Cisco MGX 8250 Edge Concentrator Installation and Configuration

Release 1.1.3
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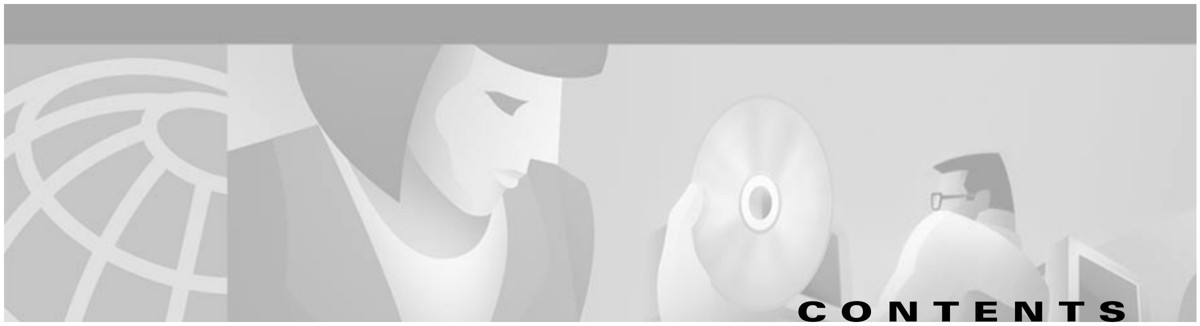

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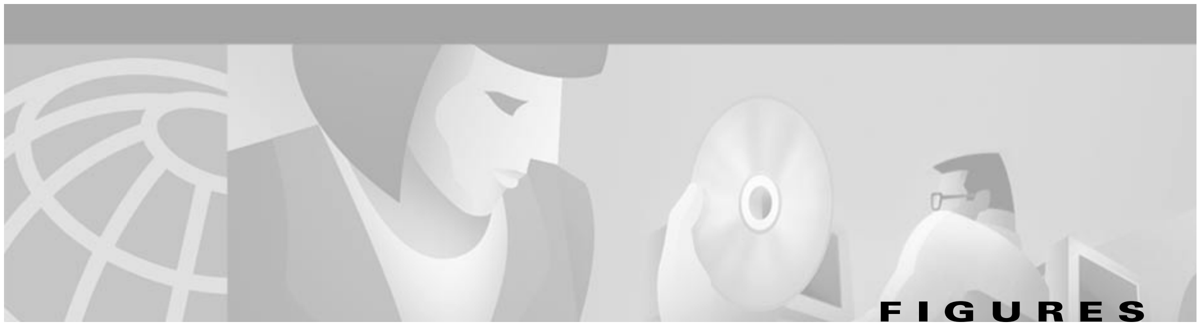

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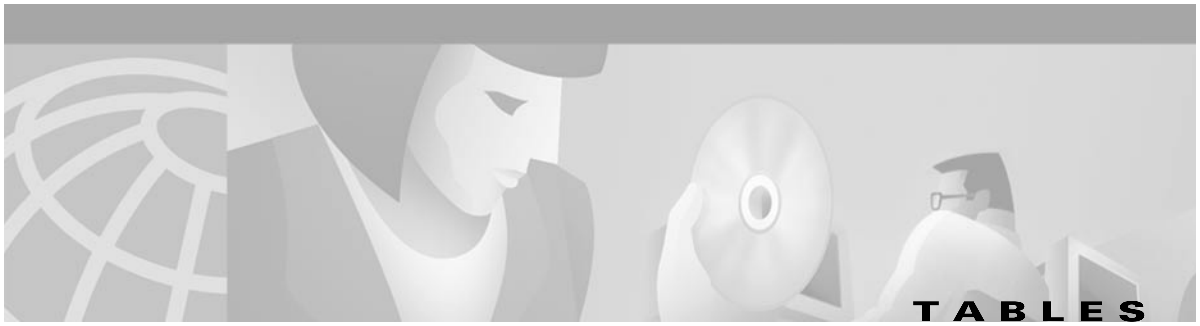

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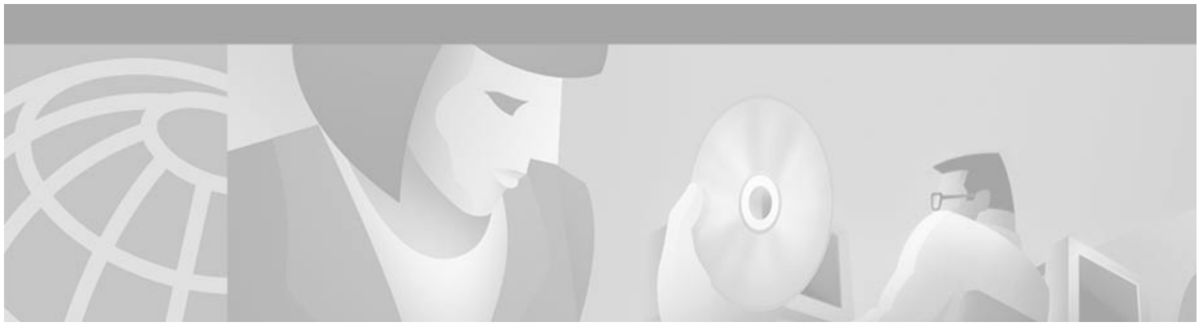


Preface

This preface describes the objectives, audience, organization, and conventions of the *Cisco MGX 8250 Edge Concentrator Installation and Configuration*.

Objectives

This publication provides descriptions for installing and configuring the following MGX 8250 hardware:

- Enclosures
- Power sources (AC and DC)
- Controller cards (the CPU for the node)
- Frame Relay interface cards
- ATM interface cards
- Circuit Emulation interface cards
- Trunk cards

Audience

The *Cisco MGX 8250 Edge Concentrator Installation and Configuration* publication provides installers, operators, and network designers and managers with the necessary understanding to set up any applications of the MGX 8250.

Organization

This publication contains the following chapters:

- Chapter 1, "Introducing the MGX 8250"
- Chapter 2, "Module and Service Descriptions"
- Chapter 3, "Site Preparation"
- Chapter 4, "Enclosure and Card Installation"
- Chapter 5, "Configuring the MGX 8250 Shelf"
- Chapter 6, "Card and Service Configuration"

- Appendix A, "System Specifications"
- Appendix B, "Cabling Summary"

Related Documentation

The following Cisco publications contain additional information related to the operation of the Cisco MGX 8250 Edge Concentrator:

MGX 8250 Edge Concentrator, Release 1.0

Table 1 lists documentation that contains additional information related to the installation and operation of the MGX 8250 Edge Concentrator.

Table 1 MGX 8250 Edge Concentrator Related Documentation

Documentation	Description
Cisco MGX 8250 Edge Concentrator Installation and Configuration, Release 1.1.3 DOC-7811217=	Provides installation instructions for the MGX 8250 Edge Concentrator.
Cisco MGX 8250 Multiservice Gateway Command Reference, Release 1.1.3 DOC-7811212=	Provides detailed information on the general command line interface commands.
Cisco MGX 8250 Error Messages, Release 1.1.3 DOC-7811216=	Provides error message descriptions and recovery procedures.
WAN CiscoView for the MGX 8250 Multiservice Gateway, Release 1.1.3 DOC-7811241=	Provides instructions for using WAN CiscoView for the MGX 8250 Edge Concentrator.
Cisco MGX 8250 Edge Concentrator Overview, Release 1.1.3 DOC-7811576=	Provides a technical description of the system components and functionary of the Cisco MGX 8250 wide area edge switch from a technical perspective.

Cisco WAN Manager, Release 10

Table 2 lists the documentation for the Cisco WAN Manager (CWM) network management system for Release 10.

Table 2 Cisco WAN Manager Release 10 Related Documentation

Documentation	Description
Cisco WAN Manager Installation for Solaris, Release 10 DOC-7810308=	Provides procedures for installing Release 10 of the CWM network management system on Solaris systems.
Cisco WAN Manager User's Guide, Release 10 DOC-7810658=	Provides procedures for operating Release 10 of the CWM network management system.

Table 2 Cisco WAN Manager Release 10 Related Documentation

Documentation	Description
Cisco WAN Manager SNMP Service Agent Guide, Release 10 DOC-7810786=	Provides information about the CWM Simple Network Management Protocol Service Agent components and capabilities.
Cisco WAN Manager Database Interface Guide, Release 10 DOC-7810785=	Provides the information to gain direct access to the CWM Informix OnLine database that is used to store information about the elements within your network.

Cisco WAN Switching Software, Release 9.3

Table 3 lists related documentation for the installation and operation of the Cisco WAN Switching Software, Release 9.3 and associated equipment in a Cisco WAN switching network.

Table 3 Cisco WAN Switching Release 9.3 Related Documentation

Documentation	Description
Cisco BPX 8600 Series Installation and Configuration, Release 9.3.10 DOC-7811603=	Provides a general description and technical details of the BPX broadband switch.
Cisco IGX 8400 Installation and Configuration DOC-7810722=	Provides installation instructions for the IGX multiband switch.
Update to the IGX 8400 Installation and Configuration, Release 9.3.10 DOC-7811029=	Update for Release 9.3.10 to the *Cisco IGX 8400 Installation and Configuration*.
Cisco IGX 8400 Series Reference DOC-7810706=	Provides a general description and technical details of the IGX multiband switch.
Cisco WAN Switching Command Reference, Release 9.3.05 DOC-7810703=	Provides detailed information on the general command line interface commands.
Update to the Cisco WAN Switching Command Reference, Release 9.3.10 DOC-7811457=	Provides detailed information on updates to the command line interface commands for features new to switch software Release 9.3.10.
Cisco WAN Switching SuperUser Command Reference, Release 9.3.10 DOC-7810702=	Provides detailed information on the command line interface commands requiring SuperUser access authorization
Cisco MPLS Controller Software Configuration Guide, Release 9.3.10 DOC-7811658=	Provides information on a method for forwarding packets through a network.

Conventions

This publication uses the following conventions to convey instructions and information.

Command descriptions use these conventions:

- Commands and keywords are in **boldface**.
- Arguments for which you supply values are in *italics*.
- Required command arguments are inside angle brackets (< >).
- Optional command arguments are in square brackets ([ ]).
- Alternative keywords are separated by vertical bars (|).

Examples use these conventions:

- Terminal sessions and information the system displays are in `screen` font.
- Information you enter is in **`boldface screen`** font.
- Nonprinting characters, such as passwords, are in angle brackets (< >).
- Default responses to system prompts are in square brackets ([ ]).

Notes, timesavers, cautions, and warnings use the following conventions and symbols:

Note Means *reader take note*. Notes contain helpful suggestions or references to materials not contained in this manual.

Caution Means *reader be careful*. In this situation, you might do something that could result in equipment damage or loss of data.

Warning **This warning symbol means danger. You are in a situation that could cause bodily injury. Before you work on any equipment, be aware of the hazards involved with electrical circuitry and be familiar with standard practices for preventing accidents.**

Obtaining Documentation

The following sections explain how to obtain documentation from Cisco Systems.

World Wide Web

You can access the most current Cisco documentation on the World Wide Web at the following URL:

http://www.cisco.com

Translated documentation is available at the following URL:

http://www.cisco.com/public/countries_languages.shtml

Documentation CD-ROM

Cisco documentation and additional literature are available in a Cisco Documentation CD-ROM package, which is shipped with your product. The Documentation CD-ROM is updated monthly and may be more current than printed documentation. The CD-ROM package is available as a single unit or through an annual subscription.

Ordering Documentation

Cisco documentation is available in the following ways:

- Registered Cisco Direct Customers can order Cisco product documentation from the Networking Products MarketPlace:

  http://www.cisco.com/cgi-bin/order/order_root.pl

- Registered Cisco.com users can order the Documentation CD-ROM through the online Subscription Store:

  http://www.cisco.com/go/subscription

- Nonregistered Cisco.com users can order documentation through a local account representative by calling Cisco corporate headquarters (California, USA) at 408 526-7208 or, elsewhere in North America, by calling 800 553-NETS (6387).

Documentation Feedback

If you are reading Cisco product documentation on Cisco.com, you can submit technical comments electronically. Click **Leave Feedback** at the bottom of the Cisco Documentation home page. After you complete the form, print it out and fax it to Cisco at 408 527-0730.

You can e-mail your comments to bug-doc@cisco.com.

To submit your comments by mail, use the response card behind the front cover of your document, or write to the following address:

Cisco Systems
Attn: Document Resource Connection
170 West Tasman Drive
San Jose, CA 95134-9883

We appreciate your comments.

Obtaining Technical Assistance

Cisco provides Cisco.com as a starting point for all technical assistance. Customers and partners can obtain documentation, troubleshooting tips, and sample configurations from online tools by using the Cisco Technical Assistance Center (TAC) Web Site. Cisco.com registered users have complete access to the technical support resources on the Cisco TAC Web Site.

Cisco.com

Cisco.com is the foundation of a suite of interactive, networked services that provides immediate, open access to Cisco information, networking solutions, services, programs, and resources at any time, from anywhere in the world.

Cisco.com is a highly integrated Internet application and a powerful, easy-to-use tool that provides a broad range of features and services to help you to

- Streamline business processes and improve productivity
- Resolve technical issues with online support
- Download and test software packages
- Order Cisco learning materials and merchandise
- Register for online skill assessment, training, and certification programs

You can self-register on Cisco.com to obtain customized information and service. To access Cisco.com, go to the following URL:

http://www.cisco.com

Technical Assistance Center

The Cisco TAC is available to all customers who need technical assistance with a Cisco product, technology, or solution. Two types of support are available through the Cisco TAC: the Cisco TAC Web Site and the Cisco TAC Escalation Center.

Inquiries to Cisco TAC are categorized according to the urgency of the issue:

- Priority level 4 (P4)—You need information or assistance concerning Cisco product capabilities, product installation, or basic product configuration.
- Priority level 3 (P3)—Your network performance is degraded. Network functionality is noticeably impaired, but most business operations continue.

- Priority level 2 (P2)—Your production network is severely degraded, affecting significant aspects of business operations. No workaround is available.
- Priority level 1 (P1)—Your production network is down, and a critical impact to business operations will occur if service is not restored quickly. No workaround is available.

Which Cisco TAC resource you choose is based on the priority of the problem and the conditions of service contracts, when applicable.

Cisco TAC Web Site

The Cisco TAC Web Site allows you to resolve P3 and P4 issues yourself, saving both cost and time. The site provides around-the-clock access to online tools, knowledge bases, and software. To access the Cisco TAC Web Site, go to the following URL:

http://www.cisco.com/tac

All customers, partners, and resellers who have a valid Cisco services contract have complete access to the technical support resources on the Cisco TAC Web Site. The Cisco TAC Web Site requires a Cisco.com login ID and password. If you have a valid service contract but do not have a login ID or password, go to the following URL to register:

http://www.cisco.com/register/

If you cannot resolve your technical issues by using the Cisco TAC Web Site, and you are a Cisco.com registered user, you can open a case online by using the TAC Case Open tool at the following URL:

http://www.cisco.com/tac/caseopen

If you have Internet access, it is recommended that you open P3 and P4 cases through the Cisco TAC Web Site.

Cisco TAC Escalation Center

The Cisco TAC Escalation Center addresses issues that are classified as priority level 1 or priority level 2; these classifications are assigned when severe network degradation significantly impacts business operations. When you contact the TAC Escalation Center with a P1 or P2 problem, a Cisco TAC engineer will automatically open a case.

To obtain a directory of toll-free Cisco TAC telephone numbers for your country, go to the following URL:

http://www.cisco.com/warp/public/687/Directory/DirTAC.shtml

Before calling, please check with your network operations center to determine the level of Cisco support services to which your company is entitled; for example, SMARTnet, SMARTnet Onsite, or Network Supported Accounts (NSA). In addition, please have available your service agreement number and your product serial number.

Introducing the MGX 8250

This chapter contains an introduction to the Cisco MGX 8250 Edge Concentrator and includes a summary of product features and equipment.

For more detailed descriptions of the Service Modules, cards and services, please refer to Chapter 2, “Module and Service Descriptions.”

This chapter contains the following information:

- MGX 8250 System Overview, page 1-2
  - Applications of the MGX 8250, page 1-3
  - Universal Edge Architecture, page 1-3
  - Standards-Based Conversion to ATM, page 1-4
  - MGX 8250 Enclosure and Power, page 1-5
  - MGX 8250 Management, page 1-5
- Summary of MGX 8250 Cards and Modules, page 1-6
  - Processor Switching Module (PXM1), page 1-6
  - Redundancy for Service Modules, page 1-10
  - Redundancy for Service Modules, page 1-10
  - Frame Service Modules, page 1-8
  - ATM UNI Service Modules (AUSM), page 1-9
  - Circuit Emulation Service Modules (CESM), page 1-9
  - Voice Interworking Service Modules (VISM), page 1-10
  - Route Processor Module (RPM), page 1-10
- Redundancy for Service Modules, page 1-10

MGX 8250 System Overview

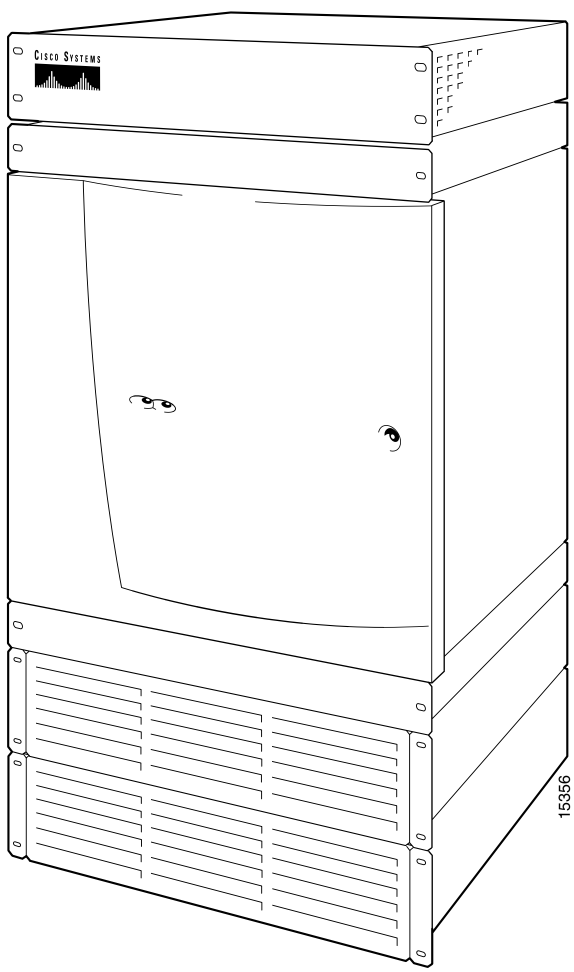
The MGX 8250 is a highly flexible IP+ATM narrowband edge concentrator for high-density aggregation of IP, voice, Frame Relay, circuit emulation and ATM services. The MGX 8250 can act as a stand-alone edge concentrator or as a feeder node for the Cisco BPX 8600 series and MGX 8850 switches. The MGX 8250 Edge Concentrator offers up to 1.2 Gbps of IP + ATM switching capacity.

The Cisco MGX 8250 edge concentrator supports the following services:

- IP VPNs using Cisco IOS software-based MPLS/label switching.
- The full suite of voice-over-IP, voice-over-ATM, and capabilities with full interworking.
- Frame Relay services.
- High-density Point-to-Point Protocol (PPP) for Internet access and aggregation.
- Narrowband ATM for managed data, voice, and video services.
- Circuit Emulation (CE) for private line replacement.

Figure 1-1 is an illustration of an AC-powered MGX 8250.

Figure 1-1 MGX 8250



Applications of the MGX 8250

The MGX 8250 operates with the applications listed in Table 1-1.

Table 1-1 MGX 8250 Applications

Application	Description
Feeder	The MGX 8250 concentrates narrow-band and medium-band ATM, Frame Relay, and into a single, wide-band ATM feeder trunk that connects to a BPX 8600 series switch or a MGX 8850 switch.
Stand-alone Switch	The MGX 8250 can be deployed as a stand-alone switch, providing "cross-connect" connections between UNI and NNI ports. Traditionally, this would be used in a concentration-type mode, allowing standards-based adaptation and concentration of multiservice traffic onto one or more high-speed ATM interfaces. This enables the MGX 8250 to interface to a multivendor ATM network, or to any other ATM attached device (such as a Cisco 7200 or GSR router LS1010, MSR 8450, and so on). The MGX 8250 interfaces to the ATM equipment using a standard ATM UNI or NNI.
Multiprotocol Label Switch	As a component of the BPX 8680-IP universal service node, the MGX 8250 is capable of forwarding traffic into the BPX Multiprotocol Label Switching (MPLS) network by acting as a multiservice feeder
Consolidation of Cisco CPE Traffic	At the edge of the network, the MGX 8250 can interwork with and consolidate a wide variety of CPE equipment.
Mulitservice Stand-alone Concentrator	The MGX 8250 can be deployed as a stand-alone concentrator, interfacing to a multivendor ATM (non-BPX) network, as shown Figure 1-5. The MGX 8250 interfaces to ATM equipment using a standard ATM UNI or NNI.

Note Refer to the *Cisco MGX 8250 Edge Concentrator Overview* for additional information on the applications of the MGX 8250.

Note See Chapter 5, "Configuring the MGX 8250 Shelf" for information on configuring the MGX 8250 applications.

Universal Edge Architecture

The MGX 8250 supports a wide range of services over narrowband and mid-band user interfaces by mapping all service traffic to and from ATM using standardized interworking methods.

The supported interfaces for user-traffic are

- Frame Relay UNI on T3, E3, HSSI, T1, and E1 lines.
- ATM UNI and FUNI interfaces.
- Optional inverse multiplexing for ATM (IMA).
- Frame Relay to ATM network interworking and service interworking.
- Circuit Emulation services for T1/E1 and T3/E3 lines.

The optional Service Resource Module-3T3 (MGX-SRM-3T3/C) can support up to 80 T1 interfaces over its three T3 lines. The MGX-SRM-3T3/C can also provide 1:N redundancy for the T1 and E1 line cards.

The modular, software-based system architecture enables the MGX 8250 to support new features through downloadable software upgrades or new hardware modules.

The MGX 8250 backplane supports individual line rates range from DS0 through OC-12.

Card Slot Locations

The reserved slots are 7 and 8 for the primary and redundant Processor Switching Modules (PXM1s) and 15, 16, 31, and 32 for the Service Resource Modules (SRMs). These slot reservations reflect a fully redundant configuration for these cards. The maximum number of slots remaining for service modules is 24—less when the unit contains one or more double-height cards such as the Route Processor Module (RPM). Also, although not reserved, slots 9 and 10 should be the first choices for the location of one or more RPMs due to backplane wiring.

If you are considering any future card changes in which you replace a single-height card with a double-height card, place the single-height replacement candidates as far left in the card cage as possible. The reason is that single to double-height slot conversions must begin at the left and proceed to the right.

The slots on the top half of the card cage are suitable for the T3/E3 and OC-3 cards because the higher speed cell buses reside in the upper portion of the backplane. Place the service modules that operate at T1 or E1 rates in the lower half of the switch.

Standards-Based Conversion to ATM

The MGX 8250 converts all user information into 53-byte ATM cells by using the appropriate ATM Adaptation Layer (AAL) for transport over the ATM backbone network. The individual service modules segment and reassemble (SAR) cells to eliminate system bottlenecks. The following list shows the applicable AAL for each service:

- Circuit emulation services uses AAL1.
- Frame Relay-to-ATM network interworking uses AAL5 and Frame Relay Service Specific Convergence Sub-layer (FR-SSCS).
- Frame Relay-to-ATM service interworking uses both transparent and translation modes to map Frame Relay to native ATM AAL5.
- Frame Forwarding uses AAL5.

MGX 8250 Enclosure and Power

The MGX 8250 enclosure contains up to 24-service modules (I/O cards). In addition, up to four optional Service Redundancy Modules (SRMs) provide redundancy. The MGX 8250 resides in either in a 19-inch or a 23-inch rack. The 19-inch Cisco-built rack also has an optional seismic anchor. The system can accept power from either a DC or an AC source (see Table 1-2).

Table 1-2 Power Supply Options

Model	Description
MGX-DC	MGX 8250 DC PEM and MBX-CAB-AC/DC
MGX-AC1-1	NR AC system for MGX 8250—AC shelf, 1 feed, 1 PS, MGX-CAB-AC/DC
MGX-AC2-2	Red AC pwr, red AC feed, AC shel, 2 PS, 2 MGX-CAB-AC/DC
PS-1200-AC	1200W power supply for AC systems

Chapter 3, "Site Preparation" and Chapter 4, "Enclosure and Card Installation" contain additional information on installing racks and the MGX 8250 chassis.

MGX 8250 Management

Firmware on each card determines the functions and operations of the module. This firmware can be upgraded by downloading new firmware with a TFTP application running on a workstation or a PC.

The current status and configuration parameters of the modules reside in a Management Information Base (MIB). The MIB is updated by the firmware in the modules whenever changes to the module status or configuration occur. The MIB can be interrogated using SNMP commands.

The MGX 8250 supports the following user interface applications:

- Cisco WAN Manager (formerly StrataView Plus)—Graphical User Interface (GUI) application for connection management. This application enables operations, administration, and maintenance of WAN-multiservice networks.
- CiscoView—GUI application for hardware configuration.
- Command line interface (CLI)—This is used for low-level control of hardware functionality and connection control.

The following ports are used to communicate with the MGX 8250:

- Control port (SLIP protocol only) on the PXM1-UI back card.
- LAN (Ethernet) port on the PXM1-UI back card.
- In-band ATM connection (feeder application only).

All of these ports support access by the CLI via Telnet, TFTP, and SNMP.

Note See the "User Interface Access Ports" section on page 5-2 for additional information on the ports used to manage and configure the MGX 8250.

Summary of MGX 8250 Cards and Modules

This section contains a summary of the service cards and modules supported by the MGX 8250.

For more detailed descriptions and illustrations of cards, modules and the services they provide, see Chapter 2, “Module and Service Descriptions”.

Introduction to Core Card Sets and Service Modules

The MGX 8250 supports *core cards* and *service modules*. The Processor Switching Module (PXM1) and optional Service Resource Module (SRM) are *core cards.*

In addition, the PXM1 is part of a *card set* consisting of a front card, a back card, and a daughter card:

- The front card contains the processing intelligence.
- The back card is a simple card that provides the electrical interface for one or more lines of a particular type.
- The daughter card contains the firmware that distinguishes the interface (OC-3, T3, E3, and so on).

Service modules are not combined in this manner and are never part of a card set. Instead, *service modules* provide the interface for transport technologies such as Frame Relay and ATM.

The MGX 8250 enclosure contains up to 24 service modules (I/O cards). Four optional Service Redundancy Modules (SRMs) provide redundancy.

Note Although technically distinct, the terms *card* and *module* are often used interchangeably.

Processor Switching Module (PXM1)

The MGX 8250 cards (modules) and their functions are described in Table 1-3.

Table 1-3 MGX 8250 Modules and Cards

Modules	Description
Processor Switching Module (PXM1)	This front card controls the MGX 8250 and supports external interfaces for user-access and trunking for UNI ports. The back cards consist of a user interface and a broadband network module.
User Interface Back Cards	• Processor Switch Module User Interface (PXM1-UI) The PXM1-UI is the *user interface* card that has various types of user access used to control and configure the MGX 8250. • Processor Switch Module User Interface (PXM-UI-S3) The PXM-UI-S3 is an optional *user interface* card that has various types of user access used to control and configure the MGX 8250. This card also provides Stratum 3 clocking capability.

Table 1-3 MGX 8250 Modules and Cards (continued)

Modules	Description
User Interface Back Cards	**OC-3 Uplink Back Cards** • MGX-MMF-4-155/B (multimode fiber uplink back card) The MGX-MMF-4-155/B is a *broadband network* module for the PXM1 and provides four SONET OC-3/STM-1 ATM interfaces at 155 Mbps. • MGX-SMFIR-4-155/B (single-mode fiber *intermediate reach* uplink back card) The MGX-SMFIR-4-155/B is a *broadband network* module for the PXM1 and provides a single-mode, intermediate-reach, fiber optic SONET OC-3 interface that conforms to ANSI T1.105 and GR-253-CORE standards. This interface uses SC connectors. Redundant configurations are supported through SONET APS functionality (APS requires the “B” model). • MGX-SMFLR-4-155/B (single-mode fiber *long reach* uplink back card) The MGX-SMFLR-4-155/B is a *broadband network* module for the PXM1 and provides a single-mode, long-reach, fiber optic SONET OC-3 interface that conforms to ANSI T1.105 and GR-253-CORE standards. This interface uses SC connectors, and redundant configurations are supported through SONET APS functionality (APS requires the “B” model). **OC-12 Uplink Back Cards** • MGX-SMFIR-1-622 The MGX-SMFIR-1-622 is a *broadband network* module for the PXM1 and provides a SONET OC-12/STM-4 ATM interface at 622 Mbps. APS requires the “B” model (SMFIR-1-622/B). • MGX-SMFLR-1-622 The MGX-SMFLR-1-622 is a *broadband network* module for the PXM1 and provides a SONET OC-12/STM-4 ATM interface at 622 Mbps. APS requires the “B” model (SMFLR-1-622/B). **T3/E3 Uplink Back Cards** • MGX-BNC-2T3 The MGX-BNC-2T3 is a *broadband network* module for the PXM1 and provides two-T3 ATM interfaces. • MGX-BNC-2E3 The MGX-BNC-2E3 is a *broadband network* module for the PXM1 and provides two-E3 ATM interfaces. Two versions of the BNC-2E3 card are available. The BNC-2E3A applies to Australia only. The BNC-2E3 applies to all other sites that require E3 lines on the PXM1 uplink card.
Service Resource Module (SRM)	• Service Resource Module (MGX-SRM-3T3/C) The optional SRM provides three major functions for service modules; bit error rate tester (BERT) of T1 and E1 lines and ports, loops back of individual Nx64 channels toward the customer premises equipment (CPE), and 1:N redundancy for the service modules.

Table 1-3 MGX 8250 Modules and Cards (continued)

Modules	Description
Frame Service Module (FRSM)	**Frame Service Modules** • Frame Service Module for eight T1 ports (AX-FRSM-8T1) The AX-FRSM-8T1 provides interfaces for up to eight *fractional* T1 lines, each of which can support one-56 kbps or one-Nx64 kbps FR-UNI, FR-NNI port, ATM-FUNI, or a Frame forwarding port. The AX-FRSM-8T1 supports fractional and unchannelized T1 port selection on a per-T1 basis. • Frame Service Module for eight E1 ports (AX-FRSM-8E1) The AX-FRSM-8E1 provides interfaces for up to eight *fractional* E1 lines, each of which can support one-56 kbps or one-Nx64 kbps FR-UNI, FR-NNI, ATM-FUNI, or Frame forwarding port. The AX-FRSM-8E1 supports fractional and unchannelized E1 port selection on a per-E1 basis. • Frame Service Module for eight *channelized* T1 ports (AX-FRSM-8T1-C) The AX-FRSM-8T1-C allows full DS0 and nxDS0 channelization of the T1s and E1s, for a maximum of 192 ports per FRSM-8T1-C. Using the FRSM-8T1-C, up to 192 fully channelized T1 lines can be operated simultaneously on the Cisco MGX 8250 platform. • Frame Service Module for eight *channelized* E1 ports (AX-FRSM-8E1-C) The AX-FRSM-8E1-C allows full DS0 and n x DS0 channelization of the E1s, for a maximum of 248 ports per FRSM-8E1-C. Using the FRSM-8E1-C, up to 192 fully channelized E1 lines can be operated simultaneously on the Cisco MGX platform. • Frame Service Module for T3 and E3 (MGX-FRSM-2E3T3) The MGX-FRSM-2E3/T3 provides interfaces for two-T3 or two-E3 Frame Relay lines, each of which can support either two-T3 lines (each at 44.736 Mbps) or two-E3 lines (each at 34.368 Mbps) FR-UNI, ATM-FUNI, or Frame Forwarding port. • Frame Service Module for *channelized* T3 (MGX-FRSM-2CT3) The MGX-FRSM-2CT3 supports interfaces for two-T3 channelized Frame Relay lines. Each interface supports 56 Kbps, 64 Kbps, Nx56 Kbps, Nx64 Kbps, T1 ports for a total of 256 ports that can be freely distributed across the two T3 lines. • Frame Service Module for high speed serial (MGX-FRSM-HS1/B) The FRSM-HS1/B supports the 12-in-1 back card. This back card supports up to four V.35 or X.25 serial interfaces. This card also supports the two port HSSI back cards with SCSI-2 connectors. • Frame Service Module for unchannelized HSSI (MGX-FRSM-HS2/B) The MGX-FRSM-HS2/B supports interfaces for two unchannelized HSSI lines. Each interface supports approximately 51 Mbps; with both lines operating, maximum throughput is 70 Mbps.

Table 1-3 MGX 8250 Modules and Cards (continued)

Modules	Description
ATM UNI Service Module (AUSM)	**ATM UNI Service Modules (AUSM)** • ATM UNI Service Module for T1 (MGX-AUSM/B-8T1) The MGX-AUSM/B-8T1 provides interfaces for up to eight-T1 lines. You can group NxT1 lines to form a single, logical interface (IMA). • ATM UNI Service Module for E1 (MGX-AUSM/B-8E1) The MGX-AUSM/B-8E1 provides interfaces for up to eight-E1 lines. You can group NxT1 lines to form a single, logical interface (IMA).
Circuit Emulation Service Module (CESM)	**Circuit Emulation Service Modules (CESM)** • Circuit Emulation Service Module for T1 (AX-CESM-8T1) The AX-CESM-8T1 provides interfaces for up to eight-T1 lines, each of which is a 1.544 Mbps structured or unstructured synchronous data stream. • Circuit Emulation Service Module for E1 (AX-CESM-8E1) The AX-CESM-8E1 provides interfaces for up to eight-E1 lines, each of which is a 2.048-Mbps structured or unstructured synchronous data stream. • Circuit Emulation Service Module for T3 and E3 (MGX-CESM-T3/E3) The MGX-CESM-T3E3 provides direct connectivity to one T3 or E3 line for full-duplex communications at the DS3 rate of 44.736 MHz or at the E3 rate of 34.368 MHz. Each T3 or E3 line consists of a pair of 75-ohm BNC coaxial connectors, one for transmit data and one for receive data, along with three LED indicators for line status.

Table 1-3 MGX 8250 Modules and Cards (continued)

Modules	Description
Voice Interworking Service Module (VISM)	**Voice Interworking Service Modules (VISM)** • MGX-VISM-8T1 and MGX-VISM-8E1 These cards support eight T1 or E1ports for transporting digitized voice signals across a packet network. The VISM provides toll-quality voice, fax and modem transmission and efficient utilization of wide-area bandwidth through industry standard implementations of echo cancellation, voice-compression and silence-suppression techniques. **Note** For configuration information on the Voice Interworking Service Module (VISM), refer to the *Cisco Voice Interworking Service Module Installation and Configuration and Configuration*.
Route Processor Module (RPM)	**Route Processor Module (RPM)** • The RPM is a Cisco 7200 series router redesigned as a double-height card. Each RPM uses two single-height back cards. The back card types are single-port Fast Ethernet, four-port Ethernet, and single-port (FDDI). **Note** For information on availability and support of the MGX-RPM-128/B and MGX-RPM-PR, refer to the Release Notes for Cisco WAN MGX 8850, MGX 8230, and MGX 8250 software. **Note** For configuration information on the Route Processor Module (RPM), refer to the *Cisco MGX Route Processor Module Installation and Configuration Guide*.

Redundancy for Service Modules

Service modules can have either 1:1 redundancy or 1:N redundancy.

See the CiscoView user documentation for instructions on using the CiscoView application to configure redundancy.

1:1 Redundancy

For 1:1 redundancy, place the card sets in adjacent slots and connect the appropriate Y-cable to the paired ports on the active and standby cards. Applicable service modules are

- MGX-FRSM-2CT3
- MGX-FRSM-2T3E3
- MGX-FRSM-HS2

Hot Standby

For hot standby, place the card sets in the same shelf and connect the appropriate Y-cable to the paired ports on the active and hot standby cards. The hot standby card will automatically configure itself to match the configuration of the primary card. This process may take up to eight minutes. After the configuration transfer process is completed, the transfer from the primary to the hot standby card takes less that one second regardless of the number of connections. Any subsequent changes to the primary card are automatically transferred to the hot standby card configuration so the two cards maintain the same configuration. Refer to the "Redundancy for Frame Service Modules" section on page 2-23 for instructions for setting up a redundant pair.

Applicable service modules are:

- MGX-FRSM-2CT3
- MGX-FRSM-2T3E3
- MGX-FRSM-HS2

To determine the hot standby status of the system, enter the **dsphotstandby** command.

Note The MGX-FRSM-HS1/B does not support redundancy.

1:N Redundancy

For 1:N redundancy, an MGX Service Resource Module-3T3 (MGX-SRM-3T3/C) card set is necessary. This card set supports 1:N redundancy for the following service modules:

- MGX-AUSM-8T1/B
- MGX-AUSM-8E1/B
- AX-FRSM-8T1
- AX-FRSM-8E1
- AX-CESM-8T1
- AX-CESM-8E1
- MGX-VISM-8T1
- MGX-VISM-8E1

With 1:N redundancy, a group of service modules has one standby module. Redundancy by way of the *redundancy bus* on the MGX-SRM-3T3/C requires the redundant card group to have one of the following special back cards for redundancy support:

- R-RJ48-8T1-LM
- R-RJ48-8E1-LM

Module and Service Descriptions

This chapter includes detailed descriptions of the modules, cards and services available with the MGX 8250.

- Processor Switching Module, page 2-1
- Service Resource Module, page 2-12
- ATM UNI Service Module (AUSM), page 2-15
- Frame Relay Service Modules, page 2-21
- Circuit Emulation Service Modules, page 2-46
- Voice Service—VISM, page 2-56

Processor Switching Module

The PXM1 card set consists of the PXM1 front card, the PXM1 User Interface back card (PXM1-UI or PXM-UI-S3), and various *uplink* back cards that can serve as either a trunk or a UNI.

For physical details of PXM1 cards, see Appendix A, “System Specifications.”

Caution Handle the PXM1 front card very carefully to preserve the alignment of the attached disk drive. Do not drop or bump the PXM1.

Caution Before using the MGX 8250, verify that the daughter card on the PXM1 corresponds to the uplink card type. Serious damage may result if the power is on and these cards are mismatched.

Note If you accidentally insert a back card for a service module into slots 7, 8, 23, or 24, then observe incorrect MGX 8250 operation. Check for bent or damaged pins on the backplane and the back card.

PXM1 Features

The PXM1 (see Figure 2-1) is a combination ATM switching fabric, data processing, and ATM interface card. This module combines a 1.2 Gbps shared-memory switching fabric with integrated trunking at speeds up to OC-12. The switching fabric provides 1.2 Gbps of non-blocking switching capacity, while the processor provides the control plane that delivers IP+ATM networking software, diagnostics, and performance monitoring.

The PXM provides integrated switching, processing, and broadband interfaces to provide the following high-performance switching and trunking features:

- 1.2-Gbps non-blocking switching
- Integrated T3/E3, OC-3c/STM-1, OC-12c/STM-16
- ATM trunking
- Linear Automatic Protection Switching for the SONET interfaces.

Note Note that APS is available for only the “B” models of the OC-3 and OC-12 uplink cards.

- Hot card insertion/removal
- 1:1 hot standby redundancy
- User-selectable primary and secondary clock sources with graceful switchover
- Internal Stratum-4 or optional Stratum-3, external BITS, or in-band clock sources
- In-band management or out-of-band via EIA/TIA-232 or 10BaseT control ports
- Narrowband service modules
- Broadband trunking support
- DSO to OC-12c/STM-4 interfaces supported

PXM1 Illustration and LED Description

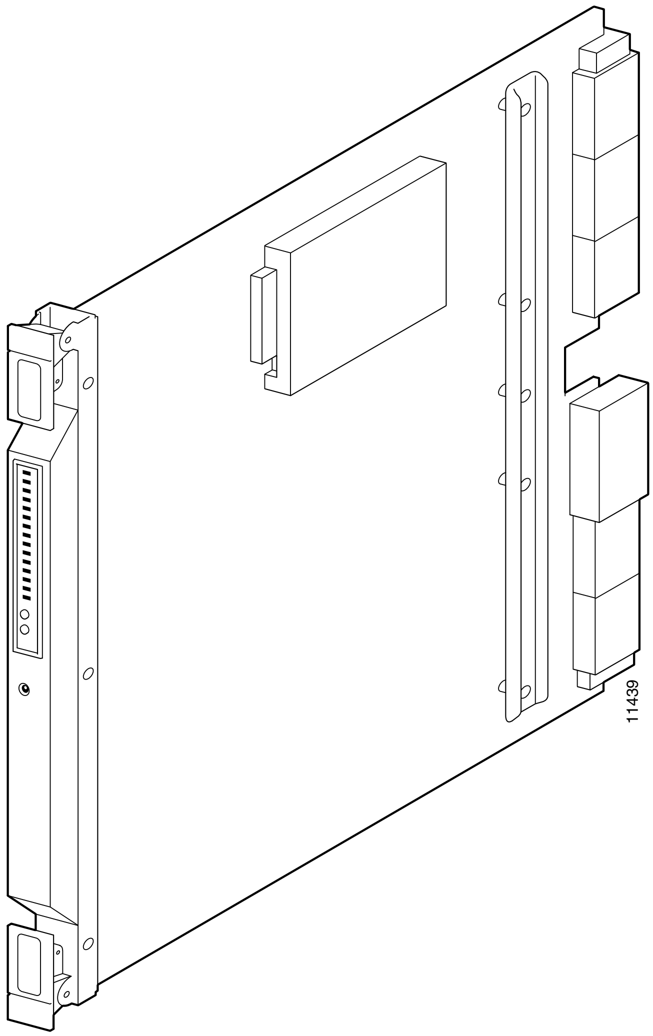
PXM1 provides connectors for external audio and visual alarms. The interface can either be always open or always closed. Major and minor alarms are controlled separately. An alarm cutoff button is accessible from the front. A history LED is set when the alarm cutoff button is pressed. The history LED can be cleared by pressing the history clear button on the faceplate.

The PXM1 provides the following indicators:

- System Status Active/Standby/Fail/standby update (green/yellow/red/flashing yellow)
- Critical alarm (blue)
- Major alarm (red)
- Minor alarm (yellow)
- DC OK A (green = OK, red = not OK)
- DC OK B (green = OK, red = not OK)
- ACO (green)
- History (green)

- Port activity (active and clear = green, remote alarm = yellow, local alarm = red)
- LAN activity (flashing green)

Figure 2-1 PXM1 Front Card



PXM1 User Interface Back Cards

The PXM1 User Interface (PXM1-UI) back card provides ports for communication and control. This card is also used to connect the system to an external clocking source. Install this card in the upper half of the back of the PXM1. See the "User Interface Access Ports" section on page 5-2 for more information on the PXM1 back card ports.

There are two options for the PXM1 back card.

1. PXM1-UI (standard)

The PXM1-UI back card shown in Figure 2-2 provides

- One RJ45/48 for external T1 or E1 clock input
- One BNC connector for E1 clock input
- One DB-15 female connector for alarm interface
- Maintenance, control and LAN ports.

2. PXM-UI-S3 (optional)

The PXM-UI-S3 back card shown in Figure 2-3 provides Stratum-3 clocking:

- One RJ-45/48 connector for external T1 or E1 clock input (CLK1).
- One DB-15 female connector for alarm interface (Alarm)
- Maintenance, Control and LAN ports.

Note The LAN2 and CLK2 ports on the PXM-UI-S3 are *not* supported in this release. All external connections are made with the LAN1 and CLK1 ports.

Making External Clock Connections

If external equipment or a local digital central office is to provide synchronization, the external clock source is connected to the PXM1-UI or PXM-UI-S3 back card.

Stratum-4 Clocking

External clocking sources are connected to the PXM1-UI back card (see Figure 2-2).

- One RJ-45/48 connector for external T1 or E1 clock input.
- One BNC connector for E1 clock input.

Stratum-3 Clocking

External clocking sources are connected to the PXM-UI-S3 back card (see Figure 2-3).

For T1 and E1 Stratum-3 external clock input, connect the source to the RJ-45/48 connector labeled “CLK1.”

Note The LAN2 and CLK2 ports on the PXM-UI-S3 are *not* supported in this release. All external connections are made with the LAN1 and CLK1 ports.

See Chapter 5, “Configuring the MGX 8250 Shelf” for information on configuring an external clocking source.

PXM1 Back Card Illustrations

This section contains illustrations of the following PXM1 cards:

- Figure 2-1, PXM1 Front Card
- Figure 2-2, PXM1-UI Back Card
- Figure 2-3, User Interface Back Card (PXM-UI-S3)—Stratum-3 Clocking
- Figure 2-4, OC-12 Long-Reach Back Card (SMFLR-1-622/B)
- Figure 2-5, OC-12 Intermediate-Reach Back Card (SMFIR-1-622)
- Figure 2-6, OC-3 Four-Port Back Card (SMF-155/B)
- Figure 2-7, Two-port T3 Back Card (BNC-2T3)
- Figure 2-8, Two-port E3 Back Card (BNC-2E3)

PXM1 User Interface Back Cards

See the "PXM1 User Interface Back Cards" section on page 2-3 for descriptions of the features available with the PXM1 User Interface (PXM1-UI) back cards.

Figure 2-2 PXM1-UI Back Card

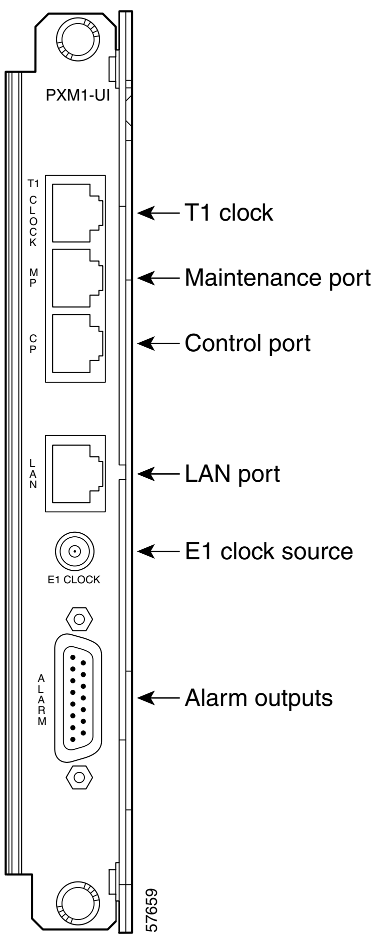
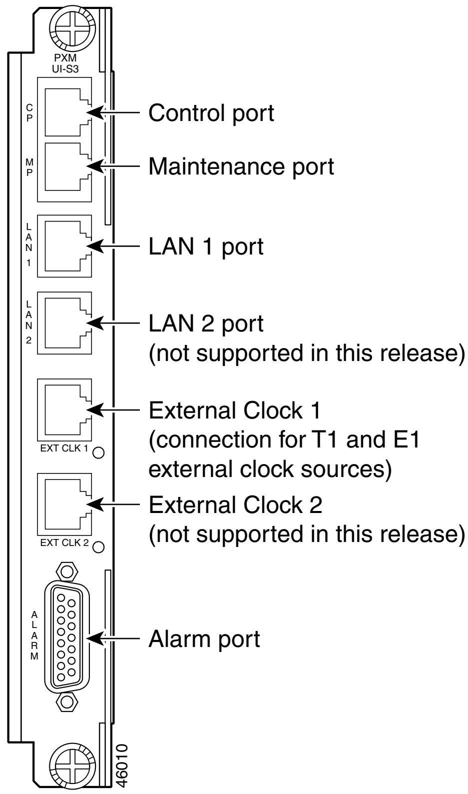


Figure 2-3 User Interface Back Card (PXM-UI-S3)—Stratum-3 Clocking



Alarm Output Connection

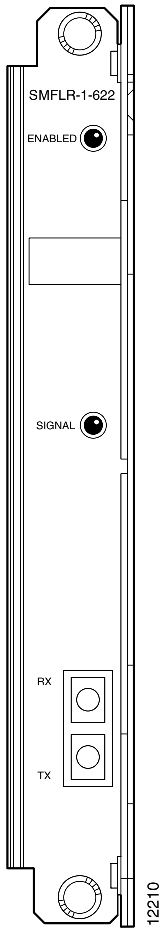
Dry contact relay closures are available for forwarding MGX 8250 alarms to an alarm system. Separate visual and audible alarm outputs are available for major and minor alarm outputs. The MGX 8250 alarm outputs are available on a DB-15 connector on the PXM-UI-S3 back card faceplate. See Appendix B, “Cabling Summary,” for the pinouts on this connector. Use the switchboard cable for running these connections.

SMFLR-1-622 Back Card

An illustration of the long-reach OC-12 card appears in Figure 2-4. For specifications on this card, see Appendix A, “System Specifications.”

Note Automatic Protection Switching (APS) requires the “B” model—SMFLR-1-622/B.

Figure 2-4 OC-12 Long-Reach Back Card (SMFLR-1-622/B)

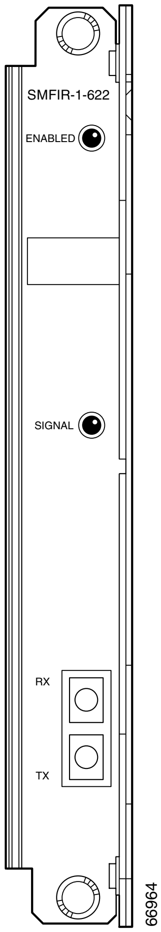


SMFIR-1-622 Back Card

The intermediate-reach OC-12 back card appears in Figure 2-5. For specifications on this card, see Appendix A, “System Specifications.”

Note Automatic Protection Switching (APS) requires the “B” model—SMFIR-1-622/B.

Figure 2-5 OC-12 Intermediate-Reach Back Card (SMFIR-1-622)

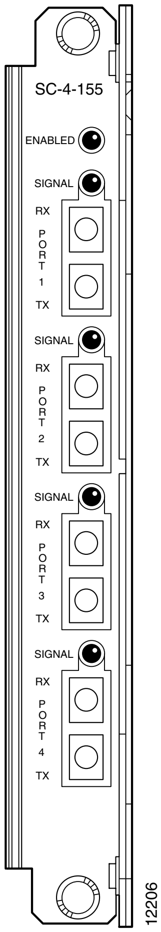


SMF-155 Back Card

The SMF-155 back card provides a physical single-mode fiber optic SONET OC-3 interface that conforms to ANSI T1.105 and GR-253-CORE standards. This interface uses SC connectors. Redundant configurations are supported through Y-cables. For specifications on this card, see Appendix A, “System Specifications.”

Note Automatic Protection Switching (APS) requires the “B” model—SMF-155/B.

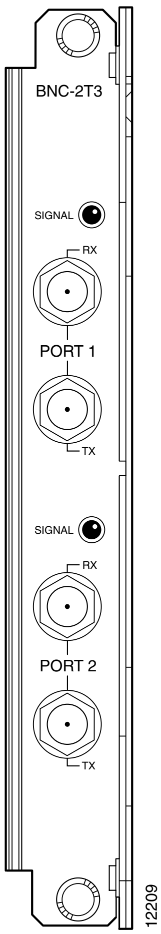
Figure 2-6 OC-3 Four-Port Back Card (SMF-155/B)



BNC-2T3 Back Card

The BNC-2T3 back card appears in Figure 2-7, for card specifications, see Appendix A, "System Specifications."

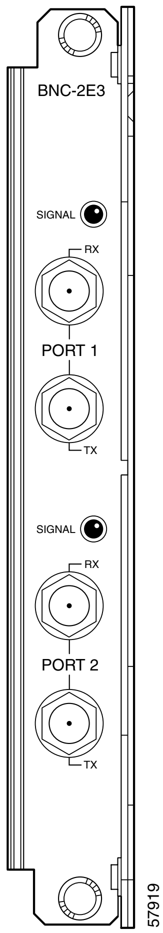
Figure 2-7 Two-port T3 Back Card (BNC-2T3)



BNC-2E3 Back Card

Two versions of the BNC-2E3 card are available; the BNC-2E3 card and the BNC-2E3A card. The BNC-2E3A card applies to Australia only. The BNC-2E3 applies to all other sites that require E3 lines on the PXM1 uplink card. An illustration of the two-port E3 back card appears in Figure 2-8. For specifications on this card, see Appendix A, "System Specifications."

Figure 2-8 Two-port E3 Back Card (BNC-2E3)



Service Resource Module

A service resource module (SRM) provides three main functions for the service modules:

- Bit Error Rate Testing
- 1:N Service Module Redundancy
- Bulk Distribution Mode

See Figure 2-9 for an illustration of the MGX-SRM-3T3/C front card and the MGX-BNC-3T3-M back card.

Bit Error Rate Testing

After a service module line or port is put into loopback mode, the SRM can generate a test pattern over the looped line or port, read the received looped data, and report on the error rate. This operation can be performed on a complete T1 or E1 line, on a fractional T1 or E1 line, on a SD0 bundle (NxDS0), or on a single DS0 channel. The SRM can support Bit Error Rate Testing (BERT) only one line or channel at a time. BERT is capable of generating a variety of test patterns, including all ones, all zeros, alternate one zero, double alternate one zero, 223-1, 220-1, 215-1, 211-1, 29-1, 1 in 8, 1 in 24, DDS1, DDS2, DDS3, DDS4, and DDS5.

1:N Service Module Redundancy

Service module redundancy provides 1:N redundancy for multiple groups of service modules (a group consists of *N* active and one standby service module). The redundant service module in a group must be a superset (with respect to functionality) of the cards. Upon the detection of a failure in any of the service modules, the packets destined for the failed service module are carried over the cellbus to the SRM in its chassis. The SRM receives the packets and switches them to the backup service module via the cellbus.

Bulk Distribution Mode

Each of the T3 ports can be used to support up to 28-multiplexed T1 lines, which are distributed to T1 service module ports in the switch. Called bulk distribution, this feature is performed when the SRM is in bulk mode. The purpose of this feature is to allow large numbers of T1 lines to be supported over three T3 lines rather than over individual T1 lines.

Out of the maximum possible 84-T1 channels (3 times 28), up to 80 channels per shelf can be active at any time. Any T1 channel in a T3 line can be distributed to any eight port on a service module in any slots of the shelf without restriction. Each MGX 8250 shelf can support up to 80 T1/E1s, and the whole chassis supports up to 160 T1s. As an option, the SRMs can use back cards and native T1/E1 interfaces to bring the total to 192 DS1s; 160 DS1s using twenty 8-port cards and the SRMs, and 32 DS1s using four 8-port cards with T1/E1 back cards (for the MGX 8250).

The SRM-3T3 can also be operated in nonbulk mode on a port-by-port basis. For a port configured in nonbulk mode, bulk distribution is disabled and the SRM provides BERT and 1:N redundancy functions only.

Linking the MGX-SRM-3T3/C to a destination card causes the switch to take CPE traffic through the MGX-SRM-3T3/C rather than the T1 card's line module. Linkage is a card-level condition. If you link just one T1 channel on a service module to the MGX-SRM-3T3/C, the back card on the service module becomes inoperative, so you must link all other T1 ports on that service module to the MGX-SRM-3T3/C if you want them to operate.

Module Requirements with Bulk Distribution and Redundancy

The use of bulk distribution affects the requirements for SRM and service module back cards:

- With bulk distribution and 1:N redundancy support by way of the distribution bus, the service modules do not use back cards.
- For just 1:N redundancy by way of the redundancy bus, the supported service modules must have back cards—including one special redundancy back card. E1 redundancy requires the AX-R-RJ48-8E or AX-R-SMB-8E1 line module, and T1 redundancy requires the R-RJ48-8T1 line module.
- For bulk distribution, the T3 lines connect to an external multiplexer. The T1 lines on the other side of the multiplexer connect to the CPE. The SRM converts the received traffic from its T3 lines to T1 channels and sends the data to *linked* service modules. For instructions on linking T1 channels and card slots to the MGX-SRM-3T3/C, see Chapter 6, "Card and Service Configuration".

Installation Requirements for the MGX-SRM-3T3/C

The following card-level characteristics apply to any SRM installation:

- The MGX-SRM-3T3/C and supported service modules must be in the same (top or bottom) bay.
- A nonredundant setup requires an MGX-SRM-3T3/C in slot 15 for the upper bay or slot 31 for redundancy in the lower bay. The PXM1 in slot 7 controls the SRMs in slots 15 and 31.
- An optional, redundant PXM1 in slot 8 controls the redundant SRMs in slots 16 and 32.
- If the MGX 8250 has one or two primary SRMs for the primary PXM1 and the switch also has a redundant PXM1, it must have redundant SRMs. Therefore, the switch can use one, two, or four MGX-SRM-3T3/Cs.
- The distribution bus does not support slots 9, 10, 25, and 26. Any service module that uses bulk distribution or relies on the distribution bus for redundancy cannot reside in these slots.
- There are four SRMs per node—two per shelf. The two on the top shelf service the upper service bay; the two on the bottom service the lower service bay. The SRMs are 1:1 redundant; two SRMs (one on each subshelf) are active, the other two provide redundancy.
- The SRMs on the upper service bay support 1:N redundancy (up to 1:11 Service Module redundancy coverage through the redundancy bus) on the upper service bay. The SRMs on the lower service bay support 1:N redundancy (up to 1:11 Service Module redundancy coverage through the redundancy bus).
- For bulk distribution, each bay can support three channelized T3s using the SRMs. The SRM can support 80 T1/E1s per shelf. Each MGX 8250 chassis can support a total of 160 DS1s. Bulk distribution operates across ten slots. Bulk distribution is not currently supported in slots 9, 10, and 25, 26.

- The SRMs can be used in conjunction with native T1/E1 Service Modules to bring the total to 192 DS1s, 160 DS1s using twenty 8-port cards and the SRMs, and 32 DS1s using four 8-port cards with T1/E1 back cards. In the future, it is anticipated that the SRM will be able to support 168 T1/E1s. The current SRM, however, is limited to 80 DS1s across the three T3s on each SRM, for a total of 160 DS1s.
- In a standard configuration, the SRMs reside in chassis slots 15, 16, 31, and 32. The active SRM associates to the active processor switch module (PXM). The SRMs in slots 15 and 31 associate to the PMX in slot 7. The SRMs in slots 16 and 32 associates to PXM in slot 8. Either SRM in slot 15 or 16 can be active (depending on the active PXM).

SRM Illustration and LED Indicators

Table 2-1 and Table 2-2 describe the SRM-3T3 LED faceplate indicators.

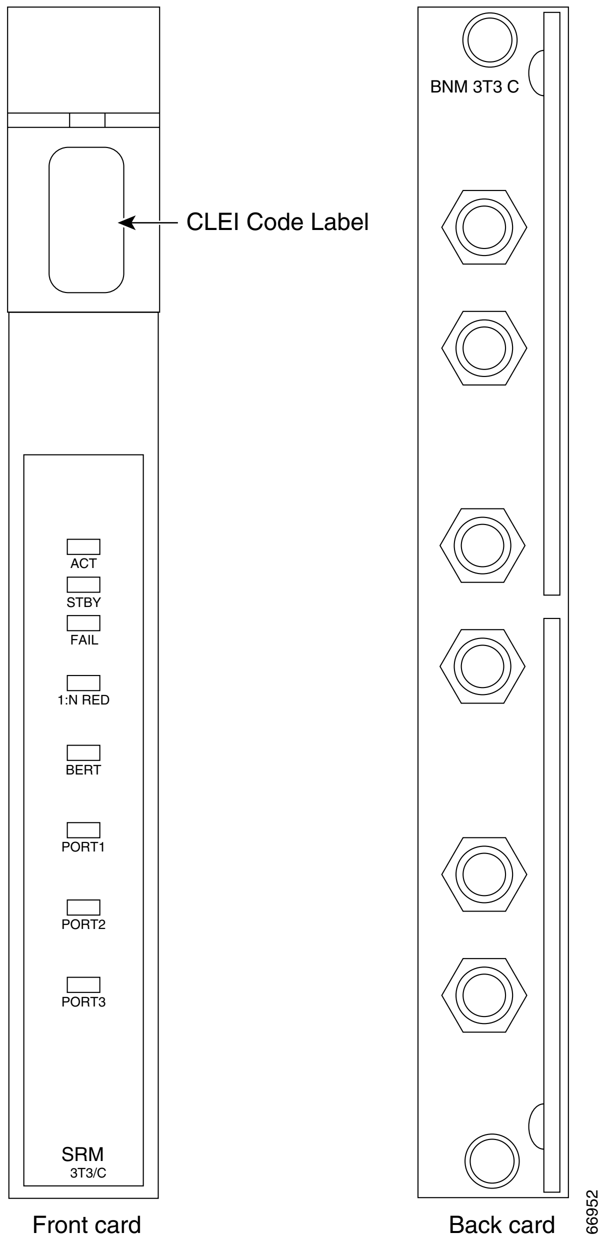
Table 2-1 LED Indicators for the SRM-3T3/C

LED	Color	Meaning
ACT	Green	Indicates card set is in active mode.
STBY	Yellow	Indicates card set is in standby mode.
FAIL	Red	Indicates the BNM-155 card set failed or the line module is missing.

Table 2-2 Line Redundancy LED Indicators for the SRM-3T3/C

LED	Color	Meaning
1:N RED	Green	On indicates 1:N redundancy is invoked. Off indicates 1:N redundancy is not active.
BERT	Green	On indicates the BERT function is active.

Figure 2-9 MGX-SRM-3T3/C Card Set



ATM UNI Service Module (AUSM)

The main function of the AUSM cards is to provide an ATM UNI/NNI interface at T1 or E1 rates so that ATM UNI user devices can transmit and receive traffic. This section contains the following information:

- AUSM Features, page 2-16
- AUSM Front Card, page 2-18
- Back Cards for the AUSM/B, page 2-19

AUSM Features

The MGX-AUSM-8T1/B and MGX-AUSM-8E1/B (AUSM) are multipurpose front cards that use an eight-port T1 or E1 back card to provide native ATM UNI interfaces.

A single AUSM/B card can provide hot standby redundancy for all active AUSM/B cards of the same type (1:N redundancy).

AUSM/B modules are supported by standards-based management tools, including Simple Network Management Protocol (SNMP), Trivial File Transfer Protocol (TFTP) for configuration and statistics collection, and a command-line interface. Cisco's WAN Manager service management tool provides full graphical user interface support for connection and equipment management.

Quality of Service Management

Consistent with the Cisco intelligent quality of service (QoS) management features, AUSM/B cards support per-VC queuing on ingress and multiple class of service queues on egress. AUSM/B cards fully support continuous bit rate (CBR), variable bit rate (VBR), unspecified bit rate (UBR), and available bit rate (ABR) service classes.

Inverse Multiplexing

AUSM/B cards also support ATM Forum-compliant inverse multiplexing for ATM (IMA). This capability enables multiple T1 or E1 lines to be grouped into a single high-speed ATM port. This NxT1 and NxE1 capability fills the gap between T1/E1 and T3/E3, providing bandwidth up to 12 Mbps (NxT1) or 16 Mbps (NxE1), without requiring a T3/E3 circuit.

Inverse Multiplexing for ATM

- ATM Forum 1.0-compliant inverse multiplexing for ATM (IMA)
- Support for differential delays of up to 200 milliseconds across the constituent T1s (up to 250 ms) and E1s of an IMA group
- With IMA disabled, each T1 or E1 interface configured as a single port running at full line rate
- With IMA, any group of NxT1s or NxE1s can support an NxT1 or NxE1 port
- With IMA, multiple IMA ports of any configuration supported per card (a specific T1 or E1 line can be in only one T1/E1 or IMA port at a time)
- Upon T1/E1 circuit failure, an IMA port automatically adjusts to continue operation over remaining circuits

Physical Layer Features

Table 2-3 shows the physical layer features for all cards, T1 cards, and E1 cards.

