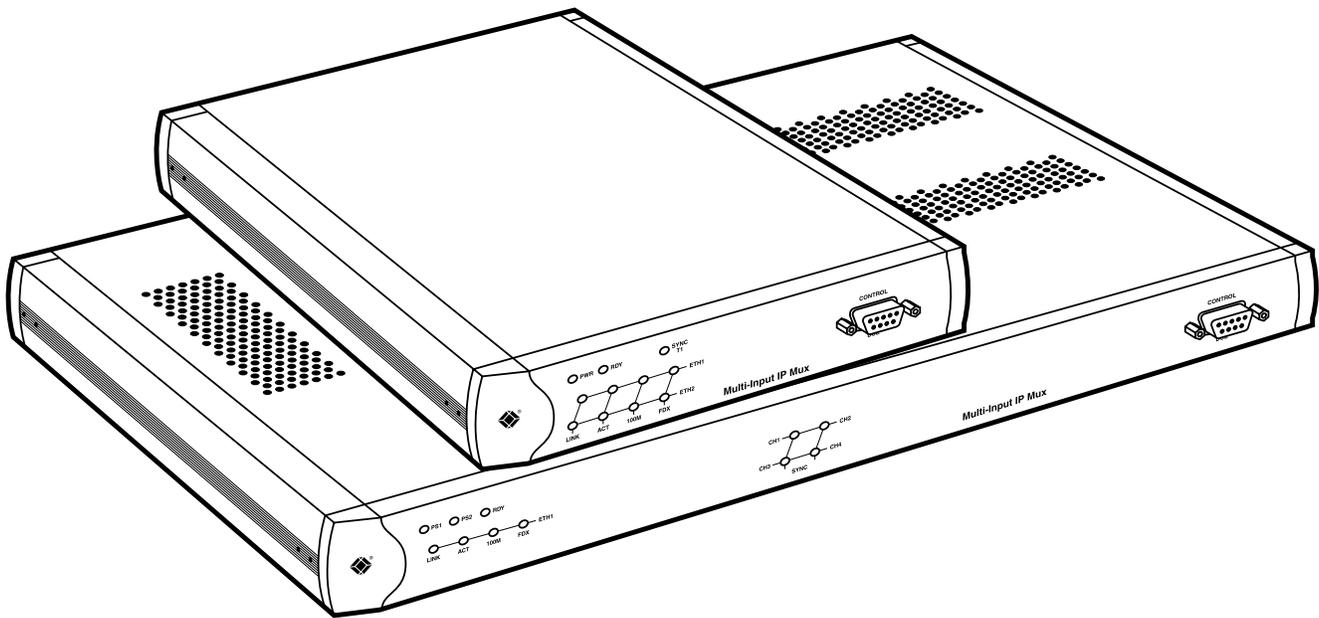




JUNE 2003
MT1050A
MT1050A-E1
MT1050A-E1-CX
MT1051A
MT1051A-E1
MT1051A-E1-CX
MT1052A
MT1053A
RM1050

Multi-Input IP Muxes



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This equipment generates, uses, and can radiate radio-frequency energy, and if not installed and used properly, that is, in strict accordance with the manufacturer's instructions, may cause interference to radio communication. It has been tested and found to comply with the limits for a Class A computing device in accordance with the specifications in Subpart B of Part 15 of FCC rules, which are designed to provide reasonable protection against such interference when the equipment is operated in a commercial environment. Operation of this equipment in a residential area is likely to cause interference, in which case the user at his own expense will be required to take whatever measures may be necessary to correct the interference.

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Declaration of Conformity

This product conforms to the following standards:

- | | | |
|----------------|--------------------------|--|
| EMC: | EN 55022 (1994) | Limits and methods of measurement of radio disturbance characteristics of information technology equipment. |
| | EN 50024 (1998) | Information technology equipment—Immunity characteristics—Limits and methods of measurement. |
| Safety: | EN 60950/A (1996) | Safety of information technology equipment, including electrical business equipment. |

These products comply with the requirements of the EMC Directive 89/336/EEC, the Low Voltage Directive 73/23/EEC, and the R & TTE Directive 99/5/EC for wired equipment. The products were tested in a typical configuration.

INSTRUCCIONES DE SEGURIDAD (Normas Oficiales Mexicanas Electrical Safety Statement)

1. Todas las instrucciones de seguridad y operación deberán ser leídas antes de que el aparato eléctrico sea operado.
2. Las instrucciones de seguridad y operación deberán ser guardadas para referencia futura.
3. Todas las advertencias en el aparato eléctrico y en sus instrucciones de operación deben ser respetadas.
4. Todas las instrucciones de operación y uso deben ser seguidas.
5. El aparato eléctrico no deberá ser usado cerca del agua—por ejemplo, cerca de la tina de baño, lavabo, sótano mojado o cerca de una alberca, etc..
6. El aparato eléctrico debe ser usado únicamente con carritos o pedestales que sean recomendados por el fabricante.
7. El aparato eléctrico debe ser montado a la pared o al techo sólo como sea recomendado por el fabricante.
8. Servicio—El usuario no debe intentar dar servicio al equipo eléctrico más allá a lo descrito en las instrucciones de operación. Todo otro servicio deberá ser referido a personal de servicio calificado.
9. El aparato eléctrico debe ser situado de tal manera que su posición no interfiera su uso. La colocación del aparato eléctrico sobre una cama, sofá, alfombra o superficie similar puede bloquea la ventilación, no se debe colocar en libreros o gabinetes que impidan el flujo de aire por los orificios de ventilación.
10. El equipo eléctrico deber ser situado fuera del alcance de fuentes de calor como radiadores, registros de calor, estufas u otros aparatos (incluyendo amplificadores) que producen calor.
11. El aparato eléctrico deberá ser conectado a una fuente de poder sólo del tipo descrito en el instructivo de operación, o como se indique en el aparato.
12. Precaución debe ser tomada de tal manera que la tierra física y la polarización del equipo no sea eliminada.
13. Los cables de la fuente de poder deben ser guiados de tal manera que no sean pisados ni pellizcados por objetos colocados sobre o contra ellos, poniendo particular atención a los contactos y receptáculos donde salen del aparato.
14. El equipo eléctrico debe ser limpiado únicamente de acuerdo a las recomendaciones del fabricante.
15. En caso de existir, una antena externa deberá ser localizada lejos de las líneas de energía.
16. El cable de corriente deberá ser desconectado del cuando el equipo no sea usado por un largo periodo de tiempo.
17. Cuidado debe ser tomado de tal manera que objetos líquidos no sean derramados sobre la cubierta u orificios de ventilación.
18. Servicio por personal calificado deberá ser provisto cuando:
 - A: El cable de poder o el contacto ha sido dañado; u
 - B: Objetos han caído o líquido ha sido derramado dentro del aparato; o
 - C: El aparato ha sido expuesto a la lluvia; o
 - D: El aparato parece no operar normalmente o muestra un cambio en su desempeño; o
 - E: El aparato ha sido tirado o su cubierta ha sido dañada.

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WARNING

Danger of electric shock! Avoid any contact with the circuit board while the product is powered on or connected to outdoor telecommunication lines.

Protective earth: The marked lug or terminal should be connected to the building protective earth bus.

Always observe standard safety precautions during product installation, operation, and maintenance. Only qualified and authorized service personnel should adjust, maintain, or repair this product. No installation, adjustment, maintenance, or repairs should be performed by either the operator or the user.

General Safety Practices

Do not touch or tamper with the power supply when the power cord is connected. Line voltages may be present inside certain products even when the power switch (if installed) is in the OFF position or a fuse is blown.

Before working on equipment connected to power lines or telecommunication lines, remove jewelry or any other metallic object that may come into contact with energized parts.

Unless otherwise specified, all products are intended to be grounded during normal use. To ground the product, connect the mains plug to a wall socket with a protective earth terminal. If an earth lug is provided on the product, it should be connected to the protective earth at all times by a wire with a diameter of 18 AWG or wider. Rackmounted equipment should be mounted only in earthed racks and cabinets.

Always make the ground connection first and disconnect it last. Do not connect telecommunication cables to ungrounded equipment. Make sure that all other cables are disconnected before disconnecting the ground.

Connection of AC Mains

Make sure that the electrical installation complies with local codes.

Always connect the AC plug to a wall socket with a protective ground.

The maximum permissible current capability of the branch distribution circuit that supplies power to the product is 16 A. The circuit breaker in the building installation should have high breaking capacity and must operate at short-circuit current exceeding 35 A.

Always connect the power cord first to the equipment and then to the wall socket. If a power switch is provided in the equipment, set it to the OFF position. If the power cord cannot be readily disconnected in case of emergency, make sure that a readily accessible circuit breaker or emergency switch is installed in the building installation.

Connection of Data and Telecommunications Cables

Data and telecommunication interfaces are classified according to their safety status.

The following table lists the status of several standard interfaces. If the status of a given port differs from the standard one, a notice will be given in the manual.

Ports	Safety Status
V.11, V.28, V.35, V.36, X.21, RS-530, X.21, 10BASE-T, 100BASE-T, Unbalanced E1, E2, E3, STM, DS-2, DS-3, S-Interface ISDN, Analog voice E&M	SELV: Safety Extra Low Voltage: Ports which do not present a safety hazard. Usually up to 30 VAC or 60 VDC.
xDSL (without feeding voltage), Balanced E1, T1, Sub E1/T1	TNV-1 Telecommunication Network Voltage-1: Ports whose normal operating voltage is within the limits of SELV, on which overvoltages from telecommunications networks are possible.
FXS (Foreign Exchange Subscriber)	TNV-2 Telecommunication Network Voltage-2: Ports whose normal operating voltage exceeds the limits of SELV (usually up to 120 VDC or telephone ringing voltages), on which overvoltages from telecommunication networks are not possible. These ports are not permitted to be directly connected to external telephone and data lines.
FXO (Foreign Exchange Office), xDSL (with feeding voltage), U-Interface ISDN	TNV-3 Telecommunication Network Voltage-3: Ports whose normal operating voltage exceeds the limits of SELV (usually up to 120 VDC or telephone ringing voltages), on which overvoltages from telecommunication networks are possible.

Always connect a given port to a port of the same safety status. If in doubt, seek the assistance of a qualified safety engineer.

Always make sure that the equipment is grounded before connecting telecommunication cables. Do not disconnect the ground connection before disconnecting all telecommunications cables.

Some SELV and non-SELV circuits use the same connectors. Use caution when connecting cables. Be extra careful during thunderstorms.

When using shielded or coaxial cables, verify that there is a good ground connection at both ends. The earthing and bonding of the ground connections should comply with the local codes.

The telecommunication wiring in the building may be damaged or present a fire hazard in case of contact between exposed external wires and the AC power lines. In order to reduce the risk, there are restrictions on the diameter of wires in the telecom cables between the equipment and the mating connectors.

WARNING

To reduce the risk of fire, use only No. 26 AWG or larger telecommunication line cords.

Some ports are suitable for connection to intra-building or non-exposed wiring or cabling only. In such cases, a notice will be given in the installation instructions.

Do not attempt to tamper with any carrier-provided equipment or connection hardware.

Electromagnetic Compatibility (EMC)

The equipment is designed and approved to comply with the electromagnetic regulations of major regulatory bodies. The following instructions may enhance the performance of the equipment and will provide better protection against excessive emission and better immunity against disturbances.

A good earth connection is essential. When installing the equipment in a rack, make sure to remove all traces of paint from the mounting points. Use suitable lockwashers and torque. If an external grounding lug is provided, connect it to the earth bus using braided wire as short as possible.

The equipment is designed to comply with EMC requirements when connecting it with unshielded twisted pair (UTP) cables. However, the use of shielded wires is always recommended, especially for high-rate data. In some cases, when unshielded wires are used, ferrite cores should be installed on certain cables.

Disconnect all wires which are not in permanent use, such as cables used for one-time configuration.

The compliance of the equipment with the regulations for conducted emission on the data lines is dependent on the cable quality. The emission is tested for UTP with 80 dB longitudinal conversion loss (LCL).

Unless otherwise specified or described in the manual, TNV-1 and TNV-3 ports provide secondary protection against surges on the data lines. Primary protectors should be provided in the building installation.

The equipment is designed to provide adequate protection against electrostatic discharge (ESD). However, it is good working practice to use caution when connecting cables terminated with plastic connectors (without a grounded metal hood, such as flat cables) to sensitive data lines. Before connecting such cables, discharge yourself by touching earth ground or wear an ESD preventive wrist strap.

Contents

Chapter	Page
1. Specifications	10
2. Introduction	11
2.1 Overview.....	11
2.1.1 Models Available	12
2.1.2 Applications.....	12
2.1.3 Features	13
2.2 What the Package Includes.....	14
2.3 Functional Description	15
2.3.1 Operation Modes	16
2.3.2 FXS/FXO Timeslot Assignment in a Bundle	17
2.3.3 Testing	17
2.3.4 Timing Modes	17
2.3.5 Network Timing Schemes.....	18
2.3.6 Frame Format	19
2.3.7 Packet Delay Variation	20
2.3.8 PDVT (Jitter) Buffer	21
2.3.9 Ethernet Throughput.....	22
2.3.10 Round-Trip Delay	24
2.3.11 VLAN Traffic Behavior	24
2.3.12 Ethernet User Port	26
2.3.13 OAM Connectivity.....	33
3. Installation.....	34
3.1 Site Requirements and Prerequisites	34
3.2 Installation and Setup	34
3.2.1 Setting Jumpers	34
3.2.2 Connecting Interfaces and Cables.....	34
3.2.3 Connecting the Power	39
4. Operation	40
4.1 Controls, Connectors, and Indicators	40
4.2 Powering Up and Logging In	44
4.2.1 Powering On the Mux.....	44
4.2.2 Login	44
4.2.3 Powering Off the Mux.....	45
4.3 Getting Started.....	45
4.4 Menu Operations.....	45
4.4.1 Main Menu.....	49
4.4.2 System Menu	49
4.4.3 Configuration Menu	50
4.4.4 Performance Monitoring Menu.....	51
4.4.5 Exit Menu.....	53

Contents (continued)

Chapter	Page
5. Troubleshooting and Diagnostics	54
5.1 Error Detection	54
5.2 Troubleshooting	56
5.3 Diagnostic Tests	56
5.3.1 E1/T1	56
5.3.2 FXS/FXO	58
Appendix A. Boot Sequence for Downloading Software	59
Appendix B. Telnet	62
B.1 Starting a Telnet Session	62
B.2 Telnet Operation	63
B.3 System Security	63
B.4 Telnet Access	63
Appendix C. SNMP Management	64
C.1 SNMP Principles	64
C.2 SNMP Operations	64
C.3 Management Information Base (MIB)	64
C.4 MIB Structure	65
C.5 MIBs Supported by the Multi-Input IP Mux SNMP Agent	65
C.6 Management Domains Under SNMP	66
C.7 SNMP Communities	66
C.8 Authentication	66
C.9 Network Management Stations	67
Appendix D. Inband TFTP Download Procedures	68
Appendix E. Configuration Menus	72
E.1 Main Menu	72
E.2 System Menu	73
E.2.1 General Information	73
E.2.2 Self-Test Results	74
E.2.3 Reset	74
E.2.4 Event Log	74
E.2.5 Ping	76
E.3 Configuration Menu	77
E.3.1 General Configuration Menu	77
E.3.2 T1 Configuration Menu	87
E.3.3 E1 Configuration Menu	91
E.3.4 Analog Configuration Menu	95
E.3.5 Bundle Connection Configuration	99
E.3.6 LAN Configuration (No User Port)	101
E.3.7 DS0 Bundle Configuration	103

Chapter	Page
E.4 Performance Monitoring	104
E.4.1 E1/T1 Statistics	104
E.4.2 Analog Status (Multi-Input IP Mux with FXS/FXO)	107
E.4.3 LAN Status (No User Port)	108
E.4.4 Bundle Connection Status/Statistics	110
E.5 Ethernet Configuration/Status Menus	112
E.5.1 General Information	112
E.5.2 LAN Configuration	112
E.5.3 Aging Time	114
E.5.4 Erase MAC Table	114
E.5.5 VLAN Configuration	115
E.5.6 LAN Status	116

1. Specifications

Diagnostics: T1 and E1 models: Remote loopback and looped locally toward the line or remote end;
FXS and FXO models: Remote analog loopback, 1-kHz tone injection, activity status

Framing: T1 models: Unframed, SF, ESF, CAS;
E1 models: Unframed, framed, CRC MF and CAS MF

Line Code: T1 models: AMI, B8ZS, B7ZS;
E1 models: HDB3;
FXS and FXO models: Modulation

Line Impedance: T1 models: Balanced: 100 ohms;
E1 models: Balanced: 120 ohms (RJ-45 connector); Unbalanced: 75 ohms (mini BNC F connectors);
FXS and FXO models: 600 ohms

Modulation Method: FXS and FXO models: PCM (per ITU-T G.711 and AT&T® 43801), μ -Law or A-Law;
T1 and E1 models: Line coding

Speed (Maximum): Control interface: 57.6 kbps;
Ethernet interface: 10 or 100 Mbps, half or full duplex;
T1 interface: 1.544 Mbps;
E1 interface: 2.048 Mbps

Standards: Ethernet: IEEE 802.3, 802.3u, 802.1 p&Q;
T1: ANSI T1.403; AT&T TR-62411; ITU-T G.703, G.704, G.824;
E1: G.703, G.704, G.823;
FXS and FXO: ITU-T G.711 and AT&T 43801

Connectors: All models: (1) DB9 F control port, RS-232 (DCE);
MT1050A: (1) RJ-48C T1 port, (1) RJ-45 Ethernet network port;
MT1050A-E1: (1) RJ-48C E1 port, (1) RJ-45 Ethernet network port;
MT1050A-E1-CX: (2) mini BNC coax F, (1) RJ-45 Ethernet network port;
MT1051A: (1) RJ-48C T1 port, (1) RJ-45 Ethernet network port, (1) RJ-45 Ethernet user port;
MT1051A-E1: (1) RJ-48C E1 port, (1) RJ-45 Ethernet network port, (1) RJ-45 Ethernet user port;
MT1051A-E1-CX: (2) mini BNC coax F, (1) RJ-45 Ethernet network port, (1) RJ-45 Ethernet user port;
MT1052A: (4) RJ-11 analog FXS ports, (1) RJ-45 Ethernet network port;
MT1053A: (4) RJ-11 analog FXO ports, (1) RJ-45 Ethernet network port

Operating Temperature: 32 to 122°F (0 to 50°C)

Power: Autosensing 100 to 240 VAC, 60 to 50 Hz;
Consumption: T1 and E1 models: 4 W (10 W with Ethernet switch);
FXS and FXO models: 25 W (32 W with Ethernet switch); All models: Fuses: 1.6 A, 250 V

Size: T1 and E1 models: 1.75"H (1U) x 8.4"W x 9.7"D (4.4 x 21.3 x 24.6 cm);
FXS and FXO models: 1.75"H (1U) x 17"W x 9.7"D (4.4 x 43.2 x 24.6 cm)

Weight: T1 and E1 models: 2.7 lb. (1.2 kg);
FXS and FXO models: 5.1 lb. (2.3 kg)

2. Introduction

2.1 Overview

Multi-Input IP Muxes transport T1/E1 and Foreign Exchange Station/Foreign Exchange Office (FXS/FXO) services over IP- or Ethernet-based networks. All of the T1 and E1 models have a 10/100BASE-T Ethernet network port for connection to standard or Fast Ethernet. The T1 models feature an RJ-48 connector for connection to the T1 circuit. The E1 models are equipped with either an RJ-48 connector (balanced interface) or a mini coax port (unbalanced interface) for connection to the E1 circuit. The mux is a 1U high, easy-to-install standalone unit. A rackmounting kit is available (ordered separately—part number RM1050).

Some models also include a 10/100BASE-T Ethernet user port. This allows you to extend your LAN by connecting a 10/100BASE-T workgroup to the T1 or E1 circuit.

The FXS or FXO models have four FXS or FXO RJ-11 ports for connection to POTS TDM services, plus a 10/100BASE-T Ethernet network port for connection to standard or Fast Ethernet.

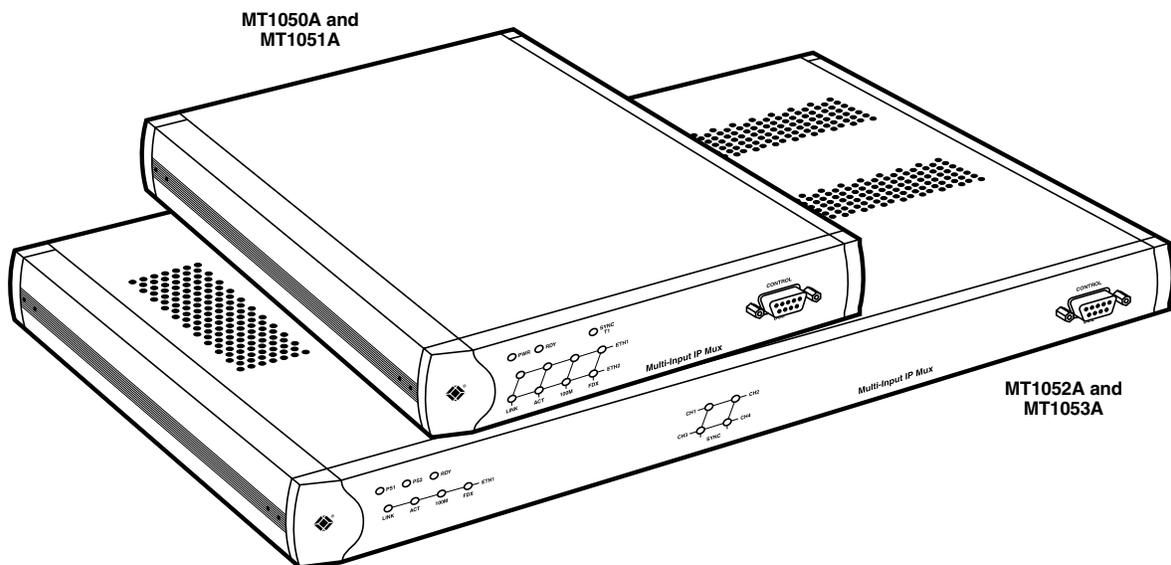


Figure 2-1. The MT1050A, MT1051A, MT1052A, and MT1053A.

MULTI-INPUT IP MUXES

2.1.1 MODELS AVAILABLE

Part Number	Multi-Input IP Mux Features
MT1050A	T1 (RJ-48 port) with 10/100BASE-T Ethernet network port.
MT1050A-E1	E1 (RJ-48 port, for connection to a balanced interface) with 10/100BASE-T Ethernet network port.
MT1050A-E1-CX	E1 (mini coax port, for connection to an unbalanced interface) with 10/100BASE-T Ethernet network port.
MT1051A	T1 (RJ-48 port) with 10/100BASE-T Ethernet network port and 10/100BASE-T Ethernet user port.
MT1051A-E1	E1 (RJ-48 port, for connection to a balanced interface) with 10/100BASE-T Ethernet network port and 10/100BASE-T Ethernet user port.
MT1051-E1-CX	E1 (mini coax port, for connection to an unbalanced interface) with 10/100BASE-T Ethernet network port and 10/100BASE-T Ethernet user port.
MT1052A	FXS Ports (four analog FXS RJ-11 connectors for connection to POTS) and 10/100BASE-T Ethernet network port.
MT1053A	FXO Ports (four analog FXO RJ-11 connectors for connection to POTS) and 10/100BASE-T Ethernet network port.

2.1.2 APPLICATIONS

Typical applications are shown with E1, T1, and FXS/FXO interfaces.

