

Vmux-2100

Voice Trunking Gateway

Version 4.0

TDM[®]
Driven

RAD

data communications
The Access Company

Vmux-2100

Voice Trunking Gateway

Version 4.0

Installation and Operation Manual

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Product Disposal



To facilitate the reuse, recycling and other forms of recovery of waste equipment in protecting the environment, the owner of this RAD product is required to refrain from disposing of this product as unsorted municipal waste at the end of its life cycle. Upon termination of the unit's use, customers should provide for its collection for reuse, recycling or other form of environmentally conscientious disposal.



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

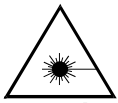
This symbol may appear on the equipment or in the text. It indicates potential safety hazards regarding product operation or maintenance to operator or service personnel.



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



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



Warning

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!

In some cases, the users may insert their own SFP laser transceivers into the product. Users are alerted that RAD cannot be held responsible for any damage that may result if non-compliant transceivers are used. In particular, users are warned to use only agency approved products that comply with the local laser safety regulations for Class 1 laser products.

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.

Connecting 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.

In cases when the power distribution system is IT type, the switch must disconnect both poles simultaneously.

Connecting 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.

If the DC mains are floating, the switch must disconnect both poles simultaneously.

Connecting 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.

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

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.

Avertissement

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.

Achtung

Das vorliegende Gerät fällt unter die Funkstörgrenzwertklasse A. In Wohngebieten können beim Betrieb dieses Gerätes Rundfunkstörungen auftreten, für deren Behebung der Benutzer verantwortlich ist.

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-2100

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

EMC:

EN 55022:1994

Limits and methods of measurement of radio disturbance characteristics of information technology equipment.

EN 50024: 1998

Information technology equipment – Immunity characteristics – Limits and methods of measurement.

Safety:

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 99/5/EC. The product was tested in a typical configuration.

Tel Aviv, 9th May, 2002



Haim Karshen

VP Quality

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

Quick Start Guide

Installation of Vmux-2100 should be carried out only by an experienced technician. If you are familiar with Vmux-2100, use this guide to prepare the unit for operation.

1. Installing Vmux-2100

Connecting the Interfaces

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

► **To connect the interfaces:**

1. Connect the incoming E1/T1 link to the RJ-45 connector of the Vmux-2100 voice module or channelized main link module, designated 1, 2, 3 or 4.
2. Connect the main link using the appropriate connector, as follows:
 - Ethernet main link: Connect the LAN to the RJ-45 or fiber optic connector designated ETH.
 - Balanced E1/T1 main link: Connect the E1/T1 link to the RJ-45 connector designated E1 A or E1 B.
 - Unbalanced E1 main link: Connect the E1 main link to the CBL-RJ45/2BNC/E1 adapter cable. Connect the adapter cable to the RJ-45 connector designated E1 A or E1 B.

Note

When using unbalanced E1 main link, make sure that the internal jumpers are set to the proper settings for the unbalanced E1 main link.

- Serial main link: Connect the network to the appropriate adapter cable (see [Appendix A](#)). Connect the adapter cable to the SCSI connector labeled LINK.
3. Connect the control terminal to the rear panel CONTROL connector using a standard DB-9 flat cable, or

Connect a modem to the CONTROL port using a CBL-VMUX-MM-MODEM cross cable. Then connect the remote modem to the ASCII terminal.

Connecting the Power

► **To connect the power:**

- Connect the power cable to the power connector on the Vmux-2100 rear panel.

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

2. Configuring Vmux-2100

Configure Vmux-2100 to the desired operation mode via an ASCII terminal connected to the rear panel CONTROL port. Alternatively, you can manage the Vmux-2100 via Telnet over an inband management connection.

Starting a Terminal Session for the First Time

- To start a terminal session:
 1. Connect a terminal to the CONTROL connector of Vmux-2100.
 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-2100 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 Menu > Configuration > System > Host IP**), set an IP address to the Vmux-2100 host.

Configuring E1 Main Link Parameters

- Configuring the E1 main link parameters:
 1. Display the Main Link menu, and configure the E1 main link parameters to the following values (**Main Menu > Configuration > Card > Main Board > E1 Parameters > Main Link 1**).
 2. Display the Time Slot Table menu and assign the timeslots to carry data (**Main Menu > Configuration > Card > Main Board > E1 Parameters > Time Slot Table**).

Configuring Voice Card Parameters

- **Configuring the voice card parameters:**
 1. From the appropriate Group menu, assign an IP address to the group (**Main Menu > Configuration > Card > Slot n > Group n**).
 2. From the Bundle Configuration menu, create new bundles as necessary (**Main Menu > Configuration > Card > Slot n > Group 1 > Bundles Parameters > Bundle Configuration > Add Bundle**).
 3. Display the Edit Bundle menu, and configure the bundle parameters for the created bundle(s) (**Main Menu > Configuration > Card > Slot n > Group n > Bundles Parameters > Bundle Configuration > Edit Bundle**).
 4. Display the E1 Parameters menu, and configure the parameters for the E1 port of group n (**Main Menu > Configuration > Card > Slot n > Group n > External n > E1 Parameters**).
 5. From the Time Slot Configuration menu, configure the timeslots belonging to the relevant external port (**Main Menu > Configuration > Card > Slot n > Group n > External n > Distribution Of Framer Time Slots > Time Slot Configuration**).

Note

When using CAS signaling, Vmux-2100 displays timeslot 16 as 'Not Connected' (NC), because it carries CAS signaling information.

6. Update the timeslot database from the Time Slot Configuration menu.
7. Repeat these steps as necessary for the other external port in the group, and for other groups.

Configuring Vmux-2100 for Operation with CAS Signaling

Remember that when using CAS signaling, timeslot 16 carries CAS signaling information and it therefore cannot be configured as a voice timeslot and appears as 'Not Connected' (NC) in the Display Time Slots screen.

Configuring the Signal Profile

If you are using CAS signaling, you must configure the signaling system of Vmux-2100 to make it compatible with the signaling method used by the PBXs connected to the voice E1/T1 ports.

- **To configure the Signal Profile:**
 1. From the Signal Profile Configuration menu (**Main Menu > Configuration > System > Management > Signaling Configuration > Signaling Profile Configuration**), enter the desired signaling system profile number.
 2. Select **Signaling Table Configuration** to configure the signaling bits according to the signaling method used by the PBX.

Configuring Vmux-2100 for Operation with CCS Signaling

Configuration of the Vmux-2100 units operating with the CCS signaling is similar to the configuration for operation with the CAS signaling, except for the following:

- Selecting G.732N framing type
 - Configuring an HDLC/TRANSPARENT timeslot to carry signaling information.
- **To configure CCS signaling:**
1. From E1 Parameters menu, set the framing type of the external E1 links to G.732N (**Main Menu > Configuration > Card > Slot n > Group n > External n > E1 Parameters**).
 2. For each external port, after assigning all the voice timeslots, assign one timeslot to carry signaling information (Type = HDLC-A, HDLC-B, HDLC-C, HDLC-D, TRANSPARENT, SUB CH-1, SUB CH-2, SUB CH-3, SUB CH-4, SUB CH-5, SUB CH-6, SUB CH-7, SUB CH-8).

Configuring Vmux-2100 for Operation with CCS-SS7 Signaling

When working with CCS-SS7, you can instruct Vmux-2100 to drop certain amount of fill-in signal units (FISUs) by selecting the appropriate SS7 keep-alive suppression rate.

- **To configure the SS7 keep-alive suppression rate:**
- From the SS7 Keep-Alive Suppression Rate menu (**Main Menu > Configuration > System > Management > Signaling Configuration > SS7 Keep-Alive Suppression Rate**), select the percentage of FISUs to suppress.

Transferring Database to a Remote Vmux-2100

- **To transfer the database to a remote Vmux-2100:**
1. Upload the **cnfg.dat** file from the local Vmux-2100 to the management station via the TFTP protocol.
 2. Download the **cnfg.dat** file to the remote Vmux-2100 via the TFTP protocol.
 3. Establish a Telnet connection.
 4. Update the remote Vmux-2100 database by typing @.

Note

The host IP and the main link values do not change when you download the new configuration and update the database.

Contents

Chapter 1. Introduction

1.1	Overview.....	1-1
	Product Options.....	1-1
	Voice Module	1-1
	Main Link Module	1-1
	Channelized E1/T1 Main Link Module	1-2
	Applications.....	1-2
	Features.....	1-4
	Main Link Ports	1-4
	Voice Modules.....	1-5
	Channelized E1/T1 Main Link Modules.....	1-7
	Diagnostics	1-8
	Statistics Collection	1-8
	Management.....	1-8
	Power	1-9
1.2	Physical Description	1-9
1.3	Functional Description.....	1-12
	Ethernet Main Link.....	1-12
	E1/T1 Main Link	1-12
	Serial Main Link.....	1-13
	Voice Modules	1-13
	Signaling	1-14
	Compression	1-14
	Voice Activity Detection.....	1-14
	Data Streams	1-14
	TDMoIP Multiplexing	1-15
	Ethernet Frame	1-16
	Ethernet Frame when Using AAL2oMPLS Format	1-18
	VLAN Support.....	1-18
	UDP Support	1-18
	Channelized E1/T1 Main Link Modules	1-19
	Bandwidth Utilization when using TDMoIP	1-20
	Bandwidth Utilization when using AAL2oMPLS.....	1-20
1.4	Technical Specifications.....	1-21
	Main Module.....	1-21
	Voice Modules	1-23
	Channelized E1/T1 Main Link Modules	1-24
	Vmux-2100 Chassis.....	1-25

Chapter 2. Installation and Setup

2.1	Introduction.....	2-1
2.2	Site Requirements and Prerequisites	2-1
2.3	Package Contents	2-2
2.4	Equipment Needed.....	2-2
2.5	Setting the Internal Jumpers and Switches.....	2-2
	Setting Up Vmux-2100	2-2
	Setting the Main Link E1 Internal Jumpers.....	2-3
2.6	Mounting the Unit.....	2-4
2.7	Connecting to Interfaces	2-4

Connecting to E1/T1 Voice Ports	2-4
Connecting to Main Link.....	2-5
Connecting to an ASCII Terminal.....	2-6
2.8 Connecting to Power.....	2-6
Connecting to AC Power.....	2-7
Connecting to DC Power	2-7

Chapter 3. Operation

3.1 Turning On the Unit	3-1
3.2 Indicators	3-1
3.3 Default Settings.....	3-3
3.4 Configuration and Management Alternatives	3-9
Working with an ASCII-based Control Terminal.....	3-9
Control Port Interface Characteristics	3-9
Levels of Security	3-10
Preparing the Terminal	3-10
Data Terminal Ready (DTR).....	3-10
Initiating a Control Session.....	3-10
Login	3-11
Working with Telnet.....	3-11
Navigating the Management Menus	3-12
Choosing Parameters	3-12
Saving and Aborting Configuration Changes.....	3-12
Using Terminal Hot Keys.....	3-13
Sample Help Screen.....	3-13
3.5 Turning Off the Unit.....	3-13

Chapter 4. Configuration

4.1 Configuring Vmux-2100 for Management.....	4-1
Configuring the Host IP.....	4-1
Defining the Manager List	4-3
Assigning a Name to Vmux-2100.....	4-4
Controlling Telnet Access	4-4
Configuring the Control Port	4-5
Configuring the Data Rate	4-5
Configuring the Timeout.....	4-6
Enabling/Disabling Dial-in Modem Access	4-6
4.2 Configuring Vmux-2100 for Operation	4-6
Configuring Signaling Information.....	4-7
Configuring Signaling Profiles	4-7
Configuring Keep-Alive Suppression Rate.....	4-10
Configuring Link Backup	4-11
Restricting LAN Traffic	4-13
TDM Uplink Loop Detect.....	4-14
Enabling TDM Line Check.....	4-15
Setting Bandwidth Control Thresholds.....	4-16
Entering Main Link and Voice Modules into the Database.....	4-17
Configuring the Main Module and I/O Ports	4-18
Configuring the Main Module	4-19
Configuring the Ethernet Port.....	4-19
Configuring the Serial Port.....	4-20
Configuring the E1 Main Link Port.....	4-22

Configuring the T1 Main Link Port.....	4-26
Configuring the Voice Module.....	4-29
Configuring Bundles	4-29
Configuring the External E1 Ports	4-38
Configuring the External T1 Ports	4-40
Configuring the E1/T1 Timeslots	4-43
Configuring the Channelized E1/T1 Main Link Module.....	4-47
Disabling the Internal Switching.....	4-47
Configuring the E1 Ports.....	4-47
Configuring the T1 Ports.....	4-49
Configuring Bundles	4-51
Configuring the E1/T1 Time Slots.....	4-53
4.3 Additional Tasks.....	4-55
Updating the Database	4-55
Displaying the Vmux-2100 Inventory	4-57
Restoring Default Settings	4-58
Managing the User Database	4-60
Adding a New User to the Database	4-60
Deleting an Existing User from the Database	4-61
Changing the User Details	4-61
Displaying the User List.....	4-62
Resetting the Vmux-2100 Modules.....	4-63
Setting Date and Time	4-63
NTP (External Clock Source).....	4-63
Internal.....	4-64

Chapter 5. Configuring Typical Applications

5.1 Configuration Sequence	5-1
5.2 Configuring Vmux-2100 for Operation with CAS.....	5-2
Configuring System Parameters	5-2
Configuring E1 Main Link Parameters	5-3
Configuring Voice Card Parameters	5-3
5.3 Transferring Database to Remote Vmux-2100	5-5
5.4 Completing Remote Vmux-2100 Configuration.....	5-5
5.5 Configuring Vmux-2100 for Operation with CCS.....	5-6

Chapter 6. Troubleshooting and Diagnostics

6.1 Monitoring Performance.....	6-1
Displaying Statistics for Voice Modules and Channelized E1/T1 Main Link Modules ...	6-1
Displaying E1/T1 Group Data Statistics	6-2
Displaying Bundle Statistics for Voice Modules.....	6-6
Tracking Packets	6-7
Displaying Timeslot Voice Statistics.....	6-13
Displaying the Voice Signaling Statistics.....	6-16
Displaying Statistics for the Main Module Ports	6-18
Displaying the Main Module CPU Utilization.....	6-18
Displaying the Main Module Ethernet Statistics	6-19
Collecting the TDM Main Link Statistics	6-21
Displaying the Backup Links Status	6-24
Clearing All Statistics.....	6-24
6.2 Detecting Errors.....	6-25
Displaying the Sanity Errors and Warnings.....	6-25

Sanity Error and Warning List	6-26
6.3 Handling Alarms	6-29
Alarm Buffer	6-29
Working with the Temporary Alarm Buffer	6-29
Working with Permanent Buffer	6-31
Setting the Alarm LED Severity	6-32
List of Vmux-2100 Alarms	6-33
6.4 Testing Vmux-2100	6-37
Tone Injection	6-37
Loopback Tests	6-39
Local Loopback	6-39
Remote Loopback	6-40
Pinging Remote Devices	6-41
Displaying the Active Tests	6-42
6.5 Frequently Asked Questions	6-42
6.6 Technical Support	6-56

Appendix A. Connector Pinouts

Appendix B. Boot Manager

Appendix C. Configuration Menus

Chapter 1

Introduction

1.1 Overview

Vmux-2100 is a modular voice trunking gateway that enables up to 16 E1 or T1 circuits to be extended over a single E1, T1, serial or IP link. Vmux-2100 implements G.723.1, G.729 A, G.711 and TDMoIP or AAL2oMPLS multiplexing algorithms to send up to 496/384 voice channels over a single E1/T1 or IP link with transparent CAS and CCS support. Vmux-2100 utilizes voice activity detection, silence suppression, echo cancellation and other techniques to improve voice quality. The gateway detects, generates and relays DTMF/MFR2/MFC signaling. Vmux-2100 supports fax relay and Voice Band Data.

In addition, Vmux-2100 supports VCA, which is a voice module (5441 DSPs) that allows modem relaying.

Vmux-2100 supports fail-over between TDM and Ethernet networks, allowing one network to act as a backup should the other network fail.

Vmux-2100 can be managed locally via an ASCII terminal or remotely via Telnet or RADview (RAD's SNMP-based network management application).

Vmux-2100 supports applications using Vmux-110 as well as other Vmux-2100 or MP2100-VF24/30/60 voice trunking gateways.

Product Options

Vmux-2100 includes one main link module and up to four voice modules or channelized E1/T1 main link modules.

Voice Module

Each voice module includes two or four balanced E1/T1 ports.

Main Link Module

The main link module supports the following interface combinations:

- A single Ethernet port
- Any one of the following options in addition to the Ethernet port:
 - Redundant pair of E1 ports (balanced)
 - Redundant pair of T1 ports (balanced)
 - Redundant pair of Serial ports.

Note *Vmux-2100 main link also supports unbalanced E1 interfaces. This requires the use of an external RJ-45-to-BNC interface adapter, CBL-RJ45/2BNC/E1, as well as setting the internal jumpers (see [Setting the Internal Jumpers and Switches](#) in [Chapter 2](#)).*

Channelized E1/T1 Main Link Module

In place of a voice module, Vmux-2100 can be equipped with a channelized E1/T1 main link module. This module enables Vmux-2100 to support up to four E1 or T1 WAN ports for point-to-multipoint TDM applications. The channelized E1/T1 main link module includes two or four balanced E1/T1 ports with support for switching (bridging) between the channels.

Applications

[Figure 1-1](#) shows a Vmux-2100 application where the gateway transmits compressed voice over an IP network, including transparent transmission of CCS and CAS signaling.

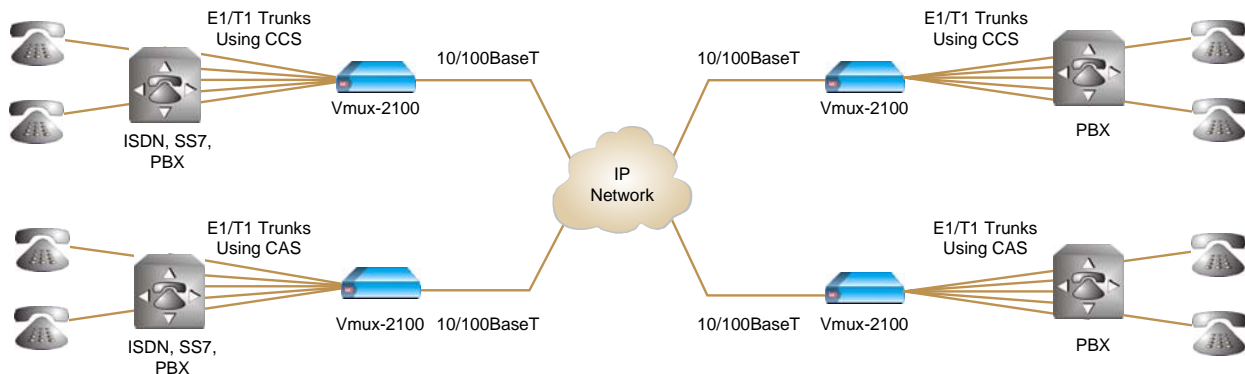


Figure 1-1. Transmitting Compressed Voice and Signaling over IP Network

[Figure 1-2](#) shows a Vmux-2100 implementing 16:1 TDMoIP compression to transmit 496/384 voice channels over a single E1/T1 link.

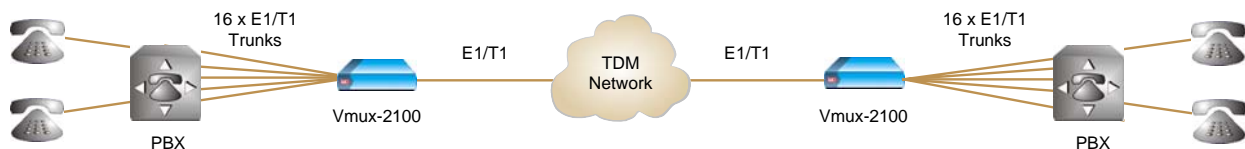


Figure 1-2. Transmitting 496/384 Voice Channels over a Single E1/T1 Link (16:1 Compression)

[Figure 1-3](#) shows a central Vmux-2100 operating opposite three remote Vmux-2100 units in a point-to-multipoint application over an IP network.

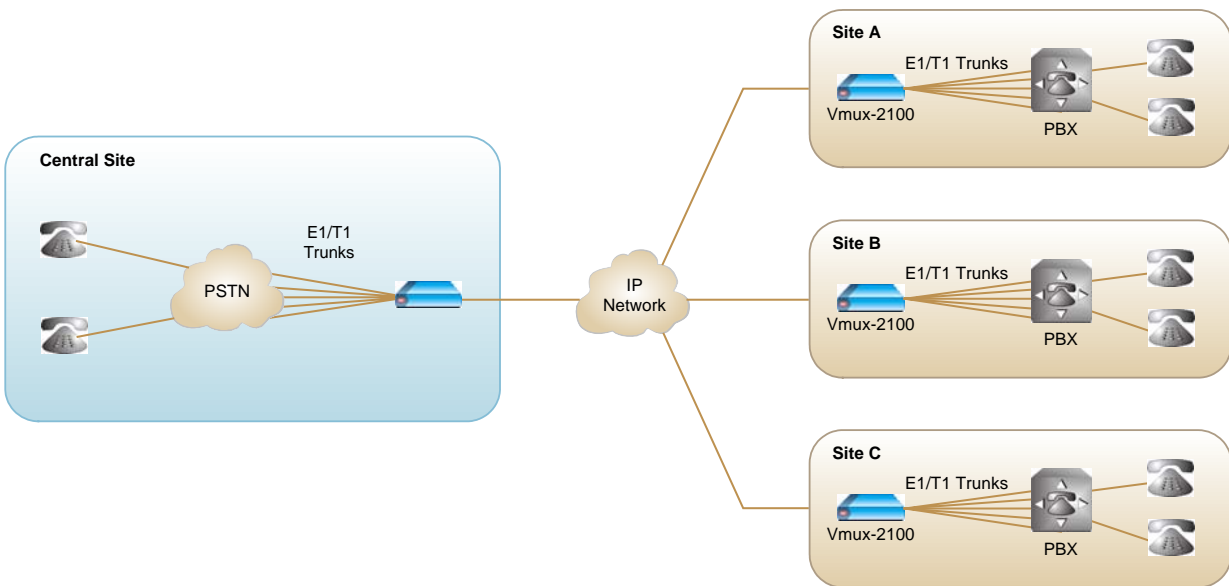


Figure 1-3. Transmitting Compressed Voice in Point-to-Multipoint Application

Figure 1-4 shows a central Vmux-2100 operating opposite three remote Vmux-2100 units in a point-to-multipoint application over a channelized TDM network.

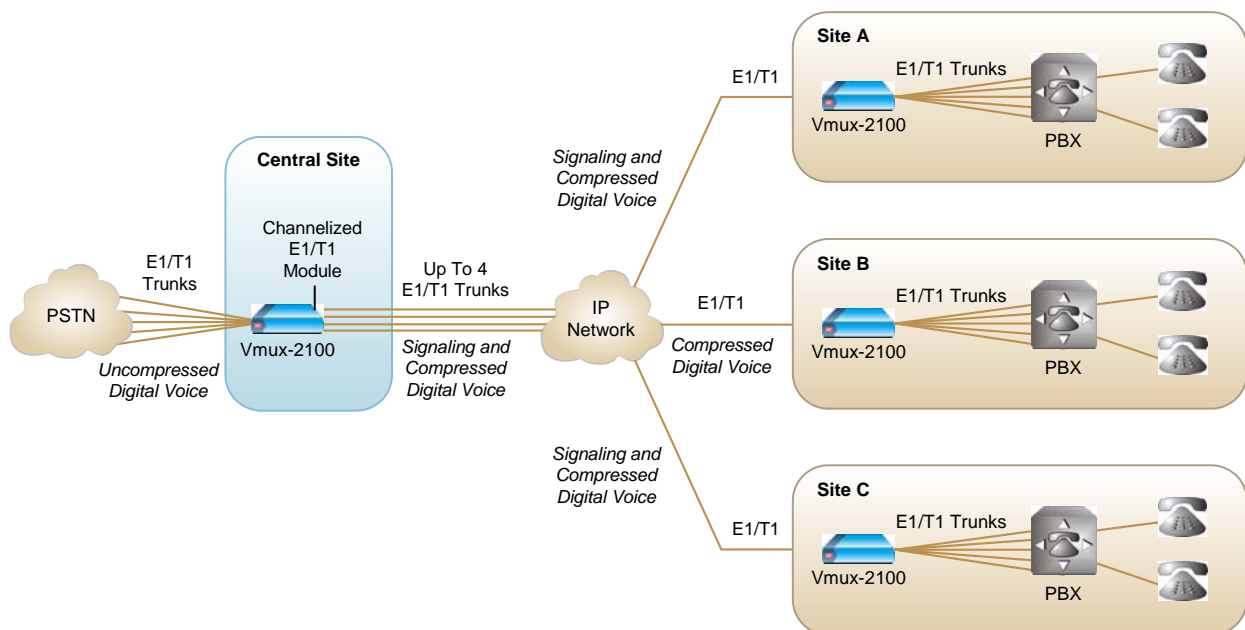


Figure 1-4. Point-to-Multipoint Application over a TDM Network

For detailed instructions for configuring Vmux-2100 for a typical application, refer to [Chapter 5](#).

Features

Main Link Ports

E1 Main Link

Balanced redundant E1 main link ports use HDB3 coding and comply with G.703, G.704, G.706, G.732 and G.823 standards. The E1 framers support pass-through G.732N framing with or without CRC-4. Integral LTU/DSU can be enabled for line protection and long haul options. Unbalanced E1 connection is achieved via an external BNC interface adapter.

The E1 Main Link also supports unframed E1, which permits up to 2048 kilobits per second (a gain of 64 kbps over framed E1).

T1 Main Link

Balanced redundant T1 main link ports use AMI coding, B8ZS zero suppression, and comply with ANSI T1.403, AT&T TR-62411 and ITU-T G.703 standards. The T1 framers support pass-through, SF, and ESF framing. Integral DSU/CSU can be enabled for line protection and long haul options.

Serial Main Link

The redundant Nx64 kbps Serial Main Links support the following interfaces: V.35, RS-232(V.28), RS-530(EIA-530), RS-530A(EIA-530A), RS-449(V.36) X.21(V.11).

Both links terminate on a single 50-pin SCSI connector. Y-cables that convert the Serial Port's 50-pin SCSI connector into two separate link connectors with standard interfaces are available. See [Appendix A](#) for a description of the Serial interface adaptor cables.

Ethernet Main Link

The Main Link module features a single 10/100BaseT UTP Ethernet port with optional Auto-Negotiation support. The Ethernet port operates at 10/100 Mbps speeds, half and full duplex. The Ethernet interface is compliant with the IEEE 802.3 standard. It supports full Auto-Negotiation according to 802.3x flow control for full duplex, and backpressure option for half duplex.

If auto-negotiation is disabled, Vmux-2100 can be configured to any of the following:

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

If the TDM uplink is used, but the Vmux-2100 ETH port is connected to a local network, the default behavior of the Vmux-2100 is to pass all LAN information over the TDM. In some applications, this behavior may be undesirable, since:

- The site network traffic will be visible outside the organization firewall
- It may overload the TDM main link, resulting in bandwidth overflow

The *Inhibit LAN* feature can be used to restrict the flow of LAN traffic such that only traffic destined for remote Vmux units is allowed to pass; traffic destined for any other IP address is blocked.

When a LAN or TDM network fails, Vmux-2100 supports automatic switching from the failed network to the alternate network. This backup feature works only between the non-channelized TDM ports on the main module and the LAN network connected to the Main Module. No backup is available between the Main Module and Channelized Uplink Modules.

Voice Modules

Vmux-2100 voice modules control E1/T1 frames, use G.723.1 (6.4 or 5.3 kbps), G.729 A (8 kbps) and G.711 compression algorithms, and handle CAS/CCS signaling transparently. Every group of two E1s or T1s is assigned a separate IP address.

Note that CAS and CCS signaling may not be mixed within one group of two E1/T1 ports. Therefore, each pair of ports must be configured to the same signaling type.

The Voice Activity Detection mechanism optimizes bandwidth utilization, since Vmux-2100 generates traffic only when voice activity is detected. Vmux-2100 uses the G.723.1 A and G.729 B techniques for silence suppression and the G.168 standard for echo cancellation (up to 32 ms per channel). Vmux-2100 detects, relays, and generates DTMF/MFR2/MFC signals, and supports Group III fax relay (4.8, 9.6, 14.4 kbps), Voice-Band modem data, and relaying of modem data.

Voice bundle packets can be duplicated and re-transmitted to the network in a few copies. This can be useful for unreliable networks and networks with high loss rate.

In addition, Vmux-2100 supports multiple data sub-channels, either HDLC or transparent, for all voice modules. It is possible to connect only part of a timeslot to a channel using a channel specific, user-defined mask.

Any combination of HDLC/SS7/transparent data channels may be used, in addition to a single type of sub-channels. You may configure up to 8 HDLC sub-channels, or 8 transparent sub-channels, but never simultaneously.

A maximum of eight data timeslots per E1/T1 interface may be occupied. These eight timeslots may be a combination of transparent timeslots with HDLC and/or SS7 signaling timeslots.

Vmux-2100 supports the Q.50 signaling protocol.

The voice modules are hot swappable.

TDMoIP Multiplexing

Vmux-2100 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 maximum packetizing interval are user-configurable.

A destination IP address must be separately configured for each bundle (see [*Bundling*](#), below).

AAL2oMPLS Multiplexing

When using non-IP based Ethernet networks, 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 port of Vmux-2100, containing up to 62 timeslots. Each E1/T1 group handles up to 30 bundles. A bundle is routed to a defined remote IP address (remote group address). Each timeslot can be included in any bundle defined in its E1/T1 group. At the remote site, it can be connected to any timeslot within a destination bundle.

You can configure the ToS (Type of Service) of the outgoing IP packets. This allows an en-route layer 3 router or switch, which supports ToS, to give higher priority to Vmux-2100 traffic for delay-sensitive and secure applications.

Vmux-2100 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).

Bundle QoS (Quality of Service) support:

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

Super Tandem

When voice data travels through several Vmux-2100 gateways, the intermediate Vmux-2100 units sense that the voice data has already been compressed, and do not uncompress and recompress the data as it moves through the phone network. This ensures that voice data is only compressed once (at the originating Vmux-2100 gateway) and decompressed once (at the terminating Vmux-2100 gateway), resulting in high quality voice, since no losses are incurred from intermediate uncompress/compress cycles.

When SS7 COT is used, SS7 Test Tone Relay continuity is also supported.

Bandwidth Management

Vmux-2100 supports two types of bandwidth management. The Q.50 protocol can be used with PBXs that support it. The built-in Vmux-2100 bandwidth control can be used with or without the Q.50 protocol. Bandwidth management is available only when the TDM port of the Main Module card is used as the main link. You can modify the threshold level for both mechanisms.

Note

There is no bandwidth management available for the Channelized Uplink Modules.

- **Q.50 Protocol** - Vmux-2100 supports the Q.50 protocol (Annex A and B), which is automatically invoked when a requesting PBX uses the Q.50 protocol. This protocol is used for the management of calls between PBXs. When the PBX requests permission to establish a call, Vmux-2100 accepts or rejects the new call depending on its current level of saturation. This call negotiation is handled by the Q.50 protocol.

- **Built-in bandwidth control** - The built-in bandwidth control mechanism works on the same principle as the Q.50 protocol, without using the protocol. At times when bandwidth is limited, some voice packets are discarded. This results in a slight reduction in voice quality. The packet discarding is done statistically to minimize the reduction in voice quality. This feature reduces the risk of overflowing the uplink, which would cause all voice packets to be lost. In addition, during overload periods, new modem calls are restricted. You can configure the threshold for blocking new modem calls.

Timing

Note

Each group of the VCA-T1 modules must use the same clock source, meaning that:

- *Both T1 ports of the same group (i.e., ports 1 & 2, or ports 3 & 4) should be configured to the same clock source (LBT or Internal)*
 - *When the two T1 voice ports in the group are set to LBT, they must receive the same clock source from the switch/PBX*
-

Available timing modes are:

- **Loopback** - E1 or T1 transmit clock is derived from the E1/T1 receive clock.
- **Internal** - Vmux-2100 features a separate internal oscillator for each pair of E1/T1 interfaces. When a voice module is configured to operate using its internal clock, transmit (Tx) and receive (Rx) trunks use the clock supplied by its internal oscillator.

Channelized E1/T1 Main Link Modules

The E1/T1 ports on the channelized main link module provide the same support as the TDM main link module, with the addition of bridging (switching) support and channelized E1/T1 support. These modules are used to implement point-to-multipoint applications over TDM networks.

Every channelized main link module supports 2 or 4 E1/T1 ports. The channelized main link module also supports backup between any two E1 ports of the same group.

The channelized E1/T1 main link module functions as a tiny bridge, which switches Ethernet packets between any two channels. Switching is based on tagged and untagged L2 MAC address. The channelized E1/T1 main link module holds an internal hash table, which stores up to 256 different MAC addresses. An aging mechanism is used to clear old entries every 5 minutes. The channelized E1/T1 main link module also forwards packets whose destination MAC addresses cannot be found in the hash table.

Note

If the TDM network that connects multiple Vmux-2100 devices is in a loop topology, you must set the Internal Switching system parameter to DISABLED to prevent the TDM network from forming a closed LAN loop.

Diagnostics

Vmux-2100 supports local (internal) and remote (external) loopback activation on E1/T1 links. You can also perform tone injection towards the local PBX. In addition, a ping utility is included to confirm IP connectivity to remote units.

Statistics Collection

Vmux-2100 provides extensive statistics collection capabilities. Statistics are collected for the following:

Main link module:

- CPU utilization
- Ethernet link (as per RFC 3638)
- TDM link
- Backup Links Status.

Voice modules:

- HDLC statistics
- Bundle statistics
- Voice statistics
- Voice Rx and Tx signaling statistics.

Channelized E1/T1 main link modules:

- Channelized bundle statistics.

Management

Vmux-2100 can be managed via a local terminal, Telnet, or RADview—RAD's network management system. Vmux-2100 has a DB-9 female port for a direct terminal connection. Alternatively, a supervisory terminal can be connected via a modem link.

Software uploads and downloads as well as system configuration can be performed via the local terminal or TFTP. Remote units are managed via Telnet or RADview over an in-band management link running on the regular unit uplink.

Vmux-2100 supports a four-level security and user-authentication system:

- **Administrator** – Allowed to configure all Vmux-2100 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-2100 and monitor its operation (for example, monitoring alarms)
- **Monitor** – Allowed to monitor the Vmux-2100 operation.

When Vmux-2100 is managed over Telnet, the ASCII terminal is disabled. Access to the Vmux-2100 configuration menu can be limited to the ASCII terminal and RADview management by disabling Telnet access. Alternatively, remote Telnet

management sessions can be limited to a predefined list of remote hosts (defined by their IP addresses).

Power

Vmux-2100 can be ordered with one or two hot-swappable power supplies, supporting load sharing and redundancy.

- AC: 100 to 240 VAC
- -48 VDC: -36 to -72 VDC
- 24 VDC: 20 to 36 VDC.

Note

When operating a Vmux-2100 unit with one AC power supply and one DC power supply, load sharing is not supported.

1.2 Physical Description

Vmux-2100 is a 1U high, easy-to-install standalone device. A 3-D view of the Vmux-2100 unit is shown in [Figure 1-5](#).



Figure 1-5. Vmux-2100, 3D View

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

Vmux-2100 is equipped with a single main module. It can be equipped with up to four voice modules and/or channelized E1/T1 main link modules, which contain two or four E1/T1 connectors each. The Vmux-2100 also contains one or two power supplies for load sharing and redundancy. The ports on the rear panel are described in [Chapter 2](#).

The rear panel of a Vmux-2100 with three 4-port E1 Voice Compression Modules, one 4-port Channelized E1 Main Link Module, and two power supplies installed is shown in [Figure 1-6](#). The Main Module shown includes two E1 ports, a control port and an Ethernet port.

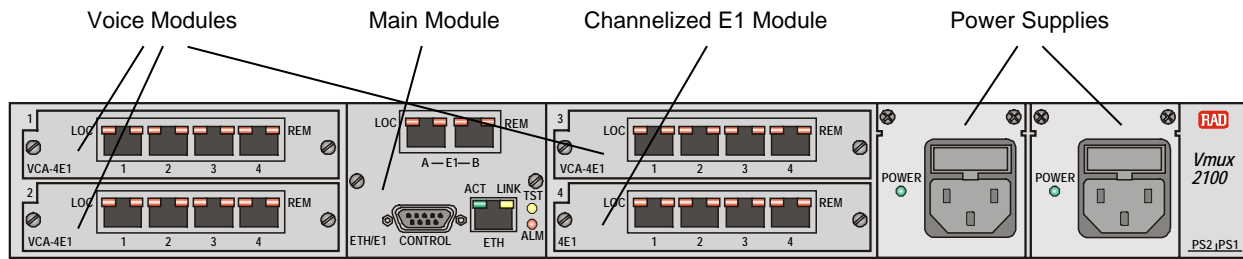


Figure 1-6. Vmux-2100, Rear View

The main module contains the following ports:

- DB-9 Control Port (to connect a management terminal)
- UTP Ethernet Port (to connect the Vmux-2100 to an IP network)
- Optional redundant E1, T1 or Serial links (to connect Vmux-2100 to a TDM network).

The available main module configurations are shown in [Figure 1-7](#).

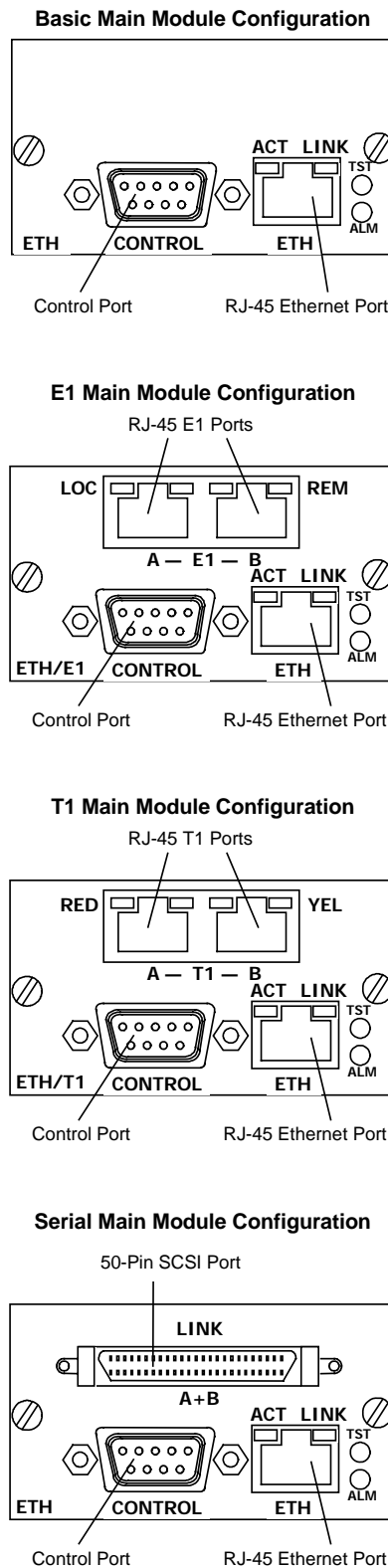


Figure 1-7. Vmux-2100 Main Module Port Configurations

1.3 Functional Description

Figure 1-8 shows a block diagram of Vmux-2100.

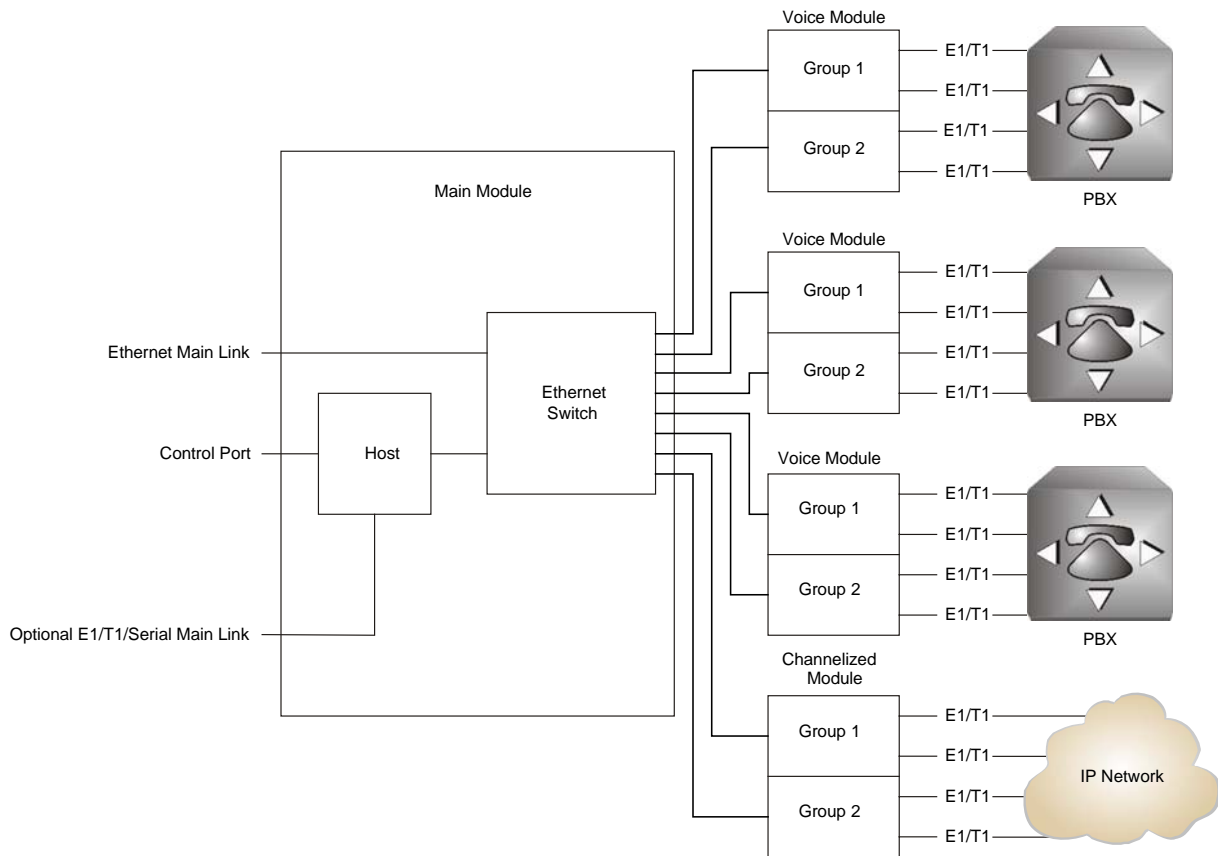


Figure 1-8. Vmux-2100 Block Diagram

Ethernet Main Link

The Ethernet main link receives Ethernet frames from the voice modules via the Ethernet switch and forwards them to the remote device over the IP network.

E1/T1 Main Link

When using the E1/T1 main link, Vmux-2100 adds HDLC flags to the Ethernet frames and transmits them over a TDM network. The E1/T1 main link interface of Vmux-2100 is fully redundant. When both links are configured as active, Vmux-2100 starts sending data over the one that was connected first. If a loss of synchronization is detected on an active link, or the end-to-end connectivity seems to be disturbed, Vmux-2100 automatically switches to the backup link.

The E1/T1 links operate with loopback timing by deriving clock from the device connected to its E1/T1 port or with internal clock provided by the Vmux-2100 internal oscillator.

Serial Main Link

When using the Serial main link, Vmux-2100 adds HDLC flags to the Ethernet frames and transmits them over a TDM network. The Serial main link interface of Vmux-2100 is fully redundant. When both links are configured as active, Vmux-2100 starts sending data over the one that was connected first. If a loss of synchronization is detected on an active link, or the end-to-end connectivity seems to be disturbed, Vmux-2100 automatically switches to the backup link.

The Serial links operate with loopback timing by deriving clock from the device connected to its Serial port (DTE mode) or with internal clock provided by the Vmux-2100 internal oscillator (DCE mode).

Voice Modules

The voice modules include two or four E1/T1 ports, which receive E1/T1 trunks from PBXs. Every two E1 and T1 ports are referred to as a *group*, which receives a separate IP address. The available voice module configurations are shown in [Figure 1-9](#).

