

IPmux-4

TDMoIP Gateway

Installation and Operation Manual

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Telecommunication Safety

The safety status of each of the ports on IPmux-4 is declared according to EN 41003 and is detailed in the table below:

Safety Status	Ports
SELV	LAN, Unbalanced E1
TNV-1	Balanced E1, T1

SELV = Safety Extra-Low Voltage

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

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Manufacturer's Name: RAD Data Communications Ltd.

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declares that the product:

Product Name: **IPmux-4**

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

EMC: EN 55022 (1994) Limits and methods of measurement of radio disturbance characteristics of information technology equipment.

EN 50082-1 (1992) Electromagnetic compatibility - Generic immunity standards for residential, commercial and light industry.

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 21st, 2000



Haim Karshen

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Chapter 1

Introduction

1.1 Overview

IPmux-4 is a modular TDMoIP gateway enabling one or four E1 or T1 circuits to be extended over IP networks. The device converts the data stream coming from the E1 or T1 ports into configurable-sized IP packets that are transported over the Ethernet port and vice versa. IPmux-4 offers end-to-end synchronization for TDM applications and large buffers, to compensate for the delay variation inserted by the network. The device can be used to extend E1 or T1 services over high-speed IP/Ethernet backbones for both Metropolitan Area Network and corporate applications. IPmux-4 can be managed locally via an ASCII terminal or remotely via Telnet or RADview (RAD's SNMP-based network management application).

Versions

IPmux-4 with an E1 interface:	Balanced line with an RJ-45 connector Unbalanced line with a mini-coaxial connector
IPmux-4 with 4E1 interfaces:	Balanced lines with RJ-45 connectors Unbalanced lines with mini-coaxial connectors
IPmux-4 with a T1 interface:	Balanced line with an RJ-45 connector
IPmux-4 with 4T1 interfaces:	Balanced lines with RJ-45 connectors

Applications

Two typical IPmux-4 applications are shown in *Figure 1-1* and *Figure 1-2*.

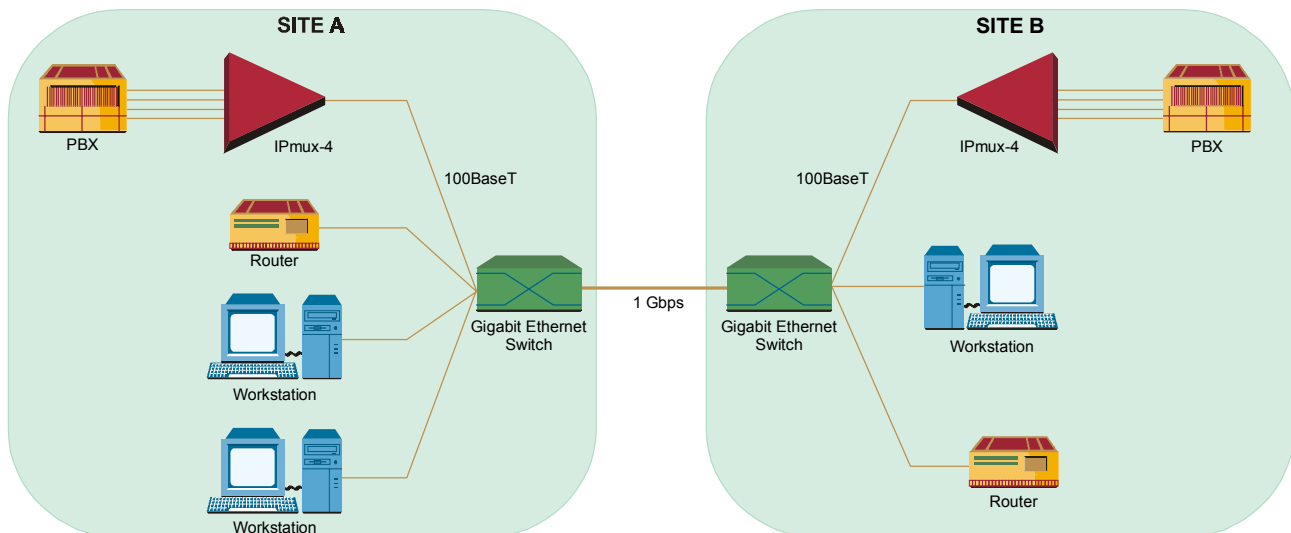


Figure 1-1. Multiplexing Voice and Data over Fast / Giga Ethernet Trunk

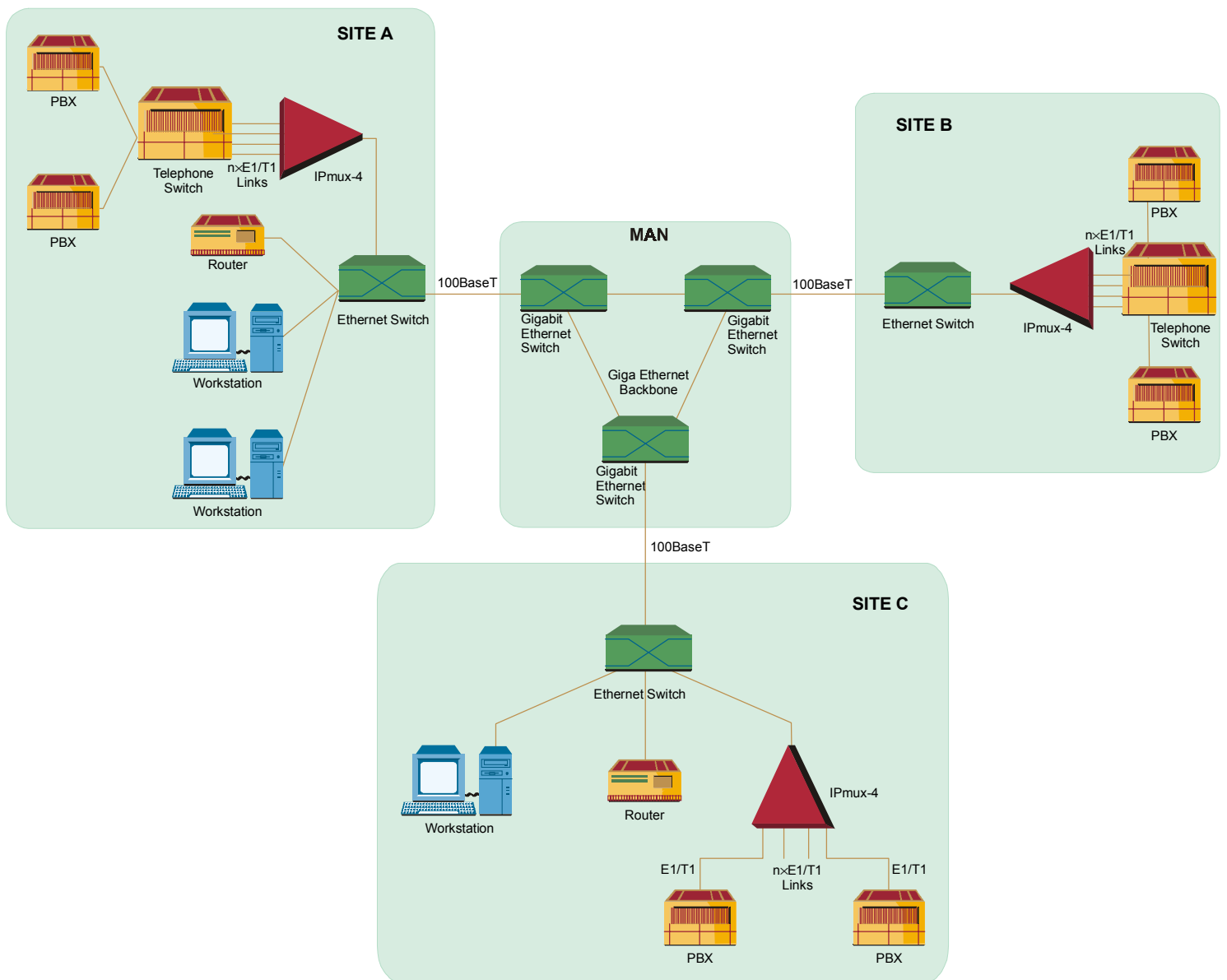


Figure 1-2. IP-based Metropolitan Area Network

Features

Management

IPmux-4 can be managed via a local terminal, Telnet, or via RADview, RAD's Network Management system. IPmux-4 has an RJ-45 port for the local terminal connection for monitoring and control. Software upload and download can be performed. Download can be performed via the local terminal or via RADview.

T1

T1 ports and framers comply with ANSI T1.403 standards. The T1 jitter performance is according to G.824, TR-62411. The T1 framers support pass-through, SF, ESF and CAS. 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

E1 ports comply with G.703 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.

IP

The data stream coming from the E1 or T1 ports into IP frames is converted and transferred over the Fast Ethernet port and vice versa.

The 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.

A single IP address should be set per device (Host IP). A destination IP address can be configured for each bundle (see *Multibundling*, below). IP ToS field support can be configured for IP Level Priority.

Ethernet

IPmux-4 has a half/full duplex, 10/100 Ethernet port for LAN connectivity.

The IPmux-4 Ethernet port supports auto-negotiation.

Half duplex operation in IPmux-4 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.

IPmux-4 supports VLAN tagging and priority.

Mode of Operation

IPmux-4 can operate in three different modes:

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

Multibundling

A bundle is a group of timeslots originating from a specific E1 or T1 channel. Up to 31 bundles per E1 channel and 24 bundles per T1 channel can be defined for transport over the network. Each bundle can contain 1 to 24/31 timeslots (T1/E1 respectively).

Two network topologies are supported:

- **Star (point-to-multipoint):** Multiple remote locations transport one or more bundles, each, to a central site that is capable of grooming the bundles into its E1 or T1 channel.
- **Mesh:** Any-to-any connectivity is supported at the bundle (DS0) level.

Internal Cross Connect

IPmux-4 allows a cross connect of bundles between its E1/T1 ports. This is accomplished internally so that it will not occupy Ethernet bandwidth.

QoS

QoS support:

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

The user can configure the ToS (Type of Service) of the outgoing IP packets. This allows an en-route layer-3 router or switch, which supports ToS, to give higher priority to IPmux-4 traffic for delay-sensitive and secure applications. IPmux-4 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

Available timing modes are:

- Loopback
- Adaptive
- Internal Clock
- External Clock.

Standards

G.703, G.704, G.706, G.823, ANSI T1.403, TR-AT&TG2411, G.824, IEEE 802.3, EMC Class B compliance – EN 55022 Class B

General

IPmux-4 is a 1U high easy to install standalone unit. A rack mount option is available.

IPmux-4 can be ordered with dual redundant power supplies (two AC or two DC modules).

1.2 Physical Description

IPmux-4 is a 1U high, easy-to-install standalone unit. A rack mount option is available.

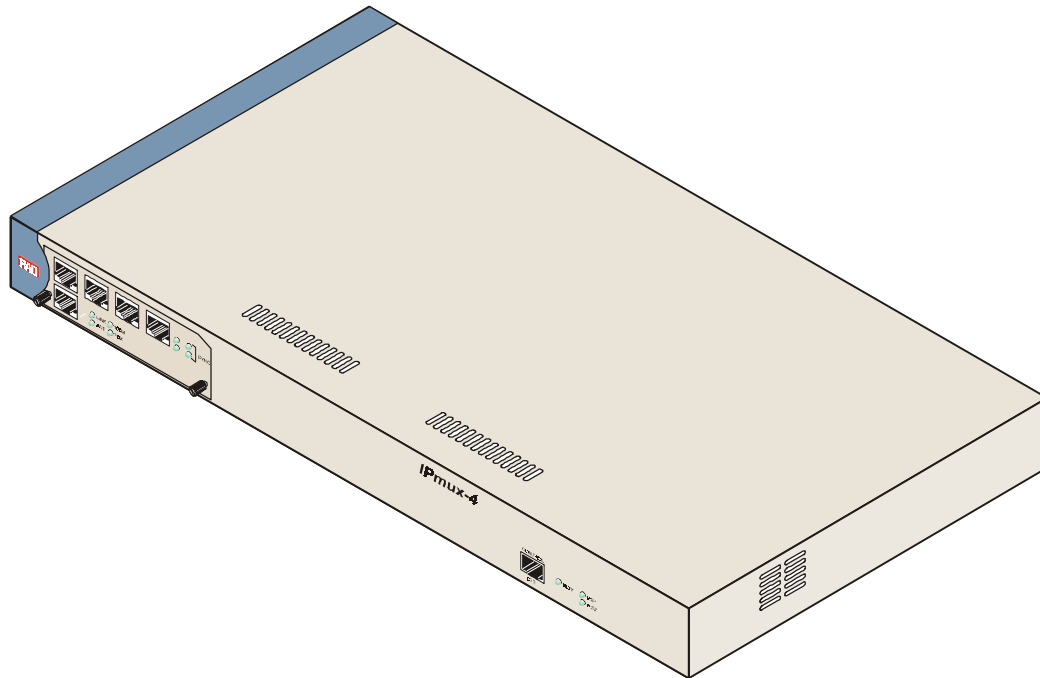


Figure 1-3. IPmux-4 3D View

Front Panel

Interface connections, the control port, and indicator LEDs are located on the front panel of IPmux-4. For further details see *Chapter 2*.

Rear Panel

Fuses, power supplies, and dry contact connector are located on the rear panel of IPmux-4. For further details see *Chapter 2*.

1.3 Functional Description

IPmux-4 modules support E1 or T1 TDM interfaces. The E1 and T1 modules have either one or four ports. Each bundle (group of timeslots) can be transmitted to a predefined destination bundle (see the following figure). IPmux-4 supports ICMP (ping), and generates ARP in case of unknown next hop MAC addresses, answers ARP requests, and supports 802.3 Ethernet format.

Configuration and management are provided via the IPmux-4 local terminal, Telnet application or SNMP such as RADview, RAD's Network Management System.