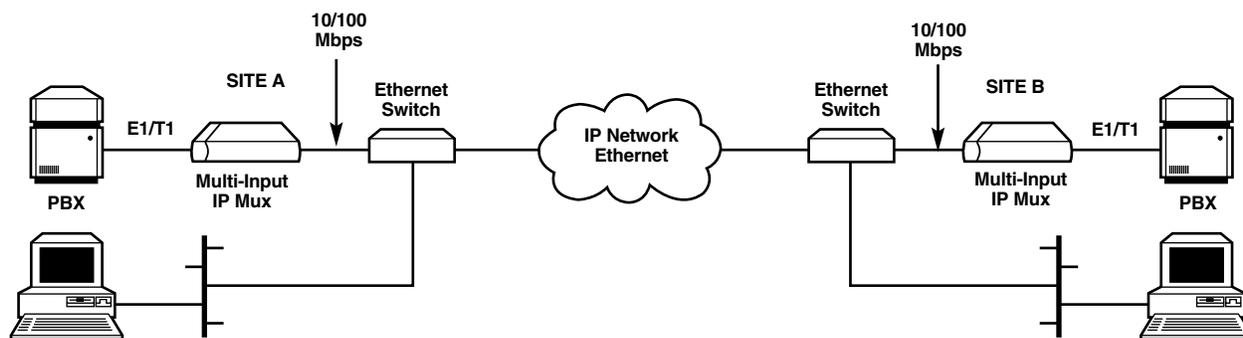


Figure 2-2. Multiplexing voice and data over an Ethernet trunk.

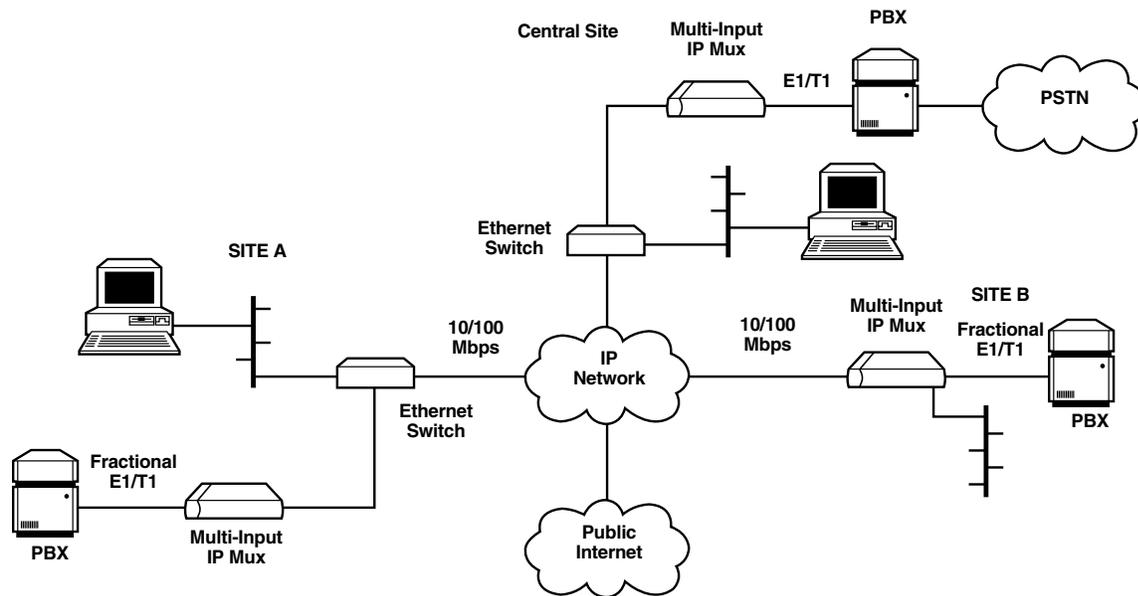


Figure 2-3. E1/T1 circuit extension over an IP-based network.

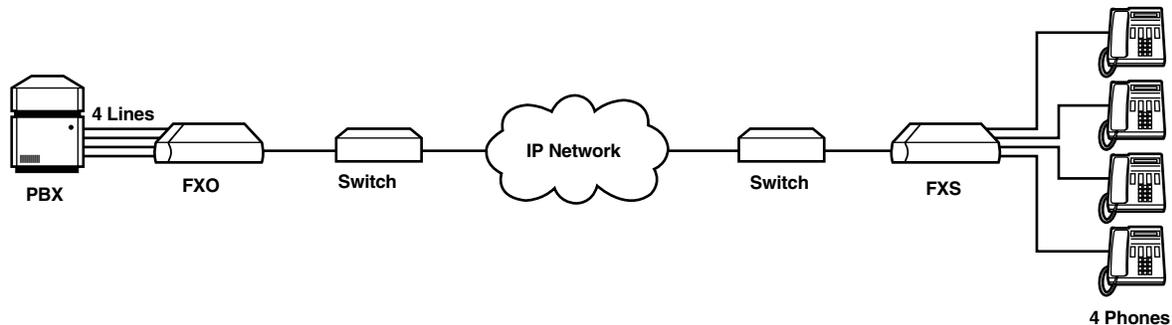


Figure 2-4. POTS application.

2.1.3 FEATURES

- Management (all models): The Multi-Input IP Mux can be managed locally by connecting an ASCII terminal to the RS-232 port on the front panel or remotely via Telnet or SNMP. SNMP management enables graphical, user-friendly management using proprietary network management stations, as well as management by other SNMP-based management systems.
- T1 (MT1050A, MT1051A): The T1 ports comply with ANSI T1.403, G.703, and G.704 standards. T1 jitter performance is according to G.824 and TR-62411. The T1 interfaces support unframed, SF, ESF, and CAS framing. The T1 port supports long-haul and short-haul input signals and can be monitored for alarms and error statistics. FDL and transmit PRM for T1/ESF are also supported.

MULTI-INPUT IP MUXES

- E1 (MT1050A-E1, MT1050A-E1-CX, MT1051A-E1, MT1051A-E1-CX): The E1 port complies with G.703, G.704, and G.823 standards. The E1 interfaces support unframed, 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.
- FXS/FXO (MT1052A, MT1053A): The Multi-Input IP Mux has 4 FXS or 4 FXO interface ports for POTS connection.
- IP (all models): The data stream coming from the E1 or T1 port is converted into IP packets that are transported over the Fast Ethernet port, and vice versa. TDM bytes are encapsulated in a UDP frame that runs over IP and over Ethernet.

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

- Ethernet User Port: The MT1051A, MT1051A-E1, and MT1051A-E1-CX have a user port for user LAN connectivity/access as well as TDM services connectivity.
- Timing: The Multi-Input IP Mux maintains synchronization between TDM devices by deploying advanced clock distribution mechanisms. Available timing modes are: loopback, adaptive, and internal clock. For more details about timing modes, see **Section 2.3.4**.
- Mode of Operation:

The Multi-Input IP Mux E1/T1 can operate in three different modes:

1. Unframed E1/T1 converted into IP over Ethernet.
2. Fractional E1/T1 converted into IP over Ethernet.
3. Fractional E1/T1 with CAS converted into IP over Ethernet.

The Multi-Input IP Mux with FXS/FXO operates in fractional E1/T1 with CAS converted into IP over Ethernet.

- QoS Supports:

Labeling IP level priority (ToS) for TDMoIP packets.

VLAN tagging and priority labeling according to IEEE 802.1p&Q for TDMoIP packets.

You can configure the ToS (Type of Service) of the outgoing TDMoIP packets. This allows an en-route Layer 3 router or switch, which supports ToS, to give higher priority to Multi-Input IP Mux TDMoIP traffic for delay-sensitive and secure applications. The Multi-Input IP Mux 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). You can also configure VLAN priority bits for Level 2 Priority.

2.2 What the Package Includes

- (1) Multi-Input IP Mux
- (1) Power cord
- This users' manual

NOTE

A rackmount kit containing hardware for mounting the mux in a 19" rack can be ordered separately (product code RM1050).

If anything is missing or damaged, please contact Black Box at 724-746-5500.

2.3 Functional Description

The MT1050A, MT1050A-E1, and MT1050A-E1-CX support a single E1 or T1 Time-Division Multiplexing (TDM) interface; it provides TDM connectivity across the IP network. A single bundle (group of timeslots) can be transmitted to a predefined far-end bundle. The mux supports ICMP (ping), generates ARP in case of unknown next hop MAC addresses, answers ARP requests, and supports 802.3 Ethernet format. These models also support a 10/100BASE-T Ethernet network port.

The MT1051A, MT1051A-E1, and MT1051A-E1-CX support a single E1 or T1 interface, a 10/100BASE-T Ethernet network port, and a 10/100BASE-T Ethernet user port for user LAN connectivity.

The MT1052A and MT1053A support four FXS or four FXO ports for transparent connectivity over the IP network, as well as a 10/100BASE-T Ethernet network port.

You can manage and configure the Multi-Input IP Mux via a local terminal, Telnet, or SNMP management tool.

Figure 2-5 shows a typical application for the MT1050A, MT1050A-E1, or MT1050A-E1-CX. In this application, an E1 or T1 connection is extended across an IP network.



Figure 2-5. Typical application.

An FXS/FXO application is shown in Figure 2-4. In this application, an FXS or FXO connection is extended across an IP network.

A application for the MT1051A, MT1051A-E1, and MT1051A-E1-CX is not shown. Typically, a T1 or E1 connection would be extended across an IP network, and a 10/100BASE-T Ethernet network segment would be attached to the mux's user port.

2.3.1 OPERATION MODES

MT1050A, MT1050A-E1, MT1050A-E1-CX, MT1051A, MT1051A-E1, and MT1051A-E1-CX

Operation modes for the above models include unframed, fractional, and fractional with CAS.

Unframed Mode

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

Fractional Mode

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

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

Fractional-with-CAS Mode

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

NOTE

Use fractional-with-CAS mode for FXS/FXO channels from a remote MT1052A or MT1053A.

MT1052A and MT1053A

The Multi-Input IP Mux FXO or FXS operates in E1 mode, T1-D4 mode, or T1 ESF mode. These operation modes allow the Multi-Input IP Mux to work opposite E1, T1-D4, or T1-ESF. Two parameters are set internally when choosing one of the options:

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

2.3.2 FXS/FXO TIMESLOT ASSIGNMENT IN A BUNDLE

The timeslot assignment in a bundle for the Multi-Input IP Mux with FXS/FXO is straightforward. Each timeslot in a bundle is assigned to a specific FXS/FXO channel. Timeslots in the bundle are assigned according to FXS/FXO channel numbers; the first timeslot is assigned to the lowest FXS/FXO channel that is configured, etc. As shown in Figure 2-6, the four FXS/FXO channels consume four timeslots in the bundle.

The E1/T1 Multi-Input IP Mux that works opposite the FXS/FXO channels should work in framed-with-CAS mode.

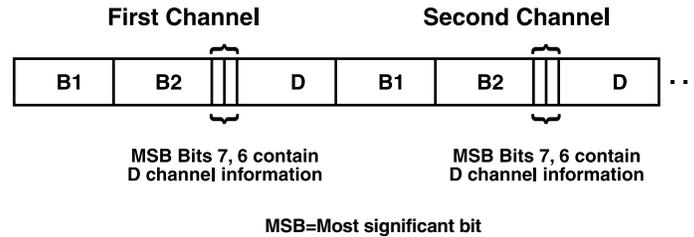


Figure 2-6. Timeslot assignment in a bundle for MT1052A and MT1053A.

2.3.3 TESTING

Diagnostic capabilities include E1/T1 local and remote loopback tests for rapid localization of faults. The E1/T1 channel can be looped locally, toward the line, or toward the remote end (see **Section 5.3.1** for more information).

Remote Loopback and Tone Injection are available for the FXS/FXO port (see **Section 5.3.2**).

2.3.4 TIMING MODES

The E1/T1 Tx clock or FXS PCM clock can operate in several timing modes to provide maximum flexibility for connecting the Multi-Input IP Mux E1, T1, or FXS/FXO channels.

Each of the clocks must be configured correctly on both the Receive and Transmit ends to ensure proper operation.

E1/T1

The E1/T1 available Tx modes are:

- Loopback Timing—the E1/T1 Tx clock is derived from the E1/T1 receive (Rx) clock.
- Adaptive Timing—in this mode, the E1 or T1 Tx clock is regenerated using the Adaptive method. In this method, the fill level of the buffer receiving packets is monitored. If the buffer begins to overflow, the regenerated Tx clock frequency increases to avoid overflow. If the buffer begins to empty, the Tx clock (toward the TDM device) decreases to avoid underflow.
- Internal Clock Timing—in this mode, the Tx clock is received from an internal oscillator.

NOTE

In Adaptive Timing mode, the regenerated clock is subject to network Packet Delay Variation, which is the maximum deviation from the nominal time the packets are expected to arrive at the far-end device (see Section 2.3.7). The regenerated clock may not comply with jitter and wander specifications.

MULTI-INPUT IP MUXES

FXS/FXO

The available timing modes for the PCM clock are:

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

2.3.5 NETWORK TIMING SCHEMES

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

External Network Timing

When the edges of the network are synchronized according to an external network clock source, all the muxes should be configured to work in loopback timing mode (see Figure 2-7). This topology enables any-to-any connectivity.

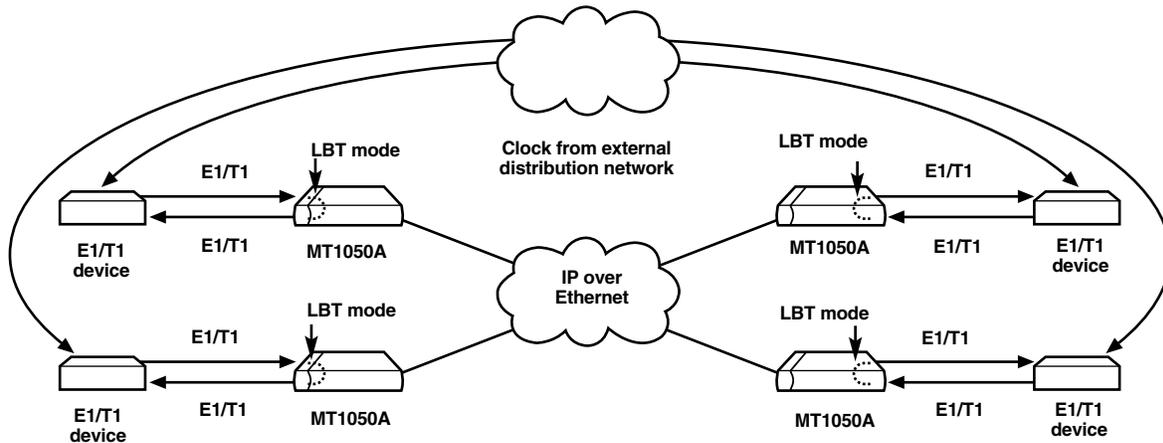


Figure 2-7. MT1050A in Loopback Timing mode.

Single Source Clock Network

When a common clock is not available on all the ends of the network, one of the Multi-Input IP Muxes is configured to work in Loopback Timing mode, while the other mux is configured to work in Adaptive Timing mode (see Figure 2-8).

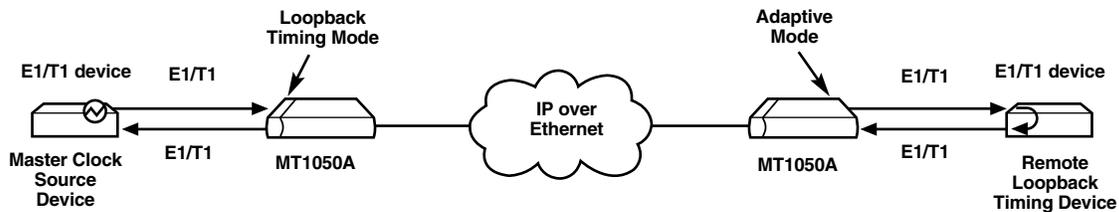


Figure 2-8. Multi-Input IP Mux in Adaptive Timing mode.

2.3.6 FRAME FORMAT

The Ethernet frame sent by the Multi-Input IP Mux is a User Datagram Protocol (a connectionless-mode transport protocol, part of the IP [Internet Protocol] suite, abbreviated UDP) datagram. The UDP 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). See Figure 2-9.

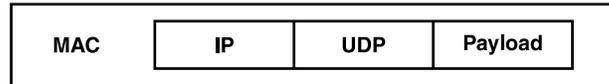


Figure 2-9. TDMoIP frame structure.

Figure 2-10 specifies the structure of the different headers, special fields, and the payload in the Ethernet packet.

Figure 2-10. Ethernet frame structure.

Field Length (bytes)	Field
MAC Layer { 7	Preamble
1	SFD
6	Destination MAC Address
6	Source MAC Address
LLC Layer → 2	Type ← NOTE: IEEE 802.1p&Q VLAN Tagging (additional 4 bytes if enabled).
1	Vers/HLEN
IP Layer {	1 Service Type
	2 Total Length
	2 Identification
	1 Flags/Fragment Offset (most)
	1 Fragment Offset (least)
	1 Time to Live
	1 Protocol
	2 Header Checksum
	4 Source IP Address
	4 Destination IP Address
UDP Layer {	2 UDP Source Port ← NOTE: The UDP source port field is used to transfer the destination bundle number.
	2 UDP Destination Port
	2 UDP Message Length
	2 UDP Checksum
Data Layer → ...	Payload
MAC Layer → 4	CRC

MULTI-INPUT IP MUXES

VLAN Support

VLAN, according to IEEE 802.1p&Q, adds four bytes to the MAC layer of the Ethernet frame. You can set the contents of these bytes, MAC layer priority, and VLAN ID. In this mode, only VLAN format frames are sent and received by the Multi-Input IP Mux. Figure 2-11 shows the VLAN tag format.

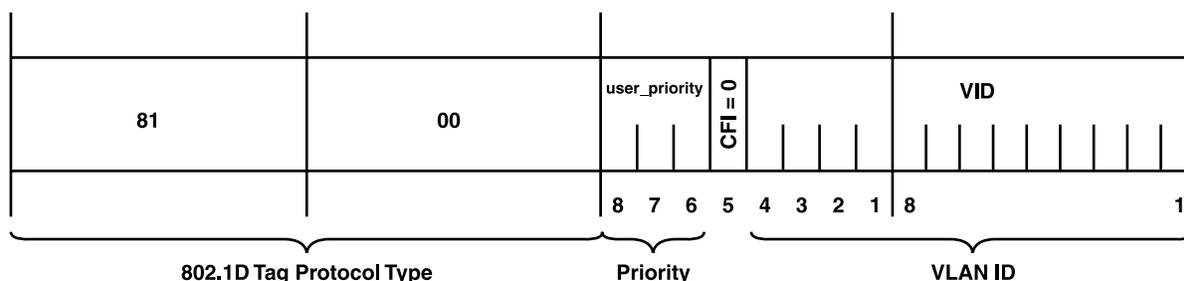


Figure 2-11. VLAN tag format (802.1p&Q).

UDP Support

Table 2-1. UDP ports definition.

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

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

NOTE

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

For more information about VLAN tagging, refer to IEEE Standard 802.1p&Q.

2.3.7 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. The Multi-Input IP Mux has a buffer that compensates for the deviation from the expected packet arrival time to prevent mux buffers from emptying out or overflowing.

Packet Delay Variation is an important network parameter. Large PDV (exceeding the jitter buffer configuration) will cause receive buffer underflows and errors at the E1/T1 level (see Figure 2-12).

To compensate for large PDV, configure the PDVT (jitter) buffer to a higher value. See **Section 2.4.8** for details.

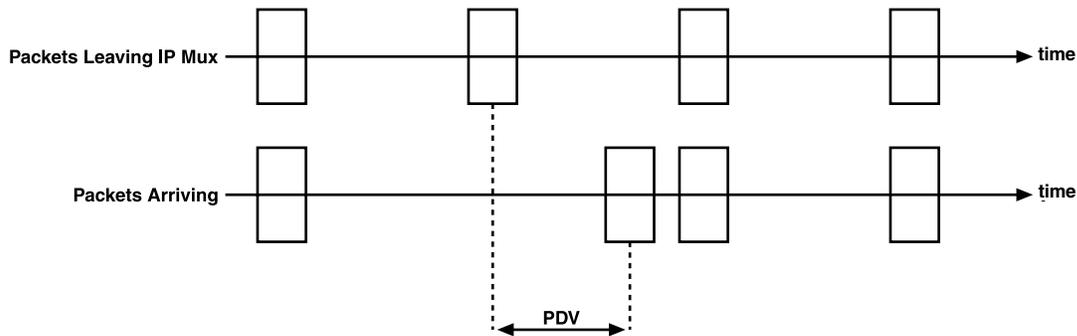


Figure 2-12. Packet Delay Variation.

2.3.8 PDVT (JITTER) BUFFER

The Multi-Input IP Mux is equipped with a configurable 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 lack of packets from the Ethernet side. The time it takes for half of the buffer to empty out is the maximum DVT time. The PDVT buffer is designed to compensate for Packet Delay Variation caused by the network + intrinsic PDV. It supports a delay variation of up to 300 ms for E1 or T1.

Intrinsic PDV

If TDM bytes per 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 per frame configuration as follows:

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

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

To configure jitter buffer depth, use the following calculation:

The 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 per frame > 48 .

NOTE

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

PDVT Buffer Effect on Delay

The PDVT buffer is on the TDM path; it adds to the total end-to-end delay.

2.3.9 ETHERNET THROUGHPUT

Configuring the TDM bytes per frame parameter can reduce Ethernet throughput (bandwidth or traffic travelling through the Ethernet). This parameter controls the number of TDM bytes encapsulated in one frame. The TDM bytes per frame parameter can be configured to $n \times 48$ bytes where n is an integer between 1 and 8. Configuring TDM bytes per 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 (PDV) are increased; this contributes to a higher end-to-end delay. This effect can be small and negligible when a full E1 (or many timeslots) are transferred, but can be very significant when few timeslots are transferred. In this case, the packetization delay and the intrinsic PDV when configuring a large value of TDM bytes per frame can be very large and may exceed the maximum PDVT (jitter) buffer on the receiving end. Tables 2-2 and 2-3 show throughput as a function of the TDM bytes per frame configuration for full E1 and full T1.

Table 2-2. Ethernet Throughput—Unframed E1.

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

Table 2-3. Ethernet Throughput—Unframed T1.

TDM bytes per 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

To calculate Ethernet throughput and intrinsic PDV as a function of TDM bytes per frame:

$$\text{Ethernet load (bps)} = [(\text{frame overhead } \{5 \text{ bytes}\} + \text{TDM bytes per frame}) \times 8] \times \text{frames per second}$$

$$\text{Frame overhead} = \text{Ethernet overhead} + \text{IP overhead} = 46 \text{ bytes}$$

NOTE

The frame overhead does not include:

- **Preamble field = 7 bytes**
- **SFD field = 1 byte**
- **Interframe gap = 12 bytes**
- **VLAN field (when used) = 4 bytes**

$$\text{Frame per second} = \text{Unframed: } 5447/n \text{ for a full E1}$$

$$4107/n \text{ for a full T1}$$

$$\text{Framed: } 8000 \times k / (46.875 \times n)$$

Where k = number of assigned timeslots (NTS)

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

Ethernet Throughput Calculation

Unstructured

$$\frac{(\text{Vlan} + \text{FrameCover} + \text{Payload}) \times \text{Data}}{\text{Frame Size}} \quad \frac{8000 \times \text{TS} \times 8}{47 \times n}$$

Structured

$$\frac{(\text{Vlan} + \text{FrameCover} + \text{Payload}) \times \text{Data}}{\text{Frame Size}} \quad \begin{matrix} \text{Data} & \text{Pointer} & \text{CAS} \\ 8000 \times \text{TS} & \frac{8000 \times \text{TS} + 500 \times \text{TS} \times 8}{(47 \times 8) - 1} & 2 \end{matrix}$$

Vlan: Optional field, if enabled, adds four bytes to the frame size.

Frame cover: Number of TDM bytes in frame, (48, 96, 144, 192...)

Payloads are 46 bytes in size and include MAC, LLC, IP, and UDP layer.

CAS: Signaling in Structured mode.

TS: Number of configured time slot.

MULTI-INPUT IP MUXES

The calculation takes into account the frame size (at left), the number of frames per minute to transmit (at right), and the result is in bits per second (bps).

2.3.10 ROUND-TRIP DELAY

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

$$(\pm 2 \mu\text{s}) \text{ RTDelay}(\mu\text{s}) = 2 \times [47 \times n \times 125 (\mu\text{s}) + \text{PDVT buffer} (\mu\text{s}) + 1000 \mu\text{s}] + \text{Network Round Trip Delay}$$

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

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 Multi-Input IP Mux to facilitate the following alarms:

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

- Far-end LOS, AIS
- PDVT underflow or overflow

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

- Far-end LOS, LOF, AIS
- PDVT underflow or overflow

2.3.11 VLAN TRAFFIC BEHAVIOR

Table 2-4 lists the IP and VLAN validity checks that are performed with each Ethernet packet that is received by Multi-Input IP Mux.