Table 2-3 Physical Layer Features

Card Type	Feature
All cards	• Transmitter is loop-timed to receiver or synchronized to shelf • Loop-up, loop-down pattern generation and verification • Transmission convergence sublayer functions per ITU G.804 • LCV, LES, LSES, CV, ES, SES, SEFS, AISS, UAS performance statistics • Bit rate error test (BERT) and extended loopback pattern generation/verification (with optional SRM) • 1:N redundancy within a group of n+1 AUSM/B cards of same type on a shelf (with optional SRM) • LOS, OOF, AIS, RAI alarms
T1 cards	• Eight T1 (1.544 Mbps +/–50 bps) lines per card • B8ZS or AMI line coding • ANSI T1.408 extended Super Frame format line framing • ANSI T1.408 support for detection and display of received T1 ESF loopback codes on extended Super Frame (ESF) data link Cell transfer capacity 3623 cells/sec per T1
E1 cards	• Eight E1 (2.048 Mbps +/–50 bps) lines per card • HDB3 or AMI line coding • ITU G.704 16-frame multiframe line framing and clear channel for E1 • BERT and extended loopback pattern generation/verification (with optional SRM) Cell transfer capacity 4528 cells/sec per E1 (G.704), 4830 cells/sec per E1 (clear channel)

AUSM Front Card

The AUSM/B front card oversees all major functions of the ATM interface. It contains firmware for both the T1 and the E1 line interfaces and downloads from the PXM1 the appropriate code when it recognizes the back card type. An illustration of an eight-port AUSM/B front card appears in Figure 2-10. For specifications on this card, see Appendix A, "System Specifications."

Figure 2-10 AUSM/B-8T1 or AUSM/B-8E1 Front Card

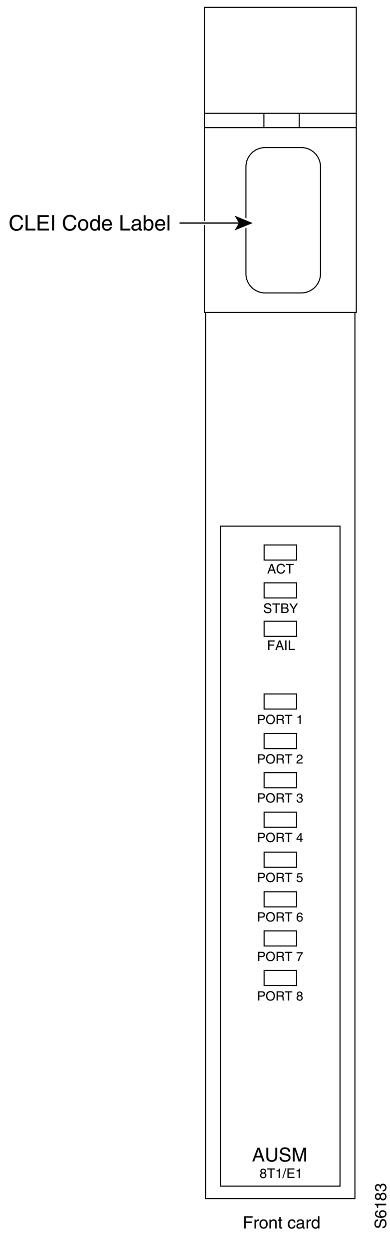


Table 2-4 contains a list of eight-port LED indicators.

Table 2-4 Eight-Port AUSM-B LED Indicators

LED	Color	Description
ACT	Green	On indicates the card set is in active mode.
STBY	Yellow	• Slow blink with Active LED off means the card is in the boot state. • Fast blink with Standby LED on means card is receiving firmware. • Fast blink indicates the service module is passing BRAM channel information to the PXM1. • Steady yellow indicates the card is in Standby mode and the firmware is executing ADMIN code.
FAIL	Red	• Steady Red with Active and Standby LEDs off indicates either the card is in the Reset condition, the card has failed, or the card set is not complete (no line module). • Steady Red with Active LED on indicates the card was active prior to failing. • Steady Red with Standby LED on indicates the card was standby prior to failing.
PORT	Green	Green indicates the port is active.
	Red	Red indicates a local alarm on the port.
	Yellow	Yellow indicates a remote alarm on the port.
		Off indicates the port has not been activated (upped).

Back Cards for the AUSM/B

The MGX-AUSM-8T1/B and MGX-AUSM-8E1/B use the generic eight-port T1 or E1 line modules that operate with the eight-port service modules (see Figure 2-11).

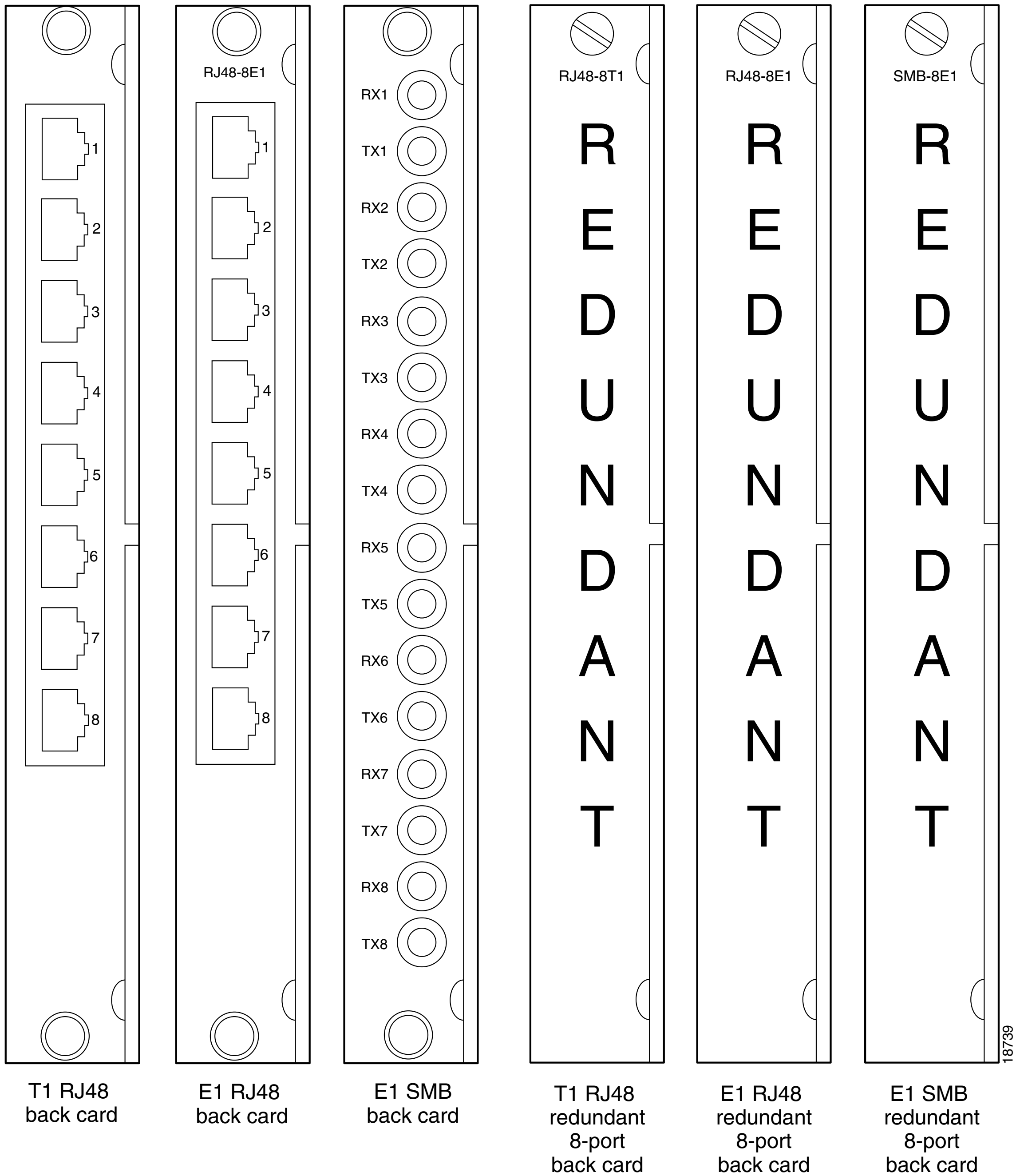
- AX-RJ48-T1—Provides eight RJ-48 connectors for T1 lines.
- AX-RJ48-E1—Provides eight RJ-48 connectors for E1 lines.
- AX-SMB-E1—Provides eight pairs of SMB connectors for E1 lines.

1:N Redundancy support for the AUSM requires the special versions of the RJ-45 back cards (see Figure 2-11). These back cards are

- AX-R-RJ48-T1
- AX-R-RJ48-E1
- AX-R-SMB-E1

Note Redundancy support differs for the MGX-AUSM-8T1/B and MGX-AUSM-8E1/B. For details on the requirements for redundancy through an MGX-SRM-3T3/C, see "“Service Resource Module” section on page 2-12.

Figure 2-11 RJ-48 and SMB Back Cards for the MGX-AUSM-8T1E1/B



Frame Relay Service Modules

The primary function of the Frame Relay Service Modules (FRSM) is to convert between the Frame Relay formatted data and ATM/AAL5 cell-formatted data. For an individual connection, you can configure network interworking (NIW), service interworking (SIW), ATM-to-Frame Relay UNI (FUNI), or frame forwarding. An FRSM converts the header format and translates the address for

- Frame Relay port number and DLCI
- ATM-Frame UNI (FUNI) port number and frame address or frame forwarding port
- ATM virtual connection identifier (VPI/VCI)

See the “Configuring Frame Relay Service” section on page 6-29 for instructions to configure the FRSMs.

This section contains the following information:

- Features Common to All FRSMs, page 2-21
- Rules for FRSM Slot Installation, page 2-23
- Redundancy for Frame Service Modules, page 2-23
- Connection Types on the FRSM, page 2-24
- Types of Frame Service Modules, page 2-28
  - FRSMs for T1 and E1 Lines, page 2-29
  - FRSMs for T3 and E3 lines, page 2-33
  - FRSMs for Serial Connections, page 2-39

Features Common to All FRSMs

This section describes features common to all FRSMs. For features specific to the individual module types, see Types of Frame Service Modules, page 2-28. For information to configure the FRSMs, see Chapter 6, “Card and Service Configuration”.

Data-Link Layer Features

- Each logical port on an FRSM independently configurable to run Frame Relay UNI, Frame Relay NNI, ATM FUNI, or frame forwarding.
- 7E flags used to delineate frames (with bit stuffing to prevent false flags) and for interframe gaps.
- One flag between frames is considered valid upon receipt.
- Supports configuration of one- or two-flag minimum interframe gap for transmission.
- Valid frame sizes from 5 to 4510 octets.

Frame Relay Features

- Each logical is port independently configurable as Frame Relay UNI or Frame Relay NNI.
- Meets ANSI T1.618, using two-octet headers.
- Interpreted CCITT-16 CRC at end of the frame (frame discard if in error).

- Supports ITU-T Q.933 Annex A, ANSI T1.617 Annex D, and LMI local management for semipermanent virtual circuits (both UNI and NNI portions); enhanced LMI provides autoconfiguration of traffic management parameters for attached Cisco routers.
- Frame Relay-to-ATM network interworking (FRF.5) and Frame Relay-to-ATM service interworking (FRF.8), both transparent and translation modes, configured on a per-permanent virtual circuit (PVC) basis.
- Standards-based CIR policing and DE tagging/discarding.
- End-to-end ForeSight rate-based flow control option.
- Capability to extend ForeSight closed-loop congestion management between two Cisco networks across Frame Relay-UNI or Frame Relay-NNI using ANSI T1.618 consolidated link-layer management (CLLM) messages.
- Support for high-priority, rt-VBR, nrt-VBR, VBR, and ABR-ForeSight QoS.

Note The ForeSight option is not available on MGX-FRSM-HS1/B.

ATM FUNI features

The MGX 8250 FRSMs support the following ATM FUNI features.

- ATM Forum FUNI mode 1A supported.
- Interpreted CCITT-16 CRC at end of the frame (frame discard if in error).
- AAL5 mapping of user payload to ATM.
- Supports 16 VPI values (15 plus the zero VPI); supports virtual path connections (VPCs) for all nonzero VPI values (up to 15 VPCs).
- Supports 64 VCI values.
- Supports OAM frame/cell flows.
- Standards-based usage parameter control.
- Support for high-priority, rt-VBR, nrt-VBR, VBR, and ABR-ForeSight QoS.

Note The ForeSight option is not available on MGX-FRSM-HS1/B.

Frame Forwarding features

The MGX 8250 FRSMs support the following frame forwarding features.

- No assumptions made on the frame header format.
- Interpreted CCITT-16 CRC at end of the frame (with frame dropping on an error).
- If a connection is set up, all frames are routed to/from that connection; otherwise the frame is discarded.
- No translation/mapping attempted between frame header bits and ATM layer EFCI and DE bits.

- A single set of Frame Relay traffic access parameters (for example, CIR) is configured for the logical port in frame-forwarding mode; all arriving frames are treated as if they arrived without a set DE bit; if the frame is determined to exceed the committed rate (exceeding CIR), the CLP of all cells associated with that frame are set to indicate low priority; if the frame exceeds the total rate allowed for committed and uncommitted traffic, the frame is discarded.
- Support for high-priority, rt-VBR, nrt-VBR, VBR, and ABR-ForeSight QoS.

Note The ForeSight option is not available on MGX-FRSM-HS1/B.

Rules for FRSM Slot Installation

The rules for slot installation are as follows:

- An FRSM can reside in any slot except slots 7, 8, 15, 16, 31, and 32.
- Any card for which you specify 1:N redundancy through the redundancy bus and the MGX-SRM-3T3/C cannot go in slot 9, 10, 25, or 26.
- Whenever possible, the VHS cards should go in the upper bay of the card cage because the upper half of the backplane provides higher bandwidth at each slot.

Note The MGX-FRSM-HS1/B does not support redundancy; redundancy is not a consideration for deciding on a slot for the card. Nevertheless, the MGX-FRSM-HS1/B should be installed in the lower bay due to cell bus speed.

Redundancy for Frame Service Modules

FRSMs can have either hot standby, 1:1 redundancy, or 1:N redundancy.

- For 1:1 redundancy, a Y-cable is necessary.
- MGX-FRSM-2CT3, MGX-FRSM-2T3E3, and MGX-FRSM-HS2 use 1:1 Y-cable redundancy.
- For 1:N redundancy, an MGX-SRM-3T3/C is required (no Y-cabling).
- Differences may exist in the way the MGX-SRM-3T3/C supports redundancy for a particular T1 or E1 configuration. See the “Service Resource Module” section in this chapter; see Chapter 6, “Card and Service Configuration”the “Service Resource Module” section.

Note The MGX-FRSM-HS1/B does not support redundancy.

Hot Standby

For hot standby, place the card sets in slots on the same card shelf and connect using an appropriate Y-cable to connect each hot standby pair. To view the hot standby status of the system, enter the **dsphotstandby** command.

1:1 Redundancy

For 1:1 redundancy, place the card sets in adjacent slots and connect a Y-cable for each pair of active and standby ports. On the CLI, configure the card for redundancy by entering the **addred** command. For instructions on how to use the CiscoView application to configure redundancy, refer to the CiscoView documentation.

1:N Redundancy

1:N redundancy for the eight-port FRSMs requires an MGX-SRM-3T3/C. With 1:N redundancy, a group of service modules includes one standby module. For installation requirements, see "“Service Resource Module” section on page 2-12”. For configuration requirements, see Chapter 6, “Card and Service Configuration” in the “Service Resource Module” section.

Connection Types on the FRSM

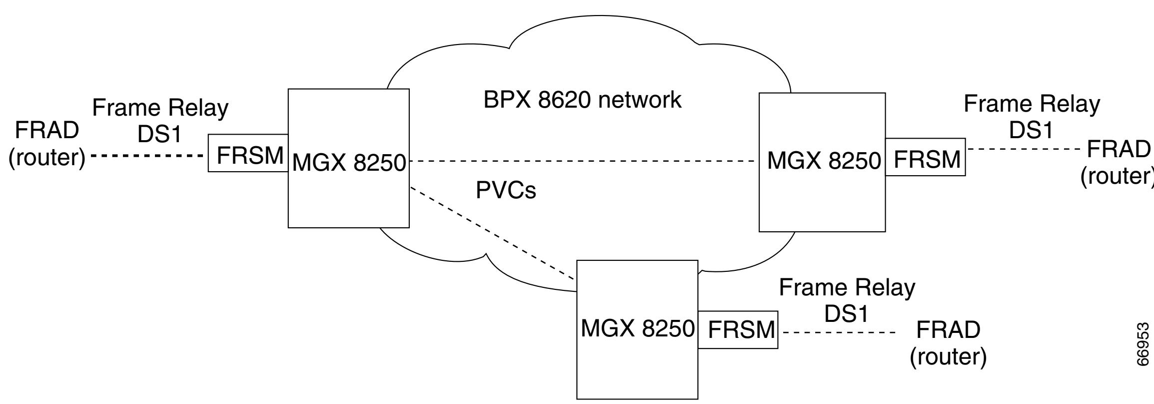
The following sections describe NIW, SIW, FUNI, and Frame forwarding. Topics include translation and congestion management.

- Frame Relay-to-ATM Service Interworking, page 2-25
- Frame Forwarding, page 2-27
- ATM Frame-to-User Network Interface, page 2-28

Frame Relay-to-ATM Network Interworking

Frame Relay-to-ATM network interworking (NIW) supports a permanent virtual connection (PVC) between two Frame Relay users over a Cisco network or a multi-vendor network. The traffic crosses the network as ATM cells. To specify NIW for a connection, add the connection with a *channel type* of “network interworking.” For an illustration of a BPX 8620 network with NIW connections, see Figure 2-12.

Figure 2-12 BPX 8620 Network with NIW Connections



Congestion Indication for NIW Connections

In addition to frame-to-cell and DLCI to VPI/VCI conversion, the network interworking feature maps cell loss priority (CLP) and congestion information from Frame Relay to ATM formats. The CLP and congestion indicators can be modified for individual connections entering the **cnfchanmap** command.

Frame Relay–to–ATM Direction

Each Frame Relay/ATM network interworking connection can be configured as one of the following DE to CLP mapping schemes:

- DE bit in the Frame Relay frame is mapped to the CLP bit of every ATM cell generated by the segmentation process.
- CLP is always 0.
- CLP is always 1.

ATM–to–Frame Relay Direction

Each Frame Relay/ATM network interworking connection can be configured as one of the following CLP to DE mapping schemes:

- If one or more ATM cells belonging to a frame has its CLP field set, the DE field of the Frame Relay frame will be set.
- No mapping from CLP to DE.

Congestion Indication

Congestion on the Frame Relay/ATM network interworking connection is flagged by the EFCI bit. The setting of this feature is dependent on traffic direction, as described below.

Frame Relay–to–ATM Direction

EFCI is always set to 0.

ATM–to–Frame Relay Direction

If the EFCI field in the last ATM cell of a segmented frame received is set, then FECN of the Frame Relay frame will be set.

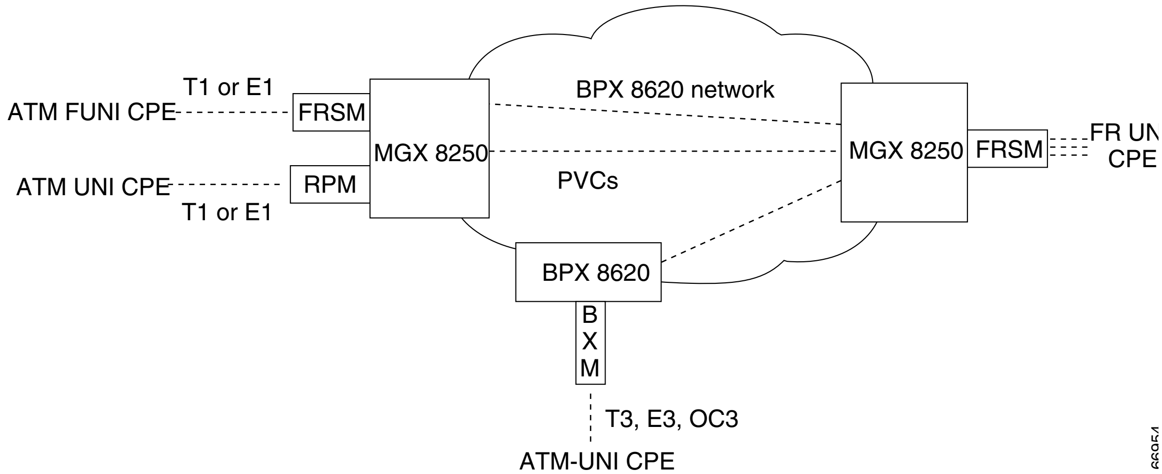
PVC Status Management

The management of ATM layer and FR PVC status management can operate independently. The PVC status from the ATM layer is used when determining the status of the FR PVC. However, no direct actions of mapping LMI A bit to OAM AIS is performed.

Frame Relay-to-ATM Service Interworking

By specifying “service interworking” as the channel type when adding a Frame Relay PVC to an FRSM, all PVC data is subject to service interworking translation and mapping in both the Frame Relay–to–ATM and ATM–to–Frame Relay directions. Figure 2-13 is an illustration of typical SIW connections.

Figure 2-13 BPX 8600 Series Network with SIW Connections



In Figure 2-13, an MGX 8250 node on the right has three-Frame Relay SIW connections terminating on an FRSM. Three far end terminations for these connections appear in other parts of Figure 2-13.

- ATM FUNI (framed UNI) port on an FRSM
- ATM UNI port on an RPM
- ATM UNI port on a BPX 8600 series BXM card

In addition to frame-to-cell and DLCI-to-VPI/VCI conversion, SIW maps cell loss priority and congestion data between the Frame Relay and ATM formats and is FRF.8-compliant. It provides full support for routed and bridged PDUs, transparent and translation modes, and VP translation.

Cell Loss Priority

In addition to frame-to-cell and DLCI-to-VPI/VCI conversion, the SIW feature maps cell loss priority (CLP) and congestion information from Frame Relay-to-ATM formats and is FRF.8-compliant. It provides full support for routed and bridged PDUs, transparent and translation modes, and VP translation. The CLP and congestion parameters can be modified for individual connections with the **cnfchanmap** command.

Frame Relay–to–ATM Direction

Each Frame Relay–to–ATM service interworking connection can be configured as one of the following Discard Eligibility (DE) to CLP schemes:

- DE bit in the Frame Relay frame is mapped to the CLP bit of every ATM cell generated by the segmentation process of the frame.
- CLP is always 0.
- CLP is always 1.

ATM–to–Frame Relay Direction

Each Frame Relay–to–ATM service interworking connection can be configured as one of the following CLP to DE mapping schemes:

- If one or more ATM cells belonging to a frame has its CLP set, the DE field of the Frame Relay frame will be set.

- DE is always 0.
- DE is always 1.

Setting up the cell loss priority option is accomplished through the MGX 8250 **cnfchanmap** (configure channel map) command.

Congestion Indication

Frame Relay–to–ATM Direction

Each Frame Relay–to–ATM service interworking connection can be configured as one of the following Forward Explicit Congestion Notification (FECN) to Explicit-Forward Congestion Indicator (EFCI) schemes:

- FECN bit in the Frame Relay frame is mapped to the EFCI bit of every ATM cell generated by the segmentation process of the frame.
- EFCI is always 0.
- EFCI is always 1.

ATM–to–Frame Relay Direction

Frame Relay–to–ATM service interworking connections use the following EFCI to FECN/BECN mapping schemes:

- If the EFCI bit in the last ATM cell of a segmented frame received is set to 1, the FECN of the Frame Relay frame will be set to 1.
- BECN is always set to 0.
- Setting up the congestion indication option is accomplished through the **cnfchanmap** (configure channel map) command.

Command and Response Mapping

Command and Response Mapping is provided in both directions.

Frame Relay–to–ATM Direction

The FRSM maps the C/R bit of the received Frame Relay frame to the CPCS-UU least-significant bit of the AAL5 CPCS PDU.

ATM to Frame Relay Direction

The least-significant bit of the CPCS-UU is mapped to the C/R bit of the Frame Relay frame.

Translation and Transparent Modes

Each service interworking (SIW) connection can exist in either *translation* or *transparent* mode. In translation mode, the FRSM translates protocols between the FR NLPID encapsulation (RFC 1490) and the ATM LCC encapsulation (RFC 1483). In transparent mode, the FRSM does not translate. Translation mode support includes address resolution by transforming address resolution protocol (ARP, RFC 826) and inverse ARP (ARP, RFC 1293) between the Frame Relay and ATM formats.

Frame Forwarding

The FRSM card can be configured as “Frame Forwarding” on a port-by-port basis.

Frame forwarding differs from the Frame Relay in the following respects.

- The 2-byte Q.922 header is not assumed/interpreted.
- All frames received are mapped to a specific connection if it exists. Otherwise, the frames are dropped.
- No DE/CLP or FECN/EFI mapping is performed.
- “Illegal header count” and “Invalid DLCI” statistics are not kept.
- “Discarded frame count due to no connection” statistic is kept.

ATM Frame-to-User Network Interface

All FRSMs support the ATM Frame-based User-to-Network Interface (FUNI). When a frame arrives from the FUNI interface, the FRSM removes the 2-byte FUNI header and segments the frame into ATM cells by using AAL5. In the reverse direction, the FRSM assembles ATM cells from the network into a frame by using AAL5, adds a FUNI header to the frame, and sends it to the FUNI port.

Loss Priority Indication

Loss Priority Indication mapping is provided in both directions.

FUNI-to-ATM Direction

The CLP bit on the FUNI header is mapped to the CLP bit of every ATM cell that is generated for the FUNI frame.

ATM-to-FUNI Direction

CLP bit in the FUNI header is always set to 0.

Congestion Indication

Congestion Indication mapping is provided in both directions

FUNI-to-ATM Direction

EFCI is set to 0 for every ATM cell generated by the segmentation process.

ATM-to-FUNI Direction

If the EFCI field in the last ATM cell of a received segmented frame is set to 1, the CN bit in the FUNI header is set to 1. The two reserve bits (the same positions as C/R and BECN in Frame Relay header) are always set to 0.

Types of Frame Service Modules

There are three types of FRSMs:

- FRSMs for T1 and E1 Lines, page 2-29.
- FRSMs for T3 and E3 lines, page 2-33.
- FRSMs for Serial Connections, page 2-39.

Note For hardware and other specifications on the FRSMs, see Appendix A, “System Specifications.” For descriptions of how to configure the card, lines, and ports and add Frame Relay connections, see Chapter 6, “Card and Service Configuration”.

FRSMs for T1 and E1 Lines

The eight-port FRSMs for T1 or E1 lines support channelized or unchannelized service. These cards provide interface support as follows.

- AX-FRSM-8T1 supports up to eight *fractional* T1 line interfaces.
- AX-FRSM-8E1 supports up to eight *fractional* E1 line interfaces.
- AX-FRSM-8T1-C supports up to eight *channelized* T1 line interfaces.
- AX-FRSM-8E1-C supports up to eight *channelized* E1 line interfaces.

FRSM for T1 features

The FRSM-8T1 and FRSM-8T1-C each provide eight T1 interfaces for full-duplex communications at up to 1.544 Mbps.

Each T1 line consists of an RJ-48, along with three LED indicators for line status. The FRSM-8T1 supports fractional and unchannelized T1 port selection on a per-T1 basis. The FRSM-8T1-C allows full DS0 and NxDS0 channelization of the T1s, for a maximum of 192 ports per FRSM-8T1-C.

Key features include:

- Eight T1 (1.544 Mbps +/-50 bps or 32 ppm) lines
- B8ZS or AMI line coding
- ANSI T1.408 extended superframe format line framing
- Each interface configurable as a single port (FRSM-8T1) or up to 24 ports (FRSM-8T1-C) running at full line rate, at 56 or Nx64 kbps
- Bit error rate tester (BERT) and extended loopback pattern generation/verification (with optional SRM)
- 1:N redundancy within a group of N+1 FRSM cards on a shelf (with optional SRM)
- LOS, OOF, AIS, RAI alarms
- Transmitter loop-timed to receiver or synchronized to shelf
- Supports up to 1000 virtual connections per card

FRSM for E1 features

The FRSM-8E1 and FRSM-8E1-C each provide eight E1 interfaces for full-duplex communications at up to 2.044 Mbps. Each E1 line consists of an RJ-48 and SMB mini-connector, along with three LED indicators for line status.

The FRSM-8E1 supports fractional and unchannelized E1 port selection on a per-E1 basis. The FRSM-8E1-C allows full DS0 and NxDS0 channelization of the E1s, for a maximum of 248 ports per FRSM-8E1-C.

Key Features include:

- Eight-E1 (2.048 Mbps +/-50 bps or 32 ppm) lines
- HDB3 or AMI line coding
- ITU G.704 16-frame multiframe line framing and clear channel E1
- Each interface configurable as a single port (FRSM-8E1) or up to 31 ports (FRSM-8E1-C) running at full line rate, at 56 or Nx64 kbps
- BERT and extended loopback pattern generation/verification (with optional SRM)
- 1:N redundancy within a group of n + 1 FRSM cards on a shelf (with optional SRM)
- LOS, OOF, AIS, RAI alarms
- Transmitter loop-timed to receiver or synchronized to shelf
- Supports up to 1000 virtual connections per card

LED Indicators

Table 2-5 and Table 2-6 describe the FRSM T1/E1 LED faceplate indicators.

Table 2-5 Card Level LED Indicators for the FRSM T1/E1

LED	Color	Meaning
ACT	Green	Active
STBY	Yellow	Standby
FAIL	Red	Fail

Table 2-6 Line Level LED Indicators for the FRSM T1/E1

LED	Color	Meaning
PORT	Green	Active and OK
	Red	Active and Local Alarm
	Yellow	Active and Remote Alarm

Card Illustrations

- Figure 2-14 is an illustration of the front card (applies to both the MGX-FRSM-8T1 and MGX-FRSM-8E1).
- Figure 2-15 is an illustration of the FRSM T1 and E1 back cards.
  - AX-RJ48-8T1 is the T1 back card. An AX-R-RJ48-8T1 is required for redundancy support.
  - AX-RJ48-8E1 and AX-SMB-8E1 are the E1 back cards for RJ48 and SMB connections. A special AX-R-SMB-8E1 card is required for redundancy support.

Figure 2-14 MGX-FRSM-8T1

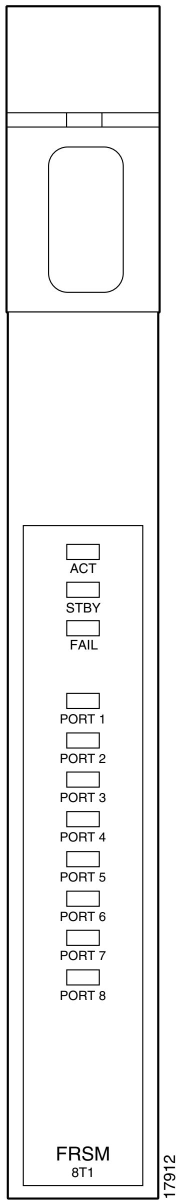
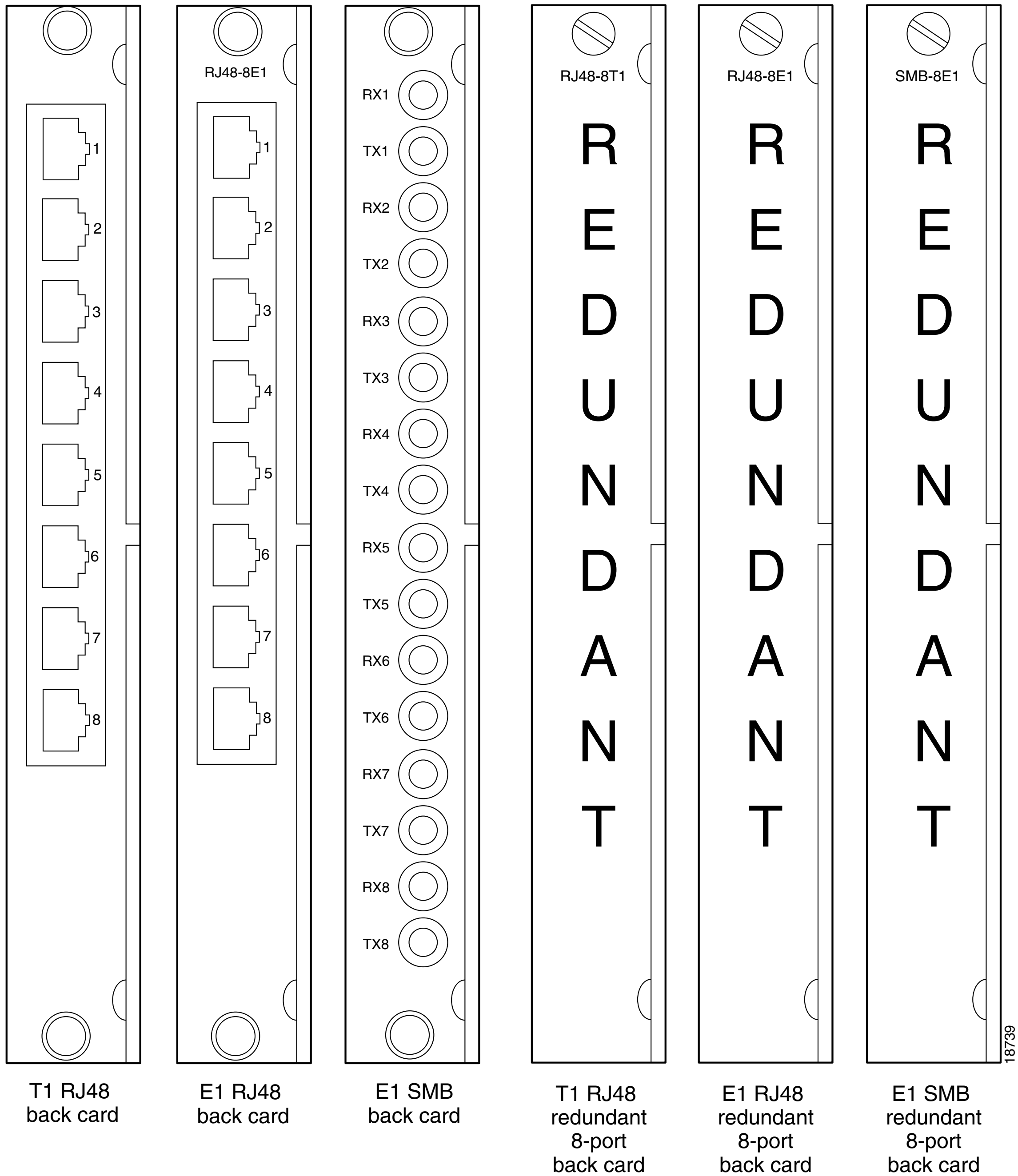


Figure 2-15 RJ-48 and SMB Back Cards for the MGX-FRSM-8T1/E1



FRSMs for T3 and E3 lines

The FRSMs for T3 and E3 lines include

- MGX-FRSM-2CT3—Provides two *channelized* T3 interfaces for high-density NxDS0 and DS1 frame services. The FRSM-2CT3 supports up to 4000 virtual connections per card.
- MGX-FRSM-2T3E3—Provides *unchannelized* Frame Relay service over two T3 or E3 lines. This module can also support subrate T3 or E3 for tiered DS3 on each physical port. The FRSM-2T3E3 supports up to 2000 virtual connections per card.

Features

This section describes the features specific to the T3 and E3 interfaces. See the "Features Common to All FRSMs" section on page 2-21 for a description of features that apply to all FRSM modules.

T3 Interfaces

- Two DSX-3 (44.736 Mbps +/-20 ppm) interfaces with dual female 75-ohm BNC coaxial connectors per port (separate RX and TX)
- B3ZS line coding
- Pulse shape conforming to ANSI T1.102.1993
- C-bit parity and M13 line framing formats
- Scrambling and subrate (FRSM-2T3E3) support of major DSU vendors
- T3 bit error rate tester (BERT) and extended loopback pattern generation/verification
- 1:1 redundancy with Y-cabling for T3 FRSM cards of the same type
- LOS, OOF, AIS, RAI, FEBE alarm detection/generation support

Note Subrate capability is not supported on Kentrox equipment.

E3 Interfaces

- Two G.703 (34.368 Mbps +/-20 ppm) interfaces with dual female 75-ohm BNC coaxial connectors per port (separate RX and TX)
- HDB3 line coding
- Pulse shape conforming to ITU G.703
- ITU G.751 line framing format
- Scrambling and subrate (FRSM-2T3E3) support of major DSU vendors
- E3 BERT and extended loopback pattern generation/verification
- 1:1 redundancy with Y-cabling for T3 FRSM cards of the same type
- LOS, OOF, AIS, RAI, FEBE alarm detection/generation support

Note Subrate capability is not supported on Kentrox equipment.

Card Combinations

The following card combinations are supported:

- MGX-FRSM-2CT3 front card with the BNC-2T3 back card
- MGX-FRSM-2T3E3 front card with a BNC-2T3 or BNC-2E3 back card

Note A special BNC-2E3A back card applies to Australia only. The BNC-2E3 applies to all other sites that require E3 lines.

Illustrations

For Illustrations of the Very High Speed FRSM front and back cards, see the following illustrations:

- For the MGX-FRSM-2CT3 front card, see Figure 2-16 on page 2-35.
- For the MGX-FRSM-2T3E3 front card, see Figure 2-17 on page 2-36.
- For the MGX-BNC-2T3 back card, see Figure 2-18 on page 2-37.
- For the MGX-BNC-2E3 back card, see Figure 2-19 on page 2-38.

FRSM-2T3E3 LED Indicators

Table 2-7 and Table 2-8 describe the FRSM-2T3E3 LED faceplate indicators.

Table 2-7 Card Level LED Indicators for the FRSM-2T3E3

LED	Color	Meaning
ACT	Green	Active
STBY	Yellow	Standby
FAIL	Red	Fail

Table 2-8 Line Level LED Indicators for the FRSM-2T3E3

LED	Color	Meaning
PORT	Green	Active and OK
	Red	Active and Local Alarm
	Yellow	Active and Remote Alarm

Figure 2-16 MGX-FRSM-2CT3

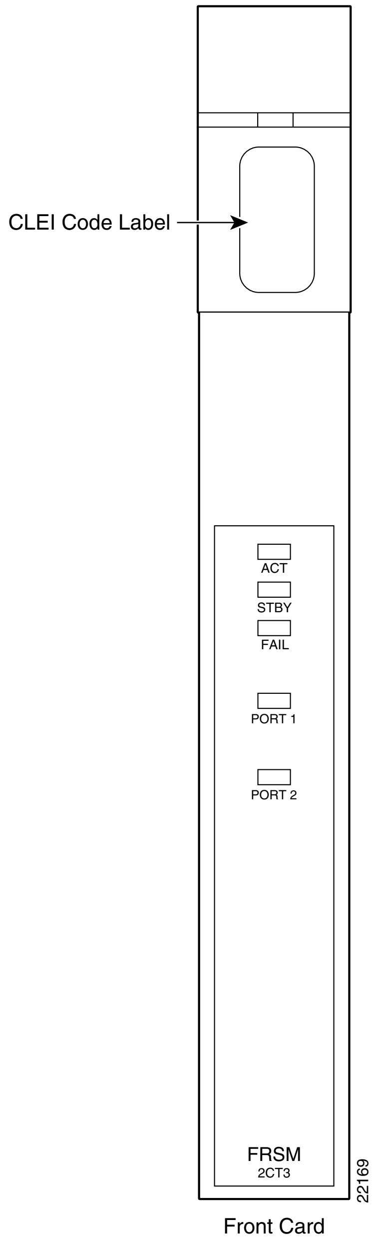


Figure 2-17 MGX-FRSM-2T3E3

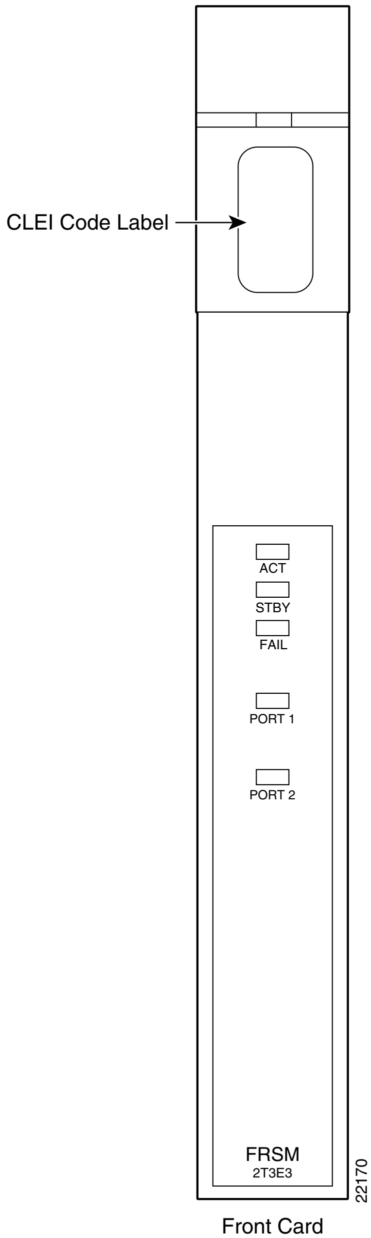


Figure 2-18 BNC-2T3

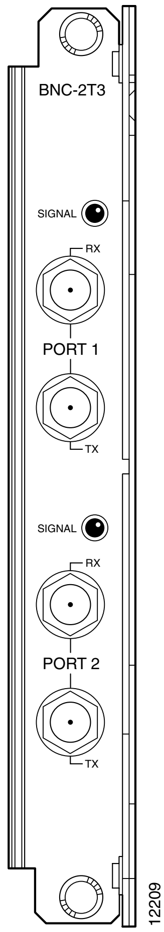
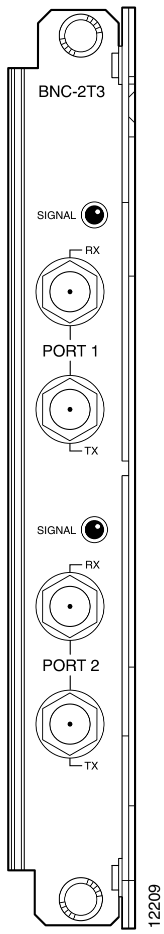


Figure 2-19 BNC-2E3



FRSMs for Serial Connections

The FRSMs that support serial connections include

- MGX-FRSM-HS2—Provides unchannelized Frame Relay service over two HSSI lines on the SCSI2-2HSSI back card. Each port can operate in either DTE or DCE mode.
- MGX-FRSM-HS1/B—Supports four V.35 or four X.21 ports. Each port can operate in DTE or DCE mode. The mode depends on the type of attached cable. See the "MGX-FRSM-HS1/B Cabling" section on page 2-40 to determine the correct cabling for the intended mode of each port.

FRSM-HS1/B X.21 and V.35 Interfaces

Features specific to the FRSM-HS1/B with X.21 and V.35 interfaces are

- Four X.21 or four V.35 lines
- DCE/DTE selection on a per-port basis
- As DCE, clock speeds of 48 Kbps, 56 Kbps, *Nx*64 Kbps up to 2 Mbps, *Nx*1.5 Mbps and *Nx*2 Mbps, up to 8 Mbps, are supported
- As DTE, obtains clock from line, up to 8 Mbps
- Total maximum throughput of all lines on a card is 16Mbps
- Supports 200 DLCIs per card
- Support for per-VC queueing on ingress with closed-loop traffic management
- Support for two priority levels of egress port queues for data traffic
- Various DCE/DTE loopbacks

FRSM-HS2 HSSI Interfaces

Features specific to the FRSM-HS2 with HSSI interfaces are

- Two HSSI lines
- DCE/DTE selection on a per-port basis
- As DCE, clock speeds of Nx1.5 Mbps and Nx2 Mbps, up to 52 Mbps, are supported
- As DTE, obtains clock from line, up to 52 Mbps
- Supports 2000 DLCIs per card
- Support for per-VC queueing on ingress with closed-loop traffic management
- Support for five classes of service (high-priority, rt-VBR, nrt-VBR, ABR, UBR) for data traffic
- Various DCE/DTE loopbacks
- 1:1 redundancy with Y-cabling for FRSM-HS2 cards

Card Combinations

The following card combinations are supported.

- MGX-FRSM-HS2 with a SCSI2-2HSSI back card

- MGX-FRSM-HS1/B with a MGX-12IN1-S4 back card

Illustrations

This chapter provides front and back card illustrations as follows.

- MGX-FRSM-HS2 front card, see Figure 2-20 on page 2-42.
- MGX-SCSI2-2HSSI back card, see Figure 2-22 on page 2-44.
- MGX-FRSM-HS1/B front card, see Figure 2-21 on page 2-43.
- Multifunction MGX-12IN1-S4 back card, see Figure 2-23 on page 2-45. This back card supports four V.35 or four X.21 ports.

LED Indicators

Table 2-9 and Table 2-10 describe the FRSM T1/E1 LED faceplate indicators for both the FRSM-HS1/B and the FRSM-HS2.

Table 2-9 Card Level LED Indicators for the FRSM-HS1/B and the FRSM-HS2

LED	Color	Meaning
ACT	Green	Active
STBY	Yellow	Standby
FAIL	Red	Fail

Table 2-10 Line Level LED Indicators for the FRSM-HS1/B and the FRSM-HS2

LED	Color	Meaning
PORT	Green	Active and OK
	Red	Active and Local Alarm
	Yellow	Active and Remote Alarm

MGX-FRSM-HS1/B Cabling

The cable models come from the Cisco 12-in-1 series of cables. (See Table 2-11.) Each cable can have a male or female connector at the far end. Also, the available clock sources depend on the mode. In DTE mode, the clock source is either *line* or *ST* (ST is a wire in the cable). For DCE, the clock source is the front card.

See Table 2-12 for the relationship between cabling and modes and Table 2-13 for part numbers.

Table 2-11 12IN1-S4 Back Card Cable Types

Cable Type	X.21	V.35
DCE	X.21 DCE	V.35 DCE
DTE	X.21 DTE	V.35 DTE

Table 2-12 Cabling and Clock Sources for the MGX-FRSM-HS1/B

Mode	Type of Cable	Clock Source	Mode of Far End
DTE	DTE	line	DCE (male or female connector at far end)
DCE	DCE	internal	DTE (male or female connector at far end)
DTE_ST	DTE	ST line	DCE (male or female connector at far end)

Table 2-13 Cabling Types and Part Numbers X.21 and V.35

Type of Cable	Far End Connector	Part Number
X.21 DTE	male (standard)	72-1440-01
X.21 DCE	female (standard)	72-1427-01
V.35 DTE	male (standard)	72-1428-01
V.35 DTE	female (atypical)	72-1436-01
V.35 DCE	female (standard)	72-1429-01
V.35 DCE	male (atypical)	72-1437-01
V.35 DTE-DCE	N/A	72-1441-01
Straight-through	N/A	72-1478-01
Loopback plug	N/A	72-1479-01

Note The cable type and part number are printed on a plastic band located near the smaller connector.

Figure 2-20 MGX-FRSM-HS2

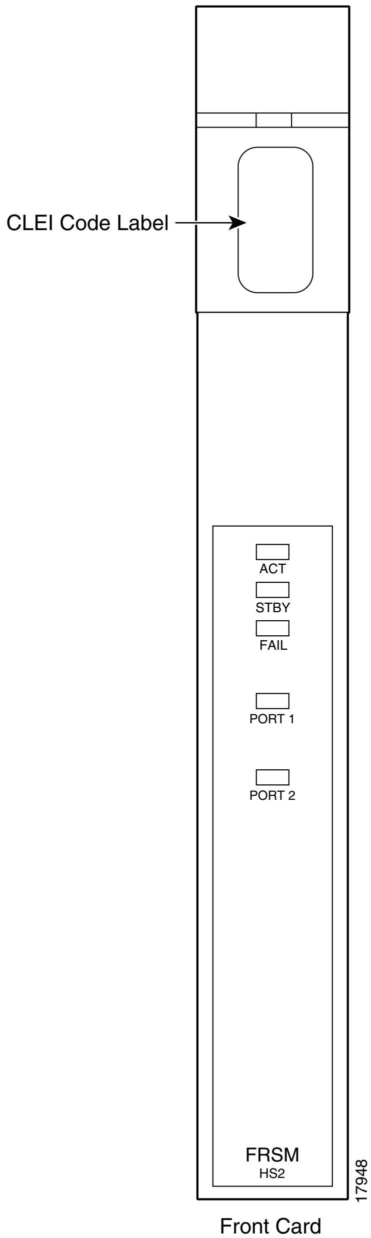


Figure 2-21 MGX-FRSM-HS1/B Front Card Faceplate

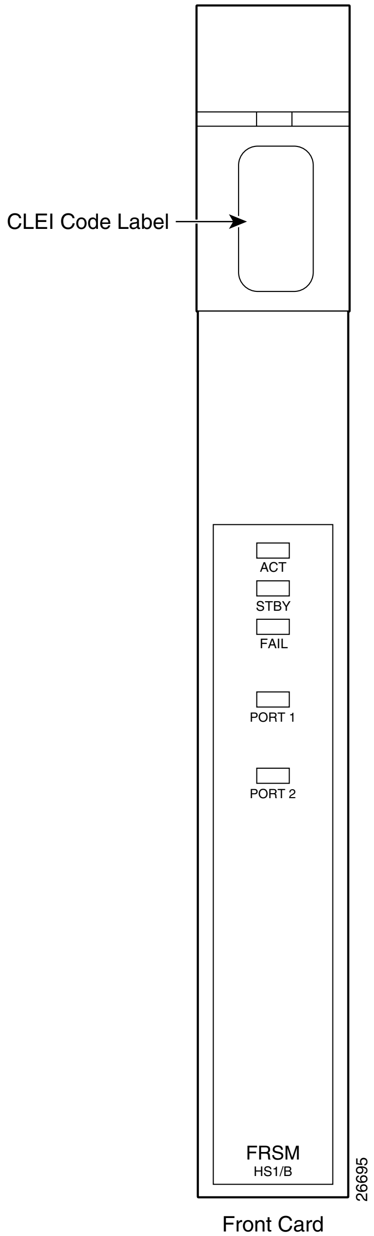


Figure 2-22   SCSI2-2HSSI

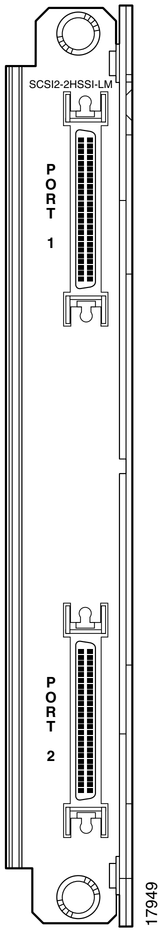
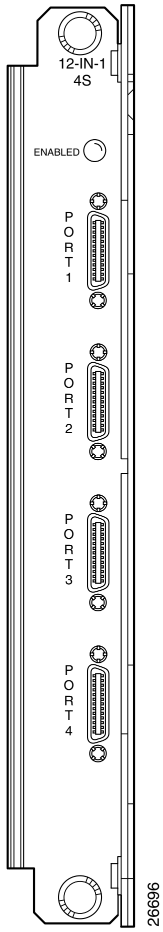


Figure 2-23 12-IN-1 S4 Back Card Faceplate



Circuit Emulation Service Modules

The main function of the Circuit Emulation Service Module (CESM) is to provide a constant bit rate (CBR) circuit emulation service by converting data streams into CBR AAL1 cells for transport across an ATM network. The CESM supports the CES-IS specifications of the ATM Forum.

There are two types of CESM modules:

- CESM for T1 and E1 Lines, page 2-46
- CESM for T3 and E3 lines, page 2-51

CESM for T1 and E1 Lines

The eight-port AX-CESM-8T1 and AX-CESM-8E1 models allow individual physical ports to be configured for structured or unstructured data transfer. The CESM provides constant bit rate (CBR) services over an ATM network. It allows circuit-based equipment, such as PBXs, to be interconnected over an ATM backbone via CBR connections. The eight port CESM cards support both channelized (*N*x64 Kbps) and unchannelized (T1/E1) circuit-based equipment. In ATM Forum terminology, the terms structured data transfer (SDT) and unstructured data transfer (UDT) are used for channelized and unchannelized circuit emulation, respectively.

In addition, flexible clocking mechanisms are provided to meet different application requirements. Synchronous clocking and asynchronous clocking, using either SRTS or Adaptive clock recovery, are both supported.

As an enhancement, dynamic bandwidth allocation is supported via on-hook/off-hook detection to reduce backbone bandwidth consumed when it is not required by the applications. This allows other traffic streams, such as VBR and ABR traffic, to take advantage of the bandwidth normally reserved for the circuit traffic.

CESM T1 and E1 Features

The eight port CESM cards offer the following features for both T1 and E1 interfaces:

- Standards-based AAL1
- Compliant with ATM Forum CES-V.2.0
- Choice of structured or unstructured data transfer per physical interface
- Time slots must be contiguous for *Nx*64-kbps fractional T1/E1 service
- Any *Nx*64-kbps channel can be mapped to any virtual circuit (VC)
- Choice of partially filled AAL1 cells per VC
- Supports Super Frame (SF) and Extended Superframe (ESF) framing modes
- Supports synchronous clocking for both UDT and SDT
- Supports asynchronous clocking for UDT, with SRTS and adaptive clock recovery methods
- ON/OFF hook detection and idle suppression using channel-associated signaling (CAS)
- Supports physical T1/E1 interfaces via back cards or higher speed channelized interfaces using TDM infrastructure on backplane (SRM)
- Traffic is mapped between service interfaces and the ATM backplane using standards-compliant adaptation. Consistent with the Cisco intelligent quality of service (QoS) management features, CESM cards support per-VC express queuing.

- Single T1/E1 CESM card can provide standby redundancy for all active CESM cards of the same type in the shelf (N:1 redundancy) with SRM.
- CESM cards are supported by standards-based management tools, including Simple Network Management Protocol (SNMP), Trivial File Transfer Protocol (TFTP) for configuration and statistics collection, and a command-line interface. Cisco WAN Manager also provides full graphical user interface (GUI) support for connection and equipment management.

1:N Redundancy for the CESM T1/E1

Redundancy for the AX-CESM-8T1 and AX-CESM-8E1 is available through the MGX-SRM-3T3/C.

- 1:N redundancy requires that the group contain one redundancy back card.
- The redundancy back card must be the special R-RJ45 version (AX-R-RJ48-8T1-LM or AX-R-SMB-8E1-LM).

For information on installation requirements, see the "Service Resource Module" section on page 2-12. For configuration requirements, see the "Service Resource Module" section on page 6-60.

For instructions on how to use the CiscoView application to configure redundancy, refer to the CiscoView user-documentation.

Card Combinations

A card set has an AX-CESM-8T1 or AX-CESM-8E1 front card and one of the following back cards:

- AX-RJ48-8T1-LM
- AX-R-RJ48-8T1-LM (for redundancy support)
- AX-RJ48-8E1-LM
- AX-SMB-8E1-LM
- AX-R-SMB-8E1-LM (for redundancy support)

CESM T1/E1 Illustrations

- Figure 2-24 on page 2-49 shows the Front Cards for the Eight-Port CESM (T1 and E1).
- Figure 2-25 on page 2-50 shows the RJ-48 and SMB Back Cards for the MGX-CESM-8T1E1.

LED Indicators for the Eight-Port CESM

The description of the LEDs on the eight-port CESM (see Table 2-14) correspond to the illustration in Figure 2-24 on page 2-49.

Table 2-14 LED Indicators for the Eight-Port CESM

LED	Color	Meaning
ACT (Active)	Green	On indicates the card set is in active mode.
STBY (Standby)	Yellow	• Slow blink without the active LED indicates the card is in the boot state. • Fast blink with the standby LED indicates the card is being downloaded. • Fast blink indicates the service module is passing BRAM channel information to the PXM1. • Steady yellow indicates the card is in Standby mode and the firmware is executing ADMIN code.
FAIL	Red	• Steady red with active standby LEDs off indicates either the card is in the Reset condition, the card has failed, or the card set is not complete (no line module). • Steady red with active LED on indicates the card was active prior to failing. • Steady red with standby LED on indicates the card was standby prior to failing. • Both standby and red LED lit indicates self-test failure.
PORT	Green	Green indicates the port is active.
	Red	Red indicates a local alarm on the port. Off indicates the port has not been activated (upped).
	Yellow	Yellow indicates a remote alarm on the port. Off indicates the port has not been activated (upped).

Figure 2-24 Front Cards for the Eight-Port CESM

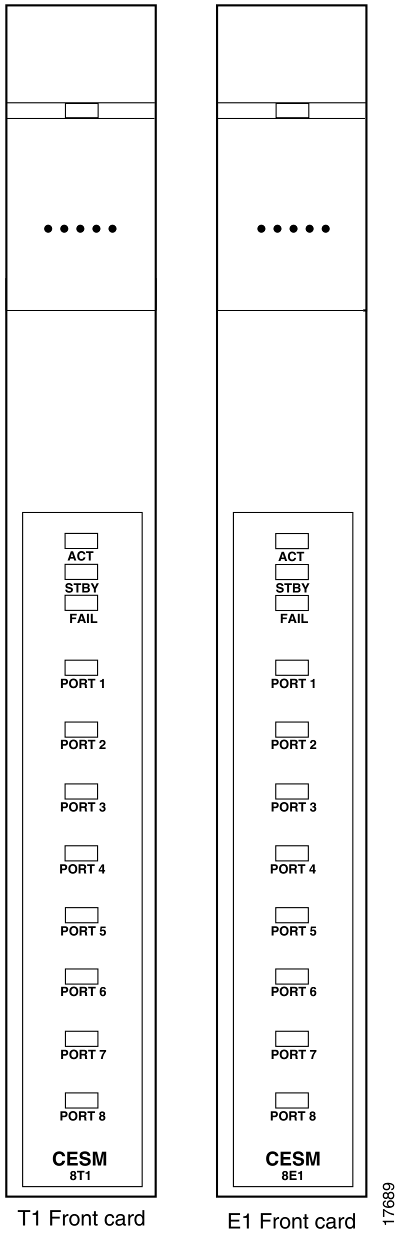
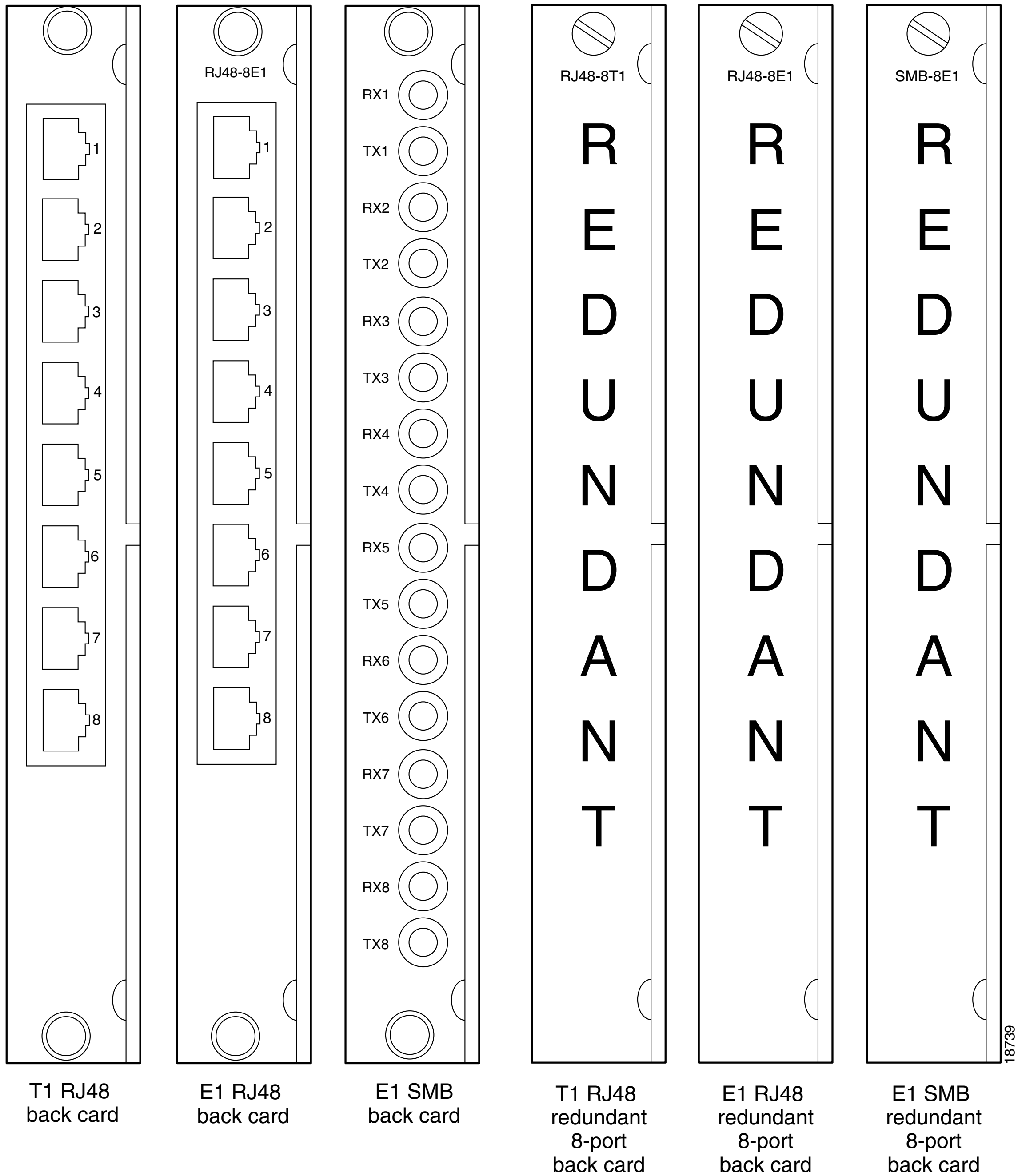


Figure 2-25 RJ-48 and SMB Back Cards for the MGX-CESM-8T1E1



CESM for T3 and E3 lines

The MGX-CESM-T3/E3 supports unstructured data transfer over a single T3 or E3 physical port at speeds of 44.736 Mbps (T3) or 34.368 Mbps (E3). Only synchronous timing is supported.

MGX-CESM-T3/E3 is a two-card set consisting of a front card and either a T3 back card or an E3 back card. Each back card provides two T3 or E3 ports (each port consisting of two BNC connectors). Only port one is available on the back card when used with the CESM-T3/E3 front card. 1:1 redundancy is supported through a Y-cable on the line module back cards.

- Figure 2-26 on page 2-53 is an illustration of the MGX-CESM-T3/E3 front card.
- An illustration of the CESM back card for T3 lines is shown in Figure 2-27 on page 2-54.
- An illustration of the CESM back card for E3 lines is shown in Figure 2-28 on page 2-55.

CESM-T3/E3 Features

CESM cards support circuit emulation services using standards-based adaptation layers over ATM. The CESM-T3E3 uses AAL1 for T3 or E3 unstructured transfer mode operation, per the ATM Forum's Circuit Emulation Specification, Version 2.0.

- Unstructured Support—Supports T3/E3 unstructured data transfer.
- Synchronous clocking—Synchronous timing mode only supported. Must derive clock from shelf.
- Onboard BERT—BERT support using on board BERT controller. BERT commands entered on the T3/E3 card.
- Maximum number of connections—Maximum number of connections is one. In the unstructured mode, one logical port is used to represent the T3/E3 line and one connection is added to the port to emulate the circuit.
- Programmable egress buffer size and CDV tolerance settings are supported for flexible support of jitter and latency requirements.
- Bit count integrity is maintained when AAL1 lost-cell condition is detected.
- CESM card provides ingress/egress data and signaling trunk conditioning per VC as per ATM Forum CES V2.0.
- T3/E3 CESM cards can be Y-cabled to provide 1:1 hot standby redundancy of the CESM.
- CESM cards are supported by standards-based management tools, including SNMP, TFTP (for configuration/statistics collection), and a command-line interface. The Cisco WAN Manager and CiscoView tools also provide full graphical user interface management support.

T3 Interfaces

The T3 CESM card supports the following T3 interface features.