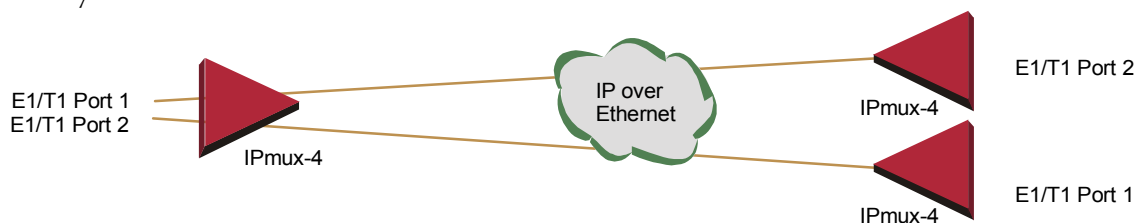


Figure 1-4. IPmux-4 Point-to-point Application

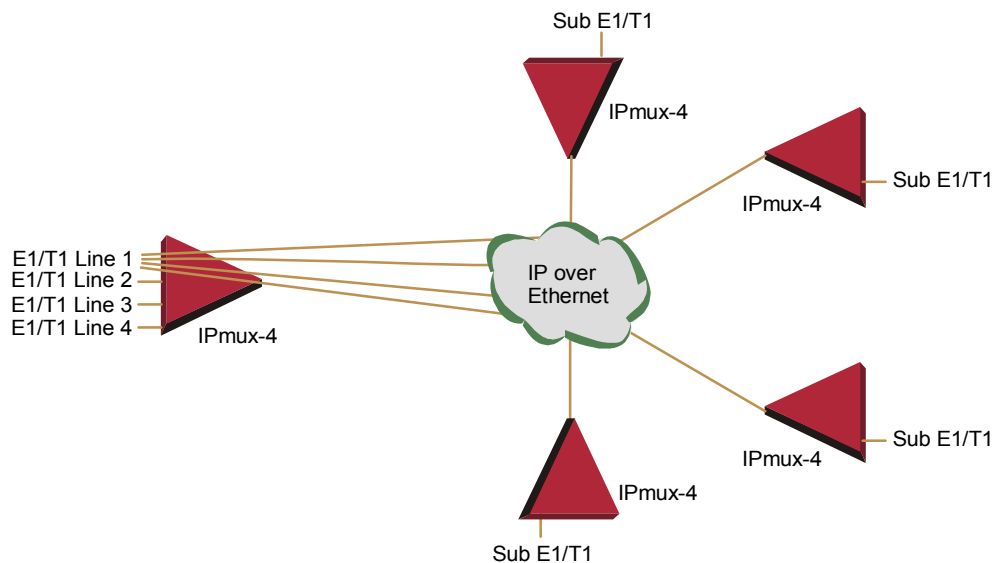


Figure 1-5. Grooming of Timeslots from Remote Sites into a Single E1/T1 Port at Central Site

Bundles composed of several timeslots (E1: 1-31, T1: 1-24) can be defined. Each bundle can be connected to a different destination bundle anywhere on the network.

Up to 124 sub-E1 or 96 sub-T1 remote bundles can be attached to one central IPmux-4. Multibundling enables concentrating many remote sites with few timeslots to the same TDM channel at the central site. A mesh topology application, in which the bundles at each site are defined to connect to several sites, is also supported.

Operation Modes

IPmux-4 operation modes are:

- Unframed
- Fractional
- Fractional with CAS.

Unframed

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

Fractional

In the fractional mode, the incoming bit stream is regarded as a sequence of nx64 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 time slots and not the whole E1/T1 as in transparent mode.

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.

Testing

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

Timing Modes

The E1/T1 Transmit (Tx) clock can operate in several timing modes to provide maximum flexibility for connecting the IPmux-4 E1/T1 interface. The clock of each port (each port is autonomous) must be configured correctly on both the Receive and Transmit ends to ensure proper operation and to prevent pattern slips.

Available timing modes are:

- Loopback – the E1 or T1 Transmit clock is derived from the E1/T1 Receive (Rx) clock.
- Adaptive – in this mode, the E1 or T1 Tx (towards the TDM device) 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 (toward the TDM device) clock decreases to avoid underflow.

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

- Internal Clock – in this mode, the Tx clock is received from an internal oscillator.
- External Clock – in the four-port version of IPmux-4, port 4 can be used to supply an external clock source. When one of the other ports (1, 2 or 3) is configured to external clock, its Tx clock is taken from the Rx clock of port 4.

Network Timing Schemes

The following paragraphs describe typical timing schemes and their correct timing mode settings in order to achieve end-to-end synchronization.

External Network Timing

All the edges of the network are synchronized according to an external network clock source. This topology enables any-to-any connectivity, thus supporting both mesh and star bundle connection topologies.

In the following application (see *Figure 1-6*), an External Clock Distribution Network provides the clock to the E1/T1 devices. All three IPmux-4 units work in LBT clock mode.

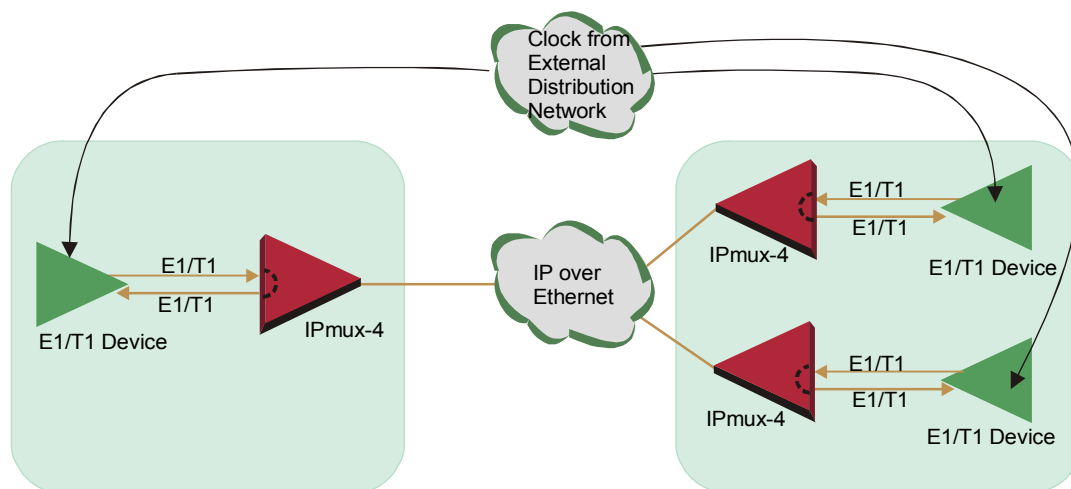


Figure 1-6. IPmux-4 in Loopback Timing Mode

In the following application (see *Figure 1-7*), the External Clock Distribution Network (GPS in this example) provides the clock directly to the IPmux-4 units that are working in EXT clock mode.

Port 4's Rx interface serves as the "Station Clock Port". Port 4 should be set to LBT clock mode. While the port (1–3) that is to work in External timing should be set to EXT clock mode (since each port is autonomous, any of the ports can be configured to either LBT or EXT clock mode).

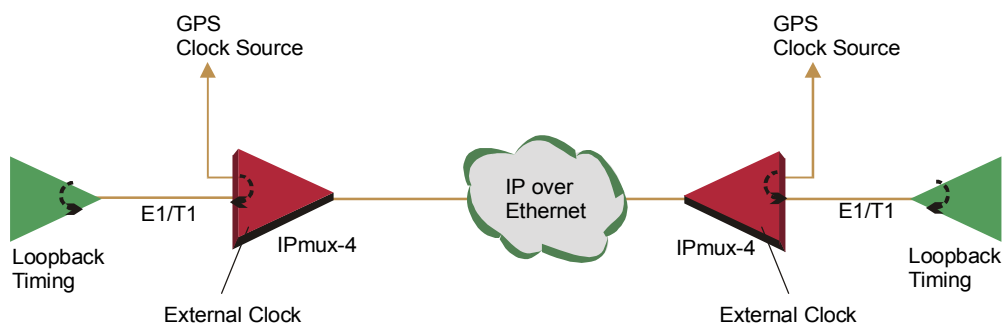


Figure 1-7. IPmux-4 in External Timing Mode

Single Clock Source Network

In this mode, the central site serves as the clock source for the whole network.

When bundles from several sources arrive at the same E1/T1 port, the clock is regenerated from the first bundle of each port (for E1, bundle number 1 for port 1, bundle number 32 for port 2, bundle number 63 for port 3, bundle number 94 for port 4).

Multiple sites that are transmitting to an IPmux-4 port that is set to adaptive mode must have the same source clock. The following table describes configuration options:

Table 1-1. Adaptive (Master) Clock Configuration Options

Central Site IPmux-4 Clock Configuration	Remote Site IPmux-4 Clock Configuration
INT	Adaptive
LBT	Adaptive
EXT	Adaptive

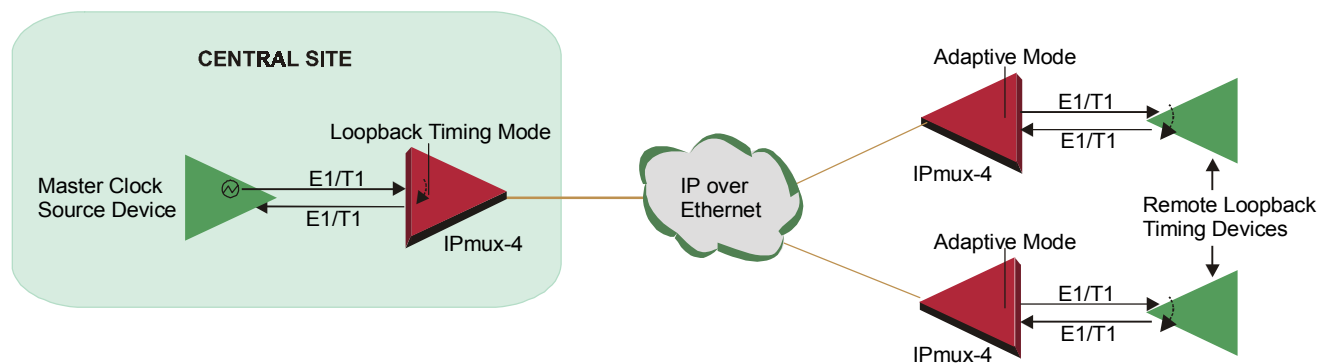


Figure 1-8. IPmux-4 in Adaptive Timing Mode

Frame Format

The Ethernet frame sent by the IPmux-4 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).

The illustration below specifies the structure of the different headers, special fields, and the payload in the Ethernet packet.

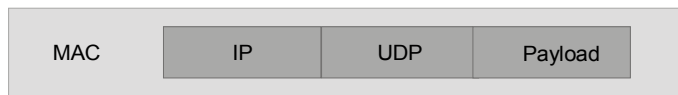


Figure 1-9. TDMoIP Frame Structure

Table 1-2. Ethernet Frame Structure

	Field length (bytes)	Field	
MAC Layer	7	Preamble	
	1	SFD	
	6	Destination MAC Address	
LLC Layer	6	Source MAC Address	
	2	Type	← IEEE 802.1p&q VLAN Tagging (additional 4 bytes if enabled)
IP Layer	1	Vers/HLEN	
	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	
UDP Layer	4	Destination IP Address	
	2	UDP Source Port	← Note: The UDP source port field is used to transfer a destination bundle number.
	2	UDP Destination Port	
	2	UDP Message Length	
Data Layer	2	UDP Checksum	
MAC Layer	...	Payload	
	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-4. The following figure describes the VLAN tag format.

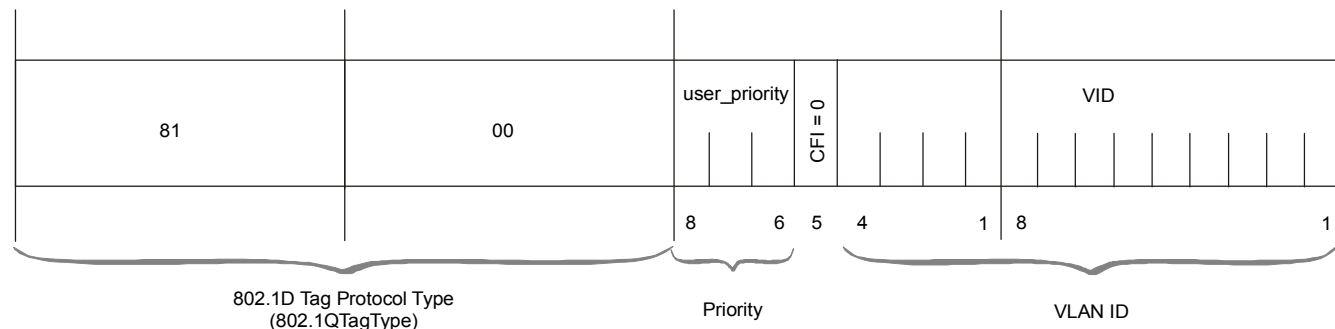


Figure 1-10. VLAN Tag Format

UDP Support

Table 1-3. UDP Source Port as Destination Voice Port

Field Length (Bits)	Field Description	Value
2 bytes	UDP Source Port*	2 – 497d
2 bytes	UDP Destination Port	2142d

* 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 voice 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, see *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-4 has a buffer that compensates for the deviation from the expected packet arrival time to prevent IPmux-4 buffers from emptying out.

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 1-11*).

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

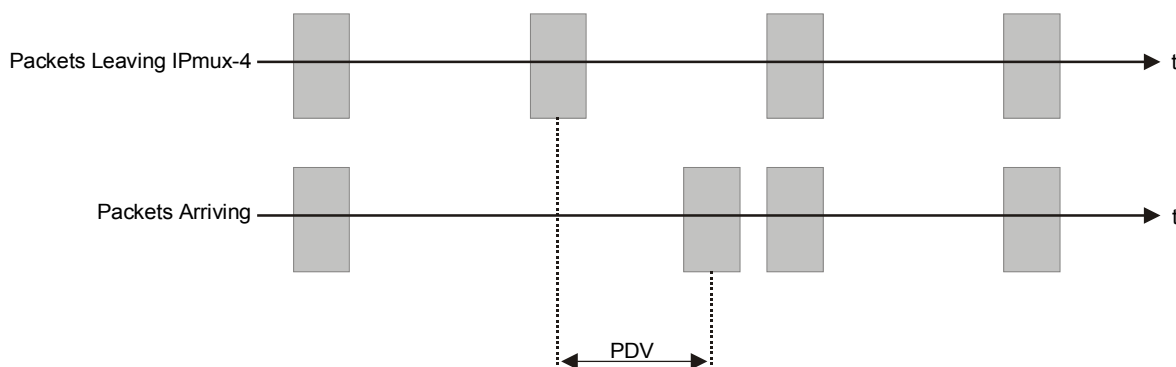


Figure 1-11. Packet Delay Variation

PDVT (Jitter) Buffer

IPmux-4 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 E1: 32 ms, T1: 24 ms.

► 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:

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

$$\text{Where } n = \frac{\text{configured TDMbytes/frame}}{48} \quad (n=1 - 8).$$

PDVT Buffer Effect on Delay

The PDVT buffer is on the TDM path. This means that 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 traveling through the Ethernet). This parameter controls the number of TDM bytes encapsulated in one frame. The TDM bytes/frame parameter can be configured to nX48 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 and 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 E1/T1 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. The tables below show the throughput as a function of the TDM bytes/frame configuration for a full E1 and a full T1.

Note Due to a limitation of IPmux-4, when configuring it to operate at TDM bytes/frame values which are >288, a single packet loss (in the IP network) will cause the jitter buffer to be flushed, so that the whole buffer contents will be lost. Thus, it is recommended to use values that are ≤288.

