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Installation and Operation Manual

# ***Vmux-110***

***Voice Trunking Gateway***



# Vmux-110

*Version 3.0*

## Voice Trunking Gateway Installation and Operation Manual

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RAD warrants to DISTRIBUTOR that the hardware in the Vmux-110 to be delivered hereunder shall be free of defects in material and workmanship under normal use and service for a period of twelve (12) months following the date of shipment to DISTRIBUTOR.

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This Agreement shall be construed and governed in accordance with the laws of the State of Israel.

# General Safety Instructions

The following instructions serve as a general guide for the safe installation and operation of telecommunications products. Additional instructions, if applicable, are included inside the manual.

## Safety Symbols



*Warning*

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**This symbol may appear on the equipment or in the text. It indicates potential safety hazards regarding product operation or maintenance to operator or service personnel.**

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**Danger of electric shock! Avoid any contact with the marked surface while the product is energized or connected to outdoor telecommunication lines.**

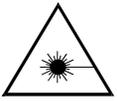
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Protective earth: the marked lug or terminal should be connected to the building protective earth bus.

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*Warning*

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**Some products may be equipped with a laser diode. In such cases, a label with the laser class and other warnings as applicable will be attached near the optical transmitter. The laser warning symbol may be also attached.**

**Please observe the following precautions:**

- **Before turning on the equipment, make sure that the fiber optic cable is intact and is connected to the transmitter.**
- **Do not attempt to adjust the laser drive current.**
- **Do not use broken or unterminated fiber-optic cables/connectors or look straight at the laser beam.**
- **The use of optical devices with the equipment will increase eye hazard.**
- **Use of controls, adjustments or performing procedures other than those specified herein, may result in hazardous radiation exposure.**

**ATTENTION: The laser beam may be invisible!**

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

# Handling Energized Products

## 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. For DC-powered products, although the voltages levels are usually not hazardous, energy hazards may still exist.

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. Grounding is provided by connecting 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. Rack-mounted 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 16A. The circuit breaker in the building installation should have high breaking capacity and must operate at short-circuit current exceeding 35A.

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 DC Mains

Unless otherwise specified in the manual, the DC input to the equipment is floating in reference to the ground. Any single pole can be externally grounded.

Due to the high current capability of DC mains systems, care should be taken when connecting the DC supply to avoid short-circuits and fire hazards.

DC units should be installed in a restricted access area, i.e. an area where access is authorized only to qualified service and maintenance personnel.

Make sure that the DC supply is electrically isolated from any AC source and that the installation complies with the local codes.

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

Before connecting the DC supply wires, ensure that power is removed from the DC circuit. Locate the circuit breaker of the panel board that services the equipment and switch it to the OFF position. When connecting the DC supply wires, first connect the ground wire to the corresponding terminal, then the positive pole and last the negative pole. Switch the circuit breaker back to the ON position.

A readily accessible disconnect device that is suitably rated and approved should be incorporated 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, RS-530, X.21, 10 BaseT, 100 BaseT, 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. Extra caution should be exercised 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.

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

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**Attention** Pour réduire les risques d'incendie, utiliser seulement des conducteurs de télécommunications 26 AWG ou de section supérieure.

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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 lock-washers 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. In such cases, special instructions are provided in the manual.

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 electro-static 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.

## FCC-15 User Information

This equipment has been tested and found to comply with the limits of the Class A digital device, pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the Installation and Operation manual, may cause harmful interference to the radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

## Canadian Emission Requirements

This Class A digital apparatus meets all the requirements of the Canadian Interference-Causing Equipment Regulation.

Cet appareil numérique de la classe A respecte toutes les exigences du Règlement sur le matériel brouilleur du Canada.

### Warning per EN 55022 (CISPR-22)

***Warning***

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This is a class A product. In a domestic environment, this product may cause radio interference, in which case the user will be required to take adequate measures.

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***Avertissement***

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Cet appareil est un appareil de Classe A. Dans un environnement résidentiel, cet appareil peut provoquer des brouillages radioélectriques. Dans ces cas, il peut être demandé à l'utilisateur de prendre les mesures appropriées.

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***Achtung***

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Dieses ist ein Gerät der Funkstörgrenzwertklasse A. In Wohnbereichen können bei Betrieb dieses Gerätes Rundfunkstörungen auftreten, in welchen Fällen der Benutzer für entsprechende Gegenmaßnahmen verantwortlich ist.

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# Declaration of Conformity

**Manufacturer's Name:** RAD Data Communications Ltd.

**Manufacturer's Address:** 24 Raoul Wallenberg St.  
Tel Aviv 69719  
Israel

declares that the product:

**Product Name:** Vmux-110

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

<b>EMC:</b>	EN 55022:1998	Information technology equipment – Radio disturbance characteristics – Limits and methods of measurement.
	EN 50024: 1998	Information technology equipment – Immunity characteristics – Limits and methods of measurement.
<b>Safety:</b>	EN 60950: 2000	Safety of information technology equipment.

## Supplementary Information:

The product herewith complies with the requirements of the EMC Directive 89/336/EEC, the Low Voltage Directive 73/23/EEC and the R&TTE Directive 1999/5/EC for wired equipment. The product was tested in a typical configuration.

Tel Aviv, 9<sup>th</sup> April, 2003



Haim Karshen  
VP Quality

**European Contact:** RAD Data Communications GmbH, Otto-Hahn-Str. 28-30, 85521  
Ottobrunn-Riemerling, Germany

# Quick Start Guide

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Installation of Vmux-110 should be carried out only by an experienced technician. If you are familiar with Vmux-110, use this guide to prepare the unit for operation.

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## 1. Installing Vmux-110

### Connecting the Interfaces

Refer to [Appendix A](#) for pinouts and further information regarding interface connections.

► **To connect the interfaces:**

1. Connect the voice port(s) using the appropriate connector, as follows:
  - E1 balanced: RJ-45 connector designated E1
  - E1 unbalanced: RJ-45 connector designated E1 with the CBL-RJ45/2BNC/E1/X adapter cable

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**Note** For E1 voice port, make sure that the internal jumpers are set to the proper settings for the type of E1 interface and grounding. (Default setting is for balanced.)

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- T1 balanced: 4-wire RJ-45 connector designated T1
  - 4 FXS: four RJ-12 connectors designated FXS
  - 4 FXO: four RJ-12 connectors designated FXO
  - 8FXS/FXO: DB-25 connector designated FXS/FXO, which is connected by cable CBL-KVF8-FXOS to the analog FXS/FXO devices via RJ-12 connectors
  - 4 E&M: four RJ-45 connectors designated E&M
  - 8 E&M: SCSI-68 connector designated E&M, which is connected by cable CBL-KVF8/E&M to the analog E&M devices via RJ-45 connectors.
2. Connect the main link using the appropriate connector, as follows:
    - Ethernet main link: Connect the IP uplink to the RJ-45 connector designated NET ETH.
    - Serial main link: Connect the serial V.35/X.21/RS-530 link to the DB-25 connector designated LINK using the appropriate adapter cable.
  3. Connect the user LAN to the RJ-45 connector designated USER ETH.
  4. Connect the control terminal to the CONTROL connector using CBL-RJ45/D9 adapter cable.

or

Connect a Telnet host to the user LAN port.

## Connecting the Power

➤ **To connect the power:**

- Connect the power cable to the power connector on the Vmux-110 rear panel.

The unit has no power switch. Operation starts when the power is applied to the rear panel power connector.

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## 2. Configuring Vmux-110

Configure Vmux-110 to the desired operation mode via an ASCII terminal connected to the rear panel CONTROL port. Alternatively, you can manage Vmux-110 over Telnet.

### Starting a Terminal Session for the First Time

➤ **To start a terminal session:**

1. Connect a terminal to the CONTROL connector of Vmux-110.
2. Turn on the control terminal PC and set its port parameters the default communication parameters: 9.6 kbps, one start bit, eight data bits, no parity, one stop bit, no flow control, VT100 emulation (for optimal view of system menus).
3. Power Vmux-110 up and proceed with management session.

### Configuring the IP Management Parameters

The host IP address, subnet mask and default gateway IP address must be configured via an ASCII terminal.

➤ **To configure the IP management parameters:**

- From the Host IP menu (**Main > Configuration > System > Host IP**), select an IP address of the Vmux-110 host.

### Configuring the Main Link

The main link may be either the NET ETH interface or the Main Serial Link (LINK interface). If the NET ETH interface is selected as the main link, the serial port is not configured. However, if the serial port is selected as the main link, both the network port and the serial port are configured.

➤ **To configure the main link:**

1. From the Management menu (**Main Menu > Management**), select the desired main link interface.
2. In the Network Port Configuration menu (**Main Menu > Configuration > Switch LAN Configuration > Network Port Configuration**) configure the Ethernet Net port operation.

3. (Only if Serial Port is selected as the main link) In the Serial Port Configuration menu (**Main Menu > Configuration > Serial Port Configuration**) configure the serial port operation.

## Configuring Bundle Connections

The voice timeslots must be assigned to a bundle. The bundle must be sent to the remote IP address and be connected to one of the destination bundles.

### ► To create and connect a bundle:

- From the Bundle Connection Configuration menu
  - (E1/T1: **Main > Configuration > Voice Configuration > Bundles Parameters > Bundle Configuration**)
  - (FXS/FXO/E&M: **Main > Configuration > Analog Voice Configuration > Bundles Parameters > Bundle Configuration**)

create and connect the bundle by setting the following:

- Connect – Yes
- Destination IP address
- Destination bundle
- Voice parameters.

### ► To assign timeslots to a bundle:

- From the Time Slot Configuration menu
  - (E1/T1: **Main > Configuration > Voice Configuration > Distribution Of Framer Time Slots > Time Slot Configuration**)
  - (FXS/FXO/E&M: **Main > Configuration > Voice Configuration > Ports Distribution > Configure Time Slots**)

assign desired timeslots to a bundle by setting the following:

- Type
- Bundle
- Destination Port ID
- Destination Time Slot ID

## Configuring the Voice Interface at the Physical Level

The voice interface (E1, T1, FXS, FXO, or E&M) must be configured at the physical level.

➤ **To configure the voice interface at the physical level:**

- From the appropriate menu
  - (E1/T1: **Main > Configuration > Voice Configuration > E1 or T1 Parameters**)
  - (FXS/FXO/E&M: **Main > Configuration > Analog Voice Configuration > Port Configuration**)

configure the necessary parameters of the voice interface.

## Configuring the Internal Router

If the internal router is disabled, skip this section.

➤ **To configure the internal router:**

1. From the Management menu, enable the internal router: (**Main Menu > Management**)
  - Router – enable.
2. The options in the Management menu change now that the router is enabled. Still in the Management menu, define the Ethernet Net/User Connection:
  - Ethernet Net/User Connection
3. Display the Router Configuration menu to configure the internal router (**Main Menu > Configuration > Router Configuration**).

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# Chapter 1

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## Introduction

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### 1.1 Overview

Vmux-110 is a voice trunking gateway that enables a single E1/T1 voice trunk or several analog voice channels to be compressed and extended over an IP or serial main link. Vmux-110 implements G.723.1, G.729 A, G.711 compression and TDMoIP or AAL2oMPLS multiplexing algorithms to send up to 30/24 digital, or four or eight analog voice channels over an IP or n x 64 kbps network, with transparent CAS and CCS support.

Vmux-110 utilizes voice activity detection, silence suppression, echo cancellation and other techniques to improve voice quality and bandwidth utilization. The gateway detects, generates and relays DTMF/MFR2/MFC signaling. In addition, Vmux-110 supports fax relay and voice band data.

The built-in router supports NAT, firewall, static and dynamic routing, RIP1 and RIP2. To facilitate the integration of new devices into a DHCP IP network, the router also supports DHCP client, server and relay.

Vmux-110 can be managed locally via an ASCII terminal or remotely via Telnet or RADview (RAD's SNMP-based network management application).

### Versions

Vmux-110 is ordered with one of the following voice port options:

- E1: Single E1 voice port
  - Fractional E1: 6/12/18/24 channels
- T1: Single T1 voice port
  - Fractional T1: 6/12/18 channels
- Four or eight analog Foreign Exchange Station (FXS) ports
- Four or eight analog Foreign Exchange Office (FXO) ports
- Four or eight analog Ear & Mouth (E&M) ports.

## Applications

The following figures show a central Vmux-2100 operating opposite remote Vmux-2100 and Vmux-110 units in point-to-multipoint applications over an IP network.

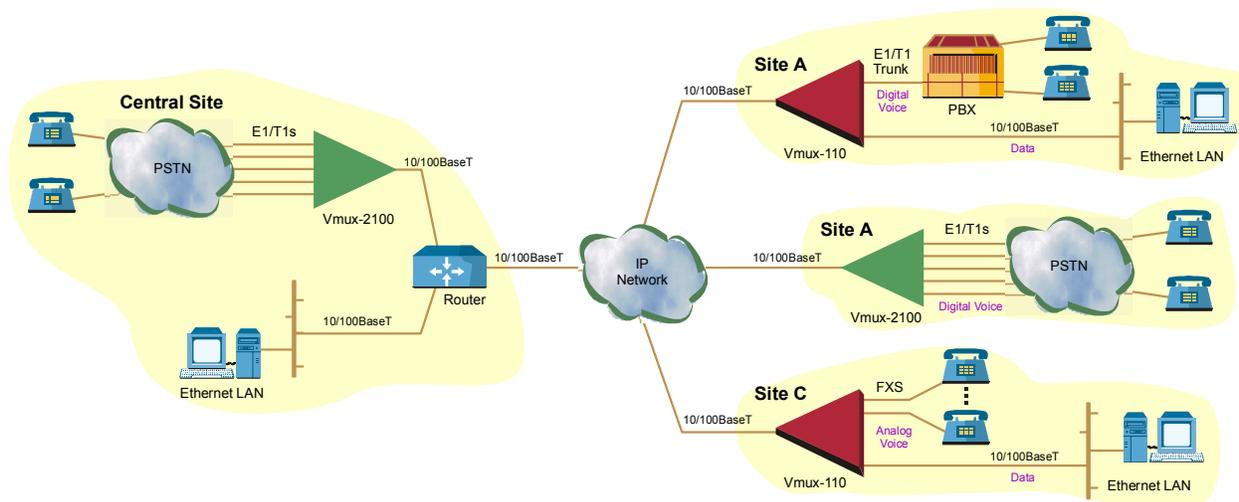


Figure 1-1. Transmitting LAN Data and Compressed Digital/Analog Voice in Point-to-Multipoint Application

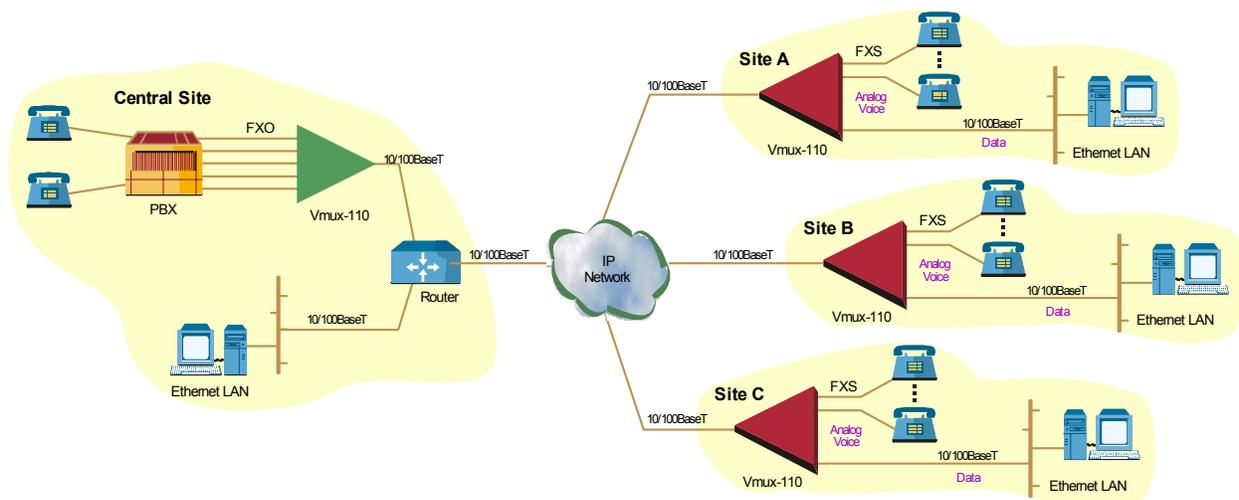


Figure 1-2. Extending Analog Voice Channels in Point-to-Multipoint Application

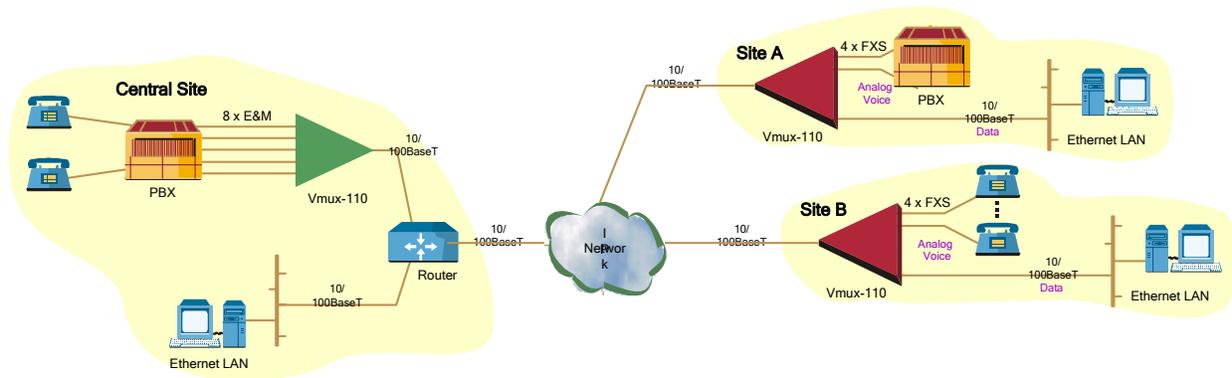


Figure 1-3. Extending Analog Voice E&M Trunk in Point-to-Multipoint Application

The following figure shows Vmux-110s in a point-to-point application over a satellite link. Here, the serial TDM link is employed to transmit the user LAN data and compressed voice in an  $n \times 64$  kbps bit stream, compatible with satellite transmission equipment.

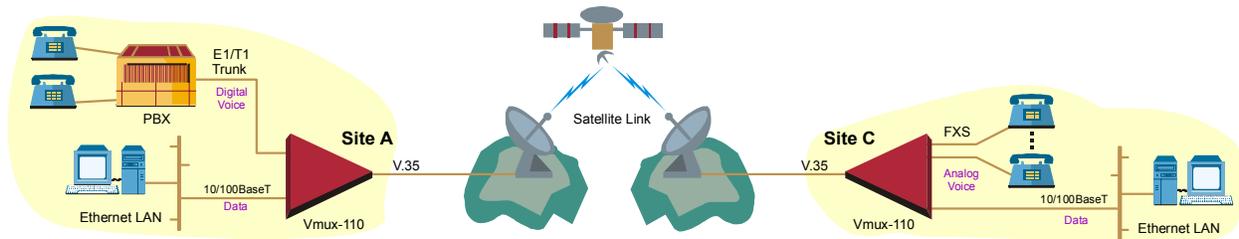


Figure 1-4. Data and Compressed Digital/Analog Voice over Satellite Link

## Features

### Ethernet Links

Vmux-110 provides two half/full duplex, 10/100BaseT Ethernet ports, each with autonegotiation support. One port can function as the uplink to the IP network, while the other is provided for connecting the user Ethernet LAN to the Vmux-110 unit. Together with the Vmux-110's integral Ethernet switch, this allows integrating the user LAN traffic with the compressed voice, over a single uplink to the network.

If autonegotiation is disabled, the Ethernet ports can be configured to any of the following operation modes:

- 10BaseT – half or full duplex
- 100BaseT – half or full duplex.

The main link Ethernet port supports direct and indirect connection to the IP network.

## Serial Main Link

Vmux-110 has a single TDM serial link with a RS-530 interface. This serial port supports  $n \times 64$  kbps data rates, from 64 to 2048 kbps.

In addition to the standard RS-530 interface, the following serial interfaces are supported by connecting an interface adapter cable to the Vmux-110 unit's RS-530 interface:

- X.21
- V.35

## Voice Interfaces

Vmux-110 is ordered with either a single E1 or T1 digital voice interface, or with one of the following analog voice interfaces:

- 4 or 8 Foreign Exchange Station (FXS) channels
- 4 or 8 Foreign Exchange Office (FXO) channels
- 4 or 8 Ear & Mouth (E&M) channels.

The voice interfaces control the E1 or T1 frames, use G.723.1 (6.4 kbps), G.723.1 (5.3 kbps), G.729 A (8 kbps) and G.711 compression algorithms, and handle CAS/CCS and other signaling transparently.

Voice Activity Detection mechanism allows optimizing bandwidth utilization, as Vmux-110 generates traffic only when voice activity is detected. Vmux-110 uses the G.723.1 and G.729 A techniques for silence suppression and the G.168 standard for echo cancellation (up to 32 ms per channel). Vmux-110 detects, relays, and generates DTMF/MFR2/MFC signals. In addition, Vmux-110 supports Group III fax relay (4.8, 9.6, 14.4 kbps) and voice band data (modem) (up to V.34).

## TDMoIP Multiplexing

Vmux-110 encapsulates the payload bytes in a UDP frame that is transferred over IP and over Ethernet.

The maximum number of TDM bytes in a multiplexed frame and packetizing interval are user-configurable.

A destination IP address is configured for each bundle (see *Bundling*, below).

## AAL2oMPLS Multiplexing

When using non-IP based Ethernet networks or the Serial uplink, the AAL2oMPLS format can be used instead of TDMoIP. The AAL2oMPLS header is smaller than the TDMoIP header, saving about 5% in bandwidth (depending on the actual frame size).

## Bundling

A bundle is a logical internal Vmux-110 port, containing up to 30 timeslots. Vmux-110 supports 12 bundles. A bundle is routed to a defined remote IP address. Each timeslot can be included in any bundle. At the remote site, it can be connected to any timeslot within a destination bundle.

---

**Note** *Every six voice timeslots are handled by a single DSP. Each DSP supports one compression method at any time.*

---

Bundle QoS supports:

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

The user can configure the ToS (Type of Service) of the outgoing IP packets. This allows an en-route layer 3 router or switch that supports ToS to give higher priority to Vmux-110 traffic for delay-sensitive and secure applications.

Vmux-110 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).

## Internal Switch and VLAN Tagging for Security and QoS

All traffic between the voice ports and the serial link is routed through the Vmux-110's built-in Ethernet switch. This switch enables optional VLAN tagging of the various traffic, as well as blocking unrecognized traffic.

### VLAN Table

Vmux-110 includes a VLAN table, which can contain up to 64 entries. Each entry defines the egress and tagging policies for packets with a specific VLAN ID, for each port. Packets with a particular VLAN ID can be blocked.

### Timing

Available timing modes for the E1/T1 voice ports are:

- **Loopback** – The transmit clock is derived from the TDM receive clock.
- **Internal** – Vmux-110 features an internal oscillator. When Vmux-110 is configured to operate with its internal clock, transmit (Tx) and receive (Rx) trunks use the clock supplied by its internal oscillator.

Available timing modes for the serial main link are:

- **DTE** – port accepts receive and transmit clock signals from the communication equipment, e.g., modem, connected to the main link. This operation requires an adaptor/cross-cable.
- **DCE** – Vmux-110 provides the transmit and receive clock signals, derived from its internal oscillator, to the communication equipment connected to the main link. This operation may require an interface adapter (straight) cable.

## Internal Router

Vmux-110 includes an internal router, which supports the following features:

- DHCP server, client, or relay
- NAT
- Firewall
- Static and dynamic routing
- RIP1 and RIP2.

When the internal router is enabled, it performs the routing between the Ethernet and Serial ports, or between the two Ethernet ports. If the internal router is disabled, the Ethernet switch performs the Ethernet switching, while voice traffic is routed directly from the Host to the DSPs. The various features of the internal router are configurable.

## Diagnostics

Vmux-110 supports local (internal) and remote (external) loopback activation on the E1, T1 voice channels and remote loopback activation on the analog voice channels. The user can also perform tone injection towards the local PBX or local/remote analog equipment. In addition, a ping utility is included to confirm IP connectivity to the remote units.

## Statistics Collection

Vmux-110 provides extensive statistics collection capabilities, which include Ethernet (as per RFC 3638) and HDLC statistics, voice, signaling, bundles, and CPU utilization.

## Management

Vmux-110 can be managed via a local terminal, Telnet or RADview, RAD's network management system. Vmux-110 has an RJ-45 port for the direct terminal connection. Alternatively, a supervisory terminal can be connected via a modem link.

Software upload and download and configuration can be performed via the local terminal or TFTP (Vmux-110 can function as either the TFTP server or TFTP client). Remote units are managed via Telnet or RADview over an inband management link.

Vmux-110 supports a four-level security and user-authentication system:

- **Administrator** – Allowed to configure all the Vmux-110 parameters.
- **Operator** – Allowed to perform all operations in the system except for user administration (adding/deleting users, changing user definitions).
- **Technician** – Allowed to test Vmux-110 and monitor its operation (for example, monitoring alarms).
- **Monitor** – Allowed to monitor the Vmux-110 operation.

When Vmux-110 is managed over Telnet, up to five simultaneous management sessions are allowed, as follows:

- One administrator or operator
- Up to four monitors.

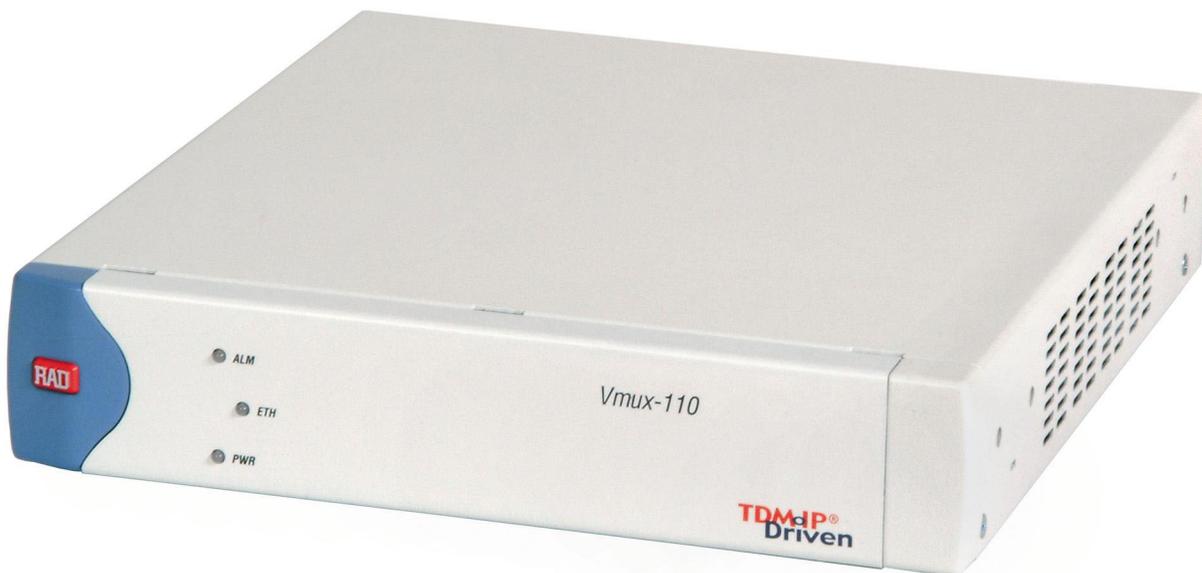
Access to the Vmux-110 software can be limited to the ASCII terminal and RADview management by disabling the Telnet access.

---

---

## 1.2 Physical Description

Vmux-110 is a 1U high, easy-to-install standalone device. [Figure 1-5](#) shows a 3D view of the unit.



*Figure 1-5. Vmux-110, 3D View*

The front panel includes LEDs that indicate power supply, alarm and Ethernet main link status. The front panel indicators are described in [Chapter 3](#).

The rear panel is different for each voice port and power supply option. [Figure 1-6](#) shows the rear panel of a Vmux-110 with the E1 voice port and AC power supply options.

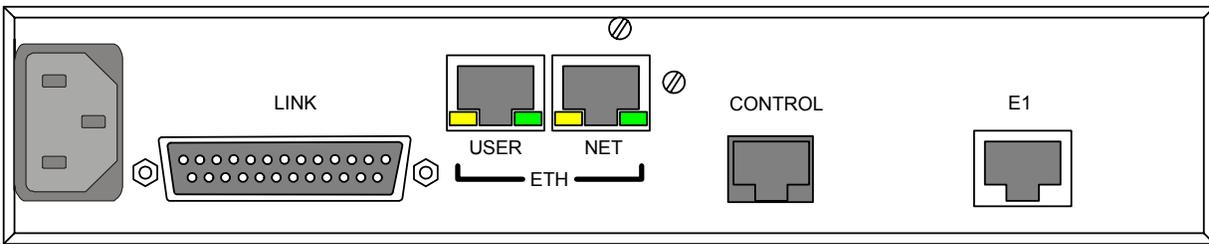


Figure 1-6. Rear Panel of Vmux-110 with E1 Voice Port and AC Power Supply

The Vmux-110 rear panel includes the following:

- One of the following voice interfaces:
  - Single E1 digital voice port
  - Single T1 digital voice port
  - Four FXS analog voice ports
  - Eight FXS analog voice ports
  - Four FXO analog voice ports
  - Eight FXO analog voice ports
  - Four E&M analog voice ports
  - Eight E&M analog voice ports.
- Two Ethernet ports (one for the main link, one to connect to the user LAN)
- One serial uplink (V.35 interface to connect to TDM link)
- One control port (RJ-45 interface; used to connect to a management terminal)
- One power supply (either AC or DC)

The rear panel is described in detail in [Chapter 2](#).

### 1.3 Functional Description

The following figures illustrate block diagrams of Vmux-110 for various applications, as indicated.

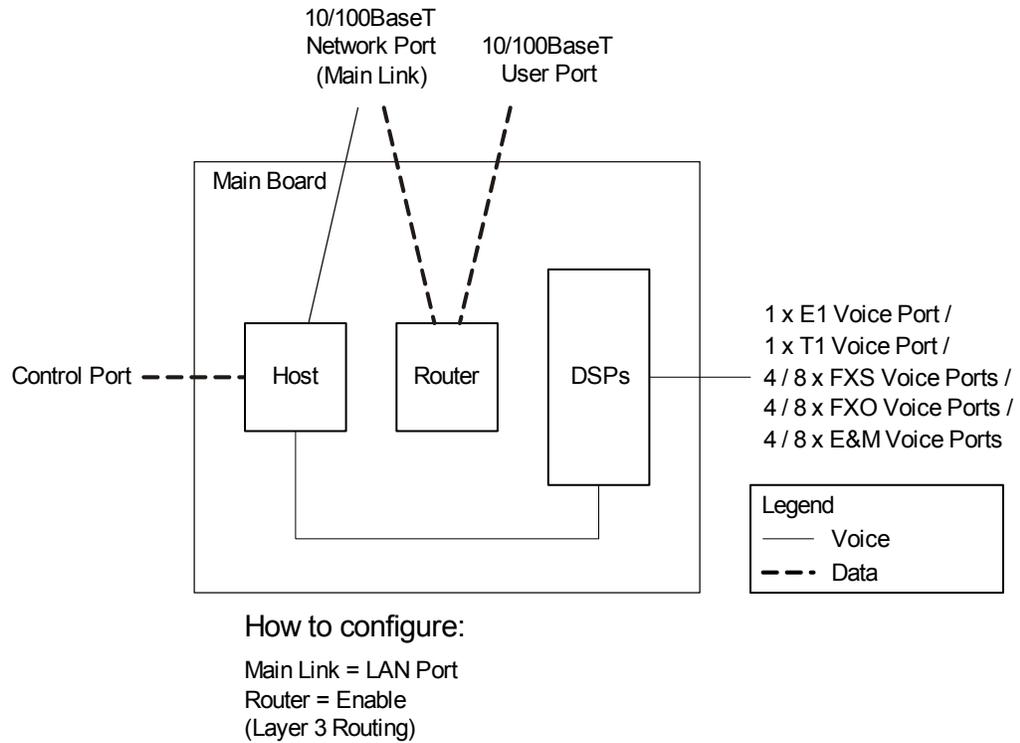
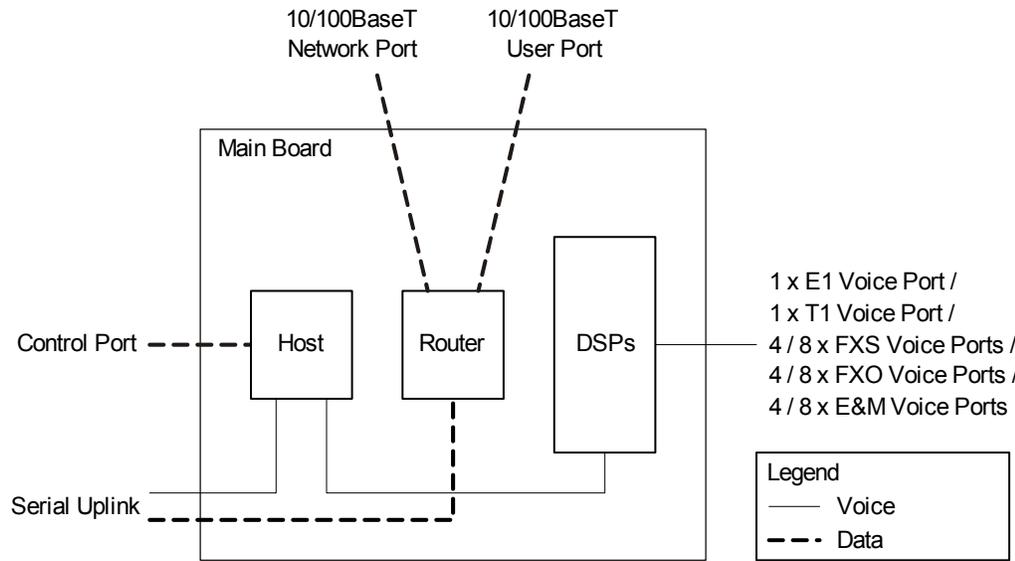


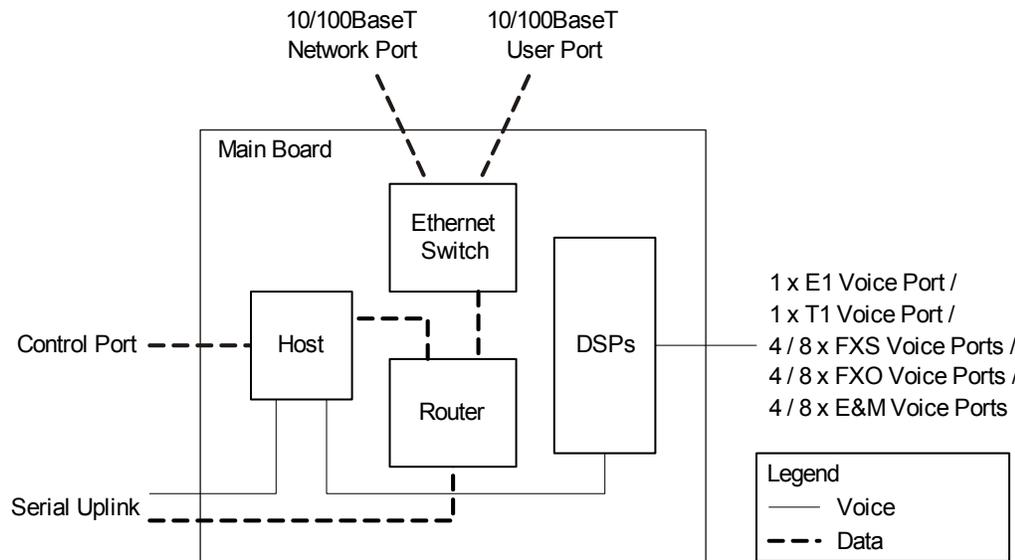
Figure 1-7. Vmux-110 Block Diagram: Routing Between the Network and the User Ports



**How to configure:**

- Main Link = Serial Port
- Router = Enable
- Eth Net/User Connection = Layer 3 Routing

Figure 1-8. Vmux-110 Block Diagram: 3-Way Routing – Routing Between Network Port, User Port, and Serial Uplink



**How to configure:**

- Main Link = Serial Port
- Router = Enable
- Eth Net/User Connection = Layer 2 Switching

Figure 1-9. Vmux-110 Block Diagram: Routing Between the Serial Port and the Ethernet Switch

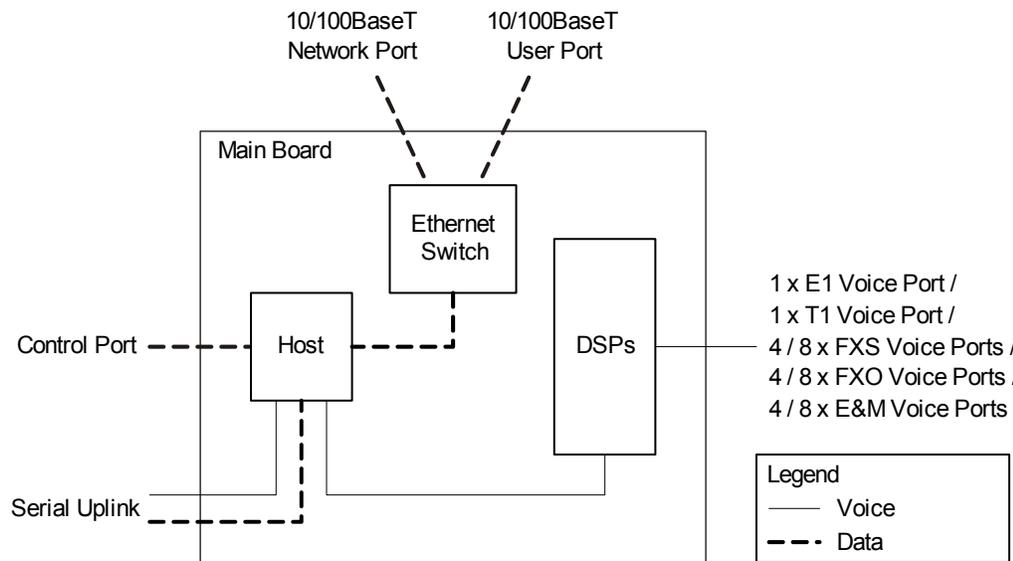


Figure 1-10. Vmux-110 Block Diagram: Router Disabled

## Voice Interface

The voice interface includes one of the following:

- One E1 port, which receives E1 trunks from PBXs
- One T1 port, which receives T1 trunks from PBXs
- Four or eight FXS analog ports that connect to POTS or faxes
- Four or eight FXO analog ports that connect to PBX
- Four or eight E&M analog ports that connect to PBX or key system.

## Signaling

Signaling information is processed according to signaling mode: CAS or CCS.

- **Channel Associated Signaling (CAS)** – The signaling data is processed by the unit's host by extracting the ABCD bits and reporting any change in their status to the host. The reporting format is similar to E1. In addition, the signaling DSP employs a refresh mechanism to update the host with the most recent status of the ABCD bits. Analog ports translate the physical signal to ABCD bits. The user configures this translation, for example, the user may define the value "1101" to indicate "ONHOOK".

The ABCD bits can be manipulated by using translation rules, which are defined by means of signaling profiles. A profile enables the user to select the translation of each individual signal bit. The available selections are A, B, C, D (value copied from the corresponding incoming bit), NOT A, NOT B, NOT C, NOT D (inverted value of corresponding incoming bit), 0 (always 0), and 1 (always 1).

In addition to the translation of individual bits, the signaling profiles can also be used to define the signaling bit patterns that indicate the idle and OOS states.

- **Common Channel Signaling (CCS)** – The signaling information is transferred transparently to the host, which encapsulates the HDLC frame with the proper IP header and sends it to the main link. The following protocols are supported: ISDN, QSIG and SS7. HDLC data can be extracted from any set of timeslots and sent to a single destination.

When operating with SS7 signaling, it is possible to control the amount of keep-alive messages transferred over the signaling links.

A maximum of 12 timeslots can be configured as transparent, and can pass proprietary signaling. Note that it is recommended that both the local and remote devices be configured with the same clock source.

### Compression

The DSPs handle the voice traffic by compressing it according to G.723.1 (6.4 or 5.3 kbps) and G.729 A (8 kbps), or digitizes it according to the G.711 requirements (A-law and  $\mu$ -law). Compression methods are user-selectable per bundle. G.711 A-law and  $\mu$ -law configuration must be the same on both the local and remote devices, and is independent of the E1/T1 voice port configuration.

Voice Activity Detection, Silence Suppression, and Comfort Noise generation are applied for all coder rates, including G.711.

---

**Note**

*Every six voice timeslots are handled by a single DSP. Each DSP supports one compression method at any time.*

---

### Voice Activity Detection

Voice Activity Detection (VAD) uses digital signal processing techniques to distinguish between silence and speech on a voice connection. VAD reduces the bandwidth requirements of a voice connection by generating traffic only during periods of active voice conversation. With Comfort Noise Generation (CNG) supported at the remote site, VAD significantly reduces bandwidth consumption without degrading voice quality. VAD achieves additional bandwidth savings when combined with voice compression techniques.

### TDMoIP Multiplexing

Compressed voice payload is multiplexed by using the TDMoIP technique. The multiplexing is performed by the Vmux-110 software. The DSPs send a continuous stream of voice packets; which are multiplexed into a TDMoIP frame by adding AAL2 headers and a TDMoIP header. *Figure 1-11* illustrates the TDMoIP frame structure.



Figure 1-11. TDMoIP Frame Structure

The size of the TDMoIP frame is determined by the following parameters:

- Packetizing interval – The maximum time interval allocated for the TDMoIP frame aggregation (10 to 90 msec).
- Maximum bytes per multiplexed frame – The maximum size of each frame (100 to 1461 bytes).

The Vmux-110 continues filling the TDMoIP frame until one of the conditions defined by the above parameters is met.

### Ethernet Frame

At a later stage, the TDMoIP frame becomes a part of the standard Ethernet frame, which also includes a UDP header, IP header and MAC. The Ethernet frames are forwarded to the CPU, which sends them to the Ethernet or Serial main links.

Figure 1-12 illustrates the structure of the Vmux-110 Ethernet frame. Table 1-1 describes the fields of the Vmux-110 Ethernet frame.

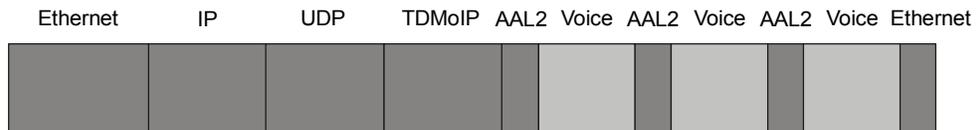


Figure 1-12. Ethernet Frame Structure

When AAL2oMPLS multiplexing is used, the IP and UDP headers are not included in the Ethernet frame.