- One DSX-3 (44.736 Mbps +/-40 ppm) interfaces with dual female 75-ohm BNC coaxial connectors per port (separate RX and TX)
- B3ZS line coding
- Pulse shape conforming to ANSI T1.102
- T3 bit error rate tester (BERT) and extended loop-up, loop-down pattern generation and verification
- 1:1 redundancy with Y-cabling for T3 CESM cards of the same type
- LOS alarm detection/generation support
- Transmitter loop-timed to receiver or synchronized to shelf

E3 Interfaces

The E3 CESM card supports the following E3 interface features.

- One G.703 (34.368 Mbps +/-20 ppm) interface with dual female 75-ohm BNC coaxial connectors per port (separate RX and TX)
- HDB3 line coding
- Pulse shape conforming to ITU G.703
- E3 BERT and extended loop-up, loop-down pattern generation and verification
- 1:1 redundancy with Y-cabling for E3 CESM cards of the same type
- LOS alarm detection/generation support
- Transmitter loop-timed to receiver or synchronized to shelf

LED Indicators

Table 2-15 LED Indicators for T3/E3 CESM

<table>
<tr><th>LED</th><th>Color</th><th>Meaning</th></tr>
<tr><td>ACT</td><td>Green</td><td>On indicates the card set is in active mode.</td></tr>
<tr><td>STBY</td><td>Yellow</td><td>Slow blink with the active LED off indicates the card is in the boot state.
Fast blink with the standby LED indicates the receiving firmware.
Fast blink indicates the service module is passing BRAM channel information to the PXM1.
Steady yellow indicates the card is in Standby mode and the firmware is executing ADMIN code.</td></tr>
<tr><td>FAIL</td><td>Red</td><td>Steady red with active and standby LEDs off indicates either the card is in the Reset condition, the card has failed, or the card set is not complete (no line module).
Steady red with LED on indicates the card was active prior to failing.
Steady red with standby LED on indicates the card was standby prior to failing.
Both standby and red LED lit indicates self-test failure.</td></tr>
<tr><td rowspan="3">PORT</td><td>Green</td><td>Green indicates the port is active.</td></tr>
<tr><td>Red</td><td>Red indicates a local alarm on the port.</td></tr>
<tr><td>Yellow</td><td>Yellow indicates a remote alarm on the port.</td></tr>
</table>

CESM T3/E3 Illustrations

This chapter provides illustrations of CESM front and back cards as follows.

- The MGX-CESM-T3/E3 front card is shown in Figure 2-26 on page 2-53.
- BNC-2T3 Back Card for the CESM-T3/E3 is shown in Figure 2-27 on page 2-54.
- BNC-2E3 Back Card for the CESM-T3/E3 is shown in Figure 2-28 on page 2-55.

Figure 2-26 CESM-T3/E3 Front Card

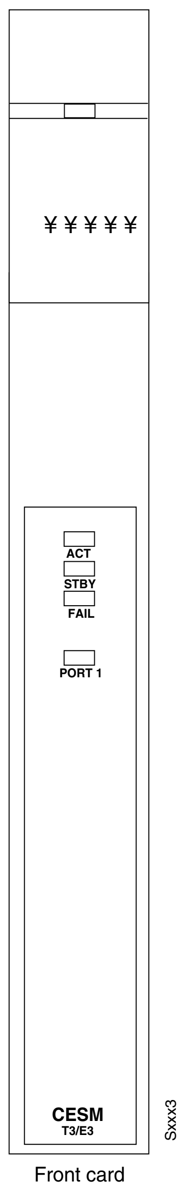
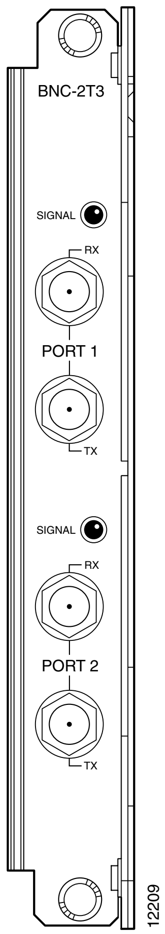
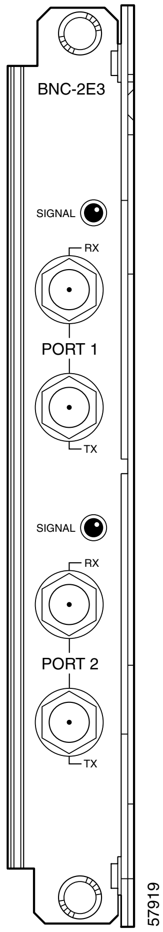


Figure 2-27 BNC-2T3 Back Card for the CESM-T3/E3



Note Only port one is available on the CESM T3/E3 back card when used with the CESM-T3/E3 front card.

Figure 2-28 BNC-2E3 Back Card for the CESM-T3/E3



Note Only port one is available on the CESM T3/E3 back card when used with the CESM-T3/E3 front card.

Voice Service—VISM

The Voice Interworking Service Module (VISM) is a front and back card set designed to transport digitized voice signals across a packet network. This provides an interface or gateway between conventional voice TDM networks and networks based upon packet switching technology.

There are two types of VISM front cards:

- MGX-VISM-8T1—Supports up to eight T1 lines carrying digitized voice
- MGX-VISM-8E1—Supports up to eight E1 lines carrying digitized voice.

VISM Documentation

Installation, configuration, and support for the VISM services are not included in this publication. For more information on the VISM, refer to the following Cisco Systems publications:

- For information on VISM features and configuration, refer to the *Cisco Voice Interworking Service Module Installation and Configuration.*
- For up to date information on VISM version support and features, refer to the *Software Release Notes Cisco WAN MGX 8850, MGX 8230, and MGX 8250 Software.*

Summary of Features Supported with VISM 1.5.5

The following features are supported with VISM 1.5.5 on the MGX 8250.

VoIP using RTP (RFC 1889)

VISMR1.5 supports standards-based VoIP using RTP (RFC 1889) and RTCP protocols. This allows VISM to interwork with other VoIP Gateways.

VoAAL2 (With sub-cell multiplexing) PVC

The VISM supports standards-compliant AAL2 adaptation for the transport of voice over an ATM infrastructure. AAL2 trunking mode is supported.

Codec Support

G.711 PCM (A-law, Mu-law), G.726, G.729a/b

Eight T1/E1 Interfaces

The VISM supports eight T1 or eight E1 interfaces when G.711 PCM coding is used. For higher complexity coders such as G.726-32K and G.729a-8K, the density drops to six T1 or five E1 interfaces (max 145 channels).

1:N Redundancy

1:N redundancy using SRM.

T3 Interfaces (via SRM bulk distribution)

T3 interfaces are supported using the SRM's bulk distribution capability. In this case, the T3 interfaces are physically terminated at the SRM module. The SRM module breaks out the individual T1s and distributes the T1s via the TDM backplane bus to the individual VISM cards for processing.

Echo Cancellation

The VISM provides on-board echo cancellation on a per-connection basis. Up to 128 msec user-configurable near-end delay can be canceled. The echo cancellation is compliant with ITU G.165 and G.168 specifications.

Voice Activity Detection

VISM uses Voice Activity Detection (VAD) to distinguish between silence and voice on an active connection. VAD reduces the bandwidth requirements of a voice connection by not generating traffic during periods of silence in an active voice connection. At the far-end, comfort noise is generated.

Fax/Modem Detection for ECAN and VAD Control

The VISM continually monitors and detects fax and modem carrier tones. When carrier tone from a fax or modem is detected, the connection is upgraded to full PCM to ensure transparent connectivity. Fax and modem tone detection ensures compatibility with all voice-grade data connections.

CAS Tunneling via AAL2 (for AAL2 Trunking Mode)

The VISM in AAL2 mode facilitates transport of CAS signaling information. CAS signaling information is carried transparently across the AAL2 connection using type 3 packets. In this mode, VISM does not interpret any of the signaling information.

PRI Tunneling via AAL5 (for AAL2 Trunking Mode)

VISM supports transport of D-ch signaling information over an AAL5 VC. The signaling channel is transparently carried over the AAL5 VC and delivered to the far-end. In this mode, VISM does not interpret any of the signaling messages.

Voice CAC

VISM can be configured to administer Connection Admission Control (CAC) so that the bandwidth distribution between voice and data can be controlled in AAL2 mode.

Type 3 Packet for DTMF

The VISM in AAL2 mode facilitates transport of DTMF signaling information. DTMF information is carried transparently across the AAL2 connection using type 3 packets.

Dual (Redundant) PVCs for Bearer/Control

The VISM provides the capability to configure two PVCs for bearer/signaling traffic terminating on two external routers (dual-homing). VISM continually monitors the status of the active PVC by using OAM loopback cells. Upon detection of failure, the traffic is automatically switched over to the backup PVC.

64 K Clear Channel Transport

The VISM supports 64 Kbps clear channel support. In this mode, all codecs are disabled and the data is transparently transported through the VISM.

DTMF Relay for G.729

In VoIP mode, DTMF signaling information is transported across the connection using RTP NSE (Named Signaling Event) packets

MGCP 0.1 for VoIP with Softswitch Control

VISM supports Media Gateway Control Protocol (MGCP) Version 0.1. This open protocol allows any Softswitch to interwork with the VISM module.

Resource Coordination via SRCP

Simple Resource Control Protocol (SRCP) provides a heartbeat mechanism between the VISM and the Softswitch. In addition, SRCP also provides the Softswitch with gateway auditing capabilities.

Full COT Functions

VISM provides the capability to initiate continuity test as well as provide loopbacks to facilitate continuity tests when originated from the far-end.

Courtesy Down

This feature provides a mechanism for graceful upgrades. By enabling this feature, no new calls are allowed on the VISM while not disrupting the existing calls. Eventually, when there are no more active calls, the card is ready for a upgrade and/or service interruption.

Summary of Features Supported with VISM 2.0.1

VISM 2.0.1 supports all of the VISM 1.5.5 features listed above. In addition, VISM 2.0.1 supports the following features:

- **PRI Backhaul to the Softswitch Using RUDP**
  The PRI backhaul capability provides PRI termination on the VISM with the Softswitch providing call control. ISDN Layer 2 is terminated on the VISM and the layer 3 messages are transported to the Softswitch using RUDP.
- **Latency Reduction (<60 ms round-trip)**
  Significant improvements have been made to bring the round-trip delay to less than 60 ms.
- **Codecs Preference**
  VISM provides the capability to have the codecs negotiated between the two end-points of the call. The VISM can be configured, for a given end-point, to have a prioritized list of codecs. Codec negotiation could be directly between the end-points or could be controlled by a Softswitch
- **31 DS0 for E1 with 240 Channels Only**
  While all 31 DS0s on a E1 port can be used, there is a limitation of 240 channels per card.

VISM Redundancy

The VISM redundancy strategy is the same as for any of the eight port cards in the MGX 8250.

- For VISM-8T1, 1:N redundancy is supported using the SRM-3T3.
- For VISM-8E1, 1:N redundancy is supported only via LMs using the SRM-3T3 or the SRM-T1E1.

Card Combinations

A card set has an VISM-8T1 or VISM-8E1 front card and one of the following back cards:

- AX-RJ48-8T1-LM
- AX-R-RJ48-8T1-LM (for redundancy support)
- AX-RJ48-8E1-LM
- AX-SMB-8E1-LM
- AX-R-SMB-8E1-LM (for redundancy support)

VISM Card Illustrations and LED Description

Table 2-16 describes the VISM card LED indicators.

See Figure 2-29 for an illustration of the VISM Front Cards.

See Figure 2-30 for an illustration of the VISM Back Cards.

Table 2-16 LED Indicators for VISM

LED	Color	Meaning
ACT (Active)	Green	On indicates the card set is in *active* mode.
STBY (Standby)	Yellow	• Slow blink with the active LED off indicates the card is in the boot state. • Fast blinking of the Standby LED indicates the receiving of firmware. • Fast blink indicates the service module is passing BRAM channel information to the PXM1. • Steady yellow indicates the card is in Standby mode and the firmware is executing ADMIN code.
FAIL	Red	• Steady red with active and standby LEDs off indicates either the card is in the Reset condition, the card has failed, or the card set is not complete (no line module). • Steady red with active LED on indicates the card was active prior to failing. • Steady red with standby LED on indicates the card was standby prior to failing. • Both standby and red LED lit indicates self-test failure.
PORT	Green	Green indicates the port is *active*.
	Red	Red indicates a *local alarm* on the port.
	Yellow	Yellow indicates a *remote alarm* on the port.

Figure 2-29 VISM Front Cards

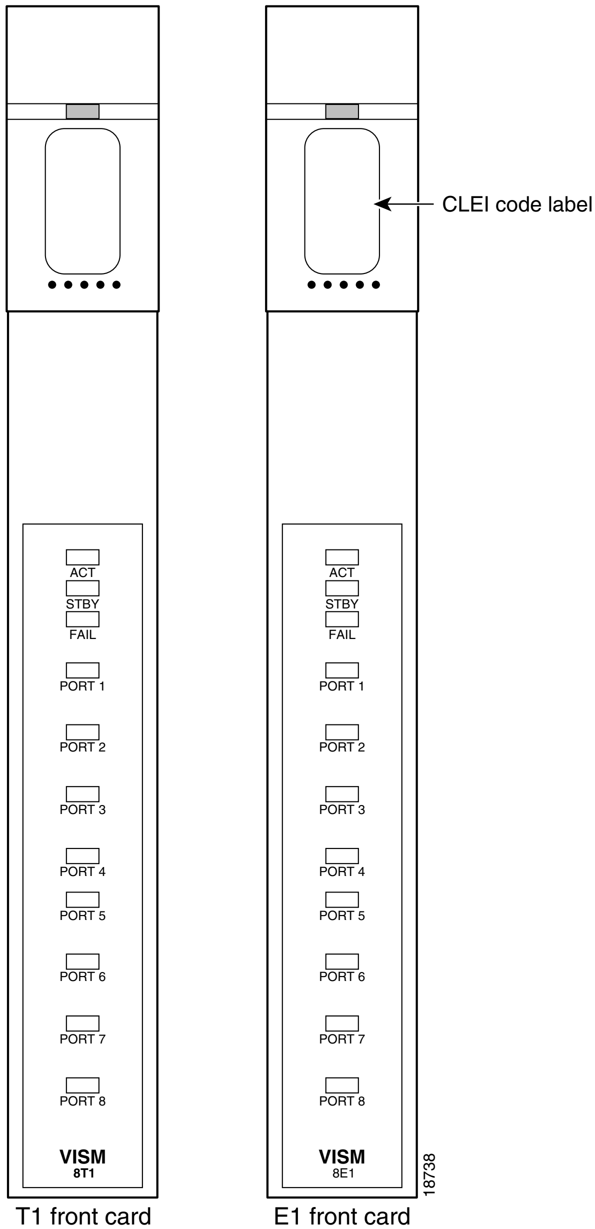
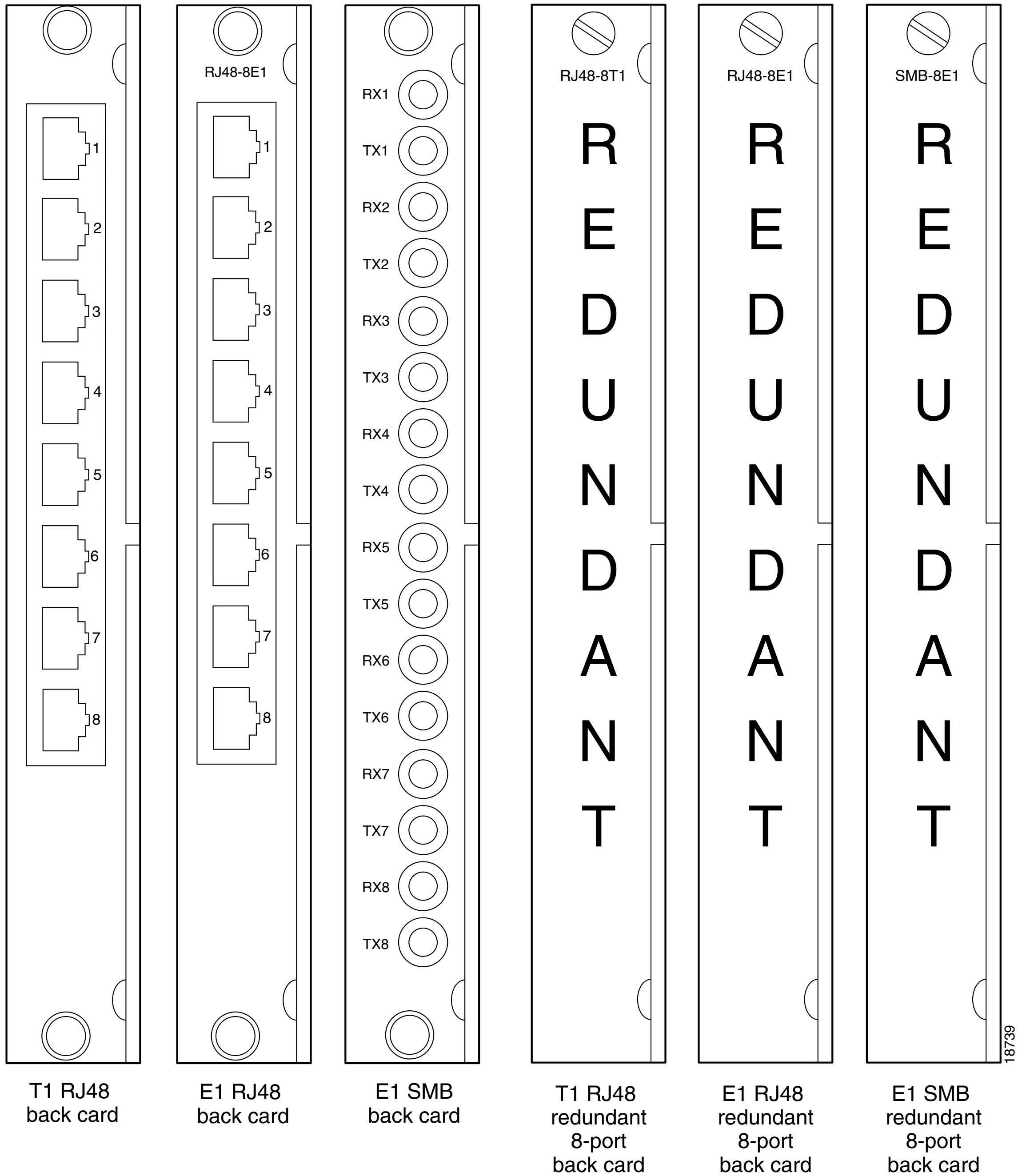


Figure 2-30 VISM Back Cards



Route Processor Module

The Route Processor Module (RPM) is a Cisco 7200 series router redesigned into a double-height card to fit in a MGX 8250 chassis. The RPM front card provides a Cisco IOS network processing engine (NPE-150), capable of processing up to 120 K packets per second (pps). The front card also provides ATM connectivity to the MGX 8250 internal cell bus at full-duplex OC-3c from the module.

Initially, three types of single-height back card types will be supported: four-port Ethernet, one-port (FDDI), and one-port Fast Ethernet. Each module can support two of these back cards.

The RPM enables high quality, scalable IP+ATM integration using multiprotocol label switching (MPLS) technology.

RPM Documentation

Installation, configuration and support for RPM services are not included in this manual. For more information on the RPM, refer to the following Cisco Systems publications:

- For information on availability and support of the MGX-RPM-128/B and MGX-RPM-PR, refer to the Release Notes for Cisco WAN MGX 8850, MGX 8230, and MGX 8250 Software.
- For configuration information on the Route Processor Module (RPM), refer to the *Cisco Route Processor Module Installation and Configuration*.

Site Preparation

This chapter describes the steps to take and the considerations you should keep in mind prior to installing the modules in an open rack. It also contains information that applies to an MGX 8250 installation in a Cisco closed rack. If the MGX 8250 arrives in a Cisco closed rack, your initial concerns would be the cabinet grounding, power connections, and optional seismic stability plate.

For specifications on the enclosure and power system, see Appendix A, “System Specifications.”

The sections in this chapter are

- Site Preparation, page 3-1, is a list of general requirements for the site.
- Regulatory Compliance and Safety Information, page 3-2, provides regulatory compliance and safety information for the AC and DC powered versions of the MGX 8250.
- Seismic Considerations, page 3-13, describes earthquake provisions.
- Seismic Anchoring for a Cisco Rack, page 3-13, contains instructions for installing the optional seismic stability plate.
- Power and Grounding, page 3-16 describes the requirements for power and grounding the switch enclosure and the building site.
- Making the Frame Bonding (Ground) Connection, page 3-22 describes how to connect grounding.

Parts Checklist

Before proceeding with the installation, verify that all the ordered parts are present and in good condition. Store a record of the parts and serial numbers. If any parts are missing or damaged, contact your sales representative.

Site Preparation

In addition to the power and grounding requirements detailed in subsequent sections, the site must satisfy requirements in the following categories:

- Telecommunications Requirements

  In some international service areas, telecommunication rules for a private network connected to the public switched networks may require that screws, bolts, or nuts that secure the cabling are tightened to the degree that removing them requires a tool.

- Space

  The MGX 8250 node requires floor space 19.9 inches (50.5 cm) wide or 23 inches wide (59 cm). Clearance around the cabinet must allow for access to the front and back of the cabinet while the door is open. The suggested clearance is 30 inches at the front and back and a nominal 12 inches on each side. DC-powered nodes occupy 28 vertical inches (71.1 cm). AC-powered nodes occupy 33.25 vertical inches (84.5 cm).

  The mounting rail pattern follows the EIA standard of 56 inches (32 rack-mount units).

- Operating Environment

  The operating environment should adhere to the following limits:

  - Temperature—0 to 40 degrees C (32 to 104 degrees F) normal operation, 50 degrees to 72 hours.
  - Humidity—up to 85% relative humidity, non condensing.
  - Shock—maximum 10 G for 10 milliseconds at 1/2 sine wave.
  - Vibration—up to 1/4 G, 20 to 500 Hz.

- Wiring to AC or DC Power Source

  For AC-powered systems, Cisco provides 6-foot (1.8-meter) power cords. For DC-powered systems, the customer or installer determines the wire length and supplies the wire. The wire should be 6 AWG (10 square millimeters).

- Heat Dissipation

  A fully loaded, AC-powered MGX 8250 node dissipates up to 9560 Btus (2.8 KW hour.)
  A DC-powered MGX 8250 node dissipates up to 8200 Btus (2.4 KW hour.)

- Weight

  A DC-powered system can weigh up to 190 lb (87 kg). An AC-powered system can weigh up to 250 lb (112.5 kg).

Caution If you move a Cisco-supplied cabinet, do not push it at its sides. Push at the front or back.

- Flooring

  Cisco recommends raised flooring with sufficient under-floor space for the cables.

- Mounting

  Node location should accommodate the routing of data cables and the termination of the telephone company or common carrier circuits.

- Electrostatic Discharge

  The building should provide enough grounding to prevent damage from electrostatic discharge. For details, see “Bonding and Grounding.” Each node comes with a protective wrist strap.

Regulatory Compliance and Safety Information

This chapter provides regulatory compliance and safety information for the AC and DC powered versions of the MGX 8250.

Warning **Only trained service personnel should install the equipment.**

Warning **Read the installation instructions before you connect the equipment to its power source.**

The MGX 8250 AC and DC powered systems are intended for installation in a RESTRICTED ACCESS LOCATION.

Safety Recommendations

The guidelines that follow help ensure your safety and protect the MGX 8250 equipment. The list of guidelines may not address all potentially hazardous situations in your working environment, so be alert, and exercise good judgement at all times.

The safety guidelines are

- Keep the chassis area clear and dust-free before, during, and after installation.
- Keep tools away from walk areas where people could fall over them.
- Do not wear loose clothing or jewelry, such as rings, bracelets, or chains, which may become caught in the chassis.
- Wear safety glasses if you are working under any conditions that may be hazardous to your eyes.
- Do not perform any actions that create a potential hazard to people or make the equipment unsafe.
- Never attempt to lift an object that is too heavy for one person to handle.

Maintaining Safety with Electricity

Warning **Before working on a chassis or working near power supplies, unplug the power cords on an AC-powered system. On a DC-powered system, disconnect the power at the circuit breakers.**

Follow these guidelines when working on equipment powered by electricity:

- Locate the emergency power-off switch for the room in which you are working. If an electrical accident occurs, you can quickly turn off the power.
- Do not work alone if potentially hazardous conditions exist anywhere in your workspace.
- Never assume that power is disconnected from a circuit: always check the circuit.
- Carefully look for possible hazards in your work area, such as moist floors, ungrounded power extension cords, or missing safety grounds.
- If an electrical accident occurs
  - Use caution—Do not let yourself become a victim.
  - Disconnect power from the system.
  - If possible, send another person to get medical aid. Otherwise, assess the condition of the victim then call for help.
- Use the MGX 8250 AC and MGX 8250 DC systems within their marked electrical ratings and product usage instructions.

- Install the MGX 8250 or MGC 8250 DC systems with the following local, national, or international electrical codes:
  - United States—National Fire Protection Association (NFPA70), United States National Electrical Code.
  - Canada—Canadian Electrical Code, Part 1, CSA C22.1.
  - Other countries—International Electromechanical Commission (IEC) 364, Part 1 through Part 7.
- MGX 8250 AC models are shipped with a 3-wire electrical cord with a grounding-type plug that fits only a grounding type power outlet. This is a safety feature that you should not circumvent. Equipment grounding should comply with local and national electrical codes.
- MGX 8250 DC models are equipped with DC power entry modules and require you to terminate the DC input wiring on a DC source capable of supplying at least 60A. A 60A circuit breaker is required at the 48 VDC facility power source. An easily accessible disconnect device should be incorporated into the facility wiring. Be sure to connect the grounding wire conduit to a solid earth ground. A closed loop ring is recommended to terminate the ground conductor at the ground stud.
- Other DC power guidelines are
  - Only a DC power source that complies with the safety extra low voltage (SELV) requirements of UL 1950, CSA C22.2 No. 950-95, EN 60950, and IEC 950 can be connected to an MGX 8250 DC-input power entry module.
  - MGX 8250 DC which is equipped with DC power entry modules is intended only for installation in a restricted access location. In the United States, a restricted access area is in accordance with Articles 110–16, 110–17, and 110–18 of the National Electrical Code ANSI/NFPA 70.

Warning Definition

Warning **Means danger. You are in a situation that could cause bodily injury. Before you work on any equipment, be aware of the hazards involved with electrical circuitry and be familiar with standard practices for preventing accidents.**

Waarschuwing **Dit waarschuwingssymbool betekent gevaar. U verkeert in een situatie die lichamelijk letsel kan veroorzaken. Voordat u aan enige apparatuur gaat werken, dient u zich bewust te zijn van de bij elektrische schakelingen betrokken risico's en dient u op de hoogte te zijn van standaard maatregelen om ongelukken te voorkomen.**

Varoitus **Tämä varoitusmerkki merkitsee vaaraa. Olet tilanteessa, joka voi johtaa ruumiinvammaan. Ennen kuin työskentelet minkään laitteiston parissa, ota selvää sähkökytkentöihin liittyvistä vaaroista ja tavanomaisista onnettomuuksien ehkäisykeinoista.**

Attention **Ce symbole d'avertissement indique un danger. Vous vous trouvez dans une situation pouvant causer des blessures ou des dommages corporels. Avant de travailler sur un équipement, soyez conscient des dangers posés par les circuits électriques et familiarisez-vous avec les procédures couramment utilisées pour éviter les accidents.**

Warnung **Dieses Warnsymbol bedeutet Gefahr. Sie befinden sich in einer Situation, die zu einer Körperverletzung führen könnte. Bevor Sie mit der Arbeit an irgendeinem Gerät beginnen, seien Sie sich der mit elektrischen Stromkreisen verbundenen Gefahren und der Standardpraktiken zur Vermeidung von Unfällen bewußt.**

Avvertenza **Questo simbolo di avvertenza indica un pericolo. La situazione potrebbe causare infortuni alle persone. Prima di lavorare su qualsiasi apparecchiatura, occorre conoscere i pericoli relativi ai circuiti elettrici ed essere al corrente delle pratiche standard per la prevenzione di incidenti.**

Advarsel **Dette varselsymbolet betyr fare. Du befinner deg i en situasjon som kan føre til personskade. Før du utfører arbeid på utstyr, må du vare oppmerksom på de faremomentene som elektriske kretser innebærer, samt gjøre deg kjent med vanlig praksis når det gjelder å unngå ulykker.**

Aviso **Este símbolo de aviso indica perigo. Encontra-se numa situação que lhe poderá causar danos físicos. Antes de começar a trabalhar com qualquer equipamento, familiarize-se com os perigos relacionados com circuitos eléctricos, e com quaisquer práticas comuns que possam prevenir possíveis acidentes.**

¡Atención! **Este símbolo de aviso significa peligro. Existe riesgo para su integridad física. Antes de manipular cualquier equipo, considerar los riesgos que entraña la corriente eléctrica y familiarizarse con los procedimientos estándar de prevención de accidentes.**

Varning! **Denna varningssymbol signalerar fara. Du befinner dig i en situation som kan leda till personskada. Innan du utför arbete på någon utrustning måste du vara medveten om farorna med elkretsar och känna till vanligt förfarande för att förebygga skador.**

Product Disposal Warning

Warning **Ultimate disposal of this product should be handled according to all national laws and regulations.**

Waarschuwing **Dit produkt dient volgens alle landelijke wetten en voorschriften te worden afgedankt.**

Varoitus **Tämän tuotteen lopullisesta hävittämisestä tulee huolehtia kaikkia valtakunnallisia lakeja ja säännöksiä noudattaen.**

Attention **La mise au rebut définitive de ce produit doit être effectuée conformément à toutes les lois et réglementations en vigueur.**

Warnung **Dieses Produkt muß den geltenden Gesetzen und Vorschriften entsprechend entsorgt werden.**

Avvertenza **L'eliminazione finale di questo prodotto deve essere eseguita osservando le normative italiane vigenti in materia.**

Advarsel **Endelig disponering av dette produktet må skje i henhold til nasjonale lover og forskrifter.**

Aviso **A descartagem final deste produto deverá ser efectuada de acordo com os regulamentos e a legislação nacional.**

¡Advertencia! **El desecho final de este producto debe realizarse según todas las leyes y regulaciones nacionales.**

Varning! **Slutlig kassering av denna produkt bör skötas i enlighet med landets alla lagar och föreskrifter.**

Lightning Activity Warning

Warning **Do not work on the system or connect or disconnect cables during periods of lightning activity.**

Waarschuwing **Tijdens onweer dat gepaard gaat met bliksem, dient u niet aan het systeem te werken of kabels aan te sluiten of te ontkoppelen.**

Varoitus **Älä työskentele järjestelmän parissa äläkä yhdistä tai irrota kaapeleita ukkosilmalla.**

Attention **Ne pas travailler sur le système ni brancher ou débrancher les câbles pendant un orage.**

Warnung **Arbeiten Sie nicht am System und schließen Sie keine Kabel an bzw. trennen Sie keine ab, wenn es gewittert.**

Avvertenza **Non lavorare sul sistema o collegare oppure scollegare i cavi durante un temporale con fulmini.**

Advarsel **Utfør aldri arbeid på systemet, eller koble kabler til eller fra systemet når det tordner eller lyner.**

Aviso **Não trabalhe no sistema ou ligue e desligue cabos durante períodos de mau tempo (trovoada).**

¡Advertencia! **No operar el sistema ni conectar o desconectar cables durante el transcurso de descargas eléctricas en la atmósfera.**

Varning! **Vid åska skall du aldrig utföra arbete på systemet eller ansluta eller koppla loss kablar.**

Jewelry Removal Warning

Warning **Before working on equipment that is connected to power lines, remove jewelry (including rings, necklaces, and watches). Metal objects will heat up when connected to power and ground and can cause serious burns or weld the metal object to the terminals.**

Waarschuwing **Alvorens aan apparatuur te werken die met elektrische leidingen is verbonden, sieraden (inclusief ringen, kettingen en horloges) verwijderen. Metalen voorwerpen worden warm wanneer ze met stroom en aarde zijn verbonden, en kunnen ernstige brandwonden veroorzaken of het metalen voorwerp aan de aansluitklemmen lassen.**

Varoitus **Ennen kuin työskentelet voimavirtajohtoihin kytkettyjen laitteiden parissa, ota pois kaikki korut (sormukset, kaulakorut ja kellot mukaan lukien). Metalliesineet kuumenevat, kun ne ovat yhteydessä sähkövirran ja maan kanssa, ja ne voivat aiheuttaa vakavia palovammoja tai hitsata metalliesineet kiinni liitäntänapoihin.**

Attention **Avant d'accéder à cet équipement connecté aux lignes électriques, ôter tout bijou (anneaux, colliers et montres compris). Lorsqu'ils sont branchés à l'alimentation et reliés à la terre, les objets métalliques chauffent, ce qui peut provoquer des blessures graves ou souder l'objet métallique aux bornes.**

Warnung **Vor der Arbeit an Geräten, die an das Netz angeschlossen sind, jeglichen Schmuck (einschließlich Ringe, Ketten und Uhren) abnehmen. Metallgegenstände erhitzen sich, wenn sie an das Netz und die Erde angeschlossen werden, und können schwere Verbrennungen verursachen oder an die Anschlußklemmen angeschweißt werden.**

Avvertenza **Prima di intervenire su apparecchiature collegate alle linee di alimentazione, togliersi qualsiasi monile (inclusi anelli, collane, braccialetti ed orologi). Gli oggetti metallici si riscaldano quando sono collegati tra punti di alimentazione e massa: possono causare ustioni gravi oppure il metallo può saldarsi ai terminali.**

Advarsel **Fjern alle smykker (inkludert ringer, halskjeder og klokker) før du skal arbeide på utstyr som er koblet til kraftledninger. Metallgjenstander som er koblet til kraftledninger og jord blir svært varme og kan forårsake alvorlige brannskader eller smelte fast til polene.**

Aviso **Antes de trabalhar em equipamento que esteja ligado a linhas de corrente, retire todas as jóias que estiver a usar (incluindo anéis, fios e relógios). Os objectos metálicos aquecerão em contacto com a corrente e em contacto com a ligação à terra, podendo causar queimaduras graves ou ficarem soldados aos terminais.**

¡Advertencia! **Antes de operar sobre equipos conectados a líneas de alimentación, quitarse las joyas (incluidos anillos, collares y relojes). Los objetos de metal se calientan cuando se conectan a la alimentación y a tierra, lo que puede ocasionar quemaduras graves o que los objetos metálicos queden soldados a los bornes.**

Varning! **Tag av alla smycken (inklusive ringar, halsband och armbandsur) innan du arbetar på utrustning som är kopplad till kraftledningar. Metallobjekt hettas upp när de kopplas ihop med ström och jord och kan förorsaka allvarliga brännskador; metallobjekt kan också sammansvetsas med kontakterna.**

Power Supply Warning

Warning **Do not touch the power supply when the power cord is connected. For systems with a power switch, line voltages are present within the power supply even when the power switch is off and the power cord is connected. For systems without a power switch, line voltages are present within the power supply when the power cord is connected.**

Waarschuwing **U dient de voeding niet aan te raken zolang het netsnoer aangesloten is. Bij systemen met een stroomschakelaar zijn er lijnspanningen aanwezig in de voeding, zelfs wanneer de stroomschakelaar uitgeschakeld is en het netsnoer aangesloten is. Bij systemen zonder een stroomschakelaar zijn er lijnspanningen aanwezig in de voeding wanneer het netsnoer aangesloten is.**

Varoitus **Älä kosketa virtalähdettä virtajohdon ollessa kytkettynä. Virrankatkaisimella varustetuissa järjestelmissä on virtalähteen sisällä jäljellä verkkojännite, vaikka virrankatkaisin on katkaistu-asennossa virtajohdon ollessa kytkettynä. Järjestelmissä, joissa ei ole virrankatkaisinta, on virtalähteen sisällä verkkojännite, kun virtajohto on kytkettynä.**

Attention **Ne pas toucher le bloc d'alimentation quand le cordon d'alimentation est branché. Avec les systèmes munis d'un commutateur marche-arrêt, des tensions de ligne sont présentes dans l'alimentation quand le cordon est branché, même si le commutateur est à l'arrêt. Avec les systèmes sans commutateur marche-arrêt, l'alimentation est sous tension quand le cordon d'alimentation est branché.**

Warnung **Berühren Sie das Netzgerät nicht, wenn das Netzkabel angeschlossen ist. Bei Systemen mit Netzschalter liegen Leitungsspannungen im Netzgerät vor, wenn das Netzkabel angeschlossen ist, auch wenn das System ausgeschaltet ist. Bei Systemen ohne Netzschalter liegen Leitungsspannungen im Netzgerät vor, wenn das Netzkabel angeschlossen ist.**

Avvertenza **Non toccare l'alimentatore se il cavo dell'alimentazione è collegato. Per i sistemi con un interruttore di alimentazione, tensioni di linea sono presenti all'interno dell'alimentatore anche quando l'interruttore di alimentazione è en posizione di disattivazione (off), se il cavo dell'alimentazione è collegato. Per i sistemi senza un interruttore, tensioni di linea sono presenti all'interno dell'alimentatore quando il cavo di alimentazione è collegato.**

Advarsel **Berør ikke strømforsyningsenheten når strømledningen er tilkoblet. I systemer som har en strømbryter, er det spenning i strømforsyningsenheten selv om strømbryteren er slått av og strømledningen er tilkoblet. Når det gjelder systemer uten en strømbryter, er det spenning i strømforsyningsenheten når strømledingen er tilkoblet.**

Aviso **Não toque na unidade abastecedora de energia quando o cabo de alimentação estiver ligado. Em sistemas com interruptor, a corrente eléctrica estará presente na unidade abastecedora, sempre que o cabo de alimentação de energia estiver ligado, mesmo quando o interruptor se encontrar desligado. Para sistemas sem interruptor, a tensão eléctrica dentro da unidade abastecedora só estará presente quando o cabo de alimentação estiver ligado.**

¡Advertencia! **No tocar la fuente de alimentación mientras el cable esté enchufado. En sistemas con interruptor de alimentación, hay voltajes de línea dentro de la fuente, incluso cuando el interruptor esté en Apagado (OFF) y el cable de alimentación enchufado. En sistemas sin interruptor de alimentación, hay voltajes de línea en la fuente cuando el cable está enchufado.**

Varning! **Vidrör inte strömförsörjningsenheten när nätsladden är ansluten. För system med strömbrytare finns det nätspänning i strömförsörjningsenheten även när strömmen har slagits av men nätsladden är ansluten. För system utan strömbrytare finns det nätspänning i strömförsörjningsenheten när nätsladden är ansluten.**

Power Supply Disconnection Warning

Warning **Before working on a chassis or working near power supplies, unplug the power cord on AC units; disconnect the power at the circuit breaker on DC units.**

Waarschuwing **Voordat u aan een frame of in de nabijheid van voedingen werkt, dient u bij wisselstroom toestellen de stekker van het netsnoer uit het stopcontact te halen; voor gelijkstroom toestellen dient u de stroom uit te schakelen bij de stroomverbreker.**

Varoitus **Kytke irti vaihtovirtalaitteiden virtajohto ja katkaise tasavirtalaitteiden virta suojakytkimellä, ennen kuin teet mitään asennuspohjalle tai työskentelet virtalähteiden läheisyydessä.**

Attention **Avant de travailler sur un châssis ou à proximité d'une alimentation électrique, débrancher le cordon d'alimentation des unités en courant alternatif ; couper l'alimentation des unités en courant continu au niveau du disjoncteur.**

Warnung **Bevor Sie an einem Chassis oder in der Nähe von Netzgeräten arbeiten, ziehen Sie bei Wechselstromeinheiten das Netzkabel ab bzw. schalten Sie bei Gleichstromeinheiten den Strom am Unterbrecher ab.**

Avvertenza **Prima di lavorare su un telaio o intorno ad alimentatori, scollegare il cavo di alimentazione sulle unità CA; scollegare l'alimentazione all'interruttore automatico sulle unità CC.**

Advarsel **Før det utføres arbeid på kabinettet eller det arbeides i nærheten av str¿mforsyningsenheter, skal str¿mledningen trekkes ut pŒ vekselstrømsenheter og strømmen kobles fra ved strømbryteren på likestrømsenheter.**

Aviso **Antes de trabalhar num chassis, ou antes de trabalhar perto de unidades de fornecimento de energia, desligue o cabo de alimentação nas unidades de corrente alternada; desligue a corrente no disjuntor nas unidades de corrente contínua.**

¡Advertencia! **Antes de manipular el chasis de un equipo o trabajar cerca de una fuente de alimentación, desenchufar el cable de alimentación en los equipos de corriente alterna (CA); cortar la alimentación desde el interruptor automático en los equipos de corriente continua (CC).**

Varning! **Innan du arbetar med ett chassi eller nära strömförsörjningsenheter skall du för växelströmsenheter dra ur nätsladden och för likströmsenheter bryta strömmen vid överspänningsskyddet.**

Power Disconnection Warning

Warning **Before working on a system that has an On/Off switch, turn OFF the power and unplug the power cord.**

Waarschuwing **Voordat u aan een systeem werkt dat een aan/uit schakelaar heeft, dient u de stroomvoorziening UIT te schakelen en de stekker van het netsnoer uit het stopcontact te halen.**

Varoitus **Ennen kuin teet mitään sellaiselle järjestelmälle, jossa on kaksiasentokytkin, katkaise siitä virta ja kytke virtajohto irti.**

Attention **Avant de travailler sur un système équipé d'un commutateur marche-arrêt, mettre l'appareil à l'arrêt (OFF) et débrancher le cordon d'alimentation.**

Warnung **Bevor Sie an einem System mit Ein/Aus-Schalter arbeiten, schalten Sie das System AUS und ziehen das Netzkabel aus der Steckdose.**

Avvertenza **Prima di lavorare su un sistema dotato di un interruttore on/off, spegnere (OFF) il sistema e staccare il cavo dell'alimentazione.**

Advarsel **Slå AV strømmen og trekk ut strømledningen før det utføres arbeid på et system som er utstyrt med en av/på-bryter.**

Aviso **Antes de começar a trabalhar num sistema que tem um interruptor on/off, DESLIGUE a corrente eléctrica e retire o cabo de alimentação da tomada.**

¡Advertencia! **Antes de utilizar cualquier sistema equipado con interruptor de Encendido/Apagado (ON/OFF), cortar la alimentación y desenchufar el cable de alimentación.**

Varning! **Slå AV strömmen och dra ur nätsladden innan du utför arbete på ett system med strömbrytare.**

Grounded Equipment Warning

Warning **This equipment is intended to be grounded. Ensure that the host is connected to earth ground during normal use.**

Waarschuwing **Deze apparatuur hoort geaard te worden Zorg dat de host-computer tijdens normaal gebruik met aarde is verbonden.**

Varoitus **Tämä laitteisto on tarkoitettu maadoitettavaksi. Varmista, että isäntälaite on yhdistetty maahan normaalikäytön aikana.**

Attention **Cet équipement doit être relié à la terre. S'assurer que l'appareil hôte est relié à la terre lors de l'utilisation normale.**

Warnung **Dieses Gerät muß geerdet werden. Stellen Sie sicher, daß das Host-Gerät während des normalen Betriebs an Erde gelegt ist.**

Avvertenza **Questa apparecchiatura deve essere collegata a massa. Accertarsi che il dispositivo host sia collegato alla massa di terra durante il normale utilizzo.**

Advarsel **Dette utstyret skal jordes. Forviss deg om vertsterminalen er jordet ved normalt bruk.**

Aviso **Este equipamento deverá estar ligado à terra. Certifique-se que o host se encontra ligado à terra durante a sua utilização normal.**

¡Advertencia! **Este equipo debe conectarse a tierra. Asegurarse de que el equipo principal esté conectado a tierra durante el uso normal.**

Varning! **Denna utrustning är avsedd att jordas. Se till att värdenheten är jordad vid normal användning.**

Installation Warning

Warning **Read the installation instructions before you connect the system to its power source.**

Waarschuwing **Raadpleeg de installatie-aanwijzingen voordat u het systeem met de voeding verbindt.**

Varoitus **Lue asennusohjeet ennen järjestelmän yhdistämistä virtalähteeseen.**

Attention **Avant de brancher le système sur la source d'alimentation, consulter les directives d'installation.**

Warnung **Lesen Sie die Installationsanweisungen, bevor Sie das System an die Stromquelle anschließen.**

Avvertenza **Consultare le istruzioni di installazione prima di collegare il sistema all'alimentatore.**

Advarsel **Les installasjonsinstruksjonene før systemet kobles til strømkilden.**

Aviso **Leia as instruções de instalação antes de ligar o sistema à sua fonte de energia.**

¡Atención! **Ver las instrucciones de instalación antes de conectar el sistema a la red de alimentación.**

Varning! **Läs installationsanvisningarna innan du kopplar systemet till dess strömförsörjningsenhet.**

Class 1 Laser Product Warning

Warning **Class 1 laser product.**

Waarschuwing **Klasse-1 laser produkt.**

Varoitus **Luokan 1 lasertuote.**

Attention **Produit laser de classe 1.**

Warnung **Laserprodukt der Klasse 1.**

Avvertenza **Prodotto laser di Classe 1.**

Advarsel **Laserprodukt av klasse 1.**

Aviso **Produto laser de classe 1.**

¡Advertencia! **Producto láser Clase I.**

Varning! **Laserprodukt av klass 1.**

Laser Beam Warning

Warning **Do not stare into the beam or view it directly with optical instruments.**

Waarschuwing **Niet in de straal staren of hem rechtstreeks bekijken met optische instrumenten.**

Varoitus **Älä katso säteeseen äläkä tarkastele sitä suoraan optisen laitteen avulla.**

Attention **Ne pas fixer le faisceau des yeux, ni l'observer directement à l'aide d'instruments optiques.**

Warnung **Nicht direkt in den Strahl blicken und ihn nicht direkt mit optischen Geräten prüfen.**

Avvertenza **Non fissare il raggio con gli occhi né usare strumenti ottici per osservarlo direttamente.**

Advarsel **Stirr eller se ikke direkte pŒ strŒlen med optiske instrumenter.**

Aviso **Não olhe fixamente para o raio, nem olhe para ele directamente com instrumentos ópticos.**

¡Advertencia! **No mirar fijamente el haz ni observarlo directamente con instrumentos ópticos.**

Varning! **Rikta inte blicken in mot strålen och titta inte direkt på den genom optiska instrument.**

Seismic Considerations

To secure a Cisco-supplied cabinet, holes in the upper and lower corners accommodate 3/8-inch or 1/2-inch bolts. Also, an optional *stability plate* can be purchased with the Cisco cabinet. The stability plate is bolted to the floor, then the Cisco cabinet is bolted to the stability plate. Instructions for installing the stability plate are in the ““Seismic Anchoring for a Cisco Rack” section on page 3-13.”

Seismic Anchoring for a Cisco Rack

This section describes how to install the Cisco cabinet with the optional stability plate for seismic anchoring. If you have no stability plate, go to Chapter 4, “Enclosure and Card Installation”

To set up the Cisco cabinet with the stability plate, perform the following steps:

Step 1 Use the dimensions in Figure 3-1 to drill the holes for installing the stability plate.

Step 2 Remove the stability plate from the base of the Cisco cabinet. Save these nuts and bolts.

Step 3 With the user-provided anchoring bolts, attach the stability plate to the floor.

Step 4 Roll the Cisco cabinet over the stability plate as Figure 3-2 illustrates.

Step 5 Use the nuts and bolts from the shipping setup to secure the cabinet to the stability plate.

Figure 3-1 Stability Plate Dimensions

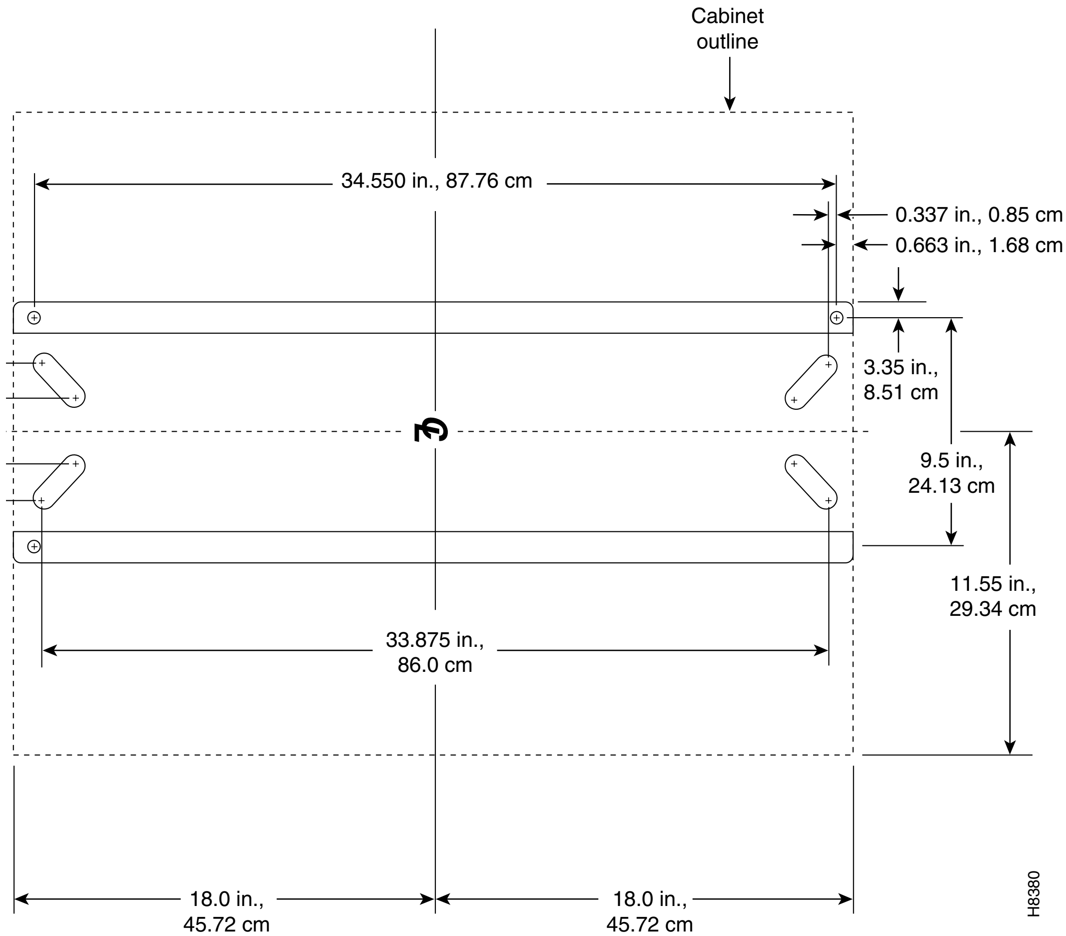
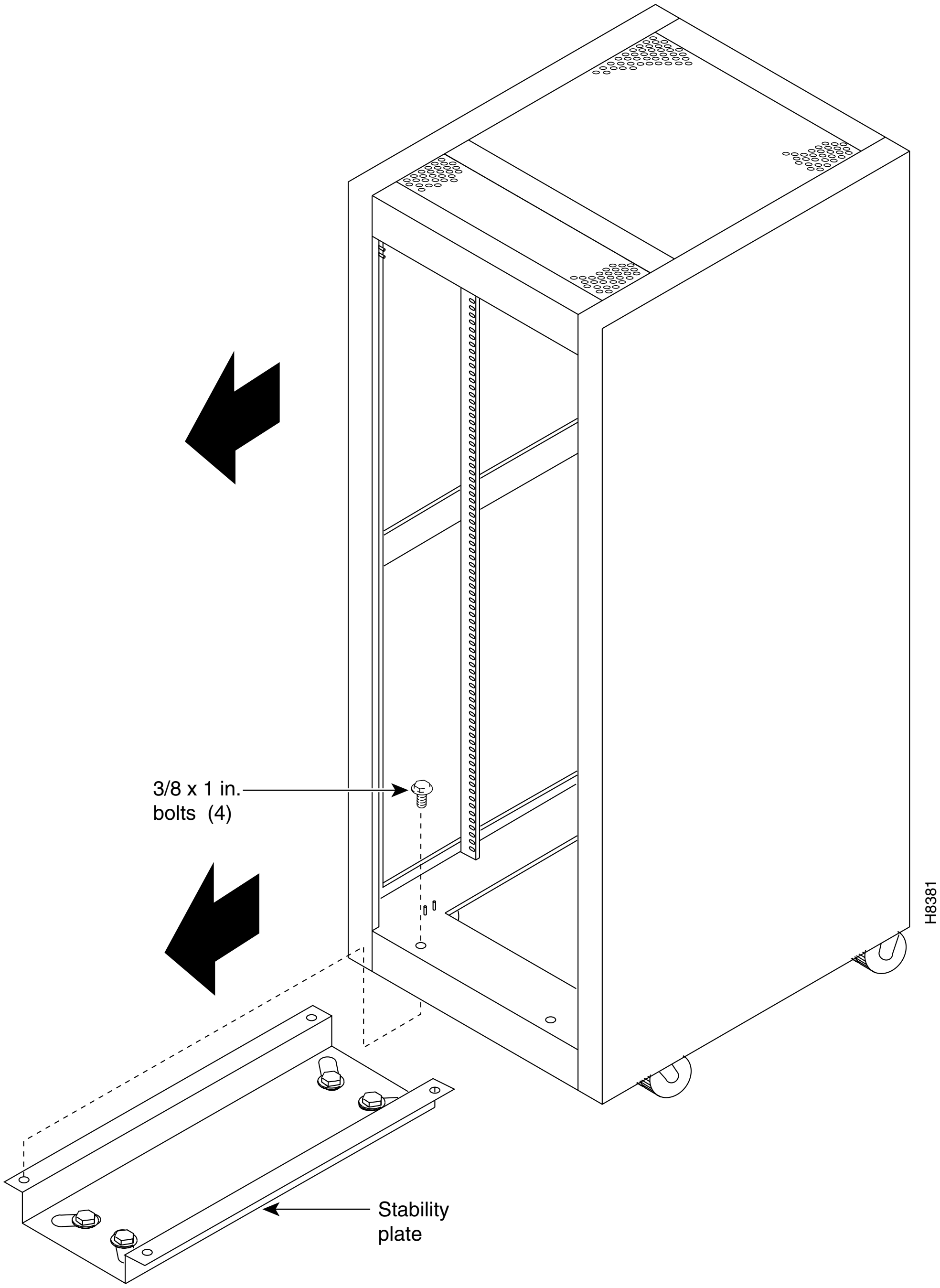


Figure 3-2 Installing a Cisco Cabinet Over the Stability Plate



Power and Grounding

This section describes the requirements for electrical power and grounding the switch and the site. These requirements apply to the Central Office (CO) and the Private Enterprise (PE) sites.

AC Power Circuit Breakers

AC power must come from dedicated, AC branch circuits. Each circuit must be protected by a dedicated, two-pole circuit breaker. The circuit breakers at the source must have a rated current and trip delay greater than those of the MGX 8250 circuit breaker. Cisco recommends that the site has a 20A, 2-pole AC circuit breaker with a long trip delay at each branch circuit.

The MGX 8250 uses a 20A, 2-pole circuit breaker for each AC input. The manufacturer of this circuit breaker is ETA. The ETA part number is 8340-F120-P1P2-B2H020A.

DC Power Circuit Breakers

For a DC-powered system, verify that its power comes from a dedicated DC branch circuit. This branch circuit must be protected by a dedicated circuit breaker. The circuit breaker must have a rated current and trip delay that is greater than those of the MGX 8250 circuit breaker. Cisco Systems recommends the site have a dedicated 60A, 1-pole circuit breaker with a medium trip delay at each branch circuit.

DC-powered nodes use a 60A, 1-pole circuit breaker with a short trip delay on each –48V input.

Electrical Power for AC-Powered Nodes

The MGX 8250 AC power requirement are 220 VAC with a worst-case range of 180–240 VAC or 110 VAC with a worst case range 100-240 VAC. See also Appendix A, "System Specifications." The AC power source must be within 6 feet (1.8 m) of the system and easily accessible. Before turning on the power, verify that the power supplied to the node comes from a dedicated branch circuit.

The 110 VAC power supply has a maximum output power of 1200W per power supply module. However, because of safety limitation imposed on the line cord, the 110 VAC power supply output power is shown in Table 3-1.

Table 3-1 110 VAC Power Module Output Power

Input voltage (Volts AC)	Power output (Watts)
100	900
110	1000
120	1100
130–264	1200

The 220 VAC power supply module has a maximum power output of 2500W with two fan trays and 1500W with one fan tray.

Note If the power requirement of the installed cards exceed the power capability of the system, an error message is generated.

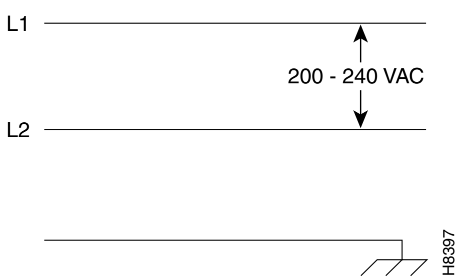
Caution Consult Cisco TAC if the plans for the MGX 8250 AC power include a portable, uninterruptible power source (UPS). Cisco recommends a UPS with a low output impedance and the capacity to provide the necessary fault current to trip the protection devices. Do not use a UPS or any power source with a Ferro-Resonant transformer.

The power receptacles to which the node connects must be of the grounding type. The grounding conductors that connect to the receptacles should connect to protective earth at the service equipment. For reference, Figure 3-3 shows the electrical relationship in the three-wire wall plug.

Cisco can provide 220 VAC power cords with the following plugs:

- 20A NEMA L620, 3-prong plug (United States)
- 13A 250 VAC BS1363, 3-prong fused plug (UK, Ireland)
- CEE 7/7 (Continental Europe)
- AS3112 (Australia, New Zealand)
- CEI23-16/VII (Italy)

Figure 3-3 Electrical Relationship of the AC Plug Wiring



Electrical Power for DC-Powered Switches

This section describes the safety and standards-body compliance issues for DC-powered systems. For the bonding and grounding issues related to electrical noise, see the “Bonding and Grounding” section that follows.

The DC-power model of the MGX 8250 uses one or two power entry modules (PEMs) to accept DC current. The DC PEMs should connect to a source capable of supplying 60A of current. Each branch circuit at the source should have a 60A circuit breaker, and the wires connecting the PEMs to the sources should be capable of carrying 60A. A 6 AWG (10 square millimeters) copper wire is adequate. Also, consult the local or national codes for conductor sizing for DC supply connections if necessary. Conductors must be suitable for 60A.

Be sure to connect the grounding wire conduit to a solid earth ground. Cisco recommends a closed loop to terminate the ground conductor at the ground stud.

In summary, note the following guidelines for DC systems:

Caution This equipment has a connection between the earth conductor of the DC power supply circuit and the earthing conductor.

This equipment must be connected directly to the DC supply system earthing electrode conductor or to a bonding jumper from an earthing terminal bar or bus to which the DC supply system earthing electrode is connected.

This equipment must be located in the same immediate area (such as adjacent cabinets) as any other equipment that has a connection between the earthed conductor to the same DC supply circuit and the earthing connector and also the point of earthing of the DC system. The DC system must not be earthed elsewhere.

The DC supply source is to be located within the same premises as this equipment. Switching or disconnecting devices must not be in the earthed circuit conductor between the DC source and the point of the connection of the earthing electrode conductor.

At the input of each power entry module (PEM) in an MGX 8250 node, connect only a –48 VDC source that complies with the Safety Extra Low Voltage (SELV) requirements in UL 1950, EC 950, EN 60950, and CSA C22.2 No. 950-95.

A DC-powered MGX 8250 node should be installed in a *restricted access* location. In the United States, restricted access is defined in Articles 10-116, 10-117, and 10-118 of the National Electrical Code ANSI/NFPA 70.

Bonding and Grounding

To maintain the full EMI and EMC integrity of this equipment, it must be bonded to an *integrated ground plane* or a *non isolated ground plane* network. The purpose is to mitigate the damaging effects of electrostatic discharge or lightning. Refer to the latest edition of the ITU-T Recommendation K.27 or Bellcore GR-1089-CORE to ensure that the correct bonding and grounding procedures are followed. As recommended in these documents, a frame bonding connection is provided on the Cisco cabinet for rack-mounted systems. To see how to make a connection, see the “Making the Frame Bonding (Ground) Connection” section later in this chapter.

Except for the AC power supply modules, every module in a rack-mount system uses the rack for grounding. Therefore, the rack must connect to protective earth ground and the equipment must be secured to the rack so as to ensure good bonding.

A DC-powered node must have grounding conductors that connect at two separate locations:

- The grounding conductor provided with the supply source must connect to the correct terminal of the power entry module (PEM).
- A grounding conductor must connect to an appropriate terminal on a rack or the chassis of a node.

For DC-powered systems, Cisco has designed the MGX 8250 node and other WAN switches to connect to a *non isolated* ground system. In contrast, routers and other LAN equipment often use an *isolated* grounding scheme. If wired together through an *equalization connection* as described in the ITU-T recommendation K.27, the isolated and non isolated ground systems can form a mixed grounding system. The potential between any points in the ground system—whether or not the ground system is mixed—must not exceed 2 percent of the referenced voltage (2 percent of 48V is 960 millivolts).

Wiring a Mixed Ground System with Redundant Supplies

A mixed ground system appears in Figure 3-4. This figure shows safety and earth grounds and the primary and redundant DC sources Battery A and Battery B. Individual ground conductors are labeled Z1 to Z5. The Z represents the impedance of the ground conductor between a chassis, for example, and a connection to the building's ground system. The numbers 1 to 4 represent building ground points and indicate that an impedance can exist between different points in the ground system of the building. Each of these symbols indicate that a voltage drop may result (but must not exceed 2 percent of the referenced voltage). See Table 3-2 for a definition of each Z1 to Z5.

Figure 3-4 Mixed Grounding System

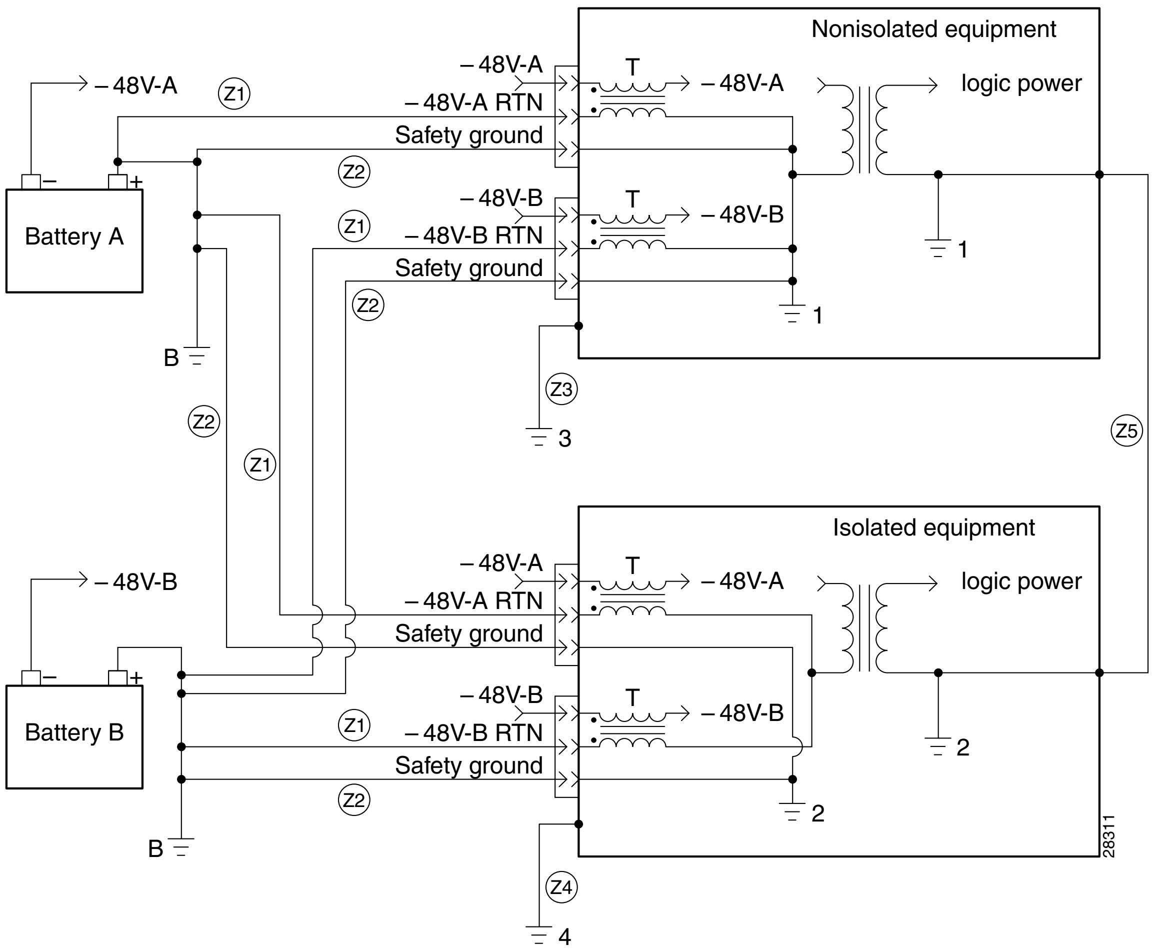


Table 3-2 Ground Point Descriptions for Mixed Grounding

Connection	Description
Z1	–48 VDC return.
Z2	Protective earth or safety ground (green/yellow).
Z3	Equipment ground for non isolated equipment.
Z4	Equipment ground for isolated equipment.