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

$$* \text{Overhead}(\%) = \frac{\text{Overhead}(\text{bytes})}{\text{TDM}(\text{Bytes} / \text{Frame})} \times 100$$

Table 1-5. Ethernet Throughput – Unframed T1

TDM bytes/frame	Frame length (bytes)	Overhead (bytes)	Overhead* (%)	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

$$* \text{Overhead}(\%) = \frac{\text{Overhead}(\text{bytes})}{\text{TDM}(\text{Bytes}/\text{Frame})} \times 100$$

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

Ethernet load (bps) = [(frame overhead (bytes) + TDM bytes/frame) × 8] × 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: $8000Xk / (46.875 \times n)$

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:

$$\text{RTDelay}_{(\mu\text{s})} = 2 \times \left(\frac{48 \times n}{\text{NTS}} \times 125 (\mu\text{s}) + \text{PDVT buffer } (\mu\text{s}) + 500 (\mu\text{s}) \right) + \text{Network round trip delay}$$

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

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 the IPmux-4 to facilitate the following alarms:

- | | |
|----------|--|
| Unframed | AIS will be transmitted toward the near-end PBX in event of: <ul style="list-style-type: none"> • Far-end LOS, AIS • PDVT underflow/overflow. |
| Framed | Timeslot / CAS configurable alarm pattern will be transmitted toward the near-end PBX in event of: <ul style="list-style-type: none"> • Far-end LOS, LOF, AIS • PDVT underflow/overflow. |

1.4 Technical Specifications

E1 Modules

E1 Port	<i>Ports</i>	1 or 4
	<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 -27 dB with LTU 0 to -10 dB without LTU Transmit Balanced: $\pm 3V \pm 10\%$ Transmit Unbalanced: $\pm 2.37V \pm 10\%$
	<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>		Passthrough, CRC4 MF, CAS MF
<i>Signaling</i>		CAS, CCS (transparent)

T1 Modules

T1 Port	<i>Ports</i>	1 or 4
	<i>Compliance</i>	ANSI T1.403, ITU-T Rec. G.703
	<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 -27 dB Transmit: 0 dB, -7.5 dB, -15 dB, -22.5 dB with CSU $\pm 2.7V \pm 10\%$, 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>	Passthrough, SF, ESF
	<i>Signaling</i>	CAS (bit robbing), CCS (transparent)
Local Terminal and Control Interface		RS-232 over RJ-45 (adapter cable to DB-15 supplied)
	<i>Mode</i>	DTE
	<i>Baud Rate</i>	9.6, 19.2, 38.4, 57.6 kbps
	<i>Connector</i>	RJ-45
Dry Contact Alarm	<i>Connector</i>	DB-9
	<i>Contacts</i>	30V 2A
Ethernet Modules	<i>Compliance</i>	IEEE 802.3, 802.3u, Ethernet, 802.1p&q
	<i>Connector</i>	RJ-45, 8 pin
	<i>Ports</i>	1
	<i>Data Rate</i>	10 Mbps or 100 Mbps, full or half duplex
	<i>Range</i>	Up to 100m over UTP Category 5 cables
General	<i>System Indicators</i>	General:
		PS1 ON when main power supply is OK OFF when a malfunction is detected
		PS2 ON when secondary power supply is OK BLINKS when a malfunction is detected OFF when secondary power supply does not exist (no power supply redundancy)
		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
FDX	OFF when half duplex ON when full duplex
100M	OFF when 10 MHz ON when 100 MHz

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)
------	---

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

<i>Power</i>	1 or 2 power supplies 30W, 100 to 240 VAC, 50/60 Hz –36 to –72 VDC (–48 VDC nominal)
<i>Physical</i>	Height 4.4 cm / 1.7 in (1U) Width 43.2 cm / 19 in Depth 35 cm / 13.78 in Weight 2.8 kg / 6.2 lb
<i>Environment</i>	Temperature: 0 to 45°C / 32 to 110°F
<i>Humidity</i>	Up to 90%, non-condensing

Chapter 2

Installation

2.1 Introduction

IPmux-4 is delivered completely assembled for bench-top installation. The only mechanical installation procedure that may be necessary is optional installation in a 19" rack. Refer to the *Rack Mounting Kit for 19-inch Racks* guide that comes with the RM kit.

After installing the unit, configure the IPmux-4 using an ASCII terminal connected to the IPmux-4 control port. The IPmux-4 configuration procedures are described in *Chapter 3* of this manual.

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



Warning

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

AC-powered IPmux-4 units should be installed 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-4 units require a -48 VDC power source.

Caution The DC power source must be isolated from the mains supply by double or reinforced insulation.

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-4 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-4 package contains the following items:

- IPmux-4 unit
- Power cord
- CBL-RJ-45/DB-9/NULL cross-cable that connects the IPmux-4 control port and an ASCII terminal (DTE) for local management.
- RM-11 kit containing hardware for mounting IPmux-4 in a 19-in rack (optionally supplied).

Power Cable

IPmux-4 comes equipped with the power cord connected to PS1 on the Rear Panel. If the unit is equipped with a redundant power supply, IPmux-4 is equipped with an additional power cord.

2.4 Equipment Needed

- Hand Tools and Kits
IPmux-4 needs no special tools for installation. A screwdriver is necessary when mounting IPmux-4 in a 19-in rack.
- Control Cable
IPmux-4 is provided with one null cable:.

The null cable (CBL-RJ-45/DB-9/NULL) is used to connect IPmux-4 (DTE) to a terminal (DTE). Terminals are usually equipped with a male connector DB-9 or DB-25; therefore the null cable should have a female connector.

A straight cable can be defined to connect IPmux-4 (DTE) to a modem (DCE).

Table 2-1. Straight Cable Pinout Connections

EIA/TIA-561 Name	EIA/TIA-561 Pin No.	DB-25 Male Pin No.	EIA 232 Name
Ring Indicator	1	6	DSR
RCV Line Signal Detector	2	8	DCD
DTE Ready	3	20	DTR
Signal Common	4	7	Common
Rx data	5	3	Rx data
Tx data	6	2	Tx data
Clear To Send	7	5	CTS
Req To Send/Ready for RCV	8	4	RTS

Table 2-2. Null Cable Pinout Connections

EIA/TIA-561 Name	EIA/TIA-561 Pin No.	DB-9 Male Pin No.	EIA 232 Name
Signal Common	4	5	Common
Rx data	5	3	Rx data
Tx data	6	2	Tx data

On the RJ-45 connector, pins 1, 2, and 3 are shorted together and pins 7 and 8 are shorted together. Refer to the following figure.

On the DB-9 connector, DCD (pin 1), DTR (pin 4) and DSR (6) are connected together. RTS (pin 7) is shorted together with CTS (pin 8). Refer *Figure 2-1*.

CBL-RJ-45/DB9/NULL

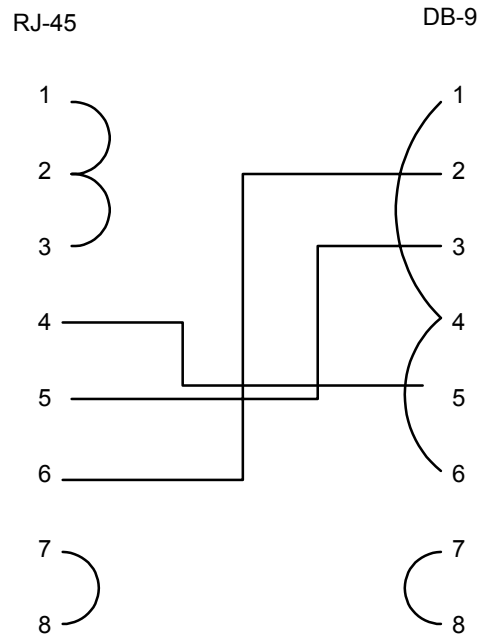


Figure 2-1. Null Cable (CBL-RJ-45/DB-9/Null) Pin Shorts

2.5 Installation and Setup

Setting Jumpers

IPmux-4 internal jumpers and switches do not need to be configured by the user and therefore removing the product cover is not required.

Connecting Interfaces and Cables

Figure 2-2 and Figure 2-3 illustrate the rear and front panel options available for IPmux-4.

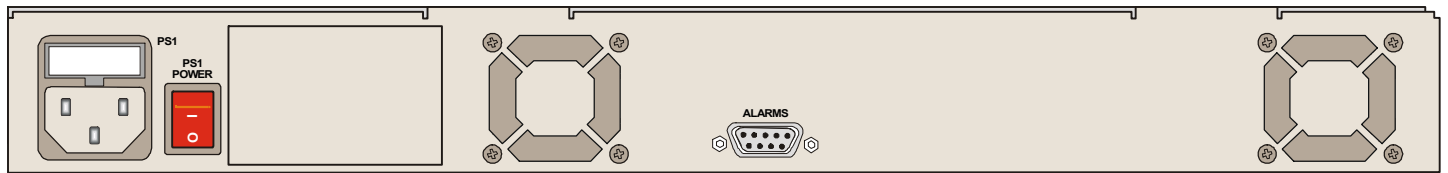


Figure 2-2. IPmux-4 Rear Panel



Figure 2-3. IPmux-4 Front Panel

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, 2 A T 250V as marked on the IPmux-4 rear panel, are used for replacement.

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

Location of Connectors

Connect the E1/T1 and Ethernet ports according to the appropriate pinout. Interface connections are made from the IPmux-4 front panel from each module, as shown in Figure 2-3. The connectors required for each interface are listed in Section 2.4, above. E1/T1 and Ethernet port pinouts are listed in the following tables.

Table 2-3. 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 2-4. Ethernet Port Pinout

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

Connecting the Control Port

The Control port is located on the right side of the IPmux-4 front panel (see *Figure 2-3*).

► **To connect the Control Port:**

- Connect the RS-232/V.24, shielded RJ-45 DTE connector cable, supplied with IPmux-4, to the IPmux and then to the DTE.
The control port is DTE for an ASCII terminal.

Connecting the Alarm Connector

An Alarms connector is located on the rear panel. A DB-9 female connector provides alarm relay dry-contacts to external supervisory equipment (for future use). This feature allows IPmux-4 to send alarms on its dry contact port (Output alarms). A single output pin indicates an IPmux-4 alarm.

DB-9 pins:

- Pin 3
 - INPUT
- Pin 4
 - Normal Operation: Closed (shorted to pin 3). This state represents no alarm in IPmux-4.
 - Alarm Detected: Open (not shorted to pin 3). This state represents an alarm in IPmux-4.
- Pin 5
 - Normal Operation: Open (not shorted to pin 3). This state represents no alarm, normal operation, in IPmux-4.
 - Alarm State: Closed (shorted to pin 3). This state represents an alarm in IPmux-4.

The DB-9 connector also allows alarms to be sent to the NMS (Input alarms). These alarms are called General Alarms and are numbered 1 through 4.

- Pin 1 (shorted to pin 8) sends NMS General Alarm 1
- Pin 2 (shorted to pin 8) sends NMS General Alarm 2
- Pin 7 (shorted to pin 8) sends NMS General Alarm 3
- Pin 8 (shorted to pin 8) sends NMS General Alarm 4.

The alarms that trigger the relay are listed in *Chapter 3, Table 3-1*. The relay will be activated only if the specific Alarm trap is enabled (not masked).

Connecting the Power

IPmux-4 is available with either an AC or a DC power supply (*Figure 2-2*).

► **To connect the power:**

1. Connect the power cord, supplied with IPmux-4, to PS1 on the IPmux-4 rear panel. If a redundant power supply is present, connect the other power cord supplied to PS2.
2. Before connecting IPmux-4 to power, check that the ON/OFF switch(es) on the rear panel is (are) set to OFF.
3. Connect the power cord first to PS1 (and PS2) and then to the mains outlet. The outlet should be within 1.5 meters (five feet) of the unit.

Caution The power cord must be plugged into an outlet with a protective ground (earth) contact. The protective action must not be negated by use of an extension cord without a protective conductor (grounding).

Chapter 3

Operation

3.1 Introduction

This chapter gives a detailed description of the front panel controls and indicators and their functions, explains power-on and power-off procedures, and provides instructions for using a terminal connected to the IPmux-4 Control Port.

3.2 Front Panel Controls, Connectors, and Indicators

Interface modules installed in IPmux-4 have their own LED indicators (see *Figure 3-1* and *Figure 3-2*). The unit's LEDs are located on the right side of the front panel.

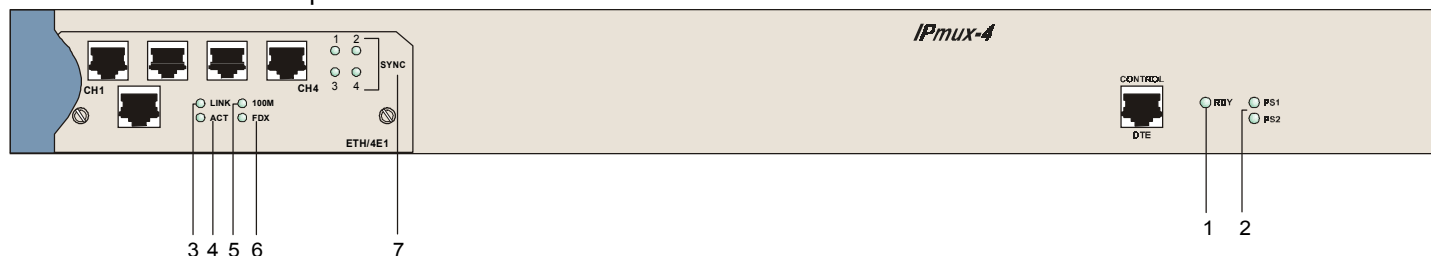


Figure 3-1. IPmux-4 Front Panel LEDs

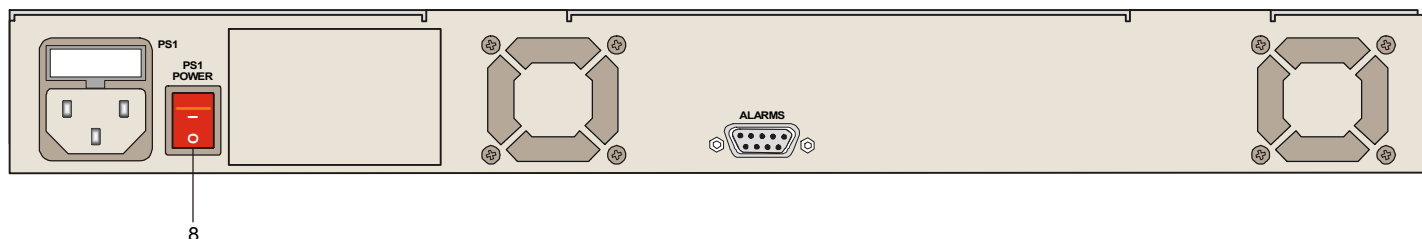


Figure 3-2. IPmux-4 Rear Panel Switch

Table 3-1 lists the functions of the IPmux-4 system indicators and switches.