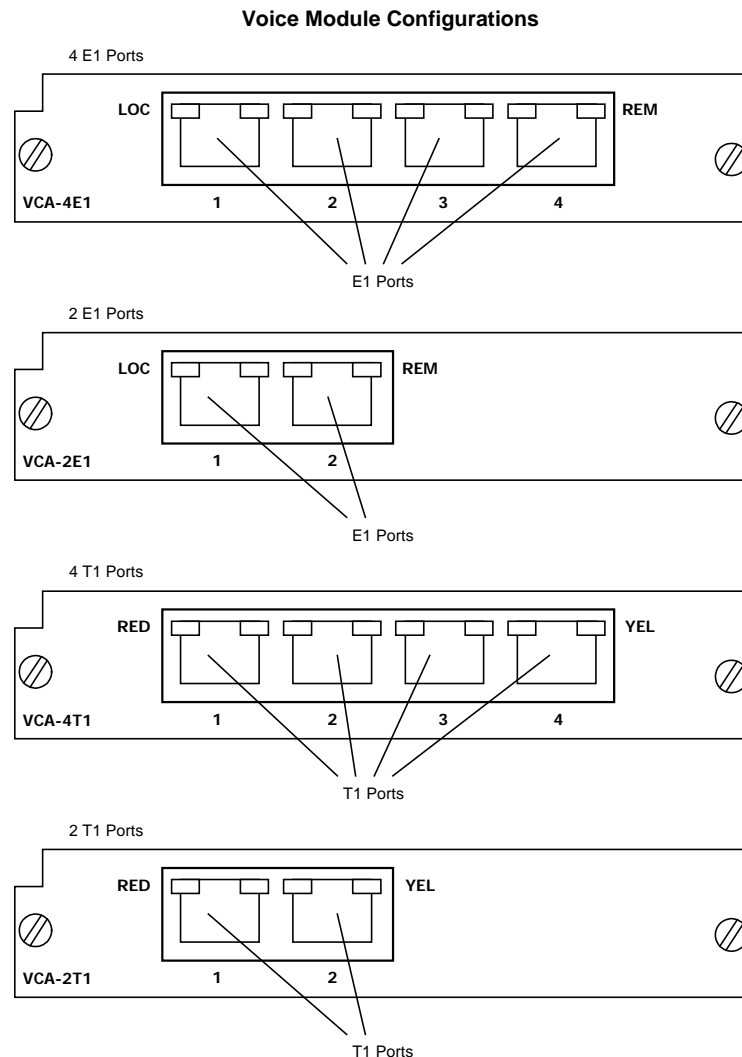


Figure 1-9. Vmux-2100 Voice Module Port Configurations

Signaling

Signaling information is processed according to signaling mode: CAS for E1, Robbed Bit MF for T1, or CCS for E1 and T1.

- **CAS/Robbed Bit MF** – The signaling data is processed by a separate DSP by extracting the ABCD bits and reporting any change in their status to the host. The reporting format is similar to E1, T1 ESF and T1 SF. In addition, the signaling DSP employs a refresh mechanism to update the host with the most recent status of the ABCD bits. By default, the ABCD bits are transmitted transparently, however, they can be manipulated by using translation rules, which are defined by means of signaling profiles.

A profile enables you 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.

- **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 number of keep-alive messages transferred over the signaling links. When using CCS, all 31 E1 timeslots are available for voice.

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 μ -law). Compression methods are user-selectable per bundle.

Note

In VCA cards, every four voice timeslots are handled by a single DSP.

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 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.

Data Streams

Vmux-2100 supports the transfer of various data streams that are not processed as voice. For example, some applications transfer SS7 signaling over two separate timeslots. Vmux-2100 supports the following data streams:

- **Multiple HDLC channels** – Vmux-2100 supports up to four independent HDLC data streams per E1/T1. Each data stream may occupy one or more consecutive timeslots.
- **SS7 channels** – Vmux-2100 supports up to two independent SS7 data streams per E1/T1. Each data stream may occupy one or more consecutive timeslots.
- **Transparent channel** – Vmux-2100 supports the transparent connection between Nx64 channels over IP and TDM networks. This feature is supported between two Vmux-2100 units as well as between Vmux-2100 and Vmux-110. A maximum of eight transparent timeslots per E1/T1 are supported.

Since Vmux-2100 cannot maintain clock synchronization between the local and remote E1/T1 ports, it is recommended that both E1/T1s use the same clock. To prevent slip caused by jitter between the E1/T1 clocks, Vmux-2100 includes a configurable internal jitter buffer, which holds up to 100 ms of data per channel. Should the network delay variation exceed 100 ms, data will be lost and the application running over the transparent channel may fail.

- **Multiple HDLC/TRANSPARENT Sub Channels** – Vmux-2100 supports up to 8 data sub channels for each port of VOICE modules. Each sub channel may be configured either as HDLC or TRANSPARENT and support up to 1 full timeslot, with any used-bits combination (0x00 - 0xFF). Sub channels may be assigned to any bundle configured in the card. The current limitation is that all sub channels used in the same port MUST be of the same type (HDLC/TRANSPARENT).

Note

The total number of HDLC, SS7, and transparent timeslots together may not exceed eight timeslots.

TDMoIP Multiplexing

Compressed voice payload is multiplexed by using the TDMoIP technique. The multiplexing is performed by the Vmux-2100 software. The DSPs send a continuous stream of voice packets; which are combined into a TDMoIP frame by adding AAL2 headers and a TDMoIP header. [Figure 1-10](#) illustrates the TDMoIP frame structure.

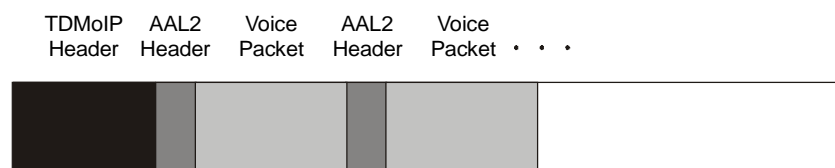


Figure 1-10. TDMoIP Frame Structure

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

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

The Vmux-2100 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 part of the standard Ethernet frame, which also includes a UDP header, IP header and MAC. The Ethernet frames are forwarded to the Ethernet switch, which sends them to one of the main links: 10/100BaseT or E1/T1. [Figure 1-11](#) illustrates the structure of the Vmux-2100 Ethernet frame. [Table 1-1](#) describes the fields of the Vmux-2100 Ethernet frame.

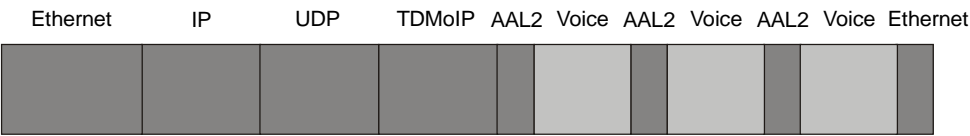


Figure 1-11. Ethernet Frame Structure

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 802.1D&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	
	4	Destination IP Address	
UDP Layer	2	UDP Source Port	Note: The UDP source port field is used to transfer a destination bundle number.
	2	UDP Destination Port	
	2	UDP Message Length	
	2	UDP Checksum	
Data Layer	...	Payload	
MAC Layer	4	CRC	

Ethernet Frame when Using AAL2oMPLS Format

The AAL2oMPLS format may be used when using non-IP based Ethernet networks. The AAL2oMPLS header is smaller than the IP header, which typically yields a 5% savings in bandwidth, depending on the actual frame size.

Figure 1-12 illustrates the structure of the Vmux-2100 Ethernet frame when using the AAL2oMPLS format.

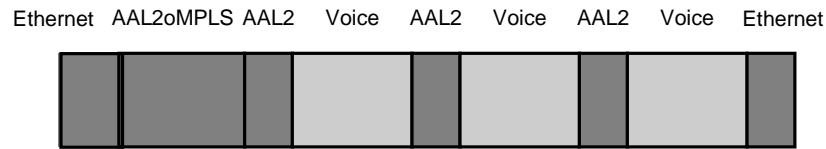


Figure 1-12. AAL2oMPLS Frame Structure

VLAN Support

Vmux-2100 supports VLAN, according to IEEE 802.1D&Q. When VLAN support is enabled, Vmux-2100 adds four bytes to the MAC layer of the Ethernet frame. You can set the content of these bytes, MAC layer priority and VLAN ID. In this mode, only VLAN format frames are sent and received by Vmux-2100. The following figure describes the VLAN tag format.

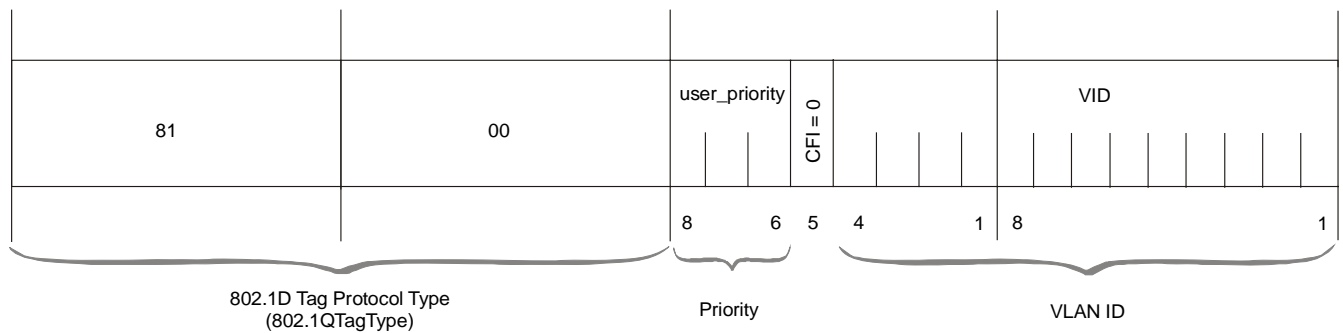


Figure 1-13. VLAN Tag Format

UDP Support

Table 1-2. UDP Source Port as Destination Voice Port

Field Length (Bits)	Field Description	Value
2 bytes	UDP Source Port. The MSB of this field can be either 1 or 0 for inband end-to-end proprietary signaling.	2 – 497d
2 bytes	UDP Destination Port	2142d

Note

The UDP Source Port field is used for destination voice bundle indication. For example, the destination may be set up as follows: Bundle 1 – 02, Bundle 2 – 03, Bundle 3 – 04, Bundle 4 – 05, etc.

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

Channelized E1/T1 Main Link Modules

The channelized E1/T1 main link module provides for channelized (bridged) TDM connections between the Vmux-2100 and the E1/T1 network. Each module supports up to four independent channelized E1 or T1 main links to allow the Vmux-2100 to be connected to multiple remote Vmux-110 and/or Vmux-2100 units. In addition, the module can provide backup between any two E1/T1 links of the same group. The channelized E1/T1 main link connections may replace the existing E1/T1 connections provided by the main module, or may compliment the main module.

Functionally, the channelized E1/T1 main links are identical to the E1/T1 links on the Main Link Module, with the addition of support for point-to-multipoint connections. The point-to-multipoint capability functions on two levels:

- Each port can be directed to a different remote location
- Within a single E1/T1 interface, different channels of Nx64 kbps can be defined. The system must be then provisioned so that the timeslots cross-connect properly between the sites.

The available port configuration options of the channelized main link module are shown in *Figure 1-14*.

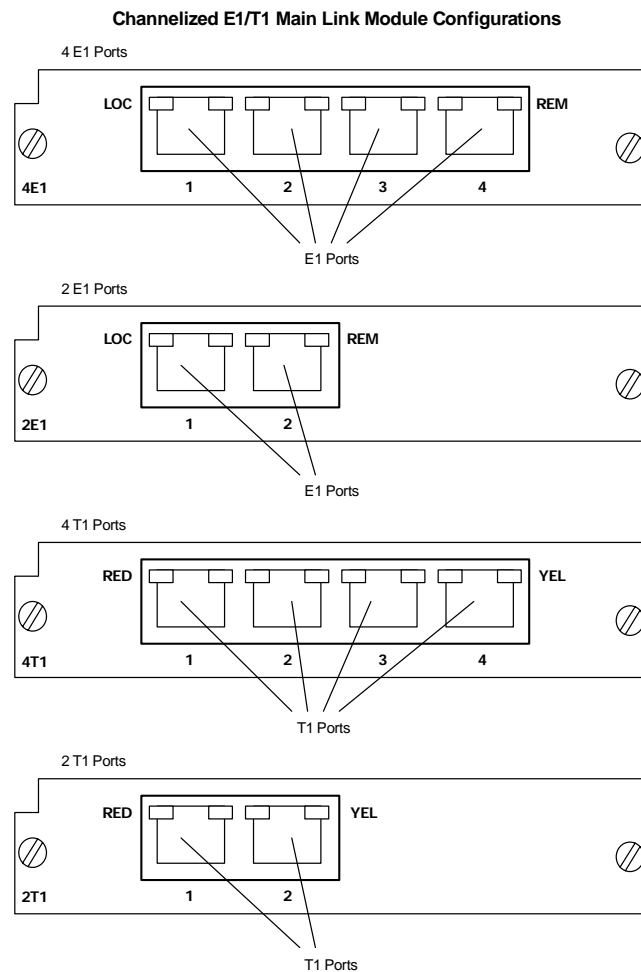


Figure 1-14. Vmux-2100 Channelized E1/T1 Main Link Module Port Configurations

Bandwidth Utilization when using TDMoIP

By using TDMoIP multiplexing and the voice activity detection, Vmux-2100 supports a higher number of voice channels over TDM than 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 (delivering up to 16:1 compression ratio over an E1 uplink), when all channels are active. Better compression, up to 20:1, is achieved when some of the voice channels are idle.

When using **TDMoIP+** (see [Chapter 4](#), page 4-32), further header optimization is achieved saving 4 bytes per voice packet. This results in further bandwidth saving of 10-12% when using a G.723.1 coder, and 20% when using a G.729A coder. Voice quality is not affected.

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

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.

When using **AAL2oMPLS+** (see [Chapter 4](#), page 4-32), further header optimization is achieved saving 4 bytes per voice packet. This results in further bandwidth saving of 10-12% when using a G.723.1 coder, and 20% when using a G.729A coder. Voice quality is not affected.

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

1.4 Technical Specifications

Main Module

Ethernet Main Link	<i>Standards</i>	IEEE 802.3, 802.3u, Ethernet 802.1D&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"> • Received frames – Correct Frames, Correct Octets, Alignment Errors, FCS Errors • Transmitted frames – Correct Frames, Correct Octets, Single Collision, Multiple Collision, Deferred Transmission, Late Collision, Carrier Sense Error
	<i>Range</i>	Copper: Up to 100m (328 feet) over UTP Cat.5 cable
	<i>Connector</i>	Copper: RJ-45, 8-pin
E1 Main Link	<i>Number of Links</i>	Two (one active, other backup)
	<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. Unframed E1 is also supported.
	<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>	Balanced: $\pm 3V$ ($\pm 10\%$) Unbalanced: $\pm 2.37V$ ($\pm 10\%$)
	<i>Jitter Performance</i>	Per ITU-T G.823
	<i>Timing</i>	Internal or loopback
	<i>Line Impedance</i>	120 Ω , balanced 75 Ω , unbalanced
	<i>Connectors</i>	Balanced: RJ-45, 8-pin Unbalanced: via CBL-RJ45/2BNC/E1 interface adapter

T1 Main Link	<i>Number of Links</i>	Two (one active, other backup)
	<i>Data Rate</i>	1.544 Mbps
	<i>Standards</i>	ANSI T1.403, AT&T TR-62411, ITU-T Rec. G.703
	<i>Line Code</i>	AMI, B8ZS
	<i>Framing</i>	SF, ESF, transparent
	<i>Timing</i>	Internal or loopback
	<i>Statistics</i>	Full statistical diagnostics capability according to ANSI T1.403-1989 Local support of ESF diagnostics according to AT&T PUB 54016
	<i>Receive Signal Level</i>	0 to -36 dB with CSU 0 to -30 dB without CSU
	<i>Transmit Signal Level</i>	0, -7.5, -15, or -22.5 dB with CSU $\pm 2.7V$ ($\pm 10\%$) at 0–655 ft without CSU
	<i>Jitter Performance</i>	Per AT&T TR-62411
	<i>Line Impedance</i>	100 Ω , balanced
	<i>Connectors</i>	RJ-45, 8-pin
Serial Main Link	<i>Number of Links</i>	Two (one active, other backup)
	<i>Standards</i>	V35, X21, EIA-530, EIA-530-A, RS-232 (V.28), RS-449
	<i>Clock Modes</i>	DCE/DTE
	<i>Data Rate</i>	n x 64 (where n = 1 to 32)
	<i>Connector</i>	Both links terminated on a single 50-pin SCSI connector. Note: Y-cables that convert the Serial Port's 50-pin SCSI connector into two separate link connectors with standard interfaces can be ordered.
Control Port	<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>	DB-9, female

Voice Modules

E1 Voice Ports	<i>Ports per Module</i>	Two or four
	<i>Data Rate</i>	2.048 Mbps per port
	<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>	$\pm 3V$ ($\pm 10\%$)
	<i>Jitter Performance</i>	Per ITU-T G.823
	<i>Line Impedance</i>	120 Ω , balanced
	<i>Connector (per port)</i>	RJ-45, 8-pin
T1 Voice Ports	<i>Ports per Module</i>	Two or four
	<i>Data Rate</i>	1.544 Mbps per port
	<i>Standards</i>	ANSI T1.403, ITU-T Rec. G.703
	<i>Line Code</i>	AMI, B8ZS
	<i>Framing</i>	D4, ESF
	<i>Receive Signal Level</i>	0 to -36 dB with CSU 0 to -30 dB without CSU
	<i>Transmit Signal Level</i>	0, -7.5, -15, or -22.5 dB with CSU $\pm 2.7V$ ($\pm 10\%$) at 0–655 ft without CSU
	<i>Jitter Performance</i>	Per AT&T TR-62411, G.824
	<i>Line Impedance</i>	100 Ω , balanced
	<i>Connector (per port)</i>	RJ-45, 8-pin

Voice Processing	<i>Compression Algorithms</i>	G.723.1 (5.3 or 6.4 kbps), G.729 A (8 kbps), 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

Channelized E1/T1 Main Link Modules

E1 Ports	<i>Ports per Module</i>	Two or four
	<i>Data Rate</i>	2.048 Mbps per port
	<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>	$\pm 3V$ ($\pm 10\%$)
	<i>Jitter Performance</i>	Per ITU-T G.823
	<i>Line Impedance</i>	120 Ω , balanced
	<i>Connector (per port)</i>	RJ-45, 8-pin
T1 Ports	<i>Ports per Module</i>	Two or four
	<i>Data Rate</i>	1.544 Mbps per port
	<i>Standards</i>	ANSI T1.403, ITU-T Rec. G.703
	<i>Line Code</i>	AMI, B8ZS
	<i>Framing</i>	D4, ESF

<i>Receive Signal Level</i>	0 to -36 dB with CSU 0 to -30 dB without CSU
<i>Transmit Signal Level</i>	0, -7.5, -15, or -22.5 dB with CSU $\pm 2.7V$ ($\pm 10\%$) at 0-655 ft without CSU
<i>Jitter Performance</i>	Per AT&T TR-62411, G.824
<i>Line Impedance</i>	100 Ω , balanced
<i>Connector (per port)</i>	RJ-45, 8-pin

Vmux-2100 Chassis

Indicators	<i>Ethernet Main Link</i>	ACT (yellow), blinks according to the Ethernet traffic LINK (green), ON – Good link integrity
	<i>E1 Main Link and Voice Port</i>	LOC (red), ON – Local sync loss occurred REM (red), ON – Remote sync loss occurred
	<i>T1 Main Link and Voice Port</i>	RED (red), ON – Red alarm is received YEL (yellow), ON – Yellow alarm is received
	<i>General</i>	PWR1 (green), ON – Power supply 1 is on PWR2 (green), ON – Power supply 2 is on ALM (red), ON – An alarm is present in the system TST (yellow), ON – A test is active Flashes – Sync loss is detected on the TDM uplink (only if the TDM Line Check feature is enabled) POWER (green), ON – Power supply is on POWER (red), ON – Power supply is off

Diagnostics	<i>Tests</i>	Local and remote loopbacks, tone injection towards the local PBX, ping utility
	<i>Statistics Collection</i>	<p>Main link module:</p> <ul style="list-style-type: none"> • CPU utilization • Ethernet link (as per RFC 3638) • TDM link • Backup Links Status <p>Voice modules:</p> <ul style="list-style-type: none"> • HDLC • Bundles • Voice • Voice Rx and Tx signaling • Bandwidth Control <p>Channelized main link modules:</p> <ul style="list-style-type: none"> • Channelized bundle
Power Supply	<i>Number</i>	Two, redundant, hot-swappable
	<i>Input</i>	<p>AC source: 100 to 240 VAC, 50/60 Hz</p> <p>-48 VDC source: -36 to -72 VDC</p> <p>24 VDC source: 20 to 36 VDC</p>
	<i>Output per PS module</i>	<p>3.3 VDC: up to 15A</p> <p>5 VDC: up to 5A</p> <p>Total: 60W</p>
Physical	<i>Height</i>	4.3 cm / 1.7 in (1U)
	<i>Width</i>	43.5 cm / 17.1 in
	<i>Depth</i>	24.0 cm / 9.5 in
	<i>Weight</i>	7.0 kg / 15.5 lb
Environment	<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

Installation and Setup

This chapter describes installation and setup procedures for the Vmux-2100 device.

2.1 Introduction

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-2100 control port.

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



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.

2.2 Site Requirements and Prerequisites

AC-powered Vmux-2100 units should be installed within 1.5m (5 ft) of an easily-accessible grounded AC outlet capable of furnishing the voltage in accordance with Vmux-2100 nominal supply voltage.

DC-powered Vmux-2100 unit requires a -48 VDC power source, which must be adequately isolated from the main supply.

The trunk circuit that supplies power to the unit must be protected by a circuit breaker of 16A maximum.

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-2100 is 0 to 50°C (32 to 122°F), at a relative humidity of up to 90%, non-condensing.

2.3 Package Contents

The Vmux-2100 package includes the following items:

- One Vmux-2100 unit
- Vmux-2100 installation and operation manual/CD
- CBL-RJ45/2BNC/E1, RJ-45 to BNC interface adapter (if ordered)
- CBL-VMUX-MM-MODEM cross cable (if ordered)
- AC power cord or DC power supply connector kit.

2.4 Equipment Needed

The Vmux-2100 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.

2.5 Setting the Internal Jumpers and Switches

Setting Up Vmux-2100

➤ **To set up Vmux-2100:**

1. Determine the required configuration of Vmux-2100, in accordance with your application.
2. (E1 uplink only) Set the E1 main link board internal jumpers to match E1 connection type: balanced or unbalanced.
3. Connect the E1/T1 voice port.
4. Connect the Ethernet or E1/T1 main link.
5. Connect an ASCII terminal or a PC running a terminal emulation software.
6. Connect power to the unit.

Note

The channelized E1/T1 main link modules do not have jumpers.

Setting the Main Link E1 Internal Jumpers

When using the E1 main link, set the E1 main link board internal jumpers to match the E1 connection type: balanced or unbalanced. In addition, you can connect pin 3 and pin 6 of the RJ-45 E1 main link connector to the frame ground.

Note *This procedure is required only for the E1 Main Link Module. Channelized E1 Main Link Module jumpers cannot be set to unbalanced.*

➤ **To set the E1 main link board jumpers:**

1. Disconnect all power and interface cables from Vmux-2100.
2. Release the two main link rear panel screws.
3. Slide the main link board interior out of the unit.
4. Set the E1 main link jumpers (see [Figure 2-1](#) and [Table 2-1](#)).

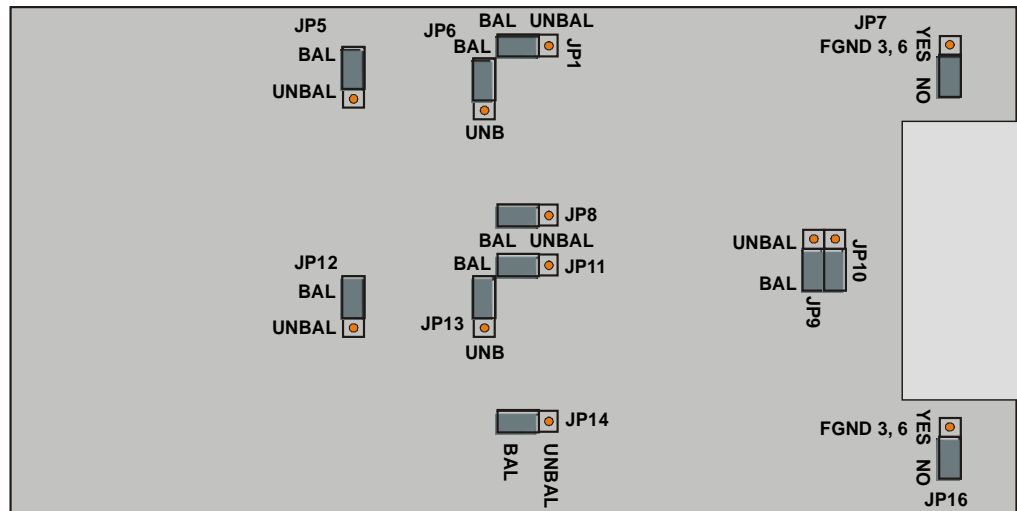


Figure 2-1. E1 Main Link Jumper Locations

Table 2-1. E1 Main Link Jumper Settings

Jumper	Description	Values	Factory Setting
E1 interface type jumpers, JP1, JP2, JP5, JP6, JP8, JP9, JP10, JP11, JP12, JP13, JP14, JP15	Select the E1 interface type: balanced or unbalanced. Note: All the jumpers must be set to the same position (balanced or unbalanced).	BAL – E1 balanced interface UNBAL – E1 unbalanced interface	BAL
Shield ground reference jumpers, JP16 (port A), JP7 (port B)	Control connection between the E1 cable shield (pin 3 and pin 6) and the frame ground.	YES – Shields are connected to the frame ground (in compliance with ITU-T I.431 requirements) NO – Shields are not connected to the frame ground	NO

2.6 Mounting the Unit

Vmux-2100 is designed for installation as a desktop or wall-mounted unit. It can also be mounted in a 19" rack.

- For rack mounting instructions, refer to the RM-34 Kit Installation Manual.
- If Vmux-2100 is to be used as a desktop unit, place and secure the unit on a stable, non-movable surface.

Refer to the clearance and temperature requirements in Site Requirements and Prerequisites.

2.7 Connecting to Interfaces

Figure 2-2 shows the rear panel of an AC-powered Vmux-2100 unit.

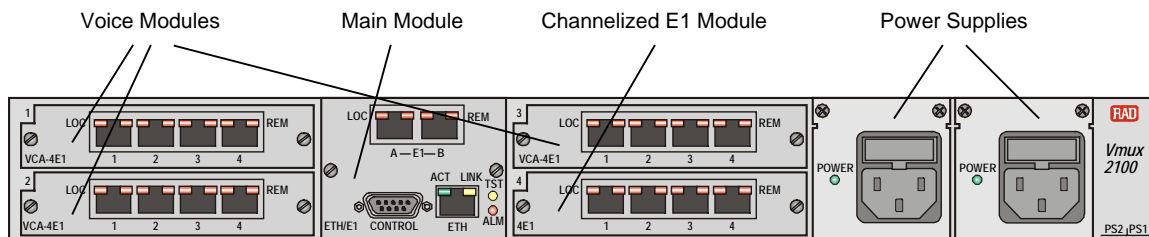


Figure 2-2. Vmux-2100 Rear Panel

Connecting to E1/T1 Voice Ports

Each E1/T1 voice port terminates in RJ-45 balanced connector. [Appendix A](#) specifies the pinout of the E1 connector.

➤ **To connect the E1/T1 voice port:**

- Connect the incoming E1/T1 link to the RJ-45 connector of the Vmux-2100 voice module or channelized main link module, designated 1, 2, 3 or 4 (see [Figure 2-3](#)).

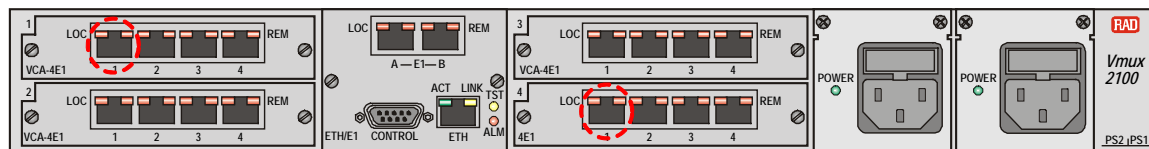


Figure 2-3. E1/T1 Voice Module and Channelized E1 Module Connectors

Connecting to Main Link

The Vmux-2100 Ethernet 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 LAN to the RJ-45 connector designated ETH (see [Figure 2-4](#)).

The E1/T1 main link interface terminates in an 8-pin RJ-45 balanced connector. [Appendix A](#) specifies the pinout of the E1/T1 balanced connector.

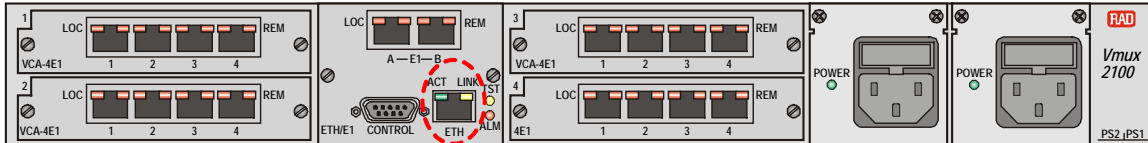


Figure 2-4. ETH Connector

➤ **To connect the balanced E1/T1 main link:**

- Connect the E1/T1 link to the RJ-45 connector designated E1 A or E1 B (see [Figure 2-5](#)).

➤ **To connect the unbalanced E1 main link:**

- Insert the RJ-45 plug of the CBL-RJ45/2BNC/E1 adapter into the Vmux-2100 RJ-45 connector designated E1 A or E1 B (see [Figure 2-5](#)).
- Connect the coax cable to the BNC connectors of the CBL-RJ45/2BNC/E1 adapter.

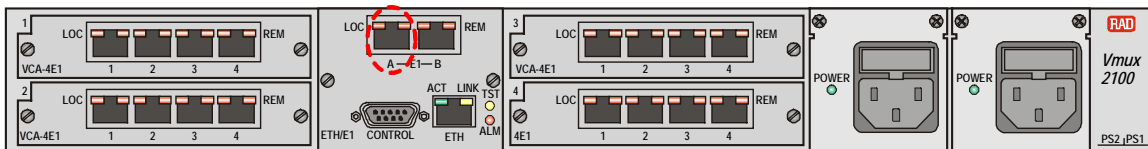


Figure 2-5. E1/T1 Main Link Module Connector

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

- Connect the SCSI connector of the appropriate Serial Interface Adapter Cable (Y-cable) to the port labeled LINK (see [Figure 2-6](#)). The Serial Interface Adapter Cables are described in [Appendix A](#).
- Connect the network to the two serial interfaces of the Serial Interface Adapter Cable.

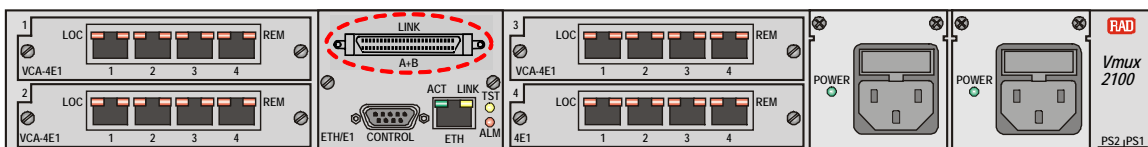


Figure 2-6. Serial Main Link Module Connector

Connecting to an ASCII Terminal

The Vmux-2100 control port terminates in a 9-pin D-type female interface connector. [Appendix A](#) specifies the pinout of the control port connector.

- **To connect the ASCII terminal directly to the CONTROL port:**
 1. Connect the standard DB-9 flat cable to the 9-pin connector, designated CONTROL.
 2. Connect the other side of the cable to the ASCII terminal.
- **To connect the ASCII terminal via modem link:**
 1. Connect the VMUX connector of the CBL-VMUX-MM-MODEM cross cable to the CONTROL port (see [Figure 2-7](#)). See [Appendix A](#) for the cable wiring diagram.
 2. Connect the MODEM connector of the cross cable to the local modem.
 3. Connect the remote modem to the ASCII terminal.

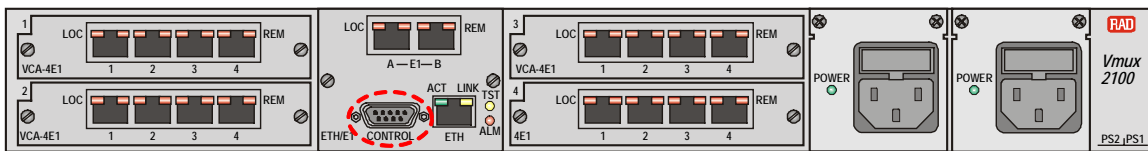


Figure 2-7. CONTROL Connector

2.8 Connecting to Power

Vmux-2100 includes two hot-swappable AC or DC power supplies, supporting load sharing. To connect Vmux-2100 to the power source, refer to the appropriate section below, depending on your version of the unit (AC or DC).



Before connecting or disconnecting any communication cable, the unit must be earthed by connecting its power cord to a power outlet with an earth terminal, and by connecting the earth terminal on the panel (if provided) to a protective earth.

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.

The line fuse is located in an integral-type fuse holder located on the rear panel. Make sure that only fuses of the required rating, as marked on the rear panel, are used for replacement. Do not use repaired fuses or short-circuit the fuse holder. Always disconnect the mains cable before removing or replacing the fuse. Whenever it is likely that the fuse protection has been damaged, make the unit inoperative and secure it against unintended operation.

Connecting to AC Power

AC power is supplied to Vmux-2100 through a standard 3-prong plug with an integral fuse holder (see *Figure 2-2*).

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

➤ **To connect to AC power:**

1. Connect the power cable(s) to the power connector(s) on the Vmux-2100 rear panel.
2. Connect the power cable to the mains outlet.

The unit will be turned on automatically upon connection to the mains.

Connecting to DC Power

DC power is supplied to a Vmux-2100 through special 3-prong plug.

Note that the J5 jumper on the DC power supply is permanently set to YES and must not be moved by the user.

➤ **To connect to DC power:**

- Refer to the DC power supply connection supplement, located on the Technical Documentation CD or at the back of the official printed version of this manual. Also, refer to the safety instructions at the beginning of this document.

Chapter 3

Operation

This chapter provides the following information for Vmux-2100:

- Vmux-2100 front-panel indicators
- Operating procedures (turn-on, front-panel indications, performance monitoring, and turn-off).

Installation procedures given in [Chapter 2](#) must be completed and checked before attempting to operate Vmux-2100.

3.1 Turning On the Unit

➤ To turn on the unit:

- Connect the power cord(s) to the mains.

The PWR1(2) indicator lights up and remains lit as long as Vmux-2100 receives power.

3.2 Indicators

The front panel of Vmux-2100 includes a series of LED indicators that show the current operating status of the unit (see [Figure 3-1](#)). Additional indicators are located on the rear panel, as shown in [Figure 3-2](#). [Table 3-1](#) lists and describes the Vmux-2100 indicators.



Figure 3-1. Vmux-2100 Front Panel

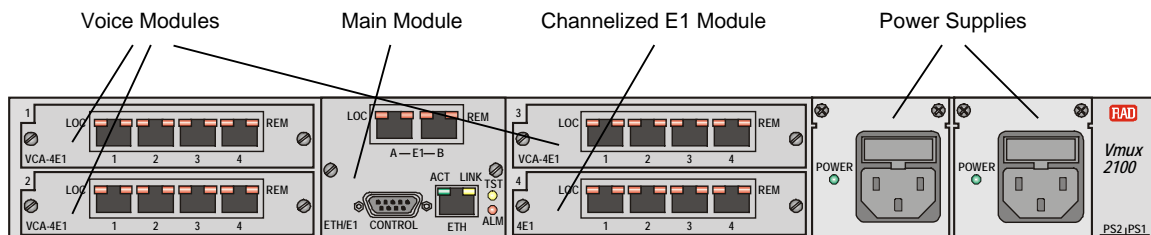


Figure 3-2. Vmux-2100 Rear Panel

Table 3-1. Vmux-2100 LEDs

Name	Function	Location
TST (yellow)	ON – A test is active Flashes – Connection loss is detected on the TDM uplink (only if the TDM Line Check feature is enabled)	Front panel and main link module
ALM (red)	ON – Alarm is present	Front panel and main link module
PWR1 (green)	ON – Power supply 1 is ON	Front panel
PWR2 (green)	ON – Power supply 2 is ON	Front panel
POWER	ON (green) – A power supply is ON ON (red) – A power supply is OFF	Power supply module
LINK (green)	ON – Good link integrity	Ethernet main link connector (UTP only)
ACT (yellow)	Flashes according to the Ethernet traffic	Ethernet main link connector (UTP only)
LOC (red)	ON – Local sync loss occurred	E1 connector on main link module, voice module and channelized main link module
REM (red)	ON – Remote sync loss occurred	E1 connector on main link module, voice module and channelized main link module
RED (red)	ON – Red alarm is received	T1 connector on main link module, voice module and channelized main link module
YEL (yellow)	ON – Yellow alarm is received	T1 connector on main link module, voice module and channelized main link module

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

Table 3-2. Vmux-2100 Indicator Status

Indicator	Status
PWR1/PWR2	On
TEST	Off
ALM	On
L	Off
R	Off

If the above LED indications do not appear following initial power turn-on, refer to [Chapter 5](#) for the diagnostic test instructions.

3.3 Default Settings

Vmux-2100 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-2100 configuration parameters.

Table 3-3. Vmux-2100 Default Settings

Parameter	Default Value				
System					
Management					
Set Host IP address	0.0.0.0				
Set Subnet Mask	0.0.0.0				
Set Default Gateway	0.0.0.0				
Read	public				
Write	private				
Trap	public				
Manager List	0.0.0.0				
Signaling Profile Table Configuration	ABCD Bits	A	B	C	D
	Idle	1	0	0	0
	OOS	1	0	0	0
SS7 Keep-Alive Suppression Rate	0% - No Suppression / Not SS7				
Backup Configuration	Disable				
Remote MM IP address	0.0.0.0				
Primary Link type	None				
Default Gateway for Primary link	0.0.0.0				
Subnet Mask for Primary link	0.0.0.0				
Link connectivity packet rate (if Backup Configuration is enabled)	6000 msec (60 x 100 msec)				
Link connectivity timeout cycles (if Backup Configuration is enabled)	3				
Inhibit LAN (available only if Backup Configuration is disabled)	Enable LAN				
TDM Uplink Loop Detect	Disable				
TDM Line check	Disable				
Telnet	Enable				
Q.50 stop new calls threshold	88				
Discard voice packets threshold	94				
Block New Modem Calls Threshold	80				

Table 3-3. Vmux-2100 Default Settings (Cont.)

Parameter	Default Value
<i>Control Port</i>	
Set Baud Rate (bps)	9600
Timeout (minutes)	3
Dial-In Modem	Disable
<i>Alarm Operations</i>	
Set Alarm LED Severity	Event
Hub	
Main Board	NO CARD
Slot 1	NO CARD
Slot 2	NO CARD
Slot 3	NO CARD
Slot 4	NO CARD
<i>Main Link LAN Parameters</i>	
Set Auto Negotiation	Enable
Set Default Type	10BaseT Half Duplex
<i>Main Link E1 Parameters</i>	
Connect	No
Frame	G732N
Restoration Time	1 Second (Fast)
Clock Source	LBT
Interface Type	DSU
Idle Code	FF
<i>Main Link T1 Parameters</i>	
Connect	No
Clock Source	LBT
Frame	ESN
Interface Type	DSU
Line Code	B8ZS
Rx Sensitivity (CSU interface only)	LOW (-30 dB)
Tx Gain Level (CSU interface only)	0 dBm
Line Length (Feet) (DSU interface only)	0-133
Restoration Time	1 Second (Fast)
Idle Code	7F
<i>Main Link Serial Parameters</i>	
Interface Type	V35

Table 3-3. Vmux-2100 Default Settings (Cont.)

Parameter	Default Value
Connect	No
Clock Mode	DTE
Speed (N*64)	1
Control Signals (only when Interface Type is V35 and Clock Mode is DTE)	Ignore
HDLC Mode	Transparent HDLC
Voice Module Group Parameters	
IP Address	0.0.0.0
Voice Module Bundle Configuration	
Enter Bundle Number	1
Connect (only if bundle exists)	No
Function (only if bundle exists)	TDMoIP+
Destination IP	0.0.0.0
Next Hop	0.0.0.0
TDM Next Hop	0.0.0.0
Destination Bundle	1
TOS Byte	0x00
TOS Parameters > Precedence	Routine
TOS Parameters > Delay	Normal
TOS Parameters > Throughput	Normal
TOS Parameters > Reliability	Normal Reliability
VLAN Parameters > VLAN exists	No
VLAN Parameters > VLAN ID (only when Vlan Tagging is Yes)	26
VLAN Parameters > VLAN Priority (only when Vlan Tagging is Yes)	0
Max Bytes In Multiplexed Frame (only if bundle exists)	500
Packetizing Interval (msec) (only if bundle exists)	30
Packet Redundancy (only if bundle exists and device is E1/T1)	1
Connectivity Mode	With Ping
Connectivity Packet Rate (sec)	60
Connectivity Timeout Cycles	3
Transparent Jitter Size (Nx10 msec)	2
Coder/Rate	G.723.1/6.4

Table 3-3. Vmux-2100 Default Settings (Cont.)

Parameter	Default Value
Caller ID TX Delay (msec) (available only if Coder/Rate is G.729A/8)	400 msec
Volume	0 dB
Modem (for all modems except Relay, which will be shown only when card is VCA)	Disable
Fax	Enable
Fax Rate (kbps) (only when Fax is enabled)	14.4 kbps
MF Parameters (only for E1/T1 device)	
MFCR2 Relay	Disable
MF Minimum Pulse Width (milliseconds) (only when MFCR2 Relay is enabled)	50 msec
MF Minimum Power Level (negative dBm) (only when MFCR2 Relay is enabled)	-20 dBm
MF Spoofing (only when MFCR2 Relay is enabled)	Disable
MF Tone Ack Interval (N * 20) (only when MFCR2 Relay is enabled and MF Spoofing is enabled)	60 msec (3 x 20 msec)
Tone Detection	Disable
Select Tone (only if Tone Detection enabled)	2000 Hz
Super Tandem	Disable
Noise level for VAD	Low
CNG Mode	On
Echo Canceller	Enable
Coding (only for E1/T1 device)	A-Law (for E1); U-Law (for T1)
External E1 Parameters	
Connect	No
Frame	G732N
Interface Type	DSU
Restoration Time	1 Second (Fast)
Clock Source	LBT
Idle Code	FF
Q.50 Protocol (only when using E1 ports with Line Types: G732S and G732S-CRC4)	Disable

Table 3-3. Vmux-2100 Default Settings (Cont.)

Parameter	Default Value
Q.50 Bits Pair (only if Q.50 Protocol is not disabled)	A & B
Profile (only when Frame type is G732S or G732S-CRC)	1
External T1 Parameters	
Connect	No
Clock Mode	LBT
Frame	ESF
Interface Type	DSU
Line Code	B8ZS
Rx Sensitivity (CSU interface only)	LOW (-30 dB)
Tx Gain Level (CSU nterface only)	0 dBm
Line Length (Feet) (DSU interface only)	0-133
Restoration Time	1 Second (Fast)
Idle Code	7F
Signaling	CCS
TS Rate	64 kbps
Profile (only when signaling is Robbed Bit MF)	1
External Timeslot Configuration Parameters	
Update from Time Slot	1
To Time Slot	1
Type	Voice
Bundle	1
Destination Port ID	1
Destination Time Slot ID	1
Destination SS7 Ch ID (only when Type is SS7)	SS7 1
Destination HDLC Ch ID (only when Type is HDLC)	HDLC 1
Destination HDLC Sub Ch ID (only when Type is HDLC Sub Ch)	HDLC_SUB-1
Destination TRANSP Sub Ch ID (only if Type is TRANSP Sub Ch)	TRANSP_SUB-1
Sub Ch Mask	FF

Table 3-3. Vmux-2100 Default Settings (Cont.)

Parameter	Default Value
Channelized Main Link Module E1 Parameters	
Internal Switching (only when Main link is Serial or E1/T1)	Enable
Connect	No
Frame	G732N
Restoration Time	1 Second (Fast)
Clock Source	LBT
Interface Type	DSU
Idle Code	FF
Channelized Main Link Module T1 Parameters	
Connect	No
Clock Source	LBT
Frame	ESF
Interface Type	DSU
Line Code	B8ZS
Rx Sensitivity (CSU interface only)	LOW (-30dB)
Tx Gain Level (CSU interface only)	0 dBm
Line Length (Feet) (DSU interface only)	0-133
Restoration Time	1 Second (Fast)
Idle Code	7F
Channelized Main Link Module Bundle Parameters	
Enter Bundle Number	1
Connect (only if bundle exists)	No
Function (only if bundle exists)	Data Relay
Back-Up Bundle (only if bundle exists, and only for the first external)	N.C.
TDM Uplink Loop Detect (only when Main link is Serial or E1/T1)	Enable
Channelized Main Link Module Timeslot Configuration	
Update from Time Slot	1
To Time Slot	1
Assign to Bundle	1

3.4 Configuration and Management Alternatives

Vmux-2100 can be managed using different ports and applications:

- Local out-of-band management via an ASCII terminal connected to RS-232 port. Usually, preliminary configuration of the system parameters is performed via ASCII terminal. Once the Vmux-2100 host IP parameters are set, it is possible to access it via Telnet for further configuration.
- Remote inband management via the MNG Ethernet port. Remote management is performed using Telnet, or RADView SNMP client application.