Table 3-2 Ground Point Descriptions for Mixed Grounding (continued)

Connection	Description
Z5	Equalizing frame ground. This ground creates low-impedance equalization between frames.
B	Battery ground.
1, 2, 3, 4	Connection points to the building's ground system—A potential can exist between these points within the ground system.
T	Common-mode EMI filters.

As Figure 3-4 shows, the non isolated system has a 48 VDC return that internally connects to the backplane. (This design calls for a hard-wired return and so does not allow for an *optional* or alternate ground connection.) The internal connection provides a low-impedance connection between 48 VDC return and frame ground. This grounding scheme protects the signals on the backplane from corruption by transients that can result from lightning or electrostatic discharge.

To improve protection against transients, the loop area (and resultant loop impedance) should be made as small as possible by locating the –48 VDC supply, 48 VDC return, and protective earth conductors as close to each other as possible.

As recommended in ITU-T K.27, the multi point grounding in a mesh bonding network provides the best protection for equipment by providing the lowest impedance in the ground system. For more detailed information, refer to the recommendation itself.

Conductor Characteristics for Carrying Current and Ensuring Low Voltage Drops

To prevent signal degradation, a conductor must be large enough to prevent its impedance from creating a voltage drop equal to 2 percent of the reference voltage. Also, the protective earth conductor must be large enough to carry all the current if the 48 VDC return fails. This latter requirement is for safety. Full fault redundancy is achieved by having equal size conductors for the protective earth ground and the 48 VDC return of the switch.

For wire gauges that prevent unacceptable voltage drops over different lengths of copper wire, see Table 3-3. For the resistance of 1000 feet of copper wire for each gauge of wire, see Table 3-4. These references are for planning purposes and may be further subject to local laws and practices.

Table 3-3 Wire Gauge for Current Loads Over Copper Wire Lengths

DC Current	Distance in Feet						
	25 feet	50 feet	75 feet	100 feet	150 feet	200 feet	400 feet
5A	18	14	14	12	10	8	6
10A	14	12	10	8	8	6	2
15A	14	10	8	8	6	4	2
20A	12	8	8	6	4	2	0
25A	12	8	6	4	4	2	0
30A	10	8	6	4	2	2	00
35A	10	6	4	2	2	1	000
40A	8	6	2	2	2	0	000

Table 3-3 Wire Gauge for Current Loads Over Copper Wire Lengths (continued)

DC Current	Distance in Feet					
45A	8	6	4	2	1	0	0000
50A	8	4	4	2	1	00	—
55A	8	4	2	2	0	00	—
60A	8	4	2	2	0	00	—
65A	6	4	2	1	0	000	—
70A	6	4	2	1	00	000	—
75A	6	4	2	1	00	000	—
100A	4	2	1	00	000	—	—

Table 3-4 Resistance for Each Gauge of Copper Wire

Gauge	Ohms per 1000 Feet	Gauge	Ohms per 1000 Feet
0000	0.0489	10	0.9968
000	0,0617	11	1.257
00	0.0778	12	1.5849
0	0.098	13	1.9987
1	0.1237	14	2.5206
2	0.156	15	3.1778
3	0.1967	16	4.0075
4	0.248	17	5.0526
5	0.3128	18	6.3728
6	0.3944	19	8.0351
7	0.4971	20	10.1327
8	0.6268	21	12.7782
9	0.7908	22	16.1059

Using the Electrostatic Wrist Strap

The MGX 8250 ships with a wrist strap for grounding the user and protecting the electronic components from electrostatic shock. The wrist strap kit consists of a strap, a coiled cord, and a clip for holding the strap.

Step 1 Cisco recommends you install the base of the wrist strap cable on the left front flange of one of the units at a convenient height.

Step 2 Use a front mounting screw to secure the ring lug to the flange and front rail. The other end of the cord connects to the strap with a snap connector.

Step 3 Peel the back off the clip to expose the adhesive surface and attach to the front of the unit above the ring lug.

Step 4 Mount the clip sideways to allow the strap to be held in a position that will not interfere with the removal of the number card. Use the clip to store the strap.

Co-Locating Cisco Units in the Same Rack

Different Cisco products can reside in the same rack. If a multi system rack configuration includes a BPX 8600 series switch, it should reside as the bottom unit.

Making the Frame Bonding (Ground) Connection

This section describes the steps for making ground connections that comply with the Cisco grounding policies. The descriptions cover optional ground connections from each node to the ground connector of the rack as well as the equalization connections between racks that are part of the earth grounding network.

The Cisco-supplied cabinet has two pairs of grounding studs and the hardware for securing a ground conductor to the studs at the top and bottom of the cabinet. The studs measure 1/4-inch by 20 threads per inch. The studs can accept the two-holed grounding connector designed to prevent rotation and possible loosening of the connector. Figure 3-5 shows the Cisco cabinet with the ground attachment studs in the upper and lower parts of the cabinet. A ground symbol on the Cisco rack indicates the points of attachment.

Making Cisco Cabinet Ground Connections

Cisco recommends the following steps for attaching a ground conductor to the frame of a Cisco rack:

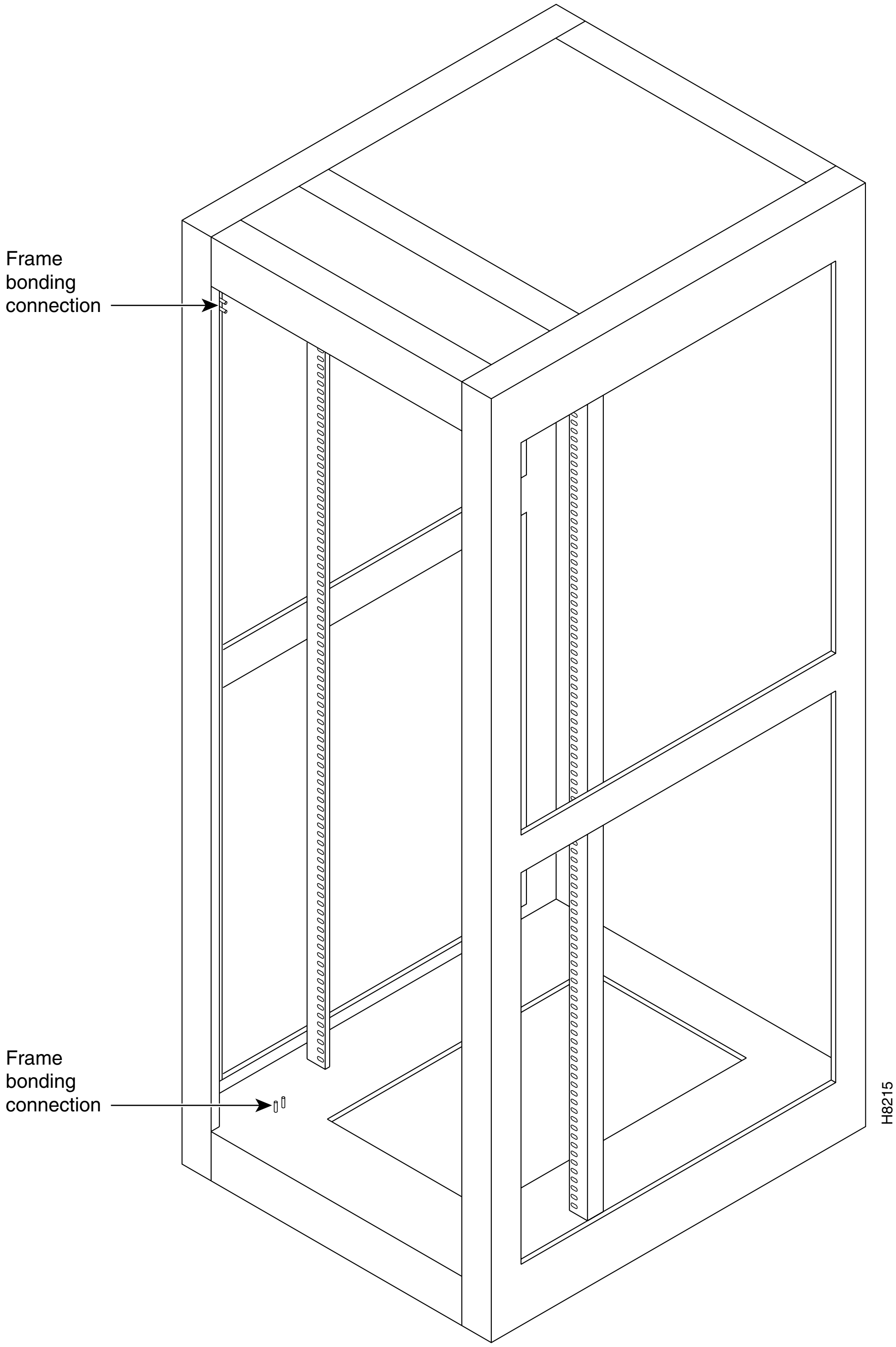
Step 1 Place an external, toothed star washer onto the stud.

Step 2 Place the connector terminating the grounding conductor closed-loop ring or two-hole compression fitting onto the stud.

Step 3 Place another external, toothed star washer or lock washer onto the stud.

Step 4 Screw a nut onto the threaded stud.

Figure 3-5 Frame Bonding Connection in a Cisco-Supplied Rack



CHAPTER 4

Enclosure and Card Installation

Chapter Summary

This chapter contains hardware installation instructions for the MGX 8250. Follow the appropriate instructions carefully to ensure successful installation.

Summary of Rack Installation Steps

The steps involved in the installation of the MGX 8250 are described as shown below.

- Prepare for Installation, page 4-1
- Cisco Rack Installations, page 4-6
- Open Rack Installations, page 4-6
- Install Electrical Connections, page 4-13
- MGX 8250 with 110 VAC Power Supply, page 4-17
- MGX 8250 Low-Profile System with the DC Power Supply, page 4-20
- Initial Start-up of the MGX 8250, page 4-30

Prepare for Installation

Before installation, review this section for general information on the installation and placement of the MGX 8250.

- Layout Plans, page 4-2
- Rack Configuration, page 4-2
- Module Stacking Order, page 4-2
- Considerations for Mounting the MGX 8250 Modules, page 4-3
- Installation Tools, page 4-4
- Mounting Rails for the Enclosure Modules, page 4-4

Layout Plans

A layout plan should exist for the entire network and for each card. This information comes from the site survey detailing rack/equipment positioning and specific implementation instructions. This survey includes

- Floor number and position number where the cabinet is to be located.
- Cabinet Layout Diagram for information on the equipment to be installed.
- Cisco Cabinet Layout for information on the equipment to be housed in a Cisco cabinet.
- Equipment Chassis Card Layout for information on the placement of individual cards.

The initial sections in this chapter also include a review of the planning decisions that must be made before installation of the switch.

For a list of physical and electrical characteristics of the switch, see Appendix A, "System Specifications."

Refer to the documentation supplied with each piece of equipment for additional installation information.

Rack Configuration

Rack configuration rules for the MGX 8250 rack are as follows.

- A maximum of two MGX 8250 nodes can fit in a rack.
- If the rack installation includes a BPX 8600 series switch, it must reside at the bottom of the rack.
- The recommended stacking order is the BPX on the bottom, the 7204 Tag Switch Controller (if ordered), and the MGX 8250 on top.
- The gap between products is designed to be. 060-inch minimum to allow for replacement clearance.
- Ensure that the rear support brackets are fitted for the BPX 8650 and MGX 8850.

Module Stacking Order

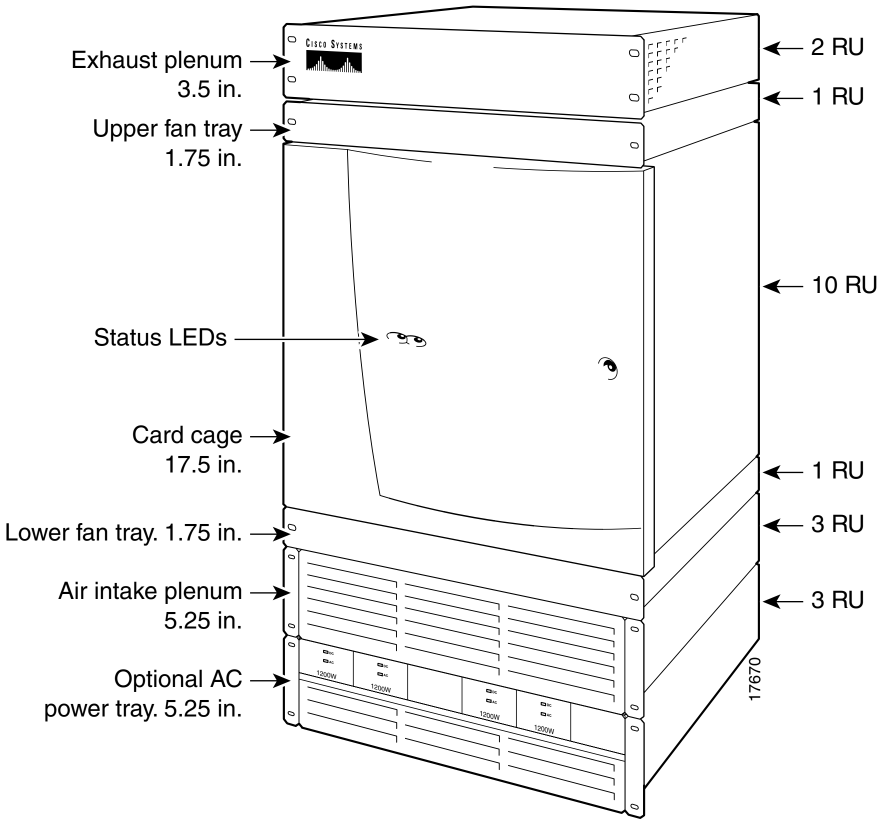
The following list contains the stacking order for modules from the bottom up (see Figure 4-1).

Optional spacers for 23-inch racks are also included.

Modules must be installed in a specific order.

1. Optional AC power assembly
2. Air intake chamber
3. Lower spacer unit or optional lower fan tray
4. Card cage
5. Upper (mandatory) cooling unit fan tray
6. Exhaust plenum
7. Optional spacers for 23-rack installation

Figure 4-1 Component Locations in a 220 VAC-Powered MGX 8250



Considerations for Mounting the MGX 8250 Modules

When installing the modules, observe the following rules.

- Handle the Processor Switching Modules (PXMs) with caution to preserve alignment of the hard disk drives.
- For an AC-powered mid-mount rack installation, remove the AC power supplies.
- Two or more people are needed to lift even an empty card cage. Installation with a mechanical lift is recommended.
- When placing modules in the rack, be sure they do not drag across the surface of the module beneath it. Lower the module to rest only when it is all the way in the rack and directly above the module beneath it.
- The vertical spacing between all modules must be in the range .047-inch to .077-inch (about 1/16-inch) or 0.119 cm to 0.196 cm. This space allows the easy removal of a single module, if necessary. This clearance is not necessary beneath the exhaust plenum.
- Two installers can maneuver a module to provide the vertical gap while driving in the first two screws. If only one person is installing the modules, use a *nonabrasive* object to create this gap until the screws are installed. For modules with four or eight screws, two people are required until the bottom two screws are in place.

- If an enclosure module requires more than two screws, install the two bottom screws first.
- If space around a mid-mount installation is narrow, use thread-forming screws to prethread mounting holes. The prethreaded holes make screw insertion much easier.

Caution Do not use power screwdrivers on captive screws.

Caution The rack must be securely supported. Verify that the equipment does not create a hazardous condition due to uneven mechanical loading.

Caution The rack location must allow an unrestricted air to flow in and out of the node.

Warning **Before handling any cards, ground yourself to the card cage with a wrist strap.**

Installation Tools

The installation tools are needed for installation.

- PC with VT100 emulator, 10BaseT interface, FTP Server, TFTP Client, Svlite and lanbtld applications.
- Console port cable DB9-RJ45/DB25.
- Mechanical lifting device (if available). See the "Install the MGX 8250 with a Mechanical Lift (Recommended)" section on page 4-7.
- Two spacers ~.060-inch (1/16-inch) thick, by ~2 inches by ~ 30 inches fabricated from HDPE, aluminium or cardboard.
- Ethernet transceiver and 10BaseT Ethernet cable.
- Standard toolkit—including Phillips #1 and 6 mm flat blade drivers.
- Cable ties, cable labeling machine, and cable label holders (key-fob style).
- Digital volt meter.
- BPX switch software 9112b.img and associated files.
- BCC4V bootcode H.C.M.
- IOS image rpm-js-mz.120-2.5.T.
- Plastic zip lock bags to hold loose parts.

Mounting Rails for the Enclosure Modules

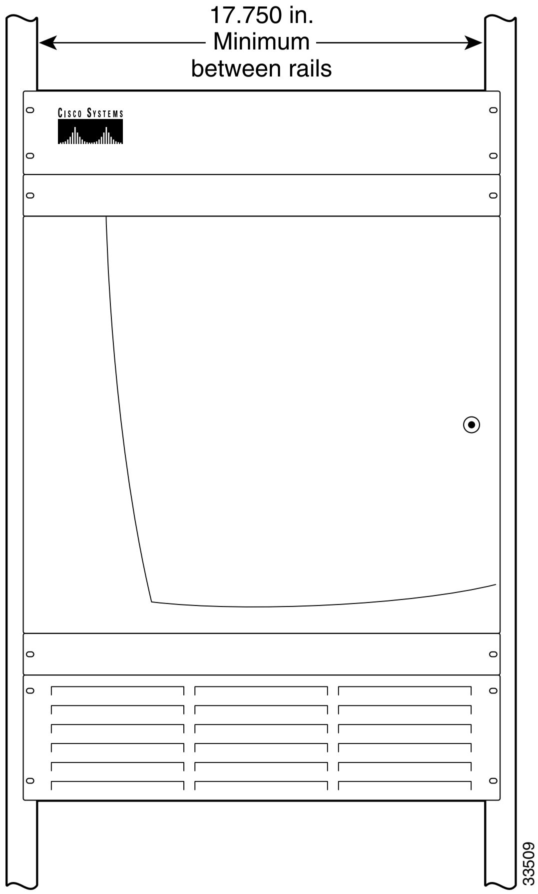
The minimum distance between left and right mounting rails is 17.75 inches or 45.08 cm. The width of the modules (such as card cage and fan tray) is 17.73 inches.

If a standard 19-inch (48.25 cm) rack cannot provide this space, a 23-inch rack is necessary.

Flanges at the front of each module serve as mounting brackets in a 19-inch rack. For 23-inch racks, Cisco Systems provides special brackets. The 19-inch rack version appears in Figure 4-2.

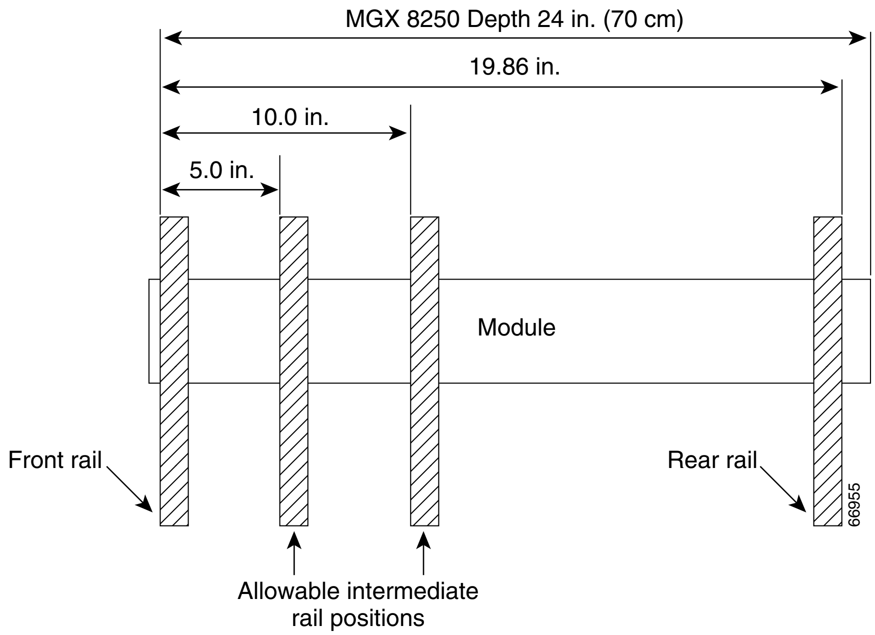
- Attach the enclosure modules to the mounting rails using the front flanges (see Figure 4-2).
- At the node's midpoint attach brackets to the modules, then attach the modules to mounting rails.
- For 23-inch racks, use the special extension brackets.

Figure 4-2 19-inch Rack Mounted DC-Powered MGX 8250



The mounting rail locations comply with sites that require mounting on front, middle, and rear mounting rails (Figure 4-3).

Figure 4-3 Mounting Rail Distances



Cisco Rack Installations

To install a MGX 8250 that is pre-installed in a Cisco rack

1. Review the "Layout Plans" section on page 4-2.
2. Continue to the "Install Electrical Connections" section on page 4-13.

Caution When moving a Cisco-supplied cabinet, do not push the cabinet at its sides. Instead, grip its front or back edges.

Open Rack Installations

Cisco recommends the use of a mechanical lift to install the MGX 8250 in an open rack.

If a mechanical lift is not available, the cards and power supplies must be removed from the chassis so it can be lifted into the rack. This option is not recommended due to the possibility that a backplane pin might be bent or broken.

The following sections contain instructions to install the switch in an open rack:

- "Prepare for Installation" section on page 4-1
  Review to verify your installation plans.
- "Install the MGX 8250 with a Mechanical Lift (Recommended)" section on page 4-7
  Use a mechanical lift to lift the chassis into the rack without removing the cards or power supplies.

- "Install the MGX 8250 without a Mechanical Lift (Optional)" section on page 4-8
  If no mechanical lift is available, the cards and power supplies must be removed so the chassis can be lifted into the rack. Once the chassis is in place, the cards and power supplies are re-installed.
- "Install Electrical Connections" section on page 4-13
  Connect the internal fan, system cables, external power, and cable manager.

Warning **Removing and re-installing the cards and power supplies increases the chance of broken or bent pins on the backplane. Use caution when cards are removed or replaced. Cisco Systems recommends the use of a mechanical lift for open rack installations.**

Install the MGX 8250 *with* a Mechanical Lift (Recommended)

Due to the weight of the equipment, a mechanical lift should be used to install the chassis into the rack. The instructions in this section assume the use of such a lift.

Use of a lift greatly simplifies the installation process since the cards and power supplies do not need to be removed.

- The lift should be capable of handling 300 lb.
- A sample lift is the T & S Hefti-Lift, Model HYD-5. For specifications, see the following URL: http://www.tseq.com/products/ergosol/hefti-lift.htm.
- The minimum platform dimensions are 175" wide by 24" deep.

Step 1 Use a lift raise the chassis to the desired position.

Step 2 Insert two spacers: one on left edge and one on right edge of lower adjacent chassis. The spacers should be ~.060-inch (1/16-inch) thick, by ~2 inches by ~ 30 inches and fabricated from HDPE, aluminium or cardboard.

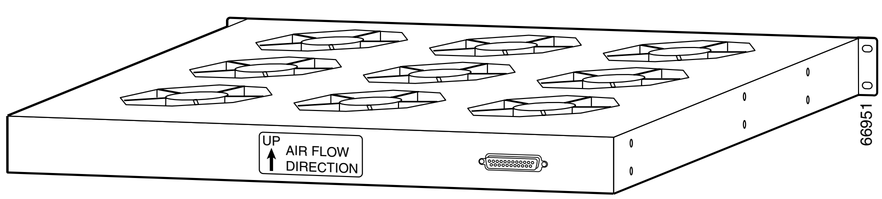
Step 3 Slide the MGX 8250 across the spacer and mount the chassis to the open rack.

Step 4 If this node requires the brackets for a 23-inch rack, attach them to the enclosure modules.

Step 5 Install the mandatory fan tray (1 RU, see). Note the label that says "Air Flow Direction."

Note When you move the fan tray into position, make sure the back base clears the top-rear edge of the card cage beneath it.

Figure 4-4 Fan Tray



Step 6 Install the exhaust plenum (2 RUs).

Install the MGX 8250 *without* a Mechanical Lift (Optional)

Because the MGX 8250 chassis with installed modules is too heavy to lift, a mechanical lift should be used to install the switch into the rack.

If a mechanical lift is not available, the cards and power supplies should be removed before the chassis is installed.

This section contains instructions to remove the cards, install the chassis into the rack, and re-install the cards.

Warning **Removing and re-installing the cards and power supplies increases the chance of broken or bent pins on the backplane. Be careful to properly align and install the cards and power supplies. To avoid the possibility of bent or broken pins, and to simplify installation, Cisco Systems recommends the use of a mechanical lift for open rack installations.**

To install an MGX 8250 *without* a mechanical lift, perform the following items

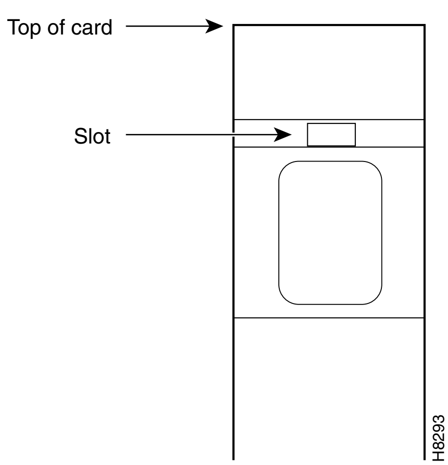
1. Remove all cards and power supplies (except the PXMs) according to the following instructions:
   - Remove Front Cards, page 4-8.
   - Remove Back Cards, page 4-9.
   - Remove 220 VAC Power Supplies, page 4-9.
2. Install the Enclosure, page 4-10.
   - Additional information is listed in Module Stacking Order, page 4-2.
3. Re-install the Front and Back Cards, page 4-12

Remove Front Cards

A latch on each single-height front card secures it to the backplane.

Double-height cards have latches at the top and the bottom (see Figure 4-5).

Figure 4-5 Front Card Insertion/Extractor Latch



Perform the following steps to remove a front card.

Step 1 Press the tip of a small, flat-blade screwdriver into the slot of the insertion/extractor lever until the latch springs open. For double-height cards, repeat this action at the bottom latch.

Step 2 Lift the lever to dislodge the card from the connector.

Step 3 Gently pull the card out of the card cage.

Remove Back Cards

A screw at the top and bottom of the faceplate on each back card, line module, or port adapter secures the card in its backplane connector. Perform the following steps to remove a back card.

Step 1 Use a flat-blade screwdriver to loosen the two retaining screws in the faceplate.

Step 2 Simultaneously pull both extractor levers out to disconnect the card from the backplane.

Step 3 Gently pull the card out of the card cage and store it in a safe location.

Remove 220 VAC Power Supplies

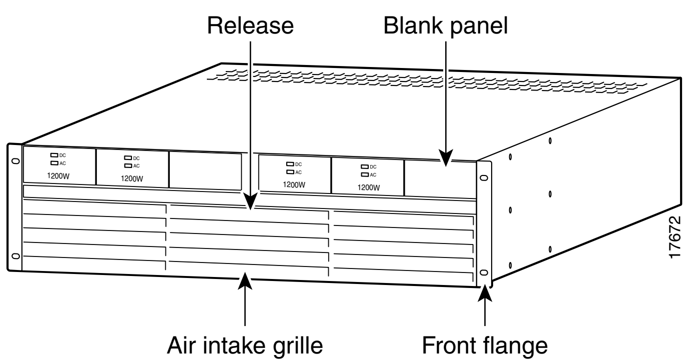
This section describes how to remove the 220 VAC power supply.

- Removing 220 VAC power supplies makes the AC power tray installation much easier.
- For a mid-mount installation, the power supplies must be removed. See the “Install the Enclosure” section on page 4-10 for more information.
- Create a record of the location for each power supply before they are removed.

Perform the following steps to remove a 220 VAC power supply.

Step 1 Remove the air intake grille: insert a flat-blade screwdriver in the access hole at the top, then rotate the screw until the spring latch opens. See “Release” in Figure 4-6.

Figure 4-6 Removing a 220 VAC Power Supply



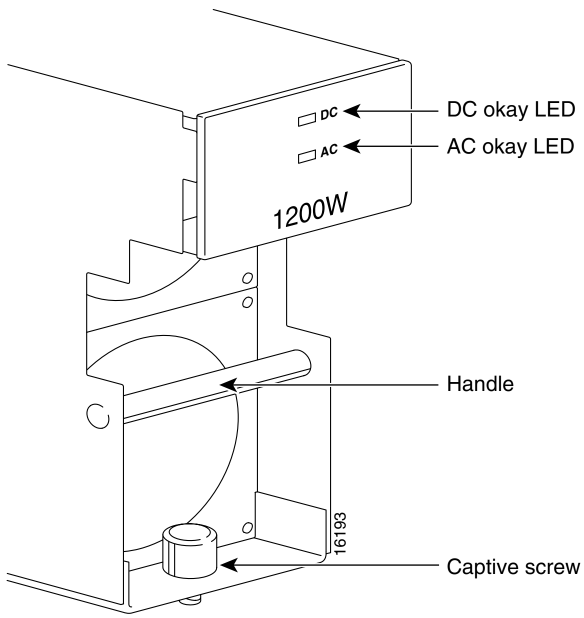
Step 2 Tilt the air inlet grille down to about a 45-degree angle, lift it out and set it aside. This action exposes the hinged door that serves as the power supply retainer bracket.

Step 3 Use a flat-blade screwdriver to unscrew the captive retainer screw in the center of the hinged door. Tilt the door down.

Step 4 Loosen the captive screw at the front-bottom of the power supply (see Figure 4-7).

Step 5 Grip the handle and remove the power supply.

Figure 4-7 AC Power Supply



Install the Enclosure

Once the cards and power supplies are removed, the enclosure can be installed in the open rack.

Use the guidelines in the "Rack Configuration" section and the "Module Stacking Order" section to determine the placement of each component.

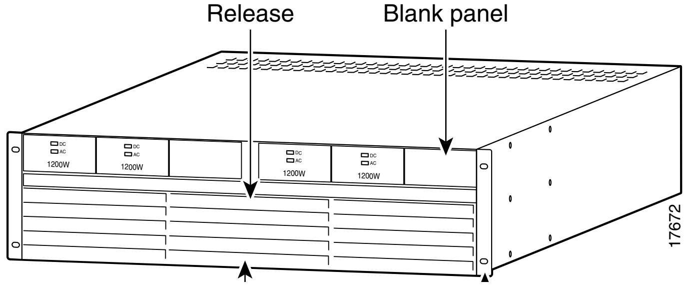
For specific instructions for each type of component, see the following steps.

Step 1 Attach the brackets for a 23-inch rack to the enclosure modules, if necessary.

Step 2 For an AC-powered system, install the optional AC power tray. Its height is three rack-mount units (three RUs is 5.25 inches or 13.34 cm). (See Figure 4-8.)

For a mid-mount installation, insert each mounting screw from the inside the power tray so that the nut is on the outside of the tray. This allows room for power supplies in either the first or last power supply trough.

Figure 4-8 Optional 220 VAC Power Tray



While you secure the front of the power supply tray with the front screws, hold the adjacent front flange of the tray slightly to the outside so the hinged door can freely open and close. See “Front Flange” in Figure 4-8. The space between the right-angle edge of the flange and the edge of the hinged door should be about the thickness of a thumbnail.

Step 3 For a DC-powered system, install the DC-PEMs at the back of the air intake module. If you install only one DC-PEM, install it on the right. (See Figure 4-9 and Figure 4-10.)

Figure 4-9 DC-PEM

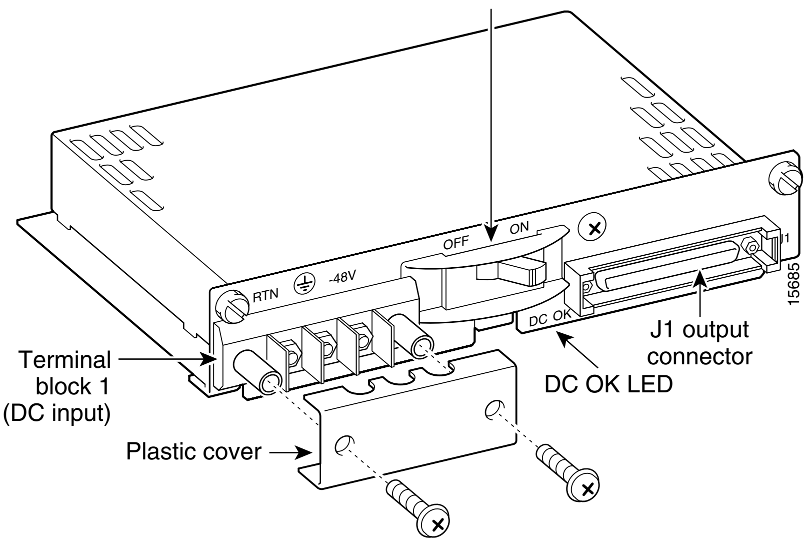


Figure 4-10 DC-PEMs Installed in Back of the Air Intake Module

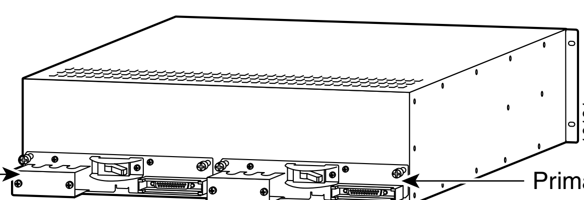
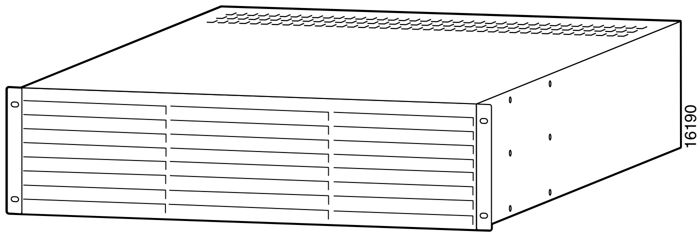


Figure 4-11 Air Intake Module



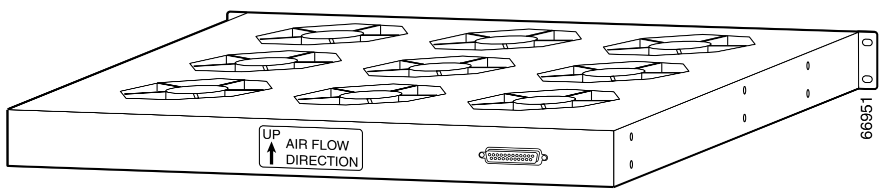
Step 4 Install the air intake module (3 RUs). (See Figure 4-11.)

Step 5 Install the optional booster fan tray, if present; otherwise install the spacer unit (1 RU). (See Figure 4-4.) If you install a fan tray, note the label that says "This Side Up."

Step 6 Install the card cage (10 RUs). When you move the card cage into position, be sure the base of the card cage at the back fully clears the top-rear edge of the spacer unit or fan tray beneath it.

Step 7 Install the mandatory fan tray (1 RU). (See Figure 4-4.) Note the label that says "Air Flow Direction." When you move the fan tray into position, make sure its base at the back fully clears the top-rear edge of the card cage beneath it.

Figure 4-12 Fan Tray



Step 8 Install the exhaust plenum (2 RUs).

If you install the cable manager, proceed to the "Install the Cable Manager," section before you do the tasks in the "Swapping a Primary or Redundant DC PEM with Power On." section.

Re-install the Front and Back Cards

This section describes how to install front and back cards. Service modules can go in any slot except reserved slots 7, 8, 15, 16, 23, 24, 31, and 32. The PXMs and optional SRM *core cards* occupy these reserved slots. Additionally, upper slots 9 and 10 and lower slots 25 and 26 do not have a special bus for the bulk distribution feature. For this reason, Cisco recommends that if the switch contains one or more Route Processor Modules (RPM/Bs), the first two RPM/Bs go in slots 9 and 10.

Caution To prevent damage to the cards from static electricity, put on a wrist strap and connect it to any metal contact on the switch before you touch any cards.

Caution Handle the PXM1 front card very carefully to preserve the alignment of the attached disk drive. Do not drop or bump the PXM1.

Caution Inserting the cards in the correct slot is especially important for the back cards because of the potential for electrical damage. Damage to the card and backplane may occur if a service module back card is inserted into a PXM1 back card slot (7, 8, 23, or 24).

If incorrect switch behavior is observed after a service module back card is accidently inserted into any of PXM1 slots 7, 8, 23, or 24, check the backplane and cards for bent or damaged pins.

Re-install a Front Card

Verify the slot placement of each card before you begin installation.

Perform the following steps to re-install a front card:

Step 1 Position the rear card guides over the appropriate slot at the top and bottom of the cage.

Step 2 Gently slide the card all the way into the slot.

Step 3 Press the insertion-extractor lever until it snaps into the vertical position.

Note The card should slide in and out with only slight friction on the adjacent board's EMI gaskets. Investigate any binding. Do not use force.

Re-install a Back Card

Verify the slot placement of each card before you begin installation.

Caution Before using the switch, verify that the daughter card type on the PXM1 corresponds to the uplink card type. Serious damage may result if the power is on and these cards are mismatched.

Perform the following steps to install a back card:

Step 1 Make sure the two extractor levers are in the *in* position. As you move the card, the levers should be flush with the vertical edge of the back card.

Step 2 Gently slide the card all the way into the slot.

Step 3 Push the card into the connector.

Step 4 Tighten the two captive screws on the card faceplate to secure the card. Do not overtighten the screws.

Install Electrical Connections

This section contains the following instructions:

- Install 220 VAC Power Supplies (if necessary), page 4-14.
- Connect 220 VAC Power to the MGX 8250, page 4-14.

- Connect DC Power to the MGX 8250, page 4-15.

Install 220 VAC Power Supplies (if necessary)

If you left the AC power supplies in the tray during installation, proceed to the "Connect 220 VAC Power to the MGX 8250." section.

Perform the following steps to re-install power supplies you removed:

Step 1 Push each power supply into the tray.

When it almost reaches the end of the slot in the tray, a slight resistance is encountered. Push the power supply slightly farther in to achieve the final position and full connector mating.

Step 2 Secure each supply to the tray by tightening the captive screw at the bottom-front of each supply.

For slots without a power supply, the hinged door on the tray should have a removable, blank panel.

Step 3 Close the hinged door and secure it with the screw at the top-center of the door.

Connect 220 VAC Power to the MGX 8250

If you removed the AC power supplies before installing the AC power tray, re-install them in the same locations they had when the switch arrived. If necessary, use the steps in the section titled "Redundancy for Service Modules" section on page 1-10. At the switch, the AC power receptacle is an IEC-type with a clamp.

Note The AC voltage range is 200–240 VAC.

Perform the following steps to install the power cord:

Step 1 Loosen the cable clamp around the receptacle, otherwise the plug may not properly fit.

Step 2 Firmly seat the plug. This may require you to hold the chassis with one hand while you push the plug in with the other hand.

Step 3 Tighten the clamp.

Cisco can provide AC power cords with the following types of AC wall plugs:

- 20 A NEMA L620, 3-prong plug (U.S.)
- 13 A 250 VAC BS1363, 3-prong fused plug (UK, Ireland)
- CEE 7/7 (Continental Europe)
- AS3112 (Australia, New Zealand)
- CEI23-16/VII (Italy)

Connect DC Power to the MGX 8250

The DC switch uses 6 AWG (10 square mm) copper wire. For details on wire lengths, wire gauges, and grounding concerns, see Chapter 3, "Site Preparation".

Each primary or redundant DC source connects to one or two DC PEMs in the switch. Make sure that each source comes from a dedicated branch circuit. Only a source that complies with safety extra low voltage (SELV) requirements in AS/NZ 3260 and EN60950 should connect to a DC-powered switch. The wiring for a DC-powered system is provided by the customer and must be three-wire solid or stranded copper (with insulation rated for 60 degrees centigrade).

The recommended terminal lug to be used with the DC PEM terminal block is Panduit LCAS6-10-L.

For installations where protection conduit is not required by local codes, the plastic cover visible at the bottom of Figure 4-13 is sufficient. Two phillips screws secure this cover to the PEM.

Use the visual information in Figure 4-13 and Figure 4-14 to connect the DC wiring.

Step 1 Cut the appropriate wire lengths.

Step 2 Strip the insulation back 0.25 inches (6 mm).

Step 3 With power off at both the switch and the source, attach each wire to the #10-32 lugs. See (Figure 4-14).

Figure 4-13 DC-PEM

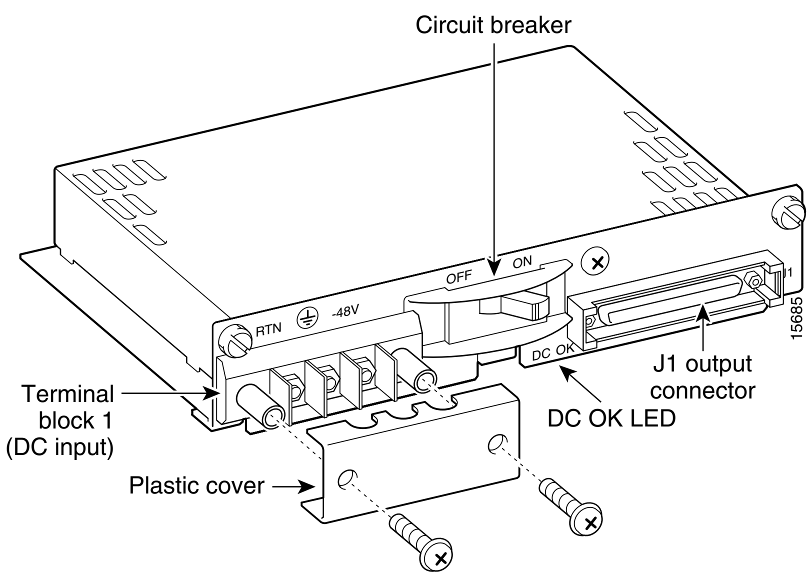
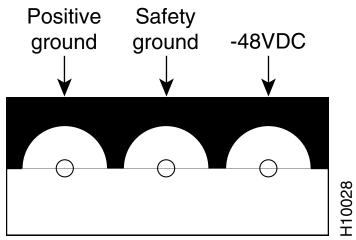


Figure 4-14 Placement of DC Wiring Lugs on the DC-PEM



Swapping a Primary or Redundant DC PEM with Power On

If necessary, you can swap out and replace either a primary or a redundant PEM with power on. To avoid possibly tripping the system circuit breaker in the process, use the sequence described in this section for disconnecting and reconnecting the system power cabling.

Caution The cable connector must be disconnected at the backplane end during hot PEM insertion or removal.

If you disconnect the cable first at the PEM, the system power cable is still hot. These hot contacts may inadvertently touch a surface of the chassis or metal connected to the chassis. If this contact occurs, the –48 VDC is shorted to the chassis, and the circuit breaker on the still-active PEM opens.

To remove a PEM with the system power on, perform the following steps:

Step 1 Turn off the circuit breaker to *only* for the PEM you intend to replace.

Step 2 Turn off the branch circuit at the DC source (for example, the distribution box).

Step 3 Disconnect the three DC source wires at the wiring block on the PEM.

Step 4 Locate the backplane end of the cable for the PEM you intend to replace.

Step 5 At the backplane end of the cable, loosen the captive screws on the cable bracket.

Step 6 Pull the cable bracket out approximately one inch to disconnect the cable.

Step 7 At the end of the cable connected to the PEM, loosen the jack screws and disconnect the power cable from the PEM.

Step 8 Remove the PEM.

Install a PEM in a System with Power On

Perform the following steps to install a PEM with the power on.

Step 1 Make sure the circuit breaker is in the off position.

Step 2 Insert the PEM and tighten the captive mounting screws.

Step 3 Connect the system power cable first at the PEM.

Step 4 Connecting the backplane end of the system power cable to the backplane requires some dexterity, especially if the cabling around the system power cable is dense. Grasp the cable bracket at the captive screws and gently push the bracket straight in.

- To align the pins of the backplane and cable pins, move the cable connector slightly up and down or side to side until the connectors are aligned and able to mate.
- When executing this step, keep the bracket as level as possible.
- The connector is fully inserted when the connector shell (housing) easily moves all the way in to the enclosure hole and the exterior of the shell with the captive screws is fully flush with the enclosure.

Step 5 Tighten the connector screws.

Step 6 Attach the three DC source wires at the wiring block on the PEM.

Step 7 Turn on the DC power at the circuit branch source.

Step 8 Turn on the circuit breaker of the PEM.

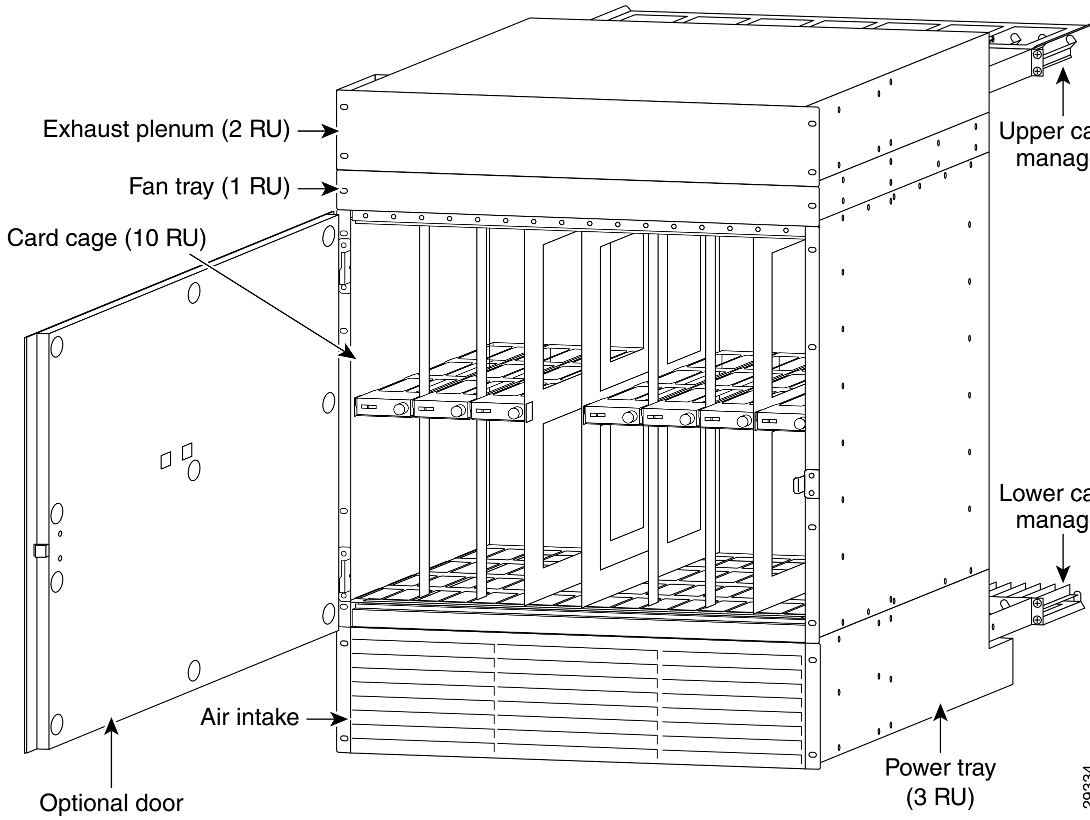
MGX 8250 with 110 VAC Power Supply

The version of the MGX 8250 powered by either a single or redundant 110 VAC power supply is shown in Figure 4-15. The version shown has the optional door installed.

- The power supply will accept voltages in the ranges of 100 VAC to 130 VAC.
- The 110V power supply has a maximum output power of 1200W per power supply module. However, because of safety limitations imposed on the line cord, the power is restricted to 1000W output.
- The Low Profile 110 VAC version of the MGX 8250 has a combination air intake plenum and power supply tray.

Note The system is limited to using cards from Release 1.3 and earlier. Cards in future releases will not supported by this system.

Figure 4-15 MGX 8250 with 110 VAC Power Supply



Remove or Replace Cards to the 110 VAC Node

To remove and replace cards in the MGX 8250 low-profile AC version, see "Install the MGX 8250 without a Mechanical Lift (Optional)" section on page 4-8.

Note The card cage for the MGX 8250 low-profile AC version is identical to the standard MGX 8250 card cage.

Removing 110 VAC Power Supply

The 110 VAC power supplies are accessed from the rear of the unit. The front grill cannot be removed on this node.

Perform the following steps to remove a 110 VAC power supply.

Step 1 Turn off the power switch on the power supply.

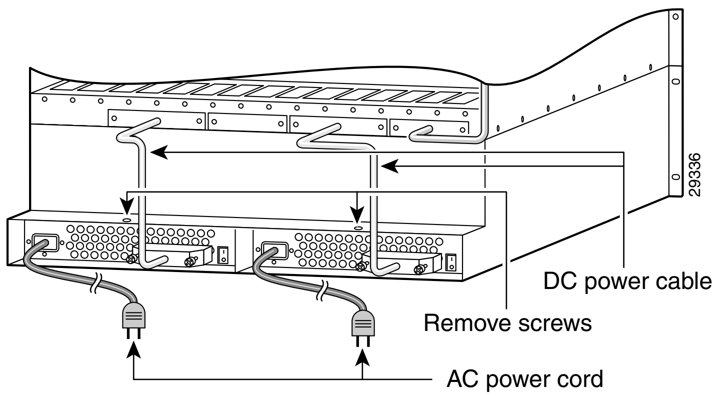
Step 2 Disconnect the AC input power cable from the power supply.

Step 3 Remove the DC power cable from the power supply side (see Figure 4-16). Leave the other side attached to the motherboard.

Step 4 Use a Phillips screwdriver to remove the screw at the rear of the unit (see Figure 4-16).

Step 5 Gently pull the power supply from the case toward the rear.

Figure 4-16 Removing 110 VAC Power Supply



Replacing 110 VAC Power Supply

Perform the following steps to replace a front card:

Step 1 Slide the power supply into a vacant position and secure with the screw with a Phillips screwdriver (see Figure 4-16).

Step 2 Connect the DC power cable to the power supply. Verify that the connectors are firmly seated.

Step 3 Secure the cable connector with the two connector screws using a Phillips screwdriver.

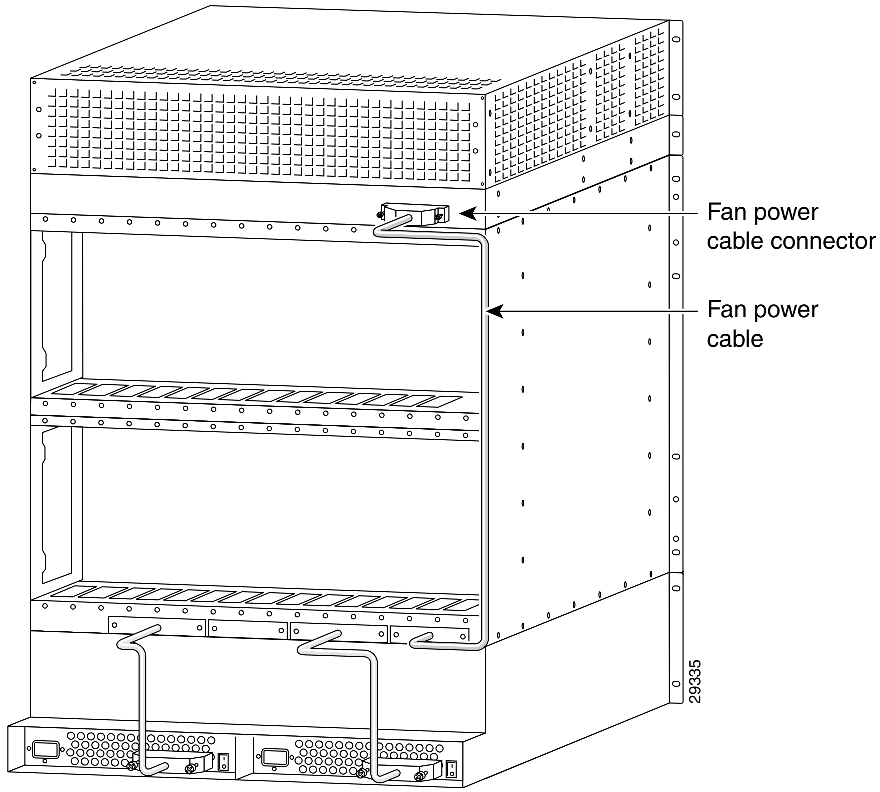
Step 4 Connect the AC power cable to the power supply.

Step 5 Turn the power switch on the power supply to its *on* position.

Installing the Fan Power Cable in a 110 VAC Node

After the system has been mounted, connect the fan power cable to the mother board and to the fan power connector on the fan tray. Route the power cable as shown in Figure 4-17.

Figure 4-17 Installing the Fan Power Cable



MGX 8250 Low-Profile System with the DC Power Supply

The rear of a MGX 8250 low-profile DC version is shown in Figure 4-18. This illustration shows

- Connections between the system motherboard and the PEMs.
- Routing for the fan power cable.

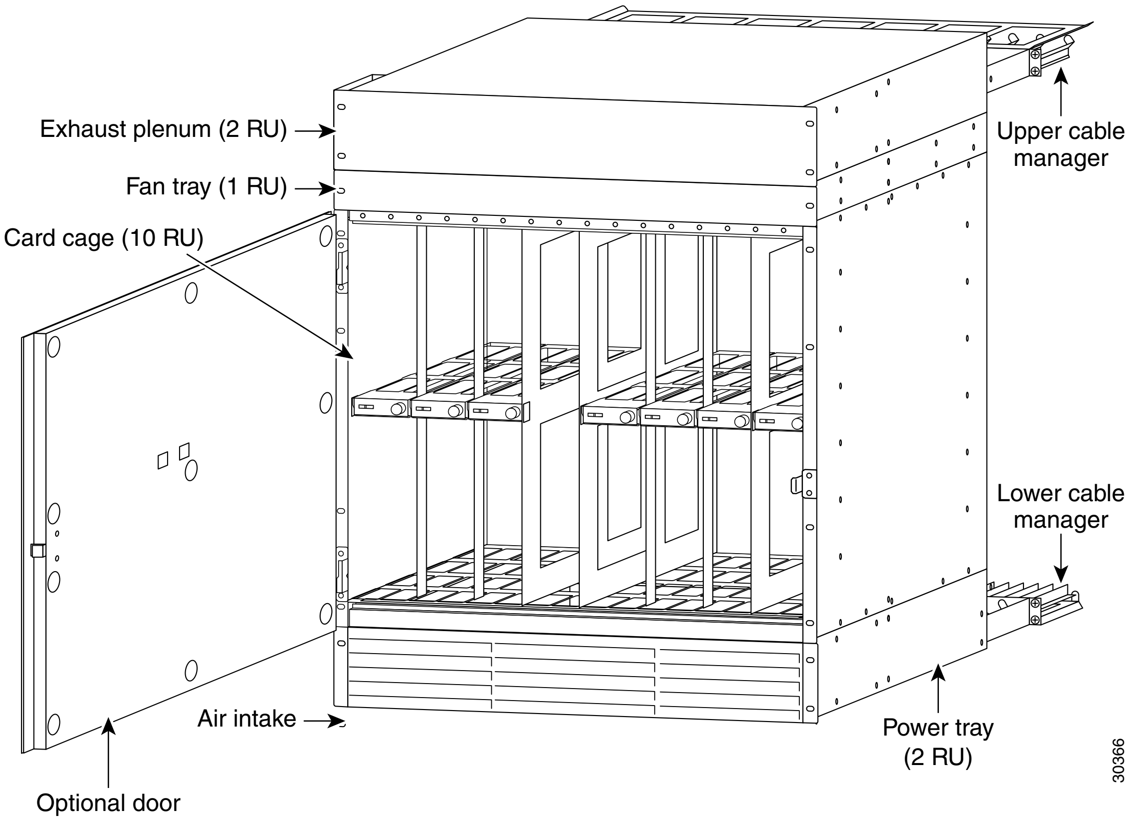
Up to three of these units can be placed in a standard 7-foot rack. The low-profile system is 15 RU high.

Configuration Limitations

Because only a single fan tray is available, the MGX 8250 low-profile system limits the type and number of cards that can be installed to a maximum total power dissipation of 1000W.

- See Table A-2 for detailed thermal information on the card content of a system.
- System software recognizes the system card and fan tray configuration and will issue an error message if the thermal limitations are exceeded.
- The MGX 8250 low-profile system supports cards of Release 1.3 and earlier but will not support cards for future releases.

Figure 4-18 MGX 8250 Low-Profile DC Version—Front View



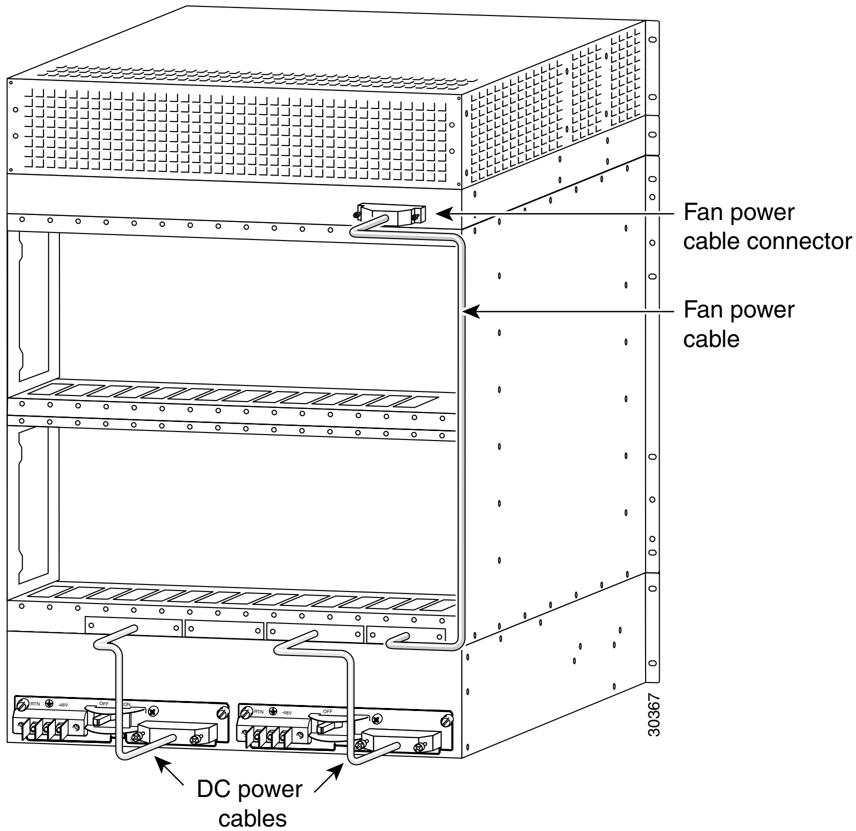
Adding and Removing Cards in the MGX 8250 Low-Profile DC Version

Adding and removing cards in the card cage for the low profile DC version of the MGX 8250 is identical to the procedure described in the "Install the MGX 8250 without a Mechanical Lift (Optional)" section on page 4-8.

To install and remove cards:

- Connect the fan power cable see the "Swapping a Primary or Redundant DC PEM with Power On" section on page 4-16.
- Install the DC power cables to the motherboard and PEM, see the "Connect DC Power to the MGX 8250" section on page 4-15.

Figure 4-19 MGX 8250 Low-Profile DC System Power Connections



Install the Cable Manager

This cable manager consists of

- Two identical cable managers
- Left- and right-side mounting brackets
- Screws

The cable management system is shown in Figure 4-20.

Perform the following steps to attach the mounting brackets:

Step 1 Hold the bracket with one hand and position it so the lower flange fits inside the card cage wall. Make sure the screw hole on the bracket aligns with the screw hole on the card cage.

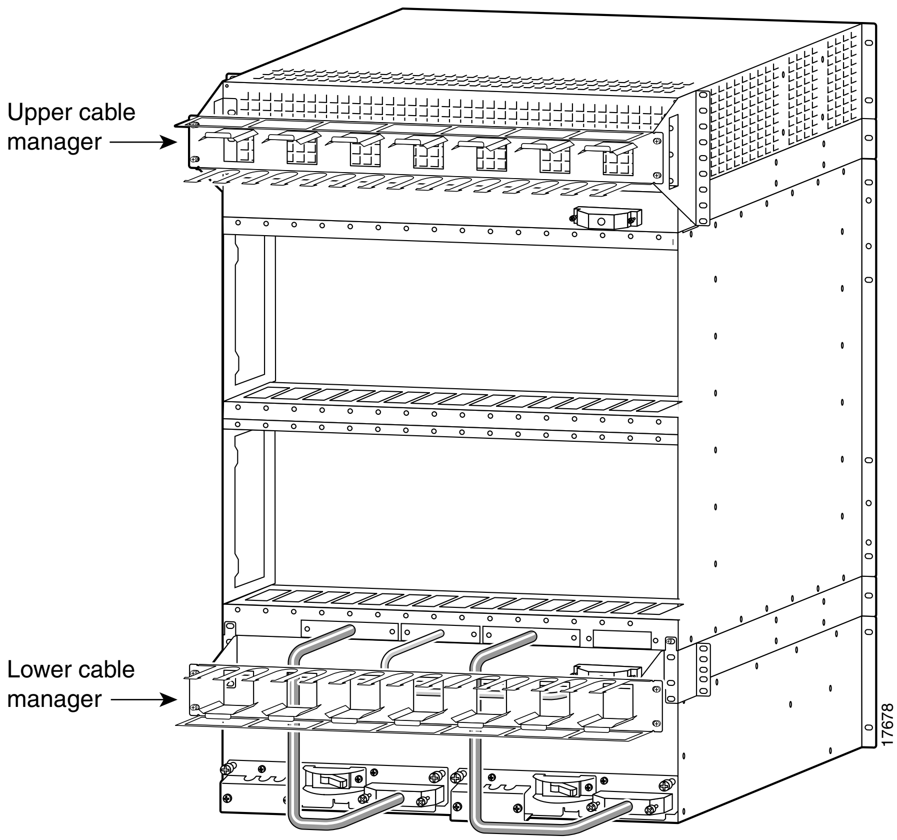
Step 2 Drive in the screw.

Step 3 Use the provided 10-32 sized screws to install the cable managers.

The cable managers must be oriented so that the cable channels on the top cable manager are on top, and the cable channels on the bottom cable manager are on the bottom (see Figure 4-20).

Note Fiber optic cabling and copper cabling take different paths on the cable manager. Use the cable channels for the copper cabling, but run the fiber optic cables over the sheet metal portion.

