Cisco MGX 8230 Edge Concentrator Installation and Configuration

Release 1.1.31
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Preface

This preface describes the objectives, audience, organization, and conventions of the *Cisco MGX 8230 Edge Concentrator Installation and Configuration* Guide.

Audience

This publication is intended for the person who will do the physical installation of the MGX 8230. The MGX 8230 is typically co-located and rack-mounted with either an IGX 8400 or BPX series switch. The MGX 8230 installer should be familiar with electronic circuitry and wiring practices and have experience as an electronic or electromechanical technician, as well as with the Cisco IGX/BPX switches.

Note This *Cisco MGX 8230 Edge Concentrator Installation and Configuration* covers the installation and configuration for the equipment. The command reference and error codes for the MGX 8230 are described in the section "Related Documentation."

Warning **Installation of the equipment should be performed by trained service personnel.**

Organization

This document is organized into the following chapters:

- Chapter 1, "Introducing the MGX 8230"
- Chapter 2, "Module and Service Descriptions"
- Chapter 3, "Site Preparation"
- Chapter 4, "Enclosure Installation"
- Chapter 5, "Configuring the MGX 8230 Shelf"
- Chapter 6, "Card and Service Configuration"

Related Documentation

The following Cisco publications contain additional information related to the operation of the Cisco MGX 8230 Edge Concentrator.

MGX 8230 Edge Concentrator, Release 1.0 Related Documentation

The following table lists documentation that contains additional information related to the installation and operation of the MGX 8230 Edge Concentrator.

Table 1 MGX 8230 Edge Concentrator Related Documentation

Documentation	Description
Cisco MGX 8230 Edge Concentrator Installation and Configuration, Release 1.1.31 DOC-7811215=	Provides installation instructions for the MGX 8230 Edge Concentrator.
Cisco MGX 8230 Edge Concentrator Command Reference, Release 1.1.31 DOC-7811211=	Provides detailed information on the general command line interface commands.
Cisco MGX 8230 Error Messages, Release 1.1.31 DOC-7811213=	Provides error message descriptions and recovery procedures.
WAN CiscoView for the MGX 8230 Edge Concentrator, Release 1.1.31 DOC-7810617=	Provides instructions for using WAN CiscoView for the MGX 8230 Edge Concentrator.

Cisco WAN Manager, Release 10, Related Documentation

The following table 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.
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 Related Documentation

This table 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* manual.
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.

Table 3 Cisco WAN Switching Release 9.3 Related Documentation

Documentation	Description
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, tips, 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.

Timesaver Means *the described action saves time*. You can save time by performing the action described in the paragraph.

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

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- http://www-europe.cisco.com

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Technical Assistance Center

The Cisco TAC website is available to all customers who need technical assistance with a Cisco product or technology that is under warranty or covered by a maintenance contract.

Contacting TAC by Using the Cisco TAC Website

If you have a priority level 3 (P3) or priority level 4 (P4) problem, contact TAC by going to the TAC website:

http://www.cisco.com/tac

P3 and P4 level problems are defined as follows:

- P3—Your network performance is degraded. Network functionality is noticeably impaired, but most business operations continue.
- P4—You need information or assistance on Cisco product capabilities, product installation, or basic product configuration.

In each of the above cases, use the Cisco TAC website to quickly find answers to your questions.

To register for Cisco.com, go to the following website:

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

If you cannot resolve your technical issue by using the TAC online resources, Cisco.com registered users can open a case online by using the TAC Case Open tool at the following website:

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

Contacting TAC by Telephone

If you have a priority level 1(P1) or priority level 2 (P2) problem, contact TAC by telephone and immediately open a case. To obtain a directory of toll-free numbers for your country, go to the following website:

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

P1 and P2 level problems are defined as follows:

- P1—Your production network is down, causing a critical impact to business operations if service is not restored quickly. No workaround is available.
- P2—Your production network is severely degraded, affecting significant aspects of your business operations. No workaround is available.

CHAPTER 1

Introducing the MGX 8230

This chapter contains an introduction to the Cisco MGX 8230 Edge Concentrator including a summary of product features and equipment.

This chapter contains the following information:

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

For additional descriptions of the MGX 8230 capabilities and specifications, refer to the Cisco document *MGX 8230 Edge Concentrator Overview.*

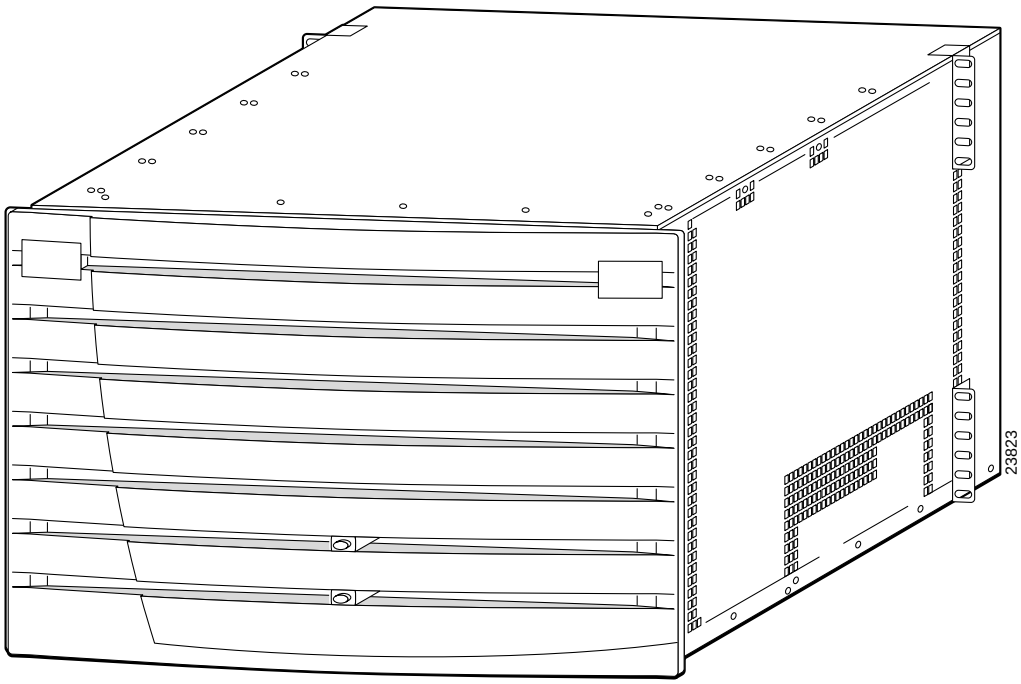
MGX 8230 System Overview

The Cisco MGX™ 8230 Edge Concentrator is a small footprint Multiservice Gateway specifically designed for Service Providers with space and power constraints. The Cisco MGX 8230 offers cost effective narrowband, voice, and IP services; and acts as a feeder shelf to Cisco BPX 8600 series, MGX 8850, and Cisco IGX 8400 series Multiservice Switches. The MGX 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 a MGX 8230 with its door attached. Note that there are light pipes in the door that display the status of the processor models (PXM1s).

Figure 1-1 MGX 8230 with Door Attached



The Applications of the MGX 8230

The MGX 8230 operates in the following *applications*:

Note Refer to the Cisco document *MGX 8230 Edge Concentrator Overview* for additional information on the applications of the MGX 8230.

Note See Chapter 5, "Configuring the MGX 8230 Shelf" for information on configuring MGX8230 applications.

As a feeder

The MGX 8230 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.

As a Stand-Alone Switch

The MGX 8230 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 8230 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 8230 interfaces to the ATM equipment using a standard ATM UNI or NNI..

Multiprotocol Label Switching (MPLS)

As a component of the BPX 8680-IP universal service node, the MGX 8230 is capable of forwarding traffic into the BPX MPLS network by acting as a multiservice feeder

Consolidation of Cisco CPE Traffic

At the edge of the network, the MGX 8230 can interwork with and consolidate a wide variety of CPE equipment.

Multiservice Stand-alone Concentrator

The MGX 8230 can be deployed as a stand-alone concentrator, interfacing to a multivendor ATM (non-BPX) network, as shown Figure 1-5. The MGX 8230 interfaces to ATM equipment using a standard ATM UNI or NNI.

Universal Edge Architecture

The MGX 8230 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 MGX 8230 supports up to 64 channelized or non-channelized T1 and E1 interfaces on a single IP + ATM multiservice gateway

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 64 T1 interfaces. 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 8230 to support new features through downloadable software upgrades or new hardware modules.

The MGX 8230 backplane supports individual line rates range from DS0 through OC-3.

Standards-Based Conversion to ATM

The MGX 8230 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 8230 Enclosure and Power

The MGX 8230 has a 14 single-height slot (7 double-height) chassis. This chassis can be rack mounted in a 19-inch rack, or fitted with side panels to be a free-standing box (referred to as a “stand-alone” MGX 8230). An optional mounting bracket kit is also available for mounting the MGX 8230 in 23-inch racks.

Note Although the card slots in an MGX 8230 are horizontal, this manual refers to the card slots and modules as single-height and double-height. This is for consistency: the PXM1 core card and service module cards are a subset of the MGX 8250 cards that are installed vertically in an MGX 8250 chassis.

Slot Numbering and Placement

The MGX 8230 slots are populated with cards and modules according to the following rules (Figure 1-2):

- The slots are numbered 1 to 7 on the left half of the chassis. The slots on the right side of the chassis are numbered 8 to 14.

- Each service module slot can accept one single-height card or be converted to accept two double-height cards.
- Slots are 1 and 2 are always double-height slots and reserved for the primary and redundant MGX 8230 Processor Switch Modules (PXM1s).
- Slots 7 and 14 are reserved for SRM modules only: no other service modules can be used in these two slots.
- Eight single-height slots (four double-height slots) are available for service modules.

Figure 1-2 is a conceptual drawing of an MGX 8230 showing the dimensions and the slot numbering. The slot numbering is as it appears from the front of the MGX 8230; slots 8 and 9 refer to back card slots only.

Single Height and Double Height Slots

Single-height slots on the MGX 8230 chassis can be converted into double-height slots.

- When a double-height front card is plugged in, the left slot number is used. The back cards are numbered according to the front card numbering scheme, with the exception of slots 8 and 9 as noted below.
- Since front slots 1 and 2 are always double-height for PXM1 processor modules, slots 8 and 9 only refer to the back card slots that correspond to the two lower single-height slots on the left side of the chassis as seen from the rear.
- When converting single-height slots into double-height slots the conversion must start from the bottom and be contiguous. For example, before you can convert slot 4 into double height, slot 3 must be converted first (as shown in Figure 1-3 on page 1-6).

Figure 1-2 MGX 8230 Slot Placement

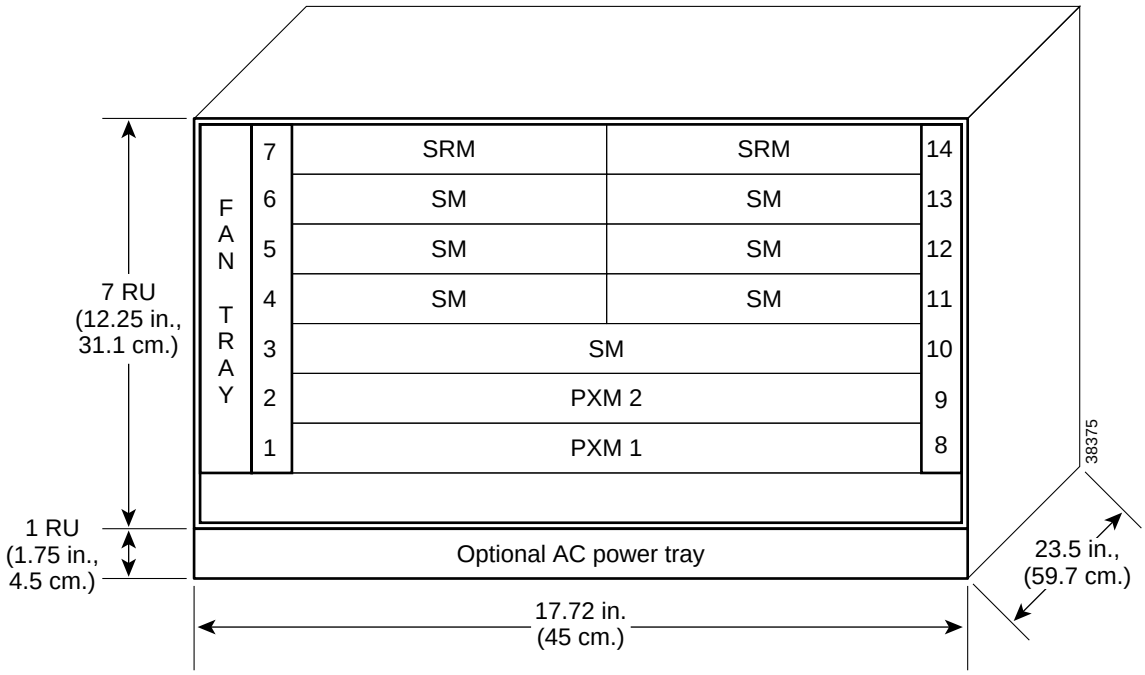
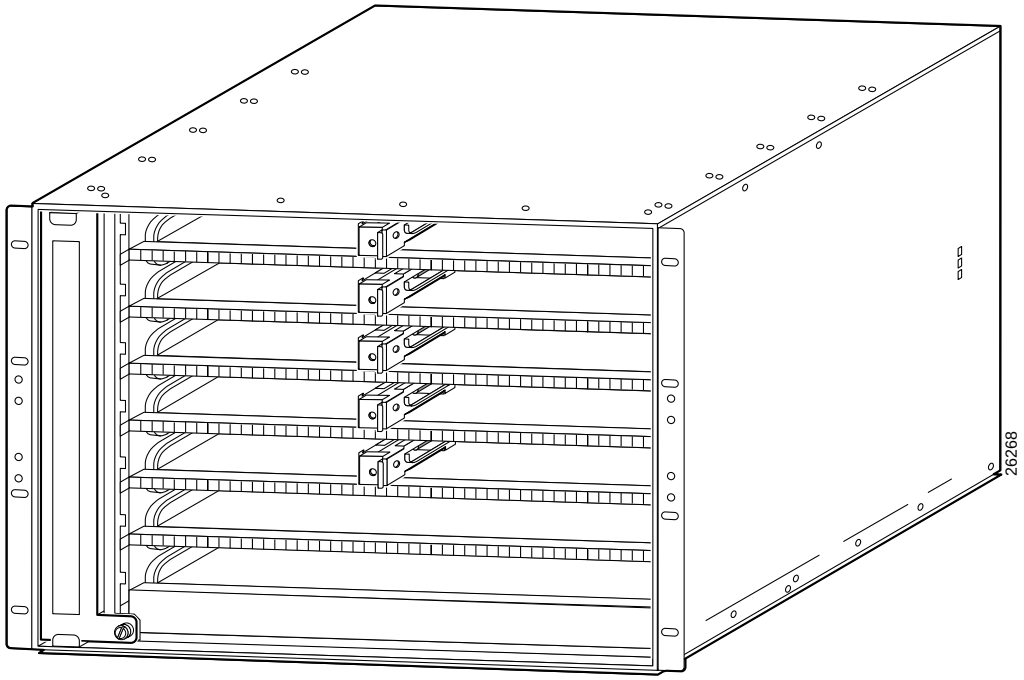


Figure 1-3 MGX 8230 Card Cage, Front View



Chapter 3, "Site Preparation" and Chapter 4, "Enclosure Installation" contain additional information on installing racks and the MGX 8230 chassis.

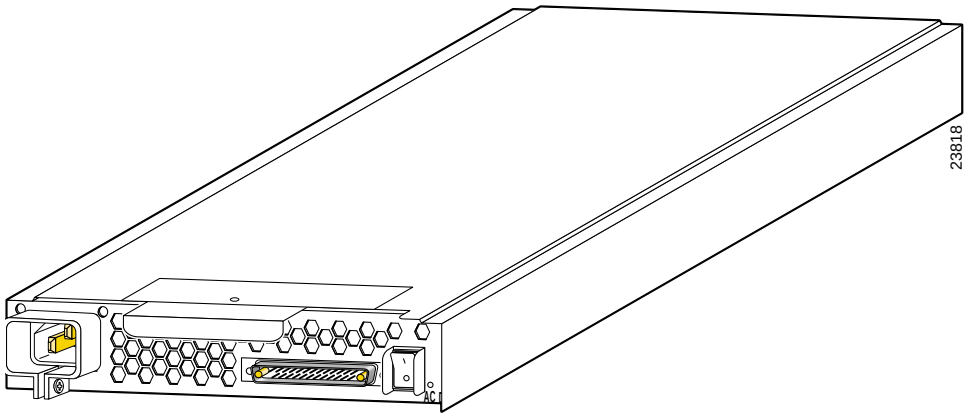
MGX 8230 Power System

The MGX 8230 power system is designed with distributed power architecture centered around a -48 VDC bus on the system backplane. The -48 VDC bus accepts redundant DC power from either a -42 to -56 VDC source via optional DC power entry modules (PEMs) or from a 100 to 120 or a 200 to 240 VAC source via the optional AC Power Supply Tray. The MGX 8230 backplane distributes power via connectors on the - 48 VDC bus to each hot-pluggable processor or service module. Each card incorporates on-board DC-DC converters to convert the -48 VDC from the distribution bus voltage to the voltages required on the card.

Optional AC Power Supply

For an AC-powered MGX 8230, an optional AC power supply tray is attached to the bottom of the MGX 8230 card cage at the factory. The AC power supply tray is one rack-unit high, and can hold up to two AC Power Supply modules. Each AC Power Supply module can provide up to 1,200W at -48 VDC and has its own AC power cord and power switch. Figure 1-4 shows the rear view of an optional AC Power Supply module. The power supplies can be configured as 1+1 redundant. If no redundancy is desired, an AC tray with one AC power supply and one AC power cord can also be ordered.

Figure 1-4 AC Power Supply Module, Rear View



Each AC Power Supply Module incorporates the following features:

- 1 rack unit high
- An output capacity of 1200 Watts at -48 VDC
- O-ring diode
- EMI filtering
- Cooling fan
- Power switch
- DC and AC status LEDs

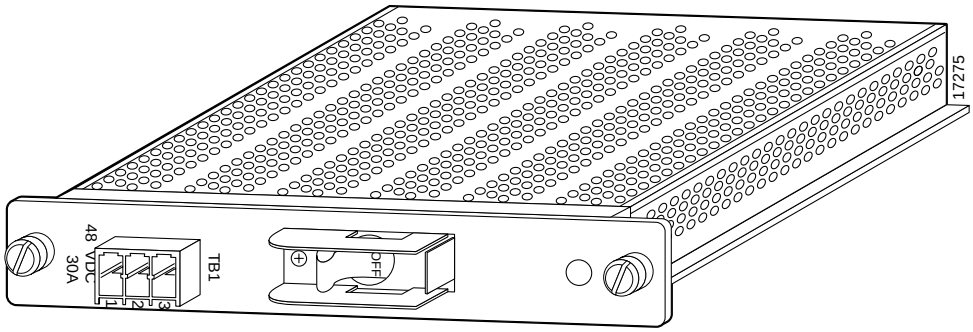
DC-Powered MGX 8230

For DC systems, a DC Power Entry module (PEM) is required for each DC source of central office power -42 to -56 VDC. The MGX 8230 can support two DC power sources and has rear panel slots for two DC PEMS. Figure 1-5 illustrates a DC PEM.

The DC PEMs incorporate the following features:

- Hot swappable
- O-ring diode
- EMI filtering

Figure 1-5 MGX 8230 DC Power Entry Module

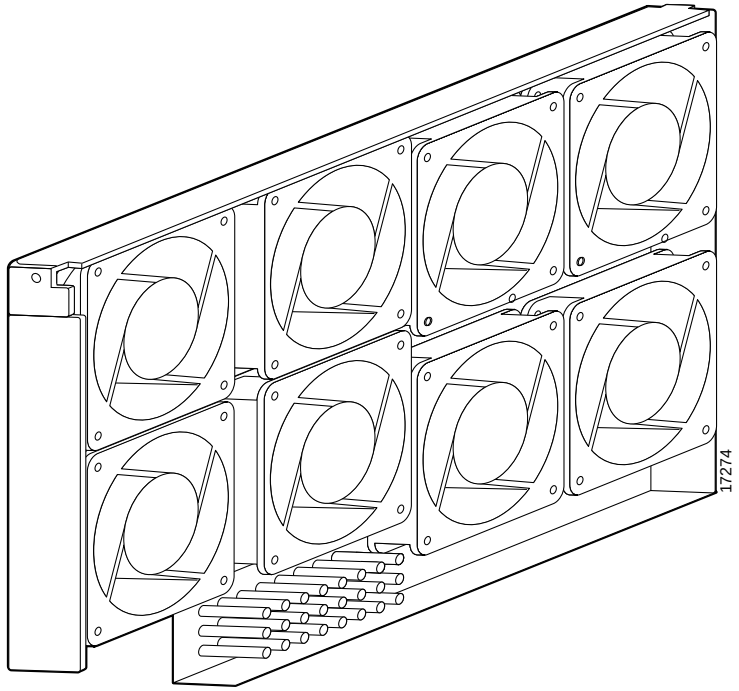


Cooling System

The MGX 8230 incorporates a fan tray assembly (with eight fans) located on the left side of the card cage to pull ambient cooling air into the system through openings between front card faceplates, over the boards in the card cage, and out through air exhaust openings on the left side of unit. Figure 1-6 is an illustration of the MGX 8230 fan tray assembly. The cooling system incorporates the following design features:

- -48 VDC fans with rotation sensing
- N+1 fan redundancy
- Hot pluggable (if done quickly) Fan Tray Assembly
- Noise level < 65 dBA

Figure 1-6 MGX 8230 Fan Tray Assembly



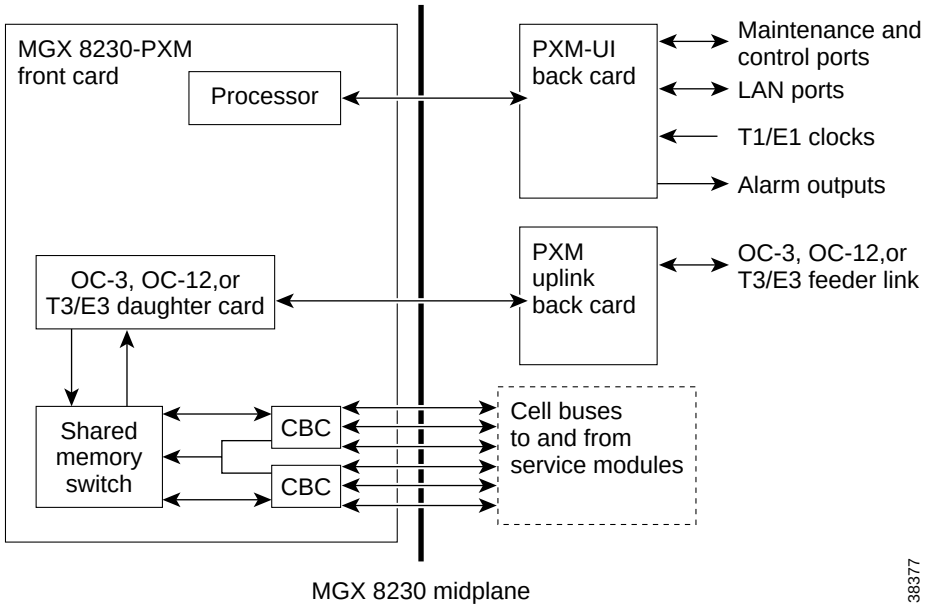
MGX 8230 Architecture

The MGX 8230 architecture is built around the switching fabric on the processor switching module (PXM1), the backplane, and the service modules. Figure 1-7 is a very simple block diagram of the MGX 8230 architecture.

The main functions of the MGX 8230 backplane are to connect cards together, terminate critical signals properly, provide -48 VDC power to all cards, and set ID numbers for each slot. In addition, the MGX 8230 backplane interconnects both front cards and back cards together via pass-through connectors. A software readable ID on the backplane is available for software to identify that the chassis is an MGX 8230.

The cell bus controllers (CBCs) are application-specific integrated circuits (ASICs) and provide the interface between the switching fabric and the service modules.

Figure 1-7 MGX 8230 Architecture Simple Block Diagram



Cell Bus

The MGX 8230 cell bus (CB) provides high-speed interface between the switch fabric and the service modules.

Figure 1-8 shows the overall cell bus distribution of MGX 8230 backplane and Table 1-1 lists the specific cell bus allocation to each slot with respect to master and slave cell bus ports.

Each PXM1 supports eight master cell buses and one slave cell bus connected to the backplane. The service modules have two slave cell bus ports, one from each PXM1. The master cell bus ports are CB0 to CB7 and the PXM1 slave ports are referred to as 7S and 8S in Table 1-1.

A cell bus comprises the group of signals used to transfer data between the PXM and a service module. CB 0, 6, 1, 2, 4, and 3 are dedicated service modules, CB5 supports physical slot 6. CB7 supports physical slot 13 as well as the alternate PXM1's slave port.

There is a connection on cell bus 7 to the alternate PXM1. A PXM1 is able to communicate with the other PXM1 using the slave cell bus port on that card. Slots 8 and 9 only refer to back card slots.

Figure 1-8 Cell Bus Distribution

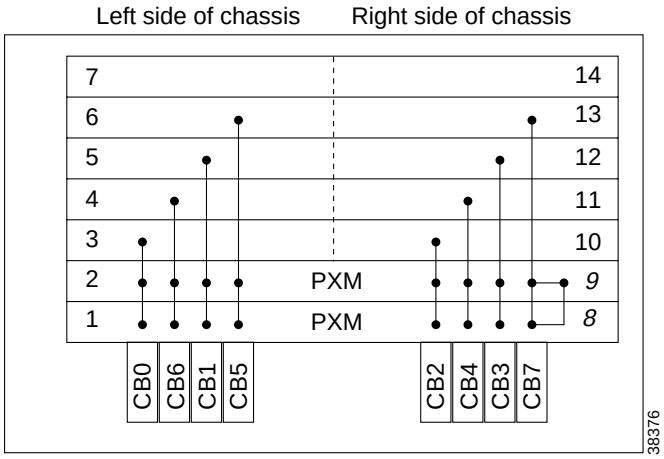


Table 1-1 Cell Bus Distribution

	Left Side Chassis							Right Side Chassis				
Physical Slot #	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**10**	**11**	**12**	**13**	**14**
Slot ID Address	**1s**	**2s**	**9**	**A**	**B**	**C**	**D**	**9**	**A**	**B**	**C**	**D**
CB0_A/B			x									
CB1_A/B					x							
CB2_A/B								x				
CB3_A/B										x		
CB4_A/B									x			
CB5_A/B						x						
CB6_A/B				x								
CB7_A		x									x	
CB7_B	x										x	

MGX 8230 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 8230 supports the following user interface applications:

- Cisco WAN Manager (formerly StrataView Plus): a Graphical User Interface (GUI) application for connection management. This application enables operations, administration, and maintenance of WAN-multiservice networks.
- CiscoView: a GUI application for hardware configuration.

- Command line interface (CLI): the CLI is used for low-level control of hardware functionality and connection control.

The following ports are used to communicate with the MGX 8230:

- The Control port (SLIP protocol only) on the PXM1-UI back card.
- The LAN (Ethernet) port on the PXM1-UI back card.
- The 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, page 5-2 for additional information on the ports used to manage and configure the MGX 8230.

Summary of MGX 8230 Cards and Modules

This section contains a summary of the service cards and modules supported by the MGX 8230.

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

Introduction to Core Card Sets and Service Modules

The MGX 8230 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 daughter card contains the firmware that distinguishes the interface (OC-3, T3, E3, and so on).
- The back card is a simple card that provides the electrical interface for one or more lines of a particular type.

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 8230 enclosure contains up to 8 service modules (I/O cards). The optional Service Redundancy Modules (SRMs) provide redundancy.

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

Processor Switching Module (PXM1)

- Processor Switching Module (PXM1)
  This front card controls the 8230 and supports external interfaces for user-access and trunking or UNI ports. The back cards consist of a user interface card 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 8230.
- 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 8230. This card also provides Stratum 3 clocking capability.

OC-3 Uplink Back Cards

- MGX-MMF-4-155/B (multi-mode 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 automatic protection switching (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 Automatic Protection Switching (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. Automatic Protection Switching (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. Automatic Protection Switching (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 N x 64 channels toward the customer premises equipment (CPE), and 1:N redundancy for the service modules.

Frame Relay Service Modules (FRSM)

- 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 n x DS0 channelization of the T1s. Each interface is configurable as up to 24 ports running at full line rate, at 56 or n x 64 kbps for a maximum of 192 ports per FRSM-8T1-C.
- 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. Each interface is configurable as up to 31 ports running at full line rate, at 56 or n x 64 kbps for a maximum of 248 ports per FRSM-8E1-C.
- Frame Service Module for T3 and E3 (MGX-FRSM-2E3T3)
  The MGX-FRSM-2E3/T3 provides interfaces for two T3 or E3 Frame Relay lines, each of which can support either two T3 lines (each at 44.736 Mbps) or two E3 lines (each at 34.368Mbps) 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 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.

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 *N* x T1 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 *N* x T1 lines to form a single, logical interface (IMA).

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.

Voice 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), see the *Voice Interworking Service Module Installation and Configuration* Guide

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, see the *Release Notes* for "*Cisco WAN MGX 8850, 8230, and 8250 Software*"

Note For configuration information on the Route Processor Module (RPM), see the *Cisco Route Processor Module Installation and Configuration* Guide.

Redundancy for Service Modules

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

Refer to 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 Service Modules" section on page 1-16 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, use the command **dsphotstandby**.

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

CHAPTER 2

Module and Service Descriptions

This chapter includes detailed descriptions of the modules, cards and services available with the MGX 8230:

Note Although the illustrations in this chapter display the equipment in a vertical position, the cards and modules are rotated 90 degrees (to a horizontal position) when installed in the MGX 8230 back card slots. See the "MGX 8230 Enclosure and Power" section on page 1-4 for more information on slot assignments and module installation.

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, "Technical 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 8230, 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 The PXM1 processor module for the MGX 8230 is identical to the PXM1 for the MGX 8250.