Table 2-4. Checks for received packets.

Packet Type	Source IP Check	VLAN Check
Management	Performed.	Performed.
TDM over IP	Performed.	Performed.
Receiving Ping	Not performed.	Not performed, even if it is one of the IPs that is configured for the manager or for the connection.
ARP	Not performed.	Not performed, even if it is one of the IPs that is configured for the manager or for the connection.
Telnet	Performed only when Telnet access mark is from manager.	Performed only when Telnet access mark is from manager.

Table 2-5 lists the IP and VLAN validity checks that are performed with each Ethernet packet that is sent by the Multi-Input IP Mux.

Table 2-5. Checks for packets sent.

Packet Type	VLAN Support
Management	As configured for the manager.
TDM over IP	As configured for the connection.
Answer to Ping	If received with VLAN—the same VLAN value that was received (even if it's one of the IPs configured for the manager or for the connection).
	If received with No VLAN—if it's one of the IPs configured for the manager or for the connection, the mux sends the packet with the VLAN value configured.
ARP initiated by user	No VLAN value unless it is one of the manager's addresses or the connection's IP address.
Telnet	
Ping initiated by user	

MULTI-INPUT IP MUXES

2.3.12 ETHERNET USER PORT

The Ethernet user port allows a user to connect both TDMoIP traffic and his private network LAN traffic to a single Ethernet network connection without requiring an access switch. This is a cost-effective solution for a multitenant unit (such as an office computer) or small-office applications. A rate limiter to restrict user-port traffic is supported.

The Multi-Input IP Mux contains an internal switch where one of its ports is connected to a TDMoIP interworking function, another external switch port is used as the user port, and the third is used as an Ethernet network port.

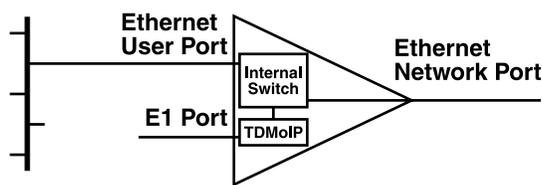


Figure 2-13. Multi-Input IP Mux T1 or E1 with Ethernet user port.

NOTE

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

Internal Switch Operation Modes

The Multi-Input IP Mux T1 or E1 with Ethernet user port offers a user LAN port in addition to the LAN port on the network side. The device performs switching at level 2. The switch supports both transparent bridging and VLAN-aware bridging. (VLAN-aware bridging supports or recognizes VLAN subgrouping.) The switch supports rate limiting of traffic going from the user port to the network port. It supports up to 12K of MAC addresses (depending on their values and the order in which they are learned).

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

NOTE

Access to the Multi-Input IP Mux host for management is possible only from the network port.

The switch modes are:

- Basic mode
- User tagged mode
- User untagged mode
- Rate mode
- Rate + user tagged mode
- Rate + user untagged mode

Basic Mode

Features:

- Network-port learning is based on MAC.
- User-port learning is based on MAC.
- TDMoIP & Managers traffic is tagged or untagged.

Table 2-6. Basic mode.

Frame Action	Switch Action
A tagged frame enters the network port.	Switched to user port without changing the frame (see Note 1).
A tagged frame enters the user port.	Switched to network port without changing the frame (see Note 1).
An untagged frame enters the network port (see Note 2).	Switched to user port without changing the frame (see Note 1).
An untagged frame enters the user port (see Note 2).	Switched to network port without changing the frame (see Note 1).

NOTES

- 1. The switch may decide not to pass the frame to the other port, based on its learning.**
- 2. A priority-tagged frame (frame with a tag and VLAN-ID 0) is treated just like an untagged frame. This includes rewriting the priority field with 0.**

User Tagged Mode

Features:

- Network-port learning is based on MAC+VLAN.
- User-port learning is based on MAC+VLAN.
- TDMoIP & Managers traffic must be tagged.

Table 2-7. User tagged mode.

Frame Action	Switch Action
A tagged frame enters the network port.	
Both user and network ports are members of the frame's VLAN.	Switched to the user port without changing the frame (see Note 1).
Either the user or the network port is not a member of the frame's VLAN.	Discarded.
A tagged frame enters the user port.	
Both user and network ports are members of the frame's VLAN.	Switched to the network port without changing the frame (see Note 1).
Either the user or the network port is not a member of the frame's VLAN	Discarded.
An untagged frame enters the network port (see Note 2).	
Both user and network ports are members of the network port default VLAN.	Switched to user port (see Note 1). Default network port VLAN ID is added with priority 0.
Either the user or the network port is not a member of the network port default VLAN.	Discarded.
An untagged frame enters the user port (see Note 2).	
Both user and network ports are members of the user port default VLAN.	Switched to network port (see Note 1). Default user port VLAN ID is added with priority 0.
Either the user or network port is not a member of the user port default VLAN.	Discarded.

NOTES

1. The switch may decide not to pass the frame to the other port, based on its learning.
2. A priority-tagged frame (frame with a tag and VLAN-ID 0) is treated just like an untagged frame. This includes writing zeros into the priority field location.

User Untagged Mode

Features:

- Network-port learning is based on MAC+VLAN.
- User-port learning is based on MAC+VLAN.
- TDMoIP & Managers traffic must be untagged.

Table 2-8. User untagged mode.

Frame Action	Switch Action
A tagged frame enters the network port.	
Both user and network ports are members of the frame's VLAN.	Switched to the user port (see Note 1) and the tag is removed.
Either the user or the network port is not a member of the frame's VLAN.	Discarded.
A tagged frame enters the user port.	
Both the user and network port are members of the frame's VLAN.	Switched to the network port without changing the frame (see Note 1).
Either the user or the network port is not a member of the frame's VLAN.	Discarded.
An untagged frame enters the network port (see Note 2).	
Both user and network ports are members of the network port default VLAN.	Switched to the user port without changing the frame (see Note 1).
Either the user or the network port is not a member of the network port default VLAN.	Discarded.
An untagged frame enters the user port (see Note 2).	
Both the user and network ports are members of the user port default VLAN.	Switched to the network port (see Note 1).
Either the user or the network port is not a member of the user port default VLAN.	Discarded.

NOTES

1. The switch may decide not to pass the frame to the other port, based on its learning.
2. A priority-tagged frame (frame with a tag and VLAN-ID 0) is treated just like an untagged frame. This includes writing zeros into the priority field location.

MULTI-INPUT IP MUXES

Rate Mode

Features:

- There is no network-port learning.
- User-port learning is based on MAC.
- TDMoIP & Managers traffic are tagged or untagged.

Table 2-9. Rate mode.

Frame Action	Switch Action
A tagged frame enters the network port.	Switched to the user port without changing the frame (see Note 3).
A tagged frame enters the user port.	Switched to the network port without changing the frame (see Note 1).
	Subject to rate limiting.
An untagged frame enters the network port.	Switched to the user port without changing the frame (see Note 3).
An untagged frame enters the user port.	Switched to the network port without changing the frame (see Note 1).
	Subject to rate limiting.
A priority-tagged frame enters the network or user port.	A priority-tagged frame (frame with a tag and VLAN-ID 0) is treated just like an untagged frame. This includes rewriting the priority field with 0.

NOTES

- 1. The switch may decide not to pass the frame to the other port, based on its learning.**
- 2. Learning is disabled; therefore, every frame is switched. The network port is typically connected to another switch.**

Rate + User Tagged Mode

Features:

- No network-port learning.
- User-port learning is based on MAC.
- TDMoIP & Managers traffic must be tagged.

Table 2-10. Rate + user tagged mode.

Frame Action	Switch Action
A tagged frame enters the network port.	Switched to the user port without changing the frame (see Note 3).
A tagged frame enters the user port.	
Both user and network ports are members of the frame's VLAN.	Switched to the network port without changing the frame (see Note 1).
	Subject to rate limiting.
Either the user or the network port is not a member of the frames's VLAN.	Discarded.
An untagged frame enters the network port.	Switched to the user port without changing the frame (see Note 3).
An untagged frame enters the user port (see Note 2).	Discarded.

NOTES

1. The switch may decide not to pass the frame to the other port, based on its learning.
2. A priority-tagged frame (frame with a tag and VLAN-ID 0) is treated just like an untagged frame. This includes rewriting the priority field with 0.
3. Learning is disabled; therefore, every frame is switched. The network port is typically connected to another switch.

Rate + User Untagged Mode

Features:

- Network-port learning is based on MAC + VLAN number.
- User-port learning is based on MAC + VLAN number.
- TDMoIP & Managers traffic must be tagged.

Table 2-11. Rate + user untagged mode.

Frame Action	Switch Action
A tagged frame enters the network port.	
Both user and network ports are members of the frame's VLAN.	Switched to the user port (see Note 1), and tag is removed.
Either the user or network port is not a member of the frame's VLAN.	Discarded.
A tagged frame enters the user port.	Discarded.
An untagged frame enters the network port (see Note 2).	
Both user and network ports are members of the network port default VLAN.	Switched to the user port without changing (see Note 1).
Either the user or the network port is not a member of the network port default VLAN.	Discarded.
A untagged frame enters the user port (see Note 2).	
Both the user and the network ports are members of the user port default VLAN.	Switched to the network port (see Note 1).
	Subject to rate limiting.
	Default user port VLAN ID is added with priority 0.
Either the user or the network port is not a member of the user port default VLAN.	Discarded.

NOTES

1. The switch may decide not to pass the frame to the other port, based on its learning.
2. A priority-tagged frame (frame with a tag and VLAN-ID 0) is treated just like an untagged frame. This includes rewriting the priority field with 0.

2.3.13 OAM CONNECTIVITY

When a destination Multi-Input IP Mux is lost, the traffic load that is transmitted to that mux is significantly decreased (several packets per second per connection). The mux starts transmitting at full rate only when detecting a Multi-Input IP Mux on the other side of the line.

OAM connectivity is used to detect a valid connection (the remote Multi-Input IP Mux will confirm that it recognizes the connection and that it is enabled). It prevents flooding by a handshake.

The control packets are run over a unique bundle number that is used for this purpose. The control packets have the same VLAN ID and TOS of the originating connection. The control packet uses the TDMoIP UDP number.

OAM connectivity can be set to Disable or Enable.

NOTE

For control packets, the UDP check sum is not calculated or checked.

3. Installation

The Multi-Input IP Mux is completely assembled for desktop installation. You may also choose to install the mux in a 19-inch rack using the RM1050 rackmount kit (sold separately).

After installing the mux, configure it using an ASCII terminal connected to the mux's control port, or via Telnet or the TDMoIP management application. The mux's configuration procedures are described in **Section 4.4** and **Appendix E**.

If you encounter problems, refer to **Chapter 5** for test and diagnostics instructions.

WARNING

No internal settings, adjustment, maintenance, or 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.

3.1 Site Requirements and Prerequisites

Install AC-powered Multi-Input IP Muxes within 5 feet (1.5 m) of an easily accessible grounded AC outlet capable of furnishing the required supply voltage.

Allow at least 36 inches (91 cm) at the front of the mux for operator access. Allow at least 4 inches (10.2 cm) at the rear of the mux for cable connections. Make sure that the ventilation holes are not blocked.

The mux's ambient operating temperature is 32 to 122°F (0 to 50°C), at a relative humidity of up to 90%, noncondensing.

The Multi-Input IP Mux needs no special tools for installation. You will, however, need to supply a screwdriver if you want to mount the mux in a 19-inch rack.

3.2 Installation and Setup

3.2.1 SETTING JUMPERS

The Multi-Input Mux internal jumpers and switches never need to be configured.

3.2.2 CONNECTING INTERFACES AND CABLES

Figures 3-1 through 3-8 show the front and rear panels for the different mux models.

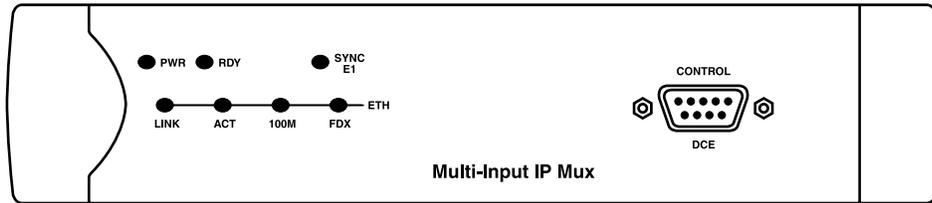


Figure 3-1. MT1050A-E1 or MT1050A-E1-CX front panel.

NOTE

The MT1050A front panel looks the same as Figure 3-1 except that it has a Sync T1 LED instead of a Sync E1 LED.

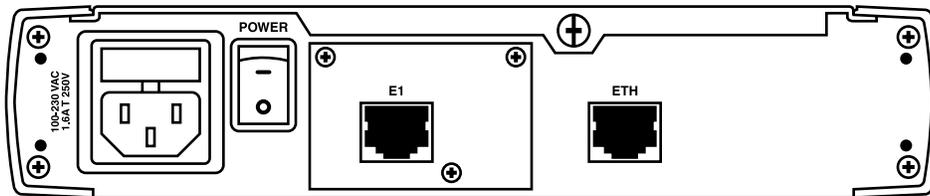


Figure 3-2. MT1050A or MT1050A-E1 rear panel.

NOTE

The MT1050A-E1-CX has a coax connector for the E1 instead of an RJ-48 connector on its rear panel.

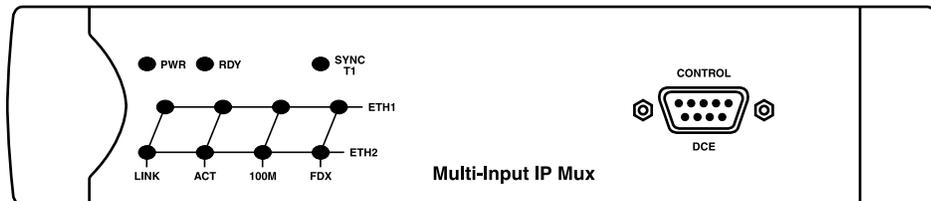


Figure 3-3. MT1051A front panel.

NOTE

The MT1051A-E1 and MT1051A-E1-CX front panels look the same as Figure 3-3 except that they have a Sync E1 LED instead of a Sync T1 LED.

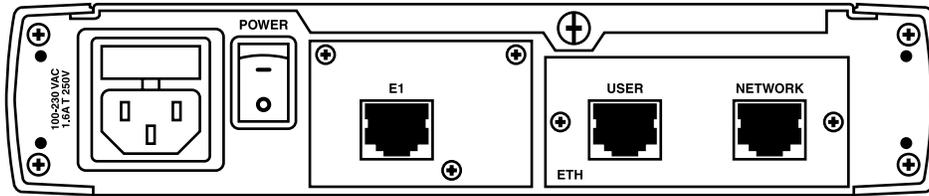


Figure 3-4. MT1051A or MT1051A-E1 rear panel.

NOTE

The MT1051A-E1-CX has a coax connector for E1 instead of an RJ-48 connector on its rear panel.

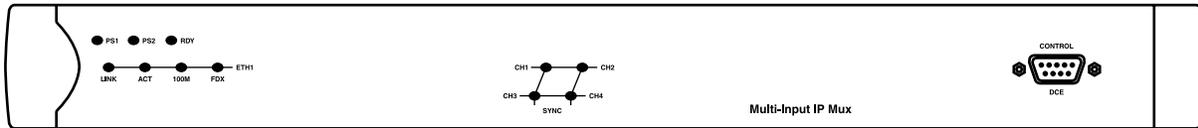


Figure 3-5. MT1052A front panel.



Figure 3-6. MT1052A rear panel.

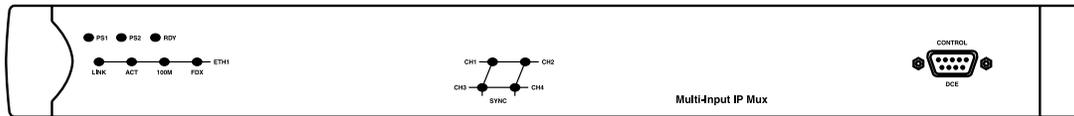


Figure 3-7. MT1053A front panel.

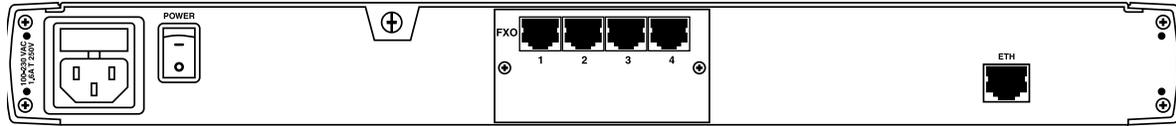


Figure 3-8. MT1053A rear panel.

Grounding

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

NOTE

Before switching on the mux and before connecting any other cable, connect the mux’s protective earth terminals to the power cord’s protective ground conductor.

Fuses

Make sure that only fuses with the required rated current and specified type, as marked on the Multi-Input IP Mux rear panel, are used for replacement.

Whenever it’s likely that the protection offered by fuses has been impaired, do not operate the mux.

Location of Connectors

Interface connections are made from the mux’s rear panel, as shown in Figures 3-2, 3-4, 3-6, and 3-8. The control port is located on the mux’s front panel (Figures 3-1, 3-3, 3-5, and 3-7). Port pinouts are shown in Tables 3-1 through 3-4.

Table 3-1. E1/T1 port connectors pinout.

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

Table 3-2. Ethernet port pinout.

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

Table 3-3. Control port pinout.

Pin	Pinout
1	—
2	Rx
3	Tx
4	—
5	GND
6	—
7	—
8	—
9	—

Table 3-4. FXS/FXO interface pin assignments for RJ-11.

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

3.2.3 CONNECTING THE POWER

AC power is supplied through the 5-ft. (1.5-m) standard power cable terminated by a standard 3-prong plug. The cable is included with the mux.

To connect AC power to the mux:

1. Verify that the AC outlet is grounded properly. Make sure that the supply voltage is in the range of 100 to 240 VAC.
2. Make sure the Power switch on the rear panel is off.
3. Connect the power cable to the rear panel connector first, then to the AC mains outlet.

4. Operation

4.1 Controls, Connectors, and Indicators

The MT1050A-E1 and MT1052A's LEDs (see Figures 4-1 through 4-4) are located on the left side of the front panel. Tables 4-1 and 4-2 describe the system indicators, connectors, and switches. Figures 3-1 through 3-8 illustrate the positions of the LEDs and connectors on the other mux models. The numbers in Figures 4-1 through 4-4 correspond to the "No." column in Tables 4-1 or 4-2.

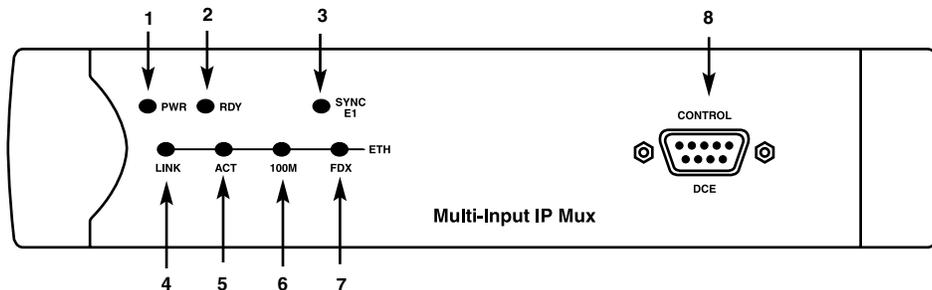


Figure 4-1. MT1050A-E1 front-panel indicators.

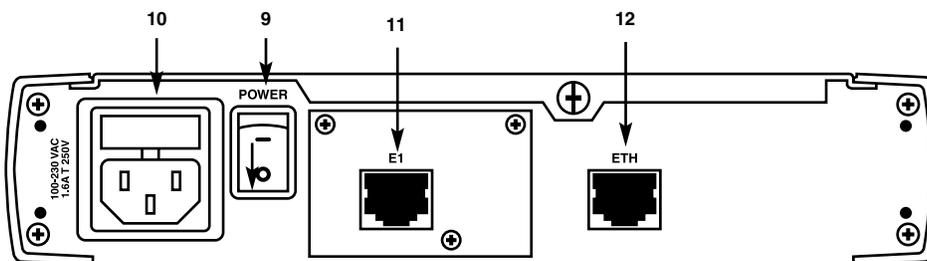


Figure 4-2. MT1050A-E1 rear-panel indicators.

Table 4-1. System indicators, switches, and connectors for the T1/E1 mux models.

No.	Name	Type	Function
1	PWR	LED	On: Unit powered. Off: Unit not powered.
2	RDY	LED	On: Device OK. Off: Self-test in progress. Blinking: Malfunction detected.
3	SYNC E1 or SYNC T1	LED	On: Port synchronized (no alarm). Off: Unframed: Signal loss or AIS detected. Framed: Signal loss, loss of frame, or AIS detected. Blinking: RDI detected (remote alarm).
4	ETH LINK	LED	On: Line OK. Off: Link not active.
5	ETH ACT	LED	On: Frame being transferred on-line. Off: No activity.
6	ETH 100M	LED	On: 100 Mbps. Off: 10 Mbps.
7	ETH FDX	LED	On: Full duplex. Off: Half duplex.
8	Control/DCE	DB9 Connector	Control port for connection to a terminal or PC.
9	POWER	Switch	Turns mux's power on and off.
10	—	3-Prong Connector	Connects the mux to AC power.
11	E1 or T1	RJ-48 Connector	Connects to the T1 or E1 balanced interface.
12	ETH	RJ-48 Connector	Connects to the 10/100BASE-T Ethernet network. (This connector is not included on the -CX models.)

MULTI-INPUT IP MUXES

Table 4-1 (continued). System indicators, switches, and connectors for the T1/E1 mux models.

No.	Name	Type	Function
Not shown (would be in place of #12 on -CX models)	—	Mini Coax Connector	Mini coax connects to the E1 unbalanced interface.

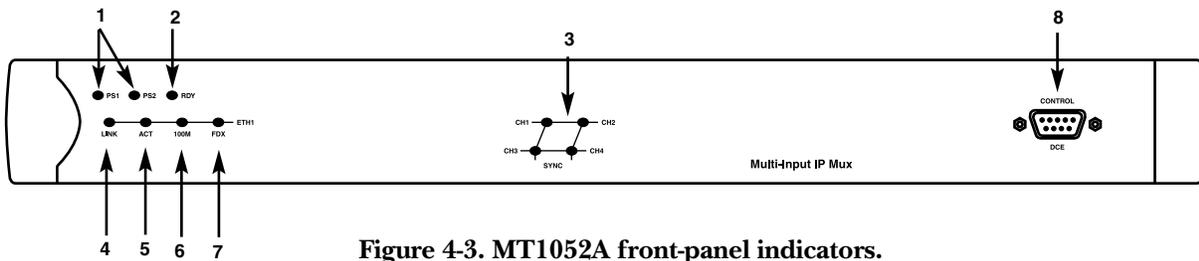


Figure 4-3. MT1052A front-panel indicators.

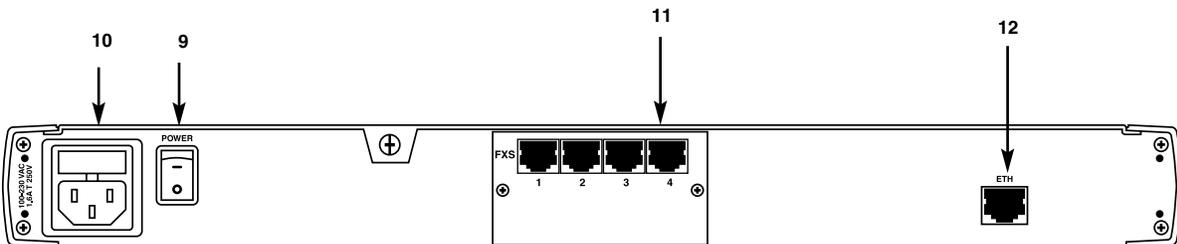


Figure 4-4. MT1052A rear-panel indicators.