The following functions are supported by the Vmux-2100 management software:

- Viewing system information
- Modifying configuration and mode of operation, including setting system default values and resetting the unit
- Monitoring Vmux-2100 performance
- Alarms Monitoring
- Initiating tests
- Upgrading software.

Working with an ASCII-based Control Terminal

The configuration of Vmux-2100 may be performed via menu-driven embedded software, using a standard ASCII terminal or a PC running a terminal emulation application connected to the front panel CONTROL port.

Refer to [Chapter 4](#) for instructions on how to configure Vmux-2100 using the menu-driven software.

Control Port Interface Characteristics

Vmux-2100 includes a V.24/RS-232 asynchronous DCE port, designated CONTROL. The port terminates in a 9-pin D-type connector. The control port continuously monitors the incoming data stream and immediately responds to any input string received through this port.

The terminal can be connected either directly to the Vmux-2100 control port, or through a modem or any other type of full-duplex data link.

- Direct connection to terminals. Since terminals usually have DTE interfaces, the connection to the port is made by means of a straight cable.
- Connection through a modem or data link. In this case, you need a cross cable to connect to the CONTROL connector ([see Appendix A](#) for the cross cable wiring diagram).

Levels of Security

Vmux-2100 supports a four-level security and user authentication system:

- **Administrator** – Allowed to configure all the parameters of Vmux-2100.
- **Operator** – Allowed to perform all operations in the system, except for user administration (adding/deleting users, changing user definitions).
- **Technician** – Allowed to test Vmux-2100 and monitor its operation (for example, monitoring alarms).
- **Monitor** – Allowed to monitor the Vmux-2100 operation.

The maximum number of users supported by Vmux-2100 is 20. When managing Vmux-2100 over Terminal/Telnet, only one user is allowed at a time. Only one administrator is allowed to enter the management session at a time.

Vmux-2100 displays the management menus in accordance with a user's access rights. For example, configuration screens dealing with the unit configurations are not available for the users, who logged in as technicians or monitors.

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-2100.

Refer to [Chapter 4](#) for instructions on how to configure Vmux-2100 using the menu-driven software.

Data Terminal Ready (DTR)

When connected and turned on, the terminal sets the DTR line ON (active) to gain control over Vmux-2100 and starts a configuration or monitoring session.

Initiating a Control Session

Vmux-2100 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-2100 front panel.
2. Connect the terminal cable to the serial port of the control terminal.
3. Turn on the control terminal.
4. Configure the terminal to the default communication parameters: 115.2 kbps, one start bit, eight data bits, no parity, one stop bit, no flow control, VT100 emulation.
5. Turn on Vmux-2100.

Login

To prevent unauthorized modification of the operating parameters, Vmux-2100 supports a four-level security and user authentication system as described in [Chapter 1](#).

Vmux-2100 is supplied with one administrator account:

- User name: su (not case-sensitive)
- Password: 1234.

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

➤ **To login to Vmux-2100:**

1. Type in your user name, and press **<Enter>**.
For initial login: Enter **su** for user name.
2. Type in your password (up to eight characters), and press **<Enter>**.
For initial login: Enter **1234** for password.

The Main menu is displayed.

This allows you to configure all the parameters of Vmux-2100 and to create new users.

Working with Telnet

Telnet provides remote access to the same menu-driven embedded software used to configure the Vmux-2100 from the local console. Vmux-2100 accesses Telnet via the MNG Ethernet port, which provides management access through the LAN.

➤ **To login via a Web browser:**

1. Connect the MNG Ethernet port of Vmux-2100 to the LAN.
2. Enter the IP address of the Vmux-2100 in the address field of the browser in the following format: **http://'IP address'** and then press **<Enter>** to command the browser to connect ('IP address' stands for the actual Vmux-2100 IP address which has been pre-configured via an ASCII terminal).
3. Enter your user name and password.

The Main menu is displayed.

Navigating the Management Menus

This section provides a general description of the conventions for navigating the software menus accessible from either the local console or via Telnet.

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, and 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

To save configuration changes, you must update the Vmux-2100 database. If the database is not updated, Vmux-2100 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-2100 displays the following confirmation message:
Are you sure you want to update data base ?
Press Y/N :
 2. Type **Y** to save the changes.

Note *Each time you update the Vmux-2100 database, the management software analyzes the changes. If a major error is detected, Vmux-2100 aborts the database update and displays "ERROR" on the upper right side. In this case, check the sanity error, as described in [Chapter 6](#), and re-enter the erroneous values.*

If sanity errors were detected, the errors will appear on the screen, and the database will not be changed.

- **To undo the changes:**
 1. Type **# (Shift+3)** and press **<Enter>**.
Vmux-2100 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.

Using Terminal Hot Keys

Terminal hot keys are provided per screen to enhance the functionality that is required of that screen. The available hot keys are listed in the lower part of each screen. The following hot keys are system keys, available on screens:

- **Esc** – Return to previous menu
- **!** – Return to the Main Menu
- **&** – Exit to password screen (to prevent unauthorized access after completing the session)
- **@** – Update database
- **#** – Undo database (only changes since last update)
- **CTRL+D** – Scroll down (read-only tables)
- **CTRL+U** – Scroll up (read-only tables)
- **Arrow Keys, Tab** – Scroll (read-write tables)
- **G <row number>,<column number>** – Go to cell (read-write tables)
- **?** – Help screen

The path at the top of the screen indicates the menu path for reaching the currently displayed menu from the Main Menu (for example: **Main > Configuration > System**).

Sample Help Screen

The following figure shows a typical Help screen, which summarizes the keyboard shortcuts that are available in the functional screen from which the Help screen was invoked.

The Help screen is invoked by pressing SHIFT-/ (the '?' symbol) from the relevant functional screen. However, not all functional screens have Help available.

Table Hot Keys
Right Arrow - move right
Down Arrow - move down
TAB - select next changeable cell
G <row number>,<col number> - go to cell

Figure 3-3. Typical Help Screen

3.5 Turning Off the Unit

► To turn off the unit:

- Remove the power cord from the power source.

Chapter 4

Configuration

The configuration of Vmux-2100 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-2100 via Telnet connection, which also establishes an inband management link to the remote unit.

4.1 Configuring Vmux-2100 for Management

Vmux-2100 can be managed by a network management station, which is located on the 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

The management host parameters are configured via the Host IP menu.

► To configure the host IP parameters:

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

The Configuration menu appears (see *Figure 4-1*).

```
Configuration
1. System
2. Hub
3. Card

@ - Db Update; # - Db Undo
Esc-prev.menu; !-main menu; &-exit
```

Figure 4-1. Configuration Menu

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

The System menu appears (see *Figure 4-2*).

```
System

1. Management
2. Control Port
3. Date & Time Update
4. Factory Default
5. Show Partition Information
6. Set the active application
7. Reset Card
8. Alarm Operations>

@ - Db Update; # - Db Undo
Esc-prev.menu; !-main menu; &-exit
```

Figure 4-2. System Menu

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

The Management menu appears (see [Figure 4-3](#)).

```
Management

1. Host IP
2. Manager List
3. Host Mux Name... (155)
4. User Administration
5. Signaling Configuration
6. Backup Configuration
7. Inhibit LAN> (Enable LAN)
8. TDM Uplink Loop Detect (Disable)
9. TDM Line check (Disable)
10. Telnet> (Enable)
11. Bandwidth control

@ - Db Update; # - Db Undo
Esc-prev.menu; !-main menu; &-exit
```

Figure 4-3. Management Menu

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

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

```
Host IP

1. Set Host IP Address      ... (170.185.190.15)
2. Set Subnet Mask         ... (255.255.255.0)
3. Set Default Gateway     ... (170.185.190.1)
4. Read... (public)
5. Write...(private)
6. Trap... (public)

@ - Db Update; # - Db Undo
Esc-prev.menu; !-main menu; &-exit
```

Figure 4-4. Host IP Menu

5. From the Host IP menu, 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
 - **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-2100 will send traps.
6. Enter the desired value, and press **<Enter>**.

Defining the Manager List

You can define the network management stations to which the SNMP agent of Vmux-2100 will send traps. Up to ten managers can be defined.

➤ **To define the manager list:**

1. From the Management menu, choose **Manager List**.

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

```

Manager List

Managers ID                IP Address
      1                170.185.190.5
      2                0.0.0.0
|      3                0.0.0.0
v      4                0.0.0.0
      5                0.0.0.0

1. Change cell      (170.185.190.5)
>

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

```

Figure 4-5. Manager List Menu

2. Select a manager IP address by pressing **<Shift> U** to scroll up or **<Shift> D** to scroll down.
3. Choose **Change cell** (type **1**, and press **<Enter>**) to enter/edit the selected manager IP address.
4. Type the desired IP address, and press **<Enter>**.

Assigning a Name to Vmux-2100

The Vmux-2100 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 (see [Figure 4-3](#)), choose **Host Mux Name**.
2. Enter a name for the Vmux-2100, and press **<Enter>**.

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

Controlling Telnet Access

You can disable Telnet access to Vmux-2100. By doing this, you prevent unauthorized access to the system when security of the Vmux-2100 IP address has been compromised. When Telnet access is disabled, Vmux-2100 can be managed via an ASCII terminal or RADview.

► To disable the Telnet access:

1. From the Management menu ([Figure 4-3](#)), choose **Telnet**.

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

```
Telnet

1. Disable
2. Enable
3. Enable Managers Only

>

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

Figure 4-6. Telnet Menu

2. From the Telnet menu, choose:
 - **Disable** to disable telnet access.
 - **Enable** to enable telnet access.
 - **Enable Managers Only** to allow Telnet access only from remote hosts that appear in the Manager List (see [Defining the Manager List](#) on page 4-3).

Configuring the Control Port

Vmux-2100 allows you to configure the baud rate, timeout period, and connection of a dial-in modem to the rear panel CONTROL port.

Configuring the Data Rate

The Vmux-2100 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 4-2](#)), choose **Control Port**.

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

```
Control Port

1. Set Baud Rate (bps) > (9600)
2. Timeout (minutes) [3 - 10]... (10)
3. Dial-In Modem > (Disable)

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

Figure 4-7. Control Port Menu

2. Choose **Set Baud Rate** from the Control Port menu.
3. Select a new baud rate from the Set Baud Rate menu.

Configuring the Timeout

The timeout specifies a time interval after which Vmux-2100 automatically disconnects from the supervisory terminal if no input from the user is detected. The timeout can be set for between 3 to 10 minutes.

➤ **To configure the timeout:**

1. From the Control Port menu (see [Figure 4-7](#)), choose **Timeout**.
2. Enter the desired number of minutes and press **<Enter>**.

Enabling/Disabling Dial-in Modem Access

A dial-in modem can be connected to the CONTROL port for remote management.

➤ **To enable or disable dial-in modem connection via the CONTROL port:**

1. From the Control Port menu (see [Figure 4-7](#)), choose **Dial-In Modem**.

The Dial-In Modem menu appears.

2. From the Dial-In Modem menu, choose:
 - **Disable** to disable connection of a dial-in modem to the control port
 - **Enable** to enable connection of a dial-in modem to the control port.

Note

*If an ASCII terminal or PC is connected directly to the control port while the dial-in modem access option is enabled, signals from the terminal or PC may be confused with modem control signals by the Vmux-2100 modem auto detect capability and inadvertently cause the Vmux-2100 to disable the terminal or PC connection. To avoid this situation, verify that the Control port dial-in modem access is set to **Disable** (this is the default setting) before attempting to make a direct terminal or PC connection to the Control Port (this can be accomplished safely via Telnet). If dial-in modem access is not required, it is recommended to leave this option disabled.*

4.2 Configuring Vmux-2100 for Operation

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-2100 management software.

The Vmux-2100 management software allows you to perform the following:

- Manipulate the user administration system
- Define the signaling bits table (for CAS usage) and the suppression ratio (for SS7 usage)
- Define BACKUP parameters
- Define LAN over TDM traffic policy
- Define remote management (via TELNET) policy

- Set parameters for the Main Module TDM uplink bandwidth control
- Set parameters for the serial port running the ASCII terminal
- Set Date and Time to the internal time base
- Reset the device's Database, I/O modules, and Main Module
- Set the alarm LED severity (see [Chapter 6](#))
- Set built-in tests, such as TDM loop detect and TDM line check (see [Chapter 6](#))
- Control the software version of the device (see [Appendix B](#)).

Configuring Signaling Information

Vmux-2100 allows you to configure the signaling parameters according to the selected signaling mode: CAS for E1, Robbed Bit MF for T1 or CCS for E1/T1. Signaling mode is selected via the E1 Parameters menu of the voice card (see [Configuring the External E1 Ports](#) on page 4-38).

- **CAS/Robbed Bit MF** – You must configure a signaling profile and signaling table associated with it (ABCD bits, idle code and OOS signals).
- **CCS** – When working with CCS-SS7, you can configure the fill-in signal unit (FISU) packets flow by selecting the SS7 keep-alive suppression rate.

Note *When changing from CCS to CAS signaling, the Vmux-2100 unit must be rebooted.*

Configuring Signaling Profiles

If you are using CAS signaling, you must configure the signaling system of Vmux-2100 to make it is compatible with the signaling method used by the PBXs connected to the voice E1/T1 ports. 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 for connection of PBXs, which use different signaling formats.

You can store up to four signaling profiles; Vmux-2100 uses only one of them at a time. The signaling profile selection is performed via the E1 Parameters menu of the voice card (see [Configuring the External E1 Ports](#) on page 4-38).

Note *The signaling profile configuration takes effect only for the units operating with CAS signaling.*

➤ **To configure the signaling profile:**

1. From the Management menu (see [Figure 4-3](#)), choose **Signaling Configuration**.

The Signaling Configuration menu appears (see [Figure 4-8](#)).

Signaling Configuration

1. **Signaling Profile Configuration**
2. **SS7 Keep-Alive Suppression Rate** (0% - No Suppression / Not SS7)

@ - Db Update; # - Db Undo

Esc-prev.menu; !-main menu; &-exit

Figure 4-8. Signaling Configuration Menu

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

The Signaling Profile Configuration menu appears (see [Figure 4-9](#)).

Signaling Profile Configuration

1. **Profile Number To Configure [1 - 4]** ... (1)
2. **Signaling Table Configuration** []>

@ - Db Update; # - Db Undo

Esc-prev.menu; !-main menu; &-exit

Figure 4-9. Signaling Profile Configuration Menu

3. From the Signaling Profile Configuration menu, choose **Profile Number To Configure**.
4. Enter the number of the signaling profile that you want to configure by typing a number from **1** to **4**, and pressing **<Enter>**.
5. From the Signaling Profile Configuration menu, choose **Signaling Table Configuration**.

The Signaling Table Configuration menu appears (see [Figure 4-10](#)).

Signaling Table Configuration				
	A Bit	B Bit	C Bit	D Bit
ABCD BITS	A	B	C	D
IDLE SIGNAL	1	0	1	1
OOS SIGNAL	1	0	1	1
1. 0	8. NOT C			
2. 1	9. D			
3. A	10. NOT D			
4. NOT A				
5. B				
6. NOT B				
7. C				
@ - Db Update; # - Db Undo				
Esc-prev.menu; !-main menu; &-exit ?-help				

Figure 4-10. Signaling Table Configuration Menu

- In the signaling table, select a 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 pressing **<Enter>**.

Table 4-1. Signaling Bits Configuration

Parameter	Description	Value
A, B, C, D Bit	Selects which incoming bit (from the remote side) to transmit on the A bit toward the Vmux-2100's local PBX.	0 – Transmits zero 1 – Transmits one A – Transmits the incoming A bit B – Transmits the incoming B bit C – Transmits the incoming C bit D – Transmits the incoming D bit NOT A – Inverts the incoming A bit and transmits it NOT B – Inverts the incoming B bit and transmits it NOT C – Inverts the incoming C bit and transmits it NOT D – Inverts the incoming D bit and transmits it
IDLE SIGNAL	Selects the code transmitted on A, B, C, and D bit when the channel is idle	0 – Transmits zero 1 – Transmits one
OOS SIGNAL	Selects the code transmitted on A, B, C, and D bit when the channel is out of service	0 – Transmits zero 1 – Transmits one

Configuring Keep-Alive Suppression Rate

When Vmux-2100 with CCS signaling is connected to the PBXs operating with the SS7 signaling, the PBXs use one or more timeslots 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 and overloading the uplink with useless data. In order to prevent this, you can enforce Vmux-2100 to drop certain amount of FISUs (up to 90%).

FISU dropping policy is active only for data channels of type SS7 (SS7-1 and SS7-2). There is no effect on regular HDLC channels (HDLC-1, HDLC-2, HDLC-3, and HDLC-4).

There are two methods for disabling FISU dropping:

- Choose an HDLC data channel instead of an SS7 data channel
- Choose an SS7 channel with a '0' suppression rate. This has the same effect as selecting an HDLC channel.

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 4-8](#)), choose **SS7 Keep-Alive Suppression Rate**.

The SS7 Keep-Alive Suppression Rate menu appears (see [Figure 4-11](#)).

```

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>
@ - Db Update; # - Db Undo
Esc-prev.menu; !-main menu; &-exit

```

Figure 4-11. SS7 Keep-Alive Suppression Rate Menu

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

Configuring Link Backup

When a LAN or TDM network fails, Vmux-2100 supports automatic switching from the failed primary network link to an alternate network link. This backup feature works between the non-channelized TDM ports and the Ethernet port on the main module in point-to-point applications only. A Primary, Secondary and Third links are configured so that if the primary link fails, Vmux-2100 automatically switches to the next link. Once a failed higher link has been restored, the voice traffic is automatically switched back.

You can configure which one of the following events triggers the backup:

- An alarm is triggered on the TDM port
- A connectivity problem on the IP port is detected.

Note *The Backup function does not support the channelized E1/T1 main link modules, which have their own automatic backup mechanism between the two ports in each group.*

Note *Inhibit LAN is disabled when the backup function is enabled.*

Note *When the TDM to ETH Backup feature is enabled, management is available only via the IP network. Inband management is not supported.*

➤ To configure link backup:

1. From the Management menu (*Figure 4-3*), choose **Backup Configuration**.

The Backup Configuration menu appears displaying only the Backup parameter.

2. Choose **Backup** and set it to **Enable**.

Now the full configuration parameters of the Backup Configuration menu are displayed (see *Figure 4-12*).

```
Backup Configuration

1. Backup>      (Enable)
2. Remote MM ... (0.0.0.0)
3. Primary link configuration
4. Secondary link configuration
5. Third link configuration

>

Please select item <1 to 5>

@ - Db Update; # - Db Undo
Esc-prev.menu; !-main menu; &-exit
```

Figure 4-12. Backup Configuration Menu

3. From the Backup Configuration menu, choose **Remote MM IP address** and then enter the host IP address of the remote Vmux-2100 Main Module.
4. Configure the primary link by choosing **Primary link configuration** from the Backup Configuration menu.

The Primary link configuration menu appears (see *Figure 4-13*).

```
Primary link configuration

1. Link type>    (None )
2. Default Gateway for Primary link... (0.0.0.0)
3. Subnet Mask for Primary link... (0.0.0.0)
4. Connectivity Parameters for Primary link
```

Figure 4-13. Primary Link Configuration Menu

5. To select the primary link, choose **Link type** from the Primary link configuration menu:
 - To set one of the TDM links as the primary link, choose **TDM A** or **TDM B**.
 - To set the Ethernet network as the primary link, choose **Ethernet**
 - To disable the primary link, choose **None**.

Note *The Primary link is the link that is normally active. Vmux-2100 monitors the Primary link and, should it fail, directs voice traffic to the Secondary network link. Should the secondary link also fail, Vmux-2100 directs voice traffic to the Third network link. Vmux-2100 continues monitoring the primary link, and restores voice traffic to it as soon as it returns to service.*

6. To change the default gateway and subnet mask for the Primary link (by default these are the same as those defined for the system via the Host IP menu), choose **Default Gateway for Primary link** or **Subnet Mask for Primary link** from the Primary link configuration menu.
7. From the Primary link configuration menu (see [Figure 4-13](#)), choose **Connectivity Parameters for Primary link**.

The Backup Connectivity Parameters menu appears (see [Figure 4-14](#)).

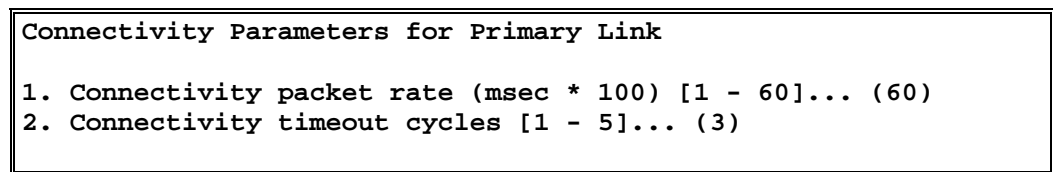


Figure 4-14. Backup Connectivity Parameters Menu

8. Set the Primary link connectivity parameters as follows:
 - **Connectivity packet rate**—The frequency with which the primary connection is checked. The period between consecutive checks can be set for between 100 to 6000 msec (in steps of 100 msec).
 - **Connectivity timeout cycles**—The number of consecutive timeouts of the connectivity check after which voice traffic is directed to the alternate network.
9. Configure the Secondary and Third links by choosing **Secondary link configuration** and **Third link configuration** from the Backup Configuration menu (see [Figure 4-12](#)). Repeat steps 5 through 8 for each link.

Restricting LAN Traffic

The default behavior of Vmux-2100 is to pass all LAN information over the TDM uplink. In some applications, this behavior may be undesirable for two reasons:

- It consumes bandwidth over the TDM uplink
- The site network traffic will be visible outside the organization's firewall.

The LAN restriction algorithm uses the RIP2 protocol to obtain the IP addresses of the remote main modules. Only traffic destined for main modules is allowed to pass; traffic destined for any other IP address is blocked.

Note *The Inhibit LAN feature is available only when the Backup feature is disabled.*

The LAN restriction operates over the E1/T1 Main Module and the Channelized E1/T1 Main Link Module(s).

➤ To restrict the type of LAN information that is passed over TDM:

1. From the Management menu (*Figure 4-3*), choose **Inhibit LAN**.

The Inhibit LAN menu appears (see *Figure 4-15*).

```
Inhibit LAN (Enable LAN)

1. Enable LAN
2. Enable only Voice
3. Enable MNG and Voice

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

Figure 4-15. Inhibit LAN Menu

2. Set the desired level of restriction as follows:
 - To allow all LAN traffic to be passed over TDM, choose **Enable LAN**.
 - To restrict all LAN traffic from being passed over TDM, choose **Enable only Voice**. It is not be possible to manage any remote Vmux-2100, since no management information is passed over the TDM.
 - To restrict LAN data, but allow Vmux-2100 inband management information and voice to be passed over TDM, choose **Enable MNG and Voice**.

TDM Uplink Loop Detect

This option is used to detect loops on the E1/T1/Serial uplink. When the TDM uplink loop detect option is enabled, the last four bytes of the local MAC address are added at the beginning of transmitted data. When packets are received, the first four bytes of the received packet are examined. If those bytes match the bytes added by the system, a loop is detected and an event is sent. The event is turned off when a packet is detected that does not contain the bytes from the MAC address.

The location of this option depends on the hardware configuration of the system:

- If the system contains a TDM uplink, the TDM Uplink Loop Detect option is in the Management menu (see *Figure 4-16*).


```

Management

1. Host IP
2. Manager List
3. Host Mux Name... (.190.15)
4. User Administration
5. Signaling Configuration
6. Backup Configuration
7. Inhibit LAN> (Enable LAN)
8. TDM Uplink Loop Detect (Disable)
9. TDM Line check (Disable)
10. Telnet> (Enable)
11. Bandwidth control

@ - Db Update; # - Db Undo
Esc-prev.menu; !-main menu; &-exit

```

Figure 4-16. Management Menu

- If the system contains a main link card, the TDM Uplink Loop Detect option is in the group menu (see [Figure 4-17](#)).

```

Edit Bundle >Slot 1> Group 1> External 1> Bundle 1

1. Enter Bundle Number > (Bundle 1 )
2. Connect > (No)
3. Function > (Data Relay)
4. Back-Up Bundle > (N.C)
5. TDM Uplink Loop Detect (Disable)
6. Bundle Name > ()

```

Figure 4-17. Group Menu

- To enable TDM uplink loop detection:
 1. Access the appropriate menu:
 - System > Management
 - Configuration > Card > Group.
 2. Select TDM Uplink Loop Detect and select **Enable**.

Enabling TDM Line Check

Standard TDM link sync loss alarms (Red and Yellow alarms) are based on the physical layer level. Since the link traffic may be passed through intermediate links or networks that do not enable end-to-end alarm reporting, a local TDM link failure alarm might not be reported all the way to the Vmux-2100 at the far end, and vice versa. For this reason, Vmux-2100 features a Layer-4 connectivity check on the TDM uplink that sends messages between Vmux-2100 units over the TDM link, and based on receiving those messages, determines the synchronization status of the link. When the TDM line check is enabled, a message is sent every 1 second. If a connectivity message is not received back within 3 seconds, the link is considered down and the TST LEDs will flash.

Note For the TDM Line check to function, the Vmux-2100 on the opposite side must also have the TDM Line Check feature enabled.

► **To enable or disable the TDM line check:**

- From the Management menu (*Figure 4-3*), choose **TDM Line check**.

The TDM Line check feature will toggle between Enable and Disable settings.

Setting Bandwidth Control Thresholds

The Q.50 protocol is used to block new calls from being made during times of network congestion. By default, the Q.50 Stop New Calls congestion threshold is set to 88%, although, a higher threshold can normally be used without degrading service. You can change this threshold so that new calls will not be rejected when ample bandwidth still remains.

Likewise, the default threshold (94%) by which the bandwidth control mechanism begins to discard voice packets so that the buffer does not overflow, can also be modified. The bandwidth control mechanism discards voice packets in a way that minimizes the effect on the voice quality of the overall active voice channels.

In addition, the default bandwidth utilization level (80%), at which new modem calls will be rejected, can also be modified.

The bandwidth control is always active.

The Q.50 threshold is put into effect independently per external E1/T1.

► **To set the bandwidth control thresholds:**

- From the Management menu (*Figure 4-3*), choose **Bandwidth control**.

The Bandwidth control menu appears (see *Figure 4-18*).

Bandwidth Control	
1. Q.50 Stop New Calls Threshold	[25 - 98]... (88)
2. Discard Voice Packets Threshold	[25 - 99]... (94)
3. Block New Modem VBD Calls Threshold	[20 - 98]... (90)
4. Block New Modem Relay Calls Threshold	[20 - 98]... (90)
>	
Please select item <1 to 2>	

Figure 4-18. Bandwidth Control Menu

- Set the **Q.50 Stop New Calls Threshold** —The bandwidth utilization level at which new calls will be turned away as per the Q.50 protocol. This threshold can be set for between 25% and 98%.
- Set the **Discard Voice Packets Threshold** —The bandwidth utilization level at which packets will be thrown out. This threshold can be set for between 25% and 99%.

Note *The **Discard voice packets threshold level** must always be higher than the **Q.50 stop new calls threshold level**.*

4. Set the **Block New Modem VBD Calls Threshold** – This object indicates the Modem Relay Calls Threshold percent (%) above which new modem VBD calls will be rejected. This threshold can be set for between 20% and 98% (default is 90%).
5. Set the **Block New Modem Relay Calls Threshold** – This object indicates the Modem Relay Calls Threshold percent (%) above which new modem Relay calls will be rejected. This threshold can be set for between 20% and 98% (default is 90%).

Entering Main Link and Voice Modules into the Database

Before starting the configuration process of the 10/100BaseT and E1/T1 ports of Vmux-2100, it is necessary to identify the modules installed in your system and enter their types into the unit database. You can perform identification prior to the physical installation of the modules. This allows you to reduce the system downtime by preparing Vmux-2100 for a new configuration or upgrade.

Note *You can check the number and types of the main link and voice modules currently installed in Vmux-2100 by displaying the unit's inventory (**Main Menu > Inventory**).*

► To identify the modules:

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

The Hub menu appears (see [Figure 4-19](#)) displaying the Main Board.

```

Hub

Main Board > (M-IP E1 )

1. Slot 1 > (NO CARD )
2. Slot 2 > (NO CARD )
3. Slot 3 > (NO CARD )
4. Slot 4 > (NO CARD )

@ - Db Update; # - Db Undo
Esc-prev.menu; !-main menu; &-exit

```

Figure 4-19. Hub Menu

2. From the Hub menu, choose **Slot 1** to select the slot 1 module.

The Slot 1 menu appears.

3. From the Slot 1 menu, select one of the following module types:
 - **NO CARD** – No module installed in slot 1
 - **VCA-2E1** – Two E1 ports

- **VCA-4E1** – Four E1 ports
 - **VCA-2T1** – Two T1 ports
 - **VCA-4T1** – Four T1 ports
 - **IO-ML-2E1** – Channelized Main Link Module with two E1 ports
 - **IO-ML-4E1** – Channelized Main Link Module with four E1 ports
 - **IO-ML-2T1** – Channelized Main Link Module with two T1 ports
 - **IO-ML-4T1** – Channelized Main Link Module with four T1 ports.
4. Repeat step 4 and step 5 to select the module types for all utilized Vmux-2100 slots.

Configuring the Main Module and I/O Ports

Once the main modules and the I/O modules are installed in Vmux-2100 and identified by the system, you can start configuring the E1/T1 and Ethernet connections of the unit.

It is recommended to configure the main modules and I/O modules in the following order:

1. Configure the main module
 - Set the Ethernet parameters of the main link 10/100BaseT port, if necessary (autonegotiation or LAN mode).
 - Configure the E1/T1 parameters of the main link, if necessary (framing mode, restoration time, clock source, interface type, idle code).
 - Assign the E1/T1 main link timeslots to carry user data.
2. Configure the I/O modules:
 - For VCA Modules:
 - Assign IP address to a group
 - Configure each E1/T1 port at the physical level (framing mode, restoration time, clock source, interface type, idle code, signaling type, signaling profile)
 - Configure each E1/T1 port at the physical level (framing mode, restoration time, clock source, interface type, idle code, signaling type, signaling profile)

Note *The two E1/T1 ports in a group must be configured with the same signaling type.*

- Configure the timeslots of each E1/T1 port (voice or data, mapping to specific bundles, routing to remote ports and timeslots).
- For Channelized Uplink Modules:
 - Configure each E1/T1 port at the physical level (framing mode, restoration time, clock source, interface type, idle code, signaling type, signaling profile)
 - Add bundles to a group (up to 31 bundles per group)

- ❑ Set backup Bundles for Port 1's bundles (if necessary)
- ❑ Assign timeslots to the configured bundles.

Configuring the Main Module

The main link module of Vmux-2100 may include the following ports:

- Ethernet port (10/100BaseT)
- Serial port (RS-530/V.35)
- E1/T1 port.

Configuring the Ethernet Port

The Ethernet port of the Vmux-2100 main link module supports autonegotiation. If the autonegotiation is disabled, the Ethernet port can be configured to operate in 10BaseT (half duplex or full duplex) or 100BaseT (half duplex or full duplex) mode.

➤ **To configure the Ethernet port:**

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

The Card menu appears (see [Figure 4-20](#)).

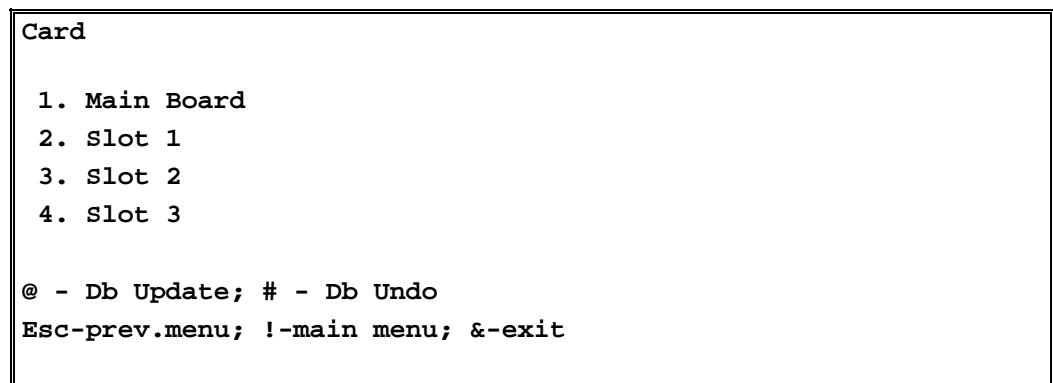


Figure 4-20. Card Menu

2. From the Card menu, choose **Main Board**.

The Main Board menu appears (see [Figure 4-21](#)).

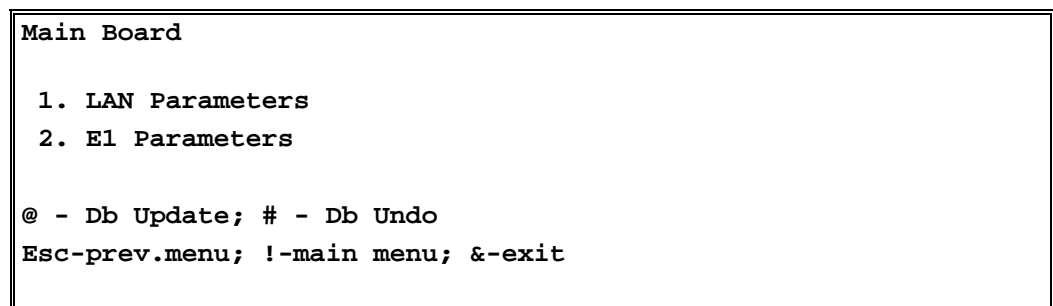


Figure 4-21. Main Board Menu

3. From the Main Board menu, choose **LAN Parameters**.

The LAN Parameters menu appears (see [Figure 4-22](#)).

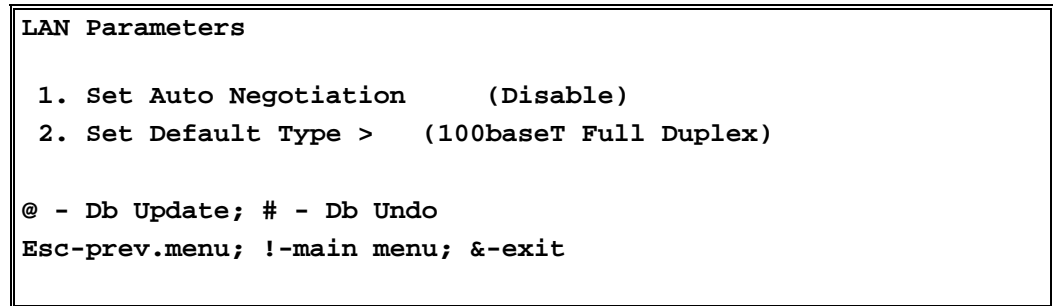


Figure 4-22. LAN Parameters Menu

4. From the LAN Parameters menu, choose **Set Auto Negotiation** to enable or disable the autonegotiation.
5. If the autonegotiation is disabled, choose **Set Default Type** from the LAN Parameters menu.

The Set Default Type menu appears.

6. Select the desired LAN operation mode by choosing one of the following:
 - 10BaseT half duplex
 - 10BaseT full duplex
 - 100BaseT half duplex
 - 100BaseT full duplex.

Configuring the Serial Port

The M-IPSERIAL main link module includes two serial ports. The following parameters can be set for each external serial port:

- Interface type
- Whether the port is connected or not
- The clock mode to be used
- The speed of the serial port
- Whether control signals are to be ignored
- Whether HDLC data will pass transparent or adjusted to cisco bridged Ethernet devices.

► To configure the serial port:

1. From the Card menu ([Figure 4-20](#)), choose **Main Board**.

The Main Board menu for the M-IPSERIAL main link module appears (see [Figure 4-23](#)).

```

Main Board

1. LAN Parameters
2. Serial Parameters

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

```

Figure 4-23. Main Board Menu for the M-IPSERIAL card

2. From the Main Board menu, choose **Serial Parameters**.

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

```

Serial Parameters

1. External 1
2. External 2

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

```

Figure 4-24. Serial Parameters Menu

3. From the Serial Parameters menu, choose the external serial port to be configured.

The configuration menu for the serial port appears (see [Figure 4-25](#)).

```

External 1

1. Interface Type >      (V35)
2. Connect >            (No)
3. Clock Mode >         (DTE)
4. Speed (N*64)[1 - 32]... (64)
5. Control Signals>     (Ignore)
6. HDLC Mode

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

```

Figure 4-25. Serial Port Configuration Menu for External Port 1

4. Choose **Interface Type** and press <Enter>.

The Interface Type menu appears.

5. Select the desired interface type by choosing one of the following:

- V35
- X21 (V.11)

- RS232 (V.28)
- RS449 (V.36)
- RS530 (EIA530)
- RS530A (EIA530A).

Note *All interfaces require the use of an adapter cable. For more information, see [Appendix A](#).*

6. Choose **Connect**.

The Connect menu appears.

7. If the serial port is to be connected to the telephone network, choose **Yes**. Otherwise, choose **No**.

8. Choose **Clock Mode**.

The Clock Mode menu appears.

9. Select the clock mode by choosing **DTE** or **DCE**. The clock mode must match the mode supported by the Serial Interface Adapter Cable connecting the Vmux-2100 to the Serial network.

10. Choose **Speed**.

The Speed menu appears.

11. Type the desired speed (**1 to 32**).

12. Choose **Control Signals**.

The Control Signals menu appears.

Note *This field is displayed only when the Interface Type is V35 and the Clock Mode is DTE.*

13. To ignore the control signals, choose **Ignore**. Otherwise, choose **Obey**.

14. Choose **HDLC Mode**.

The HDLC Mode menu appears.

15. Select the HDLC mode by choosing **Transparent HDLC** or **CISCO Bridged Eth**.

Configuring the E1 Main Link Port

The M-IPE1 main link modules include two fully redundant E1 ports. When both of them are configured as active, Vmux-2100 starts sending data over the one that has been connected first. If a loss of synchronization is detected on an active link, Vmux-2100 automatically switches to the backup.

➤ **To configure the main link E1 port:**

1. From the Main Board menu (see [Figure 4-21](#)), choose **E1 Parameters**.

The E1 Parameters menu appears (see [Figure 4-26](#)).


```

E1 Parameters

1. Main Link 1
2. Main Link 2
3. Time Slot assignment

@ - Db Update; # - Db Undo
Esc-prev.menu; !-main menu; &-exit

```

Figure 4-26. E1 Parameters Menu

2. From the E1 Parameters menu, choose **Main Link 1** to configure E1 port 1 or choose **Main Link 2** to configure E1 port 2.

The Main Link 1/2 menu appears (see [Figure 4-27](#)).

```

Main Link 1

1. Connect > (Yes)
2. Frame > (G.732N)
3. Restoration Time> (CCITT)
4. Clock Source> (Lbt (Local))
5. Interface Type> (Ltu)
6. Idle Code [1 - ff]... (ff)

@ - Db Update; # - Db Undo
Esc-prev.menu; !-main menu; &-exit

```

Figure 4-27. Main Link 1/2 Menu for E1 Port Module

3. From the Main Link 1/2 menu, configure the following E1 parameters:
 - Connect:
 - **Yes** (E1 link is enabled)
 - **No** (E1 link is disabled).
 - Frame (E1 framing mode):
 - **Unframed** (Framing is not used, allowing the entire link to carry voice data; this provides an additional 64 kbps over framed E1)
 - **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).
- 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-2100 internal oscillator).
- 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).
- Idle Code (code transmitted to fill unused timeslots in the E1 frames): **01 to FF**.

Note

The following values are illegal, and are replaced by the software with the appropriate default value: 0x00, 0x08, 0x10, 0x12, 0x21, 0x24, 0x42, 0x49, 0x84, 0x92.

4. From the E1 Parameters menu, choose **Time Slot Assignment** to assign the E1 main link timeslots to carry the user data.

Note

The Time Slot Table menu option is not available when using unframed E1, since timeslots are not relevant when using this mode.

The Time Slot Assignment menu appears (see [Figure 4-28](#)).

Time slot assignment 1. Display Time Slots 2. Time Slots Configuration

Figure 4-28. Time Slot Assignment Menu

5. Choose "1" to display following table:

Timeslots that are connected (assigned to carry data) are marked **Yes**; timeslots that are disconnected (not assigned) are marked **No**.

Time Slot Table

Ts#	1	2	3	4	5	6	7	8	9	10	11	12
	Yes	Yes	Yes	No	No	No	No	No	No	No	No	No
Ts#	13	14	15	16	17	18	19	20	21	22	23	24
	No	No	No	No	Yes	No	No	No	No	No	No	No
Ts#	25	26	27	28	29	30	31					
	No	No	No	No	No	No	No					

1. No
2. Yes

>

@ - Db Update; # - Db Undo

Esc-prev.menu; !-main menu; &-exit

Figure 4-29. Time Slot Table (for E1 Link)

The table displayed 1 is read only (as opposed to option #2), and you cannot change the timeslot connectivity from it.

6. To edit timeslots, select option 2 in the 'Time slot assignment menu: "Time Slot Configuration".

The following menu opens:

Time Slots Configuration

1. Update from Time Slot [1 - 31]> (1)
2. To Time Slot [1 - 31]> (1)
3. Time Slot Status : (Connect)
4. Update Time Slot

@ - Db Update; # - Db Undo

Esc-prev.menu; !-main menu; &-exit

Figure 4-30. Time Slots Configuration Menu

7. To change the state of consecutive timeslots, select values for the following fields:
 - Define the range of timeslots: select "from time slot" – the beginning timeslot number and "to time slot" – the last timeslot number
 - Select the desired status
 - Select "update".

Note *Since Vmux-2100 uses only one E1 main link at a time, the timeslot mapping is applicable also for the inactive E1 port.*

Configuring the T1 Main Link Port

The procedure for configuring the T1 main link port is similar to the procedure described above for configuring the E1 main link port. The Main Link menu for the T1 main link port is shown in [Figure 4-31](#).

```

Main Link 1

1. Connect > (Yes)
2. Clock Source>   (Lbt       (Local))
3. Frame   >   (Esf)
4. Interface Type>   (Csu))
5. Line Code>   (B8ZS)
6. Rx Sensitivity>   (LOW (-30dB))
7. Tx Gain Level>   (0 dBm)
8. Line Length>   (0-133 Feet)
9. Restoration Time>   (1 Second (Fast))
10. Idle Code   [1 - ff]... (ff)

>

Please select item <1 to 10>
@ - Db Update; # - Db Undo
Esc-prev.menu; !-main menu; &-exit

```

Figure 4-31. Main Link 1/2 Menu for T1 Main Link Port

The following parameters, which are configured via the Main Link 1 or Main Link 2 menu (see [Figure 4-31](#)), are unique to the T1 links:

- 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).
- 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) (-30 dB relative to the nominal transmit level of 0 dB)
 - **High** (-36 dB) (-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)
- Line Length (DSU mode only, length of a cable in feet between the Vmux-2100 T1 port connector and the network access point):
 - **0–133 Feet**
 - **133–266 Feet**
 - **266–399 Feet**
 - **399–533 Feet**
 - **533–655 Feet.**
- Restoration Time (time required for the T1 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).
- Idle Code (code transmitted to fill unused timeslots in the E1 frames): **01** to **FF**.

Note

The following values are illegal, and are replaced by the software with the appropriate default value: 0x00, 0x08, 0x10, 0x12, 0x21, 0x24, 0x42, 0x49, 0x84, 0x92.

➤ **To edit T1 timeslots:**

1. From the T1 Parameters menu, choose **Time Slot Assignment** to assign the T1 main link timeslots to carry the user data.

The Time Slot Assignment menu appears.

Time slot assignment 1. Display Time Slots 2. Time Slots Configuration

Figure 4-32. Time Slot Assignment Menu

2. Choose "1" to display following table:

Timeslots that are connected (assigned to carry data) are marked **Yes**; timeslots that are disconnected (not assigned) are marked **No**.

Time Slot Table

Ts#	1	2	3	4	5	6	7	8	9	10	11	12
	Yes	Yes	Yes	No	No	No	No	No	No	No	No	No
Ts#	13	14	15	16	17	18	19	20	21	22	23	24
	No	No	No	No	Yes	No	No	No	No	No	No	No

1. No
2. Yes

@ - Db Update; # - Db Undo

Esc-prev.menu; !-main menu; &-exit

Figure 4-33. Time Slot Table (for T1 Link)

The table displayed when you select #1 is read only (as opposed to option #2), and you cannot change the timeslot connectivity from it.

3. To edit timeslots, select option 2 in the 'Time slot assignment menu: "Time Slot Configuration".

The following menu opens:

Time Slots Configuration

1. Update from Time Slot [1 - 31]> (1)
2. To Time Slot [1 - 31]> (1)
3. Time Slot Status : (Connect)
4. Update Time Slot

@ - Db Update; # - Db Undo

Esc-prev.menu; !-main menu; &-exit

Figure 4-34. Time Slots Configuration Menu

4. To change the state of consecutive timeslots, select values for the following fields:
 - Define the range of timeslots: select "Update from Time Slot" – the beginning timeslot number and "To Time Slot" – the last timeslot number
 - Select the desired status
 - Select "Update Time Slot".

Note

Since Vmux-2100 uses only one T1 main link at a time, the timeslot mapping is applicable also for the inactive T1 port.

Configuring the Voice Module

You have to assign an IP address to each E1/T1 group.

➤ **To assign an IP address to a group:**

1. From the Card menu (see [Figure 4-20](#)), select the slot to which the group you want to configure belongs by choosing the corresponding number.

The Slot menu appears (see [Figure 4-35](#)).