---

**Note** When using the Serial main link, an additional 4 bytes are added to the packet (HDLC framing).

---

Table 1-1. Ethernet Frame Fields

Layer	Field Length [bytes]	Field	Note
MAC Layer	7	Preamble	
	1	SFD	
	6	Destination MAC Address	
	6	Source MAC Address	
LLC Layer	2	Type	IEEE 802.1p&Q VLAN Tagging (additional 4 bytes if enabled)
IP Layer	1	Vers/HLEN	
	1	Service Type	
	2	Total Length	
	2	Identification	
	1	Flags/Fragment Offset (most)	
	1	Fragment Offset (least)	
	1	Time to Live	
	1	Protocol	
	2	Header Checksum	
	4	Source IP Address	
UDP Layer	4	Destination IP Address	
	2	UDP Source Port	<i>The UDP source port field is used to transfer a destination bundle number.</i>
	2	UDP Destination Port	<i>Fixed value of 2142 (decimal). Assigned to RAD by the IANA</i>
	2	UDP Message Length	
	2	UDP Checksum	
Data Layer	...	Payload	
MAC Layer	4	CRC	

Table 1-2. Ethernet Frame Fields (AAL2oMPLS Multiplexing)

Layer	Field Length [bytes]	Field	Note
MAC Layer	7	Preamble	
	1	SFD	
	6	Destination MAC Address	
	6	Source MAC Address	
LLC Layer	2	Type	IEEE 802.1p&Q VLAN Tagging (additional 4 bytes if enabled)
Data Layer	...	Payload	
MAC Layer	4	CRC	

### VLAN Support (per bundle)

Vmux-110 supports VLAN, according to IEEE 802.1p&Q. When VLAN support is enabled, Vmux-110 adds four bytes to the MAC layer of the Ethernet frame. The content of these bytes, MAC layer priority and VLAN ID, can be set by the user. In this mode, only VLAN format frames are sent and received by Vmux-110. The following figure describes the VLAN tag format.

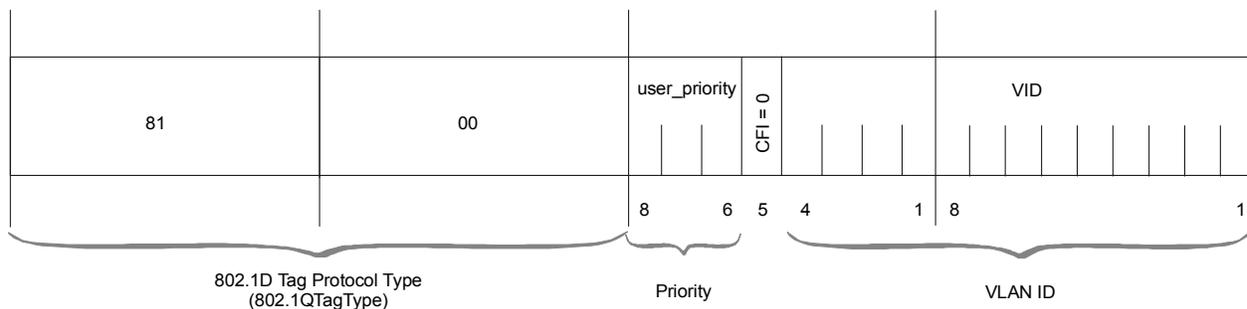


Figure 1-13. VLAN Tag Format

### UDP Support

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

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

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

---

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

---

For more information about VLAN tagging, see IEEE Std 802.1p&Q.

## Serial Main Link

The RS-530 serial main link receives Ethernet frames from the voice modules and forwards them to the remote device over a TDM network or a leased line.

### Cisco-compatible HDLC Header

The serial link normally transmits the HDLC data transparently. However, a special mode to support applications opposite certain Cisco-manufactured equipment is provided. This mode uses a Cisco HDLC header format.

## Ethernet Main Link (ETH NET Port)

The 10/100BaseT main link receives Ethernet frames from the voice modules via the Ethernet switch and forwards them to the remote device over the IP network. The 10/100BaseT main link supports full duplex transmission with autonegotiation and half duplex with the backpressure option.

## Ethernet User LAN (ETH USER Port)

The 10/100BaseT user LAN port receives Ethernet frames from the user's LAN via the internal Ethernet switch and forwards them to the remote device over the main link. This port supports full duplex transmission with autonegotiation and half duplex with the backpressure option.

## Rate Limiting on Ethernet ports

To solve the problem of transferring voice as well as 10/100 Mbps Ethernet data over a TDM serial uplink with small bandwidth (for example, 256 kbps), the ingress data rate on either Ethernet ports can be limited to one of several values between 128 kbps and 2 Mbps, plus fragmentation of the packets.

## Integral Ethernet Switch

All traffic between the voice ports, the Ethernet ports and the serial link is routed through the Vmux-110's built-in Ethernet switch. This switch provides the capability for VLAN tagging of the various traffic, as well as the capability for discarding unrecognized traffic.

### VLAN Tagging on Ethernet and Serial ports

The VLAN tagging feature enables adding a VLAN tag to the traffic coming out of a certain port, in order to identify its source, as well as offering the ability to remove the VLAN tag from all traffic coming out of a certain port. In addition, a "Double Tagging" mode is available to always add a tag to packets, even if one already exists. The VLAN ID and priority level of the added tag are given according to the port from which the packet *entered* (ingress) the integral Ethernet switch.

For untagged packets, or packets tagged with an unrecognized ID, two possible security policies can be set per port: ON (broadcast all) or OFF (discard all).

Each VLAN tag contains a Priority field. The Ethernet switch in the Vmux-110 decides the transmission priority of a packet based on this field.

A packet whose VLAN ID appears in the VLAN table will *exit* (egress) the switch based on the policy in the VLAN table (see next section).

### VLAN Table

Vmux-110 includes a VLAN table, which can contain up to 64 entries, in which packet egress policies are defined for different VLAN ids. A policy for a certain VLAN ID determines which ports will transmit packets tagged with this ID, how the ports will transmit them (tagged/untagged), and which ports will discard packets tagged with this ID.

## DHCP Client Support

To facilitate integration of a new device into a DHCP IP network, if the DHCP client is enabled, but no IP address has been manually configured, Vmux-110 will automatically request one from the DHCP server upon booting. Once an address has been assigned by the DHCP server, it will be saved in the database. In order to request a new address, the current one must be deleted (0.0.0.0).

## Calculating Approximate Bandwidth Utilization

The following formula is used to calculate the approximate bandwidth utilization:

$$\left\{ \frac{[(\text{Header size} \times \text{packets per second}) + (\# \text{ timeslots} \times \text{size of compressed G.732 packet} \times 1000/30 \times \text{actual transmission time (\% non-silence)})] \times 8 \text{ bytes per bit}}{1000 \text{ bits per kilobit}} \right\} + \text{rate converted to kbps}$$

## Bandwidth Utilization when using TDMoIP

By using TDMoIP multiplexing and the voice activity detection, Vmux-110 supports a higher number of voice channels over TDM than it is possible by utilizing conventional compression methods alone. TDMoIP multiplexing and grouping the timeslots of compressed voice together into bundles with a common IP address reduces the actual bandwidth used per channel to as low as 4 kbps (up to 16:1), when all channels are active. Better compression, up to 20:1, is achieved when some of the voice channels are idle.

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**Note** *The actual compression achieved at any time depends on the voice activity on the network, the signaling system in use, and the number of modem/fax calls.*

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The actual bandwidth utilization is determined by the following factors:

- Header sizes:
  - Ethernet – 18 bytes
  - IP – 20 bytes

- UDP – 8 bytes
- TDMoIP – 4 bytes
- VLAN (if exists) – 4 bytes.
- Size of the voice packet:
  - G.723 – 31 bytes (AAL2 header [3 bytes] + voice header [4 bytes] + compressed voice payload [24 bytes])
  - G.729 – 17 bytes (AAL2 header [3 bytes] + voice header [4 bytes] + compressed voice payload [10 bytes])
  - G.711 – 47 bytes (AAL2 header [3 bytes] + voice header [4 bytes] + compressed voice payload [40 bytes]).
- Packet interval:
  - G.723.1 – 30 msec
  - G.729 – 10 msec
  - G.711 – 5 msec.
- Number of timeslots in a bundle
- Silence percentage. Studies show that an average person speaks only 40% of the time during a telephone conversation. 50% of the time is spent listening to the other party, while the remaining 10% is spent quietly contemplating.
- Connectivity packets – 64 bytes per minute.

### Calculating Approximate Bandwidth Utilization (TDMoIP)

Let us calculate an approximate bandwidth for 30 timeslots in one bundle with G.723.1 compression, 60 % of silence:

$$\left\{ \frac{[(50 \times 1000/40) + (30 \times 31 \times 1000/30 \times 0.4)] \times 8}{1000} \right\} + 0.00853 = 109.208 \text{ kbps}$$

where:

- 50 – size of Ethernet, IP, UDP, TDMoIP headers
- 1000/40 – packet per seconds (pps) transmission rate, calculated according to the packetizing interval chosen (40 msec in this example)
- 30 – number of timeslots
- 31 – size of the compressed G.723 packet plus AAL2 header and voice payload
- 0.4 – 60% of silence
- 8 – conversion from bytes to bits
- 1000 in the denominator – conversion from bits to kilobits
- 0.00853 – connectivity packets rate (64 bytes per minute) converted to kbps.

**Note** A *Vmux Bandwidth Calculator* tool is included on the *Technical Documentation CD*.

## Bandwidth Utilization when using AAL2oMPLS

When using non-IP based Ethernet networks or the Serial uplink, the AAL2oMPLS format can be used instead of the TDMoIP multiplexing format. The AAL2oMPLS header is smaller than the TDMoIP header (23 rather than 50 bytes), saving about 5% in bandwidth when compared to TDMoIP multiplexing (depending on the actual size of the multiplexed frames).

The actual bandwidth utilization is determined by the following factors:

- Header sizes:
  - Ethernet – 18 bytes
  - AAL2oMPLS – 5 bytes
- Size of the voice packet:
  - G.723 – 31 bytes (AAL2 header [3 bytes] + voice header [4 bytes] + compressed voice payload [24 bytes])
  - G.729 – 17 bytes (AAL2 header [3 bytes] + voice header [4 bytes] + compressed voice payload [10 bytes]).
- Packet interval:
  - G.723.1 – 30 msec
  - G.729 – 10 msec.
- Number of timeslots in a bundle
- Silence percentage. Studies show that an average person speaks only 40% of the time during a telephone conversation. 50% of the time is spent listening to the other party, while the remaining 10% is spent quietly contemplating.
- Connectivity packets – 64 bytes per minute.

### Calculating Approximate Bandwidth Utilization (AAL2oMPLS)

The approximate bandwidth for 30 timeslots in one bundle with G.723.1 (6.4 kbps) compression, 60 % of silence is calculated as follows:

$$\left\{ \frac{[(23 \times 1000/40) + (30 \times 31 \times 1000/30 \times 0.4)] \times 8}{1000} \right\} + 0.00853 = 103.80853 \text{ kbps}$$

where:

- 23 – size of Ethernet and AAL2oMPLS headers
- 1000/40 – packets per second (pps) transmission rate, calculated according to the packetizing interval chosen (40 msec in this example)
- 30 – number of timeslots

- 31 – size of the compressed G.732 packet plus AAL2 header and voice payload
- 0.4 – 60% of silence
- 8 – conversion from bytes to bits
- 1000 in the denominator – conversion from bits to kilobits
- 0.00853 – connectivity packets rate (64 bytes per minute) converted to kbps.

**Note** A *Vmux Bandwidth Calculator* tool is included on the *Technical Documentation CD*.

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## 1.4 Technical Specifications

### Ethernet Links

<i>Number of Ports</i>	2 (NET and USER)
<i>Standards</i>	IEEE 802.3, 802.3u, Ethernet 802.1p&Q
<i>Data Rate</i>	10 or 100 Mbps, half duplex or full duplex, autonegotiation support
<i>Statistics</i>	According to RFC 3638 or RFC 3635: <ul style="list-style-type: none"> <li>• Received frames – Total Frames, good Frames, Broadcast Frames, Multicast Frames, Undersize, Oversize, CRC, Fragments, Jabber, Filtered, Discarded, Total Bytes, Bytes</li> <li>• Transmitted frames – Correct Frames, Broadcast Frames, Multicast Frames, Collision, Bytes</li> </ul>
<i>Range</i>	Up to 100m (328 ft) over UTP Cat.5 cable
<i>Connectors</i>	RJ-45 per port

### Serial Link

<i>Function</i>	Main Link
<i>Interface</i>	<ul style="list-style-type: none"> <li>• RS-530</li> <li>• V.35 (requires adapter cable)</li> <li>• X.21 (requires adapter cable)</li> </ul>
<i>Data Rate</i>	n x 64 kbps, for rates from 64 to 2048 kbps
<i>Timing</i>	<ul style="list-style-type: none"> <li>• DCE</li> <li>• DTE (requires adapter/cross cable)</li> </ul>
<i>Connector</i>	DB-25, female

<b>Voice Ports</b>	<i>Configuration</i>	<p><i>Choice of one of the following:</i></p> <ul style="list-style-type: none"> <li>• One E1 digital voice port</li> <li>• One T1 digital voice port</li> <li>• Four or eight FXS analog voice ports</li> <li>• Four or eight FXO analog voice ports</li> <li>• Four or eight E&amp;M analog voice ports</li> </ul>
<b>Router</b>	<i>Features</i>	<ul style="list-style-type: none"> <li>• Maximum of three interfaces</li> <li>• Maximum 4000 pps</li> <li>• Static routing</li> <li>• DHCP server</li> <li>• DHCP relay</li> <li>• NAT</li> <li>• Firewall</li> </ul>
<b>E1 Port</b>	<i>Number of Ports</i>	One
	<i>Data Rate</i>	2.048 Mbps
	<i>Standards</i>	ITU-T Rec. G.703, G.704, G.706, G.732, G.823
	<i>Framing</i>	G.732S and G.732N with or without CRC-4, in compliance with ITU-T Rec. G.703, G.704, G.732 requirements
	<i>Line Code</i>	HDB3
	<i>Receive Signal Level</i>	0 to -43 dB with LTU 0 to -12 dB without LTU
	<i>Transmit Signal Level</i>	±3V (±10%)
	<i>Jitter Performance</i>	Per ITU-T G.823
	<i>Line Impedance</i>	120Ω, balanced
	<i>Connector</i>	RJ-45, balanced  CBL-RJ45/2BNC/E1 adapter cable converts to a pair of BNC coaxial connectors, unbalanced
<b>T1 Port</b>	<i>Number of Ports</i>	One
	<i>Data Rate</i>	1.544 Mbps
	<i>Standards</i>	ANSI T1.403, ITU-T Rec. G.703
	<i>Line Code</i>	AMI
	<i>Zero Suppression</i>	B8ZS, AMI

	<i>Framing</i>	<i>D4, ESF</i>
	<i>Receive Signal Level</i>	<i>0 to -36 dB with CSU 0 to -30 dB without CSU</i>
	<i>Transmit Signal Level</i>	<i>0, -7.5, -15, or -22.5 dB with CSU ±2.7V (±10%) at 0–655 ft without CSU</i>
	<i>Jitter Performance</i>	<i>Per AT&amp;T TR-62411, G.824</i>
	<i>Line Impedance</i>	<i>100Ω, balanced</i>
	<i>Connector</i>	<i>RJ-45</i>
<b>FXS Ports</b>	<i>Number of Ports</i>	Four or eight
	<i>Analog Parameters</i>	ITU-T standards: G.713, 2-wire for voice and signaling Nominal level: 0 dBm Nominal impedance: 600Ω Return loss (300 to 3400 Hz): better than 20 dB Frequency response (Ref: 1020 Hz): <ul style="list-style-type: none"> <li>• 300 to 3000 Hz: ±0.5 dB</li> <li>• 250 to 3400 Hz: ±1.1 dB</li> </ul> Level Adjustment, soft selectable: <ul style="list-style-type: none"> <li>• TX: +5 dBm to -4 dBm</li> <li>• RX: +5 dBm to -10 dBm</li> <li>• Steps: 1 dB (±0.1 dB), nominal</li> </ul> Signal to Total Distortion, G.712, G.713 method 2: <ul style="list-style-type: none"> <li>• 0 to -30 dBm0: better than 33dB</li> <li>• +3 to -45 dBm0: better than 22dB</li> </ul> Idle channel noise: better than -70 dBm0 (+20 dBnc)
	<i>Signaling</i>	Signaling type: EIA RS-464 Loop-Start On-Hook/Off-Hook Threshold: <ul style="list-style-type: none"> <li>• 3V to 24V between TIP and RING at off-hook state</li> <li>• Higher than 25V between TIP and RING at on-hook state</li> </ul> Feed Current: 24 mA ±10% Ringer: <ul style="list-style-type: none"> <li>• Voltage: 50 VRMS (±10%), overload protected</li> <li>• Frequency: 25 Hz (±10%)</li> </ul>

		<ul style="list-style-type: none"> <li>• Cadence: 1 sec ON / 3 sec OFF (default), user-configurable</li> </ul>
		Reverse Polarity Generation
	<i>Connectors</i>	D-type 25-pin or 6-pin RJ-12 connector for each channel.
<b>FXO Ports</b>	<i>Number of Ports</i>	Four or eight
	<i>Analog Parameters</i>	<p>ITU-T standards: G.713, 2-wire for voice and signaling</p> <p>Nominal level: 0 dBm</p> <p>Nominal impedance: 600Ω</p> <p>Return loss (300 to 3400 Hz): better than 20 dB</p> <p>Frequency response (Ref: 1020 Hz):</p> <ul style="list-style-type: none"> <li>• 300 to 3000 Hz: ±0.5 dB</li> <li>• 250 to 3400 Hz: ±1.1 dB</li> </ul> <p>Level Adjustment, soft selectable:</p> <ul style="list-style-type: none"> <li>• TX: +5 dBm to -4 dBm</li> <li>• RX: +1 dBm to -17 dBm</li> <li>• Steps: 1 dB (±0.1 dB), nominal</li> </ul> <p>Signal to Total Distortion, G.712, G.713 method 2:</p> <ul style="list-style-type: none"> <li>• 0 to -30 dBm0: better than 33dB</li> <li>• +3 to -45 dBm0: better than 22dB</li> </ul> <p>Idle channel noise: better than -70 dBm0 (+20 dBnc)</p>
	<i>Signaling</i>	<p>Signaling type: EIA RS-464 loop start</p> <p>DC Impedance:</p> <ul style="list-style-type: none"> <li>• Off-hook: 100Ω at 100 mA feed; 230Ω at 25 mA feed</li> <li>• On-hook: Above 1 MΩ</li> </ul> <p>Ring detector:</p> <ul style="list-style-type: none"> <li>• Impedance: 20 kΩ @ 20 Hz, 70 VRMS</li> <li>• Detection: At least 20 VRMS, 17 to 25 Hz</li> <li>• No Detection: Maximum 5 VRMS</li> <li>• Dialing: DTMF or pulse</li> </ul> <p>Reverse polarity detection</p>
	<i>Connectors</i>	DB-25 or 6-pin RJ-12 connector for each channel.

<b>E&amp;M Ports</b>	<i>Number of Ports</i>	Four or eight	
	<i>Analog Parameters</i>	<p>ITU-T standards: G.713, for voice and signaling:</p> <ul style="list-style-type: none"> <li>• 2-wire or 4-wire</li> <li>• software-selectable per two channels</li> </ul> <p>Nominal level: 0 dBm</p> <p>Nominal impedance: 600Ω</p> <p>Return loss (300 to 3400 Hz): better than 20 dB</p> <p>Frequency response (Ref: 1020 Hz):</p> <ul style="list-style-type: none"> <li>• 300 to 3000 Hz: ±0.5 dB</li> <li>• 250 to 3400 Hz: ±1.1 dB</li> </ul> <p>Level Adjustment, soft selectable:</p> <ul style="list-style-type: none"> <li>• TX: +5 dBm to -7 dBm</li> <li>• RX: +2 dBm to -17 dBm</li> <li>• Steps: 1 dB (±0.5 dB), nominal</li> </ul> <p>Signal to Total Distortion, G.712, G.713 method 2:</p> <ul style="list-style-type: none"> <li>• 0 to -30 dBm0: better than 33dB</li> <li>• +3 to -45 dBm0: better than 22dB</li> </ul> <p>Idle channel noise: better than -70 dBm0 (+20 dBnc)</p>	
	<i>Signaling</i>	<p>Signaling type: EIA RS-464 Types I, II, III or V (British Telecom SSDC5) software-selectable per four channels</p> <p>Signaling voltage: -12 VDC to -60 VDC externally supplied</p> <p>Dial pulse distortion: ±2 msec max</p>	
	<i>Connectors</i>	68-pin SCSI connector or 8-pin RJ-45 connector for each channel	
	<b>Voice Processing</b>	<i>Compression Algorithms</i>	G.723.1, G.729 A, G.711 (a-law/μ-law)
		<i>Silence Suppression</i>	G.723.1A, G.729B
		<i>Echo Cancellation</i>	32 ms per channel as per G.168
		<i>Fax Relay</i>	Group III: 4.8, 9.6, 14.4 kbps
		<i>Voice-Band Modem</i>	Transparent transfer
		<i>MF Signaling Support</i>	DTMF, MFR2, MFC detection, generation and relay

<b>Control Port</b>	<i>Standard</i>	V.24/RS-232 (DCE)
	<i>Data Rate</i>	9.6, 19.2, 38.4, 57.6 or 115.2 kbps
	<i>Connector</i>	RJ-45
<b>Diagnostics</b>	<i>Tests</i>	Ethernet Ports: <ul style="list-style-type: none"> <li>• Performance monitoring</li> <li>• LAN statistics</li> <li>• PING</li> </ul>
		E1/T1 Voice Ports: <ul style="list-style-type: none"> <li>• Local and remote loops on entire E1/T1</li> <li>• Tone injection per timeslot towards local side</li> </ul>
		FXS/FXO/E&M Voice Ports: <ul style="list-style-type: none"> <li>• Remote loops per channel</li> <li>• Tone injection per channel towards local and remote side</li> </ul>
		<i>Statistics Collection</i> <ul style="list-style-type: none"> <li>• Ethernet</li> <li>• CPU utilization</li> <li>• HDLC</li> <li>• Bundles</li> <li>• Voice</li> <li>• Voice Rx and Tx signaling</li> </ul>
<b>Indicators</b>	<i>ALM (red)</i>	Alarm
	<i>ETH (green)</i>	Ethernet link status
	<i>PWR (green)</i>	Power
<b>Power Supply</b>	<i>Input</i>	AC Source: 100 to 240 VAC, 50/60 Hz, 40W DC Source: -40 to -72 VDC (-48 VDC, nominal)
	<i>Consumption</i>	<b>4FXS:</b> <ul style="list-style-type: none"> <li>• AC: 19.0 VA</li> <li>• DC: 18.0W</li> </ul> <b>8FXS:</b> <ul style="list-style-type: none"> <li>• AC: 28.0 VA</li> <li>• DC: 27.0W</li> </ul>

**4FXO:**

- AC: 9.0 VA
- DC: 8.0W

**8FXO:**

- AC: 9.5 VA
- DC: 8.5 W

**4E&M:**

- AC: 11.0 VA
- DC: 10.0 W

**8E&M:**

- AC: 12.5 VA
- DC: 11.5 W

**E1/T1:**

- AC: 10.2 VA
- DC: 9.0 W

<b>Physical</b>	<i>Height</i>	4.3 cm (1.7 in)
	<i>Width</i>	21.5 cm (8.5 in)
	<i>Depth</i>	23.7 cm (9.3 in)
	<i>Weight</i>	2.0 kg (4.4 lb)
<b>Environment</b>	<i>Operating Temperature</i>	0 to 50°C (32 to 122°F)
	<i>Storage Temperature</i>	-20 to 70°C (4 to 158°F)
	<i>Humidity</i>	Up to 90%, non-condensing

# Chapter 2

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## Installation and Setup

This chapter describes installation and setup procedures for the Vmux-110 device.

After installing the unit:

- Refer to [Chapter 3](#) for the operating instructions.
- Refer to [Chapter 4](#) for the detailed system configuration procedures using an ASCII terminal connected to the Vmux-110 control port.

If a problem is encountered, refer to [Chapter 6](#) and [Chapter 7](#) for test and diagnostic instructions.



**Warning**

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**Internal settings, adjustment, maintenance, and repairs may be performed only by a skilled technician who is aware of the hazards involved.**

**Always observe standard safety precautions during installation, operation, and maintenance of this product.**

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### 2.1 Site Requirements and Prerequisites

The AC-powered Vmux-110 unit should be installed within 1.5 m (5 ft) of an easily accessible, grounded AC outlet capable of furnishing the voltage in accordance with Vmux-110 nominal supply voltage.

The DC-powered Vmux-110 unit requires a -48 VDC power source, which must be adequately isolated from the main supply.

Allow at least 90 cm (36 in) of frontal clearance for operating and maintenance accessibility. Allow at least 10 cm (4 in) clearance at the rear of the unit for signal lines and interface cables.

The ambient operating temperature of Vmux-110 is 0 to 50°C (32 to 122°F), at a relative humidity of up to 90%, non-condensing.

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## 2.2 Package Contents

The Vmux-110 package includes the following items:

- One Vmux-110 unit
- Technical Documentation CD
- CBL-RJ45/D9/F/STR cable for ASCII terminal connection
- CBL-RJ45/2BNC/E1 adapter cable is the unbalanced E1 voice port is ordered
- AC power cord or DC power supply connector kit.

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## 2.3 Installation and Setup

The Vmux-110 unit is designed for desktop or bench installation and is delivered as a fully assembled unit. No provisions are made for bolting the unit to a tabletop. For installation of one or two units in a 19" rack, refer to the [Rack Mounting Kit for 19-inch Racks Guide](#) that comes with the RM kit.

► **To install Vmux-110:**

1. Determine the required configuration of Vmux-110, in accordance with your application.
2. Set the E1 internal jumpers to match the E1 connection type: balanced or unbalanced.
3. Set the ground reference jumpers.
4. Connect the voice port(s).
5. Connect the main link to the 10/100BaseT (NET Ethernet) port or the serial port.
6. Connect the LAN to the USER Ethernet port.
7. Connect an ASCII terminal or a PC running a terminal emulation software.
8. Connect power to the unit.

### Opening the Vmux-110 Case

In order to access internal jumpers of Vmux-110, you must open the unit's case.

► **To open the Vmux-110 case:**

1. Disconnect the power cable from the electricity outlet.
2. Disconnect all cables from the Vmux-110.
3. Release the two screws on each side panel of the unit.
4. Release the screw on the rear panel of the unit.
5. Slide the top cover backward to open the case.

## Setting the E1 Voice Port Internal Jumpers

If the Vmux-110 uses the E1 voice port, you may need to set the internal jumpers to match the E1 connection type: balanced or unbalanced. Factory setting for the jumpers is for balanced E1 interface.

**Note** Only jumpers J5, J6, and J7 are relevant. All other jumpers should remain in their factory settings.

► **To set the internal jumpers:**

1. Release the two screws holding the DSP board (see [Figure 2-1](#)).
2. Remove the DSP board by lifting it straight up.
3. Set the Vmux-110 internal jumpers J5, J6, and J7 (see [Figure 2-1](#)):
  - BAL: Balanced (factory setting)
  - UBAL: Unbalanced.

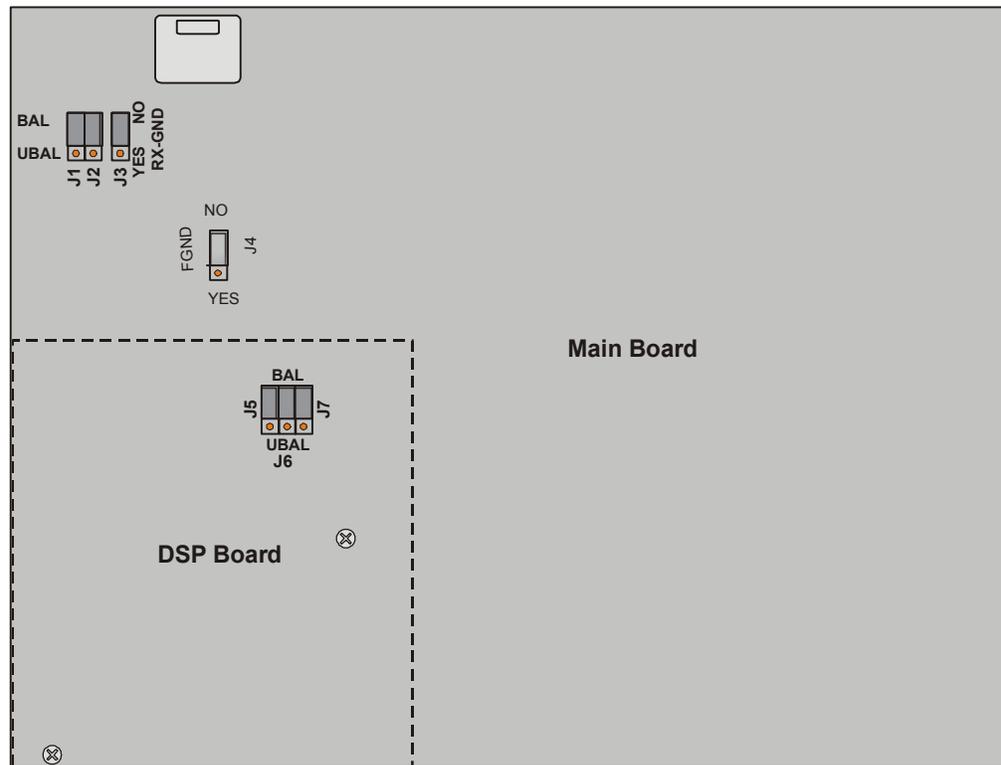


Figure 2-1. E1 Jumper Locations

## Closing the Vmux-110 Case

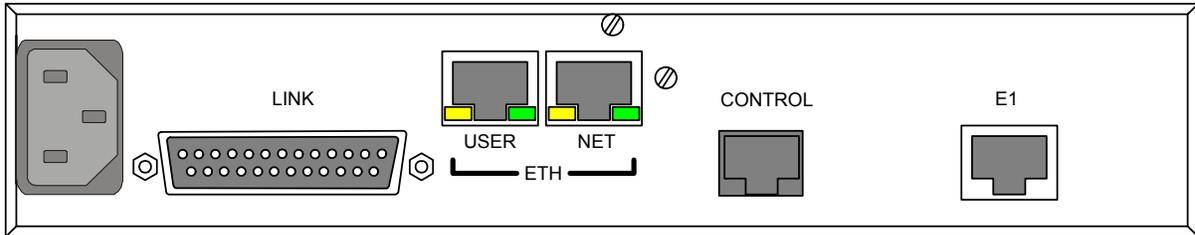
After completing the internal settings, close the unit case.

► **To close the Vmux-110 case:**

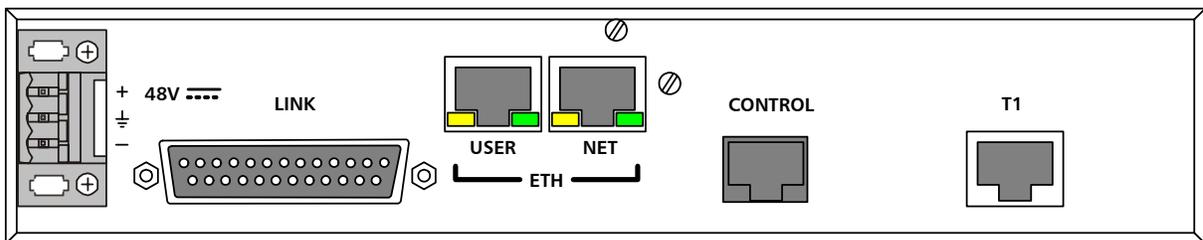
1. Re-install the top cover.
2. Secure the top cover with the four side panel screws and one rear panel screw.

## Connecting the Interfaces

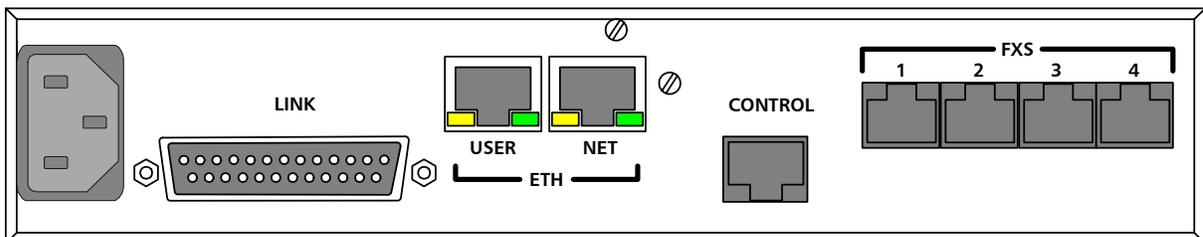
*Figure 2-2* shows the rear panel of an AC-powered Vmux-110 unit with E1 voice port. *Figure 2-3* shows the rear panel of a DC-powered Vmux-110 unit with T1 voice port. *Figure 2-4* shows the rear panel of an AC-powered Vmux-110 unit with FXS voice ports.



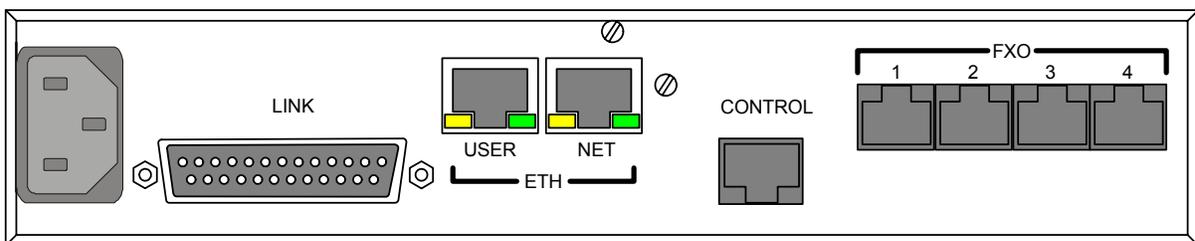
*Figure 2-2. Vmux-110 Rear Panel (with E1 Voice Port and AC Power Supply)*



*Figure 2-3. Vmux-110 Rear Panel (with T1 Voice Port and DC Power Supply)*



*Figure 2-4. Vmux-110 Rear Panel (with Four FXS Voice Ports and AC Power Supply)*



*Figure 2-5. Vmux-110 Rear Panel (with Four FXO Voice Ports and AC Power Supply)*

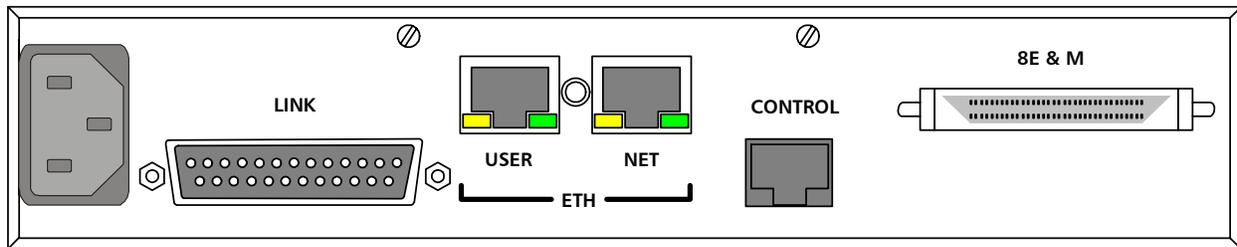


Figure 2-6. Rear Panel (with Eight E&M Voice Ports and AC Power Supply)

### Connecting the E1 Voice Port

The E1 voice port terminates in an RJ-45 balanced connector. [Appendix A](#) specifies the pinout of the E1 connector.

➤ **To connect the balanced E1 interface:**

- Connect the incoming E1 link to the RJ-45 connector on the Vmux-110 rear panel, designated E1.

➤ **To connect the unbalanced E1 interface:**

1. Connect the receive line to the connector labeled RX of the CBL-RJ45/2BNC/E1 adapter cable, using a 75Ω coaxial cable.
2. Connect the transmit line to the connector labeled TX of the CBL-RJ45/2BNC/E1 adapter cable, using a 75Ω coaxial cable.
3. Connect the CBL-RJ45/2BNC/E1 adapter cable to the RJ-45 connector on the Vmux-110 rear panel, designated E1.

### Connecting the T1 Voice Port

The T1 voice port terminates in an RJ-45 balanced connector. [Appendix A](#) specifies the pinout of the T1 connector.

➤ **To connect the T1 interface:**

- Connect the incoming T1 link to the RJ-45 connector on the Vmux-110 rear panel, designated T1.

### Connecting the FXS Voice Ports (4-port version)

The 4-channel FXS voice interface terminates in four RJ-11 connectors. [Appendix A](#) specifies the pinout of the FXS connectors.

➤ **To connect the 4-channel FXS interface:**

- Connect each 2-wire line to one of the four RJ-11 connectors on the Vmux-110 rear panel, designated FXS.

### Connecting the FXS Voice Ports (8-port version)

The 8-channel FXS voice interface terminates in a single DB-25 connector. [Appendix A](#) specifies the pinout of the FXS connector.

➤ **To connect the 8-channel FXS interface:**

1. Connect one end of the connector cable to the POTS or FAX units.
2. Connect the other end of the connector cable to the DB-25 connector on the Vmux-110 rear panel, designated 8 FXS.

**Connecting the FXO Voice Ports (4-port version)**

The 4-channel FXO voice interface terminates in four RJ-11 connectors. [Appendix A](#) specifies the pinout of the FXO connectors.

➤ **To connect the 4-channel FXO interface:**

- Connect each 2-wire line to one of the four RJ-11 connectors on the Vmux-110 rear panel, designated FXO.

**Connecting the FXO Voice Ports (8-port version)**

The 8-channel FXO voice interface terminates in a single DB-25 connector. [Appendix A](#) specifies the pinout of the FXO connector.

➤ **To connect the 8-channel FXO interface:**

1. Connect one end of the connector cable to the PBX or PSTN units.
2. Connect the other end of the connector cable to the DB-25 connector on the Vmux-110 rear panel, designated 8 FXO.

**Connecting the E&M Voice Ports (4-port version)**

The 4-channel E&M voice interface terminates in four RJ-45 connectors. [Appendix A](#) specifies the pinout of the E&M connectors.

➤ **To connect the 4-channel E&M interface:**

- Connect each E&M line to one of the four RJ-45 connectors on the Vmux-110 rear panel, designated E&M.

**Connecting the E&M Voice Ports (8-port version)**

The 8-channel E&M voice interface terminates in a single SCSI-68 connector. [Appendix A](#) specifies the pinout of the E&M connector.

➤ **To connect the 8-channel E&M interface:**

1. Connect one end of the connector cable to the PBX units.
2. Connect the other end of the connector cable to the SCSI-68 connector on the Vmux-110 rear panel, designated 8 E&M.

**Connecting the Main Link**

The Vmux-110 main link may be either the Ethernet NET interface or the serial main link interface.

The Vmux-110 Ethernet NET main link interface terminates in an 8-pin RJ-45 connector. [Appendix A](#) specifies the pinout of the Ethernet connector. The Ethernet main link port supports connection via straight and cross cables.

➤ **To connect the Ethernet main link:**

- Connect the IP uplink to the RJ-45 connector designated NET ETH.

The serial main link interface terminates in a female DB-25 connector. [Appendix A](#) specifies the pinout of the serial connector.

➤ **To connect the serial main link:**

- Connect the serial V.35 link to the DB-25 connector designated LINK.

### Connecting the User LAN Port

The user LAN can be connected to the Ethernet USER port. [Appendix A](#) specifies the pinout of the Ethernet connectors.

➤ **To connect the user LAN port:**

- Connect the user LAN to the RJ-45 connector designated USER ETH.

### Connecting the ASCII Terminal

The Vmux-110 control port terminates in an 8-pin RJ-45 connector. [Appendix A](#) specifies the pinout of the control port connector.

➤ **To connect the ASCII terminal directly to the CONTROL port:**

1. Connect the CBL-RJ45/D9/F/STR cable to the RJ-45 connector, designated CONTROL.
2. Connect the other side of the cable to the ASCII terminal, or PC running a terminal emulation software.

## Connecting the Power

Vmux-110 includes AC or DC power supply. To connect Vmux-110 to the power source, refer to the appropriate section below, depending on your version of the unit (AC or DC).



**Warning**

---

**Before switching on this unit and connecting or disconnecting any other cable, the protective earth terminals of this unit must be connected to the protective ground conductor of the mains (AC or DC) power cord. If you are using an extension cord (power cable) make sure it is grounded as well.**

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

---

### Connecting AC Power

AC power is supplied to Vmux-110 through a standard 3-prong plug (see [Figure 2-2](#)).

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

➤ **To connect AC power:**

1. Connect the power cable to the power connector on the Vmux-110 rear panel.
2. Connect the power cable to the electricity outlet.

The unit will turn on automatically upon connection to the electricity supply.

### Connecting DC Power

DC power is supplied to Vmux-110 through a special 3-prong plug (see [Figure 2-3](#)).

➤ **To connect DC power:**

- Refer to the DC power supply connection supplement.

# Chapter 3

---

## Operation

This chapter provides the following information for Vmux-110:

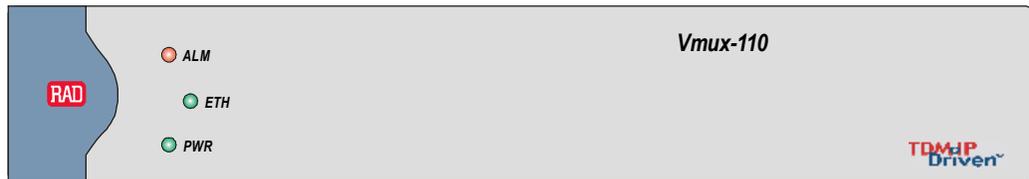
- Vmux-110 front-panel indicators
- Operating procedures (turn-on, front-panel indications, performance monitoring and turn-off).

The installation procedures given in [Chapter 2](#) must be completed and checked before attempting to operate the Vmux-110.

---

### 3.1 Front Panel Indicators

The Vmux-110 front panel includes a series of LED indicators that show the current operating status of the unit (see [Figure 3-1](#)). [Table 3-1](#) lists and describes the Vmux-110 indicators.



*Figure 3-1. Vmux-110, Front Panel*

*Table 3-1. Vmux-110 LEDs*

Name	Function
ALM (red)	ON – Alarm is present
ETH (green)	ON – 10/100BaseT link is established on network port
PWR (green)	ON – Power supply is ON

---

---

## 3.2 Operating Vmux-110

### Turning On Vmux-110

➤ **To turn on Vmux-110:**

- Connect the power cable to the electricity outlet.

The PWR indicator lights up and remains lit as long as Vmux-110 receives power.

### Normal Indications

*Table 3-2* shows the correct status of the indicators a few seconds after power-up.

*Table 3-2. Vmux-110 Indicator Status*

Indicator	Status
PWR	ON
ETH	ON
ALM	ON

If the above LED indications do not appear following initial power turn-on, refer to [Chapter 6](#) for the diagnostic test instructions.

### Turning Off Vmux-110

➤ **To turn off Vmux-110:**

- Disconnect the power cable from the electricity outlet.

### 3.3 Default Settings

Vmux-110 is managed by an ASCII terminal or PC running a terminal emulation program via menu-driven embedded software. [Table 3-3](#) lists the default settings of the Vmux-110 configuration parameters.

Table 3-3. Vmux-110 Default Settings

Parameter	Default Value				
<b>System</b>					
<i>Management</i>					
Host IP> Set Host IP address	0.0.0.0				
Host IP> Set Subnet Mask	0.0.0.0				
Host IP> Set Default Gateway	0.0.0.0				
Host IP> DHCP Client	Disable				
Host IP> Read	public				
Host IP> Write	private				
Host IP> Trap	public				
Manager list	0.0.0.0				
Signaling Profile (E1/T1 units only)	ABCD Bits				
	Idle	1	0	0	0
	OOS	1	0	0	0
SS7 Keep-Alive Suppression Rate (E1/T1 units only)	0% - No Suppression / Not SS7				
Telnet	Enable				
Main Link	Serial Port				
Router	Disable				
SNMP Community> Read	public				
SNMP Community> Write	private				
SNMP Community> Trap	public				
Ethernet Net/User Connection	Layer 2 Switching				

Table 3-3. Vmux-110 Default Settings (Cont.)