Table 3-1. IPmux-4 System Indicators and Switches

No	Module	Name	Type	Function
1	System	RDY	LED	On: Device OK OFF: Self-test in progress Blinking: Malfunction detected
2	System	PS1/PS2	LED	On: Unit powered Off: Unit not powered
3	Ethernet	LINK	LED	Off: Link not active On: Line OK
4	Ethernet	ACT	LED	Off: No activity On: Frame being transferred on line
5	Ethernet	100M	LED	Off: 10 MHz On: 100 MHz
6	Ethernet	FDX	LED	Off: Half duplex On: Full duplex
7	E1	SYNC	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)
8	Rear panel	PS1/PS2	Switch	Turns IPmux-4 power On and Off

3.3 Operating Instructions

Turning IPmux-4 On – Without Control Terminal

IPmux-4 power switches are located on the back panel, as shown in *Figure 3-2*.

➤ **To power up IPmux-4 without a terminal:**

- Switch the PS1 power supply switch, located on the rear panel, to ON. IPmux-4 can be optionally equipped with a second power supply (PS2). If present, switch PS2 to ON.

After power-up, check the unit LED indicators, located on the right side of the front panel, and the module indicators for proper operation (see *Figure 3-1*, *Figure 3-2*, and *Table 3-1*).

Turning IPmux-4 On – With Control Terminal

➤ **To power up IPmux-4 with a control terminal:**

Note *If you want to download software, refer to Appendix B, which describes the boot procedure for software download.*

1. Verify that 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), with the null cable supplied with the unit (CBL-RJ-45/DB-9/NULL).
3. Turn on the control-terminal PC.
Set the 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 PS1 power supply switch, located on the rear panel. IPmux-4 can be optionally equipped with a second power supply (PS2). If present, switch PS2 ON.
5. When the test is over, a message appears "Self Test Ended." If the self-test is successful, the RDY LED (*Figure 3-1*) on the right side of the front panel lights. If problems are encountered, refer to *Chapter 4* for instructions.
6. Press **ESC** to open the configuration software or press **M** for details.
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 **xxxxxxxxxx**).
The Main Menu is displayed (*Figure 3-4*).

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

User Name and Password

➤ **To enter as a superuser:**

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

This allows you to configure all the parameters of Ipmux-4, and to change the *su* and *user* passwords.

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

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

This does not allow you to make configuration changes.

- **To set all passwords to the default value (xxxxxxxx):**
 - Enter as **su** and 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 a user forgets his password:**
 - Consult Technical Support at RAD for further assistance (send email to support@rad.co.il).

Turning IPmux-4 Off

- **To power off the unit:**
 1. If you are using a terminal connection, press escape until you return to the main menu and press **4. Exit**.
 2. Switch PS1 (and PS2 if connected) to OFF.

3.4 Getting Started

After installation, there are no special operating procedures for IPmux-4. Once it is powered up, the unit operates automatically. Proper operation is indicated by the front-panel LED indicators (*Figure 3-1* and *Figure 3-2*). The unit operational status can be monitored constantly.

If required, IPmux-4 can be reconfigured. Both the IPmux-4 configuration and monitoring operations are performed locally from an ASCII terminal connected to the Control Port. Detailed configuration procedures are given in *Section 3.6* and *Appendix E*. The following functions are supported:

- View system information
- Modify configuration and mode of operation, including setting system default values
- View statistics and status
- Perform diagnostics.

IPmux-4 configuration and system monitoring, including troubleshooting procedures, can also be performed from a remote site using a Telnet application or RADview (RAD's HP OpenView based SNMP).

3.5 Overview of Menu Operations

Navigating

Navigate the IPmux-4 terminal menus to set and view configuration parameters. *Figure 3-3* maps the IPmux-4 terminal menus. Use this tree as a reference aid while performing configuration and control functions. Refer to *Appendix E* to find specific parameters.

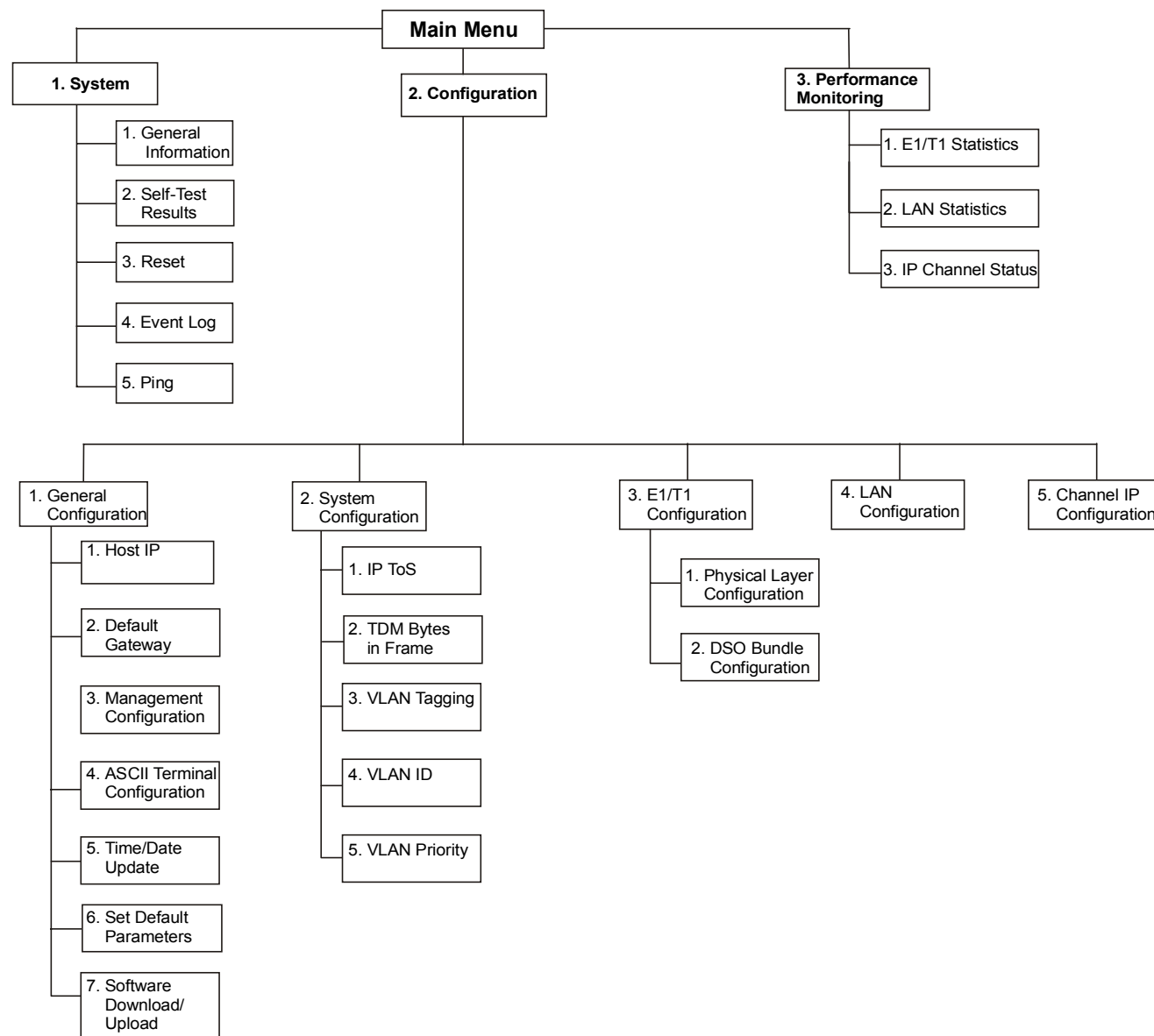


Figure 3-3. IPmux-4 Terminal Menu Tree

3.6 Configuring Parameters

Main Menu

Figure 3-4 shows the IPmux-4 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.

Only from this menu can you exit the program. 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 re-entry.

```

                                MAIN MENU
1.System                        >
2.Configuration                 >
3.Performance Monitoring       >
4.Exit                          >

Select item from the menu:      _

```

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


```

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

ESC.  Exit
Select item from the menu.

```

Figure 3-5. System Menu

Refer to *Appendix E* for specific parameters.

Setting IPmux-4 Configuration Options

Main Menu
↓
2. Configuration

► **To access the Configuration menu:**

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

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

- | | |
|---|---|
| 1. General Configuration | Configure Host IP, Default Gateway, Management Configuration, ASCII Terminal Configuration, Time/Date update, Default parameters, and download software updates |
| 2. System Configuration | Configure IP ToS, TDM bytes/frame and VLAN tagging |
| 3. E1/T1 Configuration | E1/T1 physical layer and bundle configuration |
| 4. LAN Configuration | Configure LAN parameters |
| 5. Bundle Connection Configuration | Configure connection parameters. |

```

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

ESC.  Exit
Select item from the menu:  _

```

Figure 3-6. Configuration Menu

Type the number for the type of configuration; the appropriate menu appears. Refer to *Appendix E* for configuration menus and specific parameters.

Performance Monitoring

Main Menu



**3. Performance
Monitoring**

► **To view Performance Statistics:**

- Type **3** (Performance Monitoring) in the **Main** menu.

From the Performance Monitoring menu you can view:

- 1. E1/T1 Statistics**
- 2. LAN Statistics**
- 3. Bundle Connection Status**

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

Chapter 4

Troubleshooting and Diagnostics

4.1 Error Detection

Front Panel LEDs

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

Working with the Alarm Buffer

IPmux-4 maintains an Event Log File that stores up to 2000 events. All events are time-stamped. The user can view the contents of the Event Log File via an ASCII terminal or a Network Management Station. The user can also clear the contents of the Log File.

Table 4-1 alphabetically presents the event types that appear on the Event Log File, 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-4 **MUST** be checked by the **authorized** technical support personnel.

Table 4-1. Event Types

Event	Description	Corrective Action
COLD_START	The IPmux-4 has been powered up	None
PS1_ACTIVE OR PS2_ACTIVE	One of the IPmux-4 power supply units is powered on	None
PS1_NOT_ACTIVE OR PS2_NOT_ACTIVE	One of the IPmux-4 power supply units is powered off	Check the external mains supply
FATAL ERR	The IPmux-4 has encountered an internal fatal error	The IPmux-4 requires servicing
SYS USER RESET	The IPmux-4 had been reset by the user	None
LOS START	The IPmux-4 has a LOS (loss of signal) state on one of its E1/T1 channels	1. Check the port cable connection 2. Check input signal
LOS END	The LOS state detected has ended	
LOF START	The IPmux-4 has a LOF (Loss of frame synchronization) state on one of its E1/T1 channels	1. Check port cable connection 2. Check input signal
LOF END	The LOF state detected has ended	None
LINE AIS START	The IPmux-4 has AIS (alarm indicator signal) state on one of its E1/T1 channels	Check for a fault at the E1/T1 network, on the receive direction
LINE AIS END	The line AIS state detected has ended	None
LINE RDI START	The IPmux-4 has LINE RDI (remote defect indicator) state on one of its E1/T1 channels	Check for an E1/T1 connectivity fault on the transmit side
LINE RDI END	The LINE RDI state detected has ended	None
LINE FEBE START (SDH module only)	The IPmux-4 has LINE FEBE state on one of its E1/T1 channels	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-4 on the specified connection	Check Eth/IP path
Remote Fail End	The remote fail state has ended	None
Local Fail Start	Ethernet frames are not received by the local IPmux-4 on the specified connection	Check Eth/IP path
Local Fail End	The local fail state has ended	None

4-2 Error Detection

4.2 Troubleshooting

The following table 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-4 Troubleshooting Chart

Fault	Probable Cause	Remedial Action
The E1/T1 equipment connected to IPmux-4 is not synchronized (E1/T1 level) with IPmux-4	Configuration problems	<ol style="list-style-type: none"> 1. Check IPmux-4 port configuration and, if necessary, other IPmux-4 parameters. 2. Check E1/T1 physical connection (use loopbacks).
Slips and errors in E1/T1 equipment	<p>Ethernet port in switch and IPmux-4 are not in the same rate or duplex mode</p> <p>Ethernet port is set to work in half duplex mode (may cause extreme PDV because of collisions and backoffs)</p> <p>Timing configuration is not properly set (periodic buffer under/overflows – bundle connection status menu)</p> <p>Network PDV or Lost Frames</p>	<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-4 port configuration (negotiation, rate, duplex mode) 4. Check PDV introduced by the network, and, if necessary, increase PDVT jitter buffer setting.
Echo in voice		<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.

Main Menu
↓
2. Configuration
↓
3. E1/T1
Configuration
↓
**1. Physical Layer
Configuration**

► To run a loopback test:

- From the main menu press **2** (Configuration), **3** (E1/T1 Configuration) and then **1** (Physical Layer Configuration).
- Type **2** and press the spacebar on your keyboard to toggle between: Internal / External / Disable.
 - 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/T1 Tx path toward the PBX. Incoming data from the PBX will be ignored.
 - External: Data received from the PBX at the receive E1/T1 line will be looped back to the E1/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**

External Loop

IPmux-4 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.

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

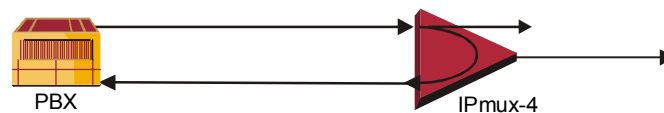


Figure 4-1. External Loop

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.

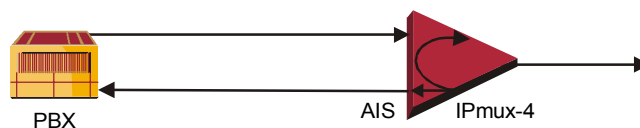


Figure 4-2. Internal Loop

T1 FDL Support

The following FDL commands are supported:

- Line Loopback (LLB): external loop
- Line Loopback Release: normal state.

T1 PRM Support

The T1 module supports PRM message transmission according to the ANSI T1.403 protocol. Messages are transmitted every second.

Chapter 5

Application Configuration Procedures

This chapter 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*).