PXM1 Features

The PXM1 (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 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 inband clock sources
- Inband 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

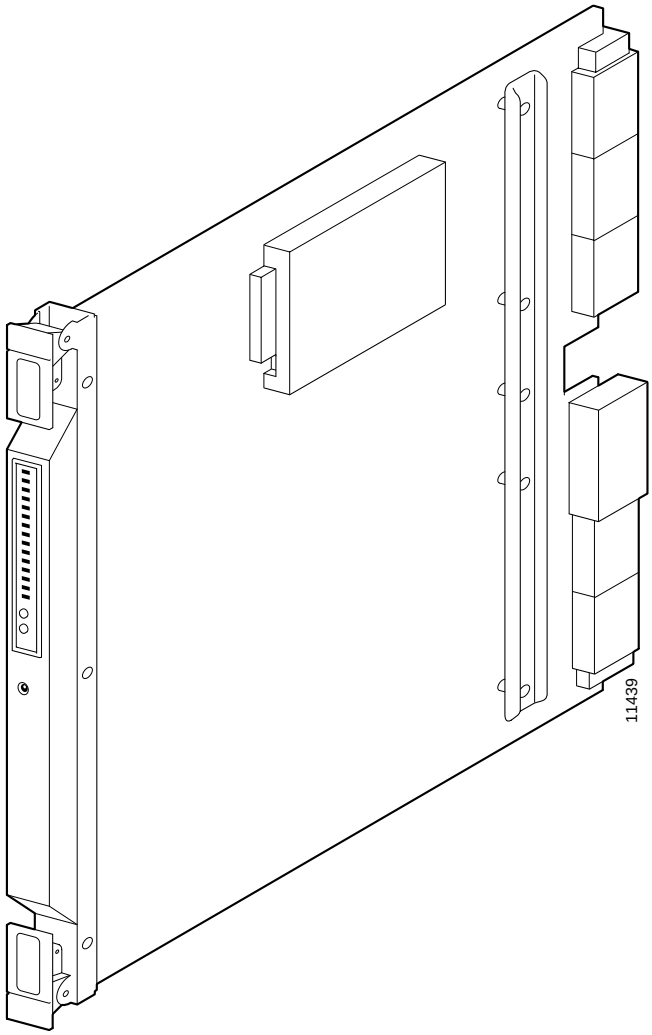
PXM1 Illustration and LED Description

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 User Interface back card:

PXM1-UI (standard)

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

- One RJ-45/48 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.

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 (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 (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 8230 Shelf" for further information on configuring an external clocking source.

PXM1 Back Cards

This section contains illustrations of the following PXM1 cards.

- Figure 2-2: User Interface Back Card (PXM1-UI)
- 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/B)
- 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

Refer to PXM1 User Interface Back Cards, page 2-3 for descriptions of the features available with the PXM1 User Interface back cards.

Figure 2-2 User Interface Back Card (PXM1-UI)

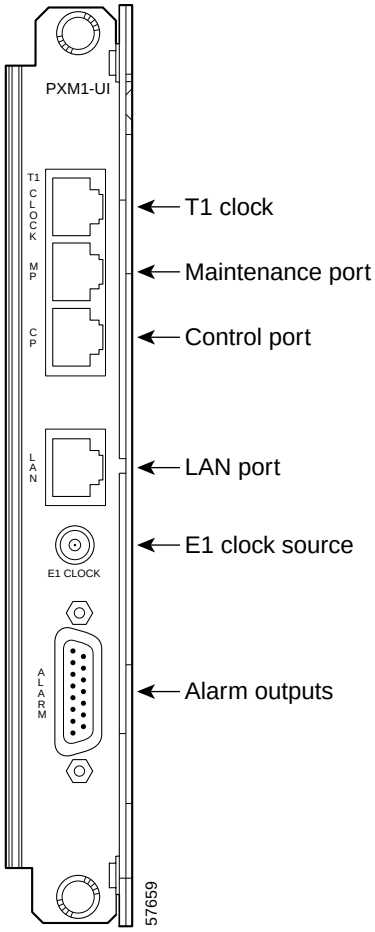
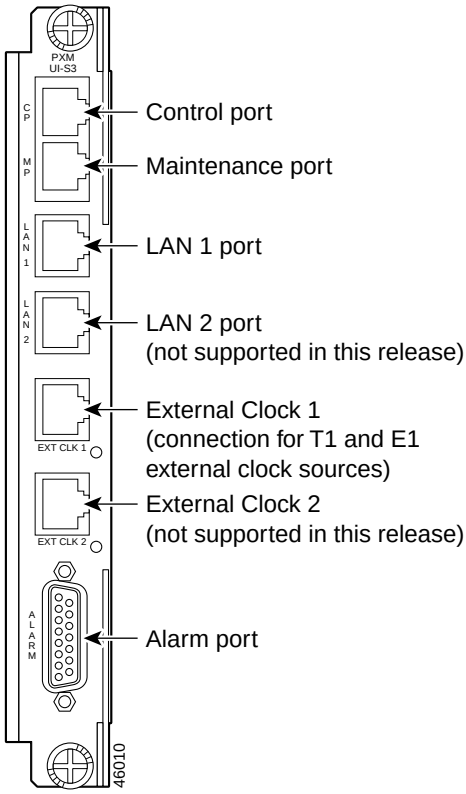


Figure 2-3 User Interface Back Card (PXM-UI-S3): Stratum 3 Clocking



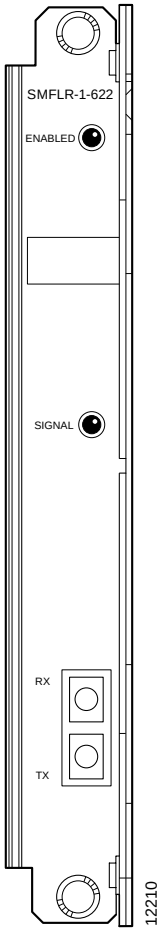
Alarm Output Connection

Dry contact relay closures are available for forwarding MGX 8230 alarms to an alarm system. Separate visual and audible alarm outputs are available for major and minor alarm outputs. The MGX 8230 alarm outputs are available on a DB-15 connector on the PXM-UI-S3 back card faceplate.

SMFLR-1-622 Back Card

An illustration of the long-reach OC-12 card appears in Figure 2-4. For specifications on this card, refer to Appendix A, "Technical Specifications." Note that Automatic Protection Switching (APS) requires the "B" model—an SMFLR-1-622/B.

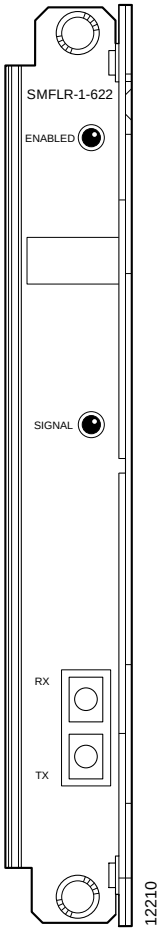
Figure 2-4 OC-12 Long-Reach Back Card (SMFLR-1-622/B)



SMFIR-1-622 Back Card

The intermediate-reach OC-12 back card appears in Figure 2-5. For specifications on this card, refer to Appendix A, "Technical Specifications." Note that Automatic Protection Switching (APS) requires the "B" model—an SMFIR-1-622/B.

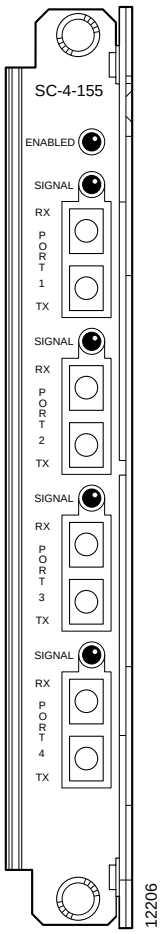
Figure 2-5 OC-12 Intermediate-Reach Back Card (SMFIR-1-622/B)



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, and redundant configurations are supported through Y-cables. For specifications on this card, refer to Appendix A, "Technical Specifications." Note that Automatic Protection Switching (APS) requires the "B" model—an SMF-155/B.

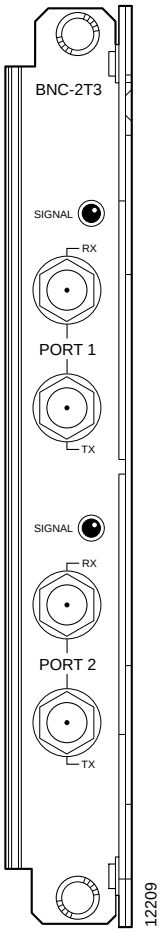
Figure 2-6 OC-3 Four-Port Back Card (SMF-155/B)



BNC-2T3 Back Card

For card specifications, refer to Appendix A, “Technical Specifications.”

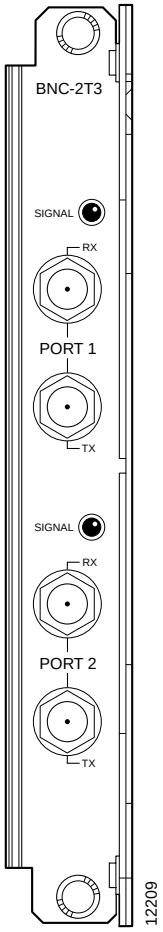
Figure 2-7 Two-port T3 Back Card (BNC-2T3)



BNC-2E3 Back Card

Two versions of the BNC-2E3 card are available. The BNC-2E3A applies to Australia only, and 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, refer to Appendix A, "Technical 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 (N x DS0), or on a single DS0 channel. The SRM can support 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 T3 lines rather than over individual T1 lines.

Any T1 channel in a T3 line can be distributed to any eight port service module in any slot . Each MGX 8230 shelf can support up to 64 T1 lines.

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 are card-level characteristics that apply to any SRM installation:

- Only MGX-SRM-3T3/C cards can be installed in slots 7 and 14.
- No other service modules can be installed in slots 7 and 14. These slots do not have cell bus connections. The SRM modules use a local bus to communicate with the PXM.
- The PXM1 in slot 1 controls the SRM in slot 7. The PXM1 in slot 2 controlsthe SRM in slot 14.
- Either SRM in slot 7 or 14 can be active (depending on the active PXM1).

SRM Illustration and LED Indicators

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

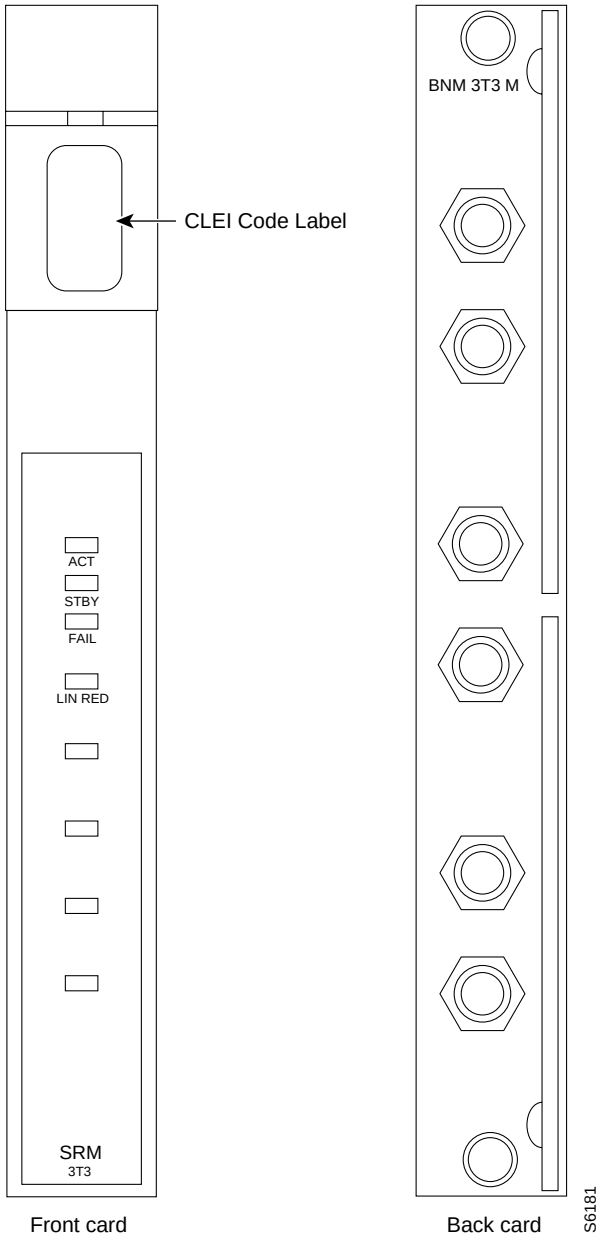
Table 2-1 LED Indicators for the SRM-3T3/C

Type of LED	Color	Meaning
ACTIVE (ACT) LED	Green	Indicates card set is in active mode.
STANDBY (STBY) LED	Yellow	Indicates card set is in standby mode.
FAIL (FAIL) LED	Red	Indicates BNM-155 card set has failed or the line module is missing.

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

Type of LED	Color	Meaning
(1:N RED) LED	Green	On indicates 1:N redundancy has been invoked. Off indicates 1:N redundancy is not active.
BERT (BERT) LED	Green	On indicates 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

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 (QoS) Management

Consistent with Cisco's 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 n x T1 and n x E1 capability fills the gap between T1/E1 and T3/E3, providing bandwidth up to 12 Mbps (n x T1) or 16 Mbps (n x E1), 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 n x T1s or n x E1s can support an n x T1 or n x E1 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

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 Illustration and LED Description

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, refer to Appendix A, "Technical Specifications."

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

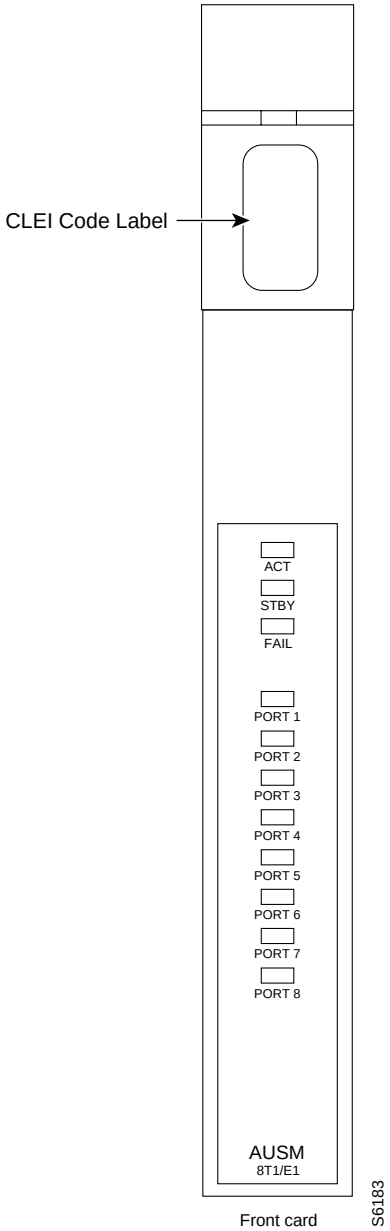


Table 2-3 contains a list of eight-port LED indicators:

Table 2-3 Eight-Port AUSM/B LED Indicators

Type of LED	Color	Description
PORT LED	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).
ACTIVE LED	Green	On indicates the card set is in active mode.
STANDBY LED	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 LED	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.

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 on page 2-19).

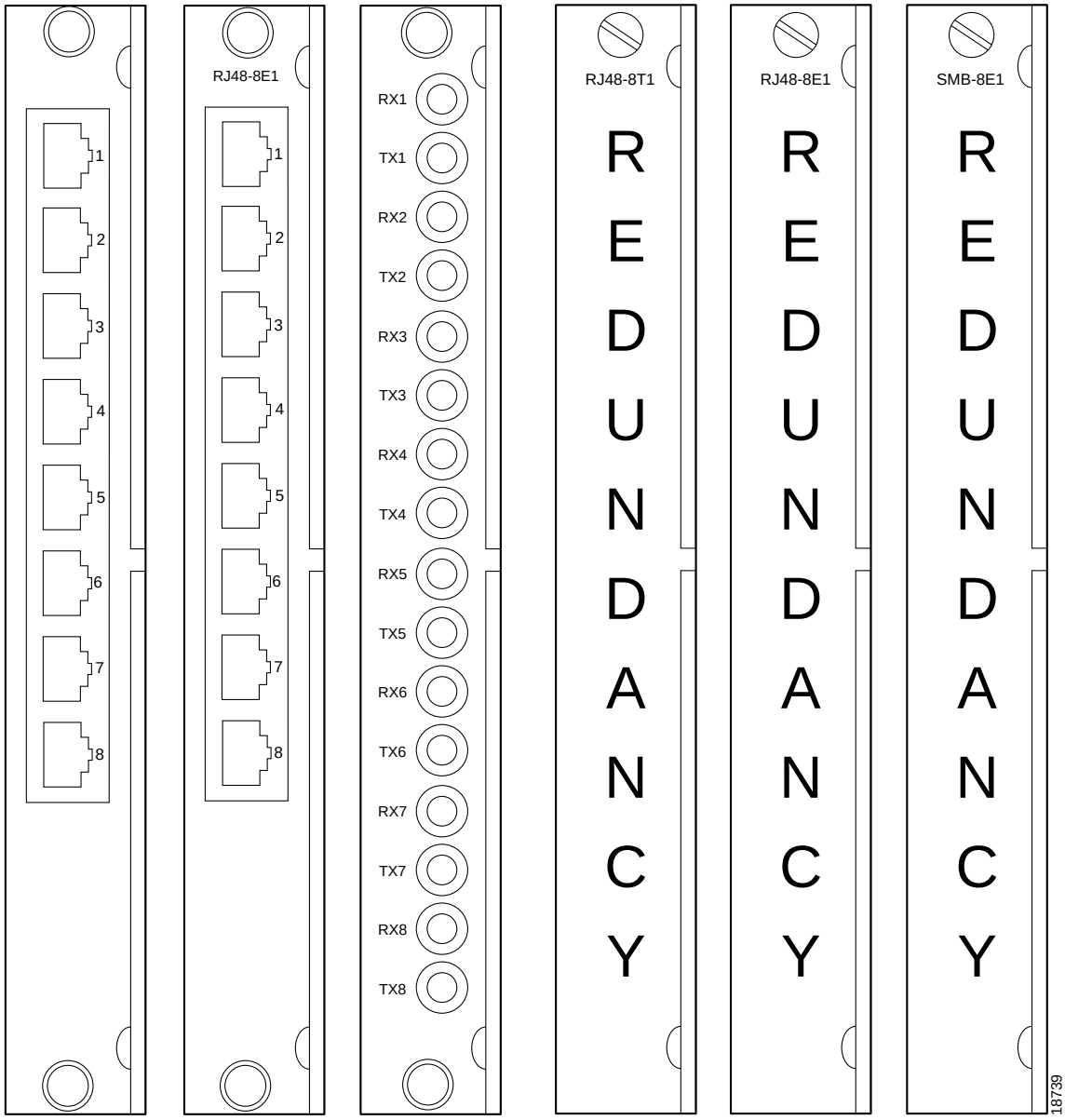
- AX-RJ48-T1: provides eight RJ-48 connectors for T1 lines.
- AX-RJ48-E1: provides eight RJ-48 connectors for E1 lines.
- AX-SMB-E1: provides eight pairs of SMB connectors for E1 lines.

1:N Redundancy support for the AUSM requires the special versions of the RJ-45 back cards (Figure 2-11 on page 2-19). 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, refer to "Service Resource Module, 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 Configuring Frame Relay Service, page 6-27 for instructions to configure the FRSMs.

This section contains the following information:

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 2-27. For information to configure the FRSMs, see Configuring Frame Relay Service, page 6-27.

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 up to 4510 octets.

Frame Relay features

- Each logical 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.
- Standard ABR (TM 4.0 compliant).

Note Note: the Foresight option is not available on MGX-FRSM-HS1/B.

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 value.s
- Supports OAM frame/cell flows.
- Standards-based usage parameter control.
- Support for high-priority, rt-VBR, nrt-VBR, VBR, and ABR-ForeSight QoS.
- Standard ABR (TM 4.0 compliant).

Note Note: the Foresight option is not available on MGX-FRSM-HS1/B.

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.

- Standard ABR (TM 4.0 compliant).

Note Note: the Foresight option is not available on MGX-FRSM-HS1/B.

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. Refer to the section titled "Service Resource Module" in this chapter and the Service Resource Module description in Chapter 6, "Card and Service Configuration"

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, use 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 executing the **addred** command. For instructions on how to use the CiscoView application to configure redundancy, refer to the CiscoView user-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, page 2-12". For configuration requirements, see the section on the MGX-SRM-3T3/C in Chapter 6, "Card and Service Configuration"

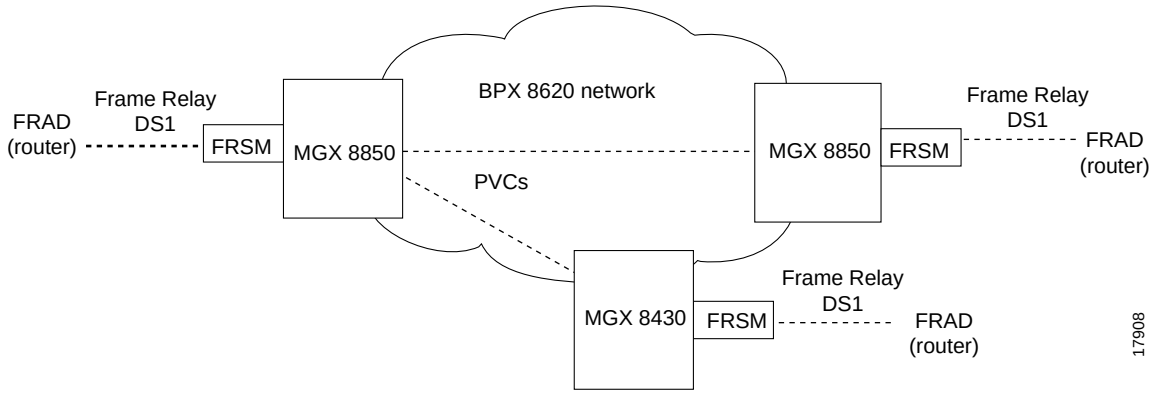
Connection Types on the FRSM

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

Frame Relay-to-ATM 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 using 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.

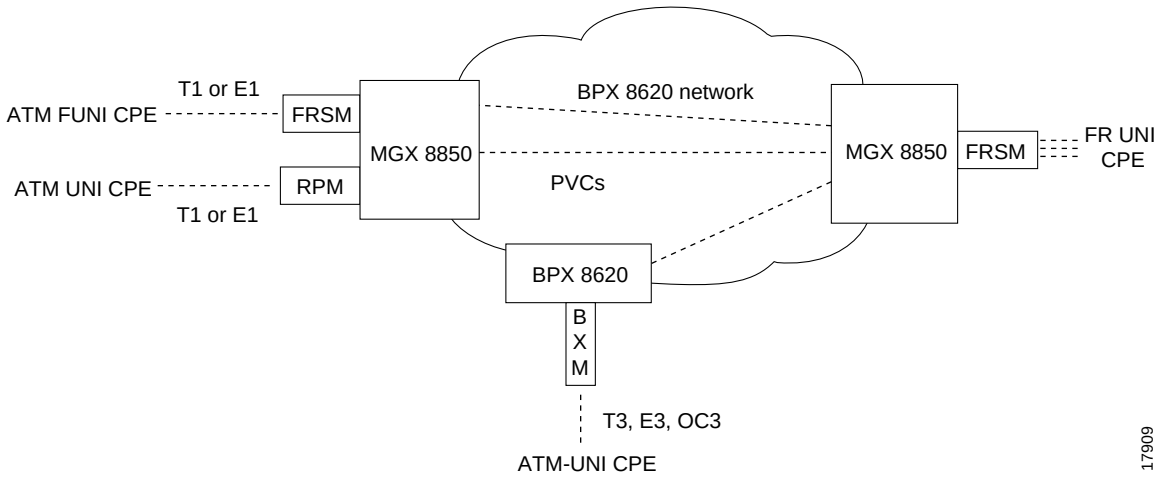
PVC Status Management

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 8230 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 Cell Loss Priority (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 8220 **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/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 (inARP, 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 operates the same as standard Frame Relay except that the FRSM:

- 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

The FRSM maps congestion indication in both directions:

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 2-27.
- FRSMs for T3 and E3 lines, page 2-32.
- FRSMs for Serial Connections, page 2-38.

Note For hardware and other specifications on the FRSMs, refer to Appendix A, "Technical Specifications." For descriptions of how to configure the card, lines, and ports and add Frame Relay connections, refer to 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 include the following:

- 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 n x DS0 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 n x 64 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 n x DS0 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 n x 64 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 2-4 and Table 2-5 describe the FRSM T1/E1 LED faceplate indicators.

Table 2-4 Card Level LED Indicators for the FRSM T1/E1

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

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

Type of LED	Color	Meaning
Individual Port LEDs	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

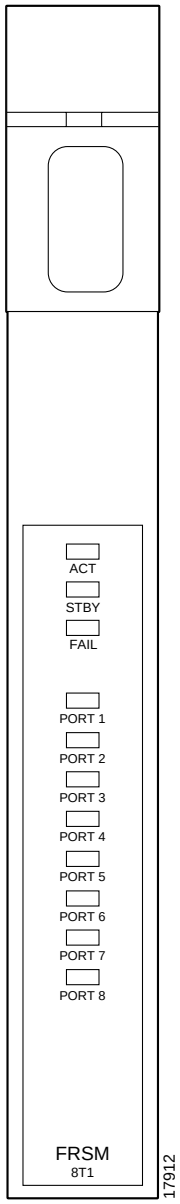
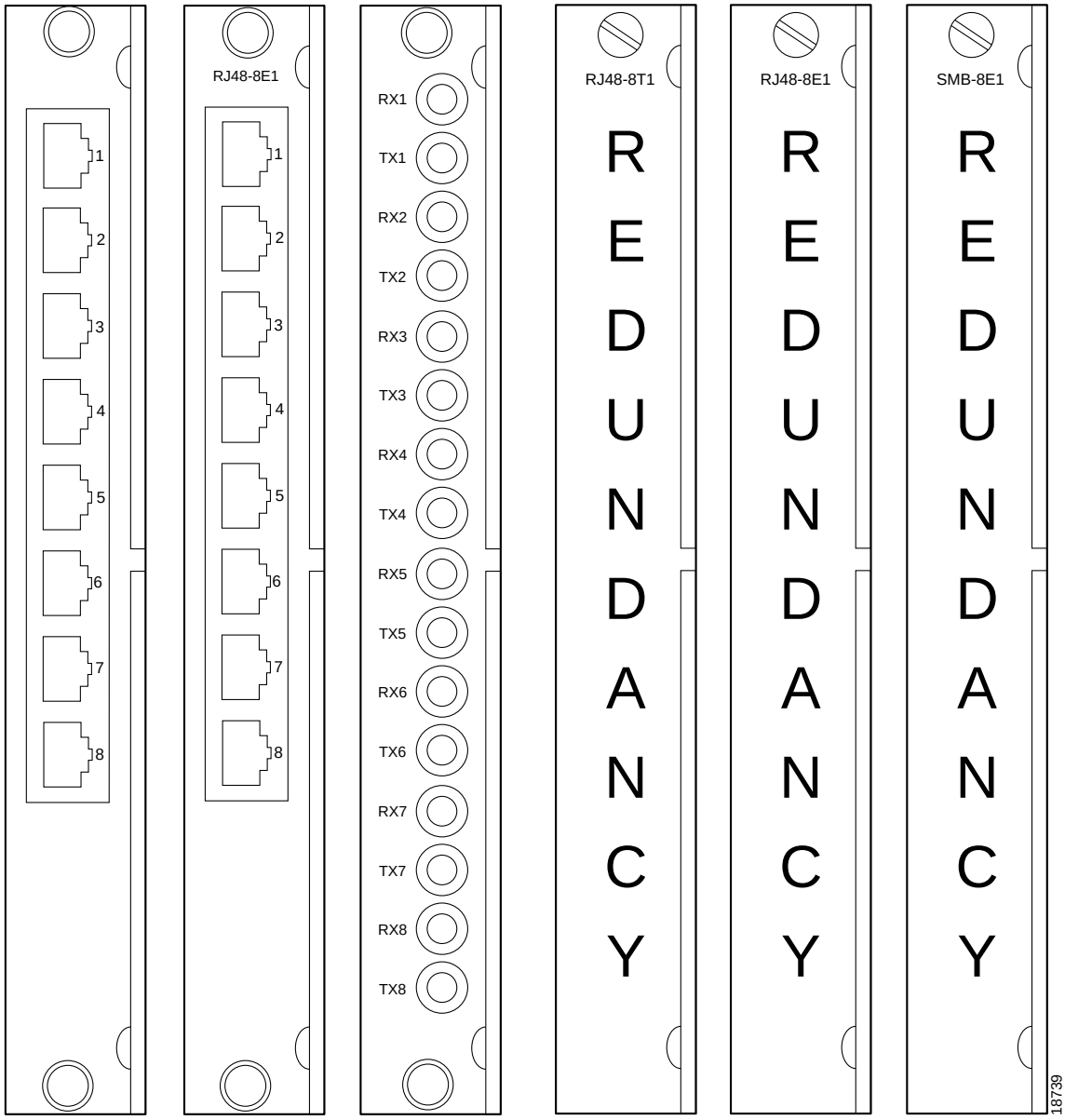


Figure 2-15 RJ-48 and SMB Back Cards for the MGX-FRSM-8T1/E1



FRSMs for T3 and E3 lines

The FRSMs for T3 and E3 lines include the following:

- MGX-FRSM-2CT3: provides two *channelized* T3 interfaces for high-density n x DS0 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 Features Common to All FRSMs, page 2-20 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 2-34.
- For the MGX-FRSM-2T3E3 front card, see Figure 2-17 on page 2-35.
- For the MGX-BNC-2T3 back card, see Figure 2-18 on page 2-36.
- For the MGX-BNC-2E3 back card, see Figure 2-19 on page 2-37.

FRSM-2T3E3 LED Indicators

Table 2-6 and Table 2-7 describe the FRSM-2T3E3 LED faceplate indicators.

