity

Refer to Figure 2 for proper mapping of the power supply wire leads to the TB plug's three terminals.



Warning:
Reversing the wire voltage polarity can cause serious damage to the unit!

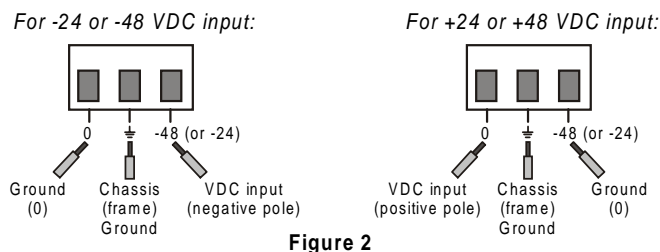


Figure 2

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