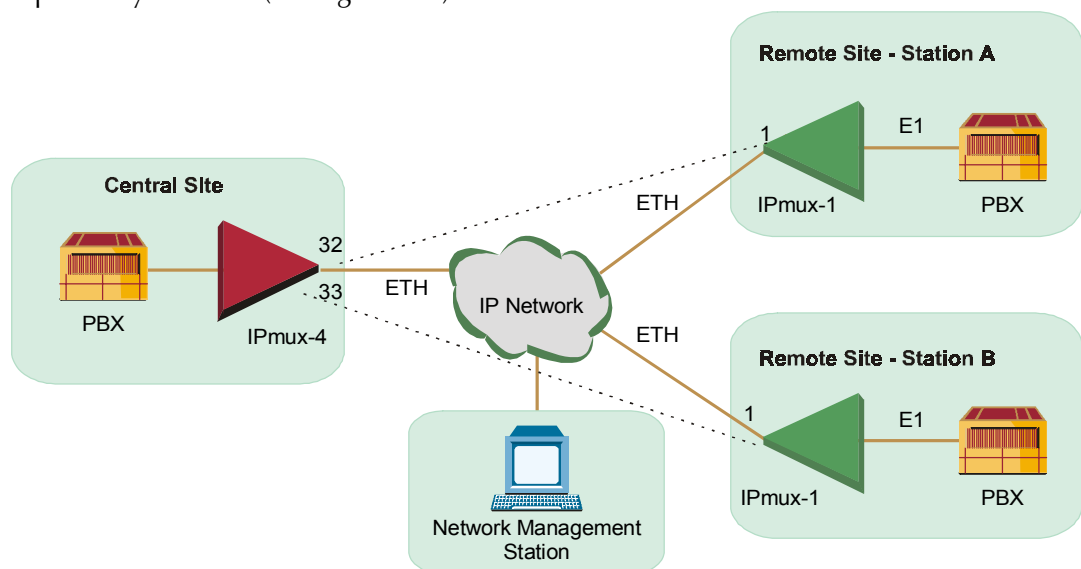


Figure 5-1. IPmux-1 Operating Opposite IPmux-4

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.

Further details are explained in *Chapter 2*.

➤ **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 for 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

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

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** (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 for 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

► 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** (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

► To create the bundles:

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

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

► 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** (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.*

- | | |
|--|--|
| <p>Main Menu
↓
2. Configuration
↓
1. General Configuration
↓
1. Host IP</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

➤ **To configure E1/T1:**

- | | |
|---|---|
| <p>Main Menu
↓
2. Configuration
↓
3. E1/T1 Configuration
↓
2. Channel Number Configuration
↓
1. Physical Layer Configuration</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:**

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

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

- From the Management Configuration menu, press **2 Manager List** (see Figure 5-9).
- 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).
- Select **Status Change Trap** according to your application requirements (for details refer to *Manager List* in the *IPmux-4 manual*).
- Select **Alarm Trap** according to your application requirements (for details refer to *Manager List* in the *IPmux-4 manual*).
- Select **System Trap** according to your application requirements (for details refer to *Manager List* in the *IPmux-4 manual*).
- Press **<S>** to save the configuration.
- 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**.

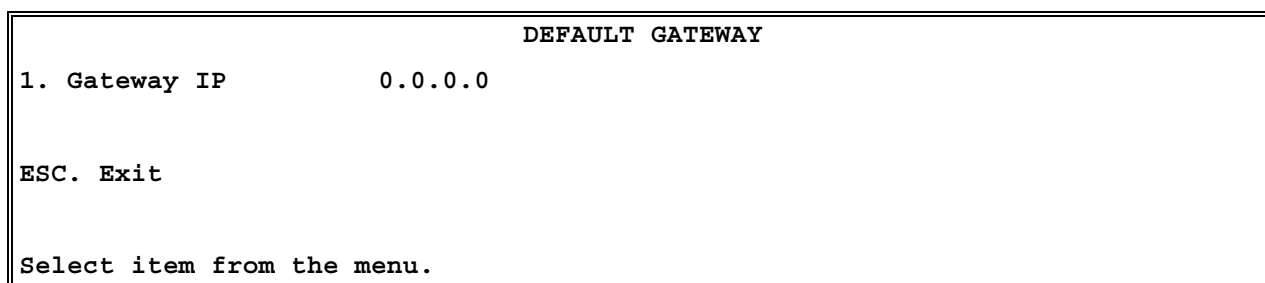


Figure 5-11. Default Gateway Menu

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.

Step 1 – Using IPmux Statistics

► **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.

Step 2 – Using TDM Equipment Statistics and Functionality

After you have verified all the issues in *Step 1*, check the following:

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-4 boot procedure via an ASCII terminal for downloading software.

The IPmux-4 software is stored in the 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-4 code. One copy is called the **operating file**, and the other is called the **backup file**. The operating file is the default-executable IPmux-4 code. The backup file is used whenever the operating file is absent or corrupted.

A.2 Booting IPmux-4

General

IPmux-4 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-4 configuration.

Boot Sequence

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

```
BOOT Program V 2.0  7-29-98 08:37
Flash : size 400000h, FileSys sectors 64
  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: anteappl.bin
  #clcod #IPmux-4 m68360 code: V 1.0 10-21-99 08:02
  got start addr : a60000
  Decompression-process.....
  Decompression Ended !!!
Jumping to Application, addr = a60008
```

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-4 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 **Ctrl+A** within this delay interval; the File System menu is displayed. (If you do not press **Ctrl+A** within three seconds, booting will continue normally.)

```
IPmux-1 BOOT MENU

The IPmux-1 can store two software files in its File System.
One is called Operating file and the Second is called Backup file.

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) :

After this operation the system will RESET !
Please confirm (Y or N): Y
```

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, a prompt asking for confirmation is displayed.

Appendix B

SNMP Management

This appendix provides specific information for IPmux-4 management by SNMP (Simple Network Management Protocol).

The SNMP management functions of IPmux-4 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.

B.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-4 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-4 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
- 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-4 object id is **iso(1).org(3).dod(6).internet(1).private(4).enterprises(1).rad(164).radGen(6).systems(1).radAce(3).radIPmux4(81)**

Enterprise-specific MIBs supported by RAD equipment, including IPmux-4, 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-4 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-4 SNMP agent stores the IP address of the Network Management Station (NMS) that is intended to manage it.

Appendix C

Telnet

C.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-4 inband via remote ASCII Terminal using the Telnet IP protocol.

C.2 Using Telnet to Manage the IPmux-4

Starting a Telnet Session

IPmux-4 is normally controlled by an ASCII terminal emulation application running on an OS. To control the IPmux-4 using Telnet, you must first open a Telnet application on a local PC.

See *Figure C-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-4.
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 will now be active.

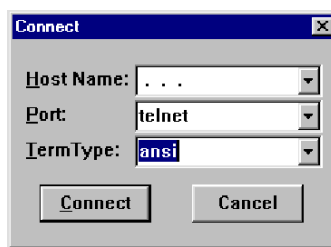


Figure C-1. Telnet Logon Dialog

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 minutes if no characters were sent (see the ASCII terminal Configuration Menu – Chapter 3).

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.

When configured to default values from the terminal, host and default gateway parameters will be erased.

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 D

TFTP Download Procedures

D.1 Inband TFTP Download Procedure

General

A new IPmux-4 software version can be downloaded to the IPmux-4 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 the TFTP window in *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*.

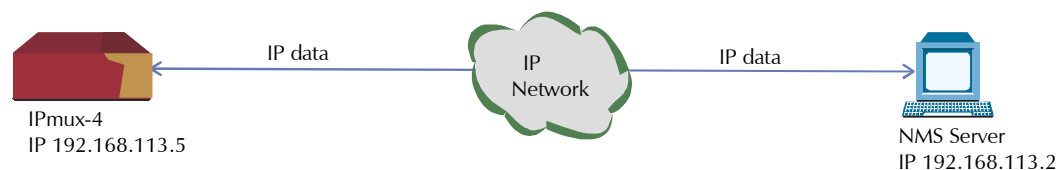


Figure D-1. TFTP Downloading Procedure

The IPmux-4 manager station must be equipped with a TFTP server and the new software.



Warning

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

► To start download:

1. Set the appropriate IPmux-4 MIB parameter. The IPmux-4 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 the IPmux-4 and the TFTP server.

Preliminary Procedure

► Before performing TFTP download:

1. Ping the IPmux-4 from the station running the TFTP server to ensure that the IPmux-4 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-4; 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.filetransfer**; 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.

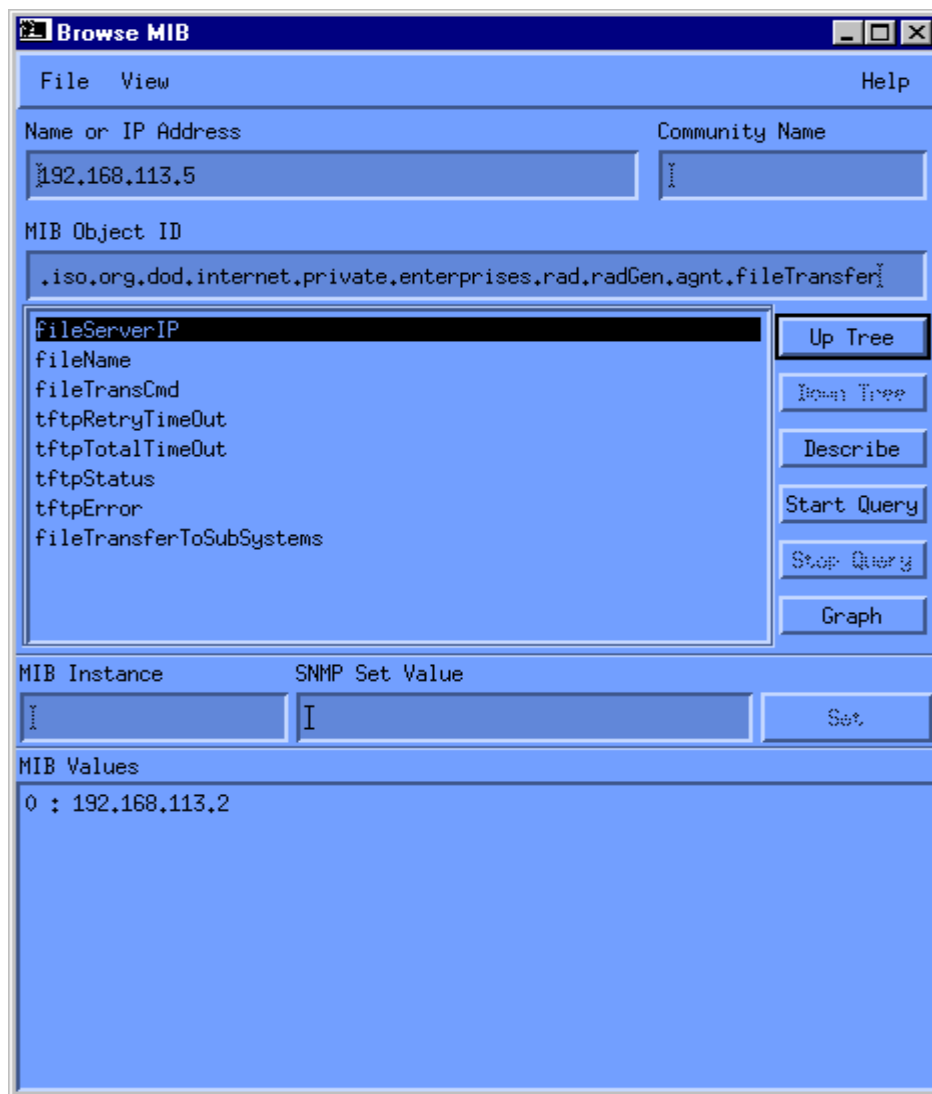


Figure D-2. Agent and Server IP Addresses

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 the <**Start Query**> button.
3. Scroll right to check that the application version you have just loaded is the correct one.

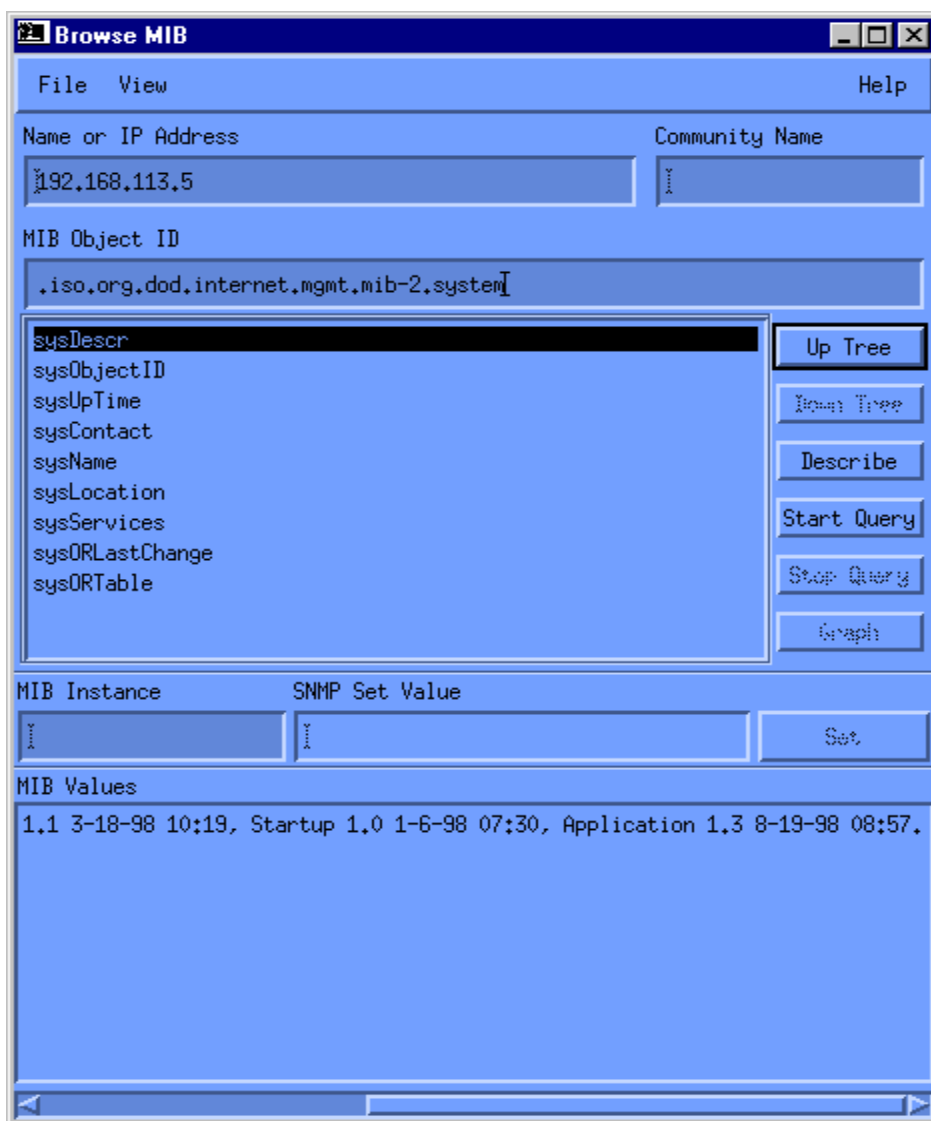


Figure D-3. System Description

Appendix E

Parameters and Screens

This appendix illustrates the IPmux-4 screens and explains:

- Viewing the IPmux-4 System in *Section E.1*
 - General Information
 - Self-Test Results
 - Reset
 - Event Log
 - Ping
- General Configuration in *Section E.2*
 - Host IP
 - Default Gateway
 - Authentication/Community
 - Manager List
 - Alarms Trap Mask
 - ASCII Terminal Configuration
 - Time/Date Update
 - Set Default Parameters
 - X-Modem
 - TFTP
- System Configuration in *Section E.3*
 - IP ToS
 - TDM Bytes in Frame
 - VLAN Tagging
 - VLAN ID
 - VLAN Priority
- E1/T1 Configuration in *Section E.4*
 - E1/T1 Physical Layer
 - DS0 Bundle Configuration
- LAN Configuration in *Section E.5*
- Bundle Connection Configuration in *Section E.6*

- Performance Monitoring in *Section E.7*
 - E1/T1 Statistics
 - LAN Statistics
 - Bundle Connection Statistics.