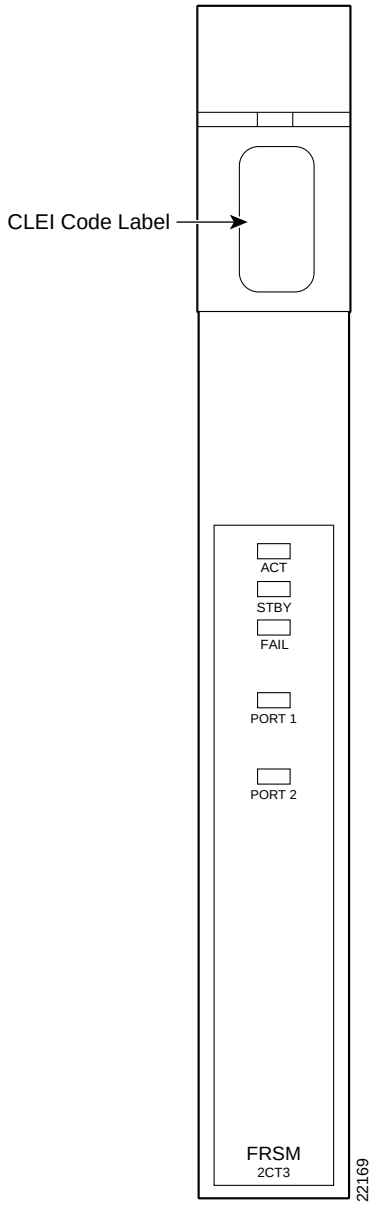
Table 2-6 Card Level LED Indicators for the FRSM-2T3E3

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

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

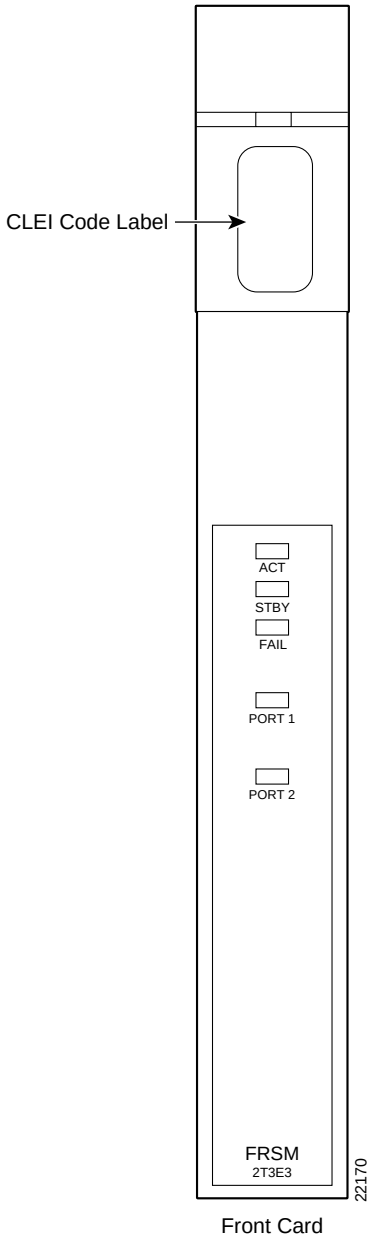
Type of LED	Color	Meaning
Individual Port LEDs	Green	Active and OK
	Red	Active and Local Alarm
	Yellow	Active and Remote Alarm

Figure 2-16 MGX-FRSM-2CT3



Front Card

Figure 2-17 MGX-FRSM-2T3E3



Front Card

Figure 2-18 BNC-2T3

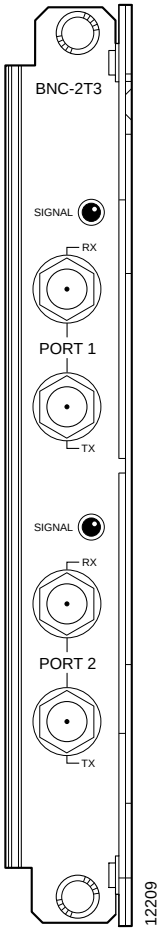
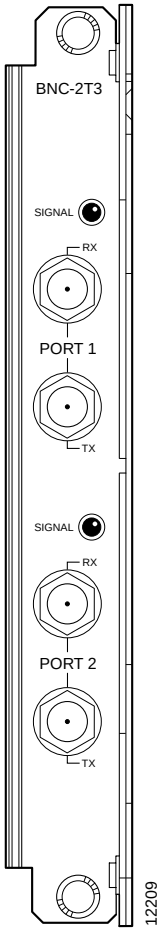


Figure 2-19 BNC-2E3



FRSMs for Serial Connections

The FRSMs that support serial connections include the following:

- 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 MGX-FRSM-HS1/B Cabling, page 2-39 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, n x 64 Kbps up to 2 Mbps, n x 1.5 Mbps and n x 2 Mbps, up to 8 Mbps, are supported
- As DTE, obtains clock from line, up to 8 Mbps
- The 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 n x 1.5 Mbps and n x 2 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

- MGX-FRSM-HS2 with a SCSI2-2HSSI back card
- MGX-FRSM-HS1/B with a MGX-12IN1-S4 back card

Illustrations

- For the MGX-FRSM-HS2 front card, see Figure 2-20 on page 2-41.

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

LED Indicators

Table 2-8 and Table 2-9 describe the FRSM T1/E1 LED faceplate indicators for both the FRSM-HS1/B and the FRSM-HS2.

Table 2-8 Card Level LED Indicators for the FRSM-HS1/B and the FRSM-HS2

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

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

Type of LED	Color	Meaning
Individual Port LEDs	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 2-10.) 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 2-11 for the relationship between cabling and modes and Table 2-12 for part numbers.

Table 2-10 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 2-11 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)

Table 2-11 Cabling and Clock Sources for the MGX-FRSM-HS1/B

Mode	Type of Cable	Clock Source	Mode of 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 2-12 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		72-1441-01
Straight-through		72-1478-01
Loopback plug		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

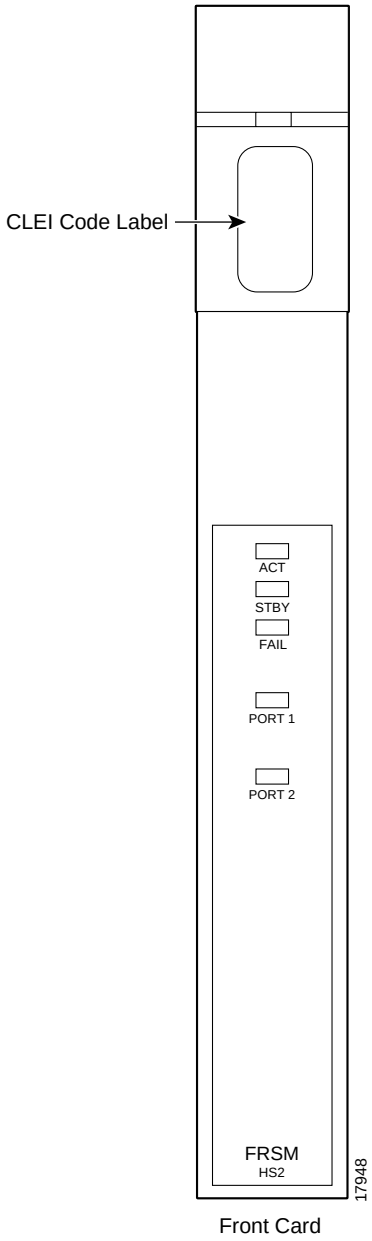
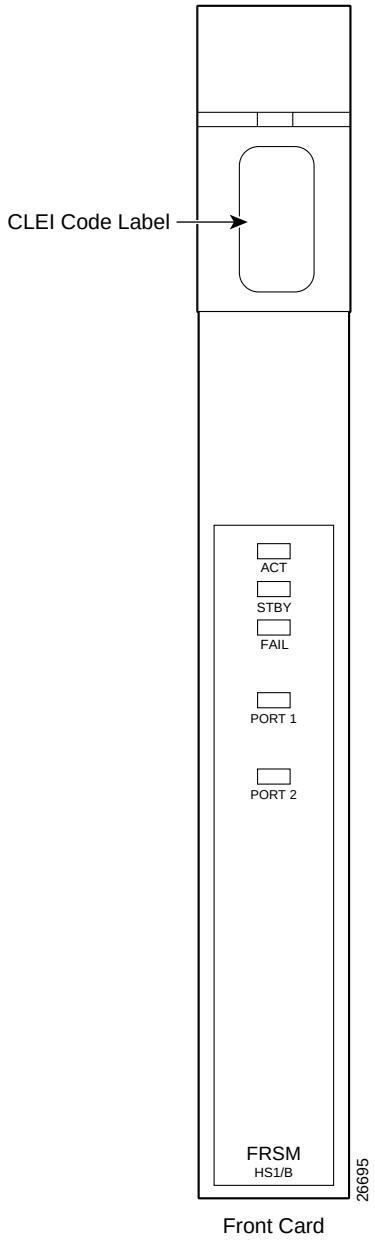


Figure 2-21 MGX-FRSM-HS1/B Front Card Faceplate



Front Card

Figure 2-22 SCSI2-2HSSI

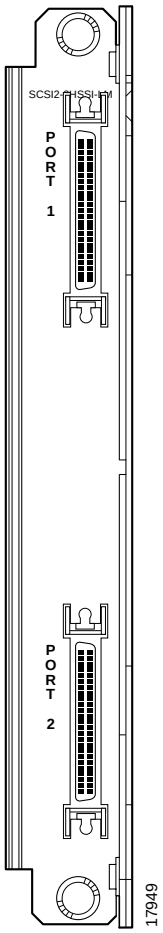
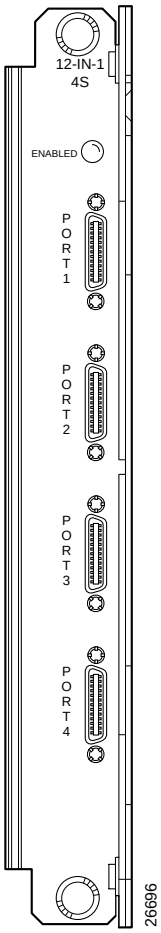


Figure 2-23 12IN1 S4 Back Card Faceplate



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 2-45.
- CESM for T3 and E3 lines, page 2-50.

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 x 64 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 key 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 n x 64-kbps fractional T1/E1 service
- Any n x 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 Cisco's intelligent quality-of-service (QoS) management features, CESM cards support per-VC express queuing.

- A single T1/E1 CESM card can provide standby redundancy for all active CESM cards of the same type in the shelf (1:N 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, refer to the Service Resource Module, page 2-12. For configuration requirements, see the "Service Resource Module" section on page 6-49.

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 2-48 shows the Front Cards for the Eight-Port CESM (T1 and E1).
- Figure 2-25 on page 2-49 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 correspond to the illustration in Figure 2-24 on page 2-48.

Table 2-13 LED Indicators for Eight-Port CESM

Type of LED	Color	Meaning
PORT LEDs	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).
ACT LED (Active)	Green	On indicates the card set is in active mode.

Table 2-13 LED Indicators for Eight-Port CESM (continued)

Type of LED	Color	Meaning
STBY LED (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 LED	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.

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

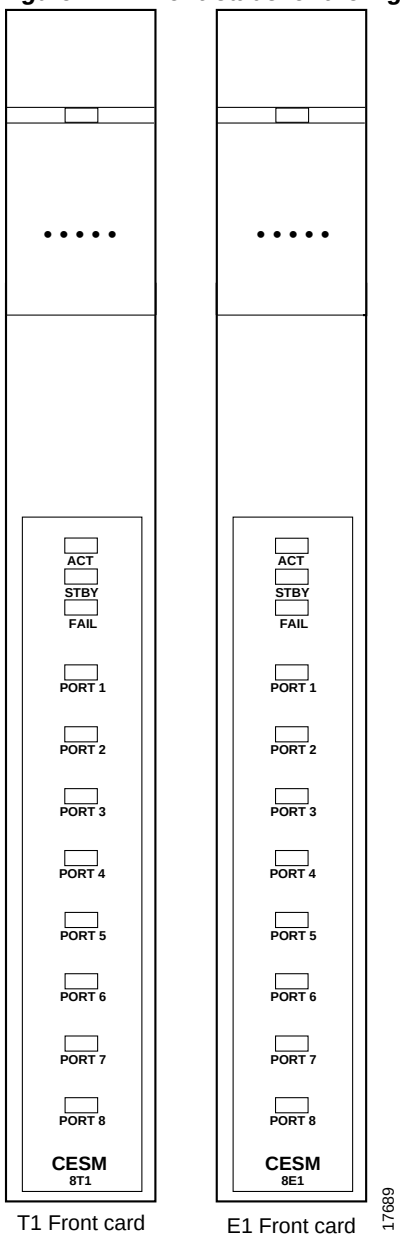
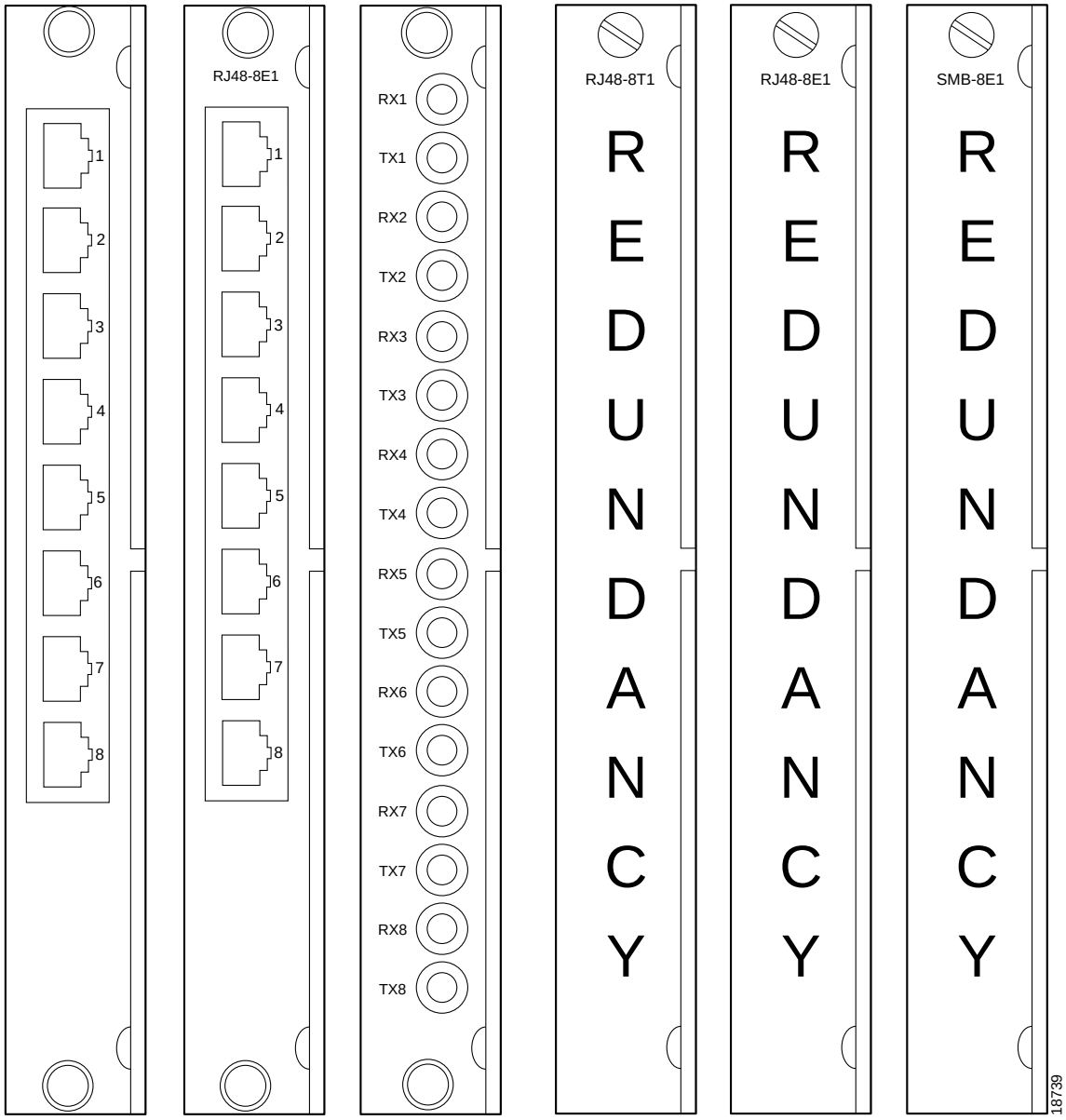


Figure 2-25 RJ-48 and SMB Back Cards for the MGX-CESM-8T1E1



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 2-52 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 2-53.
- An illustration of the CESM back card for E3 lines is shown in Figure 2-28 on page 2-54.

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 executed on 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.
- The 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

- 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

- 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

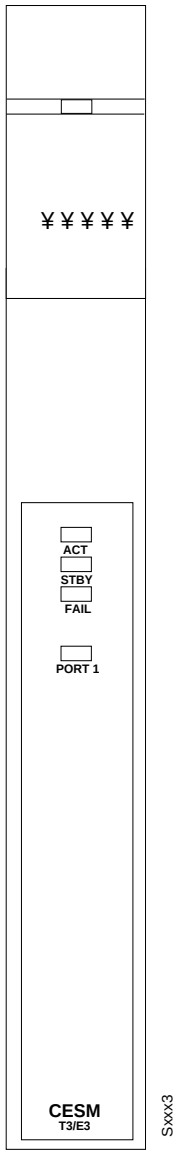
Table 2-14 LED Indicators for T3/E3 CESM

Type of LED	Color	Meaning
ACT LED (Active)	Green	On indicates the card set is in *active* mode.
STBY LED (Standby)	Yellow	• 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.
FAIL LED	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 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.

CESM T3/E3 Illustrations

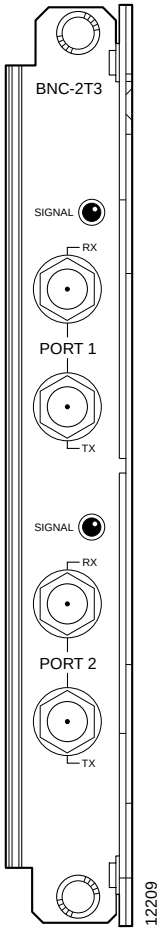
- The MGX-CESM-T3/E3 front card is shown in Figure 2-26 on page 2-52.
- BNC-2T3 Back Card for the CESM-T3/E3 is shown in Figure 2-27 on page 2-53.
- BNC-2E3 Back Card for the CESM-T3/E3 is shown in Figure 2-28 on page 2-54.

Figure 2-26 CESM-T3/E3 Front Card



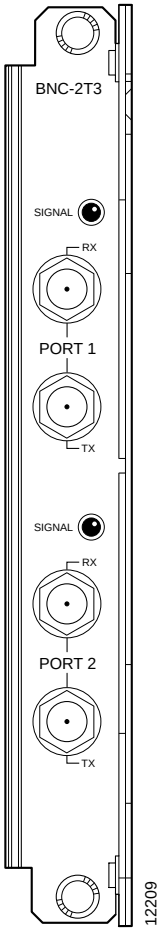
Front card

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: The 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 manual. For more information on the VISM, refer to the following Cisco Systems publications:

- For information on VISM features and configuration, refer to *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, 8230, and 8250 Software.*

Summary of Features Supported with VISM 2.0.1

The following features are supported with VISM 2.0.1 on the MGX 8230.

Note The MGX 8230 supports VISM 2.0.1 and higher. All of the features available in VISM 1.5.5 are also available in version 2.0.1

VoIP using RTP (RFC 1889)

VISMR1.5 supports standards-based VoIP using RTP (RFC1889) 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 (VAD)

VISM uses 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.

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 8230.

- 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 2-15 is a description of 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 2-15 LED Indicators for VISM

Type of LED	Color	Meaning
ACT LED (Active)	Green	On indicates the card set is in *active* mode.
STBY LED (Standby)	Yellow	• 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.
FAIL LED	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 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.

Figure 2-29 VISM Front Cards

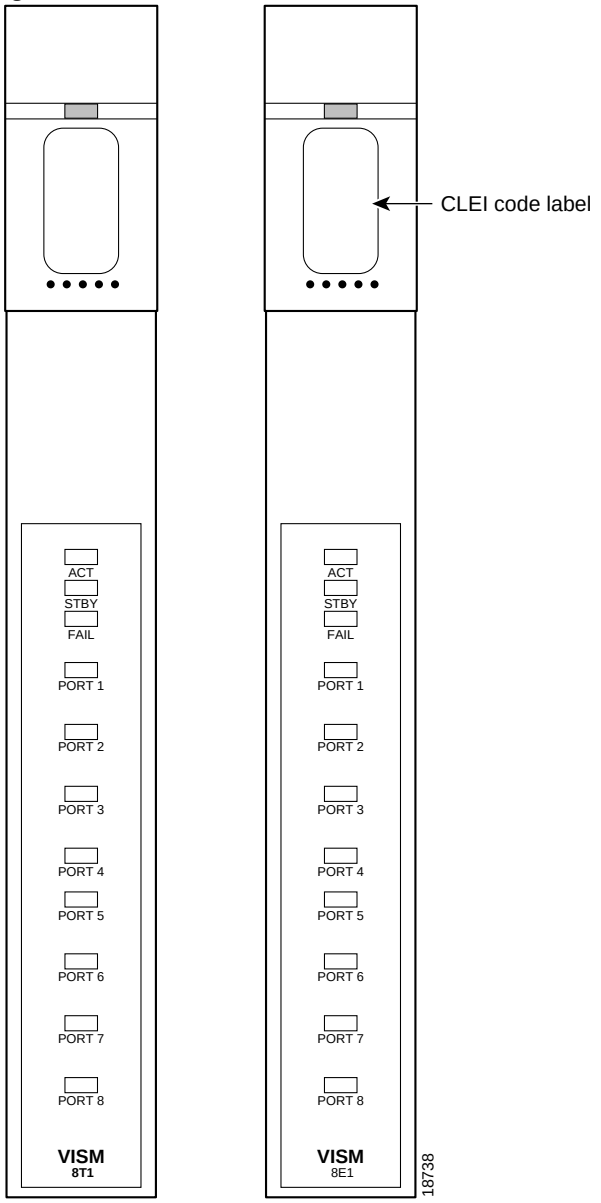
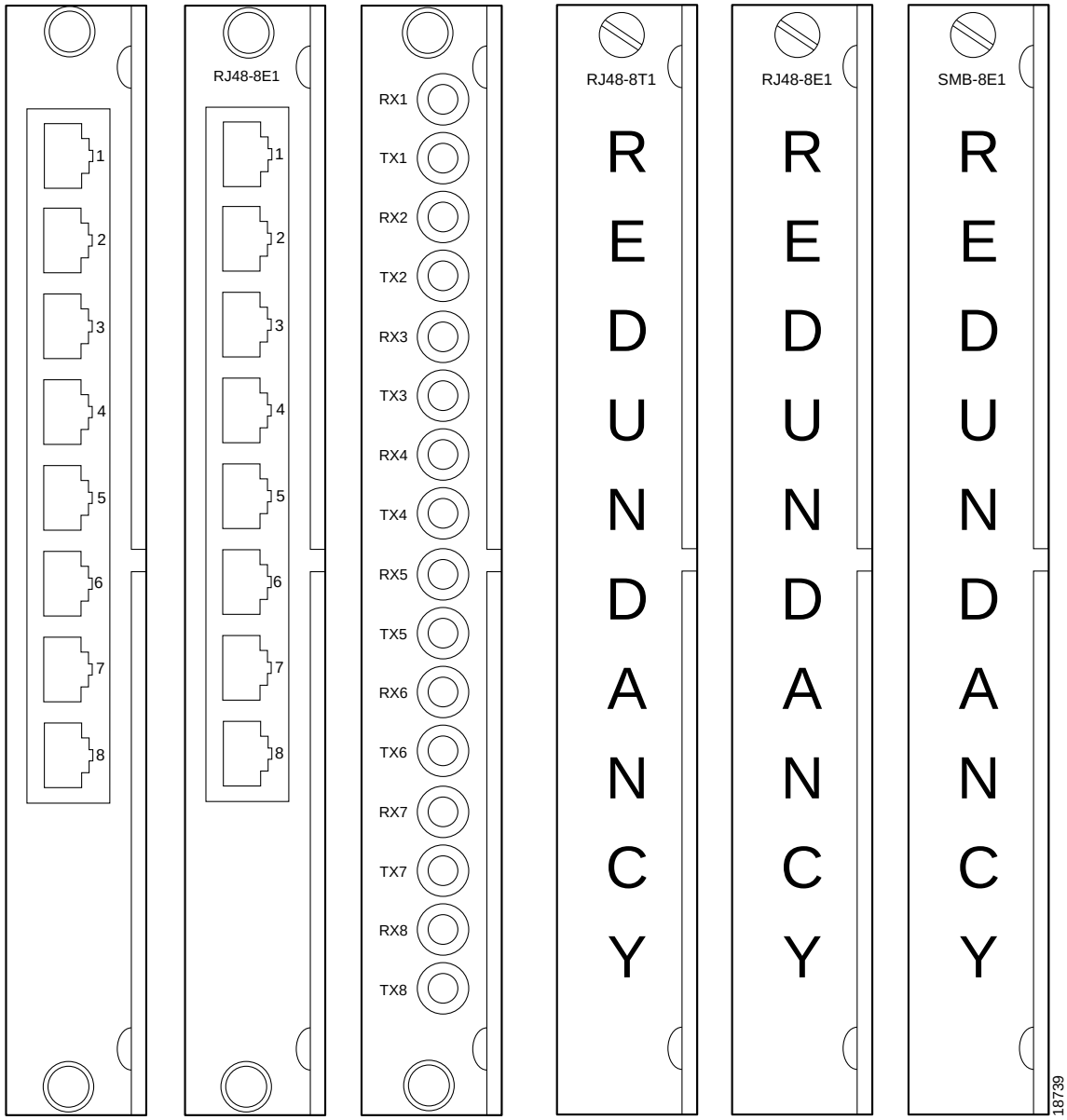


Figure 2-30 VISM Back Cards



T1 RJ48 back card | E1RJ48 back card | E1 SMB back card | T1 RJ48 redundant 8-port back card | E1 RJ48 redundant 8-port back card | E1 SMB redundant 8-port back card

Route Processor Module (RPM)

The Route Processor Module is a Cisco 7200 series router redesigned into a double-height card to fit in a MGX 8230 chassis. The RPM front card provides a Cisco IOS network processing engine (NPE-150), capable of processing up to 120K packets per second (pps). The front card also provides ATM connectivity to the MGX 8230 internal cell bus at full-duplex OC-3c from the module.

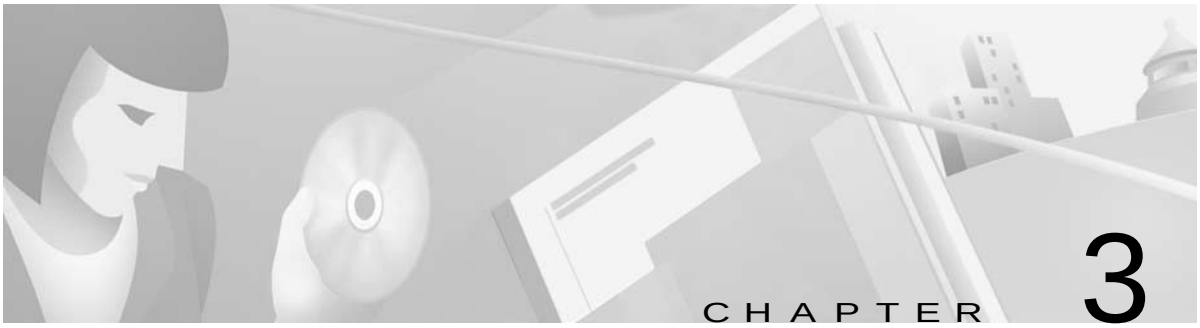
Initially, three types of single-height back card types will be supported: four-port Ethernet, one-port (FDDI), and one-port Fast Ethernet. Each module can support two of these back cards.

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, see the *Release Notes* for "*Cisco WAN MGX 8850, 8230, and 8250 Software*"
- For configuration information on the Route Processor Module (RPM), see the *Cisco Route Processor Module Installation and Configuration* Guide.



CHAPTER 3

Site Preparation

This section describes the steps to take and the considerations you should keep in mind prior to installing an MGX 8230 chassis in a rack. It also contains information that applies to an MGX 8230 installation in a Cisco closed rack. If the MGX 8230 arrives in a Cisco closed rack, your initial concerns would be the cabinet grounding, and power connections.

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

The topics and section names in this chapter are:

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

The site must satisfy the requirements in the following categories:

- Space

  The MGX 8230 IP + ATM Edge Concentrator is typically co-located in a rack with either an MGX switch or a BPX switch.
  Refer to the *Cisco BPX 8600 Series Installation and Configuration* documents for information about rack and cabinet mounted switches.

- Environment

  The operating environment should be as follows:

Temperature and humidity range: 0° to 40°C (32° to 104°F) for normal operation, 50°C for up to 72 hours. Recommend range of 20° to 30°C. Up to 85% relative humidity, non-condensing.

- Shock
  - Operating: 10 g shock, three pulses in the positive and negative directions, all axes, 1/2 sine wave, 11 ms duration.
  - Non-operating: 20 g shock, three pulses in the positive and negative directions, all axes, 1/2 sine wave, 11 ms duration.
- Vibration
  - Operating: 5 Hz to 2 kHz at .75 g peak, limited to 0.25-inch double amplitude, sine wave, 1 octave/minute, two sweeps.
  - Non-operating: 5 Hz to 500 Hz at 1.0 g peak, limited to 0.50-inch double amplitude, sine wave, 1 octave/minute, two sweeps.
- Power

  For AC power use, an AC power source must be available within 6 feet (1.8 m) of the MGX 8230. For systems using a DC source, Cisco does not supply the DC power cord, so the user or installer determines the wire length and the distance to the DC source. The wire should be 10 AWG (4 square millimeters).
- Heat Dissipation

  A fully loaded, AC-powered MGX 8230 dissipates up to 4,800 BTUs (1.4 KW hour). A DC-powered MGX 8230 dissipates up to 4,100 BTUs.
- Weight

  A fully loaded, DC-powered MGX 8230 can weigh up to 120 lbs (54.3 Kgs). A fully loaded AC-powered MGX 8230 can weigh up to 150 lbs (68.03 Kgs).

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

- Flooring
  Raised flooring with sufficient under-floor space for external cabling is best.
- Mounting

  The location of the IGX or BPX switch, which has a co-located MGX 8230 IP + ATM Edge Concentrator, should accommodate the routing of the data cables and the termination of the telephone company's or common carrier's circuits.
- Electrostatic Discharge

  The building should provide adequate grounding to prevent damage from electrostatic discharge. See the sections "Bonding and Grounding" in the IGX or BPX installation documents for specific details.

  In addition, the MGX 8230 comes with a wrist strap that you can connect to the rear of the chassis near the ground lug or to a convenient point on the front of the chassis. You should put on a wrist strap before handling any cards.

Regulatory Compliance and Safety Information

This chapter provides regulatory compliance and safety information for the AC and DC powered versions of the MGX 8230.

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 8230 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 8230 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 8230 AC and MGX 8250 DC systems within their marked electrical ratings and product usage instructions.
- Install the MGX 8230 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 8230 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 8230 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 60 amps. A 60-amp 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 8230 DC-input power entry module.
  - MGX 8230 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" or 1/2" 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 appear in the section "Seismic Anchoring for a Cisco Rack."

Seismic Anchoring for a Cisco Rack

This section describes how to install the Cisco cabinet with the optional stability plate for seismic anchoring.