<b>Parameter</b>	<b>Default Value</b>
<b><i>Control Port</i></b>	
Set Baud Rate (bps)	9600
Timeout (min)	3
<b>Switch LAN Configuration</b>	
<b><i>Network/User Port Configuration</i></b>	
Set Auto Negotiation	Disable
Set Default Type	10BaseT half duplex
VLAN Tagging Mode	Unmodified
Default VLAN Id	1
Default Priority	0
VLAN Security Mode	Basic
Ingress Rate Limit	No Limit
<b><i>VLAN Table Configuration</i></b>	
<i>Table is empty by default</i>	
VLAN exists	No
VLAN ID ( <i>if VLAN exists = Yes</i> )	26
VLAN Priority ( <i>if VLAN exists = Yes</i> )	0
Set Alarm LED Severity	Event
<b>Voice Bundle Parameters</b>	
Enter Bundle Number	1
Connect	No
Function	TDMoIP
Max Bytes In Multiplexed Frame	500
Destination IP	0.0.0.0
Destination Bundle	1
Destination Type ( <i>FXS units only</i> )	PBX
Packetizing Interval (msec)	30
Transparent Jitter Size	20 msecs

Table 3-3. Vmux-110 Default Settings (Cont.)

<b>Parameter</b>	<b>Default Value</b>
<b>Voice Bundle Parameters</b>	
Enter Bundle Number	1
Connect	No
Function	TDMoIP
Max Bytes In Multiplexed Frame	500
Destination IP	0.0.0.0
Destination Bundle	1
Destination Type ( <i>FXS units only</i> )	PBX
Packetizing Interval (msec)	30
Transparent Jitter Size ( <i>E1/T1 only</i> )	20 msec
<b>Connectivity Parameters</b>	
Connectivity Packet Rate	60
Connectivity Timeout Cycles	3
<b>TOS Parameters</b>	
TOS Parameters> Precedence	Routine
TOS Parameters> Delay	Normal
TOS Parameters> Throughput	Normal
TOS Parameters> Reliability	Normal Reliability
<b>Voice Parameters</b>	
Coder/Rate	G.723.1/6.4
Volume ( <i>E1/T1 units only</i> )	0 db
Modem	Disable
Fax	Enable
Fax Rate	14.4 kbps
<b>MF Parameters (<i>E1/T1 units only</i>)</b>	
MFCR2 Relay	Disable
Minimum Pulse Width ( <i>if MFCR2 Relay = enable</i> )	60 msec

Table 3-3. Vmux-110 Default Settings (Cont.)

<b>Parameter</b>	<b>Default Value</b>
Minimum Power Level (if MFCR2 Relay = enable)	-12 dBm
MF Compelled (if MFCR2 Relay = enable)	Disable
Minimum Tone Duration (if MF Compelled = enable)	80 msec
Tone Detection (E1/T1 units only)	Disable
Select Tone (E1/T1 units only)	2000 Hz
Noise level for VAD	Low
Echo Cancellor	Enabled
Coding (E1/T1 units only)	A-Law (E1); U-Law
<b>VLAN Parameters</b>	
VLAN exists	No
VLAN ID (if VLAN exists = Yes)	26
VLAN Priority (if VLAN exists = Yes)	0
<b>E1 Port</b>	
Connect	No
Frame	732S
Restoration Time	1 second
Clock Source	Lbt
Interface Type	Ltu
Idle Code	ff
Profile	1
<b>T1 Port</b>	
Connect	No
Clock Source	Lbt
Frame	Esf

Table 3-3. Vmux-110 Default Settings (Cont.)

Parameter	Default Value				
Interface Type	Dsu				
Line Code	B8ZS				
Rx Sensitivity (CSU mode only)	LOW (-30 dB)				
Tx Gain Level (CSU mode only)	0 dBm				
Line Length (DSU mode only)	0-133 ft				
Restoration Time	1 second				
Idle Code	ff				
Signaling	Robbed Bit MF				
Profile	1				
<b>FXS Ports</b>					
Ring Timeout	120 seconds				
On hook duration in Flash	700 seconds				
Ringing profile (1 & 2)					
Period #1: Ring	1 second (10 * 100 msec)				
Period #1: Silence	3 seconds (30 * 100 msec)				
Period #2: Ring	0				
Period #2: Silence	0				
TX gain	0				
RX gain	-4				
		A	B	C	D
FXS Signaling Parameters	On-hook	0	1	0	1
	Off-hook	1	1	0	1
	Ring 1	1	1	0	1
	Ring 2	1	1	0	1
	Reverse Polarity	1	0	0	1

Table 3-3. Vmux-110 Default Settings (Cont.)

Parameter	Default Value				
<b>FXO Ports</b>					
TX gain	0				
RX gain	–				
FXO Signaling Parameters		A	B	C	D
	On-hook	0	1	0	1
	Off-hook	1	1	0	1
	Reverse polarity	1	0	0	1
<b>E&amp;M Ports</b>					
TX gain	0				
RX gain	0				
E&M Signaling Parameters		A	B	C	D
	On-hook	0	1	0	1
	Off-hook	1	1	0	1
<b>Timeslots</b>					
Update from Time Slot	1				
To Time Slot	1				
Type	N.C.				
Bundle	1				
Destination Port ID	1				
Destination Time Slot	1				
<b>Serial Port</b>					
Interface Type	V35				
Connect	No				
Speed	64 kbps				
Clock Mode	DTE				
Clock Invert	No				
Control Signals <i>(available only if Interface Type = V35 and Clock Mode = DTE)</i>	Ignore				
Fragmentation	610				
HDLC Mode	Transparent HDLC				

Table 3-3. Vmux-110 Default Settings (Cont.)

<b>Parameter</b>	<b>Default Value</b>
<b><i>VLAN Parameters</i></b>	<i>available only when main link is Serial port and router is disabled</i>
VLAN Tagging Mode	Unmodified
Default VLAN Id	1
Default Priority	0
Default Security Mode	Off
<b>Router</b>	
Entry Aging Time	5 minutes
RIP Status	Disable
Send RIP type	None
Receive RIP type	None
Firewall Status	Disable
Firewall Direction	Outbound
Active FTP	No
Forged IP Protection	No
DHCP Relay	Disable
<b>Firewall Global Parameters</b>	
All Fragments	No
TCP Aging	15 seconds
UDP Aging	15 seconds
ICMP Aging	15 seconds
Default Aging	15 seconds



# Chapter 4

---

## Management from a Terminal

The configuration of Vmux-110 is performed via menu-driven embedded software, using a standard ASCII terminal or a PC running a terminal emulation application connected to the rear panel CONTROL port. Alternatively, you can configure Vmux-110 via Telnet connection, which also establishes an inband management link to the remote unit.

---

### 4.1 Preparing for the Control Session

This section describes how to prepare Vmux-110 and the supervisory terminal for the control session.

#### Control Port Interface Characteristics

Vmux-110 includes a V.24/RS-232 asynchronous DCE port, designated CONTROL. The port terminates in an RJ-45 connector. The control port continuously monitors the incoming data stream and immediately responds to any input string received through this port.

The terminal is connected directly to the Vmux-110 control port. Since terminals usually have DTE interfaces, the connection to the port is made by means of a straight cable, CBL-RJ45/D9/F/STR, supplied with the unit.

#### Preparing the Terminal

Any standard ASCII terminal (a “dumb” terminal or a personal computer running a terminal emulation application) equipped with a V.24/RS-232 communication interface can be used to configure Vmux-110.

#### Initiating a Control Session

Vmux-110 supports two default terminal rates:

- 115.2 kbps, for 20–30 seconds after the power-up, until the boot sequence is completed. Supervisory terminal connection may be required at this stage for software downloading purpose.
- 9.6 kbps, during normal operation.

► **To initiate a control session:**

1. Connect the terminal cable to the CONTROL connector on the Vmux-110 back panel.

2. Connect the terminal cable to the serial port of the control terminal.
3. Turn the control terminal on.
4. Configure the terminal to the default communication parameters: 9.6 kbps, one start bit, eight data bits, no parity, one stop bit, no flow control, VT100 emulation.
5. Turn Vmux-110 on.

## Levels of Security

Vmux-110 supports a four-level security and user authentication system:

- **Administrator** – Allowed to configure all the parameters of Vmux-110.
- **Operator** – Allowed to perform all operations in the system, except for user administration (adding/deleting users, changing user definitions).
- **Technician** – Allowed to test Vmux-110 and monitor its operation (for example, monitoring alarms).
- **Monitor** – Allowed to monitor the Vmux-110 operation.

The maximum number of users supported by Vmux-110 is 20. When managing Vmux-110 over Telnet, up to five simultaneous management sessions are permitted. Only one administrator or operator is allowed to enter the management session at a time. The other four users may enter the session as monitors.

Vmux-110 displays the management menus in accordance with a user's access rights. For example, configuration screens dealing with the unit configurations are not available to users who logged in as technicians or monitors.

## Default Security Configuration

Vmux-110 is supplied with two administrator accounts:

- Account 1:
  - User name: admin
  - Password: 12345.
- Account 2:
  - User name: su
  - Password: 1234.

When the first management session is initiated, it is recommended to create a new administrator account, and delete the default one.

---

**Note** *If the password is lost, consult your local RAD distributor.*

---

---

---

## 4.2 Navigating the Management Menus

This section provides a general description of the software menu operation and conventions for navigating the menus. [Appendix C](#) lists all menus of the Vmux-110 management software.

### Choosing Parameters

➤ **To choose an option:**

- Type the number corresponding to the option, and press **<Enter>**.  
The screen for the chosen option is displayed.

➤ **To correct an erroneous entry:**

- Press **<Backspace>** to clear the error, then enter the correct characters.

Alternatively, press **<Esc>** to exit the current menu, and then return to the menu to re-enter the required value.

### Saving and Aborting Configuration Changes

You must save the configuration changes by updating the Vmux-110 database. If the database is not updated, Vmux-110 discards all the user settings when it is reset. You can save changed values at any stage of the configuration procedure. Alternatively, you can abort the new settings and return to the previous values.

➤ **To save the changes:**

1. Type **@ (Shift+2)** and press **<Enter>**.

Vmux-110 displays the following confirmation message:

```
Are you sure you want to update data base?  
Press Y/N :
```

2. Type **Y** to save the changes.

Vmux-110 displays the following message:

```
Data base was changed. Press any key to continue.
```

3. Press any key to continue the management session.

---

**Note** *Each time you update the Vmux-110 database, the management software analyzes the changes. If a major error is detected, Vmux-110 aborts the database update and displays the following message:*

```
Data base wasn't changed. Sanity Error - Check alarm.
```

*In this case, check the sanity error, as described in Chapter 7, and re-enter the erroneous values.*

---

➤ **To undo the changes:**

1. Type **# (Shift+3)** and press **<Enter>**.

Vmux-110 displays the following confirmation message:

```
Are you sure you want to undo data base?  
Press Y/N :
```

2. Type **Y** to abort the changes and use the previous database settings.

---

---

## 4.3 Starting the Control Session

Once you have installed Vmux-110, and completed the installation and operation procedures described in [Chapter 2](#) and [Chapter 3](#), you can start the control session.

You have to enter a user name and password in order to start the Vmux-110 management software (see [Figure 4-1](#)).

```
USER NAME:
PASSWORD:

ESC - clear; & - exit
```

*Figure 4-1. Password Request Screen*

► **To enter the user name and password:**

1. Type in your user name, and press **<Enter>**.
2. Type in your password (up to eight characters), and press **<Enter>**.

The Main menu is displayed (see [Figure 4-2](#)).

```
Main Menu

1. Inventory[]
2. Configuration>
3. Monitoring>
4. Diagnostics>

>

Please choose item <1 to 4>
@ - Db Update; # - Db Undo
ESC-prev.menu; !-main menu; &-exit
```

*Figure 4-2. Main Menu*

---

---

## 4.4 Displaying the Vmux-110 Inventory

Vmux-110 inventory displays information on its hardware and software versions.

► **To display the Vmux-110 inventory:**

- From the Main menu, choose **Inventory**.

The Vmux-110 inventory screen appears (see [Figure 4-3](#)).

```
Inventory
      HW Revision  FW Revision  SW Revision
Vmux110-E1      01.00         01.40         03.00
>
@ - Db Update; # - Db Undo
ESC-prev.menu; !-main menu; &-exit; ?-help
```

Figure 4-3. Inventory Screen (Vmux-110 Unit with E1 Voice Port)

---

**Note** The actual information shown in the Inventory screen depends on the Vmux-110 model in use.

---

---

---

## 4.5 Configuring the Vmux-110 System

The Vmux-110 management software allows you to perform the following:

- Configuring parameters of the Ethernet management connection
- Managing the user database (adding/deleting/changing user details)
- Configuring control port for ASCII terminal connection
- Defining the signaling bits table (for CAS signaling)
- Configuring SS7 keep-alive suppression rate (for CCS signaling)
- Controlling the software versions (see [Appendix B](#))
- Changing the real-time system clock settings
- Setting alarm LED severity (see [Chapter 7](#))
- Resetting Vmux-110
- Performing TFTP transfers (see [Downloading Application Files using the TFTP Client](#) on page [B-3](#))
- Configuring the main link
- Configuring the router mode

► **To display the System Configuration menu:**

1. From the Main menu, choose **Configuration**.

The Configuration menu appears (see [Figure 4-4](#)).

```
Configuration
1. System>
2. Switch LAN Configuration>
3. Voice Configuration>
4. Router Configuration>
5. Serial Port Configuration>
>
Please choose item <1 to 5>
@ - Db Update; # - Db Undo
ESC-prev.menu; !-main menu; &-exit
```

*Figure 4-4. Configuration Menu (Vmux-110 unit with E1 voice port)*

2. From the Configuration menu, choose **System**.

The System menu appears (see [Figure 4-5](#)).

```
System
1. Management>
2. Control Port>
3. Date & Time Update>
4. Factory Default
5. Show Partition Information
6. Set Active Partition
7. TFTP Transfer
8. Reset Unit
9. Open Internal Alarms>
10. Alarm Operations>
>
Please choose item <1 to 10>
@ - Db Update; # - Db Undo
ESC-prev.menu; !-main menu; &-exit
```

*Figure 4-5. System Menu*

## Configuring the Control Port

Vmux-110 allows you to configure the baud rate and the timeout of the rear panel CONTROL port.

### Configuring the Data Rate

The Vmux-110 control data port supports baud rates in the range of 9.6 to 115.2 kbps.

► **To configure the baud rate:**

1. From the System menu (see [Figure 4-5](#)), choose **Control Port**.

The Control Port menu appears (see [Figure 4-6](#)).

```
Control Port
1. Set Baud Rate (bps)> (9600)
2. Timeout (minutes)[3 - 10]... (3)
>
Please select item <1 to 2>
```

*Figure 4-6. Control Port Menu*

2. From the Control Port menu, choose **Set Baud Rate**.  
The Set Baud Rate menu appears.
3. Enter a new baud rate by typing the corresponding number from the Set Baud Rate menu, and then pressing **<Enter>**.

### Configuring the Timeout

The timeout specifies a time interval after which Vmux-110 automatically disconnects from the supervisory terminal if no input from the user is detected. Vmux-110 supports 3–10 minute timeout.

► **To configure the timeout:**

1. From the Control Port menu, choose **Timeout**.
2. Enter the desired timeout value by typing the corresponding number, and then pressing **<Enter>**.

## Configuring the Ethernet Management Connection

Vmux-110 can be managed by a network management station, which is located on the user LAN connected to the unit's 10/100BaseT port. In order to establish a proper connection, it is necessary to configure the following:

- Host IP address, subnets mask, default gateway, its trap, read and write communities.
- Manager IP addresses.

### Configuring the Host IP

IP parameters of the management host are configured via the Host IP menu (see [Figure 4-9](#)). Unlike more complex Vmux-2100 systems, which use separate IP addresses for their main link cards and E1/T1 groups, Vmux-110 provides only one IP address. This IP address is used for management connection and for bundle routing.

---

**Note** *When the router is enabled, the Host IP configuration is not applicable and the Host IP menu is not available.*

---

The following procedure applies only if the internal router is disabled.

► **To configure the IP host parameters:**

1. From the System menu, choose **Management**.

The Management menu appears (see [Figure 4-7](#)).

```
Management
1. Host IP>
2. Manager List[]>
3. Host Mux Name... (18.105)
4. User Administration>
5. Signaling Configuration>
6. Telnet> (Enable)
7. Main Link> (Serial Port)
8. Router (Disable)

>
Please choose item <1 to 7>
```

*Figure 4-7. Management Menu (Router Disabled)*

```
Management
1. SNMP community>
2. Manager List[]>
3. Host Mux Name... (18.105)
4. User Administration>
5. Signaling Configuration>
6. Telnet> (Enable)
7. Main Link> (Serial Port)
8. Router (Enable)
9. Ethernet Net/User Connection> (Layer 3 Routing)

>
Please choose item <1 to 9>
```

*Figure 4-8. Management Menu (Router Enabled)*

When the internal router is enabled, the Host IP menu option is replaced by the SNMP Community option and the Ethernet Net/User Connection option is added (see [Figure 4-71](#)).

2. From the Management menu, choose **Host IP**.

The Host IP menu appears (see [Figure 4-9](#)).

```
Host IP
1. Set Host IP address      ... (0.0.0.0)
2. Set Subnet Mask         ... (0.0.0.0)
3. Set Default Gateway     ... (0.0.0.0)
4. DHCP Client (disable/enable)
5. Read... (public)
6. Write.. (private)
7. Trap... (public)

>
Please choose item <1 to 7>
```

Figure 4-9. Host IP Menu

- From the Host IP, choose the following:
  - Set Host IP Address** to define the host IP
  - Set Subnet Mask** to define the subnet mask
  - Set Default Gateway** to set the default gateway IP address
  - DHCP Client** to enable or disable the DHCP client

---

**Note** *An unlimited lease time must be configured for DHCP client.*

---

- Read** to enter the name of a community with read-only authorization
- Write** to enter the name of a community with write authorization.
- Trap** to enter the name of a community to which the Vmux-110 will send traps

- Enter the desired value, and press **<Enter>**.

### Defining the Manager List

You can define the network management stations to which the SNMP agent of the Vmux-110 will send traps. Up to ten managers can be defined. In addition, you can configure Vmux-110 to accept Telnet management traffic only from the management stations defined in the manager list (see [Configuring Telnet Access](#) below).

► **To define the manager list:**

- From the Management menu, choose **Manager List**.  
The Manager List menu appears (see [Figure 4-10](#)).

```

Manager List

  Managers ID      IP Address
      1            0.0.0.0
      2            0.0.0.0
      3            0.0.0.0
      4            0.0.0.0
      5            0.0.0.0

1. Change cell                ... (0.0.0.0)
>
@ - Db Update; # - Db Undo
ESC-prev.menu; !-main menu; &-exit; ?-help

```

Figure 4-10. Manager List Menu

2. Select a manager by pressing **<Shift> U** to choose the previous entry in the list or **<Shift> D** to choose the next entry in the list.
3. Choose **Change cell**.
4. Enter the desired IP address, and press **<Enter>**.

## Configuring Telnet Access

You can disable Telnet access to Vmux-110 or allow access only to the management stations specified in the manager list (see [Defining the Manager List](#) above).

By disabling Telnet, you prevent unauthorized access to the system when security of the Vmux-110 IP address has been compromised. When Telnet access is disabled, Vmux-110 can be managed via an ASCII terminal or RADview.

► **To configure the Telnet access:**

1. From the Management menu ([Figure 4-7](#)), choose **Telnet**.  
The Telnet menu appears (see [Figure 4-11](#)).

```

Telnet (Enable)

1. Disable
2. Enable
3. Enable Managers Only

>

Please select item <1 to 3>

```

Figure 4-11. Telnet Menu

2. From the Telnet menu, choose **Disable** to disable Telnet access, choose **Enable** to enable it, or choose **Enable Managers Only** to grant the Telnet access only to the management stations specified in the manager list.

## Managing the User Database

An administrator manages the database of users who are allowed to operate or monitor the Vmux-110 system. This allows the administrator to do the following:

- Add a new user
- Delete an existing user
- Change user's details, including the name, password or access level
- Display the list of users, including date and time.

### Adding a New User to the Database

► **To add a new user:**

1. From the Management menu (see [Figure 4-7](#)), choose **User Administration**.  
The User Administration menu appears (see [Figure 4-12](#)).

```
User Administration
1. Add New User>
2. Delete User>
3. Change User details>
4. Show all users[]
>
Please choose item <1 to 4>
```

*Figure 4-12. User Administration Menu*

2. From the User Administration menu, choose **Add New User**.  
The Add New User menu appears (see [Figure 4-13](#)).

```
Add New User
1. Enter UserName          ... ()
2. Enter Access Level     > (x)
3. Enter Password        ...
4. Confirm Password and save ...
>
Please choose item <1 to 4>
```

*Figure 4-13. Add New User Menu*

3. From the Add New User menu, choose **Enter UserName**.
4. Type a new user name, and then press **<Enter>**.  
A new user name appears.

---

**Note** *User names are case-sensitive.*

---

5. From the Add New User menu, choose **Enter Access Level** to define the new user access level.

6. Choose the desired value (Monitor, Technician, Operator or Administrator) by entering the corresponding number from the Enter Access Level menu.  
An access level of a new user is displayed.
7. From the Add New User menu, choose **Enter Password**.
8. Type the new user password (four to eight characters), and press **<Enter>**.  
Vmux-110 responds to the password entry with asterisks.
9. From the Add New User menu, choose **Confirm Password and save**.
10. Re-type the new user password, and press **<Enter>** to save it.

### Deleting an Existing User from the Database

► **To delete an existing user:**

1. From the User Administration menu, choose **Delete User**.

The Delete User menu appears (see [Figure 4-14](#)).

```
Delete User

1. Enter UserName (to delete)      ... ()
2. Confirm and delete             ...

>

Please select item <1 to 2>
```

*Figure 4-14. Delete User Menu*

2. From the Delete User menu, choose **Enter UserName (to delete)**.
3. Type the name of the user that you intend to delete, and press **<Enter>**.
4. From the Delete User menu, choose **Confirm and delete**.
5. Enter the administrator password to confirm the deletion.

### Changing the User Details

The administrator is allowed to change a user's password and access level.

► **To change user details:**

1. From the User Administration menu, choose **Change User Details**.

The Change User Details menu appears (see [Figure 4-15](#)).

```
Change User details
1. Enter UserName (to change)      ... ()
2. Change password                  ...
3. Confirm and save password       ...
4. Change access level             >  (x)
5. Confirm and save access level   ...

>
Please select item <1 to 5>
```

Figure 4-15. Change User Details Menu

2. From the Change User Details menu, choose **Enter UserName (to change)**.
3. Type the name of the user whose details you want to change, and press **<Enter>**.
4. From the Change User Details menu, choose **Change password**.
5. Type the new password, and press **<Enter>**.
6. From the Change User Details menu, choose **Confirm and save password**.
7. Re-type the new password, and press **<Enter>** to confirm the change.
8. From the Change User Details menu, choose **Change access level**.  
The Change Access Level menu appears.
9. Enter a new access value (Monitor, Technician, Operator or Administrator) by entering the corresponding number from the Change Access Level menu.
10. From the Change User Details menu, choose **Confirm and save access level**.
11. Enter administrator password to confirm the change.

### Displaying the User List

► **To display a list of registered users:**

- From the User Administration menu, choose **Show All Users**.

The Show All Users screen appears (see [Figure 4-16](#)). Press **<D>** to scroll down the list; press **<U>** to scroll up the list.

```

Show all users

      UserName   Access Level   DBchange date   DBchange time
1      admin     Administrator   3/1/2056        17:08:27
2      qwerty    Monitor
3
4
5
6
7
8
9
10
>

@ - Db Update; # - Db Undo
ESC-prev.menu; !-main menu; &-exit; ?-help

```

Figure 4-16. Show All Users Screen

## Setting the Date and Time

You can set the time on the Vmux-110 internal real-time clock.

### ► To set date and time:

1. From the System menu (see [Figure 4-5](#)), choose **Date & Time Update**.

The Date & Time Update menu appears (see [Figure 4-17](#)).

```

Date & Time Update

1. Set Time (hh:mm)... (22:39)
2. Set Date (dd/mm/yyyy)... (10/1/2056)

>
Please select item <1 to 2>

```

Figure 4-17. Date & Time Update Menu

2. From the Date & Time Update menu, choose **Set Time**.
3. Type the new time value in the hh:mm format, and then press **<Enter>**.
4. From the Date & Time Update menu, choose **Set Date**.
5. Type the new date value in the dd/mm/yyyy format, and then press **<Enter>**.

## Assigning a Name to the Vmux-110 Unit

The Vmux-110 management software allows you to assign a name to the unit to distinguish it from the other devices installed in your system.

### ► To assign a name:

1. From the Management menu ([Figure 4-7](#)), choose **Host Mux Name**.
2. Type the name you want to use to identify this Vmux-110 device, and then press **<Enter>**.

The assigned name appears at the top of each terminal screen.

---

---

## 4.6 Configuring Signaling Information for E1/T1 Ports

Vmux-110 allows you to configure the signaling parameters according to the chosen signaling mode: CAS for E1, Robbed Bit MF for T1 or CCS for E1/T1. The signaling mode is configured via the E1/T1 Parameters menu of the voice card (see the [Configuring the E1 Voice Port](#) section below).

- **CAS/Robbed Bit MF** – You must configure a signaling profile and signaling table associated with it (ABCD bits, idle code and OOS signals). By default, ABCD bits are transmitted transparently.
- **CCS** – When working with CCS-SS7, you should configure the fill-in signal unit (FISU) packets flow by choosing the SS7 keep-alive suppression rate. For optimal performance, an initial suppression rate of 30% is recommended.

---

**Note** *When changing from CCS to CAS signaling, the Vmux-110 unit must be rebooted.*

---

### Configuring Signaling Profiles

If you are using CAS signaling, you must configure the Vmux-110 signaling system to make it compatible with the signaling method used by the PBXs connected to the voice E1 or T1 port. The management software allows you to manipulate the ABCD signaling bits and methods of representation of the idle code and out-of-service signals generated by the PBXs (see [Table 4-1](#)). Signaling conversion is used to connect to PBXs that use different signaling formats.

You can store up to five signaling profiles; Vmux-110 uses only one of them at a time. The signaling profile is configured via the E1/T1 Parameters menu of the E1/T1 card (see the [Configuring the E1 Voice Port](#) section below).

---

**Note** *Signaling profile translates bits from network side to user side (uplink).*

---

---

**Note** *The signaling profile configuration is available only for the units operating with CAS signaling.*

---

► **To configure the signaling profile:**

1. From the Management menu (see [Figure 4-7](#)), choose **Signaling Configuration**.

The Signaling Configuration menu appears (see [Figure 4-18](#)).

```
Signaling Configuration
1. Signaling Profile Configuration>
2. SS7 Keep-Alive Suppression rate> ( 0% - No Suppression / Not SS7)
>
Please select item <1 to 2>
```

Figure 4-18. Signaling Configuration Menu

- From the Signaling Configuration menu, choose **Signaling Profile Configuration**.

The Signaling Profile Configuration menu appears (see [Figure 4-19](#)).

```

Signaling Profile Configuration

1. Profile Number To Configure [1 - 5]      ... (1)
2. Signaling Table Configuration           []>

>

Please select item <1 to 2>

```

*Figure 4-19. Signaling Profile Configuration Menu*

- From the Signaling Profile Configuration menu, choose **Profile Number To Configure**.
- Type the number of the signaling profile that you want to configure by typing a number from **1** to **5**, and then press **<Enter>**.
- From the Signaling Profile Configuration menu, choose **Signaling Table Configuration**.

The Signaling Table Configuration screen appears (see [Figure 4-20](#)).

```

Signaling Table Configuration

          A Bit  B Bit  C Bit  D Bit
ABCD BITS  A    B    C    D
IDLE SIGNAL  1    0    0    0
OOS  SIGNAL  1    0    0    0

1. 0          9. D
2. 1          10. NOT D
3. A
4. NOT A
5. B
6. NOT B
7. C
8. NOT C

>

Please select item <1 to 10>

```

*Figure 4-20. Signaling Table Configuration Screen*

- In the signaling table, select the signaling bit that you want to configure by pressing **<Tab>**.
- Configure the signaling bit by typing a number corresponding to the desired value (see [Table 4-1](#)), and then pressing **<Enter>**.

Table 4-1. Signaling Bits Configuration

Parameter	Description	Value
A, B, C, D Bit	Chooses which incoming bit (from the remote side) to transmit on the A bit toward the Vmux-110's local PBX.	<b>0</b> – Transmits zero <b>1</b> – Transmits one <b>A</b> – Transmits the incoming A bit <b>B</b> – Transmits the incoming B bit <b>C</b> – Transmits the incoming C bit <b>D</b> – Transmits the incoming D bit <b>NOT A</b> – Inverts the incoming A bit and transmits it <b>NOT B</b> – Inverts the incoming B bit and transmits it <b>NOT C</b> – Inverts the incoming C bit and transmits it <b>NOT D</b> – Inverts the incoming D bit and transmits it
IDLE SIGNAL	Chooses the code transmitted on A, B, C, and D bit when the channel is idle	<b>0</b> – Transmits zero <b>1</b> – Transmits one
OOS SIGNAL	Chooses the code transmitted on A, B, C, and D bit when the channel is out of service	<b>0</b> – Transmits zero <b>1</b> – Transmits one

## Configuring Keep-Alive Suppression Rate

When Vmux-110 with CCS signaling is connected to PBXs operating with SS7 signaling, the PBXs use one timeslot to transmit signaling information. The signaling information is passed over the signaling link in the form of the following signal units:

- **Message signal units** (MSUs) provide all signaling associated with call setup and tear down, database query and response, and SS7 network management.
- **Link status signal units** (LSSUs) provide information on the link status between the network nodes (initiation of link alignment, quality of the signaling traffic etc).
- **Fill-in signal units** (FISUs) carry no information payload. They occupy the link, when there are no MSUs or LSSUs to send. FISUs are also referred to as “keep-alive” messages.

Often, in the absence of signaling traffic, the signaling links become flooded with the FISUs, causing communication disruptions. In order to prevent this, you can instruct Vmux-110 to drop a specified amount of FISUs (up to 90%). You can also disable the FISU dropping by configuring the keep-alive suppression rate to 0%. This is necessary when working with non-SS7 CCS signaling (for example, ISDN), or if the FISUs are used to acknowledge the receipt of signaling messages. In the latter case, system performance may become unsatisfactory.

For optimal performance, an initial suppression rate of 30% is recommended, which can then be adjusted as needed.

► **To configure the keep-alive suppression rate:**

1. From the Signaling Configuration menu (see [Figure 4-18](#)), choose **SS7 Keep-Alive Suppression Rate**.

The SS7 Keep-Alive Suppression Rate menu appears (see [Figure 4-21](#)).

```
SS7 Keep-Alive Suppression rate ( 0% - No Suppression / Not SS7)
1. 0% - No Suppression / Not SS7
2. 10%
3. 20%
4. 30%
5. 40%
6. 50%
7. 60%
8. 70%
9. 80%
10. 90%
>
Please select item <1 to 10>
```

*Figure 4-21. SS7 Keep-Alive Suppression Rate Menu*

2. From the SS7 Keep-Alive Suppression Rate menu, type the number corresponding to the desired value, and then press **<Enter>**.

---

## 4.7 Configuring the Main Link

It is recommended to configure the main link in the following order:

1. Choose the main link interface you want to use.
2. Configure the Ethernet Network port.
3. Configure the Serial port (only if main link is NOT Ethernet).

### Choosing the Main Link Interface

Either the Ethernet Network port or the Serial port can be selected as the main link for the Vmux-110.

► **To specify the main link interface:**

1. From the Management menu (see [Figure 4-7](#)), choose **Main Link**.  
The Main Link menu appears.
2. Choose the interface which will be the Vmux-110 main link:
  - Serial Port – Serial Link is the uplink
  - LAN – Network Ethernet port is the uplink.

## Configuring the Ethernet Network Port

### Configure the Ethernet Port Operation Mode

► **To configure the Ethernet Network port operation:**

1. From the Configuration menu (see [Figure 4-4](#)), choose **Switch LAN Configuration**.

The Switch LAN Configuration menu appears (see [Figure 4-22](#))

```
Switch LAN Configuration
1. Network Port Configuration>
2. User Port Configuration>
3. VLAN Table Configuration>
>
Please select item <1 to 4>
```

*Figure 4-22. Switch LAN Configuration Menu*

2. To configure the Ethernet link, choose **Network Port Configuration**

The Network Port Configuration menu appears (see [Figure 4-23](#)).

```
Network Port Configuration
1. Set Auto Negotiation      (Disable)
2. Set Default Type >      (10baseT Half Duplex)
3. VLAN Tagging Mode >    (Unmodified)
4. Default VLAN Id [1 - 4094]... (1)
5. Default Priority [0 - 7]... (0)
6. VLAN Security Mode >   (Off)
7. Ingress Rate Limit >   (No Limit)
>
Please select item <1 to 7>
```

*Figure 4-23. Network Port Configuration Menu*

The Ethernet ports of the Vmux-110 support autonegotiation. If the autonegotiation is disabled, the Ethernet ports can be configured to operate in 10BaseT (half duplex or full duplex) or 100BaseT (half duplex or full duplex) mode.

---

**Note** *If autonegotiation is enabled in the Vmux-110, but is not employed at the device connected to the Vmux-110, the Vmux-110 will automatically default to 10BaseT and half duplex.*

---

3. From the Network Port Configuration menu, choose **Set Auto Negotiation** to toggle the autonegotiation setting between *enable* and *disable*.
4. If autonegotiation is disabled, choose **Set Default Type** from the Network Port Configuration menu.

The Set Default Type menu appears.

5. Choose the desired LAN operation mode (10BaseT half duplex, 10BaseT full duplex, 100BaseT half duplex, 100BaseT full duplex), by typing the corresponding number and then pressing **<Enter>**.

### Configure the Ethernet Port VLAN Parameters

► **To configure the Ethernet Network port VLAN parameters:**

1. Choose **VLAN Tagging Mode** from the Network Port Configuration menu to select how the packets are tagged when they leave (egress) this port.  
The VLAN Tagging Mode menu appears.
2. Choose the desired VLAN tagging mode:
  - Unmodified – packets will be passed transparently by the port, no VLAN tag will be added or removed
  - Untagged – port removes the packets' original VLAN tag (if such exist). This may be desired when the port is operating as a user port transmitting only data
  - Tagged – one tag only will be attached to the packets leaving this port. This tag will either be the packets' original tag, or if non-existent, then the packets will be tagged with the default VLAN ID of the port from which they were received
  - Double – the port always adds the default VLAN ID of the port from which the packets were received, to the packets leaving it. When working in this mode, the opposite Vmux should also be set to Double.

---

**Note** *All VLAN tagging modes (other than Double) affect only packets without VLAN IDs that are listed in the Vmux-110's VLAN table. Packets with recognized VLAN IDs are processed according to the rules of the table.*

---

3. Choose **Default VLAN Id** to define the default VLAN ID number that will be tagged to packets that enter (ingress) this port.
  - Select any unique number between **1** to **4094**
4. Choose **Default Priority** to designate the default priority level of the VLAN tag assigned to packets that enter (ingress) this port.
  - **0** to **7** (where 7 is the highest level)
5. Choose **VLAN Security Mode** to prevent untagged packets, or packets without recognized tags (i.e. not registered in the Vmux-110's VLAN Table) from being accepted:
  - **Off** – All packets are accepted
  - **On** – Packets without recognized VLAN ID numbers are discarded.

## Configure the Ethernet Port Ingress Rate Limit

To solve the problem of transferring voice as well as 10/100 Mbps Ethernet data over a TDM serial uplink with a small bandwidth (such as for satellite applications), the ingress data rate on the Ethernet ports can be limited.

### ► To set the Ingress Rate Limit:

1. Choose **Ingress Rate Limit** from the Network Port Configuration menu (this parameter is only available if the Main Link has been set to Serial Port).
2. Select one of the available values to define the limit of the data traffic that will be allowed to enter the Ethernet port
  - **No Limit** – Ethernet port data intake is unlimited
  - **128K to 2M** – Ethernet port data intake is limited to the specified data rate (in kbps or Mbps: 128K, 256K, 512K, 1M, 2M).

## Configuring the Serial Port

The Serial port can be configured as the main link of the Vmux-110 to n x 64 kbps networks.

### ► To configure the Serial port:

1. From the Configuration menu (see [Figure 4-4](#)), choose **Serial Port Configuration**.

The Serial Port Configuration menu appears (see [Figure 4-24](#)).

**Note** *The VLAN Parameters option is available only if the router is disabled and the main link is the serial port.*

```
Serial Port Configuration
1. Interface Type >   (V35)
2. Connect>         (Yes)
3. Speed (N*64) [1 - 32]... (64)
4. Clock Mode >     (DTE)
5. Clock Invert>    (No)
6. Control Signals> (Ignore)
7. Fragmentation [200 - 1550]... (610)
8. HDLC Mode >     (Transparent HDLC)
9. VLAN Parameters

>
Please select item <1 to 8>
```

Figure 4-24. Serial Port Configuration Menu

2. From the Serial Port Configuration menu, configure the following parameters:
  - Interface Type:
    - **V35** for V.35
    - **X21** for X.21

- **EIA-530** for RS-530
- **EIA-530-A** for RS-530A
- Connect:
  - **Yes** – port is connected
  - **No** – port is not connected.
- Speed – port data rate, in rates of n x 64 kbps between **64** and **2048** kbps.
- Clock Mode:
  - **DTE** – Vmux-110 transmit and receive timing are according to clock signals received from the connected communication equipment
  - **DCE** – Vmux-110 provides the transmit and receive clock signals, derived from its internal oscillator, to the communication equipment connected to the link.

---

**Note** *Each clock mode requires a different cable. Please refer to Appendix A for more information.*

---

- Clock Invert – In a few rare cases, even though the Serial uplink is correctly configured, there are problems with line synchronization. In this case, inverting the clock often resolves the line synchronization problem.
  - **Yes** – Invert the clock
  - **No** – Clock is not inverted.
- Control Signals (available only if the Serial uplink's Interface type is V.35 and in DTE clock mode) – determines whether Vmux-110 monitors the control signals. For example, if the DCD signal is not sensed, Vmux-110 will know there is a problem with the line connection and will trigger the TRUNK IS DOWN alarm:
  - **Ignore** – Do not monitor the control signals
  - **Obey** – Monitor the control signals.
- Fragmentation – Vmux-110 chops up the Ethernet packets directed from the LAN to the Serial uplink. This parameter specifies the size of the chopped-up Ethernet packets. Specify a value between **200** and **1550**.
- HDLC Mode – In typical applications where Vmux-110 units operate opposite each other, the HDLC data is transmitted transparently over the serial link. However, for Vmux-110 operation opposite certain Cisco equipment, a special mode that uses a compatible HDLC header is available.
  - **Transparent HDLC** – Default HDLC header is used, LAN data is transmitted transparently over the serial link
  - **CISCO Bridged Eth** – HDLC header is compatible with that used in certain Cisco equipment.

## 4.8 Configuring the Serial Port VLAN Parameters

When the Serial port is used as the Vmux-110 main link, and the router is disabled, the packet traffic leaving the internal Ethernet switch can be tagged to support VLANs. This allows the Ethernet traffic coming from the user or network port to be identified.

► **To configure the Serial Port VLAN parameters:**

1. From the Serial Port Configuration menu (see [Figure 4-22](#)), choose **VLAN Parameters** (the main link must be set to Serial Port and the router must be disabled for this option to be available –refer to [Choosing the Main Link Interface](#) section above and to [Configuring the Internal Router](#) on page 4-56).

The VLAN Parameters menu appears (see [Figure 4-25](#)).

```
VLAN Parameters

1. VLAN Tagging Mode > (Unmodified)
2. Default VLAN Id [1 - 4094]... (1)
3. Default Priority [0 - 7]... (0)
4. VLAN Security Mode > (Off)
>
Please select item <1 to 4>
```

Figure 4-25. VLAN Parameters Menu

2. Choose **VLAN Tagging Mode** from the VLAN Parameters menu to select how packets are tagged when they leave (egress) this port.

The VLAN Tagging Mode menu appears.

3. Choose the desired VLAN tagging mode:
  - **Unmodified** – packets will be passed transparently by the Internal port, no VLAN tag will be added or removed
  - **Untagged** – port removes the packets' original VLAN tag (if such exist).
  - **Tagged** – one tag only will be attached to the packets leaving the Internal port. This tag will either be the packets' original tag, or if non-existent, then the packets will be tagged with the default VLAN ID of the port from which they were received
  - **Double** – the Internal port always adds the default VLAN ID of the port from which the packets were received, to the packets leaving it. When working in this mode, the opposite Vmux should also be set to Double.

**Note** *All VLAN tagging modes (other than Double) affect only packets without VLAN IDs that are listed in the Vmux-110's VLAN table. Packets with recognized VLAN IDs are processed according to the rules defined in the table.*

4. Choose **Default VLAN Id** to define the default VLAN ID number that will be tagged to packets that enter (ingress) the Internal port.
  - Select any unique number between **1** to **4094**
5. Choose **Default Priority** to designate the default priority level of the VLAN tag assigned to packets that enter (ingress) the Internal port.
  - **0** to **7** (where 7 is the highest level)
6. Choose **VLAN Security Mode** to prevent untagged packets, or packets without recognized tags (i.e. not registered in the Vmux-110's VLAN Table) from being accepted by the Internal port:
  - **Off** – all packets are accepted
  - **On** – packets without recognized VLAN ID numbers are discarded.

---

## 4.9 VLAN Table Configuration

The VLAN table contains all the VLAN IDs recognized by the Vmux-110. The VLAN table can support up to 64 entries. Each VLAN table entry defines the packet egress policy for the Network, User and Internal ports separately.

**Note** *If the VLAN table is used, the definitions in it override the VLAN Tagging Modes set separately in the Network/User Port and the VLAN Parameters Menus. However, a port set to **Double** mode will continue to always add the default VLAN ID of the port from which the packets were received, to the packets leaving it.*

► **To configure a VLAN ID:**

1. From the Switch LAN Configuration menu (see [Figure 4-22](#)), choose **VLAN Table Configuration**.

The VLAN Table Configuration menu appears (see [Figure 4-26](#)):

```
VLAN Table Configuration
1. Display Table[]
2. Add/Edit VLAN>
3. Delete VLAN[1 - 4094]... (1)
>
Please select item <1 to 3>
```

*Figure 4-26. VLAN Table Configuration Menu*

2. From the VLAN Table Configuration menu), choose **Add/Edit VLAN**.  
The Add/Edit VLAN menu appears.

Note that the options available in this menu vary, depending on which port is selected as the main link (see [Figure 4-27](#) and [Figure 4-28](#)).

```
Add/Edit VLAN

1. VLAN Id[1 - 4094]... (1)
2. Network Port> (Forbidden)
3. User Port> (Forbidden)
4. Voice + Mng Port> (Forbidden)
>
Please select item <1 to 4>
```

Figure 4-27. Edit VLAN Menu (Main link = Ethernet port)

```
Add/Edit VLAN

1. VLAN Id[1 - 4094]... (1)
2. Network Port> (Forbidden)
3. User Port> (Forbidden)
4. Serial + Mng Port> (Forbidden)
>
Please select item <1 to 4>
```

Figure 4-28. Edit VLAN Menu (Main Link = Serial Port)

3. Choose **VLAN Id** and then enter the ID number of the VLAN that you want to add or edit. ID numbers between 1 and 4094 can be used.
  4. Set the VLAN policy for the **Network, User** and **Voice + Mng** or **Serial + Mng** ports:
    - **Unmodified** – packets with this VLAN are allowed to leave (egress) unmodified from this port
    - **Forbidden** – packets with this VLAN are blocked from leaving this port
    - **Untagged** – packets with this VLAN are stripped of their original VLAN tag (if such exist) and then passed forward
    - **Tagged** – packets with this VLAN will be passed forward tagged.
- **To display the VLAN Table:**
- From the VLAN Table Configuration menu, select **Display Table**
- The VLAN Table Display Screen is displayed (see [Figure 4-29](#)).

```

Display Table

      VLAN Id      Network Port      User Port      Voice + Mng Port
      1            Unmodified      Tagged         Unmodified
      2            Tagged          Tagged         Tagged
      13           Tagged          Forbidden      Unmodified
      666           Forbidden       Tagged         Forbidden
      4094          Unmodified      Unmodified     Unmodified

>
@ - Db Update; # - Db Undo
ESC-prev.menu; !-main menu; &-exit; ?-help

```

Figure 4-29. VLAN Table Display Screen (Main link = Ethernet port)

```

Display Table

      VLAN Id      Network Port      User Port      Serial + Mng Port
      1            Unmodified      Tagged         Unmodified
      2            Tagged          Tagged         Tagged
      13           Tagged          Forbidden      Unmodified
      666           Forbidden       Tagged         Forbidden
      4094          Unmodified      Unmodified     Unmodified

>
@ - Db Update; # - Db Undo
ESC-prev.menu; !-main menu; &-exit; ?-help

```

Figure 4-30. VLAN Table Display Screen (Main Link = Serial Port)

➤ **To delete a VLAN ID from the VLAN Table:**

- From the VLAN Table Configuration menu, select **Delete VLAN** and enter the VLAN ID number you wish to delete, and then press **<Enter>**.