E.1 Viewing the IPmux-4 System

General Information

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

This displays information including software and hardware versions and module descriptions. A typical General Information window for an IPmux-4 is shown in the following figure.

```

                                GENERAL INFORMATION

Software Versions                Hardware Version    Inventory No.
Boot:  2.00 10-14-98 10:59      1.0, CSL: A       102392
Application: 2.00-B1 8-31-00
                13:12
Backup Application:
                .00-A1 8-30-99
                14:34

#s
Module      Description          Versions           Inventory No.
User        4 E1 over UTP             HW:1.0/4.0 SW:M.4  113853
            ETHERNET over UTP

Press ESC to exit
  
```

Figure E-1. General Information Window

Self-Test Results

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

A typical Self-Test Results window for an IPmux-4 is shown in the following figure. If a problem is encountered refer to *Chapter 4*

► **For details:**

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

```

                                SELF TEST RESULTS
USER PORT: Framer Test  --  Ok
USER PORT: SAR Test    --  Ok
LAN RAM test           --  Ok
LAN card code download --  Ok
Ethernet test         --  Ok
USER PORT: RT Registers--  Ok
USER PORT: RT RAM Size -- 512 KB
USER PORT: RT Ext RAM  --  Ok
MAIN BOARD: RT Registers      --  Ok
MAIN BOARD: RT RAM Size-- 512 KB
MAIN BOARD: RT Ext RAM  --  Ok
Self test ended           --  successfully

Press ESC to exit

```

Figure E-2. Last Self-Test Results Window

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.

```
Are you sure you want a total reset??? (Y/N)
```

Figure E-3. Reset Confirmation Message

Logfile Events

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

LOGFILE EVENTS				
1999-09-15	10:35:01	UAS START		USER_PORT
1999-09-15	10:34:52	PS2 NOT ACTIVE		
1999-09-15	10:34:52	PS1 ACTIVE		
1999-09-15	10:34:52	LOS START		USER_PORT
1999-09-15	10:34:52	COLD START		
1999-09-08	18:30:19	UAS START		USER_PORT
1999-09-08	18:30:11	PS2 NOT ACTIVE		
1999-09-08	18:30:11	PS1 ACTIVE		
1999-09-08	18:30:11	LOS START		USER_PORT
1999-09-08	18:30:11	COLD START		

N. Next				
ESC. Exit				

Figure E-4. Logfile Events – Sample Menu

For a complete list of events, refer to *Working with the Alarm Buffer in Chapter 4*.

Ping

Main Menu
↓
1. System
↓
5. Ping

- This option enables the user to ping other network devices for diagnostic purposes.
- **To ping:**
 1. Enter the **Destination IP Address** and press <Enter>.
 2. Press the <Space bar> to set the number of ping repetitions.
 3. Press <Enter> to apply the settings.

SYSTEM	
PING	
Enter Destination IP And Press Enter.	
Destination IP:	111.123.112.215
ESC. Exit	
Enter new value. Range:	

Figure E-5. Ping Dialog Box

E.2 General Configuration

Host IP

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

► **To configure the Host IP address and IP Mask:**

1. Press **1** and enter the **Host IP**.
2. Press **2** and enter **IP Mask**.

This combines the IP packet (source IP Add). This Host IP is also necessary for the inband management capability of IPmux-4.

Note

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

HOST IP	
1. IP Address	192.168.217.12
2. IP Mask	255. 255. 255. 0
ESC. Exit	D. Delete
Select item from the menu: _	

Figure E-6. User Port Configuration Menu

Note

To change the Host IP configuration, you must first delete all connections defined in the Bundle Connection Configuration, the Default Gateway and any defined managers, and then delete the Current Host Configuration and then reconfigure both.

Default Gateway

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

Default gateway defines the gateway to which management frames will be sent (when the manager is not in the host subnet).

► **To configure the default gateway:**

- Type **1** and then type in the **IP address** of the default gateway.

DEFAULT GATEWAY	
1. Gateway IP	0.0.0.0
ESC. Exit	
Select item from the menu.	

Figure E-7. Default Gateway Menu

Authentication/Community

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

Configure the Authentication/Community parameters when the IPmux-4 inband management capability is used. The parameters define the community names used by SNMP to write, read or accept traps from IPmux-4.

The Community window is displayed in *Figure E-8*.

The default value for all three operations is **public**.

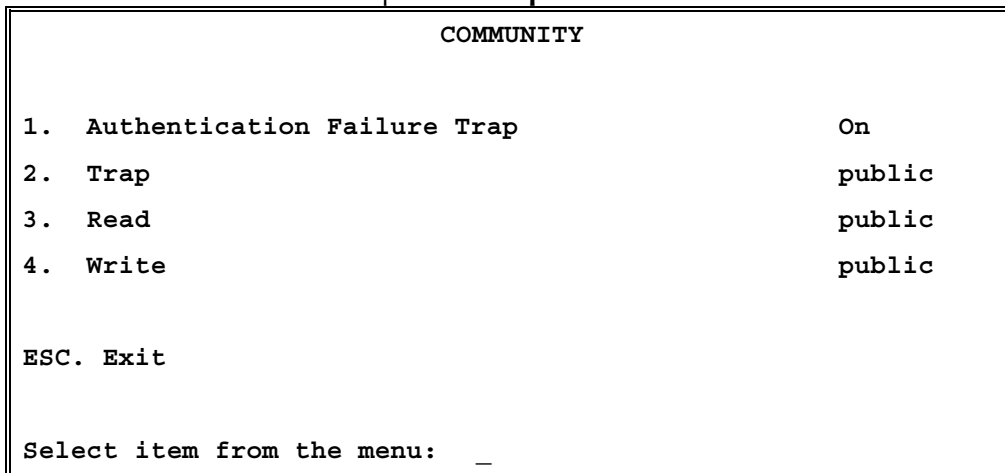
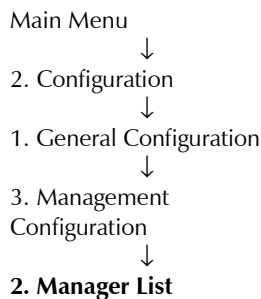


Figure E-8. Community Window

Table E-1. Community Parameters

Key	Parameter	Possible Values	Remarks
1	Authentication-Failure Trap	On Off	An authentication-failure trap is generated when a system manager attempts to set a parameter within IPmux-4 with an incorrect community value
2	Trap community	A name of up to 10 alphanumeric characters	The entry is case-sensitive
3	Read Community	A name of up to 10 alphanumeric characters	The entry is case-sensitive
4	Write Community	A name of up to 10 alphanumeric characters	The entry is case-sensitive

Manager List



The Manager List window parameters are used when IPmux-4 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**.

The Manager List screen is shown in *Figure E-9*. *Table E-2* lists the Manager List parameters.

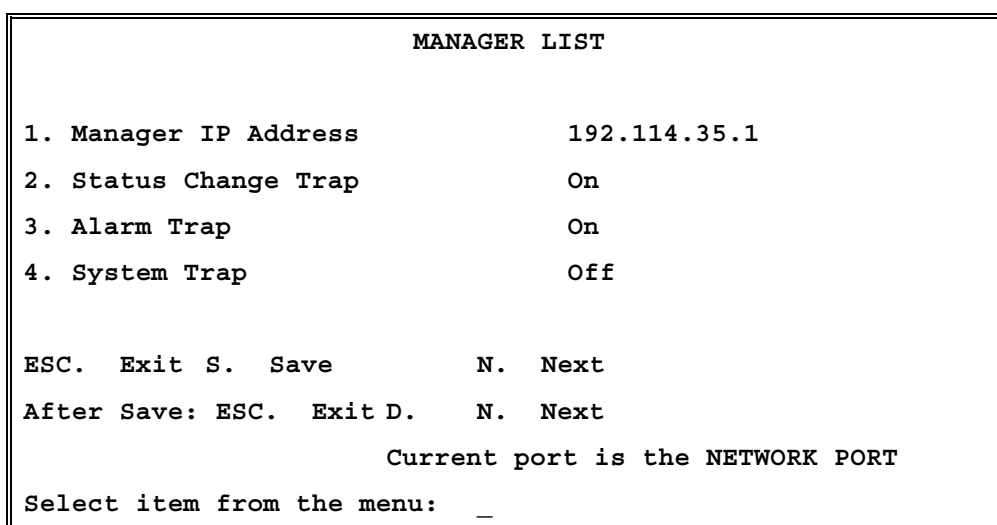


Figure E-9. Manager List Window

Table E-2. Manager List Parameters

Key	Parameter	Possible Values	Remarks
1	Manager IP Address	0.0.0.0 to 255.255.255.255	
2	Status-Change Trap	On, Off	Informs the manager that a LED indicator on the front panel has changed its indication.
3	Alarm Trap	On Off	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. No alarm trap will be sent, regardless of the Mask defined in the Alarm Trap Mask screen.
4	System Trap	On, Off	Informs the manager whenever there is a change in the system power-supply status, heat alarm

- **To ping the manager**
 - Press **P**.
- **To access additional manager-list parameters,**
 - Press **N** to go to the next manager-list window.

Alarms Trap Mask

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

Alarms Trap Mask	
1. Alarm ID	1
2. Trap Status	Active
ESC. Exit	S. save
ACTIVE ALARM TRAPS:	1, 2, 6, 8

Figure E-10. Alarms Trap Mask Window

Each of the IPmux-4 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.

Table E-3. Alarms Trap Parameters

Key	Parameter	Possible Values	Remarks
1	Alarm ID	1 – 40	See Table E-4
2	Trap Status	Active Masked	Generates a trap No alarms are sent Default: Masked

Table E-4. IPmux-4 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

Table E-4 IPmux-4 Alarms (Cont.)

Alarm ID	Alarm Description	Trap Sent to NMS
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

All other Alarms are unused.

ASCII Terminal Configuration

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

ASCII Terminal Configuration

1. **Display Mode** **Color**

2. **Baud Rate** **19200 bps**

3. **Change Password** **>**

4. **15 Min. Timeout** **Off**

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:

Figure E-11. ASCII Terminal Configuration Menu

Table E-5 ASCII Terminal Parameters

Key	Parameter	Possible Values	Remarks
1	Display Mode	Color, MonoChrome 3 color, MonoChrome 2 color	
2	Baud Rate	9600, 19200, 38400, 57600 in units of bps	Default: 19200 bps
3	Change Password		Next menu – allows the user to change the current password
4	15 Min. Timeout	On Off	Terminal exits to the password screen if no characters were sent by the terminal for 15 minutes

Time/Date Update

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

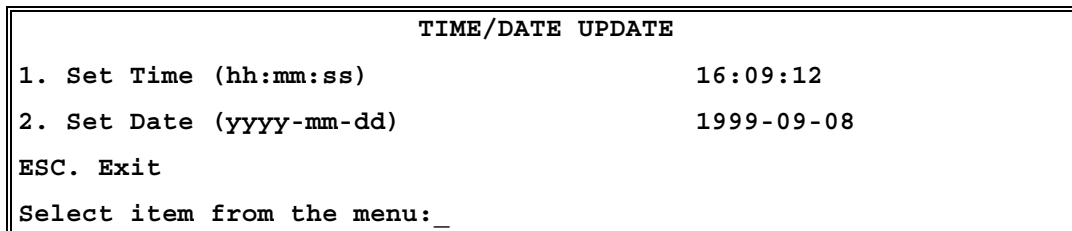


Figure E-12. Time/Date Update Menu

Table E-6. Time/Date Update Parameters

Key	Parameter	Possible Values	Remarks
1	Time	00:00:00 – 23:59:59	Setting time in the device
2	Date	1970/01/01 – 2099/01/01	Setting date in the device

Set Default Parameters

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

This reconfigures the device according to default parameters. Before overwriting the system, the following warning appears asking you to confirm your selection.

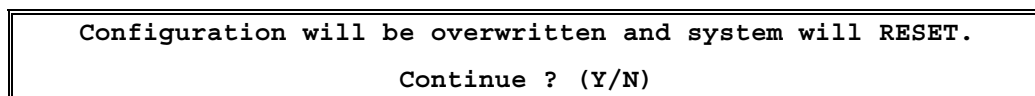


Figure E-13. Reset Default Warning

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

- Type **Y**.
 IPmux-4 will be reconfigured according to default settings.
- OR
- Type **N** to exit and return to the **General Configuration** menu.

X-Modem

- Main Menu
- ↓
- 2. Configuration
- ↓
- 1. General Configuration
- ↓
- 7. Software Download/Upload
- ↓
- 1. Download/Upload Using XMODEM**

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

A confirmation message appears. Upon confirmation, the download or upload procedure begins.

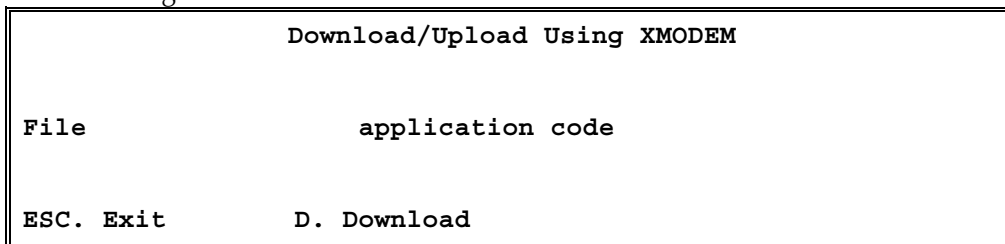


Figure E-14. Download/Upload Using X-Modem Window

Table E-7. 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
↓
7. Software Download/Upload
↓
2. Download/Upload Using 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 S. Save & Start action	

Figure E-15. Download/Upload Using TFTP Window

Table E-8. Download/Upload Using TFTP Parameters

Key	Parameter	Possible Values	Remarks
1	File name		
2	Command	No Operation, Software Download, Configuration Download, Configuration Upload, LAN Code Download	
3	Server IP		IP address of the server from/to which the file is loaded
4	Retry Timeout		Selected retry timeout period (in seconds)
5	Total Timeout		Selected total timeout period (in seconds), which is the maximum time allowed for attempted transmission
6	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-16).