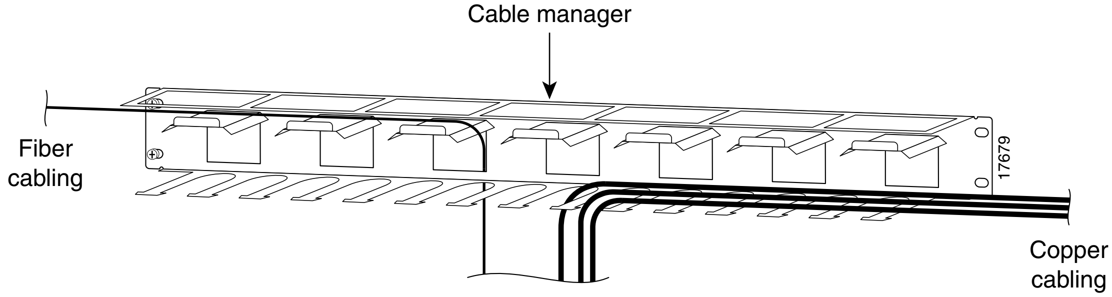
Figure 4-20 Cable Management Assembly at the Back Enclosure



Routing Data Cables

Copper-based data cables from the back cards run up or down to the cable manager and pass through the channels then run to either the left or right side of the rack. Fiber optic cables pass over the sheet metal portion. The cables subsequently go to the related equipment (for example, CPE). The view in Figure 4-21 shows only the cable manager on top.

Figure 4-21 Routing Data Cables at the Cooling Assembly



Install System Power Cables

This section describes the system power cables and how to install them.

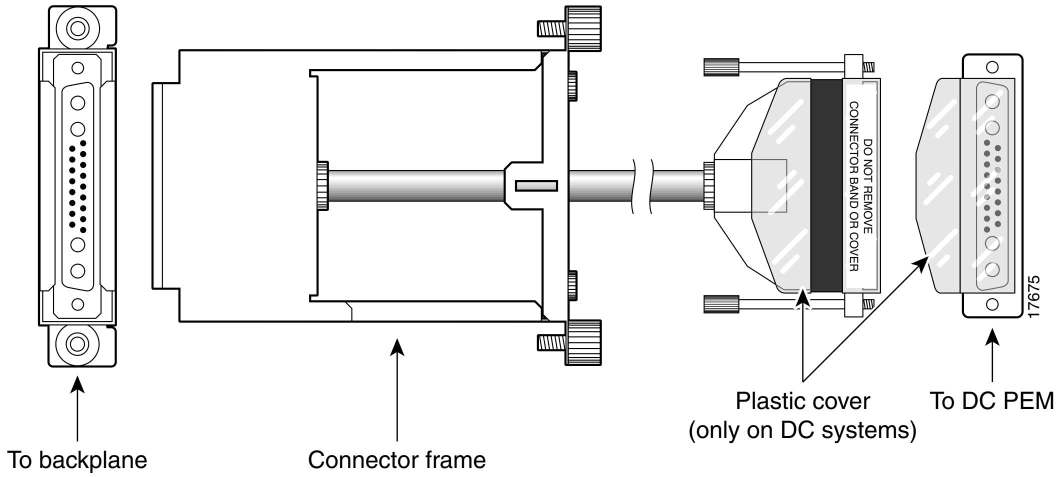
Power Cable Description

A system power cable (see Figure 4-22) carries current from either a DC PEM or AC-DC power module to the backplane. The cable is the same for AC and DC power systems. When installing the power cable, the following notes should be observed.

- The end with the metal frame around the D-connector plugs into the larger of the access holes to the backplane.
- The other end connects to the power supply and has a protective connector cover; this prevents the possibility of shorting the DC power supply while the connector is removed.
- Press the connector cover on the cable side to lift the cover away from the D-connector when installing the cable into the PEM.
- From left to right, the first and third access holes are for system power.
- An AC- or a DC-power system has D-connectors to receive the unframed connector. Connecting a power cable at the backplane has no requirement to connect at a particular connector.

See Figure 4-23 for an AC-powered system and Figure 4-24 for a DC-powered system.

Figure 4-22 Cable Assembly for System Power



Steps to Install System Power Cabling

The following procedure should be followed when installing the system power cables.

Step 1 With the narrow row of pins in the D-connector on the bottom, use two hands to slip the larger connector through the access hole at the base of the card cage.

Step 2 Move the connector straight toward the backplane so you can guide it through the second, internal guide.

When you have fully seated the D-connector in the backplane connector, the captive screws on the frame are clearly aligned with the threaded holes on the chassis.

Step 3 Tighten the captive screws only enough to secure the connector. Do not apply much torque. Do not use a power screw driver.

Step 4 Insert the D-connector without the frame in J1 on the power assembly

Step 5 Tighten captive screws only enough to secure the connector. Do not use a power tool.

If you need to swap a DC PEM in a redundant system with the power on, see the “Redundancy for Service Modules” section on page 1-10 for instructions.

Figure 4-23 Access for System Power at the Backplane, 220 VAC-Powered Node

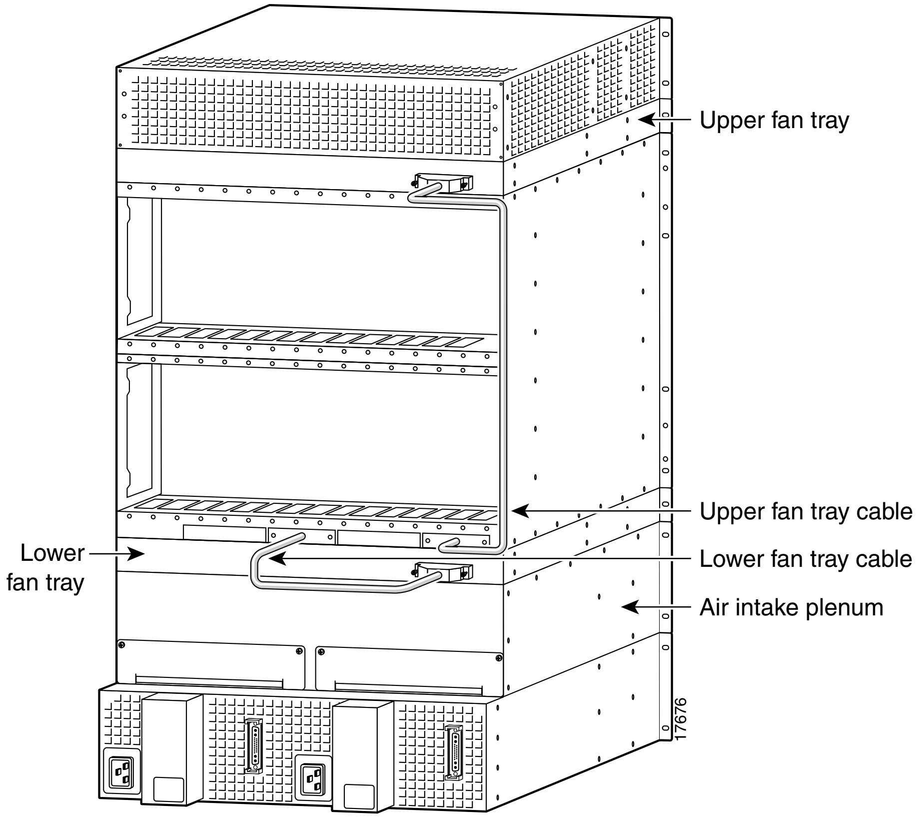
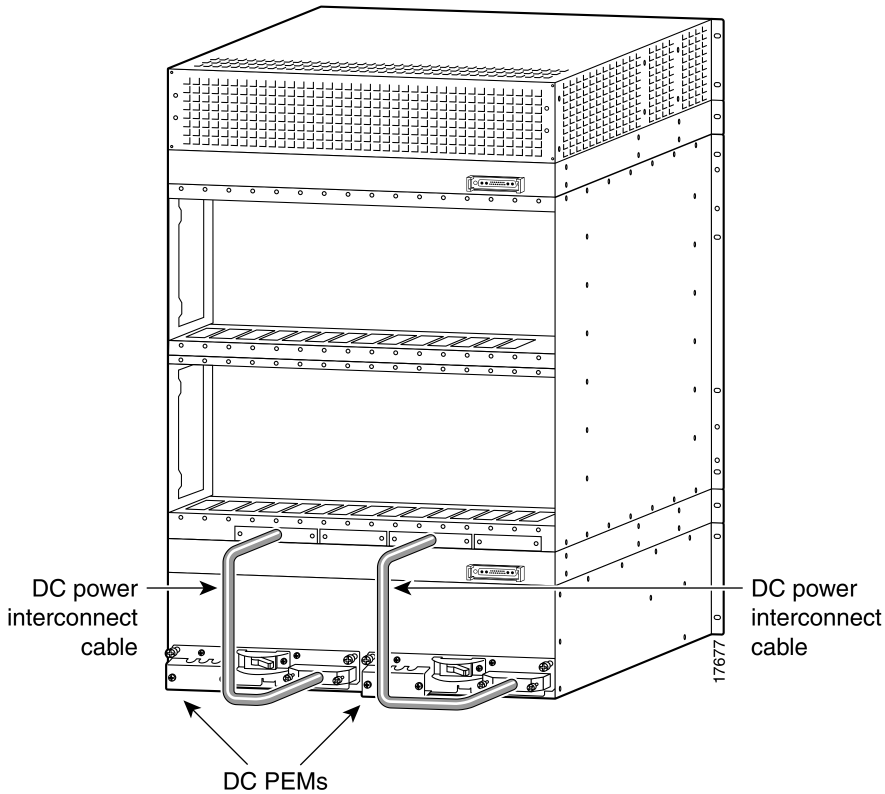


Figure 4-24 Access for System Power at the Backplane, DC-Powered Node



Install the Fan Power Cable

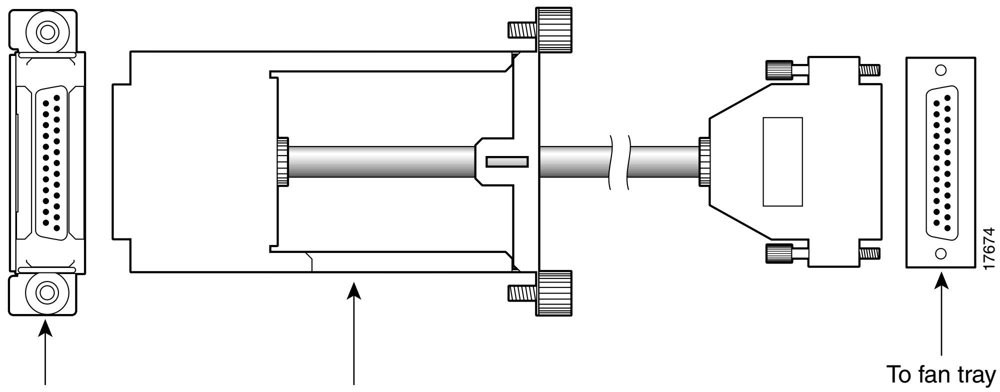
This section describes the fan power cables and how to install them.

Fan Cable Description

The fans receive power from the backplane through a fan power cable (see Figure 4-25). To reach the backplane connector, the fan power cable D-connector passes through an outer hole at the base of the card cage.

At the fan-tray end of the cable, the D-connector plugs into J1.

Figure 4-25 Fan Power Cable



Steps to Install the Fan Cable

Note that the holes for the system power cabling alternate with the smaller holes for fan power. From left to right, the sequence of access holes is

1. System power
2. Fan power
3. System power
4. Fan power. Use the fan power access hole on the far right for the upper fan tray.

Illustrations of the card cage area with the cabling holes for AC- and DC-powered systems are shown in Figure 4-26 and Figure 4-27.

Perform the following steps to install the fan power cabling:

Step 1 With the narrow row of pins shown in in the D-connector on the bottom, use two hands to slip the framed connector through the access hole at the base of the card cage. Move the connector straight toward the backplane so you can guide it through the second internal guide.

With the D-connector fully inserted in the backplane connector, the captive screws on the frame are clearly aligned with the threaded holes on the chassis.

Step 2 Tighten the captive screws only enough to secure the connector. Do not apply much torque, and do not use a power screw driver.

Step 3 Insert the D-connector in J1 on the fan tray and tighten the captive screws only enough to secure the connector. Do not use a power screw driver.

Step 4 For the mandatory fan tray, position its power cable to run through the channel formed by the mounting bracket on the right.

Figure 4-26 Access for Fan Power at the Backplane, 220 VAC-Powered Node

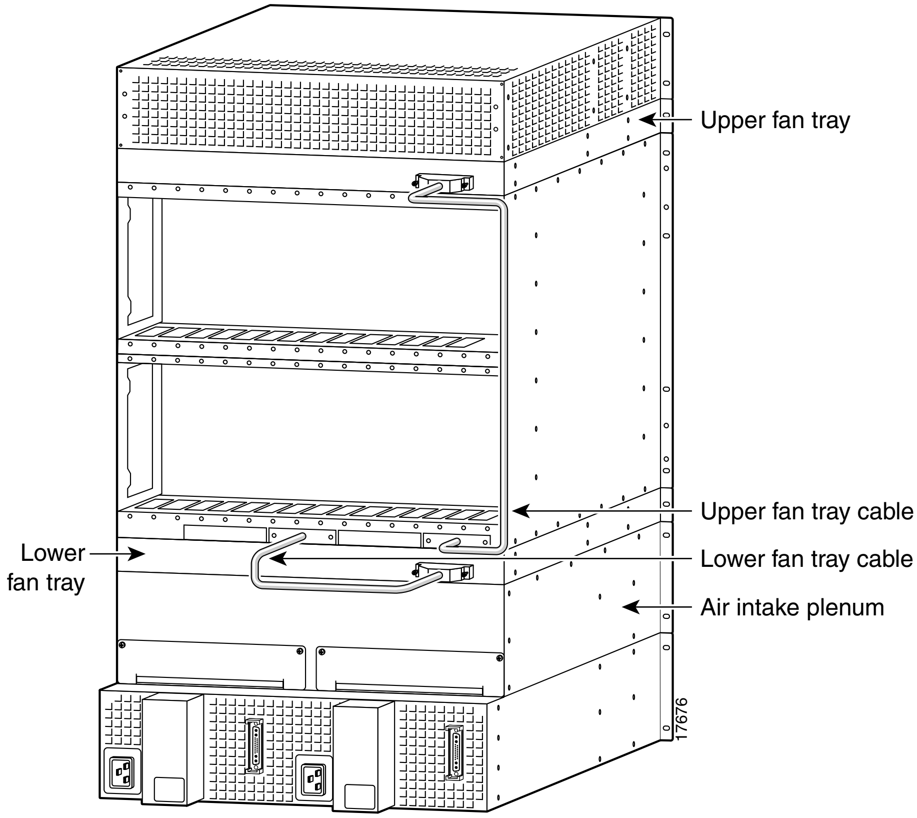
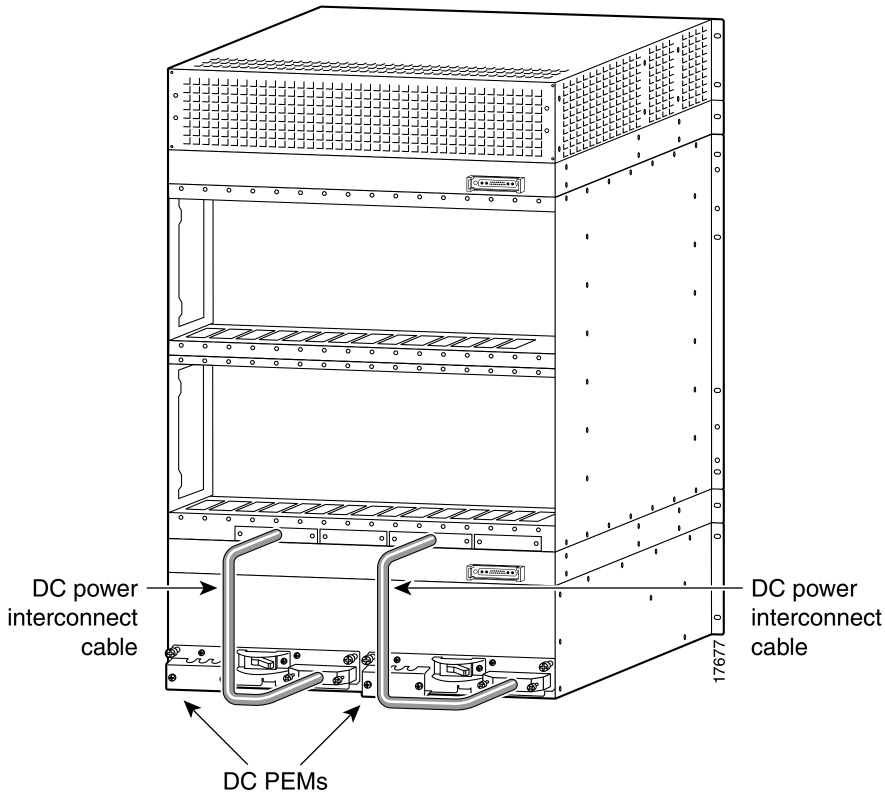


Figure 4-27 Access for Fan Power at the Backplane, DC-Powered Node



Initial Start-up of the MGX 8250

Before applying power to the MGX 8250, check the following items:

1. Switch has proper grounding.
2. AC or DC power sources are correctly installed.
3. All cards are locked in the correct slots.
4. All cables are secure.
5. Control terminal is connected.

After the preceding checks, turn on the power. Check the following items:

1. At the front of the unit, the status light on the PXM1 should be green.
2. For an AC-powered system, the AC and DC LEDs on each power supply should be green.
3. For a DC-powered system, the DC OK LED should be on.
4. After each service module comes up, the status LED should show that the card is in standby.
5. When power is turned on, make a visual check to verify that all fans are running.
6. After the system comes up, enter the **dsppwr** command.

Note Neither the AC power supplies nor any other components have test points for checking power supply voltages. For a visual check, observe whether the AC OK LED and DC OK LED are lit.

Note If you remove and reseat a back card or change it for another card, reset the related front card.

Converting Single-Height Slots to Double-Height Slots

Description	Parameters
Interfaces	Eight T1 or E1 T3 with optional SRM module Up to 5760/4608 (E1/T1) G.711 channels per MGX chassis
Voice Coding/Compression	PCM (G.711) ADPCM (G.726) CS-ACELP (G.729a/b) When mixing compression types, the overall capacity varies between 145 and 240 channels per VISM.
Voice Activity Detection	Configurable threshold on a per-channel basis
Echo Cancellation	Per G.164, G.165, and G.168, programmable up to 128 msec
Fax and Modem Transmission	Using PCM connection, 240 channels per module
PCM Encoding Types	mu-law or a-law encoding End-to-end conversion available
Channel Gain Control	-8 dB to +6 dB
Quantizing Distortion Added	2.5 quantizing distortion units (QDUs) with 32-kbps ADPCM over one hop plus 0.7 QDUs with digital loss packet assembler/disassembler (PAD) (mu-law or a-law)
Nominal Transmission Loss	0 dB at 1 kHz
Power Consumption	60W (estimated)
Weight (including back card)	Approximately 1.74 lb

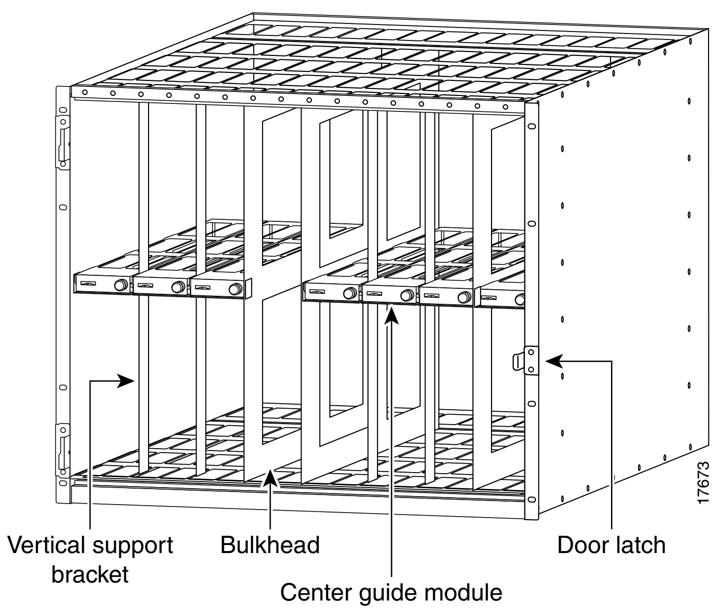
The wiring on the Cisco MGX 8250 backplane requires you to consider the conversion sequence and other details when you convert single-height slots to double-height slots. One slot conversion means that you convert four single-height slots to two double-height slots. Be aware of the following before you convert the slots:

- Slot conversions begin on the left (as you face the front of the chassis) and progress to the right. The starting point can be either slots 1–2 or slots 9–10. The exceptions are reserved slots 15–16 for the SRMs. You can convert SRM slots out of sequence.
- Slot conversions take place in the following pairs: 1–2, 3–4, 5–6, 9–10, 11–12, and 13–14.

- For conversions that involve either the left wall of the card cage or a bulkhead to the left of the slot, you must unscrew a track from the wall.
- After conversion, the new double-height slots take the number of the upper slot. For example, after you convert slots 1 and 2, slot numbers 17 and 18 become meaningless.
- Slots 7, 8, 15, 16, 31, and 32 are the reserved slots. The PXM1 cards (in a redundant configuration) reserve 7 and 8. If your system has one or more SRMs, the primary pair must reside in slots 15 and 31. The redundant pair resides in 16 and 32.

With a factory-installed MGX 8250 node, the single- and double-height cards reside in the preassigned locations. See Figure 4-28 for an illustration of an enclosure that shows installed cards and center guide modules. Certain slots have a small, L-shaped bracket holding in the card. All instances of this bracket are the card slots immediately to the right of an enclosure wall (or bulkhead). The system has three such brackets.

Figure 4-28 Front View of an AC-Powered Cisco MGX 8250



Each center guide module is secured by either a *vertical support bracket* or a simpler *support bracket*. Most center guide modules rely on the vertical support bracket. Three locations use the small support bracket: at the left wall of the card cage and at the bulkhead to the right of slot 8 or slot 14. For an illustration of a center guide module with support bracket, see Figure 4-30. For an illustration of a center guide module with *vertical* support bracket, see Figure 4-29.

Warning **Use extreme caution when completing the following steps with the system power turned on.**

Perform the following steps to convert four single-height slots to two double-height slots in an operational system:

Step 1 Remove the cabling from the back card unless the back card applies to the double-height configuration after the conversion.

Step 2 Remove the back card.

Step 3 Remove the front card.

Step 4 Repeat steps 2 and 3 for every other single-height module you remove.

Step 5 Rotate the screw that holds in the vertical center guide module.

Where either the left wall of the card cage or a bulkhead exists on the left of the single-height card slots, a simple, L-shaped bracket holds in the center guide module.

Step 6 If the center guide module has either type of wall to the left, unscrew the track attached to the wall. If necessary, remove cards to unscrew it.

Step 7 Remove the vertical support bracket by moving it up and down until you can take it out. A hole becomes visible in the center guide module for inserting a screwdriver.

Step 8 Insert a screwdriver and loosen the long screw that holds in the center guide module.

Step 9 Remove the center guide module.

Step 10 Install the double-height front card and back cards as needed.

A simpler situation exists when you install a new MGX 8250 in a non-Cisco rack or an existing Cisco cabinet—unscrew the center guide module and remove it. If the enclosure has the optional front door, blank faceplates are not necessary. With no door, you must install a blank faceplate if you create two double-height slots but install only one card.

Figure 4-29 Center Guide Module with Support Bracket

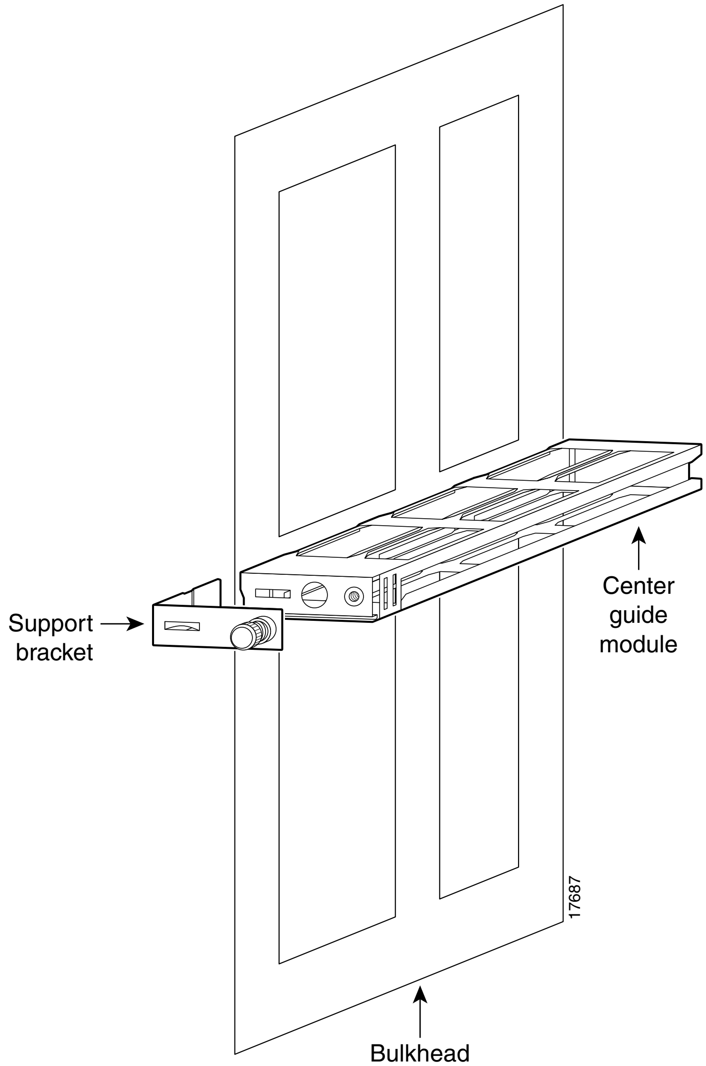
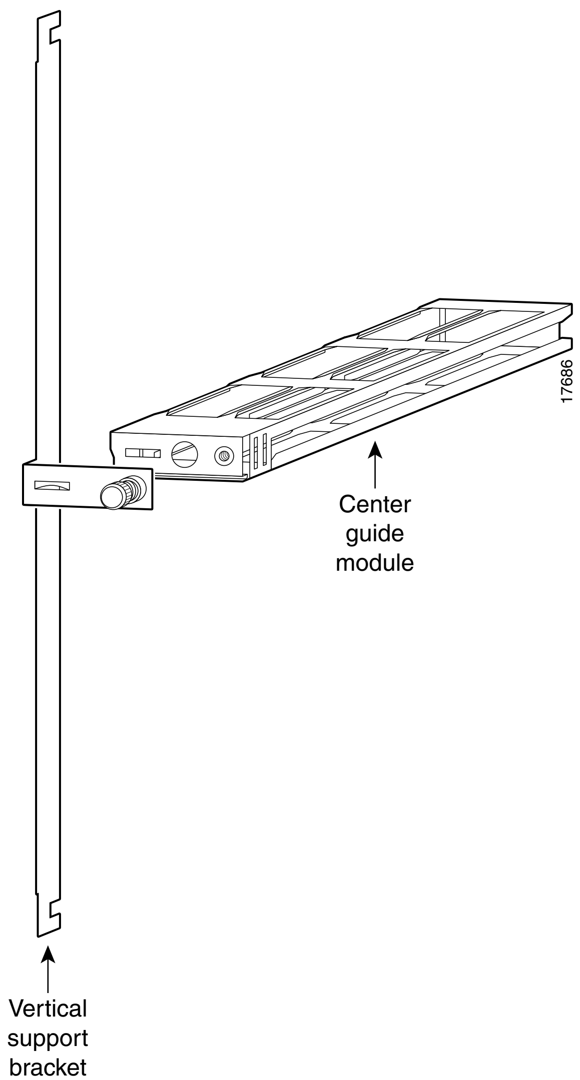


Figure 4-30 Center Guide Module with Vertical Support Bracket



CHAPTER 5

Configuring the MGX 8250 Shelf

Summary of Shelf-Level Tasks

This chapter describes the shelf-level tasks used to bring up and configure the MGX 8250. These tasks are performed after all hardware is installed and the power is on and alarm-free.

The initial tasks require the use of the command line interface (CLI) on an ASCII terminal.

Subsequent steps are performed with either the CiscoView application or the CLI.

This chapter contains the following sections:

- "User Interface Access Ports, page 5-2" describes the role of each shelf control port.
- "Initial Shelf Bring-Up, page 5-3" includes a summary of tasks to configure the shelf.
- "Bringing Up a PXM1 with No Runtime Firmware, page 5-4" describes how to load runtime firmware.
- "Configuring Node-Level Parameters, page 5-6" describes how to configure node-level parameters.
- "Downloading Firmware to a Service Module, page 5-11" describes service module firmware loading.

Note The words switch, node, and shelf are synonymous for the MGX 8250 product. The word bay refers to the upper or lower half of the enclosure.

Note To add an MGX 8250 feeder to the network, enter the **addshelf** command at the BPX 8600 series switch.

User Interface Access Ports

There are three external user-interface access ports on the PXM1 User Interface back card (PXM1-UI or PXM-UI-S3).

- control port
- Ethernet port
- maintenance port

See the "Initial Shelf Bring-Up" section on page 5-3 for additional information on the use of these ports.

Control Port

The control port (sometimes called the console port) is accessed with a CLI on an ASCII terminal. This port is used to make the initial IP address settings and to troubleshoot the shelf.

Low-level control and troubleshooting can be accessed through the CLI on a terminal connected to the shelf or through the CLI in a window of the Cisco WAN Manager application.

Initial Assignment of IP Addresses

IP addresses are assigned to the

- Ethernet port
- maintenance port
- in-band ATM IP address is used in the MGX 8250 feeder applications to link the PXM1 and BPX 8600 series switch
- IP address of the statistics manager

Note When the MGX 8250 is configured in a stand-alone application, only the workstation connected to the shelf can detect these IP addresses.

Before CiscoView or the Cisco WAN Manager (formerly StrataView Plus) can be used, the IP addresses for the shelf must reside on the workstation in the *etc/hosts* file. Also, the text file *config.sv* on the workstation must contain the name of the shelf is specified to be the gateway node, the network ID, the network name, and so on. Refer to the Cisco WAN Manager documentation for the file system requirements on the workstation.

Note When you use the CLI, you must *type* all required parameters and any optional parameters before you press **Return** or **Enter**.

Ethernet Port

Through the Ethernet port, you can use a workstation running a Cisco network management application such as the Cisco WAN Manager or CiscoView application. Typically, the workstation on a LAN is co-located with the MGX 8250.

Maintenance Port

Through the maintenance port (sometimes called the modem port), you can connect either a single workstation running an IP-based application or a terminal server that supports multiple workstations. The workstation must support SLIP. Typically, use of this port includes a modem because the shelf resides at a remote location. The typical applications are software and firmware download or tasks that require low-level access.

Other Ports

Other ports exist on the PXM1-UI and PXM-UI-S3. These ports support external clock sources and external, third-party audio or visual alarm systems.

IP-Based Applications

The maintenance port and Ethernet port support IP-based applications. Through these ports, the following applications run:

- Telnet supports CLI command execution from any IP-based application window as well as a window in the Cisco WAN Manager application.
- TFTP lets you download firmware and upload and download configuration information.
- SNMP supports equipment management through the CiscoView application and connection management through the Cisco WAN Manager application.

Initial Shelf Bring-Up

This section describes how to start up the MGX 8250 shelf for the first time.

- If the PXM1 does not have a runtime (or "online") firmware image, begin with the ""Bringing Up a PXM1 with No Runtime Firmware" section on page 5-4."
- If the PXM1 has a runtime firmware image, go to the ""Configuring Node-Level Parameters" section on page 5-6."

These two sections contain instructions for the following tasks:

- Establish communication with a shelf.
- Configure one or more boot-level IP addresses to make the shelf available to the network.
- Download PXM1 firmware.
- Configure a new, shelf-level Ethernet IP address for the PXM1 as needed or other SLIP or IP addresses.
- Specify a name for the shelf.
- Specify the time on the shelf.

Optionally configure a time zone for the Western Hemisphere, or configure a time zone relative to Greenwich Mean Time if the shelf resides outside the Western Hemisphere.

- Download firmware to the service modules.

Bringing Up a PXM1 with No Runtime Firmware

This section describes the tasks for loading runtime firmware onto a PXM1 that has only a boot loader. If the PXM1 already has a runtime firmware image, go to the ““Configuring Node-Level Parameters” section on page 5-6.”

Step 1 Establish communication with the shelf.

- If you are using an ASCII terminal connected to the control port, the command prompt is present upon power-up (if the display is skewed, make sure the terminal speed and PXM1-UI port speeds are the same).
- If you are using a utility such as Hyper Terminal on a PC, the firmware may reside on either a floppy or the hard drive.

Step 2 Enter the **bootChange** command to configure boot-level IP parameters.

If the shelf has a redundant PXM1, enter the **bootChange** command on each PXM1 to configure unique, boot-level IP addresses.

Note During the subsequent shelf-level configuration, you must configure another Ethernet IP address that applies to *both* PXM1s.

The following are the only parameters that are meaningful at this point. Press **Return** for other parameters.

- Mandatory “host name” is a name for the workstation. For the MGX 8250 node, enter the letter **c**.
- Ethernet IP address and subnet mask for the PXM1 LAN port are mandatory (see “inet on Ethernet” in the following example). Follow the IP address with a colon and a net mask. The netmask is eight hexadecimal numbers with no embedded periods. Do not type spaces on either side of the colon.
- If the workstation from which you download firmware is on a subnet other than the subnet of the PXM1, enter a gateway IP address (“gateway inet”).

Note There are three editing functions near the top of the following example. Of these, typing a period to clear the current field is the most commonly used.

```
>bootChange
'.' = clear field;  '-' = go to previous field;  ^D = quit
boot device          : lnPci
processor number     : 0
host name            :c
file name            :
inet on ethernet (e) : 188.29.37.14:ffffff00
inet on backplane (b):
host inet (h)        :
gateway inet (g)     : 188.29.37.1
user (u)             :
ftp password (pw) (blank = use rsh):
flags (f)            : 0x0
target name (tn)     :
startup script (s)   :
other (o)            :
```

The PXM1 now has a boot-level IP address. Remember to repeat the **bootChange** command on the redundant PXM1, if one is installed.

Step 3 Enter **reboot** to reset the PXM1.

The PXM1 is ready to receive a firmware image through the Ethernet port. Use the workstation for the next steps.

Step 4 To confirm that the node is accessible (optional), ping the PXM1 at the workstation.

Step 5 Establish communication with the PXM1 according to the user-communication device type. For example, at the prompt on a UNIX workstation, you could enter:

>tip -9600 /dev/ttya

The device specification could also be ttyb.

Step 6 Enter the **tftp** command with the IP address set at the ASCII terminal. For example, if the console port is connected to the serial port of the workstation enter:

$**tftp** 162.29.38.101

Step 7 At the tftp prompt, enter binary mode:

>bin

Step 8 From the directory where the firmware resides, enter the **put** command.

Include the arguments that specify the firmware release number, the statement that this firmware applies to the active PXM1, and the release directory. If necessary, refer to the release notes for new firmware release numbers. The entries are case-sensitive.

For example,

>put pxm_*release_number*.fw POPEYE@PXM_ACTIVE.FW

release_number is a decimal number in the form *n.n.nn*. Currently, the initial *n* is typically a “1.” An example filename for PXM1 firmware is “pxm_1.0.03.”

Note The download automatically includes the firmware for the standby PXM1 (if present). You can subsequently see POPEYE@PXM_STANDBY.FW in c:/FW.

Check the console to verify that the transfer completed and the checksum passed.

Step 9 Quit the TFTP application. Go to the ASCII terminal connected to the control port and enter the **quit** command.

>quit

Step 10 At the ASCII terminal, enter the **cd** command to access the FW directory on the hard drive.

Step 11 List the contents to confirm that the firmware resides in the FW directory.

>cd “c:/FW”

>ll

Note These required quote marks are absent when you use the CLI after you reboot the PXM1 with its runtime image (see the ““Configuring Node-Level Parameters” section on page 5-6”).

Step 12 Enter the following command.

>setPXMPrimary “*version*”

version is the version number of the firmware. The name of a PXM1 firmware file has the format pxm_*version*.fw. For example: in PXM_1.0.03.fw, *version* is 1.0.03.

Step 13 Reboot the system again.

>reboot

A login prompt appears on the ASCII terminal. The PXM1 is now the same as a PXM1 that Cisco ships with a runtime firmware image.

Configuring Node-Level Parameters

Except for adding a user and creating a password, all the tasks described in this section can be performed through the CiscoView application. For descriptions of the commands you enter at the CLI, refer to the *Cisco MGX 8250 Multiservice Gateway Command Reference*.

A representation of the feeder application of the MGX 8250 shelf appears in Figure 5-1.

A representation of the stand-alone application of the shelf appears in Figure 5-2.

Figure 5-1 Feeder Application

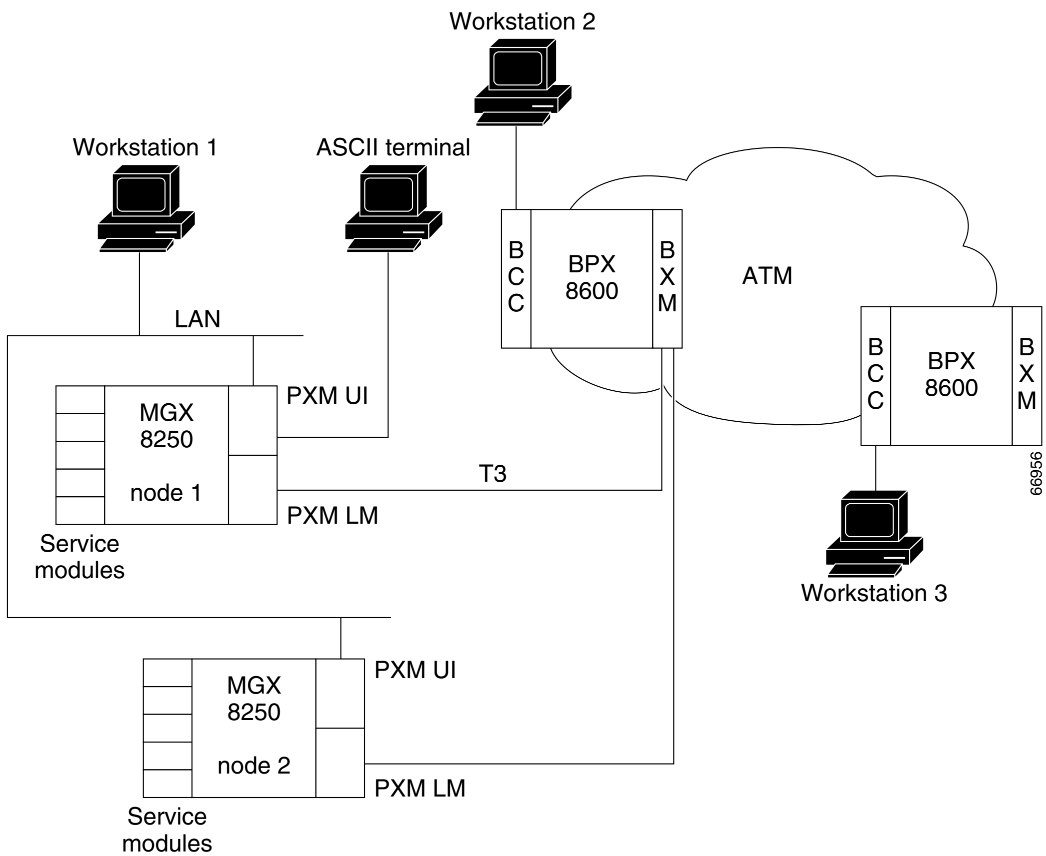
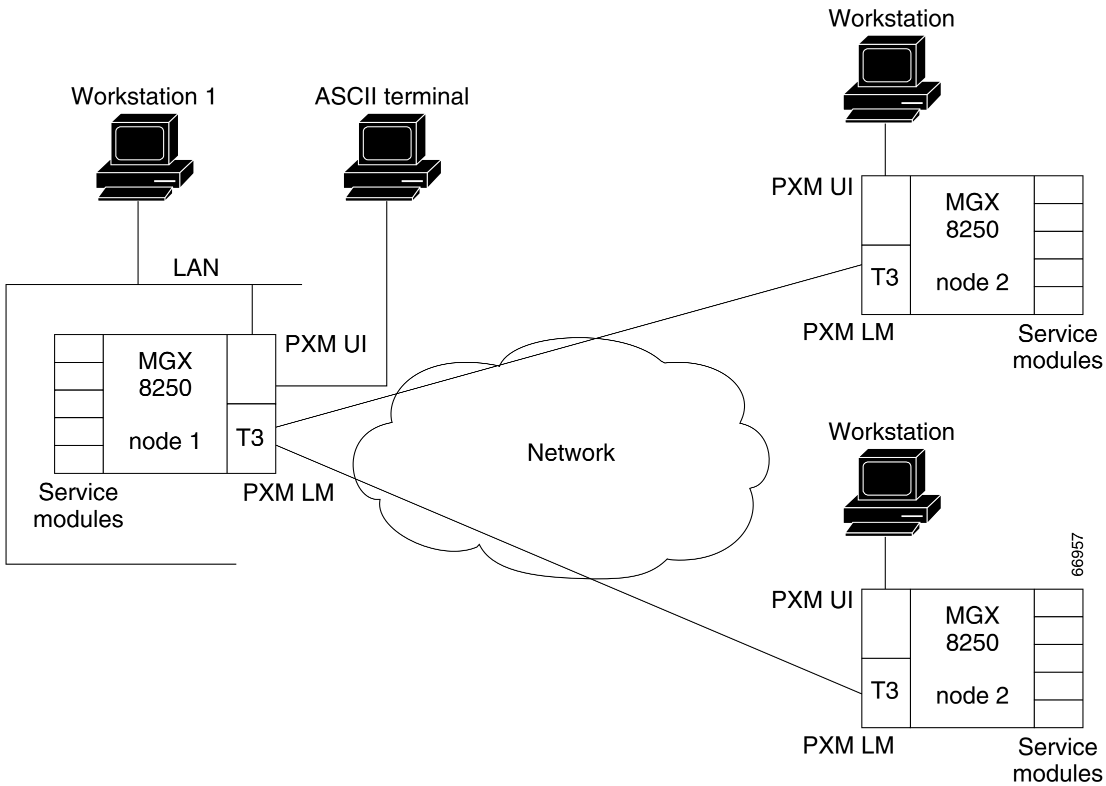


Figure 5-2 Stand-Alone Application



At the CLI prompt on the ASCII terminal perform the following steps.

Step 1 Enter the default login and password provided in the Release Notes.

The terminal displays the slot number of the PXM1 you have logged into by default:

card number [7].

Step 2 Press **Return** to enter the CLI of this PXM1.

At runtime, you could also enter the slot number of a service module or a standby PXM1. In this case, the CLI prompt shows:

NODENAME.1.7.PXM.a>

where NODENAME shows that the node has no name; the slot number of the PXM1 is 7; and this PXM1 is active. The general format of the CLI prompt is:

nodename.1.*slot*.*cardtype*.a>

where *nodename* is the name of the node; the shelf (node) number is always 1; *slot* is the card location; *cardtype* identifies the card; and the card state is active (a) or standby (s).

Step 3 Display the cards in the system

NODENAME.1.7.PXM.a> **dspcds**

Step 4 Display any IP addresses in the system

NODENAME.1.7.PXM.a> **dspifip**

Step 5 Change the IP addresses as needed

NODENAME.1.7.PXM.a> **cnfifip** <*interface*> <*IP_Addr*> <*Net_Mask*> [*BrocastAddr*]

where *interface* is a number: 26 is the Ethernet (LAN AUI) port, 28 is the maintenance port (SLIP), or 37 for the ATM IP address (feeder application only). Note that *BrocastAddr* applies to only the Ethernet interface (number 26).

Note Check the Release Notes for any variations in how to configure IP addresses.

Step 6 Enter the **cnfname** command to assign a name to the shelf.

UNKNOWN.1.7.PXM.a> **cnfname** <*node name*>

where *node name* is a case-sensitive name up to eight characters. For example,

UNKNOWN.1.7.PXM.a> **cnfname** cisco22

Step 7 Enter the **cnftime** command to specify the time on the shelf.

cisco22.1.7.PXM.a> **cnftime** <*hh:mm:ss*>

hh	The hour of the day in the range 1–24
mm	The minute of the hour in the range 1–60
ss	The number of seconds in the minute and has a range of 1–6

Step 8 Optionally configure a time zone for the node. Enter **cnftmzn** to specify a time zone in the Western Hemisphere. To configure a time zone outside the Western Hemisphere, first specify Greenwich Mean Time (GMT) with **cnftmzn** then specify the offset from GMT by entering **cnftmzngmt**:

- cisco22.1.7.PXM.a> **cnftmzn** <*timezone*>

timezone	The timezone of the shelf: 1 for GMT, 2 for EST, 3 for CST, 4 for MST, 5 for PST

- cisco22.1.7.PXM.a> **cnftmzngmt** <*timeoffsetGMT*>

timeoffset	The timezone offset from GMT in hours. In the range of -12 to 12.

Step 9 Execute the **cnfstatsmgr** command to specify the IP address of the workstation that runs the Cisco WAN Manager application.

Before it sends statistics, the MGX 8250 node must have the IP address of the workstation with this application. The syntax is

>**cnfstatsmgr** <*IP_Addr*>

IP_Addr	The IP address of the workstation

If the node has a redundant PXM1, it automatically receives the same IP addresses and configuration as the primary PXM1. With the IP addresses in place, you can configure the logical ports for the broadband interface through the CiscoView application or the CLI.

Step 10 Add one or more users by entering the **adduser** command once for each new user.

Note Note that the access privilege level is case-sensitive as the syntax description indicates. After you enter the privilege level, the system prompts for a new password for the user. (This password parameter does not appear in the help information for **adduser**.)

adduser <*user_Id*> <*accessLevel*>

user_Id	The *user_Id* is 1–12 alphanumeric characters
accessLevel	The *accessLevel* is the case-sensitive privilege level. It can be ANYUSER or within the range GROUP1–GROUP5. For example, to specify a privilege level 2, type GROUP2

After you enter a user-name and privilege level, the system prompts for a password. The password is a string of 5–15 characters. If you press Enter without entering a password, the system assigns the default password "newuser."

Step 11 Optionally change your password or another user's password by entering:

cnfpasswd [*username*]

username is the name of another user whose password you are changing. That user must have a privilege level that is lower than your privilege. To change your own password, enter **cnfpasswd** with no *username*.

Step 12 To specify the shelf as a feeder, enter the **cnfswfunc** command.

cnfswfunc <*-ndtype*>

and follow -ndtype with "fdr."

Step 13 Configure an external clock if needed.

a. Set the clock interface type.
cnfextclk <clock-type>: "1" is for T1 connections, "2" is for E1 connections.

b. Set the external clocking type.
cnfclklevel 4: to enable Stratum-4 clocking.
cnfclklevel 3: to enable Stratum-3 clocking.

Note Stratum 3 clocking is available with the PXM -UI-S3 back card. Stratum-4 clocking is only available with internal clock sources or with the PXM1-UI back card.

Note See the "Configuring Synchronization for the Shelf" section on page 6-6 for more information on configuring external clock sources.

> **Note** See the "Making External Clock Connections" section on page 2-4 for information on the physical connections for external clocking. This section also contains a description of the PXM1-UI and PXM-UI-S3 back cards.

Step 14 Configure (as needed) double-speed clocks for individual cell buses by entering **cnfcbclk**.

cnfcbclk <*cellBus*> <*clockRate*>

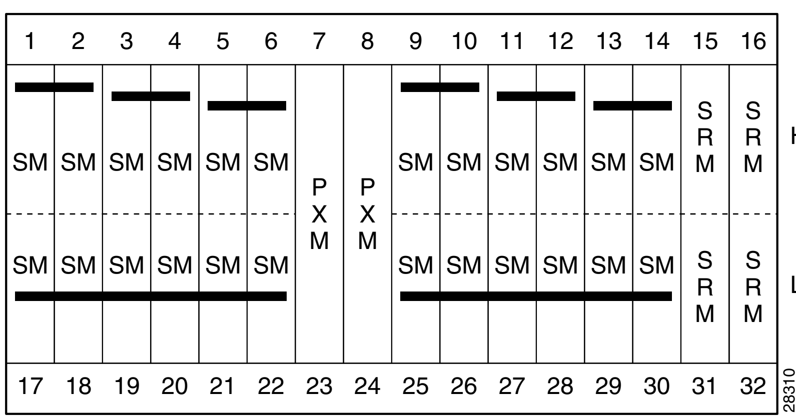
cellBus	A string in the range CB1–CB8 that identifies the cell bus
clockRate	A number that identifies the rate in megahertz; choices are 21 or 42

The distribution of the eight cell buses follows.

- cell bus 1 (CB1) connects slots 1 and 2 to the PXM1
- cell bus 2 (CB2) connects slots 3 and 4 to the PXM1
- cell bus 3 (CB3) connects slots 5 and 6 to the PXM1
- cell bus 4 (CB4) connects slots 9 and 10 to the PXM1
- cell bus 5 (CB5) connects slots 11 and 12 to the PXM1
- cell bus 6 (CB6) connects slots 13 and 14 to the PXM1
- cell bus 7 (CB7) connects slots 17, 18, 19, 20, 21 and 22 to the PXM1
- cell bus 8 (CB8) connects slots 25, 26, 27, 28, 29 and 30 to the PXM1

In the top bay, each of the six cell buses serves two card slots. In the bottom bay, each of the two cell buses serves six card slots. Therefore, each top slot has three times the available bandwidth of the lower slots and is therefore better suited to the higher speed cards. The bandwidth concentration for cell buses in the upper and lower bays is illustrated in Figure 5-3.

Figure 5-3 Bandwidth Concentration in Upper and Lower Bays



Downloading Firmware to a Service Module

This section contains instructions to load service module firmware from a workstation to the hard drive on the PXM1. This is done when upgrading the existing firmware or because no runtime firmware resides on the hard drive.

Service modules do not retain runtime firmware. The hard drive on the PXM1 may come with default firmware for the service modules, but the details of the customer order actually determine whether firmware is on the disk. If default firmware exists on the hard drive, the PXM1 downloads it upon power-up or when you reset the card. You can download firmware from the workstation according to the instructions that follow.

Note If you download firmware from a workstation to the hard drive, the PXM1 does not automatically load the firmware to the card. You must reset the card (**resetcd** on the CLI) to download firmware from disk to the card. With the single execution of a command, you can load either generic firmware for all cards of a certain type or firmware destined to a specific slot.

Step 1 Start the TFTP application:

$**tftp** <*IP address*>

then

>**bin**

Step 2 Enter the **put** command to download generic firmware for a type of service module to the PXM1 hard drive:

>**put** *cardtype*.fw POPEYE@SM_1_0.FW

cardtype is the firmware for a type of card; the shelf number always is 1; and the 0 represents the slot number for the purpose of generic download. An example of *cardtype*.fw is “frsm8t1e1_10.0.11.fw.” Note the space between “.fw” and “POPEYE.”

Step 3 Enter the **put** command to load slot-specific firmware at a particular card:

>**put** *cardtype*.fw POPEYE@SM_1_*slot*.FW

cardtype is the firmware, and *slot* is the number of the card slot. Note the space between “.fw” and “POPEYE.” Repeat this step for each slot as needed.

Note Slot-specific firmware overwrites the current firmware at a slot.

With slot-specific firmware, the card does not come up if you:

- Specify the wrong firmware, where the firmware specified by *cardtype* does not match the targeted card at *slot*.
- Insert a different card (which does not use the firmware specified for the slot).

An example command for downloading specific firmware for an FRSM-2CT3 in slot 3 is

>**put** frsm2ct3_10.0.01.fw POPEYE@SM_1_3.FW

“frsm2ct3_10.0.0” refers to the firmware for the FRSM-2CT3, and “3” is the slot.

Note Refer to the Release Notes for the current names of firmware files and release directories.

Step 4 When you have finished downloading firmware, enter **quit** to quit the TFTP application.

Step 5 At the CLI on either the workstation or the ACSII terminal, display the firmware files. Note that the directory specification **ll** c:/FW has no quote marks.

cisco22.1.7.PXM.a> **ll** c:/FW

Step 6 If you want to download the firmware from the disk to a card, enter the **resetcd** command.

CHAPTER 6

Card and Service Configuration

This chapter includes instructions to configure MGX 8250 cards and services. This chapter includes the following sections:

- Tasks and Rules to Configure Cards and Services, page 6-2
- Processor Switching Module, page 6-5
- ATM Universal Service Module (AUSM), page 6-16
- Frame Service Module Features, page 6-26
- Configuring Frame Relay Service, page 6-29
- Circuit Emulation Service Module for T3 and E3, page 6-45
- Eight-Port Circuit Emulation Service Modules, page 6-51
- Service Resource Module, page 6-60
- Online Diagnostics Test, page 6-67
- DS3 Loopback Test, page 6-69

Note The instructions in this chapter presume that a plan exists for your network. Some of the information related to network planning is reviewed in this chapter.

Note For configuration information on the Voice Interworking Service Module (VISM), refer to the *Cisco Voice Interworking Service Module Installation and Configuration* Guide

Note For configuration information on the Route Processor Module (RPM), refer to the *Cisco MGX Route Processor Module Installation and Configuration Guide*.

Note General instructions to physically insert and remove cards are in “Chapter 4, “Enclosure and Card Installation”

Tasks and Rules to Configure Cards and Services

This section contains a general description of the sequence of tasks to configure cards and services. Tasks for individual cards appear in the subsequent sections.

This section contains the following topics:

- Sequence of Configuration Tasks, page 6-2.
- Modifying the Resource Partitioning, page 6-2.
- Rules for Adding Connections, page 6-3.
  - Rules for Adding a DAX Connection, page 6-3
  - Rules for Adding Three-Segment Connections, page 6-4
  - Rules for Adding Management Connections, page 6-4

Sequence of Configuration Tasks

In a new shelf, the common approach is to perform the same configuration task for all cards at once. For example, adding logical ports to all applicable cards.

When installing a single card, the likely sequence is to first specify the card-level features, and continue until you have configured every connection.

The following list outlines the common tasks for configuring cards in a new shelf:

1. Optionally configure the service modules for redundancy (this does not apply to the RPM). This card-level operation requires redundant cards and possibly an MGX-SRM-3T3/C.
2. Optionally configure resource partitioning for the whole card (if the default partitioning does not fulfill the purpose of the card).
3. Activate the physical lines.
4. Configure the line if default the parameters are not appropriate.
5. Create the logical ports, then modify them as needed.
6. Optionally configure resource partitions for a logical port (if the default partitioning does not support the intended operation of the port).
7. Add connections, then modify them as needed.

Modifying the Resource Partitioning

A resource partition at the card level consists of a number of logical connection numbers (LCNs). At the port level, a resource partition consists of a percentage of bandwidth, a DLCI or VPI/VCI range, and the number of LCNs available to a network control application. On the PXM1, the connections are global logical connection numbers (GLCNs).

By default, all resources on a a card or logical port are available to any controller on a first-come, first-served basis. If necessary, you can modify the resource partitioning at the card level or logical port level. Port-level resource modification follows card-level modification, so the available port-level resources depend on whether and how much you change the card-level resource partitioning. You do not have to change the resource partitioning for the card before changing resource partitioning for a port.

The current network control application is Portable AutoRoute (PAR). Planning considerations should include the possibility of modifying the partitioning of resources for the interface. For example, the MGX 8250 has the capacity to support a Cisco Multiprotocol Label Switching (MPLS) controller or a private network-to-network interface (PNNI) controller.

Rules for Adding Connections

This section includes rules for adding the following types of connections:

- Rules for Adding a DAX Connection—Local-only, digital access, and cross-connect (DAX) connections.
- Rules for Adding Three-Segment Connections—Connections across an ATM or Frame Relay network.
- Rules for Adding Management Connections—In-band connection that allow a workstation to control a local or remote MGX 8250 through a service module. Although the rules include references to CLI syntax, they also apply to the Cisco WAN Manager application.

Rules for Adding a DAX Connection

A DAX connection is a connection whose endpoints for the entire connection exist on the same shelf. The following rules apply to the MGX 8250:

1. On a feeder, a DAX connection can exist between different service modules or the same service module.
2. A stand-alone node supports DAX connections with one or both endpoints on the PXM1 in addition to DAX cons between service modules.
3. Either endpoint can be the master.
4. The first endpoint to add is the slave. The generic syntax is

   addcon <*local parameters*>

local parameters	The port, DLCI or VPI and VCI, and mastership status

   Slave is the default case, so you actually do not explicitly have to specify it. When you press **Return**, the system returns a connection identifier. The identifier includes the port and DLCI or VPI and VCI.

   Use the identifier to specify the slave endpoint when you subsequently add the connection at the master end. The slave endpoint is specified as the *remote parameters* in item 5.
5. To complete the DAX con, add the master endpoint. The generic syntax is

   addcon <*local parameters*> <*remote parameters*>

local parameters	The port, DLCI or VPI and VCI, and mastership status (master in this case).
remote parameters	The items in the connection identifier that the system returned when you added the slave endpoint.

6. If the endpoint is a PXM1 port in a stand-alone node, specify the slot as 0. The **addcon** command is the only command in which you specify the slot number for the PXM1 as 0.

Rules for Adding Three-Segment Connections

A three-segment connection consists of a local segment on each MGX 8250 at the edges of the network cloud, and a middle segment across the network cloud.

The MGX 8250 requirements are:

1. For MGX 8250 feeder nodes, the backbone must consist of BPX 8600 series switches.
2. For MGX 8250 stand-alone shelves, the backbone switches can be either BPX 8600 series switches or switches from another manufacturer.
3. On a feeder node, the local segment exists between a service module and the PXM1.
4. On a stand-alone node, the local segment can exist between a service module and a port on the PXM1 card or between two ports on the PXM1 card.
5. For the local segment, add the connection at only the master endpoint. The generic syntax for the **addcon** command is:

   addcon <*local parameters*> <*remote parameters*>

local parameters	The port, DLCI or VPI and VCI, and mastership status (master in this case)
remote parameters	The current nodename, slot, port, and VPI and VCI of the slave end For the PXM1 endpoints, specify the slot number as 0. The **addcon** command is the only command in which you specify the slot number for the PXM1 as 0.

Rules for Adding Management Connections

This section describes the requirements for adding an inband ATM PVC for managing an MGX 8250 in stand-alone node. A management connection lets a workstation connected through a router control either the local MGX 8250 node or a remote MGX 8250 node that has no workstation. The typical configuration has as the connecting router feed an AUSM/B, FRSM, RPM, or PXM1 UNI port.

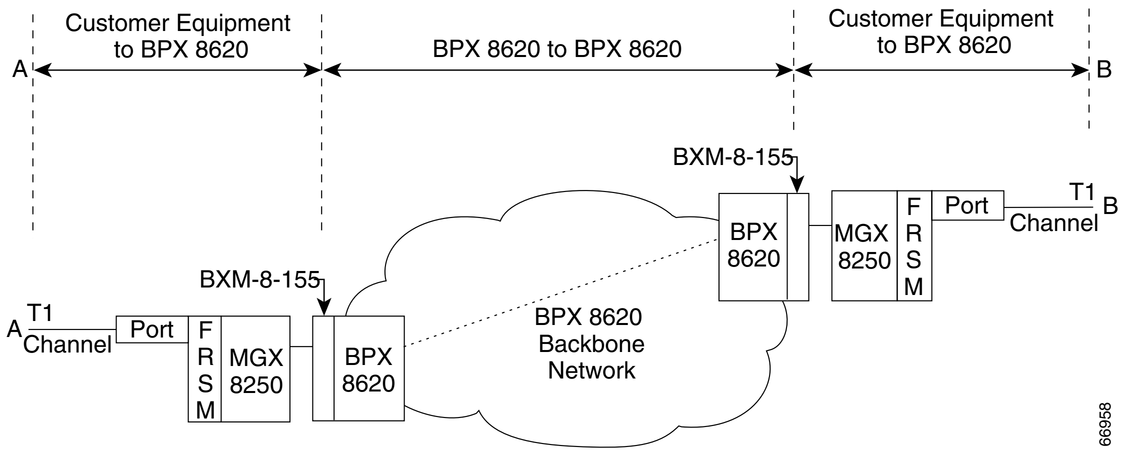
A management connection can be either a DAX connection or a three-segment connection. The maximum number of management connections is eight. The DAX connection exists between a service module or PXM1 UNI and port 34 of the local PXM1. PXM1 port 34 is a reserved port for management connections on a stand-alone node. The network in Figure 6-1 shows FRSMs in a feeder application.

A three-segment management connection includes the following segments:

1. Local segment between a near-end service module or PXM1 UNI and a PXM1 port in the range 1–32.
2. Middle segment across the network cloud.
3. Local segment between a remote PXM1 port in the range 1–32 and port 34 of that same PXM1.

The path from “A” to “B” in Figure 6-1 consists of three segments. A segment exists between the FRSM and the PXM1 on each MGX 8250. The middle segment exists between the BXMs at the edges of the ATM cloud and may traverse BPX 8600 via nodes in the cloud. The VPI and VCI at each BPX 8600 series switch connected to an MGX 8250 feeder must match the VPI and VCI on the slave endpoint of the connected PXM1. The VPIs and VCIs at the endpoints of the middle segment do not have to match. If you use the CLI rather than the Cisco WAN Manager application, add each segment through the CLI at each switch.

Figure 6-1 Frame Relay Connection Through an MGX 8250-BPX 8600 Series Network



Processor Switching Module

This section describes how to activate and configure the card-level parameters, lines, and ports on the PXM1 uplink card. This section also describes how to add connections to the PXM1 in a stand-alone node.

The descriptions include instructions to complete the following tasks:

- Modify the resource partitioning at the card level (optional).
- Activate a line on the *uplink* card. On a stand-alone node, you can activate more than one line if the uplink card has multiple lines. One physical line must be the trunk to a network routing node.
- Optionally configure a clock source on the PXM1 or a service module. Note that a service module line must be active before you can configure it as a clock source. See the "Configuring Synchronization for the Shelf" section on page 6-6 for more information.
- If the shelf has a pair of SRMs for bulk distribution and you use the CLI rather than the CiscoView application, activate the SRM lines from the PXM1.
- Optionally modify the resource partitioning at the port level.
- Create logical ports.
- On a stand-alone node, specify the cell header type. UNI cell headers typically apply where a workstation connects to a UNI port on the uplink card rather than a port on the PXM1-UI card. Such an implementation is not common.
- On a stand-alone node, add standard connections and optional management connections.
- On a stand-alone node, configure Automatic Protection Switching (APS).
- For a feeder, complete the steps on the connected BPX 8600 series switch to make the feeder an available resource in the network.

Note For a description of the bit error rate test (BERT) functions, see the "Bit Error Rate Testing Through an MGX-SRM-3T3" section on page 6-63.

Configuring Synchronization for the Shelf

This section defines the clock sources for the MGX 8250, then describes how to configure each source.

Clock Sources

The available clock sources are as follows:

- The *internal* clock comes from an oscillator on the PXM1. It is the default source when the shelf first comes up and it remains until a different clock source is specified. This default source is a Stratum-4 clock. Stratum-3 can also be used as an internal clock source.
- The *trunk interface* clock originates on a BPX 8600 series node or another vendor's switch and comes through the line on the PXM1s back card.
- An *external* clock source comes from an external timing source and arrives at the T1 or E1 connections on the PXM1 user interface back card. Frequently, the external device is a highly reliable, dedicated device.
- For *external* Stratum-4 clock sources, the PXM1-UI back card must be used.
- For *external* Stratum-3 clock sources, the PXM-UI-S3 back card must be used.

  Note See the "Making External Clock Connections" section on page 2-4 for information on the physical connections for external clocking.

- An additional step is necessary to configure an external clock source (see below).
- A *UNI interface* on a service module or PXM1 UNI port can be a clock source. A line must be active before you can specify it as a clock source.

Clock Source Types

The clock *types* are: *primary*, *secondary*, and *tertiary*.