Table 4-2. System indicators, switches, and connectors for MT1052A and MT1053A.

No.	Name	Type	Function
1	PS1 or PS2	LED	Green On: Unit powered. Red On: Power supply failure. Off: Unit not powered.
2	RDY	LED	On: Device OK. Off: Self-test in progress. Blinking: Malfunction detected.
3	SYNC CH1-CH4	LED	On: Off hook. Off: On hook. Blinking: Ringing.
4	ETH LINK	LED	On: Line OK. Off: Link not active.
5	ETH ACT	LED	On: Frame being transferred on-line. Off: No activity.
6	ETH 100M	LED	On: 100 Mbps. Off: 10 Mbps.
7	ETH FDX	LED	On: Full duplex. Off: Half duplex.
8	Control/DCE	DB9 Connector	Control port for connection to a terminal or PC.
9	POWER	Switch	Turns the mux's power on and off.
10	—	3-Prong Connector	Connects the mux to AC power.
11	FXS or FXO	RJ-48 Connector	Connects to the FXO or FXS interface.
12	ETH	RJ-48 Connector	Connects to the 10/100BASE-T Ethernet network.

4.2 Powering Up and Logging In

4.2.1 POWERING ON THE MUX

You can connect a control terminal to the Control/DCE port on the mux for configuration.

Without Control Terminal

The Multi-Input IP Mux's power switch is located on the rear panel, as shown in Figures 4-2 and 4-4.

To power up the mux without a control terminal:

1. Turn the power supply switch to ON.
2. Check the unit LED indicators, located on the left side of the front panel, for proper operation (see Figures 4-1 through 4-4 and Tables 4-1 and 4-2).

With Control Terminal

To power up the mux with a control terminal:

1. Make sure all mux cables and connectors are properly connected.
2. Connect the mux to a PC equipped with an ASCII terminal-emulation application (for example, Windows® Hyperterminal or ProComm®).
3. Turn on the control-terminal PC and set its default port parameters to 19,200 baud, 8 bits per character, 1 stop bit, no parity. Set the terminal emulator to ANSI VT100™ emulation (for optimal view of system menus).
4. Switch on the power supply switch.
5. When the initialization and self-test are over, a menu displays the initialization and self-test results. If the self-test is successful, the RDY LED on the left side of the front panel lights. If problems are encountered, refer to **Chapter 5** for instructions.
6. Press <Esc> to open the configuration software.
7. Enter your user name according to your assigned system privileges (either Supervisor [su] or User), then your password (the factory-set password is xxxxxxxxxxx).

The Main menu appears (see Figure 4-8).

If more than three invalid passwords are entered, the system becomes inaccessible for 15 minutes.

4.2.2 LOGIN

To enter as a supervisor:

1. Enter su for the user name.
2. Enter xxxxxxxxxxx for the password.

This allows you to configure all of the mux's parameters and to change the supervisor and user passwords.

To view the unit's configuration:

1. Enter `user` for the user name.
2. Enter `xxxxxxxxxxx` for the password.

This does not allow you to make configuration changes.

To set all passwords to the default value (`xxxxxxxxxxx`), delete the mux's configuration through the Configuration screens.

NOTE

Deleting the mux's configuration using `<Ctrl+A>` and choosing 4 in the Boot menu does not set the password to the default value.

If you forget your password, call Technical Support at 724-746-5500.

4.2.3 POWERING OFF THE MUX

To power off the mux, switch the power supply switch to OFF.

4.3 Getting Started

After installation, there are no special operating procedures for the mux. Once it is powered up, the mux operates automatically. The front-panel LED indicators will monitor operation status.

If required, you can reconfigure the mux. Both the mux configuration and monitoring operations are performed locally from an ASCII terminal connected to the Control port. Detailed configuration procedures are given in **Section 4.4** and **Appendix E**.

The following functions are supported (see the menu trees in Figures 4-5 through 4-7):

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

4.4 Menu Operations

Sections 4.4.1 through **4.4.5** describe the Main menu and the four main submenus (System, Configuration, Performance Monitoring, and Exit).

Navigate the Multi-Input Mux terminal menus to set and view configuration parameters.

Figure 4-5 shows the T1 terminal menus (models MT1050A and MT1051A). Figure 4-6 shows the E1 terminal menus (models MT1050A-E1, MT1050A-E1-CX, MT1051A-E1, and MT1051A-E1-CX). Figure 4-7 shows the FXS/FXO terminal menus (models MT1052A and MT1053A). Use these illustrations as a reference when performing configuration and control functions. **Appendix E** illustrates menus, explains parameters, and lists default values.

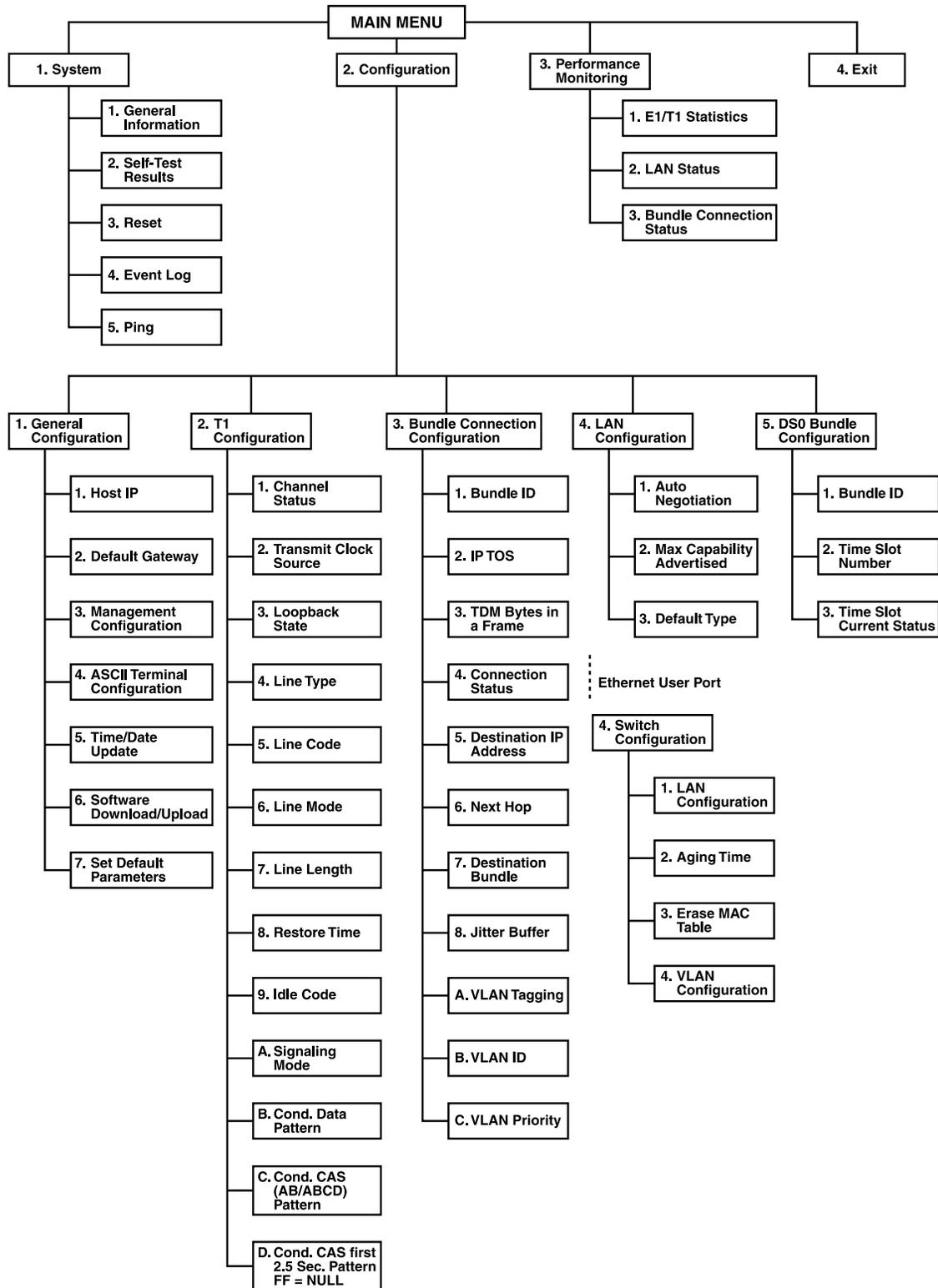


Figure 4-5. T1 terminal menus (MT1050A and MT1051A).

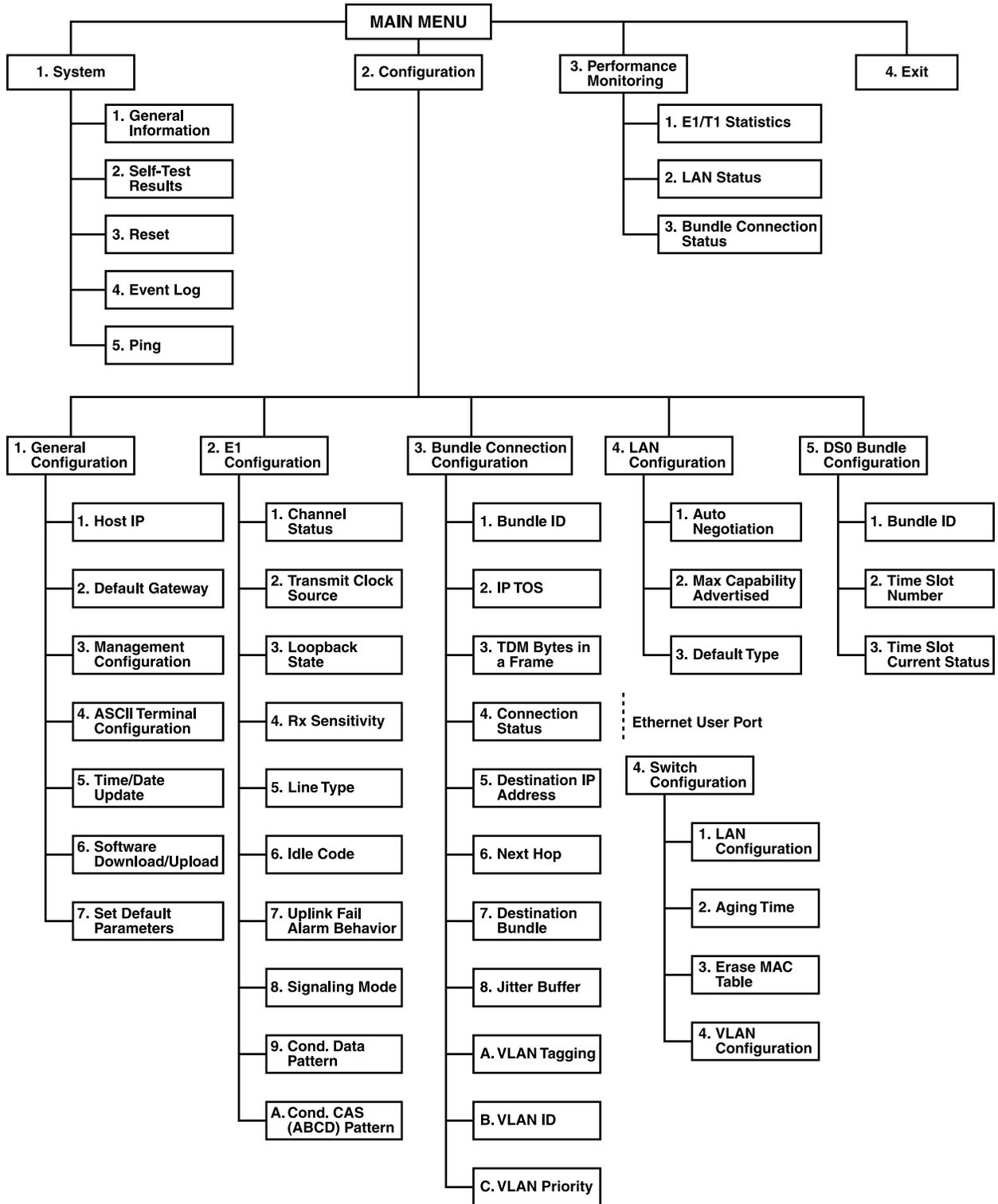


Figure 4-6. E1 terminal menus (MT1050A-E1, MT1050A-E1-CX, MT1051A-E1, and MT1051A-E1-CX).

MULTI-INPUT IP MUXES

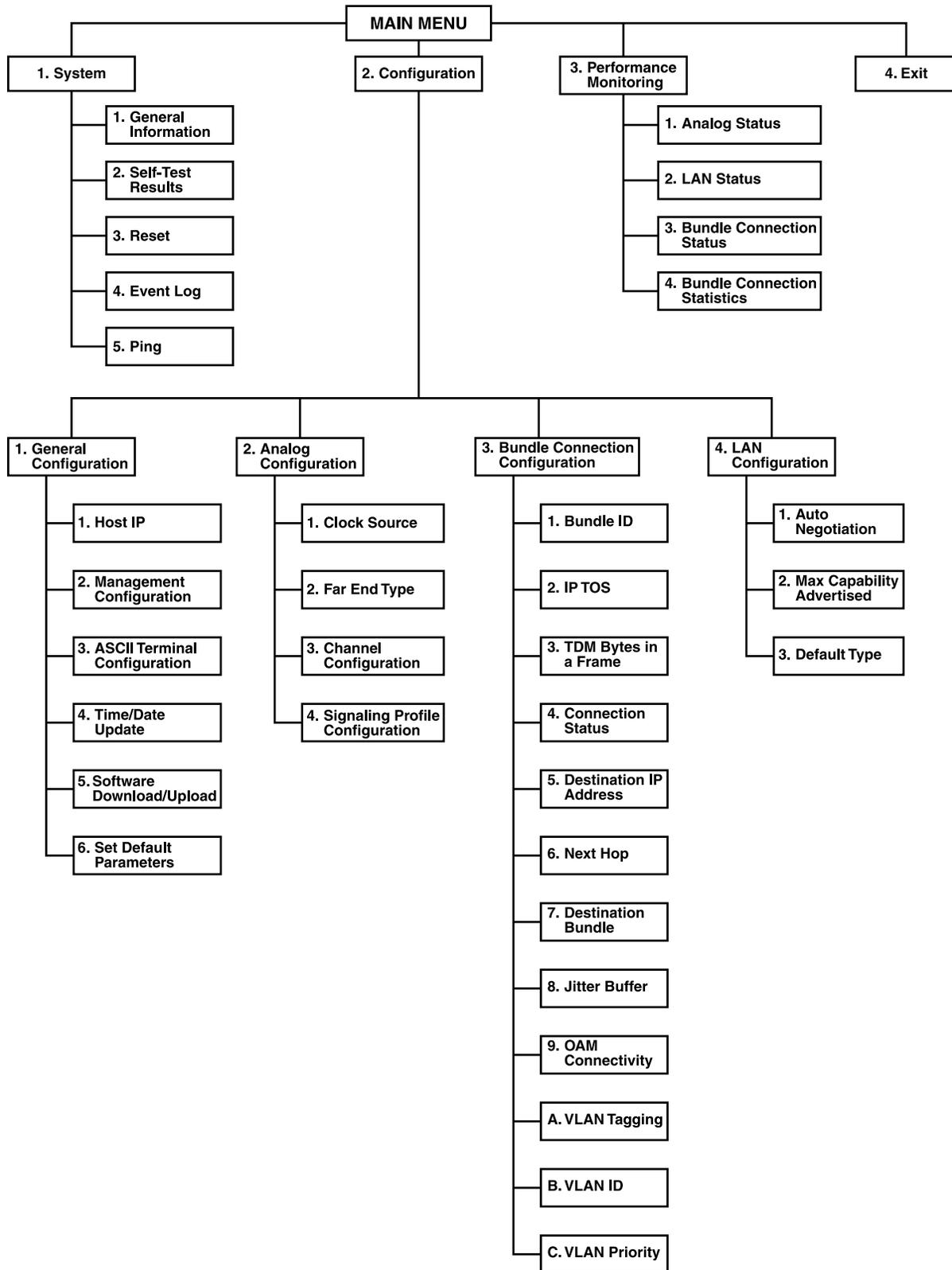


Figure 4-7. MT1052A and MT1053A terminal menus.

4.4.1 MAIN MENU

Figure 4-8 shows the Multi-Input IP Mux’s Main menu. Access all system configuration and control functions via this menu.

The Main menu options are described in Table 4-3.

At any point and from any screen, press <Esc> repeatedly to access previous screens until you reach the Main menu.

Exit the program from this menu only. In order to prevent unauthorized access, we recommend returning to the Main menu after finishing a session. Type 4 to exit the program. A password is then required for reentry.

Table 4-3. Multi-Input IP Mux’s Main menu options.

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

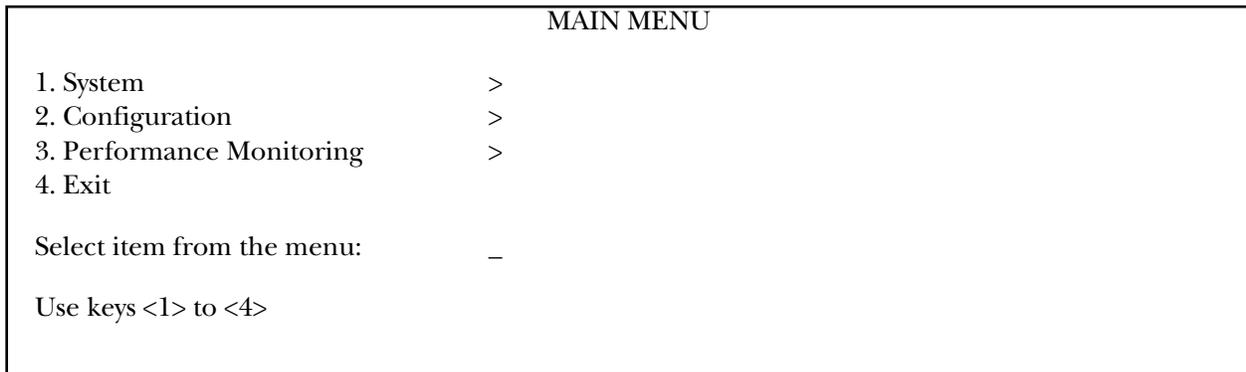


Figure 4-8. Multi-Input IP Mux’s Main menu.

4.4.2 SYSTEM MENU

Type 1 in the Main menu to access the System menu.

From the System menu (see Figure 4-9) you can view and configure the options described in Table 4-4. These options are explained in full detail in **Appendix E**.

Table 4-4. Multi-Input IP Mux System Menu options.

Option	Description
1. General information	View Multi-Input IP Mux general information.
2. Self-test results	Review self-test results obtained during system power-up.
3. Reset	Reset the Multi-Input IP Mux.
4. Event Log	View a list of Multi-Input IP Mux events.
5. Ping	Ping other network devices.

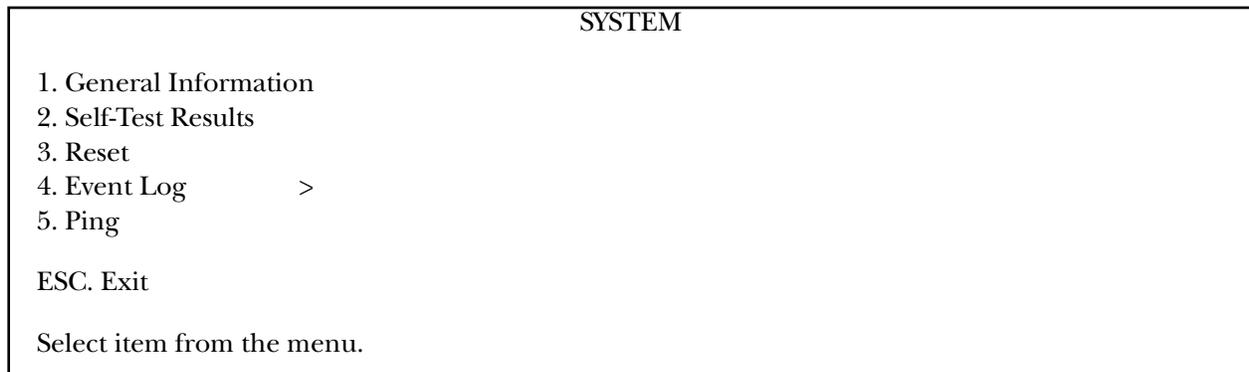


Figure 4-9. Multi-Input IP Mux’s System menu.

4.4.3 CONFIGURATION MENU

Type 2 in the Main menu to access the Configuration menu.

The Configuration menu for MT1050A, MT1050A-E1, MT1050A-E1-CX, MT1051A, MT1051A-E1, MT1051A-E1-CX is shown in Figure 4-10.

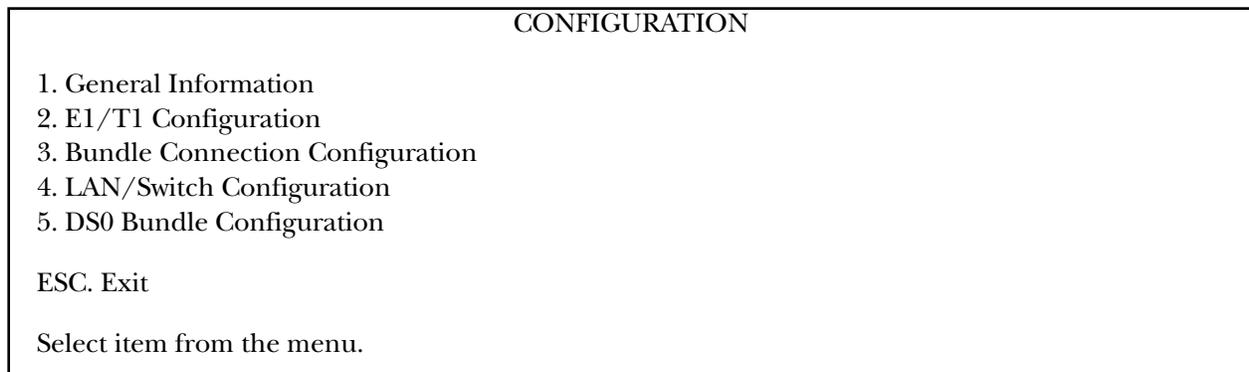


Figure 4-10. Configuration menu for MT1050A, MT1050A-E1, MT1050A-E1-CX, MT1051A, MT1051A-E1, and MT1051A-E1-CX.

The Configuration menu for MT1052A and MT1053A is shown in Figure 4-11.

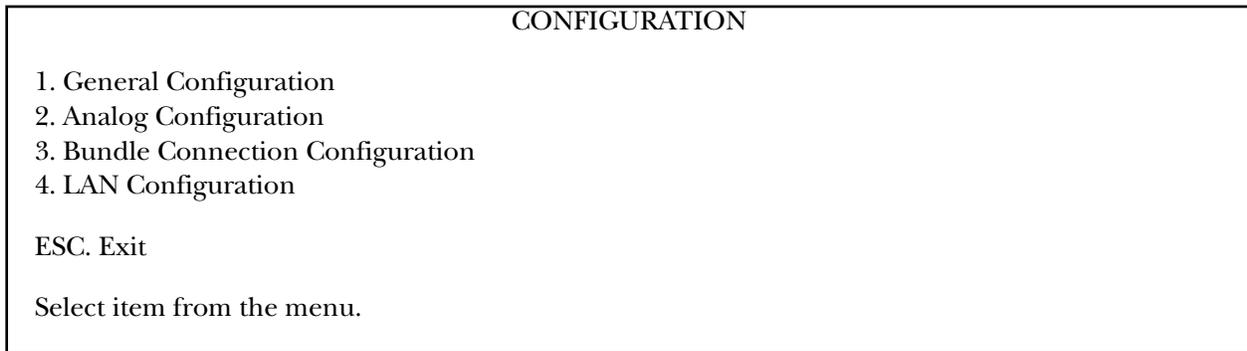


Figure 4-11. Configuration menu for MT1052A and MT1053A.

Table 4-5 describes the configuration options for all Configuration menus.

Table 4-5. Configuration options.