The View Transfer Status values are listed in listed in Table E-9.

Note *Boot code download is not possible using TFTP.*

```

                VIEW TRANSFER STATUS

Status      Transferring Data
Error       No Error

ESC. Exit
    
```

Figure E-16. View Transfer Status Window

Table E-9. 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	

E.3 System Configuration

Main Menu
 ↓
 2. Configuration
 ↓
2. System Configuration

VLAN ID (4) and VLAN Priority (5) are configurable only if VLAN Tagging (3) is set to Yes.

```

                SYSTEM CONFIGURATION

1. IP TOS                0
2. TDM bytes in frame    48
3. VLAN Tagging          Yes
4. VLAN ID               0
5. VLAN Priority          0
ESC. Exit

Select item from the menu.
    
```

Figure E-17. System Configuration Menu

Table E-10. System Configuration Parameters

Key	Parameters	Possible Values	Remarks
1	IP ToS	0 – 255	<p>Sets the IP ToS (Type of Service) field in the IP frames transmitted by the device.</p> <p>ToS configuration configures the WHOLE byte.</p> <p>IPmux-4 allows you to configure the WHOLE ToS byte field, since different vendors may use different bits to tag packets for traffic prioritization. The user can also configure VLAN priority bits for Level 2 Priority.</p> <p>ToS assignment applies to all TDM packets leaving IPmux-4.</p> <p>Default configuration: 0</p>
2	TDM Bytes in Frame	(single payload - eight payloads): 48, 96, 144, 192, 240, 288, 336, 384	<p>Sets the UDP payload length. This parameter enables reduction of Ethernet throughput (detailed explanation in <i>Chapter 1</i>).</p> <p>Default payload: single payload (48)</p>
3	VLAN Tagging	Yes, No	<p>See <i>Chapter 1</i> for an explanation of VLAN tagging.</p> <p>Yes: set options 4 and 5 on the System Configuration Menu</p>
4	VLAN ID	0 – 4095	Default value: 0
5	VLAN Priority	0 – 7	Default value: 0

E.4 E1/T1 Configuration Parameters

E1 Physical Layer Configuration

Main Menu
↓
2. Configuration
↓
3. E1/T1 Configuration
↓
1. Physical Layer

For IPmux-4 options, you must first choose which port to configure (see *Figure E-18*). Once you choose a channel number, the Physical Layer Configuration menu appears (see *Figure E-19* or *Figure E-20*).

The Physical Layer Configuration parameters are listed in *Table E-11*.

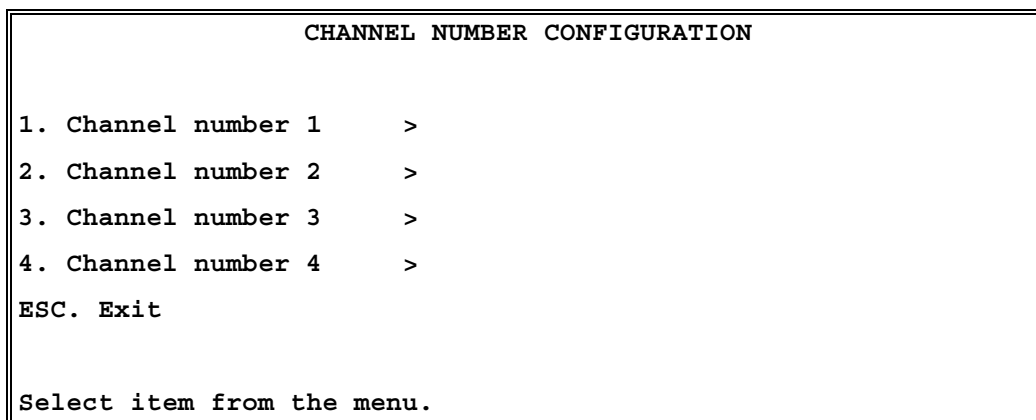


Figure E-18. Channel Number Configuration Window
(For versions with 4 ports)

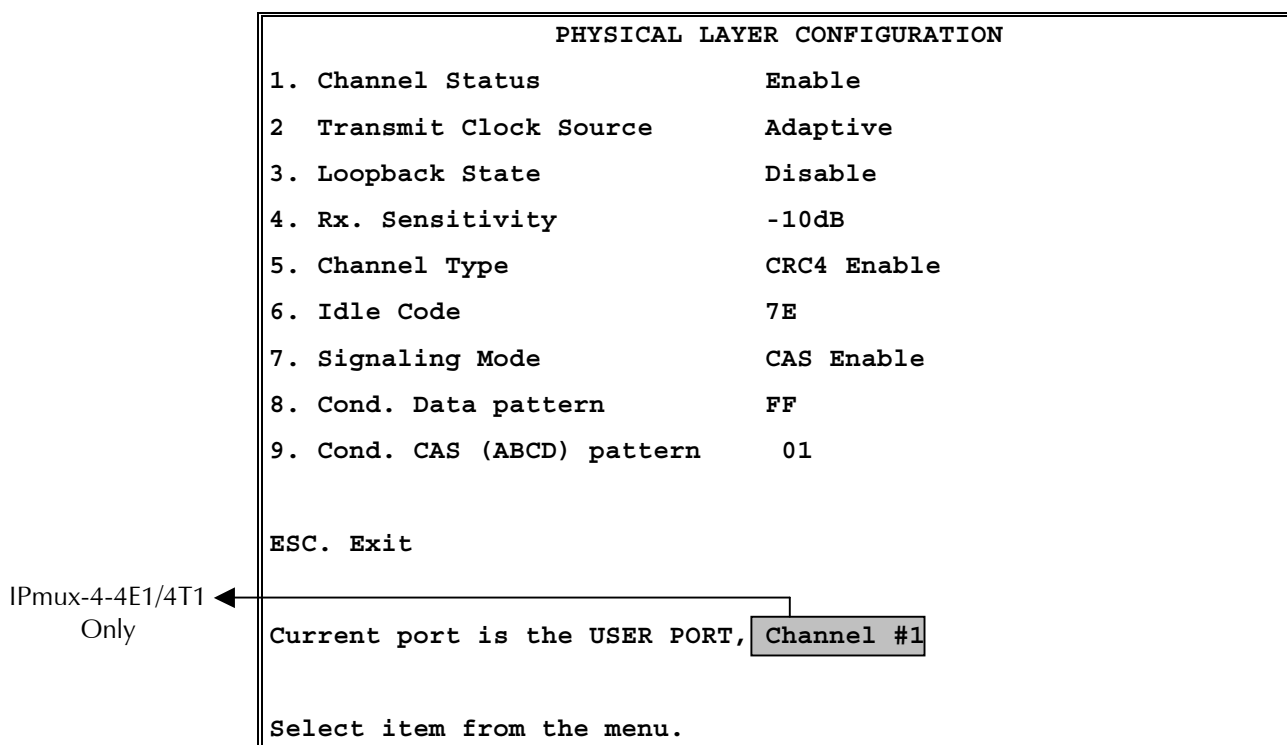


Figure E-19. E1 Physical Layer Configuration Menu

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

Key	Parameter	Possible Values	Remarks
1	Channel Status	Disable Enable	E1 stops gathering statistics data and reports that the line is operating properly. This does not affect the data flow. Default value: Enable
	Transmit Clock Source	Adaptive Loopback Internal External	Adaptive clock regeneration The E1 recovered receive clock is used as the transmit clock. A local clock source is used. Clock is derived from Channel 4. When one of the other ports (1, 2, 3) is configured to external clock, its transmit clock is taken from the receive clock of port number 4. Default value: Adaptive
3	Loopback State		Refer to <i>Chapter 4</i> for detailed instructions on loopback tests.
4	RX Sensitivity	-10 dB, -32 dB	Determines the maximum attenuation of the receive signal that can be compensated for by the interface receive path Default value: E1: -10 dB
5	Channel Type	Unframed CRC4 Enable CRC4 Disable	Determines the framing mode and operation mode for each configuration Framer will be configured to pass through mode and the operation mode will be set to Unframed (see <i>Chapter 1</i>) 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 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>) Default value: CRC4 enabled Note: Changing the Channel Type setting will delete all connections.

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

Key	Parameter	Possible Values	Remarks
6	Idle Code	00 – FF	<p>The idle code inserted into unused time slots by IPmux-4-E1 at the transmit path towards E1 equipment</p> <p>Default value: 7E</p> <p>Note: This field will not appear if “unframed” is selected in the Line Type field.</p>
7	Signaling Mode	<p>CAS Enable</p> <p>CAS Disable</p>	<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>Default value: CAS Enable</p> <p>Note: This field will not appear if “unframed” is selected in the Line Type field.</p>
8	Cond. Data Pattern	00 – FF	<p>The byte code applied to time slots when fault conditions occur.</p> <p>Conditioning pattern can be applied to time slots toward the IP path when loss of signal, loss of frame or AIS detected at the E1 line. Conditioning pattern can also be applied to time slots toward the E1 line when packets 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>Default Value: FF</p> <p>Note: This field will not appear if “unframed” is selected in the Channel Type field.</p>
9	Cond CAS (ABCD) Pattern	1 – F	<p>The 4 bit code applied to ABCD bits when fault conditions occur.</p> <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>Default Value: 1</p> <p>Note: This field will not appear if “unframed” is selected in the Channel Type field.</p>

T1 Physical Layer Configuration

Main Menu
↓
2. Configuration
↓
3. E1/T1
Configuration
↓
1. Physical Layer

PHYSICAL LAYER CONFIGURATION	
1. Channel Status	Enable
2. Transmit Clock Source	Adaptive
3. Loopback State	Disable
4. Channel Type	T1-ESF
5. Channel Code	B8ZS
6. Channel Mode	DSU
7. Channel 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
E. Cond. CAS first 2.5sec pattern (FF=NULL)	FF
ESC. Exit	
Current port is the USER PORT	
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 2.5sec pattern (FF=NULL) fields are not present.
When CAS Disabled is selected, the Cond CAS Pattern and Cond. CAS first 2.5sec pattern (FF=NULL) fields are not present.

Table E-12. T1 Physical Layer Configuration Parameters

Key	Parameter	Possible Values	Remarks
1	Channel Status	Disable	T1 stops gathering statistics data and reports that the line is operating properly. This does not affect the data flow.
		Enable	Default value: Enable
2	Transmit Clock Source	Adaptive	Adaptive clock regeneration
		Loopback	The T1 recovered receive clock is used as the transmit clock.
		Internal	A local clock source is used.
		External	Clock is derived from Channel 4. When one of the other ports (1, 2, 3) is configured to external clock, its transmit clock is taken from the receive clock of port number 4. Default value: Adaptive
3	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
4	Channel Type	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 Note: Changing the Channel Type setting will delete all connections.

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

Key	Parameter	Possible Values	Remarks
5	Channel Code	B7ZS , B8ZS, AMI	Default value: B8ZS
6	Channel Mode	DSU, CSU	Default value: DSU
7	Channel Length/TX Gain	For DSU: 0–133, 134–266, 267–399, 400–533, 534–655 For CSU: 0 dB, –7.5 dB, –15 dB, –22.5 dB	Default value: 0–133 Default value: 0 dB
8	Restore Time	1 second, 10 seconds	This setting chooses the T1 red alarm recovery time. Default value: 1 second
9	Idle Code	00 – FF	Determines the idle code inserted into unused time slots by IPmux-4-T1 at the transmit path towards T1 equipment. Default value: 7E <i>Note: This field will not appear if “unframed” is selected in the Line Type field.</i>
A	Signaling Mode	CAS Enable CAS disable	The T1 framer is set to CAS mode and the operation mode to Fractional with CAS mode. The 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
B	Cond. Data Pattern	00 – FF	The byte code applied to time slots when fault conditions occur: Conditioning pattern can be applied to time slots 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 time slots toward the T1 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 T1 line, or when packet receive buffer overrun or under run occurs. Default value: 7F <i>Note: This field will not appear if “unframed” is selected in the Channel Type field.</i>

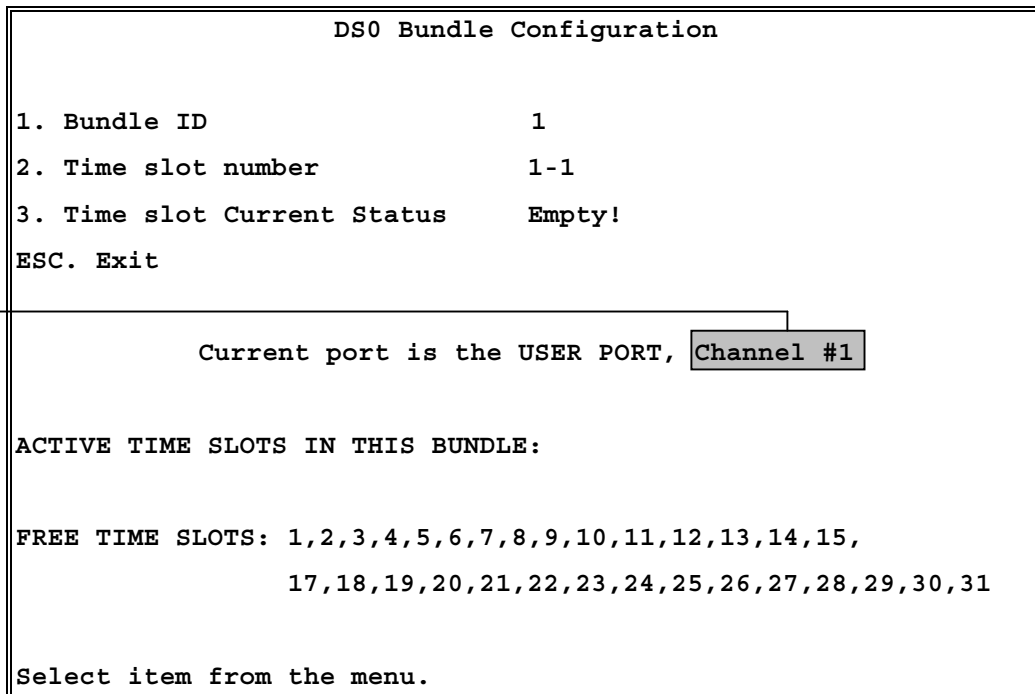
Table E-12. T1 Physical Layer Configuration Parameters (Cont.)