For example, you could configure an external clock source as the primary source, a line as a secondary source, and the internal oscillator as the tertiary source. Note that if you specify a tertiary source, it is always the internal oscillator.

Clock Source Configuration

After the PXM1 broadband interfaces and the service module lines are configured, you can configure the clock sources through the CiscoView application or the CLI. If you use the CLI, enter the **cnfclksrc** command on the active PXM1 one time for each clock source.

cnfclksrc <*slot.port*> <*clktyp*>

slot.port	The parameter *slot.port* specifies the clock source. If a service module provides the source, *slot* is the slot number of the card, and *port* is the number of the line that provides the clock. On the PXM1 • *slot* is 7 regardless of where the active PXM1 resides. • *port* for the in-band clock is always 1. • *port* for the external clock is always 35. • *port* for the UNI line (stand-alone only) depends on the number of lines you have set up on the back card.
clktyp	The clock type: P for primary, S for secondary, T for tertiary, or N for null. The only purpose of null is to remove the clock configuration that currently applies to the specified source (*slot.port*).

Caution Be careful not to set multiple primary and secondaries.

Configuration Example

For example, to configure the inband interface as the primary clock source and an external clock device as the secondary source, enter the following commands.

Step 1 Specify the clock source.

a. For an external clock source:

```
popeye1r.1.8.PXM.a > cnfclksrc 7.35 S
```

b. For an internal clock source:

```
popeye1r.1.8.PXM.a > cnfclksrc 7.1 P
```

Step 2 To check the configuration by entering the **dspclksrc** command.

If you have specified an external clock source, use the CiscoView application or the CLI command **cnfextclk** to select the T1 or E1 line and the impedance of the line. The syntax for **cnfextclk** is

cnfextclk <*ClockType*> <*Impedance*>

ClockType	The clock type: 1 for T1 or 2 for E1
Impedance	The Impedance: 1 for 75 ohms, 2 for 100 ohms, or 3 for 120 ohms

Step 3 Specify the Stratum level of the clock source (Stratum-3 or Stratum-4).

cnfclklevel <*level*>

level	The Stratum level: 3 for Stratum-3 clocking or 4 for Stratum-4 clocking.

Note For external clocking sources, Stratum-3 is supported by the PXM-UI-S3 card; Stratum-4 sources are supported by the PXM1-UI back card. Either Stratum-3 or Stratum-4 can be used as *internal clocking sources*.

Configuring PXM1 Card-Level Parameters, Lines, and Ports

This section describes how to configure card-level features, activate a physical line, and configure logical elements such as a port.

See the "Tasks and Rules to Configure Cards and Services" section on page 6-2 for background information on these types of tasks.

Step 1 Optionally, to modify the resource partitioning for the whole card by entering the **cnfcdrscprtn** command. You can view resource partitioning through the **dspcdrscprtn** command.

cnfcdrscprtn <*number_PAR_conns*> <*number_PNNI_conns*> <*number_TAG_conns*>

number_PAR _conns	The number of connections in the range 0–32767 for PAR
number_PNN I_conns	The number in the range 0–32767 available to PNNI
number_TAG _conns	The number of connections in the range 0–32767 for MPLS

- *number_PAR_conns* is the number of connections in the range 0–32767 for PAR.
- *number_PNNI_conns* is the number in the range 0–32767 available to PNNI.
- *number_TAG_conns* is the number of connections in the range 0–32767 for MPLS.

For example, to reserve 10,000 connections for each controller on a PXM1 with

cnfcdrscprtn 10000 10000 10000

Step 2 Activate a line by entering the **addln** command.

addln -ds3 <*slot.line*> | -e3 <*slot.line*> | -sonet <*slot.line*>

-ds3	Indicates a T3 line parameter follows.
-e3	Indicates an E3 line parameter follows.
-sonet	Indicates an OC-3 or OC-12 line parameter follows.
slot	Slot is 7 or 8 for the PXM1. If the shelf has a redundant pair of SRMs, enter the **addln** command for slots 15, 16, 31, and 32
line	The range is 1–4 but it depends on the number of lines on the back card.

For a feeder, you can activate only one line. For a stand-alone, you can activate more than one line if the back card has multiple lines. One line must serve as the trunk to the ATM network. With an OC-3, T3, or E3 card, remaining lines can serve as UNI ports to CPE.

Step 3 If necessary, modify the characteristics of a line by entering the **cnfln** command.

Step 4 Configure logical ports for the physical line by entering the **addport** command. Enter the **addport** command once for each logical port. Related commands are **cnfport**, **dspports**, and **delport**.

addport <*port_num*> <*line_num*> <*pct_bw*> <*min_vpi*> <*max_vpi*>

port_num	The number for the logical port. The range is 1–32 for user-ports or 34 for inband ATM PVCs that serve as management connections
line_num	The line number in the range 1–4 but depends on the type of uplink card
pct_bw	The percentage of bandwidth. The range is 0–100. This parameter applies to both ingress and egress
min_vpi	The minimum VPI value. On a feeder, the range is 0–4095. On a stand-alone node, the range is 0–255
max_vpi	The maximum VPI value. On a feeder, the range is 0–4095. On a stand-alone node, the range is 0–255

The following example uses 100% of the bandwidth on one logical port 1

addport 1 1 100 1 200

- The first "1" is the logical port number.
- The second "1" is the line number on the PXM1 back card to which you are assigning this logical port number.
- "100" is the percentage of bandwidth this port has in both directions;
- The VPI range is 1–200.

Step 5 If necessary, enter the **cnfportrscprtn** command to modify port-level resources for a controller

cnfportrscprtn <*port_no*> <*controller*> <*ingress_%BW*> <*egress_%BW*> <*min_VPI*> <*max_VPI*> <*min_VCI*> <*max_VCI*> <*max_GLCNs*>

port_no	The logical port number in the range 1–32 for user-connections or 34 for inband ATM PVCs for network management
controller	A string identifying the network controller—PAR, PNNI, or TAG
ingress_%BW	The percentage of ingress bandwidth in the range 0–100
egress_%BW	The percentage of egress bandwidth in the range 0–100
min_VPI	The minimum VPI in the range 0–4095
max_VPI	The maximum VPI in the range 0–4095
min_VCI	The minimum VCI in the range 0–65535
max_VCI	The maximum VCI in the range 0–65535
max_GLCNs	The maximum GLCNS in the range 0–32767

Step 6 On a stand-alone node, specify the cell header type as needed by entering the **cnfatmln** command.

cnfatmln <*line_num*> <*type*>

- *line_num* is the line number in the range 1–4.

line_numer_Id	The line number in the range 1–4
type	The ATM interface type: 2 for UNI or 3 for NNI (the default)

UNI cell headers typically apply where a workstation connects through a line to a PXM1 UNI port (rather than a SLIP-based port on the PXM1-UI card). Such an implementation is not common, so entering **cnfatmln** is not necessary.

Automatic Protection Switching on the PXM1

Automatic Protection Switching (APS) provides redundancy for an OC-3 or OC-12 line on the PXM1 (if a failure occurs someplace other than the PXM1 front card). The failure can originate on the daughter card, uplink card, or any part of the physical line.

With APS, the active PXM1 remains active and passes the cells from the failed line-path through the redundant line. The advantage of APS is that a line switchover requires significantly less time than a full PXM1 switchover.

Note A failure of the PXM1 front card in a redundant system causes the entire PXM1 card set to switch over.

As defined in GR-253, a variety of APS modalities are possible (see the command summaries that follow).

APS Requirements

The current requirements for APS service on an MGX 8250 shelf are

- Redundant PXM1s (currently, the PXM1 does not support an APS configuration where the working and protection lines on the same uplink card).
- A “B” version of an OC-3 or OC-12 back card (SMLR-1-622/B, and so on).
- The connected network shelf or CPE must also support APS.

APS Configuration

Initial APS specification consists of the *working* and *protection* slot and line and the *mode* for APS. After the initial APS specification, you can configure additional APS parameters, give commands for switching lines, and display the APS configuration. The CiscoView application and CLI provide access to the APS feature. For detailed descriptions of the CLI commands, refer to the *Cisco MGX 8250 Multiservice Gateway Command Reference*. Note that APS is available for only the “B” versions of the SONET cards—SMLR-1-622/B, and so on. The applicable CLI commands are

- **addapsln** to specify the lines and mode for APS
- **cnfapsln** to modify the following details of the APS operation:
  - error thresholds
  - wait period before the PXM1 restores the working line after errors clear
  - unidirectional or bidirectional switchover, which specifies whether one or both directions of a line are switched when the criteria for a hard or soft failure are met for *one* direction
  - *revertive* recovery, where the working line automatically returns to operation after errors clear and any wait period has elapsed
  - enable use of K1 and K2 bytes in the line-level frame for equipment at both ends to exchange APS-related information
- **delapsln** to delete the APS configuration
- **dspapsln** to display the configuration for an APS-configured line
- **switchapsln** to issue commands for line switching that:
  - clear previous user requests
  - lock out (block) line switching
  - manually switch to the protection line if the following conditions are true: no errors exist, the working line is active, and your request has an equal or higher priority than the last switch request.
  - force a line switch regardless of existing errors if the following conditions are true: the working line is active and your request has an equal or higher priority than the last switch request.
  - switch all traffic to either the working lines or protection lines so you can remove a card (applies to only the currently supported configuration of 1+1 mode on two uplink cards).

To specify APS, use the following syntax:

addapsln <*workline*> <*workingslot*> <*protectionline*> <*protectionslot*> <*archmode*>

workline	The line of the APS working line
workingslot	The slot of the APS working line
protectionline	The protection line
protectionslot	The protection slot
archmode	Identifies the type of APS operation. The GR-253 mode definitions include, 1+1 on one back card, 1+1 on two back cards, 1:1, and Annex B Currently, the only supported mode is 1+1 with two uplink cards (*mode* = 2). With 1+1 APS, both the working line and the protection line carry duplicate data even though no error threshold has been exceeded or line break occurred. This mode requires that two standard cables (rather than a Y-cable) connect at two ports on the equipment at the opposite end. With the two-card implementation, *workline* must be the same as *protectionline*.

Adding Connections on a PXM1 in a Stand-Alone Node

This section describes the CLI commands for provisioning connections on a PXM1 in a stand-alone node. Connection addition conforms to the rules for a standard connection or a management connection. (See the "Rules for Adding Connections" section on page 6-3). In addition, this section describes the commands for modifying specific features for a connection and policing connections by way of usage parameter control (UPC).

The CLI commands correspond to functions in the Cisco WAN Manager application. The preferred CLI command is **addcon**. (If the application requires NSAP addressing, enter the **addchan** command to add a connection and the **cnfchan** command to modify a connection. To see the syntax for these two commands, refer to the command reference.)

Complete the following steps on the PXM1 CLI:

Step 1 Enter the **addcon** command according to the following syntax:

addcon <*port_num*> <*conn_type*> <*local_VPI*> <*local_VCI*> <*service*> [*CAC*] [*mastership*] [*remoteConnId*]

port_num	The logical port in the range 1–32 for a user connection or 34 for a management connection
conn_type	A number identifying the connection type—1 for VPC or 2 for VCC
local_VPI	The local VPI in the range 0–4095
local_VCI	The local VCI in the range 0–65535

service	A number in the range 1–4 to specify the type of service: 1 = CBR, 2 = VBR, 3 = ABR, and 4 = UBR
CAC	Lets you turn off the loading effect of a connection on the aggregated load on a port (Optional)
mastership	Specifies whether the endpoint you are adding is the master or slave: 1 = master and 2 = slave (default). The syntax shows this parameter as optional because you need to enter it at only the master end. Slave is the default, you do not need to specify it explicitly when entering a DAX con
remoteConnId	Identifies the connection at the slave end. The format for *remoteConnId* is *Remote_nodename.slot_num.remote_VPI.remoteVCI*

Note The slot number of the active PXM1 is always 0 when you add a connection.

Step 2 If necessary, modify a connection by entering **cnfcon**:

cnfcon <*conn_ID*> <*route_priority*> <*max_cost*> <*restrict_trunk_type*> [CAC]

conn_ID	Identifies the connection. The format is *logical_port.VPI.VCI*
route_priority	The priority of the connection for rerouting. The range is 1–15 and is meaningful only in relation to the priority of other connections
max_cost	A number establishing the maximum cost of the connection route. The range is 1–255 and is meaningful only in relation to the cost of other connections for which you specify a maximum cos
restrict_trunk_type	A number that specifies the type of trunk for this connection. Specify 1 for no restriction, 2 for terrestrial trunk only, or 3 for satellite trunk only
CAC	*CAC* optionally lets you turn on or off the addition of the loading effect of a connection to the aggregated load on a port (optional)

Step 3 As needed, specify usage parameter control according to the connection type. Enter either **cnfupccbr**, **cnfupcvbr**, **cnfupcabr**, or **cnfupcubr**.

This step defines the parameters for each of these commands. Note that the parameters for **cnfupcvbr** and **cnfupcabr** are the same. Also, the *polType* parameter has numerous variations in accordance with ATM Forum v4.0. For a list of these variations, see Table 6-1 after the syntax descriptions.

cnfupccbr <*conn_ID*> <*polType*> <*pcr[0+1]*> <*cdvt[0+1]*> <*IngPcUtil*> <*EgSrvRate*> <*EgPcUtil*>

conn_ID	Identifies the connection. The format is *port.vpi.vci.*
polType	The policing type. The choices are 4 or 5. See Table 6-1 for a description of these types

pcr[0+1] The number of seconds in the minute and has a range of 1–6

cdvt[0+1] The peak call rate in the range 50–1412832 cps

IngPcUtil The cell delay variation tolerance in the range 1–5000000 microseconds

EgSrvRate The egress service rate. The range is 50–1412832 cps

EgPcUtil The percentage of utilization on the egress. The range is 1–100

cnfupcvbr or **cnfupcabr** <*conn_ID*> <*polType*> <*pcr*[0+1]> <*cdvt*[0+1]> <*scr*> <*scr*> <*IngPcUtil*> <*EgSrvRate*> <*EgPcUtil*>

conn_ID Identifies the connection. The format is *port.vpi.vci*

polType The policing type in the range 1–5. See Table 6-1 for a list of these types

pcr[0+1] The peak call rate in the range 50–1412832 cps

cdvt[0+1] The cell delay variation tolerance in the range 1–5000000 microseconds

scr The sustained cell rate. The range is 50–1412832 cps

scr The maximum burst size. The range is 1–5000000 cells

IngPcUtil The percentage of utilization on the ingress. The range is 1–100

EgSrvRate The egress service rate. The range is 50–1412832 cps

EgPcUtil The percentage of utilization on the egress. The range is 1–100

cnfupcubr <*conn_ID*> <*polType*> <*pcr*[0+1] >< *cdvt*[0+1]> <*IngPcUtil*>

conn_ID Identifies the connection. The format is *port.vpi.vci*

polType The policing type. The range is 3–5. See Table 6-1 for a list of these types

pcr[0+1] The peak call rate in the range 50–1412832 cps

cdvt[0+1] The cell delay variation tolerance in the range 1–5000000 microseconds

IngPcUtil The percentage of utilization on the ingress. The range is 1–100

Table 6-1 Policing Definitions According to Policing and Connection Type

Policing by Connection Type	ATM Forum TM spec. 4.0 conformance definition	PCR Flow (1st leaky bucket)	CLP tagging (for PCR flow)	SCR Flow (2nd leaky bucket)	CLP tagging (for SCR flow)
CBR *polType*=4	CBR.1 (PCR Policing only)	CLP(0+1)	no	off	—
CBR *polType*=5	When policing=5 (off)	off	—	off	—
UBR *polType*=3	UBR.1 when CLP setting=no	CLP(0+1)	no	off	—
UBR *polType*=4	UBR.2 when CLP setting=yes	CLP(0+1)	no	CLP(0)	yes
UBR *polType*=5	Policing is off	off	—	off	—
VBR and ABR *polType*=1	VBR.1 1	CLP(0+1)	no	CLP(0+1)	no
VBR and ABR *polType*=2	VBR.2	CLP(0+1)	no	CLP(0)	no
VBR and ABR *polType*=3	VBR.3	CLP(0+1)	no	CLP(0)	yes
VBR and ABR *polType*=4	(when Policing=4)	CLP(0+1)	no	off	—
VBR and ABR *polType*=5	Policing is off	off	—	off	—

ATM Universal Service Module (AUSM)

The MGX-AUSM/B-8T1 and MGX-AUSM/B-8E1 ATM Universal Service Modules are eight port multipurpose card sets for T1 or E1 lines. This section includes the following instructions for the CLI:

- Summary of AUSM Features, page 6-16
- Configure the Card, Lines, and Ports, page 6-17
- Configure Inverse Multiplexing, page 6-20
- Adding and Configuring Connections on the AUSM/B, page 6-20

Summary of AUSM Features

The ATM Universal Service Modules (AUSM) include the following features:

- ATM UNI with high port-density for the CPE—With AUSMs in all 24 service module slots, an MGX 8250 shelf can support up to 192 individual T1 or E1 lines. An individual card set can support 1000 data connections and 16 management connections.
- Inverse multiplexing for ATM (IMA) that complies with ATM Forum v3.0 and v3.1—The 8-port AUSM can provide *n*xT1 or *n*xE1 logical ports up to maximum rates of 12 Mbps for T1 or 16 Mbps for E1.
- Classes of Service (CoS)—CBR, ABR, non-real-time VBR, real-time VBR, and UBR with per-VC queuing on ingress and multiple class of service queues on egress. ABR includes support of both ForeSight ABR and standard ABR (TM 4.0 compliant).
- Statistics collection.
- Virtual path connections (VPCs).
- Network synchronization derived from one of its lines.
- Bit error rate test (BERT) functionality with loop back pattern generation and verification on individual lines or logical port. For a description of the BERT functions, see the "Bit Error Rate Testing Through an MGX-SRM-3T3" section on page 6-63.
- 1:N redundancy through the optional MGX-SRM-3T3/C card.
- Automatic card-restore.
- SNMP and TFTP to support card and connection management.
- Resource partitions for individual network control applications.

Note See the "ATM UNI Service Module (AUSM)" section on page 2-15 for additional information on AUSM features.

Configure the Card, Lines, and Ports

You can activate and configure the AUSM card, lines, and ports with either the CLI or the CiscoView application. This section includes descriptions of the CLI commands used to perform the following tasks:

- Optionally modify resource partitioning at the card level
- Activate and configure a line
- Create and configure a logical port
- Optionally modify resource partitioning at the port level
- Configure usage parameters
- Configure queue depths
- Configure the ForeSight ABR feature
- Configure standard ABR
- Configure a line as a clock source

Note For connection-related tasks, seethe "Adding and Configuring Connections on the AUSM/B" section on page 6-20.

Perform the following steps on the CLI of the AUSM/B:

Step 1 If necessary, modify the resource partitioning for the whole card by entering the **cnfcdrscprtn** command. You can view resource partitioning through **dspcdrscprtn**.

cnfcdrscprtn <*number_PAR_conns* | *number_PNNI_conns* | *number_TAG_conns*>

number_PAR_conns	Maximum number of PAR connections, in the range 1–1000
number_PNNI_conns	Maximum number of PNNI connections. Enter the value 0 (zero), in the range 1–1000
number_Tag_conns	Maximum number of Tag connections, in the range 1–1000

For example, you could reserve 300 connections for each controller on the AUSM with

cnfcdrscprtn 300 300 300

Step 2 Activate a physical line by entering **addln** for each of the eight lines as needed.

addln <*line_number*>

Step 3 Optionally, enter the **cnfln** command to specify line coding, line length, and clock source.

cnfln <*line_num*> <*line_code*> <*line_len*> <*clk_src*> [*E1-signaling*]

line_num	Line number, in the range 1–8.
line_code	Line coding. • 2 = B8ZS, applies to T1 • 3 = HDB3, applies to E1 • 4 = AMI, applies to T1 or E1
line_len	Line length, as appropriate for the interface. • T1: 10–15 – 10: 0–131 ft. – 11: 131–262 ft. – 12: 262–393 ft. – 13: 393–524 ft. – 14: 524–655 ft. – 15: 655+ ft. • E1 with SMB module: 8 • E1 with RJ-48 module: 9
clk_src	Clock source, either loop clock or local clock. • 1 = loop clock • 2 = local clock
E1-signalling	• CAS: CAS, no CRC • CAS_CRC: CAS with CRC • CCS: CCS no CRC • CCS_CRC: CCS with CRC • CLEAR: Clear E1

Step 4 Enter **upport** to activate the logical operation of the line.

upport <*port_number*>,

where *port_number* is in the range 1–8.

Step 5 If necessary, enter **cnfportq** to modify the egress queues.

cnfportq <*port_num*> <*q_num*> <*q_algo*> <*q_depth*> <*clp_high*> <*clp_low*> <*efci_thres*>

port_num	Logical port number in the range 1–8.
q_num	Queue number in the range 1–16; 0 is the default for **addchan**. 1 = CBR 2 = VBR 3 = ABR 4 = UBR
q_algo	Number to specify the queue algorithm. 0 = disable queue 1 = high priority—always serve 2 = best available 3 = minimum guaranteed bandwidth 4 = minimum guaranteed bandwidth with maximum rate shaping 5 = CBR with smoothing
q_depth	Maximum queue depth in the range 1–16000 cells.
clp_high	High cell loss priority in the range 1–16000 cells.
clp_low	Low cell loss priority in the range 1–16000 cells.
efci_thres	EFCI threshold in the range 1–16000 cells.

Step 6 If necessary, configure resources at the port level by entering **cnfportrscprtn**. Enter **dspportrscprtn** to see the current resource partitioning.

cnfportrscprtn <*port_num*> <*controller*> <*ingress_%BW*> <*egress_%BW*> <*number_of_cons*> <*VPImin/VPImax*> [*VCImin/VCImax*]

port_num	Port number in the range 1–8.
controller	Number representing the controller—1 = PAR, 2 = PNNI, and 3 = MPLS.
ingress_%BW	Percentage of ingress bandwidth in the range 0–100.
egress_%BW	Percentage of egress bandwidth in the range 0–100.
number_of_cons	Maximum number of connections on the port.
VPImin/VPImax	Minimum and maximum VPI numbers.
VCImin/VCImax	Optional specification for VCI range.

Configure Inverse Multiplexing

This section describes the CLI command sequence for configuring the IMA feature.

Step 1 **addln** on all constituent links.

Step 2 **cnfln** if not already properly configured.

Step 3 **addimagrp** (or addaimgrp) to create the IMA group by using the following syntax:

addimagrp <*group_num*> <*port_type*> <*list_of_links*> <*minNumLink*>

group_num	Number for the IMA group. The range is 1–8.
port_type	Port type—1 = UNI, 2 = NN1.
list_of_links	List of links to be included in the group. Separate each link number by a period.
minNumLink	Minimum number of links in the range 1–8 to form a group.

For example the following command creates IMA group 1 with lines 3, 4, and 5. The minimum is 3.

```
addimagrp 1 3.4.5 3
```

IMA-related commands are **dspimagrp**, **dspimagrpcnt**, **dspimagrps**, **dspimainfo**, and **dspimalncnt**. Refer to the *Cisco MGX 8800 Series Switch Command Reference* for descriptions.

Adding and Configuring Connections on the AUSM/B

Connections can be added and modified through the Cisco WAN Manager or the CLI. Refer to applicable documentation if you use the Cisco WAN Manager application.

This section describes how to add an ATM connection through the CLI according to the rules for adding a standard connection or a management connection in the form of either a DAX con or a three-segment connection. See the “Rules for Adding Connections” section on page 6-3.

Perform the following steps on the CLI of the AUSM/B:

Step 1 Enter the **addcon** command.

When you add a connection with **addcon**, the system automatically assigns the next available *channel number*, so **addcon** does not require it. However, some related commands require a channel number—**cnfchanfst**, **cnfchanq**, **cnfconstdabr**, and **cnfupcabr**. To see the channel number after you add a connection, enter **dspcons**.

The **addcon** syntax is

addcon <*port_number*> <*vpi*> <*vci*> <*ConType*> <*SrvType*> [*Controller_Type*] [*mastership*] [*remoteConnID*]

port_number	The port number in the range 1–8.
vpi	The VPI number in the range 0–255.
vci	The VCI number in the range 0–65535 for a VCC or * for a VPC.
ConType	Connection type: 0 = VCC, and non-0 is the local ID of a VPC in the range 1–1000.
SrvType	Service type: 1 = CBR, 2 = VBR, 3 = Standard ABR, 4 = UBR, 5 = rt-VBR, and 6 = ForeSight ABR.
Controller_Type	Optional controller specification: 1=PAR (the default) and 2 = SPVC (PNNI).
mastership	Mastership status of the endpoint: 1 = master, and 2 = slave. The default is slave, so you actually do not need to type a 2.
remoteConnID	The node name, slot number, port number, vci, and vpi of the slave end (entered at only the master end).

Note To migrate between ForeSight ABR and TM 4.0 ABR, the connections must be manually deleted and then re-added. This migration is not possible at run-time.

Step 2 To configure usage parameter control (UPC) for the connection (channel), use **cnfupccbr**, **cnfupcvbr**, **cnfupcrtvbr**, **cnfupcabr**, or **cnfupcubr**. Enter **dspcons** to obtain the channel number.

cnfupccbr <*port.vpi.vci*> <*enable/disable*> <*pcr*[0+1]> <*cdvt*[0+1]> <*IngPcUtil*> <*EgSrvRate*> <*EgPcUtil*>

port.vpi.vci	identifies the connection.
enable/disable	UPC enable: 1 = disable, 2 = enable.
pcr[0+1]	peak cell rate. Without IMA, the range is as follows: • T1, 10–3622 cells per second • E1, 10–4528 cells per second • clear E1, 10–4830 cells per second For IMA, multiply the line rate by the number of links.
cdvt[0+1]	cell delay variation tolerance for cells with CLP = 0 and CLP = 1. The range is 1–250000 microseconds.

IngPcUtil	percent utilization on the ingress. The range is 1–127. The default is 0.
EgSrvRate	egress service rate. Without IMA, the range is as follows: • T1, 10–3622 cells per second • E1, 10–4528 cells per second • clear E1, 10–4830 cells per second For IMA, multiply the line rate by the number of links.
EgrPcUtil	Percent utilization on the egress. The range is 1–127. The default is 0.

cnfupcvbr has the same syntax and parameters as **cnfupcabr**

cnfupcvbr or **cnfupcabr** <*port.vpi.vci*> <*enable*> <*pcr*[0+1]> <*cdvt*[0+1]> <*scr*> <*scr_police*> <*mbs*> <*IngPcUtil*> <*EgSrvRate*> <*EgPcUtil*> <*clp_tag*>

port.vpi.vci	Identifies the connection.
enable	UPC: 1 = Disable, 2 = Enable.
pcr	Peak cell rate. Without IMA, the range is as follows: • T1, 10–3622 cells per second • E1, 10–4528 cells per second • clear E1, 10–4830 cells per second For IMA, multiply the line rate by the number of links.
cdvt	The cell delay variation tolerance for cells with CLP = [0+1]. The range is 1–250000 micro seconds.
scr	The peak cell rate. Without IMA, the range is as follows: • T1, 10–3622 cells per second • E1, 10–4528 cells per second • clear E1, 10–4830 cells per second For IMA, multiply the line rate by the number of links.
scr_police	The type of scr policing—1 = CLP[0] cells, 2 = CLP[0+1] cells, and 3 = no SCR policing.
mbs	Maximum burst size—range is 1–5000 cells.
IngPcUtil	Percent utilization on the egress—range is 1–127. The default is 0.

EgSrvRate	Egress service rate. Without IMA, the range is as follows: • T1, 10–3622 • E1, 10–4528 • clear E1, 10–4830 For IMA, multiply the line rate by the number of links.
EgrPcUtil	Percent utilization on the ingress. The range is 1–127. The default is 0.
clp_tag	Enables CLP tagging—1 = disable, 2 = enable.

cnfupcubr <*port.VPI.VCI*> <*enable*> <*pcr*[0–1]> <*cdvt*[0–1]> <*IngPcUtil*> <*clp_tag*>

port.vpi.vci	Identifies the connection.
enable	Enabled/disable for UPC: 1=Disable, 2=Enable.
pcr	Peak cell rate. Without IMA, the range is: T1, 10–3622 E1, 10–4528 clear E1, 10–4830 For IMA, multiply the line rate by the number of links.
cdvt	Cell delay variation tolerance for cells with CLP=[0+1]. The range is 1–250000 microseconds.
IngPcUtil	Percent utilization on the ingress—range is 1–127. The default is 0.
clp_tag	Enable for CLP tagging—1 = disable, 2 = enable.

Step 3 Enter **cnfchanfst** to configure the parameters for a ForeSight channel, if necessary.

ForeSight ABR is a connection-level feature that require the Rate Control Feature to be enabled on the card.

cnfchanfst <*port.vpi.vci*> <*enable*> <*fgcra_enable*> <*ibs*> <*pcr*> <*mcr*> <*icr*>

port.vpi.vci	Identifies the connection.
enable	The enable/disable for the ForeSight feature: 1 = disable, 2 = enable.
fgcra_enable	The enable/disable for the Frame-based generic cell rate algorithm: 1 = disable, 2 = enable.
ibs	Initial burst size in the range 0–5000 cells.

pcr	Peak cell rate. Without IMA, the range is • T1, 10–3622 • E1, 10–4528 • clear E1, 10–4830 For IMA, multiply the line rate by the number of links.
mcr	Minimum cell rate. Without IMA, the range is • T1, 0–3622 • E1, 0–4528 • clear E1, 0–4830 For IMA, multiply the line rate by the number of links.
icr	Initial cell rate. Without IMA, the range is as follows: • T1, 0–3622 • E1, 0–4528 • clear E1, 0–4830 For IMA, multiply the line rate by the number of links.

Step 4 Enter **cnfconstdabr** to configure the parameters for a standard ABR (TM 4.0 compliant).

cnfconstdabr *<Chan_Num ABRType> <mcr> <pcr> <icr> <rif> <rdf> <nrm> <trm> <tbe> <frtt> <adtf> <cdf>*.

Please note the following items.

- Standard ABR is a connection-level feature that requires the Rate Control Feature to be enabled on the card.
- Virtual Source/Virtual Destination behavior (VS/VD) is not supported.
- Standard ABR does not support Explicit Rate (ER) marking of RM cells.
- **cnfconabrrates** can be used to modify the rates:
  Usage: **cnfconabrrates** *<Port.Vpi.Vci/Chan_Num> <mcr> <pcr> <icr>*
- **cnfconabrparams** can be used to modify the parameters:
  Usage: **cnfconabrparams** *<Port.Vpi.Vci/Chan_num> <ABRType> <rif> <rdf> <nrm> <trm> <tbe> <rtt> <adtf>*
- *rif* and *rdf* values for a Standard ABR connection need to be configured to be <= PCR for the connection.

Variable	Description	Value range	Default value
Chan_Num ABRType	ABRType	1 (Switch Behavior) and 2 (Source Destination Behavior).	1 (Switch Behavior)
mcr	Minimum Rate	Valid value range from 10 to 38328 (includes RM cell and data cell bandwidth).	Derived from PCR(0+1)
pcr	Peak Rate	Valid value range from 10 to 38328 (includes RM cell and data cell bandwidth).	Derived from PCR (0+1)

Variable	Description	Value range	Default value
icr	Initial Cell Rate	Valid value range from 10 to 38328 (includes RM cell and data cell bandwidth).	Derived from PCR (0+1)
rif	Rate Increase Factor	Valid range from 1 to 32768 (power of 2)	64
rdf	Rate Decrease Factor	Valid range from 1 to 32768 (power of 2)	16
nrm	Inrate Cell Count	Valid value range from 2 to 256 (power of 2).	64
trm	Time limit for Frm	Valid value range from 3 to 255 msec.	255 msec.
tbe	Transient Buf Exposure	Valid value range from 0 to 16777215 cells.	16777215 cells
frtt	Fixed Round Trip Time	Valid value range from 0 to 16700 msec.	0 msec.
adtf	ACR Decrease Time Factor	Valid value range from 10 to 10230 msec.	500 msec.
cdf	Cutoff Decrease Factor	Valid value range from 0 to 64 (power of 2).	16

Step 5 If necessary, change the queue depths by using **cnfchanq**.

cnfchanq <*port.vpi.vci*> <*discard_option*> <*vc_q_depth*> <*clp_thresh_high*> <*clp_thresh_low* | *epd_threshold*> <*efci_thresh*>

port.vpi.vci	Identifies the connection.
discard_option	Discard option: 1 for CLP hysteresis or 2 for Frame-based.
vc_q_depth	Ingress queue depth in the range 1–16000 cells.
clp_thresh_high	CLP high threshold in the range 1–16000 cells.
clp_thresh_low or *epd_threshold*	CLP low threshold in the range 1–16000 cells for CLP hysteresis-based discard. EPD threshold in the range 1–16000 cells Frame-based discard.
efci_thresh	EFCI threshold in the range 1–16000 cells.

BPX 8600-to-BPX 8600 Segment

For the middle segment, be sure to use the connection type as the local segments on the MGX 8250 node (CBR, VBR, ABR, or UBR). The parameters directly map from those specified at the connection endpoint.

Frame Service Module Features

This section describes the features available on each of the Frame Service Modules (FRSMs). The primary function of the FRSM is to convert between the Frame Relay formatted data and ATM/AAL5 cell-formatted data. For an individual connection, you can configure network interworking (NIW), service interworking (SIW), ATM-to-Frame Relay UNI (FUNI), or frame forwarding.

Note See the "Frame Relay Service Modules" section on page 2-21 for more information on the features of FRSM service modules.

An FRSM converts the header format and translates the address for

- Frame Relay port number and DLCI
- ATM-Frame UNI (FUNI) port number and frame address or frame forwarding port
- ATM virtual connection identifier (VPI/VCI)

This section includes the following topics:

- Summary of Frame Service Module Features, page 6-26
- Configuring the FRSM Cards, Lines, and Ports, page 6-30

Summary of Frame Service Module Features

This section contains a summary of the features common to all FRSM models. The following sections contain summaries of the features unique to each type of FRSM.

All FRSMs support:

- Frame Relay-to-ATM Network Interworking (NIW) as defined in FRF.5.
- Frame Relay-to-ATM Service Interworking (SIW) with or without translation as in FRF.8.
- Frame Forwarding.
- ATM Frame-UNI.
- Maximum frame sizes of 4510 bytes for Frame Relay and 4096 bytes for ATM-FUNI.
- Per-virtual circuit (VC) queuing in the ingress direction (toward the cell bus). Traffic arriving at the network on a connection has a dynamically assigned buffer at the entrance to the shelf. Buffer size depends on the amount of traffic and the service-level agreement (SLA).
- Advanced buffer management. When a frame arrives, the depth of the queue for the LCN is compared against the peak queue depth scaled down by a specified factor. The scale-down factor depends on the amount of congestion in the free buffer pool. As the free buffer pool begins to empty, the scale-down factor is increased, preventing an excessive number of buffers from being held up by any single LCN.

- Multiple, priority-level queuing to support class of service on the egress. The FRSM services egress queues according to a weighted priority. The priority depends on the percentage of logical port bandwidth needed by all connections of a particular type on a port. FRSM supports
  - High-priority queue
  - Real-time variable bit rate (rt-VBR) queue
  - Common queue for non-real-time variable bit rate (nrt-VBR) and ABR connections
  - UBR queue
- Initial burst per channel. After a period of silence, the FRSM sends a configurable number of bytes at a peak service rate.
- ForeSight option (except on MGX-FRSM-HS1/B). This Cisco mechanism for managing congestion and optimizing bandwidth monitors the utilization of ATM trunks. It proactively adjusts the bandwidth for connections to avoid queuing delays and cell discards.
- Consolidated Link Layer Management (CLLM), an out-of-band mechanism to transport congestion-related information to the far end.
- Dual leaky bucket policing. Within the basic parameters such as committed burst, excess burst, and CIR, incoming frames go into two buckets: those to be checked for compliance with the committed burst rate and those to be checked for compliance with the excess burst rate. Frames that overflow the first bucket go into the second bucket. The buckets "leak" by a certain amount to allow for policing without disruption or delay of service.
- Standards-based management tools. Each FRSM supports SNMP, TFTP for configuration and statistics collection, and a command line interface. The Cisco WAN Manager application provides full graphical user interface support for connection management. The CiscoView application provides equipment management.
- MGX 8250 network management functions, including image download, configuration upload, statistics, telnet, UI, SNMP, trap, and MIBs.
- OAM features—LMI and Enhanced LMI (ANNEX A, ANNEX D, Strata LMI).
- Hot standby with 1:1 redundancy (see sections for individual FRSM card types).
- Resource partitioning at the card level or port level.
- Bit error rate test (BERT) functions for all card types except the HSSI card types. For a description of BERT on the MGX-FRSM-2T3E3, see the "Bit Error Rate Testing on an Unchannelized T3 or E3 FRSM" section on page 6-44. Running a BERT session on an MGX-FRSM-2CT3 or an eight-port FRSM requires a set of MGX-SRM-3T3s in the system. For a description of BERT on these cards, see the "Bit Error Rate Testing Through an MGX-SRM-3T3" section on page 6-63.
- User-selectable weighted fair queuing or fixed-rate queuing. The user can select either fixed-rate queuing to provide highest egress port speed while reducing quality of service or weighted fair queuing to provide maximum quality of service but slower egress port speed. This feature applies to the FRSM-2CT3, FRSM-2T3E3, and FRSM-HS2 cards.
- Subrate support is provided for the MGX-FRSM-2T3E3 card. This feature applies to the MGX-FRSM-2T3E3 card only when used with Digital Link equipment.

Note Subrate capability is not supported on Kentrox equipment.

- Zero CIR Service for FRSM-VHS, FRSM-8T1 and FRSM-8E1 cards.

- The features of the FRSM service modules are listed in Table 6-2.

Table 6-2 FRSM Card Features

Model	Features
MGX-FRSM-2CT3	• Up to 4000 user-connections • Two T3 lines • Up to 256 logical ports • Logical port speed from DS0 56 Kbps through DS1 1.536 Mbps • Support for five class of service (CoS) queues (high priority, rt-VBR, nrt-VBR, ABR, UBR) • Supports Hot Standby with less than 1 second switchover using 1:1 redundancy through Y-cable redundancy (no Service Resource Module required) • OAM Continuity Traffic Generation Test for use on defective PVCs
MGX-FRSM-2T3E3	• Up to 2000 user-connections • Two T3 or E3 lines coinciding with two logical ports • ADC Kentrox and Digital Link methods for supporting fractional T3 or E3 ports • Maximum possible number of DLCIs per port by using the Q.922 two-octet header format • Support for five CoS queues (high priority, rt-VBR, nrt-VBR, ABR, UBR) • Supports Hot Standby with less than 1 second switchover using 1:1 redundancy through Y-cable redundancy (no Service Resource Module required) • Fractional T3 speeds available through either the Digital Link or ADC Kentrox method • Supports running lines at subrates when used with Digital Link equipment • OAM Continuity Traffic Generation Test for use on defective PVCs
MGX-FRSM-HS2	• Up to 2000 user-connections • Maximum two logical ports • Two HSSI lines with configurable line speeds in multiples of 56 Kbps or 64 Kbps • Selectable DTE or DCE mode for each port • In DCE mode, per port clock speeds of *n*xT1 and *n*xE1 up to 52 Mbps • Various DTE/DCE loopback operations • Maximum possible number of DLCIs per port by using the Q.922 two-octet header format • Supports Hot Standby with less that 1 second switchover using 1:1 redundancy through a Y-cable

Table 6-2 FRSM Card Features (continued)

Model	Features
MGX-FRSM-HS1/B Features	• Up to 200 data connections • In addition to data connections, support for – LMI according to ITU-T Q.333 Annex A and ANSI T1.617 Annex D – OAM messaging • Total card throughput of 16 Mbps • Choice of the operating card as either X.21 or V.35 • Maximum of 8 Mbps per line • Choice of DTE or DCE mode for each line • Maximum frame size of 4510 bytes • One-to-one mapping between a logical port and a physical line • Support for metallic (internal) loopback (ITU-T type 1) • V.35-specific alarms (in addition to standard alarms such as LOS, and so on) – Inactive DCD and CTS signals in DTE mode (red alarm) – Inactive RTS signal in DCE mode (red alarm) – Selected line type (for example, through the **cnfln command** on the CLI) and the attached cable are incompatible (red alarm) – Disconnected cable, such as a disconnect at the far end (creating LOS, a red alarm) – No cable attached (a red alarm) • Support for ANSI/EIA/TIA-613-1993 and ANSI/EIA/TIA-612-1993
Eight-Port FRSM	• Eight-Port FRSM Fractional FRSMs support a single 56 Kbps or multiple 64 Kbps user-ports (FR-UNI, FR-NNI, FUNI, and Frame forwarding) per T1 or E1 line. • Channelized FRSMs (AX-FRSM-8T1-C and AX-FRSM-8E1-C) support multiple 56 Kbps or Nx64 Kbps user-ports per line up to the physical line bandwidth limit. • Bulk distribution for T1 only through the MGX-SRM-3T3. See the “Service Resource Module” section on page 6-60. • Redundancy support: the MGX-SRM-3T3 can provide 1:N redundancy for T1 or E1 operation if the FRSM uses an SMB-8E1 back card. • Supports OAM Loopback non intrusive test. • Supports zero CIR service. • Standard ABR (TM 4.0 compliant). • Class of service (CoS) mapping.

Configuring Frame Relay Service

This section first describes how to configure the FRSM card, lines, and ports, then describes how to add connections. The descriptions are for the CLI execution of the tasks.

Note FRSM card, lines, and ports can also be configured using the CiscoView application. Refer to the CiscoView documentation for the directions.

Note The easiest way to add connections is by using the Cisco WAN Manager application. For full details on how to set up a connection through the Cisco WAN Manager GUI, refer to the *Cisco WAN Manager Operations*.

This section contains the following information:

- Configuring the FRSM Cards, Lines, and Ports, page 6-30
- Adding a Frame Relay Connection, page 6-36
- Establishing the BPX 8600-to-BPX 8600 Series Segment, page 6-42
- Test Commands for FRSM Cards, page 6-43
- Support for Alarm Reporting, page 6-44
- Bit Error Rate Testing on an Unchannelized T3 or E3 FRSM, page 6-44

Configuring the FRSM Cards, Lines, and Ports

This section describes how to configure card-level parameters—including Y-cable redundancy, where applicable, as well as physical lines and logical ports on the FRSM-series cards.

Step 1 If necessary, modify the resource partitioning for the whole card by entering the **cnfcdrscprtn** command. You can view resource partitioning by entering the **dspcdrscprtn** command.

cnfcdrscprtn <*number_PAR_conns* | *number_PNNI_conns* | *number_TAG_conns*>

number_PAR_conns	number of connections in the range 0–1000 available to the PAR controller
number_PNNI_conns	number of connections in the range 0–1000 available to a PNNI controller
number_TAG_conns	number of connections in the range 0–1000 available to the Tag controller

For example, you could reserve 300 connections for each controller on the FRSM with

cnfcdrscprtn 300 300 300

Step 2 If the physical line is not yet active, enter the **addln** command to activate it. The only argument **addln** takes is the line number.

Step 3 If necessary, modify a line on the MGX-FRSM-2CT3, MGX-FRSM-HS2, MGX-FRSM-HS1/B, AX-FRSM-8T1, or AX-FRSM-8E1 by entering the **cnfln** command.

To change the line parameters on an MGX-FRSM-2CT3 or MGX-FRSM-2T3E3, enter **cnfds3ln**. Note that both **cnfln** and **cnfds3ln** apply to the MGX-FRSM-2CT3 but apply to different features. Refer to the *Cisco MGX 8800 Series Command Reference* for the syntax of the line modification commands on all cards except the MGX-FRSM-HS1/B.

The syntax for **cnfln** on the MGX-FRSM-HS1/B is:

cnfln <*line_num*> <*line_type*> <*line_rate*>

line_num Range 1–4.

line_type Number that specifies the mode and must match the 12IN1 cable connected to the port: 1 = DTE, 2 = DCE, 3 = DTE_ST (V.35 only).

Note If no cable is attached, the system lets you specify any line type, but the Alarm LED on the front card turns from yellow to red.

line_rate Number in the range 1–50. The number corresponds to the bits per second for the line. (The range of line rates is 48 Kbps–52 Mbps.) See Table 6-1.

Table 6-3 Supported Lines Rates on the MGX-FRSM-HS1/B

1–50 Correspond to Line Rates in Kbps.				
1=48000	2=56000	3=64000	4=112000	5=128000
6=168000	7=192000	8=224000	9=256000	10=280000
11=320000	12=336000	13=384000	14=392000	15=448000
16=512000	17=768000	18=1024000	19=1536000	20=1544000
21=1792000	22=1920000	23=1984000	24=2048000	25=3097000
26=3157000	27=4096000	28=4645000	29=4736000	30=6195000
31=6315000	32=7744000	33=7899000	34=8192000	35=9289000
36=9472000	37=10240000	38=10890000	39=11059000	40=12390000
41=12629000	42=13897000	43=14222000	44=14336000	45=15488000
46=15799000	47=16384000	48=20025000	49=2498600	50=52000000

The possible errors for the **cnfln** command are

- One or more parameters are invalid.
- Line does not exist (has not been added).
- Loopback or BERT is on.
- Active port already exists on this line.

Step 4 If the logical port does not exist or is not the appropriate type (Frame Relay, FUNI, or frame forwarding), enter the **addport** command to create the appropriate type of port. If the logical port already exists and needs no modification (**cnfport**), you can add connections by performing the tasks in the "Adding a Frame Relay Connection" section on page 6-36. The parameters for **addport** depend on the type of FRSM.

For MGX-FRSM-2T3E3 or MGX-FRSM-HS2

addport <*port_num*> <*line_num*> <*port_type*>

port_num	Logical port number in the range 1–2. The mapping between a logical port and a line is one-to-one for these cards. **Note** Maximum committed information rate (CIR) on each line for these cards is 1 to 44210000 bps for MGX-FRSM-2T3, 1 to 34010000 bps for MGX-FRSM-2E3, and 1 to 51840000 bps for MGX-FRSM-HS2. Specify CIR with **addcon** (or **addchan** if necessary).
line_num	Physical line number in the range 1–2.
port_type	Number representing the mode of operation for the logical port—1 for Frame Relay; 2 for FUNI mode-1a; or 3 for frame forwarding.

For an MGX-FRSM-2CT3

addport <*port_num*> <*line_num*> <*ds0_speed*> <*begin_slot*> <*num_slot*> <*port_type*>

port_num	Logical port number in the range 1–256. When you subsequently add a connection through the preferred command **addcon** or the **addchan** command (which requires NSAP format), you must indicate a logical port by using this singular *port_num* regardless of the number of DS0s. (You can add 1–24 DS0s to a single *port_num* through the other **addport** parameters.)
line_num	DS1 number in the range 1–56 to which you assign the DS0 when both lines are active. If you activate only one line, the range is 1–28. You can assign up to 24 contiguous DS0s to one DS1. Each physical line supports up to 28 DS1s. The number of DS0s cannot span more than DS1.
ds0_speed	Number representing the DS0 speed: 1 for 56 Kbps or 2 for 64 Kbps.
begin_slot	Beginning DS0 timeslot in 1 base. For example, on port number 50, you could specify *begin_slot* to be 9 then specify *num_slot* to be in the range 1–16.
num_slot	Number of DS0s in the associated DS1. Note that the number of DS0s cannot be such that the logical port spans more than DS1.
port_type	Number representing the mode of operation for the logical port—1 for Frame Relay, 2 for FUNI mode-1a, and 3 for frame forwarding.

For MGX-FRSM-HS1/B

cnfbctype is the command to change a 12-in-1 back card type between support for x.21 and v.35.

addport <*port_num*> <*port_type*>

port_num	Port number, in the range appropriate for the interface type. • X.21 range = 1–4 • HSSI range = 1–2
port_type	Type of service as Frame Relay, FUNI, or frame forwarding. • 1 = Frame Relay • 2 = FUNI • 3 = frame forwarding

For AX-FRSM-8T1 and AX-FRSM-8E1:

addport <*port_num*> <*line_num*> <*ds0_speed*> <*begin_slot*> <*num_slot*> <*port_type*>

port_num	Port number of either the FRSM-8T1 or the FRSM-8E1. • FRSM-8T1 range = 1–192 • FRSM-8E1 range = 1–248
line_num	FRSM-8T1E1 line number, in the range 1–8.
ds0_speed	Bit rate as either 56 Kbps or 64 Kbps for the DS0. • 1 = 56 Kbps • 2 = 64 Kbps
begin_slot	Number of the beginning timeslot in the T1 or E1 frame.
num_slot	Number of consecutive timeslots in the T1 or E1 frame.
port_type	Type of service as Frame Relay, FUNI, or frame forwarding. • 1 = Frame Relay • 2 = FUNI • 3 = frame forwarding

Step 5 Modify as needed the signaling on a port by entering cnfport.

cnfport <*port_num*> <*lmi_sig*> <*asyn*> <*elmi*> <*T391*> <*T392*> <*N391*> <*N392*> <*N393*>

port_num	Logical port number, in the range appropriate for the current card. • FRSM – 8-port T1 range = 1–192 – 8-port E1range = 1–248 – 4-port HS1 or HS2 range 1–4 – Unchannelized E1 or T1 range = 1–4 – 2-port HS1 or HS2 range = 1–2 – Unchannelized E3 or T3 = 1–2 – Channelized T3 = 1–56
lmi_sig	LMI signalling protocol type. • 1 = Other • 2 = None • 3 = StrataLMI • 4 = AnnexAUNI • 5 = AnnexDUNI • 6 = AnnexANNI • 7 = AnnexDNNI
asyn	Enable or disable asynchronous update. • (y)es = enable • (n)o = disable (default)
ELMI	Enable or disable enhanced LMI. • N or n = disable • Y or y = enable
T391	T391 timer, in the range 5–30 seconds. This setting is the interval in seconds for NNI status polling. Default = 10
T392	T392 timer, in the range 5–30 seconds. This setting is the interval in seconds for UNI status polling. Default = 15
N391	N391 counter, in the range 1–255. This setting establishes the number of UNI/NNI polling cycles. Default = 6

N392	N392 counter, in the range 1–10. This setting is the UNI/NNI error threshold. Default = 3
N393	N393 counter, in the range 1–10. This setting is the UNI/NNI monitored events threshold, which must be greater than *N392*. Default = 4

Step 6 Configure resources for the port as needed by entering **cnfportrscprtn**. To see the partitioning, enter **dspportrscprtn**. The description has a high- and low-bandwidth version:

cnfportrscprtn <*port_num*> <*controller-name*> <*conn ID range*> <*percent bandwidth*> [*number of conns*]

port_num	Logical port number, in the range appropriate for the current card. • FRSM – 8-port T1 range = 1–192 – 8-port E1range = 1–248 – 4-port HS1 (X.21) or HS2 range 1–4 – Unchannelized E1 or T1 range = 1–4 – 2-port HS1 (HSSI) or HS2 range = 1–2 – Unchannelized E3 or T3 = 1–2 – Channelized T3 = 1–56
controller-name	Controller type. • 1 = PAR • 2 = PNNI (currently not used) • 3 = TAG
conn ID range	Range of connection IDs available to the controller.
percent bandwidth	Percentage of the port bandwidth available to the controller. This setting applies to both the ingress and egress.
number of conns	Connections available to a controller on a port.

Note The following step applies to Y-cable redundancy for the MGX-FRSM-2T3E3. For 1:N redundancy on the eight-port FRSMs, see the "Redundancy Support by the MGX-SRM-3T3/C" section on page 6-61.

Step 7 Optionally, configure Y-cable redundancy if you have connected the lines of adjacent MGX-FRSM-2T3E3 cards through a Y-cable. The applicable commands are **addred**, **dspred**, and **delred**. These commands run on the PXM1 rather than the service module, change to the PXM1 CLI to enter them:

addred <*redPrimarySlotNum*> <*redSecondarySlotNum*> <*redType*>

redPrimarySlotNum	Slot number that contains the primary card of the card pair, in the ranges 1–6, or 9–14, or 17–22, or 25–30.
redSecondarySlotNum	Slot number that contains the secondary card of the card pair, in the ranges 1–6, or 9–14, or 17–22, or 25–30.
redType	Value to set type of redundancy to be deployed on the PXM. 1 = 1:1 2 = 1:*N*

Enter the display commands **dspcd**, **dspln**, and so on to check the configuration and status.

Adding a Frame Relay Connection

The user should add a Frame Relay connection according to the following steps for adding a standard connection or a management connection in the form of either a DAX con or a three-segment connection. See the "Rules for Adding Connections" section on page 6-3.

Step 1 Add a connection by entering **addcon**. If the application requires the NSAP form for the endpoint, enter **addchan** as described in the command reference.

The system automatically assigns the next available *channel number*, so the **addcon** command does not require it. However, some related commands require a channel number. To see the channel number after you add a connection, enter **dspcons**.

On the FRSM-VHS cards (2CT3, 2T3E3, or HS2):

addcon <*port*> <*DLCI*> <*cir*> <*chan_type*> <*egress_service_type*> [*CAC*] <*controller_type*> <*mastership*> [*connID*] <*controllerID*>

port number	Port number in the range 1–256.
DLCI	Data-link connection identifier (DLCI) value, in the range 0–1023.
CIR	Committed information rate (CIR) bps value, in the range 0–1536000.
channel type	Value to set type of connection on this channel. • 1 = NIW (network interworking) • 2 = SIW-transparent (service interworking without any SDU translation) • 3 = SIW-translation (service interworking with SDU translation) • 4 = FUNI (Frame Relay UNI) • 5 = Frame forwarding

egress service type	Value to set type of egress service provided on this channel. • 1 = highpriorityQ (typically committed bit rate connections) • 2 = rtVBRQ (real-time variable bit rate connections) • 3 = nrtVBRQ (non-real-time variable bit rate connections) • 4 = aBRQ (available bit rate connections) • 5 = uBRQ (unspecified bit rate connections)
Adm_cntrl	Value to enable or disable connection admission control (CAC). • 1 = enable CAC • 2 = disable CAC (default)
controller_type	Value to set signalling controller type as either PVC or SPVC. • 1 = PVC (PAR) (default) • 2 = SPVC (PNNI)
mastership	Value to set status of connection as master or slave. • 1 = master • 2 = slave (default)
RemoteEndConID	Node name, slot number, port number, and DLCI. or Node name, slot number, port number, Controller ID, and DLCI for a Frame Relay endpoint. Use one of the following values to set controller type: • 1 = PAR • 2 = PNNI • 3 = TAG or Node name, slot number, port number, and VPI.VCI for an ATM endpoint.

For AX-FRSM-8T1 and AX-FRSM-8E1:

addcon <*port*> <*DLCI*> <*cir*> <*chan_type*> [*CAC*] <*controller_type*> <*mastership*> <*remoteConnID*> <*serv_type*>

port number	Port number in the range: • T1 = 1–192 • E1 = 1–248
DLCI	Data-link connection identifier (DLCI) value, in the range 0–1023.

CIR	Committed information rate (CIR) bps value: • For T1 = in the range 0–1536000 • For E1 = in the range 0–2048000.
channel type	Value to set type of connection on this channel. • 1 = NIW (network interworking) • 2 = SIW-transparent (service interworking without any SDU translation) • 3 = SIW-translation (service interworking with SDU translation) • 4 = FUNI (Frame Relay UNI) • 5 = frame forwarding
Connection Admission Control (CAC)	This is an optional parameter. You can select one of the following values: • 1 = enable • 2 = disable (the default)
controller type	Value to set signalling controller type as either PVC or SPVC. • 1 = PVC (PAR) (default) • 2 = SPVC (PNNI)
mastership	Value to set status of connection as master or slave. • 1 = master • 2 = slave (default)
Adm_cntrl	Value to enable or disable connection admission control (CAC). • 1 = enable CAC • 2 = disable CAC (default)

RemoteEndConID	Node name, slot number, port number, and DLCI. or Node name, slot number, port number, Controller ID, and DLCI for a Frame Relay endpoint. Use one of the following values to set controller type: • 1 = PAR • 2 = PNNI • 3 = TAG or Node name, slot number, port number, and VPI.VCI for an ATM endpoint.
service type	Select one of the following service types: • 1 = high priority • 2 = rtVBR (real-time) • 3 = nrtVBR (non-real-time) • 4 = fstABR (ForeSight) • 5 = UBR • 9 = stdABR

Service Type	Default EgressQueue	PXM1 Service Type
HighPriority	Hi Priority	CBR
VBR-RT	Hi Priority	VBR-RT
VBR-NRT	Low Priority	VBR-NRT
ABR-FS	Low Priority	ABR-FST
STD-ABR	Low Priority	ABR-STD
UBR	Low Priority	UBR

For MGX-FRSM-HS1/B:

addcon *<port_number> <DLCI> <CIR> <chan_type> <CAC> <Controller_type> <mastership> <connID>*

port number	Port number, in the range 1–2.
DLCI	Data-link channel identifier (DLCI) value, in the range 0–1023.
CIR	Committed information rate (CIR) bps value, in the range 0–51840000.

channel type	Value to set type of connection on this channel. • 1 = NIW (network interworking) • 2 = SIW-transparent (service interworking without any SDU translation) • 3 = SIW-translation (service interworking with SDU translation) • 4 = FUNI (Frame Relay UNI) • 5 = frame forwarding
egress service type	Value to set type of egress service provided on this channel. • 1 = highpriorityQ (typically committed bit rate connections) • 2 = rtVBRQ (real-time variable bit rate connections) • 3 = nrtVBRQ (non-real-time variable bit rate connections) • 4 = aBRQ (available bit rate connections) • 5 = uBRQ (unspecified bit rate connections)
Adm_cntrl	Value to enable or disable CAC. • 1 = enable CAC • 2 = disable CAC (default)
controller_type	Value to set signalling controller type as either PVC or SPVC. • 1 = PVC (PAR) (default) • 2 = SPVC (PNNI)
mastership	Value to set status of the connection as master or slave. 1 = master 2 = slave (default)
RemoteEndConID	Node name, slot number, port number, and DLCI. or Node name, slot number, port number, Controller ID, and DLCI for a Frame Relay endpoint. Use one of the following values to set controller type: • 0 = PAR • 1 = PNNI • 2 = TAG or Node name, slot number, port number, and VPI.VCI for an ATM endpoint.

Step 2 Modify a connection as needed by executing **cnfcon**. See the command line Help or the command reference for the parameters for individual card types.

Step 3 If necessary, modify the CLP and congestion indicator fields by using **cnfchanmap**. Use **dspchanmap** to check this configuration for a connection.

cnfchanmap <*chan_num*> <*chanType*> <*FECN/EFCI*> <*DE to CLP*> <*CLP to DE*>

chan_num	Channel (connection) number. The ranges are • 2CT3, 16–4015 • 2T3, 2E3, HS2, 16–2015 • HS1, 16–215 • T1, E1, 16–1015
chanType	Number in the range 1–5 indicating the service type for the connection. • 1 = NIW • 2 = SIW in transparent mode • 3 = SIW in translation mode • 4 = FUNI • 5 = frame forwarding
FECN/EFCI	Number in the range 1–2 that specifies the mapping between FECN and EFCI fields. • 1 = map EFCI (SIW only) • 2 = set EFCI to 0
DE to CLP	Number in the range 1–3 that specifies the DE to CLP mapping. • 1 = map DE to CLP • 2 = set CLP to 0 • 3 = set CLP to 1
CLP to DE	Number in the range 1–4 that specifies the CLP to DE mapping. • 1 = map CLP to DE • 2 = set DE to 0 • 3 = set DE to 1 • 4 = ignore CLP (NIW only)

Step 4 To check statistics for a connection, enter **dspchstats** as needed.

Step 5 Enter **cnfchanstdabr** to configure the parameters for standard ABR (TM 4.0), if they are not properly configured:

cnfchanstdabr *<Port.DLCI/CHAN_NUM> <mcr> <pcr> <icr> <rif> <rdf> <nrm> <trm> <tbe> <frtt> <adtf> <cdf>*

Please note the following items:

- Standard ABR is a connection-level feature that requires the Rate Control Feature to be enabled on the card.
- Standard ABR does not support Explicit Rate (ER) marking of RM cells.
- **cnfconabrrates** is used to modify the rates:
  Usage: **cnfconabrrates** <Port.Vpi.Vci/Chan_Num> <mcr> <pcr> <icr>

- **cnfconabrparams** is used to modify the parameters.
  Usage: **cnfconabrparams** <Port.Vpi.Vci/Chan_num> <ABRType> <rif> <rdf> <nrm> <trm> <tbe> <rtt> <adtf>

Variable	Description	Value range	Default value
mcr	Minimum Cell Rate	Valid value range from 10 to 10,000 (includes RM cell and data cell bandwidth).	Derived from CIR
pcr	Peak Cell Rate	Valid value range from 10 to 10,000 (includes RM cell and data cell bandwidth).	Derived from CIR
icr	Initial Cell Rate	Valid value range from 10 to 10,000 (includes RM cell and data cell bandwidth).	Derived from CIR
rif	Rate Increase Factor	Valid value range from 1 to 32768 (power of 2).	64
rdf	Rate Decrease Factor	Valid value range from 1 to 32768 (power of 2).	16
nrm	Inrate Cell Count	Valid value range from 2 to 256 (power of 2).	64
trm	Time limit for Frm	Valid value range from 3 to 255 msec.	255 msec
tbe	Transient Buf Exposure	Valid value range from 0 to 16777215 cells.	16777215 cells
frtt	Fixed Round Trip Time	Valid value range from 0 to 16700 msec.	0 msec
adtf	ACR Decrease Time Factor	Valid value range from 10 to 10230 msec.	500 msec
cdf	Cutoff Decrease Factor	Valid value range from 0 to 64 (power of 2).	16

Step 6 Enter **cnfchanfst** to configure the parameters for ForeSight ABR, if necessary.

cnfchanfst *<Port.DLCI/CHAN_NUM> <ForeSight enable> <mir> <pir> <uir>*

Establishing the BPX 8600-to-BPX 8600 Series Segment

For a three-segment connection, establish a BPX 8600-to-BPX 8600 series (middle) segment. This type of connection is used to establish feeder connections across a BPX network. To establish such a connection, execute the **addcon** command at *one* of the BPX 8600 series nodes, as follows.

- For slot and port number—Specify the slot and port of the BXM connected to the MGX 8250 node.
- For VPI and VCI values—Specify the VPI and VCI at the endpoint on the PXM1 card.
- For nodename—Specify the name of the BPX 8600 series switch at the far end of the connection.

- For remote channel—Specify the slot and port number of the BXM port attached to the MGX 8850 node at the far end. Specify the VPI as the slot number of the remote MGX 8850 FRSM connected to the BPX 8600 series switch, and specify the VCI as the LCN of the Frame Relay connection at the remote MGX 8850 node.
- For connection type—Specify **ATFST** if the ForeSight feature is operating; if ForeSight is not operating, specify **ATFR**.

Specify the other **addcon** command bandwidth parameters, such as MCR, PCR, %Util, and so on.

- Minimum cell rate (MCR) is only used with the ForeSight feature (ATFST connections).
- MCR and peak cell rated (PCR) should be specified according to the following formulae:
  - MCR=CIR *3/800 cells per second.
  - PCR=AR * 3/800 cells per second but less than or equal to 6000.
    AR=Frame Relay port speed in bps. For example,

AR equals 64K, PCR = 237, or
AR speed equals 256K, PCR = 950, or
AR speed equals 1536K, PCR = 5703

The above MCR and PCR formulas are predicated on a relatively small frame size of 100 octets. Smaller frame sizes can result in worst-case scenarios, as shown in the following table:

For a frame size of 64 octets, the PCR formula becomes	PCR=AR * 2/512 cells per sec
For a frame size of 43 octets, the PCR formula becomes	PCR=AR * 2/344 cells per sec

The *%Util* parameter should be set to the same value as that used for the Frame Relay segments of the connection.