Option	Description
1. General Configuration	Configure Host IP, Default Gateway, ASCII Terminal Configuration, Time/Date update, default parameters, and download software updates.
2. Analog Configuration, T1 Configuration, or E1 Configuration	Configure FXS, FXO, T1, or E1 physical layer.
3. Bundle Connection Configuration	Configure Connection parameters: Configure IP ToS, TDM bytes/frame, and VLAN tagging.
4. LAN/Switch Configuration	Configure Ethernet physical layer.
5. DS0 Bundle Configuration	Configure a group of DS0 timeslots.

Specific parameters are explained in **Appendix E**.

4.4.4 PERFORMANCE MONITORING MENU

Type 3 in the Main menu to view Performance Statistics.

Typical menus are shown in Figure 4-12 and 4-13.

Table 4-6 describes the Performance Monitoring options.

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

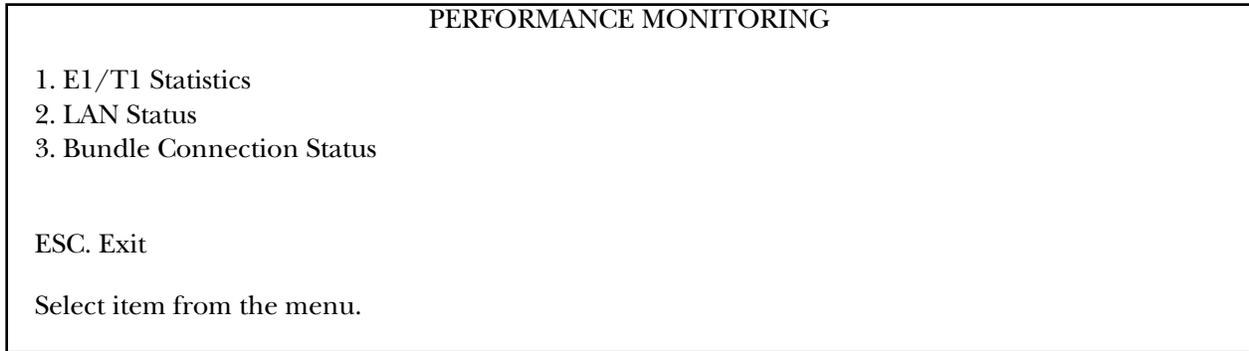


Figure 4-12. Performance monitoring for MT1050A, MT1050A-E1, MT1050A-E1-CX, MT1051A, MT1051A-E1, and MT1051A-E1-CX.

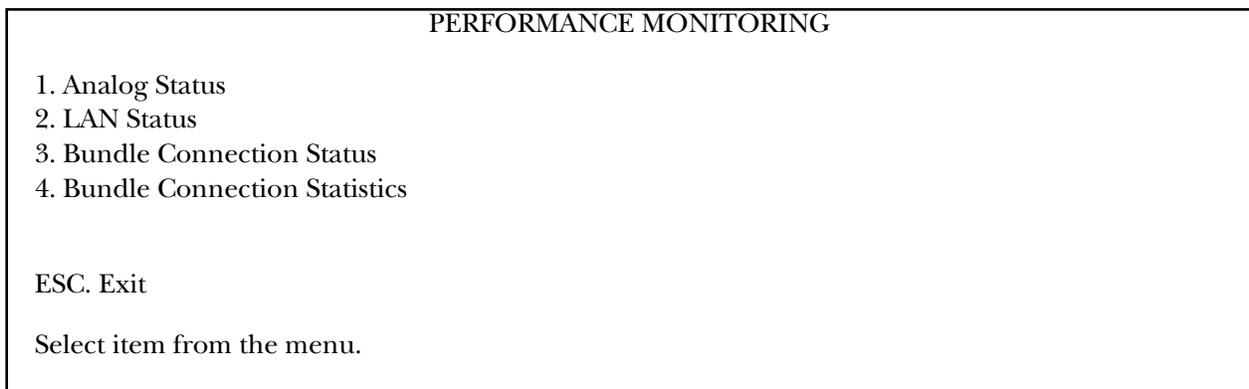


Figure 4-13. Performance monitoring for MT1052A and MT1053A.

Table 4-6. Performance monitoring menu options.

Option	Description
1. E1/T1 Statistics or Analog Status	Statistics for E1/T1 or Analog.
2. LAN Status	Statistics for LAN. MAC Address. Frames Received. Frames Transmitted.
3. Bundle Connection Status	Statistics for Bundle Connection. Destination IP Address. Next Hop MAC Address. Connectivity Status. Sequence Errors. Jitter Buffer Underflow. Jitter Buffer Overflow.
4. Bundle Connection Statistics	Statistics for Bundle Connection

4.4.5 EXIT MENU

Type 4 to exit from the Main menu.

5. Troubleshooting and Diagnostics

5.1 Error Detection

The first indication that something is wrong may come from the LED indicators. The Multi-Input IP Mux's front-panel LEDs tell you the module's operating status. For a detailed description of the indicators, see **Chapter 4**.

Another way to spot errors is by using the Event Log File. All events are time-stamped. You can view the contents of the Event Log File via an ASCII terminal or a Telnet session.

You can also clear the contents of the Log File.

Table 5-1 presents the event types that appear on the Event Log File alphabetically, as well as the actions required to correct the event (alarm) indication.

To correct the reported problem, perform corrective actions in the given order until the problem is corrected. If the problem cannot be fixed by carrying out the listed actions, the Multi-Input IP Mux *must* be checked by authorized technical support personnel.

Table 5-1. Event types.

Event	Description	Corrective Action
COLD START	The mux has been powered up.	None.
CON LOCAL FAIL	Ethernet frames are not received by the local mux on the specified connection.	Check Ethernet/IP path.
CON REMOTE FAIL	Ethernet frames are not received by the remote mux on the specified connection.	Check Ethernet/IP path.
CON SYNC	Bundle connection failure has ended (only applicable when OAM is enabled).	None.
CON UNAVAILABLE	Remote mux is not available (only applicable when OAM is enabled).	Check the connection of the remote mux.

Table 5-1 (continued). Event types.

Event	Description	Corrective Action
CON VALIDATION FAIL	Connection is invalid (only applicable when OAM is enabled).	Check the bundle parameters.
FATAL ERROR	Mux has encountered an internal fatal error.	The mux requires servicing.
LINE AIS END	Line AIS state detected has ended.	None.
LINE AIS START	Mux has AIS (alarm indicator signal) on its E1/T1 port.	Check for a fault at the PDH network on the receive direction.
LINE FEBE END	LINE FEBE state detected has ended.	None.
LINE FEBE START	Mux has LINE FEBE state on its E1/T1 port.	Check for errors in the E1/T1 connection on the transmit direction.
LINE RDI END	LINE RDI state detected has ended.	None.
LINE RDI START	Mux has LINE RDI (remote defect indicator) state on its T1/E1 port.	Check for a fault at the E1/T1 connectivity on the transmit direction.
LOF END	LOF state detected has ended.	None.
LOF START	Mux has a LOF (loss of frame synchronization) state on its E1/T1 port.	1. Check port cable connection. 2. Check input signal.
LOS END	LOS state detected has ended.	None.
LOS START	Mux has a LOS (loss of signal) state on its E1/T1 port.	1. Check the port cable connection. 2. Check input signal.
PS ACTIVE	Mux power supply unit is powered on.	None.
SYSTEM USER RESET	Mux was reset by the user.	None.

5.2 Troubleshooting

Table 5-2 describes the event types as they appear on the Event Log File and lists the actions required to correct the event (alarm) indication.

Table 5-2. Problems, causes, and solutions.

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

5.3 Diagnostic Tests

Maintenance capabilities include external and internal loopbacks. Go to the Main menu, the Configuration menu, the E1/T1 Configuration menu, and the Loopback State menu. Press the <Spacebar> on the keyboard to toggle between Internal, External, and Disable. Press **Enter**.

5.3.1 E1/T1

External Loop

The mux can be set to an external loop to test the connection between the E1/T1 port and the PBX (refer to **Sections E.3.2** and **E.3.3** in **Appendix E**). In this mode, data coming from the PBX is both looped back to the PBX and transmitted forward to the IP network (see Figure 5-1).

This mode can also be achieved by a T1 Facility Data Link (FDL) from the T1.

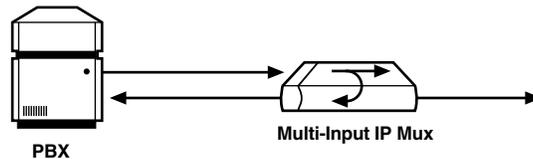


Figure 5-1. Mux external loop.

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 **Sections E.3.2** and **E.3.3** in **Appendix E**). In this mode (E1/T1 only), data coming from the IP network is both looped back to the IP network and an AIS pattern is transmitted forward to the PBX connected to the E1/T1 port (see Figure 5-2).

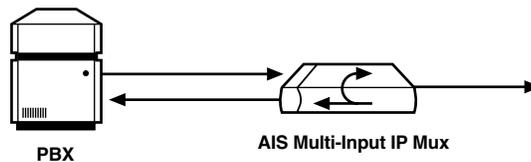


Figure 5-2. Mux internal loop.

To run a loopback test:

Press the **Spacebar** on your keyboard to toggle between Internal, External, and Disable.

Internal: Data received from the IP network side is looped back to the network transmit line. An unframed all “1” code (AIS) is transmitted in the E1 Tx path toward the PBX. Incoming data from the PBX is ignored.

External: Data received from the PBX at the receive E1 line is looped back to the E1 Tx path (toward the same PBX), and continues its way to the IP network. Data coming from the IP network is ignored.

Disable: No loopback. Regular operation.

The default value is Disable.

5.3.2 FXS/FXO

Remote Loopback

You can set a remote loopback analog signal, per port, in the mux with an FXS/FXO interface. The analog signal is looped back toward the IP network.

Tone Injection

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

To run a test, go to the Main menu, the Configuration menu, the Analog Configuration menu, the Channel Configuration menu, the Channel Number menu, and the Testing menu.

Press the <Spacebar> on your keyboard to toggle between **Remote Loopback**, **Tone Injection**, and **Disable**.

The default value is Disable.

Appendix A. Boot Sequence for Downloading Software

This chapter provides a description of the mux's boot procedure via an ASCII terminal for downloading software.

The mux's software is stored in flash memory in two sections: in the boot sector and in the file system. The boot sector holds a boot program that calls up the rest of the program from the file system.

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

The Multi-Input IP Mux boots up automatically. After powering up, no user intervention is required, except when you want to access the file system to modify or update the software or the mux's configuration.

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

1. The boot program searches for the operating file in the file system.
 - If the file exists, a message appears and the program continues.
 - If the file does not exist, the boot program searches for the backup file, renames the file to operating file, 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 mux software starts to execute and you can begin working.

```
BOOT Program V 1.21 7-1-2001 08:35

Flash : size 3e0000h, FileSys sectors 62

BOOT Program is running !!!
Checking File System.....-> exists.
Backup file EXIST
Operating file EXIST
Press Cntl-A within 3 seconds to get File-System Menu !!!
#c1cod code: V 2.00 8-9-2000 11:58
got start addr : 100000
Decompression-process.....
Decompression Ended !!!

Jumping to Application, addr = 100008.
```

Figure A-1. Boot screen.

You may want to access the file system menu, a feature that allows you 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 appears (see Figure A-2).

NOTE

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

```
BOOT MENU

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

Operating file           EXIST
Backup file              EXIST
Configuration file      EXIST

0. Exit
1. File swap: Operating •Backup
2. Download NEW Operating file (existing Operating file will be saved as Backup)
3. Delete Operating file (existing Backup file will be saved as Operating)
4. Delete Configuration file
9. Delete ALL FileSystem (Software and Configuration files)

Type in one of the above option numbers (or <ESC> to exit):
```

Figure A-2. File System menu.

From the File System menu, you can:

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

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

Appendix B. Telnet

Telnet (short for Telecommunications Network) is a protocol that gives you the ability to connect to a remote machine. It does so 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 are transmitted directly to the remote machine, and the response from the remote machine is displayed on your monitor screen. You can manage the mux inband via remote ASCII terminal using the Telnet IP protocol.

B.1 Starting a Telnet Session

The Multi-Input IP Mux is normally controlled by an ASCII terminal emulation application running on an OS. To control the mux using Telnet, you must first open a Telnet application on a local PC.

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

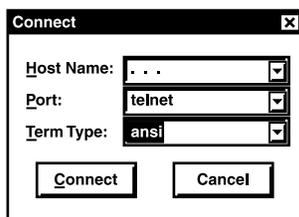


Figure B-1. Telnet logon dialog.

To open a Telnet application:

1. In the Host Name field, type the IP number of the Multi-Input IP Mux.
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 user name and password. The Telnet session is now active.

B.2 Telnet Operation

Telnet and ASCII terminal cannot be active at the same time. If a terminal is active, a Telnet session cannot be established.

To establish a Telnet session, exit the terminal by selecting **Exit** in the Main menu. If the auto-disconnect is ON, the terminal will be disconnected automatically after 15–30 minutes if no characters were sent.

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. This prevents a loss of connectivity.

NOTE

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

B.3 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. To get to this window, go to the Main Menu, the Configuration menu, the General Configuration menu, and the ASCII Terminal Configurations menu. In this menu go to line 4, 15 Minute Timeout.

B.4 Telnet Access

The Multi-Input IP Mux has the ability to configure Telnet access. Options include:

- Enable—Telnet is enabled.
- Disable—Telnet is disabled.
- Managers—Telnet is enabled only when the Manager's list contains the IP and VLAN of the computer that opens the Telnet session (see **Section E.5.5**).

Appendix C. SNMP Management

The Multi-Input IP Mux's SNMP management functions are provided by an internal SNMP agent. The SNMP management communication uses UDP (User Datagram Protocol), which is a connectionless-mode transport protocol, part of the IP (Internet Protocol) protocol suite.

This appendix covers the information related to the SNMP environment.

C.1 SNMP 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.

C.2 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.

C.3 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.

C.4 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) branches.

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 subtree of non-standard MIBs. Enterprise MIBs described in this manual 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.

C.5 MIBs Supported by the Multi-Input IP Mux 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 mux's SNMP agent are:

- rfc1213.mib (except the interfaces view which is supported via RFC 2233)
- ianaiftype.mib (defines the ifType)
- rfc2233.mib (IF-MIB)
- rfc1493.mib
- rfc2665.mib
- rfc1907.mib
- rfc2493.mib
- ces.mib
- rfc2127 (ISDN-MIB)
- rfc2495.mib (except far-end objects and RW configuration objects which are different for each configuration)—replaces RFC 1406, which is now obsolete.
- rfc2494.mib
- rfc2239.mib

- Multi-Input IP Mux private mib

The MT1050A and MT1051A object id is:

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

The MT1050A-E1, MT1050A-E1-CX, MT1051A-E1, MT1051A-E1-CX object id is:

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

C.6 Management Domains Under SNMP

In theory, 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. This allows a limited number of managers to access the device.

C.7 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 Multi-Input IP Mux 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. 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.

C.8 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.

C.9 Network Management Stations

The Multi-Input IP Mux agent stores the IP address of the Network Management Station (NMS) that is intended to manage it.

Appendix D. Inband TFTP Download Procedures

NOTE

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

New Multi-Input IP Mux software versions can be downloaded to the mux using TFTP.

There are three types of users:

- Users who access the mux using Telnet can perform software download and configuration upload/download using the configuration screens.
- Users who have access to the proprietary Network Management.
- Users who access a MIB browser. The TFTP download procedure is illustrated in Figure D-1.



Figure D-1. TFTP downloading procedure.

The Multi-Input IP Mux manager station must be equipped with a TFTP server and the new software.

Before performing TFTP download:

1. Ping the Multi-Input IP Mux from the station running the TFTP server to ensure that the mux has communication with the machine.
2. Log in as **su**.
3. Edit the `inetd.conf` file found at the `/etc` directory, as follows:
 - Search for the line starting with `#tftp`. Delete the `#` sign.
 - At the end of that line, you should see `-S <directory name>`. For the directory name, specify *only the path* to the file that is to be downloaded to the Multi-Input IP Mux. For example, `/export/home/demo/tftp`.
4. Save modified `inetd.conf` file and type `INIT` on the UNIX machine. For example, in Solaris®, type `init 0`.

5. After the station reboots, type `ovw &` to open HPOV.
6. Open the MIB Browser by going to MISC, then SNMP MIB BROWSER.
7. Type `iso.org.dod.courier.plain.enterprises.rad.radGen.agnt.filetranster`. The Browse MIB window showing the Agent IP and Server IP addresses is displayed (see Figure D-2). Downloading should take between 60 to 120 seconds.

The screenshot shows a window titled "Browse MIB" with a menu bar containing "File", "View", and "Help". The window is divided into several sections:

- Name or IP Address:** A text field containing "192.168.113.5".
- Community Name:** An empty text field.
- MIB Object ID:** A text field containing ".iso.org.dod.internet.private.enterprises.rad.radGen.agnt.fileTransfer".
- MIB Object List:** A list of objects including "fileServerIP" (highlighted), "fileName", "fileTransCmd", "tftpRetryTimeOut", "tftpTotalTimeOut", "tftpStatus", "tftpError", and "fileTransferToSubSystems".
- Navigation Buttons:** A vertical stack of buttons: "Up Tree", "Down Tree", "Describe", "Start Query", "Stop Query", and "Graph".
- MIB Instance:** An empty text field.
- SNMP Set Value:** An empty text field.
- Set Button:** A button labeled "Set".
- MIB Values:** A text area containing "0 : 192.168.113.2".

Figure D-2. Agent and server IP addresses.

The menu fields in Figure D-2 are described in Table D-1.

Table D-1. Browse MIB fields.

Field	Description
fileServerIP	Specify the IP address of the TFTP server where the software file resides.
fileName	Specify the file name containing the new software version. Include 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 (the default is 15).
tftpTotalTimeOut	Specify the retry duration, in seconds (the default is 60).
tftpStatus	Specifies the status of the mux.
tftpError	Lists the errors in the mux.
fileTransferToSubSystems	Files transferred to subsystem.
MIB Instance	Set to 0.

To start downloading:

1. Set the appropriate Multi-Input IP Mux MIB parameter. The mux 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 Multi-Input IP Mux and the TFTP server.

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 appears (see Figure D-3).

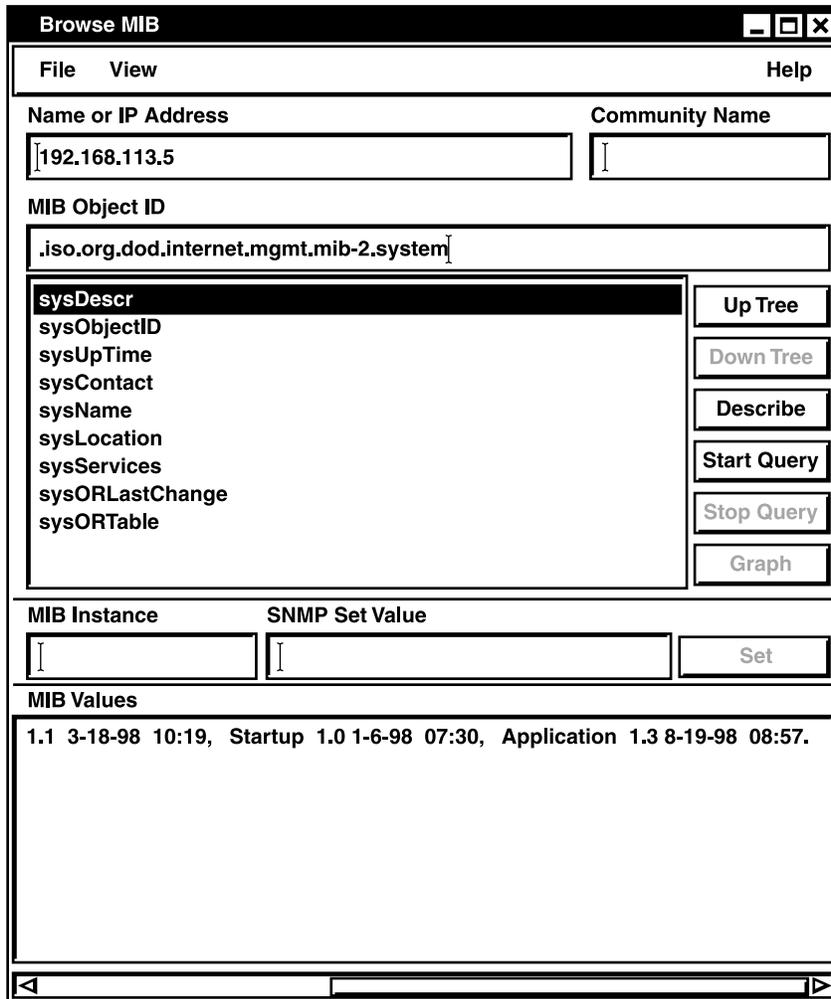


Figure D-3. System description.

2. Press <Start Query>.
3. Scroll to the right to make sure that the application version you have just loaded is the correct one.

Appendix E. Configuration Menus

This appendix illustrates the Multi-Input IP Mux screens and explains the parameters for:

- Main menu in **Section E.1**.
- System menu in **Section E.2** (includes general information, self-test results, reset, event log, and ping).
- Configuration menu in **Section E.3**.
- General Configuration menu in **Section E.3.1**.
- T1 Configuration menu in **Section E.3.2**.
- E1 Configuration menu in **Section E.3.3**.
- Analog Configuration menu in **Section E.3.4** (includes analog [FXS/FXO] configuration).
- Bundle Connection Configuration in **Section E.3.5**.
- LAN Configuration (no user port) in **Section E.3.6**.
- DS0 Bundle Configuration in **Section E.3.7**.
- Performance Monitoring in **Section E.4** (includes E1/T1 statistics, analog status for FXO/FXS muxes, LAN status [no user port], and bundle connection status/statistics).
- Ethernet Configuration/Status menus in **Section E.5** (includes general information, LAN configuration, aging time, erase MAC table, VLAN configuration, and LAN status).

Menu trees for the Multi-Input IP Muxes are shown in Figures 4-5 through 4-7 in **Chapter 4**. Refer to these trees as you navigate through the menus.

E.1 Main Menu

The Main Menu options are:

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

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

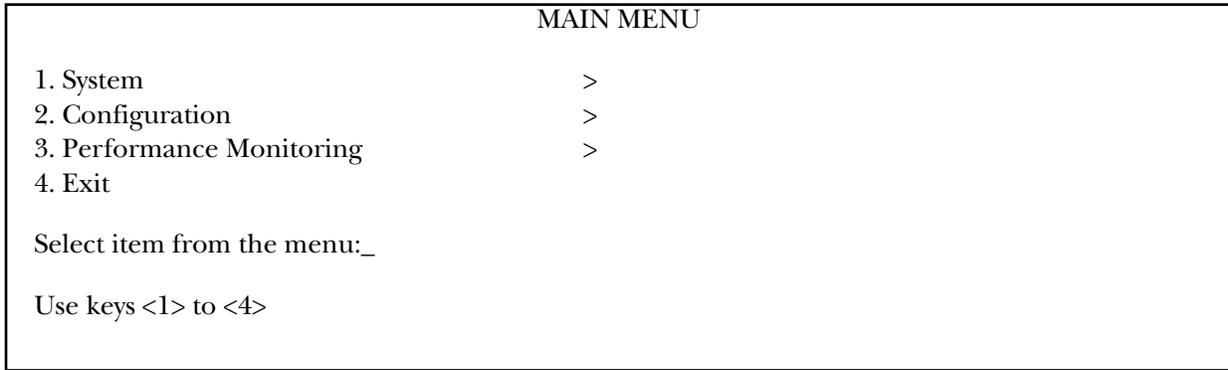


Figure E-1. Main menu.

E.2 System Menu

E.2.1 GENERAL INFORMATION

This screen displays information including software and hardware versions and module descriptions. To get to this window, go to the Main menu, the System menu, then the General Information window.