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

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

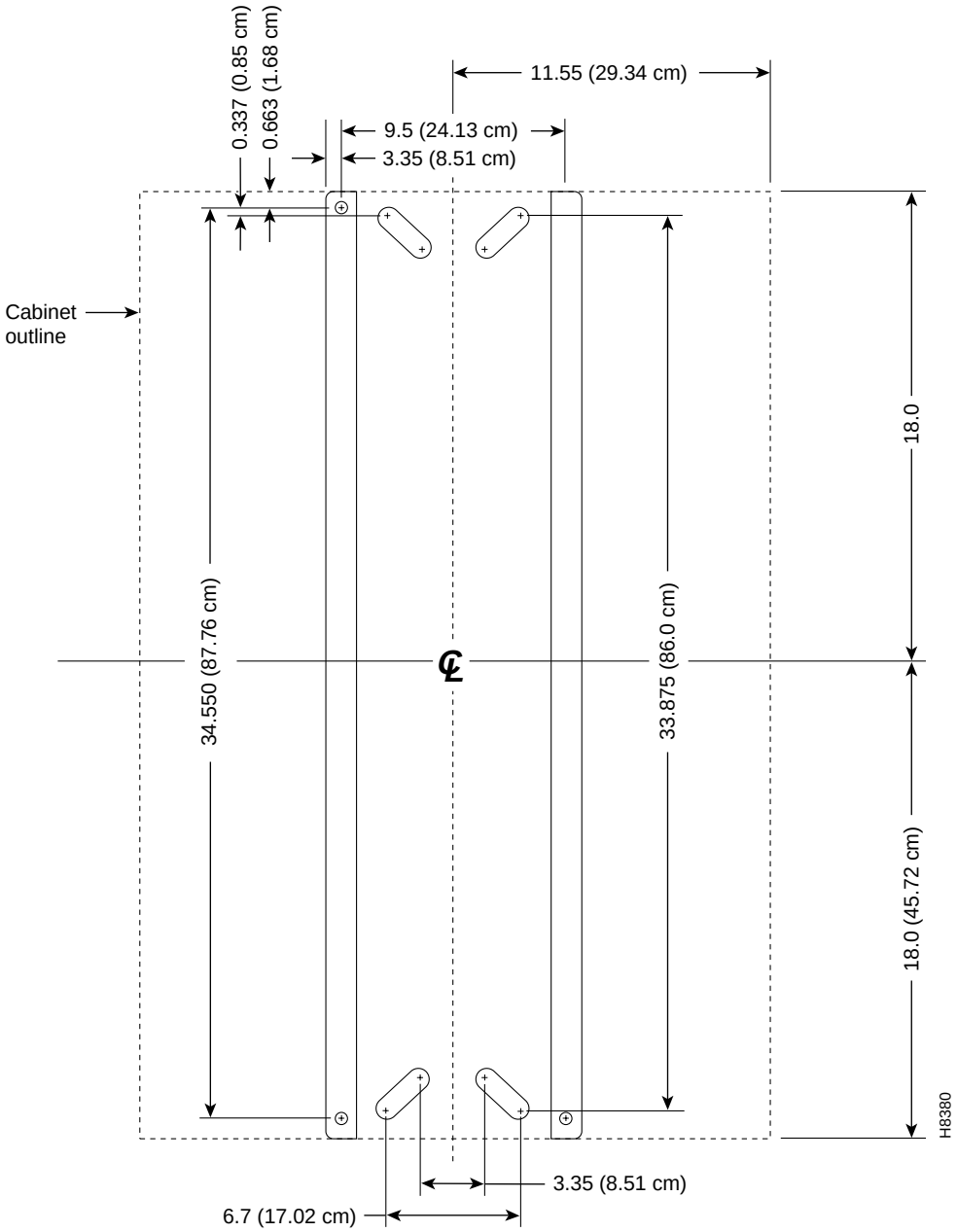
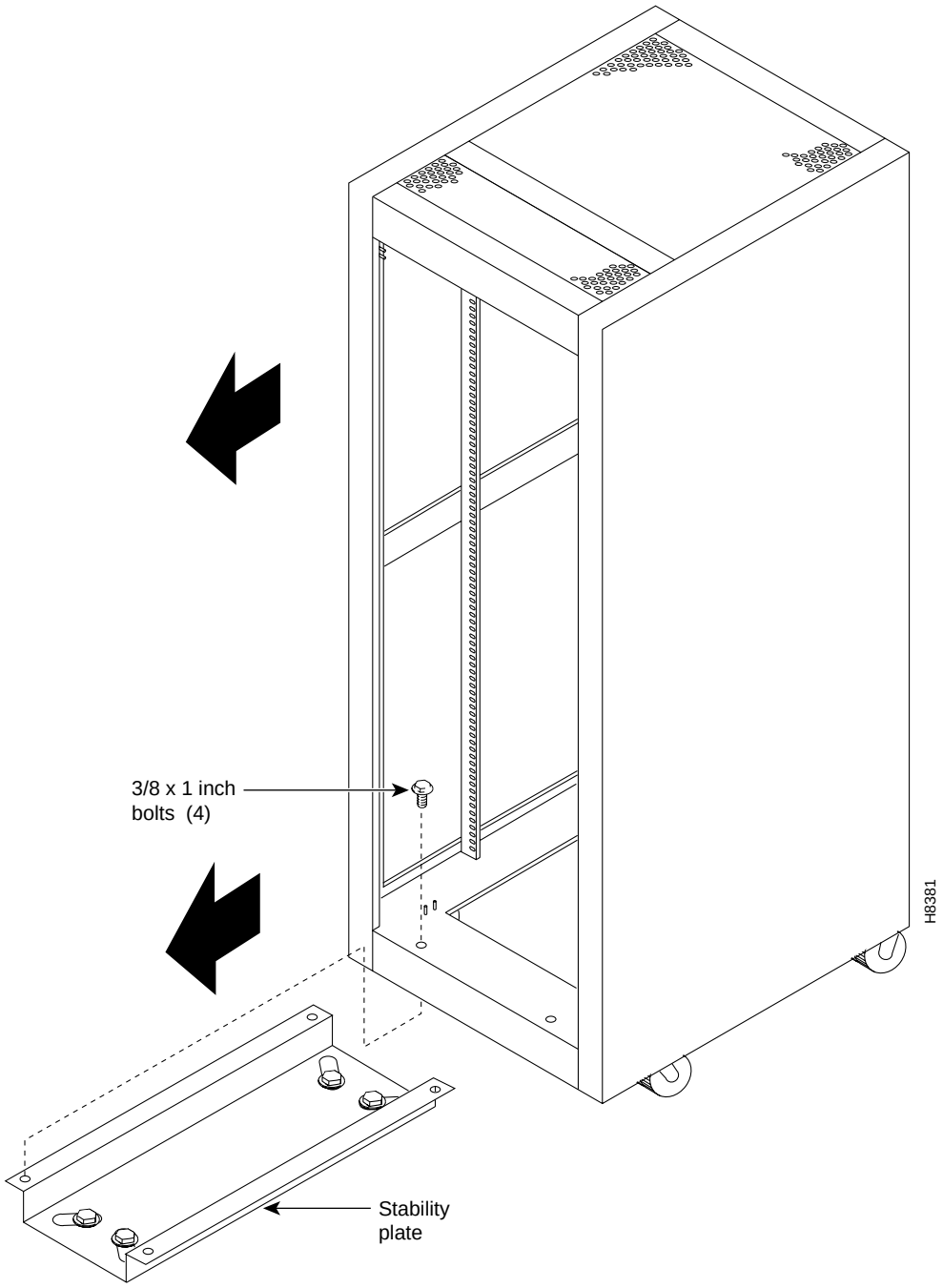


Figure 3-2 Installing a Cisco Cabinet Over the Stability Plate



Power and Grounding

This section describes the requirements for electrical power and grounding the switch and the site. These requirements apply to Central Office (CO) and 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 8230 circuit breaker. Cisco recommends that the site have a 20A, 2-pole AC circuit breaker with a long trip delay at each branch circuit.

The MGX 8230 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 MGX 8230, verify that its power comes from a dedicated DC branch circuit. This branch circuit must be protected by a dedicated circuit breaker. Cisco Systems recommends the site have a dedicated 30 Amp circuit breaker with a medium trip delay at each branch circuit.

A DC-powered MGX 8230 uses a single pole 30 Amp circuit breaker with a short trip delay on each –48V input. The circuit breaker manufacturer is ETA. The part number is ETA 8340-F110-PIKI-A2H030A.

Electrical Power for AC-Powered Nodes

The MGX 8230 AC power requirement is a voltage range of 100 to 120 or 200 to 240 VAC. A worst-case 90 VAC is allowed. Refer to Appendix A, “Technical Specifications.” An AC power source must be available within 6 feet (1.8 m) of the system and easily accessible. Before turning on the power, verify that each power source to the MGX 8230 comes from a dedicated branch circuit.

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.

Cisco can provide AC power cords with the following plugs:

- 20 A NEMA Lb-20P, twist lock plug (domestic 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)
- NEMA5-15P 125V/15 A 3-prong plug, grounding type (North America)

Electrical Power for a DC-Powered MGX 8230

Only a - 48 VDC supply that complies with the Safety Extra Low Voltage (SELV) requirements of EN 60950 can connect to the DC input.

For DC supply connections, consult local or national codes for conductor sizing. Conductors must be suitable for 30 Amps. Wiring that is 10 AWG (4 square millimeters) is adequate.

Bonding and Grounding

To maintain the full EMI and EMC integrity of this equipment, it must be bonded to an *integrated ground plane* or an *isolated ground plane* network. The purpose of this requirement is to mitigate the damaging effects to equipment from electrostatic discharge and lightning. Refer to the latest edition of ITU Recommendation K.27 or Bellcore GR-1089-CORE requirements 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-supplied cabinet for rack-mounted systems.

Refer to the section "Making the Frame Bonding (Ground) Connection" in the IGX or the BPX installation documents for information on how to make a connection.

Note Except for the AC power supply module, every module in a rack-mount system relies on the rack itself for grounding. Therefore, the rack must be properly connected to protective earth before operating the system.

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

- The grounding conductor provided with the supply source must connect to the correct terminal of the Power Entry Module (PEM).
- A grounding conductor as described previously must connect to the appropriate terminal of a rack assembly or to the grounding point on the lower-right corner of the MGX 8230 chassis rear panel.

Wiring a Mixed Ground System with Redundant Supplies

A mixed ground system appears in Figure 3-3. 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, Z2, ..., 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, ..., 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 3-1 for a definition of each Z1–Z5.

Figure 3-3 Mixed Grounding System

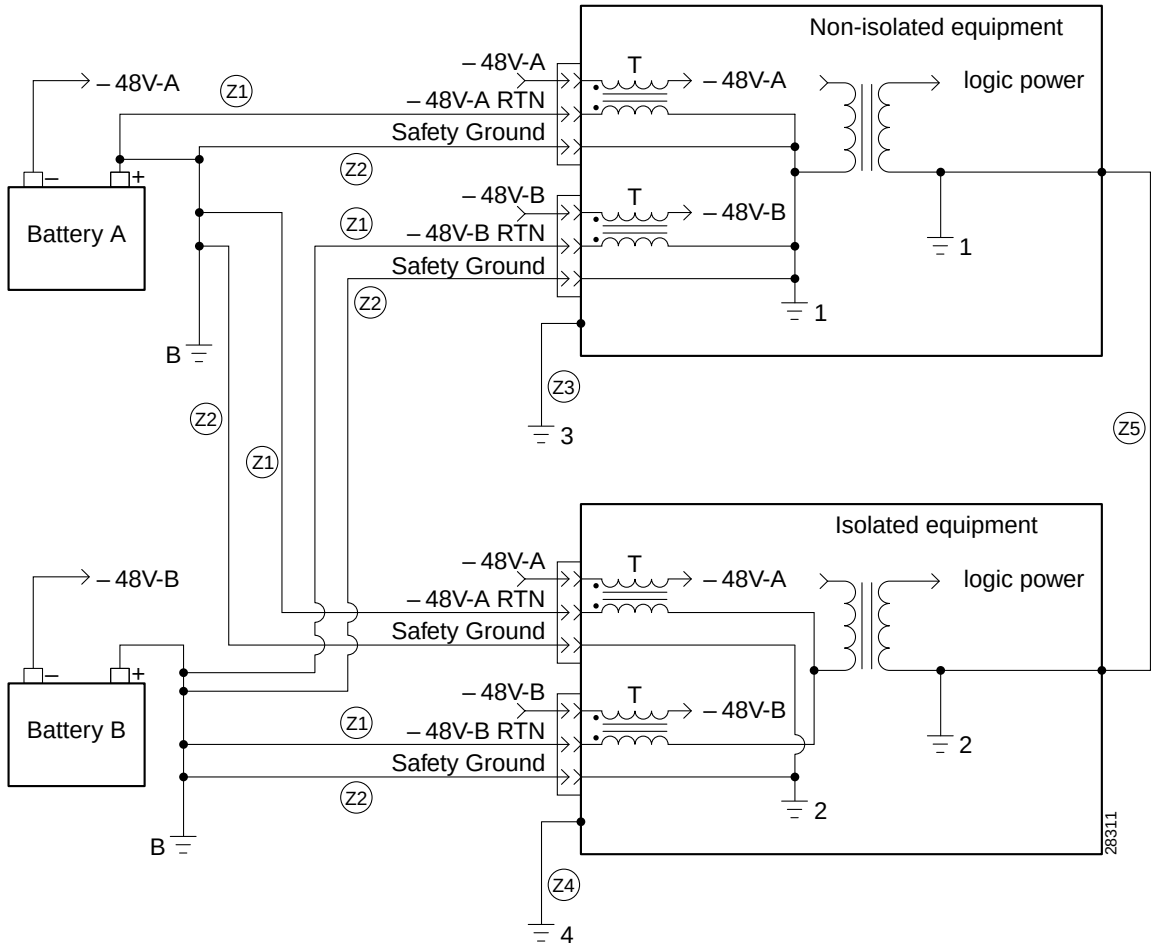


Table 3-1 Ground Point Descriptions for Mixed Grounding

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.
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 3-3 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 3-2. For the resistance of 1000 feet of copper wire for each gauge of wire, see Table 3-3. These references are for planning purposes and may be further subject to local laws and practices.

Table 3-2 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
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 3-3 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 8230 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.

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. 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. Peel the back off the clip to expose the adhesive surface and attach to the front of the unit above the ring lug. 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 an MGX 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 MSSBU 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" 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 3-4 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:

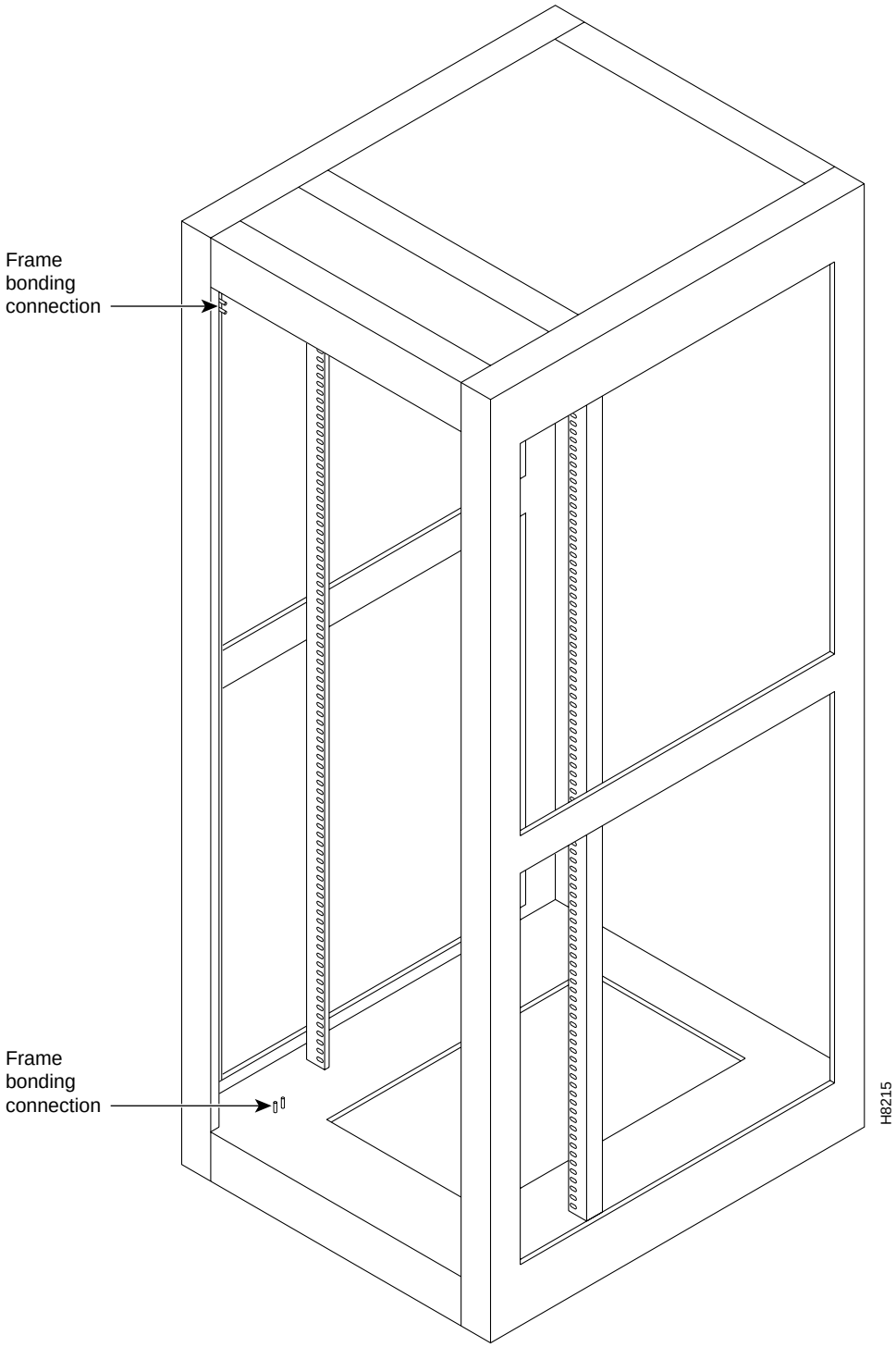
Step 1 Place an external, toothed star washer onto the stud.

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 3-4 Frame Bonding Connection in Cisco-Supplied Rack



CHAPTER 4

Enclosure Installation

Chapter Summary

This chapter contains instructions for installing an MGX 8230 as a stand-alone unit or in a rack. Due to the weight of the equipment, a mechanical lift should be used to install the MGX 8230 chassis.

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

This chapter contains the following sections:

Mechanical Lift Guidelines

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

If a mechanical lift is not available, the cards and power supplies must be removed so the chassis can be lifted into the rack. This section contains instructions for installations with or without a mechanical lift.

Installing a Stand-Alone MGX 8230

If the switch is a stand-alone unit, proceed directly to:

- Connecting Power for DC Systems, page 4-11
- Connecting Power for AC Systems, page 4-14.

If a lift is not available and the cards need to be removed, review the appropriate instructions to remove and replace modules in the "Install the MGX 8230 Without a Mechanical Lift (Optional)" section on page 4-7.

Rack Mounting an MGX 8230

To install the MGX 8230 into a 19- or 23-inch rack, follow the instructions outlined below:

- Prepare for Rack Installation, page 4-3.
- Install the MGX 8230 Using a Mechanical Lift (Recommended), page 4-6.
- Install the MGX 8230 Without a Mechanical Lift (Optional), page 4-7.
- Connecting Power for DC Systems, page 4-11.
- Connecting Power for AC Systems, page 4-14.
- Install the Cable Manager, page 4-17.
- Power up the MGX 8230, page 4-18.

Prepare for Rack Installation

Review this section for information on mounting and positioning the switch in a rack.

Rack Positioning

Different Cisco products can reside in the same rack.

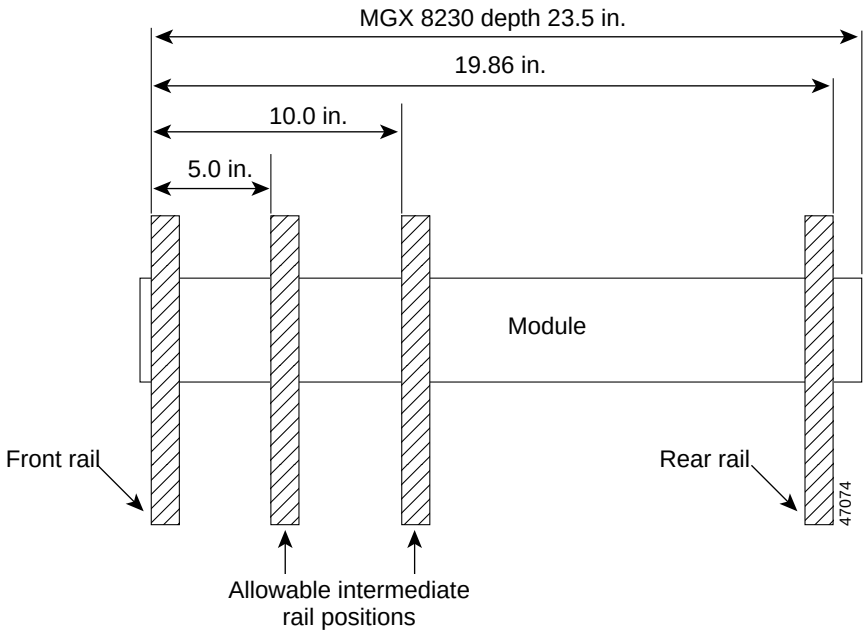
- When used as a feeder, an MGX 8230 is typically co-located and rack-mounted with either an IGX or BPX switch.
- The recommended stacking is the BPX on the bottom, then the 7204 Tag Switch Controller (if ordered), and the MGX 8230 on top. The gap between products is designed to be .060" minimum to allow for replacement clearance.

Bracket Placement

An MGX 8230 can be mid-mounted or mounted flush with the front rails.

- When the MGX 8230 is flush mounted with the front of the rack, it must be supported by a pair of mounting rails at the rear of the unit.
- When the MGX 8230 is mid-mounted, it is typically attached to only one intermediate rail on each side. The allowable positions for intermediate rails are shown in Figure 4-1.

Figure 4-1 MGX 8230 Mounting Rail Positions



Mounting Kits

There are two mid-mount brackets in each rack-mounting kit. One mid-mount bracket fits on each side of the MGX 8230 chassis. The mid-mount bracket is 12.25 inches (seven rack units) high and has cutouts along the flange that attaches to the side of the MGX 8230 to allow air flow. The same mid-mount bracket is used for the AC or DC-powered MGX 8230s; thus for an AC-powered MGX 8230, with the optional AC power tray assembly attached underneath the MGX 8230 chassis, the mid-mount bracket does not extend down to AC power tray assembly. There are some shorter screws included in the rack-mount kits for attaching mid-mount brackets; these shorter screws are included specifically for attaching the mid-mount bracket to the side of the MGX 8230 chassis that has the Fan Tray Assembly. Longer screws can interfere with the spinning of the fans in the Fan Tray Assembly. The shorter screws can be used on both mid-mount brackets, however.

A rack-mount kit can be ordered for either 19- or 23-inch racks:

- MGX-8230-MNT19—Mounting kit for 19-inch rack
- MGX-8230-MNT23—Mounting kit for 23-inch rack

These kits include rear and mid-mount brackets as well as the hardware for mounting the brackets to the MGX 8230 chassis. Note that there are extra 10-32 screws included in the 19-inch rack-mounting kit that can be used to secure the MGX 8230 to standard EIA/RETMA rack mounting rails. If the rack being used has metric or other non-standard mounting holes, the customer must supply appropriate mounting screws. Since racks often have metric or non-standard threaded holes, you must supply the screws appropriate for your rack that attach the MGX 8230 to rack mounting rails.

In each 19-inch rack-mounting kit, there are two sets of rear brackets; one set for each side. As shown in Figure 4-2, one bracket fits on the top at the rear of the MGX 8230, and the other fits on the bottom. There is a little bend in the bracket that fits over the top (or bottom) of the MGX 8230 chassis. The other set of brackets fits on the other side of the MGX 8230 chassis.

Figure 4-2 MGX 8230 Chassis with Rear Mounting Brackets for 19-Inch Rack

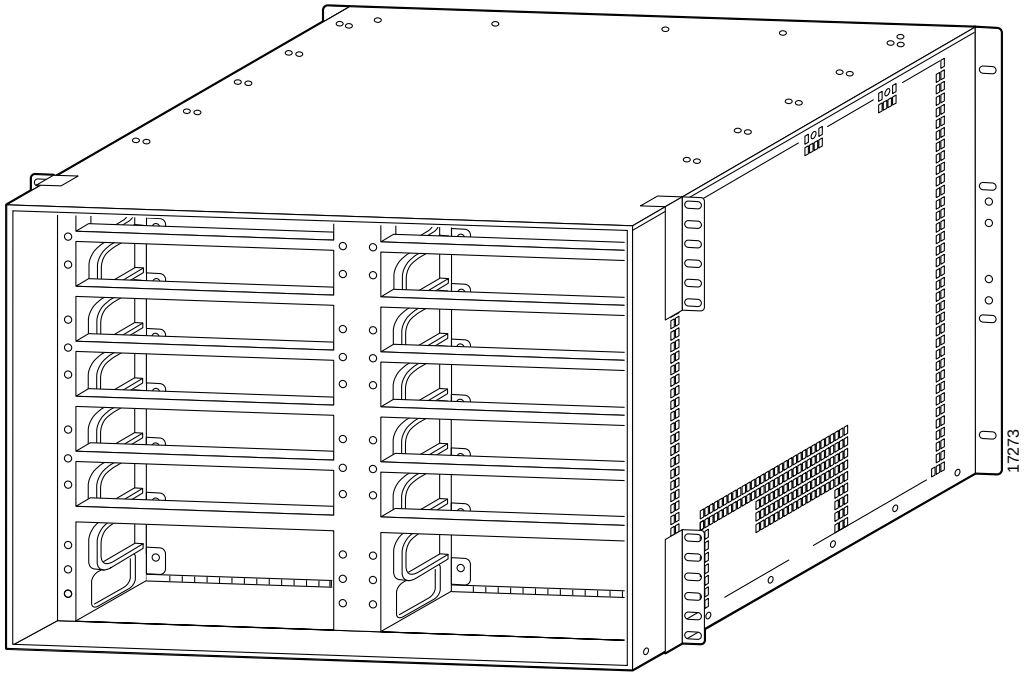
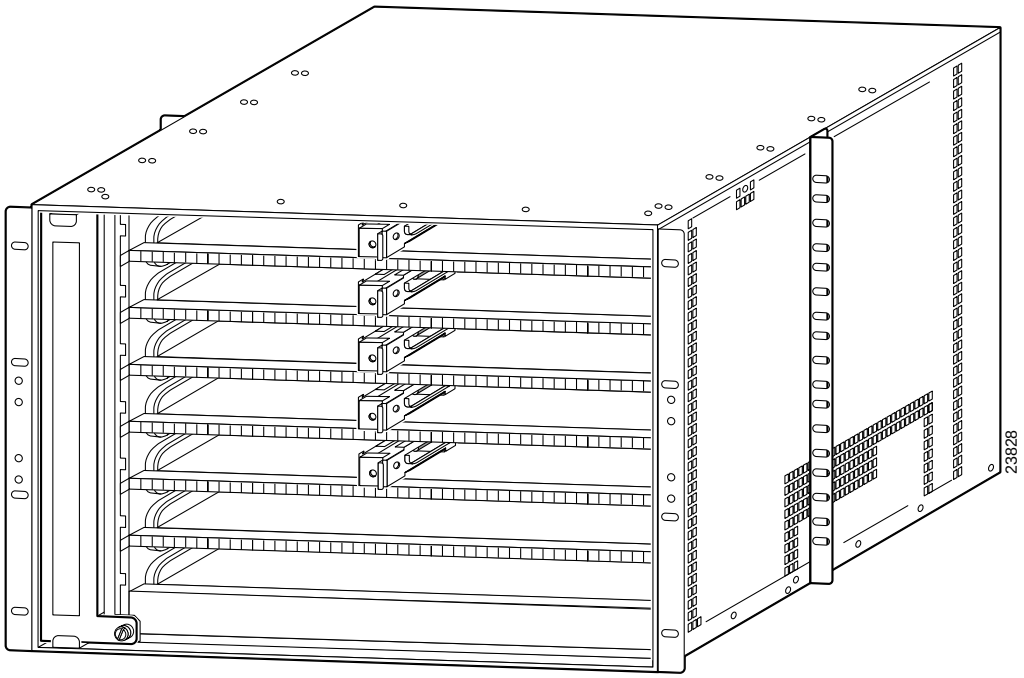


Figure 4-3 MGX 8230 Chassis Front View with 19-Inch Mid-Mounting Bracket



Install the MGX 8230 *Using* a Mechanical Lift (Recommended)

The MGX 8230 is shipped with all the ordered modules installed and tested at the factory. If you've ordered an AC power option, the AC power supply tray is attached to the bottom of the MGX 8230 chassis at the factory.

This switch can easily be installed by a single person using a mechanical lift.

Rack Mounting Procedures for 19-Inch Racks (Mechanical Lift)

Note the following before installation is begun:

- On MGX 8230 systems that will be mid-mounted, attach mid-mounting brackets before installing the unit in a rack.
- Use MGX-8230-MNT19 mounting kit for 19-inch rack.
- Rear mounting brackets cannot be installed before putting a unit in a 19-inch rack.

Step 1 If applicable, attach one mid-mounting bracket to each side of the MGX 8230.

Step 2 Use a lift raise the chassis to the desired position. Place 2 spacers (~.060" (1/16") thick, by ~2" by ~ 30" fabricated from HDPE, aluminium or cardboard), one on left edge and one on right edge of lower adjacent chassis. Slide the MGX 8230 across the spacer and position it in the rack.

Step 3 Use the 10-32 truss head screws to secure the MGX 8230 to the front mounting rails (or mid-mounting rails if appropriate).

Step 4 Use the10-32 screws to secure the MGX 8230 to the rear mounting rails and to the rear mounting bracket, if applicable.

Rack Mounting Procedures for 23-Inch Racks (Mechanical Lift)

Use the MGX-8230-MNT23 mounting kit for 23-inch racks.

Step 1 Attach the 23-inch mounting brackets to both sides of the MGX 8230 chassis.

Step 2 Use a lift raise the chassis to the desired position. Place 2 spacers (~.060" (1/16") thick, by ~2" by ~ 30" fabricated from HDPE, aluminium or cardboard), one on left edge and one on right edge of lower adjacent chassis. Slide the MGX 8230 across the spacer and position it in the rack.

Step 3 Secure the MGX 8230 to the rack mounting rails.

Install the MGX 8230 *Without* a Mechanical Lift (Optional)

Because of the risk of damage to the modules and backplanes, Cisco strongly recommends the use of a mechanical lift. Using a lift greatly simplifies the installation and reduces the risk of damage. See Install the MGX 8230 Using a Mechanical Lift (Recommended), page 4-6.

If a mechanical lift is not available for installation, the MGX 8230 must be manually lifted into place.

Since the MGX 8230 is shipped with all equipment pre-installed, you may have to remove some of the service modules, the AC Power Supply Modules, or the Fan Tray Assembly to more easily lift the chassis into the rack.

This section contains instructions to install a MGX 8230 chassis without the use of a mechanical lift.