## 4.10 Configuring the Voice Ports

It is recommended to configure the voice port in the following order:

1. Configure the voice port at a bundle level (frame size, destination IP, destination bundle, packetizing interval, TOS parameters, compression method, fax relay, VLAN parameters).
2. Configure the voice port at the physical level (framing mode, restoration time, clock source, interface type, idle code, signaling type, signaling profile).
3. Configure the timeslots (voice or data, mapping to specific bundles, routing to remote Vmux-2100 ports and timeslots).

### Configuring Bundles

Voice timeslots are grouped together into bundles. Vmux-110 supports 12 bundles, with a maximum of 31 timeslots per bundle.

Before configuring bundles, you must add at least one bundle.

#### Configuring E1/T1 Bundles

► **To add a bundle for the E1/T1 port:**

1. From the Configuration menu ([Figure 4-4](#)), choose **Voice Configuration**.  
The Voice Configuration menu appears ([Figure 4-31](#)).

```
Voice Configuration
1. Bundles Parameters>
2. E1 Parameters>
3. Distribution Of Framer Time Slots>
>
Please select item <1 to 3>
```

*Figure 4-31. Voice Configuration Menu*

2. From the Voice Configuration menu, choose **Bundles Parameters**.  
The Bundles Parameters menu appears (see [Figure 4-32](#)).

```
Bundles Parameters
1. Display Bundles[]
2. Bundle Configuration >
>
Please select item <1 to 2>
```

*Figure 4-32. Bundles Parameters Menu*

3. From the Bundles Parameters menu, choose **Bundle Configuration**.  
The Bundle Configuration menu appears (see [Figure 4-33](#)).

```

Bundle Configuration

1. Add Bundle[1 - 12]... (1)
2. Delete Bundle[1 - 12]... (1)
3. Edit Bundle>

>

Please select item <1 to 3>

```

Figure 4-33. Bundle Configuration Menu

4. From the Bundle Configuration menu, choose **Add Bundle**.
  5. Type the number to assign to the bundle you are adding and then press **<Enter>**. The bundle number must be in the range from 1 to 12.
- **To configure an existing bundle on an E1/T1 port:**
1. From the Bundle Configuration menu (see [Figure 4-33](#)), choose **Edit Bundle**. The Edit Bundle menu appears (see [Figure 4-34](#)).

```

Edit Bundle

1. Enter Bundle Number[1 - 12]... (1)
2. Connect> (Yes)
3. Function> (TDMoIP)
4. Routing Parameters>
5. Max Bytes In Multiplexed Frame[100 - 1461]... (500)
6. Packetizing Interval (msec)[10 - 90]... (30)
7. Connectivity Parameters>
8. Voice Parameters>
9. Transparent Jitter Size (N x 10mSec)[2-30]... (2)
10. Bundle Name... ()

>

Please select item <1 to 12>

```

Figure 4-34. Edit Bundle Menu for Vmux-110 with E1/T1 Port

2. From the Edit Bundle menu, type **1**, press **<Enter>**, and then enter the number of the bundle you want to configure.
3. Configure the following parameters of the selected bundle:
  - **Connect:**
    - **Yes** –bundle is connected
    - **No** –bundle is not connected
  - **Function:**
    - **TDMoIP** –Uses the TDMoIP protocol to transmit the voice and data over the network. For IP-based networks, this option must be used.
    - **AAL2oMPLS** –Uses the AAL2oMPLS protocol to transmit the voice and data over the network. This option, which requires less bandwidth than TDMoIP, may be used for non-IP networks.

- Routing Parameters

```

Routing Parameters
1. Destination IP... (0.0.0.0)
2. Destination Bundle[1 - 30]... (1)
3. TOS Parameters>
4. VLAN Parameters>

>

Please select item <1 to 5>
@ - Db Update; # - Db Undo
ESC-prev.menu; !-main menu; &-exit

```

Figure 4-35. Routing Parameters Menu (E&M)

- Destination IP – IP address of the destination Vmux-2100 group or Vmux-110
- Destination Bundle – number of the destination bundle of the group with the IP address specified in the previous step: **1 to 30**
- TOS Parameters – standard Type of Service parameters of the outgoing IP frames:
  - Precedence (Routine, Priority, Immediate, Flash, Flash Override, Critic/Ecp, Internetwork Control, Network Control)
  - Delay (Normal, Low)
  - Throughput (Normal, High)
  - Reliability (Normal, High).

```

TOS Parameters
1. Precedence > (Routine)
2. Delay > (Normal)
3. Throughput > (Normal)
4. Reliability> (Normal Reliability)

>

Please select item <1 to 4>

```

Figure 4-36. TOS Parameters Menu

- VLAN Parameters –enable/disable virtual LAN tagging, specify VLAN number, and its priority:
  - Vlan Id: **26 to 4094**
  - Vlan Priority: **0** (minimum) to **7** (maximum).

```
VLAN Parameters

1. Vlan Exist > (Yes)
2. Vlan Id [26 - 4094]... (26)
3. Vlan Priority [0 - 7]... (1)
>

Please select item <1 to 3>
```

Figure 4-37. VLAN Parameters Menu

- Max Bytes In Multiplexed Frame –size of a multiplexed TDMoIP frame in bytes:
  - **100 to 1461** bytes

**Note** This parameter is affected by the number of transparent timeslots configured. The minimum value required for this parameter for “N” transparent timeslots is  $N \times 80 \times (\text{Packetizing Interval} / 10)$

- Packetizing Interval (msec) – maximum time interval allocated for the TDMoIP frame aggregation:
  - **10 to 90** msec

**Note** When configuring transparent timeslots, the recommended value for the “Packetizing Interval” parameter is 10 msec.

- Connectivity parameters –keep-alive messages configuration

```
Connectivity Parameters

1. Connectivity Mode >(with ping)
2. Connectivity-packet rate (sec)[1 - 60]... (60)
3. Connectivity timeout cycles[1 - 5]... (3)
>

Please select item <1 to 3>
```

Figure 4-38. Connectivity Parameters Menu

Vmux-110 constantly monitors the status of all connected bundles, by sending 64-byte keep-alive messages to the remote device. Connectivity is confirmed by receiving a reply from the remote unit. This process is similar to pinging remote IP hosts. If a reply is not received, usually due to a main link failure, Vmux-110 disconnects the bundle and generates the BUNDLE IS OOS (Out Of Service) alarm. When the BUNDLE IS OOS alarm is generated, Vmux-110 notifies the PBX by sending “all 1s” string (CCS signaling) or the OOS message (CAS signaling) on all timeslots of the disconnected bundle. This notification allows the attached PBX to stop transmitting over a faulty link and to switch to a backup link.

You can specify the following connectivity parameters:

- Connectivity mode - the mode used to check for connectivity: With Ping: (ping is used, which may be blocked by some firewalls)  
Without Ping: (Vmux-110 layer 4 OAM messages are used to monitor connectivity).
- Connectivity packet rate –frequency of sending the keep-alive packets, from one packet per **1** second to one packet per **60** seconds
- Connectivity timeout cycles –number of attempts within which Vmux-110 expects to receive at least one reply from the remote device.

For example, if you set the connectivity packet rate to 60 seconds and connectivity timeout to 3, Vmux-110 disconnects a bundle from which it did not receive at least one reply within 180 seconds.

**Note** *In IP networks, where delays are more common, it is recommended to set the connectivity parameters to their maximum values.*

- Voice Parameters (see [Figure 4-39](#)):

```
Voice Parameters
```

```
1. Coder/Rate (kbps)> (G.723.1/6.4)
2. Volume> (0 dB)
3. Fax/Modem>
4. MF Parameters>
5. Custom Tone Detection>
6. Noise level for VAD> (low)
7. Echo Canceller> (Enable)
8. Coding> (A-Law)
>
```

```
Please select item <1 to 7>
```

*Figure 4-39. Voice Parameters Menu for E1/T1 Port*

- Coder/Rate –compression algorithm and corresponding rate:
  - G.723.1/6.4** –as per G.723.1 requirements at 6.4 kbps
  - G.723.1/5.3** –as per G.723.1 requirements at 5.3 kbps
  - G.729A/8** –as per G.729 A requirements at 8 kbps
  - G.711 a LAW** –as per G.711 requirements, A-law companding
  - G711 u LAW** –as per G.711 requirements,  $\mu$ -law companding.

The Coder/Rate configuration must be identical on both the local and the remote devices.

Note that this setting is used by the DSP at both the local and remote VMUX, and is unrelated to the Coding setting (#7 in this menu).
- Volume –sets the volume gain transmitted from the DSPs towards the PBX. For example, if the gain received from the remote voice switch/PBX is very low, you may set the volume to +3 dB, thereby amplifying the TX

- voice volume without the need to change the configuration of the voice switch. **-6 dB** to **+6 dB** in steps of 1 dB.
- Fax/Modem –configure fax and modem settings
    - Modem – **enable/disable** the modem signal identification and relay
    - Fax – **enable/disable** the fax signal identification and relay
    - Fax Rate – set the fax transmission rate (in kbps): **4.8, 9.6, 14.4**.
  - MF Parameters – configure MF parameters
    - MFCR2 Relay – **enable/disable** MF tone relay
    - Minimum Pulse Width – minimum pulse width of the MF tone to be detected and relayed: **45** to **300** msec
    - Minimum Power Level – minimum power level of the MF tone to be detected and relayed: **0** to **-35** dBm.
    - Compelled – if enabled, this feature shortens the call setup delay when using MFCR2 signaling by sending MF Forward Tone acknowledge after the Min Tone Duration expires. If your PBX uses MFC, set this parameter to **Enable**.
    - Min Tone Duration –the waiting period (in msec) after which the compelled MF Forward Tone acknowledge will be sent: **60** to **400** msec.
  - Custom Tone Detection –set tone detection parameters
    - Tone Detection –enable/disable tone detection. Enable if the PBX/Voice switch checks the line quality before establishing a call on a specific timeslot. The line is checked by sending a 2000 Hz tone on the line. Since Vmux-110 compresses the Voice, the tone is usually also compressed and as a result the PBX may fail to detect the originated 2000 Hz tone. When Tone Detection is enabled, upon detecting a 2000Hz tone, the DSP sends a message to the remote DSP to generate this specific 2000 Hz tone (tone relaying).
    - Select Tone –the frequency of the tone to be detected and relayed: **2000** Hz.
  - Noise level for VAD – set the acceptable noise level for Voice Activity Detection (VAD):
    - High:** VAD mechanism sensitivity is higher than detection threshold
    - Low:** VAD mechanism sensitivity is lower than detection threshold
  - Echo Canceller –enable/disable the built-in echo canceller, which supports up to a 32 msec delay.
    - If you have an external echo canceller on your telephone network, disable the built-in Vmux-110 DSP echo canceller.
  - Coding –set the coding used by your PBX:
    - A-Law** – usually used for E1
    - U-Law** –  $\mu$ -Law, usually used for T1

Note that the coding setting is related only to the local PBX, and is unrelated to the Coder/Rate setting (#1 in this menu)

- Transparent Jitter Size (relevant for transparent channels only) – the size of the internal buffer used to store transparent channel data when jitter exists between the E1/T1 clocks; specify a value in units of 10 milliseconds.

Transparent jitter size must be larger than the configured packetizing interval.

- Bundle Name –assign an identification name to a bundle.

### Configuring FXS Bundles

#### ► To add a bundle to an FXS port:

1. From the Main Menu (*Figure 4-2*), choose Configuration.  
The Configuration menu (*Figure 4-40*) is displayed.

```

Configuration
1. System>
2. Switch LAN Configuration>
3. Analog Voice Configuration>
4. Serial Port Configuration>

>

Please choose item <1 to 4>

```

*Figure 4-40. Configuration Menu for Analog Voice Ports*

2. From the Configuration menu (*Figure 4-40*), choose **Analog Voice Configuration**.

The Analog Voice Configuration menu appears (see *Figure 4-41*).

```

Analog Voice Configuration
1. Bundles Parameters>
2. Timeouts >
3. Ringer Profiles >
4. Reverse Polarity > (Disable )
5. Ports Distribution>
6. Port Configuration>

>

Please select item <1 to 5>

```

*Figure 4-41. Analog Voice Configuration Menu for FXS*

3. From the Analog Voice Configuration menu, choose **Bundles Parameters**.  
The Bundles Parameters menu appears (see *Figure 4-32*).
4. Continue using the procedure above for the E1/T1 voice port.

► **To configure an existing bundle on an FXS port:**

1. From the Bundle Configuration menu (see [Figure 4-33](#)), choose **Edit Bundle**.  
The Edit Bundle menu appears.

```

Edit Bundle

1. Enter Bundle Number[1 - 8]... (1)
2. Connect>      (No)
3. Function>     (TDMoIP)
4. Routing Parameters>
5. Max Bytes In Multiplexed Frame[100 - 1461]... (500)
6. Packetizing Interval (msec)[10 - 90]... (30)
7. Connectivity Parameters>
8. Voice Parameters>
9. Bundle Name... ()

>

Please select item <1 to 13>

```

*Figure 4-42. Edit Bundle Menu for Vmux-110 with FXS Port*

2. From the Edit Bundle menu, type **1**, press **<Enter>**, and then enter the number of the bundle you want to configure.
3. Configure the following parameters of the selected bundle:
  - **Connect:**
    - **Yes** – bundle is connected
    - **No** – bundle is not connected.
  - **Function:**
    - **TDMoIP** – Uses the TDMoIP protocol to transmit the voice and data over the network. For IP-based networks, this option must be used.
    - **AAL2oMPLS** – Uses the AAL2oMPLS protocol to transmit the voice and data over the network. This option, which requires less bandwidth than TDMoIP, may be used for non-IP networks.
  - **Routing Parameters**

```

Routing Parameters

1. Destination IP... (0.0.0.0)
2. Destination Type>  (PBX)
3. Destination Bundle[1 - 30]... (1)
4. TOS Parameters>
5. VLAN Parameters>

>

Please select item <1 to 5>
@ - Db Update; # - Db Undo
ESC-prev.menu; !-main menu; &-exit

```

*Figure 4-43. Routing Parameters Menu (FXS)*

- Destination IP – IP address of the destination Vmux-2100 group or Vmux-110
- Destination Type – type of device connected to this bundle: **PBX, Phone**
- Destination Bundle – number of the destination bundle of the group with the IP address specified in the previous step: **1 to 30**
- TOS Parameters – standard Type of Service parameters of the outgoing IP frames:
  - Precedence (Routine, Priority, Immediate, Flash, Flash Override, Critic/Ecp, Internetwork Control, Network Control)
  - Delay (Normal, Low)
  - Throughput (Normal, High)
  - Reliability (Normal, High).

- VLAN Parameters –enable/disable virtual LAN tagging, specify VLAN number, and its priority:

Vlan Id: **26 to 4094**

Vlan Priority: **0** (minimum) to **7** (maximum).

- Max Bytes In Multiplexed Frame – size of a multiplexed TDMoIP frame in bytes:
  - **100 to 1461** bytes
- Packetizing Interval (msec) – maximum time interval allocated for the TDMoIP frame aggregation:
  - **10 to 90** msec
- Connectivity parameters – keep-alive messages configuration

Vmux-110 constantly monitors the status of all connected bundles, by sending 64-byte keep-alive messages to the remote device. Connectivity is confirmed by receiving a reply from the remote unit. This process is similar to pinging remote IP hosts. If a reply is not received, usually due to a main link failure, Vmux-110 disconnects the bundle and generates the BUNDLE IS OOS (Out Of Service) alarm.

You can specify the following connectivity parameters:

- Connectivity Mode – the mode used to check for connectivity: With Ping (ping is used, which may be blocked by some firewalls), Without Ping (Vmux-110 layer 4 OAM messages are used to monitor connectivity)
- Connectivity packet rate – frequency of sending the keep-alive packets, from one packet per **1** second to one packet per **60** seconds
- Connectivity timeout cycles – number of attempts within which Vmux-110 expects to receive at least one reply from the remote device.

For example, if you set the connectivity packet rate to 60 seconds and connectivity timeout to 3, Vmux-110 disconnects a bundle from which it did not receive at least one reply within 180 seconds.

**Note** *In IP networks, where delays are more common, it is recommended to set the connectivity parameters to their maximum values.*

- Voice Parameters

```

Voice Parameters
1. Coder/Rate (kbps)>   (G.723.1/6.4)
2. Fax/Modem>
3. Echo Canceller>    (Enable)

>
Please select item <1 to 3>

```

Figure 4-44. Voice Parameters Menu for FXS Port

- Coder/Rate – compression algorithm and corresponding rate:
    - G.723.1/6.4** –as per G.723.1 requirements at 6.4 kbps
    - G.723.1/5.3** –as per G.723.1 requirements at 5.3 kbps
    - G.729A/8** –as per G.729 A requirements at 8 kbps
    - G.711 a LAW** –as per G.711 requirements, A-law companding
    - G711 u LAW** –as per G.711 requirements,  $\mu$ -law companding.
  - Fax/Modem – configure fax and modem settings
    - Modem – **enable/disable** the modem signal identification and relay
    - Fax – **enable/disable** the fax signal identification and relay
    - Fax Rate – set the maximum fax transmission rate (in kbps):  
**4.8, 9.6, 14.4.**
  - Echo Canceller –enable/disable the built-in echo canceller, which supports up to a 32 msec delay.
    - If you have an external echo canceller on your telephone network, disable the built-in Vmux-110 DSP echo canceller.
- Bundle Name –assign an identification name to a bundle.

## Configuring FXO Bundles

### ► To add a bundle to an FXO port:

1. From the Main Menu, choose Configuration.  
The Configuration menu is displayed.
2. From the Configuration menu, choose **Analog Voice Configuration**.  
The Analog Voice Configuration menu appears.

```

Analog Voice Configuration

1. Bundles Parameters>
2. Reverse Polarity > (Disable )
3. Ports Distribution>
4. Port Configuration>

>

Please select item <1 to 5>

```

Figure 4-45. Analog Voice Configuration for FXO

3. From the Analog Voice Configuration menu, choose **Bundles Parameters**. The Bundles Parameters menu appears (see [Figure 4-32](#)).
4. Continue using the procedure above for the E1/T1 voice port.

► **To configure an existing bundle on an FXO port:**

1. From the Bundle Configuration menu (see [Figure 4-33](#)), choose **Edit Bundle**. The Edit Bundle menu appears.

```

Edit Bundle

1. Enter Bundle Number[1 - 8]... (1)
2. Connect> (No)
3. Function> (TDMoIP)
4. Routing Parameters>
5. Max Bytes In Multiplexed Frame[100 - 1461]... (500)
6. Packetizing Interval (msec)[10 - 90]... (30)
7. Connectivity Parameters>
8. Voice Parameters>
9. Bundle Name... ()

>

Please select item <1 to 13>

```

Figure 4-46. Edit Bundle Menu for Vmux-110 with FXO Port

2. From the Edit Bundle menu, type **1**, press **<Enter>**, and then enter the number of the bundle you want to configure.
3. Configure the following parameters of the selected bundle:
  - **Connect:**
    - **Yes** – bundle is connected
    - **No** – bundle is not connected.
  - **Function:**
    - **TDMoIP** – Uses the TDMoIP protocol to transmit the voice and data over the network. For IP-based networks, this option must be used.
    - **AAL2oMPLS** – Uses the AAL2oMPLS protocol to transmit the voice and data over the network. This option, which requires less bandwidth than TDMoIP, may be used for non-IP networks.

- Routing Parameters

```

Routing Parameters
1. Destination IP... (0.0.0.0)
2. Destination Bundle[1 - 30]... (1)
3. TOS Parameters>
4. VLAN Parameters>

>

Please select item <1 to 5>
@ - Db Update; # - Db Undo
ESC-prev.menu; !-main menu; &-exit

```

Figure 4-47. Routing Parameters Menu

- Destination IP – IP address of the destination Vmux-2100 group or Vmux-110
- Destination Bundle – number of the destination bundle of the group with the IP address specified in the previous step: **1 to 30**
- TOS Parameters – standard Type of Service parameters of the outgoing IP frames:
  - Precedence (Routine, Priority, Immediate, Flash, Flash Override, Critic/Ecp, Internetwork Control, Network Control)
  - Delay (Normal, Low)
  - Throughput (Normal, High)
  - Reliability (Normal, High).
- VLAN Parameters –enable/disable virtual LAN tagging, specify VLAN number, and its priority:
  - Vlan Id: **26 to 4094**
  - Vlan Priority: **0** (minimum) to **7** (maximum).
- Max Bytes In Multiplexed Frame – size of a multiplexed TDMoIP frame in bytes:
  - **100 to 1461** bytes
- Packetizing Interval (msec) – maximum time interval allocated for the TDMoIP frame aggregation:
  - **10 to 90** msec
- Connectivity parameters – keep-alive messages configuration
 

Vmux-110 constantly monitors the status of all connected bundles, by sending 64-byte keep-alive messages to the remote device. Connectivity is confirmed by receiving a reply from the remote unit. This process is similar to pinging remote IP hosts. If a reply is not received, usually due to a main link failure, Vmux-110 disconnects the bundle and generates the BUNDLE IS OOS (Out Of Service) alarm.

You can specify the following connectivity parameters:

- Connectivity Mode – the mode used to check for connectivity: With Ping (ping is used, which may be blocked by some firewalls), Without Ping (Vmux-110 layer 4 OAM messages are used to monitor connectivity)
- Connectivity packet rate – frequency of sending the keep-alive packets, from one packet per **1** second to one packet per **60** seconds
- Connectivity timeout cycles – number of attempts within which Vmux-110 expects to receive at least one reply from the remote device.

For example, if you set the connectivity packet rate to 60 seconds and connectivity timeout to 3, Vmux-110 disconnects a bundle from which it did not receive at least one reply within 180 seconds.

**Note** *In IP networks, where delays are more common, it is recommended to set the connectivity parameters to their maximum values.*

- Voice Parameters

```
Voice Parameters
1. Coder/Rate (kbps)>   (G.723.1/6.4)
2. Fax/Modem>
3. Echo Canceller>    (Enable)
>
Please select item <1 to 3>
```

Figure 4-48. Voice Parameters Menu for FXO Port

- Coder/Rate – compression algorithm and corresponding rate:
  - G.723.1/6.4** –as per G.723.1 requirements at 6.4 kbps
  - G.723.1/5.3** –as per G.723.1 requirements at 5.3 kbps
  - G.729A/8** –as per G.729 A requirements at 8 kbps
  - G.711 a LAW** –as per G.711 requirements, A-law companding
  - G711 u LAW** –as per G.711 requirements,  $\mu$ -law companding.
- Fax/Modem – configure fax and modem settings
  - Modem – **enable/disable** the modem signal identification and relay
  - Fax – **enable/disable** the fax signal identification and relay
  - Fax Rate – set the maximum fax transmission rate (in kbps):  
**4.8, 9.6, 14.4.**
- Echo Canceller –enable/disable the built-in echo canceller, which supports up to a 32 msec delay.

If you have an external echo canceller on your telephone network, disable the built-in Vmux-110 DSP echo canceller.

- Bundle Name –assign an identification name to a bundle.

### Configuring E&M Bundles

#### ► To add a bundle to an E&M port:

1. From the Main Menu, choose Configuration.  
The Configuration menu is displayed.
2. From the Configuration menu, choose **Analog Voice Configuration**.  
The Analog Voice Configuration menu appears.

```

Analog Voice Configuration

1. Bundles Parameters>
2. Ports Distribution>
3. Port Configuration>

>

Please select item <1 to 5>

```

Figure 4-49. Analog Voice Configuration Menu for E&M

3. From the Analog Voice Configuration menu, choose **Bundles Parameters**.  
The Bundles Parameters menu appears (see [Figure 4-32](#)).
4. Continue using the procedure above for the E1/T1 voice port.

#### ► To configure an existing bundle on an E&M port:

1. From the Bundle Configuration menu (see [Figure 4-33](#)), choose **Edit Bundle**.  
The Edit Bundle menu appears.

```

Edit Bundle

1. Enter Bundle Number[1 - 8]... (1)
2. Connect> (No)
3. Function> (TDMoIP)
4. Routing Parameters>
5. Max Bytes In Multiplexed Frame[100 - 1461]... (500)
6. Packetizing Interval (msec)[10 - 90]... (30)
7. Connectivity Parameters>
8. Voice Parameters>
9. Bundle Name... ()

>

Please select item <1 to 13>

```

Figure 4-50. Edit Bundle Menu for Vmux-110 with E&M Port

2. From the Edit Bundle menu, type **1**, press **<Enter>**, and then enter the number of the bundle you want to configure.

3. Configure the following parameters of the selected bundle:
  - Connect:
    - **Yes** – bundle is connected
    - **No** – bundle is not connected.
  - Function:
    - **TDMoIP** – Uses the TDMoIP protocol to transmit the voice and data over the network. For IP-based networks, this option must be used.
    - **AAL2oMPLS** – Uses the AAL2oMPLS protocol to transmit the voice and data over the network. This option, which requires less bandwidth than TDMoIP, may be used for non-IP networks.
  - Routing Parameters

```

Routing Parameters

1. Destination IP... (0.0.0.0)
2. Destination Bundle[1 - 30]... (1)
3. TOS Parameters>
4. VLAN Parameters>

>

Please select item <1 to 5>
@ - Db Update; # - Db Undo
ESC-prev.menu; !-main menu; &-exit

```

Figure 4-51. Routing Parameters Menu (E&M)

- Destination IP – IP address of the destination Vmux-2100 group or Vmux-110
- Destination Bundle – number of the destination bundle of the group with the IP address specified in the previous step: **1 to 30**
- TOS Parameters – standard Type of Service parameters of the outgoing IP frames:
  - Precedence (Routine, Priority, Immediate, Flash, Flash Override, Critic/Ecp, Internetwork Control, Network Control)
  - Delay (Normal, Low)
  - Throughput (Normal, High)
  - Reliability (Normal, High).
- VLAN Parameters –enable/disable virtual LAN tagging, specify VLAN number, and its priority:
  - Vlan Id: **26 to 4094**
  - Vlan Priority: **0** (minimum) to **7** (maximum).
- Max Bytes In Multiplexed Frame – size of a multiplexed TDMoIP frame in bytes:

- **100 to 1461** bytes
- Packetizing Interval (msec) – maximum time interval allocated for the TDMoIP frame aggregation:
  - **10 to 90** msec
- Connectivity parameters – keep-alive messages configuration

Vmux-110 constantly monitors the status of all connected bundles, by sending 64-byte keep-alive messages to the remote device. Connectivity is confirmed by receiving a reply from the remote unit. This process is similar to pinging remote IP hosts. If a reply is not received, usually due to a main link failure, Vmux-110 disconnects the bundle and generates the BUNDLE IS OOS (Out Of Service) alarm.

You can specify the following connectivity parameters:

- Connectivity Mode – the mode used to check for connectivity: With Ping (ping is used, which may be blocked by some firewalls), Without Ping (Vmux-110 layer 4 OAM messages are used to monitor connectivity)
- Connectivity packet rate – frequency of sending the keep-alive packets, from one packet per **1** second to one packet per **60** seconds
- Connectivity timeout cycles – number of attempts within which Vmux-110 expects to receive at least one reply from the remote device.

For example, if you set the connectivity packet rate to 60 seconds and connectivity timeout to 3, Vmux-110 disconnects a bundle from which it did not receive at least one reply within 180 seconds.

**Note** *In IP networks, where delays are more common, it is recommended to set the connectivity parameters to their maximum values.*

- Voice Parameters

```
Voice Parameters
1. Coder/Rate (kbps)>   (G.723.1/6.4)
2. Fax/Modem>
3. Echo Canceller>    (Enable)
>
Please select item <1 to 3>
```

Figure 4-52. Voice Parameters Menu for E&M Port

- Coder/Rate – compression algorithm and corresponding rate:
  - G.723.1/6.4** –as per G.723.1 requirements at 6.4 kbps
  - G.723.1/5.3** –as per G.723.1 requirements at 5.3 kbps
  - G.729A/8** –as per G.729 A requirements at 8 kbps

**G.711 a LAW** –as per G.711 requirements, A-law companding

**G.711 u LAW** –as per G.711 requirements,  $\mu$ -law companding.

- Fax/Modem – configure fax and modem settings

Modem – **enable/disable** the modem signal identification and relay

Fax – **enable/disable** the fax signal identification and relay

Fax Rate – set the maximum fax transmission rate (in kbps):

**4.8, 9.6, 14.4.**

- Echo Canceller –enable/disable the built-in echo canceller, which supports up to a 32 msec delay.

If you have an external echo canceller on your telephone network, disable the built-in Vmux-110 DSP echo canceller.

- Bundle Name –assign an identification name to a bundle.

### Configuring the E1 Voice Port

One of the available Vmux-110 configurations includes a single E1 port, which receives voice traffic from the PBX.

#### ► To configure the E1 port:

1. From the Voice Configuration menu (see [Figure 4-31](#)), choose **E1 Parameters**. The E1 Parameters menu appears (see [Figure 4-53](#)).

```
E1 Parameters
```

```
1. Connect>      (No)
2. Frame>       (G.732S)
3. Interface Type> (Ltu)
4. Restoration Time> (1 Second (Fast))
5. Clock Source>  (Lbt      (Local))
6. Idle Code[1 - ff]... (ff)
7. Profile[1 - 5]... (1)
```

```
>
```

```
Please select item <1 to 7>
```

*Figure 4-53. E1 Parameters Menu*

2. From the E1 Parameters menu, configure the following E1 parameters:
  - Connect:
    - **Yes** –E1 link is enabled
    - **No** –E1 link is disabled.
  - Frame –E1 framing mode:
    - **G.732N** –256N multiframe, 2 frames per multiframe, CRC-4 function disabled
    - **G.732N-CRC4** –256N multiframe, 2 frames per multiframe, CRC-4 function enabled

- **G.732S** –256S multiframe, 16 frames per multiframe, CRC-4 function disabled
- **G.732S-CRC4** –256S multiframe, 16 frames per multiframe, CRC-4 function enabled.

---

**Note** *By choosing an E1 framing mode, you also set the signaling mode:*

- *G.732N/G.732N-CRC4 framing – CCS signaling*
  - *G.732S/G.732S-CRC4 framing – CAS signaling.*
- 
- Interface Type –maximum attenuation of the Rx signal that can be compensated for by the port Rx path, to obtain BER performance required by the standards:
    - **Ltu** –maximum attenuation of 43 dB, relative to the nominal transmit level of 0 dB, operates at longer ranges
    - **Dsu** –maximum attenuation of 12 dB, relative to the nominal transmit level of 0 dB.
  - Restoration Time –time required for the E1 port to return to normal operation after sync loss:
    - **1 Second** –after 1 second, fast
    - **10 Second** –as per requirements of AT&T TR-62411
    - **CCITT** –as per requirements of ITU-T Rec.G.732.
  - Clock Source:
    - **Lbt** –derived from the received E1 signal
    - **Internal** –received from the Vmux-110 internal oscillator.
  - Idle Code –code transmitted to fill unused timeslots in the E1 frames: **00** to **ff**.
  - Signaling profile for the CAS signaling (**1** to **5**). The profile must be compatible with the PBX signaling (signaling profile configuration is explained in the [Configuring Signaling Information](#) section, above).

---

**Note** *If you intend to change the E1 signaling configuration, it is recommended to disconnect the bundle to which the E1 timeslots are assigned before configuring the signaling mode. The bundle must be disconnected at the local and remote sites. If you do not disconnect the bundle, you must reset the local and remote voice interfaces carrying the E1 links after you complete configuring the E1 signaling.*

---

➤ **To configure the E1 timeslots:**

1. From the Voice Configuration menu (see [Figure 4-31](#)), choose **Distribution Of Framer Time Slots**.

The Distribution Of Framer Time Slots menu appears (see [Figure 4-54](#)).

```

Distribution Of Framer Time Slots

1. Display Time Slots Configuration[]
2. Configure Time Slots>

>

Please select item <1 to 2>

```

Figure 4-54. Distribution Of Framer Time Slots Menu

2. From the Distribution Of Framer Time Slots menu, choose **Configure Time Slots**.

The Configure Time Slots menu appears (see [Figure 4-55](#)).

```

Configure Time Slots

1. Update from Time Slot[1 - 31]... (1)
2. To TimeSlot[1 - 31]... (1)
3. Type> (N.C)
4. Bundle[1 - 12]... (1)
5. Destination Port ID[1 - 4]... (1)
6. Destination Time Slot ID[1 - 31]... (1)
7. Update Time Slot

>

Please select item <1 to 7>

```

Figure 4-55. Configure Time Slots Menu

3. From the Configure Time Slots menu, configure the following parameters:
  - Define the range of timeslots you want to configure:
    - Set **Update from Time Slot** to the number of the first timeslot in the range.
    - Set **To Time Slot** to the number of the last timeslot in the range.

To configure a single timeslot, set both parameters to the number of the timeslot you want to configure.
  - Set the timeslot type by choosing **Type**:
    - **N.C.** –timeslot is not connected
    - **Voice** –timeslot transmits voice
    - **SS7** – timeslot transmits data, the SS7 signaling information
    - **HDLC** –timeslot transmits data, for example, signaling information.
    - **Transparent** – timeslot transmits unspecified traffic, either voice or data transparently. There is no processing or checking of any sort.

---

**Note** The number of transparent timeslots configured affects the “Max bytes in multiplexed frame” parameter. The minimum value required for this parameter for “N” transparent timeslots is:  $N \times 80 \times (\text{Packetizing Interval} / 10)$ .

---

- Note** When configuring transparent timeslots, the recommended value for the “Packetizing Interval” parameter is 10 msec (minimum value).
- Note** The maximum number of data channels (HDLC/SS7/transparent) configurable for an E1/T1 trunk is 12.
- Assign the timeslot(s) to a bundle on the local Vmux-110, by choosing **Bundle**, and entering a bundle number.
  - Specify a Vmux-2100 destination port, by choosing **Destination Port**, and entering a port number.
- Note** For applications when Vmux-110 operates opposite remote Vmux-110, the destination port ID is always 1.
- Define the destination timeslots to which the local timeslots are routed. You have to specify only a starting timeslot; the rest of the destination timeslots are configured automatically in accordance with the number of timeslots set in steps 1 and 2 of the Time Slot Configuration (see [Figure 4-55](#)). To define a destination timeslot, choose **Destination Time Slot ID** and then enter the number of the first timeslot in the range, on the remote Vmux-110 or Vmux-2100.
  - Save the changes that you made to the timeslots, by choosing **Update Time Slot**.
- Note** Make sure to save the changes that you have made to the timeslot configuration.
4. Check the resulting timeslot configuration by choosing **Display Time Slots Configuration** from the Distribution Of Framer Time Slots menu.  
The Display Time Slots Configuration screen appears (see [Figure 4-56](#)).

```

Display Time Slots Configuration

  Ts#   Type   Bundle  Dest Port  Dest Ts
   1    N.C    0       1          0
   2    Voice  1       4          1
   3    Voice  1       4          2
   4    Voice  1       4          3
   5    Voice  1       4          4
   6    N.C    0       1          0
   7    N.C    0       1          0
   8    N.C    0       1          0
   9    N.C    0       1          0
  10    N.C    0       1          0

>

@ - Db Update; # - Db Undo
ESC-prev.menu; !-main menu; &-exit; ?-help

```

Figure 4-56. Display Time Slots Configuration Screen

## Configuring the T1 Voice Port

One of the available Vmux-110 configurations includes a single T1 port, which receives voice traffic from the PBX.

► **To configure the T1 port:**

1. From the Voice Configuration menu (see [Figure 4-31](#)), choose **T1 Parameters**.  
The T1 Parameters menu appears (see [Figure 4-57](#)).

```

T1 Parameters
1. Connect>          (Yes)
2. Clock Mode>      (Lbt      (Local))
3. Frame>           (Esf)
4. Interface Type>  (Dsu)
5. Line Code>       (B8ZS)
6. Line Length>     (0-133 Feet)
7. Restoration Time> (1 Second (Fast))
8. Idle Code[1 - ff]... (44)
9. Signaling>       (Robbed bit MF)
10. CCS Data Rate>  (64 Kbps)
11. Profile[1 - 5]... (1)

>
Please select item <1 to 10>

```

*Figure 4-57. T1 Parameters Menu*

2. From the T1 Parameters menu, configure the following T1 parameters:
  - Connect:
    - **Yes** –T1 link is enabled
    - **No** –T1 link is disabled.
  - Clock Mode:
    - **Lbt** –derived from the received T1 signal
    - **Internal** –received from the Vmux-110 internal oscillator.
  - Frame –T1 framing mode:
    - **Esf** –24 frames per multiframe
    - **SF (D4)** –12 frames per multiframe.
  - Interface Type:
    - **DSU** –DSU interface
    - **CSU** –CSU interface.
  - Line Code –line code and zero suppression method used by the port:
    - **B8ZS** –B8ZS coding
    - **AMI** –AMI coding.
  - Line Length –DSU mode only, length of a cable in feet between the Vmux-110 T1 port connector and the network access point:

- 0–133 Feet
- 133–266 Feet
- 266–399 Feet
- 399–533 Feet
- 533–655 Feet.
- Rx Sensitivity –CSU mode only, maximum attenuation of the Rx signal that can be compensated for by the port Rx path, to obtain BER performance required by the standards:
  - **Low** (-30 dB– relative to the nominal transmit level of 0 dB)
  - **High** (-36 dB – relative to the nominal transmit level of 0 dB).
- Tx Gain Level –CSU mode only, relative T1 output transmit level:
  - **0 dB** –no attenuation
  - **7.5 dB** – attenuation of 7.5 dB relative to the nominal transmit level
  - **15 dB** –attenuation of 15 dB relative to the nominal transmit level
  - **22.5 dB** –attenuation of 22.5 dB relative to the nominal transmit level
- Restoration Time –time required for the E1 port to return to normal operation after sync loss:
  - **1 Second** –after 1 second, fast
  - **10 Second** –as per requirements of AT&T TR-62411
  - **CCITT** –as per requirements of ITU-T Rec.G.732.
- Idle Code –code transmitted to fill unused timeslots in the E1 frames:  
**00 to ff.**
- Signaling –select a signaling mode for the T1 links:
  - **Robbed Bit MF**
  - **CCS.**
- CCS Data Rate (*relevant for HDLC and SS7 types*) – select the CCS data rate:
  - 64 kbps
  - 56 kbps
- Profile –select the signaling profile. When operating with RBMF signaling, it is necessary to assign a signaling profile to the T1 link. The profile must be compatible with the PBX signaling (signaling profile configuration is explained in *Configuring Signaling Profiles*, above).

---

**Note** *If you intend to change the T1 signaling configuration, it is recommended to disconnect the bundle to which the T1 timeslots are assigned before configuring the signaling mode. The bundle must be disconnected at the local and remote sites. If you do not disconnect the bundle, you must reset the local and remote voice modules carrying the T1 links after you complete configuring the T1 signaling.*

---

► **To configure the T1 timeslots:**

1. From the Voice Configuration menu (see [Figure 4-31](#)), choose **Distribution Of Framer Time Slots**.

The Distribution Of Framer Time Slots menu appears (see [Figure 4-54](#)).

2. Continue using the same procedure as for the E1 timeslots. For more information, see [Configuring the E1 Voice Port](#), above.

### Configuring the FXS Voice Ports

One of the available Vmux-110 configurations includes four or eight analog FXS voice ports. If the FXS ports connect to a telephone handset, the FXS ports need to be configured to function like the PBXs at the location. The DSP on the Vmux-110 is capable of producing all of the tones and signals that a PBX usually sends to a telephone handset.

► **To configure an FXS port:**

1. From the Configuration menu ([Figure 4-4](#)), choose **Analog Voice Configuration**.

The Analog Voice Configuration menu appears.

```
Analog Voice Configuration
```

- ```
1. Bundles Parameters>
2. Timeouts >
3. Ringer Profiles >
4. Reverse Polarity > (Disable )
5. Ports Distribution>
6. Port Configuration>
```

```
>
```

```
Please select item <1 to 5>
```

*Figure 4-58. Analog Voice Configuration Menu for FXS*

2. From the Analog Voice Configuration menu, choose **Reverse Polarity** to toggle reverse polarity on or off.
3. From the Analog Voice Configuration menu, choose **Timeouts**.

The Timeouts menu appears (see [Figure 4-59](#)).

```
Timeouts
```

- ```
1. Ring Timeout (sec) [60 - 600]... (120)
2. On hook duration in Flash (mSec) [10 - 2000]... (700)
```

```
>
```

```
Please select item <1 to 2>
```

*Figure 4-59. Timeouts Menu*

4. Set the timeouts:
  - **Ring Timeout**—the number of seconds for which Vmux-110 waits for a telephone handset to be answered
  - **On hook duration in Flash**—the duration of Flash—the Flash key on the phone keypad—in msec. Different PBXs have different Flash durations, so you can configure this parameter according to the PBX in use. The Flash is a fast ON HOOK and OFF HOOK operation.
5. From the Analog Voice Configuration menu, choose **Ringer Profiles**.  
The Ringer Profile menu appears (see [Figure 4-60](#)).

```
Ringer Profiles

1. Profile 1
2. Profile 2
3
>

Please select item <1 to 4>
```

*Figure 4-60. Ringer Profiles Menu*

6. Select the desired profile from the menu.  
The appropriate menu appears for the selected Profile:

```
Profile 1

1. Period #1: Ring (100 mSec) [1 - 50]... (10)
2. Period #1: Silence (100 mSec) [1 - 50]... (30)
3. Period #2: Ring (100 mSec) [0 - 50]... (0)
4. Period #2: Silence (100 mSec) [0 - 50]... (0)
>

Please select item <1 to 4>
```

*Figure 4-61. Ringer Profile Menu*

7. The ringer profile determines the ring tone. Use this menu to configure the ring tone to match the standard ring tone at the location. To define a ringer profile, set the first two, or all four, parameters (specify **0** to **50**, in units of 100 msec):
  - **Period #1 Ring**—the length of the first ring tone
  - **Period #1 Silence**—the length of the first silence period; for locations that have only one ring tone, specify the period of silence between rings; for locations that have a double ring tone, specify the silence between the two ring tones
  - **Period #2 Ring**—the length of the second ring tone
  - **Period #2 Silence**—the length of the silence between each set of double ring tones.

8. From the Analog Voice Configuration menu, choose **Port Configuration**.  
The Port Configuration menu appears (see [Figure 4-62](#)).

```
Port Configuration
1. Port Number>   (Port #1)
2. Gains>
3. Signaling Parameters[]>
>
Please select item <1 to 3>
```

*Figure 4-62. Port Configuration Menu*

9. Choose **Port Number** and then select the number of the port you want to configure.
10. Choose **Gains** and then set the following gains:
  - **TX gain** – the gain applied by the PBX or handset towards the Vmux-110 analog port. The Vmux-110 will adjust according to this gain (for example, if the PBX amplifies by 4 dB, the Vmux-110 will reduce by 4 dB).
  - **RX gain** –the gain to applied by the Vmux-110 towards the PBX or handset.
11. The FXS signaling parameter configuration determines the value of ABCD bits as follows:
  - Indicates whether the local or remote phone connected to the FXS port is ON-HOOK or OFF-HOOK
  - When working opposite a PBX that sends a different indication for “Off-hook” and “Ring”, the RING1 bits should be configured according to the PBX “Ring” bits.
  - RING2 should be used when the PBX can identify a different ringer profile to be used by sending different ABCD bits.
  - Indicates that reverse polarity is detected.