Test Commands for FRSM Cards

To check the state of cards, lines, ports, queues, and connections, enter the display commands (**dsp**...) and **addchanloop**. The following commands are available for testing the FRSM cards (refer to the *Cisco MGX 8800 Series Command Reference* for descriptions):

- **addlnloop**, **cnflnloop**, and **dellnloop** are line-level, diagnostic commands that require the *service level* user privilege.
- **addchanloop** and **delchanloop** are standard user commands for looping on a channel.
- **tstcon** checks the integrity of a connection.
- **tstdelay** measures the round-trip delay on a connection.
- **cnftrafficgen** enables/disables traffic-generation tests on a per LCN basis. Enter the **dsptrafficgen** command to display the traffic-generation test results.

Support for Alarm Reporting

The FRSM cards support card and line-level alarm reporting. Use the CiscoView application or the CLI to view current alarms. The CLI commands are **dspalmcnt**, **dspalm**, and **dspalms**. These commands require a *switch,* either "-x21 or "-hs1" whichever is valid, to identify the interface type. Refer to the Cisco *MGX 8800 Series Command Reference* for syntax and alarm descriptions.

Bit Error Rate Testing on an Unchannelized T3 or E3 FRSM

The MGX 8250 shelf can perform a bit error rate test (BERT) on one active line at a time on the MGX-FRSM-2T3E3. This type of testing disrupts service because it requires the tested path to be in loopback mode. You can configure a BERT session and perform related tasks through the CiscoView application or the CLI.

The MGX 8250 bus structure supports one BERT session per upper or lower bay of the card cage, so the shelf can run a maximum of two sessions at once. When you specify the target slot through the CiscoView application or the **acqdsx3bert** command on the CLI, the system determines if a BERT configuration already exists in the bay that has the specified slot. If no BERT configuration exists in the bay, the display presents a menu for the BERT parameters.

The CLI commands (whose functions correspond to CiscoView selections) are

- **acqdsx3bert** to determine if other BERT sessions exist in the bay
- **cnfdsx3bert** to specify a pattern for the BERT test
- **startdsx3bert** to start a BERT test (after resetting BERT counters)
- **moddsx3bert** to inject multi-rate errors into the BERT bit stream
- **dspdsx3bert** to display the parameters and results of the current test
- **deldsx3bert** to end the current test (and retain the values in the BERT counters)

Refer to the *Cisco MGX 8250 Wide Area Edge Switch Command Reference* for command details.

Note When a BERT session begins, all the connections on the line go into alarm and return to normal when you end the test. Consequently, the test may result in a large number of traps and other types of traffic (such as AIS).

Circuit Emulation Service Module for T3 and E3

The main function of the Circuit Emulation Service Module (CESM) is to provide a constant bit rate (CBR) service. The CESM converts data streams into CBR AAL1 cells according to the CES-IS specifications of the ATM Forum for *unstructured* transport across an ATM network. Unstructured transport means the CESM does not interpret or modify framing bits, so a high-speed CESM creates a single data pipe The most common application is legacy support for digitized voice from a PBX or video from a codec. Using circuit emulation, a company can expand its data communication network without specific voice or video cards to meet its voice or teleconferencing requirements.

The higher speed CESM uses a T3 or E3 line. The card set consists of an MGX-CESM-T3 or MGX-CESM-E3 front card and either a BNC-2T3 or BNC-2E3 back card. In this CESM application, only one line on the two-port back card is operational. Furthermore, it supports one logical port and one logical connection (as a data pipe) on the line and runs at the full T3 or E3 rate. Although the typical connection setup is the three-segment connection across an ATM network, the CESM can support a DAX connection. Up to 26 CESM card sets can operate in an MGX 8250 shelf.

Features

The MGX-CESM-T3 or MGX-CESM-E3 support the following features:

- Unstructured data transfer: T3 CESM 44.736 Mbps (1189980 cells per second) for T3, or 34.368 Mbps (91405 cells per second) for E3
- Synchronous timing by either a local clock sourced on the PXM1 or loop timing (transmit clock derived from receive clock on the line)
- 1:1 redundancy is through a Y-cable
- Programmable egress buffer size (in the form of cell delay variation)
- Programmable cell delay variation tolerance (CDVT)
- Per VC queuing for the transmit and receive directions
- An idle code suppression option
- Bit count integrity when a lost AAL1 cell condition arises
- Alarm state definitions per G.704
- Trunk conditioning by way of framed AIS for T3 and unframed, alternating 1s and 0s for E3
- On-board bit error rate testing (BERT)

Cell Delay Treatment

You can configure a tolerable variation in the cell arrival time (CDVT) for the receive buffer. After an underrun, the receiver places the contents of the first cell to arrive in a receive buffer then plays it out at least one CDVT value later. The maximum cell delay and CDVT (or jitter) are

- For T3
  - Cell delay of 4 msec
  - CDVT of 1.5 msec in increments of 125 microseconds

- For E3
  - Cell delay of 2.9 msec
  - CDVT of 2 msec in increments of 125 microseconds

Error and Alarm Response

When it detects a loss of signal (LOS) alarm, the CESM notifies the connected CPE in the upstream direction after an integration period. The CESM continues to emit cells at the nominal rate but sets the ATM cell payload with an appropriate data pattern as specified by the ATM Forum CES V2.0 specification. Also, an OAM cell with RDI code goes to the far end to indicate out-of-service. The differences between the types are shown in Table 6-4.

Table 6-4 CESM Errors and Alarms

Error	Alarm Type	Down stream	Up Stream	Comments
Link Failure (RX)	Blue (LOS)	AIS—OAM cells	none	Data cells according to the ATM-Forum CES-IS V 2.0
Receive RAI	Yellow	None	None	—
Receive LOF	—	—	—	—
Receive AIS	Blue (AIS)	AIS (link)	FERF OAM cells	AIS—done over the T3/E3 link by sending the AIS data over the T3/E3 link

Configuring Service on a T3 or E3 CESM

This section first describes the steps for configuring the card, line, and port-level parameters for an MGX-CESM-T3 and MGX-CESM-E3. It then describes how to add a connection. See the “Tasks and Rules to Configure Cards and Services” section on page 6-2 for background information on these types of tasks. Use either the CLI or the CiscoView application to set up the card and line parameters. Use either the CLI or the Cisco WAN Manager application to add connections. The fundamental tasks and applicable CLI commands appear in the following list. For a complete list of CLI commands that apply to the CESM cards, enter the **Help** command on the CLI of the card or refer to the tables at the front of the *Cisco MGX 8000 Series Command Reference*.

- Optionally configure Y-cable redundancy at the card level (**addred** command).
- Optionally modify resource partitioning at the card level (**cnfcdrscprtn** command)
- Activate a physical line (**addln** on the CLI) and optionally configure the line (**cnfln** command) for line coding, line length, and clock source
- Activate the functioning of the logical port on a physical line (**addport** command)
- Optionally modify resource partitioning at the port level (**cnfportrscprtn** command)
- Add the connections by entering **addcon** command (or **addchan** command if NSAP addressing is necessary)
- Configure the connection for CDVT, cell loss integration period, and egress buffer size by entering **cnfcon** command (or **cnfchan** command if NSAP addressing is necessary)

Configuring the Card, Lines, and Ports

This section describes how to configure parameters for the card, line, and port through the CLI. If you use the CiscoView application, refer to the CiscoView documentation. The steps are:

Step 1 Enter **addln** <*line number*>

where *line number* is 1. You can modify line characteristics with **cnfln**.

Step 2 Optionally enter **cnfln** to modify line characteristics:

cnfln <*line_num*> <*line_code*> <*line_len*> <*clk_src*>

line_num — Line number, in the range 1–8.

line_code — Line coding.

- 2 = B8ZS, applies to T1
- 3 = HDB3, applies to E1
- 4 = AMI, applies to T1 or E1

line_len — Line length, as appropriate for the interface.

- T1: 10–15
  - 10: 0–131 ft.
  - 11: 131–262 ft.
  - 12: 262–393 ft.
  - 13: 393–524 ft.
  - 14: 524–655 ft.
  - 15: 655+ ft.
- E1 with SMB module: 8
- E1 with RJ-48 module: 9

clk_src — Clock source, either loop clock or local clock.

- 1 = loop clock
- 2 = local clock

Step 3 Enter **dspln** or **dsplns** to check the line. For **dspln**, the valid line number is 1.

Step 4 Enter **addport** to create a logical port

addport <*port_num*> <*line_num*>

port_num — The logical port number and is always 1

line_num — The number of the physical line and is always 1

Step 5 Enter **cnfportrscprtn** to configure resources at the port level as needed

cnfportrscprtn <*port_num*> <*controller_name*>

port_num	The logical port number and is always 1
controller_name	The name of the network control application. Enter one of the following strings: PAR, PNNI, or MPLS

Step 6 Optionally configure Y-cable redundancy if you have connected the lines of adjacent CESMs through a Y-cable. The applicable commands are **addred**, **dspred**, and **delred**. These commands run on the PXM1 rather than the service module, you must change to the PXM1 CLI to enter them:

addred <*redPrimarySlotNum*> <*redSecondarySlotNum*> <*redType*>

redPrimarySlotNum	The slot number of the primary card. The possible numbers are 1–6, 9–14, 17–22, and 25–30
redSecondarySlotNum	The slot number of the primary card. The possible numbers are 1–6, 9–14, 17–22, and 25–30
redType	The type of redundancy. Enter a 1 for 1:1 Y-cable redundancy

Adding and Modifying Connections

Use either the Cisco WAN Manager application or the CLI to add or modify connections. If you use the Cisco WAN Manager application, refer to the *Cisco WAN Manager Operations Guide*.

This section describes how to add a connection to a PXM1 in a stand-alone shelf according to the rules for a standard connection or a management connection in the form of either a three-segment connection or a DAX con. See the "Rules for Adding Connections" section on page 6-3. The preferred command is **addcon**. If the application requires NSAP addressing, use **addchan** to add the connection and **cnfchan** if you need to modify it. Refer to the command reference for the syntax.

To add a connection perform the following steps.

Step 1 Add a connection by entering **addcon**. (Alternatively, you can enter **addchan** if your application requires the NSAP format of end-point specification.) Enter **addcon** at both ends of the connection—unless the remote end-point is on port 34 of a PXM1 (see the note at the end of this step).

The syntax for **addcon** is

addcon <*port_num*> [*mastership* [*remoteConnId*]]

port_num	The logical port number and is always 1

mastership	Indicates whether this end-point is the master or slave 1 = master; 2 = slave (default)
remoteConnId	The identification for the connection at the slave end. The format is *switchname.slot_number.port_number.vpi.vci*. For the MGX-CESM-T3 and MGX-CESM-E3, the VPI and VCI are typically 0 or 1

Note For the *channel number*, the system always returns the number 32 for the high-speed CESM. If you enter **dspchan**, use channel number 32 to see details about the channel (or **dspchans**—and no arguments—to see high-level details about the channel). In contrast, the **dspcon** command takes the *port number* 1 to identify the connection even though it shows the same information as **dspchan**.

Step 2 Optionally, you can enter **cnfcon** to modify the connection.

cnfcon <*port_num*> <*CDVT*> <*CellLossIntegPeriod*> <*bufsize*>

port_num	The port number and is always 1
CDVT	A tolerable variation for the arrival time of cells. For T3, the range is 125–1447 microseconds in 125-microsecond increments. For E3, the range is 125–1884 microseconds in 125-microsecond increments
CellLossIntegPeriod	The amount of time a connection can be in an error condition before an alarm is declared. The range is 1000–65535 milliseconds
bufsize	The egress buffer size in bytes. You can let the CESM compute the size by entering 0 for *bufsize* or enter the number of bytes up to a maximum of 16224

Step 3 Optionally, you can enter **cnfswparms** on a BPX 8600 series switch to configure connection parameters for the network segment of a three-segment connection. For a stand-alone application, use whatever means are supported by the backbone switches.

cnfswparms <*chan_num*> <*mastership*> <*vpcflag*> <*conn_service_type*> (=cos) <*route_priority*> <*max_cost*> <*restrict_trunk_type*> <*pcr*> <*mcr*> <*pct_util*>

chan_num	The channel (connection) number and is always 32
mastership	The current end-point as master or slave: 1 = master; 2 = slave (default)
vpcflag	Indicates whether the connection is a VPC or a VCC: 1 = VPC and 2 = VCC
conn_service_type	The type of service for the connection: 1 = cbr, 2 = vbr, 3 is not used; 4 = ubr, 5 = atfr; 6 = abrstd, and 7 = abrfst
route_priority	The priority of the connection for rerouting. The range is 1–15 and is meaningful only in relation to the priority of other connections
max_cost	A number establishing the maximum cost of the connection route. The range is 1–255 and is meaningful only in relation to the cost of other connections
restrict_trunk_type	A number that specifies the type of trunk this connection can traverse. The numbers are 1 for no restriction, 2 for terrestrial trunk only, and 3 for satellite trunk only
pcr	The peak cell rate in cells per second (cps). For T3, the maximum is 118980 cps. For E3, the maximum is 91405 cps
mcr	The minimum cell rate. The range is 1–65535 cells per second
pct_util	The percent utilization in the range 1–100

Bit Error Rate Testing on a T3 or E3 CESM

An active MGX-CESM-T3 or MGX-CESM-E3 can perform a bit error rate test (BERT). Each of these cards contains its own BERT controller, so BERT sessions can run on any number of these cards in the system. However, only one user at a time can run BERT on a card. BERT disrupts service because it requires the tested path to be in loopback mode.

The CLI commands (whose functions correspond to CiscoView selections) appear in the following list. The correct order of task execution is crucial for obtaining valid results. With the exception of **dspdsx3bert**, you must enter the commands in the order they appear in the following list. You can enter **dspdsx3bert** before, during, or after a session. Because the order command sequence is crucial, read the command descriptions whether you use the CiscoView application or the CLI.

1. **acqdsx3bert** determines if another user currently is running a BERT session on the card.
2. **startdsx3bert** starts a BERT test (after resetting BERT counters).
3. **cnfdsx3bert** specifies a pattern for the BERT test.
4. **moddsx3bert** injects multi-rate errors into the BERT bit stream.

5. **deldsx3bert** ends the current test (and retains the values in the BERT counters). This command also resets the status of current users that **acqdsx3bert** detects.
6. **dspdsx3bert** displays the parameters and results of the current test. You can enter this command at any time.

Refer to the *Cisco MGX 8000 Series Command Reference* for command details.

Note When a BERT session begins, all the connections on the line go into alarm and return to normal when you end the test. Consequently, the test may result in a large number of traps and other types of traffic (such as AIS).

Eight-Port Circuit Emulation Service Modules

The main function of the Circuit Emulation Service Module (CESM) is to provide a constant bit rate (CBR) circuit emulation service by converting data streams into CBR AAL1 cells for transport across an ATM network. The CESM supports the CES-IS specifications of the ATM Forum.

The 8-port CESM lets you configure individual physical ports for structured or unstructured data transfer. The card sets consist of an AX-CESM-8T1 or AX-CESM-8E1 front card and one of the following back cards:

- RJ48-8T1
- R-RJ48-8T1 for supporting 1:N redundancy through the optional MGX-SRM-3T3/C
- RJ48-8E1
- R-RJ48-8E1 for supporting 1:N redundancy through the optional MGX-SRM-3T3/C
- SMB-8E1

Structured Data Transfer

If you configure an individual port for structured data transfer, the 8-port CESM supports:

- Synchronous timing.
- Superframe or Extended Superframe for T1.
- *N*x64 Kbps, fractional DS1/E1 service (contiguous time slots only). You can map an *N*x64 Kbps channel to any VC.
- CAS robbed bit for T1 (ABCD for ESF and SF frames) and CAS for E1 (channel 16).
- CCS channel as a transparent data channel.
- Choice of partial-fill payload sizes.
- Idle detection and suppression for 64 Kbps CAS connections.
- Loopback diagnostics on a line or a connection (**addlnloop**, **tstcon**, and **tstdelay** commands).
- BERT functionality with loopback pattern generation and verification on individual lines or logical port. For a description of the BERT functions, see the “Bit Error Rate Testing Through an MGX-SRM-3T3” section on page 6-63.

Unstructured Data Transfer

If you configure an individual port for unstructured data transfer, the 8-port CESM supports:

- Synchronous or asynchronous timing at T1 (1.544 Mbps) or E1 (2.048 Mbps) rates. For asynchronous timing, you can select its basis as either SRTS and adaptive clock recovery.
- The special port type *framingOnVcDisconnect*. This port type prevents a remote-end CPE from going to LOF by placing a line in remote loopback mode when the CESM determines that a connection deletion or suspension occurred at the network-side ATM interface.
- Ability to detect and display a yellow alarm for the ESF framing on a T1 line.
- Loopback diagnostics on a line or a connection (**addlnloop**, **tstcon**, and **tstdelay** commands).
- Bit error rate test (BERT) functionality with loopback pattern generation and verification on individual lines. For a description of BERT functions, see the "Bit Error Rate Testing Through an MGX-SRM-3T3" section on page 6-63.

Cell Delay Treatment

For each connection, you can configure a tolerable cell delay variation time (CDVT) according to the expected reliability of the route. The CDVT applies to the receive buffer. After an underrun, the receiver places the contents of the first cell to arrive in a receive buffer then plays it out at least one CDVT value later. For each VC, the maximum cell delay and CDVT (or jitter) are

- For T1
  - Cell delay of 48 msec
  - CDVT of 24 msec in increments of 125 microseconds
- For E1
  - Cell delay of 64 msec
  - CDVT of 32 msec in increments of 125 microseconds

Redundancy Support for the Eight-Port CESM

The AX-CESM-8T1 and AX-CESM-8E1 can have 1:N redundancy support but with some variations between the T1 and E1 modes of operation. The type of redundancy and the type of back card are interdependent. See the "Service Resource Module" section on page 6-60 for more details. Some general observations are:

- With an RJ48-8T1, an MGX-SRM-3T3 can provide 1:N redundancy through the distribution bus or the redundancy bus.
- With an RJ48-8E1, an MGX-SRM-3T3 can provide 1:N redundancy through the redundancy bus.

Back card requirements for the MGX-SRM-3T3 and service modules vary, as follows:

- If you are using the MGX-SRM-3T3 for *bulk distribution* of T1 channels, the CESMs do not use back cards, but each MGX-SRM-3T3/C must have an MGX-BNC-3T3-M back card. (Bulk distribution is not available for E1 operation.)
- If the MGX-SRM-3T3/C supports T1 or E1 1:N redundancy through the *redundancy bus* (no bulk distribution), the MGX-SRM-3T3/C does not require a back card, but the *N* CESM primary cards must have one redundant version of the back card.

Error and Alarm Response

When it detects a loss of signal (LOS) alarm, the CESM notifies the connected CPE in the upstream direction after an integration period. The CESM continues to emit cells but sets the ATM cell payload with an appropriate data pattern as specified by the ATM Forum CES V2.0 specification. Also, an OAM cell with RDI code goes to the far end to indicate out of service. See (Table 6-5).

Table 6-5 CESM Errors and Alarms

Error	Alarm Type	Down stream	Up Stream	Comments
Link Failure (RX)	Blue (LOS)	AIS—OAM cells	None	Data cells According to ATM-Forum CES-IS V 2.0
Receive RAI	Yellow	None	None	—
Receive LOF	—	—	—	—
Receive AIS	Blue (AIS)	AIS (link)	FERF OAM cells	AIS over the T1 link or alternating 1s and 0s E1 link.

Configuring Service on an Eight-Port CESM

This section describes the steps for setting up a CESM and adding connections. The maximum number of connections is 248 on the MGX-CESM/B-8E1 and 192 on the MGX-CESM/B-T1. Use either the CLI or the Cisco WAN Manager application to set up a CESM and add connections. The following list shows the fundamental tasks and applicable CLI commands:

- Optionally configure redundancy at the card level (**addred** and possibly **addlink** on the PXM1)
- Optionally modify resource partitions at the card level (**cnfcdrscprtn**)
- Activate a physical line (**addln**) and optionally configure the line (**cnfln**)
- Create logical ports for structured data transport on a physical line (**addport**)
- Optionally modify resource partitions at the port level (**cnfportrscprtn**)
- Add connections by entering **addcon** (or **addchan** if NSAP addressing is necessary)

For CESM-related commands, see the list of service module commands at the beginning of the *Cisco MGX 8000 Series Command Reference*. Also, each command description in the command reference lists related commands. For example, it shows display commands that relate to addition commands.

Configuring the Card, Lines, and Ports

This section describes how to configure parameters for the card, lines, and ports through the CLI. If you use the CiscoView application, refer to the CiscoView documentation. On the CLI, the command sequence is:

Step 1 Add the line by entering the **addln** <*line number*> command.

where *line number* is in the range 1–8. You can modify line characteristics with **cnfln**.

Step 2 Optionally execute **cnfln** to modify line characteristics from the defaults. (Use **dspln** or **dsplns** to check). The syntax for **cnfln** is:

cnfln <*line_num*> <*line_code*> <*line_len*> <*clk_src*> [*E1-signalling*]

line_num	Line number, in the range 1–8.
line_code	Line coding. • 2 = B8ZS, applies to T1 • 3 = HDB3, applies to E1 • 4 = AMI, applies to T1 or E1
line_len	Line length, as appropriate for the interface. • T1: 10–15 – 10: 0–131 ft. – 11: 131–262 ft. – 12: 262–393 ft. – 13: 393–524 ft. – 14: 524–655 ft. – 15: 655+ ft. • E1 with SMB module: 8 • E1 with RJ-48 module: 9
clk_src	Clock source, either loop clock or local clock. • 1 = loop clock • 2 = local clock
E1-signalling	• CAS: CAS, no CRC • CAS_CRC: CAS with CRC • CCS: CCS no CRC • CCS_CRC: CCS with CRC • CLEAR: Clear E1

Step 3 Create a logical port with **addport** if the application requires *N* x 64Kbps channels:

addport <*port_num*> <*line_num*> <*begin_slot*> <*num_slot*> <*port_type*>

Step 4

port_num	Logical port number in the range 1–256. When you subsequently add a connection through the preferred command **addcon** or the **addchan** command (which requires NSAP format), you must indicate a logical port by using this singular *port_num* regardless of the number of DS0s. (You can add 1–24 DS0s to a single *port_num* through the other **addport** parameters.)
line_num	DS1 number in the range 1–56 to which you assign the DS0 when both lines are active. If you activate only one line, the range is 1–28. You can assign up to 24 contiguous DS0s to one DS1. Each physical line supports up to 28 DS1s. The number of DS0s cannot span more than DS1.

begin_slot	Beginning DS0 timeslot in 1 base. For example, on port number 50, you could specify *begin_slot* to be 9 then specify *num_slot* to be in the range 1–16.
num_slot	Number of DS0s in the associated DS1. Note that the number of DS0s cannot be such that the logical port spans more than DS1.
port_type	Number representing the mode of operation for the logical port—1 for Frame Relay, 2 for FUNI mode-1a, and 3 for frame forwarding.

Step 5 Configure resources at the port level as needed by executing **cnfportrscprtn**:

cnfportrscprtn <*port_num*> <*controller_name*>

port_num	The logical port number in the range 1 – 192 for T1 or 1 – for E1.
controller_name	The name of the network control application. Enter one of the following strings: PAR, PNNI, or MPLS

Configuring Bulk Distribution and Redundancy

You can configure either bulk distribution alone, redundancy alone, or both of these features according to the restrictions in the "Redundancy Support for the Eight-Port CESM" section on page 6-52. On the CLI of the PXM1, execute **addlink** for bulk distribution (T1 only) before you enter **addred** for redundancy. To configure bulk distribution enter **addlink** to create the links:

addlink <*T3 line number*> <*T1 line number*> <*Target Slot number*> <*Slot line number*>

- *T3 line number* — MGX-SRM-3T3/C line number in the format *slot.line*. The *slot* can be 15 or 31. The range for *port* is 1–3
- *T1 line number* — Starting T1 line number within the T3 line. The range for the T1 line number is 1–28.
- *Target Slot number* — Slot number for the T1 service module.
- *Slot line number* — T1 line number in the range 1–8.

Execute **addred**:

addred <*redPrimarySlotNum*> <*redSecondarySlotNum*> <*RedType*>

redPrimarySlotNum	The primary slot. For the redundancy bus (no bulk distribution), valid slot numbers are 1–6, 9–14, 17–22, and 25–30. With bulk distribution of T1 channels, do not specify 9, 10, or 26.
redSecondarySlotNum	The secondary slot. For the redundancy bus (no bulk distribution), valid slot numbers are 1–6, 9–14, 17–22, and 25–30. With bulk distribution of T1 channels, do not specify 9, 10, or 26.
RedType	The type of redundancy. A 1 specifies 1:1 for E1 with SMB connectors. A 2 specifies 1:N for T1 or E1.

Adding and Modifying Connections

Use either the Cisco WAN Manager application or the CLI to add or modify connections. If you use the WAN Manager application, refer to the *Cisco WAN Manager Operations Guide*.

This section describes how to add a connection to a PXM1 in a stand-alone shelf according to the rules for a standard connection or a management connection in the form of either a three-segment connection or a DAX con. See the "Rules for Adding Connections" section on page 6-3. The preferred command is **addcon**. If the application requires NSAP addressing, enter **addchan** to add the connection and **cnfchan** if you need to modify it. Refer to the command reference for the syntax. Perform the following steps to add a connection

Step 1 Add a connection through the preferred command **addcon**. (Alternatively, you can use **addchan** if your application requires the NSAP format of end-point specification.)

Enter the **addcon** command at both ends of the connection—unless the remote end-point is on port 34 of a PXM1 (see the note at the end of this step). The maximum number of connections for the AX-CESM-8T1 is 248 and 192 for the AX-CESM-8E1. Note that because you can add only one connection per port, **addcon** does not request a connection number.

The system automatically assigns the next available *channel number*, so the **addcon** command does not require it. However, some related commands require a channel number. To see the channel number after you add a connection, enter **dspcons**.

The syntax for **addcon** is:

addcon <*port_num*> <*sig_type*> <*partial_fill*> <*cond_data*> <*cond_signalling*> [*controller_type*] [*mastership*] [*remoteConnId*]

port_num	Port number for T1 or E1 interface. • T1 range = 1–192 • E1 range = 1–248
sig_type	Channel associated signalling (CAS) value. • 1 = basic • 2 = E1 CAS • 3 = DS1 superframe CAS • 4 = DS1 extended superframe CAS
partial_fill	Number of bytes to set cell fills, as associated with line types. • Partial fill, in the range 0–47. Enter the value either 0 or 47 to set this parameter for fully filled cells. • Structured T1, in the range 25–47. • Structured E1, in the range 20–47. • Unstructured T1/E1, in the range 33–47.
cond_data	Conditional data UDT or SDT. • UDT = 255 • SDT range = 0–255 Conditional data is sent on the line when there is an underflow and also toward the network when forming dummy cells.
cond_signalling	Conditional signalling, in the range 0–15. Conditional signalling is sent on the line when there is an underflow and also toward the network when forming dummy cells.
controller_type	Value to set signalling controller type as either PVC or SPVC. • 1 = PVC (PAR) (default) • 2 = SPVC (PNNI)

mastership	Value to set status of current end as the master or slave. • 1 = master • 2 = slave (default)
RemoteEndConID	Node name, slot number, port number, and DLCI. or Node name, slot number, port number, Controller ID, and DLCI for a Frame Relay endpoint. Use one of the following values to set controller type: • 0 = PAR • 1 = PNNI • 2 = TAG or The node name, slot number, port number, and VPI.VCI for an ATM endpoint. **Note** Note: the slot number should be set to 0 (zero) to point to the active PXM.

Step 2 Optionally, you can use **cnfcon** to modify an individual connection. This command requires a channel number. If you add a connection by using **addcon**, you do not need to specify a channel number because the system automatically uses the next available number. To obtain the channel number for **cnfcon**, execute **dspcons**.

cnfcon <*port_num*> <*CDVT*> <*CLIP*> <*bufsize*> <*cbrclkmode*> <*IdleSuppEnable*> <*ForceSuppression*>

port_num	Unique port number.
CDVT	Cell delay variation tolerance (CDVT), as appropriate for the interface. • T1 range = 125–24000 microseconds • E1 range = 125–26000 microseconds
CLIP	Cell loss integration period (CLIP), in the range 1000–65535 milliseconds.
bufsize	• Egress bufsize = 0 to autocompute. • Min value depends on CDVT configured. • Min BufSize = greater (CDVT in frames * 2) * *N*, (CDVT + frames in two cells) * *N* • Max for T1 UDT and E1 UDT: 16224 bytes • Max for T1 SDT: 384 * *N* bytes • Max for E1 SDT: 417 * *N* bytes, where *N* is the number of timeslots assigned in *N*x64 connection, and *N* = 32 for T1/E1 UDT

clockmode	Clock mode. • 1 = synchronous • 2 = SRTS • 3 = adaptive
IdleSuppEnable	Idle suppression, either enabled or disabled. • 1 = disable • 2 = enable
ForceSuppression	External idle suppression, either enabled or disabled. • 1 = disable • 2 = enable

Step 3 Optionally, you can configure connection parameters for the network segment of a three-segment connection:

cnfswparms <*chan_num*> <*mastership*> <*vpcflag*> <*conn_service_type*> (=cos) <*route_priority*> <*max_cost*> <*restrict_trunk_type*> <*pcr*> <*mcr*> <*pct_util*>

chan_num	The channel (connection) number and is always 32
mastership	The current end-point as master or slave: 1 = master; 2 = slave (default)
vpcflag	Indicates whether the connection is a VPC or a VCC: 1 = VPC and 2 = VCC
conn_service_type	The type of service for the connection: 1 = cbr, 2 = vbr, 3 is not used; 4 = ubr, 5 = atfr; 6 = abrstd, and 7 = abrfst
route_priority	The priority of the connection for rerouting. The range is 1–15 and is meaningful only in relation to the priority of other connections
max_cost	A number establishing the maximum cost of the connection route. The range is 1–255 and is meaningful only in relation to the cost of other connections
restrict_trunk_type	A number that specifies the type of trunk this connection can traverse. The numbers are 1 for no restriction, 2 for terrestrial trunk only, and 3 for satellite trunk only
pcr	The peak cell rate in cells per second (cps). For T3, the maximum is 118980 cps. For E3, the maximum is 91405 cps
mcr	The minimum cell rate. The range is 1–65535 cells per second
pct_util	The percent utilization in the range 1–100

Service Resource Module

This section describes how to use the features of the T3 version of the Service Resource Module (MGX-SRM-3T3/C). This multipurpose card can provide:

- Demultiplexing of T3 service called *bulk distribution.*
- 1:N redundancy support for service modules with T1 or E1 lines.
- Bit error rate testing (BERT) for T3, E3, T1, E1, fractional T1, or subrate operation with loopback pattern generation and verification on individual lines or logical port. For a description of the BERT functions, see the “Bit Error Rate Testing Through an MGX-SRM-3T3” section on page 6-63.

An MGX-SRM-3T3/C installation requires at least one card set in the upper bay of the card cage and one card set in the lower bay. Each set services one half of the backplane. The PXM1 in slot 7 controls the SRMs in slots 15 and 31. The PXM1 in slot 8 controls the redundant SRMs in slots 16 and 32. If the shelf has SRMs with redundant PXM1s, the SRMs must occupy all the reserved slots for this feature—15, 16, 31, and 32.

Configuring Card and Line Parameters

You can configure card- and line-level parameters for an SRM through the CiscoView application or the CLI on the PXM1 (not the SRM itself). For descriptions of the commands, refer to the *Cisco MGX 8250 Wide Area Edge Switch Command Reference*. The CLI commands that apply to the SRM are:

- **addln**
- **delln**
- **cnfln**
- **dspln**
- **dsplns**
- **addlmiloop**
- **dellmiloop**
- **cnfsrmclksrc**
- **dspsrmclksrc**
- **dspalm**
- **dspalms**
- **dspalmcnt**
- **clralmcnt**
- **clralm**
- **dspalmcnt**
- **addlink**
- **dsplink**
- **dellink**
- **addred**
- **dspred**
- **delred**

Bulk Distribution for T1 Service

The MGX-SRM-3T3/C supports a demultiplexing function called *bulk distribution*. With bulk distribution, the MGX-SRM-3T3/C converts traffic from its T3 lines to T1 channels and sends the data streams across the *distribution bus* to the appropriate service modules. The benefit of this feature is that the number of T1 cables and back cards is greatly reduced. Applicable service modules are the MGX-AUSM/B-8T1, AX-FRSM-8T1, and AX-CESM-8T1.

At its MGX-BNC-3T3-M back card, the MGX-SRM-3T3/C connects to an external multiplexer. The multiplexer connects to the T1 lines from user-equipment and places the data streams on T3 lines to the MGX-SRM-3T3/C. Each T3 line can contain 28 T1 channels. An individual MGX-SRM-3T3/C can support 10 card slots, so the maximum number of T1 channels it can process is 80.

Linking the MGX-SRM-3T3/C to a destination card causes the shelf to take CPE traffic through the MGX-SRM-3T3/C rather than the T1 card’s line module. Linkage is a card-level condition. If you link just one T1 channel on a service module to the MGX-SRM-3T3/C, the back card on the service module becomes inoperative, so you must link all other T1 ports on that service module to the MGX-SRM-3T3/C if you want them to operate. Linking T1 ports into a group does not form an N X T1 channel. Each T1 channel remains a distinct T1 channel. Furthermore, a group belongs to one slot, so it cannot include T1 channels belonging to another card.

For a description of how the MGX-SRM-3T3/C supports redundancy for linked channels, see the “Redundancy Support by the MGX-SRM-3T3/C” section on page 6-61.

Before configuring bulk distribution on an SRM, perform the following tasks:

1. Activate the lines (**addln** on the CLI).
2. Optionally configure the lines (**cnfln** on the CLI).
3. Display the state of the lines (**dspln** and **dsplns** on the CLI).

To link T1 ports on a service module to a T3 line on an MGX-SRM-3T3/C:

- Enter **addlink** on the active PXM1. Related commands are **dsplink** and **dellink**.
  addlink <*T3 line number*> <*T1 slot*> <*NumberOfT1s*> <*TargetSlotLineNum*>

T3 line number	The line number in the format *slot.line,* where *slot* is 15 or 31 (regardless of whether redundant SRMs exist in slots 16 and 32), and the range for *line* is 1–3.
T1 slot	The start T1 line number within the T3 line (range 1–28).
NumberOfT1s	The slot number of the T1 service module. *Target Slot number* can be 1-6, 11-14, 17-22, or 27-30.
TargetSlotLineNum	The T1 line number in the linked card slot. The range is 1–8.

Redundancy Support by the MGX-SRM-3T3/C

The MGX-SRM-3T3/C can provide redundancy to service modules with T1 or E1 lines. For E1 or T1 modules, it can provide redundancy through the *redundancy* bus. For T1 modules only, it can provide redundancy through the *distribution* bus. The *redundancy* and *distribution* buses impose different requirements, but the common requirement is that all primary and secondary cards supported by a particular MGX-SRM-3T3/C must reside on the same level of the card cage as that SRM.

The need for back cards and the choice of bus for redundancy support depends on whether the MGX-SRM-3T3/C must provide bulk distribution:

- With bulk distribution, the T1 service modules do not use back cards. The MGX-SRM-3T3/C uses the distribution bus to support redundancy.
- Without bulk distribution, the supported service modules must have back cards. The redundant card set requires a special redundancy back card (R-RJ48-8T1 or R-RJ48-8E). The primary card sets use standard back cards (RJ48-8T1 or RJ48-8E1).

With redundancy provided by the SRM, no Y-cables are necessary because the MGX-SRM-3T3/C itself passes the traffic to the redundant front card if a failure necessitates switchover. Conversely, any card with 1:1 redundancy supported by Y-cabling does not require an SRM. For example, the FRSM-VHS cards have 1:1 redundancy through a Y-cable. The MGX-SRM-3T3/C redundancy feature is particularly important for cards that do not have Y-cable redundancy—the T1 and E1 service modules.

Configuring Redundancy Through the Redundancy Bus

For redundancy that utilizes the redundancy bus, the characteristics are

- Both the primary and the redundant front cards must have back cards. The secondary back card must be the version specifically designed to be redundant cards. Examples are the R-RJ48-8T1 and R-RJ48-8E1, where the first "R" means redundant.
- An MGX-SRM-3T3/C can redirect traffic for only one failed card at a time regardless of the number of redundant groups you have configured to rely on that MGX-SRM-3T3/C for redundancy.

Perform the following steps to configure redundancy through the redundancy bus.

Step 1 Execute **addred** on the active PXM1:

addred <*redPrimarySlotNum*> <*redSecondarySlotNum*> <*RedType*>

where:

redPrimarySlotNum	Slot number of the slot containing the primary card. The slot numbers are 1–6, 9–14, 17–22, and 25–30.
redSecondarySlotNum	Slot number of the slot containing the secondary card of the card pair. The ranges are 1–6, 9–14, 17–22, and 25–30.
RedType	A number that specifies the type of redundancy. Enter a one to specify 1:1 redundancy. Enter a two to specify 1:N redundancy. Only an SRM can support 1:N redundancy.

Step 2 Check the redundancy status for all cards by entering the **dspred** command.

To remove redundancy, enter the **delred** command.

Configuring Redundancy Through the Distribution Bus

Redundancy by way of the distribution bus applies to T1 channels you linked for bulk distribution. For a redundancy configuration on the MGX-SRM-3T3/C that utilizes the distribution bus note the following items.

- No back cards are necessary.
- The MGX-SRM-3T3/C can support multiple switchovers for different 1: N redundancy groups.
- Slots 9, 10, 15, or 26 are not supported.

Before you specify redundancy with bulk distribution, linkage must exist between a T3 line on the MGX-SRM-3T3/C and a primary service module with the T1 lines. No linkage should exist on the secondary service module. To configure redundancy through the CLI:

Step 1 Execute **addred** on the active PXM1:

addred <*redPrimarySlotNum*> <*redSecondarySlotNum*> <*RedType*>

where:

redPrimarySlotNum	Slot number of the slot containing the primary card. Permissible slot numbers are in the range 1–6, 11–14, 17–22, and 27–30.
redSecondarySlotNum	Slot number of the slot containing the secondary card of the card pair. Permissible slot numbers are in the range 1–6, 11–14, 17–22, and 27–30.
RedType	A number that specifies the type of redundancy. Enter a 1 to specify 1:1 redundancy. Enter a 2 to specify 1:N redundancy. Only an SRM can support 1:N redundancy.

Step 2 Check the redundancy status for all cards by entering the **dspred** command.

To remove redundancy, enter the **delred** command.

Bit Error Rate Testing Through an MGX-SRM-3T3

The MGX 8250 shelf can perform a bit error rate test (BERT) on an active line or port. This type of testing disrupts service because a BERT session requires the tested path to be in loopback mode. In addition, the pattern test replaces user-data in the path with the test pattern. The applicable line types and variations for a DS1 are

- T1 or E1 line
- Fractional portions of a T1 line that add up to a DS1
- Single 56 Kbps or 64 Kbps DS0
- DS0 bundle consisting of Nx64 Kbps DS0s

With a set of MGX-SRM-3T3/C cards in the system, you can initiate a BERT session on an MGX-FRSM-2CT3 or any eight-port service module. (In contrast, the MGX-FRSM-2T3E3, MGX-CESM-T3, and MGX-CESM-E3 do not use the MGX-SRM-3T3/C for BERT. See the sections for these service modules in this chapter for applicable BERT.)

The MGX 8250 bus structure supports one BERT session per upper or lower bay, so the shelf can run a maximum of two sessions at once. When you specify the target slot through the CiscoView application or the CLI, the system determines if a BERT configuration already exists in that bay. After the system determines that no BERT configuration exists in the applicable bay, the display presents a menu for the BERT parameters.

The CLI commands (whose functions correspond to CiscoView selections) are

- **cnfbert** to configure and start a test
- **modbert** to inject errors into the BERT bit stream
- **dspbert** to display the parameters and results of the current test
- **delbert** to end the current test

Note When a BERT session begins, all connections on a line or port go into alarm and return to normal when the test ends. Consequently, the test may result in other types of traffic (such as AIS).

During configuration, the parameter display or menu items depend first on the card type and whether the test medium is a physical line or a logical port. Subsequent choices are test type, test patterns, loopback type, and so on. Refer to the *Cisco MGX 8250 Wide Area Edge Switch Command Reference* for details on **cnfbert** and the other BERT commands. The concatenation of menu to menu is extensive, so this section contains tables of menu selections based on the card types and the test type.

The test type can be *pattern*, *loopback*, or *DDS seek*. The choice of test type leads to further menu displays. Following the tables of menu choices, the remaining sections define the parameters in these menu choices.

- For AX-FRSM-8T1, AX-CESM-8T1, and MGX-FRSM-2CT3, see Table 6-6 pattern tests and Table 6-7 for loopback tests.
- For AX-FRSM-8E1 and AX-CESM-8E1, see Table 6-8 for pattern tests and Table 6-9 for loopback tests.
- For MGX-AUSM-8T1, see Table 6-10 for pattern tests and Table 6-11 for loopback tests.
- For MGX-AUSM-8E1, see Table 6-12 for pattern and Table 6-13 loopback tests.

Table 6-6 *Pattern Test for AX-FRSM-8T1, AX-CESM-8T1, and MGX-FRSM-2CT3*

Test Medium	Medium Type	Device to Loop	BERT Pattern
Port	• Port with *N* timeslots (can also submit to the DDS seek test)	v54	all patterns
	• Port with one 64 Kbps timeslot (can also submit to the DDS seek test)	latch or v54	all patterns
	• Port with one 56 Kbps timeslot (can also submit to the DDS seek test)	noLatch latch or v54	2^9 or 2^{11} all patterns
Line	—	in-band/ESF or metallic	all patterns

Table 6-7 *Loopback Test for AX-FRSM-8T1, AX-CESM-8T1, and MGX-FRSM-2CT3*

Test Medium	Medium Type	Loopback
Port	• Port with N timeslots (can also submit to the DDS seek test)	far end or remote
	• Port with one 64 Kbps timeslot (can also submit to the DDS seek test)	far end or remote
	• Port with one 56 Kbps timeslot (can also submit to the DDS seek test)	far end or remote
Line	—	metallic, far end, or remote

Table 6-8 *Pattern Test for AX-FRSM-8E1 and AX-CESM-8E1*

Test Medium	Medium Type	Device to Loop	BERT Pattern
Port	any	none	all patterns
Line	—	metallic	all patterns

Table 6-9 *Loopback Test for AX-FRSM-8E1 and AX-CESM-8E1*

Test Medium	Medium Type	Loopback
Port	any	remote loopback
Line	—	metallic or remote

Table 6-10 Pattern Test for MGX-AUSM-8T1

Test Medium	Medium Type	Device to Loop	BERT Pattern
Line	—	in-band/ESF	all patterns

Table 6-11 Loopback Test for MGX-AUSM-8T1

Test Medium	Medium Type	Loopback
Line	—	far end, remote, or metallic

Table 6-12 Pattern Test for MGX-AUSM-8E1

Test Medium	Medium Type	Device to Loop	BERT Pattern
Line	—	none	all patterns

Table 6-13 Loopback Test for MGX-AUSM-8E1

Test Medium	Medium Type	Loopback
Line	n/a	remote or metallic

Pattern Test Options

The pattern test options consist of the device to loop and the pattern. This section lists the device options and patterns that appear in the menus. See the preceding tables. The *device to loop* options identify the type of device that participates in the test.

- *noLatch* is a device that does not latch the data. It can be:
  - Nonlatching office channel unit (OCU) that consists of one device
  - Nonlatching OCU that consists of a chain of devices
  - Nonlatching channel service unit (CSU)
  - Nonlatching data service unit (DSU)
- *Latch* is a device that can latch the data. It can be:
  - Latching DS0-DP drop device
  - Latching DS0-DP line device
  - Latching office channel unit (OCU)
  - Latching channel service unit (CSU)
  - Latching data service unit (DSU)
  - Latching HL96 device
- *in-band/ESF*
- *v54* is a polynomial loopback
- *metallic* is a local loopback within the service module and does not involve an external device.

The available patterns are

1. All 0s
2. All 1s
3. Alternating 1-0 pattern
4. Double 1-0 pattern
5. 2^{15}-1 pattern
6. 2^{20}-1 pattern
7. 2^{20}-1 QRSS pattern
8. 2^{23}-1 pattern
9. 1 in 8 pattern
10. 3 in 24 pattern
11. DDS-1 pattern
12. DDS-2 pattern
13. DDS-3 pattern
14. DDS-4 pattern
15. DDS-5 pattern
16. 2^9 pattern
17. 2^{11} pattern

Loopback Test Options

The loopback tests do not monitor the integrity of the data but rather the integrity of the path. The type of loopback indicates the direction of test data transmission. The choices are

- *far end* means the service module transmits data to the CPE and receives the data back
- *remote* means the service module receives data from the CPE and loops back to the CPE
- *metallic* means the service module receives data from the network and loops it back to the network

Online Diagnostics Test

The Online Diagnostics are used to test components on the PXM1 and SRM modules of the MGX 8250 while the shelf is running. Connections, states, and tasks are not affected by the tests.

The diagnostic test is invoked from the active PXM1. If a standby PXM1 exists and is in standby state, it will also be tested. When the test is run, each component is checked and the results are presented on the screen. Results are also saved to a log file.

Automatic Switchover

The Online Diagnostic command (**oldiags**) includes an option to automatically switch operations from the active PXM1 to the standby PXM1 if a major problem is detected. This behavior is possible only when a standby PXM1 is installed and no errors are detected on the standby PXM1 during the test.

Alarms

If a failure is detected and an automatic switchover is not performed, a major alarm is set. This alarm is displayed in the card Major Alarm Bit Map field when the **dspcd** command is entered. The alarm message indicates the failed PXM1 by slot.

Note Certain hardware failures prevent alarms from being set. If this occurs, the log files and screen display should be used to determine if a failure has occurred.

Log Files

Each time the diagnostics are run, the results are logged in a file on the PXM1 drive. If a standby PXM1 exists, a separate log file is written to that disk and must be viewed separately.

- The log files on the active PXM1 also indicate if a failure occurred on the standby PXM1.
- Only the three most recent log files are retained. If three files exist and a new test is run, the oldest log file is overwritten by the new file.
- Log files are named *onlinediag.MONTHDAY_hh:mm*. The files are saved in C:DIAG.
- If a failure occurs, a message is also added to the shelf event log.

Commands to Operate the Online Diagnostics

The following commands are used to operate the Online Diagnostics:

oldiags <debug_level> <switch_enable>

This command runs the diagnostics on both the active PXM1 and the standby PXM1 (if available). Two options are available for this command. If the command is entered without specifying any options, the default values are automatically used. If options are used, they must be entered in the order shown:

- **<debug_level>** This option determines the amount of information to be displayed on the screen. This detail is shown on the screen only. Log files contain a standard set of information and are not affected by this option.
  - **debug_level** is a value between 0 and 3.
  - 0 (the default) displays the least amount of detail.
  - 3 displays the most detail.
- **<switch_enable>** enables or disables automatic switchover to the standby PXM1.
  - 0 (the default) disables automatic switchover.
  - 1 enables automatic switchover.

oldiags-help or oldiags help

These help commands display a description of the **oldiags** command and options.

oldclrlock

The **oldclrlock** command clears the lock of a previous **oldiags** process.

If an **oldiags** process is stopped while running (either from a keyboard command or unexpected process shutdown), the command will be locked and cannot be run again until the lock is cleared. The **oldclrlock** command clears this lock.

Note Do not enter **oldclrlock** while another instance of **oldiags** is running on the shelf.

oldsplog <log_name>

The **oldsplog** command displays the log files that are automatically created each time a diagnostic test is performed. Log files are named *onlinediag.MONTHDAY_hh:mm*. The files are saved in C:DIAG.

If **oldsplog** is run without a variable, the most recent log file will be displayed by default.

The **log_name** variable is used to view an older file or a file that resides in a directory other than C:DIAG. If the file to be viewed is saved in C:DIAG, only the name of the file needs to be entered. A full path name can also be used if the file resides outside the default directory.

The **oldsplog** command can be run from either the active or standby PXM1. Log files are saved on each individual PXM1 and must be viewed separately.

oldclralm <slot_number>

The **oldclralm** command clears Online Diagnostic alarms.

The variable **<slot_number>** is used to specify which PXM1 slot is to be cleared. This variable is mandatory.

The **oldclralm** command can only be run from the active PXM1.

DS3 Loopback Test

This section contains instructions to test DS3 loopback functionality using CLI commands.

Loopback Tests

Loopback tests can be performed on both DS3 lines and DS1s in DS3 lines.

Configure Loopback on the Entire DS3 Line

Perform the following steps to verify that the loopback can be configured on the entire DS3 line.

Step 1 Select a node with PXM-T3 back card.

Step 2 Configure the line entering **cnfln -felpbnum 30**.

Step 3 Check that **dsplog** does not show any errors or alarms logged.

Step 4 Enter **dspln** to check that *FarEndLoopbkLineNum* has been configured to be **ds3line**.

Pass Criteria:

- No errors logged on the console or the log due to configuring loopback on PXM-T3.

- Configured loopback can be displayed entering **dspln**.

Configure Loopback on all DS1s in a DS3 Line

Perform the following steps to verify that the loopback can be configured on all the DS1s of the DS3 line:

Step 1 Select a node with PXM-T3 back card.

Step 2 Configure the line using **cnfln -felpbnum 29**.

Step 3 Check that **dsplog** does not show any errors or alarms logged.

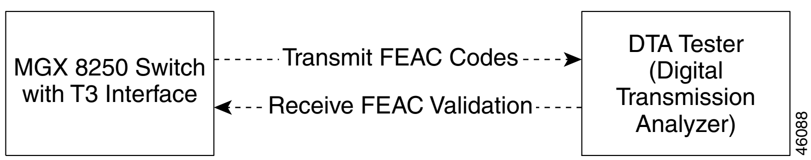
Step 4 Enter **dspln** to check that *FarEndLoopbkLineNum* is configured to be **ds1lineall**.

Pass Criteria:

- No errors logged on the console or the log due to configuring loopback on all DS1 lines of PXM-T3.
- Configured loopback can be displayed using **dspln.**

Receive a Loopback Request

Perform the following steps to verify that DS3 interface can be put into loopback:



Step 1 Select a node with PXM-T3 back card.

Step 2 Make sure that the FEAC code validation criteria on the DS3 interface is not disabled entering **dspln -ds3** <*slot*>.<*port*>.

Step 3 Configure the HP cerjac tester to send a pattern to the DS3 interface of the node.

Any pattern sent will cause the interface to put itself into loopback and the interface retransmits the same pattern back to the tester.

Step 4 From the tester, verify that the same pattern is received back on the tester thus validating the loopback on the DS3 interface.

Step 5 Check that **dsplog** does not show any errors or alarms logged.

Pass Criteria:

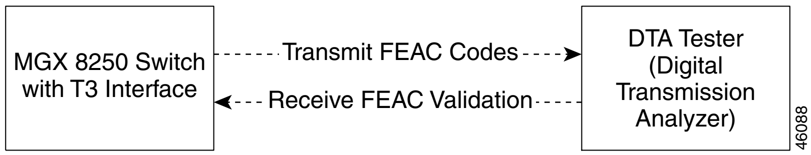
- The pattern sent by the tester is received back to the tester as is.
- No errors logged on the console or the log.

Configure Transmit FEAC code

This section describes how to configure a transmit FEAC code.

Configure Ds3 for Sending Looped or Normal Data

Perform the following steps to verify that DS3 can be configured to send looped or normal data:



Step 1 Select a node with PXM-T3 back card.

Step 2 Configure the line entering **cnfln -felpbnum 30**.

Step 3 Configure the transmit FEAC code to be '*dsx3SendNoCode*' by entering CLI command, **cnfln -ds3** <*slot*>.<*port*> **-tfeac 1**.

Step 4 On the node, verify that the default FEAC code shows up as *LineXmtFEACCode* : *SendNoCode* using **dspln -ds3** <*slot*>.<*port*>.

Step 5 Check that **dsplog** does not show any errors or alarms logged.

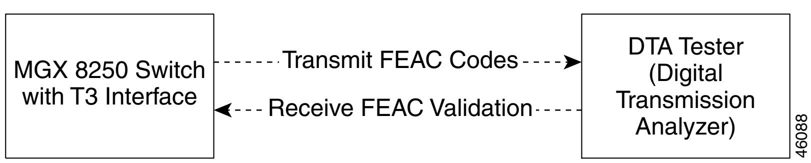
Step 6 On the tester (for example, HP cerjac tester), check that the code for *dsx3SendNoCode* is received.

Pass Criteria:

- **dspln** should show *LineXmtFEACCode* as *SendNoCode*.
- The code that was transmitted is received on the tester and verified.
- No errors logged on the console or the log.

Configure DS3 for to Send Line Loopback

Perform the following steps to verify that DS3 can be configured to send line loopback:



Step 1 Select a node with PXM-T3 back card.

Step 2 Configure the line using **cnfln -felpbnum 30**.

Step 3 Configure the transmit FEAC code to be *dsx3SendLineCode* by entering CLI command, **cnfln -ds3** <*slot*>.<*port*> **-tfeac 2**.

Step 4 On the node, verify that the default FEAC code shows up as *LineXmtFEACCode* : *SendLineCode* using **dspln -ds3** <*slot*>.<*port*>.

Step 5 Check that **dsplog** does not show any errors or alarms logged.

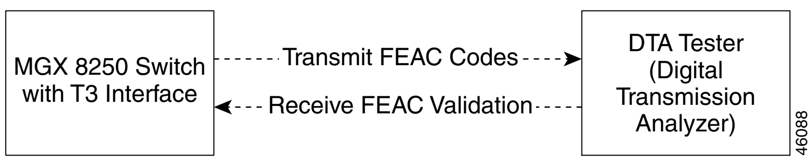
Step 6 On the tester (HP cerjac), check that the code for *dsx3SendLineCode* is received.

Pass Criteria:

- **dspln** should show *LineXmtFEACCode* as *SendLineCode*.
- The code is transmitted is received on the tester and verified.
- No errors logged on the console or the log.

Configure DS3 for Sending Loopback Deactivation Request

Perform the following steps to verify that DS3 can be configured to send loopback deactivation request:



Step 1 Select a node with PXM-T3 back card.

Step 2 Configure the line entering **cnfln -felpbnum 30**.

Step 3 Configure the transmit FEAC code to be *dsx3SendResetCode* by using CLI command, **cnfln -ds3** <*slot*>.<*port*> **-tfeac 4**.

Step 4 On the node, verify that the default FEAC code shows up as *LineXmtFEACCode* : *SendResetCode* using **dspln -ds3** <*slot*>.<*port*>.

Step 5 Check that **dsplog** does not show any errors or alarms logged.

Step 6 On the tester (HP cerjac), check that the code for *dsx3SendResetCode* is received.

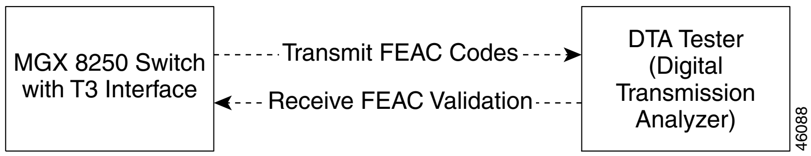
Pass Criteria:

- **dspln** should show *LineXmtFEACCode* as *SendResetCode*.
- The code that is transmitted is received on the tester and verified.
- No errors logged on the console or the log.

Configure Receive Validation FEAC Code

Configuring FEAC Validation Criteria to be FEACCodes4Of5

Perform the following steps to verify that validation criteria for DS3 can be configured to be *FEACCodes4Of5*:



Step 1 Select a node with PXM-T3 back card.

Step 2 Configure the receive FEAC validation criteria to be 4 out of 5 by entering the CLI command, **cnfln -ds3** <*slot*>.<*port*> **-rfeac 1**.

Step 3 On the node, verify that the default FEAC code shows up as *LineRcvFEACValidation* : *4 out of 5 FEAC codes* using **dspln -ds3** <*slot*>.<*port*>.

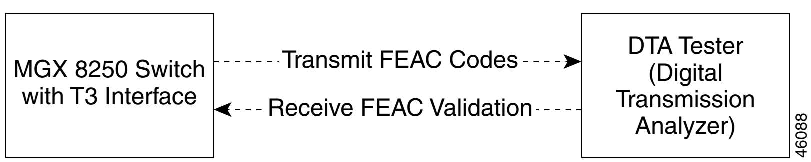
Step 4 Check that **dsplog** does not show any errors or alarms logged.

Pass Criteria:

- **dspln** should show *LineRcvFEACValidation* as *4 out of 5 FEAC codes*.
- The validation code that is received on the node, is verified.
- No errors logged on the console or the log.

Configure FEAC Validation Criteria to be FEACCodes8Of10

Perform the following steps to verify that validation criteria for DS3 can be configured to be *FEACCodes8Of10*:



Step 1 Select a node with PXM-T3 back card.

Step 2 Configure the receive FEAC validation criteria to be 8 out of 10 by entering the CLI command, **cnfln -ds3** <*slot*>.<*port*> **-rfeac 2**.

Step 3 On the node, verify that the default FEAC code shows up as *LineRcvFEACValidation* : *8 out of 10 FEAC codes* using **dspln -ds3** <*slot*>.<*port*>.

Step 4 Check that **dsplog** does not show any errors or alarms logged.

Pass Criteria:

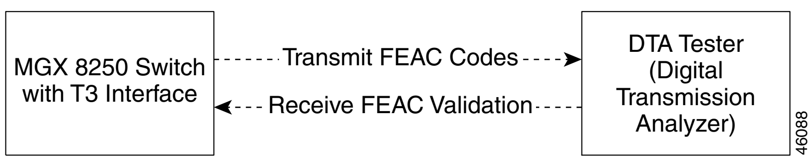
- **dspln** should show *LineRcvFEACValidation* as *4 out of 5 FEAC codes*.
- The validation code that has been received on the node and verified.
- No errors logged on the console or the log.

Negative Tests

This section describes procedures for ensuring that FEAC codes can be disabled.

Disable FEAC Codes

Perform the following steps to verify that the FEAC codes can be disabled to ensure the remote end initiated FEAC does not result in an automatic loop of the near end equipment:



Step 1 Select a node with PXM-T3 back card.

Step 2 Disable the receive FEAC validation criteria by using CLI command, **cnfln -ds3** <*slot*>.<*port*> **-rfeac 3**.

Step 3 Using **dspln -ds3** <*slot*>.<*port*>, check that the FEAC validation code is disabled and the line is not in loopback.

Step 4 Put the HP cerjac tester in loopback mode by pressing the loopback up button.

Step 5 From the tester, send a pattern and verify that it is not received back on the tester.

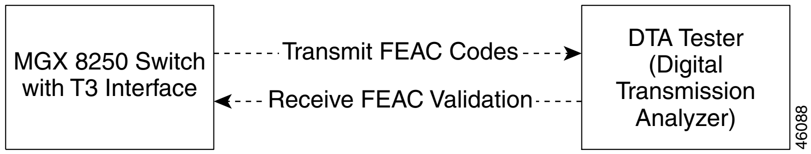
Step 6 Check that **dsplog** does not show any errors or alarms logged.

Pass Criteria:

- Disabling the FEAC validation code puts the line into a no loop condition.
- Anything transmitted from the tester is not received back on the tester when FEAC codes are disabled on the DS3 interface.
- No errors logged on the console or the log.

Configure DS3 Loopback Codes from the Standby PXM1 Card

Perform the following steps to verify that DS3 loopback codes cannot be configured from the standby PXM1 card:



Step 1 Select a node with redundant PXM-T3 cards.

Step 2 Log on to the standby card.

Step 3 Configure the line using **cnfln -ds3** <*slot*>.<*port*> **-felpbnum 30**.

Step 4 Try to configure the transmit FEAC code to be '*dsx3SendNoCode*' by entering the CLI command, **cnfln -ds3** <*slot*>.<*port*> **-tfeac 1**.

Step 5 Check that CLI rejects the command and fails to accept it.

Step 6 The **dsplog** command shows logs an error or a alarm logged.

Step 7 On the tester (e.g. HP cerjac tester), check that the code for '*dsx3SendNoCode*' is not received.

Pass Criteria:

- DS3 loopback codes cannot be invoked from the standby card.
- The code that is transmitted is not received on the tester.
- Error message should be logged in the log regarding a unaccepted command.

APPENDIX A

System Specifications

This appendix contains information for the hardware that makes up a Cisco MGX 8250. The descriptions apply to the enclosure, power systems, cooling system, and cards. The types of information consist of:

- Operational ranges, such as bits per second, voltage ranges, and temperature ranges
- Physical layer characteristics, such as line coding and line framing
- Standards compliance, supported protocols, and tolerances, such as parts per million (ppm) for clocks and jitter
- Per card capacities, such as types and sizes of memory, number of ports, and maximum number of connections

Enclosure and System Power Specifications

This section describes the physical characteristics and system power requirements for the MGX 8250. For a list of the dimensions, weight, and power consumption for each card, see the “Physical and Electrical Characteristics for Cards” section on page A-3 in this appendix. For a list of the AC power plugs for domestic and international use, see Appendix B, “Cabling Summary.”

Physical and Electrical Characteristics for the Enclosure

For quick reference, Table A-1 shows the physical dimensions and power consumption for the switch enclosure.

Table A-1 Enclosure and Electrical Characteristics

Item	Value
Card Slot Capacity	Supports combinations of full and single-height service modules. Two double-height slots reserved for PXMs. Up to 28 single-height slots for service modules or up to 14 double-height slots for service modules.
Enclosure Size, AC-powered system:	Height: 33.25 inches (45.5 cm). Width: 17.75 inches (45.08 cm) for all enclosure modules, so the rack must have this minimal, inner width. If a 19-inch rack cannot provide it, use a 23-inch rack. Depth: 27.0 inches (68.6 cm).
DC-powered system:	Height: 28 inches (71.1 cm.). Width: 17.75 inches (45.08 cm) for all enclosure modules, so the rack must have this minimal, inner width. If a 19-inch rack cannot provide it, use a 23-inch rack. Depth: 27.0 inches (68.6 cm) with cable manager, 21.5 inches (54.6 cm) without cable manager.
Shipping Weight for Populated Enclosure	DC: 190 lb (87 Kgs) with 2 DC PEMs. AC: 230 lb (104.5 Kgs).
Shipping Weight for Individual Components	Single-height, front and back cards: 2.48 lb (1.13 Kgs) Double-height, front and back cards: 6.0 lb (2.73 Kgs) Card cage with boards: 160 lb (72.73 Kgs) Exhaust plenum: 8 lb Fan tray: 9.5 lb Inlet plenum: 8 lb AC power tray with power supplies: 45 lb
Clearance Requirement for the Enclosure	Minimum 30 inches front and rear; nominal 12-inch side clearance.
Power Input Voltage	AC system: Normal operating range is 200–240 VAC, 47 to 63 Hz. The maximum voltage range is 180–264 VAC. DC system: –42 to –56 VDC. Each AC supply can provide up to 1200W.
Current Requirements, AC System	Configuration-dependent: use Network Design Tool for exact requirements. For general planning purposes: 14.4A at a nominal voltage of 200 VAC. At the minimum voltage limit of 180 VAC, the current draw is a maximum of 16A.
Current Requirements, DC System	Configuration-dependent: use the Network Design Tool for exact requirements. For general planning purposes: 43.2A at nominal –48 VDC; 49.4A at –42 VDC maximum.
Input AC Power Connector	IEC 16A input connector. For a list of the AC power plugs for domestic and international use, see Appendix B, “AC Power Cabling” section on page B-8
DC Input Connections	Three-position terminal block for 6 AWG wire (10 square millimeters) and #10 screw lugs designed for 6 AWG wire.

Table A-1 Enclosure and Electrical Characteristics (continued)

Item	Value
Operating Environment	0–40 degrees Celsius (32–104 degrees Fahrenheit) normal operation (50 degrees Celsius or 122 degrees Fahrenheit up to 72 hours). Maximum 85% relative humidity.
Shock	Withstands 10 G, 10 ms at 1/2 sine wave.
Vibration	Withstands 1/4 G, 20–500 Hz.
Heat Transfer to Environment	AC-powered: maximum 9560 BTUs. DC-powered: maximum 8200 BTUs.

Physical and Electrical Characteristics for Cards

For quick reference, Table A-2 shows physical dimensions and power consumption for each card. Detailed information for each card appears in the section of this appendix for a specific card.