Prepare for Installation

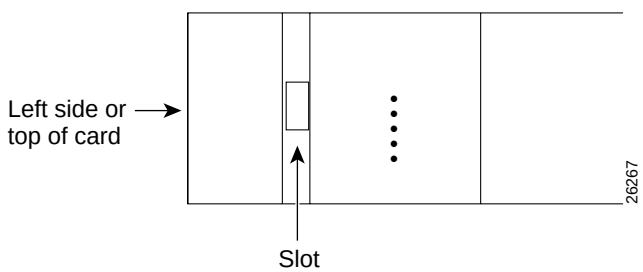
Review the following points before installation is begun:

- Handle the PXM front card very carefully. This card contains a disk drive that is easily damaged. Cisco recommends not removing the PXMs.
- Before removing any modules or assemblies, Cisco suggests that you carefully note and write down their location or slot number in the chassis.
- The MGX 8230 includes a grounding wrist strap to protect the user and the electronic components from electrostatic shock. This strap can be connected to the lower rear corner near the grounding lug, or to the front panel.
- Inserting the cards in the correct slot. If back cards are installed in the wrong slot, electrical damage may occur. If a back card is inserted into a PXM back slot (1 or 2), damage to the card and backplane can result. Never remove or insert either card in a PXM/SONET back card set with the power on.
- If a service module back card is accidently inserted into slots 1 or 2 and then removed, check for bent or broken pins on the backplane. Such damage can result in faulty operation of the switch.
- Both the front card and the corresponding back card of all card sets must be installed for proper operation.
- If a back card is removed, reseated or changed for another back card, the associated front card must be reset.

Remove the Front Cards

The front cards are held in place by a mechanical latch attached to the card. The top of a front card corresponds to the left side of the MGX 8230 card cage as seen from the front, as shown in Figure 4-4.

Figure 4-4 Front Card Insertion/Extractor Lever



To remove a front card:

Step 1 Insert a the small flat head screwdriver into the lever slot and press until the latch springs open (approximately 10°).

There are two levers on the left and right side for single height cards, or top and bottom on double-height cards.

Step 2 Pull/rotate the insertion/extractor lever to disconnect the card from the backplane.

Caution When extracting a front card, keep the card level until it is completely extracted from the chassis. Do not allow the front cards to drop against the cards below them. This could damage components on the cards.

Step 3 Gently pull the card out of the card cage. Keep it level and make sure that the card does not hit the one beneath it.

Remove the Back Cards

Back cards are retained with two captive screws: one at the top of the faceplate and one at the bottom of the faceplate.

To remove a back card:

Step 1 Label and remove any cables connected to the back card.

Step 2 Use a screwdriver (flat or phillips as applicable) to undo the two retaining screws in the back card's faceplate.

Step 3 Pull both of the two extractor levers out to the horizontal position, this will start the removal of the card.

Step 4 Gently pull the card out of the card cage.

Rack Mount the MGX 8230 chassis

Even with the cards removed, the weight and bulk of the card cage mandate that three or more people install it. Two installers can support and maneuver the MGX 8230 while a third secures it to the rack.

- Rear mounting brackets cannot be installed before putting a unit in a 19-inch rack.
- On MGX 8230 systems that will be mid-mounted, attach mid-mounting brackets before installing the unit in a rack.

Caution The MGX 8230 weighs **120** lbs to **150** lbs (54 kg to 68 kg) depending upon the number of installed cards. Have two persons, one each side, lift the MGX 8230 into the rack, or use a mechanical lift as shown in Install the MGX 8230 Using a Mechanical Lift (Recommended), page 4-6.

19-inch rack mounting

Follow these steps to mount an MGX 8230 in a 19-inch rack:

Step 1 If applicable, attach one mid-mounting bracket to each side of the MGX 8230.

Step 2 Have two people position the MGX 8230 into the rack.

Step 3 Use the 10-32 truss head screws to secure the MGX 8230 to the front mounting rails (or mid-mounting rails if appropriate).

Step 4 Use the10-32 screws to secure the MGX 8230 to the rear mounting rails and to the rear mounting bracket, if applicable.

23-inch rack mounting

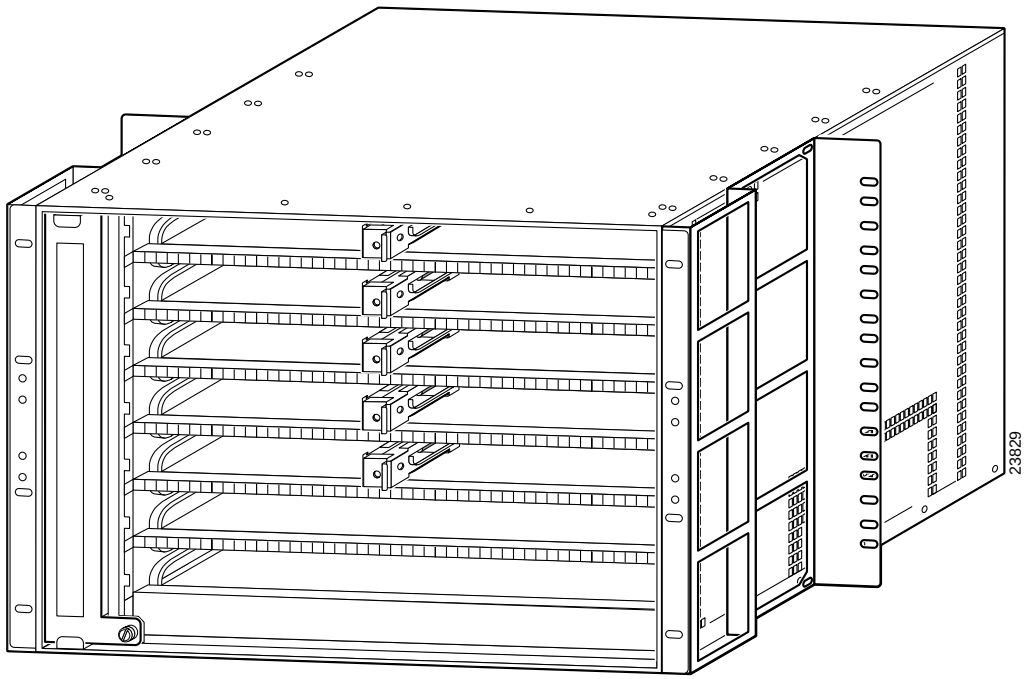
Follow these steps to mount an MGX 8230 in a 23-inch rack:

Step 1 Attach the 23-inch mounting brackets to both sides of the MGX 8230 chassis, as shown in Figure 4-5.

Step 2 Have two people position the MGX 8230 into the rack.

Step 3 Using hardware that you supply, and is appropriate for your 23-inch rack, secure the MGX 8230 to the rack mounting rails.

Figure 4-5 Front View of MGX 8230 with 23-Inch Mid-Mounting Brackets



Re-install the front cards

Step 1 Be sure the extractor is in the unlatch position.

Step 2 Position the rear card guides over the appropriate slot at the left (top) and right (bottom) of the card cage.

Step 3 Gently slide the card all the way into the slot and then press/rotate the insertion/extractor lever (or both levers on double-height cards) until it (or they) snaps into the vertical position.

Caution To prevent damage to components on the bottom side of the card, support the face plate and keep the card level while sliding it into the chassis.

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

Re-install the back cards

Step 1 Ensure the two extractor levers are rotated to the "in" position. When the card is being inserted into the slot, the levers should be horizontal along the line of the back card.

Step 2 Position the rear card edges over the appropriate guides at the left and right sides of the MGX 8230 card cage.

Step 3 Gently slide the card all the way into the slot and push to seat the card.

Step 4 Alternately tighten the two captive screws on the back card's faceplate.

Tighten the right and left captive screws in increments to prevent misalignment of the card. Do not overtighten the screws, but secure the card.

Warning **Cards must be inserted in the correct slot positions. This is particularly true with back cards. If service module back cards are inserted into slots intended only for MGX 8230 PXM back cards, slots 1 and 2, damage can be done.**

If you accidentally attempt to insert a service module back card into slots 1 and 2 and have difficulty in operating the shelf, examine the backplane pins and the back card connector to see if they have been bent or damaged.

Connecting Power for DC Systems

DC power is connected to one or two DC PEMs located on the MGX 8230 chassis rear panel. You must supply the wiring from the DC source(s) to the DC PEM(s). The wiring should be 10 AWG (4 square millimeters).

Warning **Be sure the power to the shelf is OFF at this point. DO NOT apply power until later.**

To connect DC power to a DC MGX 8230, follow these steps:

Step 1 Locate the DC power entry module(s) on the rear panel of the MGX 8230.

There will be one or two DC PEMs installed and shipped with your MGX 8230 according to your order. Figure 4-6 illustrates the rear panel of an MGX 8230 with two DC PEMS, and Figure 4-7 illustrates the rear panel of an MGX 8230 with one DC PEM.

Figure 4-6 Rear View of MGX 8230 with Two DC PEMs

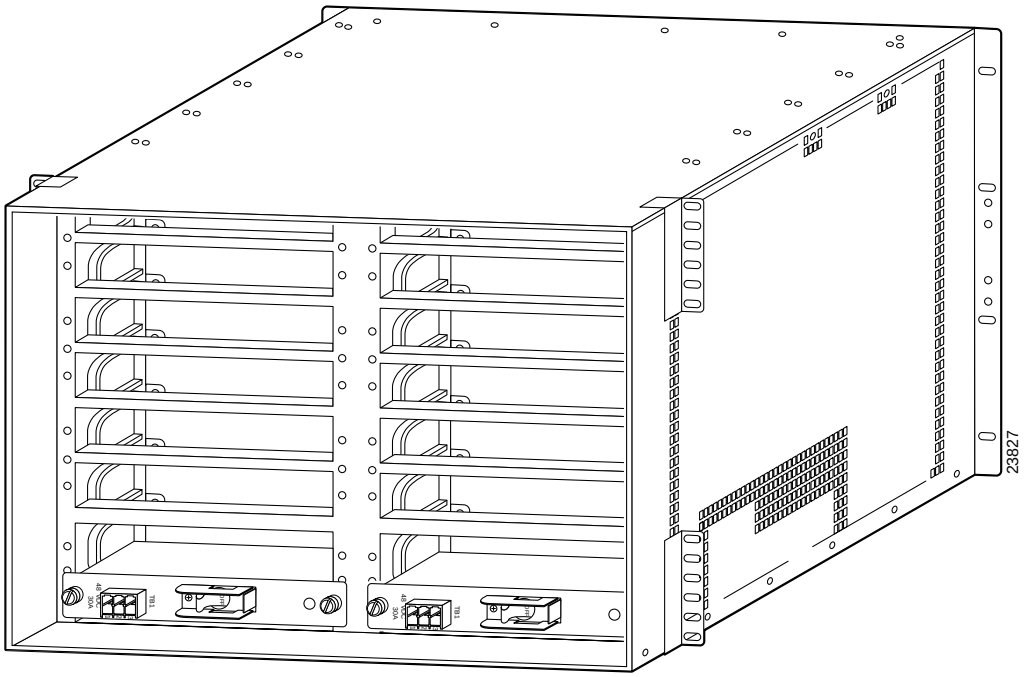
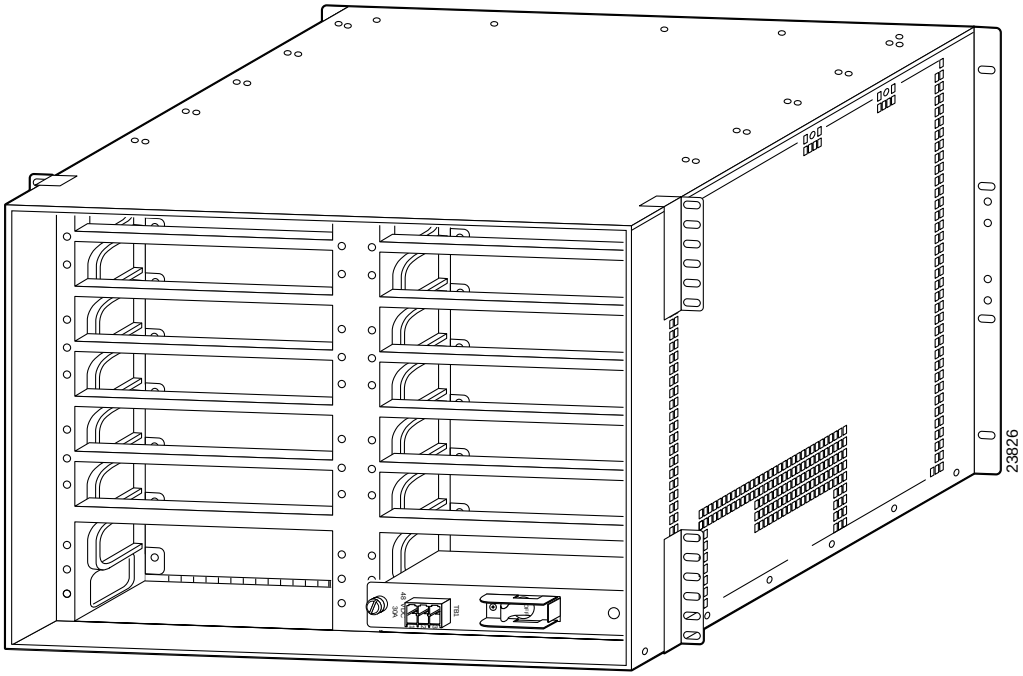
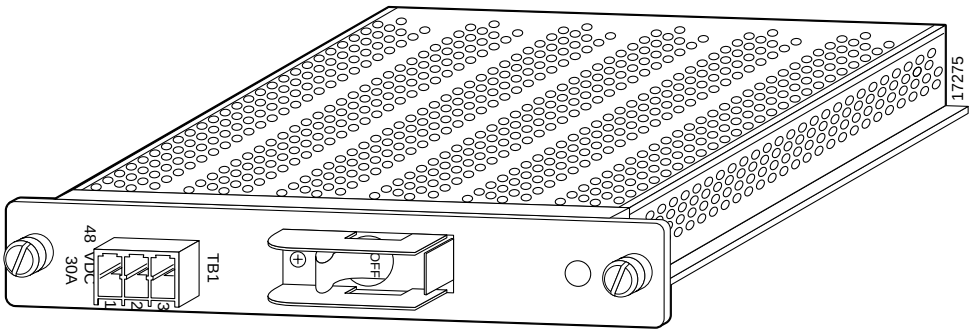


Figure 4-7 Rear View of MGX 8230 with 1 DC PEM



Step 2 Locate the pluggable terminal block (TB1) on the DC PEM to which you are connecting source power.

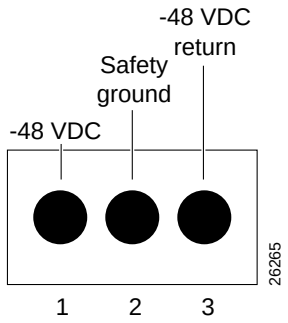
Figure 4-8 DC Power Entry Module, Rear View



Step 3 Note the polarities of the TB1 connection points.

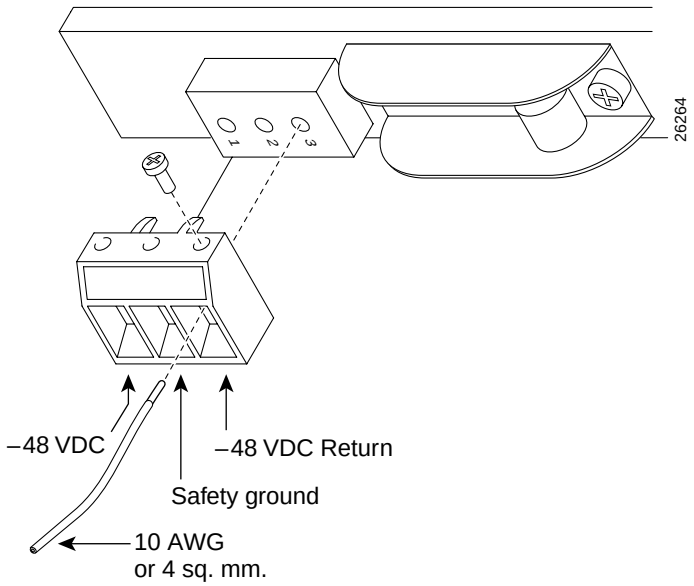
Figure 4-9 illustrates the polarity of each connection on the pluggable terminal block. The numbers start with 1 on the left and go to 3. The connection at the left is for the –48 VDC wire. The middle wire is Safety Ground. The connection at the right is for the positive return wire (for the –48 VDC).

Figure 4-9 Polarities at MGX 8230 PEM Pluggable Terminal Block



Step 4 Locate the wiring block for TB1. Figure 4-10 illustrates the TB1 wiring block (that is, the mating plug that attaches to TB1).

Figure 4-10 Pluggable Terminal Block on MGX 8230 PEM



Step 5 Insert and secure the stripped ends of the 10 AWG wire in the wiring block as shown in Figure 4-9 and Figure 4-10. Figure 4-10 shows the assembly with an example wire and the screw that secures it in the pluggable wire block.

Step 6 Plug the pluggable terminal block to the receptacle TB1 on the PEM.

Step 7 If you have a redundant DC PEM installed in your MGX 8230, repeat step 1 through step 6 for the second DC PEM.

Step 8 For each DC PEM, connect the DC input wiring to a separate dedicated DC source capable of supplying at least 30 Amps (typical). The –48VDC power source in the building should have a 30 Amp DC circuit breaker. The building's wiring should include an easily accessible disconnect device. Make sure the safety ground wire connects to a reliable building (earth) ground.

Warning **For personnel safety, the green or green/yellow wire must connect to safety (earth) ground at both the equipment and at the supply side of the DC wiring.**

Step 9 Before you turn on the system power, check the supply voltage.

The screws at positions 1 and 3 on the pluggable terminal block are convenient measuring points. Also, check the impedance between the safety ground (screw at location 2 on the pluggable terminal block) and the chassis. It should be close to 0.

Step 10 Turn the circuit breaker on all installed PEMs to the off position.

Step 11 Turn on the source power, and check the voltage at the screws at positions 1 and 3 on the pluggable terminal block for all installed PEMs.

Step 12 Turn off the source power, and go to the section "Install the Cable Manager," which is followed by the section "Power up the MGX 8230."

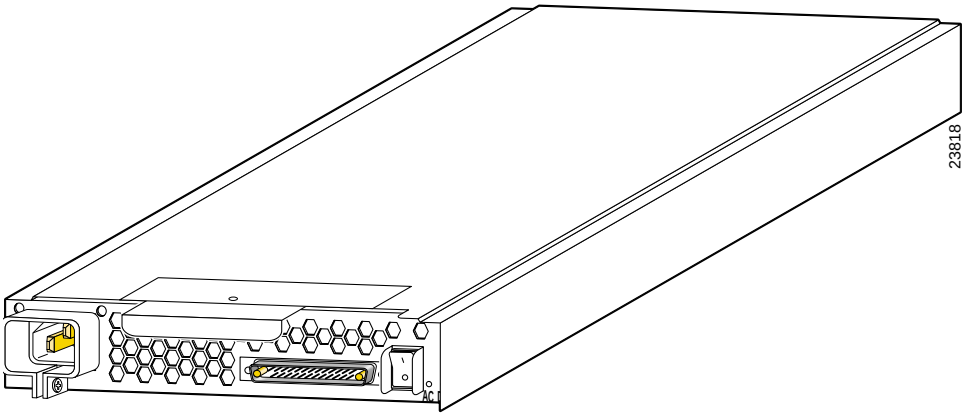
Connecting Power for AC Systems

This section describes how to connect AC power to an MGX 8230, which has an optional AC power supply.

The optional AC power supply tray is factory-installed on the bottom of the MGX 8230 chassis. It is one rack unit high and can hold one or two 1200 Watt AC Power Supply Modules. These modules must be re-installed if they were removed during installation of the card cage.

Figure 4-11 illustrates a rear view of an AC Power Supply Module. Each AC Power Supply Module has its own independent connectors, power switch, and LEDs.

Figure 4-11 Optional 1200 Watt AC Power Supply Module, Rear View



Each AC power supply module takes AC power and converts it to -48 VDC, which is then routed through an external cable to the MGX 8230 backplane connector. (There are no DC PEMs in an AC-powered MGX 8230.) Each power supply provides a signal that indicates the status of the power supply.

Note There must be at least two inches of empty space around the front and rear panels of the AC power supply for cooling air.

The rear panel of each AC Power Supply Module has:

- An AC input connector
- A special cable that connects the DC output connector of the AC Power Supply Module to the MGX 8230 backplane is supplied with your MGX 8230 for each AC Power Supply Module.
- Power Supply Enable (On/Off) switch
- Status light
- Power cable strain relief clamp

The AC Power Supply Module front panel has both a DC OK LED and an AC OK LED.

Installing AC Power Supply Modules in the AC Power Supply Tray (optional)

The AC Power Supply Modules slide into the Optional AC Power Supply Tray from the rear of the MGX 8230. As seen from the front of the MGX 8230, AC Power Supply A (PSA) is on the left, and AC Power Supply B (PSB) is on the right. The front grill of the Optional AC Power Supply Tray has cutouts that allow the AC OK and DC OK LEDs on the AC Power Supply Modules (PSA and PSB) to be seen.

If these power supplies were removed during installation of the card cage, follow the instructions below to re-install them.

To install a 1200 Watt Power Supply Module in the AC Power Supply Tray, follow these steps:

Step 1 From the rear of the MGX 8230, slide a 1200 Watt AC Power Supply Module into the AC Power Supply Tray.

Step 2 Secure the set screw on the top of the AC Power Supply Module to secure it in the AC Power Supply Tray.

Step 3 Repeat step 1 and step 2 for the second 1200 Watt Power Supply Module if applicable.

If only one AC Power Supply Module is used in your system, make sure that the slot for the other AC Power Supply Module is covered with a blank faceplate.

Making the Connections to the AC Power Supply Module(s)

Step 1 Connect a cable supplied with your MGX 8230 to the DC out connector on the optional AC power supply.

Note Without the DC cable connected to the MGX 8230 backplane, the AC power supply will not power up. This is a safety feature.

The other end of this cable has a connector and a fixture for attaching to the MGX 8230 backplane. The cable from the left AC Power Supply Module is connected to the connector on the left side of the MGX 8230 backplane. Likewise, the cable from the right AC Power Supply Module is connected to the connector on the right side of the MGX 8230 backplane.

Step 2 Use the appropriate AC power cord to connect the AC power source to the IEC receptacle(s) on the AC Power Supply Module and tighten the strain relief clamp to secure the cable.

Step 3 Make sure that the building AC receptacle is properly grounded.

Step 4 Repeat steps 2 through 3 for the second AC Power Supply Module if appropriate.

Figure 4-12 illustrates a MGX 8230 chassis with two AC Power Supply Modules connected to the MGX 8230 backplane.

Figure 4-13 illustrates an MGX 8230 with one AC Power Supply Module connected to the MGX 8230 backplane. If only one AC Power Supply Module is used in your MGX 8230, make sure that there are blank faceplates covering the slots for the second AC Power Supply Module and the opening where the DC PEM would otherwise be installed.

In order for the AC power supply to function the enable switch must be in the "On" position, and the DC cable must be connected between the AC power supply connector and the MGX 8230 backplane. Proceed to the section "Install the Cable Manager," which is followed by the section "Power up the MGX 8230."

Note An AC power module will not power on if the DC cable is disconnected from the MGX 8230 backplane.

Figure 4-12 Rear View of MGX 8230 with Two Optional AC Power Supply Modules

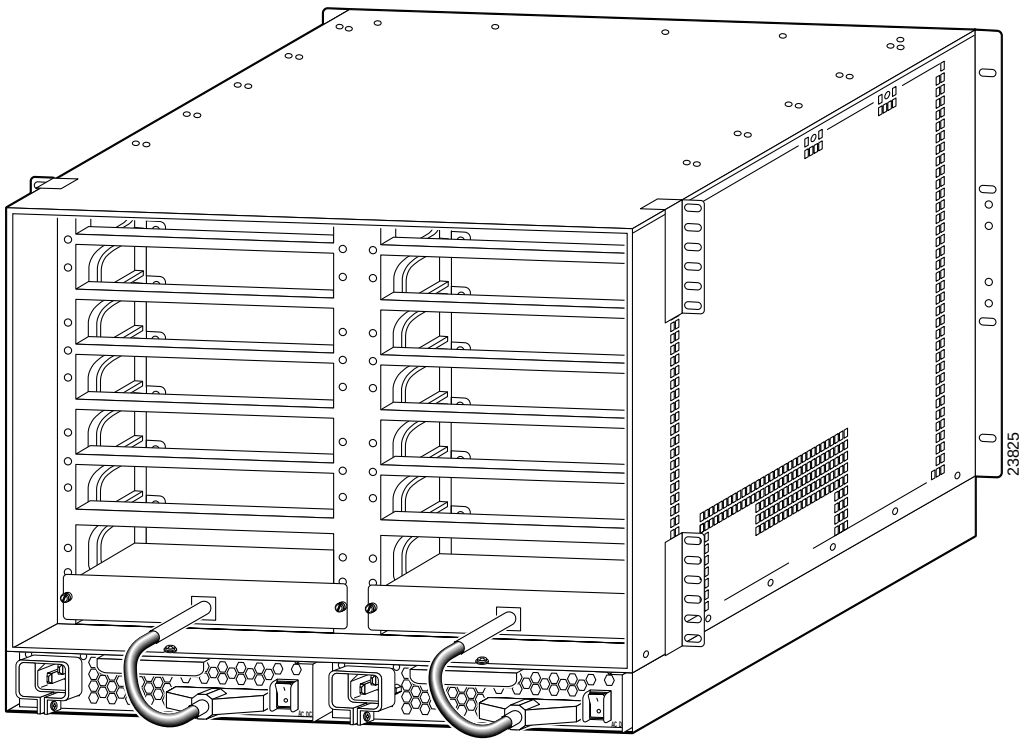
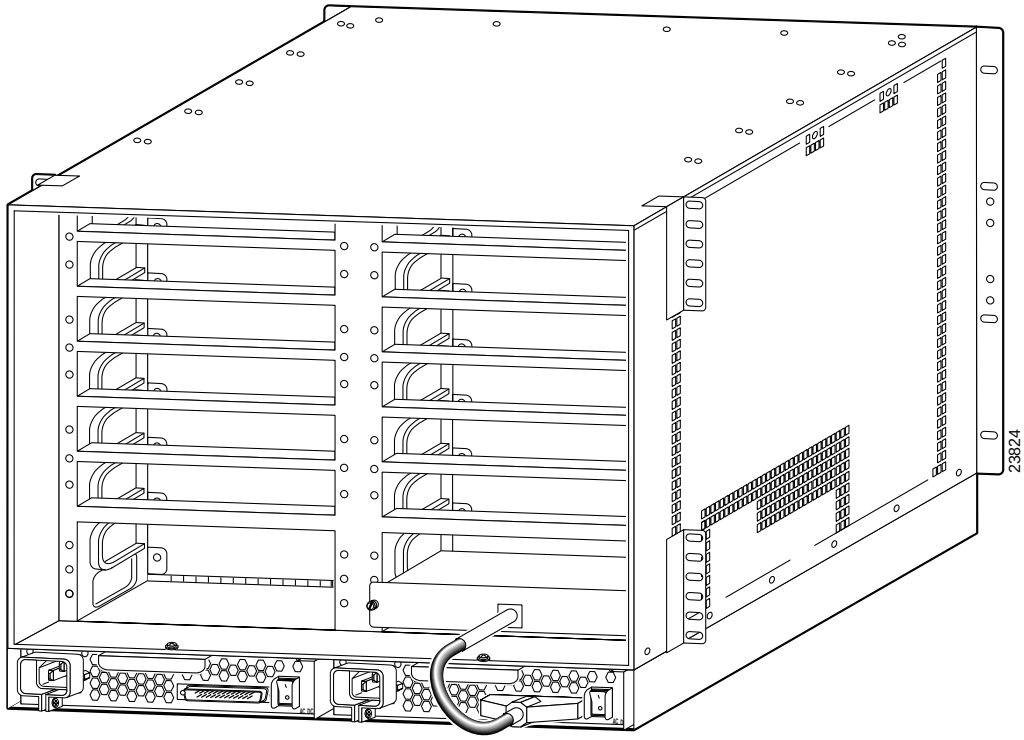


Figure 4-13 Rear View of MGX 8230 with One AC Power Supply Module

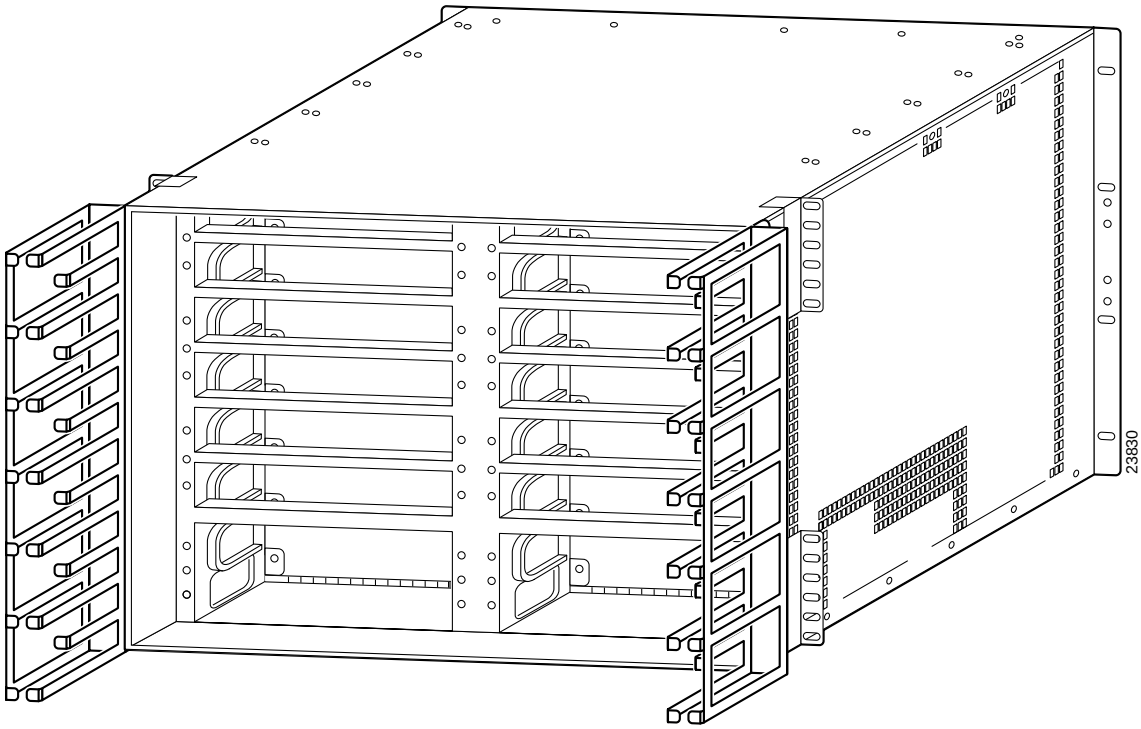


Install the Cable Manager

A fully loaded MGX 8230 may have many cables attached to the rack's modules. Cable management kits are available for installation on the rear of rack modules. These kits provide the means to route the power and data cables in a neat and orderly fashion to and from the modules in the MGX 8230. The cable management system is shipped with attaching hardware along with your MGX 8230.