```
>Slot 1

1. Group 1
2. Group 2

@ - Db Update; # - Db Undo
Esc-prev.menu; !-main menu; &-exit
```

Figure 4-35. Slot Menu

2. From the Slot menu, select a group to configure.

The Group menu appears (see [Figure 4-36](#)).

```
>Slot 1> Group 1

1. IP Address ... (0.0.0.0)
2. Bundles Parameters
3. External 1
4. External 2

@ - Db Update; # - Db Undo
Esc-prev.menu; !-main menu; &-exit
```

Figure 4-36. Group Menu

3. From the Group menu, choose **IP Address**.
4. Enter the desired IP address, and press **<Enter>**.

Configuring Bundles

E1/T1 timeslots are grouped together into bundles. The payload of each E1/T1 group can be arranged into up to 31 bundles, with maximum of 62 timeslots per bundle.

Displaying Bundles

Vmux-2100 allows you to display the bundles.

➤ **To display the bundles:**

1. From the Group menu (see [Figure 4-36](#)), choose **Bundles Parameters**.

The Bundles Parameters menu appears (see [Figure 4-39](#)).

```
Bundles Parameters    >Slot 1> Group 1

1. Display Bundles
2. Bundle Configuration

@ - Db Update; # - Db Undo
Esc-prev.menu; !-main menu; &-exit
```

Figure 4-37. Bundles Parameters Menu

- From the Bundles Parameters menu, choose **Display Bundles**.

The Display Bundles screen appears (see [Figure 4-38](#)).

```
Display Bundles

Bundle#    State      Name      Dest IP      Dest Bundle
Bundle 1    Connect    232.32.222.222  1
Bundle 2    Connect    132.32.211.211  2
| Bundle 3    Connect    232.32.32.112   3
v Bundle 4    Not Exist   0.0.0.0         1
Bundle 5    Not Exist   0.0.0.0         1
Bundle 6    Not Exist   0.0.0.0         1
Bundle 7    Not Exist   0.0.0.0         1
Bundle 8    Not Exist   0.0.0.0         1
Bundle 9    Not Exist   0.0.0.0         1
Bundle 10   Not Exist   0.0.0.0         1
```

Figure 4-38. Display Bundles Screen

Adding a Bundle

The first step to configure a bundle is to “add” it to a group.

➤ **To add a bundle:**

- From the Group menu, choose **Bundles Parameters**.

The Bundles Parameters menu appears (see [Figure 4-39](#)).

```
Bundles Parameters    >Slot 1> Group 1

1. Display Bundles
2. Bundle Configuration

@ - Db Update; # - Db Undo
Esc-prev.menu; !-main menu; &-exit
```

Figure 4-39. Bundles Parameters Menu

- From the Bundles Parameters menu, choose **Bundle Configuration**.

The Bundle Configuration menu appears (see [Figure 4-40](#)).

```

Bundle Configuration    >Slot 1> Group 1

1. Add Bundle          [1 - 30]... (1)
2. Delete Bundle       [1 - 30]... (1)
3. Edit Bundle

@ - Db Update; # - Db Undo
Esc-prev.menu; !-main menu; &-exit

```

Figure 4-40. Bundle Configuration Menu

- From the Bundle Configuration menu, choose **Add Bundle**.
- Choose its number and pressing <Enter>.

Configuring an Existing Bundle

- To configure an existing bundle:

- From the Bundle Configuration menu (see [Figure 4-40](#)), choose **Edit Bundle**.

The Edit Bundle menu appears (see [Figure 4-41](#)).

```

Edit Bundle

1. Enter Bundle Number          [1 - 30]>      (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. Packet Redundancy             [1 - 4]>      (1)
8. Connectivity Parameters
9. Voice Parameters
10. Transparent Jitter Size (N x 10mSec)[2 - 10]> (2)
11. Bundle Name>      ( )
12. CAS Redundancy

@ - Db Update; # - Db Undo
Esc-prev.menu; !-main menu; &-exit

```

Figure 4-41. Edit Bundle Menu

- From the Edit Bundle menu, choose **Enter Bundle Number** and select a bundle (1 through 31) to configure.
 - Connect:
 - **Yes** –bundle is connected

- **No** –bundle is not connected
- **Function:**
 - **TDMoIP:** TDMoIP format must be selected for IP-based networks.
 - **TDMoIP+ (default):** Further header optimization that saves 4 bytes per voice packet. This results in further bandwidth saving of 10-12% when using a G.723.1 coder, and 20% when using a G.729A coder. Voice quality is not affected.
 - **AAL2oMPLS:** AAL2oMPLS format may be selected for non-IP based Ethernet networks. The AAL2oMPLS header is smaller than the IP header, thus saving bandwidth.
 - **AAL2oMPLS+:** Further header optimization that saves 4 bytes per voice packet. This results in further bandwidth saving of 10-12% when using a G.723.1 coder, and 20% when using a G.729A coder. Voice quality is not affected.
- **Routing Parameters** (see [Figure 4-42](#)):

```

Routing Parameters > Slot 1 > Group 1 > Bundle 1

1. Destination IP           >   (0.0.0.0)
2. Next hop                 >   (0.0.0.0)
3. TDM next hop            >   (0.0.0.0)
4. Destination Bundle[1 - 8063]>   (1)
5. TOS Parameters
6. VLAN Parameters

@ - Db Update; # - Db Undo
Esc-prev.menu; !-main menu; &-exit

```

Figure 4-42. Routing Parameters Menu

- Destination IP – IP address of the destination group
- Next Hop – specifies a default router for the bundle. This is used to configure a default router for a specific bundle or group of bundles. If this value is not set, the Main Module default router assigned to the Vmux-2100 is used.

Note

The Next Hop feature can be used to configure a VPN of voice cards, while the Main Module is on a different network.

- TDM Next Hop - IP address of the Next IP hop when using the TDM uplink of the local Vmux and when traffic goes on from the remote Vmux-2100 over an IP network.
- Destination Bundle – number of destination bundle of the group with IP specified in the previous step (1 through 8063).
- TOS Parameters – standard Type of Service parameters of the outgoing IP frames:

Signaling TOS: The hexadecimal byte to be inserted to the Signaling TOS field of all the frames of this bundle – all non-media frames will be set with signaling TOS (**0x00 to 0xFC**)

Media TOS: The hexadecimal byte to be inserted to the Media TOS field of all the frames of this bundle – all multiplexed frames that contain at least one media packets will be set with Media TOS (**0x00 to 0xFC**)

Precedence: (Routine, Priority, Immediate, Flash, Flash Override, Critic/Ecp, Internetwork Control, Network Control)

Delay: (Normal, Low)

Throughput: (Normal, High)

Reliability: (Normal Reliability, High Reliability).

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

VLAN Exist: **Yes, No**

VLAN ID: **26 to 4094**

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

- Max Bytes In Multiplexed Frame – maximum size of a multiplexed TDMoIP frame in bytes:
 - **100** to 1461 bytes
- Packetizing Interval (msec) – maximum time interval allowed for the TDMoIP frame aggregation:
 - **10** to **90** msec
- Packet Redundancy – the number of times to re-send every packet
 - 1 to 4 times
- Connectivity parameters – keep-alive messages configuration (see [Figure 4-43](#)):

```
Connectivity Parameters >Slot 1> Group 1> Bundle 1

1. Connectivity Mode>      (With Ping)
2. Connectivity-packet rate (sec) [1 - 60]... (60)
3. Connectivity timeout cycles    [2 - 5] ... (3)
```

Figure 4-43. Connectivity Parameters Menu

Vmux-2100 constantly monitors status of all connected bundles by sending the 64-byte keep-alive messages to 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 the main link failure, Vmux-2100 disconnects the bundle and generates the BUNDLE IS OOS alarm. When the BUNDLE IS OOS alarm is generated, Vmux-2100 notifies appropriate PBX by sending “all 1s” AIS signal (CCS signaling) or OOS message (CAS signaling) on all timeslots of the

disconnected bundle. This notification allows the attached PBX to stop transmitting over a faulty E1/T1 and switch to a backup link.

Since some routers might discard the ping messages and thus not allow the Vmux-2100 to connect through it, the bundle connectivity status is now carried with Vmux Layer-4 connectivity messages rather than with pings. However, to enable interoperability with Vmux-2100 versions earlier than 3, the ping mode is still supported.

You can specify the following connectivity parameters:

- Connectivity mode:

With Ping –proprietary pings are used to test bundle connectivity. This mode is required when working opposite Vmux-2100 units with software versions earlier than 3

Without Ping –bundle connectivity status is part of Vmux-2100 messages, and pings are not used to test connectivity. This method is preferred since it avoids flooding the network with pings. It can be used when working opposite Vmux-2100 units with software versions 3 or higher.

- 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-2100 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-2100 disconnects a bundle from which it did not receive at least one reply within 180 seconds.

Note

When operating Vmux-2100 in a TDM network (for example, leased line), where delays are minimal, you can configure Vmux-2100 to generate the keep-alive packets more frequently to ensure the early notification of a main link failure. In IP networks, where delays are more common, it is recommended to set the connectivity parameters to their maximum values.

- Voice Parameters (see [Figure 4-44](#)):

```

Voice Parameters >Slot 1> Group 1> Bundle 1

1. Coder/Rate (kbps)>    (G.723.1/6.4)
2. Caller ID Type
3. Tx Delay For Caller ID
4. Volume (To Line)>    (0 dB)
5. Volume (From Line)>(0 dB)
6. Fax/Modem>
7. MF Parameters>
8. Custom Tone Detection>
9. Super Tandem>
10. VAD>
11. CNG Mode (On)
12. Echo Canceller>    (Enable)
13. Coding>    (U-Law)
14. Advanced Voice Parameters

Please select item <1 to 11>

```

Figure 4-44. Voice Parameters Menu

Notes

- "MF Parameters" submenu appears only if device is E1/T1 and coder rate is not G.711.
 - "Custom Tone Detection" submenu appears only if device is E1/T1.
- 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, U-Law companding)
 - Caller ID Type - Type of Caller ID used by DSP for this bundle (this parameter is available only when Coder/Rate = G.729A/8):
 - Bellcore type 1**
 - V.23**
 - Default: **Bellcore type 1**
 - Tx Delay For Caller ID - Delay before transmitting Caller ID for this bundle (this parameter is available only when Coder/Rate = G.729A/8):
 - 0..3000**
 - Default: **400**
 - Volume (To Line) – sets the volume gain transmitted from the DSP to the line (this parameter is available only for E1/T1 devices):
 - 6 dB to 6 dB in steps of 1 dB**

- Volume (From Line) – sets the volume gain transmitted upon entry from line to the DSP:
-6 dB to 6 dB in steps of 1 dB
-12 dB and 12 dB (-12 dB should not be used)
- Fax/Modem Parameters
Modem - enable/disable modem signal identification and relay. 'Relay' is displayed only when card is VCA.
V.22 Mode - Relay/VBD for V.22 mode (this parameter is available only when modem is in Relay mode):
VBD, Relay (default).
VBD Rate – Select VBD rate for this bundle (this parameter is unavailable when coder is G.726 32k & G.726 24k are disabled):
G.711 64k 5 msec (default), **G.711 64k 10 msec**, **G.726 32k**, **G.726 24k**
Fax - enable/disable fax signal identification and relay
Fax Rate (kbps) -define the maximum fax transmission rate in kbps: **4.8, 9.6, 14.4.**
Max VBD Modem Calls - Maximum VBD modem calls for this bundle:
1..62 (1..48 for T1), default: **62 (48 for T1)**
Max Relay Modem Calls - Maximum Relay modem calls for this bundle:
1..62 (1..48 for T1), default: **62 (48 for T1)**
- MF Parameters (displayed only if device is E1/T1 and coder rate is not G.711)
MFCR2 Relay – enable/disable MFR2/R2-MFC tone identification and relay.

Note

The DTMF relay is always active.

Minimum Pulse Width (displayed only if MFCR2 Relay is enabled) – minimum pulse width of the MF tone to be detected and relayed: **45 to 300** milliseconds.

Minimum Power Level (displayed only if MFCR2 Relay is enabled) – minimum power level of the MF tone to be detected and relayed: **-1 to -35** dBm.

MFC Spoofing (displayed only if MFCR2 Relay is enabled) - enable/disable MFC tones. If enabled, this feature shortens the call setup delay when using R2-MFC signaling by forcing MF Forward Tone acknowledge after 80 msec.

Tone Ack Interval (N*20) (displayed only if MFCR2 Relay and Spoofing is enabled) - minimum duration of MFC tone: 3 to 20.

- Custom Tone Detection
Tone Detection - enable/disable Tone Detection and relay for this bundle (currently only 2000 Hz tone is supported).

Tone Frequency - Specific tone to be detected and relayed. In each of the options, the DSP will not compress the selected tones in order to enable the PBX to perform the custom tone detection on the timeslots (available only if Tone Detection = Enable):

2000 Hz (default), **1780 Hz**, **1780 Hz + 2000 Hz**

□ Super Tandem

Super Tandem Mode – Enables/Disables the Super Tandem feature.
Enable, **Disable** (default). Enable only on Fax & modem Relay Calls.

Bit Mask - Channel rate control. **0x1 – 0xFF**, **0x7E is default**. This parameter is available only if Super Tandem mode is not disabled.

□ VAD

VAD Method - Select the VAD method to work with:

Generic (default), **Internal**.

Noise Level for VAD – Determines sensitivity of VAD to noise (available only if Generic VAD is selected):

Off, **Low** (default), **High** (**Off** is not available when Coder Rate is G.711)

□ CNG Mode - Determines the comfort noise generation for this bundle:

Off, **On**.

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

If you have an external echo canceller on your telephone network, disable the built-in Vmux-2100 DSP echo canceller.

□ Coding (only for E1/T1 device) - set the coding used by your PBX:

A-Law – usually used for E1

U-Law – U-Law, usually used for T1

□ Advanced Voice Parameters

DTMF Detection - Enable/Disable DTMF detectors for this bundle.

Enabled by default, to allow DTMF detection and relay. When disabled, DTMF tones pass as normal voice traffic (may be required in special applications).

NLP Cutoff Level - Determines from which value and below to enable the NLP (Non Linear Processor) mechanism (to reduce to "0" low signals), preventing a situation where the mechanism is reducing signals that were actually voice and causing voice clipping:

0..1023 (default is **512**)

DTD ERL Cutoff Level - DTD (Double Talk Detector) ERL (Echo Return Loss) improves the initialization mechanism of the Echo Canceller:

0..96 (default is **15**)

VBD SwitchBack Time (N x 30 msec) - The amount of time it takes the DSP to switch back from VBD to Voice (for now, relevant only to VCA cards):

50...350 (default is 120, which is 5.4 sec)

Cdis/CNG detection time (N*10 msec) - The amount of time in which 1100 Hz & 2100 Hz are detected before switching to modem or fax (relevant only to VCA cards)

10...100 (default is 40, which is 400 msec)

- **Transparent Jitter Size (N * 10 msec)** (only for E1/T1 device)– 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. Range is set between 2 to 10.

Note *The Transparent Jitter Size must be greater than the packetizing interval.*

- **Bundle Name** – assign identification to a bundle.
- **CAS Redundancy** – Determine whether or not to duplicate CAS packets for the timeslot assigned to the bundle.
Possible values: Disable (default), Enable. This parameter is available only if a bundle exists

Configuring the External E1 Ports

► To configure an external E1 port on a voice module:

1. From the Card menu (see [Figure 4-20](#)), choose the slot housing the voice module to be configured.
2. From the Slot menu (see [Figure 4-35](#)), choose the group containing the port you want to configure.
3. From the Group menu (see [Figure 4-36](#)), choose the external port you want to configure.

The External menu appears (see [Figure 4-45](#)).

```
>Slot 1> Group 1> External 1

1. E1 Parameters
2. Distribution Of Frammer Time Slots

@ - Db Update; # - Db Undo
Esc-prev.menu; !-main menu; &-exit
```

Figure 4-45. External Menu (E1)

4. From the External menu, choose **E1 Parameters**.

The E1 Parameters menu appears (see [Figure 4-46](#)).


```

E1 Parameters >Slot 1> Group 1> External 1

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. Q.50 Protocol      >    (Disable
8. Q.50 Bits Pair     >    (A&B)
9. Profile[1 - 4]... (1)
>

Please select item <1 to 9>
@ - Db Update; # - Db Undo
Esc-prev.menu; !-main menu; &-exit

```

Figure 4-46. E1 Parameters Menu of Voice Module

5. Configure the E1 parameters as follows:

- 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).

For E1 links, selecting the frame mode automatically determines the signaling mode:

- G.732S or G.732S-CRC4 framing: CAS signaling
- G.732N or G.732N-CRC4 framing: CCS signaling.

Note

The two E1/T1 ports in a group must be configured with the same signaling mode. Therefore, since for E1 links, the frame mode automatically determines the signaling mode, both ports in the group must be configured to the same frame mode.

- 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-2100 internal oscillator).
- Idle Code - code transmitted to fill unused timeslots in the E1 frames: **01** to **FF**.

Note

The following values are illegal, and are replaced by the software with the appropriate default value :0x00, 0x08, 0x10, 0x12, 0x21, 0x24, 0x42, 0x49, 0x84, 0x92.

- Q.50 Protocol (only when using E1 ports with Line Types: G.732S, G.732S-CRC4) - enable/disable support for the Q.50 protocol. Enable this option only if your PBX supports the protocol, and you want to use it to prevent bandwidth overflow: **Disable, Annex A, Annex B**.
- Q.50 Bits Pair (only if Q.50 Protocol is not disabled) - Q.50 Signaling bits Pair that is currently in use. When Q.50 Protocol is Annex B, then only A & B bits can be chosen: **A & B, C & D**.
- Profile (only for G.732S or G732S-CRC frame mode; select a signaling profile). When operating with CAS signaling (for E1 links in G.732S or G732S-CRC frame modes), it is necessary to assign a signaling profile (1 to 5) to the E1 link. 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 E1/T1 signaling, it is recommended to disconnect a bundle, to which the E1/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 perform reset of the local and remote voice modules carrying the E1/T1 links after you complete configuring the E1/T1 signaling.

Configuring the External T1 Ports

► To configure an external T1 port on a voice module:

1. From the Card menu (see [Figure 4-20](#)), choose the slot housing the voice module to be configured.

2. From the Slot menu (see [Figure 4-35](#)), choose the group containing the port you want to configure.
3. From the Group menu (see [Figure 4-36](#)), choose the external port you want to configure.

The External menu appears (see [Figure 4-47](#)).

```
>Slot 1> Group 1> External 1

1. T1 Parameters
2. Distribution Of Framer Time Slots

@ - Db Update; # - Db Undo
Esc-prev.menu; !-main menu; &-exit
```

Figure 4-47. External Menu (T1)

4. From the External menu, choose **T1 Parameters**.

The T1 Parameters menu appears (see [Figure 4-48](#)).

```
T1 Parameters >Slot 2> Group 1> External 1
1. Connect > (No)
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]... (ff)
9. Signaling> (Robbed Bit MF)
10. TS Rate (Kbps) > (64 KBPS)
11. Profile[1 - 4]... (1)

>

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

Figure 4-48. T1 Parameters Menu of Voice Module

5. Configure the T1 parameters as follows:
 - 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-2100 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-2100 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) (-30 dB relative to the nominal transmit level of 0 dB)
 - **High** (-36 dB) (-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 T1 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).
- Idle Code - code transmitted to fill unused timeslots in the T1 frames): **01 to FF**.

Note

The following values are illegal, and are replaced by the software with the appropriate default value: 0x00, 0x08, 0x10, 0x12, 0x21, 0x24, 0x42, 0x49, 0x84, 0x92.

- Signaling - select a signaling mode for the T1 links:

- ❑ Robbed Bit Multi-Frame (RBMF)
- ❑ CCS (SS7, ISDN-PRI).

Note *The two E1/T1 ports in a group must be configured with the same signaling mode.*

Note *If you intend to change E1/T1 signaling, it is recommended to disconnect a bundle, to which the E1/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 perform reset of the local and remote voice modules carrying the E1/T1 links after you complete configuring the E1/T1 signaling.*

- TS Rate (only for timeslots configured as HDLC or SS7) -sets the T1 data rate: **56** or **64** kbps.
- Profile (only when signaling is Robbed Bit MF) - 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 the [Configuring Signaling Information](#) section above).

Configuring the E1/T1 Timeslots

Configure the E1/T1 timeslots, as explained below.

► To configure E1/T1 timeslots:

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

The Card menu appears (see [Figure 4-20](#)).

2. From the Card menu, select a slot to configure.

The Slot menu appears (see [Figure 4-35](#)).

3. From the Slot menu, select an E1/T1 group to configure.

The Group menu appears (see [Figure 4-36](#)).

4. From the Group menu, select an external E1/T1 to configure by choosing **External 1** or **External 2**.

The External menu appears (see [Figure 4-49](#)).

```
>Slot 1> Group 1> External 1
```

1. **E1 Parameters**
2. **Distribution Of Framer Time Slots**

@ - Db Update; # - Db Undo

Esc-prev.menu; !-main menu; &-exit

Figure 4-49. External Menu

5. From the External menu, choose **Distribution Of Framer Time Slots**.

The Distribution Of Framer Time Slots menu appears (see [Figure 4-50](#)).

```
Distribution Of Framer Time Slots >Slot 1> Group 1> External 1

1. Display Time Slots
2. Time Slots Configuration

@ - Db Update; # - Db Undo
Esc-prev.menu; !-main menu; &-exit
```

Figure 4-50. Distribution Of Framer Time Slots Menu

6. From the Distribution Of Framer Time Slots menu, choose **Time Slots Configuration**.

The Time Slot Configuration menu appears (see [Figure 4-51](#)).

```
Time Slot Configuration >Slot 1> Group 1> External 1

1. Update from Time Slot [1 - 31]... (1)
2. To Time Slot [1 - 31]... (1)
3. Type > (Voice)
4. Bundle [1 - 30]... (1)
5. Destination Port ID [1 - 16]... (1)
6. Destination Time Slot ID [1 - 31]... (1)
7. Update Time Slot

@ - Db Update; # - Db Undo
Esc-prev.menu; !-main menu; &-exit
```

Figure 4-51. Time Slot Configuration Menu

7. From the Time Slot Configuration menu, configure the following parameters:
 - Define timeslot(s) to configure by choosing **Update from Time Slot** to select the first timeslot and then choosing **To Time Slot** to select the last timeslot.
 - Assign a timeslot to a bundle by choosing **Bundle**, and selecting a bundle number.
 - Specify a destination port by choosing **Destination Port ID**, and entering a port number.
 - Define the destination timeslots to which the local timeslots are routed by choosing **Destination Time Slot ID**. You only have to specify a starting timeslot (the rest of the destination timeslots are configured automatically according to the number of timeslots previously set by the Update from Time Slot/To Time Slot parameters).
 - Select a timeslot type by choosing **Type**:
 - **N.C.** (timeslot is not connected)
 - **Voice** (timeslot transmits voice)

- **SS7** - Timeslot carries SS7 signaling data. If SS7 signaling compression is configured (see Configuring Signaling Profiles), compression is performed on this timeslot range.

When this option is selected, the additional menu option **Destination SS7 Ch ID** appears. Vmux-2100 supports up to two separate SS7 data streams. Set **Destination SS7 Ch ID** to identify which data stream is being configured on this timeslot range (either **SS7-1** or **SS7-2**).

- **HDLC** - Timeslot transmits data, for example, PRI signaling information.
When this option is selected, the additional menu option **Destination HDLC Ch ID** appears. Vmux-2100 supports up to four separate HDLC data streams. Set **Destination HDLC Ch ID** to identify which data stream is being configured on this timeslot range (**HDLC-1**, **HDLC-2**, **HDLC-3**, or **HDLC-4**).
- **HDLC Sub Ch.** - Determines which HDLC sub-stream the timeslots belong to.

When this option is selected, two additional menu options appear: **Destination HDLC Sub Ch ID** and **Sub Ch Mask**.

Vmux-2100 supports up to eight separate HDLC sub-data streams. Set **Destination HDLC Sub Ch ID** to identify which sub-data stream is being configured on this timeslot range (**HDLC-SUB-1**, **HDLC-SUB-2**, **HDLC-SUB-3**, **HDLC-SUB-4**, **HDLC-SUB-5**, **HDLC-SUB-6**, **HDLC-SUB-7**, or **HDLC-SUB-8**). Make sure the range contains only one timeslot, that is, the values of 'Update from Time Slot' and 'To Time Slot' are the same.

In addition, set **Sub Ch Mask** to define the bit mask for the channel: **01** to **FF**.

- **Transparent** - The content of the timeslot is treated as data and is transmitted as-is.

For transparent timeslots recommended values of related parameters are as follows:

Packetizing Interval: 10 msec

Max Bytes In Multiplexed Frame:

Recommended value: at least 1000 bytes

Minimum value for "n" transparent timeslots:

$n \times 80 \times (\text{packetizing interval}/10)$

Note

You cannot configure more than eight timeslots of 'DATA' type for a single E1 port, where 'DATA' is: SS7-1, SS7-2, HDLC-1, HDLC-2, HDLC-3, HDLC-4, TRANSPARENT.

- **Transparent Sub Ch.** - The content of the timeslot is treated as data and is transmitted as-is. Determines which transparent sub-stream the timeslots belong to.

When this option is selected, two additional menu options appear: **Destination TRANSP Sub Ch ID** and **Sub Ch Mask**.

Vmux-2100 supports up to eight separate transparent sub-data streams. Set **Destination TRANSP Sub Ch ID** to identify which sub-data stream is being configured on this timeslot range (**TRANSP -SUB-1, TRANSP -SUB-2, TRANSP -SUB-3, TRANSP -SUB-4, TRANSP -SUB-5, TRANSP -SUB-6, TRANSP-SUB-7, or TRANSP-SUB-8**). Make sure the range contains only one timeslot, that is, the values of Update from Time Slot and To Time Slot are the same.

In addition, set **Sub Ch Mask** to define the bit mask for the channel: **01** to **FF**.

- **Ph.2 Data Compatible** (Phase 2 data compatible channel) - Used only in systems that mix Vmux-2100 Ph2 devices with Vmux-2100 Ph4 devices.

Select this data type to define an HDLC data stream in a bundle between the Ph2 Vmux-2100 device and the Ph4 Vmux-2100 device.

- 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.*

8. Check the resulting timeslot configuration by choosing **Display Time Slots** from the Distribution Of Framer Time Slots menu (see [Figure 4-50](#)).

The Display Time Slots screen appears (see [Figure 4-52](#)).

Display Time Slots						
Ts#	Type	Bundle	Dest Port	Dest Ts	Bit Mask	
1	Voice	1	1	1		
2	Voice	1	1	2		
3	Voice	1	1	3		
4	HDLC-1	1	1	4		
5	TRNSPT	1	1	5		
6	N.C	0	0	0		
7	N.C	0	0	0		
8	TRANSP-SUB-1	1	1	8	FF	
9	TRANSP-SUB-2	1	1	9	F0	
10	N.C	0	0	0		

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

1 user(s)

Figure 4-52. Display Time Slots Screen

Configuring the Channelized E1/T1 Main Link Module

Configuring a channelized E1/T1 main link module (IO-ML-2E1, IO-ML-4E1, IO-ML-2T1, IO-ML-4T1) consists of the following:

- Configure the E1/T1 parameters.
- Configure the Bundles.
- Assign the timeslots.

Disabling the Internal Switching

If the TDM network that connects multiple Vmux-2100 devices in a loop configuration, you must disable the Internal Switching in one of the Vmux-2100 devices to prevent the TDM network from forming a closed LAN loop. (Only available when Main link is Serial or E1/T1.)

► **To enable or disable the Internal Switching of the channelized E1/T1 main link module:**

1. From the Card menu ([Figure 4-20](#)), choose the slot containing the channelized main link module whose internal switching you want to disable or enable.
2. Choose the group whose internal switching you want to disable or enable.

The following menu appears:

```
>Slot 3> Group 1>  
  
1. External 1  
2. External 2  
3. Internal Switching    >    (Disable)
```

3. Choose **Internal Switching**, and then choose **Enable** or **Disable**.

Configuring the E1 Ports

► **To configure the E1 parameters:**

1. From the group menu above choose the external port you want to configure.

The Bundles menu appears (see [Figure 4-53](#)).

```
>Slot 3> Group 1> External 1  
  
1. E1 Parameters  
2. Channelized Bundles  
3. Time slot assignment
```

Figure 4-53. Bundles Menu

2. Choose **E1 Parameters**.

The E1 Parameters menu appears (see [Figure 4-54](#)).

```

E1 Parameters >Slot 1> Group 1> External 1

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

>

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

```

Figure 4-54. E1 Parameters of Channelized Main Link Module

3. Configure the E1 parameters as follows:

- Connect:
 - **Yes** (E1 link is enabled)
 - **No** (E1 link is disabled).
- Frame - E1 framing mode:
 - **Unframed** (Framing is not used, allowing the entire link to carry voice data; this provides an additional 64 kbps over framed E1)
 - **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).

For E1 links, selecting the frame mode automatically determines the signaling mode:

- G.732N or G.732N-CRC4 framing: CCS signaling.
- 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-2100 internal oscillator).

- 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).
- Idle Code (code transmitted to fill unused timeslots in the E1 frames): **01** to **FF**.

Note

The following values are illegal, and are replaced by the software with the appropriate default value: 0x00, 0x08, 0x10, 0x12, 0x21, 0x24, 0x42, 0x49, 0x84, 0x92.

Configuring the T1 Ports

► To configure the T1 parameters:

1. From the Card menu (see [Figure 4-20](#)), choose the slot that houses the channelized main link module you want to configure.
2. Choose the group containing the T1 port you want to configure.
3. Choose the external port you want to configure.
4. Choose **T1 Parameters**.

The T1 Parameters menu appears (see [Figure 4-55](#)).

```
T1 Parameters > Slot 2> Group 1> External 1

1. Connect > (No)
2. Clock Source> (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]... (ff)

>

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

Figure 4-55. T1 Parameters of Channelized Main Link Module

5. Configure the T1 parameters as follows:
 - 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-2100 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-2100 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) (-30 dB relative to the nominal transmit level of 0 dB)
 - **High** (-36 dB) (-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 T1 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).
- Idle Code (code transmitted to fill unused timeslots in the T1 frames): **01** to **FF**.

Note The following values are illegal, and are replaced by the software with the appropriate default value: 0x00, 0x08, 0x10, 0x12, 0x21, 0x24, 0x42, 0x49, 0x84, 0x92.

Configuring Bundles

► To configure the bundles:

1. From the External menu of the port you want to configure, choose **Channelized Bundles**.

The Bundles menu appears (see [Figure 4-53](#)).

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

The Bundles Configuration menu appears (see [Figure 4-56](#)).

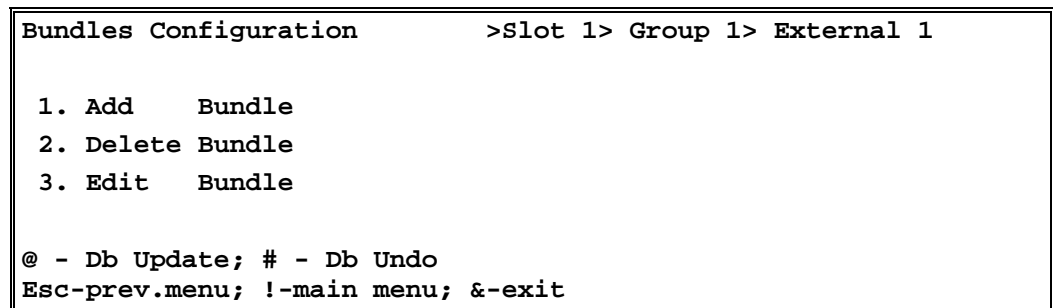


Figure 4-56. Bundles Configuration Menu

3. To add a new bundle, choose **Add Bundle**.

The Add Bundle menu appears (see [Figure 4-57](#)).

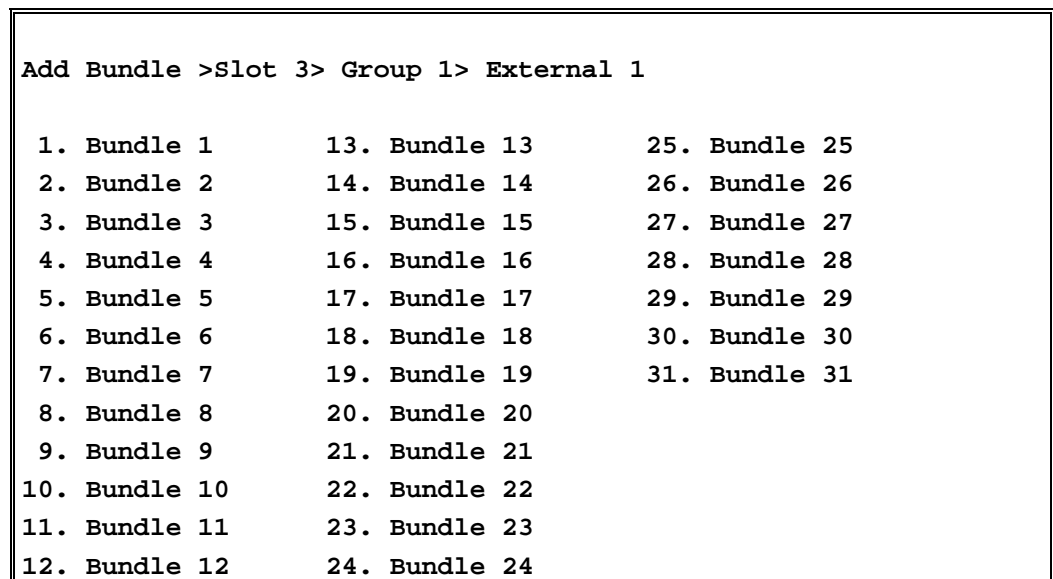


Figure 4-57. Add Bundle Menu

4. Select the number of the bundle you want to add. You must add a bundle before you can configure its parameters for the first time.
5. To edit the bundle configuration, choose **Edit Bundle**.

The Edit Bundle menu appears (see [Figure 4-58](#)).

```

Edit   Bundle  >Slot 1> Group 1> External 1> Bundle 1

1. Enter Bundle Number >   (Bundle 1  )
2. Connect>   (No)
3. Function>   (Data Relay)
4. Back-Up Bundle>   (N.C)
5. TDM Uplink Loop Detect   (Disable)
6. Bundle Name           >   ( )
7. TS Bit Mask Mode
8. Auto Rate Selection
9. Bit Mask Set

@ - Db Update; # - Db Undo
Esc-prev.menu; !-main menu; &-exit

```

Figure 4-58. Bundle Parameters of Channelized Main Link Module

Note

"Back-Up Bundle" only appears only for External 1.

6. Configure the bundle as follows:

- Enter Bundle Number - select the number of the bundle to configure: **1 to 31** (E1) or **1 to 24** (T1)
- Connect:
 - **Yes** (bundle is connected)
 - **No** (bundle is not connected)
- Function (currently this is read only):
 - **Data Relay**
- Back-Up Bundle:
 - **N.C** (No back-up bundle is connected)
 - **Bundle 1, Bundle 2, ...**(only if bundle exists, and only for the first external) – Set the channel number in the range of 1 to 31 (E1) or 1 to 24 (T1).

All connected bundles on External port 2 appear in the list. Select a bundle to use it as the backup bundle on External 2 for the currently selected bundle on External 1. The bundle on External 1 will be used whenever External 1 port is available. Whenever External port 1 fails, the Vmux-2100 switches to the specified bundle on External port 2. When External port 1 returns to service, the Vmux-2100 uses it again, instead of External 2.

- TDM Uplink Loop Detect enable/disable detection of loop in TDM network see [TDM Uplink Loop Detect](#) on page [4-14](#)
- Bundle Name - assign identification to a bundle.

- Ts Bit Mask Mode - Select between bit mask mode insertion (relevant only for ML-T1 cards):
 - **Menu** (default)
 - **User Defined**
- Auto Rate selection - Select the rate for the timeslot (relevant only for ML-T1 cards, & Menu was selected):
 - **64 kbps** (default)
 - **56 kbps**
- Bit Mask Set - Select the rate for the timeslot (relevant only for ML-T1 cards, & Menu was selected):
 - **0x01 – 0xFF** (default is 0xFF)

Configuring the E1/T1 Time Slots

You set up a point-to-multipoint application using the channelized main link module by assigning a range of timeslots to a channelized bundle on the main link module.

► To configure the timeslots:

1. From the External menu of the port you want to configure, choose **Time Slot Assignment**.

The Time Slot Assignment menu appears.

2. From the Time Slot Assignment menu, choose **Time Slots Configuration**.

The Time Slots Configuration menu appears (see [Figure 4-59](#)).

Time Slots Configuration

1. Update from Time Slot [1 - 31]... (1)

2. To Time Slot [1 - 31]... (3)

3. Assign to Bundle :> (Bundle 1)

4. Update Time Slot

>

@ - Db Update; # - Db Undo

Esc-prev.menu; !-main menu; &-exit

Figure 4-59. Time Slots Configuration Menu of Channelized Main Link Module

3. Configure the time slots as follows:
 - **Update from Time Slot** (the first time slot in the range of timeslots to be configured).
 - **To Time Slot** (the last time slot in the range of timeslots to be configured).
 - **Assign to Bundle** (the bundle to which the specified time slot range is to be assigned).
 - **N.C** (the specified time slot range is not connected).

- **Bundle number** (the number of the bundle to which the specified time slot range is to be assigned).
4. Choose **Update Time Slot** to save your changes.
 5. Check the resulting timeslot configuration by choosing **Display Time Slots Configuration** from the Time Slot Assignment menu.

The Display Time Slots Configuration screen appears (see [Figure 4-60](#)).

Display Time Slots										
Ts#	1	2	3	4	5	6	7	8	9	10
	Bu1	Bu1	Bu1	N.C	Bu2	Bu2	Bu2	Bu2	Bu2	Bu3
Ts#	11	12	13	14	15	16	17	18	19	20
	Bu3	Bu3	Bu3	Bu3	Bu3	Bu3	Bu3	Bu3	N.C	N.C
Ts#	21	22	23	24	25	26	27	28	29	30
	N.C	N.C	N.C	N.C	N.C	N.C	N.C	N.C	N.C	N.C
Ts#	31									
	N.C									
>										
@ - Db Update; # - Db Undo.menu; !-main menu; &-exit; ?-help										
Esc-prev										

Figure 4-60. Display Time Slots Configuration Screen

For each timeslot (1-31 in E1, 1 - 24 in T1) the table displays the bundle to which the timeslot is assigned (Bu1, Bu2 Bu31). N.C indicates that the selected timeslot is currently not connected.

4.3 Additional Tasks

Updating the Database

You must save the selected values by updating the Vmux-2100 database. If the database is not updated, Vmux-2100 discards all the user settings when it is reset. You can save selected 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 @ and press **<Enter>**.

Vmux-2100 displays the following confirmation screen (see *Figure 4-61*).

```

????????????????????????????????????????????????????????????????????????????????????????????
????????????????????????????????????????????????????????????????????????????????????????????
????????????????????????????????????????????????????????????????????????????????????????????
????????????????????????????????????????????????????????????????????????????????????????????
?????????????                                     ???????????
?????????????                                     ???????????
?????????????                                     ???????????
????????????? Are You Sure You Want To Update The Data Base (Y/N)? ???????????
?????????????                                     ???????????
?????????????                                     ???????????
?????????????                                     ???????????
?????????????                                     ???????????
????????????????????????????????????????????????????????????????????????????????????????????
????????????????????????????????????????????????????????????????????????????????????????????
????????????????????????????????????????????????????????????????????????????????????????????

```

Esc-prev.menu; !-main menu; &-exit
1 user(s)

Figure 4-61. Confirm Update Database Screen

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

Note

Each time you update the Vmux-2100 database, the management software analyzes the changes.

If a major error is detected, Vmux-2100 aborts the database update and displays the following screen:

```

!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!!!!!!      Attention !                                     !!!!!
!!!!!!      -----                                     !!!!!
!!!!!!                                     !!!!!
!!!!!!      DB UPD FAILED !!!! Data Base was NOT changed      !!!!!
!!!!!!      Sanity Error Occurred - Check Sanity Alarm Report  !!!!!
!!!!!!                                     !!!!!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!

Press 'y' To Exit This Screen

Esc-prev.menu; !-main menu; &-exit                                     1 user(s)
-----

```

Figure 4-62. Sanity Error Screen

In this case, check the sanity error as described in [Chapter 6](#), and re-enter the erroneous values.

If a major error and warning are detected, Vmux-2100 aborts the database update and displays the following screen:

```

!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!!!!!!      Attention !                                     !!!!!
!!!!!!      -----                                     !!!!!
!!!!!!                                     !!!!!
!!!!!!      DB UPD FAILED !!!! Data Base was NOT changed      !!!!!
!!!!!!      Sanity Error Occurred - Check Sanity Alarm Report  !!!!!
!!!!!!                                     !!!!!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!!!!!!                                     !!!!!
!!!!!!      Sanity Warning Occurred - Check Sanity Alarm Report.  !!!!!
!!!!!!                                     !!!!!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!

Press 'y' To Exit This Screen

Esc-prev.menu; !-main menu; &-exit                                     1 user(s)
-----

```

Figure 4-63. Sanity Error and Warning Screen

In this case, check the sanity error and warning as described in [Chapter 6](#), and re-enter the erroneous values.

► To undo the changes:

1. Type # and press <Enter>.

Vmux-2100 displays the following confirmation screen.

```

????????????????????????????????????????????????????????????????????????????????????
????????????????????????????????????????????????????????????????????????????????????
????????????????????????????????????????????????????????????????????????????????????
?????????????                                     ???????????
?????????????                                     ???????????
?????????????                                     ???????????
????????????? Are You Sure You Want To Undo All Data Base Changes Y/N)?????????????
?????????????                                     ???????????
?????????????                                     ???????????
?????????????                                     ???????????
????????????????????????????????????????????????????????????????????????????????????
????????????????????????????????????????????????????????????????????????????????????
????????????????????????????????????????????????????????????????????????????????????
Esc-prev.menu; !-main menu; &-exit                                     1 user(s)
-----

```

Figure 4-64. Confirm Undo Database Changes Screen

2. Type Y to abort the changes and use the last saved database settings.

Displaying the Vmux-2100 Inventory

Vmux-2100 inventory displays information on the types of the voice modules detected in the unit, together with their hardware and software versions.

► To display the Vmux-2100 inventory:

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

The Vmux-2100 inventory screen appears (see [Figure 4-65](#)).

Inventory				
Slot Number	Name	HW Revision	SW Revision	
Main Module	Main link E1	02.00	04.00A2	
Slot 1 Group 1	2T1 Voice	01.00	04.00A2	
Slot 1 Group 2	2T1 Voice	01.00	04.00A2	
Slot 2 Group 1	Not exist			
Slot 2 Group 2	Not exist			
Slot 3 Group 1	2T1 IO-M1	01.00	04.00A2	
Slot 3 Group 2	Not exist			
Slot 4 Group 1	2E1 Voice	01.00	04.00A2	
Slot 4 Group 2	Not exist			
>				
@ - Db Update; # - Db Undo				
Esc-prev.menu; !-main menu; &-exit; ?-help				1 user(s)

Figure 4-65. Vmux-2100 Inventory

Restoring Default Settings

You can restore default settings of the external E1/T1 ports. There are two options available:

- **Clean Bundles DB:** Erases only those portions of the database that contain BUNDLE (Voice and ML cards) information.

No information regarding the Main Module or External ports of the IO cards will be erased.

- **Clean Slots DB:** Erases any information regarding the IO cards. IO cards will be totally removed from the database, including the "HUB" menu in the Main menu screen.

No information regarding the Main Module will be erased.

➤ To restore the Vmux-2100 to the defaults:

1. From the System menu (see [Figure 4-2](#)), choose **Factory Defaults**.

The following Factory Defaults menu appears:

```

Factory Defaults

1. Clean Bundles DB
2. Clean Slots DB

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

```

Figure 4-66. Factory Defaults Menu

2. Select the desired option.

Vmux-2100 displays one of the following screens:

```

=====
*****
*****
*****
*****      Set Factory Default      *****
*****      -----                  *****
*****      Are You Sure You Want To Clean The Bundles DB ?(Y/N) *****
*****                                     *****
*****
*****
*****
=====

```

Figure 4-67. Confirm Clean Bundles DB Screen

```

=====
*****
*****
*****
*****      Set Factory Default      *****
*****      -----                  *****
*****      Are You Sure You Want To Clean The Slots DB ?(Y/N) *****
*****                                     *****
*****
*****
*****
=====

```

Figure 4-68. Confirm Clean Slots DB Screen

3. Type Y, and press <Enter>.

Vmux-2100 restores the relevant default settings, depending on the selected option.

Managing the User Database

An administrator manages the database of the users who are allowed to operate or monitor the Vmux-2100 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 the users, including date and time.

Adding a New User to the Database

► To add a new user:

1. From the Management menu (see [Figure 4-3](#)), choose **User Administration**.

The User Administration menu appears (see [Figure 4-69](#)).