Table A-2 Physical Characteristics and Power Consumption by Card

Module	Back Cards	Front Card Dimensions (inches)	Back Card Dimensions (inches)	Weight (front and back card)	Power Consumption
MGX-FRSM-8T1 MGX-FRSM-8E1 MGX-FRSM-8T1c MGX-FRSM-8E1c	8 T1, 8 E1	7.25 x 16.25	7.00 x 4.50	1.74 lb/ 0.76 lb	30WW
MGX-FRSM-2CT3	2 T3	7.25 x 16.25	7.00 x 4.50	1.74 lb/ 0.76 lb	60W
MGX-FRSM-2T3E3	2 T3, 2 E3	7.25 x 16.25	7.00 x 4.50	1.74 lb/ 0.76 lb	60W
MGX-FRSM-HS2	2 HSSI	7.25 x 16.25	7.00 x 4.50	1.74 lb/ 0.6 lb	75W
MGX-CESM-8T1E1	8 T1, 8 E1	7.25 x 16.25	7.00 x 4.50	1.74 lb 0.76 lb	30W
MGX-CESM-T3E3	2 T3, 2 E3	7.25 x 16.25	7.00 x 4.50	1.74 lb/ 0.76 lb	60W
MGX-AUSM/B-8T1E1	8-T1, 8-E1	7.25 x 16.25	7.00 x 4.50	1.74 lb 0.76 lb	30W

Table A-2 Physical Characteristics and Power Consumption by Card (continued)

Module	Back Cards	Front Card Dimensions (inches)	Back Card Dimensions (inches)	Weight (front and back card)	Power Consumption
RPM	4-Ethernet, 1-FE (RJ45/mmf), 1-FDDI (smf, mmf) Up to 2 back cards	15.65 x15.9	7.00 x 4.125	4.80 lb	110W
PXM1	2 T3/E3, OC-3c/STM-1, OC12c/STM-4, VI	15.65 x 15.83	7.00 x 4.5	4.80 lb	100W

Electromagnetic Compatibility and Immunity

This section lists the national and international standards for electromagnetic compatibility and immunity to which this Cisco product complies. It consists of a list of reference documents, a table that indicates applicability of the standards, and the test levels for mandatory and non-mandatory CE mark immunity.

The applicable standards for electromagnetic compatibility and immunity:

- NEBS Systems Requirements (GR-1089-CORE, GR-63-CORE).
- EN 55022/08.94 (EMC Directive 89/336/EEC).
- EN 50081-1/01.92 and EN 50082-1/01.92 (Generic Immunity Requirements), International Electromechanical Commission (IEC 1000-4-2 through IEC 1000-4-13 / European Norm designation EN 61000-4-2 through EN 61000-4-13.
- Cisco Systems Electronic Design Validation Test (EDVT) Plan ABC-123, Rev A, dated 1/29/1996.
- Cisco Systems Mechanical Environmental Design and Qualification Guideline (ENG-3396, Rev. 7).
- European Telecommunication Standards Institute (ETSI) ETS 300 386-1 (December 1994).

Details on how each standard applies for this Cisco product appear in Table A-3.

Table A-3 Electromagnetic Compatibility and Immunity

Category	AC-Powered (220 VAC)	DC-Powered (-48V)
U.S.A EMC	FCC Part 15, Class A	not applicable
Japan EMC	Austel 3548 Class A	not applicable
Australia EMC	VCCI Class A	not applicable

Table A-3 Electromagnetic Compatibility and Immunity (continued)

Category	AC-Powered (220 VAC)	DC-Powered (-48V)
CE M mark (EMC and immunity)	EMC: EN 55022 Class A Immunity: • EN 50082-1 (generic immunity) • EN 61000-4-2 through -5 (mandatory) • EN 61000-4-6 through -13 (not mandatory)	not applicable
NEBS (EMC and immunity)	Not applicable	EMC: GR-1089-CORE Class A (radiated and magnetic fields) and line conductance. Immunity: GR-1089-CORE ESD (8 KV contact) RS (10 V/meter) CS (clause 3.3.3) European Telecom Standards (ETSI) for Surge: ETSI 300 386-1, DC power leads only (200 VAC–1000 VAC)
EDVT	Cisco Systems: Electronic Design Validation Test (EDVT) Plan ABC-123, Rev. A, dated 1/29/1996	Cisco Systems: Electronic Design Validation Test (EDVT) Plan ABC-123, Rev. A, 1/29/1996—DC power cycling portions only.
MDVT	Cisco Systems: Mechanical Environmental Design and Qualification Guideline, ENG-3398, Rev. 7.	NEBS requirements, physical: (GR-63-CORE, Issue 1, October, 1995). See mandatory CE mark immunity tests in forthcoming list.

The levels for the mandatory CE mark immunity tests are

- For IEC 1000-4-2 (ESD), the test level is 4.
- For IEC 1000-4-3 (RS), the test level is 3.
- For IEC 1000-4-4 (EFT), the test level is 4.
- For IEC 1000-4-5 (Surge), the test level is 3.

The levels for the non-mandatory CE mark immunity tests are

- For IEC 1000-4-6 and ENV 50141 (conducted disturbances induced by RF fields), the test level is 3.
- For IEC 1000-4-7 and EN 610009-3-2 (harmonics and interharmonics), the test level is Class B.
- For IEC 1000-4-8 (Power Frequency Magnetic Fields), the test level is 3.
- For IEC 1000-4-9 (pulse magnetic field), the test level is 3.

- For IEC 1000-4-10 (damped oscillatory magnetic field), the test level is 3.
- For IEC 1000-4-11 (voltage dips, interruptions, and variations), no test level applies, as defined by the manufacturer per the functionality of EUT.
- For ENV 50140 (RF immunity at 800 MHz), the test level is 3.

Processor Switching Module Specifications

This section contains general specifications for the Processor Switching Module (PXM1). The information in Table A-4 includes information for the two types of back cards—the PXM1-UI user interface for switch and the uplink card for trunking and CPE access.

Table A-4 PXM1 Specifications

Category	Description
Maximum switch fabric throughput.	1.2 Gbps.
Control access: These ports exist on the PXM1-UI back card.	Control port: RJ-45 connector, EIA/TIA 232, DTE mode, asynchronous interface 19,200 baud, 1 start, 1 stop, no parity. Maintenance port: RJ-45 connector, EIA/TIA 232, DTE mode, asynchronous interface 9600 baud, 1 start bit, 1 stop bit, no parity bits. LAN port: RJ-45 connector, 10-BaseT, 802.3 Ethernet.
Uplink ports and connectors: An uplink card can haveone of these number and type of connectors. The wavelength on optical lines is 1310 nm.	2 T3 ports, BNC connectors 2 E3, BNC connectors 4 OC-3 multi-mode fiber, SC connectors 4 OC-3 single-mode fiber, intermediate reach, SC connectors 4 OC-3 single-mode fiber, long reach, SC connectors 1 OC-12 single-mode fiber, intermediate reach, SC connectors 1 OC-12 single-mode fiber, long reach, SC connectors
Number of logical ports:	32 across all physical ports on the uplink card (regardless of line type).

Table A-4 PXM1 Specifications (continued)

Category	Description
LEDs on PXM1 front card LEDs display status, but alarm history is a switch.	Status for the card: • Green means active. • Red means failed. • Yellow indicates the standby card. LAN activity: flashing green indicates activity. Node alarm: • Red indicates major alarm. • Yellow indicates minor alarm. Node power (note that each AC power supply also has an LED): • "DC OK A" is green for okay or red for trouble. • "DC OK B" is green for okay or red for trouble. Alarm history: ACO Port interface (per port): • Green means active and okay. • Red means active and local alarm. • Yellow means active and remote alarm. • No light means inactive or not provided.
LEDs on back cards	Green means active. No light means inactive or not provided.
Stratum-4 synchronization (internal only)	8 KHz clock derived from • Internal 8 KHz clock (10 ppm).
Stratum-3 synchronization (internal and external)	• Free-Run Accuracy of +/- 4.6 ppm (+/- 7 Hz @ 1.544 MHz) • Holdover stability of less than 255 slips (+/- .37 ppm) for the initial 24 hours of holdover. • Upon clock switchover, MTIE (Maximum Time Interval Error) shall not exceed 1 micro second. The rate of phase change shall not exceed 81 ns in 1.326ms interval. • Pull-in range of accuracy +/- 4.6 ppm. • Provide Jitter filtering and tolerate Jitter according to AT&T T1.5 and ITU G.824 specifications. • Declare a bad reference if LOS detected >50 ms or error burst of duration >2.5 sec.
BITS clock interface	T1 and E1 with an RJ-45 connector. **Note** Older systems with a PXM1-UI back card have a SMB connector for E1.

Table A-4 PXM1 Specifications (continued)

Category	Description
Trunk history counters	Ingress, per connection: Number of received cells with CLP = 0. Number of received cells with CLP = 1. Egress, per connection: Number of received cells. Number of transmitted cells. Number of received cells with EFCI bit set. Number of transmitted cells with EFCI bit set.
Connection capacities supported by PXM1	Maximum number of connections: 16,000 bi-directional channels for local switching. 32,000 bi-directional channels for switching across uplink card. Maximum aggregate bandwidth: 600 Mbps local switching (service module to service module). 1,200 Mbps switching across uplink. Cell memory: 256K cells.
Processor clock speed and memory specifics	Clock speed: 200 MHz internal, 50 Mhz external. Flash memory: 2 Mbytes. DRAM: 64 Mbytes, upgradeable to 128 Mbytes. Secondary cache: 512 Kbytes. BRAM: 128 Kbytes. Hard disk: 4 Gbytes.
Alarm indicators (audible and visual)	Central office-compatible alarm indicators and controls through a DB15 connector.
Maintenance features	Internal isolation loopback. External remote loopback. Hot-pluggable.
Card dimensions	Front card: 15.65 inches by 16.83 inches (39.75 cm by 42.75 cm). Back cards: 7.25 inches by 4.125 inches (18.42 cm by 10.48 cm).
Power	Requires –48 VDC, dissipates 100W.

MGX-AUSM/B-8T1E1 Interface Characteristics

This section contains details for the MGX-AUSM/B-8T1E1. For physical characteristics, see Table A-5. For the T1 and E1 characteristics, see Table A-6 and Table A-7, respectively. For ATM interface characteristics, see Table A-8. For statistics and counters, see Table A-9.

Table A-5 Physical Characteristics of the Eight-Port MGX-AUSM/B

Category	Description
LED Indicators Per Card	Active (green), Standby (yellow), Fail (red)
LED Indicators Per Line	One per line: Active and OK (green), Active and Local Alarm (red) Active and Remote Alarm (yellow)
Maintenance and Serviceability	Facility loopback via loop up/down per ANSI T1.408 and ATT TR 62411 (T1), CCITT G.7xx (E1) Facility loopback via management console internal problem isolation loopbacks Hot pluggable
Card Size	Front card: 7.25" x 16.25" (18.43 cm x 41.28 cm) Back cards: 7" x 4.5" (17.78 cm x 11.43 cm)
Power	–48 VDC, 30W
Safety	EN 60950 2nd edition (including EN 41003) UL 1950 2nd edition
Compliance	T1: Accunet 62411 E1: G.703, G.823
ESD	IEC 1000-4-2

Table A-6 T1 Interface Characteristics

Category	Description
Line Interface	RJ48 (100 ohm) on the LM-RJ48-8T1 back card
Line Rate	1.544 Mbps ±50 bps (T1)
Synchronization	Transmitter can be: loop-timed, Receiver, or synchronized to node (normal mode)
Line Code	Bipolar 8 Zero Substitution (B8ZS) per ANSI T1.408 (T1)
Line Framing	Extended Superframe Format (ESF 24 frame multiframe) per ANSI T1.408
ESF Maintenance	Bit-oriented alarm and loopback messages of ESF Data Link per ANSI T1.408
Input Jitter Tolerance	Per ATT TR 62411
Output Jitter	Per ATT TR 62411 using normal mode synchronization
Physical Layer Alarms	LOS, OOF, AIS, RAI
Physical Layer Performance Statistics	LCV, LES, LSES, CV, ES, SES, SEFS, AISS, UAS

Table A-7 E1 Interface Characteristics

Category	Description
Line Interface Connector	RJ48 (120 ohm) on LM-RJ48-8E1, or SMB (75 Ω) on LM-BNC-8E1
Line Rate	2.048 Mbps ± 100 bps
Synchronization	Transmitter can be: loop-timed, Receiver, or synchronized to shelf (normal mode)
Line Code	HDB3 (E1)
Line Framing	16-frame multiframe as in G.704
Input Jitter Tolerance	As specified in ITU G.823 for 2.048 Mbps
Output Jitter Generation	As specified in ITU G.823 for 2.048 Mbps
Physical Layer Alarms	LOS, OOF, AIS, RAI
Physical Layer Statistics	LCV, LES, LSES, CV, ES, SES, SEFS, AISS, UAS

Table A-8 ATM Interface Characteristics

Category	Description
Standards	ATM UNI v3.1, ITU-T G.804, per CCITT I.361.
Channel Configuration	1000 per card, across any of the T1 or E1 ports.
VPI/VCI Ranges	VPI: 0–255. VCI: 0–4096.
Traffic Classes	CBR, VBR, rt-VBR, ABR, UBR.
UPC Parameters	PCR, SCR, rt-VBR, non-rt-VBR, ABR, CCDV (CBR).
Congestion Control Support	ForeSight (toward Network for ABR), ATM Forum TM 4.0 compliant mechanisms for ABR.
ForeSight Parameters	MIR, PIR, Rate Up, Rate Down, QIR, QIR Timeout, IBS.

Table A-9 MGX-AUSM/B-8T1E1 Statistics and Counters

Counter Type	Description
Per Port	Number of cells received from the interface. Number of cells received with unknown VPI/VCI. Last known VPI/VCI received from the port. Number of cells discarded due to error in Cell Header. Number of cells received with non-zero GRC field. Number of cells transmitted to the interface. Number of cells transmitted for which EFCI was set. Number of egress cells discarded due to service interface physical alarm.
Endpoint (channel)	
Ingress	Number of cells received from port. Number of cells received from the port with CLP = 1. Number of cells received from the port with EFCI = 1. No, of cells from the port discarded due to queue exceeded QDepth. Number of cells (with CLP) set) discarded due to queue exceeded CLP threshold. Number of cells from the port for which CLP was set due to UPC violations.
ATMizer channel counters	
Ingress	Number of cells transmitted to cell bus. Number of cells to cell bus for which EFCI was set. Number of cells to cell bus discarded due to shelf alarm.
Egress	Number of cells received from the cell bus. Number of cells discarded due to queue exceeded QDepth (per Egress Q). Number of cells discarded due to queue exceeded CLP threshold (per Egress Q). Number of cells received with CLP = 1.
Other Counters	
Ingress	Number of OAM cells discarded. Number of AIS cells received from the port. Number of RDI (FERF) cells received from the port. Number SegmentLpBk cells received from the port. Number of SegmentLpBk cells transmitted to cell bus.
Egress	Number of OAM cells discarded. Number of AIS cells transmitted to the port. Number of SegmentLpBk cells transmitted to the port. Number of SegmentLpBk cells received from the port.
Diagnostic Statistics	Peak Queue Depth (Ingress: per channel).

MGX-FRSM-2CT3 Specifications

This section provides details for the following topics:

- Transport technology standards with which the card complies. (See Table A-10.)
- General physical attributes of the card, such as LEDs on the faceplate. (See Table A-11.)
- Line and framer characteristics. (See Table A-12 and “MGX-FRSM-2CT3 Framer” section.)
- Line alarms. (See “MGX-FRSM-2CT3 Line Alarms” section.)

Table A-10 Frame Relay Interface Standards

Interface	Standard
Frame Relay Interface	ANSI T1.618, 2-octet header
ATM Layer	CCITT I.361 and ATM UNI v3.1
AAL Layer	AAL5 per Draft CCITT I.363
FR-Cell Interworking	Per Draft CCITT I.555 and I.36x.1, as summarized in “ATM-to-Frame Relay Interoperability Implementation Agreement” v 1.0

Table A-11 MGX-FRSM-2CT3 Front Card Physical Characteristics

Feature	Significance or Value
Power	48 VDC, 50W (estimated)
Card Status Indicator LEDs	
ACT	**Green** On indicates the card set is in active mode.
STBY	**Yellow** Slow blink without the Active LED indicates the card is in the boot state. Fast blink with the Active LED indicates the card is being downloaded. Fast blink indicates the service module is passing BRAM channel information to the ASC. Steady yellow indicates the card is in Standby mode and the firmware is executing ADMIN code.
Fail	**Red** Steady Red with Active and Standby LEDs off indicates either the card is in the Reset condition or the card has failed. Steady Red with Active LED on indicates the card was active prior to failing. Steady Red with Standby LED on indicates the card was standby prior to failing.

Table A-11 MGX-FRSM-2CT3 Front Card Physical Characteristics (continued)

Feature	Significance or Value
Line Status Indicator LEDs	
Green	Green indicates the port is active.
Red	Red indicates a local alarm on the port.
Yellow	Yellow indicates a remote alarm on the port. Off indicates the port has not been activated (upped).
Reliability	> 85000 hours MTBF (target)
Card Size	7.25 inches by 16.5 inches

Table A-12 MGX-FRSM-2CT3 Line Level

Feature	Significance or Value
Number of T3 Lines	Two
Line Interface Connector	75 ohm BNC
Line Rate	44.736 Mbps +/- 20 ppm
Line Coding	B3ZS
Transmit Timing	Normal or Loop timed
Input Jitter Tolerance	Per TR-TSY-000499
Output Jitter	0.05 UI maximum with jitter-free input clock
Output Pulse	Per T1.102.1993

MGX-FRSM-2CT3 Framer

The functions of the MGX-FRSM-2CT3 line framer are

- Supports M13 or C-bit parity format.
- Performs required inversion of second and fourth multiplexed DS1 streams per ANSI T1.107.
- Generates loop-up code to the far-end device to loop back any of the DS1s or entire DS3 signal stream by way of the FEAC channel.
- Automatically detects the incoming loop-up codes from the far-end device as well as loop back any of the DS1s or entire DS3 signal stream back to the far-end device. The loopback occurs at the M13 framer chip.

MGX-FRSM-2CT3 Line Alarms

For line alarms, the MGX-FRSM-2CT3 supports:

- Detection and generation of Remote Alarm Indicator (RAI) signal (also known as FERF and Yellow signal)
- Detection and generation of Alarm Indication Signal (AIS)

- Detection of Out Of Frame (OOF) condition
- Detection of Loss Of Frame (LOS) condition
- Automatic generation of Far End Block Error (FEBE)

MGX-FRSM T3 and E3 Specifications

This section provides details for the MGX-FRSM-2T3E3. Where appropriate, it has separate sections for T3 and E3 technologies. Topics consist of

- Transport technology standards with which the card complies. (See Table A-13.)
- General physical attributes of the card, such as LEDs on the faceplate. (See Table A-14.)
- Line and framer characteristics for T3 operation. (See Table A-15 and "“T3 Framer Level” section on page A-16.")
- Line and framer characteristics for E3 operation. (See Table A-16 and "“E3 Framer Level” section on page A-17.")
- Line alarms. (See "“MGX-FRSM T3 and E3 Line Alarms” section on page A-17.")

Table A-13 Frame Relay Interface Standards

Interface	Standard
Frame Relay Interface	ANSI T1.618, 2-octet header
ATM Layer	CCITT I.361 and ATM UNI v3.1
AAL Layer	AAL5 per Draft CCITT I.363
FR-Cell Interworking	Per Draft CCITT I.555 and I.36x.1, as summarized in “ATM-to-Frame Relay Interoperability Implementation Agreement” v 1.0

Table A-14 MGX-FRSM-2T3E3 Front Card Physical Characteristics

Feature	Significance or Value
Power	48 VDC, 50W (estimated)
Card Status Indicator LEDs	
ACT	**Green** On indicates the card set is in active mode.
STBY	**Yellow** Slow blink without the Active LED indicates the card is in the boot state. Fast blink with the Active LED indicates the card is being downloaded. Fast blink indicates the service module is passing BRAM channel information to the ASC. Steady yellow indicates the card is in Standby mode and the firmware is executing ADMIN code.
Fail	**Red** Steady Red with Active and Standby LEDs off indicates either the card is in the Reset condition or the card has failed. Steady Red with Active LED on indicates the card was active prior to failing. Steady Red with Standby LED on indicates the card was standby prior to failing.
Line Status Indicator LEDs	
Green	Green indicates the port is active.
Red	Red indicates a local alarm on the port.
Yellow	Yellow indicates a remote alarm on the port. Off indicates the port has not been activated (upped).
Reliability	> 85000 hours MTBF (target)
Card Size	7.25 inches by 16.5 inches

MGX-FRSM T3 Line

The T3 line characteristics appear in Table A-15.

Table A-15 T3 Line Level Characteristics

Feature	Significance or Value
Number of T3 Lines	Two
Line Interface Connector	75 ohm BNC
Line Rate	44.736 Mbps +/- 20 ppm
Line Coding	B3ZS
Transmit Timing	Normal or Loop timed
Input Jitter Tolerance	Per TR-TSY-000499
Output Jitter	0.05 UI maximum with jitter-free input clock
Output Pulse	Per T1.102.1993

T3 Framer Level

For the framing characteristics of T3 operation, the MGX-FRSM-2T3E3

- Supports C-bit parity and M13 DS3 format.
- Frames to a DS3 signal with a maximum average reframe time per TR-TSY-000009 and TR-TSY-000191.
- Detects the alarm indication signal (AIS) in milliseconds in the presence of a 10^{-3} bit error rate.
- When in-frame, indicates M-bit or F-bit framing errors as well as P-bit errors. In C-bit parity mode, it also indicates both C-bit parity errors and far end block errors.

MGX-FRSM E3 Line

Table A-16 lists the characteristics of the line on an MGX-FRSM-2T3E3 with an E3 back card:

Table A-16 E3 Line Level

Feature	Significance or Value
Number of E3 Lines	Two
Line Interface Connector	75 ohm BNC
Line Rate	34.368 Mbps +/- 20 ppm
Line Coding	HDB3
Transmit Timing	Normal or Loop timed
Input Jitter Tolerance	Per G.823

Table A-16 E3 Line Level (continued)

Feature	Significance or Value
Output Jitter	0.05 UI maximum with jitter-free input clock per G.823
Output Pulse	Per G.703

E3 Framer Level

For line framing, the E3 operation of the MGX-FRSM-2T3E3 complies with G.751.

MGX-FRSM T3 and E3 Line Alarms

For line alarms, the MGX-FRSM-2T3E3 supports:

- Detection and generation of Remote Alarm Indicator (RAI) signal (also known as FERF and Yellow signal)
- Detection and generation of Alarm Indication Signal (AIS)
- Detection of Out Of Frame (OOF) condition
- Detection of Loss Of Frame (LOS) condition
- Automatic generation of Far End Block Error (FEBE)

Statistics and Counter Specifications

For lists of applicable statistics and counters, "Counters and Statistics for FRSM-VHS Cards" in this appendix.

MGX-FRSM-HS2 Specifications

The MGX-FRSM-HS2 is the Frame Relay module with two HSSI ports. The topics in this section are:

- Transport technology standards with which the card complies. (See Table A-17.)
- General physical attributes of the card, such as LEDs on the faceplate. (See Table A-18.)
- Line and framer characteristics. (See Table A-19.)

For lists of the counters and statistics that are available on the MGX-FRSM-VHS series of cards, see "Counters and Statistics for FRSM-VHS Cards" in this appendix.

Table A-17 Frame Relay Interface Standards

Interface	Standard
Frame Relay Interface	ANSI T1.618, 2-octet header
ATM Layer	CCITT I.361 and ATM UNI v3.1

Table A-17 Frame Relay Interface Standards (continued)

Interface	Standard
AAL Layer	AAL5 per Draft CCITT I.363
FR-Cell Interworking	Per Draft CCITT I.555 and I.36x.1, as summarized in *ATM-to-Frame Relay Interoperability Implementation Agreement* v 1.0

Table A-18 MGX-FRSM-HS2 Physical Characteristics

Feature	Significance or Value
Power	48 VDC, 50W (estimated) The SCSI2-2HSSI back card consumes 5 watts at 5 VDC and 6W at -5 VDC.
Card Status Indicator LEDs	
ACT	**Green** On indicates the card set is in active mode.
STBY	**Yellow** Slow blink without the Active LED indicates the card is in the boot state. Fast blink with the Active LED indicates the card is being downloaded. Fast blink indicates the service module is passing BRAM channel information to the ASC. Steady yellow indicates the card is in Standby mode and the firmware is executing ADMIN code.
Fail	**Red** Steady Red with Active and Standby LEDs off indicates either the card is in the Reset condition or the card has failed. Steady Red with Active LED on indicates the card was active prior to failing. Steady Red with Standby LED on indicates the card was standby prior to failing.
Line Status Indicator LEDs	
Green	Green indicates the port is active.
Red	Red indicates a local alarm on the port.
Yellow	Yellow indicates a remote alarm on the port. Off indicates the port has not been activated (upped).
Reliability	> 85000 hours MTBF (target)
Card Size	Front card: 7.25” x 16.25” (18.43 cm x 41.28 cm) Back card: 7” x 4.5” (17.78 cm x 11.43 cm)

Table A-19 MGX-FRSM-HS2 Line Characteristics

Feature	Significance or Value
Number of HSSI Lines	Two
Connector Type	SCSI-2
Line Rate	44.736 Mbps +/- 20 ppm
Line Coding	B3ZS
Line Framing	not applicable
Line Alarms	• Control lead is inactive • Recovered clock does not match configured line rate
Synchronization	Transmitter may be either loop-timed to Receiver (DTE mode), or synchronized to shelf, (DCE mode)
Input Jitter Tolerance	Per TR-TSY-000499
Output Jitter	0.05 UI maximum with jitter-free input clock
Output Pulse	Per T1.102.1993

Counters and Statistics for FRSM-VHS Cards

This section lists counters and statistics that apply to most types of cards in the FRSM-VHS group (MGX-FRSM-2CT3, MGX-FRSM-2T3E3, and MGX-FRSM-HS2).

Table A-20 FRSM-VHS Counters and Statistics

Counter
Received frames lost due to aborts
Received frames lost due to illegal header (EA bit)
Received frames lost due to CRC errors
Received frames with bit alignment errors
Received frames with unknown DLCI
Received frames with illegal frame length
Received good frame
Transmit frames lost due to under-run/Abort count
Transmit good frame
LMI status inquiry request count
LMI signaling protocol (keep alive time-out count)
LMI sequence number error count
LMI status transmit count (in response to request)
LMI update status transmit count (in response to configuration changes

Table A-20 FRSM-VHS Counters and Statistics (continued)

Counter
Frames with FECN set count
Frames with BECN set count
DE frames discarded count
Number of frames reassembled but discarded due to service interface physical layer alarm

Table A-21 Service-Related Statistics

Service Statistic
Number of received frames
Number of bytes received
Number of frames received with DE = 1
Number of frames received but discarded
Number of received bytes discarded
Number of frames received but discarded due to • CRC error • Illegal frame length • Alignment error • Abort
Number of frames reassembled and transmitted
Number of frames reassembled and transmitted with DE = 1
Number of frames discarded due to reassembly errors
Number of frames transmitted
Number of bytes transmitted
Number of frames transmitted with DE set
Number of frames transmitted during LMI logical port alarm
Frames FECN set count
Frames BECN set count
Number of transmit frames discarded

Table A-21 Service-Related Statistics (continued)

Service Statistic
Number of transmit bytes discarded
Number of transmit frames discarded due to • CRC error • Illegal frame length • Alignment error • Abort • DE egress queue threshold exceeded • Physical link failure

Table A-22 ATM Cell-Related Statistics

ATM Cell Statistic
Number of cells transmitted to PXM1
Number of cells discarded due to intershelf link alarm
Number of cells transmitted with CLP bit set
Number of AIS cells transmitted
Number of FERF cells transmitted
Number of BCM cells transmitted
Number of end-end loop-back cells transmitted
Number of segment loop-back cells transmitted
Number of cells received from PXM1
Number of cells received with CLP bit set
Number of AIS cells received
Number of FERF cells received
Number of BCM cells received
Number of end-end loop-back cells received
Number of segment loop-back cells received
Number of OAM cells discarded due to CRC-10 error

Table A-23 Diagnostic-Related Statistics

Diagnostic Statistic
Header of last cell with unknown LCN
Header of last received frame with unknown DLCI
ECN current queue depth

Table A-24 Troubleshooting-Related Statistics

Troubleshooting Statistic
ECN current queue depth, per channel

MGX-FRSM-8T1 Specifications

This section provides information on the operation of the MGX-FRSM-8T1 card set. Topics are:

- General physical information about the card set (see Table A-25).
- System-level interface (see Table A-26).
- Information about the Frame Relay service (see Table A-27).
- Statistics and counters (see Table A-28).

Table A-25 General Card Specifications

Category	Description
Indicators per card	Active (Green), Standby (Yellow), Fail (Red)
Indicators per line	Active and Okay (Green) Active and Local Alarm (Red) Active and Remote Alarm (Yellow)
Line Interface connector	RJ-48 when used with RJ48-8T1 back card.
Line Rate	1.544 Mbps ±50 bps
Line Framing	ESF per ATT TR 54016
Maintenance/Serviceability Features	Internal Problem Isolation Loopbacks Hot-pluggable cards
Reliability, MTBF	> 65000 hours
Card Size	MGX-FRSM-8T1: 7.25" x 16.25" LM-DB15-8T1: 7.0" x 4.5" Power: –48 VDC, 30W with 8 active T1 lines

Table A-26 System Interface

Category	Description
ATM Layer	Per CCITT I.361 and ATM UNI v3.1
AAL Layer	AAL5 per Draft CCITT I.363
FR-Cell Interworking	Per Draft CCITT I.555 and I.36x.1, as summarized in Frame Relay Forum, FR/ATM PVC Interworking Implementation Agreement FRF.5

Table A-27 Frame Relay Service with T1 Lines

Category	Description
Synchronization	Transmitter may be either loop-timed to Receiver or synchronized to shelf (called normal mode)
Input Jitter Tolerance	Per ATT TR 62411
Output Jitter Generation	Per ATT TR 62411 using normal mode synchronization
Physical Layer Alarms	LOS, OOF, AIS, RAI
Number of Frame Relay Ports	One-a single Frame Relay stream occupying N consecutive time slots
Frame Relay Interface Rates	• 56 Kbps. or • N x 64 Kbps (where N is the number of consecutive time slots)
Frame Relay Interface	Per ANSI T1.618, 2-octet header
Frame Relay Performance Counters (per Port; n x DS0)	Received frames discarded due to Aborts Received frames discarded due to illegal header (EA bit)(s) Received frames discarded due to CRC error(s) Received frames discarded due to alignment error(s) Received frames discarded due to unknown DLCI(s) Received frames discarded due to illegal frame length(s) Received frames discarded due to DE threshold exceeded Received frames with DE already set Received frames with FECN already set Received frames with BECN already set Received frames tagged FECN Received frame(s) Received byte(s) Transmit frames discarded due to underrun Transmit frames discarded due to Abort Transmit frames discarded due to egress Q-depth exceeded Transmit bytes discarded due to egress Q-depth exceeded Transmit frames discarded due to egress DE threshold exceeded Transmit frame(s)
	Transmit byte(s) Transmit Frames with FECN set(s) Transmit Frames with BECN set(s)
	LMI receive status inquiry request count(s) LMI transmit status inquiry request count LMI invalid receive status count(s) LMI signaling protocol (keep alive time-out count)(s) LMI sequence number error count(s) LMI receive status transmit count (in response to request) LMI transmit status transmit count (in response to request) Transmit frames during LMI alarm(s) Transmit bytes during LMI alarm(s) LMI update status transmit count (in response to configuration changes)
Diagnostics (per port):	Last unknown DLCI received

Table A-28 List of Counters

Category	Description
Channels (endpoints) per card	256, which you can allocate across any of the interfaces
Service Counters	Number of frames received (s) Number of bytes received (s) Number of frames received with DE already set (s) Number of bytes received with DE already set (s) Number of frames received with unknown DLCI Number of frames received but discarded (s) Number of received bytes discarded (s) Number of received bytes discarded due to exceeded Q-depth (s) Number of frames received and discarded due to: intershelf alarm exceeded DE threshold (s) exceeded Q depth (s) Number of frames received with FECN set Number of frames received with BECN set Number of frames received tagged FECN Number of frames received tagged BECN
	Number of frames transmitted (s) Number of bytes transmitted (s)
	Number of frames transmitted with DE set (s) Number of frames discarded due to reassembly errors (s) Number of frames transmitted during LMI logical port alarm (s) Number of frames transmitted with FECN set (s) Number of frames transmitted with BECN set (s) Number of transmit frames discarded (s) Number of transmit bytes discarded Number of transmit frames discarded due to: CRC error (s) egress Q depth exceeded (s) egress DE threshold exceeded source abort physical link failure (T1) ATM cells: Number of cells transmitted to PXM1 Number of cells transmitted with CLP bit set Number of OAM AIS cells transmitted (s) Number of OAM FERF cells transmitted (s) Number of BCM cells transmitted Number of OAM end-end loopback cells transmitted (s) Number of OAM segment loopback cells transmitted Number of cells received from PXM1 Number of cells received with CLP bit set Number of OAM AIS cells received (s) Number of OAM FERF cells received (s) Number of BCM cells received Number of OAM end-end loopback cells received (s) Number of OAM segment loopback cells received Number of OAM cells discarded due to CRC-10 error (s)

Table A-28 List of Counters (continued)

Category	Description
Statistics:	If any of the counters in the preceding category of Service Counters includes an "(s)," you can configure it for statistics usage.
Diagnostics:	Last unknown LCN received, Number of cells with unknown LCN.

Note An (s) at the end of the description means the data in the counter is usable as a statistic.

MGX-FRSM-8E1 Specifications

This section provides information on the operation of the MGX-FRSM-8E1 card set. Topics are

- System-level interface. (See Table A-29.)
- General physical information about the card set. (See Table A-30.)
- Information about the Frame Relay service. (See Table A-31.)
- Statistics and counters. (See Table A-32.)

Table A-29 System Interface

Category	Description
ATM Layer	Per ITU-T I.361 and ATM UNI v3.1
AAL Layer	AAL5 per Draft CCITT I.363
FR-Cell Interworking	Per Draft CCITT I.555 and I.36x.1, as summarized in Frame Relay Forum, FR/ATM PVC Interworking Implementation Agreement FERF.5

Table A-30 General Card Specifications

Category	Description
Line Interface connector	RJ-48 when used with RJ-48-8E1 line module SMB when used with SMB-8E1 line module
Line Rate	2.048 Mbps ±100 bps
Synchronization	Transmitter may be either loop-timed to Receiver or synchronized to shelf (*normal* mode)
Input Jitter Tolerance	Per G.703
Output Jitter Generation	Per G.703
Physical Layer Alarms	LOS, OOF, AIS, RAI
Card Status Indicator LEDs	

Table A-30 General Card Specifications (continued)

Category	Description
ACt	**Green** On indicates the card set is in active mode.
STBY	**Yellow** Slow blink without the Active LED indicates the card is in the boot state. Fast blink with the Active LED indicates the card is being downloaded. Fast blink indicates the service module is passing BRAM channel information to the ASC. Steady yellow indicates the card is in Standby mode and the firmware is executing ADMIN code.
Fail	**Red** Steady Red with Active and Standby LEDs off indicates either the card is in the Reset condition or the card has failed. Steady Red with Active LED on indicates the card was active prior to failing. Steady Red with Standby LED on indicates the card was standby prior to failing.
Line Status Indicator LEDs	
Green	Green indicates the port is active.
Red	Red indicates a local alarm on the port.
Yellow	Yellow indicates a remote alarm on the port. Off indicates the port has not been activated (upped).
Maintenance/Serviceability Features	Internal Problem Isolation Loopbacks Hot-pluggable cards
Reliability, MTBF	> 65000 hours
Card Size	MGX-FRSM-8E1: 7.25" x 16.25" (18.43 cm x 41.28 cm) RJ48-8E1: 7.0" x 4.5" (17.78 cm x 11.43 cm) SMB-8E1: 7.0" x 4.5" (17.78 cm x 11.43 cm)
Power	–48V DC, 30W with 8 active E1 lines

Table A-31 Frame Relay Service with E1 Lines

Category	Description
Number of Frame Interfaces	1–31 occupying n, where $1 < n < 31$. Sum of all < 31 for CCS or 1–30 for CAS.
Frame Relay Interface Rates	Either 56 Kbps or Nx64 Kbps, where n is the same as defined in the preceding item the preceding item "Number of Frame Interfaces."

Table A-31 Frame Relay Service with E1 Lines (continued)

Category	Description
Ingress	8000 cell buffer shared between virtual channels/paths standard usage parameter control (UPC) Selective Cell Discard Virtual Circuit Queuing EFCI setting per VC
Egress	8000 cell storage capacity shared between four ports Up to 12 user-selectable egress queues per port Selective Cell Discard EFCI setting per Queue
Frame Relay Interface	Per ANSI T1.618, 2-octet header
Frame Relay Performance Counters (per Port; NxDS0)	Received frames discarded due to Aborts Received frames discarded due to illegal header (EA bit)(s) Received frames discarded due to CRC error(s) Received frames discarded due to alignment error(s) Received frames discarded due to unknown DLCI(s) Received frames discarded due to illegal frame length(s) Received frames discarded due to DE threshold exceeded Received frames with DE already set Received frames with FECN already set Received frames with BECN already set Received frames tagged FECN Received frame(s) Received byte(s)
	Transmit frames discarded due to underrun Transmit frames discarded due to Abort Transmit frames discarded due to egress Q-depth exceeded Transmit bytes discarded due to egress Q-depth exceeded Transmit frames discarded due to egress DE threshold exceeded Transmit frame(s) Transmit byte(s) Transmit Frames with FECN set(s) Transmit Frames with BECN set(s) LMI receive status inquiry request count(s) LMI transmit status inquiry request count LMI invalid receive status count(s) LMI signaling protocol (keep alive time-out count)(s) LMI sequence number error count(s) LMI receive status transmit count (in response to request) LMI transmit status transmit count (in response to request) Transmit frames during LMI alarm(s) Transmit bytes during LMI alarm(s) LMI update status transmit count (in response to configuration changes)
Diagnostics (per port):	Last unknown DLCI that arrived

Table A-32 List of Counters

Category	Description
Channels (Endpoints)	256 per card—can be allocated across any of the frame relay interfaces
Counters	Number of frames received Number of bytes received Number of frames received with DE already set(s) Number of bytes received with DE already set(s) Number of frames received with unknown DLCI Number of frames received but discarded Number of received bytes discarded Number of received bytes discarded due to exceeded Q-Depth(s) Number of frames received and discarded due to • intershelf alarm • exceeded DE threshold(s) • exceeded Q depth(s) Number of frames received with FECN set Number of frames received with BECN set

Table A-32 List of Counters (continued)

Category	Description
Counters	Number of frames received tagged FECN Number of frames received tagged BECN Number of frames transmitted Number of bytes transmitted Number of frames transmitted with DE set(s) Number of frames discarded due to reassembly error(s) Number of frames transmitted during LMI logical port alarm(s) Number of frames transmitted with FECN set(s) Number of frames transmitted with BECN set(s) Number of transmit frames discarded Number of transmit bytes discarded Number of transmit frames discarded due to: CRC error(s) egress Q depth exceeded egress DE threshold exceeded source abort physical link failure (T1)
ATM cells	Number of cells transmitted to PXM1 Number of cells transmitted with CLP bit set Number of OAM AIS cells transmitted Number of OAM FERF cells transmitted Number of BCM cells transmitted Number of OAM end-end loopback cells transmitted Number of OAM segment loopback cells transmitted Number of cells received from PXM1 Number of cells received with CLP bit set Number of OAM AIS cells received Number of OAM FERF cells received Number of BCM cells received Number of OAM end-end loopback cells received Number of OAM segment loopback cells received Number of OAM cells discarded due to CRC-10 error(s) Statistics: All of the above counters followed by an(s) can be configured as statistics. Diagnostics: 8Last unknown LCN received Cells with unknown LCN count Card General

MGX-SRM-3T3/B Specifications

Specifications for the MGX-SRM-3T3/B appear in Table A-33.

Table A-33 MGX-SRM-3T3/B Specifications

Category	Description
Connectors	BNC-3T3, with three pairs of BNC connectors
T1/E1 Line Interface Connector on Service Modules	No connectors required for primary service module. If the MGX-SRM-3T3 provides 1:N redundancy, the standby service module requires a special back card: R-RJ48-8T1 or R-RJ48-8E1.
T1 Channel Rate	T1: 1.544 Mbps ±75 bps (50 ppm)
Transmit Clocking	Normal or looped clocking
Input Jitter Tolerance	Per AT&T Accunet T1.5 Service 1990-T1 Per G.703-E1
Physical Layer Alarms	Indicated in respective Service Modules
Physical Layer Performance Statistics	—
LED Indicators per Card	Active (green), Failed (red), Standby (yellow)
BERT	Active (green), Errors (yellow)
1 to N Redundancy	Active (green)
Indicator for each T3 lone	Active (green)
Maintenance/Serviceability Features	DS1 Loopback toward service modules Hot pluggable
Reliability	>85000 hours MTBF
Card Size	Front card 7.25" (18.43 cm) x 16.25" (41.28 cm) Back card 7" (17.78 cm) x 4.5" (11.43 cm)
Power	48 VDC, 50W
Loopback codes	Fractional T1 inband loopback- ANSI T1/E1-2/92-003 R3 DS0 loopback- TA-TSY-000055 TA-TSY-000057 TA-TSY-0000476
Monitoring trouble codes	TA-TSY-000077 TA-TSY-0000280 ATT TR-62310

Circuit Emulation Service for T3 and E3

The physical layer characteristics for the MGX-CESM-T3 and MGX-CESM-E3 are the same as the MGX-CESM-T3 and MGX-CESM-E3, respectively. For these characteristics, refer to Table A-14 and Table A-16. The available counters appear in the lists that follow. The categories are:

- T3 and E3 line framers
- AAL1 SAR
- Transmitted and received ATM cells

The counters for the T3 and E3 line framers are:

- F-Bit error count (T3)
- P-Bit error Count (T3)
- CP-Bit error Count
- FEBE Count
- BPV Count

The counters for AAL1 SAR are

- Number of OAM cells received
- Number of OAM cells dropped. FIFO Full
- Number of SN CRCs not correctable
- Number of Cells with SN different than SN+1
- Number of Cells received from UTOPIA Interface
- Number of Cells transmitted to UTOPIA Interface
- Number of Conditioned Cells transmitted to UTOPIA Interface
- Number of Cells not sent due to line resynchronization

The counters for transmitted ATM cells are

- Number of cells transmitted to PXM1
- Number of cells discarded due to intershelf link alarm
- Number of cells transmitted with CLP bit set
- Number of AIS cells transmitted
- Number of FERF cells transmitted
- Number of BCM cells transmitted
- Number of end-end loop-back cells transmitted
- Number of segment loop-back cells transmitted

The counters for received ATM cells are

- Number of cells received from PXM1
- Number of cells received with CLP bit set
- Number of AIS cells received
- Number of FERF cells received
- Number of BCM cells received

- Number of end-end loop-back cells received
- Number of segment loop-back cells received
- Number of OAM cells discarded due to CRC-10 error

The diagnostics report the header of last cell with an unknown logical connection number LCN.

Circuit Emulation Service Module for T1 Operation

This section contains operational details for the MGX-CESM-8T1 and MGX-CESM-8E1.

Table A-34 CESM 8T1 Card Information

Category	Description
Back Card	RJ48-8T1
Line Rate	T1: 1.544 Mbps ±75 bps (50 ppm)
Transmit Clocking	Normal clock or SRTS generated
Line Coding	B8ZS AMI
Frame mode	SF ESF
Line alarms	Loss of signal (LOS) Loss of frame (LOF) Loss of multiframe (LOMF) Remote loss of signal or frame (RAI) All ones received (AIS) Bipolar violation
Alarm indication times	Near end alarm up-count Near end alarm down-count Near end alarm maximum count Far end alarm up-count Far end alarm down-count Far end alarm maximum count
Supported OAM cells	AIS FERF End-to-end loopback Segment loopback RTD loopback BCM
Physical Layer Performance Statistics	—
LED Indicators Per Card	Active (green), Failed (red), Standby (yellow)
BERT	T1 E1 1.2
1-to-N Redundancy	Active (green)
Indicator for each T1	Active (green)
Reliability, MTBF	—

Table A-34 CESM 8T1 Card Information (continued)

Category	Description
Card Size	Front card: 7.25" x 16.25" (18.43 cm x 41.28 cm) Back card: 7" x 4.5" (17.78 cm x 11.43 cm)
Power	48 VDC, 50W
Loopbacks	On or Off

Circuit Emulation Service Module for E1 Operation

This section contains operational details for the MGX-CESM-8E1.

Table A-35 CESM 8E1 Card Set Details

Category	Description
Back Card	RJ48-8E or SMB-8E1
Line Rate	E1: 2.048 Mbps ± 100 bps (50 ppm)
Transmit Clocking	Normal clock or SRTS generated
Line Coding	HDB3 AMI
Frame mode	single frame multiframe
Line alarms	Loss of signal (LOS) Loss of frame (LOF) Loss of multiframe (LOMF) Remote loss of signal or frame (RAI) All ones received (AIS) Bipolar violation
Alarm indication times	Near end alarm up-count Near end alarm down-count Near end alarm maximum count Far end alarm up-count Far end alarm down-count Far end alarm maximum count
Supported OAM cells	AIS FERF End-to-end loopback Segment loopback RTD loopback BCM
Physical Layer Performance Statistics	N/A
Indicators	
Card-level	Active (green), Failed (red), Standby (yellow)
BERT	Active (green), Errors (yellow)
1-to-N Redundancy	Active (green)

Table A-35 CESM 8E1 Card Set Details (continued)

Category	Description
Indicator for each T1	Active (green)
Reliability, MTBF	—
Card Size	Front card: 7.25" x 16.25" (18.43 cm x 41.28 cm) Back card: 7" x 4.5" (17.78 cm x 11.43 cm)
Power	48 VDC, 50W
Loopbacks	On or Off

APPENDIX B

Cabling Summary

Introduction

This appendix contains details on the MGX 8250 cabling.

Note In all cable references, the transmit direction is away from the switch, and the receive direction is toward the switch.

T3 Trunk Cabling

A trunk cable connects each T3 port on the BNC-2T3 back card to a T3 port on the co-located BPX-8600-series node. See Table B-1 and Table B-2 for details.

Table B-1 Trunk Cables

Cable Parameter	Description
Type	75-ohm coax cable (RG-59 B/U for short runs, AT&T 734A for longer runs). Two per T3 line (XMT and RCV).
Max. Length	450 feet max. between the BPX 8600-series node and the MGX 8250 node.
Connector:	Terminated in male BNC; Rx is received from trunk, Tx is transmitted to trunk.

Table B-2 T3 Connector Pin Assignments

Connector	Description
Rx BNC	Receive T3 from trunk
Tx BNC	Transmit T3 to trunk

Frame Relay Cabling

This section describes the cabling and connector pinouts for the Frame Relay cards.

1 Cabling

Trunk cables connect the customer DSX-1 cross-connect point or T1 Channel Service Unit (CSU) to the node at the T1 back card.See Table B-3 and Table B-4 for details.

Table B-3 T1 Trunk/Circuit Line Cabling Specification

Cable Parameter	Description
Cable Type	Western Electric 22 AWG, ABAM individually shielded twisted pair (100 ohm balanced). Two pair per T1 line (1 transmit and 1 receive).
Cable Connector	Male DB-15 subminiature.
Max. Cable Length	533 ft. (162 m) maximum between the MGX 8250 node and the first repeater or CSU. Selection of cable length equalizers.

Table B-4 T1 Connector Pin Assignments

Pin No.	Description
1	Transmit, Tip
2	Transmit Pair Shield
3	Receive, Tip
4	Receive Pair Shield
9	Transmit, Ring
11	Receive, Ring

Note Transmit direction is toward the T1 trunk.

E1 Cabling

E1 cables are equipped with either BNC connectors or DB15 connectors.

BNC Connector

E1 trunk cables connect the customer DSX-1 cross-connect point or E1 Channel Service Unit (CSU) to the node at the FRSM E1 back card (BNC-8E1). See Table B-5 and Table B-6.

Table B-5 E1 Trunk/Circuit Line Cabling Specification

Cable Parameter	Description
Cable Type: BNC-8E1	75-ohm coax cable for unbalanced connection. Two cables/pairs (1 transmit, 1 receive) per E1 line.
Cable Connector	Two female BNC for unbalanced connection; male DB15 for balanced connection. See Tables A-2 and A-3 for pinouts.
Max. Cable Length	Approximately 100 meters maximum between the MGX 8250 node and the first repeater or CSU. Equalizer for cable length.

Table B-6 E1 Connector Pin Assignments (unbalanced)

Connector	Description
Rx BNC	Receive E1 from trunk
Tx BNC	Transmit E1 to trunk

DB15 Connector

E1 trunk cables connect the customer DSX-1 cross-connect point or E1 CSU to the node at the FRSM E1 back card (DB15-8E1). See Table B-7 and Table B-8.

Table B-7 E1 Trunk/Circuit Line Cabling Specification

Cable Parameter	Description
Cable Type: DB15-8E1‘	Western Electric 22 AWG, ABAM individually shielded twisted pair (120 ohm balanced). Two pair per T1 line (1 transmit and 1 receive).
Cable Connector:	Male DB-15 subminiature.
Max. Cable Length:	533 ft. (162 m) maximum between the MGX 8250 node and the first repeater or CSU. Selection of cable length equalizers.

Table B-8 E1 Connector Pin Assignments

Pin No.	Description
1	Transmit, Tip
2	Transmit Pair Shield
3	Receive, Tip
4	Receive Pair Shield
9	Transmit, Ring
11	Receive, Ring

Note Transmit direction is toward the E1 trunk.

12IN1-S4 V.35/X.21 Back Card

The back card for the MGX-FRSM-HS1/B is the 12IN1-S4. Each port on the back card connects through a DTE version or DCE version of the Cisco 12IN1 cable. For the signals on the back card, see Table B-10 and Table B-11. The tables show the signal acronym, signal name, and signal source. The signal depends whether the back card connector is either DTE or DCE and whether the back card has been set as either X.21 or V.35 as listed in Table B-9. For the part numbers of the standard and nonstandard versions of the 12IN1 cables, see Table B-12.

Table B-9 12IN1-S4 Cable Types

Cable Type	X.21	V.35
DCE	X.21 DCE	V.35 DCE
DTE	X.21 DTE	V.35 DTE

Note The cable type and part number are printed on a plastic band located near the smaller connector.

Table B-10 V.35 Signals

Signal	Name	Source
RTS	Request to Send	DTE
DTR	Data Terminal Ready	DTE
CTS	Clear To Send	DCE
DSR	Data Set Ready	DCE
DCD	Data Carrier Detect	DCE
GND	Ground	both
B_LL	Local Loopback	DTE
GND	Ground	both
TxD+	Transmit Data	DTE
TxD–	Transmit Data	DTE
RxD+	Receive Data	DCE
RxD–	Receive Data	DCE
TXCE	Secondary Clear to Send	DTE
TXCE	Secondary Clear to Send	DTE
RxC+	Receive Clock	DCE
RxC–	Receive Clock	DCE
TxC+	Transmit Clock	DCE
TxC–	Transmit Clock	DCE

Table B-11 X.21 Signals

Signal	Name
Mode_2	Local connections
Mode_DCE	Local connections
Ground	Shield Ground
O_TXD/RSC+	Transmit +
OTXD/RXD-	Transmit -
O_RTS/CTS+	Control +
O_RTS/CTS-	Control -
I_RDX/TXD+	Receive +
I_RXD/TXD-	Receive -
ICTS/RTS+	Indication +
I_CTS/RTS-	Indication -
I_RXC/TXCE+	Timing +
I_RXC/TXCE-	Timing -
GND	CCT Ground

Table B-12 Cable Part Numbers for MGX-FRSM-HS1/BV

Type of Cable	Far End Connector	Part Number
X.21 DTE	male	72-1440-01
X.21 DCE	female	72-1427-01
V.35 DTE	male (standard)	72-1428-01
V.35 DTE	female (atypical)	72-1436-01
V.35 DCE	female (standard)	72-1429-01
V.35 DCE	male (atypical)	72-1437-01
V.35 DTE-DCE		72-1441-01
Straight-through		72-1478-01
Loopback plug		72-1479-01

HSSI Port Connectors

The High Speed Serial Interface (HSSI) port connects through a female SCSI-II connector. This connector accords with ANSI/TIA/EIA-613. See Table B-13 for the pinouts.

Table B-13 Pinouts for SCSI-II Connector

Pin No.	Name	Signal Function	Polarity	Signal Source
11	SD	Send Data	+	DTE
36			-	

Table B-13 Pinouts for SCSI-II Connector (continued)

Pin No.	Name	Signal Function	Polarity	Signal Source
4	RD	Receive Data	+	DCE
29			-	
6	ST	Send Timing	+	
31			-	
2	RT	Receive Timing	+	
27			_	
6	TT	Terminal Timing	+	DCE
13			-	
3	CA	DCE Available	+	DCE
28			-	
8	TA	DTE Available	+	DTE
33			-	
10	LA	Loop Ckt A	+	DTE
35			-	
12	LB	Loop Ckt B	+	DTE
37			-	
5	LC	Loop Ckt C	+	DCE
30			-	
1, 26, 7, 32, 13, 38, 19, 44, 25, 50	SG	Signal Ground		

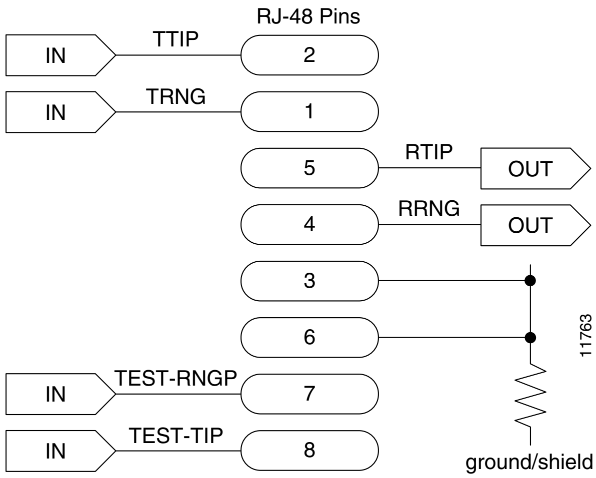
Cabling for RJ-48 Connectors on T1 and E1 Ports

For T1 and E1 ports that connect through a RJ-48 connector, each connector has

- Transmit TIP pin
- Transmit RING pin
- Receive TIP pin
- Receive RING pin
- Two pins for shielded ground

An illustration of the connector wiring appears in Figure B-1.

Figure B-1 RJ-48 Connectors



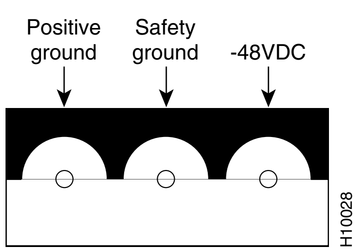
DC Power Cabling

DC Power connections are made to the DC Power Entry Modules at the rear of the MGX 8250 node. (See Figure B-2.) See Table B-14 and Table B-15 for acceptable cable and wire types. Cisco normally does not provide wiring for DC-powered systems. See Table B-14 for details on DC wiring.

Table B-14 DC Power Wiring

Cable Parameter	Description
Wiring:	Three conductor, 12 AWG recommended wire gauge, min. 60° C insulation rating, copper conductors only. Solid or stranded wires. Wire insulation stripped back 0.25 in (6 mm) at the MGX 8250 connector end.
Connection:	EURO Block.

Figure B-2 DC Power Connections



AC Power Cabling

Either Cisco Systems or the customer can provide the AC power cord. See Table B-15 for the power cords that Cisco can supply. In addition, you can special-order AC cables with other plugs or different lengths. If you want to construct the power cord, it must mate with an IEC320 16/20A male receptacle on the back of the AC power module.

Table B-15 AC Power Cables

Cable Parameter	Description
Cable	Provided with 8 feet (2.3 m) of 3-conductor wire with plug.
Plug: customer end	20A NEMA L620, 3-prong plug (U.S.) 13A 250 VAC BS1363, 3-prong fused plug (U.K., Ireland) CEE 7/7 (Continental Europe) AS3112 (Australia, New Zealand) CEI23-16/VII (Italy)

Control and Clock Cabling

This section describes the cables that connect to the PXM-UI-S3 card.

Maintenance and Control Ports

The maintenance (or modem) port and the control (or console) port connect a node to an ASCII terminal, workstation, or modem for remote alarm reporting or system monitoring. See Table B-16 for a description of the cabling and Table B-17 for the pinout of the associated RJ-48 connector.

Table B-16 Maintenance and Control Port Cabling

Cable Parameter	Description
Interface	EIA/TIA-232—both are DTE ports.
Suggested Cable	24 AWG, 25-wire. A straight-through EIA/TIA-232 cable provides a terminal or printer connection. For an interface with modems on either port, a null modem cable may be necessary.
Cable Connector	RJ-48, subminiature, male. Table B-17 contains a list of the port pin assignments.
Max. Cable Length	50 feet (15 m)

Table B-17 Maintenance and Control Port Pin Assignments

Pin No.	Name	Description
1	RTS out	Request to Send
2	DTR out	Data Terminal Ready
3	TxD	Transmit Data
4	GND	Chassis ground

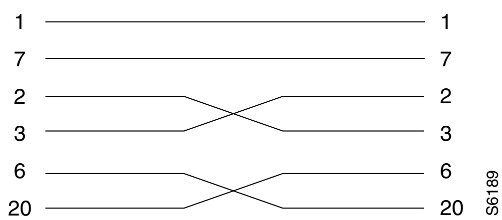
Table B-17 Maintenance and Control Port Pin Assignments (continued)

Pin No.	Name	Description
1	RTS out	Request to Send
5	GND	Chassis ground
6	RxD	Receive Data
7	DSR	Data Set Ready
8	CTS	Clear to Send

Modem Cable

Figure B-3 shows a modem cable that is used for connecting modems to the MGX 8250 control and maintenance ports.

Figure B-3 Null Modem Cable



External Clock Input Cabling

The external clock input cable connects the external clock inputs through the T3E3-D, T3E3-B, and SMF-155 EXT. TMG connectors. The clock may be 1.544 Mbps for T3E3-D or 2.048 Mbps for T3E3-D.

External Clock Input Cabling

The MGX 8250 has two external clock input connectors:

1. T1 RJ-48 connector
2. E1 SMB connector.

T1 Clock Cabling

The clock port can accept a T1 or E1 BITS clock input. (See Table B-18)

Table B-18 7T1 Clock Cabling

Pin No.	Name
1	Tx ring out
2	Tx tip out
3	Ground

Table B-18 7T1 Clock Cabling (continued)

Pin No.	Name
4	Rx ring in
5	Rx tip in
6	No comment
7	Test point ring out
8	Test point tip out

External Alarm Cabling

The external alarm cable connects to the Alarm connector on the PXM1-UI card. See Table B-19 for physical characteristics of the cable and Table B-20 for the pinouts.

Table B-19 External Alarm Cabling

Cable Parameter	Description
Interface	Dry-contact relay closure.
Wire	24 AWG, shielded, 6-pair.
Connector	DB-15, subminiature, male.

Table B-20 Network Alarm Pin Assignments

Pin No.	Alarm	Description
1	Audible—Major	Normally open
2		Common
9		Normally closed
4	Visual—Major	Normally open
5		Common
12		Normally closed
7	unused	n.c.
8	unused	n.c.
3	Audible—Minor	Normally open
11		Common
10		Normally closed
6	Visual—Minor	Normally open
14		Common
13		Normally closed
15	unused	n.c.

Standard MGX 8250 Cables

For a list of the standard cables that Cisco can supply for the MGX 8250 switch, see Table B-21. The suffix to the model number indicates the length of the cable. For example, 5610-50 indicates a 50-foot cable. Cables are available in standard lengths of 10 ft. (3 m), 25 ft. (7.6 m), 50 ft. (15 m), 75 ft. (22.8 m), and 100 ft. (30 m). Lengths of 100 ft. (30 m) to 600 ft. (183 m) are available through a special order.

Where applicable, Table B-21 includes the gender of the connector and the number of pins. For example, EIA/TIA-232/M25-M25 indicates a cable terminated with a male DB25 at both ends.

Table B-21 Standard Cables Available from Cisco

Model Number	Description	Usage
T3-E3-10 T3-E3-25 T3-E3-50 T3-E3-75 T3-E3-xx	75 ohm coax/BNC-BNC, 10' 25' 50' 75' length to be specified	T3 or E3 trunk interface
5620	EIA/TIA-232/M25-F25	PXM1-UI maintenance port to control terminal, Cisco WAN Manager, or external window device
5621	EIA/TIA-232/M25-M25 special	Control or maintenance port to modem
5601	Ground cable	DC power
5670	Molex-pigtail	DC power
5671	Spade lug-pigtail	DC power

Redundancy Y-Cable

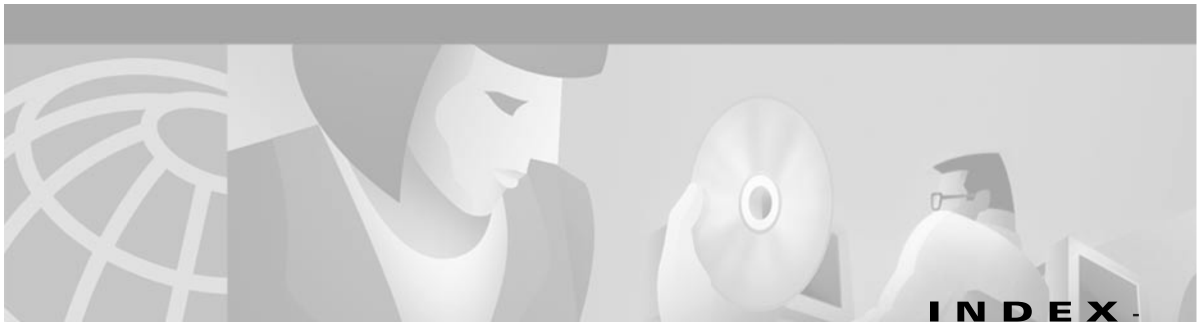
Special Y-cables provide line redundancy where applicable. (The Service Resource Module can also provide redundancy where certain Y-cables do not apply.) Table B-22 lists the Y-cables used with various MGX 8250 cards.

Table B-22 Y-Cable Product Names for Applicable Cards

Applicable Card Name	Connector Hardware	Type/Standard Interface	Product Number
PXM1-UI	RJ-45	EIA/TIA-232	CAB-5684-06 (6-inch Y)
PXM1-UI	RJ-45	EIA/TIA-232	CAB-5684-18
PXM1-UI	RJ-45	T1 BITS Clock	CAB-5686-06 (6-inch Y)
PXM1-UI	SMB	E1 BITS Clock	CAB-5681-06 (6-inch Y)
PXM1-UI	SMB	E1 BITS Clock	CAB-5681-18 (18-inch Y)
PXM1-UI	DB15	Alarm Output	CAB-5607-10 (10-inch Y)
PXM1-4-155	SC	SMF, MMF	CAB-SMF-Y-SC
PXM1-1-622	SC	SMF	CAB-SMF-Y-SC
PXM1-2T3E3	BNC	75 ohm, coaxial	CAB-T3E3-Y

Table B-22 Y-Cable Product Names for Applicable Cards (continued)

Applicable Card Name	Connector Hardware	Type/Standard Interface	Product Number
MGX-BNC-3T3-M	BNC	75 ohm, coaxial	CAB-T3E3-Y
MGX-FRSM-2T3E3	BNC	75 ohm, coaxial	CAB-T3E3-Y
MGX-CESM-T3E3	BNC	75 ohm, coaxial	CAB-T3E3-Y
MGX-FRSM-HS2	SCSI2		CAB-SCSI2-Y
SMSCFC010250-01M	SC to FC		72-1246-01



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