Install the cable management brackets after a rack mounted unit has been installed in a rack, or a standalone MGX 8230 has been positioned. Figure 4-14 illustrates an installed cable management system. When installing the cable management system on a rack-mount MGX 8230, the screws securing the cable guides to the MGX 8230 chassis are inserted from the outside into the captive nuts in the chassis. When installing the cable management system in a standalone MGX 8230, the screws securing the cable guides to the MGX 8230 chassis are inserted from the outside into the captive nuts in the chassis.

Figure 4-14 Cable Management System on Rack-Mount MGX 8230



The cable management system provides the following features:

- Cards can be inserted or removed without disturbing cables attached to cards in adjacent slots.
- Cables can be routed from both above and below the chassis.

Power up the MGX 8230

Before applying power to the MGX 8230, check the following items:

1. Assure that the unit is properly connected to site safety 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 to the Console Port on the PXM-UI (and PXM-UI-S3) back card. (See the "MGX 8230 Feeder" appendix in the *Cisco IGX 8400 Series Installation and Configuration* document for Release 9.2.)

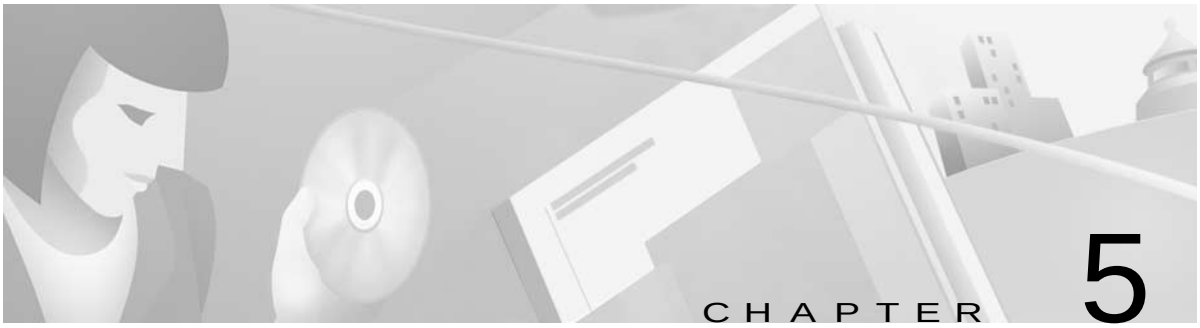
After the preceding checks, turn on the power. Check the following:

1. At the front of the unit, the status light on the PXM should be green.
2. For an AC-powered system, the "AC" and "DC" LEDs on each AC Power Supply Module, as applicable, should be green.
3. For a DC-powered system, the "DC OK" LED on each DC PEM should be on.

4. After each service module comes up, the status LEDs on each should show that it 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, execute the **dsppwr** command.

Configuring the MGX 8230 as an BPX Feeder

Connecting an MGX 8230 to an BPX and configuring it to function as a feeder is covered in Chapter 5, "Configuring the MGX 8230 Shelf."



CHAPTER 5

Configuring the MGX 8230 Shelf

Summary of Shelf-Level Tasks

This chapter describes the shelf-level tasks used to bring up and configure the MGX 8230. 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:

Note The words “switch,” “node,” and “shelf” are synonymous for the MGX 8230 product. The word “bay” refers to the upper or lower half of the enclosure.

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): the *control* port, the *Ethernet* port and the *maintenance* port. See Initial MGX 8230 Bring-Up, 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 command line interface (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 following:

- *Ethernet* port
- *maintenance* port
- inband ATM IP address: this address is used in MGX 8230 feeder applications to link the PXM1 and BPX 8600 series switch.
- the IP address of the statistics manager.

Note When the MGX 8230 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 you intend to be the gateway node, the network ID, the network name, and so on. See 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 8230.

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. For information on the function of other ports, see Chapter 6, "Card and Service Configuration"

IP-Based Applications

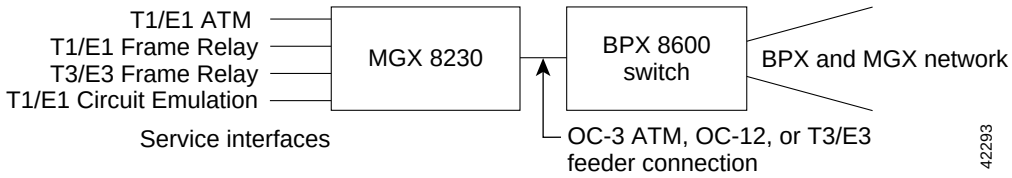
The maintenance port and Ethernet port support IP-based applications. Through these ports, the following applications run:

- 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.

MGX 8230 MGX to BPX Feeder

As a BPX feeder, the MGX 8230 concentrates user ATM, Frame Relay, and circuit emulation traffic and feeds it to a BPX 8000 series switch over an OC-3 or OC-12 feeder trunk. The BPX series switch performs the switching and routing of the MGX 8230 user-connections through an MGX and BPX network. Figure 5-1 is a simplified diagram of the MGX 8230 MGX feeder application.

Figure 5-1 MGX 8230 MGX Feeder Application



Initial MGX 8230 Bring-Up

This section describes how to start up the MGX 8230 for the first time. It begins with an MGX 8230 PXM that has only boot-mode firmware. The descriptions tell you how to:

1. Establish communication with the MGX 8230.
2. Configure one or more boot-level IP addresses to make the MGX 8230 available to the network.

3. Download MGX 8230 PXM firmware.
4. Configure a new, MGX 8230-level Ethernet IP address for the MGX 8230 PXM as needed or other SLIP or IP addresses.
5. Specify a name for the MGX 8230.
6. Specify the time on the MGX 8230.
7. Optionally configure a time zone for the Western Hemisphere, or configure a time zone relative to Greenwich Mean Time if the MGX 8230 resides outside the Western Hemisphere.
8. Download firmware to the service modules.

If the MGX 8230 PXM has no runtime (or "on-line") firmware Image, begin with the boot-mode description in the "Bringing Up an MGX 8230 PXM With No Run-time Firmware" section on page 5-4. If the MGX 8230 PXM has a run-time firmware image, go to the section "Bringing Up an MGX 8230 PXM With No Run-time Firmware."

Bringing Up an MGX 8230 PXM With No Run-time Firmware

The section describes the tasks for loading runtime firmware onto a MGX 8230 PXM that has only a boot loader.

Step 1 Establish communication with the MGX 8230 by doing one of the following:

- Connect a cable between your terminal or PC and the PXM-UI or PXM-UI-S3 control port.
- If you are using an ASCII terminal connected to the control port, the prompt for the next command is already present upon power-up. (If the display is skewed, make sure the terminal speed and PXM-UI or PXM-UI-S3 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 Execute the command **bootChange** to configure boot-level IP parameters.

If the MGX 8230 has a redundant MGX 8230 PXM, execute **bootChange** on each MGX 8230 PXM to configure unique, boot-level IP addresses. (During the subsequent MGX 8230-level configuration, you must configure another Ethernet IP address that applies to *both* MGX 8230 PXMs.) The following are the only parameters that are meaningful at this point, so press *Return* other parameters:

- Mandatory "host name" is a name for the workstation. For the MGX 8230, enter the letter **c**.
- Ethernet IP address and subnet mask for the MGX 8230 PXM 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 MGX 8230 PXM, enter a gateway IP address ("gateway inet").

Note the three editing functions near the top of the following example. Of these, typing a period to the 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 MGX 8230 PXM now has a boot-level IP address. Remember to repeat the **bootChange** command on the redundant MGX 8230 PXM if the system has one.

Step 3 Enter **reboot** to reset the MGX 8230 PXM.

The MGX 8230 PXM is ready to receive a firmware image through the Ethernet port. Use the workstation for the next steps.

Step 4 At the workstation, you can optionally ping the MGX 8230 PXM using the IP address to confirm that the node is reachable.

Step 5 Establish communication with the MGX 8230 PXM 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:

$**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 and include the arguments that specify the firmware release number, the statement that this firmware applies to the active MGX 8230 PXM, 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

where *release_number* is a decimal number in the form *n.n.nn.* Currently, the initial *n* typically is a "1." An example filename for MGX 8230 PXM firmware is "pxm_1.0.03." Note that the download automatically includes the firmware for the standby MGX 8230 PXM (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 ftp application, then go to the ASCII terminal connected to the control port:

>**quit**

Step 10 At the ASCII terminal, **cd** to 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 MGX 8230 PXM with its run-time image (see "Configuring Node-Level Parameters").

Step 12 Enter the following:

>setPXMPrimary "*version*"

where *version* is the version number of the firmware. The name of a MGX 8230 PXM 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 MGX 8230 PXM is now the same as an MGX 8230 PXM that Cisco ships with a run-time firmware image.

Configuring Node-Level Parameters

Except for adding a user or creating a password, all the tasks in this section can be performed with the CiscoView application.

Resource Partitioning

A resource partition on an MGX 8230 PXM consists of a percentage of bandwidth, a VPI/VCI range, and the number of global logical connection numbers (GLCNs) available to a network control application. By default, all resources on a logical interface are available to any controller on a first-come, first-served basis. In this release of the MGX 8230 MGX feeder application, Portable AutoRoute (PAR) is the only network control application. Future releases of the MGX 8230 may include other network control applications such as Multiprotocol Label Switching (MPLS), then the resources will have to be carefully partitioned.

Note The MGX 8230 PXM resources do not have to be partitioned for the MGX 8230 MGX feeder application.

Procedure

At the MGX 8230 CLI prompt on the ASCII terminal:

Step 1 Enter the default login and password provided in the release notes.

The terminal displays the slot number of the MGX 8230 PXM you have logged into by default:

card number [1]:

Step 2 Press *Return* to enter the CLI of this MGX 8230 PXM.

At run-time, you could also enter the slot number of a service module or a standby MGX 8230 PXM. In this case, the CLI prompt shows:

NODENAME.1.1.PXM.a>

where NODENAME shows that the node has no name; the slot number of the MGX 8230 PXM is 1; and this MGX 8230 PXM 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.1.1.PXM.a> **dspcds**

Step 4 Display any IP addresses in the system:

NODENAME.1.1.PXM.a> **dspifip**

Step 5 Change any IP addresses as needed:

NODENAME.1.1.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 Execute the **cnfname** command to assign a name to the MGX 8230:

UNKNOWN.1.1.PXM.a> **cnfname** <*node name*>

where *node name* is a case-sensitive name up to eight characters. For example:

UNKNOWN.1.1.PXM.a> **cnfname** cisco22

Step 7 Execute the **cnftime** command to specify the time on the MGX 8230:

cisco22.1.1.PXM.a> **cnftime** <*hh:mm:ss*>

where *hh* is the hour of the day in the range 1–24; *mm* is the minute of the hour in the range 1–60; and *ss* is the number of seconds in the minute and has a range of 1–60.

Step 8 Optionally configure a time zone for the node. Use **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 using **cnftmzngmt**:

- cisco22.1.1.PXM.a> **cnftmzn** <*timezone*>

where *timezone* is 1 for GMT, 2 for EST, 3 for CST, 4 for MST, 5 for PST.

- cisco22.1.1.PXM.a> **cnftmzngmt** <*timeoffsetGMT*>

where *timeoffsetGMT* is the offset in hours from GMT. The range of possible values for *timeoffsetGMT* is -12 through +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 8230 must have the IP address of the workstation with this application. The syntax is:

>**cnfstatsmgr** <*IP_Addr*> where *IP_Addr* is the IP address of the workstation.

If the node has a redundant MGX 8230 PXM, it automatically receives the same IP addresses and configuration as the primary MGX 8230 PXM. 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 executing **adduser** once for each new user.

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 is 1–12 alphanumeric characters.

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 Return without entering a password, the system assigns the default password “newuser.”

Step 11 Optionally change your password or another user’s password by executing:

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 MGX 8230 as a feeder, execute the **cnfswfunc** command:

cnfswfunc <-ndtype>

and follow -ndtype with “fdr.”

Step 13 Configure an external clock if needed:

- **cnfextclk** <clock-type>: “1” is for T1 connections, “2” is for E1 connections.

For external clocking with the PXM-UI back card, the Stratum level must be set to “4.”

- **cnfclklevel 4**: to enable Stratum 4 clocking.

For external clocking with the PXM-UI-S3 back card, the Stratum level must be set to “3.”

- **cnfclklevel 3**: to enable Stratum 3 clocking.

Note Stratum 3 clocking is available only with the PXM-UI-S3 back card. Stratum 4 clocking is available only with internal clock sources or with the PXM-UI back card.

Downloading Firmware to a Service Module

This section describes how to download firmware for a service module from a workstation. The descriptions apply whether you are upgrading the existing firmware or downloading because no runtime firmware resides on the hard drive.

Service modules do not retain runtime firmware. The hard drive on the MGX 8230 PXM 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 MGX 8230 PXM downloads it upon power-up or when you reset the card, otherwise you can download firmware from the workstation according to the instructions that follow.

Note that if you download firmware from a workstation to the hard drive, the MGX 8230 PXM 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.

To load service module firmware from a workstation to the hard drive on the MGX 8230 PXM:

Step 1 Start the tftp application:

$**tftp** <*IP address*>

then

>**bin**

Step 2 To download generic firmware for a type of service module to the MGX 8230 PXM hard drive:

>**put** *cardtype*.fw POPEYE@SM_1_0.FW

where *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 To load slot-specific firmware at a particular card:

>**put** *cardtype*.fw POPEYE@SM_1_*slot*.FW

where *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 do either of the following:

- 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

where “frsm2ct3_10.0.0” refers to the firmware for the FRSM-2CT3, and “3” is the slot.

Note See the Release Notes for 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.

cisco22.1.1.PXM.a> **ll** c:/FW

Step 6 If you want to download the firmware from the disk to a card, execute **resetcd**.

MGX 8230 CLI Configuration of a Feeder

This section first describes how to use the CLI to configure physical and logical characteristics of the equipment, such as physical line, logical ports, and resource partitioning. The section then describes how to add daxcons and three-segment connections. To do these tasks, the requisite IP addresses must have been assigned. The descriptions tell you how to:

- Specify that the application of the MGX 8230 is a feeder to a BPX series switch.
- At the card-level, optionally specify the total number of connections available to each network controller (PAR, and so on).
- Activate a line on the broadband interface of the MGX 8230 PXM—only one line for an MGX feeder.
- Optionally modify the characteristics of the line.
- Create one or more logical ports on the line. Each port has associated bandwidth and VPI/VCI ranges. By default, each controller competes for all the resources you assign to the port.
- Optionally specify the amount of resources a network controller has on a logical port rather than allow the controllers to compete for resources.
- Add the MGX 8230 shelf from the BPX side.

Configuring the OC-3 Uplink

The MGX 8230 PXM uses only an OC-3 uplink back card as a feeder trunk.

Step 1 Execute the **cnfswfunc** command to specify the feeder application:

cnfswfunc <-vsvd enable(yes)/disable(no)> | <-ndtype>

Follow -ndtype with “fdr” or “routing.” The default application is routing.You can configure one option each time you execute **cnfswfunc**.

Step 2 If the MGX 8230 must support the paid feature of virtual source/virtual destination (VSVD) on ABR connections, execute **cnfswfunc**. The **cnfswfunc** syntax is:

cnfswfunc <-vsvd enable(yes)/disable(no)> | <-ndtype>

where you follow “-vsvd” with “e” or “d.”

Step 3 Optionally, modify the resource partitioning for the whole card by executing the **cnfcdrscprtn** command. You can view resource partitioning through **dspcdrscprtn**.

cnfcdrscprtn <*number_PAR_conns*> <*number_PNNI_conns*> <*number_TAG_conns*>

number_PAR_conns is the number of connections in the range 0–32767 available to PAR.

number_PNNI_conns is the number of connections in the range 0–32767 available to PNNI.

number_TAG_conns is the number of connections in the range 0–32767 available to Tag.

For example, you could reserve 10,000 connections for each controller on the MGX 8230 PXM with:

cnfcdrscprtn 10000 10000 10000

Note In this release, there is no need to partition MGX 8230 PXM resources.

Step 4 Activate the uplink line by executing **addln** according to the following syntax:

addln -ds3 <*slot.line*> | -e3 <*slot.line*> | -sonet <*slot.line*>

where:

- -ds3 indicates a T3 line
- -e3 indicates an E3 line
- **-sonet** indicates an OC-3 or OC-12 line
- *slot* is always 1 for the MGX 8230 PXM whether the active MGX 8230 PXM is in slot 1 or 2
- line has the range 1–4 but depends on the number of lines on the uplink card

You can activate only one MGX 8230 PXM line for the feeder application.

Step 5 If necessary, you can configure line characteristics by using the **cnfln** command.

Step 6 Create logical ports for the physical line by executing **addport** once for each logical interface. (Related commands are **cnfport**, **dspports**, and **delport**.)

addport <*port_num*> <*line_num*> <*pct_bw*> <*min_vpi*> <*max_vpi*>

port_num is the number for the logical port. The range is 1–32 for standard connections, and 34 is the port number reserved for inband ATM PVCs for network management.

line_num is the physical line in the range 1–*N*. *N* is the number of lines on the card.

pct_bw is percentage of bandwidth. The range is 0–100. This parameter applies to both ingress and egress.

min_vpi is the minimum VPI value. The range is 0–4095.

max_vpi is the maximum VPI value. The range is 0–4095.

Step 7 Optionally use **cnfportrscprtn** to specify the resources that a controller has on a port:

cnfportrscprtn <*port_no*> <*controller*> <*ingress_%BW*> <*egress_%BW*>

<*min_VPI*> <*max_VPI*> <*min_VCI*> <*max_VCI*> <*max_GLCNs*>

port_no is the number for the logical port in the range 1–32 for user-connections or 34 for inband ATM PVCs for network management.

controller is a string identifying the network controller—"**PAR**," "PNNI," or "TAG."

ingress_%BW is the percentage of ingress bandwidth—a number in the range 0–100.

egress_%BW is the percentage of egress bandwidth—a number in the range 0–100.

min_vpi is the minimum VPI Value—a number in the range 0–4095.

max_vpi is the maximum VPI Value—a number in the range 0–4095.

min_vci is the minimum VCI Value—a number in the range 0–65535.

max_vci is the maximum VCI Value—a number in the range 0–65535.

max_chans is the maximum GLCNS—a number in the range 0–32767.

Step 8 Execute **cnfifastrk** to configure the *port* as a trunk. To change the port usage after you execute **cnfifastrk**, first execute the **uncnfifastrk** command.

cnfifastrk <*slot.port*> <*trunk*>

- *slot.port* is the slot and port number of the line you want to serve as the trunk. Note that, whether the active MGX 8230 PXM is in slot 1 or 2, always specify slot 1 in CLI syntax because this parameter is a logical value.
- *trunk* is the MGX 8230 application and can be either “fdr” for a feeder or “rtrk” for a stand-alone node. Specify “fdr.”

Step 9 Log in to the MGX at the other end of the feeder trunk and use the **addshelf** command to add the MGX 8230 as a feeder.

Establishing the BPX 8600-to-BPX 8600 Series Segment

For a three-segment connection, establish a BPX 8600-to-BPX 8600 series (middle) segment. Execute **addcon** at *one* of the BPX 8600 series nodes, as follows.

- For slot and port number, specify slot and port of the BXM connected to MGX 8230 node.
- For VPI and VCI, specify the VPI and VCI at the endpoint on the PXM1.
- For Nodename, use 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 8230 node at the far end. Specify the VPI as the slot number of the remote MGX 8230 FRSM connected to the BPX 8600 series switch, and specify VCI as the LCN of the Frame Relay connection at the remote MGX 8230 node.
- Specify the type of connection. Enter ATFST if the ForeSight feature is operating and ATFR if this feature is not operating.

Specify the other **addcon** 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,

For example: AR equals 64K, PCR = 237, or
AR speed equals 256K, PCR = 950, or
AR speed equals 1536K, PCR = 5703

The preceding MCR and PCR formulae are predicated on a relatively small frame size of 100 octets, and even smaller frame sizes can result in worst-case scenarios. For example:

For a frame size of 64 octects the PCR formula becomes: PCR = AR * 2/512 cells per sec

For a frame size of 43 octects the PCR formula becomes: PCR = AR * 2/344 cells per sec

% Util should be set to the same value as that used for the Frame Relay segments of the connection.

CiscoView Configuration of a Feeder

This section describes how to use the CiscoView application to create and optionally modify the characteristics of the logical ports on the MGX 8230 uplink card. It provides another way of configuring the MGX 8230. To configure equipment on an MGX 8230, you must use Release 2.x or higher of CiscoView. No CiscoView screen representations appear in this appendix. For a description of CiscoView usage, see the CiscoView documentation. The task descriptions begin from the point where you have already specified all IP addresses and the top-level CiscoView window is on-screen. The task descriptions tell you how to:

- Specify that the application of the MGX 8230 is a feeder to a BPX series switch.
- At the card level, optionally specify the number of connections available to a network controller.
- Activate and optionally modify the characteristics of a line on the broadband interface of the MGX 8230 PXM—only one line for an MGX feeder.
- Create 1–32 logical ports on the line. By default, each network controller can compete for all the resources you assign to the port.
- Optionally specify the amount of resources each network controller has on a logical port rather than allow the controllers to compete for resources. (Note that for this release PAR is the only network controller using MGX 8230 resources.)

Selecting an MGX 8230

To reach the target MGX 8230:

Step 1 Click on the File option at the top of the CiscoView - Main window, then click on the Open Device option.

Step 2 Enter the node name or IP address of the MGX 8230 in the Device Select window. When the graphical representation of the MGX 8230 shows the cards' faceplate features, you can begin configuration.

Step 3 You can configure features from either the front or back view of the MGX 8230. Optionally, select a side of the MGX 8230 through the View option at the top of CiscoView - Main.

Note If you configure MGX 8230 PXM features at the back card, select the Configure Card options by clicking with the left mouse button on the MGX 8230 PXM back card but away from the connectors. If you successfully select the card features, an outline of the entire back card lights up. To select the Configure Line features, click on the back card near the connectors. If you select the line features, an outline around the connectors lights up. Similarly, in the front view, select either a port LED for line configuration or a nonspecific area of the MGX 8230 PXM front card for card configuration.

Specifying the Feeder Application

To specify that the MGX 8230 operate as a feeder to a BPX series switch:

Step 1 Click with the left mouse button on the MGX 8230 PXM so that the card outline lights up.

Step 2 Click on the Configure option at the top of the CiscoView - Main window; then click on the highlighted "card" choice that appears under "Configure." The Configure Card box appears. Next to the "CATEGORY" label, the menu button shows "Card."

Step 3 Click on Card to display the node configuration options.

Step 4 Select PAR Configuration. The Configure PAR window opens.

Step 5 Click on the menu button next to the CATEGORY field to display the PAR topics.

Step 6 Select PAR SW Configuration. The PAR Configuration box shows the defaults of "false" for VS/VD and "routing" for Node Type. Change the selection to "feeder."

Step 7 Select Modify at the bottom of the box.

Step 8 Select Cancel to exit the PAR Configuration box or select another PAR topic at the menu button next to the CATEGORY field.

Activating a Physical Line for the Uplink

To activate a line for the uplink:

Step 1 Click on the LED that corresponds to the MGX 8230 PXM line you want to activate. For the feeder application, only port 1 is selectable. If you correctly select the LED of an *inactive* line, an *outline* of the LED lights up. If an outline of the card lights up, you have selected the card rather than the port.

Step 2 Click on the Configure option at the top the screen then the line option in the subsequent pull-down list. The Configure Line window appears and shows the selected line with its current characteristics.

Step 3 Change appropriate line characteristics as needed, then select the LineEnable button and change the state to "enable."

Step 4 Click on the Modify button to transmit any configuration changes and enable the line.

Configuring Logical Interfaces for the Feeder

To configure logical, broadband interfaces on the physical interface:

Step 1 Select the MGX 8230 PXM by clicking on the faceplate of the card. An outline of the card lights up.

Step 2 Select "Configure" then "card" at the top of the MGX 8230 graphic. The Configure Card window appears with information on the current card.

Step 3 Click on the button next to the CATEGORY field, then select Broadband Interfaces. A matrix appears for configuring logical interfaces on the *active* lines. The maximum number of user-ports is 32.

Step 4 Select the Create button to add a logical interface. A text box appears that lets you enter:

- A number in the range 1–32 for the new logical interface
- The port number of the physical line to which you assign the logical interface
- A percentage of the maximum bandwidth on the line for the new logical interface
- A minimum VPI number for the new logical interface in the range 0–4095
- A maximum VPI number for the new logical interface in the range 0–4095

Step 5 Type a value in each of the fields, then press the Apply button. The message "Addition of broadband interface is successful" appears, otherwise an error message appears. Example errors are entries out-of-range or values that conflict with existing configurations.

Note The Create window's message of successful addition of an interface is accurate, but new interfaces do not appear in the Configure Broadband Interfaces per Card window until you close and reopen this window.

Step 6 If necessary, specify additional interfaces in the matrix. You can leave the Create box open and write over residual text or reopen this box later.

Step 7 Select the Cancel button at the bottom of the window to exit.

If you subsequently want to delete or change a logical interface:

Step 1 Open the Broadband Interfaces window.

Step 2 On the row for the targeted logical interface, move the cursor to the Status column and hold the left mouse button down on the current status. A small menu opens with "add, "del," and "mod" choices.

- Select "del" to delete the interface.

  or

- Select "mod" to change a parameter.

Step 3 Select the Modify button at the bottom of the window. To see the result of any changes, close then reopen the Broadband Interfaces window.

Partitioning Resources on the Broadband Interface

Note in this release, since PAR is the network controller controlling the MGX 8230, there is no need to configure resources.

Configuring the Line as a Feeder Trunk

A line connected to the MGX 8230 PXM line module can function as a feeder trunk. In addition to configuring the use of the trunk at the MGX 8230, you must also configure the trunk at the far-end BPX.

To configure the trunk for the feeder application at the near-end:

Step 1 Open the Configure Card window.

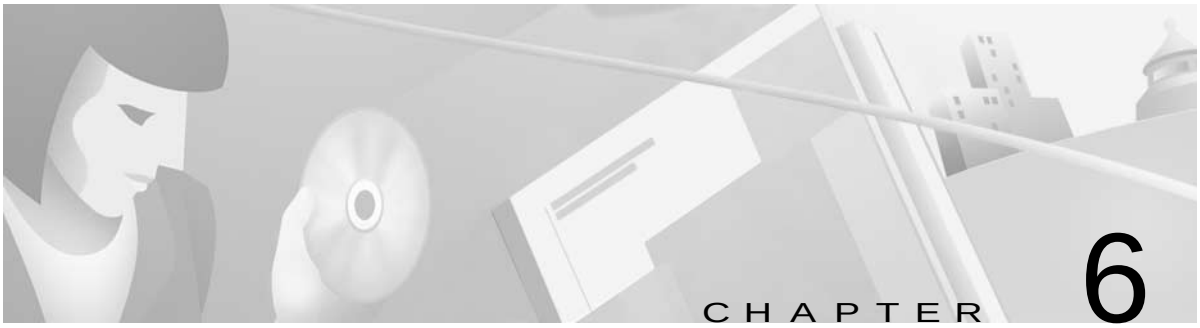
Step 2 For the CATEGORY, select PAR Configuration.

Step 3 In the PAR Configuration window, select PAR Interface. In the PAR Interface window, the only configurable column is the PAR Interface Type.

Step 4 For the logical interface type—1 for the feeder trunk—hold the left mouse button down in the PAR Interface Type column for this logical interface. The choices are “feedertrunk” and “routing trunk.”

Step 5 Select “feedertrunk,” then click on the modify button at the bottom of the screen.

Step 6 Log in to the BPX at the other end of the feeder trunk and use the **addshelf** command to add the MGX 8230 as a feeder.



CHAPTER 6

Card and Service Configuration

This chapter describes how to configure the MGX 8230 cards and the services they support.

This section also contains instructions to configure resource partitions, add local connections and three-segment connections. Detailed descriptions of these tasks for individual service modules appear in subsequent sections.

Although many of the configuration and connection tasks can be done with either Cisco WAN Manager (CWM) and CiscoView network management applications, this appendix uses the MGX 8230 command line interface commands in its examples. Refer to the appropriate CWM 9.2.xx and CiscoView 2.xx documentation for information about using those applications with the MGX 8230.

Connections on a Feeder

The MGX 8230 MGX feeder can support local connections (daxcons) and three-segment connections across the network. How you add connections depends on the technology of the service module, which card is the master or slave end of the connection, and whether the connection is a daxcon or part of a three-segment connection. The following rules govern connection addition in an MGX 8230 feeder.

The descriptions of connection addition later in this section reflect these rules:

1. If the MGX 8230 PXM is an endpoint, it functions as the slave. The service module is the master end.
2. For a daxcon, you first add the connection at the slave end then add it at the master end. Further, when you start by adding a connection at the slave end, the system generates the remote (master) *connection ID* for you. The remote connection ID contains required information for adding the connection at the master end.
3. For a three-segment connection, you start the segment by adding a connection at the master end. In this case, you specify the connection ID of the slave end of the segment and subsequently use that information for adding the connection at the slave end.
4. If the remote termination is an MGX 8230 PXM on the other side of a network cloud, specify the slot number as “0.” (This requirement applies to only the feeder application of the MGX 8230.)

Modifying the Resource Partitioning

A resource partition on a card consists of a percentage of bandwidth, a DLCI or VPI/VCI range, and the number of logical connection numbers (LCNs) available to a network control application. On the MGX 8230 PXM, the connections are global logical connections (GLCNs). By default, all resources on a

logical interface are available to any controller on a first-come, first-served basis. If necessary, you can modify the resources for a controller at the card level and 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 8230 has the capacity to support a Cisco Multiprotocol Label Switching (MPLS) controller or a Private Network to Network Interface (PNNI) controller.

Note There is no need to partition MGX 8230 service module resources in this release of the MGX 8230 BPX feeder.

Sequence of Configuration Tasks

In a new MGX 8230, the common approach is to configure the same aspect for all cards at once—adding logical ports, for example. In contrast, the likely sequence for installing a new or replacement card is to begin with the card-level features and continue until you have added every connection. The common tasks for a new MGX 8230 are:

1. Activate physical lines.
2. Optionally configure the line if default parameters are not appropriate.
3. Create the logical ports then modify as needed the logical ports.
4. Optionally configure resource partitions for a logical port if the default partitioning does not support the intended operation of the port. (With this release of MGX 8230 BPX feeder, there is no need to partition resources.)
5. Add connections, then modify as needed individual connections.