```
User Administration
1. Add New User
2. Delete User
3. Change User details
4. Show all users
>

@ - Db Update; # - Db Undo
Esc-prev.menu; !-main menu; &-exit
```

Figure 4-69. User Administration Menu

2. From the User Administration menu, choose **Add New User**.

The Add New User menu appears (see [Figure 4-70](#)).

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

@ - Db Update; # - Db Undo
Esc-prev.menu; !-main menu; &-exit
```

Figure 4-70. Add New User Menu

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

The new user name is displayed.

Note *User names are case-sensitive.*

5. Choose **Enter Access Level** to define the new user access level.
6. Select the desired level (Monitor, Technician, Operator or Administrator).
The access level of a new user is displayed.
7. Choose **Enter Password**.
8. Enter the new user password (four to eight characters), and press **<Enter>**.
Vmux-2100 responds to the password entry with asterisks.
9. Choose **Confirm Password and save**.
10. Enter 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 4-71](#)).

```
Delete User

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

@ - Db Update; # - Db Undo
Esc-prev.menu; !-main menu; &-exit
```

Figure 4-71. Delete User Menu

2. From the Delete User menu, choose **Enter UserName (to delete)**.
3. Enter 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 administrator password to confirm the deletion.

Changing the User Details

Administrator is allowed to change 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 4-72](#)).

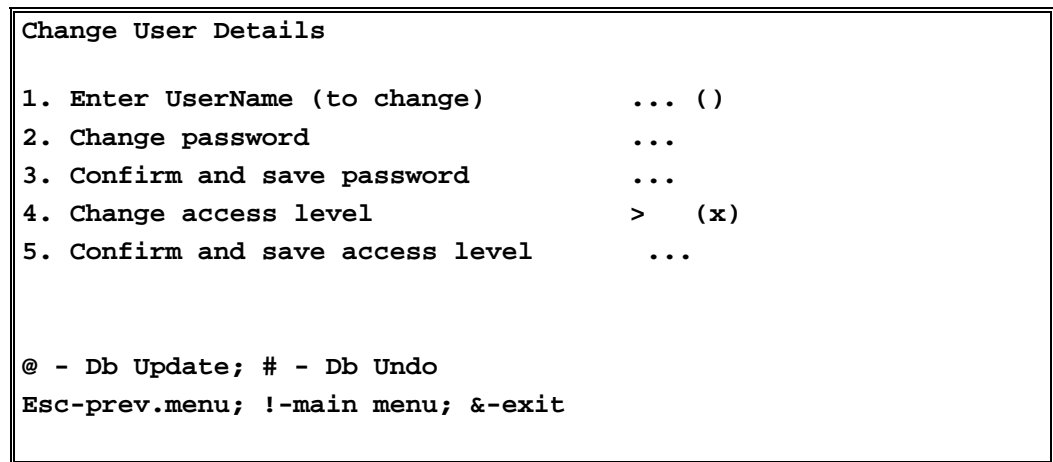


Figure 4-72. Change User Details Menu

2. From the Change User Details menu, choose **Enter UserName (to change)** and then enter the name of the user, whose details you want to change.
3. To change the user password, choose **Change password** and then enter a new password.
4. Choose **Confirm and save password** and then re-enter the new password to confirm the change.
5. To change the user access level, choose **Change access level** and then enter a new value (Monitor, Technician, Operator or Administrator) from the [Change Access Level](#) menu.
6. Choose **Confirm and save access level** and then enter the administrator password to confirm the change.

Displaying the User List

- From the User Administration menu, choose **Show all users**.

The Show All Users screen appears (see [Figure 4-73](#)).

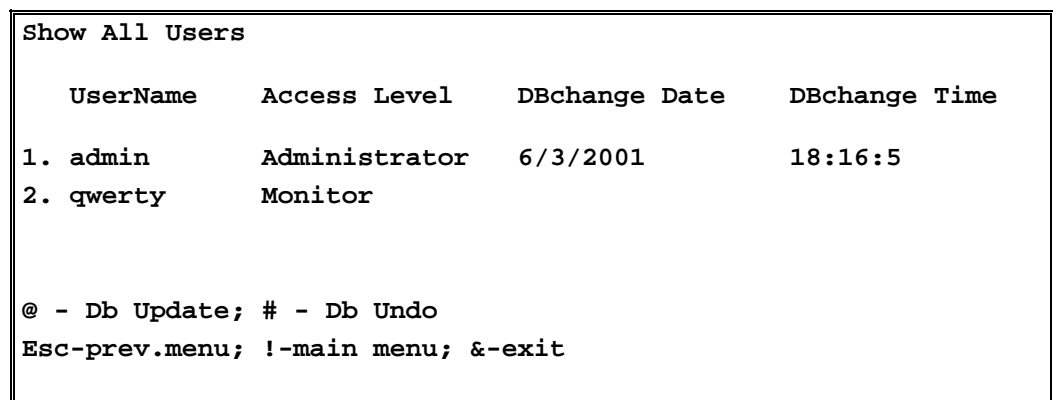


Figure 4-73. Show All Users Screen

Resetting the Vmux-2100 Modules

The Vmux-2100 management software allows you to re-initialize a single E1/T1 group of each voice module or the main board CPU.

Resetting the main board is equivalent to rebooting the entire Vmux-2100 unit.

► **To reset the Vmux-2100 components:**

1. From the System menu (see [Figure 4-2](#)), choose **Reset Card**.

The Reset Card menu appears (see [Figure 4-74](#)).

```
Reset Card

Reset Slot-1 Group-1
Reset Slot-1 Group-2
Reset Slot-2 Group-1
Reset Slot-2 Group-2
Reset Slot-3 Group-1
Reset Slot-3 Group-2
Reset Slot-4 Group-1
Reset Slot-4 Group-2
Reset MainBoard

@ - Db Update; # - Db Undo
Esc-prev.menu; !-main menu; &-exit
```

Figure 4-74. Reset Card Menu

2. From the Reset Card menu, select a Vmux-2100 component to reset by typing its number, and pressing **<Enter>**.

Vmux-2100 displays the following message:

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

3. Type **Y**, and press **<Enter>**.

The card is re-initialized; the software from the active partition of the modules' storage is decompressed and loaded into the RAM.

Setting Date and Time

There are two options for setting the date and time:

- Using a read-only external clock (NTP protocol)
- Using the Vmux-2100 internal clock.

NTP (External Clock Source)

► **To set the date and time:**

1. From the Main Menu, select **Configuration > System > Date & Time Update**.
2. Set the **Clock Source** parameter to **NTP**.

The following screen appears:

Time (hh:mm)	...	(16:58)
Date	...	(28/2/2007)
1. Clock Source	>	(NTP)
2. Date Format	>	(European Format [dd/mm/yyyy])
3. NTP Server IP Address	...	(172.17.150.1)
4. GMT (+/- XX)	>	(+2 [Jerusalem, Kyiv])

Figure 4-75. Date & Time Menu - External Clock Source (NTP)

Table 4-2. Date & Time Parameters- External Clock Source (NTP)

Parameter	Description	Possible Values/Reference
Time	Displays the current time	Valid time in hh:mm format
Date	Displays the current date	According to the format selected in the Date Format parameter
Clock Source	Sets the clock source	NTP Internal Default: NTP [External]
Date Format	Sets the date display format <i>Note: All date displays (alarms, traps, administration records) are according to the selected date format.</i>	American Format [mm/dd/yyyy] European Format [dd/mm/yyyy] ISO-8601 Format [yyyy/mm/dd] Default: American Format [mm/dd/yyyy]
NTP Server IP Address	Sets the NTP-server IP Address <i>Note: This parameter is available only if Clock Source is set to NTP [External].</i>	0.0.0.0....255.255.255.255 Default: 0.0.0.0
GMT	Sets the GMT offset <i>Note: This parameter is available only if Clock Source is set to NTP [External].</i>	-12....+11 Default: 0 (GMT)

Internal

1. From the Main Menu, select **Configuration > System > Date & Time Update**.
2. Set the **Clock Source** parameter to **Internal**.

The following screen appears:

1. Clock Source	>	(Internal)
2. Time (hh:mm)	...	(00:00)
3. Date	...	(8/4/2000)
4. Date Format	>	(European Format [dd/mm/yyyy])

Figure 4-76. Date & Time Menu - Internal Clock Source

Table 4-3. Date & Time Parameters - Internal Clock Source

Parameter	Description	Possible Values/Reference
Clock Source	Sets the clock source	NTP Internal Default: NTP
Time	Displays the current time	Valid time in hh:mm format
Date	Displays the current date	According to the format selected in the Date Format parameter
Date Format	Sets the date display format <i>Note: All date displays (alarms, traps, administration records) are according to the selected date format.</i>	American Format [mm/dd/yyyy] European Format [dd/mm/yyyy] ISO-8601 Format [yyyy/mm/dd] Default: American Format [mm/dd/yyyy]

Chapter 5

Configuring Typical Applications

This chapter gives detailed instructions for configuring Vmux-2100 for a typical application in which two Vmux-2100 units operate point-to-point over a TDM network.

Figure 5-1 illustrates a typical TDM application, in which two Vmux-2100 units with VCA-4E1 modules transmit four E1 trunks over a single E1 link.

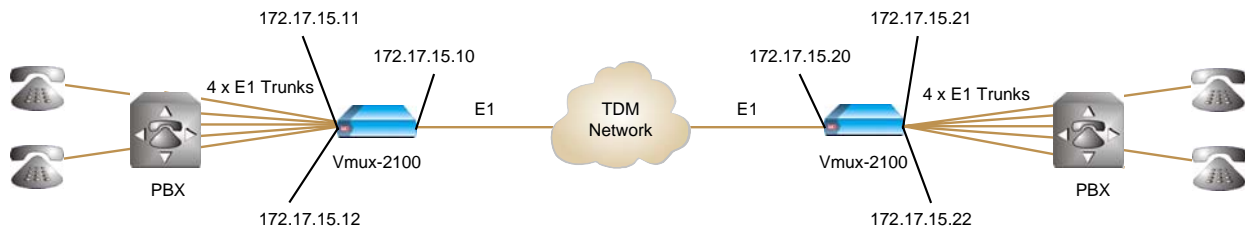


Figure 5-1. Typical TDM Application

The following network requirements exist:

- Four E1 trunks over one E1 link
- Each local timeslot carries voice. It is routed to the same timeslot of the corresponding E1 port at the remote site
- CAS signaling or CCS signaling
- G.732S or G.732N framing mode, without CRC-4 bits generation
- G.729 A voice compression
- Loopback timing
- Fax relay at 9.6 kbps.

5.1 Configuration Sequence

The recommended configuration procedure for the local and remote Vmux-2100 units includes the following steps:

- Configuring the IP host parameters for both units via an ASCII terminal connection.
- Installing the two units at their locations.
- Configuring the local Vmux-2100.

- Saving the configuration file (cnfg.dat) of the local unit at the management station.
- Downloading the configuration file to the remote Vmux-2100 and updating its database.
- Changing the IP addresses of the remote E1 groups to the valid ones.

5.2 Configuring Vmux-2100 for Operation with CAS

Most of the configuration procedures are performed on the local unit, except for defining IP host parameters and IP addresses for the remote E1 groups.

The configuration procedure is divided into three main stages:

- Defining system parameters.
- Configuring main link parameters.
- Setting voice card parameters.

Note

You must save the selected values by updating the Vmux-2100 database. If the database is not updated, Vmux-2100 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-2100 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, and VT100 emulation.
2. Connect the terminal to the local Vmux-2100 DB-9 CONTROL port.
3. Press <Enter> to initiate the control session and then enter the user name and password.
4. Verify that the main link card (M-IPE1) and the voice card (VCA-4E1) are identified by Vmux-2100 (**Main Menu > Inventory**).
5. Display the Host IP menu and enter the host IP address (172.17.15.10), its subnet mask and default gateway values (**Main Menu > Configuration > System > Management > Host IP**).
6. Repeat step 2 to step 5 for the Vmux-2100 unit to be installed at the remote location.

Note

The rest of the configuration procedure refers to the local unit. Information applicable to both units (or only to remote Vmux-2100) is explicitly identified.

7. 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 VCA-4E1 card (**Main Menu > Configuration > System > Management > Signaling Configuration > Signaling Profile Configuration**).

8. Display the Hub menu and enter the existing main link card (M-IPE1) and the voice card (VCA-4E1) into the unit's database (**Main Menu > Configuration > Hub**).

Configuring E1 Main Link Parameters

► Configuring the E1 main link parameters:

1. Display the Main Link menu, and configure the E1 main link parameters to the following values (**Main Menu > Configuration > Card > Main Board > E1 Parameters > Main Link 1**):
 - Connect – Yes
 - Frame – G.732N
 - Restoration – CCITT
 - Clock Source – Lbt
 - Interface Type – Dsu
 - Idle Code – 7E.
2. Display the Time Slot Table menu and assign the timeslots to carry data (**Main Menu > Configuration > Card > Main Board > E1 Parameters > Time Slot Table**):
 - **Yes** – connected (assigned)
 - **No** – disconnected (not assigned).

Configuring Voice Card Parameters

► Configuring the voice card parameters:

1. Display the Group 1 menu, and assign the 172.17.15.11 IP address to the group 1 (**Main Menu > Configuration > Card > Slot 1 > Group 1**).
2. Display the Bundle Configuration menu, and add bundle 1 to the system (**Main Menu > Configuration > Card > Slot 1 > Group 1 > Bundles Parameters > Bundle Configuration**).
3. For group 1 external 1, add the bundle number 1 to the system ((**Main Menu > Configuration > Card > Slot 1 > Group 1 > Bundles Parameters > Bundle Configuration > Add Bundle**)).
4. Display the Edit Bundle menu, and configure the group 1 bundle 1 parameters to the following values (**Main Menu > Configuration > Card > Slot 1 > Group 1 > Bundles Parameters > Bundle Configuration > Edit Bundle**):
 - Enter Bundle Number – 1
 - Connect – Yes
 - Function – TDMoIP+
 - Routing Parameters > Destination IP – 172.17.15.21
 - Routing Parameters > Destination Bundle – 1
 - Max Bytes In Multiplexed Frame – 500

- Packetizing Interval – 30
 - Connectivity Parameters > Connectivity Mode – With Ping
 - Connectivity Parameters > Connectivity-packet rate – 60 sec
 - Connectivity Parameters > Connectivity timeout cycles – 3
 - Voice Parameters > Coder/Rate – G.723.1/6.4
 - Voice Parameters > Fax/Modem – Enable at 9.6 kbps.
5. Display the E1 Parameters menu, and set the E1 port of group 1 to the following values (**Main Menu > Configuration > Card > Slot 1 > Group 1 > External 1 > E1 Parameters**):
 - Connect – Yes
 - Frame – G.732S
 - Interface Type – Dsu
 - Restoration Time – CCITT
 - Clock Source – Lbt
 - Idle Code – 7E
 - Profile – 1.
 6. Display the Time Slot Configuration menu, and configure the timeslots belonging to the external port 1 of group 1 (**Main Menu > Configuration > Card > Slot 1 > Group 1 > External 1 > Distribution Of Framer Time Slots > Time Slot Configuration**):
 - Update from Time Slot – 1
 - To Time Slot – 31
 - Type – Voice
 - Bundle – 1
 - Destination Port ID – 1
 - Destination Time Slot ID – 1.

Note

Vmux-2100 displays timeslot 16 as 'Not Connected' (NC), because it carries CAS signaling information.

7. Update the timeslot database from the Time Slot Configuration menu.
8. Repeat step 3 to step 7 for the external port 2 of group 1, except for the following:
 - Assign **2** to the Destination Port ID for the timeslots in step 6.
9. Display the Group 2 menu, and assign the 172.17.15.12 IP address to the group 2 (**Main Menu > Configuration > Card > Slot 1 > Group 2**).
10. Repeat step 2 to step 7 for the external port 1 of group 2, except for the following:
 - Assign destination IP 172.17.15.21 to the bundle 1 in step 4
 - Assign **3** to the Destination Port ID for the timeslots in step 7.

11. Repeat step 5 to step 7 for the external port 2 of group 2, except for the following:

- Assign **4** to the Destination Port ID for the timeslots in step 6.

Figure 5-2 summarizes the external E1 bundle and timeslot configuration of the local and remote units.

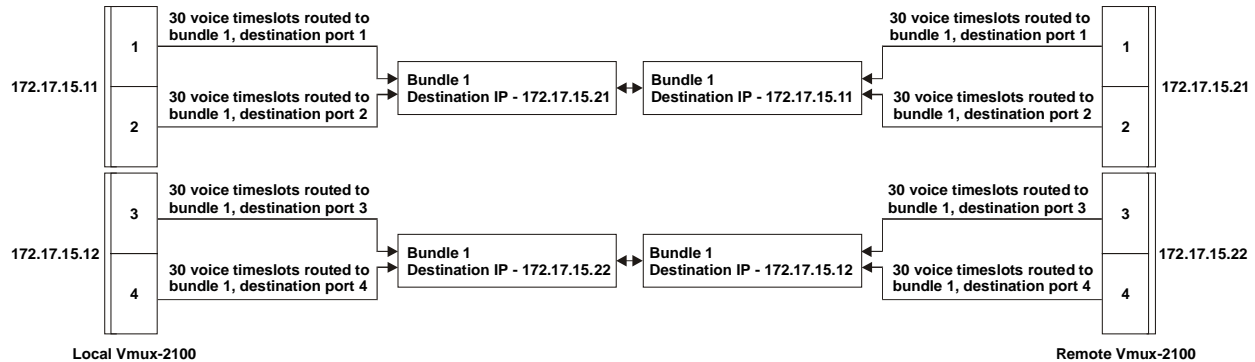


Figure 5-2. External E1 Bundle and Timeslot Configuration

5.3 Transferring Database to Remote Vmux-2100

- To transfer the database to the remote Vmux-2100:
 1. Upload the **cnfg.dat** file from the local Vmux-2100 to the management station via the TFTP protocol.
 2. Download the **cnfg.dat** file to the remote Vmux-2100 via the TFTP protocol.
 3. Establish a Telnet connection.
 4. Update the remote Vmux-2100 database by typing **@**.

Note

The host IP and the main link values do not change when you download the new configuration and update the database.

5.4 Completing Remote Vmux-2100 Configuration

The only difference between configurations of the local and remote units is the source and destination IP addresses of their bundles.

- To complete the remote Vmux-2100 configuration:
 1. Display the Group 1 menu, and assign the 172.17.15.21 IP address to the group 1 (**Main Menu > Configuration > Card > Slot 1 > Group 1**).
 2. Display the Group 2 menu, and assign the 172.17.15.22 IP address to the group 2 (**Main Menu > Configuration > Card > Slot 1 > Group 2**).
 3. Display the Edit Bundle menu, and configure the group 1 bundle 1 destination IP to 172.17.15. 11 (**Main Menu > Configuration > Card > Slot 1 > Group 1 > Bundles Parameters > Bundle Configuration > Edit Bundle**).

4. Display the Edit Bundle menu, and configure the group 2 bundle 1 destination IP to 172.17.15. 12 (**Main Menu > Configuration > Card > Slot 1 > Group 2 > Bundles Parameters > Bundle Configuration > Edit Bundle**).

Now local and remote Vmux-2100 units are ready for operation.

5.5 Configuring Vmux-2100 for Operation with CCS

Configuration of the Vmux-2100 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 framing type of the external E1 links to G.732N (**Main Menu > Configuration > Card > Slot 1 > Group 1 > External 1 > E1 Parameters**).
2. Display the Time Slot Configuration menu, and configure the timeslots belonging to the external port 1 of group 1 (**Main Menu > Configuration > Card > Slot 1 > Group 1 > External 1 > Distribution Of Framer Time Slots > Time Slot Configuration**):
 - Update from Time Slot – 1
 - To Time Slot – 31
 - Type – Voice
 - Bundle – 1
 - Destination Port ID – 1
 - Destination Time Slot ID – 1.
5. Once you assign all timeslots belonging to the external port 1 of group 1 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 – HDLC
 - Bundle – 1
 - Destination Port ID – 1
 - Destination Time Slot ID – 31.
6. Update the timeslot database from the Time Slot Configuration menu.
7. Repeat step 1 to step 4 for all active external ports on all Vmux-2100 slots.
8. When working with CCS-SS7, you can instruct Vmux-2100 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**).

Chapter 6

Troubleshooting and Diagnostics

This chapter describes the Vmux-2100 troubleshooting and diagnostic functions.

6.1 Monitoring Performance

This section explains how to display performance data collected on the Vmux-2100 main link and E1/T1 groups.

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

Displaying Statistics for Voice Modules and Channelized E1/T1 Main Link Modules

Vmux-2100 supports statistics collection of the voice E1/T1 group performance, as well as the bundle statistics of the channelized E1/T1 main links. Statistics are accessed via the Cards Statistics menu.

► To display the Card Statistics menu:

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

The Monitoring menu appears.

2. From the Monitoring menu, choose **Statistics**.

The Statistics menu appears (see [Figure 6-1](#)).

```
Statistics

1. Cards statistics
2. Main Module statistics
3. Clear All Statistics
>

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

Figure 6-1. Statistics Menu

3. From the Statistics menu, choose **Cards Statistics**.

The Cards Statistics menu appears (see [Figure 6-2](#)).

```

Cards statistics

1. Data statistics
2. Bundles / Channelized Bundles statistics
3. Voice statistics
4. Voice Rx Signaling statistics
5. Voice Tx Signaling statistics
>

@ - Db Update; # - Db Undo
Esc-prev.menu; !-main menu; &-exit

```

Figure 6-2. Cards Statistics Menu

Displaying E1/T1 Group Data Statistics

When the E1/T1 timeslots are configured to carry any kind of data (HDLC, SS7 or Transparent), Vmux-2100 collects data traffic statistics (see [Figure 6-6](#)).

[Table 6-1](#) describes the data statistics values.

► To display the E1/T1 group data statistics:

1. From the Cards Statistics menu, choose **Data statistics**.

The Data statistics menu appears (see [Figure 6-3](#)).

```

Data statistics

1. Slot > (Slot 1)
2. Group Number> (Group 1)
3. External > (External 1)
4. Channel > (HDLC-1)
5. Mode >

>

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

```

Figure 6-3. Data Statistics Menu

2. From the Data Statistics menu, choose **Slot**, and then enter the desired slot number from the displayed list to select the slot.
3. From the Data Statistics menu, choose **Group Number**, and then enter the desired group number from the displayed list to select the group.
4. From the Data Statistics menu, choose **External**, and then enter the desired external link number from the displayed list to select the link.
5. From the Data Statistics menu, choose **Channel**.

The Channel menu appears.

6. From the Channel menu, select the desired data type.

```

Channel      (SS7-1)

1. SS7-1
2. SS7-2
3. HDLC-1
4. HDLC-2
5. HDLC-3
6. HDLC-4
7. TRANSP-1
8. PH-2 COMPT.
9. SUB-CH-1
10. SUB-CH-2
11. SUB-CH-3
12. SUB-CH-4
13. SUB-CH-5
14. SUB-CH-6
15. SUB-CH-7
16. SUB-CH-8
>

Please select item <1 to 16>
@ - Db Update; # - Db Undo
Esc-prev.menu; !-main menu; &-exit                                1 user(s)
-----

```

Figure 6-4. Channel Menu

7. 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 6-5. Mode Menu

8. From the Mode menu, choose **Display** to display the statistics for the selected E1/T1 group and channel or **Clear** to clear the statistics registers for the selected group. [Figure 6-6](#) shows a typical Data Statistics Screen for the HDLC data. The SS7 statistics screen look similar. [Table 6-1](#) explains the HDLC and SS7 statistics parameters.

```
Data Statistics on Slot 1 External 1 Data Ch :HDLC-1
```

Rx statistics									
Total Frames	:	[	0	]	Total Bytes	:	[	0]
60 sec Frames	:	[	0	]	60 sec Bytes	:	[	0]
LG Err	:	[	0	]	NO Err	:	[	0]
CR Err	:	[	0	]	OV Err	:	[	0]
AB Err	:	[	0]					

Tx statistics									
Total Frames	:	[	0	]	Total Bytes	:	[	0]
60 sec Frames	:	[	0	]	60 sec Bytes	:	[	0]
UN Err	:	[	0]					

Tx Queue Low - Max Frames	:	[	0	]	Current Frames	:	[	0]
Tx Queue High - Max Frames	:	[	0	]	Current Frames	:	[	0]

Press 'Y' for refresh.

Esc-prev.menu; !-main menu; &-exit

Figure 6-6. Sample E1/T1 Group Statistics Screen (HDLC)

In this table, the direction of the statistics is as follows:

- Rx: Received from the local switch/PBX
- Tx: Transmitted to the local switch/PBX.

Note also that in this table "data" refers to the selected data channel (SS7-1, SS7-2, HDLC-1, HDLC-2, HDLC-3, HDLC-4, TRANSP-1, Sub CH-1, Sub CH-2, Sub CH-3, Sub CH-4, Sub CH-5, Sub CH-6, Sub CH-7, Sub CH-8), rather than to total data statistics.

Table 6-1. E1/T1 Group Data Statistics

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
Tx Total Frames	Total number of data packets transmitted
Tx Total Bytes	Total number of data octets of all packets transmitted
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 Queue Low - Max Frames	Maximum number of frames that were queued in the low priority queue, since the last clear command.
Tx Queue Low - Current Frames	Current number of frames in the low priority queue, since the last clear command.
Tx Queue High - Max Frames	Maximum number of frames that were queued in the high priority queue, since the last clear command.
Tx Queue High - Current Frames	Current number of frames in the high priority queue, since the last clear command.

The Data Statistics Screen for the transparent data looks slightly different (see [Figure 6-7](#)) and contains additional parameters listed in [Table 6-2](#).

Data Statistics on Slot 1 External 1 Data Ch :TRN					
Rx statistics					
Total Frames	:	[1272]	Total Bytes	:	[101760]
60 sec Frames	:	[504]	60 sec Bytes	:	[40320]
LG Err	:	[0]	NO Err	:	[0]
CR Err	:	[0]	OV Err	:	[54]
AB Err	:	[0]			
Tx statistics					
Total Frames	:	[0]	Total Bytes	:	[0]
60 sec Frames	:	[0]	60 sec Bytes	:	[0]
UN Err	:	[0]			
Over Flow :[0] In Q:[0] In BD:[0] Un Fill In :[0]					
Tx Queue High - Max Frames :[0] Current Frames :[0]					
Press 'Y' for refresh.					
ESC-prev.menu; !-main menu; &-exit					1 user(s)

Figure 6-7. Sample E1/T1 Group Statistics Screen (Transparent)

Table 6-2. E1/T1 Group Data Statistics: Additional Parameters for Transparent Data

Field	Description
Over Flow	Number of Transparent packets that were discarded by the system due to an overflow.
In Q	Number of blocks currently in the Level 2 Tx Q
In BD	Number of blocks currently in the Level 1 Tx Q Level 1 Tx Q + Level 2 Tx Q equal the current depth of the JITTER BUFFER
Un Fill In	Number of dummy packets that were transmitted to the channel because packets from the link were missing / did not arrive on time.

Displaying Bundle Statistics for Voice Modules

The Vmux-2100 software enables you to evaluate performance of an individual bundle (see [Figure 6-9](#)). [Table 6-3](#) describes the bundle statistics values.

The bundles may have one of the following status:

- **Connect** – Bundle connectivity is up
- **Disconnected** – The bundle is configured to CONNECT = NO
- **Echo Wait** – There is IP connection, but the remote bundle is not active since the UDP level is down

- **IP OOS** – There is no IP connectivity between bundles. The reason for this condition may be an illegal IP address of the destination E1/T1 group, or network problems.

Tracking Packets

You can use packet tracking 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: 36,41,42,43,44,45,46.... 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 Cards Statistics menu, choose **Bundles statistics**.

The Bundles statistics menu appears (see [Figure 6-8](#)).

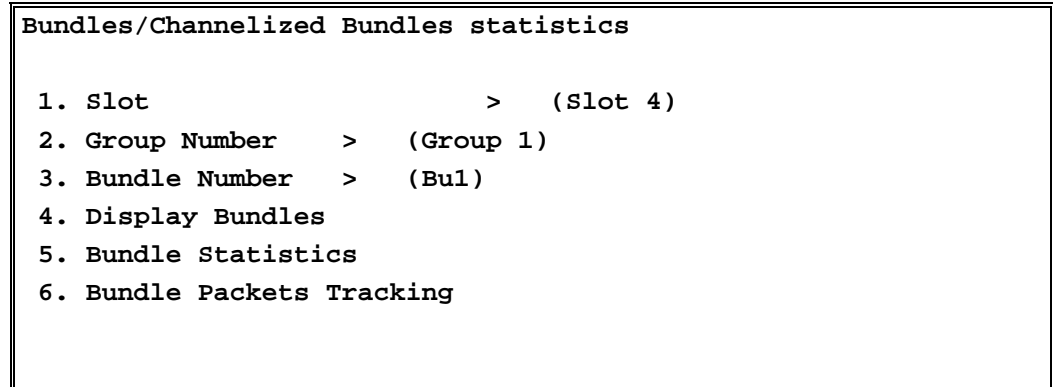


Figure 6-8. Bundles Statistics Menu

2. From the Bundle Statistics menu, choose **Slot**, and then enter the desired slot number from the displayed list to select the slot.
3. From the Bundle Statistics menu, choose **Group Number**, and then enter the desired group number from the displayed list to select the group.
4. From the Bundle Statistics menu, choose **Bundle Number**, and then enter the desired bundle number (from **1** to **30**) to select the bundle.
5. From the Bundle Statistics menu, choose **Display Bundles** to display the selected E1/T1 group bundle statistics (see [Figure 6-9](#)).

[Table 6-3](#) describes the bundle statistics values. The direction of the statistics is as follows:

- Rx: Received from the TDM/IP network
- Tx: Transmitted to the TDM/IP network.

```

Statistics on Slot: 4, Group: 1, Bundle: 1, State: DISCONNECT

                        Rx statistics
Total Frames   :[      1253 ]  Total Bytes   :[      76130 ]
60 sec Frames  :[          0 ]  60 sec Bytes  :[          0 ]

                        Tx statistics Type
Total Frames   :[      1080 ]  Total Bytes   :[     114450 ]
60 sec Frames  :[          0 ]  60 sec Bytes  :[          0 ]
Tx on Timeout  :[      1080 ]  Tx Max Size   :[          0 ]
60 sec Timeout :[          0 ]  60 sec Max Size :[          0 ]

                        Data Type
Total - Rx Sg  :[      6200 ] Rx Voice :[      509 ] Rx Hd1c :[          0 ]
60 sec- Rx Sg  :[          0 ] Rx Voice :[          0 ] Rx Hd1c :[          0 ]
Total - Tx Sg  :[      6196 ] Tx Voice :[      306 ] Tx Hd1c :[          0 ]
60 sec- Tx Sg  :[          0 ] Tx Voice :[          0 ] Tx Hd1c :[          0 ]

Silence percent on bundle - Rx :[      100 ]  Tx :[      100 ]
Discarded Overflow Packets: [          0 ]

Press 'Y' for refresh , ESC - for exit.

```

Figure 6-9. Bundle Statistics

6. From the Bundle Statistics menu, choose **Bundle Statistics** to display the channelized main link bundle statistics (see [Figure 6-10](#)).

[Table 6-4](#) describes the main link bundle statistics values. In the table, the direction of the statistics is as follows:

- Rx: Received from the TDM/IP network
- Tx: Transmitted to the TDM/IP network.

```

Channelized Hdlc Stat on Slot 1 Group 1 External 1 Bundle 1

                                Rx statistics
Total Frames      :[          0 ]      Total Bytes      :[          0 ]
60 sec Frames    :[          0 ]      60 sec Bytes     :[          0 ]
LG Err           :[          0 ]      NO Err           :[          0 ]
CR Err           :[          0 ]      OV Err           :[          0 ]
AB Err           :[          0 ]

                                Tx statistics
Total Frames      :[          0 ]      Total Bytes      :[          0 ]
60 sec Frames    :[          0 ]      60 sec Bytes     :[          0 ]
UN Err           :[          0 ]

Tx Queue Low  - Max Frames :[  0 ]      Current Frames :[  0 ]
Tx Queue High - Max Frames :[  0 ]      Current Frames :[  0 ]
Incoming BW From Bus: Avg. [          0 ] Max :[          0 ] bps
Outgoing BW To Line: Avg. [          0 ] Max :[          0 ] bps
User Configured BW:                [  64000 ] bps

Press 'Y' for refresh.

```

Figure 6-10. Bundle Statistics for Channelized E1/T1 Main Link Module

- From the Bundle Statistics menu, choose **Bundle Packets Tracking** to display the statistics for the packets sequential (see [Figure 6-11](#)).

[Table 6-5](#) describes the bundle packets tracking statistics values.

```

Statistics on Slot: 1, Group: 1, Bundle: 1, State: ECHO WAIT

                                Rx statistics
Num Of Freed Packets.....[          0]
Num Of missing Packets.....[          1]
Longest Series Of Missing Packets.....[          1]

Num of Series With 1 Missing Packet.....[          1]
Num of Series With 2 Missing Packets.....[          0]
Num of Series With 3 Missing Packets.....[          0]
Num of Series With 4 Missing Packets.. [          0]
Num of Series With 5 Missing Packets.....[          0]
Num of Series With More Than 5 Missing Packets..[          0]

Press 'Y' for refresh.

```

Figure 6-11. Bundle Statistics Packets Tracking

Table 6-3. E1/T1 Voice Bundle Statistics Values

Field	Description
State	State of this bundle
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 data packets transmitted
Tx Total Bytes	Total number of data octets of all packets transmitted
Tx 60 sec Frames	Number of data 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
Tx 60 sec Timeout	Number of packets transmitted as a result of reaching the maximum packetizing interval during the last 60 seconds
Tx 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 bits
Total - Rx Voice	Total number of received voice bits
Total - Rx HdLc	Total number of received data bits
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 data packets received during last 60 seconds
Total - Tx Sg	Total number of transmitted signaling bits
Total - Tx Voice	Total number of transmitted voice bits
Total - Tx HdLc	Total number of transmitted HDLC bits
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 data 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
Discarded Overflow Packets	Number of voice packets that were discarded when bandwidth was not available.
seq num: freed	Number of duplicate packets that were received and dropped. (Duplicate problem in the network)

Table 6-3. E1/T1 Voice 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)

Table 6-4. Statistics Values for Channelized E1/T1 Main Link Module

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 LG Err	Number of packets received with frame length violations
Rx NO Error	Number of non-octet aligned packets received
Rx CR Error	Number of packets received containing CRC errors
Rx OV Error	Number of overrun errors in the received packets
Rx AB Error	Number of packets received with abort sequence violations (7 or more consecutive ones)
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 UN Err	Number of transmitted HDLC packets discarded due to lack of buffer resources
Tx Queue Low - Max Frames	Maximum number of frames that were queued in the low priority queue, since the last clear command.
Tx Queue Low - Current Frames	Current number of frames in the low priority queue, since the last clear command.
Tx Queue High - Max Frames	Maximum number of frames that were queued in the high priority queue, since the last clear command.
Tx Queue High - Current Frames	Current number of frames in the high priority queue, since the last clear command.
Incoming BW From Bus - Avg.	Current TDM bandwidth transmitted since the last clear.
Incoming BW From Bus - Max	Peak TDM bandwidth transmitted since the last clear.

Table 6-4. Statistics Values for Channelized E1/T1 Main Link Module (Cont.)

Field	Description
Outgoing BW To Line – Avg.	Current bandwidth transmitted on the line since the last clear (adds HDLC flags and CRC to TDM bandwidth).
Outgoing BW To Line - Max	Peak bandwidth transmitted on the line since the last clear (adds HDLC flags and CRC to TDM bandwidth).
User Configured BW	According to the number of physical time slots allocated to the bundle (nx64).

Table 6-5. Bundle Packets Tracking Statistics Values

Field	Description
Freed	Number of packets were dropped because they were duplicates (meaning that they had the same sequential number as a packet before them).
Missing	Total number of packets missing (according to the last arrived sequential number).
Longest Series Of Missing Packets	Longest number of consecutive missing sequential numbers.

Displaying Timeslot Voice Statistics

The Vmux-2100 software enables you to evaluate performance of an individual timeslot as well as the performance of the DSP it uses (see [Figure 6-13](#)).

[Table 6-6](#) describes the timeslot voice statistics values.

► To display the timeslot voice statistics:

1. From the Cards Statistics menu, choose **Voice statistics**.

The Voice statistics menu appears (see [Figure 6-12](#)).

```

Voice statistics

1. Slot          >   (Slot 1)
2. Group Number >   (Group 1)
3. External      >   (External 1)
4. Time Slot     [1 - 31]... (1)
5. Mode

>

@ - Db Update; # - Db Undo
Esc-prev.menu; !-main menu; &-exit

```

Figure 6-12. Voice Statistics Menu

2. From the Voice Statistics menu, choose **Slot**, and then enter the desired slot number from the displayed list to select the slot.

3. From the Voice Statistics menu, choose **Group Number**, and then enter the desired group number from the displayed list to select the group.
4. From the Voice Statistics menu, choose **External**, and then enter the desired external link number from the displayed list to select the external link.
5. From the Voice Statistics menu, choose **Time Slot**, and then enter the number of the desired voice timeslot (from **1** to **31** for E1 ports; from **1** to **24** for T1 ports).
6. From the Voice Statistics menu, choose **Mode**.

The Mode menu appears.

7. From the Mode menu, choose **Display** to display the selected timeslot voice statistics (see [Figure 6-13](#)) or **Clear** to clear the statistics registers.

```

Voice Statistics on Slot: 1, Port: 1, Time Slot: 1

Dsp Mode      :[          VOICE ]
Total Rx Voice :[          20 ]   Total Tx Voice  :[          0 ]
Total Rx Sid   :[          1 ]   Total Tx Sid     :[          0 ]
Total Rx Fax   :[          0 ]   Total Tx Fax     :[          0 ]
Total Underrun :[          0 ]   Total Overrun   :[          0 ]
Total Heartbeat:[        8914 ]
Max jitter len :[          150 ]
Silence percent since last clear: Rx: [          100 ] Tx: [          100 ]

                                Q50
64K Seize      :[          0]   Speech Seize     :[          0]
Release        :[          0]   Not Available    :[          0]
Speech Ack     :[          0]   Speech Nack      :[          0]
64K Nack       :[          0]   Circuit State    :[NOT USED ]

Press 'Y' for refresh , ESC - for exit.

Esc-prev.menu; !-main menu; &-exit

```

Figure 6-13. Timeslot Voice Statistics Screen

In the following table, the direction of the statistics is as follows:

- Rx: Received from the local switch/PBX
- Tx: Transmitted to the local switch/PBX.

Table 6-6. Timeslot Voice Statistics Values

Field	Description
DSP Mode	<ul style="list-style-type: none"> • IDLE – DSP is idle For unconfigured channels, mode should always be IDLE • VOICE – DSP is transmitting voice packets • DATA – DSP is transmitting modem packets • FAX – DSP is relaying fax signal • VOICEBAND – DSP is transmitting voiceband data (modem) • TANDEM - Super Tandem has been triggered <p>The DSP mode for Voice channels should always be VOICE, with the following exceptions:</p> <ul style="list-style-type: none"> • Modem transmission: mode is VOICEBAND • Fax transmission: mode is FAX • Super Tandem was triggered: mode is TANDEM.
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 Underun	Total underrun of the jitter buffer (in packets)
Total Overun	Total overrun of the jitter buffer (in packets)
Max jitter len	Max length of the jitter buffer (in msec)
Heartbeat	An up-counter that is updated by the DSP a few times every second. It indicates that the DSP is alive and functioning. If the value of this field is not increasing periodically, this may indicate an error state in the DSP that requires a DSP RESET.
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
64K Seize	Number of 64K clear channel requests from PBX
Speech Seize	Number of 3.1K voice channel requests from PBX
Release	Number of calls that were released by Vmux after established
Not Available	Number of times channel was not available
Speech Ack	Number of 3.1K voice channel requests being accepted by Vmux
Speech Nack	Number of 3.1K voice channels requests being rejected by Vmux

Table 6-6. Timeslot Voice Statistics Values (Cont.)

Field	Description
64K Nack	Number of 64K clear channel requests being rejected by Vmux
Circuit State	<ul style="list-style-type: none"> • OOS – Q.50 is enabled but signaling between Vmux and PBX is out of service • USED – Q.50 is enabled and signaling between Vmux and PBX is activate • NOT USED – Q.50 is not available on this channel

Displaying the Voice Signaling Statistics

When operating with the CAS signaling, Vmux-2100 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 6-14](#) and [Figure 6-15](#)).

- **Rx signaling** – Signaling transmitted from the DSP (from the switch/PBX)
- **Tx signaling** – Signaling transmitted towards the DSP (to the switch/PBX).

➤ To display the timeslot voice statistics:

1. From the Cards Statistics menu, choose **Voice Rx Signaling Statistics** to display Rx Signaling or choose **Voice Tx Signaling Statistics** to display Tx Signaling.
2. From the Voice Rx/Tx Signaling Statistics menu, choose **Slot**, and then enter the desired slot number from the displayed list to select the slot.
3. From the Voice Rx/Tx Signaling Statistics menu, choose **Group Number**, and then enter the desired group number from the displayed list to select the group.
4. From the Voice Rx/Tx Signaling Statistics menu, choose **External**, and then enter the desired external link number from the displayed list to select the link.
5. From the Voice Rx/Tx Signaling Statistics menu, choose **Mode**.
The Mode menu appears.
6. From the Mode menu, choose **Display** to display the voice statistics for the selected link.

```

Voice Rx Signaling Statistics on Slot: 1, Port: 1

Ts1  :[      1111 ]   Ts2  :[      1111 ]   Ts3  :[      0000 ]
Ts4  :[      0000 ]   Ts5  :[      0000 ]   Ts6  :[      1111 ]
Ts7  :[      1111 ]   Ts8  :[      0000 ]   Ts9  :[      0000 ]
Ts10 :[      0000 ]   Ts11 :[      1111 ]   Ts12 :[      1111 ]
Ts13 :[      0000 ]   Ts14 :[      0000 ]   Ts15 :[      0000 ]
Ts17 :[      1111 ]   Ts18 :[      0000 ]   Ts19 :[      0000 ]
Ts20 :[      0000 ]   Ts21 :[      1111 ]   Ts22 :[      1111 ]
Ts23 :[      0000 ]   Ts24 :[      0000 ]   Ts25 :[      0000 ]
Ts26 :[      1111 ]   Ts27 :[      0000 ]   Ts28 :[      0000 ]
Ts29 :[      0000 ]   Ts30 :[      0000 ]   Ts31 :[      0000 ]

Press 'Y' for refresh , ESC - for exit.