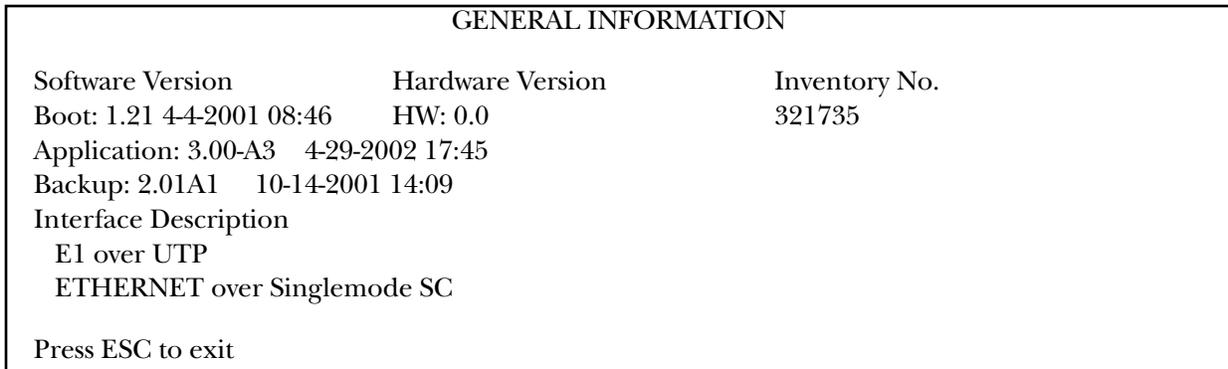


Figure E-2. General information window, E1/T1.

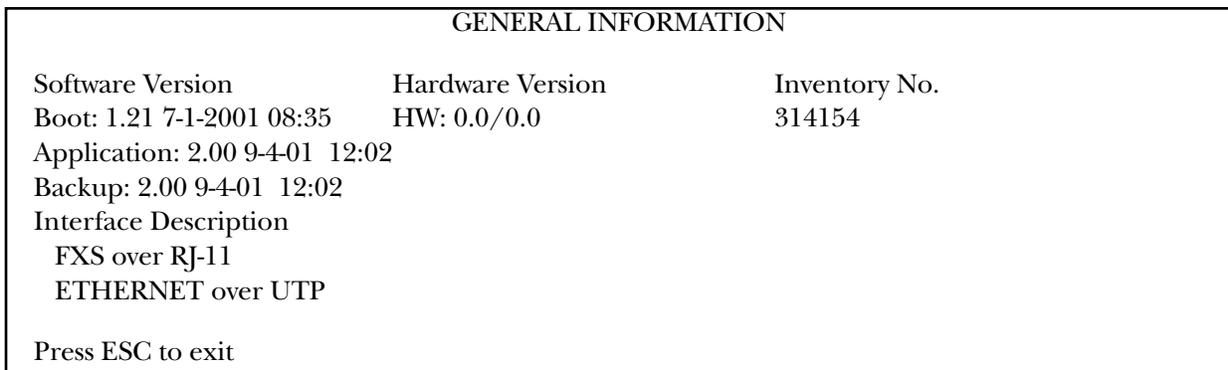


Figure E-3. General information window, FXS.

E.2.2 SELF-TEST RESULTS

To get to this screen, go to the Main menu, the System menu, and the Self-Test Results screen.

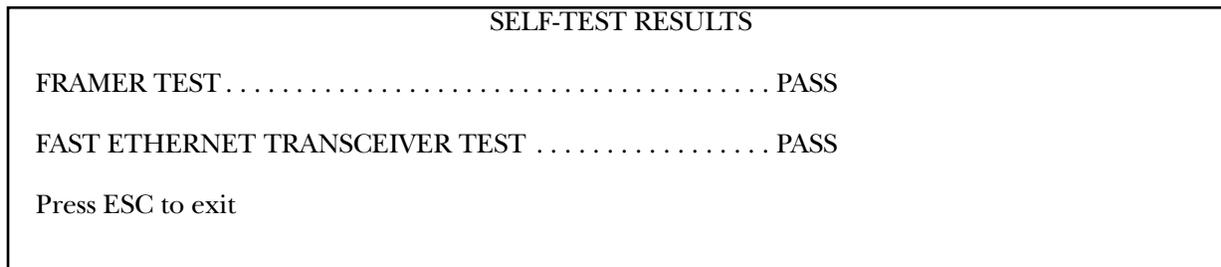


Figure E-4. Last Self-Test Results window.

For details, type M. If you encounter a problem, refer to **Chapter 5**.

E.2.3 RESET

To reset the Multi-Input IP Mux configuration, go to the Main menu, then the System menu.

1. Type 3 in the System menu. The following confirmation message appears.

Are you sure you want to reset??? (Y/N)

2. Press **Y** to confirm System Reset.

E.2.4 EVENT LOG

To get to this screen, go to the Main menu, the System menu, and the System Event Log menu.

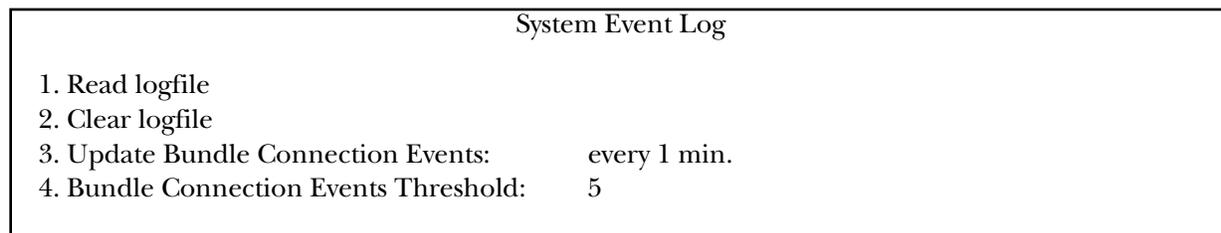


Figure E-5. System Event Log menu.

Table E-1. System Event log parameters.

Parameter	Possible Values	Remarks
Update Bundle Connection Events	Every 1 min.	Interval period.
Bundle Connection Events Threshold	1 to 100	Number of events that cause a report to be initiated.

Logfile Events

To get to this screen, go to the Main menu, the System menu, the Event Log menu, and the Read logfile menu.

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

Figure E-6. Logfile events—sample menu.

For the full events list, see **Chapter 5**.

E.2.5 PING

This option enables you to ping other network devices for diagnostic purposes. To get to this screen, go to the Main menu, the System menu, and the Ping menu.

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

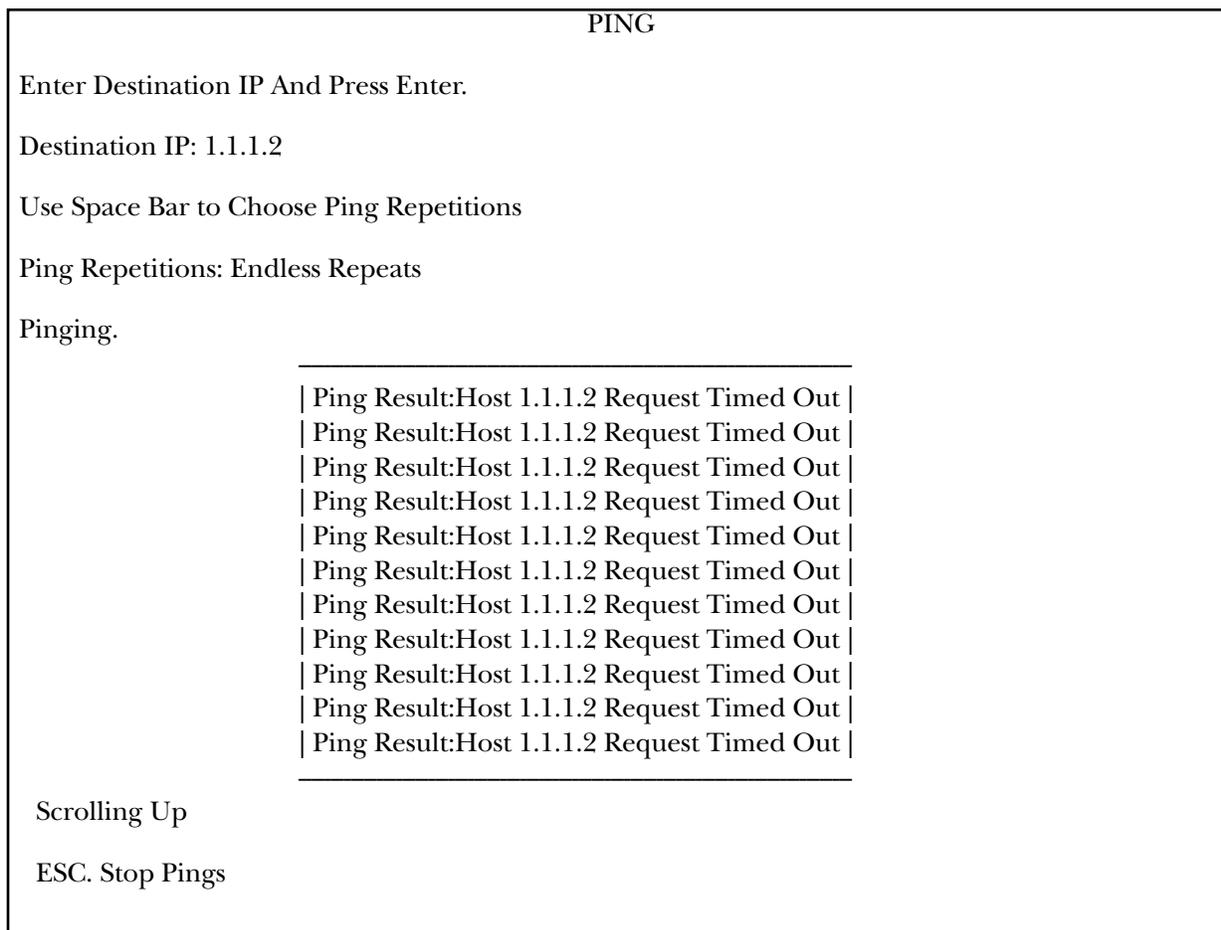


Figure E-7. Ping dialog box.

E.3 Configuration Menu

E.3.1 GENERAL CONFIGURATION MENU

To get to this menu, go to the Main menu, the Configuration menu, and the General Configuration menu.

NOTE

MT1052A and MT1053A don't have menu option #2, Default Gateway.

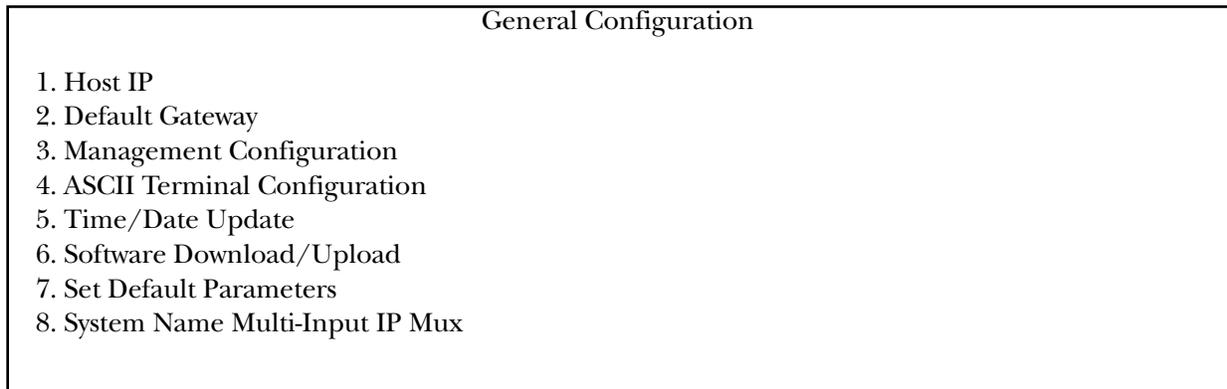


Figure E-8. General Configuration menu.

1. HOST IP

To get to this menu, go to the Main menu, the Configuration menu, the General Configuration menu, and the Host IP menu.

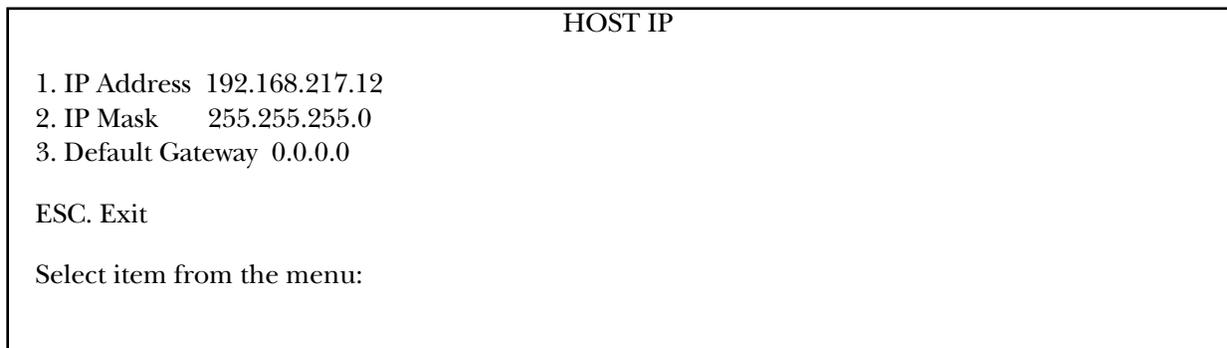


Figure E-9. Host IP menu.

To configure the Host IP address and IP Mask, on the Host IP menu, select **1** and type the IP address. On the Host IP menu, select **2** and type the IP mask.

NOTE

The device reboots if you change any parameter.

To change a configured Host IP, set the device to the default settings.

NOTE

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

2. DEFAULT GATEWAY

This option does not appear in the menus for the MT1052A and MT1053A. Default gateway defines the management Next Hop. When Next Hop is not defined for the bundle connection, the Default Gateway Address will be used. To get to this menu, go to the Main menu, the Configuration menu, the General Configuration menu, the Host IP menu, and the Default Gateway menu.

To configure the Default Gateway, select **3** on the Host IP menu, and type the Default Gateway IP address.

NOTE

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

3. MANAGEMENT CONFIGURATION

To get to this menu, go to the Main menu, the Configuration menu, the General Configuration menu, and the Management Configuration menu.

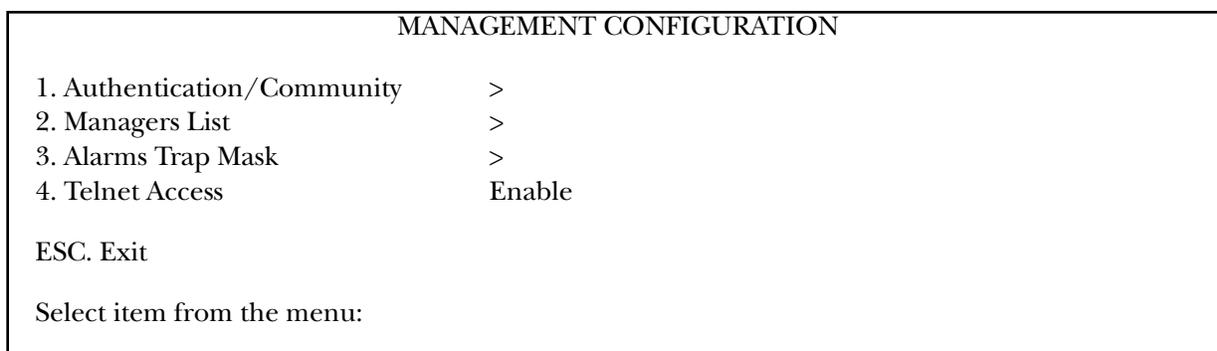


Figure E-10. Management Configuration menu.

Authentication/Community

To get to this menu, go to the Main menu, the Configuration menu, the General Configuration menu, the Management Configuration menu, and the Authentication/Community menu.

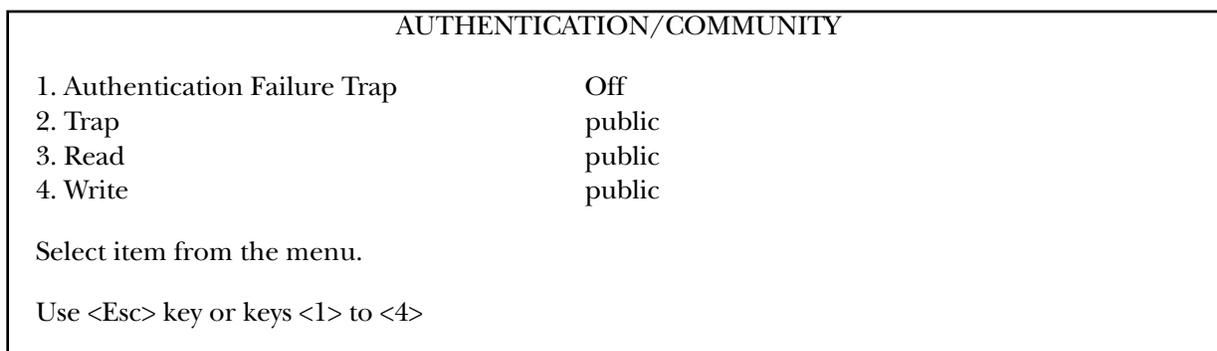


Figure E-11. Authentication/Community menu.

Table E-2. Authentication/Community parameters.

Parameter	Possible Values	Remarks
Authentication Failure Trap	On Off	On—an authentication failure trap is generated when a system manager attempts to set a parameter within the Multi-Input IP Mux with an incorrect community value.
Trap	Up to 10 alphanumeric characters	The entry is case-sensitive.
Read	Up to 10 alphanumeric characters	The entry is case-sensitive.
Write	Up to 10 alphanumeric characters	The entry is case-sensitive.

Managers List

To get to this window, go to the Main menu, the Configuration menu, the General Configuration menu, the Management Configuration menu, and the Managers List window. The Managers List window parameters are used when the Multi-Input IP Mux inband management capability is used. The parameters define the parameters for up to eight managers. These parameters are:

- Manager IP address, and
- Host index.

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

To access additional manager list parameters, press <N> to go to the next Managers List window.

MANAGERS LIST		
1. Manager IP Address		192.333.234.172
2. Link Up/Down Trap		On
3. Alarm Trap		On
5. VLAN Tagging		
6. VLAN ID		
7. VLAN Priority		
ESC. Exit	S. Save	N. Next
Select item from the menu.		
Use <Esc> key or keys <1> to <3>		

Figure E-12. Managers List menu.

Table E-3. Managers List Parameters.

Parameter	Possible Values	Remarks
Manager IP Address	0.0.0.0. to 255.255.255.255	Sets the Manager IP address.
Link Up/Down Trap	On, Off	Link Down informs the manager that there is a physical failure. Link Up informs the manager that the device has recovered from the failure.
Alarm Trap	On	The alarm trap informs the manager of the occurrence of any alarm enabled in the Alarms Trap Mask screen. It informs the manager of both entry and exit from an alarm state.
	Off	No alarm trap will be sent regardless of the Mask defined in the Alarms Trap Mask screen.
VLAN Tagging	Yes, No	See Chapter 2 for an explanation of VLAN tagging. Yes: Set options 4 and 5 on the System Configuration Menu.
VLAN ID	0 to 4095	The default value is 0.
VLAN Priority	0 to 7	The default value is 0.

Alarms Trap Mask

Each of the Multi-Input IP Mux alarms can activate a trap toward the network management station (NMS). It is possible to enable/disable the trap operation for each of the alarms by using the Alarms Trap Mask screen. To get to this screen, go to the Main menu, the Configuration menu, the General Configuration menu, the Management Configuration menu, and the Alarms Trap Mask menu.

ALARMS TRAP MASK	
1. Alarm ID <refer to Manual>	1
2. Trap Status	Active
Alarm Active Traps:	
Select item from the menu.	
Use <Esc> key or keys <1> to <2>	

Figure E-13. Alarms Trap Mask menu.

Table E-4. Alarms Trap Mask parameters.

Parameter	Possible Values	Remarks
Alarm ID	1, 2, 6, 8, 21, 26	Multi-Input IP Mux alarm.
Trap Status	Active	Generates an alarm.
	Masked	Does not send an alarm. The default for all traps is Masked.

Table E-5. Multi-Input IP Mux alarms.

Alarm ID	Alarm Description	Trap Sent to NMS
1	Loss of Signal (LOS Physical Layer)	Alarm LOS 1.3.6.1.4.1.164.6.1.3.0.7
2	Loss of Frame (LOF Physical Layer)	Alarm LOF 1.3.6.1.4.1.164.6.1.3.0.8
6	Alarm Indication Signal Received (AIS Line Physical Layer)	Alarm AIS 1.3.6.1.4.1.164.6.1.3.0.10
8	Remote Defect Indication Received (RDI Line Physical Layer)	Alarm RDI 1.3.6.1.4.1.164.6.1.3.0.11
21	Far End Block Error (FEBE Line Layer)	Alarm FEBE 1.3.6.1.4.1.164.6.1.3.0.12
26	Connectivity Status	Conn Status Trap 1.3.6.1.4.1.164.6.1.3.0.15

NOTE

The other alarms are not used.

Telnet Access

To get to this menu, go to the Main menu, the Configuration menu, the General Configuration menu, the Management Configuration menu, and the Telnet Access menu. It is possible to manage the Multi-Input IP Mux inband via remote ASCII Terminal using the Telnet IP protocol.

To configure Telnet Access, select one of the following:

- Enable—Telnet is enabled.

MULTI-INPUT IP MUXES

- Disable—Telnet is disabled.
- Managers—Telnet is enabled only when the Managers List contains the IP and VLAN of the computer that opens the Telnet session (see **Appendix B**).

4. ASCII TERMINAL CONFIGURATION

To get to this menu, go to the Main menu, the Configuration menu, the General Configuration menu, and the ASCII Terminal Configuration menu.

ASCII TERMINAL CONFIGURATION	
1. Display Mode	Color
2. Baud Rate (bps)	19200
3. Change Password	
4. 15 Min. Timeout	On
ESC. Exit	
NOTICE: Change the Baud Rate of the ASCII terminal after changing and saving of new Baud Rate data!	
Select item from the menu: _	
Use <Esc> key or keys <1> to <4>	

Figure E-14. ASCII Terminal Configuration menu.

Table E-6. ASCII Terminal Configuration parameters.

Parameter	Possible Values	Remarks
Display Mode	Color MonoChrome 3 color MonoChrome 2 color	The default is Color.
Baud Rate (bps)	9600, 19200, 38400, 57600, 115200	The default is 19200 bps.
Change Password	—	Choose this option to enter a menu that allows the user to change the current password.
15 Min. Timeout	On, Off	On—Terminal/Telnet exits to the password screen if no characters are sent by the terminal for 15 minutes.

5. TIME/DATE UPDATE

To get to this menu, go to the Main menu, the Configuration menu, the General Configuration menu, and the Time/Date Update menu.

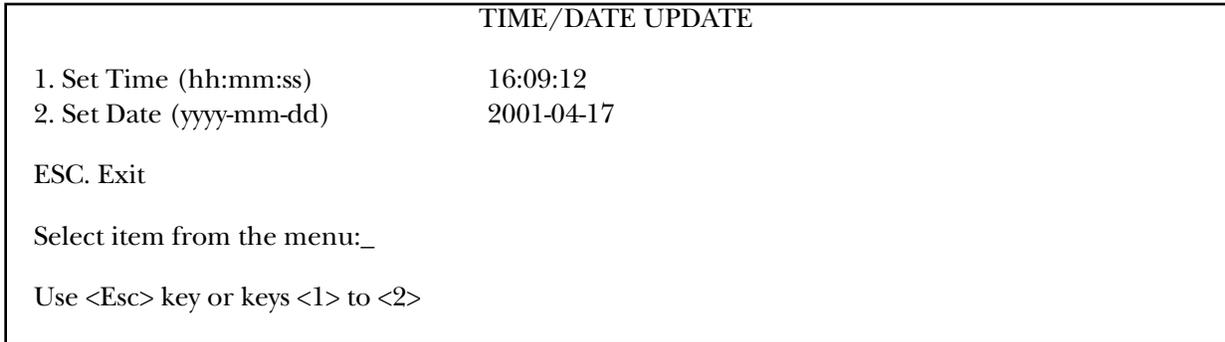


Figure E-15. Time/Date Update menu.

Table E-7. Time/Date Update parameters.