Rules for Adding Connections

This section describes the rules for adding local connections, three-segment connections, and management connections. The MGX 8230 can support

- Local-only, digital access cross-connect (DAX) connections
- Three-segment connections across an ATM or Frame Relay network

As a preface to the steps for adding connections, this section describes the applicable rules for these connections. 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 con is a connection whose endpoints for the entire connection exist on the same MGX 8230. The following apply to the MGX 8230:

1. On a feeder, a DAX con can exist between different service modules or within the same service module.

2. A stand-alone node supports DAX cons with one or both endpoints on the MGX 8230 PXM 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*>

   where *local parameters* are the port, DLCI or VPI and VCI, and mastership status. Slave is the default case, so you actually do not have to specify it. When you press Return, the system returns an identifier for this connection. The identifier includes the port and DLCI or VPI and VCI.

   Use the returned 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*>

   where *local parameters* are the port, DLCI or VPI and VCI, and mastership status (master in this case). The *remote parameters* are the items in the connection identifier that the system returned when you added the slave endpoint.
6. If the endpoint is a MGX 8230 PXM 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 MGX 8230 PXM as 0.

Rules for Adding Three-Segment Connections

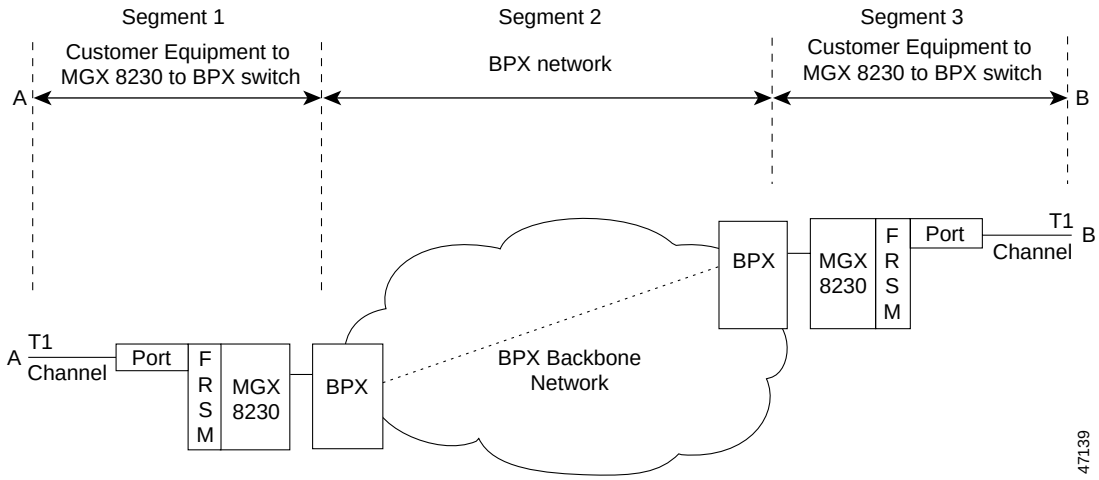
A three-segment connection consists of a local segment on each MGX 8230 at the edges of the network cloud and a middle segment across the network cloud. Figure 6-1 illustrates a three-segment Frame Relay connection. The MGX 8230 requirements are:

1. For MGX 8230 feeders, the backbone must consist of MGX 8000 series or BPX 8600 series switches.
2. On a feeder, the local segment exists between a service module and the MGX 8230 PXM.
3. On a stand-alone node, the local segment can be between a service module and the uplink port on the MGX 8230 PXM.
4. For the local segment, add the connection at only the master endpoint. The generic syntax is:

   addcon <*local parameters*> <*remote parameters*>

   where *local parameters* are the port, DLCI or VPI and VCI, and mastership status (master in this case). The *remote parameters* are the current nodename, slot, port, and VPI and VCI of the slave end. For the MGX 8230 PXM endpoints, specify the slot number as 0. The **addcon** command is the only command in which you specify the slot number for the MGX 8230 PXM as 0.

Figure 6-1 Frame Relay Connection Through an MGX 8230/BPX Network



The 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 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. Refer to the section "Configuring Synchronization for the Shelf" 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, execute 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 section titled "Bit Error Rate Testing Through an MGX-SRM-3T3."

Configuring Synchronization for the Shelf

This section defines the clock sources for the MGX 8230, 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 remains so until you specify a different clock source. 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 PXM1's 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 have been configured, you can configure the clock sources through the CiscoView application or the CLI. If you use the CLI, execute **cnfclksrc** on the active PXM1 one time for each clock source:

cnfclksrc <*slot.port*> <*clktyp*>

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 inband 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.

The value for **clktyp** is 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 primaries 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, execute the following two 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 Check the configuration by executing **dspclksrc**.

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 can be 1 for T1 or 2 for E1. *Impedance* can be 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*>

The *level* can be 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.

Refer to the section titled "Sequence of Configuration Tasks, page 6-2" for background information on these types of tasks.

Step 1 Optionally, you can modify the resource partitioning for the whole card by executing **cnfcdrscprtn**. You can view resource partitioning through **dspcdrscprtn**.

cnfcdrscprtn <*number_PAR_conns*> <*number_PNNI_conns*> <*number_TAG_conns*>

- *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, you could reserve 10,000 connections for each controller on a PXM1 with:

cnfcdrscprtn 10000 10000 10000

Step 2 Activate a line by executing **addln**:

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* is the slot number for the PXM1. If the switch has a redundant pair of SRMs, execute **addln** again for those slots.

- *line* has the range 1–4 but 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 using **cnfln**.

Step 4 Configure logical ports for the physical line by executing **addport**. Execute **addport** 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* is 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* is the line number in the range 1–4 but depends on the type of uplink card.
- *pct_bw* is the percentage of bandwidth. The range is 0–100. This parameter applies to both ingress and egress.
- *min_vpi* is the minimum VPI value. On a feeder, the range is 0–4095. On a stand-alone node, the range is 0–255.
- *max_vpi* is the maximum VPI value. On a feeder, the range is 0–4095. On a stand-alone node, the range is 0–255.

Using an example of 100% of the bandwidth on one logical port 1:

addport 1 1 100 1 200

where 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; and the VPI range is 1–200.

Step 5 If necessary, use **cnfportrscprtn** 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* is the logical port number in the range 1–32 for user-connections or 34 for inband ATM PVCs for network management.
- *controller* is a string identifying the network controller—"PAR," "PNNI," or "TAG."
- *ingress_%BW* is the percentage of ingress bandwidth in the range 0–100.
- *egress_%BW* is the percentage of egress bandwidth in the range 0–100.
- *min_vpi* is the minimum VPI in the range 0–4095.
- *max_vpi* is the maximum VPI in the range 0–4095.
- *min_vci* is the minimum VCI in the range 0–65535.
- *max_vci* is the maximum VCI in the range 0–65535.
- *max_chans* is the maximum GLCNS in the range 0–32767.

Step 6 On a stand-alone node, specify the cell header type as needed by executing **cnfatmln**.

cnfatmln <*line_num*> <*type*>

- *line_num* is the line number in the range 1–4.
- *type* is either 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 **cnfatmln** usually 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 8230 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, see the *Cisco MGX 8230 Wide Area Edge Switch 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 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 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 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*>

where *workline* and *workingslot* identify the line and slot of the APS working line, and *protectionline* and *protectionslot* identify the protection line and slot. According to GR-253, the *archmode* identifies the type of APS operation. The mode definition includes:

1. 1+1 on one back card
2. 1+1 on two back cards
3. 1:1
4. 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 has 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 "Rules for Adding Connections" earlier in this chapter). 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, use **addchan** to add a connection and **cnfchan** 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 Execute the **addcon** command according to the following syntax:

addcon <*port_num*> <*conn_type*> <*local_VPI*> <*local_VCI*> <*service*> [*CAC*] [*mastership*] [*remoteConnId*]

- *port_no* is the logical port in the range 1–32 for a user connection or 34 for a management connection.
- *conn_type* is a number identifying the connection type—1 for VPC or 2 for VCC.
- *local_VPI* is the local VPI in the range 0–4095.
- *local_VCI* is the local VCI in the range 0–65535.
- *service* is a number in the range 1–4 to specify the type of service: 1=CBR, 2=VBR, 3=ABR, and 4=UBR.
- (Optional) *CAC* lets you turn off the loading effect of a connection on the aggregated load on a port.
- *mastership* specifies whether the endpoint you are adding is the master or slave: 1=master. 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, so 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 using **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* is 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* is 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 cost.
- *restrict_trunk_type* is 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* optionally lets you turn on or off the addition of the loading effect of a connection to the aggregated load on a port.

Step 3 As needed, specify usage parameter control according to the connection type. Use 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* is the policing type. The choices are 4 or 5. See Table 6-1 for a description of these types.
- *pcr* is the peak call rate in the range 50–1412832 cps.
- *cdvt* is the cell delay variation tolerance in the range 1–5000000 microseconds.
- *IngPcUtil* is the percentage of utilization on the ingress. The range is 1–100.
- *EgSrvRate* is the egress service rate. The range is 50–1412832 cps.

- *EgPcUtil* is 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*> <*mbs*> <*IngPcUtil*> <*EgSrvRate*> <*EgPcUtil*>

- *conn_ID* identifies the connection. The format is *port.vpi.vci*.
- *polType* is the policing type in the range 1–5. See Table 6-1 for a list of these types.
- *pcr* is the peak call rate in the range 50–1412832 cps.
- *cdvt* is the cell delay variation tolerance in the range 1–5000000 microseconds.
- *scr* is the sustained cell rate. The range is 50–1412832 cps.
- *mbs* is the maximum burst size. The range is 1–5000000 cells.
- *IngPcUtil* is the percentage of utilization on the ingress. The range is 1–100.
- *EgSrvRate* is the egress service rate. The range is 50–1412832 cps.
- *EgPcUtil* is 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* is the policing type. The range is 3–5. See Table 6-1 for a list of these types.
- *pcr* is the peak call rate in the range 50–1412832 cps.
- *cdvt* is the cell delay variation tolerance in the range 1–5000000 microseconds.
- *IngPcUtil* is 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	n/a
CBR *polType*=5	When policing=5 (off)	off	n/a	off	n/a
UBR *polType*=3	UBR.1 when CLP setting=no	CLP(0+1)	no	off	n/a
UBR *polType*=4	UBR.2 when CLP setting=yes	CLP(0+1)	no	CLP(0)	yes
UBR *polType*=5	Policing is off	off	n/a	off	n/a
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

Table 6-1 Policing Definitions According to Policing and Connection Type (continued)

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)
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	n/a
VBR and ABR *polType*=5	Policing is off	off	n/a	off	n/a

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

The ATM Universal Service Modules (AUSM) include the following features:

- ATM UNI with high port-density for the CPE—with AUSMs in all 8 service module slots, an MGX 8230 shelf can support up to 64 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* x T1 or *N* x E1 logical ports up to maximum rates of 12 Mbps for T1 or 16 Mbps for E1.
- Classes of Service—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 section titled “Bit Error Rate Testing Through an MGX-SRM-3T3.”
- 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, see Adding and Configuring Connections on the AUSM/B, page 6-17.

On the CLI of the AUSM/B:

Step 1 If necessary, modify the resource partitioning for the whole card by executing the **cnfcdrscprtn** command. You can view resource partitioning through **dspcdrscprtn**.

cnfcdrscprtn <*number_PAR_conns* | *number_PNNI_conns* | *number_TAG_conns*>

- *number_PAR_conns* is the number of connections in the range 0–1000 for PAR.
- *number_PNNI_conns* is the number of connections in the range 0–1000 for PNNI.
- *number_TAG_conns* is the number of connections in the range 0–1000 for MPLS.

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 using **addln** for each of the eight lines as needed:

addln <*line_number*>

Step 3 Optionally, use the **cnfln** command to specify line coding, line length, and clock source:

cnfln <*line_num*> <*line_code*> <*line_len*> <*clk_src*> [*E1-signaling*]

Step 4 Execute **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, execute **cnfportq** to modify the egress queues:

cnfportq <*port_num*> <*q_num*> <*q_algo*> <*q_depth*> <*clp_high*> <*clp_low*> <*efci_thres*>

- *port_num* is the logical port number in the range 1–8.
- *q_num* is the queue number in the range 1–16; 0 is the default for **addchan**.

  1=CBR
  2=VBR
  3=ABR
  4=UBR

- *q_algo* is a 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* is the maximum queue depth in the range 1–16000 cells.
- *clp_high* is the high cell loss priority in the range 1–16000 cells.
- *clp_low* is the low cell loss priority in the range 1–16000 cells.
- *efci_thres* is the EFCI threshold in the range 1–16000 cells.

Step 6 If necessary, configure resources at the port level by executing **cnfportrscprtn**. Use **dspportrscprtn** to see the current resource partitioning.

cnfportrscprtn <*port_num*> <*controller*> <*ingress_%BW*> <*egress_%BW*> <*number_of_cons*> <*VPImin/VPImax*> [*VCImin/VCImax*]

- *port_num* is the port number in the range 1–8.
- *controller* is a number representing the controller: 1=PAR, 2=PNNI, and 3=MPLS.
- *ingress_%BW* is the percentage of ingress bandwidth in the range 0–100.
- *egress_%BW* is the percentage of egress bandwidth in the range 0–100.
- *number_of_cons* is the maximum number of connections on the port.
- *VPImin/VPImax*is the minimum and maximum VPI numbers.
- *VCImin/VCImax* is the 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 necessary.

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* is a number for IMA group. The range is 1–8.
- *port_type* is the port type: 1=UNI, 2=NN1.
- *list_of_links* is the list of links to be included in the group. Separate each link number by a period.
- *minNumLink* is the minimum number of links in the range 1–8 to form a group.

For example: the following 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 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 "Rules for Adding Connections" earlier in this chapter.

On the CLI of the AUSM/B:

Step 1 Execute 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**, for example. To see the channel number after you add a connection, use **dspcons**.

The **addcon** syntax is:

addcon <*port_number*> <*vpi*> <*vci*> <*ConType*> <*SrvType*> [*Controller_Type*] [*mastership*] [*remoteConnID*]

- *port number* is in the range 1–8.
- *vpi* has a value in the range 0–255.
- *vci* can be in the range 0–65535 for a VCC or * for a VPC.
- *Conn type* is the connection type: 0=VCC, and non-0 is the local ID of a VPC in the range 1–1000.
- *Service Type* is the service type: 1=CBR, 2=VBR, 3=Standard ABR, 4=UBR, 5=rt-VBR, and 6=ForeSight ABR.
- *mastership* is the mastership status of the endpoint: 1=master, and 2=slave. The default is slave, so you actually do not need to type a 2.
- *Controller_Type* is the optional controller specification: 1=PAR (the default}. 2=SPVC (PNNI).
- *connID* is entered at only the master end and consists of the node name, slot number, port number, vci, and vpi of the slave 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**. Use **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* is the UPC enable: 1=disable, 2=enable.
- *pcr*[0+1] is 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.
- *cdvt*[0+1] is the cell delay variation tolerance for cells with CLP=0 and CLP=1. The range is 1–250000 microseconds.
- *IngPcUtil* is the percent utilization on the ingress. The range is 1–127. The default is 0.

- *EgSrvRate* is the 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* is the 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* is the enabled/disable for UPC: 1=Disable, 2=Enable.
- *pcr* is 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.
- *cdvt* cdvt[0+1] is the cell delay variation tolerance for cells with CLP=[0+1]. The range is 1–250000 micro seconds.
- *scr* is 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* specifies the type of scr policing: 1= CLP[0] cells, 2=CLP[0+1] cells, and 3=no SCR policing.
- *mbs* is the maximum burst size: the range is 1–5000 cells.
- *IngPcUtil* is the percent utilization on the egress. The range is 1–127. The default is 0.

- *EgSrvRate* is the 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* is the percent utilization on the ingress. The range is 1–127. The default is 0.
- *clp_tag* is the enable for CLP tagging: 1=disable, 2=enable.

cnfupcubr <*port.vpi.vci*> <*enable*> <*pcr*[0+1]> <*cdvt*[0+1]> <*IngPc*> <*util*> <*clp_tag*>

- *port.vpi.vci* identifies the connection.
- *enable* is the enabled/disable for UPC: 1=Disable, 2=Enable.
- *pcr* is the 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* cdvt[0+1] is the cell delay variation tolerance for cells with CLP=[0+1]. The range is 1–250000 micro seconds.
- *scr* is the 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.
- *scr_police* specifies the type of scr policing: 1= CLP[0] Cells, 2=CLP[0+1] cells, and 3=no SCR policing.
- *mbs* is the maximum burst size: the range is 1–5000 cells.
- *IngPc* is the percent utilization on the ingress. The range is 1–127. The default is 0.
- *clp_tag* is the enable for CLP tagging: 1=disable, 2=enable.

Step 3 Use **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* is the enabled/disable for the ForeSight feature: 1=disable, 2=enable.
- *fgcra_enable* is the enabled/disable for the Frame-based generic cell rate algorithm: 1=disable, 2=enable.
- *ibs* is the initial burst size in the range 0–5000 cells.
- *pcr* is the 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* is the 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* is the 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 Use **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:

- 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)
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.	500msec.
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* is either 1 for CLP hysteresis or 2 for Frame-based.
- *vc_q_depth* is the ingress queue depth in the range 1–16000 cells.
- *clp_thresh_high* is the CLP high threshold in the range 1–16000 cells.
- *clp_thresh_low* is the CLP low threshold in the range 1–16000 cells for CLP hysteresis-based discard.
- or
- *epd_threshold* or is the EPD threshold in the range 1–16000 cells Frame-based discard.
- *efci_thresh* is the 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 8230 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 2-20 for more information on the features of the FRSM 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

This section contains a summary of the features common to all FRSM models. The following sub-sections also 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. The FRSM supports a:
  - 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.
- The 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 8800 series 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 forthcoming section titled "Bit Error Rate Testing on an Unchannelized T3 or E3 FRSM." 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 section titled "Bit Error Rate Testing Through an MGX-SRM-3T3."
- 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 and FRSM-8T1 and FRSM-8E1 cards

MGX-FRSM-2CT3 Features

The specific features are:

- 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 Features

The specific features are:

- 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 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)
- 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 Features

The specific features are:

- 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 NxT1 and NxE1 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

MGX-FRSM-HS1/B Features

The specific features and characteristics are:

- 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 operating card as either X.21 or V.35
- Maximum of 8 Mbps per line
- Choice of DTE or DCE mode for each line
- A 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 (through **cnfln** on the CLI, for example) 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 Features

The specific features are:

- Up to 1000 user-connections.
- 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 N x 64 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 in this chapter.
- 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 of how to set up a connection through the WAN Manager GUI, refer to the *Cisco WAN Manager Operations* manual.

This section contains information on the following:

Configuring the FRSM Cards, Lines, and Ports

This section describes how to configure card-level parameters—including Y-cable redundancy where applicable, physical lines, and logical ports on the FRSM-series cards.

Step 1 If necessary, modify the resource partitioning for the whole card by executing the **cnfcdrscprtn** command. You can view resource partitioning through **dspcdrscprtn**.

cnfcdrscprtn <*number_PAR_conns* | *number_PNNI_conns* | *number_TAG_conns*>

number_PAR_conns is the number of connections in the range 0–1000 available to the PAR controller.

number_PNNI_conns is the number of connections in the range 0–1000 available to a PNNI controller.

number_TAG_conns is the 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, use 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 using **cnfln**.

To change the line parameters on an MGX-FRSM-2CT3 or MGX-FRSM-2T3E3, use **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* has the range 1–4.
- *line_type* is a 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* is a 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 6-2 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

Table 6-2 Supported Lines Rates on the MGX-FRSM-HS1/B

1–50 Correspond to Line Rates in Kbps.				
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 **cnfln** are:

- One or more parameters are invalid.
- Line does not exist (has not been added).
- Loopback or BERT is on.
- An 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), execute **addport** 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 "Adding a Frame Relay Connection." 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* is the 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 that the maximum committed information rate (CIR) on each line for these cards is from 1 to 44210000 bps for MGX-FRSM-2T3, from 1 to 34010000 bps for MGX-FRSM-2E3, and from 1 to 51840000 bps for MGX-FRSM-HS2. Specify CIR with **addcon** (or **addchan** if necessary).
- *line_num* is the physical line number in the range 1–2.
- *port_type* is a 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* is the 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* is the 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* is a number representing the DS0 speed: 1 for 56 Kbps or 2 for 64 Kbps.
- *begin_slot* is the 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* is the 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* is a 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-in1 back card type between support for x.21 and v.35.

addport <*port_num*> <*port_type*>

- *port_num* is the port number in the range 1–4.
- *port_type* is a number representing the type of frame interface technology for the logical port: 1 for Frame Relay; 2 for FUNI mode-1a; or 3 for 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* is the logical port number in the range of either 1–192 for T1 or 1–248 for E1. 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 line through the other **addport** parameters.)
- *line_num* is the physical line number in the range 1–8.
- *ds0_speed* is a number representing the DS0 speed: 1 for 56 Kbps or 2 for 64 Kbps.
- *begin_slot* is the 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* is the consecutive DS0s that each connection on *port_num* has.
- *port_type* is a 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 Modify as needed the signaling on a port by executing cnfport.

cnfport <*port_num*> <*lmi_sig*> <*asyn*> <*elmi*> <*T391*> <*T392*> <*N391*> <*N392*> <*N393*>

- *port_num* is the logical port number with a range that depends on the type of FRSM:
  - For the MGX-FRSM-2CT3, 1–56.
  - For a channelized AX-FRSM-8T1, 1–192.
  - For a channelized AX-FRSM-8E1, 1–248.
  - For the unchannelized cards, the range equals the number of lines.
- *lmi_sig* specifies the LMI signaling. 1=Other, 2=None, 3=StrataLMI, 4=AnnexAUNI, 5=AnnexDUNI, 6=AnnexANNI, 7=AnnexDNNI LMI signaling, N=none, S=StrataLMI, and au=AnnexAUNI.
- *asyn* enables asynchronous updates: (y)es or (n)o.
- *elmi* enables Enhanced LMI: (N or n) disable (Y or y) enable.
- *T391* sets the T391 timer. The range is 5–30 seconds. It sets the interval in seconds for NNI status polling. The default is 10.
- *T392* sets the T392 timer. The range is 5–30 seconds. It sets the interval in seconds for UNI status polling. The default is 15.
- *N391* sets the N391 counter (the number of UNI/NNI polling cycles). The range is 1–255. The default is 6.
- *N392* sets the N392 counter (the threshold for UNI/NNI *errors).* The range is 1–10. The default is 3.
- *N393* sets the N393 counter (the UNI/NNI threshold for monitored events). The range is 1–10 and must be greater than the value of N392. The default is 4.

Step 6 Configure resources for the port as needed by executing **cnfportrscprtn**. To see the partitioning, use **dspportrscprtn**. The description has a high- and low-bandwidth version:

cnfportrscprtn <*port_num*> <*controller*> <*percent BW*> <*low DLCI*> <*high DLCI*> <*max LCN*>

For serial FRSM cards:

- *port_num* is the port number in the range 1–2 for MGX-FRSM-2T3E3 and MGX-FRSM-HS2, 1–4 for MGX-FRSM-HS1/B, or 1–256 for MGX-FRSM-2CT3.
- *controller* is a number representing the controller: 1=PAR, 2=PNNI, and 3=Tag.
- *percent BW* is the percentage of the bandwidth in the range 0–100 and applies to both egress and ingress.
- *low DLCI* is in the range 0–1023.
- *high DLCI* is in the range 0–1023.
- *max LCN* is the maximum number of logical connections available to the controller on this port. The ranges are 1–4000 for MGX-FRSM-2CT3, and 1–2000 for MGX-FRSM-2T3E3 and MGX-FRSM-HS2.

For AX-FRSM-8T1 or AX-FRSM-8E1:

- *port_num* is the logical port number in the range 1–192 for T1 or 1–248 for E1.
- *controller-name* is PAR, PNNI, or TAG.
- *percent BW* is the percentage of the bandwidth in the range 0–100 and applies to both egress and ingress.
- *low DLCI* is in the range 0–1023.
- *high DLCI* is in the range 0–1023.
- *max LCN* is the maximum number of logical connections available to the controller on this port. The range is 1–1000.

Note The following step applies to Y-cable redundancy for the MGX-FRSM-2T3E3. For 1:N redundancy on the eight-port FRSMs, refer to "Redundancy Support by the MGX-SRM-3T3/C."

Adding a Frame Relay Connection

This section describes how to add a Frame Relay connection 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 "Rules for Adding Connections" earlier in this chapter.

Step 1 Add a connection by using **addcon**. If the application requires the NSAP form for the endpoint, use **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, use **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* is the logical port number on the MGX-FRSM-2CT3 in the range 1–256. On the MGX-FRSM-2T3E3 and MGX-FRSM-HS2, the range is 1–2. (See **addport** step if necessary.)
- *DLCI* is the DLCI number in the range 0–1023 (2CT3/2T3/2E3/HS2).
- *cir* is the committed information rate in one of the following ranges: for 2CT3, 1–1536000 bps; for 2T3, 1–44210000 bps; 2E3, 1–34010000 bps; and for HS2, 1–51840000 bps.
- *chan_type* specifies the type of connection: 1=NIW; 2=SIW-transparent mode; 3=SIW with translation; 4=FUNI; and 5=frame forwarding.
- *egress_service_type* is a number that specifies the type of queue on the egress: 1=high priority; 2=real-time VBR, 3=nonreal-time VBR; 4=ABR; and 5=UBR.
- *CAC* optionally enables connection admission control: 1=enable; 2=disable (default). With CAC enabled, the system adds the resource consumption represented by adding the connection to the total resources consumed on a logical port.
- *controller_type* is the controller type for signaling connections: 1 (the default) specifies a PVC and applies to PAR; 2 specifies a SPVC and applies to PNNI.
- *mastership* indicates if this end of the connection is master or slave: 1=master, 2=slave.
- *connID* is the connection identifier at the remote end. It appears in the syntax as an optional parameter because it is mandatory only when you add the connection at the master end. See "Rules for Adding Connections" at the beginning of this chapter. *connID* can have one the following formats according to the slave endpoint:

  Nodename.SlotNo.PortNo.DLCI

  Nodename.SlotNo.PortNo.ControllerId.DLCI

  Nodename.SlotNo.PortNo.VPI.VCI for ATM endpoint
- *controllerID* is a number indicating the type of network control application: 1=PAR, 2=PNNI, 3=MPLS.

For AX-FRSM-8T1 and AX-FRSM-8E1:

addcon <*port*> <*DLCI*> <*cir*> <*chan_type*> [*CAC*] <*controller_type*> <*mastership*> <*remoteConnID*> <*serv_type*>

- *port* is the logical port number in the range 1–192 for T1 or 1–248 for E1. (See **addport** step if necessary.)
- *DLCI* is the DLCI number in the range 0–1023.
- *cir* is the committed information rate in one of the following ranges: for T1, 0–1536000 bps for T1; for E1, 0–2048000 bps.
- *chan_type* specifies the type of connection: 1=NIW; 2=SIW-transparent mode; 3=SIW with translation; 4=FUNI; and 5=frame forwarding.
- *CAC* optionally enables connection admission control: 1=enable; 2=disable (default).
- *controller_type* is the controller type for signaling: 1=PVC (PAR), the default, 2=SPVC (PNNI).
- *mastership* indicates if this end of the connection is master or slave: 1=master, 2=slave.

- *remoteConnID* is the connection identifier at the remote end and can have one the following formats according to the type of card at the slave endpoint:

  NodeName.SlotNo.PortNo.DLCI

  NodeName.SlotNo.PortNo.ControllerId.DLCI

  Note ControllerId is a number indicating the type of network control application: 1=PAR, 2=PNNI, 3=TAG.

  NodeName.SlotNo.PortNo.VPI.VCI for ATM endpoint

  If the remote end is a PXM1, the port number can be in the range 1–32 for user connections or 34 for inband management connections (stand-alone node only).

- *serv_type* is the Channel Service Type: 1=high priority, 2=rt-VBR, 3=nrtVBR, 4=fstABR, 5=uBR, 9=stdABR

The *Channel Service Type* is used to provide the default egress queue mapping and PXM1 Service Type mapping:

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* is the logical port in the range 1–4.
- *DLCI* is the DLCI in the range 0–1023.
- *CIR* specifies the committed information rate. The range is 1–10000000 bps (although the V.35 version supports a maximum of 8 Mbps sustained).
- *chan_type* is a number that identifies the channel type: 1=NIW; 2=transparent SIW; 3=SIW with translation; 4=FUNI; 5=frame forwarding.
- *CAC* enables connection admission control.
- *Controller_type* identifies the network control application. The only valid type is the default of 1 (PAR).
- *mastership* indicates the mastership status for this end of the connection: 1=master; 2=slave.
- *connID* is the "remote" connection identifier from the slave end if you need to enter it at the master end. See "Rules for Adding Connections" for an explanation. The possible formats are:
  - *NodeName.SlotNo.PortNo.DlCI*
  - *NodeName.SlotNo.PortNo.ControllerId.DlCI* for Frame Relay end point.

– *NodeName.SlotNo.PortNo.VPI.VCI* for ATM end point.

Where *ControllerId* can be 1 (PAR), 2 (PNNI), or 3 (TAG)

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* is the channel (connection) number. The ranges are:
  - 2CT3, 16–4015
  - 2T3, 2E3, HS2, 16–2015
  - HS1, 16–215
  - T1, E1, 16–1015
- *chanType* is a 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* is a 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* is a 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* is a 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, use **dspchstats** as needed.

Step 5 Use **cnfchanstdabr** to configure the parameters for standard ABR (TM 4.0), if necessary:

cnfchanstdabr <Port.DLCI/CHAN_NUM> <mcr> <pcr> <icr> <rif> <rdf> <nrm> <trm> <tbe> <frtt> <adtf> <cdf>

Please note the following:

- 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** 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>

Variable	Description	Value range	Default value
mcr	Minimum Rate	Valid value range from 10 to 10,000 (includes RM cell and Data cell bandwidth).	Derived from CIR
pcr	Peak 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.	500msec
cdf	Cutoff Decrease Factor	Valid value range from 0 to 64 (power of 2).	16

Step 6 Use **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. Execute **addcon** at *one* of the BPX 8600 series nodes, as follows.

- For slot and port number, specify slot and port of the BXM connected to MGX 8230 node.
- For VPI and VCI, specify the VPI and VCI at the endpoint on the PXM1.
- For Nodename, use 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 8230 node at the far end. Specify the VPI as the slot number of the remote MGX 8230 FRSM connected to the BPX 8600 series switch, and specify VCI as the LCN of the Frame Relay connection at the remote MGX 8230 node.
- Specify the type of connection. Enter ATFST if the ForeSight feature is operating and ATFR if this feature is not operating.

Specify the other **addcon** 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 preceding MCR and PCR formulae are predicated on a relatively small frame size of 100 octets, and even smaller frame sizes can result in worst-case scenarios. For example:

For a frame size of 64 octects the PCR formula becomes:	PCR=AR * 2/512 cells per sec
For a frame size of 43 octects the PCR formula becomes:	PCR=AR * 2/344 cells per sec

% Util should be set to the same value as that used for the Frame Relay segments of the connection.