Esc-prev.menu; !-main menu; &-exit

```

Figure 6-14. Voice Rx Signaling

```

Voice Tx Signaling Statistics on Slot: 1, Port: 1

Ts1  :[      1000 ]   Ts2  :[      1000 ]   Ts3  :[      0000 ]
Ts4  :[      0000 ]   Ts5  :[      0000 ]   Ts6  :[      1000 ]
Ts7  :[      1000 ]   Ts8  :[      0000 ]   Ts9  :[      0000 ]
Ts10 :[      0000 ]   Ts11 :[      1000 ]   Ts12 :[      1000 ]
Ts13 :[      0000 ]   Ts14 :[      0000 ]   Ts15 :[      0000 ]
Ts17 :[      1000 ]   Ts18 :[      0000 ]   Ts19 :[      0000 ]
Ts20 :[      0000 ]   Ts21 :[      1000 ]   Ts22 :[      1000 ]
Ts23 :[      0000 ]   Ts24 :[      0000 ]   Ts25 :[      0000 ]
Ts26 :[      1000 ]   Ts27 :[      0000 ]   Ts28 :[      0000 ]
Ts29 :[      0000 ]   Ts30 :[      0000 ]   Ts31 :[      0000 ]

Press 'Y' for refresh , ESC - for exit.

Esc-prev.menu; !-main menu; &-exit

```

Figure 6-15. Voice Tx Signaling

Displaying Statistics for the Main Module Ports

Note The Main Module Ethernet statistics are **NOT** Ethernet Uplink Port statistics, but are the statistics of the switch port connected to the Main Module CPU.

Displaying the Main Module CPU Utilization

Vmux-2100 displays the following statistics for the Main Module CPU usage:

- Current CPU utilization
- Maximum utilization of the CPU resources registered by the management software since the last time the Main Module CPU statistics registers were cleared.

➤ To display the main module CPU utilization:

- From the Statistics menu (see [Figure 6-1](#)), choose **Main Module Statistics**.

The Main Module Statistics menu appears (see [Figure 6-16](#)).

```

Main Module Statistics

1. CPU Utilization
2. Ethernet statistics
3. TDM statistics
4. Backup Between links statistics

>

@ - Db Update; # - Db Undo
Esc-prev.menu; !-main menu; &-exit
  
```

Figure 6-16. Main Module Statistics Menu

1. From the Main Module Statistics menu, choose **CPU Utilization**.
2. From the CPU Utilization menu, choose **Display** to display the CPU utilization statistics (see [Figure 6-17](#)) or **Clear** to clear the registers.

```

CPU Utilization  :[ 5 %      ]   Max CPU Utilization  :[ 70 %      ]

Press 'Y' for refresh , ESC - for exit.

Esc-prev.menu; !-main menu; &-exit
  
```

Figure 6-17. Main Card CPU Utilization Statistics

Displaying the Main Module Ethernet Statistics

- To display the main module Ethernet statistics:
 1. From the Main Module Statistics menu, choose **Ethernet statistics**.
 2. From the Ethernet Statistics menu, choose **Display** to display the main link Ethernet statistics.

Figure 6-18 illustrates the Ethernet statistics screen. *Table 6-7* describes the statistics values.

Ethernet Statistics			
Rx statistics			
Total Frames:	[359540]	Total Bytes:	[47587419]
Frames:	[31424]	Bytes:	[3704499]
Brdcst Frames:	[27767]	Multcst Frames:	[2533]
Tx statistics			
Frames:	[675]	Bytes:	[78120]
Brdcst Frames:	[17]	Multcst Frames:	[0]
Frame sizes statistics (Rx+Tx)			
64b:	[56127]	65b-127b:	[169767]
128b-255b:	[115637]	256b-511b:	[8937]
512b-1023b:	[2245]	1024b-max:	[5451]
Rx Errors statistics			
Undersize:	[0]	Oversize:	[0]
CRC:	[0]	Fragments:	[2052]
Collision:	[1]	Late Collision:	[0]
Jabber:	[0]	Dropped:	[0]
Press 'Y' for refresh , ESC - for exit.			
Esc-prev.menu; !-main menu; &-exit			

Figure 6-18. Main Link Ethernet Statistics Screen

In the following table, the direction of the statistics is as follows:

- Rx: Received from the TDM/IP network
- Tx: Transmitted to the TDM/IP network.

Table 6-7. Main Link Ethernet Statistics Values

Field	Description
Rx Total Frames	Total number of packets received
Rx Total Bytes	Total number of data octets of all packets received
Note: A data octet is a single byte from the packet data section	
Rx Frames	Number of good packets received
Rx Bytes	Number of data octets of good packets received
Rx Brdcst Frames	Number of good broadcast packets received
Rx Multcst Frames	Number of good multicast packets received
Tx Frames	Number of good packets transmitted
Tx Bytes	Number of data octets of good packets transmitted
Tx Brdcst Frames	Number of good broadcast packets transmitted
Tx Multcst Frames	Number of good multicast packets transmitted
Frames 64b	Number of received and transmitted packets with size of 64 bytes
Frames 65b-127b	Number of received and transmitted packets with size of 65 to 127 bytes
Frames 128b-255b	Number of received and transmitted packets with size of 128 to 255 bytes
Frames 256b-511b	Number of received and transmitted packets with size of 256 to 511 bytes
Frames 512b-1023b	Number of received and transmitted packets with size of 512 to 1023 bytes
Frames 1024b-max	Number of received and transmitted packets with size of 1024 to 1518/1536 bytes
Rx Undersize	Number of received packets which meet the following conditions: <ul style="list-style-type: none"> • Packet data length is less than 64 bytes • Collision event has not been detected • Late collision event has not been detected • Packet has valid CRC
Rx Oversize	Number of received packets which meet the following conditions: <ul style="list-style-type: none"> • Packet data length equals or is greater than 1518/1536 bytes • Packet has valid CRC
Rx CRC	Number of received packets which meet the following conditions: <ul style="list-style-type: none"> • Packet data length is between 64 and 1518/1536 bytes • Packet has invalid CRC • Collision event has not been detected • Late collision event has not been detected
Rx Fragments	Number of received packets which meet the following conditions: <ul style="list-style-type: none"> • Packet data length is less than 64 bytes • Packet has invalid CRC • Collision event has not been detected • Late collision event has not been detected

Table 6-7. Main Link Ethernet Statistics Values (Cont.)

Field	Description
Rx Collision	Number of received packets with collision event detected
Rx Late Collision	Number of received packets with late collision event detected
Jabber	Number of received packets which meet the following conditions: <ul style="list-style-type: none">• Packet data length is greater than 1518/1536 bytes• Packet has invalid CRC
Dropped	Number of received dropped packets

➤ **To clear the main port Ethernet statistics:**

- From the Ethernet Statistics menu, choose **Clear** to reset the Ethernet performance registers.

Collecting the TDM Main Link Statistics

If the Vmux-2100 unit is equipped with a Serial, E1 or T1 main link, the TDM Statistics option line will appear on the Main Module Statistics menu (see [Figure 6-16](#)).

➤ **To display the TDM main link statistics:**

1. Choose **TDM Statistics**.
2. From the TDM Statistics menu, choose **Display** to display the statistics.

[Figure 6-19](#) illustrates the Ethernet statistics screen. [Table 6-8](#) describes the TDM statistics values.

```

TDM      Statistics

Rx  : Frames [          0]  Bytes [          0]
Tx  : Frames [        113]  Bytes [        6528]

Rx Err : BSY      [          0] GLITCH [          0] DE[          0] LG[          0]
        NO      [          0] AB      [          0] CR[          0] OV[          0]
Tx Err : Underrun [          0] GLITCH [          0]

BW :To TDM - Curr [          0] Max  [          688]                      (bit/Sec)
    To Line- Curr [          0] Max  [          688]                      (bit/Sec)
    Thresh - Q.50 [  1745920] Voice[  1864960] Modem [  1587200] (bit/Sec)
    State  - Q.50 [NORMAL    ] Voice[NORMAL    ] Modem [NORMAL    ]

Tx Q :Hi Max[    0]  Hi Curr[    0 ] Lo Max[    0]  Lo Curr[    0]

Press 'Y' for refresh.

ESC-prev.menu; !-main menu; &-exit                                     1 user(s)
-----

```

Figure 6-19. TDM Main Link Statistics Screen

In the following table, the direction of the statistics is as follows:

- Rx: Received from the TDM network
- Tx: Transmitted to the TDM network.

Table 6-8. TDM Main Link 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 BSY Error	Number of received HDLC packets discarded due to lack of buffer resources (buffer is busy)
Rx Glitch Error	Number of clock glitches in the received packets
Rx DE Error	Number of packets received containing DPLL errors
Rx LG Error	Number of packets received with frame length violations

Table 6-8. TDM Main Link Statistics Values (Cont.)

Field	Description
Rx NO Error	Number of non-octet aligned packets received
Rx AB Error	Number of packets received with abort sequence violations (7 or more consecutive ones)
Rx CR Error	Number of packets received containing CRC errors
Rx OV Error	Number of overrun errors in the received packets
Tx Total Frames	Total number of HDLC packets transmitted
Tx Total Bytes	Total number of data octets of all packets transmitted
Tx Underrun Error	Number of transmitted HDLC packets discarded due to lack of buffer resources
Tx Glitch Error	Number of clock glitches in the transmitted packets
Bandwidth to TDM – Current	Current TDM bandwidth transmitted since the last clear
Bandwidth to TDM – Max	Peak TDM bandwidth transmitted since the last clear
Bandwidth to Line – Current	Current bandwidth transmitted on the line since the last clear (adds HDLC flags and CRC to TDM bandwidth)
Bandwidth to Line – Max	Peak bandwidth transmitted on the line since the last clear (adds HDLC flags and CRC to TDM bandwidth)
High Tx Queue – Max Frames	Peak number of packets waiting in the high priority to be transmitted to the network (since the last clear)
Low Tx Queue – Max Frames	Peak number of packets waiting in the low priority to be transmitted to the network (since the last clear)
High Tx Queue – Current Frames	Current number of packets waiting in the high priority to be transmitted to the network
Low Tx Queue – Current Frames	Current number of packets waiting in the low priority to be transmitted to the network
Tx Queue – Free Frames	Number of network packets that were discarded due to lack of buffer resources (since last clear)
Bw: Thresh - Q.50	The threshold set by the user to operate Q.50 mechanism.
Bw: Thresh - Voice	The threshold set by the user to start discarding voice packets.
Bw: Thresh - Modem	The threshold set by the user to block new modem call.
Bw: State - Q.50	Current state of Q.50 mechanism (normal / blocked).
Bw: State - Voice	Current state of voice calls (normal / discarding).
Bw: State - Modem	Current state of modem calls (normal / blocked).

Displaying the Backup Links Status

You can display the following information for the links used by the backup feature:

- The current state of the primary link
- The current state of the secondary link
- The current state of the third link
- The link that is currently active.

➤ **To display the status of the backup links:**

- From the Main Module statistics menu, choose **Backup Between links statistics**.

The Backup Statistics screen appears (see [Figure 6-20](#)). [Table 6-9](#) describes the backup links status values.

```
Backup Statistics.
PRIMARY link state : [ DOWN]
SECONDARY link state: [ DOWN]
THIRD link state:   [ DOWN]
Current active link: [ NONE]

Press 'Y' for refresh.
```

Figure 6-20. Backup Statistics Screen

Table 6-9. Backup Statistics Values

Field	Description
Primary link state	Indicates the status of the primary link. Either Down or UP .
Secondary link state	Indicates the status of the secondary link. Either Down or UP .
Third link state	Indicates the status of the secondary link. Either Down or UP .
Current active link	When link backup is enabled, indicates which link is currently the active main link. Values are None , TDM A , TDM B or Ethernet .

Clearing All Statistics

➤ **To clear all statistics:**

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

The Monitoring menu appears (see [Figure 6-24](#)).

2. From the Monitoring menu, choose **Statistics**.

The Statistics menu appears (see [Figure 6-1](#)).

3. Choose **Clear All Statistics** to delete all of the statistics.

Vmux-2100 deletes all statistics.

6.2 Detecting Errors

Configuration errors and mismatches are rendered by the Vmux-2100 management software as sanity checks. Their main purpose is to maintain the database validity. Vmux-2100 supports two types of the sanity check messages:

- **Error** – major configuration error that prevents the Vmux-2100 database from updating and saving changes.
- **Warning** – minor configuration error that allows you to update the database and save the changes.

Displaying the Sanity Errors and Warnings

Each time you update the Vmux-2100 database, the management software analyzes the changes. If a major error is detected, Vmux-2100 aborts the database update and displays the following screen:

```

!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!!!!!!      Attention !                                     !!!!!!!
!!!!!!      -----                                     !!!!!!!
!!!!!!                                     !!!!!!!
!!!!!!      DB UPD FAILED !!!! Data Base was NOT changed   !!!!!!!
!!!!!!      Sanity Error Occurred - Check Sanity Alarm Report !!!!!!!
!!!!!!                                     !!!!!!!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!

Press 'y' To Exit This Screen

Esc-prev.menu; !-main menu; &-exit                               1 user(s)
-----

```

Figure 6-21. Sanity Error Screen

If a minor error is detected, Vmux-2100 updates the database and displays the following screen:

```

!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!!!!!!                                     !!!!!!!
!!!!!!      Sanity Warning Occurred - Check Sanity Alarm Report. !!!!!!!
!!!!!!                                     !!!!!!!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!

Press 'y' To Exit This Screen

ESC-prev.menu; !-main menu; &-exit                               1 user(s)
-----

```

Figure 6-22. Sanity Warning Screen

➤ To display the sanity errors and warnings:

1. From the Status menu (see [Figure 6-25](#)), choose **Display Sanity**.

The Display Sanity menu appears (see [Figure 6-23](#)).

```

Display Sanity

1. Error
2. Warning

@ - Db Update; # - Db Undo
Esc-prev.menu; !-main menu; &-exit

```

Figure 6-23. Display Sanity Menu

- 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.

Sanity Error and Warning List

[Table 6-10](#) lists in alphabetical order all sanity errors and warnings generated by Vmux-2100.

Table 6-10. Sanity Errors and Warnings

ID Code	Display	Type	Description
110	BACKUP BETWEEN LINKS CONFIGURED - REMOTE MM IP MISSING	Error	The IP address of the remote backup MM had not been configured.
111	BACKUP BETWEEN LINKS CONFIGURED - DUPLICATE LINK TYPE	Error	A duplicate link type exists between link and backup link
112	SERIAL INTERFACES SHOULD HAVE THE SAME CLOCK MODE	Error	Serial interfaces should have the same clock mode.
113	SERIAL S SHOULD HAVE THE SAME CLOCK RATE	Error	Serial interfaces should have the same clock rate.
114	SERIAL INTERFACES SHOULD HAVE THE SAME CONTROL SIGNAL MODE	Error	Serial interfaces should have the same control signal mode.
115	Q.50 'STOP NEW CALLS' > 'DISCARD VOICE PACKETS'	Error	Q.50's 'stop new calls' threshold had been reached. Hence arriving voice packets will be discarded.
116	UNFRAMED MUST BE USE ON BOTH EXTERNAL	Error	Configuring unframed line type should be done on both externals.
117	EMPTY ADMINISTRATOR LIST	Error	The last administrator account has been deleted from the user database.
210	CARD DOES NOT EXIST IN SLOT	Warning	IO card has been configured on the HUB but does not physically exist on the slot.

Table 6-10. Sanity Errors and Warnings (Cont.)

ID Code	Display	Type	Description
211	CARD EXISTS IN SLOT	Warning	IO card physically exists on the slot but was not configured on the HUB.
212	CARD TYPE MISMATCH	Warning	Mismatch exists between the types of the physical and configured cards.
310	CONNECTIVITY VALUES MUST BE THE SAME FOR ALL GROUP BUNDLES	Error	All bundles must have the same connectivity values.
311	TOO MANY EXIST BUNDLE (MAX 30 BUNDLE IN GROUP)	Error	A maximum of 30 bundles can be configured into one group.
312	E1/T1 NOT THE SAME FRAME TYPE	Error	Port is E1 but configured to be T1 and vice versa.
313	ILLEGAL SOURCE IP ADDRESS	Error	Illegal source IP address had been configured. Note: The following IP addresses are reserved for the main and voice card internal communication and cannot be assigned by the user: 1.1.1.255 and 1.1.1.0 to 1.1.1.8.
410	TOO MANY CONFIGURED TS	Error	User has defined more timeslots than available.
411	TS 16 SHOULD BE DISCONNECTED IN CAS MODE	Error	Timeslot 16 configuration must be configured to N.C. (not connected) when signaling is CAS.
412	Q.50 - CARD TYPE MISMATCH	Error	A Q.50 card type mismatch had occurred.
413	Q.50 - FRAME TYPE MISMATCH	Error	A Q.50 frame type mismatch had occurred.
422	IN HDLC CISCO MODE - DISABLE UPLINK LOOP DETECTION	Error	When working in Cisco bridged Ethernet mode on the serial uplink, the uplink loop detection mechanism must be disabled.
424	NO OTHER DATA CH ALLOWED WHEN PH2 COMPATIBLE CH CONFIGURED	Error	No other data channel is allowed when Ph2 compatible channel is configured.
425	CAN'T USE HDLC AND TRANSP DATA SUB CH SIMULTANEOUSLY	Error	It is not allowed to use HDLC and transparent sub channel simultaneously.
510	ILLEGAL DESTINATION IP ADDRESS	Error	Destination IP address for a bundle is not defined.
512	CAN'T CONFIGURE VLAN ON AAL2oMPLS BUNDLE	Error	A bundle that was configured to work over AAL2oMPLS cannot support VLAN.
513	AAL2oMPLS FUNCTION CAN'T WORK WITH BACKUP MODE	Error	No backup mode is allowed when working with AAL2oMPLS.

Table 6-10. Sanity Errors and Warnings (Cont.)

ID Code	Display	Type	Description
514	ILLEGAL VLAN ID	Error	VLAN ID for a bundle is out of the legal range.
517	BUNDLE FRAME TOO SMALL FOR TRANSP CH DEMANDS	Error	The transparent channel bandwidth consumption exceeded the maximum frame size configured for this bundle.
518	SUPER TANDEM IS ENABLED WITH G711 CODER	Error	Super Tandem cannot be enabled when working with a G.711 coder.
610	CODER PROBLEM	Error	Time slots on the same DSP are assigned different coder rates.
611	A_LAW U_LAW PROBLEM	Error	All bundles must have the same coding value: A-law or U-law.
616	DOUBLE ROUTE	Error	More than one timeslot is connected to the same destination timeslot.
617	BUNDLE IS NOT CONNECTED	Warning	A timeslot is assigned to a bundle that is not connected.
618	EXTERNAL IS NOT CONNECTED	Warning	A timeslot is assigned to an E1/T1 port that is not connected.
620	TS OF SAME DATA CH MUST RELATE TO SAME BUNDLE	Error	Timeslot of the same data channel must relate to the same bundle.
621	ILLEGAL DESTINATION TS	Error	Destination timeslot is out of range.
622	MAX 8 DATA TS PER EXTERNAL ALLOWED	Error	A maximum of 8 data timeslots per external is allowed.
627	ONLY 1 TS ALLOWED FOR DATA SUB-CH	Error	Only 1 timeslot is allowed for each data sub channel.
628	MASK 00 IS NOT ALLOWED FOR DATA CHANNELS	Error	Data channel's mask cannot be 00.
629	WHEN CODER IS G.711 DTMF RELAY PARAMETER SHOULD BE SET TO DISABLE.	Warning	It is recommended to set DTMF relay to Disable when working with G.711 coder

6.3 Handling Alarms

This section describes the alarms for Vmux-2100. It also describes how to configure the Alarm LED mode.

Vmux-2100 detects fault conditions and initiates alarms and events.

- **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 you that something important had happened, but not as dangerous to damage the system functionality.

You can control the alarm severity that causes the ALM LED to turn on.

Alarm Buffer

Vmux-2100 maintains two alarm buffers:

- **Temporary buffer**, represented in the **Display All Alarms** screen. You can delete all alarms, including the active ones from this display.
- **Permanent buffer**, represented in the **Alarm Status** screen. You can delete only inactive alarms from the Alarm Status display.

An alarm enters both logs simultaneously, and the ALM LED turns on to indicate the condition. In addition, Vmux-2100 displays ALARM ON indication in the top right-hand corner of the ASCII terminal screen. When the event that caused the alarm is cleared, the alarm status changes to OFF, enabling you to remove it from the permanent buffer.

Working with the Temporary Alarm Buffer

The temporary buffer is represented by 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 6-24](#)).

```
Monitoring

1. Status
2. Statistics

@ - Db Update; # - Db Undo
Esc-prev.menu; !-main menu; &-exit
```

Figure 6-24. Monitoring Menu

2. From the Monitoring menu, choose **Status**.

The Status menu appears (see [Figure 6-25](#)).

```

Status
1. Display
2. Clear
3. Display Sanity

@ - Db Update; # - Db Undo
Esc-prev.menu; !-main menu; &-exit

```

Figure 6-25. Status Menu

- From the Status menu, choose **Display**.

The Display menu appears (see [Figure 6-26](#)).

```

Display
1. Display All Alarms
2. Display & Clear Alarms
3. Display Alarm Status

@ - Db Update; # - Db Undo
Esc-prev.menu; !-main menu; &-exit

```

Figure 6-26. Display Menu

- From the Display menu, choose **Display All Alarms** to view the alarms.

Vmux-2100 displays the temporary alarm buffer (see [Figure 6-27](#)).

```

(A)(003)          SWITCH OF DB OCCURRED          EVENT  15-05-2005 12:02:07
(A)(018)          DB UPDATE OCCURRED             EVENT  15-05-2005 12:02:07
(A)(047)          FAN No. 4 FAILURE               MAJOR   15-05-2005 12:02:07
(A)(046)          FAN No. 3 FAILURE               MAJOR   15-05-2005 12:02:07
(A)(045)          FAN No. 2 FAILURE               MAJOR   15-05-2005 12:02:07
(A)(044)          FAN No. 1 FAILURE               MAJOR   15-05-2005 12:02:07
(A)(022)IO-1      GR1 MODULE WAS INSERTED         EVENT  15-05-2005 12:02:07
(A)(087)MM-A EX1  T1/E1 SIGNAL LOSS              MAJOR   15-05-2005 12:02:07
(A)(089)MM-A EX1  RED ALARM                      MAJOR   15-05-2005 12:02:07

Press 'y' To Continue...
Press 'n' To Stop.

@ - Db Update; # - Db Undo
Esc-prev.menu; !-main menu; &-exit

```

Figure 6-27. Temporary Buffer (Display All Alarms Screen)

The display includes alarm identification code, its severity, status, and generation date and time. Only active alarms appear on the screen.

➤ To delete alarms from the temporary buffer:

- From the Display menu, choose **Display & Clear Alarms** to view and then delete the current alarms.

Vmux-2100 displays the current alarms and deletes them from the buffer when you exit the screen.

Working with Permanent Buffer

The permanent buffer is represented by the Alarm Status screen.

➤ To access the Alarm Status screen:

- From the Display menu (see [Figure 6-26](#)), choose **Display Alarm Status**.

Vmux-2100 displays the permanent alarm buffer (see [Figure 6-28](#)).

Note

The last column to the right shows the number of times that the alarm occurred.

```
(A)(003)          SWITCH OF DB OCCURRED          EVENT  1
(A)(018)          DB UPDATE OCCURRED             EVENT  2
(A)(047)          FAN No. 4 FAILURE               MAJOR   1
(A)(046)          FAN No. 3 FAILURE               MAJOR   1
(A)(045)          FAN No. 2 FAILURE               MAJOR   1
(A)(044)          FAN No. 1 FAILURE               MAJOR   1
(A)(022)IO-1      GR1 MODULE WAS INSERTED         EVENT  1
(A)(087)MM-A  EX1  T1/E1 SIGNAL LOSS             MAJOR   1
(A)(089)MM-A  EX1  RED ALARM                     MAJOR   1
```

Press 'y' To Continue...

Press 'n' To Stop.

@ - Db Update; # - Db Undo

Esc-prev.menu; !-main menu; &-exit

Figure 6-28. Permanent Buffer (Alarm Status Screen)

➤ To delete inactive alarms from the permanent buffer:

- From the Status menu (see [Figure 6-25](#)), choose **Clear**.

The Clear menu appears.

- Confirm the alarm deletion by choosing **Clear all Alarms**.

Vmux-2100 deletes all alarms in the OFF state and events from the permanent buffer.

Setting the Alarm LED Severity

You can configure the alarm severity level that will cause the ALM LED to turn on. 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 (Event)

1. Event
2. Minor
3. Major

Please choose items <1> to <3>
@ - Db Update; # - Db Undo
Esc-prev.menu; !-main menu; &-exit
```

Figure 6-29. Set Alarm LED Severity Menu

2. Select the alarm severity that will cause the LED to turn on.

List of Vmux-2100 Alarms

Table 6-11 lists the Vmux-2100 alarms according to their identification codes.

Table 6-11. Vmux-2100 Alarms

ID Code	Terminal Message	Description	Type+Severity
3	SWITCH OF DB OCCURRED	VMUX-2100 database has been replaced	Event
4	LOSS OF ALMS FROM HISTORY BUFF	Too many alarms caused the dropping of alarms from buffer.	Event
5	NO MEM LEFT FOR TRACING NEW ALMS	There is no memory left for recording new alarms	Major
13	AGENT WITH SAME IP IN NET	Another Main Module with the same IP address exists in the network.	Major
14	AGENT WITH SAME NAME IN NET	Another Main Module with the same name (ASCII STRING) exists in the network.	Minor
17	DBS LEXICAL SANITY CORRECTION	A lexical sanity correction was performed on Data Base.	Event
18	DB UPDATE OCCURRED	Vmux-2100 database has been updated	Event
21	GR1 MODULE WAS REMOVED	A voice module installed in the specified slot has been removed.	Event
22	GR1 MODULE WAS INSERTED	A voice module has been inserted into a slot.	Event
26	GR1 MODULE TYPE MISMATCH	A module type mismatch occurred	Major
36	GR1 SOFTWARE LOADING	Main Module is currently uploading updated software to group 1 of the IO module located in the slot.	Major
40	POWER SUPPLY No. 2 FAILURE	Power supply 2 failure has been detected	Major
41	POWER SUPPLY No. 1 FAILURE	Power supply 1 failure has been detected	Major
42	POWER SUPPLY No. 2 WAS REMOVED	Power supply 2 has been removed from its slot	Major
43	POWER SUPPLY No. 1 WAS REMOVED	Power supply 1 has been removed from its slot	Major
44	FAN No.1 FAILURE	Fan 1 failure has been detected	Major
45	FAN No.2 FAILURE	Fan 2 failure has been detected	Major
46	FAN No.3 FAILURE	Fan 3 failure has been detected	Major
47	FAN No.4 FAILURE	Fan 4 failure has been detected	Major

Table 6-11. Vmux-2100 Alarms (Cont.)

ID Code	Terminal Message	Description	Type+ Severity
48	POWER SUPPLY No.2 WAS INSERTED	Power supply 2 has been inserted to its slot.	Event
49	POWER SUPPLY No.1 WAS INSERTED	Power supply 1 has been inserted to its slot.	Event
52	DB SENT BY TFTP/SW VER MISMATCH	There was a software version mismatch between the current sw and the one sent by TFTP.	Event
53	DB SENT BY TFTP IS CORRUPTED	The database that was downloaded by TFTP was corrupted.	Event
60	DEFAULT DB LOADED ON STARTUP	No db or incompatible db existed in NVRAM on startup	Event
65	SAVE TO NVRAM FAIL	Failed to save into NVRAM.	Event
66	NVRAM ALMOST FULL	NVRAM is almost full.	Major
67	TDM/SERIAL MAIN LINK OVERFLOW	The required bandwidth exceeds the available bandwidth on serial uplink	Major
68	Q.50 DISABLE NEW CALLS	Q.50 had reached its "disable new calls" threshold.	Major
69	DISCARD VOICE PACKETS	Q.50 had reached its "discard voice packets" threshold.	Major
70	BLOCK MODEM CALLS	New modem calls are now disabled due to TDM uplink overflow. The defined threshold was reached.	Major
71	GR2 MODULE WAS REMOVED	See 21.	Event
72	GR2 MODULE WAS INSERTED	See 22.	Event
74	GR2 MODULE TYPE MISMATCH	A module type mismatch occurred on group 2.	Major
75	GR2 SOFTWARE LOADING	See 36.	Major
80	BPV ERROR HAS OCCURRED	Bipolar violation on E1/T1 port	Event
81	EXCESSIVE ERROR RATION	The bit error rate of the port exceeds 0.001	Major
82	ALARM INDICATION SIGNAL	AIS detected on the E1/T1 port	Major
83	EXCESSIVE BIPOLAR VIOLATION	Excessive BPVs on the E1/T1 port	Major

Table 6-11. Vmux-2100 Alarms (Cont.)

ID Code	Terminal Message	Description	Type+Severity
84	T1/E1 FRAME SLIP HAS OCCURRED	Frame Slip occurred on the E1/T1 port	Event
87	T1/E1 SIGNAL LOSS	Loss of input signal on the E1/T1 port	Major
88	AIS RED ALARM	Local loss of frame synchronization on the T1 port caused by AIS condition	Major
89	LOC SYNC LOSS (RED ALARM)	Local loss of frame synchronization on the E1/T1 port	Major
90	REM SYNC LOSS (YELLOW ALARM)	<p>Remote loss of frame synchronization on the E1/T1 port</p> <p>Recommendations:</p> <ul style="list-style-type: none"> 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-2100 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-2100 towards the PBX/Switch. If a Red Alarm (Alarm 89, "LOC SYNC LOSS") is active on the destination port at the remote Vmux-2100, this will trigger transmission of an AIS signal to the local PBX, which in turn sends the local Vmux-2100 E1/T1 port a RAI/Yellow Alarm indication. Solve the physical problem on the remote E1/T1port. <p>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/T1port and PBX/Switch (either set Vmux to CRC, or disable CRC in PBX/Switch).</p>	Major
92	NETWORK LLB	Line loopback command is received from the network at the T1 port	Minor
93	NETWORK PLB	Payload loopback command is received from the network at the T1 port	State+Minor

Table 6-11. Vmux-2100 Alarms (Cont.)

ID Code	Terminal Message	Description	Type+ Severity
97	LOCAL MULTIFRAME ALARM	Local loss of multiframe synchronization at the E1 port Recommendation: Verify that frame types match: set the PBX/Switch connected to the Vmux-2100 E1 port to G.732S or set the Vmux-2100 to G.732N.	Minor
98	REMOTE MULTIFRAME ALARM	Remote loss of multiframe synchronization at the E1 port Recommendation: Verify that frame types match: set the Vmux-2100 to G.732S or set the PBX/Switch connected to the Vmux-2100 E1 port to G.732N.	Minor
100	CRC ERROR OCCURRED	CRC-4 error on the E1 port receive signal	Event
101	TDM UPLINK LOOP DETECTED	When working with E1/T1 or Serial uplink, a loop exists in the TDM network.	Major
112	TRUNK IS DOWN	A fault exists on the line. This alarm applies only to the serial uplink with the DTE clock mode configured and control signals enabled.	Major
195	GR1BUNDLE IS OOS	Group 1 Bundle is out of service due to network connectivity problems	Major
196	GR2BUNDLE IS OOS	Group 2 Bundle is out of service due to network connectivity problems	Major
210	TOO MANY MACS IN TABLE GR1	The hash table of the ML card in group 1 is overloaded, therefore, no new MAC addresses will be updated to the card, and traffic might be affected.	Event
211	TOO MANY MACS IN TABLE GR2	See 210.	Event
212	OVER USAGE OF BANDWIDTH GR1	The traffic demanded from the specified channelized bundle is too high compared to the defined bandwidth. The bundle bandwidth should be enlarged.	Event
213	OVER USAGE OF BANDWIDTH GR2	See 212.	Event

6.4 Testing Vmux-2100

This section describes the Vmux-2100 diagnostic functions, which include:

- Tone injection
- Loopbacks (local and remote)
- Ping utility
- Display active tests.

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-2100 supports tone injection towards the local side only (see [Figure 6-30](#)).

The tone injection is activated individually per timeslot. However, multiple tone injections can be run at the same time. Vmux-2100 allows you to set the tone injection timeout causing the tone relay to deactivate automatically after the desired period of time.

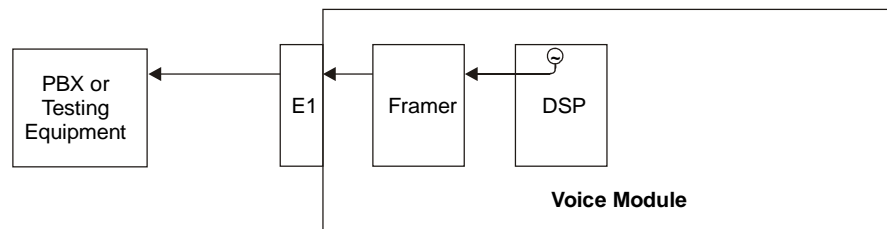


Figure 6-30. Local Tone Injection

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.

➤ **To activate tone injection:**

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

The Diagnostics menu appears (see [Figure 6-31](#)).

```

Diagnostics
1. Inject Tone test
2. Local Loop test (voice cards only)
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 6-31. Diagnostics Menu

- From the Diagnostics menu, choose **Inject Tone Test**.

The Inject Tone Test menu appears (see [Figure 6-32](#)).

```

Inject Tone test

1. Slot > (Slot 1)
2. Group Number > (Group 1)
3. External > (External 1)
4. Time Slot > (Ts 1 )
5. Direction > (Local)
6. Time Out(seconds, 0=forever) [0 - 60]... (0)
7. Activate

>

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

```

Figure 6-32. Inject Tone Menu

- From the Inject Tone Test menu, choose **Slot**, and then select the desired slot.
- From the Inject Tone Test menu, choose **Group Number**, and then select the desired E1/T1 group number.
- From the Inject Tone Test menu, choose **External**, and then select the desired E1/T1 external link number.
- From the Inject Tone Test menu, choose **Time Slot**, and then select the desired timeslot for the tone injection.
- From the Inject Tone Test menu, choose **Direction**, and then select the desired direction of the tone injection:
 - Local** (towards the local PBX, see [Figure 6-30](#))
 - Remote** (available only for analog devices)

8. From the Inject Tone Test menu, choose **Time Out**, and then enter the desired tone injection timeout (the period of time after which the tone injection stops automatically):
 - **0** seconds (forever) or until manually stopped
 - **1** to **60** seconds
9. From the Inject Tone Test menu, choose **Activate**, and then choose **Yes** to activate the tone injection.

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.

Loopback Tests

Vmux-2100 supports activation of the 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 per E1/T1 port.

Local Loopback

Vmux-2100 can activate a local loopback to test the connection between the E1/T1 voice port and the local side PBX. In this mode, data coming from the PBX side is looped back (to the testing equipment). See [Figure 6-33](#).

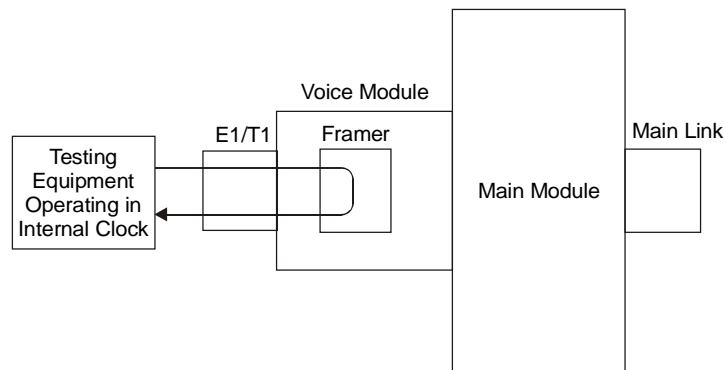


Figure 6-33. Local Loopback

➤ **To activate a local loopback:**

1. Configure the testing equipment to internal clock.
2. From the Diagnostics menu, choose **Local Loop Test**.

The Local Loop Test menu appears (see [Figure 6-34](#)).

Local Loop test (voice cards only)

```

1. Slot>      (Slot 1)
2. Group Number>      (Group 1)
3. External >      (External 1)
4. Time Out (seconds, 0=forever) [0 - 60]>      (0)
5. Activate

>

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

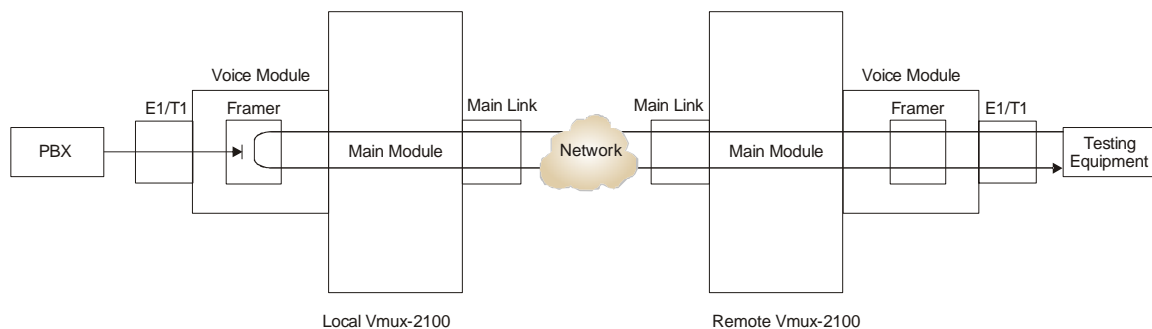
```

Figure 6-34. Local Loop Test Menu

3. From the Local Loop Test menu, choose **Slot**, and then select the desired slot.
4. From the Local Loop Test menu, choose **Group Number**, and then select the desired E1/T1 group number.
5. From the Local Loop Test menu, choose **External**, and then select the desired E1/T1 external link number.
6. From the Local Loop Test menu, choose **Time Out**, and then enter the desired timeout (the period of time after which the Local Loop test stops automatically):
 - **0** seconds (forever)
 - **1** to **60** seconds
7. From the Local Loop Test menu, choose **Activate**, and then choose **Yes** to activate the local loopback.

Remote Loopback

Vmux-2100 can activate a remote loopback to test internal connection between the E1/T1 voice port and the main link. In this mode, data coming from the network (E1/T1 or IP) is looped back to the network (to the remote side). See [Figure 6-35](#).

*Figure 6-35. Remote Loopback*

► **To activate a remote loopback:**

1. From the Diagnostics menu, choose **Remote Loop Test**.

The Remote Loop Test menu appears (see [Figure 6-36](#)).

```
Remote Loop test

1. Slot > (Slot 1)
2. Group Number > (Group 1)
3. External > (External 1)
4. Time Out(seconds, 0=forever) [0 - 60]> (0)
5. Activate
>

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

Figure 6-36. Remote Loop Test Menu

2. From the Remote Loop Test menu, choose **Slot**, and then select the desired slot.
3. From the Remote Loop Test menu, choose **Group Number**, and then select the desired E1/T1 group number.
4. From the Remote Loop Test menu, choose **External**, and then select the desired E1/T1 external link number.
5. (Only for E1/T1 Uplink) From the Remote Loop Test menu, choose **Time Out**, and then enter the desired timeout (the period of time after which the Remote Loop test stops automatically):
 - 0 seconds (forever)
 - 1 to 60 seconds
6. From the Remote Loop Test menu, choose **Activate**, and then choose **Yes** to activate the remote loopback.

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 3 seconds.

► **To ping a host:**

1. From the Diagnostics menu, choose **Ping**.

The Ping menu appears (see [Figure 6-37](#)).

```

Ping

1. Ip Address          ... (172.17.172.150)
2. Number Of Pings [1 - 16]... (10)
3. Activate

>

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

```

Figure 6-37. Ping Menu

2. From the Ping menu, choose **Ip Address**, and enter the desired host IP address.
3. From the Ping menu, choose **Number Of Pings**, and enter the number of pings.
4. From the Ping menu, choose **Activate** to activate the pinging.

Displaying the Active Tests

The Vmux-2100 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 Test**.

Vmux-2100 displays a list of active tests, specifying the exact slot and E1/T1 port. For 'inject tone' test, 'timeslot' is also specified.

6.5 Frequently Asked Questions

Q: I am experiencing an active YELLOW ALARM on my Vmux-2100 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-2100/E1 voice module opposite a Vmux-2100/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-2100 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-2100 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 Bundle Voice 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-2100 over low quality TDM uplink (10^3 - 10^5); will I have a service problem using it?

A: The Vmux-2100 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 10^3 , 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-2100 will be completely functional.

Q: Does Vmux-2100 support ISDN data calls, such as WAP (V-110)?

A: The Vmux-2100 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-2100 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-2100?

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-2100 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: Can the Vmux-2100 E1 ports provide an Unbalanced, 75 Ω , BNC interface?

A: Main Module E1 ports can be converted to Unbalanced, 75 Ω , BNC connector. This conversion requires the following procedure:

1. Set jumpers on main board to Unbalanced (see [Chapter 2](#)).
2. Use the CBL-RJ45/2BNC/E1 adapter cable (see [Appendix A](#)).

Voice and Channelized E1 ports CANNOT be converted to Unbalanced using the above adapter cable. Conversion can be achieved only by use of an external BALUN converter (such as BE-1 from RAD).

Q: After placing a loop on the main link port (E1/T1/Serial) of my Vmux-2100, 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-2100 is looped back into the internal switch and via the Vmux-2100 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-2100 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-2100.

Q: Is it possible to double the total TDM uplink bandwidth between two Vmux units by adding a second E1/T1/Serial connection?

A: No.

More than one E1/T1/Serial uplink connection between a given pair of Vmux units is not permitted, as this would cause two possible paths for each

bundle between these two units - an illegal condition resulting in unstable bundle connectivity.

In addition, it should be noted that:

- There is no load sharing mechanism that can equally distribute the voice traffic between such two TDM uplinks.
- The same restriction applies to TDM+IP uplinks: it is not allowed to have a TDM uplink connection between two Vmux units, and in parallel, to enable IP connectivity between the voice modules of these two sites.
- If IP connectivity between two Vmux units with TDM uplink is required for out-of-band management purposes *only*, it can be achieved by doing the following:
 1. Separate the voice modules and hosts to different IP networks (i.e. Voice modules on Network A, Hosts on Networks B and C).
 2. Set the 'Next Hop' of each Voice Bundle to the IP address of the destination bundle.
 3. Set the **INHIBIT LAN** parameter to **ENABLE VOICE ONLY**.

Q: Can I test a Vmux-2100 link using Voice Frequency test equipment?

A: Yes, with the following considerations:

- Since Vmux-2100 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-2100 relay mechanisms must be avoided:
 - 1100 Hz (CNG) will cause the Vmux-2100 to switch into fax-relay mode (if fax relay is enabled).
 - 2100 Hz (fax/modem CED) will cause the Vmux-2100 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-2100, you should AVOID the following frequency ranges: 1050-1150 Hz, 1950-2150 Hz.

Q: Is it possible to send a BERT pattern across a Vmux-2100 voice channel?

A: No.

Since Vmux-2100 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-2100 at the local end.

The audio signal transmitted to the local Vmux-2100 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-2100 (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-2100. 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: Does modem support across a Vmux-2100 link require any special timing considerations?

A: Yes.

The present generation of Vmux-2100 (Phase 3) 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-2100 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-2100 was tested successfully using a Secured Telephone Encryption unit of Snapshield (<<http://www.snapshield.com>>).

Q: How can I enable Vmux-2100 to support R2-MFC?

A: Perform the following steps to enable Vmux-2100 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-2100 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-2100 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-2100 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	> (Enable)
2. Minimum Pulse Width (milliseconds)[45 - 300]	> (60)
3. Minimum Power Level (negative dBm)[1 - 35]	> (12)
4. MFC Spoofing	> (Disable)

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-2100 when working with different compression algorithms (Coders)?

A: The end-to-end processing delay contributed by the Vmux-2100 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-2100 uses jitter buffers in order to compensate for packet delay variation. The jitter buffers are implemented in the Vmux-2100 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-2100 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-2100 inform the local PBX regarding an Out-Of-Service state of a certain bundle?

A: When one of the Vmux-2100 bundles enters an Out-Of-Service state (no response to the connectivity messages), the Vmux-2100 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-2100 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-2100 voice modules (**Main Menu > Configuration > Voice Configuration > E1 parameters**).

You 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-2100?

A: See the following table.

Table 6-12. Vmux File Transfers

Vmux-2100	Vmux-110	Direction	Purpose	Remarks
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.

Q: What is the rating of the power supply fuse of the Vmux-2100?

A: The rating of the power supply fuse is as follows:

- AC: power supply fuse is 3.15A.
- DC: power supply fuse is 5A.

Q: Can I upload a configuration file from any Vmux-2100to any Vmux-2100?

A: No.

Due to software changes and added parameters between the various versions, it is impossible to perform an upload of a `cnfg.dat` file between two Vmux-2100 units that do not have the exact same software version.

When you send `cnfg.dat` files to Tech Support, please remember to provide us with the exact software version from which this file was taken.

Q: When using the Q.50 feature, how does Vmux-2100 inform the switches/PBXs on both sides to block new calls?