To configure the signaling bits, choose **Signaling Parameters**.

The Signaling Parameters screen appears (see [Figure 4-63](#)).

```

Signaling Parameters >Port #1

      A Bit   B Bit   C Bit   D Bit
ON HOOK      0       1       0       1
OFF HOOK      1       1       0       1
RING1         1       1       0       1
RING2         1       1       0       1
Reverse Polarity 1       0       0       1

1. 0
2. 1

>

Please select item <1 to 2>

```

Figure 4-63. Signaling Parameters Screen

12. Set the A, B, C and D bits that determine the relevant signals. To set a value, press **<Tab>** to select the value to be changed, and then choose the appropriate menu option below to make the desired setting.

► **To configure the FXS timeslots:**

1. From the FXS Configuration Menu (see [Figure 4-41](#)), choose **Ports Distribution**.

The Ports Distribution menu appears (see [Figure 4-64](#)).

```

Ports Distribution

1. Display Time Slots Configuration[]
2. Configure Time Slots>

>

Please select item <1 to 2>

```

Figure 4-64. Ports Distribution Menu

2. Continue using the same procedure as for the E1 timeslots. For more information, see [Configuring the E1 Voice Port](#), above.

### Configuring the FXO Voice Ports

One of the available Vmux-110 configurations includes four or eight analog FXO voice ports. Follow the procedure below to configure the FXO voice ports.

► **To configure an FXO port:**

1. From the Configuration menu, choose **Analog Voice Configuration**.

The Analog Voice Configuration menu appears.

2. From the Analog Voice Configuration menu, choose **Reverse Polarity** to toggle reverse polarity on or off.

3. From the Analog Voice Configuration menu, choose **Port Configuration**.

The Port Configuration menu appears (see [Figure 4-62](#)).

```

Port Configuration

1. Port Number>   (Port #1)
2. Gains>
3. Signaling Parameters[]>

>

Please select item <1 to 3>

```

Figure 4-65. Port Configuration Menu for FXO

4. Choose **Port Number** and then select the number of the port you want to configure.
5. Choose **Gains** and then set the following gains:
  - **TX gain** –the gain applied by the PBX or handset towards the Vmux-110 analog port. The Vmux-110 will adjust according to this gain (for example, if the PBX amplifies by 4 dB, the Vmux-110 will reduce by 4 dB).
  - **RX gain** –the gain to applied by the Vmux-110 towards the PBX or handset.
6. The FXO signaling parameter configuration determines the value of ABCD bits that signal the following:
  - Whether the local or remote phone connected to the FXO port is ON-HOOK or OFF-HOOK
  - Indicates that reverse polarity is detected.

To configure the signaling bits, choose **Signaling Parameters**.

The Signaling Parameters screen appears (see [Figure 4-63](#)).

```

Signaling Parameters >Port #1

          A Bit   B Bit   C Bit   D Bit
ON HOOK      0     1     0     1
OFF HOOK     1     1     0     1
REVERSE POLARITY 1     0     0     1

1. 0
2. 1

>

Please select item <1 to 2>

```

Figure 4-66. Signaling Parameters Screen

7. Set the A, B, C and D bits that make up the on-hook, off-hook, and reverse polarity signals. To set a value, press **<Tab>** to select the value to be changed, and then choose the appropriate menu option to make the desired setting.

➤ **To configure the FXO timeslots:**

1. From the FXO Configuration Menu (see [Figure 4-41](#)), choose **Ports Distribution**.

The Ports Distribution menu appears (see [Figure 4-64](#)).

```

Ports Distribution

1. Display Time Slots Configuration[]
2. Configure Time Slots>

>

Please select item <1 to 2>

```

Figure 4-67. Ports Distribution Menu

2. Continue using the same procedure as for the E1 timeslots. For more information, see [Configuring the E1 Voice Port](#), above.

### Configuring the E&M Voice Ports

One of the available Vmux-110 configurations includes four or eight analog E&M voice ports.

► **To configure an E&M port:**

1. From the Configuration menu, choose **Analog Voice Configuration**.  
The Analog Voice Configuration menu appears.
2. From the Analog Voice Configuration menu, choose **Port Configuration**.  
The Port Configuration menu appears.

```

Port Configuration

1. Port Number>    (Port #1)
2. Gains>
3. E&M Type>     (SSDC5 )
4. Wires>        (4W)
5. Signaling Parameters[]>

>

Please select item <1 to 3>

```

Figure 4-68. Port Configuration Menu for E&M

3. Choose **Port Number** and then select the number of the port you want to configure.
4. Choose **Gains** and then set the following gains:
  - **TX gain** –the gain applied by the PBX or handset towards the Vmux-110 analog port. The Vmux-110 will adjust according to this gain (for example, if the PBX amplifies by 4 dB, the Vmux-110 will reduce by 4 dB).
  - **RX gain** –the gain to applied by the Vmux-110 towards the PBX or handset.
5. Choose **E&M Type** to select the E&M mode to use per four channels (Channels 1-4 and 5-8):
  - Type 1
  - Type 2

- Type 3
  - SSDC5
6. Choose **Wires** to select the number of wires used to connect the E&M devices per two channels (Channels 1-2, 3-4, 5-6, 7-8):
    - 4W (4 wires)
    - 2W (2 wires)
  7. The E&M signaling parameter configuration determines the value of ABCD bits that signal whether the local or remote phone connected to the E&M port is ON-HOOK or OFF-HOOK

To configure the signaling bits, choose **Signaling Parameters**.

The Signaling Parameters screen appears.

```

Signaling Parameters >Port #1

      ON HOOK      A Bit   B Bit   C Bit   D Bit
      OFF HOOK      1       1       0       1

1. 0
2. 1

>

Please select item <1 to 2>

```

Figure 4-69. Signaling Parameters Screen for E&M

8. Set the A, B, C and D bits that make up the on-hook and off-hook signals. To set a value, press **<Tab>** to select the value to be changed, and then choose the appropriate menu option to make the desired setting.

► **To configure the E&M timeslots:**

1. From the E&M Configuration Menu (see [Figure 4-41](#)), choose **Ports Distribution**.

The Ports Distribution menu appears (see [Figure 4-64](#)).

```

Ports Distribution

1. Display Time Slots Configuration[]
2. Configure Time Slots>

>

Please select item <1 to 2>

```

Figure 4-70. Ports Distribution Menu

2. Continue using the same procedure as for the E1 timeslots. For more information, see [Configuring the E1 Voice Port](#), above.

---

---

## 4.11 Configuring the Ethernet User Port

The Vmux-110 Ethernet User port can be used to connect the local user network. The Vmux-110 includes a switch that routes the voice and data intelligently.

➤ **To configure the Ethernet user port:**

1. From the Switch LAN Configuration menu (see [Figure 4-22](#)), choose **User Port Configuration**.

The User Port Configuration menu appears. This menu is identical to the Network Port Configuration menu (see [Figure 4-23](#)).

2. Configure the user Ethernet port. The procedure is the same as configuring the main link network port (see [Configuring the Ethernet Network Port](#), above).

---

---

## 4.12 Configuring the Internal Router

Voice traffic is always transmitted over the Main Link, which can be either the serial port or the network port. When the internal router is enabled, voice traffic is routed from the user voice port to the Main Link only. However, the router can be managed via any of the three IP addresses associated with these three interfaces, including the interface that is not configured for voice traffic.

When the internal router is enabled, the following parameters can be configured:

- Serial and network interfaces
- Static routing
- Default gateway
- DHCP
- NAT
- Firewall

### Enabling the Internal Router

➤ **To enable the internal router:**

1. From the Management menu ([Figure 4-7](#)), choose **Router** to enable the router

When the internal router is enabled, the Management menu has the options shown in the following figure.

```
Management

1. Snmp Community>
2. Manager List[]>
3. Host Mux Name... (18.105)
4. User Administration>
5. Signaling Configuration>
6. Telnet> (Enable)
7. Main Link> (Serial Port)
8. Router (Enable)
9. Ethernet Net/User Connection> (Layer 2 Switching)

>

Please select item <1 to 8>
@ - Db Update; # - Db Undo
ESC-prev.menu; !-main menu; &-exit
```

Figure 4-71. Management Menu with Internal Router Enabled

When the internal router is enabled, the Host IP menu option is replaced by the SNMP Community option and the Ethernet Net/User Connection option is added.

## Disabling the Internal Router

► **To enable the internal router:**

1. From the Management menu, choose **Router**.
2. Choose **Disable**.

The Management menu shows the options available when the internal router is disabled ([Figure 4-7](#)).

## Configuring the Ethernet Net/User Connection

When the router is enabled, you must specify the mechanism used by the Ethernet network/user connection:

- Layer 2 Switching
- Layer 3 Routing

► **To configure the Ethernet net/user connection:**

1. From the Management menu ([Figure 4-7](#)), choose **Ethernet net/user connection**.

The **Ethernet Net/User Connection** menu appears (see [Figure 4-11](#)).

```
Ethernet Net/User Connection (Layer 3 Routing)

1. Layer 2 Switching
2. Layer 3 Routing

>

Please select item <1 to 2>
```

Figure 4-72. Ethernet Net/User Connection Menu

2. From the Ethernet Net/User Connection menu, choose the desired connection mechanism.

## Configuring the Interfaces

When the internal router is enabled, the serial and network ports must be configured so that the router transfers their packets correctly. Note that if the Ethernet network port has been configured as the main link, the serial port is not used and is not configured.

► **To configure the interfaces:**

1. From the Configuration menu (*Figure 4-71*), choose **Router Configuration**.  
The Router Configuration menu appears.

```
Router Configuration
1. Interfaces Menu>
2. Static Routing>
3. Default Gateway>
4. DHCP Menu>
5. NAT>
6. Firewall Global Parameters>
>
Please select item <1 to 6>
@ - Db Update; # - Db Undo
ESC-prev.menu; !-main menu; &-exit
```

*Figure 4-73. Router Configuration Menu*

2. Choose **Interfaces Menu**.

The Interfaces menu appears.

Note that if the Ethernet network port has been configured as the main link, the serial port is not used, and therefore the Serial Port Configuration option does not appear in the Interfaces menu.

```
Interfaces Menu
1. Serial Port Configuration>
2. Net Port Configuration>
3. User Port Configuration>
>
Please select item <1 to 3>
@ - Db Update; # - Db Undo
ESC-prev.menu; !-main menu; &-exit
```

*Figure 4-74. Interfaces Menu*

Choose Net Port Configuration.

The Net Port Configuration menu appears.

```
Net Port Configuration
1. IP... (0.0.0.0)
2. Mask... (0.0.0.0)
3. ARP Table Param>
4. RIP Menu>
5. Firewall Menu>
6. DHCP Relay (Disable)
>
Please select item <1 to 6>
@ - Db Update; # - Db Undo
ESC-prev.menu; !-main menu; &-exit
```

Figure 4-75. Net Port Configuration Menu

3. Choose **IP** and then set the IP address of the serial port.
4. Choose **Mask** and then set the IP mask of the serial port.
5. Choose **ARP Table Param**.

The ARP Table Param menu appears.

```
ARP Table Param
1. Entry Aging Time (minutes)[1 - 99]... (5)
>
Please select item <1 to 1>
@ - Db Update; # - Db Undo
ESC-prev.menu; !-main menu; &-exit
```

Figure 4-76. ARP Table Param Menu

6. Set the ARP table parameters:
  - **Entry Aging Time** (the time period for which entries are preserved in the ARP table; 1–99 minutes)
7. Choose **RIP Menu**.

The RIP menu appears.

```
RIP Menu
1. RIP Status (Enable)
2. Send RIP type> (None)
3. Receive RIP type> (None)
>
Please select item <1 to 1>
@ - Db Update; # - Db Undo
ESC-prev.menu; !-main menu; &-exit
```

Figure 4-77. RIP Menu

8. Set the RIP (Routing Information Protocol) parameters:
  - **RIP Status** (enables or disables RIP)
  - **Send RIP type** (the send RIP to use)
  - **Receive RIP type** (the receive RIP to use)
9. Choose **Firewall Menu**

The Firewall menu appears.

```

Firewall Menu

1. Firewall Status      (Enable)
2. Firewall Direction  (Outbound)
3. Active FTP          (No)
4. Forged IP Protection (No)
5. Rules>

>

Please select item <1 to 5>
@ - Db Update; # - Db Undo
ESC-prev.menu; !-main menu; &-exit

```

Figure 4-78. Firewall Menu

10. Set the firewall parameters:
  - **Firewall Status** (toggles the firewall on or off; when disabled, the firewall configuration options are hidden)
  - **Firewall Direction** (the direction in which the firewall works: outbound or inbound)
  - **Active FTP** (determines whether FTP is allowed or not)
  - **Forged IP Protection** (enables forged IP protection)
  - **Rules** – sets the firewall rules. Note that the rules must be defined before they can be assigned to an interface. See [Set the firewall](#) parameters on page 4-60.

```

Rules

1. Rule Number[1 - 50]... (1)
2. Add To Interface
3. Delete From Interface
4. Display Interface Active Rules[]

>

Please select item <1 to 4>
@ - Db Update; # - Db Undo
ESC-prev.menu; !-main menu; &-exit

```

Figure 4-79. Rules Menu

- **Rule Number** (enter the number of the rule to define)
- **Add To Interface** (adds the specified rule to the interface)

- **Delete From Interface** (deletes the specified rule from the interface)
  - **Display Interface Active Rules** (displays the active rules).
11. To enable the interface to relay DHCP packets, from the Net Port Configuration menu, choose **DHCP Relay** and set to **Enable**. Then, specify the **DHCP Server IP** address to which this interface will relay DHCP packets.

```

Net Port Configuration
1. IP... (0.0.0.0)
2. Mask... (0.0.0.0)
3. ARP Table Param>
4. RIP Menu>
5. Firewall Menu>
6. DHCP Relay (Enable)
7. DHCP Server Ip... (0.0.0.0)

>

Please select item <1 to 7>
@ - Db Update; # - Db Undo
ESC-prev.menu; !-main menu; &-exit

```

Figure 4-80. Net Port Configuration Menu with DHCP Enabled

12. If the serial port has been configured as the main link, the serial port must be configured. From the Interfaces menu, choose **Serial Port Configuration** and then configure the serial port. All menus are the same as for configuring the net port.

If the Ethernet network port has been configured as the main link, the Serial Port Configuration option does not appear in the Interfaces menu.

13. From the Interfaces menu, choose **User Port Configuration** and then configure the user port. All menus are the same as for configuring the net port.

## Configuring Static Routing

### ► To configure static routing:

1. From the Router Configuration menu, choose **Static Routing**.

The Static Routing menu appears.

```

Static Routing
1. Add Static Routing>
2. Delete Static Routing>
3. Edit Static Routing>
4. Display Static Routing[]

>

Please select item <1 to 4>
@ - Db Update; # - Db Undo
ESC-prev.menu; !-main menu; &-exit

```

Figure 4-81. Static Routing Menu

2. To add a new static route, choose **Add Static Routing** and then select the static route to be added.
3. To delete a static route, choose **Delete Static Routing** and then select the static route to be deleted.
4. To edit a static route, choose **Edit Static routing**, select the static route to configure, and then configure the selected static route:
  - Net IP (the network IP to be assigned to this static route)
  - Mask (the network mask of the static route)
  - NextHop IP (the next hop IP of the static route).
5. To view the current static routing configuration, from the Static Routing menu, choose **Display Static Routing**.

The static routing is displayed.

```

Display Static Routing

      #           NetIP           Mask           NextHop Ip
      1           0.0.0.0         0.0.0.0         0.0.0.0

>

@ - Db Update; # - Db Undo
ESC-prev.menu; !-main menu; &-exit; ?-help

```

Figure 4-82. View Static Routing

## Configuring the Default Gateway

### ► To set the default gateway:

1. From the Router Configuration menu, choose **Default Gateway**.  
The Default Gateway menu appears.
2. Choose **Default Gateway** to toggle the default gateway on or off. When disabled, the Default Gateway configuration options are hidden.

```

Default Gateway

1. Default Gateway      (Enable)
2. Default Gateway IP... (0.0.0.0)

>

Please select item <1 to 2>
@ - Db Update; # - Db Undo
ESC-prev.menu; !-main menu; &-exit

```

Figure 4-83. Default Gateway Menu

3. Choose **Default Gateway IP** and enter the IP address for the default gateway.

## Configuring the DHCP Server

► **To configure the DHCP Server:**

1. From the Router Configuration menu, choose **DHCP Menu**.

The DHCP menu appears.

```
DHCP Menu

1. DHCP Server      (Enable)
2. Add Pool>
3. Delete Pool>
4. Edit Pool>
5. Delete DHCP client>
6. Delete All DHCP clients>

>

Please select item <1 to 6>
@ - Db Update; # - Db Undo
ESC-prev.menu; !-main menu; &-exit
```

Figure 4-84. DHCP Menu

2. Choose **DHCP Server** to toggle DHCP on or off. When disabled, the DHCP configuration options are hidden.
3. To add a DHCP pool, choose **Add Pool** and then choose the pool to be added.
4. To delete a DHCP pool, choose **Delete Pool** and then choose the pool to be deleted.
5. To configure a DHCP pool, choose Edit Pool, then specify the number of the pool to configure, and then set the selected pool's parameters:
  - DHCP Lowest Ip (the starting IP address in the IP range of this pool)
  - DHCP Highest Ip (the highest IP address in the IP range of this pool)
  - DHCP Mask (the mask of this pool)
  - Default Gateway (the default gateway of this pool)
  - Primary DNS (the primary DNS of this pool)
  - Secondary DNS (the secondary DNS of this pool)
  - LeaseTimes (the time for which an IP address is leased, or assigned, to a client; specify a time period of 1–60,000 minutes or 0 for no time limit)
6. To delete a specific DHCP client (for example, to free up its leased IP address):
  1. From the DHCP menu, choose **Delete DHCP client**.  
The Delete DHCP client menu appears.
  2. Choose **IP Address** and then enter the IP address to free up.
  3. Choose **Delete** to remove the DHCP client and thereby free up the specified IP address on the DHCP server.

7. To delete all DHCP clients (in order to free up all leased IP addresses):
  1. From the DHCP menu, choose **Delete All DHCP clients**. A confirmation message appears.
  2. Choose Yes to delete all the DHCP clients and free up all the leased IP addresses.

## Configuring NAT

### ► To configure NAT:

1. From the Router Configuration menu, choose **NAT**.  
The NAT menu appears.

```
NAT
1. Add NAT>
2. Delete NAT>
3. Edit NAT  >

>

Please select item <1 to 3>
@ - Db Update; # - Db Undo
ESC-prev.menu; !-main menu; &-exit
```

Figure 4-85. NAT Menu

2. To add a new NAT (Network Address Translation), choose **Add NAT** and then choose the NAT to be added.
3. To delete a NAT, choose **Delete NAT** and then choose the NAT to be deleted.
4. To configure a NAT, choose **Edit NAT**, select the NAT to configure, and then set the NAT's parameters:
  - NAT Type
  - Interface
  - Real IP
  - Virtual IP
  - Virtual Mask

## Configuring the Firewall

You can define up to 50 firewall rules. These rules do not take effect until they are assigned to the appropriate interface. (See [Set the firewall parameters](#) on page 4-60.)

### ► To configure the firewall:

1. From the Router Configuration menu, choose **Firewall Global Parameters**.  
The Firewall Global Parameters menu appears.

```
Firewall Global Parameters

1. All Fragments      (No)
2. TCP Aging(seconds) [1 - 10000]... (15)
3. UDP Aging(seconds) [1 - 10000]... (15)
4. ICMP Aging(seconds) [1 - 10000]... (15)
5. Default Aging(seconds) [1 - 10000]... (15)
6. Define Rules Menu>

>

Please select item <1 to 6>
@ - Db Update; # - Db Undo
ESC-prev.menu; !-main menu; &-exit
```

Figure 4-86. Firewall Global Parameters Menu

2. Set the following parameters:
  - All Fragments
  - TCP Aging
  - UDP Aging
  - ICMP Aging
  - Default Aging
3. To set firewall rules, choose **Define Rules Menu**.  
The Define Rules Menu appears.

```
Define Rules Menu

1. Rule Number[1 - 50]... (1)
2. Add Rule
3. Delete Rule
4. Edit Rule Menu>
5. Display Existing Rules[]

>

Please select item <1 to 5>
@ - Db Update; # - Db Undo
ESC-prev.menu; !-main menu; &-exit
```

Figure 4-87. Define Rules Menu

4. To add a new firewall rule, choose **Add Rule**.
5. To delete a firewall rule:
  - Choose **Rule Number** and enter the number of the rule to be deleted.
  - Choose **Delete Rule** to delete the rule.
6. To define a firewall rule:
  - Choose **Edit Rule Menu**. The Edit Rule menu appears.

```

Edit Rule Menu

1. Enter Rule Number To Edit[1 - 50]... (1)
2. Destination IP High... (0.0.0.0)
3. Destination IP Low... (0.0.0.0)
4. Source IP High... (0.0.0.0)
5. Source IP Low... (0.0.0.0)
6. Destination Port High[1 - 65000]... (1)
7. Destination Port Low[1 - 65000]... (1)
8. Source Port High[1 - 65000]... (1)
9. Source Port Low[1 - 65000]... (1)
10. Message Type[1 - 65000]... (1)
11. IP Protocol Number [1 - 255]... (1)

>

Please select item <1 to 11>
@ - Db Update; # - Db Undo
ESC-prev.menu; !-main menu; &-exit

```

Figure 4-88. Edit Rule Menu

- Choose **Enter Rule Number To Edit** and enter the number of the firewall rule to define.
  - Use the options on the Edit Rule menu to set the firewall rule.
7. To view the firewall rules, choose **Display Existing Rules**.  
The list of rules appears. Rules that have been defined are identified by the word Yes below the rule number.

```

Display Existing Rules

Rule #   1    2    3    4    5    6    7    8    9   10
        Yes

Rule #   11   12   13   14   15   16   17   18   19   20

Rule #   21   22   23   24   25   26   27   28   29   30

Rule #   31   32   33   34   35   36   37   38   39   40

Rule #   41   42   43   44   45   46   47   48   49   50

>

@ - Db Update; # - Db Undo
ESC-prev.menu; !-main menu; &-exit; ?-help

```

Figure 4-89. Display Existing Rules

---

---

## 4.13 Restoring Default Settings

You can restore the voice port settings of the Vmux-110 to the factory default settings. Restoring the defaults erases defined bundles and assigned timeslots. The system parameters are not affected.

► **To restore the Vmux-110 to the defaults:**

1. From the System menu (see *Figure 4-5*), choose **Factory Default**.

Vmux-110 displays the following message:

```
Are you sure you want to initialize to default  
configuration (Y/N) ?
```

2. Type **Y**, and then press **<Enter>**.

Vmux-110 restores configuration of the voice port(s) to the default settings.

3. Type **@** (**<Shift+2>**) to update the database.

---

---

## 4.14 Resetting the Vmux-110

The Vmux-110 management software allows you to re-initialize the main board CPU of the unit.

► **To reset the Vmux-110 components:**

1. From the System menu, choose **Reset Unit**.

Vmux-110 displays the following message:

```
Are you sure you want to reset the Vmux? Press Y/N
```

2. Type **Y**, and then press **<Enter>**.

The unit is re-initialized; its active software is decompressed and loaded into the RAM.



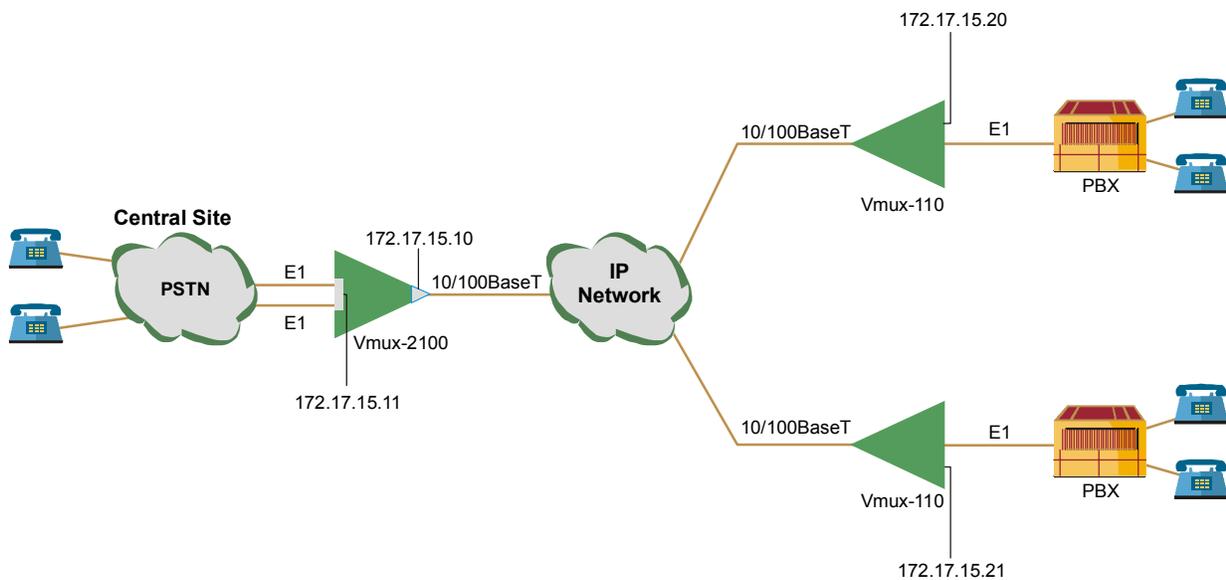
# Chapter 5

## Configuring Vmux-110 for a Typical Application

This chapter gives detailed instructions for configuring Vmux-110 for a typical application in which two Vmux-110 units operate opposite a central Vmux-2100 unit over an IP network.

### 5.1 Application Requirements

*Figure 5-1* illustrates a typical TDM application, in which two Vmux-110 units operate opposite a central Vmux-2100 over an IP network.



*Figure 5-1. Typical Application*

The following network requirements exist:

- Two E1 trunks are transmitted by the central Vmux-2100 over IP network to two remote Vmux-110 units. Both E1s belong to the same group.
- Local timeslots carrying voice are routed to the same timeslot of the corresponding E1 at the remote site
- CAS signaling
- G.732S framing mode, without CRC-4 bits generation
- G.729 A voice compression
- Loopback timing
- Fax relay at 9.6 kbps

- Internal router is enabled at the remote Vmux-110 units
- Main Link is the Ethernet NET interface at the remote Vmux-110 units
- Four transparent channels in each trunk
- Max Bytes In Multiplexed Frame (Edit Bundle menu) –  
 $\#transparent\ timeslots * 80 * Packetizing\ Interval/10 =$   
 $4 * 80 * 30/10 = 960$
- Ethernet Net/User Connection - Layer 2 Switching.

---

---

## 5.2 Outline of Configuration Procedure

The recommended configuration procedure for this application includes the following steps:

1. Configure the local Vmux-2100.
2. Configure the IP host parameters for both remote Vmux-110 units via an ASCII terminal connection.
3. Install the two Vmux-110 units at their locations.
4. Configure one of the Vmux-110 units.
5. On the management station, save the configuration file (**cnfg110.dat**) of the configured Vmux-110 unit. This is done by running a TFTP client or server application on the management station.
6. Download the configuration file to the second Vmux-110 unit. This is done by running a TFTP client or server application on the management station.
7. Modify the relevant parameters on the second Vmux-110 unit.

---

---

## 5.3 Configuring the Local Vmux-2100

This section provides only a summary of the parameters necessary for the voice E1 configuration of the central Vmux-2100. Refer to appropriate sections of the *Vmux-2100 Installation and Operation Manual* for more detailed instructions.

► **To configure the central Vmux-2100:**

1. Assign the 172.17.15.11 IP address to the E1 group 1.
2. Add two bundles and configure them as follows:
  - Connect – Yes
  - Function – TDMoIP
  - Max Bytes In Multiplexed Frame – 960
  - Destination IP:
    - Bundle 1 – 172.17.15.20
    - Bundle 2 – 172.17.15.21

- Destination Bundle – 1
  - Packetizing Interval – 30
  - Coder Rate – G723.1/6.4
  - Fax/modem – Enable at 9.6 kbps.
3. Configure E1 parameters of the first external E1 bundle:
    - Connect – Yes
    - Frame – G.732S
    - Restoration – CCITT
    - Clock Source – Lbt
    - Interface Type – Dsu
    - Idle Code – 7E
    - Profile – 1.
  4. Assign voice timeslots of the first external E1 bundle:
    - Update from Time Slot – 1
    - To Time Slot – 27
    - Type – Voice
    - Bundle – 1
    - Destination Port ID – 1
    - Destination Time Slot ID – 28.
  5. Assign transparent timeslots of the first external E1 bundle:
    - Update from Time Slot – 28
    - To Time Slot – 31
    - Type – Transparent
    - Bundle – 1
    - Destination Port ID – 1
    - Destination Time Slot ID – 28.
  6. Enable the router and configure it:
    - Router – Enable
    - Serial Interface is not configured
    - Net Port IP address - 172.17.15.20
    - All other internal router features are disabled (Static Routing, Default Gateway, DHCP Server)
  7. Configure E1 parameters, timeslots, and internal router of the second external E1 bundle (steps 3 –6 above) to the same parameters, except for the following:
    - Assign the timeslots to bundle 2
    - Net Port IP address - 172.17.15.21

Now you can proceed with configuration of remote Vmux-110 units.

---

---

## 5.4 Configuring Vmux-110 for Operation with CAS Signaling

Most of the configuration procedures are performed on one of the units, except for the defining IP parameters of the second Vmux-110.

Configuration procedure is divided into three main stages:

- Defining system parameters.
- Configuring main link parameters.
- Setting voice E1 parameters.

---

**Note** *You must save the selected values by updating the Vmux-110 database. If the database is not updated, Vmux-110 discards all the user settings when it is reset. You can save selected values at any stage of the configuration procedure.*

---

### Configuring System Parameters

➤ **To configure the Vmux-110 system parameters:**

1. Configure an ASCII terminal to: 9.6 kbps, one start bit, eight data bits, no parity, one stop bit, no flow control, VT100 emulation.
2. Connect the terminal to the first Vmux-110 RJ-45 CONTROL port.
3. Initiate the control session by entering the user name and password.
4. Display the Host IP menu and enter the IP address (172.17.15.20), its subnet mask and default gateway values (**Main Menu > Configuration > System > Management > Host IP**).
5. Repeat step 2 to step 4 for the second Vmux-110 unit, and assign the 172.17.15.21 IP address to it.

---

**Note** *The rest of the configuration procedure refers to the first unit. Information applicable to both units (or only to the second Vmux-110) is explicitly identified.*

---

6. Display the Signal Profile Configuration menu, enter a desired signaling system profile number (1) and configure it according to the system used by the PBX connected to the E1 port (**Main Menu > Configuration > System > Management > Signaling Configuration > Signaling Profile Configuration**).

### Configuring the Main Link

➤ **To configure the Main Link:**

1. Display the Management menu and select the Main Link port: (**Main Menu > Management**)
  - Main Link – LAN.
2. In the Network Port Configuration menu ((**Main Menu > Configuration > Switch LAN Configuration > Network Port Configuration**)) configure the Ethernet Net port operation.

## Configuring Voice E1 Parameters

► **To configure the voice E1 parameters:**

1. Display the Bundle Configuration menu, and add bundle 1 to the system (**Main Menu > Configuration > E1 Voice Configuration > Bundles Parameters > Bundle Configuration > Add Bundle**).
2. Display the Edit Bundle menu, and configure the bundle 1 parameters to the following values (**Main Menu > Configuration > E1 Voice Configuration > Bundles Parameters > Bundle Configuration > Edit Bundle**):
  - Connect – Yes
  - Function – TDMoIP
  - Max Bytes In Multiplexed Frame – 960
  - Destination IP – 172.17.15.11
  - Destination Bundle – 1
  - Packetizing Interval – 30
  - Coder/Rate – G723.1A/6.4
  - Fax/Modem – Enable at 9.6 kbps.
3. Display the E1 Parameters menu, and set the E1 port parameters to the following values (**Main Menu > Configuration > E1 Voice Configuration > E1 Parameters**):
  - Connect – Yes
  - Frame – G.732S
  - Restoration – CCITT
  - Clock Source – Lbt
  - Interface Type – Dsu
  - Idle Code – 7E
  - Profile – 1.
4. Display the Time Slot Configuration menu, and configure the voice timeslots belonging to the external port 1 of group 1 (**Main Menu > Configuration > E1 Voice Configuration > Distribution Of Framer Time Slots > Time Slot Configuration**):
  - Update from Time Slot – 1
  - To Time Slot – 27
  - Type – Voice
  - Bundle – 1
  - Destination Port ID – 1
  - Destination Time Slot ID – 1.

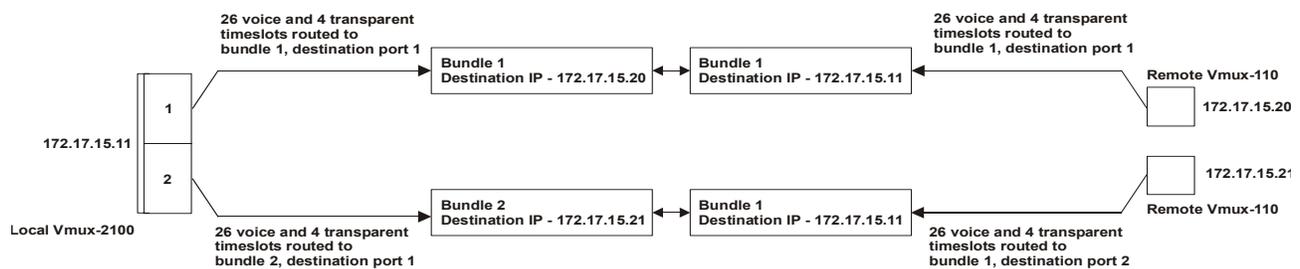
---

**Note** *Vmux-110 displays timeslot 16 as 'Not Connected' (NC), because it carries CAS signaling information.*

---

5. Also in the Time Slot Configuration menu, configure the transparent timeslots belonging to the external port 1 of group 1:
  - Update from Time Slot – 28
  - To Time Slot – 31
  - Type – Transparent
  - Bundle – 1
  - Destination Port ID – 1
  - Destination Time Slot ID – 28.
6. Update the timeslot database from the Time Slot Configuration menu.

*Figure 5-2* summarizes the external E1 bundle and timeslot configuration of the local and remote units.



*Figure 5-2. E1 Bundle and Timeslot Configuration*

## Configuring the Internal Router

### ► To configure the internal router:

1. Display the Management menu and enable the internal router: (**Main Menu > Management**)
  - Router – enable.
2. The options in the Management menu change now that the router is enabled. In the Management menu, define the Ethernet Net/User Connection:
  - Ethernet Net/User Connection - Layer 2 Switching
3. Display the Router Configuration menu to configure the internal router (**Main Menu > Configuration > Router Configuration**).
4. Display the Net Port Configuration menu to define the IP address to which the Net Port (Main Link) routes traffic (**Main Menu > Configuration > Router Configuration > Interfaces Menu > Net Port Configuration**).
  - IP - 172.17.15.20
5. Display the Default Gateway menu to disable the Default Gateway (**Main Menu > Configuration > Router Configuration > Default Gateway**).
6. Display the DHCP menu to disable the DHCP Server (**Main Menu > Configuration > Router Configuration > DHCP**).

## Transferring Database to the Second Vmux-110

► **To transfer the database to the second Vmux-110:**

1. Upload the **cnfg110.dat** file from the first Vmux-110 to the management station via the TFTP protocol.
2. Download the **cnfg110.dat** file to the second Vmux-110 via the TFTP protocol.  
*See [Appendix B](#) for information on TFTP client/server operations for the Vmux-110.*
3. Establish a Telnet connection to the second Vmux-110 unit.
4. Display the Time Slot Configuration menu and set the **Destination Port ID** parameter to **2** and the **Destination Bundle Number** to **2**.
5. Display the Net Port Configuration menu and set the **IP** address to **172.17.15.21**. Also edit the default gateway if needed.
6. Update the second Vmux-110 database by typing **@**.  
Now both remote Vmux-110 units are ready for operation.

---

**Note** *The host IP and the main link values do not change when you download the new configuration and update the database.*

---

---

---

## 5.5 Configuring Vmux-110 for Operation with CCS Signaling

Configuration of the Vmux-110 units operating with the CCS signaling is similar to the configuration for operation with the CAS signaling, except for the following:

1. From E1 Parameters menu, set the E1 framing type to G.732N (**Main Menu > Configuration > E1 Voice Configuration > E1 Parameters**).
2. Display the Time Slot Configuration menu, and configure the timeslots (**Main Menu > Configuration > E1 Voice Configuration > Distribution Of Framed Time Slots > Time Slot Configuration**):
  - Update from Time Slot – 1
  - To Time Slot – 30
  - Type – Voice
  - Bundle – 1
  - Destination Port ID – 1
  - Destination Time Slot ID – 1.
3. Once you assign all timeslots to carry voice, assign one of them (for example, timeslot 31) to carry signaling information:
  - Update from Time Slot – 31
  - To Time Slot – 31

- Type – either HDLC, SS7, or transparent
  - Bundle – 1
  - Destination Port ID – 1
  - Destination Time Slot ID – 31.
4. Update the timeslot database from the Time Slot Configuration menu.
  5. When working with CCS-SS7 (**Type** would be SS7), you can instruct Vmux-110 to drop certain amount of fill-in signal units (FISUs) by selecting the appropriate SS7 keep-alive suppression rate (**Main Menu > Configuration > System > Management > Signaling Configuration > SS7 Keep-Alive Suppression Rate**).
  6. Set all relevant parameters of the central Vmux-2100 in a similar manner (see Vmux-2100 installation and operation manual).

# Chapter 6

---

## Diagnostics

This chapter describes the Vmux-110 diagnostic functions, which include:

- Tone injection
- Local loopbacks (not on analog interfaces)
- Remote loopbacks
- Ping utility.

---

### 6.1 Tone Injection

The test tone is a data sequence at a rate of 1 kHz. This data sequence is identical to the data sequence that would have been generated if a 1 kHz signal having a nominal level 0 dBm were applied to the input of the channel speech processor. The tone should be received clearly by the corresponding subscriber connected to the PBX at the nominal receive level. Vmux-110 with E1/T1 voice port supports tone injection towards the local side only.

The tone injection is activated individually per timeslot. However, multiple tone injections can be run at the same time. Vmux-110 allows you to set the tone injection timeout causing the tone relay to deactivate automatically after the desired period of time.

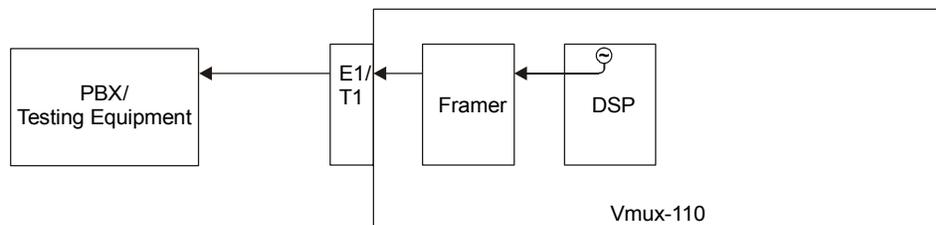


Figure 6-1. Local Tone Injection on the E1/T1 Voice Ports

**Note** Before performing tone injection, make sure that the timeslot to which you intend to inject the tone belongs to the properly configured E1/T1 port.

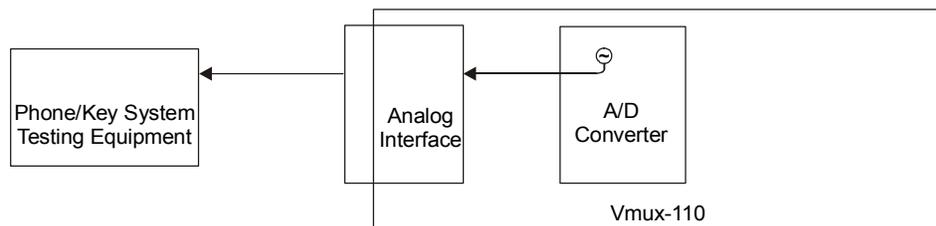


Figure 6-2. Local Tone Injection on the Analog Voice Ports

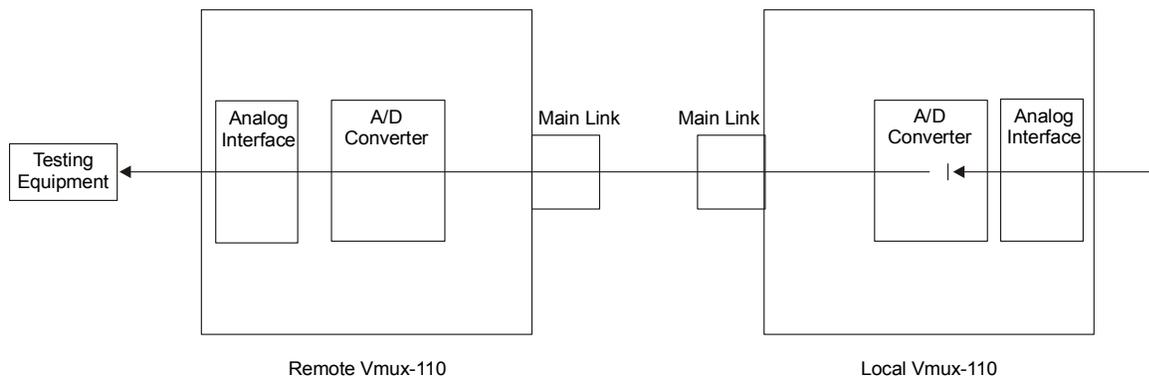


Figure 6-3. Remote Tone Injection on the Analog Voice Ports

► **To activate tone injection:**

1. From the Main menu, select **Diagnostics**.

The Diagnostics menu appears (see [Figure 6-4](#)).

```

Diagnostics
1. Inject Tone test>
2. Local Loop test>
3. Remote Loop test>
4. Display Active tests
5. Ping >

>
Please select item <1 to 5>
@ - Db Update; # - Db Undo
ESC-prev.menu; !-main menu; &-exit

```

Figure 6-4. Diagnostics Menu

2. From the Diagnostic menu, select **Inject Tone Test**.

The Inject Tone Test menu appears (see [Figure 6-5](#)).

```

Inject Tone test
1. Time Slot[1 - 31]... (1)
2. Direction> (Local)
3. Time Out(seconds, 0=forever)[0 - 60]... (0)
4. Activate>

>
Please select item <1 to 4>
@ - Db Update; # - Db Undo
ESC-prev.menu; !-main menu; &-exit

```

Figure 6-5. Inject Tone Menu

3. From the Inject Tone Test menu, perform the following steps to complete the tone injection activation:

- Select a timeslot for the tone injection.
- Specify the direction of the tone injection:
  - **Local:** towards the local PBX/phone device, see [Figure 6-1](#) and [Figure 6-2](#)
  - **Remote** (analog voice ports only): towards the network, see [Figure 6-3](#).
- Define the tone injection timeout (period of time after which the tone injection stops automatically):
  - **0 seconds** (forever) to **60 seconds**
- Activate the tone injection by choosing **Activate**, and then selecting **Yes** from the Activate menu.
- Repeat the procedure for all timeslots that you intend to test.

**Note** You can display information on all tests running at a time by selecting *Display Active Tests* from the *Diagnostics* menu.

## 6.2 Loopback Tests

Vmux-110 supports activation of local and remote loopbacks. The purpose of these tests is to determine the source of a break in the data flow. The loopbacks are activated via voice port .

### Local Loopback

Vmux-110 can be set to a local loopback to test the connection between the voice port and the local side PBX. In this mode, data coming from the PBX is looped back to the PBX (see [Figure 6-6](#)).