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

6. SOFTWARE DOWNLOAD/UPLOAD

To get to the Download/Upload Using Xmodem menu, go to the Main menu, the Configuration menu, the General Configuration menu, the Software Download menu, and the Download/Upload Using Xmodem menu. Only configuration files can be uploaded. If you enter a software file, the Upload option is not displayed.

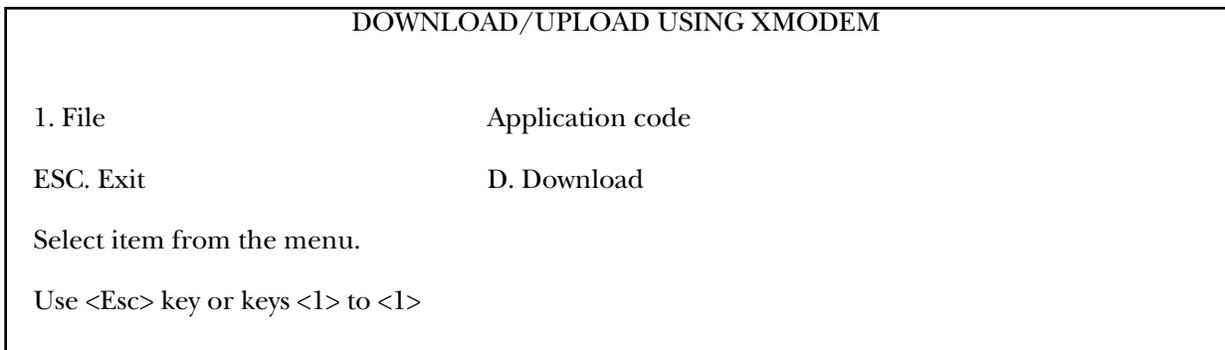


Figure E-16. Download/Upload Using Xmodem menu.

To download/upload using Xmodem:

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

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

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

TFTP

To get to this menu, go to the Main menu, the Configuration menu, the General Configuration menu, the Software Download menu, and the Download/Upload Using TFTP menu.

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

Figure E-17. Download/Upload Using TFTP window.

Table E-9. Download/Upload Using TFTP parameters.

Parameter	Possible Values	Remarks
File name	Variable	—
Command	No Operation, Software Download, Configuration Download, Configuration Upload	—
Server IP	0.0.0.0 to 255.255.255.255	IP address of the server from which the file is loaded.
Retry timeout	0 to 10,000	Selected retry timeout period (in seconds).
Total timeout	0 to 10,000	Selected total timeout period (in seconds), which is the maximum time allowed for attempted transmission.
View transfer status	—	View the transfer status in real-time. It is updated every second. The screen is read-only.

To save the parameters and start the transmission process, type 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-18).

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

NOTES

- 1. Boot-code download is not possible using TFTP.**
- 2. Reboot the system after you have completed TFTP download via X-modem screens.**

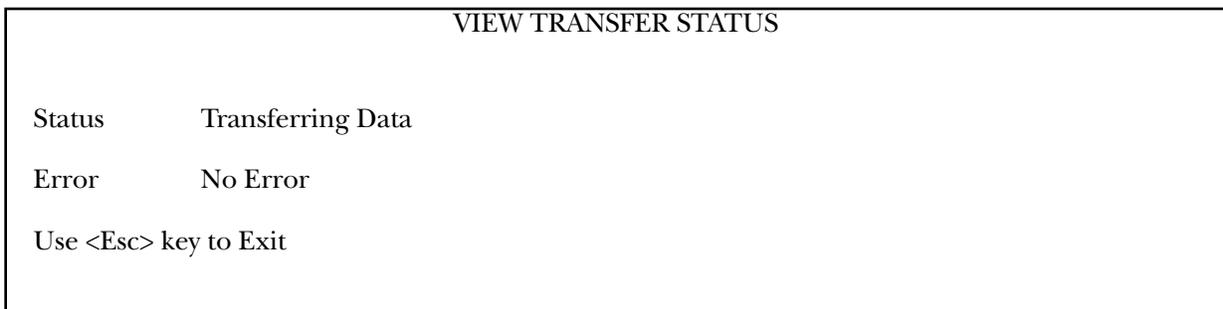


Figure E-18. View Transfer Status window.

Table E-10. View Transfer Status parameters.

Parameter	Values
Status	No Operation, Connecting, Transferring Data, Ended on Time Out, Ended OK, Error
Error	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

7. SET DEFAULT PARAMETERS

To get to this menu, go to the Main menu, the Configuration menu, the General Configuration menu, and the Set Default Parameters menu. Setting Default Parameters reconfigures the device according to default parameters. Before overwriting the system, you're asked to confirm your selection.

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

To overwrite the system and reconfigure it according to default settings, at the prompt, do one of the following:

1. Type Y. A prompt asks for confirmation.

Are you sure? Y/N

Type Y. A second prompt asks for confirmation (if you have configured the host):

Save Host Connection? Y/N

2. Perform one of the following: Type Y, and the Default Configuration returns all the default settings except for Host IP, Default Gateway, and Managers, or type N. The Default Configuration returns all the default settings and deletes the Host IP, Default Gateway, and Managers. Or, press **ESC** to exit and return to the General Configuration menu. The Multi-Input IP Mux will perform an automatic reset.

8. SYSTEM NAME MULTI-INPUT MUX

To get to this menu, go to the Main menu, the Configuration menu, the General Configuration menu, and the System Name Multi-Input Mux menu. This option lets you set the system name.

E.3.2 T1 CONFIGURATION MENU

The Multi-Input IP Mux automatically detects whether the interface is E1 or T1. If it's T1, this menu appears (see Figure E-19).

To get to this menu, go to the Main menu, Configuration (T1) menu, and the T1 Configuration menu.

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

Figure E-19. T1 Physical Layer configuration menu.

NOTE

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

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

Table E-11. T1 Configuration parameters.

Parameter	Possible Values	Remarks
1. Channel Status	Enable	Detection of LOS alarm. (This is the default.)
	Disable	No detection of LOS alarm.
2. Transmit Clock Source	Adaptive	Adaptive clock regeneration. (This is the default.)
	Loopback	T1 recovered receive clock is used as the transmit clock.
	Internal	Local clock source is used.
3. Loopback State	Internal	Data received from the IP network side is looped back to the network transmit line. An unframed all "1" code (AIS) is transmitted in the T1 Tx path toward the PBX. Incoming data from the PBX is ignored.
	External	Data received from the PBX at the receive T1 line is looped back to the T1 Tx path (toward the same PBX) and continues its way to the IP network. Data coming from the IP network is ignored.
	Disable	No loopback; regular operation. (This is the default.)
4. Line Type	T1-D4	Framer is configured to T1-D4 mode for each configuration. Operation mode is set by Signaling mode field #6 to either Fractional or Fractional with CAS (see Chapter 2).
	T1-ESF	Framer will be configured to T1-ESF mode for each configuration. Operation mode will be set by signaling mode field #6 to either Fractional or Fractional with CAS (see Chapter 2). (This is the default.)
	Unframed	Framer will be configured to pass-through mode for each configuration and the operation mode will be set to unframed (see Chapter 2).

Table E-11 (continued). T1 Configuration parameters.

Parameter	Possible Values	Remarks
5. Line Code	B7ZS, B8ZS, AMI	The default value is B8ZS.
6. Line Mode	DSU, CSU	The default value is DSU.
7. Line Length (ft)/ Tx Gain (dB)	DSU: 0–133, 134–266, 267–399, 400–533, 534–655	The default value is 0 to 133 ft.
	CSU: 0 dB, -7.5 dB, -15 dB, -22.5 dB	The default value is 0 dB.
8. Restore Time	1 second, 10 seconds	Selects the T1 red alarm recovery time. The default value is 1 second.
9. Idle Code	00 to FF	Inserted into unused timeslots by the Multi-Input IP Mux at the transmit path towards T1 equipment The default value is 7E.
A. Signaling Mode	CAS enable	T1 framer is set to CAS mode; the operation mode is set to Fractional with CAS mode.
	CAS disable	CAS mode is not set in the T1 framer; the operation model is configured to Fractional mode. The default value is CAS Enable.
B. Cond. Data Pattern	00 to FF	Byte Code is applied to timeslots when fault conditions occur. Conditioning pattern can be applied to timeslots toward the IP path when loss of signal, loss of frame, or AIS is detected at the T1 line. Conditioning pattern can also be applied to timeslots toward the T1 line when packet receive buffer overruns or underruns occur. In unframed mode, conditioning state results in AIS transmission. This is applied when a LOS is detected at T1 line, or when the packet receive buffer is overrun or underrun. The default value is 7F.

Table E-11 (continued). T1 Configuration parameters.

Parameter	Possible Values	Remarks
C. Cond. (AB/ABCD) Pattern	01 to F	<p>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 underrun occur.</p> <p>The default value is 1.</p>
D. Cond. CAS first 2.5 sec pattern (FF=NULL)	0 to F (ESF) 0 to 3 (D4) FF	<p>2 or 4 Bit Code applied (during the first 2.5 seconds) to AB(D4) or ABCD (ESF) bits (relevant in CAS mode only) when fault conditions occur. After the first 2.5 seconds the code specified in “Cond. CAS (AB/ABCD) pattern” is applied. ABCD conditioning pattern can be applied toward the IP path when loss of signal, loss of frame, or AIS is detected at the T1 line. Conditioning pattern can also be applied toward the T1 line when packet receive buffer overrun or underrun occurs. When configuring FF to this function, this parameter is ignored and the CAS pattern applied in the first 2.5 seconds is the same as defined in “Cond. CAS (AB/ABCD) pattern.”</p> <p>The default value is FF.</p>

E.3.3 E1 CONFIGURATION MENU

To get to this menu, go to the Main menu, the Configuration (E1) menu, and the E1/T1 Configuration menu.

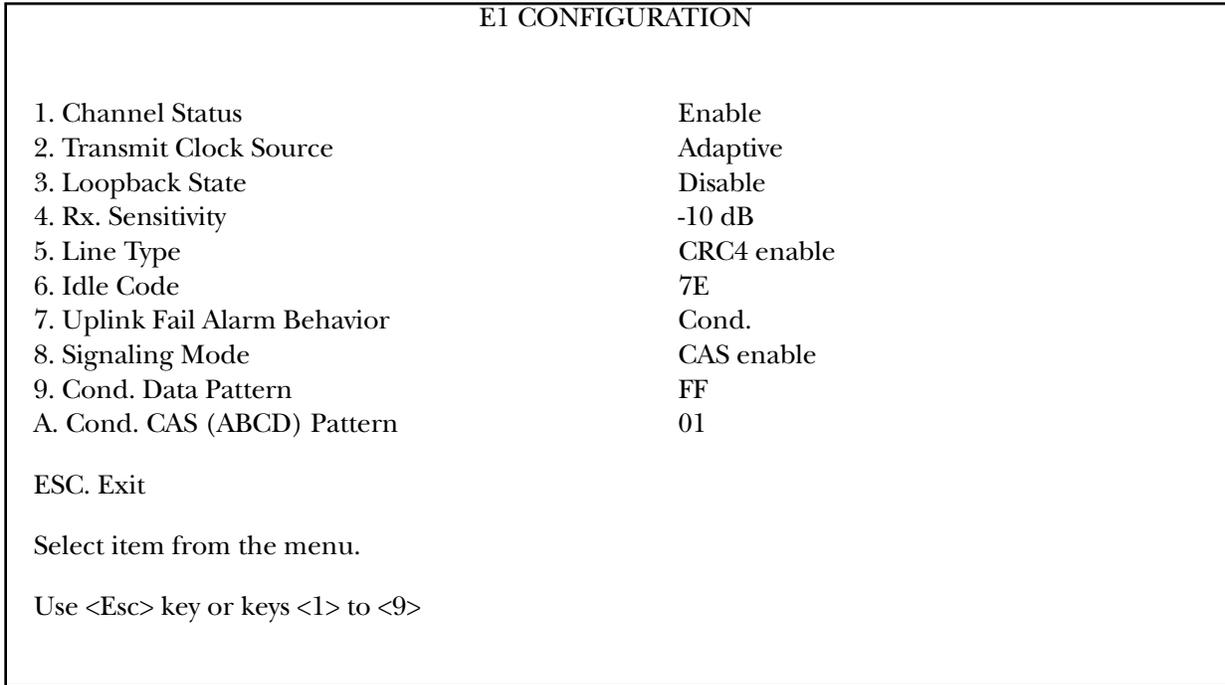


Figure E-20. E1 physical layer configuration menu.

NOTE

When “unframed” mode from the phone company is selected in the Line Type parameter, the Idle Code, Signaling Mode, Cond. Data Pattern, and Cond. CAS (ABCD) Pattern fields are not present.

When CAS Disabled is selected in the Signaling Mode parameter, the Cond. CAS (ABCD) Pattern field is not present.

Table E-12. E1 Physical Layer Configuration parameters.

Parameter	Possible Values	Remarks
1. Channel Status	Enable	Detection of LOS alarm. (This is the default.)
	Disable	No detection of LOS alarm.
2. Transmit Clock Source	Adaptive	Adaptive clock regeneration. This is the default.
	Loopback	The E1 recovered receive clock is used as the transmit clock. A local clock source is used.
	Internal	Clock is received from the internal oscillator.
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 E1 Tx path toward the PBX. Incoming data from the PBX will be ignored.
	External	Data received from the PBX at the receive E1 line will be looped back to the E1 Tx path (toward the same PBX) and will continue its way to the IP network. Data coming from the IP network will be ignored.
	Disable	No loopback; regular operation. This is the default.
4. Rx Sensitivity	-10 dB,-32 dB	Maximum attenuation of the receive signal that can be compensated for by the interface receive path. The default value is E1: -10 dB.
5. Line Type	Unframed	Framer will be configured to pass-through mode. The operation mode will be set to Transparent (see Chapter 2).

Table E-12 (continued). E1 Physical Layer Configuration parameters.

Parameter	Possible Values	Remarks
5. Line Type (continued)	CRC4 enable	Framer will be configured to CRC4 MF mode. Operation mode will be set by Signaling mode field #6 to either Fractional or Fractional with CAS (see Chapter 2). This is the default.
	CRC4 disable	CRC4 MF mode is disabled. Operation mode will be set by Signaling mode field #6 to either Fractional or Fractional with CAS (see Chapter 2).
6. Idle Code	00 to FF	Determines the idle code inserted into unused timeslots by the Multi-Input IP Mux at the transmit path towards E1 equipment. The default value is 7E.
7. Uplink Fail Alarm Behavior	Selects notification by the agent TDM side if Ethernet link fails.	
	Cond. AIS	The Multi-Input IP Mux sends a Cond. error that was configured by the user. The mux transmits unframed AIS on the E1 channel that was connected to the LAN.
8. Signaling Mode	CAS enable	The E1 framer is set to CAS MF mode and the operation mode to fractional with CAS mode. This is the default.
	CAS disable	CAS MF will not be set in the E1 framer, and the operation mode will be configured to fractional mode.

Table E-12 (continued). E1 Physical Layer Configuration parameters.

Parameter	Possible Values	Remarks
9. Cond. Data Pattern	00 to FF	<p>Conditioning pattern can be applied to timeslots toward the IP path when loss of signal, loss of frame, or AIS is detected at the E1 line. Conditioning pattern can also be applied to timeslots toward the E1 line when packet receive buffer overrun or underrun 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 underrun occurs.</p> <p>The default value is FF.</p>
A. Cond. CAS (ABCD) Pattern	01 to F	<p>The ABCD conditioning pattern can be applied toward the IP path when loss of signal, loss of frame, or AIS is detected at the E1 line. Conditioning pattern can also be applied toward the E1 line when packet receive buffer overrun or underrun occur.</p> <p>The default value is 1.</p>

E.3.4 ANALOG CONFIGURATION MENU

To get to this menu, go to the Main menu, the Configuration (Analog) menu, and the Analog Configuration menu.

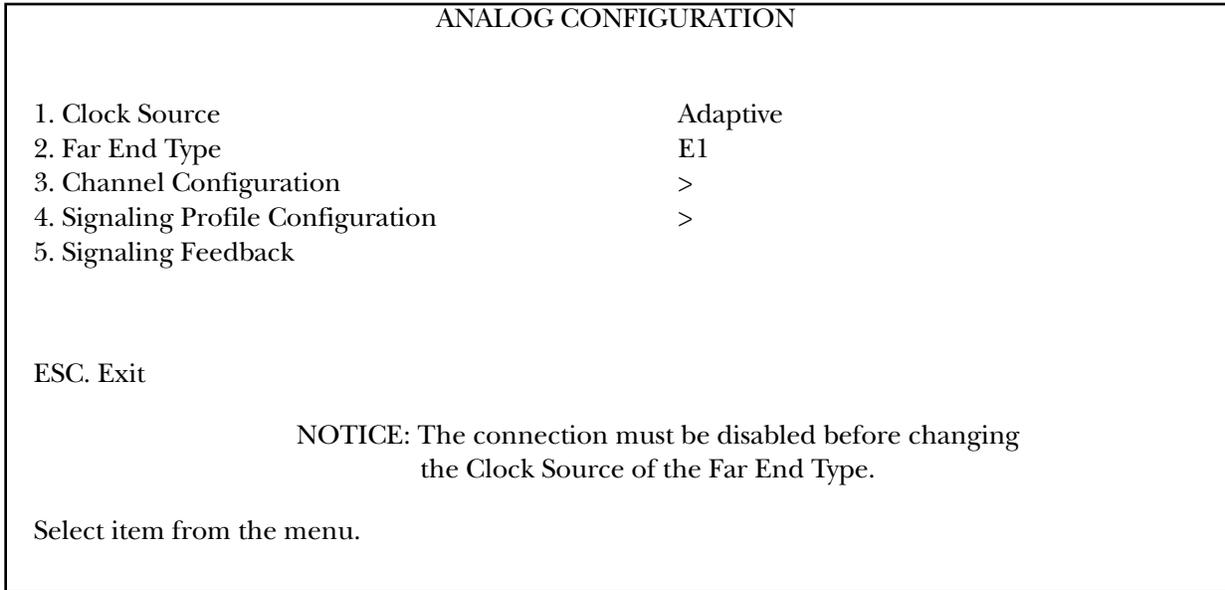


Figure E-21. Analog Configuration menu.

Table E-13. Analog Configuration parameters.

Parameter	Possible Values	Remarks
1. Clock Source	Internal	Local clock source is used.
	Adaptive	Adaptive clock regeneration.
2. Far End Type	E1 T1-ESF, T1-D4	Sets A-Law/ μ -Law and TDMoIP encapsulation mode.
3. Channel Configuration	—	When you press 3 , the Channel Configuration menu appears.
4. Signaling Profile Configuration	—	When you press 4 , the Signaling Profile Configuration menu appears.
5. Signaling Feedback	—	Valid only for FXO.

MULTI-INPUT IP MUXES

1. CLOCK SOURCE

To get to this menu, go to the Main menu, the Configuration (Analog) menu, and the Clock Source menu. Possible values are internal (local clock source used) and adaptive (clock regeneration).

2. FAR END TYPE

To get to this menu, go to the Main menu, the Configuration (Analog) menu, and the Far End Type menu. Possible values are E1, T1-ESF, or T1-D4.

3. CHANNEL CONFIGURATION

To get to this menu, go to the Main menu, the Configuration (Analog) menu, the Analog Configuration menu, and the Channel Configuration menu.

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

Figure E-22. Channel Configuration menu.

Table E-14. Channel Configuration parameters.

Parameter	Possible Values	Remarks
Channel Number	1, 2, 3, 4	Selects channel to be configured.
Channel Status	Enable	Channel is enabled.
	Disable	Channel is disabled.
Rx Gain	-10, -8, -6, -4, -2, 0, 1, 2, 3, 4, 5 (dBm)	Sets the gain towards the phone.
Tx Gain	-10, -8, -6, -4, -2, 0, 1, 2, 3, 4, 5 (dBm)	Sets the analog gain as transmitted from the phone to configure the analog receiver dynamic range.
Testing	Tone Injection	1-kHz tone is injected towards the local phone.
	Remote Loopback	A remote loopback analog signal is set for the Multi-Input IP Mux FXO/FXS.
	Disable	Testing is disabled.
Echo Cancellation Status	Enable, Disable	Selectable only with echo cancellation module.

MULTI-INPUT IP MUXES

4. SIGNALING PROFILE CONFIGURATION

To get to this menu, go to the Main menu, the Configuration (Analog) menu, the Analog Configuration menu, and the Signaling Profile Configuration menu.

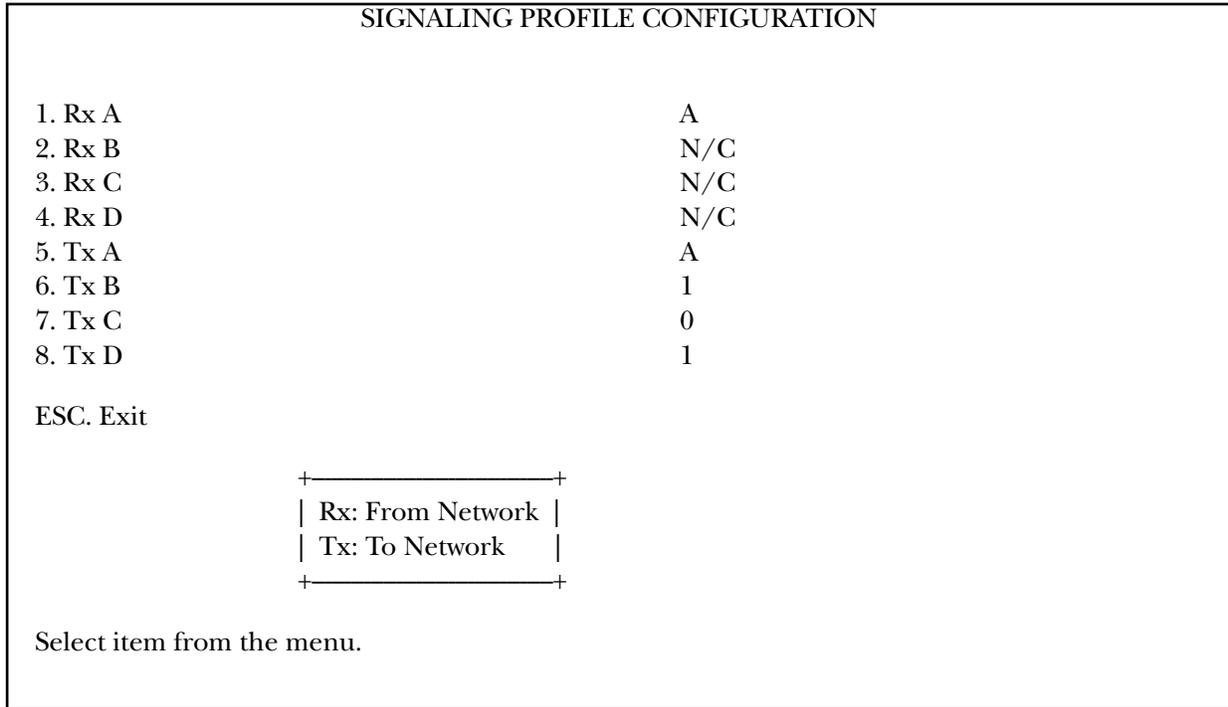


Figure E-23. Signaling Profile Configuration menu.

Table E-15. Signaling Profile parameters.

Parameter	Possible Values	Remarks
Rx A Rx B Rx C Rx D	A, A Inverse, N/C B, B Inverse, N/C C, C Inverse, N/C D, D Inverse, N/C	Specifies which ABCD Signaling Bit (only one) and its polarity carries the on-hook/off-hook information from the far-end device.
Tx A Tx B Tx C Tx D	A, A Inverse, 0, 1 B, B Inverse, 0, 1 C, C Inverse, 0, 1 D, D Inverse, 0, 1	Specifies which ABCD Signaling Bit carries the on-hook/off-hook information to the far-end device.

NOTE

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

5. SIGNALING FEEDBACK

Valid only for FXO.

E.3.5 BUNDLE CONNECTION CONFIGURATION

To get to this menu, go to the Main menu, the Configuration menu, and the Bundle Connection Configuration menu.