Key	Parameter	Possible Values	Remarks
C	Cond CAS (AB/ABCD) Pattern	1 – F	<p>The 4 bit code applied to ABCD bits when fault conditions occur.</p> <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>Default Value: 1</p> <p>Note: This field will not appear if “unframed” is selected in the Channel Type field.</p>
D	Cond CAS (ABCD) pattern	1 – F	<p>The 2 or 4 bit code applied to AB(D4) or ABCD (ESF) bits when fault conditions occur.</p> <p>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.</p> <p>Default value: 1</p> <p>Note: This field will not appear if “unframed” is selected in the Channel Type field.</p>
E	Cond. CAS first 2.5 sec pattern	0 – F (ESF) 0 – 3(D4) FF	<p>The 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.</p> <p>This code will be inserted in the first 2.5 seconds and then the code specified in ‘Cond. CAS (ABCD) pattern’ will be 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. A conditioning pattern can also be applied toward the T1 line when packet receive buffer overrun or underrun occur. When configuring FF to this function, this parameter will be ignored and the CAS pattern that will be applied in the first 2.5 seconds will be the same as defined in ‘ Cond. CAS (ABCD) pattern’.</p> <p>Default value: FF</p> <p>Note: This field will not appear if “unframed” is selected in the Line Type field or if CAS Disable is selected.</p>

DSO Bundle Configuration

This configuration defines the bundles you want to send. Up to 31/24 bundles can be sent for each E1/T1 (see *Chapter 1, Functional Description* for further details).

- Main Menu
- ↓
- 2. Configuration
- ↓
- 3. E1/T1 Configuration
- ↓
- 2. DSO Bundle Configuration**



IPmux-4-4E1/4T1 Only

Figure E-21. Time Slots Configuration Menu

Table E-13. Time Slots Configuration Parameters

Key	Parameter	Possible Values	Remarks
1	Bundle ID		
2	Time slot number		Selects the timeslot to be assigned to the bundle
3	Time slot Current Status	Empty, Set, Free	

➤ **To set the timeslot(s):**

1. Toggle the timeslot status to "Set".
2. Type **S** to save the change.

IPmux-4 associates the new timeslot with the chosen bundle.

➤ **To free a time slot from the bundle:**

1. Change the timeslot status to "Free"
2. Type **S** to save the change.

IPmux-4 frees the time slot from the current bundle.

Note

You cannot change the bundle timeslot(s) if the channel is active. (First disable the channel via "Bundle Connection Configuration.")
 In Bundle Connection Configuration: Deactivate the connection first.
 In T1 configuration: Valid timeslots are 1-24.
 In E1 configuration: Timeslot 0 is **always** invalid and timeslot 16 is **not** valid for Fractional with CAS.
 A list of assigned timeslots (active timeslots in this bundle) and free timeslots on this link, is shown at the bottom of the menu screen.

E.5 LAN Configuration

Main Menu
 ↓
 2. Configuration
 ↓
 4. LAN Configuration

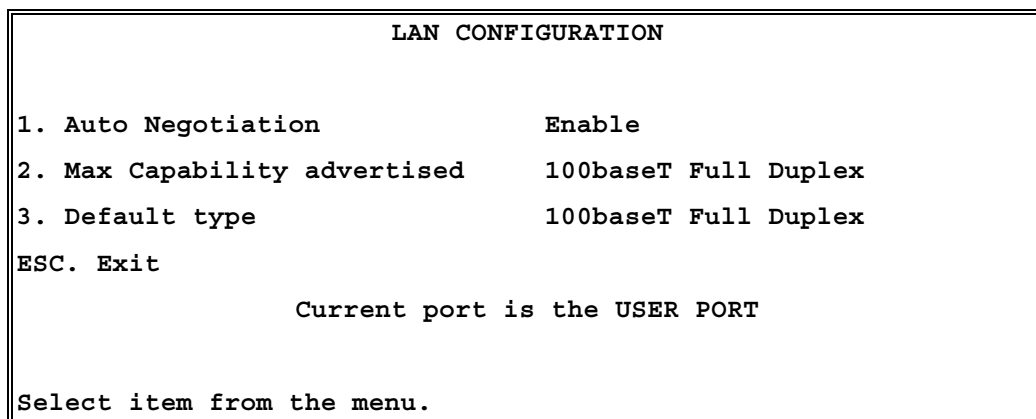


Figure E-22. LAN Configuration Menu

Table E-14. LAN Configuration Parameters

Key	Parameter	Possible Values	Remarks
1	Auto Negotiation	Enable, Disable	Auto Negotiation mode is according to RFC 2239
2	Max Capability Advertised	10BaseT Half Duplex, 10BaseT Full Duplex, 100BaseT Half Duplex, 100BaseT Full Duplex	Maximum capabilities of the port for the auto-negotiation process (can be lower than the actual capabilities)
3	Default Type	Port mode: Half Duplex, Full Duplex Rate: 10 Mbps, 100 Mbps	This parameter is valid only when the Auto-negotiation mode is disabled (RFC 2239)

Note If Auto Negotiation is set to Enable and there is some incompatibility in the Auto Negotiation process, Ipmux-4 automatically changes to half-duplex mode. To overcome this situation, set Auto Negotiation to Disable and set Default type to the desired mode.

E.6 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.

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

BUNDLE CONNECTION CONFIGURATION	
1. Bundle ID	1
2. Connection Status	Disable
3. Destination IP Address	0.0.0.0
4. Next Hop	0.0.0.0
5. Destination Bundle	1
6. Jitter Buffer(x10usec)	300
ESC. Exit	
Select item from the menu.	

Figure E-23. Bundle Connection Configuration

Table E-15. Bundle Connection Parameters

Key	Parameter	Possible Values	Remarks
1	Bundle ID	E1: 1 – 124 T1: 1 – 96	Source Bundle ID Note: First define the bundle.
2	Connection Status	Enable Disable	Frames will not be sent on this connection.
3	Destination IP Address		IP address of the destination device (IPmux-4) Note: For internal cross-connect, define the destination IP address as the host address to achieve connectivity between the source and the destination bundle.
4	Next Hop	IP address	The 'next hop' parameter should be used when the Destination IP Address is not in the device subnet. In such cases the Ethernet frame will be sent to the 'next hop' IP. The default value of the next hop field is the default gateway. Default value: 0.0.0.0 (not configured) Note: The next hop IP must be in the device subnet.

Table E-15. Bundle Connection Parameters (Cont.)

Key	Parameter	Possible Values	Remarks
5	Destination Bundle		Bundle number in the destination IPmux-4
6	Jitter Buffer	T1: 37 to 2400 (370µs – 24 µs) E1: 37 to 3200 (370µs – 32 µs)	Depth of the jitter buffer. The device holds an elastic buffer per link whose size is configurable in units of 10 microseconds (µs). Default values: 300 for all interfaces (3 msec). Note: Although PDVT input handles 10 microsecond steps, the physical resolution is 125 microseconds; input value is rounded up to the next 125µs value.

E.7 Performance Monitoring Parameters

E1/T1 Statistics

Main Menu
↓
3. Performance Monitoring
↓

1. E1/T1 Statistics

Four port version only ←

Four port version only ←

Four port version only ←

```

E1/T1 Physical Layer
4 E1          USER
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 Number          0
2. Channel Number           1
ESC. Exit  N. Next Inv:
    
```

Figure E-24. E1/T1 Statistics Menu

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

LOMF – for E1 CAS mode only.

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

Table E-16. E1/T1 Alarms and Statistics

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	<ul style="list-style-type: none"> Line Code Violation 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. BPV is the occurrence of a pulse with the same polarity as the previous pulse. EXZ is the occurrence of a zero string greater than 15 for AMI or 7 for B8ZS. Complies with ITU-TI.431, 0.161, G.775 and G.821 standards.
Rcv RAI (Yellow Alarm)	Remote Alarm Indication	<p>The Sync LED flashes.</p> <ul style="list-style-type: none"> For E1/T1, a second during which an 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>The 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>The number of seconds in which the FEBE indication is received from the remote E1 device.</p>

Table E-16. Alarms and Statistics (Cont.)

Alarm	Failure	Comments	Valid Modes
BES	Bursty Errored Seconds (Errored Second type B)	The number of seconds with from two to 319 CRC error events with no AIS nor SEF (Framing Bit Errors) error detection. Not applicable if Line Type is set to Unframed	T1-ESF or E1-CRC4 modes
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.	Any second containing the following error events: CRC SEF (OOF) AIS (T1 only). If SES is also active (see below) ES runs for 10 seconds and then stops (T1 only).	
Alarm	Failure	Comments	Valid in X only
SES	Severely Errored Seconds.	Any second containing the following errored events is counted as severely errored seconds: For E1/T1: 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 sequence in Time Slot 16	E1 models only E1 CAS mode only

► **To view Alarms and Statistics for next interval:**

- Press **N** for Next Interval.

The E1/T1 Physical Layer Menu allows you to monitor the following:

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

Time Since: The elapsed time since the beginning of the current interval (interval 0). Displayed only when the current interval is monitored.

Interval Number: The 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: The time and date when the monitored interval started. Displayed only when viewing previous intervals.

Channel Number: Select the E1/T1 physical port on which you want to view statistics (1 - 4)

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.

LAN Statistics

Main Menu ↓ 3. Performance Monitoring ↓ 2. LAN Statistics	<pre> LAN STATISTICS ETHERNET Mac Address 00-20-D2-16-3B-3D Mode half duplex Rate (Mbps) 10 Status Not connected Frames received from Ethernet Correct frames: 1 1 Correct Octets: 0 Alignment Err: 0 FCS Errors: 0 Frames transmitted to Ethernet Correct frames: 1 Correct Octets: 0 Sngl Collision: 0 Mlty Collision: 0 Deferred transm: 0 Late Collision: 0 Carrier Sense: 0 Esc. Exit </pre>
--	---

Figure E-25. LAN Statistics Menu

Note LAN statistics are not collected in intervals.

LAN Statistics are listed in *Table E-17*.

Table E-17. LAN Statistics

Statistics	Parameters	Description
MAC Address	Hard-Coded	Port local MAC address
Mode	Half duplex or Full duplex	Port mode is set by either the default mode or via auto negotiation results
Rate	10Mbps or 100Mbps	Port rate is set by either the default mode or via auto negotiation results
Status	Not connected or Connected	Not connected: Link loss Connected: Normal operation
Frames received from the user		
Correct frames		The total number of correct frames received
Correct Octets received		The total number of correct octets received
Alignment Errors		A counter of frames received that are not an integral number of octets in length (RFC 1643).
FCS Error		A counter of frames received that do not pass the FCS check (RFC 1643).
Frames transmitted to the network		
Correct Frames		The total number of frames successfully transmitted
Correct Octets		The total number of octets successfully transmitted
Single Collision	Valid only in half duplex mode (RFC 1643)	A counter of successfully transmitted frames for which transmission is inhibited by exactly one collision.
Multiple Collision	Valid only in half duplex mode (RFC 1643)	A 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)	A 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)	The 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)	The number of times that the carrier sense condition was lost or never asserted when attempting to transmit a frame.

Bundle Connection Status

Main Menu
 ↓
 3. Performance Monitoring
 ↓
3. Bundle Connection Statistics

- **To view Connection Statistics:**
 1. Select a bundle by typing **1** and then the bundle number.
 2. Press <Enter>.
- **To reset counters:**
 - Type **R**.
- **To view the next open connection:**
 - Type **F**.

BUNDLE CONNECTION STATUS	
Next Hop Mac Address	00-20-D2-16-3B-3D
Connectivity Status:	Disabled
Sequence Errors:	Empty
Jitter Buffer Underflows:	Empty
Jitter Buffer Overflows:	Empty

1. Bundle ID	R. Reset Counters
F. Forward Connection	
ESC. Exit	
Use <ESC>-key, Digit keys or Abc keys from menu	

Figure E-26. IP Channel Status Menu

Table E-18. IP Channel Status Parameters

Field	Description
Next Hop Mac Address	In this screen Next Hop Mac Address displayed is in fact the resulting Mac Address of the ARP process for the destination IP address.
Connectivity Status	Disabled: Channel is disabled OK: Indicates that Ethernet frames are received on the local and remote IPmux-4 Remote Fail: Ethernet frames are not received by the remote IPmux-4 Local Fail: Ethernet frames are not received by the local IPmux-4 Disabled: Connection is disabled
Sequence Errors	The number of times a frame was dropped because frames were received from the network with SN field not equal to the last SN + 1. This indicates a packet loss or a certain level of packet misordering.

Table E-18. IP Channel Status Parameters (Cont.)

Field	Description
Jitter Buffer Underflows	The number of times frames were dropped because the receive buffer was in an underflow state. The buffer enters underflow state when: <ul style="list-style-type: none">• Recurring or numerous sequence errors occur• Underflow 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.

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RAD

SUPPLEMENT

DC Power Supply Connection – CBL-DC-3WL/F

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

DC-powered units are equipped with a 3-pin D-type DC power input connector, located on the unit rear panel. Supplied with such a unit, is the CBL-DC-3WL/F DC connector cable for attaching to your power supply source.

Connect the power supply cable according to the voltage polarity and assembly instructions provided below.

Connecting the DC Plug

Refer to Figure 1 for assistance.

1. Connect the power supply cable to the unit by inserting the cable plug into the unit's D-type DC connector, until it snaps into place.
2. Tighten the screw pins on the two sides of the DC connector.
3. Connect the power supply wire leads to the power source (48V or 24V) according to power source regulations. See *Figure 2* for proper wire voltage polarity.

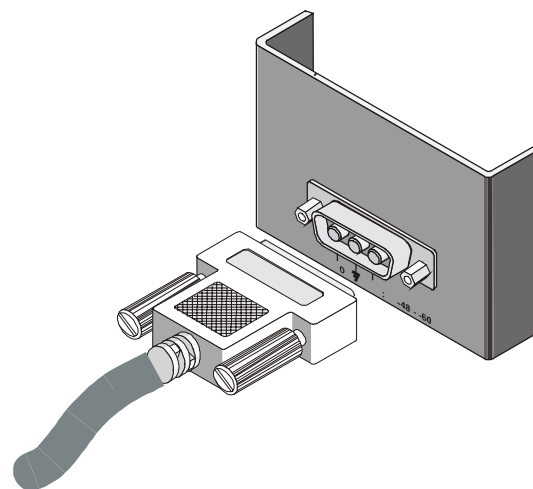


Figure 1

Warning:

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

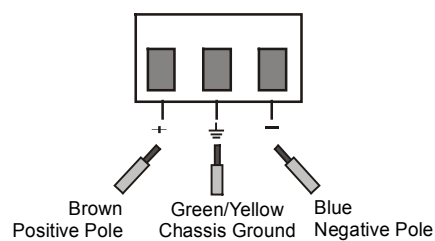


Figure 2