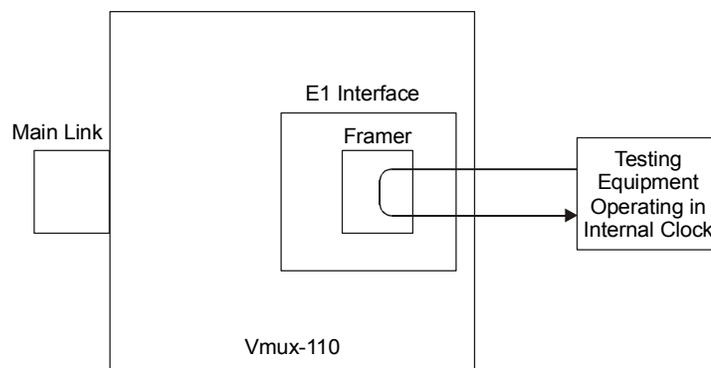


Figure 6-6. Local Loopback

#### ► To activate a local loopback:

1. Configure the testing equipment to internal clock.
2. From the Diagnostics menu, select **Local Loop Test**.  
The Local Loop Test menu appears .
3. From the Local Loop Test menu, activate the local loopback by choosing **Activate**, and then choosing **Yes** from the displayed menu.

## Remote Loopback

Vmux-110 can be set to a remote loopback to test the internal connection between the voice port and the main link. In this mode, data coming from the IP network is looped back to the network (to the remote side). [Figure 6-8](#) and [Figure 6-9](#) show the remote loopbacks on the E1/T1 voice ports and analog voice ports, respectively.

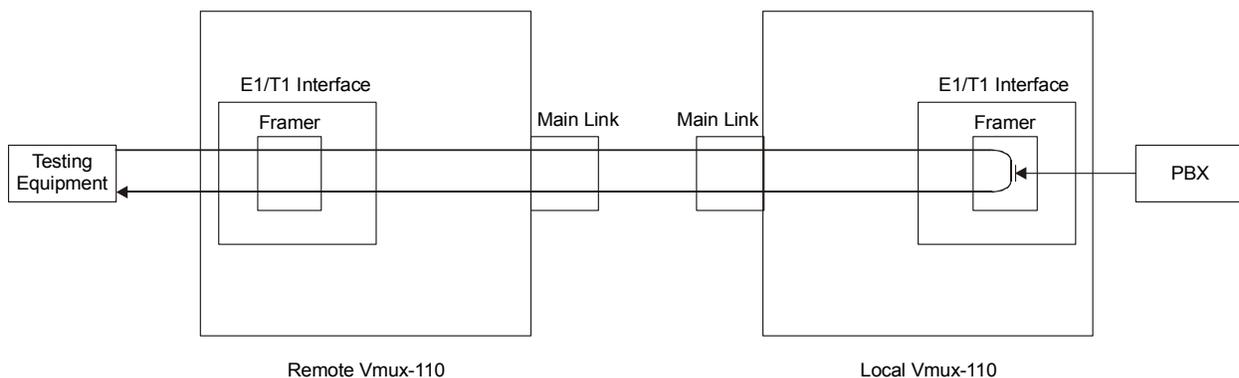
➤ **To activate a remote loopback:**

1. From the Diagnostics menu, select **Remote Loop Test**.  
The Remote Loop Test menu appears.
2. For analog voice ports only, select the port number, as shown below:

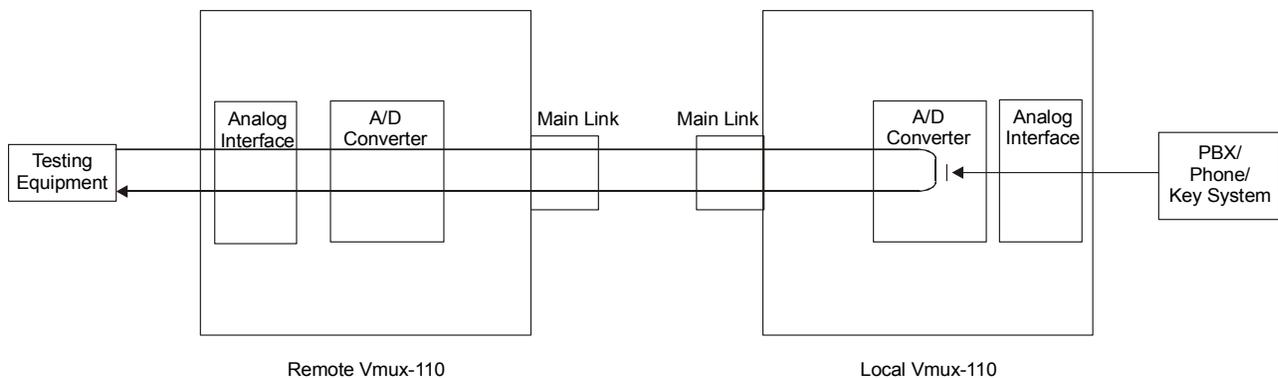
```
Remote Loop test
1. Port[1 - 4]... (1)
2. Activate>.
```

*Figure 6-7. Remote Loop Test Menu*

3. From the Remote Loop Test menu, activate the remote loopback by choosing **Activate**, and then choosing **Yes** from the displayed menu.



*Figure 6-8. Remote Loopback on the E1/T1 Voice Port*



*Figure 6-9. Remote Loopback on the Analog Voice Ports*

---

---

## 6.3 Pinging Remote Devices

The ping utility is used to confirm IP connectivity by pinging other IP hosts. The connectivity is confirmed by receiving a reply from the remote (pinged) hosts.

The ping timeout value is 10 seconds.

► **To ping a host:**

1. From the Diagnostics menu, choose **Ping**.  
The Ping menu appears (see *Figure 6-10*).
2. From the Ping menu, choose **IP Address**, and then enter the desired host IP address.
3. From the Ping menu, choose **Number of Pings**, and then enter the number of pings.
4. From the Ping menu, choose **Activate** to activate the pinging.

```
Ping
1. IP Address... (0.0.0.0)
2. Number Of Pings[1 - 16]... (1)
3. Activate

>

Please select item <1 to 3>
@ - Db Update; # - Db Undo
ESC-prev.menu; !-main menu; &-exit
```

*Figure 6-10. Ping Menu*

---

---

## 6.4 Displaying the Active Tests

The Vmux-110 management software allows you to display tone injection and loopbacks currently in progress.

► **To display all active tests:**

- From the Diagnostics menu, choose **Display Active tests**.

Vmux-110 displays a list of active tests, specifying the timeslot being tested (for tone injection only).



# Chapter 7

---

## Monitoring and Statistics Collection

This chapter describes the alarms, sanity checks (configuration errors and warnings), main link and voice module statistics supported by Vmux-110. It also describes how to configure the Alarm LED mode.

---

### 7.1 Alarms

Vmux-110 detects fault conditions and initiates alarms and events to alert the user:

- **Alarms**, or **state alarms** have two statuses, ON and OFF. The alarm status changes to OFF, when a fault condition that caused it is cleared. Alarms have two levels of severity, minor or major: major alarms are more critical/dangerous to the system functionality.
- **Events**, or **event alarms** have only ON status and serve to notify the user that something important had happened, but not as dangerous to damage the system functionality.

The user can control the alarm severity that causes the ALM LED to turn on.

#### Alarm Buffer

Vmux-110 maintains two alarm buffers:

- **Temporary buffer**, represented as the Display All Alarms screen. All alarms, including active alarms, can be deleted from this display.
- **Permanent buffer**, represented as the Alarm Status screen. Only inactive alarms can be deleted from the Alarm Status screen.

An alarm simultaneously enters both the Display All Alarms log and the Alarm Status log, and the ALM LED lights to indicate the condition. In addition, Vmux-110 displays the ALARM ON indication in the top right-hand corner of the terminal screen. When the event that caused the alarm is cleared, the alarm status changes to OFF, enabling the alarm to be deleted from the permanent buffer.

#### Working with the Temporary Alarm Buffer

The temporary alarm buffer is represented as the Display All Alarms screen.

► **To access the Display All Alarms screen:**

1. From the Main menu, choose **Monitoring**.

The Monitoring menu appears (see [Figure 7-1](#)).

2. From the Monitoring menu, choose **Status**.  
The Status menu appears (see [Figure 7-2](#)).
3. From the Status menu, choose **Display**.  
The Display menu appears (see [Figure 7-3](#)).

```
Monitoring
1. Status>
2. Statistics>
>
Please select item <1 to 2>
```

Figure 7-1. Monitoring Menu

4. From the Display menu, choose **Display All Alarms** to view the alarms.  
Vmux-110 displays the temporary alarm buffer (see [Figure 7-4](#)).  
The display includes the alarm identification code, its severity, its status, and the generation date and time.
- **To delete alarms from the temporary buffer:**
- From the Display menu, choose **Display & Clear Alarms** to view and delete the current alarms.  
Vmux-110 displays the current alarms and deletes them from the buffer when the user exits the screen.

```
Status
1. Display>
2. Clear>
3. Display Sanity>
>
Please select item <1 to 3>
```

Figure 7-2. Status Menu

```
Display
1. Display all Alarms
2. Display & Clear Alarms
3. Display Alarm status
>
Please select item <1 to 3>
```

Figure 7-3. Display Menu

```

(88)      AIS RED ALARM                MAJOR  10-03-2001 01:50:16
(88)      AIS RED ALARM                OFF    10-03-2001 01:50:1
(20)      INTERNAL ERROR              Event  10-03-2001 01:48:15

Press `y` To Continue...
Press `n` To Stop.

```

Figure 7-4. Temporary Alarms Buffer (Display All Alarms Screen)

## Working with the Permanent Buffer

The permanent buffer is represented by the Alarm Status screen.

► **To access the Alarm Status screen:**

- From the Display menu (see [Figure 7-3](#)), select **Display Alarm Status**.

Vmux-110 displays the permanent alarm buffer (see [Figure 7-5](#)).

► **To delete inactive alarms from the permanent buffer:**

1. From the Status menu, select **Clear**.

The Clear menu appears.

2. Confirm the alarm deletion by choosing **Clear All Alarms** from the Clear menu.

Vmux-110 deletes all alarms in the OFF state and events from the permanent buffer.

```

(81)      EXCESSIVE ERROR RATIO        MAJOR  1
(81)      EXCESSIVE ERROR RATIO        OFF    1
(20)      INTERNAL ERROR              Event  1

Press `y` To Continue...
Press `n` To Stop.

```

Figure 7-5. Permanent Buffer (Alarm Status Screen)

## Setting the Alarm LED Severity

You can configure the alarm severity level that will cause the ALM LED to turn.

The following levels are available:

- **Event.** The LED will turn on whenever there is an "ON" alarm in the system, or whenever an event has occurred. Since events are not state alarms, they do not switch to the "OFF" state as soon as the problem that caused them is solved, and you will have to clean the alarm buffer in order to turn the LED off.
- **Minor.** At this level, events do not turn the LED on. As long as there are "ON" alarms in the device (minor or major) the LED will be on, but as soon as **all** the state alarms are turned off, the LED will automatically turn off (no need to clean events from buffer).

- **Major.** At this level, neither events nor minor alarms turn the LED on. As long as there are major "ON" alarms in the device the LED will be on, but as soon as the **major** alarms are turned off, the LED will automatically turn off. There is still no need to clean events from buffer.

► **To set the Alarm LED severity:**

1. From the System menu (**Main > Configuration > System**) select **Alarm Operations > Set Alarm LED Severity**.

The following Alarm LED Severity options are displayed: Event, Minor, and Major:

```
Set Alarm LED Severity (Minor)

1. Event
2. Minor
3. Major

Please choose items <1> to <3>
@ - Db Update; # - Db Undo
ESC-prev.menu; !-main menu; &-exit
```

Figure 7-6. Set Alarm LED Severity Menu

2. Select the alarm severity that will cause the LED to turn on.

## List of Vmux-110 Alarms

Table 7-1 lists the Vmux-110 alarms according to their identification codes.

Table 7-1. Vmux-110 Alarms

ID Code	Terminal Message	Description	Severity
18	DB UPDATE OCCURRED	Vmux-110 database has been updated	Event
20	INTERNAL ERROR	Software error	Event
<p><b>Note:</b> The INTERNAL ERROR alarm is used for software debugging. To receive detailed description of each internal alarm, enable 'Open Internal Alarms' from the System menu (<b>Main menu &gt; Configuration &gt; System &gt; Open Internal Alarms</b>).</p>			
80	BPV ERROR HAS OCCURRED	A bipolar violation error has been detected on the E1 port	Event
81	EXCESSIVE ERROR RATIO	The bit error rate of the port exceeds $1 \times 10^{-3}$	Major
82	ALARM INDICATION SIGNAL	AIS is being detected at the E1 port	Major
83	EXCESSIVE BIPOLAR VIOLATION	Excessive BPVs at the E1 port	Major

Table 7-1. Vmux-110 Alarms (Cont.)

ID Code	Terminal Message	Description	Severity
84	T1/E1 FRAME SLIP HAS OCCURRED	A frame slip occurred at the E1/T1 port	Event
87	T1/E1 SIGNAL LOSS	Loss of input signal at the E1/T1 port	Major
88	AIS RED ALARM	Local loss of frame synchronization at the T1 port caused by AIS condition	Major
89	LOC SYNC LOSS (RED ALARM)	Local loss of frame synchronization at the E1 port	Major
90	REM SYNC LOSS (YELLOW ALARM)	Remote loss of frame synchronization at the E1 port	Major

**Recommendations:**

- Check the bundle state (display the Bundle Statistics or look for Alarm 195 "BUNDLE IS OOS" in the alarms log). If the bundle is in "Out Of Service" state, it will trigger transmission of an AIS signal from the relevant Vmux-110 voice ports to the PBXs on both sides.
- A physical problem (incorrect cabling or bad physical connections) may exist on the transmit wires of the E1 port, affecting the signal transmitted from Vmux-110 towards the PBX/Switch.
- If a Red Alarm (Alarm 89, "LOC SYNC LOSS") is active on the destination port at the remote Vmux-110, this will trigger transmission of an AIS signal to the local PBX, which in turn sends the local Vmux-110 E1/T1 port a RAI/Yellow Alarm indication. Solve the physical problem on the remote E1/T1 port.
- The PBX/Switch connected to Vmux E1/T1 port might be using CRC on its E1 framing, causing CRC errors to appear on the PBX/Switch. Match the E1 frame type between Vmux E1/T1 port and PBX/Switch (either set Vmux to CRC, or disable CRC in PBX/Switch).

Table 7-1. Vmux-110 Alarms (Cont.)

ID Code	Terminal Message	Description	Severity
97	LOCAL MULTIFRAME ALARM	Local loss of multiframe synchronization at the E1 port  <b>Recommendations:</b> Verify that frame types match: Set the PBX/Switch connected to the Vmux-110 E1 port to G.732S or set the Vmux-110 to G.732N.	Minor
98	REMOTE MULTIFRAME ALARM	Remote loss of multiframe synchronization at the E1 port  <b>Recommendations:</b> Verify that frame types match: Set the Vmux-110 to G.732S or set the PBX/Switch connected to the Vmux-110 E1 port to G.732N.	Minor
100	CRC ERROR OCCURRED	CRC-4 error in the E1 port receive signal	Minor
130	OVERFLOW	The required bandwidth exceeds the available bandwidth on the serial main link	Major
131	TRUNK IS DOWN	A fault exists on the line. This alarm applies only to the serial main link port with the DTE clock mode configured and control signals enabled.	Major
195	BUNDLE IS OOS	Bundle is out of service due to the network connectivity problems	Major

## 7.2 Sanity Checks

Configuration errors and mismatches are rendered by the Vmux-110 management software as sanity checks. Their main purpose is to maintain the database validity. Vmux-110 supports two types of the sanity check messages:

- **Error** – major configuration error, which prevents the Vmux-110 database from updating and saving changes.
- **Warning** – minor configuration error, which allows the user to update the database and save the changes.

### Displaying the Sanity Errors and Warnings

Every time you update the Vmux-110 database, the management software analyses the changes. If a major error is detected, Vmux-110 aborts the database update and displays the following message:

**Data base wasn't changed. Sanity Error - Check alarm.**

If a minor error is detected, Vmux-110 updates the database and displays the following message:

**Sanity Warning - Check alarm.**

► **To display the sanity errors and warnings:**

1. From the Status menu (see [Figure 7-2](#)), choose **Display Sanity**.

The Display Sanity menu appears (see [Figure 7-7](#)).

```

Display Sanity

1. Error
2. Warning

>

Please select item <1 to 2>

```

*Figure 7-7. Display Sanity Menu*

2. From the Display Sanity menu, choose **Error** to display the sanity errors or choose **Warning** to display the sanity warnings.

The sanity error or warning list is displayed.

## List of Sanity Errors and Warnings

[Table 7-2](#) lists all sanity errors and warnings generated by Vmux-110, in alphabetical order.

*Table 7-2. Sanity Errors and Warnings*

Display	Type	Description
BUNDLE DESTINED TO A PHONE HAS DEST TS OUT OF RANGE	Error	The destination type is a phone and the specified destination timeslot exceeds 8. Specify a timeslot between 1 and 8, since the FXS supports 8 phones.
BUNDLE IS NOT CONNECTED	Warning	A timeslot is assigned to a bundle which is not connected
BUNDLE FRAME TOO SMALL FOR TRANSP CH DEMANDS	Error	The value of "Max Bytes In Multiplexed Frame" (under Bundle Parameters) must be increased. Its minimum value for supporting "n" transparent timeslots is: $n \times 80 \times [\text{Packetizing Interval}/10]$ ; $n \leq 12$ .
CCS TS NOT RELATED TO THE SAME BUNDLE	Error	At least two timeslots of the E1/T1 port with the CCS signaling are assigned to different bundles. To avoid it, assign all timeslots of the same E1/T1 port with the CCS signaling to the same bundle.
CCS TS NOT RELATED TO THE SAME PORT	Error	At least two timeslots of the E1/T1 port with the CCS signaling are assigned to different destination ports. To avoid it, assign all timeslots of the same E1/T1 port with the CCS signaling to the same destination port.
CODER PROBLEM	Error	Conflict in the DSP capacity and timeslot configuration. Since each DSP handles six timeslots, every six consecutive timeslots must be configured to use the same voice compression method.

Table 7-2. Sanity Errors and Warnings (Cont.)

Display	Type	Description
CONNECTIVITY VALUES MUST BE THE SAME FOR ALL GROUP BUNDLES	Error	Connectivity values of all bundles must be the same.
DEST TS IS OUT OF RANGE (DEST PHONE)	Error	The destination type is a phone and the specified destination timeslot exceeds 4. Specify a timeslot between 1 and 4, since the FXS supports 4 phones.
DISCONNECT BUNDLE BEFORE CHANGING CODER RATE	Error	Voice compression type was changed for a connected bundle. A mismatch between a voice compression type of an active local bundle and that of the destination bundle may cause problems at a DSP. To avoid this, do the following: <ol style="list-style-type: none"> <li>1. Disconnect a bundle of the local Vmux-110.</li> <li>2. Disconnect destination bundle of the remote Vmux-110.</li> <li>3. Change the voice compression method for both bundles.</li> <li>4. Reconnect the bundles.</li> </ol>
DOUBLE ROUTE	Error	More than one timeslot is connected to the same destination timeslot
EMPTY ADMINISTRATOR LIST	Error	The last administrator account is deleted from the user database.
EXTERNAL NOT CONNECTED	Warning	A timeslot is assigned to an E1/T1 port which is not connected
ILLEGAL DEFAULT GATEWAY	Warning	An illegal IP address has been assigned to the Default Gateway (for example: 0.0.0.0).
ILLEGAL DESTINATION IP ADDRESS	Error	Destination IP address for a bundle is not defined
ILLEGAL RINGER PROFILE PERIOD #2	Error	One of the parameters in the second ringer period is set to zero. Either both parameters must be set to zero, or both parameters must be set to non-zero values.  The first parameter represents the ring period of the second ring; the second parameter represents the silence period that follows the second ring.
MAIN LINK ROUTER'S INTERFACE HAS NO IP ADDRESS	Error	No IP address or a non-existent IP address has been assigned to the Main Link.
TOO MANY CONFIGURED TS	Error	Number of timeslots assigned to carry voice exceeds the number of timeslots supported by the unit
TS 16 SHOULD BE DISCONNECTED IN CAS MODE	Error	Timeslot 16 is configured to Voice when operating Vmux-110 with CAS signaling. Timeslot 16 configuration must be changed to N.C.
TS INCOMPATIBLE WITH E1 TYPE	Error	Timeslot 16 is configured to HDLC when E1 is set to the G.732S framing mode. Timeslot 16 configuration must be changed to N.C.

## 7.3 Collecting Statistics

This section explains how to display performance data collected on the Vmux-110 main link and voice ports. You can access performance data via the Statistics menu (see [Figure 7-8](#)).

Note that the type of statistics available varies, depending on the hardware configuration of the Vmux-110 purchased. For the Statistics menu for analog voice interfaces (FXS, FXO, or E&M) see [Figure 7-20](#).

```
Statistics
```

1. Bundles statistics>
2. Voice statistics>
3. Voice Rx Signaling statistics
4. Voice Tx Signaling statistics
5. E1/T1 Data statistics>
6. Serial Port statistics>
7. Ethernet statistics>

```
>
```

```
Please select item <1 to 7>
```

Figure 7-8. Statistics Menu (E1/T1)

► **To display the Statistics menu:**

- From the Monitoring menu (see [Figure 7-1](#)), choose **Statistics**.

The Statistics menu appears.

### Displaying Bundle Statistics

The management software enables you to evaluate the performance of each of the 12 Vmux-110 bundles (see [Figure 7-11](#)). [Table 7-3](#) describes the bundle statistics values.

- **Rx signaling** – Signaling received from the main link.
- **Tx signaling** – Signaling transmitted to the main link.

The bundles may have one of the following states:

- **Connect** – The bundle is connected
- **Disconnected** – The bundle is disconnected
- **Echo Wait** – There is physical connection, but the remote bundle is not active. This might indicate a Layer 4 connectivity problem (UDP).
- **IP OOS** – There is no physical connection between the bundles. The reason for this may be an illegal IP address of the destination E1/T1 group, or a duplicate IP address in the network.

## Sequence Numbers

The Sequence Number statistics can help the user to trace problems in IP, TDM, or serial networks connecting Vmux devices to each other.

The sequence number is stamped in the 16-bit "seq-num" field in the TDMoIP header. Consecutive packets will have consecutive sequence numbers. When the sequence number reaches the maximum value (65535), it resets to 0.

The voice card in the remote Vmux device receives the packets from the network, and analyzes the seq\_num. The results of this analysis are summarized into 3 counters that appear in the 'Bundle Statistics' screen:

- **Missing:** The number of missing received packets. Only the total number of missing packets is relevant, not which specific packets are missing. If the network is 100% fine, then this field should be 0.

For example, if the received packets are numbered 1,2,3,5,6,7,8 then packet no.4 is missing, and the "missing" counter is increased by 1.

- **Longest Series:** The largest burst of consecutive missing packets. This field helps to identify a "bursty" network that drops bursts of packets.

For example, if the received sequence is: 39,41,42,43,44,45,46.... the longest burst is 4 (because we missed 37,38,39,40, which is 4 consecutive packets).

- **Freed:** The number of duplicated packets that were received. Duplicate sequence numbers are dropped by the receiving voice card, so a large number of dropped, or freed, packets gives an indication of a 'duplicating network'.

For example, if the received sequence is: 6,7,8,9,6,6,10,11.... then packet no.6 was duplicated twice by the network. The duplications are dropped by the voice card, and the 'Freed' counter is increased by 2.

The 'Tracing Window' is 30 packets deep. Missing packets and duplicated packets will be recognized correctly only if their Seq\_Num is within this trace window.

For example, if a received sequence is 96,97,98,99,100,75... then packet no. 75 is recognized as a duplicate ( $100 - 75 < 30 =$  inside the window) and **freed**, so now the card expects packet no.101 to arrive from the network. However, if the received sequence is 96,97,98,99,100,65... then packet no.65 is not recognized as a duplicate and is **accepted**, ( $100 - 65 > 30 =$  outside the window). Now the card expects packet no.66 to arrive, and if packet no. 101 arrives instead, then a **Longest Burst** of 35 will be detected.

### Note

*Bundle statistics must be cleared after the bundle has gone up, or the Seq Num mechanism will be irrelevant.*

*This is due to the fact that Seq Num fields are meaningless during the bundle set-up time (that is, the time it takes the bundle to go into "connected" state).*

### ► To display the bundle statistics:

1. From the Statistics menu, select **Bundles Statistics**.  
The Bundles Statistics menu appears (see [Figure 7-9](#)).
2. From the Bundles Statistics menu, choose **Bundle Number**, type the number of the bundle whose statistics you want to view, and then press **<Enter>**.

```

Bundles statistics

1. Bundle Number[1 - 12]... (1)
2. Mode>

>

Please select item <1 to 2>

```

Figure 7-9. Bundles Statistics Menu

- From the Bundles Statistics menu, choose **Mode**.  
The Mode menu appears (see [Figure 7-10](#)).

```

Mode

1. Clear
2. Display

>

Please select item <1 to 2>

```

Figure 7-10. Mode Menu

- From the Mode menu, choose **Display**.  
The Bundle Statistics screen is displayed (see [Figure 7-11](#)). [Table 7-3](#) describes the bundle statistics values.
- Press **<Y>** to refresh the display.
- Press **<ESC>** to exit the Bundle Statistics screen.

```

Statistics on Bundle: 1, State: DISCONNECT
          Rx statistics
Total Frames  :[      0 ] Total Bytes      :[      0 ]
60 sec Frames :[      0 ] 60 sec Bytes    :[      0 ]
          Tx statistics Type
Total Frames  :[      0 ] Total Bytes      :[      0 ]
60 sec Frames :[      0 ] 60 sec Bytes    :[      0 ]
Tx on Timeout :[      0 ] Tx Max Size    :[      0 ]
60 sec Timeout :[      0 ] 60 sec Max Size :[      0 ]
          Data Type
Total - Rx Sg :[      0 ] Rx Voice :[      0 ] Rx Hdlc :[      0 ]
60 sec- Rx Sg :[      0 ] Rx Voice :[      0 ] Rx Hdlc :[      0 ]
Total - Tx Sg :[      0 ] Tx Voice :[      0 ] Tx Hdlc :[      0 ]
60 sec- Tx Sg :[      0 ] Tx Voice :[      0 ] Tx Hdlc :[      0 ]
Silence percent on bundle - Rx :[      10 ] Tx :[      10 ]
seq num: freed [      0 ] missing[      0 ] longest series [      0 ]

Press 'Y' for refresh , ESC - for exit.

ESC-prev.menu; !-main menu; &-exit

```

Figure 7-11. Bundle Statistics

Table 7-3. Bundle Statistics Values

<b>Field</b>	<b>Description</b>
Rx Total Frames	Total number of packets received
Rx Total Bytes	Total number of data octets of all packets received
Rx 60 sec Frames	Number of packets received during the last 60 seconds
Rx 60 sec Bytes	Number of data octets received during the last 60 seconds
Tx Total Frames	Total number of packets transmitted
Tx Total Bytes	Total number of data octets of all packets transmitted
Tx 60 sec Frames	Number of packets transmitted during the last 60 seconds
Tx 60 sec Bytes	Number of data octets transmitted during the last 60 seconds
Tx on Timeout	Number of packets transmitted as a result of reaching the maximum packetizing interval
Tx Max Size	Number of packets transmitted as a result of reaching the maximum frame size
60 sec Timeout	Number of packets transmitted as a result of reaching the maximum packetizing interval during the last 60 seconds
60 sec Max Size	Number of packets transmitted as a result of reaching the maximum frame size during the last 60 seconds
Total - Rx Sg	Total number of received signaling packets
Total - Rx Voice	Total number of received voice packets
Total - Rx Hdlc	Total number of received HDLC packets
60 sec - Rx Sg	Number of signaling packets received during last 60 seconds
60 sec - Rx Voice	Number of voice packets received during last 60 seconds
60 sec - Rx Hdlc	Number of HDLC packets received during last 60 seconds
Total - Tx Sg	Total number of transmitted signaling packets
Total - Tx Voice	Total number of transmitted voice packets
Total - Tx Hdlc	Total number of transmitted HDLC packets
60 sec - Tx Sg	Number of signaling packets transmitted during last 60 seconds
60 sec - Tx Voice	Number of voice packets transmitted during last 60 seconds
60 sec - Tx Hdlc	Number of HDLC packets transmitted during last 60 seconds
Silence percent on bundle Rx	Average percentage of silence on all the received timeslots connected to the bundle
Silence percent on bundle Tx	Average percentage of silence on all the transmitted timeslots connected to the bundle
seq num: freed	Number of duplicate packets that were received and dropped. (Duplicate problem in the network)

Table 7-3. Bundle Statistics Values (Cont.)

Field	Description
seq num: missing	Number of packets that packets did not arrive in time according to sequence number (either lost in the network or reordered)
seq num: longest series	The largest interval of consecutively numbered missed packets. (Large value indicates bursty problem in the network)

➤ **To clear the bundle statistics registers:**

1. From the Bundles Statistics menu (see [Figure 7-9](#)), choose **Mode**.  
The Mode menu appears (see [Figure 7-10](#)).
2. From the Mode menu, choose **Clear**.

## Displaying Timeslot Voice Statistics

The Vmux-110 software enables you to evaluate performance of a separate timeslot and the DSP used by it (see [Figure 7-13](#)). [Table 7-4](#) describes the timeslot voice statistics values.

➤ **To display the timeslot voice statistics:**

1. From the Statistics menu (see [Figure 7-8](#)), select **Voice Statistics**.  
The Voice Statistics menu appears (see [Figure 7-12](#)).

```

Voice statistics
1. Time Slot[1 - 31]... (1)
2. Mode>

>

Please select item <1 to 2>

```

Figure 7-12. Voice Statistics Menu

2. From the Voice Statistics menu, choose **Time Slot**, type the number of the timeslot whose statistics you want to view, and then press **<Enter>**.
3. From the Voice Statistics menu, choose **Mode**.  
The Mode menu appears (see [Figure 7-10](#)).
4. From the Mode menu, choose **Display**.  
The Voice Statistics Timeslot screen is displayed (see [Figure 7-13](#)).  
[Table 7-4](#) describes the timeslot voice statistics values.
5. Press **<Y>** to refresh the display.
6. Press **<ESC>** to exit the Voice Statistics Timeslot Statistics screen.

```

Voice Statistics Time Slot: 1

Dsp Mode      :[          IDLE]
Total Rx Voice :[          0 ]   Total Tx Voice  :[          0 ]
Total Rx Sid   :[          0 ]   Total Tx Sid   :[          0 ]
Total Rx Fax   :[          0 ]   Total Tx Fax   :[          0 ]
Total Underun  :[          0 ]   Total Overrun  :[          0 ]
Max jitter len :[          150 ]
Silence percent since last clear: Rx: [          10 ] Tx: [          10 ]

Press 'Y' for refresh , ESC - for exit.

```

Figure 7-13. Voice Statistics Timeslot Screen

Table 7-4. Voice Statistics Timeslot Values

Field	Description
DSP Mode	<ul style="list-style-type: none"> <li>• IDLE – DSP is idle</li> <li>• VOICE – DSP is transmitting voice packets</li> <li>• DATA HDLC – DSP is transmitting HDLC packets</li> <li>• DATATRANSF – DSP is transmitting packets transparently</li> <li>• FAX –DSP is relaying fax signal</li> <li>• VOICEBAND – DSP is transmitting voiceband data (modem)</li> </ul>
Total Rx Voice	Total number of voice packets received from the DSP
Total Tx Voice	Total number of voice packets transmitted to the DSP
Total Rx Sid	Total number of silence packets received from the DSP
Total Tx Sid	Total number of silence packets transmitted to the DSP
Total Rx Fax	Total number of fax packets received from the DSP
Total Tx Fax	Total number of fax packets transmitted to the DSP
Total Underrun	Total underrun of the jitter buffer (in packets)
Total Overrun	Total overrun of the jitter buffer (in packets)
Max jitter len	Max length of the jitter buffer (in msec)
Silence percent since last clear: Rx	Average percentage of silence carried by the received timeslot since buffer was last cleared
Silence percent since last clear: Tx:	Average percentage of silence carried by the transmitted timeslot since buffer was last cleared

► **To clear the timeslot voice statistics registers:**

1. From the Voice Statistics menu, choose **Mode**.
2. From the Mode menu, choose **Clear**.

## Displaying the Voice Signaling Statistics

When operating with the CAS signaling (E1 or T1 voice port only), Vmux-110 transmits signaling information in one of the timeslots. You can display the mapping of the ABCD bits used by each timeslot inside the signaling timeslot (see [Figure 7-14](#) and [Figure 7-15](#)).

- **Rx statistics** – Packets transmitted from the E1/T1 trunk or PBX
- **Tx statistics** – Packets transmitted towards the E1/T1 trunk or PBX.

### ► To display the signaling statistics:

1. From the Statistics menu, choose **Voice Rx Signaling Statistics** to display the Rx signaling statistics, or choose **Voice Tx Signaling Statistics** to display the Tx signaling statistics.

The Voice Rx Signaling Statistics screen (see [Figure 7-14](#)) or Voice Tx Signaling Statistics screen (see [Figure 7-15](#)) appears.

2. Press **<Y>** to refresh the display.
3. Press **<ESC>** to exit the signaling statistics screen.

```

Voice Rx Signaling Statistics

Ts1  :[      0000 ]   Ts2  :[      0000 ]   Ts3  :[      0000 ]
Ts4  :[      0000 ]   Ts5  :[      0000 ]   Ts6  :[      0000 ]
Ts7  :[      0000 ]   Ts8  :[      0000 ]   Ts9  :[      0000 ]
Ts10 :[      0000 ]   Ts11 :[      0000 ]   Ts12 :[      0000 ]
Ts13 :[      0000 ]   Ts14 :[      0000 ]   Ts15 :[      0000 ]
Ts17 :[      0000 ]   Ts18 :[      0000 ]   Ts19 :[      0000 ]
Ts20 :[      0000 ]   Ts21 :[      0000 ]   Ts22 :[      0000 ]
Ts23 :[      0000 ]   Ts24 :[      0000 ]   Ts25 :[      0000 ]
Ts26 :[      0000 ]   Ts27 :[      0000 ]   Ts28 :[      0000 ]
Ts29 :[      0000 ]   Ts30 :[      0000 ]   Ts31 :[      0000 ]

Press 'Y' for refresh , ESC - for exit.

```

Figure 7-14. Voice Rx Signaling Statistics

```

Voice Tx Signaling Statistics

Ts1  :[      0000 ]   Ts2  :[      0000 ]   Ts3  :[      0000 ]
Ts4  :[      0000 ]   Ts5  :[      0000 ]   Ts6  :[      0000 ]
Ts7  :[      0000 ]   Ts8  :[      0000 ]   Ts9  :[      0000 ]
Ts10 :[      0000 ]   Ts11 :[      0000 ]   Ts12 :[      0000 ]
Ts13 :[      0000 ]   Ts14 :[      0000 ]   Ts15 :[      0000 ]
Ts17 :[      0010 ]   Ts18 :[      0010 ]   Ts19 :[      0010 ]
Ts20 :[      0010 ]   Ts21 :[      0010 ]   Ts22 :[      0010 ]
Ts23 :[      0010 ]   Ts24 :[      0010 ]   Ts25 :[      0010 ]
Ts26 :[      0010 ]   Ts27 :[      0010 ]   Ts28 :[      0010 ]
Ts29 :[      0010 ]   Ts30 :[      0010 ]   Ts31 :[      0010 ]

Press 'Y' for refresh , ESC - for exit.

```

Figure 7-15. Voice Tx Signaling Statistics

## Displaying Data Statistics

When the E1/T1 timeslots are configured to carry any kind of data (HDLC, SS7 or Transparent), Vmux-110 collects data traffic statistics. Data statistics are not relevant for the FXS voice port option.

► **To display the Data statistics:**

1. From the Statistics menu, choose **E1/T1 Data Statistics**.

The E1/T1 Data Statistics menu appears.

```
E1/T1 Data Statistics
1. Channel > (HDLC-1)
2. Mode >

Please select item <1 to 2>
@ - Db Update; # - Db Undo
ESC-prev.menu; !-main menu; &-exit 1 user(s)
```

Figure 7-16. Channel Menu

2. From the E1/T1 Data Statistics menu, choose **Channel**.

The Channel menu appears.

3. From the Channel menu, select the desired data type.

```
Channel
1. SS7-1 >
2. SS7-2 >
3. HDLC-1 >
4. HDLC-2 >
5. HDLC-3 >
6. HDLC-4 >
7. TRANSP-1 >

Please select item <1 to 7>
@ - Db Update; # - Db Undo
ESC-prev.menu; !-main menu; &-exit 1 user(s)
```

Figure 7-17. Channel Menu

4. From the Data Statistics menu, choose **Mode**.

The Mode menu appears.

```
Mode
1. Display
2. Clear

Please select item <1 to 2>
@ - Db Update; # - Db Undo
ESC-prev.menu; !-main menu; &-exit
```

Figure 7-18. Mode Menu

5. From the Mode menu, choose **Display**.

The selected Data Statistics screen is displayed (see [Figure 7-19](#)). [Table 7-5](#) describes the Data statistics values.

6. Press **<Y>** to refresh the display.
7. Press **<ESC>** to exit the Data Statistics screen.

Note that in the following table “data” refers to the selected data channel (SS7-1, SS7-2, HDLC-1, HDLC-2, HDLC-3, HDLC-4, TRANSP-1), rather than to total data statistics.

Hdlc Statistics					
Rx statistics					
Total Frames	:[	0 ]	Total Bytes	:[	0 ]
60 sec Frames	:[	0 ]	60 sec Bytes	:[	0 ]
Length Error	:[	0 ]	NonOctet Aligned	:[	0 ]
Aborted Frames	:[	0 ]	Crc Error	:[	0 ]
Overrun	:[	0 ]			
Tx statistics					
Total Frames	:[	0 ]	Total Bytes	:[	0 ]
60 sec Frames	:[	0 ]	60 sec Bytes	:[	0 ]
Underrun	:[	0 ]			
Tx Queue - Max Frames	:[	0]	Current Frames	:[	0]
Freed Frames	:[	0]			
Press 'Y' for refresh , ESC - for exit.					

*Figure 7-19. Sample E1/T1 Data Statistics Screen (HDLC)*

Note that in the following table “data” refers to the selected data channel (SS7-1, SS7-2, HDLC-1, HDLC-2, HDLC-3, HDLC-4, TRANSP-1), rather than to total data statistics.

*Table 7-5. Data Statistics Values*

Field	Description
Rx Total Frames	Total number of data packets received
Rx Total Bytes	Total number of data octets of all packets received
Rx 60 sec Frames	Number of data packets received during last 60 seconds
Rx 60 sec Bytes	Number of data octets received during last 60 seconds
Length Error	Number received frames with length violations
NonOctet Aligned	Number of received frames which contain a number of bits not divisible by eight
Aborted Frames	Number of aborted sequences. The counter is incremented by one when at least seven consecutive ones are received during frame reception
Crc Error	Number of received frames with CRC errors
Rx Overrun	Number of received data packets discarded due to lack of buffer resources
Tx Total Frames	Total number of data packets transmitted
Tx Total Bytes	Total number of data octets of all packets transmitted

Table 7-5. Data Statistics Values (Cont.)

Field	Description
Tx 60 sec Frames	Number of data packets transmitted during last 60 seconds
Tx 60 sec Bytes	Number of data octets transmitted during last 60 seconds
Tx Underrun	Number of transmitted data packets discarded due to lack of buffer resources
Tx Queue - Max Frames	Maximum number of the transmitted data packets ever accumulated in the FIFO buffer
Tx Queue - Current Frames	Current number of the transmitted data packets in the FIFO buffer
Freed Frames	Number of frames discarded from the FIFO buffer when the number of stored frames exceeded buffer capacity

- **To clear the Data statistics registers:**
  - From the Mode menu, choose **Clear**.

## Displaying the Analog Signaling Statistics

When operating with the FXS, FXO or E&M voice port, Vmux-110 records statistics about the analog voice ports.

The Statistics menu then displays the following options:

```
Statistics
```

- ```
1. Bundles statistics>
2. Voice statistics>
3. Analog Signaling statistics
4. Serial Port statistics>
5. Ethernet statistics>
```

```
>
```

```
Please select item <1 to 5>
```

Figure 7-20. Statistics Menu (Analog interface)

- **To display the analog signaling statistics:**
  - From the Statistics menu (see [Figure 7-20](#)), choose **Analog Signaling Statistics**.

The Analog Signaling Statistics screen is displayed. Press **<Enter>** to refresh the display. Press **<ESC>** to exit the Analog signaling statistics screen.

```

Analog Signaling statistics

  Ts#   Type   Bundle  Dest Type  Dest Port  Dest Ts   State
  1     N.C    0       PBX        1          0         BOTH_ON_HOOK
  2     N.C    0       PBX        1          0         BOTH_ON_HOOK
  3     N.C    0       PBX        1          0         BOTH_ON_HOOK
  4     N.C    0       PBX        1          0         BOTH_ON_HOOK

>

Press Enter for refresh

```

Figure 7-21. Analog Signaling Statistics Screen (FXS)

```

Analog Signaling statistics

  Ts#   Type   Bundle  Dest Port  Dest Ts   State
  1     N.C    0       1          0         BOTH_ON_HOOK
  2     N.C    0       1          0         BOTH_ON_HOOK
  3     N.C    0       1          0         BOTH_ON_HOOK
  4     N.C    0       1          0         BOTH_ON_HOOK

>

Press Enter for refresh

```

Figure 7-22. Analog Signaling Statistics Screen (FXO/ E&M)

The State of the analog FXS port can be one of the following:

- BOTH\_ON\_HOOK (both local and remote handsets are on-hook)
- RINGBACK (ring-back signal is being sent from remote handset)
- ACTIVE\_CALL (call is in progress)
- LOCAL\_ON\_HOOK (local handset is on-hook, remote handset is not on-hook)
- REMOTE\_ON\_HOOK (remote handset is on-hook, local handset is not on-hook)
- RINGING (local handset is ringing)

The State of the analog FXO port can be one of the following:

- IDLE (Both sides are on hook)
- RINGING (local port detects ring from PBX)
- ACTIVE\_CALL (call is in progress)
- CALLER\_ID (Interval between rings. During this interval the device is ready to pass caller Id information)
- OUT\_OF\_SERVICE (Bundle is out of service)

The State of the analog E&M port can be one of the following:

- BOTH\_ON\_HOOK (both local and remote handsets are on-hook)
- ACTIVE\_CALL (call is in progress)

- LOCAL\_OFF\_HOOK (local handset is not on-hook, remote handset is on-hook)
- REMOTE\_OFF\_HOOK (remote handset is not on-hook, local handset is on-hook)
- OUT\_OF\_SERVICE (Bundle is out of service)

## Displaying the Serial Port Statistics

Vmux-110 evaluates performance of the Serial port (see [Figure 7-24](#)). [Table 7-6](#) describes the Serial port statistics values.

- **Rx signaling** – Signaling received from the serial port.
- **Tx signaling** – Signaling transmitted to the serial port.