A: Every second, Vmux-2100 checks the actual bandwidth on the TDM Main Link. When the Q.50 bandwidth threshold is reached (user configurable, default 88%), the CPU sends a message to the local and remote voice cards to block new calls (i.e. to update the relevant TS16 bits according to Q.50 protocol Annex A or Annex B).

The time from the moment that this message is sent until the Q.50 bits are updated is typically in the order of several tens of msec, possibly reaching 100-200 msec.

To the above, we should add the network delay. However, this delay is introduced only to the remote end. In other words, the difference between the time that the local and remote voice cards enter Q.50 mode, is the network delay. The network delay naturally depends on the application itself (external to Vmux-2100).

Q: How do I order the VCA E1/T1 modules for Vmux-2100?

A: VCA E1/T1 modules ordering options:

- 2 x E1 ports: VMUX-M/VCA-E1/2 (cat. 164-036-00-00)
- 4 x E1 ports: VMUX-M/VCA-E1/4 (cat. 164-037-00-00)
- 2 x T1 ports: VMUX-M/VCA-T1/2 (cat. 164-038-00-00)
- 4 x T1 port: VMUX-M/VCA-T1/4 (cat. 164-039-00-00)

Q: How do I order the channelized E1/T1 modules for Vmux-2100?

A: Channelized E1/T1 modules ordering options:

- 2 x E1 ports: VMUX-M-E1/2 (cat. 164-014-00-00)
- 4 x E1 ports: VMUX-M-E1/4 (cat. 164-016-00-00)
- 2 x T1 ports: VMUX-M-T1/2 (cat. 164-015-00-00)
- 4 x T1 ports: VMUX-M-T1/4 (cat. 164-017-00-00).

Q: I used the Vmux bandwidth calculator to calculate the TDM uplink Bandwidth needed for my application, using an estimated silence percentage. What will happen if I my silence percentage estimation was too high, and as a consequence I will exceed the bandwidth over the Vmux-2100 E1 main link?

A: The Vmux bandwidth calculator (included in the Vmux documentation CD) is a tool that helps you estimate the bandwidth required in a certain application/situation. Since it is only estimation, we recommend monitoring the silence percentage after actual deployment of the system, and recalculating the required bandwidth.

When exceeding the bandwidth, some of the packets are lost, and there will be voice quality degradation. Activating the Bandwidth Control feature can minimize the impact of this lack of bandwidth on voice quality.

The values of the TDMoIP frame size and the TDMoIP packetization interval affect the size of the transmission throughput and the delay. Smaller TDMoIP frames and shorter packetization interval will result in lower delay, but on the other hand with higher throughput.

Q: When passing through more than one Vmux hop, how can I prevent double compression?

A: When voice travels through several Vmux-2100 gateways, the intermediate Vmux-2100 units sense that the voice data has already been compressed, and do not uncompress and recompress the data as it moves through the phone network. This ensures that voice is only compressed once (at the originating Vmux-2100 gateway) and decompressed once (at the terminating Vmux-2100 gateway), resulting in high quality voice, since no losses are incurred from intermediate uncompress/compress cycles.

How is this done? The Vmux-2100 constantly transmits a very low frequency signal (38 Hz) that enables any other Vmux-2100 receiving this information to detect that it is coming from another Vmux-2100. This 38 Hz tone cannot pass through analog telephony equipment (which is usually limited to 300-4000 Hz), while it does pass through digital PBXs (as long as there are no digital-to-analog conversions in-between).

Once the Vmux-2100 units detect each other, they both enter Super Tandem mode, and immediately stop compressing/decompressing on this segment.

The Super Tandem mechanism will work for bundles that were set to Super Tandem – Enable' in the Bundle Configuration menu.

Q: In the Time Slot Configuration field, what is the difference between 'HDLC' type and 'SS7' type?

A: The **SS7** traffic type was added to the existing **HDLC** type, in order to enable both ISDN-PRI and SS7 to operate on the same Vmux-2100 chassis.

This was necessary because when passing SS7 traffic, you must set a FISU suppression rate, which affects the entire chassis. This makes it impossible to run ISDN PRI as well as SS7 on the same chassis (even on different E1 ports), as the PRI frames get corrupted due to the FISU suppression.

The proper procedure is:

1. Select **SS7** for SS7 traffic
2. Select **HDLC** for non-SS7 traffic (e.g., ISDN PRI)

Q: When setting a Vmux-2100 (Phase 3) to factory defaults, what part of the configuration database is affected?

A: There are three options for the **Factory Default** menu:

- Option 1: Clean Bundles DB.
- Option 2: Clean Slots DB.

These three options offer increased flexibility in cleaning the Vmux-2100 Database.

- Option 1 erases only configured bundles of Voice and Channelized E1/T1 modules. Nothing else is affected, including the TDM ports of these modules and their IP address (in case of Voice modules).
- Option 2 erases all the information regarding the slots of the hub, that is, all information regarding the I/O cards (Voice and Channelized E1/T1). This option is identical to the 'factory default' option of phases 1 and 2.
- Option 3 is the most powerful one. It cleans the entire DB **excluding** the following parameters:
 - Host IP address / IP mask / Default GW
 - Serial port connection rate (terminal connection)
 - Managers table
 - CAS profiles table.

Since this option DOES clear all configurations regarding the TDM uplink, it CANNOT be used to default a remote site that is connected to the local side via TDM link (inband), because connection will be lost in this case.

Q: How many voice bundles can I configure in one Vmux-2100 unit?

A: The Vmux-2100 can be equipped with up to four voice modules. Each voice module can have two or four E1 ports. Each pair of E1 ports is called a GROUP.

- In Phase 1 of the Vmux-2100, you can configure up to 5 bundles in each group, for a maximum number of $5 * 8 = 40$ bundles.
- In Phases 2 and 3, you can configure up to 30 bundles in each group, for a maximum number of $30 * 8 = 240$ bundles.
- In Phase 4, you can configure up to 31 bundles in each group, for a maximum number of $31 * 8 = 248$ bundles.

A bundle is a logical internal port of Vmux-2100, containing up to 60 timeslots. It is routed to a defined remote IP address (remote group address).

Q: Does the Vmux support Q.50?

A: Vmux supports both ANNEX A and ANNEX B of the Q.50 protocol. However the Vmux-2100 supports only the 3.1 kHz audio or speech connection type.

ANNEX A also includes signals which are transported over three spare bits (5, 7, and 8) of TS16 frame. These are used to transmit the transmission resource information and maintenance signals when it is possible to carry TS16 frame 0 between the DCME (Digital Circuit Multiplication Equipment – in this case the Vmux-2100) and the International Switching Center. (Any equipment placed between the DCME and the International Switching Center, such as timeslot interchange equipment, may prevent this transmission.)

Q: Can you monitor throughput on the TDM uplink using statistics file (stat.dat) and VmuxStat tool?

A: In general Vmux-2100 can support up to 16 E1/T1 trunks. However, when it works over an E1 uplink, the available bandwidth is 1984 kbps (Framed E1).

The number of E1s that can be compressed by the Vmux-2100 is determined by the compression coder that is used, and the percentage of silence.

Vmux-2100 is a statistical multiplexer, which means that the bandwidth is allocated dynamically between all of the Vmux channels when they have traffic that must be transported. However, empirical tests have shown that in many cases when the Vmux-2100 uses its Main Module E1/T1 uplink, the maximum number of voice E1/T1s that can be compressed is 10 or 12. (The exact number depends on the coder and on the percentage of silence). This number still holds when using a Channelized card as an uplink. Only the combination of MM TDM uplink together with MM ETH uplink, or Channelized card uplink together with MM TDM uplink may result in a higher utilization of the Vmux-2100 hub.

The problem is that it is not really possible to know exactly how many E1s can be supported in the actual application. You can use the Vmux calculator to reach an estimate, but to derive the exact number you must test it on site, with real live voice and signaling traffic.

You can monitor the Vmux-2100 throughput in real time using the statistics menu. It is also possible to download the statistics of the most recent four days (this information is stored by the Vmux-2100 on a file named stat.dat) using a TFTP client application, and to view the throughput on the E1 uplink in a graph or table, using an application called VmuxStat, (included in the Vmux documentation CD).

The statistics are collected in 1-minute intervals, and are stored as long as the Vmux-2100 unit has not been reset and the internal file storage is not full. When the internal storage is full, newer samples will overwrite older samples. If the file is not read before older samples are overwritten, then they are lost and it is impossible to restore them.

You can use this statistical information to determine whether you can add more E1/T1s to be compressed by the Vmux-2100 application, or alternatively to see if there are overflows during peak traffic periods. In case of such overflows, you should do one of the following:

1. Increase the allowed bandwidth on your TDM uplink
2. Use another voice compression coder – e.g., G.723.1 instead of G.729, thus reducing the bandwidth consumption.
3. Reduce the total number of compressed E1s.

Q: Can I use both the E1/T1 uplink and the ETH uplink at the same time?

A: Yes, but not when both uplink ports are connected to the same remote Vmux-2100. If you are using a Central Vmux-2100, you can use the IP uplink to connect it with one remote Vmux-2100 and the TDM up link port to connect it with another remote Vmux-2100.

Connecting two Vmux-2100 units with both the E1/T1 and IP uplinks (both uplinks to the SAME remote Vmux) might cause several problems: In this case the layer 2 internal switch has two uplink ports, TDM and IP. When a bundle is initiated, it sends a ping message to its destination. The switch decides to which ports it should switch the data coming from this bundle, according to the port that answers the ping message.

The routing tables of the switches are updated approximately every four minutes. So it is possible that after the table is updated, a bundle that was transported over the TDM uplink will now be transported over the IP uplink.

(Because the answer from the IP port was received before the answer from the TDM port)

This may cause two problems:

- A Vmux-2100 will use the IP uplink for transmission and the TDM uplink for receiving the same bundle.

The delay will not be the same for the two directions and it will affect voice quality.

- During the time that the switch is updating its routing table, there may be a break in the voice traffic.

This can also overload the TDM link with broadcast messages that enter from the IP network.

If the IP network is not able to transport the Vmux-2100 traffic, it will affect the voice quality. Even if you intend only to manage the Vmux-2100 over the IP network, the voice traffic might be routed to the IP network as well.

There shouldn't be any problem accessing the remote Vmux-2100 using inband management. It will not require significant bandwidth and therefore it will not affect the voice quality.

Q: Can Vmux-2100 transmit fax over uplinks with a long delay?

A: Test results show that even with a delay of 900 msec in one direction, there are no problem sending/receiving fax messages. Therefore, according to this test, it will be possible to implement the Vmux-2100 in a link that introduces a long delay (usually a satellite application), and to be able to support a fax server application.

The application test is as follows:

MP-2100 with FXS port > Vmux > Delay line > Vmux > MP-2100 with FXS port

Q: How does the Vmux-2100 handle fax or modem transmission?

A: The DSP that is used by the Vmux-2100 voice modules has a fax/modem discriminator that allows it to detect and distinguish modem and fax start signals, according to ITU-T standards.

FAX: The Vmux-2100 DSP has a fax relay. When the DSP (Digital Signaling Processor) detects fax transmission over the voice channel, it stops the compression procedure and transfers the fax transmission at a user-configurable rate (up to 14.4 kbps). When in fax mode, the DSP serves in fact just as a fax machine: it demodulates the analog signal at the receiving end, passes the DIGITAL information to the remote end, and then remodulates the digital info into an analog signal, simulating the original fax machine.

Supported FAX standards are: G3 fax, T.30.

MODEM: When modem transmission is detected, it is given a clear channel (Voice Band Data) of 64 kbps, and it is transferred transparently. Supported modem standards are: V.34 (33.6 kbps), V.32bis (14.4 kbps), V.22bis (4.8 kbps).

Q: Can I use both T1 and E1 voice modules on the same Vmux-2100 chassis?

A: Yes.

The voice module terminates the T1 or E1 frame. The payload of the voice channels is compressed by the voice module. The compressed voice data and the signaling information are then encapsulated into a TDMoIP frame. The TDMoIP frame is sent over an internal packet-based bus to the main module.

Therefore, since the information that is received at the voice module is compressed and converted to a packet-based frame, each voice module is independent of any other voice module that is installed on the same chassis.

Q: Can I use a T1 voice module when using an E1 main link module?

A: Yes.

The voice module terminates the T1 frame. The payload of the voice channels is compressed by the voice module. The compressed voice data and the signaling information are then encapsulated into a TDMoIP frame. The TDMoIP frame is sent over an internal packet base bus to the main module.

On the main module, an additional four bytes (HDLC flags and CRC) are added to the TDMoIP frame just before it is sent over the TDM network.

Therefore, since the information that is received at the voice module is compressed and converted to a packet-based frame, there is no correlation between the interface type of the voice module and the interface type of the main module

In this way a T1 voice module can be used while the main link module has an E1 interface and vice versa.

Q: What is the MF Spoofing parameter in Vmux-2100/110, and how does it affect the R2-MFC call establishment delay?

A: MF R2 is normally a compelled system (R2-MFC, MFC=Multi-Frequency Compelled). That is, one side transmits a pair of tones representing a digit, and the other side must acknowledge that it has received that digit before the originating side will transmit another digit.

The actual process for one digit in MFC mode is as follows:

1. Calling side sends the digit.
2. Answering side sends Acknowledge.
3. Calling side stops transmitting the digit.
4. Answering side stops transmitting Acknowledge.

Only after this 4-step process, the calling side sends the next digit.

When the Vmux operates in MR Relay mode, it adds around 150 msec of delay to each step of the digits transmission (around 600 msec for each digit).

This means that for a 10-digit number, the Vmux adds about 6 seconds to the call establishment time.

When enabling the MF Spoofing* parameter (located under: Bundle Configuration > Edit Bundle > Voice Parameters > MF Parameters), Vmux accelerates the whole call establishment process by terminating the Forward signals after a configurable duration (MF Parameters > Tone Ack Interval

parameter), thus emulating the end of the Forward signal earlier than the time it would have taken for this end of signal to arrive via the Vmux and transmission delay, causing the Answering PBX/Switch to proceed with the next step. In other words, at the remote Vmux any Forward tone is transmitted only for a limited duration defined by the Tone Ack Interval parameter, and then stopped. This will cause the answering PBX to "think" that the originating PBX has received already its Backward Acknowledge tone, and therefore it will stop sending the Ack signal earlier than as it would have done if it had to travel the whole application delay. By this the whole call establishment process will eventually be shortened, as the above process is repeated for each digit.

Setting the Tone Ack Interval should be equal or higher than the minimum tone duration requirements of the PBX/Switches. The default value of 80 msec should be fine with most PBX/Switches.

Enabling the Spoofing parameter in Vmux can typically reduce the total call establishment duration by approximately 35%.

Q: What UDP ports are used by Vmux-2100/110/210?

A: The values of the UDP ports in Vmux traffic are determined as follows:

1. DESTINATION Port: always 0x085E (=2142d)
2. SOURCE Port: composed of a combination of 3 bits (MSB) that depend on the Vmux model, and 13 bits (LSB) that reflect the destination bundle number.
 - Vmux-110: 001 (=1d) + Destination Bundle Number
 - Vmux-2100: 110 (=6d) + Destination Bundle Number

NOTE: Unlike IPmux - once set, the value of the source port does not change according to the bundle state.

Example:

Vmux-110/Bundle 1 opposite Vmux-2100/Bundle 3

In this case the UDP Source Port will be set as follows:

- Packets transmitted from the Vmux-110 (Dest. Bundle=3):
0010000000000011 = 8195d = 0x2003
- Packets transmitted from the Vmux-2100 (Dest. Bundle=1):
1100000000000001 = 49153d = 0xC001

Q: Why does Vmux change the IP identifier value to 0?

A: The Identification field and source IP address are used to identify fragments of one packet. The Vmux sets it to zero, since it doesn't fragment the voice bundles.

6.6 Technical Support

Technical support for Vmux-2100 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.

This information can be found at RAD's Web site: <http://www.rad.com/> (for offices location, click **About RAD > Worldwide Offices**; for distributors location, click **Where to Buy > End Users**).

Appendix A

Connector Pinouts

A.1 E1/T1 Ports

Balanced E1/T1 Interface Connector

The balanced E1/T1 interfaces of the main link and voice modules terminate in RJ-45 connectors. [Figure A-1](#) illustrates the pin location in an RJ-45 connector. [Table A-1](#) lists the E1/T1 connector pin assignment.

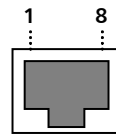


Figure A-1. RJ-45 Connector Pin Location

Table A-1. E1/T1 Balanced Connector Pinout

Pin	Function
1, 2	Receive (input)
4, 5	Transmit (output)

Unbalanced E1 Interface

When Vmux-2100 is configured to operate with unbalanced E1 interfaces, it is necessary to convert each Vmux-2100 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-2100 E1 connector and two BNC female connectors at the other end. Cable wiring is given in [Figure A-2](#).

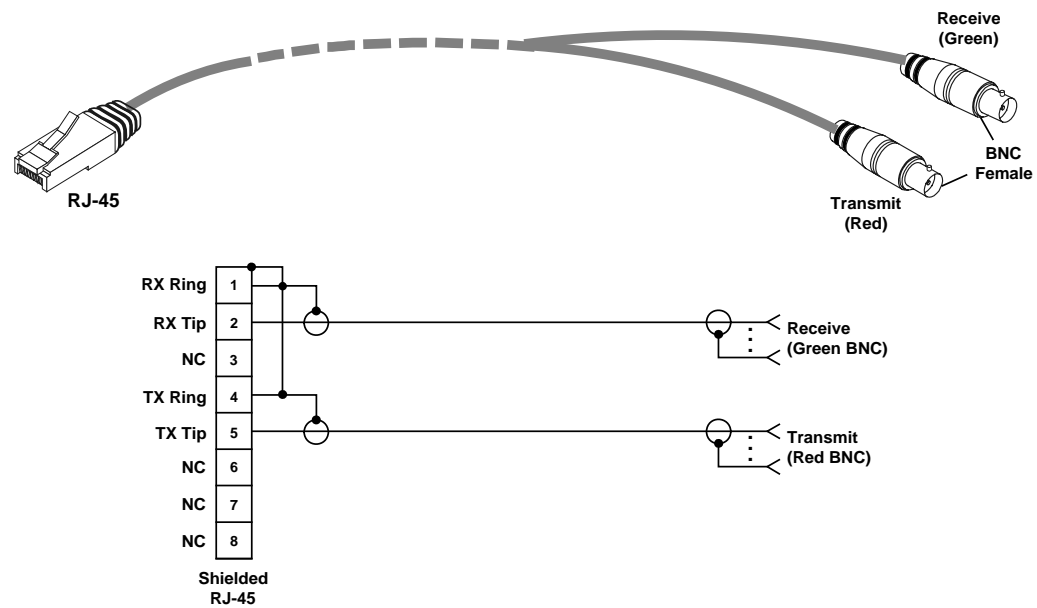


Figure A-2. E1 Adapter Cable, CBL-RJ45/2BNC/E1, Wiring Diagram

A.2 Ethernet UTP Interface Connector

The 10/100BaseT main link UTP interface also terminates in a RJ-45 connector. [Table A-2](#) lists the Ethernet connector pin assignment.

Table A-2. UTP 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.

A.3 CONTROL Connector

The control terminal interface terminates in a V.24/RS-232 9-pin D-type female DCE connector. [Table A-3](#) lists the CONTROL connector pin assignments.

Table A-3. CONTROL Connector Pinout

Pin	Function	Direction
1	Data Carrier Detect (DCD)	Out
2	Receive Data (RD)	Out
3	Transmit Data (TD)	In
4	Data Terminal Ready (DTR)	In
5	Ground (GND)	–
6	Data Set Ready (DSR)	Out
7	Request To Send (RTS)	In
8	Clear To Send (CTS)	Out
9	NC	–

Note When connected and turned on, the terminal sets the DTR line ON (active) to gain control over Vmux-2100 and starts a configuration or monitoring session.

A.4 CBL-VMUX-MM-MODEM Cross Cable

When connecting the Vmux-2100 CONTROL port to an ASCII terminal via a modem link, you must use the CBL-VMUX-MM-MODEM cross cable, which can be ordered from RAD.

CBL-VMUX-MM-MODEM cross cable includes two male DB-9 connectors, designated MODEM and VMUX. [Figure A-3](#) illustrates the cross cable. [Table A-4](#) describes the cross cable wiring.



Figure A-3. CBL-VMUX-MM-MODEM Cross Cable

Table A-4. CBL-VMUX-MM-MODEM Cross Cable Wiring

MODEM Connector Pin	VMUX Connector Pin
2	3
3	2
1	7
7	1
4	6
9	4
5	5

A.5 Serial Link Connector

The redundant Serial links terminate on a single 50-pin SCSI connector. An adapter cable is required to split and convert the SCSI connector into two separate link connectors with standard interfaces. The adapter cables are described in [Serial Interface Adapter Cables](#).

The 50-pin Serial port is shown in [Figure A-4](#). The pinout of the Serial connector is shown in [Table A-5](#).

*Figure A-4. 50-Pin SCSI Serial Link Connector**Table A-5. Serial Connector Pinout*

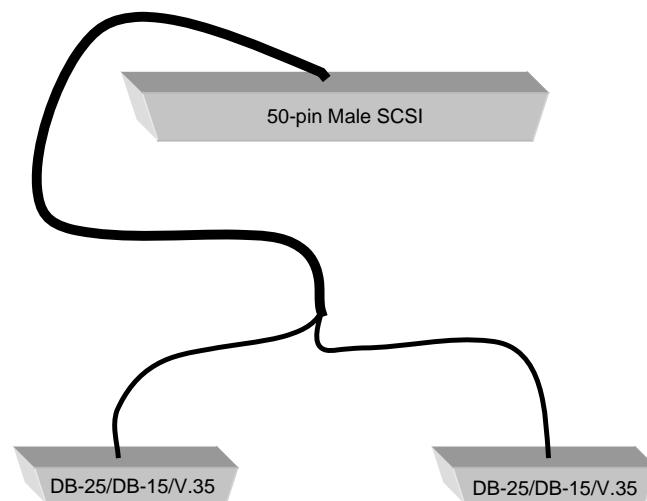
Pin	Function	Pin	Function
1	FGND	13	Not Connected
2	GND	14	DSR-P
3	DSR-P	15	DTR-P
4	DTR-P	16	DCD-P
5	DCD-P	17	RTS-P
6	RTS-P	18	CTS-P
7	CTS-P	19	ETXC-P
8	ETXC-P	20	TXC-P
9	TXC-P	21	RXC-P
10	RXC-P	22	TXD-P
11	TXD-P	23	RXD-P
12	RXD-P	24	GND

Table A-5. Serial Connector Pinout (Cont.)

Pin	Function	Pin	Function
25	FGND	38	Not Connected
26	Not Connected	39	DSR-N
27	Not Connected	40	DTR-N
28	DSR-N	41	DCD-N
29	DTR-N	42	RTS-N
30	DCD-N	43	CTS-N
31	RTS-N	44	ETXC-N
32	CTS-N	45	TXC-N
33	ETXC-N	46	RXC-N
34	TXC-N	47	TXD-N
35	RXC-N	48	RXD-N
36	TXD-N	49	Not Connected
37	RXD-N	50	Not Connected

A.6 Serial Interface Adapter Cables

A Vmux-2100 Serial Interface Adapter Cable is used to split the single 50-pin SCSI connector on the Main Module into two independent serial uplinks. One side of the interface cable has a male 50-pin SCSI connector for plugging into the Vmux-2100 Serial link port. Each of the two ends on the other side of the interface cable has a connector of the type specified (DB-25, DB-15 or V.35).

*Figure A-5. Serial Interface Adapter Cable*

The specific adapter cable required depends on the type of interface used by the serial uplink. [Table A-6](#) lists the supported interfaces and the respective RAD part number of the required adapter cable. The subsequent tables list the pinouts for each of these adapter cables.

Table A-6. Adapter Cables for Serial Interface

Interface	Cable Product Code
X.21 - DCE	CBL-VM2100/X21/DCE
X.21 - DTE	CBL-VM2100/X21/DTE
V.35 - DCE	CBL-VM2100/V35/DCE
V.35 - DTE	CBL-VM2100/V35/DTE
RS-530 - DCE RS-449 - DCE	CBL-VM2100/530/DCE
RS-530 - DTE RS-449 - DTE	CBL-VM2100/530/DTE

Table A-7. Adapter Cable for RS-530/DCE Interface (CBL-VM2100/530/DCE)

SCSI	DB25F # 1	DB25F # 2	Remarks
pin #1		pin #1	(FGND)
pin #2		pin #7	(GND)
pin #3		pin #23	(DSR-P)
pin #28		pin #20	(DSR-N)
pin #4		pin #22	(DTR-P)
pin #29		pin #6	(DTR-N)
pin #5		pin #10	(DCD-P)
pin #30		pin #8	(DCD-N)
pin #6		pin #13	(RTS-P)
pin #31		pin #5	(RTS-N)
pin #7		pin #19	(CTS-P)
pin #32		pin #4	(CTS-N)
pin #8		pin #9	(ETXC-P)
pin #33		pin #17	(ETXC-N)
pin #9		pin #12	(TXC-P)
pin #34		pin #15	(TXC-N)
pin #10		pin #11	(RXC-P)

*Table A-7. Adapter Cable for RS-530/DCE Interface (CBL-VM2100/530/DCE)
(Cont.)*

SCSI	DB25F # 1	DB25F # 2	Remarks
pin #35		pin #24	(RXC-N)
pin #11		pin #16	(TXD-P)
pin #36		pin #3	(TXD-N)
pin #12		pin #14	(RXD-P)
pin #37		pin #2	(RXD-N)
pin #14	pin #23		(DSR-P)
pin #39	pin #20		(DSR-N)
pin #15	pin #22		(DTR-P)
pin #40	pin #6		(DTR-N)
pin #16	pin #10		(DCD-P)
pin #41	pin #8		(DCD-N)
pin #17	pin #13		(RTS-P)
pin #42	pin #5		(RTS-N)
pin #18	pin #19		(CTS-P)
pin #43	pin #4		(CTS-N)
pin #19	pin #9		(ETXC-P)
pin #44	pin #17		(ETXC-N)
pin #20	pin #12		(TXC-P)
pin #45	pin #15		(TXC-N)
pin #21	pin #11		(RXC-P)
pin #46	pin #24		(RXC-N)
pin #22	pin #16		(TXD-P)
pin #47	pin #3		(TXD-N)
pin #23	pin #14		(RXD-P)
pin #48	pin #2		(RXD-N)
pin #24	pin #7		(GND)
pin #25	pin #1		(FGND)
pin #13 (N.C)	Not Connected		
pin #26 (N.C)	Not Connected		
pin #27 (N.C)	Not Connected		
pin #38 (N.C)	Not Connected		

*Table A-7. Adapter Cable for RS-530/DCE Interface (CBL-VM2100/530/DCE)
(Cont.)*

SCSI	DB25F # 1	DB25F # 2	Remarks
pin #49 (N.C)	Not Connected		
pin #50 (N.C)	Not Connected		

Table A-8. Adapter Cable for RS530/DTE Interface (CBL-VM2100/530/DTE)

SCSI	DB25M # 1	DB25M # 2	Remarks
pin #1		pin #1	(FGND)
pin #2		pin #7	(GND)
pin #3		pin #22	(DSR-P)
pin #28		pin #6	(DSR-N)
pin #4		pin #23	(DTR-P)
pin #29		pin #20	(DTR-N)
pin #5		pin #10	(DCD-P)
pin #30		pin #8	(DCD-N)
pin #6		pin #19	(RTS-P)
pin #31		pin #4	(RTS-N)
pin #7		pin #13	(CTS-P)
pin #32		pin #5	(CTS-N)
pin #8		pin #24	(ETXC-P)
pin #33		pin #11	(ETXC-N)
pin #9		pin #12	(TXC-P)
pin #34		pin #15	(TXC-N)
pin #10		pin #9	(RXC-P)
pin #35		pin #17	(RXC-N)
pin #11		pin #14	(TXD-P)
pin #36		pin #2	(TXD-N)
pin #12		pin #16	(RXD-P)
pin #37		pin #3	(RXD-N)
pin #14	pin #22		(DSR-P)
pin #39	pin #6		(DSR-N)
pin #15	pin #23		(DTR-P)
pin #40	pin #20		(DTR-N)

Table A-8. Adapter Cable for RS530/DTE Interface (CBL-VM2100/530/DTE) (Cont.)

SCSI	DB25M # 1	DB25M # 2	Remarks
pin #16	pin #10		(DCD-P)
pin #41	pin #8		(DCD-N)
pin #17	pin #19		(RTS-P)
pin #42	pin #4		(RTS-N)
pin #18	pin #13		(CTS-P)
pin #43	pin #5		(CTS-N)
pin #19	pin #24		(ETXC-P)
pin #44	pin #11		(ETXC-N)
pin #20	pin #12		(TXC-P)
pin #45	pin #15		(TXC-N)
pin #21	pin #9		(RXC-P)
pin #46	pin #17		(RXC-N)
pin #22	pin #14		(TXD-P)
pin #47	pin #2		(TXD-N)
pin #23	pin #16		(RXD-P)
pin #48	pin #3		(RXD-N)
pin #24	pin #7		(GND)
pin #25	pin #1		(FGND)
pin #13 (N.C)	Not Connected		
pin #26 (N.C)	Not Connected		
pin #27 (N.C)	Not Connected		
pin #38 (N.C)	Not Connected		
pin #49 (N.C)	Not Connected		
pin #50 (N.C)	Not Connected		

Table A-9. Adapter Cable for X.21/DCE Interface (CBL-VM2100/X21/DCE)

SCSI	DB15F # 1	DB15F # 2	Remarks
pin #1		pin #1	(FGND)
pin #2		pin #8	(GND)
pin #3			(DSR-P)
pin #28			(DSR-N)
pin #4			(DTR-P)
pin #29			(DTR-N)
pin #5		pin #12	(DCD-P)
pin #30		pin #5	(DCD-N)
pin #6			(RTS-P)
pin #31			(RTS-N)
pin #7		pin #10	(CTS-P)
pin #32		pin #3	(CTS-N)
pin #8			(ETXC-P)
pin #33			(ETXC-N)
pin #9		pin #13	(TXC-P)
pin #34		pin #6	(TXC-N)
pin #10		pin #14	(RXC-P)
pin #35		pin #7	(RXC-N)
pin #11		pin #11	(TXD-P)
pin #36		pin #4	(TXD-N)
pin #12		pin #9	(RXD-P)
pin #37		pin #2	(RXD-N)
pin #14			(DSR-P)
pin #39			(DSR-N)
pin #15			(DTR-P)
pin #40			(DTR-N)
pin #16	pin #12		(DCD-P)
pin #41	pin #5		(DCD-N)
pin #17			(RTS-P)
pin #42			(RTS-N)
pin #18	pin #10		(CTS-P)

Table A-9. Adapter Cable for X.21/DCE Interface (CBL-VM2100/X21/DCE) (Cont.)

SCSI	DB15F # 1	DB15F # 2	Remarks
pin #43	pin #3		(CTS-N)
pin #19			(ETXC-P)
pin #44			(ETXC-N)
pin #20	pin #13		(TXC-P)
pin #45	pin #6		(TXC-N)
pin #21	pin #14		(RXC-P)
pin #46	pin #7		(RXC-N)
pin #22	pin #11		(TXD-P)
pin #47	pin #4		(TXD-N)
pin #23	pin #9		(RXD-P)
pin #48	pin #2		(RXD-N)
pin #24	pin #8		(GND)
pin #25	pin #1		(FGND)
pin #13 (N.C)	Not Connected		
pin #26 (N.C)	Not Connected		
pin #27 (N.C)	Not Connected		
pin #38 (N.C)	Not Connected		
pin #49 (N.C)	Not Connected		
pin #50 (N.C)	Not Connected		

Table A-10. Adapter Cable for X.21/DTE Interface (CBL-VM2100/X21/DTE)

SCSI	DB15M # 1	DB15M # 2	Remarks
pin #1		pin #1	(FGND)
pin #2		pin #8	(GND)
pin #3			(DSR-P)
pin #28			(DSR-N)
pin #4			(DTR-P)
pin #29			(DTR-N)
pin #5		pin #12	(DCD-P)
pin #30		pin #5	(DCD-N)
pin #6		pin #10	(RTS-P)
pin #31		pin #3	(RTS-N)
pin #7			(CTS-P)
pin #32			(CTS-N)
pin #8			(ETXC-P)
pin #33			(ETXC-N)
pin #9			(TXC-P)
pin #34			(TXC-N)
pin #10		pin #13	(RXC-P)
pin #35		pin #6	(RXC-N)
pin #11		pin #9	(TXD-P)
pin #36		pin #2	(TXD-N)
pin #12		pin #11	(RXD-P)
pin #37		pin #4	(RXD-N)
pin #14			(DSR-P)
pin #39			(DSR-N)
pin #15			(DTR-P)
pin #40			(DTR-N)
pin #16	pin #12		(DCD-P)
pin #41	pin #5		(DCD-N)
pin #17	pin #10		(RTS-P)

Table A-10. Adapter Cable for X.21/DTE Interface (CBL-VM2100/X21/DTE) (Cont.)

SCSI	DB15M # 1	DB15M # 2	Remarks
pin #42	pin #3		(RTS-N)
pin #18			(CTS-P)
pin #43			(CTS-N)
pin #19			(ETXC-P)
pin #44			(ETXC-N)
pin #20			(TXC-P)
pin #45			(TXC-N)
pin #21	pin #13		(RXC-P)
pin #46	pin #6		(RXC-N)
pin #22	pin #9		(TXD-P)
pin #47	pin #2		(TXD-N)
pin #23	pin #11		(RXD-P)
pin #48	pin #4		(RXD-N)
pin #24	pin #8		(GND)
pin #25	pin #1		(FGND)
pin #13 (N.C)	Not Connected		
pin #26 (N.C)	Not Connected		
pin #27 (N.C)	Not Connected		
pin #38 (N.C)	Not Connected		
pin #49 (N.C)	Not Connected		
pin #50 (N.C)	Not Connected		

Table A-11. Adapter Cable for V.35/DCE Interface (CBL-VM2100/V35/DCE)

SCSI	V.35F # 1	V.35F # 2	Remarks
pin #1		A	(FGND)
pin #2		B	(GND)
pin #3			(DSR-P)
pin #28		H	(DSR-N)
pin #4			(DTR-P)
pin #29		E	(DTR-N)
pin #5			(DCD-P)
pin #30		F	(DCD-N)
pin #6			(RTS-P)
pin #31		D	(RTS-N)
pin #7			(CTS-P)
pin #32		C	(CTS-N)
pin #8		X	(ETXC-P)
pin #33		V	(ETXC-N)
pin #9		AA	(TXC-P)
pin #34		Y	(TXC-N)
pin #10		W	(RXC-P)
pin #35		U	(RXC-N)
pin #11		T	(TXD-P)
pin #36		R	(TXD-N)
pin #12		S	(RXD-P)
pin #37		P	(RXD-N)
pin #14			(DSR-P)
pin #39	H		(DSR-N)
pin #15			(DTR-P)
pin #40	E		(DTR-N)
pin #16			(DCD-P)
pin #41	F		(DCD-N)
pin #17			(RTS-P)
pin #42	D		(RTS-N)
pin #18			(CTS-P)
pin #43	C		(CTS-N)

Table A-11. Adapter Cable for V.35/DCE Interface (CBL-VM2100/V35/DCE) (Cont.)

SCSI	V.35F # 1	V.35F # 2	Remarks
pin #19	X		(ETXC-P)
pin #44	V		(ETXC-N)
pin #20	AA		(TXC-P)
pin #45	Y		(TXC-N)
pin #21	W		(RXC-P)
pin #46	U		(RXC-N)
pin #22	T		(TXD-P)
pin #47	R		(TXD-N)
pin #23	S		(RXD-P)
pin #48	P		(RXD-N)
pin #24	B		(GND)
pin #25	A		(FGND)
pin #13 (N.C)	Not Connected		
pin #26 (N.C)	Not Connected		
pin #27 (N.C)	Not Connected		
pin #38 (N.C)	Not Connected		
pin #49 (N.C)	Not Connected		
pin #50 (N.C)	Not Connected		

Table A-12. Adapter Cable for V.35/DTE Interface (CBL-VM2100/V35/DTE)

SCSI	V.35M # 1	V.35M # 2	Remarks
pin #1		A	(FGND)
pin #2		B	(GND)
pin #3			(DSR-P)
pin #28		H	(DSR-N)
pin #4			(DTR-P)
pin #29		E	(DTR-N)
pin #5			(DCD-P)
pin #30		F	(DCD-N)
pin #6			(RTS-P)
pin #31		C	(RTS-N)
pin #7			(CTS-P)
pin #32		D	(CTS-N)
pin #8		W	(ETXC-P)
pin #33		U	(ETXC-N)
pin #9		AA	(TXC-P)
pin #34		Y	(TXC-N)
pin #10		X	(RXC-P)
pin #35		V	(RXC-N)
pin #11		P	(TXD-P)
pin #36		S	(TXD-N)
pin #12		T	(RXD-P)
pin #37		R	(RXD-N)
pin #14			(DSR-P)
pin #39	H		(DSR-N)
pin #15			(DTR-P)
pin #40	E		(DTR-N)
pin #16			(DCD-P)
pin #41	F		(DCD-N)
pin #17			(RTS-P)
pin #42	C		(RTS-N)
pin #18			(CTS-P)
pin #43	D		(CTS-N)

Table A-12. Adapter Cable for V.35/DTE Interface (CBL-VM2100/V35/DTE) (Cont.)

SCSI	V.35M # 1	V.35M # 2	Remarks
pin #19	W		(ETXC-P)
pin #44	U		(ETXC-N)
pin #20	AA		(TXC-P)
pin #45	Y		(TXC-N)
pin #21	X		(RXC-P)
pin #46	V		(RXC-N)
pin #22	P		(TXD-P)
pin #47	S		(TXD-N)
pin #23	T		(RXD-P)
pin #48	R		(RXD-N)
pin #24	B		(GND)
pin #25	A		(FGND)
pin #13 (N.C)	Not Connected		
pin #26 (N.C)	Not Connected		
pin #27 (N.C)	Not Connected		
pin #38 (N.C)	Not Connected		
pin #49 (N.C)	Not Connected		
pin #50 (N.C)	Not Connected		

Appendix B

Boot Manager

B.1 Introduction

This chapter describes the Vmux-2100 boot software and provides instructions for software downloading via XMODEM or TFTP applications.

The Vmux-2100 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 files system.

The file system can hold two compressed copies of the Vmux-2100 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-2100 RAM upon power-up. The backup file is used whenever the active file is missing or corrupted.

B.2 Booting Vmux-2100

Vmux-2100 boots up automatically. After power-up, no user intervention is required, except when you want to access the file system to modify or update the Vmux-2100 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-2100 software starts to execute and you can begin working.

Accessing the File System

The file system menu is an option that allows you 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 up the Vmux-2100.