BUNDLE CONNECTION CONFIGURATION	
1. Bundle	1
2. IP ToS	1
3. TDM Bytes in Frame	48
4. Connection Status	Disable
5. Destination IP Address	0.0.0.0
6. Next Hop	0.0.0.0
7. Destination Bundle	1
8. Jitter Buffer (x10 μ sec) rounded up 1000 μ sec steps!	300
9. OAM Connectivity	Disable
A. VLAN Tagging	YES
B. VLAN ID	EE
C. VLAN Priority	00
ESC. Exit	
Calculated bundle throughput [BPS]: 3978080	
Select item from the menu.	

Figure E-24. Bundle Connection Configuration parameters.

NOTE

OAM Connectivity (Option 9 in the above illustration) is only available for the MT1052A and MT1053A.

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

Table E-16. Bundle Connection Configuration parameters.

Parameter	Possible Values	Remarks
1. Bundle	1	The Multi-Input IP Mux has a single bundle, with the number set at 1.
2. IP ToS	0 to 255	<p>Type of Service sets the IP ToS field in the IP frames transmitted by the device.</p> <p>ToS configuration configures the <i>whole</i> byte (since different vendors may use different bits to tag packets for traffic prioritization).</p> <p>ToS assignment applies to all TDM packets leaving the Multi-Input IP Mux.</p> <p>The default configuration is 0.</p>
3. TDM Bytes in Frame	48, 96, 144, 192, 240, 288, 336, 384	<p>Allows you to set the UDP payload length. This parameter enables reduction of Ethernet throughput (detailed explanation in Chapter 2).</p> <p>The default payload is single payload (48).</p>
4. Connection Status	Enable	Connection enabled.
	Disable	Frames will not be sent from this connection.
5. Destination IP Address	—	IP address of the destination device.
6. Next Hop	—	Use the next hop parameter when the Destination IP address is not in the device subnet. In such cases, the Ethernet frame is sent to the next hop IP. If it is not configured, the default gateway is used. The default value is 0.0.0.0 (not configured). Note that the next hop ID must be in the device subnet.
7. Destination Bundle	E1: 1 to 496 T1: 1 to 384	Bundle number in the destination device.
8. Jitter Buffer	3 to 300 milliseconds (ms)	Desired depth of the jitter buffer (PDVT buffer). The default value is 300 (10 x μ s), so 3 msec.

Table E-16 (continued). Bundle connection parameters.

Parameter	Possible Values	Remarks
9. OAM Connectivity	Enable	The device starts transmitting at full rate after it detects an active, properly configured Multi-Input IP Mux on the other side of the line.
	Disable	This is the default.
A. VLAN Tagging	Yes	For an explanation of VLAN tagging, see Chapter 2 .
	No	
B. VLAN ID	0 to 4095	The default value is 0.
C. VLAN Priority	0 to 7	—

E.3.6 LAN CONFIGURATION (NO USER PORT)

To get to this menu, go to the Main menu, the Configuration menu, and the LAN Configuration menu.

NOTE

When configuring two LANs, see Section E.5.

LAN CONFIGURATION	
1. Auto Negotiation	Enable
2. Max Capability advertised	100BASE-T Full Duplex
3. Default type	100BASE-T Full Duplex
ESC. Exit	
Select item from the menu.	

Figure E-25. LAN Configuration menu.

Table E-17. LAN Configuration parameters.

Parameter	Possible Values	Remarks
1. Auto Negotiation	Enable, Disable	Auto Negotiation mode is according to RFC 2239. The default is Enable.
2. Maximum Capabilities advertised	10BASE-T Half duplex, 10BASE-T Full duplex, 100BASE-T Half duplex, 100BASE-T Full duplex	Maximum Capabilities of the port for the Auto Negotiation process (can be lower than the actual capabilities). The default is 100BASE-T Full duplex.
3. Default type	10BASE-T Half duplex, 10BASE-T Full duplex, 100BASE-T Half duplex, 100BASE-T Full duplex	The default is 100BASE-T Full duplex.

NOTE

If Auto Negotiation is set to Enable and you experience some incompatibility in the Auto Negotiation process, set Auto Negotiation to Disable and Default type to the desired mode.

When the physical port is fiber, the operation mode is Auto Negotiation Off/full duplex/100 Mbps. This is the only possible setting.

E.3.7 DS0 BUNDLE CONFIGURATION

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

DS0 BUNDLE CONFIGURATION	
1. Bundle ID	1
2. Timeslot number	1-1
3. Timeslot Current Status	SET
ESC. Exit	
ACTIVE TIMESLOTS IN THIS BUNDLE: 1	
FREE TIMESLOTS: 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31	
Select item from the menu.	
Use <Esc> key or keys <1> to <3>	

Figure E-26. DS0 Bundle Configuration menu.

Table E-18. DS0 Bundle Configuration parameters.

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

To save the change, type S.

The Multi-Input IP Mux associates the new timeslot with the bundle.

E.4 Performance Monitoring

E.4.1 E1/T1 STATISTICS

To get to this menu, go to the Main menu, the Performance Monitoring menu, and the E1/T1 Statistics menu.

E1/T1 STATISTICS			
E1/T1 over UTP			
LOS:	0		
LOF (Red):	0		
LCV:	0		
RAI (Yellow):	0		
AIS:	0		
FEBE:	0		
BES:	0		
DM:	0		
ES:	0		
SES:	0		
UAS:	0		
LOMF:	0		
Time Since:	sec	7—Valid Intervals	12—
1. Interval		0	
ESC. Exit	N. Next Inv:		

Figure E-27. E1/T1 Statistics menu.

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

The following parameters are saved in the event log: LOS, LOF (Red), LCV, RAI (Yellow), AIS, FEBE, BES, DM, ES, SES, UAS, and LOMF.

Compliance to Standards

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

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

The alarms and statistics are described in Table E-19.

Table E-19. E1/T1 Statistics parameters.

Alarm	Failure	Comments
LOS	Loss of Signal	<p>Sync LED Off.</p> <ul style="list-style-type: none"> • For T1: A second during which 192 contiguous pulse positions have no pulse of either positive or negative polarity (signal is more than 30 dB below nominal amplitude). • For E1: A second during which 255 contiguous pulse positions have no pulse of either positive or negative polarity.
LOF	Loss of Frame	<p>Sync LED Off.</p> <ul style="list-style-type: none"> • For E1/T1: A second during which an OOF error persists for 2.5 seconds and no AIS error (see below) is detected.
LCV	Line Code Violation	<p>Line Code Violation.</p> <ul style="list-style-type: none"> • For T1: A second during which BPV (Bipolar Violation) or EXZ errors have occurred. • For E1: A second during which two consecutive BPVs of the same polarity are received. <p>BPV is the occurrence of a pulse with the same polarity as the previous pulse.</p> <p>EXZ is the occurrence of a zero string greater than 15 for AMI or 7 for B8ZS.</p> <p>Complies with ITU-T1.431, O.161, G.775, and G.821 standards.</p>
Rcv RAI (Yellow Alarm)	Remote Alarm Indication	<p>Sync LED flashes.</p> <ul style="list-style-type: none"> • For E1/T1, a second during which an RAI (Remote Alarm Indication) pattern is received from the far end when the far-end framer enters a RED state (Loss of Frame).
AIS	Alarm Indication Signal— Received from User	<p>Sync LED is Off.</p> <ul style="list-style-type: none"> • For T1: A second during which an unframed “all 1” signal is received for 3 milliseconds. • For E1: A second during which a string of 512 bits contains fewer than three zero bits.

Table E-19 (continued). E1/T1 Statistics parameters.

Alarm	Failure	Comments
FEBE	Far End Block Error	Number of seconds in which the FEBE indication is received from the remote E1 device. • For E1 MF-CRC4 only.
BES	Bursty Errored Seconds (Errored Second Type B)	Number of seconds with between two and 319 CRC error events with no AIS nor SEF (Framing Bit Errors) error detection. Complies with AT&T TR-62411 and TR-54016 standards. 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)	For E1/T1: 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.
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. Deactivated as a result of 10 consecutive seconds without SES.
LOMF	Loss of Framing	Loss Of Framing sequence in Timeslot 16. E1 CAS mode only.

E.4.2 ANALOG STATUS (MULTI-INPUT IP MUX WITH FXS/FXO)

To get to this menu, go to the Main menu, the Performance Monitoring menu, and the Analog Status menu.

ANALOG STATUS	
Channel 1:	ON HOOK
Channel 2:	ON HOOK
Channel 3:	ON HOOK
Channel 4:	ON HOOK
ESC. Exit	

Figure E-28. Analog status.

The options for each channel are on hook, off hook, and ringing.

MULTI-INPUT IP MUXES

E.4.3 LAN STATUS (NO USER PORT)

To get to this menu, go to the Main menu, the Performance Monitoring menu, and the LAN Status menu.

LAN STATUS	
Mac Address	00-20-D2-16-3B-3D
Mode	Half duplex
Rate (Mbps)	10
Status	Not connected
Frames received from the user	
Correct frames:	0
Correct Octets:	0
Alignment Err:	0
FCS Errors:	0
Frames transmitted to the user	
Correct frames:	0
Correct Octets:	0
Sngl Collision:	0
Multiple Collision:	0
Deferred transm:	0
Late Collision:	0
Carrier Sense:	0
ESC. Exit	R. Reset Counters

Figure E-29. LAN Status menu.

LAN status values are not collected in intervals.

To reset counters, type R.

Table E-20. LAN Status parameters.

Status	Values	Description
MAC Address	Hard coded	Port local MAC address.
Mode	Half duplex, Full duplex	Port mode is set by either the default mode or via auto negotiation results.
Rate	10 Mbps, 100 Mbps	Port rate is set by either the default mode or via auto negotiation results.
Status	Not connected, Connected	Not connected: Link loss. Connected: Normal operation.

Table E-20 (continued). LAN Status.

Status	Values	Description
Frames received from the user.		
Correct frames	Variable, read-only value	Total number of correct frames received.
Correct Octets	Variable, read-only value	Total number of correct octets received.
Alignment Err	Variable, read-only value	Counter of frames received that are not an integral number of octets in length (RFC 1643).
FCS Errors	Variable, read-only value	Counter of frames received that do not pass the FCS check (RFC 1643).
Frames transmitted to the user.		
Correct frames	Variable, read-only value	Total number of frames successfully transmitted.
Correct Octets	Variable, read-only value	Total number of octets successfully transmitted.
Single Collision	Valid only in half-duplex mode (RFC 1643)	Counter of successfully transmitted frames for which transmission is inhibited by exactly one collision.
Multiple Collision	Valid only in half-duplex mode (RFC 1643)	Counter of successfully transmitted frames for which transmission is inhibited by more than one collision.
Deferred transm	Valid only in half-duplex mode (RFC 1643)	Counter of frames for which the first transmission attempt is delayed because the medium is busy.
Late Collision	Valid only in half-duplex mode (RFC 1643)	Number of times that a collision is detected on a particular interface later than 512 bit-times into the transmission of a packet.
Carrier Sense	Valid only in half-duplex mode (RFC 1643)	Number of times that the carrier sense condition was lost or never asserted when attempting to transmit a frame.

E.4.4 BUNDLE CONNECTION STATUS/STATISTICS

To get to the Statistics menu, go to the Main menu, the Performance Monitoring menu, and the Bundle Connection Statistics menu.

BUNDLE CONNECTION STATISTICS (FXO/FXS)	
Sequence Errors:	0
Jitter Buffer Underflows:	0
Jitter Buffer Overflows:	0
Max Jitter Buffer Deviation	300
Time Since: 00 sec	—————valid intervals 00 —————
ESC. Exit	N. Next Inv

Figure E-30. Bundle Connection Statistics menu.

To get to the Status menu, go to the Main menu, the Performance Monitoring menu, and the Bundle Connection Status menu.

BUNDLE CONNECTION STATUS (T1/E1)	
Bundle ID:	1
Destination IP Address:	192.168.238.50
Next Hop MAC Address:	00-01-02-03-04-05
Connectivity Status:	OK
Sequence Errors:	0
Jitter Buffer Underflows:	0
Jitter Buffer Overflows:	0
1. Bundle ID: 1	
ESC. Exit	R. reset Counters N. Next

Figure E-31. Bundle Connection Status menu.

To reset counters, type R.

Table E-21. Bundle Connection Status (T1/E1) parameters.

Parameter	Possible Values/Remarks
Destination IP Address	Destination IP address of the bundle configured under Bundle Connection Configuration.
Next Hop MAC Address	In this screen the Next Hop Mac Address displayed is actually the resulting MAC Address of the ARP process for the destination IP address.
Connectivity Status	Detects a valid connection (remote Multi-Input IP Mux will confirm that it recognizes the connection and it is enabled). The problem occurs when a Multi-Input IP Mux is either disconnected from the network, shut down, or the IP path to it is broken somewhere along the way and the opposite the Multi-Input IP Mux keeps on transmitting (UDP application). The Multi-Input IP Mux starts transmitting at full rate only when it correctly detects a valid connection on the other side of the line (the remote mux will confirm it recognizes the connection and it is enabled).
	OK—Ethernet frames are received on the local and remote Multi-Input IP Mux.
	Remote Fail—Ethernet frames are not received by the remote Multi-Input IP Mux.
	Local Fail—Ethernet frames are not received by the local mux.
	Disabled—The connection is disabled.
	Validation Fail—Configuration of the local and remote mux units are not compatible.
	Unavailable—Remote Multi-Input IP Mux is unavailable.
Sequence Errors	The number of times a frame was dropped because frames were received from the network with SN fields not equal to the last SN+1 (or 2).
Jitter Buffer Underflows	The number of times frames were dropped because the receive buffer was in an underrun state. The buffer enters underflow state when: <ul style="list-style-type: none"> • Sequence errors occur. • Flow underrun takes place due to PDV expiration. • An overflow condition occurs.
Jitter Buffer Overflows	Number of times that frames were dropped because the receive buffer exceeded the maximum allowed depth.

Max Jitter Buffer Deviation, shown in the Statistics menu, is the maximum deviation from the middle of the jitter buffer, in units of 10 μ s.

E.5 Ethernet Configuration/Status Menus

This section illustrates and describes the menus for the Multi-Input IP Mux when the Ethernet User port is present (all of the MT1051A models only).

E.5.1 GENERAL INFORMATION

To get to this menu, go to the Main menu, the System menu, and the General Information menu.

GENERAL INFORMATION		
Software Version	Hardware Version	Inventory No.
Boot: 1.21 7-1-2001 08:35	HW: 0.0/1.0	232635
Application: 3.00-01 9-2-2001 16:55		
Backup: 3.00-D1 9-2-2201 16:55		
Interface Description		
E1 over UTP		
ETHERNET over UTP		
Press ESC to exit		

Figure E-32. General Information Window.

E.5.2 LAN CONFIGURATION

To get to this menu, go to the Main menu, the Configuration menu, the Switch Configuration menu, and the LAN Configuration menu.

LAN CONFIGURATION	
1. Channel	Network
2. Channel Status	Enable
3. Auto Negotiation	Enable
4. Max Capability advertised	100BASE-T Full Duplex
5. Default type	100BASE-T Full Duplex
6. VLAN Tagging	Yes/No
7. Default VLAN	
8. Rate limit (kbps) (0-Disable)	100
ESC. Exit	
Select item from the menu.	

Figure E-33. LAN Configuration.

NOTE

This parameter is valid only when the Auto 100BASE-T Half-Duplex Negotiation mode is enabled (RFC 2239).

Table E-22. LAN configuration.

Parameter	Values	Remarks
Channel	Network, User	Selects port to be configured.
Channel Status	Enable, Disable	When disabled, Ethernet LOS Events will not be sent to the Logfile.
Auto Negotiation	Enable, Disable	Enables the auto-negotiation mode (RFC 2239).
Max Capability advertised	10BASE-T Full duplex, 10BASE-T Half duplex, 100BASE-T Full duplex, 100BASE-T Half duplex	The default is 100BASE-T Full duplex.
Default type	10BASE-T Full duplex, 10BASE-T Half duplex, 100BASE-T Full duplex	The default is 100BASE-T Full duplex.
VLAN Tagging	Yes	Switch works in tag or tag+rate mode.
	No	This is the default. The switch works in basic or rate mode.
Default VLAN	Variable	VLAN associated with untagged frames arriving at the port. This item is displayed only in user tagged, user untagged, rate+user untagged modes.
Rate limit (kbps) 0-Disable	50 K to 5 MB in steps of 50 K	Only relevant to network port.
	5 MB to 100 MB in steps of 1 MB	The default is 100 MB.

NOTES

When VLAN Tagging is enabled at the network, the bundle and all managers must use VLAN tagging with VLAN ID (VLAN ID not equal to 0).

The Rate Limiter restricts the network port bandwidth:

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

E.5.3 AGING TIME

To get to the Aging Time menu, go to the Main menu, the Configuration menu, the Switch Configuration menu, and the Aging Time menu.

SWITCH CONFIGURATION	
1. LAN Configuration	>
2. Aging Time <seconds>	120
3. Erase MAC Table	
4. VLAN Configuration	
ESC. Exit	
Select item from the menu.	

Figure E-34. Switch Configuration.

To select Aging Time, enter a value from 10 to 450 seconds. The default value is 120 seconds.

NOTE

VLAN Configuration is active only when LAN Configuration sets VLAN tagging.

E.5.4 ERASE MAC TABLE

The MAC table is erased automatically every time you change the general operating mode of the switch *or* you remove a VLAN membership.

To erase the MAC Table:

1. On the Switch Configuration menu, select **3**. A confirmation line appears.

Traffic will be disrupted. Are you sure?

2. Press **Y** to erase the table.

Erasing the MAC table takes about 2 seconds, during which time all traffic through the switch is halted.

E.5.5 VLAN CONFIGURATION

NOTE

When working in Basic/Rate modes, a warning appears: VLAN tagging must be enabled for VLAN table to take effect.

To get to this menu, go to the Main menu, the Configuration menu, the Switch Configuration menu, and the VLAN Configuration menu.

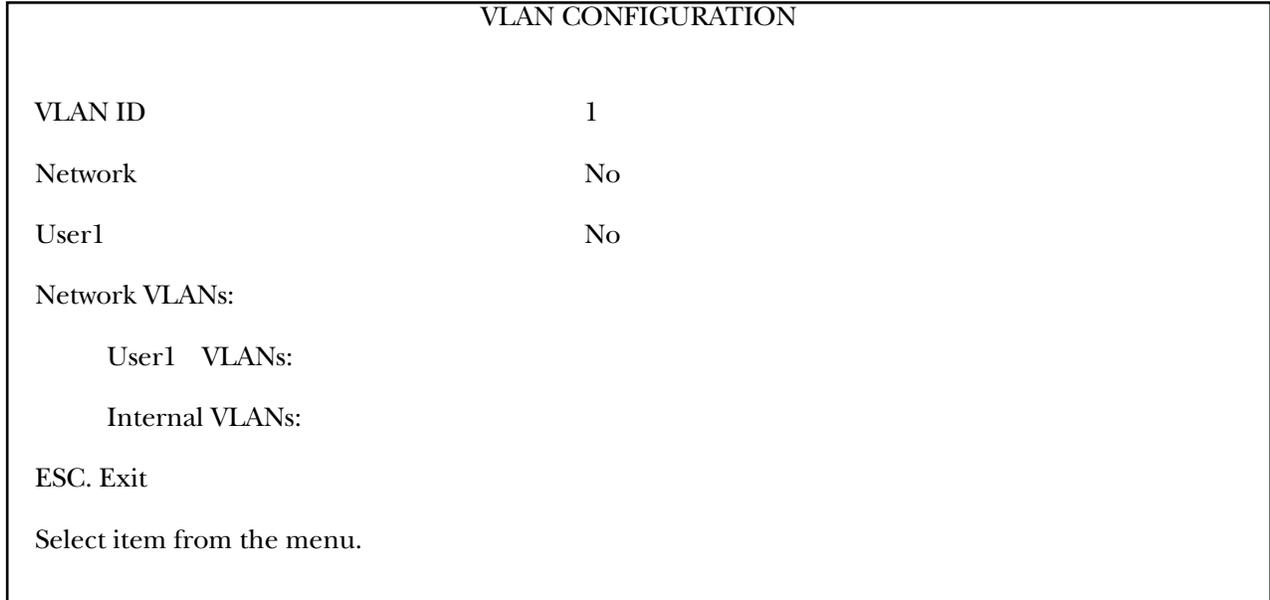


Figure E-35. VLAN Configuration menu.

Table E-23. VLAN Configuration parameters—User Tagged, User Untagged, Rate+User Untagged Modes.

Parameter	Values	Remarks
VLAN ID	1 to 4094	Selects the VLAN to edit. Creates a VLAN entry if the VLAN does not exist.
Network	Yes No	Network port is a member of VLAN. Network port is not a member.
User1	Yes No	User1 port is a member of VLAN. User1 port is not a member of VLAN.

NOTE

“N” pages between VLANs, “D” deletes the current VLAN.

Table E-24. VLAN Configuration parameters—Rate+User Tagged Mode.

Parameter	Values	Remarks
VLAN ID	1 to 4094	Selects the VLAN to edit. Creates a VLAN entry if the VLAN does not exist.
Network	Yes	Always Yes. Switched automatically to Yes when moving to this mode. Note that network cannot be switched to No.
User1	Yes	Frames of the VLAN coming into the User1 port will come out of the Network port (unless the policing discarded them).
	No	Frames of the VLAN coming into the User1 port will be discarded.

NOTES

- The maximum number of allowed entries is 16.
- In Basic Rate+User Tagged mode, all the VLANs where User1 is Yes must be in the range of 1–2047 or 2048–4094.
- In Tag mode, the Internal port is a member of VLANs used by bundle and managers only.
- In Tag+Rate mode, the User1 port cannot be a member of a VLAN used by bundle or manager. This is to remove the impression that the IPmux can communicate through the User1 port in Tag+Rate mode.
- “N” pages between VLANs, “D” deletes the current VLAN.

E.5.6 LAN STATUS

Three ports are connected to the internal switch: network, user, and internal (TDMoIP/Host).

LAN STATUS	
Unit Mac Address	00-20-02-16-3B-3D
Mode	Half duplex
Rate (Mbps)	10
Status	Not connected
Frames received	
Total Frames:	0
Total Octets:	0
Oversize Frames:	0
Fragments:	0
Jabber:	0
Dropped Frames:	0
CRC Errors:	0
Frames transmitted	
Correct frames:	0
Correct Octets:	0
Collision:	0
Channel: Network/User1/Internal	
ESC. Exit R. Reset Counters	
Use space to toggle between channels.	

Figure E-36. LAN Status menu.

LAN STATUS	
MAC Address	00-20-02-16-3B-3D
Mode	Half duplex
Rate (Mbps)	10
Status	Not connected
Frames received	
Total Frames:	0
Total Octets:	0
Frames transmitted	
Correct Frames:	0
Correct Octets:	0
Channel: Internal	
ESC. Exit	R. Reset Counters
	N. Next Channel

Figure E-37. LAN Status menu.

To reset counters, type R.

Table E-25. LAN Status parameters.

Statistics	Values	Description
MAC Address	Hard coded	Multi-Input IP Mux MAC address.
Mode	Half duplex, Full duplex	Port mode is set by either the default mode or via auto negotiation results.
Rate	10 Mbps, 100 Mbps	Port rate is set by either the default mode or via auto negotiation results.
Status	Connected	Normal operation.
	Not connected	Link loss.

Table E-25 (continued). LAN Status parameters.

Statistics	Values	Description
Frames received.		
Total Frames	Variable	Total number of correct frames received.
Total Octets	Variable	Total number of correct octets received.
Oversize Frames	Variable	Number of frames that are too long. CRC is valid.
Fragments	Variable	Number of frames that are shorter than 64 bytes and have an invalid CRC.
Jabber	Variable	Number of frames that are too long and have an invalid CRC.
Dropped Frames	Variable	Number of dropped frames due to delivery problems.
CRC Errors	Variable	Number of good frames with invalid CRC.
Frames transmitted.		
Correct Frames	Variable	Total number of frames successfully transmitted.
Correct Octets	Variable	Total number of octets successfully transmitted.
Collision	Variable	A counter of successfully transmitted frames for which transmission is inhibited by collision event, valid only in half-duplex mode.
Channel	Network, User1, Internal	—



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