### ► To display the Serial port statistics:

1. From the Statistics menu, choose **Serial Port Statistics**.

The Serial Port Statistics menu appears (see [Figure 7-23](#)).

```
Serial Port statistics
1. Clear
2. Display
>
Please select item <1 to 2>
```

*Figure 7-23. Serial Port Statistics Menu*

2. From the Serial Port Statistics menu, choose **Display**.

The Serial Port Statistics screen is displayed (see [Figure 7-24](#)). [Table 7-6](#) describes the Serial Port Statistics values.

```
Serial Port Statistics
Rx statistics
Total Frames      :[      0 ]   Total Bytes       :[      0 ]
60 sec Frames    :[      0 ]   60 sec Bytes     :[      0 ]
Length Error     :[      0 ]   NonOctet Aligned :[      0 ]
Aborted Frames   :[      0 ]   Crc Error        :[      0 ]
Overrun          :[      0 ]   Freed Rx Frames  :[      0 ]
Tx statistics
Total Frames      :[      0 ]   Total Bytes       :[      0 ]
60 sec Frames    :[      0 ]   60 sec Bytes     :[      0 ]
Underrun         :[      0 ]   Freed Tx Frames  :[      0 ]
Tx Voice Q - Current Frames :[      0 ] Max Frames :[      0 ]
Tx Data Q - Current Frames :[      0 ] Max Frames :[      0 ]
Tx Mng Q - Current Frames :[      0 ] Max Frames :[      0 ]
BandWidth To Line - Average:[      0 ] Max:[      0 ] (bit/Sec)
Press 'Y' for refresh , ESC - for exit.
```

*Figure 7-24. Serial Port Statistics Screen*

Table 7-6. Serial Port Statistics Values

| Field                       | Description                                                                                                                             |
|-----------------------------|-----------------------------------------------------------------------------------------------------------------------------------------|
| Rx Total Frames             | Total number of HDLC packets received                                                                                                   |
| Rx Total Bytes              | Total number of data octets of all packets received                                                                                     |
| Rx 60 sec Frames            | Number of HDLC packets received during last 60 seconds                                                                                  |
| Rx 60 sec Bytes             | Number of data octets received during last 60 seconds                                                                                   |
| Rx Length Error             | Number received frames with length violations                                                                                           |
| Rx NonOctet Aligned         | Number of received frames which contain a number of bits not divisible by eight                                                         |
| Rx Aborted Frames           | Number of aborted sequences. The counter is incremented by one when at least seven consecutive ones are received during frame reception |
| Rx Crc Error                | Number of received frames with CRC errors                                                                                               |
| Rx Overrun                  | Number of received HDLC packets discarded due to lack of buffer resources                                                               |
| Freed RX Frames             | Number of frames discarded from the FIFO buffer when the number of stored frames exceeded buffer capacity                               |
| Tx Total Frames             | Total number of HDLC packets transmitted                                                                                                |
| Tx Total Bytes              | Total number of data octets of all packets transmitted                                                                                  |
| Tx 60 sec Frames            | Number of HDLC packets transmitted during last 60 seconds                                                                               |
| Tx 60 sec Bytes             | Number of data octets transmitted during last 60 seconds                                                                                |
| Tx Underrun                 | Number of transmitted HDLC packets discarded due to lack of buffer resources                                                            |
| Freed Tx Frames             | Number of frames discarded from the FIFO buffer when the number of stored frames exceeded buffer capacity                               |
| Tx Voice Q - Current Frames | Current number of the transmitted HDLC voice packets in the FIFO buffer                                                                 |
| Tx Voice Q - Max Frames     | Maximum number of the transmitted HDLC voice packets ever accumulated in the FIFO buffer                                                |
| Tx Data Q - Current Frames  | Current number of the transmitted HDLC data packets in the FIFO buffer                                                                  |
| Tx Data Q - Max Frames      | Maximum number of the transmitted HDLC data packets ever accumulated in the FIFO buffer                                                 |
| Tx Mng Q - Current Frames   | Current number of the transmitted HDLC management packets in the FIFO buffer                                                            |
| Tx Mng Q - Max Frames       | Maximum number of the transmitted HDLC management packets ever accumulated in the FIFO buffer                                           |

## Displaying the Ethernet Statistics

Vmux-110 evaluates performance of the 10/100BaseT Ethernet Network and User ports (see [Figure 7-27](#)). [Table 7-7](#) describes the Ethernet statistics values.

- **Rx signaling** – Signaling received from the Ethernet port.
- **Tx signaling** – Signaling transmitted to the Ethernet port.

► **To display the Ethernet statistics:**

1. From the Statistics menu, choose **Ethernet Statistics**.

The Ethernet Statistics menu appears (see [Figure 7-25](#)).

```
Ethernet statistics
1. Network Port>
2. User Port>
>
Please select item <1 to 2>
```

*Figure 7-25. Ethernet Statistics Menu*

2. Select the Ethernet port whose statistics are desired: **Network Port** or **User Port**  
The **Network/User Port** menu appears.

```
Network Port
1. Clear
2. Display
>
Please select item <1 to 2>
```

*Figure 7-26. Network/User Port Menu*

3. From the Network/User Port menu, select **Display**.

The Ethernet Switch Statistics screen for the selected port is displayed (see [Figure 7-27](#)). [Table 7-7](#) describes the Ethernet port switch statistics values.

```
Switch Statistics - Network Port
Rx Statistics
Total Frames: [ 0 ] Total Bytes: [ 0 ]
Frames: [ 0 ] Bytes: [ 0 ]
Brdcst Frames:[ 0 ] Multcst Frames:[ 0 ]
Undersize: [ 0 ] Oversize: [ 0 ]
CRC: [ 0 ] Fragments: [ 0 ]
Jabber: [ 0 ] Discarded: [ 0 ]
Filtered: [ 0 ]
Tx Statistics
Frames: [ 0 ] Bytes: [ 0 ]
Brdcst Frames:[ 0 ] Multcst Frames:[ 0 ]
Collisions: [ 0 ]
Frame Size Statistics (Rx + Tx)
64b: [ 0 ] 65b-127b: [ 0 ]
128b-255b: [ 0 ] 256b-511b: [ 0 ]
512b-1023b: [ 0 ] 1024b-Max: [ 0 ]
Press 'Y' for refresh , ESC - for exit.
```

*Figure 7-27. Ethernet Port Switch Statistics Screen*

Table 7-7. Ethernet Port Switch Statistics Values

| Field                                | Description                                                                      |
|--------------------------------------|----------------------------------------------------------------------------------|
| <b>RX Statistics</b>                 |                                                                                  |
| Total Frames                         | Total number of frames received                                                  |
| Total Bytes                          | Total number of octets received                                                  |
| Frames                               | Number of good frames received                                                   |
| Bytes                                | Number of good octets received                                                   |
| <b>RX Statistics (cont)</b>          |                                                                                  |
| Brdcst Frames                        | Number of good broadcast frames received                                         |
| Multcst Frames                       | Number of good multicast frames received                                         |
| Undersize                            | Number of good frames received with length less than 64 bytes                    |
| Oversize                             | Number of good frames received with length more than MaxSize                     |
| CRC                                  | Number of frames received with invalid CRC                                       |
| Fragments                            | Number of frames received with invalid CRC and length less than 64 bytes         |
| Jabber                               | Number of frames received with invalid CRC and length more than MaxSize          |
| Discarded                            | Number of frames discarded due to a lack of buffer space                         |
| Filtered                             | Number of frames discarded due to an unknown VLAN Id                             |
| <b>RX Statistics</b>                 |                                                                                  |
| Frames                               | Number of good frames transmitted                                                |
| Bytes                                | Number of good octets transmitted                                                |
| Brdcst Frames                        | Number of good broadcast frames transmitted                                      |
| Multcst Frames                       | Number of good multicast frames transmitted                                      |
| Collisions                           | Number of collisions during frame transmission                                   |
| <b>Frame Size Statistics (Rx+Tx)</b> |                                                                                  |
| 64b                                  | Number of frames received and transmitted with a length of 64 bytes              |
| 65b – 127b                           | Number of frames received and transmitted with a length of 65 to 127 bytes       |
| 128b – 255b                          | Number of frames received and transmitted with a length of 128 to 255 bytes      |
| 256b – 511b                          | Number of frames received and transmitted with a length of 256 to 511 bytes      |
| 512b – 1023b                         | Number of frames received and transmitted with a length of 512 to 1023 bytes     |
| 1024b - Max                          | Number of frames received and transmitted with a length of 1024 to MaxSize bytes |

4. Press <Y> to refresh the display.
5. Press <ESC> to exit the Ethernet Port Switch Statistics screen.

► **To clear the Ethernet port switch statistics registers:**

- From the Network/User Port menu, choose **Clear**.

---

---

## 7.4 Frequently Asked Questions

**Q:** I am experiencing an active YELLOW ALARM on my Vmux-110 voice port. What could be the possible causes of this condition?

**A:** Possible causes for a Yellow Alarm on a local E1/T1 voice port:

- Incorrect cabling or bad physical connections.
- Red Alarm (Local Sync Loss) on the destination port at the remote Vmux is active (thus triggering an AIS signal to be transmitted locally to the PBX, which in return sends the local Vmux voice port an RAI/Yellow Alarm indication).
- Bundle is Out Of Service (thus triggering an AIS signal to be transmitted from the relevant Vmux voice ports to the PBXs on both sides)
- E1 framing mode of PBX/switch might be set to CRC while Vmux is not (thus causing the PBX/switch to signal to the Vmux that it is not synchronized).

**Q:** Can I use a Vmux-110/E1 opposite a Vmux-110/T1?

**A:** Yes.

You can establish a connection between one site that uses E1-based voice traffic and another site that uses T1-based voice traffic with the Vmux-110 units. Since the E1/T1 voice module terminates the E1/T1 frames (the voice traffic is then encapsulated into a TDMoIP frame), you can perform an E1 vs. T1 connection.

Note that you should open up to 24 time slots on the E1 side opposite the T1 side.

Vmux-110 automatically converts between the E1 and T1 CAS signaling bits mapping formats (TS16 and Robbed Bit Multi-Frame respectively). If any additional conversions are required on the signaling protocol itself (e.g. between different national variants), these should be handled externally.

**Q:** What is the meaning of BPV error, and what can be the reason for such an error?

**A:** A BPV error event on AMI-coded signal is the occurrence of a pulse of the same polarity as the previous pulse. A BPV error event for a B8ZS- or HDB3-coded signal is the occurrence of a pulse of the same polarity as the previous pulse without being a part of the zero substitution code.

A normal DS-1 signal uses Alternate Mark Inversion as the line code.

**Q:** Can the Vmux-110 Bundle Coder be changed remotely via Telnet? Will I have downtime while implementing this change?

**A:** Yes, the change can be done remotely via Telnet without any problem, although the bundle will be temporarily down for the period of change. The management connection in case of inband management is done over the main link and the bundles have no influence on this connection.

- Q:** I would like to use Vmux-110 over low quality TDM uplink ( $10^3 - 10^5$ ); will I have a service problem using it?
- A:** The Vmux-110 application will work when using a low quality TDM uplink, but we cannot promise that service will not be affected. In case of a link of 103, there are two possible scenarios:
- The bundle will go down (depending on the setting of the connectivity parameters). Then there will be no service available (AIS will be generated on both sides) until the Bundle is re-established.
  - The bundle will be up, but some packets will be lost. In this case the voice quality will be degraded and we will have temporary voice degradation. In addition, fax and modem transmission can be affected as well in case of packet loss.

In summary, we cannot guarantee in the worst-case scenario ( $10^3$ ) that the Vmux-110 will be completely functional

- Q:** Does Vmux-110 support ISDN data calls, such as WAP (V-110)?
- A:** The Vmux-110 does not support ISDN data calls, such as WAP (V-110). However, if the data calls can be sent over a specific/constant timeslot, we can set this TS as a Transparent TS on the Vmux-110 side. In this way, the data is transmitted transparently, but the bandwidth for these calls will be a full TS 64 kbps and not dynamically allocated. When using this option, you will need to use the transparent TS constantly only for the WAP data. This transparent data feature is supported only on phase 3 versions (up to 8 transparent TS per E1).
- Q:** Can I use Signal-to-Noise ratio to measure voice quality in the Vmux-110?
- A:** When using IP traffic to pass voice, you cannot use the difference between the peak signal and the noise floor (i.e. SNR) to determine quality. You must use voice quality tests, such as MOS.
- See also next question
- Q:** Why do I get poor results when measuring voice quality over Vmux-110 using PSQM?
- A:** PSQM (Perceptual Speech Quality Measurement) is not a suitable voice quality measurement technique for VoIP and voice compression systems that implement VAD (Voice Activity Detection) and Silence Suppression mechanisms. PSQM is not able to synchronize between the reference and recorded files when there are gaps of silence, hence the poor results.
- Acceptable voice quality techniques for this purpose are PAMS (Perceptual Analysis Measurement System) and PESQ (Perceptual Evaluation of Speech Quality).
- Q:** After placing a loop on the main serial link port (E1/T1/Serial) of my Vmux-110, some IP problems started to appear. What is the reason for this behavior?
- A:** Due to the loop on the main link, all ETH/IP traffic sent out by the Vmux-110 is looped back into the internal switch and via the Vmux-110 ETH port to any

LAN possibly connected to this Vmux. This erroneous condition will result in broadcast storms, which might cause:

- Bundle disconnections (on this Vmux-110 and on any other Vmux connected locally to the same LAN).
- Severe IP connectivity problems on the LAN connected to the ETH port of this Vmux-110.

**Q:** Can I test a Vmux-110 link using Voice Frequency test equipment?

**A:** Yes, with the following considerations:

- Since Vmux-110 applies compression on the voice traffic, there is no guarantee of single tone quality, hence the transmitted tones might suffer amplitude and/or phase distortions.
- Special tones that are detected by Vmux-110 relay mechanisms must be avoided:
  - 1100 Hz (CNG) will cause the Vmux-110 to switch into fax-relay mode (if fax relay is enabled).
  - 2100 Hz (fax/modem CED) will cause the Vmux-110 to switch into VBD (if modem relay is enabled).
  - 2000 Hz (COT - Continuity Test) will be relayed only if Custom Tone Detection is enabled.

**Important:** The above tones may be detected in the range of +/- 50 Hz (e.g. 1080 Hz can be detected as 1100 Hz). Therefore when testing voice frequency across Vmux-110, you should AVOID the following frequency ranges: 1050-1150 Hz, 1950-2150 Hz.

**Q:** Is it possible to send a BERT test pattern across a Vmux-110 voice channel?

**A:** No.

Since Vmux-110 provides a Voice Compression solution and not a Circuit Emulation one (as IPmux, for example), it does not reconstruct at the remote end the original bit stream that was transmitted into the Vmux-110 at the local end.

The audio signal transmitted to the local Vmux-110 is compressed, and silence suppression technique is applied to it. The reverse process is carried out at the remote end, and the resulting regenerated audio signal is then transmitted in digital format (PCM) to the remote TDM device connected to the Vmux-110 (PBX/Switch). The output signal is a very good "imitation" of the original input signal, but it is not represented by exactly the same PCM bytes, hence the resulting output bit stream differs from the original input data.

As a result of the above, it is not possible to perform a BER test across an E1 that is compressed by Vmux-110. Setting the bundle voice parameters to use G.711 coder type will not help in this case, since the DSP (Digital Signal Processor) applies silence suppression on the incoming voice, so the output bit stream will still be different than the original one.

**Q:** Pressing the Flash button of the telephone set connected to the FXS port of the Vmux-110 does not result in the expected function of the PBX/PSTN. What is the problem?

**A:** The problem could be related to the Vmux-110 FXS ports setting.

The Flash signal is actually a short on-hook signal, used for many kinds of PBX/PSTN features. For example, in the call-waiting feature, during an ongoing conversation, pressing the flash will switch the subscriber to a waiting call.

Another example is the conference call. A subscriber engaged in a call can press the Flash button in order to put his remote party on hold and to call a second remote party. Once the second remote party answers the call, pressing the flash again will create a bridge enabling the three parties to have a conference call.

You can define the period of an On-hook/Off-hook action that will be recognized by the Vmux-110 as a Flash.

- From the main menu go to:

**Configuration -> FXS configuration -> Timeouts**

The following screen appears:

```
Timeouts
```

```
-----
```

1. Ring Timeout (sec) [60 - 600]... (120)
2. On hook duration in Flash (msec) [10 - 2000]... (700)

Option number 2 is the on-hook duration for the Flash. The default value is 700 msec, meaning that during a call, if an on-hook state lasts between 0 and 700 msec, it will be handled as a Flash and the call will not be disconnected.

**Q:** Does modem support across a Vmux-110 link require any special timing considerations?

**A:** Yes.

The present generation of Vmux-110 (Phase 3.0) does not implement modem relay. It carries modem signal as a clear channel (VBD - Voice-Band Data). This situation imposes some restrictions on the usage scenarios, as follows. (Note that there are no restrictions on fax signals, as the Vmux-110 does implement fax relay.)

Due to the use of clear channel transmission, clock synchronization must be maintained on both sides of the link. This requires delivering the same clock (from a common source) to both sides of the link or using different Stratum 2 level clocks. In order to ensure the proper frequency lock, the voice modules of the Vmux units on both sides must be configured to LBT in order to recover the clock from the local TDM device (e.g. PBX).

When clock synchronization cannot be guaranteed, only a modem with fast retraining capabilities should be used (e.g. V.32bis, V.34 etc.)

These considerations also hold for secure voice terminals that utilize modem transmissions. The Vmux-110 was tested successfully using a Secured Telephone Encryption unit of Snapshield (<<http://www.snapshield.com>>).

**Q:** How many bundles can I configure in one Vmux-110 unit?

**A:** The Vmux-110 has a single E1 port on the user interface.

You can configure up to 12 bundles. For example, you can have a Vmux-110 at the central site connected to 12 remote sites (several time slots to each site).

Note that only CAS signaling can be split into multiple remote destinations.

**Q:** What is the meaning of the fragmentation function in the Vmux-110?

**A:** By default, voice packets get priority over data packets arriving from the LAN user port. The transmission of frames through the main link is made in accordance with their priority. However, the prioritization mechanism cannot ensure a low transmission delay in case a high-priority packet (voice) arrives after the transmission of a long, lower priority packet (data) has begun.

In order to overcome this situation, the Vmux-110 uses the fragmentation feature. The fragmentation function enables the Vmux-110 to halt the transmission of a long, lower priority packet, and begin the transmission of a higher priority packet without waiting to finish the transmission of the lower-priority packet. The transmission of the lower priority packet is then resumed automatically after the transmission of the higher priority packet is completed. In essence, fragmentation allows the Vmux-110 to "chop" long packets in order to give higher priority to voice packets.

The size of the fragment packets is user-selectable.

**Q:** How can I enable Vmux-110 to support R2-MFC?

**A:** Perform the following steps to enable Vmux-110 to support R2-MFC:

1. R2-MFC is a CAS protocol; therefore, the E1 frame should be defined as G.732S. (If the PBX uses CRC, G.732S-CRC4 should be used). Go to the following:

**Main menu>Configuration>Voice Configuration >E1 parameters**

2. Timeslot 16 is used for the line signaling information. The Vmux-110 multiplexes the line signaling status (ABCD bits of timeslot 16) with the compressed voice payload. Thus timeslot 16 does not require additional bandwidth, and therefore it should be defined as **Not Connected** on the Timeslots Configuration menu. Go to the following:

**Main menu>Configuration>Voice Configuration >Distribution Of Framer Time Slots>**

3. The Vmux-110 DSP has an MFC relay which encodes the MFC tones into codes that are sent to the remote Vmux inside the TDMoIP frame (similar to compressed voice payload). At the other end the MFC tones are then regenerated by the DSP.

By default the MFC relay is disabled. Therefore when the Vmux-110 should support MFC tones, the MFC relay has to be enabled. The MFC relay parameters are under the Edit Bundle menu. Go to the following:

**Main menu > Configuration > Voice Configuration > Bundles Parameters > Bundle Configuration > Edit Bundle > Voice Parameters > MF Parameters**

The following menu appears

```
MF Parameters
```

```
1. MFCR2 Relay> (disable)
2. Minimum Pulse Width > (60 sec)
3. Minimum Power Level > (-12 dBm)
4. Compelled > (disable)
5. Min Tone Duration > (80 sec)
```

Set the “MFCR2 Relay” parameter to **enable**.

The following two parameters must also be properly defined: Minimum Pulse Width and Minimum Power Level.

Sometimes speech is identified by the DSP as MFC tones by mistake. The result of this false detection is that the remote party will occasionally hear short MFC tones. In order to minimize the false detection of MFC tones, these two parameters are used to fine-tune the definition of the MFC tone shape. The goal is to lower the sensitivity of the DSP to MFC tones in a way that only real MFC tones will be handled as MFC tones, thus avoiding false detection of Speech tones (voice) as MFC tones. To lower this sensitivity, increase the MFC tone pulse width and lower its level.

However, if the false detection problem is not observed, it is recommended to leave the MFC tone Pulse and Level parameters at their default values.

**Q:** What is the end-to-end processing delay contributed by the Vmux-110 when working with different compression algorithms (Coders)?

**A:** The end-to-end processing delay contributed by the Vmux-110 is as follows:

- G723.1A (5.3/6.4 kbps) - 120-150 msec (depending on packet interval)
- G729.A/8 kbps - 70 msec
- G711.A/64 kbps - 45 msec

Please note that when used in an IP network, the Vmux-110 uses jitter buffers in order to compensate for packet delay variation. The jitter buffers are implemented in the Vmux-110 DSPs (Digital Signal Processors), and they are adaptive to the packet delay variation. Each timeslot has its own jitter buffer.

The size of the Vmux-110 jitter buffers is not user-configurable (with the exception of jitter buffers for transparent timeslots). The jitter buffer size is changed according to the packet delay variation, which is detected by the DSP. Each voice packet that is sent out of the DSP includes a time stamp. The

DSP analyzes the time stamps on the received packets and controls the size of the jitter buffer according to the delay between the received packets. The delay variation tolerance is from 10 msec up to 300 msec.

**Example:** When using G.723.1 compression, the DSP expects to receive a packet every 30 msec. If the delay between the received packets is higher than 30 msec, the DSP will increase the size of the jitter buffer so that data will not be lost.

- Q:** How does the Vmux-110 inform the local PBX regarding an Out-Of-Service state of a certain bundle?
- A:** When one of the Vmux-110 bundles enters an Out-Of-Service state (no response to the connectivity messages), the Vmux-110 informs the local PBX of this condition by generating an AIS (Alarm Indication Signal, all "1"s) towards the PBX.

In CAS mode, if the E1 is split over more than one bundle, then the Vmux-110 generates an OOS pattern on the ABCD bits on timeslot 16, regarding all the relevant timeslots of that bundle.

The OOS pattern is determined by the current signaling profile being used on the E1 port of the Vmux-110 voice modules (**Main menu > Configuration > Voice Configuration > E1 parameters**).

The user can verify that this signaling profile is suitable for his application and modify it, if necessary, using the following path:

**Main Menu > Configuration > System > Management > Signaling Configuration > Signaling Profile Configuration > Signaling Table Configuration.**

- Q:** What files can be transferred to/from Vmux-110?
- A:** See the following table.

*Table 7-8. Vmux File Transfers*

| <b>Vmux-2100</b> | <b>Vmux-110</b> | <b>Direction</b> | <b>Purpose</b>                                                                 | <b>Remarks</b>                                                |
|------------------|-----------------|------------------|--------------------------------------------------------------------------------|---------------------------------------------------------------|
| cnfg.dat         | cnfg110.dat     | From/To Vmux     | Upload/Download configuration database                                         | Requires DB UPDATE after file transfer.                       |
| vmux.img         | vmux110.img     | To Vmux          | Update software version                                                        | Requires reset (or power cycle) after file transfer.          |
| stat.dat         | N/A             | From Vmux        | E1/T1/Serial main link BW statistics (constantly collected, saves 4 past days) | Statistics file can be displayed by VmuxStat.exe application. |

## 7.5 Technical Support

Technical support for this product can be obtained from the local distributor from whom it was purchased.

For further information, please contact the [RAD distributor](#) nearest you or one of [RAD's offices](#) worldwide.



# Appendix A

---

## Interface Connector Specifications

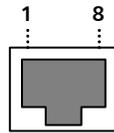
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### A.1 Voice Ports

#### E1/T1 Interface Connector

The E1/T1 voice port interface terminates in a RJ-45 connector. [Figure A-1](#) illustrates the pin location in the RJ-45 connector. [Table A-1](#) lists the E1/T1 connector pin assignment.



*Figure A-1. RJ-45 Connector Pin Location*

*Table A-1. E1/T1 RJ-45 Connector Pinout*

| Pin  | Function          |
|------|-------------------|
| 1, 2 | Receive (input)   |
| 4, 5 | Transmit (output) |

#### Unbalanced E1 Interface

When Vmux-110 is configured to operate with unbalanced E1 interfaces, it is necessary to convert each Vmux-110 RJ-45 connector to the standard pair of BNC female connectors used by unbalanced E1 interfaces.

For this purpose, RAD offers a 15-cm long adapter cable, CBL-RJ45/2BNC/E1, which has one RJ-45 plug for connection to the Vmux-110 E1 connector and two BNC female connectors at the other end. Cable wiring is given in [Figure A-2](#).

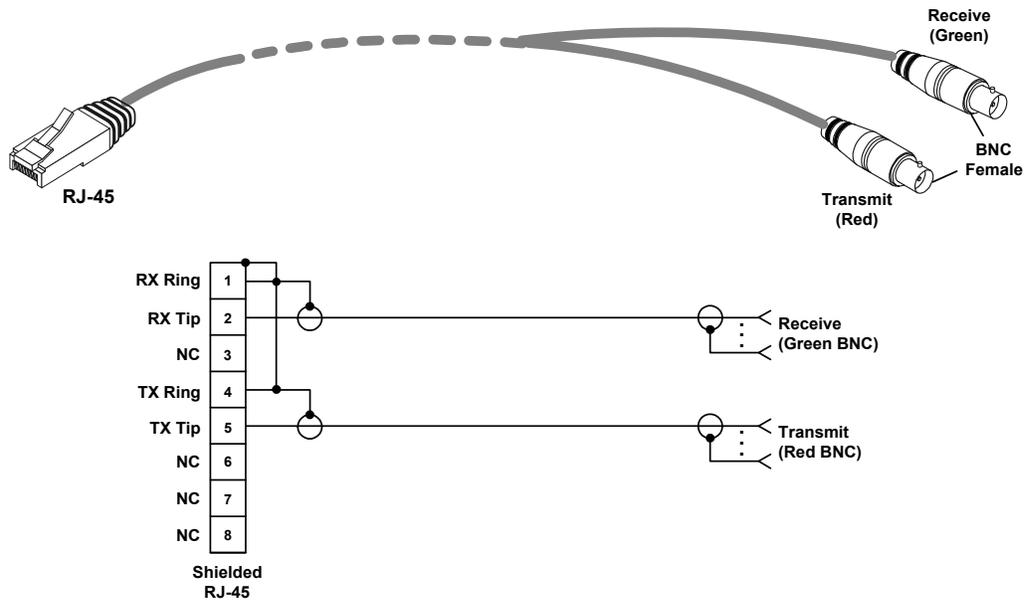


Figure A-2. E1 Adapter Cable, CBL-RJ45/2BNC/E1, Wiring Diagram

### FXS Interface Connector

The 4-port FXS interface terminates in RJ-12 connectors. [Figure A-3](#) illustrates the pin location in the RJ-12 connector. [Table A-2](#) lists the FXS connector pin assignment.

The 8-port FXS interface terminates in a single DB-25 connector, which is connected by cable CBL-KVF8-FXOS to the analog FXS devices. [Table A-3](#) describes the FXS interface cable wiring.

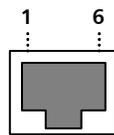


Figure A-3. RJ-12 Connector Pin Location

Table A-2. 4-port FXS/FXO Connector Pinout

| Pin | Function |
|-----|----------|
| 3   | Ring     |
| 4   | Tip      |

### FXO Interface Connectors

The 4-port FXO interface terminates in four RJ-12 connectors that connect to the analog FXO devices. [Table A-2](#) lists the FXO connector pin assignment.

The 8-port FXO interface terminates in a single DB-25 connector, which is connected by cable CBL-KVF8-FXOS to the analog FXO devices. The following table describes the FXO interface cable wiring.

Table A-3. CBL-KVF8-FXOS Wiring for the 8-port FXS/FXO Interface

| DB-25 | Channel | RJ-12 | Function |
|-------|---------|-------|----------|
| 15    | 1       | 4     | TIP      |
| 3     | 1       | 3     | RING     |
| 16    | 2       | 4     | TIP      |
| 4     | 2       | 3     | RING     |
| 17    | 3       | 4     | TIP      |
| 5     | 3       | 3     | RING     |
| 18    | 4       | 4     | TIP      |
| 6     | 4       | 3     | RING     |
| 11    | 5       | 4     | TIP      |
| 24    | 5       | 3     | RING     |
| 10    | 6       | 4     | TIP      |
| 23    | 6       | 3     | RING     |
| 9     | 7       | 4     | TIP      |
| 22    | 7       | 3     | RING     |
| 8     | 8       | 4     | TIP      |
| 21    | 8       | 3     | RING     |

## E&M Interface Connectors

The 4-port E&M interface terminates in four RJ-45 connectors that connect to the analog E&M devices. [Table A-4](#) lists the 4-port E&M connector pin assignment.

The 8-port E&M interface terminates in a single SCSI-68 connector, which is connected by cable CBL-KVF8/E&M to the analog E&M devices via RJ-45 connectors. [Table A-5](#) lists the 8-port E&M connector pin assignment.

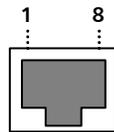


Figure A-4. 4-port E&M RJ-45 Connector Pin Location

Table A-4. 4-port E&amp;M RJ-45 Connector Pinout

| Pin | Function         |
|-----|------------------|
| 1   | Signal Battery   |
| 4   | Signaling M Lead |
| 2   | Voice RX Input   |
| 3   | Voice RX Input   |
| 4   | Voice TX Input   |
| 5   | Voice TX Input   |
| 6   | Signal GND       |
| 7   | Signaling E Lead |
| 8   | Signal Battery   |

Table A-5. CBL-KVF8/E&amp;M Wiring for the 8-port E&amp;M Interface

| Channel | RJ-45 | SCSI-68 | Function         | Comments |
|---------|-------|---------|------------------|----------|
| 1       | 1     | 37      | Signal Battery   | Twisted  |
|         | 2     | 38      | Signaling M Lead |          |
|         | 3     | 1       | Voice RX Input   | Twisted  |
|         | 4     | 2       | Voice RX Input   |          |
|         | 5     | 3       | Voice TX Input   | Twisted  |
|         | 6     | 4       | Voice TX Input   |          |
|         | 7     | 35      | Signal GND       | Twisted  |
|         | 8     | 36      | Signaling E Lead |          |
| 2       | 1     | 43      | Signal Battery   | Twisted  |
|         | 2     | 44      | Signaling M Lead |          |
|         | 3     | 7       | Voice RX Input   | Twisted  |
|         | 4     | 8       | Voice RX Input   |          |
|         | 5     | 9       | Voice TX Input   | Twisted  |
|         | 6     | 10      | Voice TX Input   |          |
|         | 7     | 41      | Signal GND       | Twisted  |
|         | 8     | 42      | Signaling E Lead |          |
| 3       | 1     | 49      | Signal Battery   | Twisted  |
|         | 2     | 50      | Signaling M Lead |          |
|         | 3     | 13      | Voice RX Input   | Twisted  |
|         | 4     | 14      | Voice RX Input   |          |

| Channel | RJ-45 | SCSI-68 | Function         | Comments |
|---------|-------|---------|------------------|----------|
|         | 5     | 15      | Voice TX Input   | Twisted  |
|         | 6     | 16      | Voice TX Input   |          |
|         | 7     | 47      | Signal GND       | Twisted  |
|         | 8     | 48      | Signaling E Lead |          |
| 4       | 1     | 55      | Signal Battery   | Twisted  |
|         | 2     | 56      | Signaling M Lead |          |
|         | 3     | 19      | Voice RX Input   | Twisted  |
|         | 4     | 20      | Voice RX Input   |          |
|         | 5     | 21      | Voice TX Input   | Twisted  |
|         | 6     | 22      | Voice TX Input   |          |
|         | 7     | 53      | Signal GND       | Twisted  |
|         | 8     | 61      | Signaling E Lead |          |
| 5       | 1     | 62      | Signal Battery   | Twisted  |
|         | 2     | 50      | Signaling M Lead |          |
|         | 3     | 25      | Voice RX Input   | Twisted  |
|         | 4     | 26      | Voice RX Input   |          |
|         | 5     | 27      | Voice TX Input   | Twisted  |
|         | 6     | 28      | Voice TX Input   |          |
|         | 7     | 59      | Signal GND       | Twisted  |
|         | 8     | 60      | Signaling E Lead |          |
| 6       | 1     | 67      | Signal Battery   | Twisted  |
|         | 2     | 68      | Signaling M Lead |          |
|         | 3     | 31      | Voice RX Input   | Twisted  |
|         | 4     | 32      | Voice RX Input   |          |
|         | 5     | 34      | Voice TX Input   | Twisted  |
|         | 6     | 65      | Voice TX Input   |          |
|         | 7     | 66      | Signal GND       | Twisted  |
|         | 8     | 54      | Signaling E Lead |          |

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## A.2 Ethernet Interface Connectors

The 10/100BaseT user and network port interfaces also terminate in RJ-45 connectors (previously illustrated in [Figure A-1](#)). [Table A-6](#) lists the Ethernet connector pin assignment.

*Table A-6. Ethernet Connector Pinout*

| Pin | Signal | Function                 |
|-----|--------|--------------------------|
| 1   | TD (+) | Transmit Data (positive) |
| 2   | TD (-) | Transmit Data (negative) |
| 3   | RD (+) | Receive Data (positive)  |
| 6   | RD (-) | Receive Data (negative)  |

**Note** *Ethernet main link port supports connection via straight and cross cables.*

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## A.3 Serial Port

### Serial Port Connector

The Vmux-110 Serial port terminates in an RS-530/DCE interface with a female DB-25 connector. [Table A-7](#) lists the pin assignment of the Serial port DB-25 connector.

Note the differences in the signal direction of the following pins, depending on whether the interface is configured by the user to DCE or DTE mode:

- Pins 8, 10, 12, 15

The Vmux-110 serial port is physically a DCE interface, and does not support an external Receive Clock. Therefore, when configured to DTE mode, the following pins are used in order to transmit/sample information to/from the modem:

- Pins 11 and 24 (External clock B, External clock A): Clock used for sampling the data signal received from the modem.
- Pins 12 and 15 (Transmit clock B, Transmit clock A): Clock used for transmitting data to the modem.

Table A-7. DB-25 Serial Port Connector Pin Assignment

| Pin Number | Function      | Direction            |
|------------|---------------|----------------------|
| 1          | Ground Signal | –                    |
| 2          | TXDa          | In                   |
| 3          | RXDa          | Out                  |
| 4          | RTSa          | In                   |
| 5          | CTSa          | Out                  |
| 6          | DSRa          | Out                  |
| 7          | Ground Signal | –                    |
| 8          | DCDa          | Out (DCE) / In (DTE) |
| 9          | RXCb          | Out                  |
| 10         | DCDb          | Out (DCE) / In (DTE) |
| 11         | E-CLKb        | In                   |
| 12         | TXCb          | Out (DCE) / In (DTE) |
| 13         | CTSb          | Out                  |
| 14         | TXDb          | In                   |
| 15         | TXCa          | Out (DCE) / In (DTE) |
| 16         | RXDb          | Out                  |
| 17         | RXCa          | Out                  |
| 18         | –             | –                    |
| 19         | RTSb          | In                   |
| 20         | DTRa          | In                   |
| 21         | –             | –                    |
| 22         | DSRb          | Out                  |
| 23         | DTRb          | In                   |
| 24         | E-CLKa        | In                   |
| 25         | –             | –                    |

Additional interfaces are supported via interface adapter cables that convert the Vmux-110 Serial port's RS-530/DCE interface to the target Serial interface. [Table A-8](#) lists the supported Serial interfaces and the name of the associated Serial interface cable. The pin assignment of the Serial interface adapter cables are provided in the sections that follow.

Table A-8. Serial Interfaces Supported by Vmux-110

| Serial Interface | Adaptor Cable     | Interface Adapter Cable Pin Assignment |
|------------------|-------------------|----------------------------------------|
| RS-530/DCE       | none required     | –                                      |
| RS-530/DTE       | CBL-VM110/530/DTE | <a href="#">Table A-9</a>              |
| RS-530A/DCE      | none required     | –                                      |
| RS-530A/DTE      | CBL-VM110/530/DTE | <a href="#">Table A-9</a>              |
| V.35/DCE         | CBL-VM110/V35/DCE | <a href="#">Table A-10</a>             |
| V.35/DTE         | CBL-VM110/V35/DTE | <a href="#">Table A-11</a>             |
| X.21/DCE         | CBL-VM110/X21/DCE | <a href="#">Table A-12</a>             |
| X.21/DTE         | CBL-VM110/X21/DTE | <a href="#">Table A-13</a>             |

### RS-530/DTE Interface Adapter Cable

The CBL-VM110/530/DTE interface adapter cable converts the Vmux-110 Serial port into an RS-530/DTE Serial interface. The interface adapter cable terminates in a female D-25 connector. [Table A-9](#) lists the pin assignment at each end of the interface cable.

Table A-9. RS-530/DTE Interface Cable Pin Assignment

| Pin on DB-25 Connector<br>(Vmux-110 Serial Port Side) | Pin on DB-25 Connector<br>(User Equipment Side) |
|-------------------------------------------------------|-------------------------------------------------|
| 1                                                     | 1                                               |
| 7                                                     | 7                                               |
| 22                                                    | 23                                              |
| 6                                                     | 20                                              |
| 23                                                    | 22                                              |
| 20                                                    | 6                                               |
| 10                                                    | 10                                              |
| 8                                                     | 8                                               |
| 19                                                    | 13                                              |
| 4                                                     | 5                                               |
| 13                                                    | 19                                              |
| 5                                                     | 4                                               |
| 11                                                    | 9                                               |
| 24                                                    | 17                                              |

Table A-9. RS-530/DTE Interface Cable Pin Assignment (Cont.)

| Pin on DB-25 Connector<br>(Vmux-110 Serial Port Side) | Pin on DB-25 Connector<br>(User Equipment Side) |
|-------------------------------------------------------|-------------------------------------------------|
| 12                                                    | 12                                              |
| 15                                                    | 15                                              |
| 9                                                     | 11                                              |
| 17                                                    | 24                                              |
| 14                                                    | 16                                              |
| 2                                                     | 3                                               |
| 16                                                    | 14                                              |
| 3                                                     | 2                                               |

### V.35/DCE Interface Adapter Cable

The CBL-VM110/V35/DCE interface adapter cable converts the Vmux-110 Serial port into a V.35/DCE Serial interface. The interface cable terminates in a male V.35 connector. [Table A-10](#) lists the pin assignment at each end of the interface cable.

Table A-10. V.35/DCE Interface Cable Pin Assignment

| Pin on DB-25 Connector | Pin on V.35 Connector |
|------------------------|-----------------------|
| 1                      | A                     |
| 3                      | R                     |
| 16                     | T                     |
| 2                      | P                     |
| 14                     | S                     |
| 24                     | U                     |
| 11                     | W                     |
| 17                     | V                     |
| 9                      | X                     |
| 15                     | Y                     |
| 12                     | AA(a)                 |
| 5                      | D                     |
| 4                      | C                     |
| 20                     | H                     |
| 7                      | B                     |
| 8                      | F                     |
| 6                      | E                     |

## V.35/DTE Interface Adapter Cable

The CBL-VM110/V35/DTE interface adapter cable converts the Vmux-110 Serial port into a V.35/DTE Serial interface. The interface cable terminates in a male V.35 connector. [Table A-11](#) lists the pin assignment at each end of the interface cable.

*Table A-11. V.35/DTE Interface Cable Pin Assignment*

| <b>Pin on DB-25 Connector</b> | <b>Pin on V.35 Connector</b> |
|-------------------------------|------------------------------|
| 1                             | A                            |
| 3                             | P                            |
| 16                            | S                            |
| 2                             | R                            |
| 14                            | T                            |
| 24                            | V                            |
| 11                            | X                            |
| 17                            | U                            |
| 9                             | W                            |
| 15                            | Y                            |
| 12                            | AA(a)                        |
| 5                             | C                            |
| 4                             | D                            |
| 20                            | E                            |
| 7                             | B                            |
| 8                             | F                            |
| 6                             | H                            |

## X.21/DCE Interface Adapter Cable

The CBL-VM110/X21/DCE interface adapter cable converts the Vmux-110 Serial port into an X.21/DCE Serial interface. The interface cable terminates in a female D-15 connector. [Table A-12](#) lists the pin assignment at each end of the interface cable.

*Table A-12. X.21/DCE Interface Cable Pin Assignment*

| Pin on DB-25 Connector | Pin on D-15 Connector | Comments |
|------------------------|-----------------------|----------|
| 1                      | 1                     |          |
| 7                      | 8                     |          |
| 4                      | 3                     | Twisted  |
| 19                     | 10                    |          |
| 8                      | 5                     | Twisted  |
| 10                     | 12                    |          |
| 15                     | 6                     | Twisted  |
| 12                     | 13                    |          |
| 2                      | 2                     | Twisted  |
| 14                     | 9                     |          |
| 3                      | 4                     | Twisted  |
| 16                     | 11                    |          |
| 24                     | 7                     | Twisted  |
| 11                     | 14                    |          |

## X.21/DTE Interface Adapter Cable

The CBL-VM110/X21/DTE interface adapter cable converts the Vmux-110 Serial port into an X.21/DTE Serial interface. The interface cable terminates in a male D-15 connector. [Table A-13](#) lists the pin assignment at each end of the interface cable.

Table A-13. X.21/DTE Interface Cable Pin Assignment

| Pin on DB-25 Connector | Pin on D-15 Connector | Comments |
|------------------------|-----------------------|----------|
| 1                      | 1                     |          |
| 7                      | 8                     |          |
| 8                      | 3                     | Twisted  |
| 10                     | 10                    |          |
| 4                      | 5                     | Twisted  |
| 19                     | 12                    |          |
| 24                     | 6                     | Twisted  |
| 11                     | 13                    |          |
| 3                      | 2                     | Twisted  |
| 16                     | 9                     |          |
| 2                      | 4                     | Twisted  |
| 14                     | 11                    |          |

## A.4 CONTROL Connector

The control terminal interface terminates in a V.24/RS-232 8-pin RJ-45 connector. Connection to an ASCII terminal is made via CBL-RJ45/D9/F/STR cable. [Table A-14](#) lists the cable pin assignment.

Table A-14. CBL-RJ45/D9/F/STR Cable Pin Assignment

| RJ-45 |          | DB-9  |     |
|-------|----------|-------|-----|
| Pin 4 | GND      | Pin 5 | GND |
| Pin 5 | RX (out) | Pin 2 | RX  |
| Pin 6 | TX (in)  | Pin 3 | TX  |
| Pin 7 | CTS      | Pin 8 | CTS |
| Pin 8 | RTS      | Pin 7 | RTS |

# Appendix B

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## Boot Manager and Software Downloading

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### B.1 Introduction

This chapter describes the Vmux-110 boot software and provides instructions for software downloading via XMODEM or TFTP applications.

The Vmux-110 software is stored in the flash memory in two sections: boot and 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 Vmux-110 application software. One copy is referred to as **active partition** (usually partition 1), the other – as **backup partition** (usually partition 0). The active partition is decompressed and loaded into the Vmux-110 RAM upon power-up. The backup file is used whenever the active file is missing or corrupted.

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### B.2 Booting Vmux-110

Vmux-110 boots up automatically. After power-up, no user intervention is required, except when the user wants to access the file system to modify or update the Vmux-110 application software.

#### Boot Sequence

The following is a description of the boot sequence. If the system is working normally, the entire process is completed within two minutes.

1. The boot program searches for the active partition in the file system. If the file exists, the program continues.

If the file does not exist, the boot program searches for the backup file. If the backup is found, it is used instead of the active partition, and the boot process continues.

If there is no backup file, you must download a file via the XMODEM protocol. The received file is saved as the active file in the file system.

2. Active and backup partitions are compressed and automatically decompressed into the RAM before execution begins.
3. After decompression, the Vmux-110 software starts to execute and the user can begin working.

## Accessing the File System

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

When working with the File System menu, configure the ASCII terminal rate to 115.2 kbps.

► **To access the File System menu:**

- Press **<Enter>** several times immediately after powering Vmux-110 up.