The File System menu is displayed (see [Figure B-1](#)).

```
RAD VMUX Boot Version 1.20 (Jun 16 2002)
RAD Boot Manager Version 3.30 (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

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).
- Select a partition for a temporary (one-time) use.
- Erase all partitions.
- Display the basic hardware information (RAM, ROM size etc).

- Note**
- *Partition information displayed via the File System menu, does not include the application software of the voice modules. Use the 'Show Partition Information' menu (**Main Menu > Configuration > System > Show Partition Information**) to display complete information on the Vmux-2100 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 Application**).*

B.3 Downloading the Application and Configuration Software

New application software releases are distributed as ***.img** files, which are downloaded to Vmux-2100 using the XMODEM protocol from the File System menu of the boot software. Alternatively, you can download a new software release via TFTP protocol, when the Vmux-2100 management software is already running.

The TFTP protocol can also be used for uploading configuration files, which contain the Vmux-2100 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, type **4**.

Vmux-2100 displays the following message:

Select partition to download

4. Select the backup partition by typing its number, **1**.

Vmux-2100 requires confirmation of the partition deletion:

The partition is full. Do you want to erase it (y/n)

5. Type **Y**.

Vmux-2100 responds with the following string:

Please start the XMODEM download.

6. Send the ***.img** file to Vmux-2100 using the XMODEM utility of your terminal application.

Once the downloading is completed, Vmux-2100 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.

Note *After the software upgrade has been performed, it will take several minutes for the Vmux-2100 to begin operating again. This delay is due to the time the main module requires to update all the voice modules.*

Downloading Application Files via TFTP

The application software is downloaded when Vmux-2100 has been already completed the boot-up procedure and the management software is running.

➤ **To download application files via TFTP:**

1. Start a TFTP client application.
2. Configure the communication parameters as follows:
 - Connection timeout – more than 30 seconds to prevent an automatic disconnection during the backup partition deletion (about 25 seconds).
 - Block size – 512 bytes.
 - UDP port – 69.
3. Select a local *.img file to download.
4. Set remote file name to **vmux.img**.
5. Enter the Vmux-2100 IP address.
6. Start downloading.

Vmux-2100 automatically erases the backup partition (it takes about 25 seconds). Once the downloading is completed, Vmux-2100 saves the new release as an active partition; the former active partition turns into backup.

7. Restart the unit.

Note *After the software upgrade has been performed, it will take several minutes for the Vmux-2100 to begin operating again. This delay is due to the time the main module requires to update all the voice modules.*

Uploading/Downloading Configuration Files via TFTP

You can upload a Vmux-2100 configuration file (**cnfg.dat**) to the management station for further distribution to all other units that use the similar configuration.

➤ **To upload application files via TFTP:**

1. Start a TFTP client application.
2. Set remote file name to **cnfg.dat**.
3. Enter the Vmux-2100 IP address.
4. Start uploading.

When the uploading is completed, you can download the **cnfg.dat** file to other Vmux-2100 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-2100 management software.

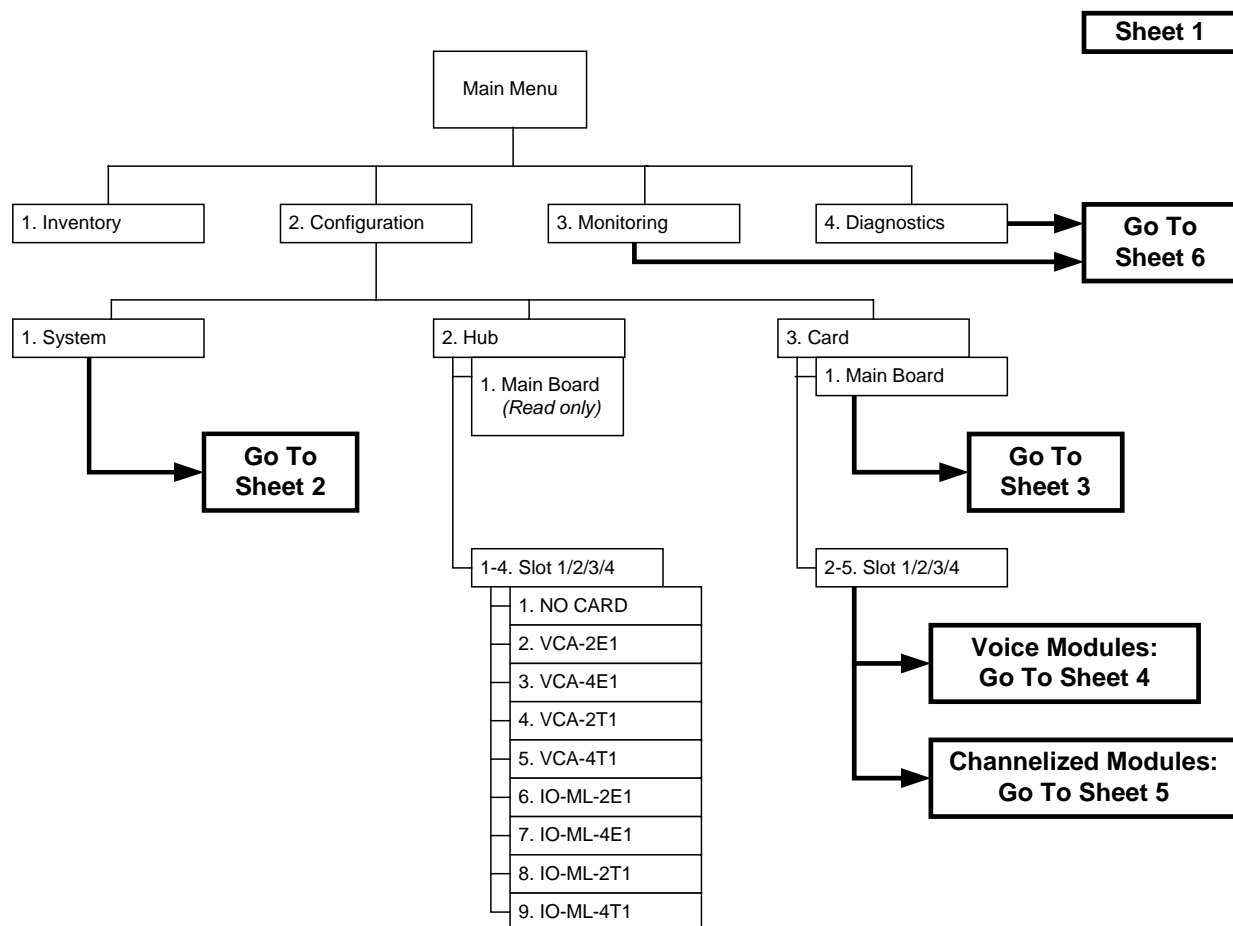


Figure C-1. Vmux-2100 Main Menu

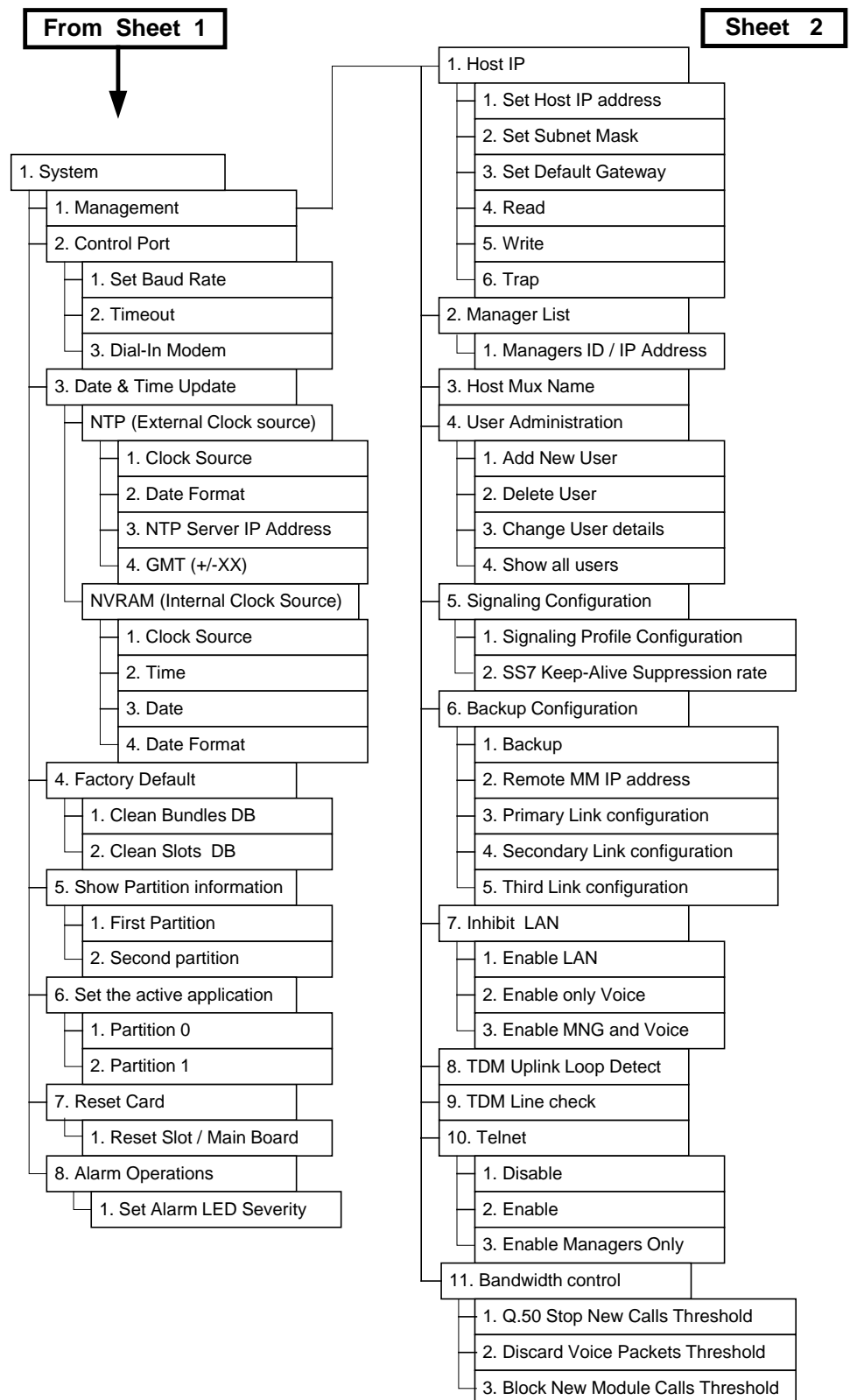


Figure C-2. System Menu

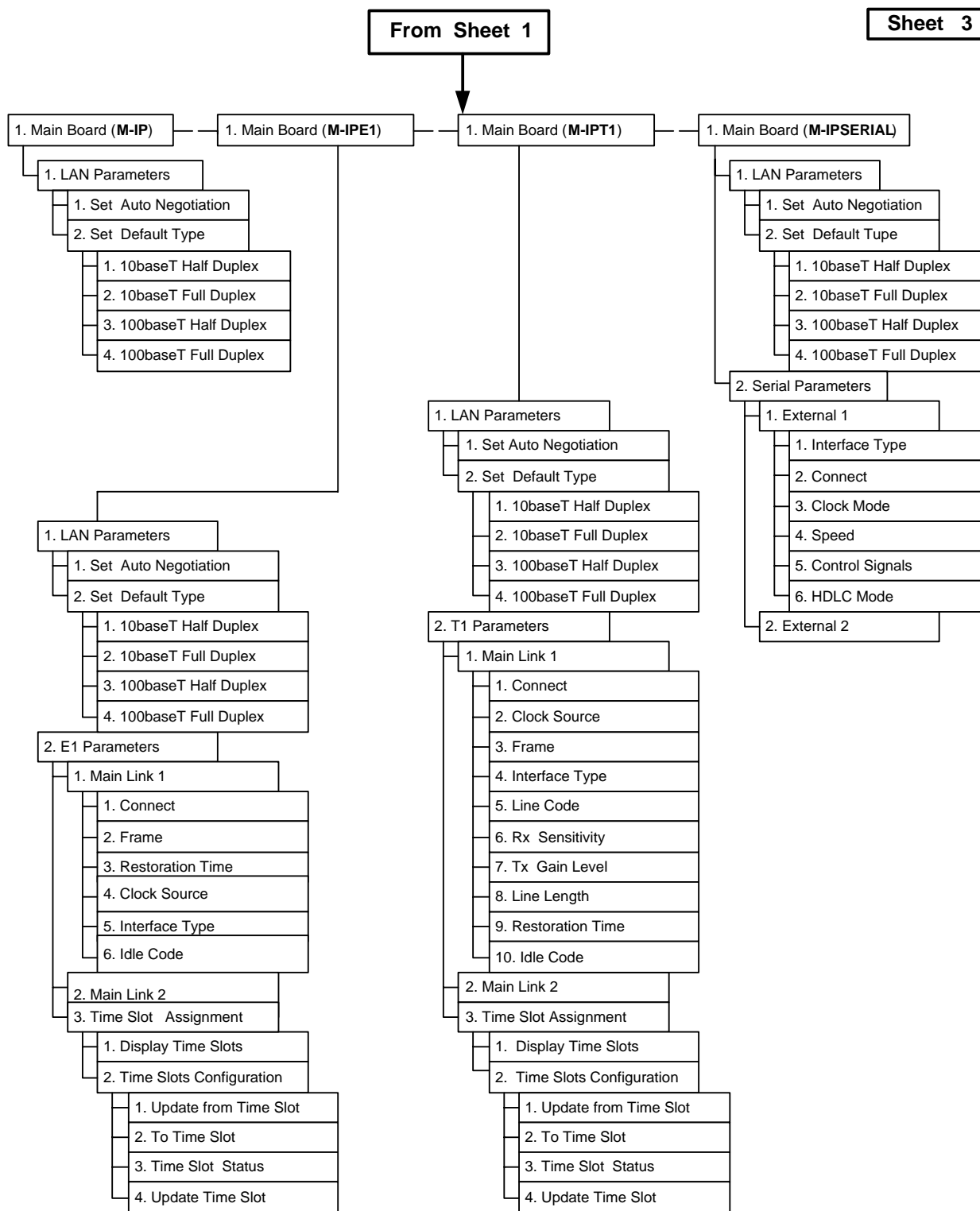


Figure C-3. Main Board Menus for Main Modules

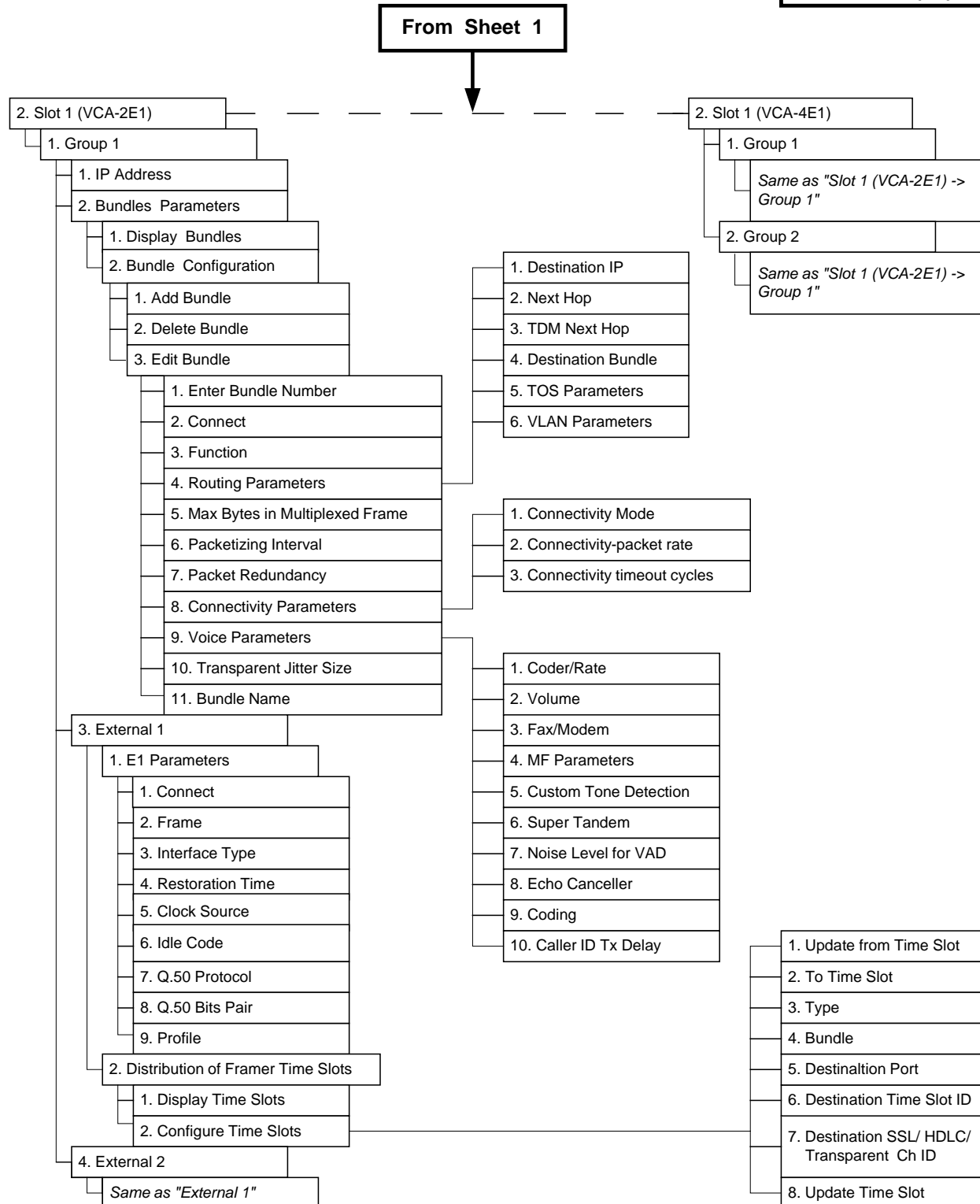
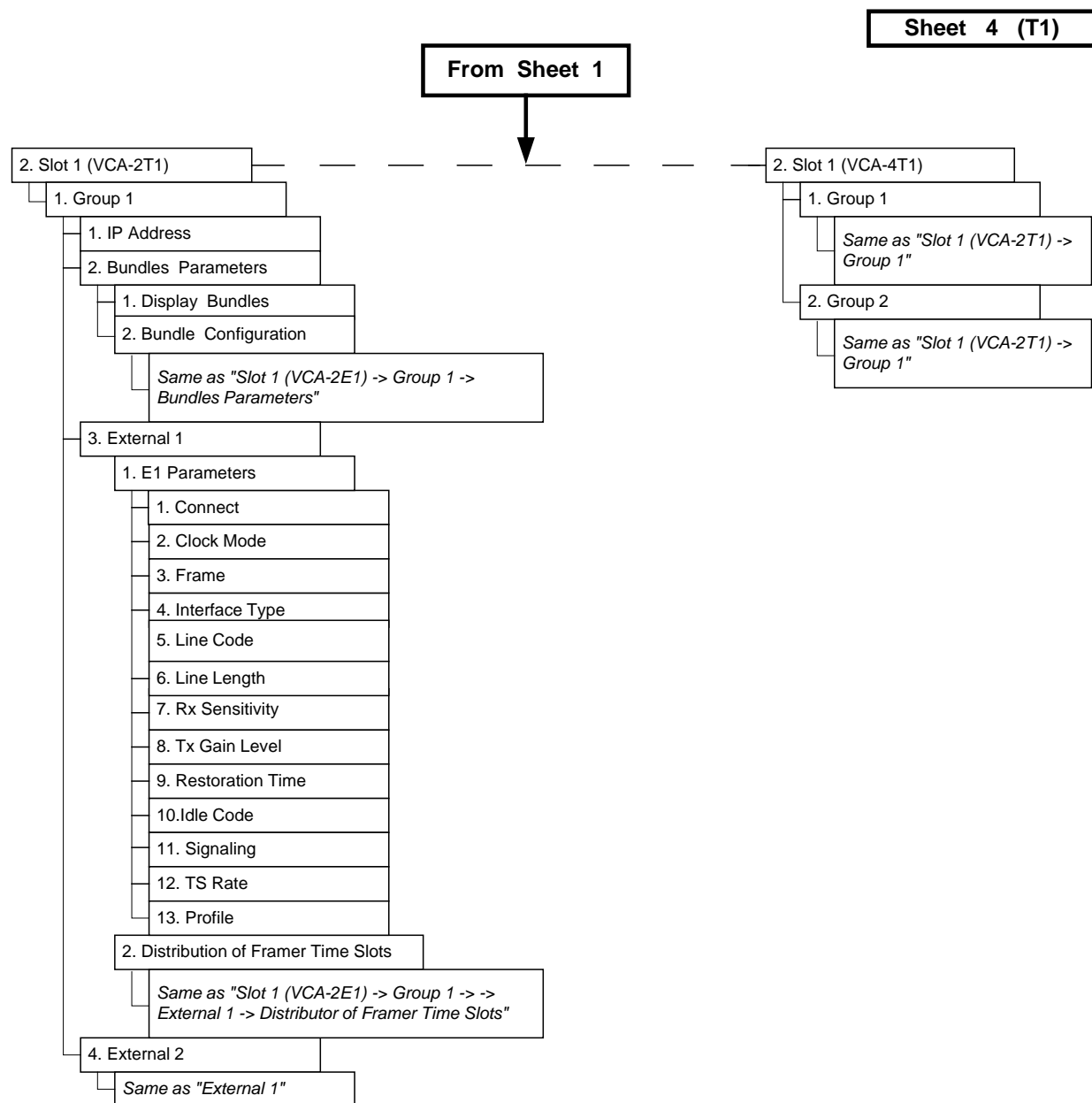
Sheet 4 (E1)

Figure C-4. Slot Menus for Voice Modules (E1)



From Sheet 1

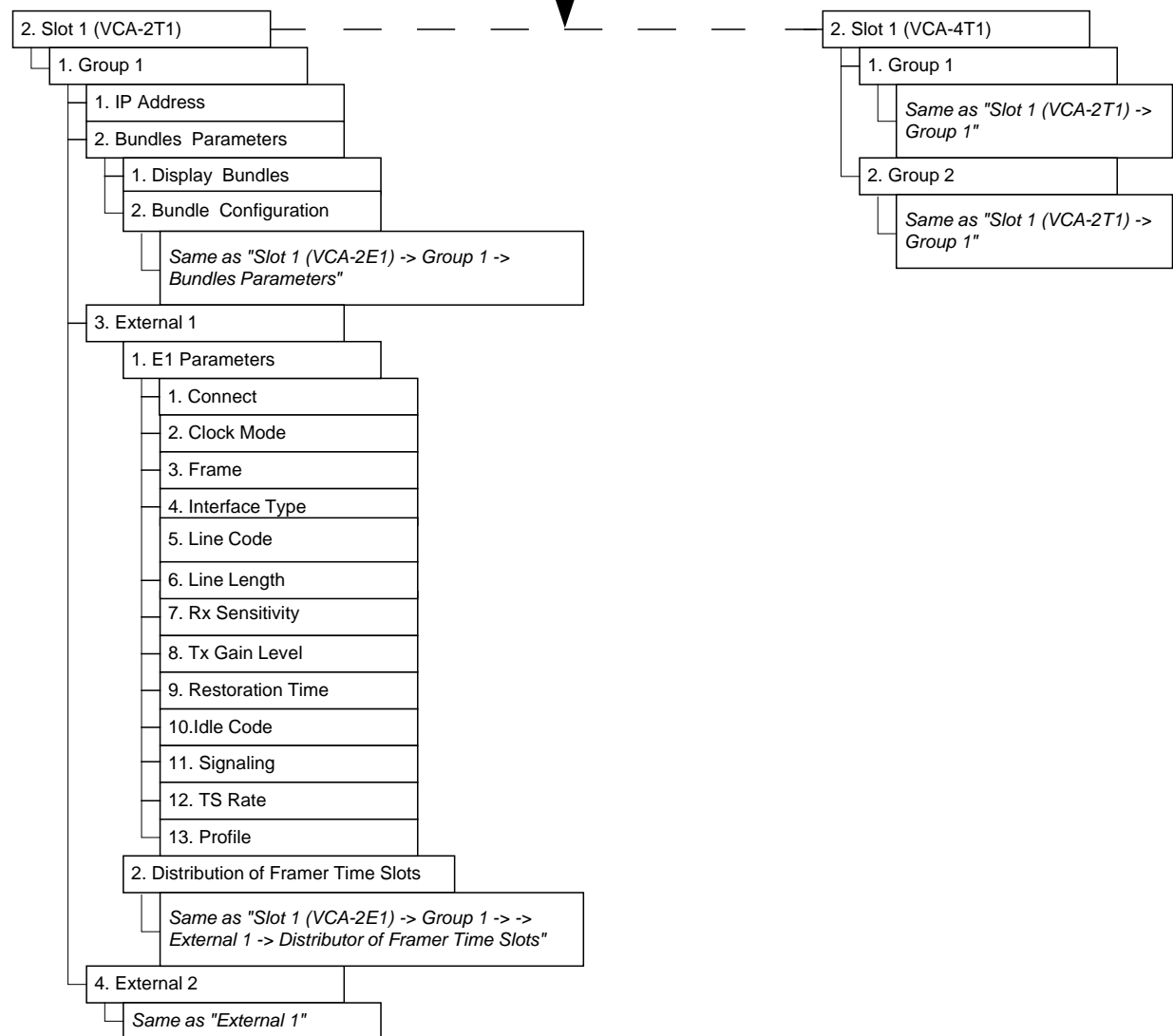


Figure C-5. Slot Menus for Voice Modules (T1)

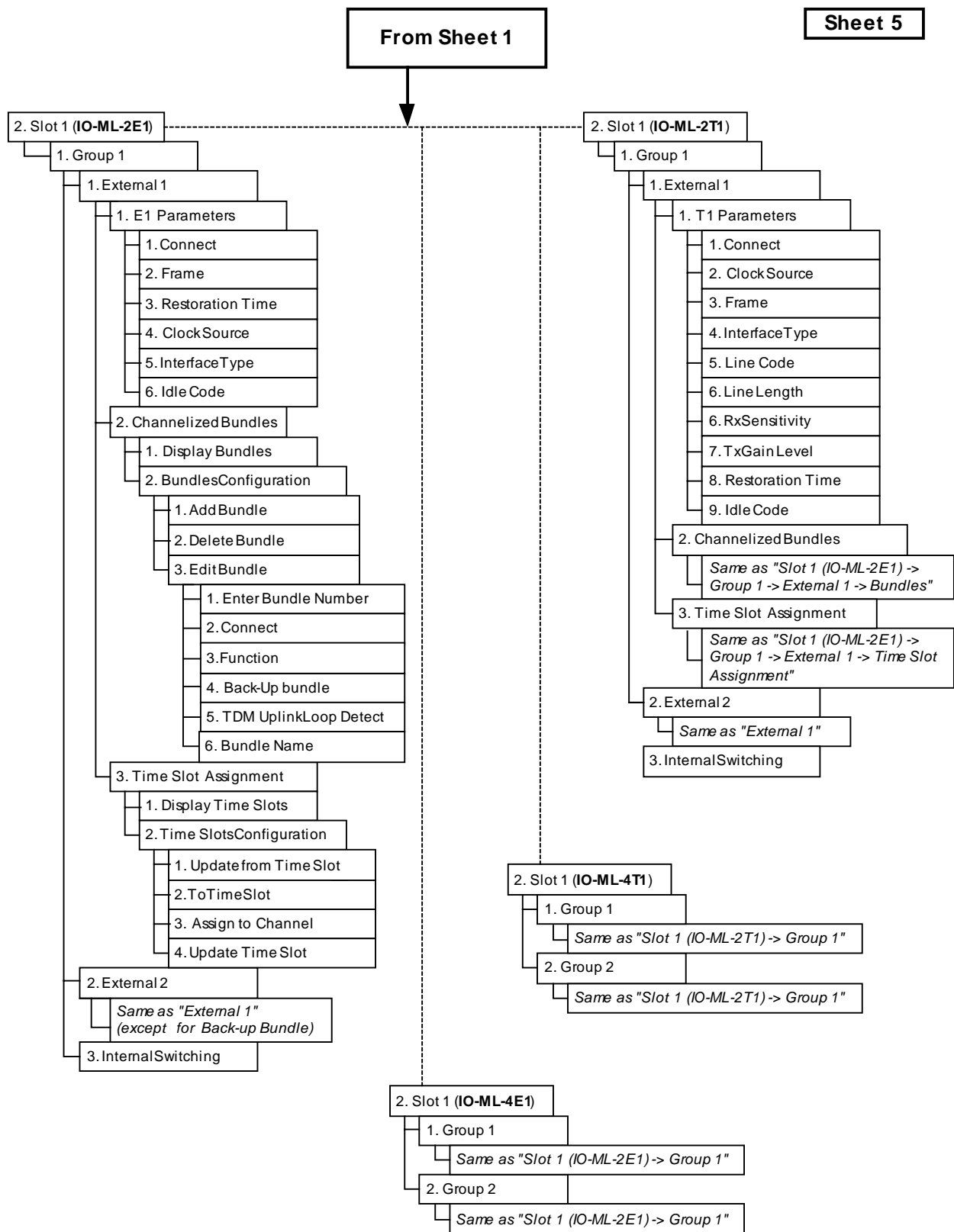


Figure C-6. Slot Menus for Channelized Modules

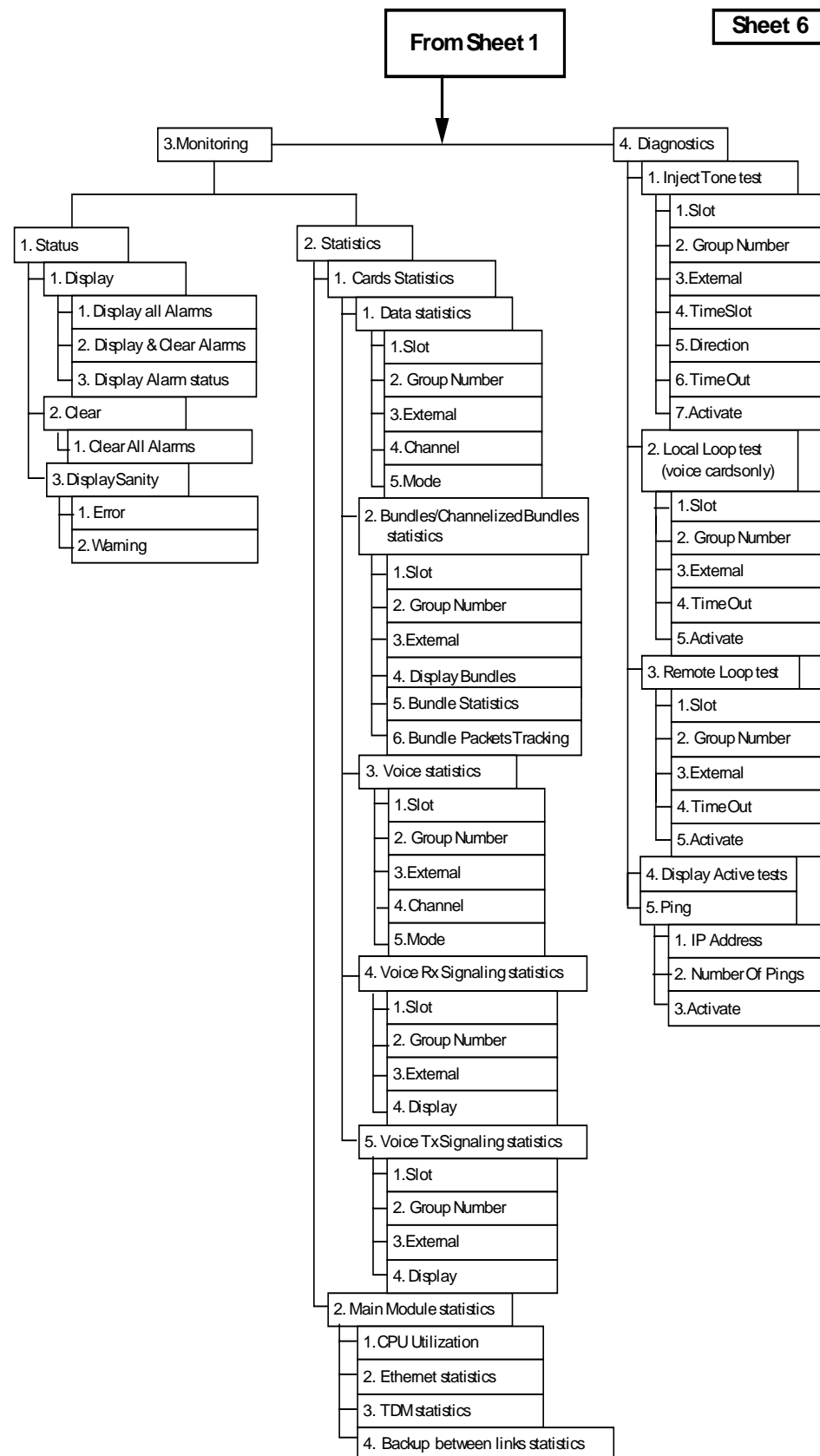


Figure C-7. Monitoring and Diagnostics Menus

Index

–A–

- AAL2oMPLS, [1-6](#), [1-20](#), [4-32](#)
- ABCD bits, [4-9](#)
- access via telnet, [4-4](#)
- adapter cables for serial interface, [A-5](#)
- adding users, [4-60](#)
- administrator, [3-10](#)
- Administrator, [3-11](#)
 - password, [3-11](#)
 - user name, [3-11](#)
- alarm buffer, [6-29](#), [6-31](#)
 - permanent, [6-31](#)
 - temporary, [6-29](#)
- alarms, [6-33](#)
 - displaying, [6-29](#)
 - handling, [6-29](#)
 - status, [6-31](#)
- application, [1-2](#)
- authentication, [1-8](#), [3-10](#)
- auto-negotiation, [1-4](#)

–B–

- backup, [4-11](#)
 - link status, [6-24](#)
- bandwidth
 - management, [1-6](#)
- bandwidth, [1-20](#)
- bandwidth control, [4-16](#)
- bandwidth management, [1-6](#)
- BERT test pattern, [6-45](#)
- boot sequence, [B-1](#)
- booting the unit, [B-1](#)
- BPV error, [6-43](#)
- buffer, alarm, [6-29](#), [6-31](#)
- bundles, [1-6](#)
 - channelized main link module statistics, [6-12](#)
 - configuring, [4-29](#)
 - configuring for channelized main module, [4-51](#)
 - voice module statistics, [6-6](#), [6-11](#)

–C–

- CAS, [1-14](#), [4-7](#)
 - configuring, [5-2](#)
- CBL-VMUX-MM-MODEM cross cable connectors, [A-3](#)
- CCS
 - configuring, [5-6](#)
- changes
 - saving, [4-55](#)
 - undoing, [4-57](#)
- channelized main link module, [1-2](#)
 - bundle statistics, [6-12](#)
 - bundles, [4-51](#)

- configuring, [4-47](#)
- E1 ports, configuring, [4-47](#)
- internal switching, configuring, [4-47](#)
- statistics, [6-1](#)
- T1 ports, configuring, [4-49](#)
- timeslots, [4-53](#)
- clock, setting, [4-63](#)
- cnfg.dat, [5-5](#)
- Communication parameters, [3-10](#)
- compression, [1-14](#)
- ConfiguRAD, [3-9](#)
 - login, [3-11](#)
- Configuration
 - aborting changes, [3-12](#)
 - alternatives, [3-9](#)
 - preliminary, [3-9](#)
 - saving changes, [3-12](#)
 - terminal, [3-9](#)
- configuration files
 - downloading, [B-4](#)
 - uploading, [B-4](#)
- configuring
 - bandwidth control, [4-16](#)
 - bundles, [4-29](#)
 - CAS signaling, [5-2](#)
 - CCS signaling, [5-6](#)
 - channelized main link E1 ports, [4-47](#)
 - channelized main link T1 ports, [4-49](#)
 - channelized main module, [4-47](#)
 - control port, [4-5](#)
 - data rate, [4-5](#)
 - date and time, [4-63](#)
 - default settings, [3-3](#)
 - device name, [4-4](#)
 - E1 timeslots, [4-25](#)
 - Ethernet management connection, [4-1](#)
 - host IP, [4-1](#)
 - keep-alive suppression rate, [4-10](#)
 - link backup, [4-11](#)
 - main link, [5-3](#)
 - main link module, [4-18](#)
 - manager list, [4-3](#)
 - modem access, [4-6](#)
 - signaling information for E1/T1 ports, [4-7](#)
 - T1 timeslots, [4-28](#)
 - telnet access, [4-4](#)
 - timeout, [4-6](#)
 - user database, [4-60](#)
 - voice module, [4-18](#), [4-29](#), [5-3](#)
- connecting
 - control port, [2-6](#)
 - E1 voice port, [2-4](#)
 - E1/T1 main link, [2-5](#), [2-6](#)
 - Ethernet main link, [2-5](#)

- interfaces, [2-4](#)
- main link, [2-5](#)
- management console, [2-6](#)
- modem, [2-6](#)
- power, [2-6](#)
- serial main link, [2-5](#)
- T1 voice port, [2-4](#)
- connectivity parameters, [4-33](#)
- connector pinouts
 - CBL-VMUX-MM-MODEM, [A-3](#)
 - control port, [A-3](#)
 - E1 port, [A-1](#)
 - Ethernet UTP, [A-2](#)
 - serial interface, [A-4](#)
 - T1 port, [A-1](#)
- connectors, [2-4](#)
- contents of package, [2-2](#)
- control port
 - configuring, [4-5](#)
 - connecting, [2-6](#)
 - connecting via modem, [2-6](#)
 - connector, [A-3](#)
 - technical specifications, [1-22](#)
- Control port
 - characteristics, [3-9](#)
- CSS, [1-14](#)
- D—**
- data channels, [1-14](#)
- data rate, [4-5](#)
- database
 - cleaning, [4-58](#)
 - configuring modules, [4-17](#)
 - transferring to remote unit, [5-5](#)
 - updating, [4-55](#)
- Date, [4-64](#), [4-65](#)
- date, setting, [4-63](#)
- Default communication parameters, [3-10](#)
- default settings, [3-3](#)
 - restoring, [4-58](#)
- deleting users, [4-61](#)
- description
 - functional, [1-12](#)
 - physical, [1-9](#)
- device name, [4-4](#)
- diagnostics, [1-8](#), [1-26](#), [6-1](#)
 - loopback, [6-39](#)
 - ping, [6-41](#)
 - tone injection, [6-37](#)
- dimensions, [1-26](#)
- displaying active tests, [6-42](#)
- displaying errors and warnings, [6-25](#)
- downloading configuration files, [B-4](#)
- downloading software, [B-3](#)
 - via TFTP, [B-4](#)
 - via XMODEM, [B-3](#)
- E—**
- E1
 - balanced interface connector, [A-1](#)
 - channelized main link
 - configuring, [4-47](#)
 - unbalanced interface connector, [A-1](#)
- E1/T1

- channelized main link
 - technical specifications, [1-24](#)
- configuring timeslots, [4-28](#)
- interface, unbalanced E1, [1-2](#)
- main link, [1-12](#)
 - configuring, [4-22](#), [4-26](#)
 - connecting, [2-5](#), [2-6](#)
 - jumpers, [2-3](#)
 - technical specifications, [1-21](#)
- main link interface, [1-4](#)
- main link module, [1-19](#)
- voice port
 - connecting, [2-4](#)
 - technical specifications, [1-23](#)
- environment
 - technical specifications, [1-26](#)
- errors, [6-26](#)
 - detecting, [6-25](#)
 - displaying, [6-25](#)
 - messages, [6-25](#)
- Ethernet
 - AAL2oMPLS frame, [1-18](#)
 - main link, [1-12](#)
 - configuring, [4-19](#)
 - connecting, [2-5](#)
 - main link interface, [1-4](#)
 - management port
 - configuring, [4-1](#)
 - TDMoIP frame, [1-16](#)
- Ethernet main link
 - technical specifications, [1-21](#)
- Ethernet UTP interface connector, [A-2](#)
- events, [6-29](#)

- F—**
- FAQ, [6-42](#)
- features, [1-4](#)
- file system, [B-2](#)
- frame
 - AAL2oMPLS, [1-18](#)
 - TDMoIP, [1-16](#)
- Frequently Asked Questions, [6-42](#)
- front panel, [1-9](#)
- functional description, [1-12](#)

- G—**
- group
 - configuring, [4-29](#)
 - IP address, [4-29](#)

- H—**
- HDLC, [1-14](#)
- HDLC statistics, [6-2](#), [6-5](#), [6-6](#)
- Help screens, [3-13](#)
- host IP, [4-1](#)
- Hot keys, [3-13](#)

- I—**
- indicators, [1-25](#)
- installing the unit, [1-2](#), [2-1](#), [2-2](#)
- interfaces
 - channelized main link E1, [4-47](#)
 - channelized main link T1, [4-49](#)

- connecting, 2-4
 - control, 2-6
 - E1
 - configuring, 4-22
 - E1/T1
 - connecting, 2-4
 - Ethernet
 - configuring, 4-19
 - main link
 - E1/T1, 2-5
 - Ethernet, 2-5
 - serial, 2-5
 - serial
 - configuring, 4-20
 - T1
 - configuring, 4-26
 - unbalanced E1, 2-5
 - internal jumpers, setting, 2-3
 - internal switching
 - disabling, 4-47
 - enabling, 4-47
 - inventory, 4-57
- J–**
- jitter buffers, 6-47
 - jumpers, 2-3
- K–**
- keep-alive suppression rate, 4-10, 5-6
- L–**
- LAN
 - restricting traffic, 4-13
 - LEDs, 1-25
 - line check, 4-15
 - link backup, 4-11
 - listing users, 4-62
 - local loopback, 6-39
 - Login
 - initial, 3-11
 - terminal, 3-11
 - loop detect, 4-14
 - loopback, 6-39
 - local, 6-39
 - remote, 6-40
- M–**
- main link
 - channelized
 - configuring, 4-47
 - internal switching, 4-47
 - channelized E1/T1
 - technical specifications, 1-24
 - configuring, 5-3
 - connecting, 2-5
 - E1, 1-4, 1-12
 - configuring, 4-22
 - E1/T1
 - connecting, 2-5
 - technical specifications, 1-21
 - Ethernet, 1-4, 1-12
 - configuring, 4-19
 - connecting, 2-5
 - interfaces, 1-4
 - serial, 1-4, 1-13
 - configuring, 4-20
 - connecting, 2-5
 - technical specifications, 1-22
 - T1, 1-4, 1-12
 - configuring, 4-26
 - Main link
 - Ethernet
 - technical specifications, 1-21
 - main link module, 1-1, 1-7, 1-21, 4-17
 - configuring, 4-18, 4-19
 - Ethernet statistics, 6-20
 - jumpers, 2-3
 - TDM statistics, 6-21, 6-22
 - Management
 - access levels, 3-11
 - administrator, 3-11
 - authentication, 3-11
 - login, 3-11
 - management console
 - connecting, 2-6
 - manager list, 4-3
 - managing the unit, 4-1
 - configuring Ethernet connection, 4-1
 - navigating, 4-6
 - max bytes in multiplexed frame, 4-33, 4-45
 - menu tree diagrams, C-1
 - menus
 - navigating, 4-6
 - Menus
 - navigating, 3-12
 - messages
 - error, 6-25
 - warning, 6-25
 - modem
 - access, configuring, 4-6
 - connecting, 2-6
 - enable/disable, 4-6
 - modifying user information, 4-61
 - modules
 - available configurations, 1-10
 - channelized main link, 1-19, 1-24, 4-47, 6-1
 - description, 1-9
 - E1/T1 main link, 1-2, 1-7
 - main link, 1-1, 1-12, 1-13, 1-21, 4-17, 4-19
 - voice, 1-1, 1-5, 1-13, 1-23, 4-17, 4-29, 6-1
 - monitor, 3-10
 - monitoring performance, 6-1
 - multiplexing
 - AAL2oMPLS, 1-6
 - TDMoIP, 1-5, 1-15
- N–**
- navigating menus, 4-6
 - saving changes, 4-55, 4-57
 - Navigating menus, 3-12
- O–**
- operation
 - powering off, 3-13
 - resetting, 4-63
 - turning on, 3-1
 - operator, 3-10

–P–

- package contents, [2-2](#)
- Packet tracking, [6-7](#)
- packetizing interval, [1-15](#), [4-33](#), [4-45](#)
- parameters
 - connectivity, [4-33](#)
 - default values, [3-3](#)
 - setting, [4-6](#)
 - voice, [4-34](#)
- Parameters
 - choosing, [3-12](#)
- Password, [3-11](#)
 - administrator, [3-11](#)
- Perceptual Speech Quality Measurement, [6-44](#)
- performance
 - monitoring, [6-1](#)
- permanent alarm buffer, [6-31](#)
- ping, [6-41](#)
 - timeout, [6-41](#)
- ports
 - main link, [1-4](#)
- power
 - connecting, [2-6](#)
 - technical specifications, [1-26](#)
- power supply, [1-9](#)
- powering off, [3-13](#)
- powering on, [3-1](#)
- prerequisites, [2-1](#)
- product options, [1-1](#)
- product specifications, [1-21](#)
- profile
 - configuring, [4-7](#)
- PSQM, [6-44](#)

–Q–

- Q.50, [1-6](#), [4-16](#), [6-49](#), [6-51](#)

–R–

- R2-MFC, [6-46](#)
- RADview, [1-8](#)
- rear panel, [1-9](#)
- remote loopback, [6-40](#)
- requirements, [2-1](#)
- resetting the unit, [4-63](#)
- restoring default settings, [4-58](#)
- restricting LAN traffic, [4-13](#)

–S–

- sanity, [6-25](#)
- sanity error, [4-55](#), [4-56](#)
- saving changes, [4-55](#)
- security, [1-8](#), [3-10](#)
- Security
 - administrator, [3-11](#)
- serial
 - main link
 - connecting, [2-5](#)
- serial interface
 - main link, [1-4](#)
 - configuring, [4-20](#)
- serial interface adapter cables, [A-5](#)
- serial interface connector, [A-4](#)
- serial main link, [1-13](#)

- technical specifications, [1-22](#)
- setting jumpers, [2-3](#)
- setting parameters, [4-6](#)
- setting up the unit, [1-2](#), [2-1](#), [2-2](#)
- settings
 - restoring default values, [4-58](#)
- settings, default, [3-3](#)
- signaling, [1-14](#), [4-7](#)
 - bits, [4-9](#)
 - profiles, [4-7](#)
 - statistics, [6-16](#)
- site requirements, [2-1](#)
- software
 - downloading, [B-3](#)
- specifications, [1-21](#)
- SS7, [1-14](#)
- statistics, [1-8](#), [1-26](#)
 - backup link, [6-24](#)
 - bundle (channelized main link module), [6-12](#)
 - bundle (voice module), [6-6](#), [6-11](#)
 - channelized main link module, [6-1](#)
 - E1 group HDLC, [6-2](#), [6-5](#), [6-6](#)
 - main link Ethernet, [6-20](#)
 - main link TDM, [6-21](#), [6-22](#)
 - T1 group HDLC, [6-2](#), [6-5](#), [6-6](#)
 - timeslot, [6-13](#), [6-15](#)
 - voice module, [6-1](#)
 - voice signaling, [6-16](#)
- Statistics
 - packet tracking, [6-7](#)
- super tandem, [1-6](#), [4-37](#), [6-50](#)
- suppression rate, [4-10](#)

–T–

- T1
 - channelized main link
 - configuring, [4-49](#)
 - interface connector, [A-1](#)
- TDM line check, [4-15](#)
- TDMoIP, [1-5](#), [1-15](#), [1-20](#), [4-32](#)
- technical support, [6-56](#)
- Technical support, [6-56](#)
- technician, [3-10](#)
- telnet
 - configuring, [4-4](#)
- Telnet, [3-9](#)
- temporary alarm buffer, [6-29](#)
- terminal, [1-8](#)
 - connecting, [2-6](#)
- Terminal
 - configuring Vmux-420 via, [3-9](#)
 - default communication parameters, [3-10](#)
 - hot keys, [3-13](#)
 - preparing, [3-10](#)
- testing, [6-37](#)
- tests, active, [6-42](#)
- tests, loopback, [6-39](#)
- Time, [4-64](#), [4-65](#)
- time, setting, [4-63](#)
- timeout, [4-6](#)
 - ping, [6-41](#)
- timeslots
 - configuring for channelized main link module, [4-53](#)

- displaying, [4-54](#)
- E1
 - configuring, [4-25](#)
 - statistics, [6-13](#), [6-15](#)
- T1
 - configuring, [4-28](#)
 - transparent, [4-45](#)
- tone injection, [6-37](#)
- Tracking packets, [6-7](#)
- transparent jitter size, [4-38](#)
- transparent timeslots, [4-45](#)
- troubleshooting, [6-1](#)
- U–**
- UDP, [1-18](#)
- unbalanced E1
 - connecting, [2-5](#)
- unit
 - resetting, [4-63](#)
- unit boot, [B-1](#)
- uplink
 - loop detect, [4-14](#)
- uploading configuration files, [B-4](#)
- usage scenarios, [1-2](#)
- User name, [3-11](#)
 - administrator, [3-11](#)
- users, [1-8](#)
 - adding, [4-60](#)
 - database, [4-60](#)
 - deleting, [4-61](#)
 - listing, [4-62](#)
 - modifying, [4-61](#)
- V–**
- VAD, [1-5](#), [1-14](#), [4-37](#)
- VLAN, [1-18](#)
- Voice Activity Detection, [1-5](#), [1-14](#), [4-37](#)
- voice module, [1-1](#), [1-5](#), [1-13](#), [4-17](#)
 - bundle statistics, [6-6](#), [6-11](#)
 - configuring, [4-18](#), [4-29](#), [5-3](#)
- E1/T1
 - technical specifications, [1-23](#)
- group, [4-29](#)
- statistics, [6-1](#)
- technical specifications, [1-23](#)
- voice parameters, [4-34](#)
- voice processing
 - technical specifications, [1-24](#)
- voice signaling statistics, [6-16](#)
- W–**
- warning messages, [6-25](#)
- warnings, [6-26](#)
 - displaying, [6-25](#)
- Y–**
- YELLOW ALARM, [6-42](#)



data communications

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Customer Response Form

RAD Data Communications would like your help in improving its product documentation. Please complete and return this form by mail or by fax or send us an e-mail with your comments.

Thank you for your assistance!

Manual Name: Vmux-2100 version 4.0

Publication Number: 164-200-09/07

Please grade the manual according to the following factors:

	<i>Excellent</i>	<i>Good</i>	<i>Fair</i>	<i>Poor</i>	<i>Very Poor</i>
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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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