The File System menu is displayed (see [Figure B-1](#)).

```
RAD VMUX_110 Boot Version 1.40 (Jun 16 2002)
RAD Boot Manager Version 4.30 (Jun 16 2002)

0 - Exit Boot-Manager
1 - Show partitions information
2 - Set the active partition
3 - Erase a partition
4 - Download an application by XMODEM
5 - Select an application to run temporarily
6 - Erase all partitions
7 - Show basic hardware information
8 - System configuration
9 - Download an application by TFTP

Select:
```

*Figure B-1. File System Menu*

From the File System menu, you can:

- Show the partition information.
- Set the active partition.
- Erase a partition.
- Download an application via XMODEM application (see the [Downloading Application Files via XMODEM](#) section below).
- Select a partition for a temporary (one-time) use.
- Erase all partitions.
- Display the basic hardware information (RAM, ROM size etc)
- Assign IP values to Vmux-110 for the client TFTP application (see the [Downloading Application Files using a TFTP](#) section below).
- Download application software via client TFTP application (see the [Downloading Application Files using a TFTP](#) section below).

- 
- Notes**
- *Partition information displayed via the File System menu, does not include the application software of the voice interface. Use the 'Show Partition Information' menu (**Main Menu > Configuration > System > Show Partition Information**) to display complete information on the Vmux-110 application software.*
  - *You can also exchange the active and backup partitions via the 'Set the Active Application' menu (**Main Menu > Configuration > System > Set the Active Partition**).*
- 

---

---

## B.3 Downloading the Application and Configuration Software

New application software releases are distributed as **\*.img** files, which are downloaded to Vmux-110 using the XMODEM protocol or client TFTP application from the File System menu of the boot software. Alternatively, you can download a new software release via TFTP protocol, when the Vmux-110 management software is already running.

The TFTP protocol can also be used for uploading configuration files that contain the Vmux-110 database to the management station. Administrators can use this capability to distribute verified configuration files to all other units that use the similar configuration.

### Downloading Application Files via XMODEM

Downloading application files using the XMODEM protocol is performed from the File System menu of the boot software.

► **To download application file via XMODEM:**

1. Configure your ASCII terminal or terminal emulation utility running on your PC to the 115.2 kbps data rate.
2. Access the File System menu (see the [Accessing the File System](#) section above).  
The File System menu appears (see [Figure B-1](#)).
3. From the File System menu, select **Download an application by XMODEM**.  
Vmux-110 displays the following message:  
**Select partition to download**
4. Select the backup partition by typing its number, **1**.  
Vmux-110 requires confirmation of the partition deletion:  
**The partition is full. Do you want to erase it (y/n)**
5. Type **Y**.  
Vmux-110 responds with the following string:  
**Please start the XMODEM download.**
6. Send the **\*.img** file to Vmux-110 using the XMODEM utility of your terminal application.

Once the downloading is completed, Vmux-110 saves the new release as an active partition, the former active partition turns into backup, and the boot sequence continues normally.

If a failure occurs during the download, the partially downloaded software is erased. In this case, only active software is left in the Flash memory.

## Downloading Application Files using a TFTP Server

Downloading application files using a TFTP server application is performed from the File System menu of the boot software. A TFTP server application must be running on the management station.

1. Access the File System menu (see the *Accessing the File System* section above).  
The File System menu appears (see *Figure B-1*).
2. From the File System menu, select **System configuration**.
3. Enter IP address of Vmux-110, and press **<Enter>**.
4. Enter IP mask of Vmux-110, and press **<Enter>**.
5. Enter default gateway of Vmux-110, and press **<Enter>**.
6. Reset Vmux-110.
7. Access the File System menu.
8. From the File System menu, select **Download an application by TFTP**.
9. Enter the application file name (**vmux110.img**), and press **<Enter>**.
10. Enter IP address of the TFTP server, and press **<Enter>**.

Vmux-110 starts downloading application software.

Vmux-110 automatically erases the backup partition (it takes about 25 seconds). Once the downloading is completed, Vmux-110 saves the new release as an active partition; the former active partition turns into backup.

11. Restart the unit.

## Downloading Application Files from the System Menu

You can download application files from the System menu, which eliminates the shut down and reboot necessary to access the boot menu. A TFTP server application must be running on the management station.

1. Open the System menu (**Main Menu>Configuration>System**).  
The System menu appears.

```
System

1. Management>
2. Control Port>
3. Date & Time Update>
4. Factory Default
5. Show Partition Information
6. Set Active Partition
7. TFTP Transfer
8. Reset Unit
9. Open Internal Alarms>

>

Please choose item <1 to 8>
@ - Db Update; # - Db Undo
ESC-prev.menu; !-main menu; &-exit
```

Figure B-2. System Menu

2. Select **TFTP Transfer**.

The TFTP Transfer menu appears.

```
TFTP Transfer

Transfer Status... (No operation)
1. TFTP File Name... (File Name)>
2. TFTP Server IP... (0.0.0.0)>
3. TFTP Mode          (OCTET)
4. TFTP Command  >

>

Please choose item <1 to 4>
@ - Db Update; # - Db Undo
ESC-prev.menu; !-main menu; &-exit
```

Figure B-3. TFTP Transfer Menu

3. From the TFTP Transfer, choose the following:

- **TFTP File Name** to specify the application file name (**vmux110.img**).
- **TFTP Server IP** to define the IP address of the TFTP server from which to download/upload the file.

**TFTP Mode** is a read-only parameter.

4. From the TFTP Transfer, choose the TFTP Command.

The TFTP Command menu appears.

```
TFTP Command

1. Cnfg Download
2. Cnfg Upload
3. SW Download

>

Please choose item <1 to 3>
@ - Db Update; # - Db Undo
ESC-prev.menu; !-main menu; &-exit
```

Figure B-4. TFTP Command Menu

5. Select the command you wish to execute:
  - Cnfg Download: define the parameters for a file download
  - Cnfg Upload: define the parameters for a file upload (the actual operation will be initiated from the TFTP server)
  - SW Download: execute the actual software download.

## Downloading Application Files using a TFTP Client

The application software is downloaded when Vmux-110 has completed the boot-up procedure and the management software is running.

### ► To download application file via TFTP:

1. Start a TFTP client application.
2. Configure the communication parameters as follows:
  - Connection timeout – more than 20 seconds to prevent an automatic disconnection during the backup partition deletion (about 15 seconds).
  - Block size – 512 bytes.
  - UDP port – 69.

3. Select a local **\*.img** file to download.
4. Set remote file name to **vmux110.img**.
5. Enter the Vmux-110 IP address.
6. Start downloading.

Vmux-110 automatically erases the backup partition (it takes about 15 seconds). Once the downloading is completed, Vmux-110 saves the new release as an active partition; the former active partition turns into backup.

7. Restart the unit.

## Uploading/Downloading Configuration Files using a TFTP Client

You can upload a Vmux-110 configuration file (**cnfg110.dat**) to the management station for further distribution to all other units that use the similar configuration.

➤ **To upload application file via TFTP:**

1. Start a TFTP client application.
2. Set remote file name to **cnfg110.dat**.
3. Enter the Vmux-110 IP address.
4. Start uploading.

When the uploading is completed, you can download the **cnfg110.dat** file to other Vmux-110 units. After the downloading, make sure to update the new database software by typing @.

---

**Note** *The system and the main link values do not change when you download the new configuration and update the database.*

---



# Appendix C

---

## Configuration Menus

This appendix lists all menus of the Vmux-110 management software.

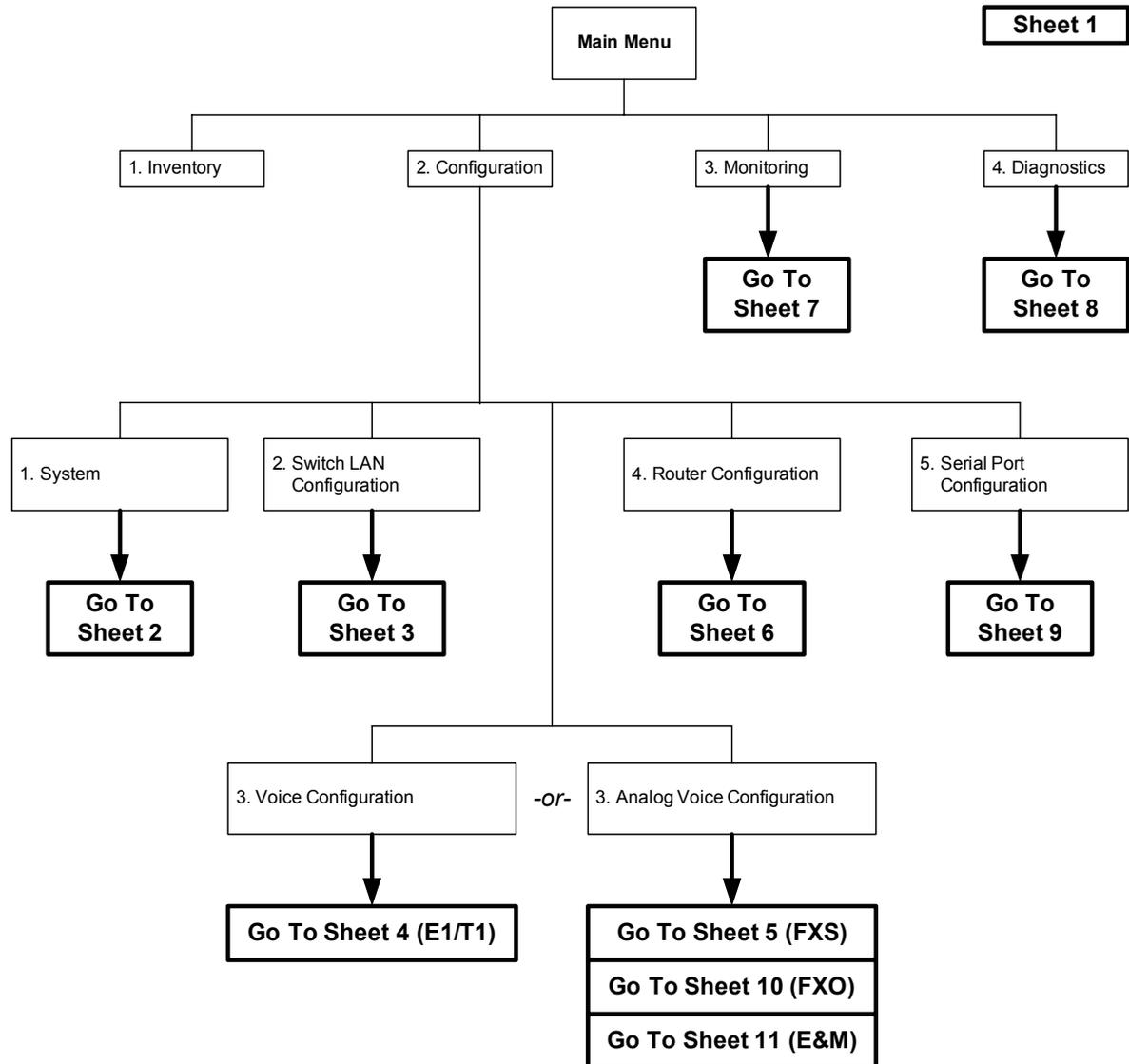


Figure C-1. Vmux-110 Menu Tree, Main Menu

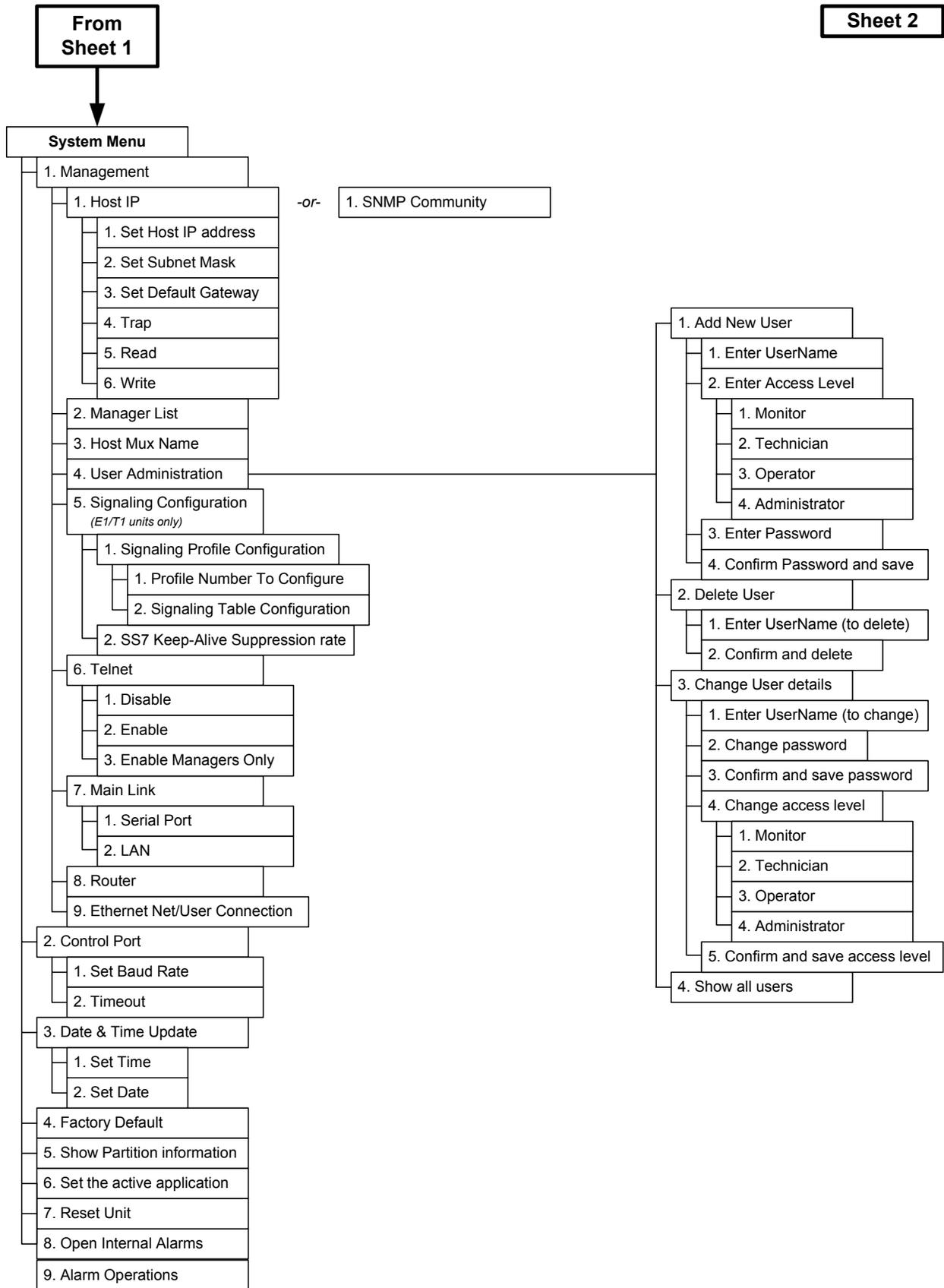


Figure C-2. Vmux-110 Menu Tree, System Menu

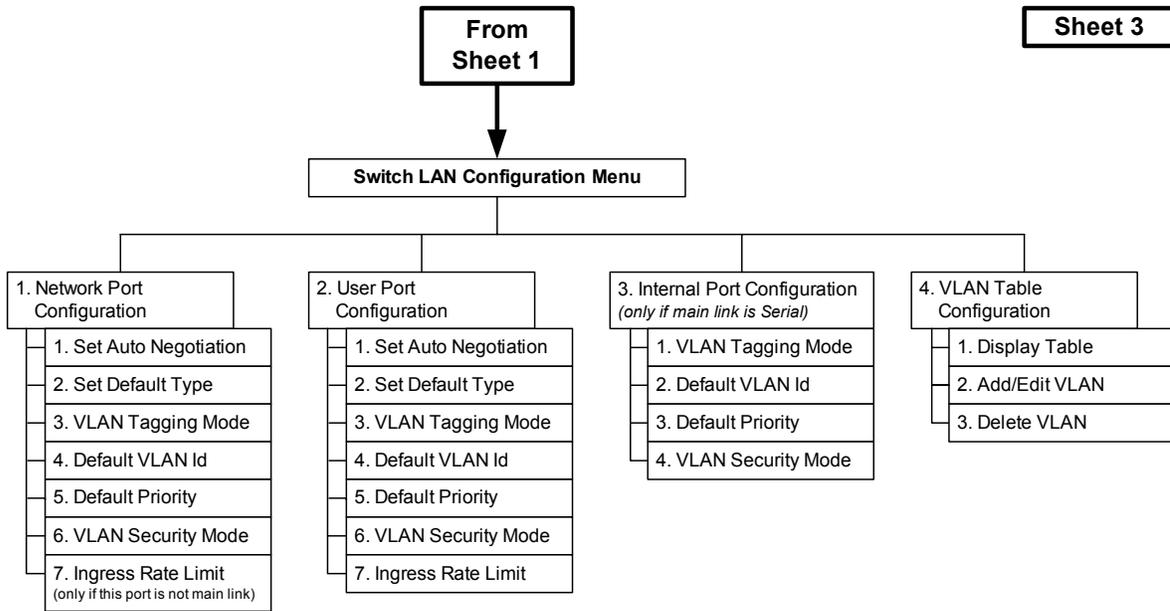


Figure C-3. Vmux-110 Menu Tree, Switch LAN Configuration Menu

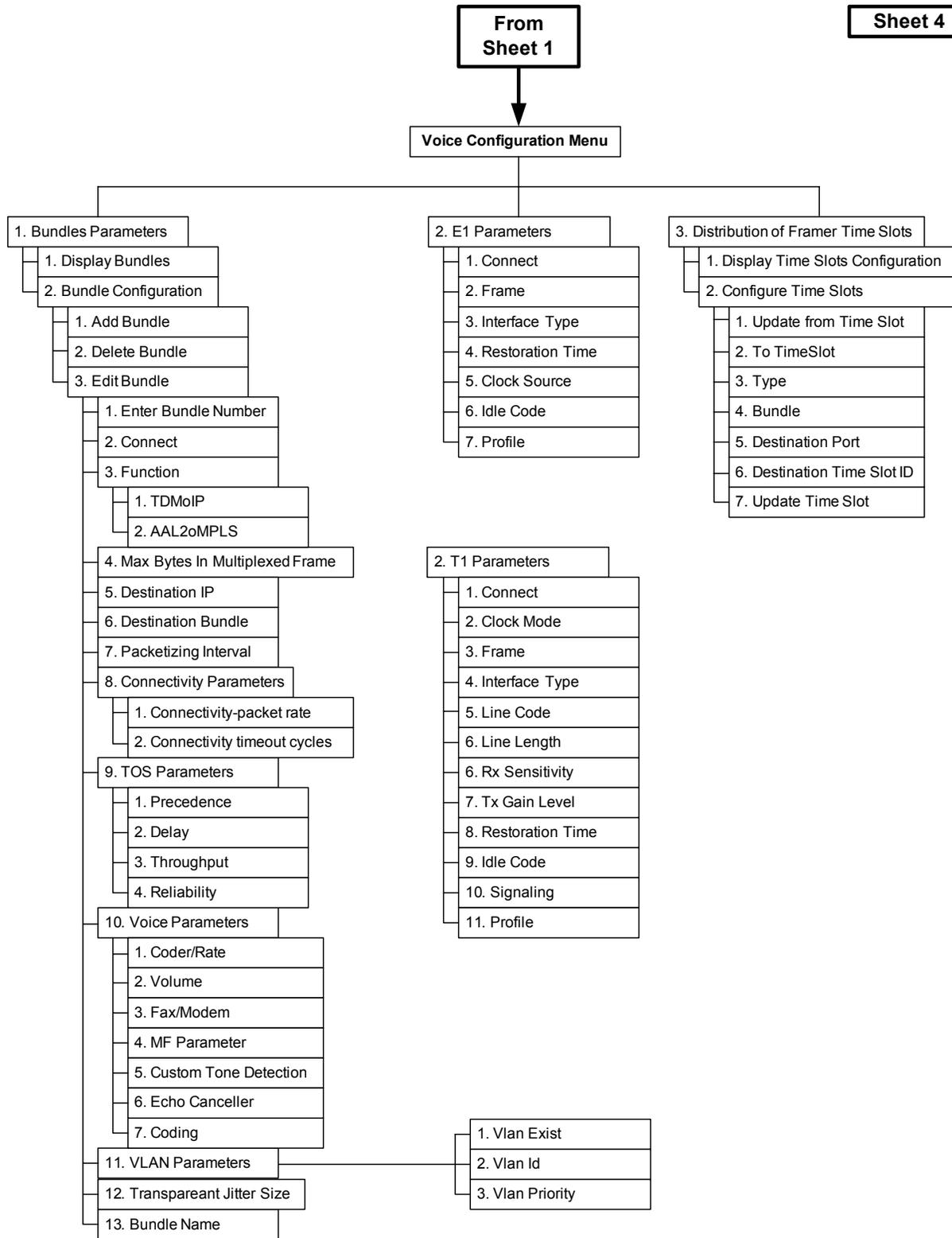


Figure C-4. Vmux-110 Menu Tree, Voice Configuration Menu (E1/T1)

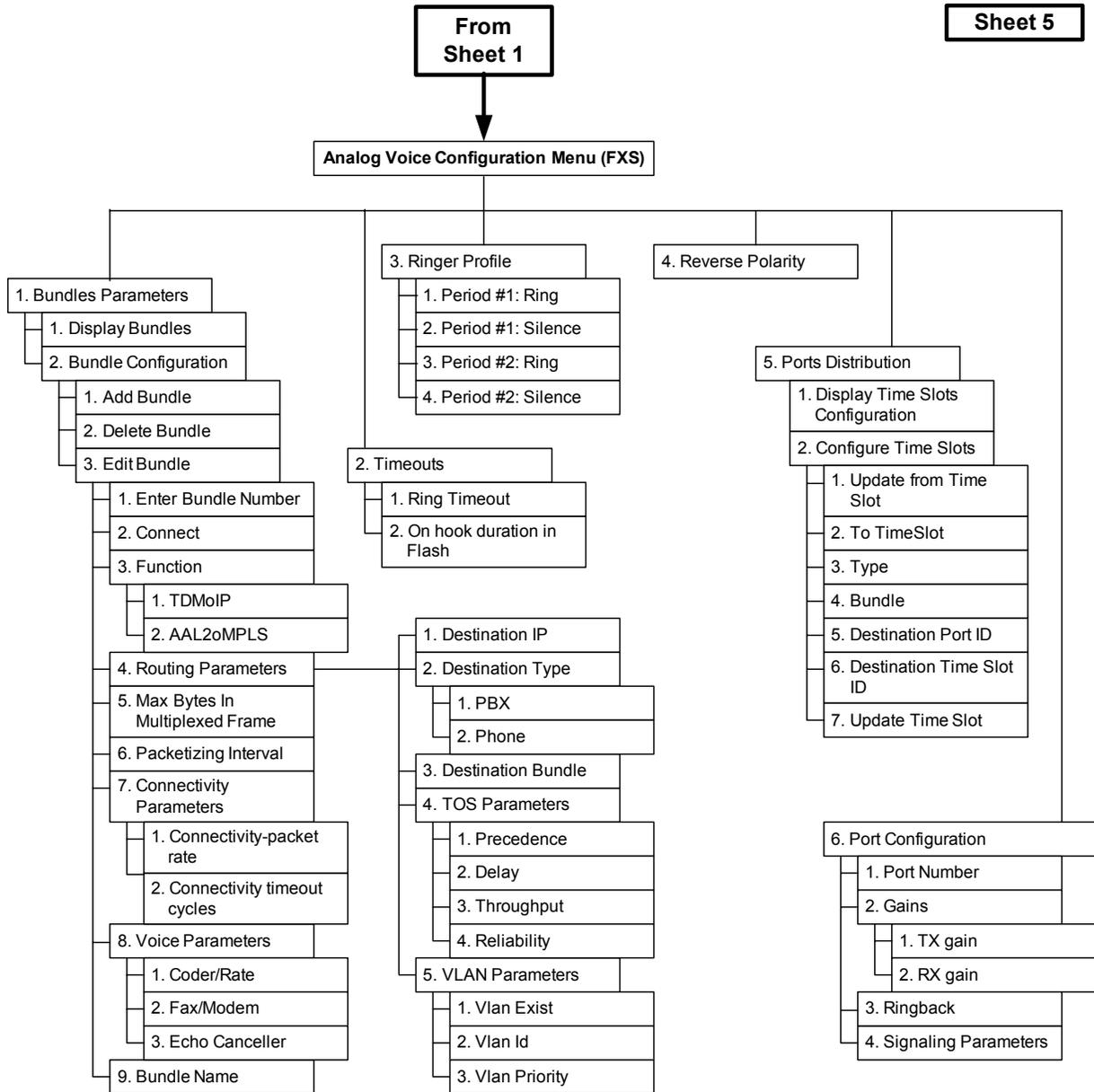


Figure C-5. Vmux-110 Menu Tree, Analog Voice Configuration Menu (FXS)

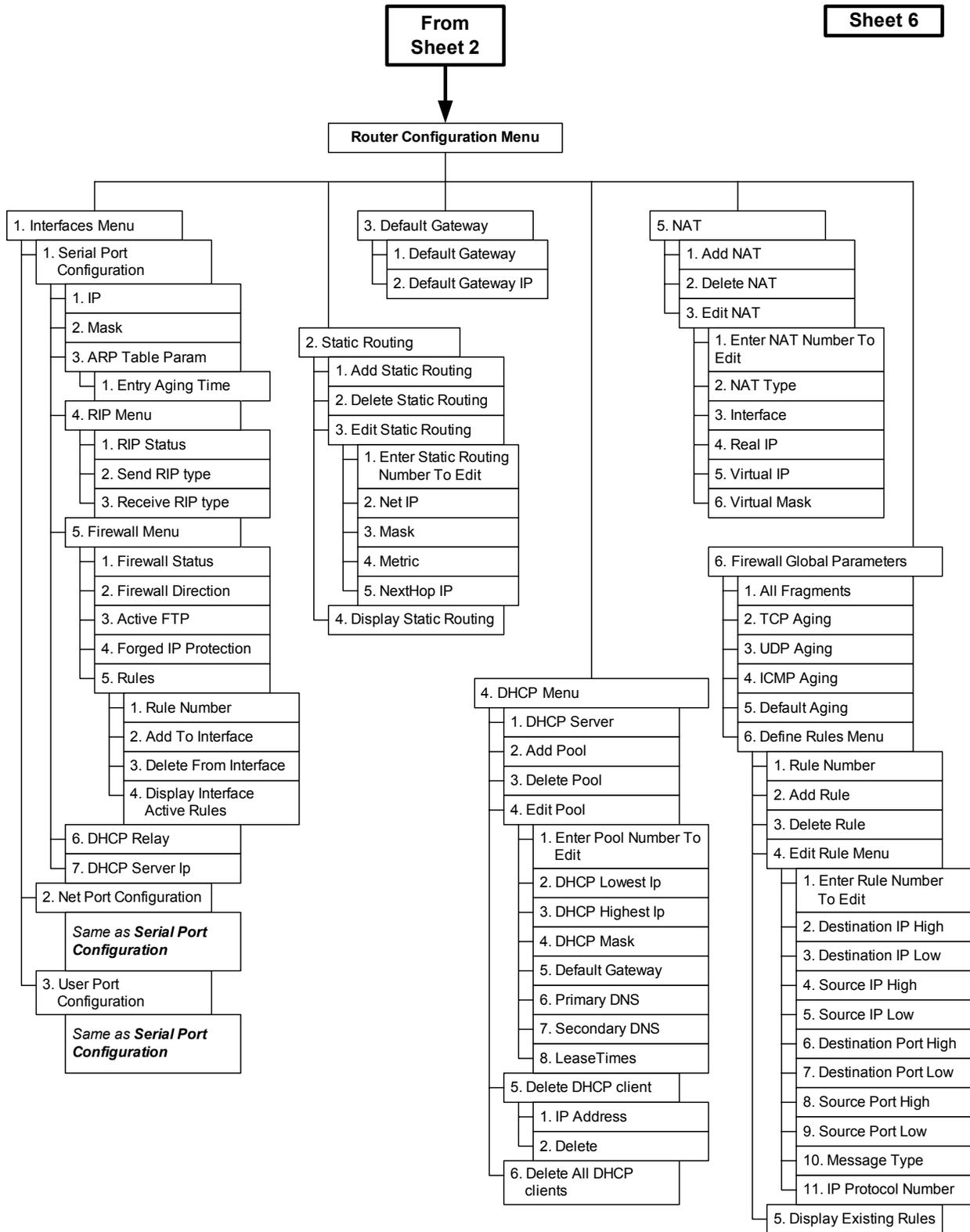


Figure C-6. Vmux-110 Menu Tree, Router Configuration Menu

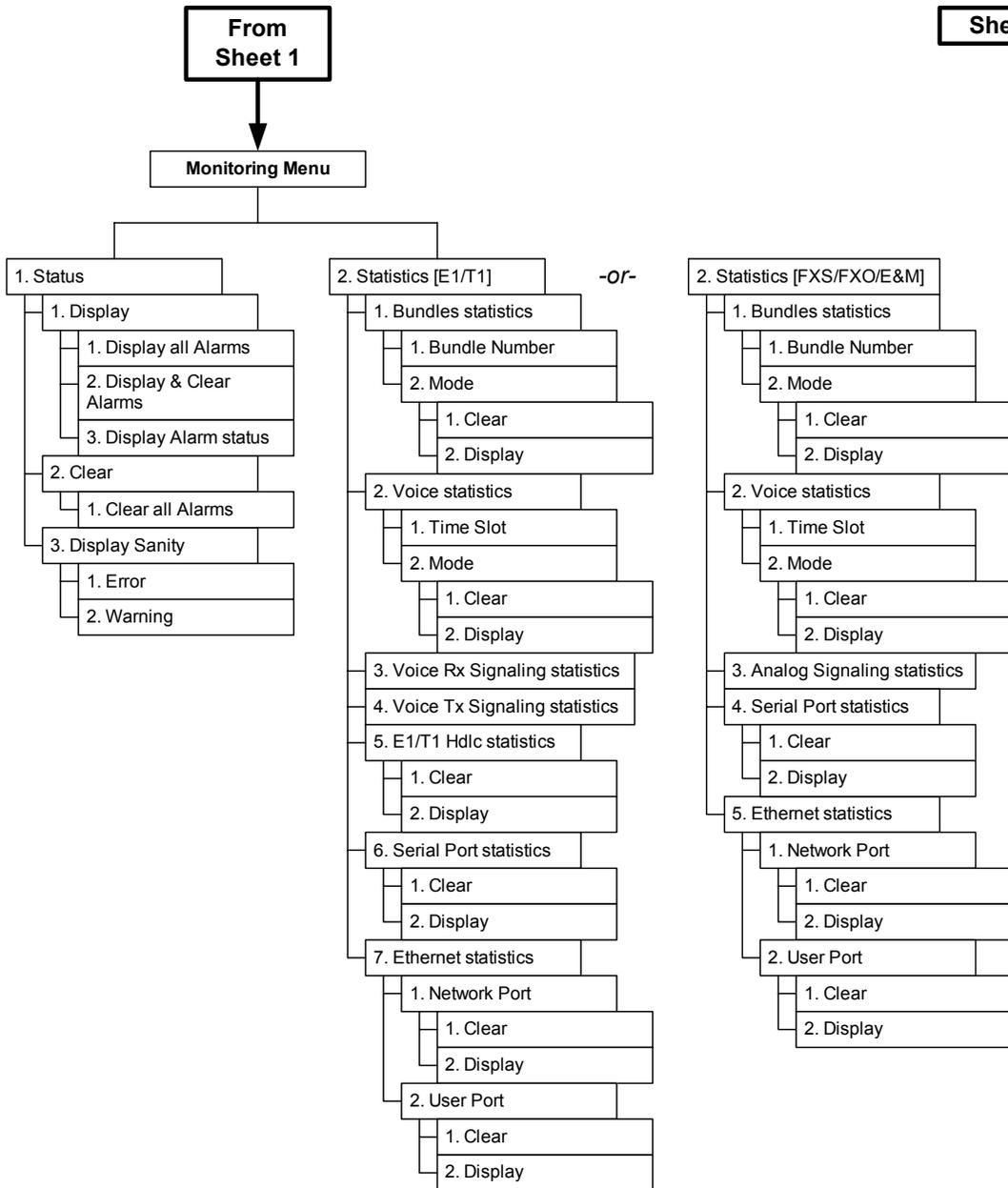


Figure C-7. Vmux-110 Menu Tree, Monitoring Menu

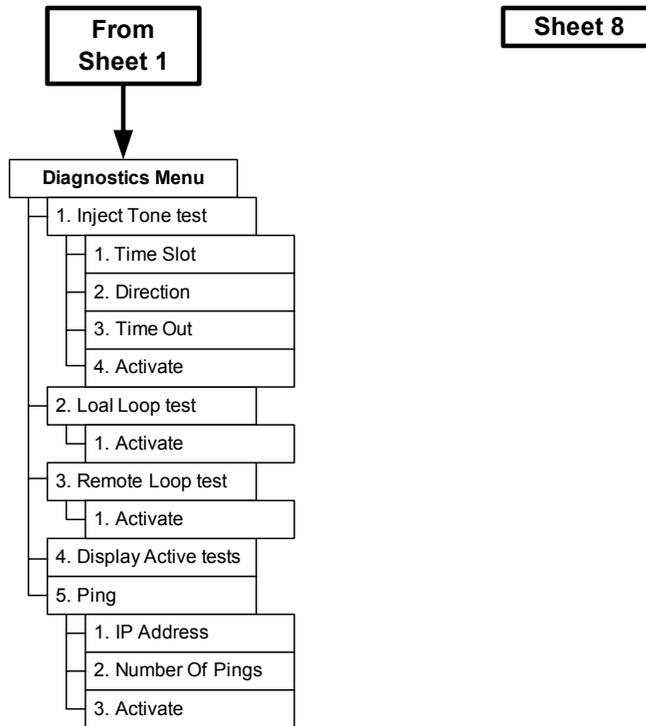


Figure C-8. Vmux-110 Menu Tree, Diagnostics Menu

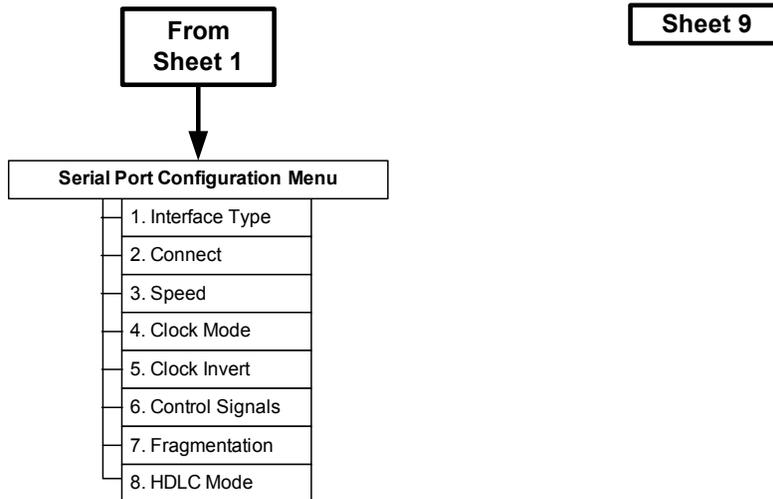


Figure C-9. Vmux-110 Menu Tree, Serial Port Configuration Menu

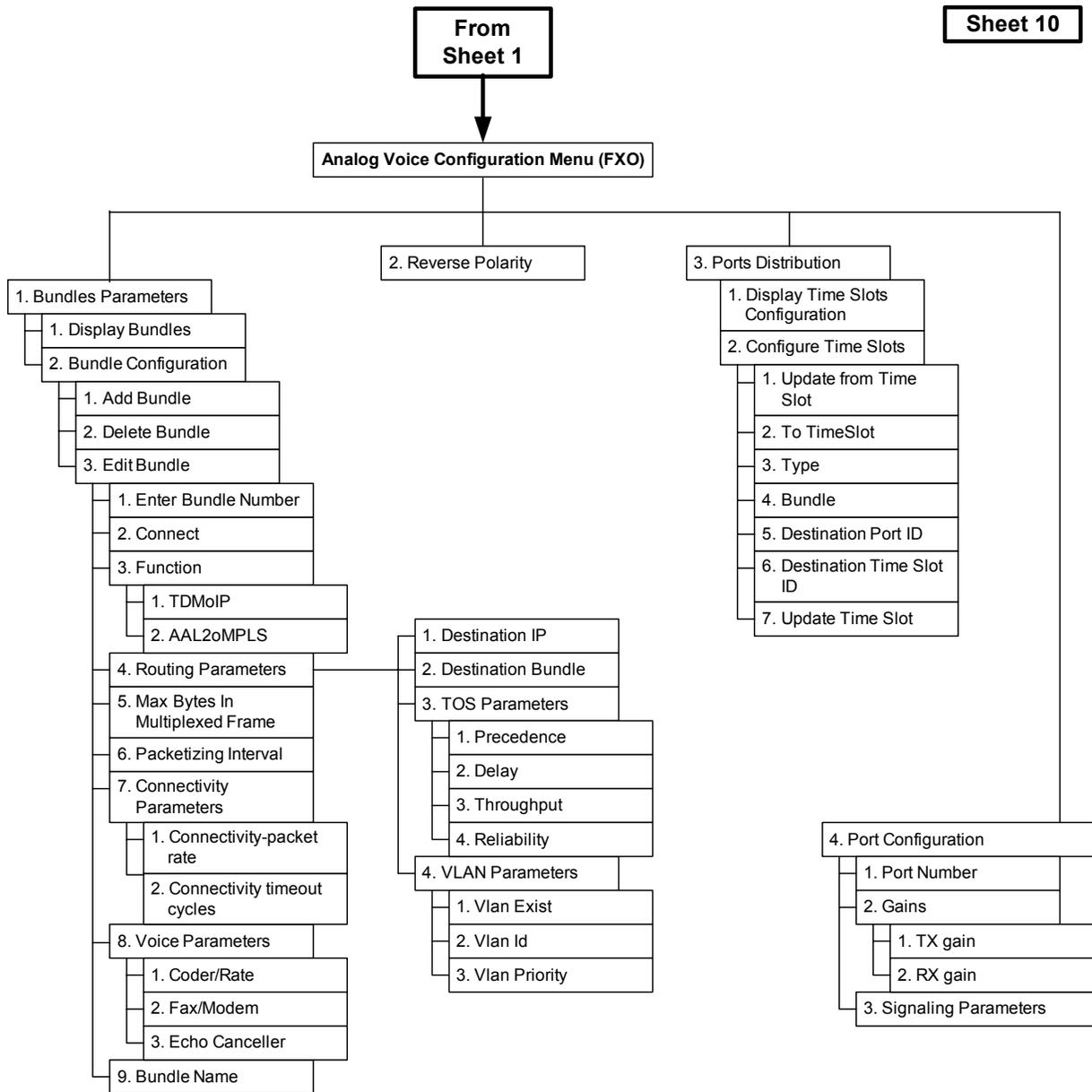


Figure C-10. Vmux-110 Menu Tree, Analog Voice Configuration Menu (FXO)

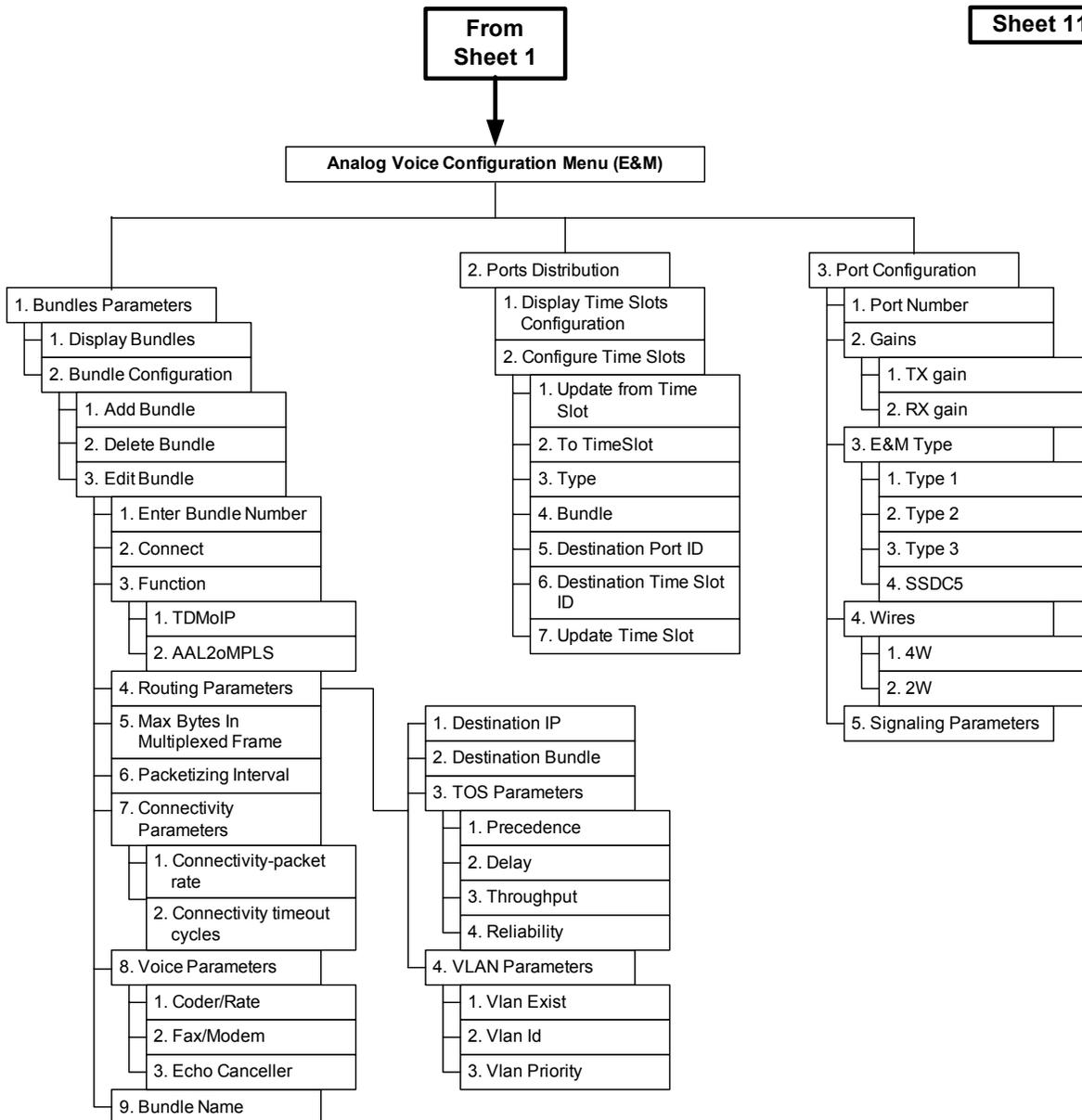


Figure C-11. Vmux-110 Menu Tree, Analog Voice Configuration Menu (E&M)

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## Error Report

- Type of Error(s)  
or Problem(s):
- Incompatibility with product
  - Difficulty in understanding text
  - Regulatory information (Safety, Compliance, Warnings, etc.)
  - Difficulty in finding needed information
  - Missing information
  - Illogical flow of information
  - Style (spelling, grammar, references, etc.)
  - Appearance
  - Other \_\_\_\_\_

Please list the exact page numbers with the error(s), detail the errors you found (information missing, unclear or inadequately explained, etc.) and attach the page to your fax, if necessary.

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Please add any comments or suggestions you may have.

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- You are:
- Distributor
  - End user
  - VAR
  - Other \_\_\_\_\_

Who is your distributor? \_\_\_\_\_

Your name and company: \_\_\_\_\_

Job title: \_\_\_\_\_

Address: \_\_\_\_\_

Direct telephone number and extension: \_\_\_\_\_

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