Test Commands for the FRSMs

To check the state of cards, lines, ports, queues, and connections, use the display commands (**dsp**...) and **addchanloop**. The following commands are available for testing the FRSMs (see 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. Use 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. See the *MGX 8800 Series Command Reference* for syntax and alarm descriptions.

Bit Error Rate Testing on an Unchannelized T3 or E3 FRSM

The MGX 8230 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 8230 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)

See the *Cisco MGX 8230 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 8230 shelf.

Features

The MGX-CESM-T3 or MGX-CESM-E3 provide the following:

- Unstructured data transfer at 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 significance of the different types of alarms appears in Table 6-3.

Table 6-3 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		n/a	n/a	Not applicable
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. If necessary, refer to the section titled "Sequence of Configuration Tasks, 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, use 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** on the CLI).
- Optionally modify resource partitioning at the card level (**cnfcdrscprtn**)
- Activate a physical line (**addln** on the CLI) and optionally configure the line (**cnfln**) for line coding, line length, and clock source
- Activate the functioning of the logical port on a physical line (**addport**)
- Optionally modify resource partitioning at the port level (**cnfportrscprtn**)
- Add the connections by using **addcon** (or **addchan** if NSAP addressing is necessary)
- Configure the connection for CDVT, cell loss integration period, and egress buffer size by using **cnfcon** (or **cnfchan** 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 CiscoView documentation. The command sequence is:

Step 1 **addln** <*line number*>

where *line number* is 1. You can modify line characteristics with **cnfln**.

Step 2 Optionally execute **cnfln** to modify line characteristics:

cnfln <*line_num*> <*line_code*> <*line_len*> <*clk_src*>

- *line_num* is 1
- *line_code* is a number to specify line coding: 1 for B3ZS (T3); and 2 for HDB3 (E3)
- *line_len* is a number that specifies the line length: 1 for up to 225 feet; 2 for more than 225 feet
- *clk_src* is a number that specifies the clock source: 1 for local clock sourced on the PXM1; 2 for looped clock

Step 3 Use **dspln** or **dsplns** to check the line. For **dspln**, the valid line number is 1.

Step 4 Create a logical port with **addport**:

addport <*port_num*> <*line_num*>

- *port_num* is the logical port number and is always 1
- *line_num* is the number of the physical line and is always 1

Step 5 Configure resources at the port level as needed by executing **cnfportrscprtn**:

cnfportrscprtn <*port_num*> <*controller_name*>

- *port_num* is the logical port number and is always 1
- *controller_name* is 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, so you must change to the PXM1 CLI to execute them:

addred <*redPrimarySlotNum*> <*redSecondarySlotNum*> <*redType*>

- *redPrimarySlotNum* is the slot number of the primary card. The possible numbers are 1–6, 9–14, 17–22, and 25–30.
- *redSecondarySlotNum* is the slot number of the primary card. The possible numbers are 1–6, 9–14, 17–22, and 25–30.
- *redType* is 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 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 “Rules for Adding Connections” earlier in this chapter. 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.
On the CESM CLI:

Step 1 Add a connection by executing **addcon**. (Alternatively, you can use **addchan** if your application requires the NSAP format of end-point specification.) Execute **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* is 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* is 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 execute **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 use **cnfcon** to modify the connection.

cnfcon <*port_num*> <*CDVT*> <*CellLossIntegPeriod*> <*bufsize*>

- *port_num* is the port number and is always 1.
- *CDVT* is 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.
- *CellLossIntegrPeriod* is the amount of time a connection can be in an error condition before an alarm is declared. The range is 1000–65535 milliseconds.
- *bufsize* is 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 use **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_number* is the channel (connection) number and is always 32.
- *mastership* specifies 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* selects 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* is 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* is 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* is 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* is the peak cell rate in cells per second (cps). For T3, the maximum is 118980 cps. For E3, the maximum is 91405 cps.
- *mcr* is the minimum cell rate. The range is 1–65535 cells per second.
- *pct_util* is 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 execute the commands in the order they appear in the following list. You can execute **dspdsx3bert** before, during, or after a session. Because the order of execution 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 execute this command at any time.

See 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* x 64 Kbps, fractional DS1/E1 service (contiguous time slots only). You can map an *N* x 64 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.
- A choice of partial-fill payload sizes.
- Idle detection and suppression for 64Kbps CAS connections.
- 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 or logical port. For a description of the BERT functions, see the section titled "Bit Error Rate Testing Through an MGX-SRM-3T3."

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 section "Bit Error Rate Testing Through an MGX-SRM-3T3."

Cell Delay Treatment

For each connection, you can configure a tolerable variation in the cell arrival 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 "Service Resource Module" for more details. In general:

- 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 6-4.

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 ATM-Forum CES-IS V 2.0
Receive RAI	Yellow	None	None	

Table 6-4 CESM Errors and Alarms (continued)

Error	Alarm Type	Down stream	Up Stream	Comments
Receive LOF		n/a	n/a	
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 using **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 **addln** <*line number*>

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* is a line number in the range 1–8
- *line_code* is a number that specifies the line coding: 2=B8ZS (T1); 3=HDB3 (E1); and 4=AMI (T1/E1)
- *line_len* is the line length: 10-15 for T1; 8 for E1 with SMB line module; 9 for E1 with RJ-48 line module
- *clk_src* is a number specifying the clock source: 1 for loop clock; 2 for local clock

- *E1-signallin*g specifies the E1 signalling. The possible entries are
  - CAS, which specifies CAS and no CRC
  - CAS_CRC, which specifies CAS with CRC
  - CCS, which specifies CCS and no CRC
  - CCS_CRC, which specifies CCS with CRC
  - CLEAR: CLEAR channel

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*>

- *port_num* is the logical port number in the range 1–192 for T1 or 1–248 for E1
- *line_num* is the number of the physical line in the range 1–8
- *begin_slot* is the beginning timeslot number in the frame: for T1, 1–24; For E1 2–32 with CCS signalling or 2–16 and 17–32 with CAS signalling
- *num_slot* is the number of timeslots in the frame for the current port (*port_num*)
- *port_type* is: 1=structured 2=unstructured; 3=framing on VC disconnect

Step 4 Configure resources at the port level as needed by executing **cnfportrscprtn**:

cnfportrscprtn <*port_num*> <*controller_name*>

- *port_num* is the logical port number in the range 1–192 for T1 or 1–248 for E1.
- *controller_name* is 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 "Redundancy Support for the Eight-Port CESM." On the CLI of the PXM1, execute **addlink** for bulk distribution (T1 only) before you execute **addred** for redundancy. To configure bulk distribution:

Execute **addlink** to create the links:

addlink <*T3 line number*> <*T1 line number*> <*Target Slot number*> <*Slot line number*>

- *T3 line number* is the 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* is the starting T1 line number within the T3 line. The range for the T1 line number is 1–28.
- *Target Slot number* is slot number for the T1 service module.
- *Slot line number* is T1 line number in the range 1–8.

Execute **addred**:

addred <*redPrimarySlotNum*> <*redSecondarySlotNum*> <*RedType*>

- *redPrimarySlotNum* is 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, 26, or 26.
- *redSecondarySlotNum* is 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, 26, or 26.
- *RedType* is 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 "Rules for Adding Connections" earlier in this chapter. 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. On the CESM CLI:

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.)

Execute **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 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, use **dspcons**.

The syntax for **addcon** is:

addcon <*port_num*> <*sig_type*> <*partial_fill*> <*cond_data*> <*cond_signalling*> [*controller_type*] [*mastership*] [*remoteConnId*]

- *port_num* is the logical port number. This port must already exist (see **addport**).
- *sig_type* is a number indicating the type of signalling: 1 specifies basic signalling, 2 specifies E1 CAS, 3 specifies ds1SFCAS (DS1 Superframe CAS), and 4 specifies ds1ESFCAS (DS1 Extended Superframe CAS).
- *partial_fill* is a number representing the number of bytes in a cell. It can be either 0 to specify that the cell must contain 48 bytes or a non-0 value that fixes the number of bytes in each cell. For structured E1, the *partial_fill* range is 20–47 bytes. For structured T1, the range is 25–47 bytes. Unstructured T1 or E1 can be 33–47 bytes.
- *cond_data* is the conditioning data in case of loss of signal (LOS). It is always 255 for unstructured data transfer or 0–255 for structured data transfer. For a voice connection, the larger the *cond_data* value, the louder the hiss heard in case of LOS.

- *cond_signalling* is the string of condition signaling bits that you specify with a decimal number in the range 0–15, where, for example, 15=1111, and 0=0000. These bits represent the ABCD signalling to the line or network when an underflow occurs.
- *mastership* indicates whether this end-point is the master or slave; 1=master; 2=slave (default).
- *remoteConnId* is the identification for the connection at the slave end. The format is *switchname.slot_number.port_number.vpi.vci*.

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*> <*isenable*> <*exttrigis*>

- *port_num* is the port number.
- *CDVT* is a tolerable variation for the arrival time of cells. For T1, the range is 125–24000 microseconds. For E1, the range is 125–26000 microseconds. Both require 125-microsecond increments.
- *CLIP* is CellLossIntegrationPeriod, an amount of time a connection can be in an error condition before an alarm is declared. The range is 1000-65535 milliseconds.
- *bufsize* is the egress buffer size in bytes. These buffers are used for tolerating variations in the cell delay. The size can be automatically computed, or you can enter a specific size in bytes.
- *cbrclkmode* is the clock mode for a circuit emulation connection. The values are 1–3:1 is synchronous; 2 is SRT. 3 is adaptive; SRT and adaptive are asynchronous clocking schemes.
- *isenable* is a flag to enable the idle code (ABCD signalling bits)–based cell suppression feature on a connection. If you enable this feature, idle suppression logic is activated so that suppression begins when valid idle ABCD bits are detected. This feature is valid for only single DS0 connections. Possible values are 1 to enable and 2 to disable.
- *exttrigis* is an enable for an external idle suppression trigger. With this feature enabled, the logic forcefully suppresses cells on a single DS0 connection. Enter a 1 to disable idle suppression or a 2 to enable idle suppression.

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_number* is the connection in the range 32–279.
- *mastership* specifies 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* selects 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* is 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* is 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* is 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* is the peak cell rate.

- *mcr* is the minimum cell rate. The range is 1–65535 cells per second.
- *pct_util* is 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 section titled "Bit Error Rate Testing Through an MGX-SRM-3T3."

One SRM acts as the active SRM while the other is in standby:

- The SRM in slot 7 is always controlled by the PXM in slot 1
- The SRM in slot 14 is always controlled by the PXM in slot 2.
- The SRM is active or standby according to the state of the corresponding PXM.

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, see the *Cisco MGX 8230 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 8 card slots, so the maximum number of T1 channels it can process is 64.

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 section "Redundancy Support by the MGX-SRM-3T3/C" in this chapter.

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:

- Execute **addlink** on the active PXM1. Related commands are **dsplink** and **dellink**.
  addlink <*T3 line number*> <*T1 slot*> <*NumberOfT1s*> <*TargetSlotLineNum*>

- *T3LineNum* Line number in the format *slot.line*.
  Slot = 7 or 14
  Line range = 1–3
- *T1Slot* T1 slot number, in the range 1–28.
- *NumberOfT1s* Number of T1s, in the range 1–8.

- *TargetSlotNum* T1 service module slot number to be linked to the T1 line, in the ranges: 3–6 and 10–13.
- *TargetSlotLineNum* T1 line number in the slot to be linked, in the range 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 (the 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.

To configure redundancy through the redundancy bus:

Step 1 Execute **addred** on the active PXM1:

addred <*redPrimarySlotNum*> <*redSecondarySlotNum*> <*RedType*>

where:

- *redPrimarySlotNum* Slot number that contains the primary card of the card pair, in the ranges 4–6 or 11–13.

- *redSecondarySlotNum* Slot number that contains the secondary card of the card pair, in the ranges 4–6 or 11–13.
- *RedType* is 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 using **dspred**.

To remove redundancy, use **delred**.

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:

- 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* is 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* is 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* is 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 using **dspred**.

To remove redundancy, use **delred**.

Bit Error Rate Testing Through an MGX-SRM-3T3

The MGX 8230 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:

- A T1 or E1 line
- Fractional portions of a T1 line that add up to a DS1
- A single 56 Kbps or 64 Kbps DS0
- A DS0 bundle consisting of N x 64 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 8230 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. See the *Cisco MGX 8230 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 6-5 pattern tests and Table 6-6 for loopback tests.
- For AX-FRSM-8E1 and AX-CESM-8E1, see Table 6-7 for pattern tests and Table 6-8 for loopback tests.
- For MGX-AUSM-8T1, see Table 6-9 for pattern tests and Table 6-10 for loopback tests.
- For MGX-AUSM-8E1, see Table 6-11 for pattern and Table 6-12 loopback tests.

Table 6-5 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	n/a	in-band/ESF or metallic	all patterns

Table 6-6 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	n/a	metallic, far end, or remote

Table 6-7 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	n/a	metallic	all patterns

Table 6-8 Loopback Test for AX-FRSM-8E1 and AX-CESM-8E1

Test Medium	Medium Type	Loopback
Port	any	remote loopback
Line	n/a	metallic or remote

Table 6-9 Pattern Test for MGX-AUSM-8T1

Test Medium	Medium Type	Device to Loop	BERT Pattern
Line	n/a	in-band/ESF	all patterns

Table 6-10 Loopback Test for MGX-AUSM-8T1

Test Medium	Medium Type	Loopback
Line	n/a	far end, remote, or metallic

Table 6-11 Pattern Test for MGX-AUSM-8E1

Test Medium	Medium Type	Device to Loop	BERT Pattern
Line	n/a	none	all patterns

Table 6-12 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. Refer to the preceding tables as needed. 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 and 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 8230 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 that 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 command dspcd is entered. The alarm message indicates the failed PXM1 by slot.

Note 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

oldclrlock 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 Note: Do not use **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.

oldsplog 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.

oldclralm 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

Configure Loopback on the Entire DS3 Line

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 using **cnfln -felpbnum 30**.

Step 3 Check that **dsplog** does not show any errors or alarms logged.

Step 4 Using **dspln**, 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 using **dspln**.

Configure Loopback on All DS1s in a DS3 Line

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.

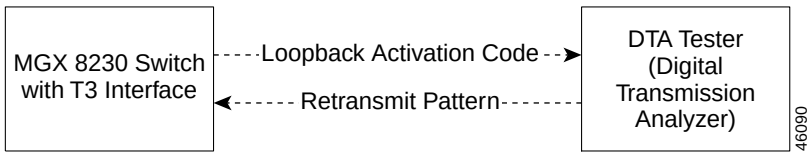
Step 4 Using **dspln**, check that *FarEndLoopbkLineNum* has been configured to be **ds1lineall**.

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

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 using **dspln -ds3** *<slot>.<port>*.

Step 3 Configure the HP cerjac tester to send a pattern to the DS3 interface of the node.

Step 4 Any pattern sent will cause the interface to put itself into loopback and the interface retransmits the same pattern back to the tester.

Step 5 From the tester, verify that the same is received back on the tester, thus validating the loopback on the DS3 interface.

Step 6 Check that **dsplog** does not show any errors or alarms logged.

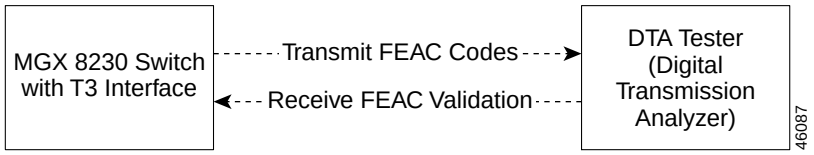
Pass Criteria:

- 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

Configure DS3 for Sending Looped or Normal Data

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 using **cnfln -felpbnum 30**.

Step 3 Configure the transmit FEAC code to be *dsx3SendNoCode* by using 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.

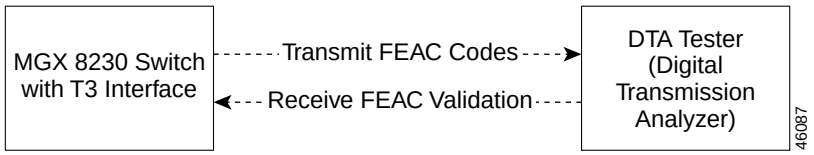
Step 6 On the tester (for example, HP cerjac tester), check that the code for *dsx3SendNoCode* has been received.

Pass Criteria:

- The **dspln** should show *LineXmtFEACCode* as *SendNoCode*.
- The code that has been transmitted is received on the tester and verified.
- No errors logged on the console or the log.

Configure DS3 to Send Line Loopback

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 using 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.

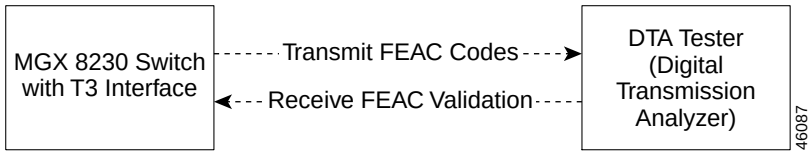
Step 6 On the tester (for example, HP cerjac), check that the code for *dsx3SendLineCode* has been received.

Pass Criteria:

- The **dspln** should show *LineXmtFEACCode* as *SendLineCode*.
- The code that has been transmitted is received on the tester and verified.
- No errors logged on the console or the log.

Configure DS3 for Sending Loopback Deactivation Request

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 using **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 (for example, HP cerjac), check that the code for *dsx3SendResetCode* has been received.

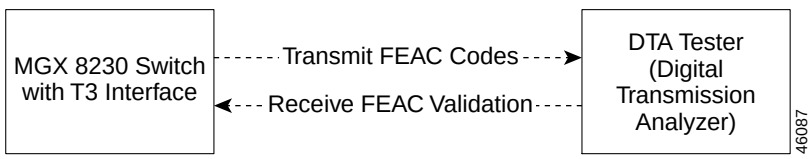
Pass Criteria:

- The **dspln** should show *LineXmtFEACCode* as *SendResetCode*.
- The code that has been 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

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 using 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*>.

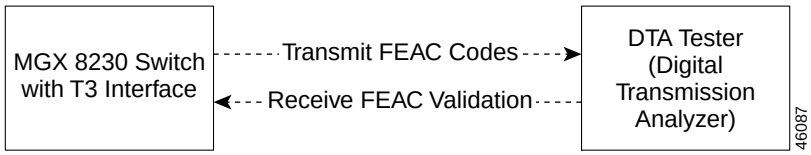
Step 4 Check that **dsplog** does not show any errors or alarms logged.

Pass Criteria:

- The **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.

Configure FEAC Validation Criteria to be FEACCodes8Of10

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 using 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.

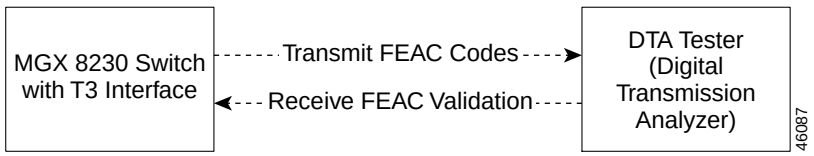
Pass Criteria:

- The **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

Disable FEAC Codes

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.

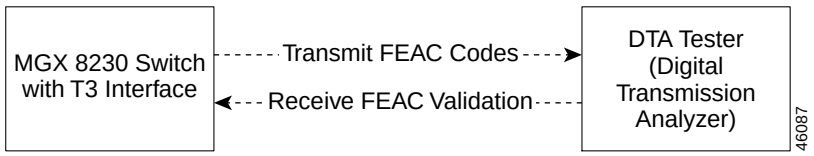
Step 6 Check that **dsplog** does not show any errors or alarms logged.

Pass Criteria:

- Disabling the FEAC validation code put the line in no loop.
- 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

To verify that DS3 loopback codes cannot be configured from the standby PXM-1 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 using CLI command, **cnfln -ds3** <*slot*>.<*port*> **-tfeac 1**.

Step 5 Check that CLI rejects the command and fails to accept it.

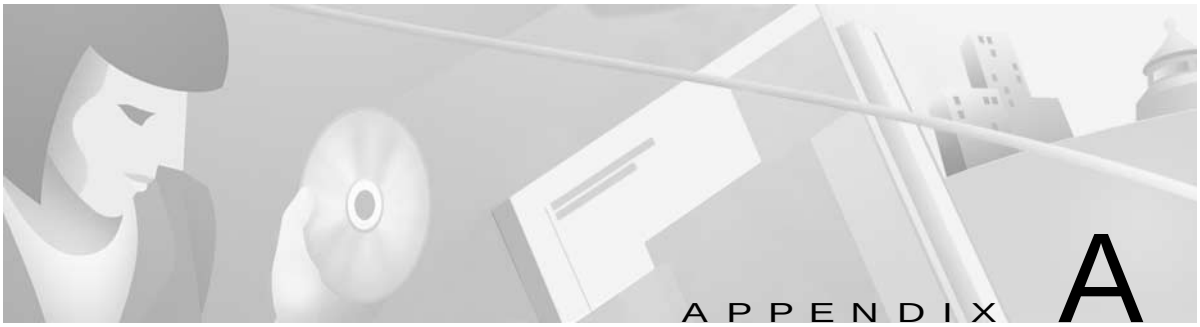
Step 6 **dsplog** shows logs an error or a alarm logged.

Step 7 On the tester (for example, HP cerjac tester), check that the code for *dsx3SendNoCode* has not been received.

Pass Criteria:

- DS3 loopback codes cannot be invoked from the standby card.

- The code that has been transmitted is not received on the tester.
- Error message should be logged in the log regarding an unaccepted command.



Technical Specifications

This appendix provides the technical specifications relevant to the MGX 8230, its processor and service modules, and the applications and services that it provides. It contains the following sections:

- MGX 8230 Enclosure, Power, and Performance Specifications
- MGX 8230 Processor Switching Module Specifications
- AUSM/B-8T1E1 Interface Characteristics
- FRSM-2CT3 Specifications
- FRSM-2T3E3 Specifications
- FRSM-HS2 Specifications
- FRSM HS1/B Specifications.
- Counters and Statistics for FRSM-2CT3, FRSM-2T3E3, and FRSM-HS2
- FRSM-8T1 Specification
- FRSM-8E1 Specification
- Circuit Emulation Service Module for T1 Operation
- Circuit Emulation Service Module for E1 Operation
- Physical and Electrical Characteristics for Cards

MGX 8230 Enclosure, Power, and Performance Specifications

This section describes the physical characteristics and system power requirements for the MGX 8230 feeder. The “MGX 8230 Processor Switching Module Specifications” section lists the dimensions, weight, and power consumption for each card. The appendix titled “Cabling Specifications” lists the AC power plugs for domestic and international use.

Table A-1 shows the MGX 8230 enclosure and electrical characteristics.

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 10 single-height slots for service modules or up to 5 double-height slots for service modules.
Enclosure Size, AC-powered system	8 Rack Units high Height: 14.00 inches (35.56 cm). Width: 17.72 ins (45.01 cm). Depth: 23.5 ins (59.69 cm) (excluding cable management)
DC-powered system	7 Rack Units high Height: 12.25 inches (63.50 cm). Width: 17.72 inches (45.01 cm). Depth: 23.5 inches (59.69 cm) (excluding cable management)
Shipping Weight for Populated Enclosure	Approximately 150 lbs.
Clearance Requirement	Minimum 30 inches front and rear; nominal 12-inch side clearance.
Power Input Voltage	AC system: Normal operating range is 100–240 VAC, 47 to 63 Hz. The maximum voltage range is 90–264 VAC. DC system: –42 to –56 VDC. Each AC supply can provide up to 1200 Watts at –48 VDC.
Current Requirements, AC System	Configuration-dependent: use Network Design Tool for exact requirements.
Current Requirements, DC System	Configuration-dependent: use Network Design Tool for exact requirements. For general planning purposes: 25 Amps at nominal –48 VDC; 29 Amps at –42 VDC maximum.
Input AC Power Connector	IEC 320 C13 input connector. The Appendix titled “Cabling Specifications” lists the AC power cords for a variety of countries and regions.
AC Power Cable	Provided with 8 feet (2.3 m) of 3-conductor wire with plug.
AC Plug at Customer end	20 A NEMA L620, 3-prong plug (domestic 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) 125V/15A North America
DC Input Connections	Three-position terminal block for 10 AWG wire (4 square millimeters).
Operating Environment	0°–40° C (32°–104° F) normal operation (50° C or 122° F 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: 4,800 BTUs. DC-powered: 4,100 BTUs.

Table A-1 Enclosure and Electrical Characteristics (continued)

Item	Value
MGX 8230 Performance	
Cell bus bandwidth Slots 3 to 5, 10 to 12: Slots 6 to 7, 13 to 14	 ~160 Mbps per slot, single speed ~320 Mbps per slot, double speed ~160 Mbps per two slots, single speed ~320 Mbps per two slots, double speed
Alarm and error handling	Same as MGX 8850 and IGX 8400 series switches

MGX 8230 Processor Switching Module Specifications

This section contains general specifications for the Processor Switching Module (PXM). The information in Table A-2 includes information for the two types of back cards—the PXM-UI user interface and the uplink card for trunking and CPE access.

Table A-2 PXM Specifications

Category	Description
Maximum switch fabric throughput.	1.2 Gbps.
Control access: These ports exist on the PXM-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 have one 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-2 PXM Specifications (continued)

Category	Description
LEDs on PXM 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 microsecond. The rate of phase change shall not exceed 81 ns in 1.326 ms 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 PXM-UI back card have an SMB connector for E1.

Table A-2 PXM 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 PXM:	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.

AUSM/B-8T1E1 Interface Characteristics

This section contains details for the AUSM/B-8T1E1. For physical characteristics, see Table A-3. For the T1 and E1 characteristics, see Table A-3 and Table A-5, respectively. For ATM interface characteristics, see Table A-6. For statistics and counters, see Table A-7.l

Table A-3 Physical Characteristics of the AUSM/B-8T1E1

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/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 inches by 15.83 inches (18.42 cm by 42.75 cm) Back cards: 7.25 inches by 4.125 inches (18.42 cm by 10.48 cm)
Power	–48 VDC, 30W
Safety	EN 60950 2nd edition (including EN 41003) UL 1950 2nd edition
Compliance	T1: G.703, G.824 E1: G.703, G.823
ESD	IEC 61000-4-2

Table A-4 T1 Interface Characteristics

Category	Description
Line Interface	RJ-48 (100 ohms) 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	Bi-polar 8 Zero Substitution (B8ZS) per ANSI T1.408 (T1)
Line Framing	Extended Superframe Format (ESF 24 frame multi-frame) per ANSI T1.408
ESF Maintenance	Bit-oriented alarm and loopback messages of ESF Data Link per ANSI T1.408
Input Jitter Tolerance	Per ITU-T G.824
Output Jitter	Per ITU-T G.824 using normal mode synchronization.

Table A-4 T1 Interface Characteristics (continued)

Physical Layer Alarms	LOS, OOF, AIS, RAI
Physical Layer Performance Statistics	LCV, LES, LSES, CV, ES, MGX 8230, SEFS, AISS, UAS

Table A-5 E1 Interface Characteristics

Category	Description
Line Interface Connector	RJ-48 (120 ohms) on LM-RJ48-8E1, or SMB (75 ohms) on LM-SMB-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 multi-frame 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, MGX 8230, SEFS, AISS, UAS

Table A-6 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, VBR+.
UPC Parameters	PCR, SCR (VBR), CCDV (CBR).
Congestion Control Support	ForeSight (toward Network for VBR+).
ForeSight Parameters	MIR, PIR, Rate Up, Rate Down, QIR, QIR Timeout, IBS.

Table A-7 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. Number 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).

FRSM-2CT3 Specifications

This section provides details for the FRSM-2CT3. Topics consist of the following:

- Transport technology standards with which the card complies (Table A-8)
- General physical attributes of the card, such as LEDs on the faceplate (Table A-9)
- Line and framer characteristics (Table A-10 and "FRSM-2CT3 Framer" section)
- Line alarms ("FRSM-2CT3 Line Alarms")

Table A-8 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 ITU-T I.363
FR-Cell Interworking	Per ITU-T I.555 and I.36x.1, as summarized in "ATM-to-Frame Relay Interoperability Implementation Agreement" v 1.0

Table A-9 FRSM-2CT3 Front Card Physical Characteristics

Feature	Significance or Value
Power	–48 VDC, 60W (estimated)
Card Status Indicator LEDs	Active (Green), Failed (Red), Standby (Yellow)
Line Status Indicator LEDs	Active & Okay (Green), Active & Local Alarm (Red), Active & Remote Alarm (Yellow)
Reliability	> 85000 hours MTBF (target)
Card Size	Front card: 7.25 inches by 15.83 inches (18.42 cm by 42.75 cm)

Table A-10 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 GR-449-CORE, ITU-T G.824
Output Jitter	0.05 UI maximum with jitter-free input clock
Output Pulse	Per T1.102.1993

FRSM-2CT3 Framer

The FRSM-2CT3 line framer:

- 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.

FRSM-2CT3 Line Alarms

For line alarms, the 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)

FRSM-2T3E3 Specifications

This section provides details for the FRSM-2T3E3. Where appropriate, it has separate sections for T3 and E3 technologies. Topics consist of the following:

- Transport technology standards with which the card complies (Table A-11)
- General physical attributes of the card, such as LEDs on the faceplate (Table A-12)
- Line and framer characteristics for T3 operation (Table A-13 and “T3 Framer Level”)
- Line and framer characteristics for E3 operation (Table A-14 and “E3 Framer Level”)
- Line alarms (“FRSM-2T3E3 Line Alarms”)

Table A-11 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 ITU-T I.363
FR-Cell Interworking	Per ITU-T I.555 and I.36x.1, as summarized in *ATM-to-Frame Relay Interoperability Implementation Agreement v 1.0*

Table A-12 FRSM-2T3E3 Front Card Physical Characteristics

Feature	Significance or Value
Power	–48 VDC, 60W (estimated)
Card Status Indicator LEDs	Active (Green), Failed (Red), Standby (Yellow)
Line Status Indicator LEDs	Active & Okay (Green), Active & Local Alarm (Red), Active & Remote Alarm (Yellow)
Reliability	> 85000 hours MTBF (target)
Card Size	Front card: 7.25 inches by 15.83 inches (18.42 cm by 42.75 cm) Back cards: 7.25 inches by 4.125 inches (18.42 cm by 10.48 cm)

FRSM-2T3E3 T3 Line

The T3 line characteristics appear in Table A-13.

Table A-13 T3 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 GR-499-CORE, ITU-T G.824
Output Jitter	0.05 UI maximum with jitter-free input clock
Output Pulse	Per ANSI T1.102

T3 Framer Level

For the framing characteristics of T3 operation, the FRSM-2T3E3:

- Supports C-bit parity and M13 DS3 format.
- Frames to a DS3 signal with a maximum average reframe time that meets the requirements set by TR-TSY-000009 and GR-499-CORE.
- 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.

FRSM-2T3E3 E3 Line

For characteristics of the line on an FRSM-2T3E3 with an E3 back card see figure A14:

Table A-14 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 ITU-T G.823
Output Jitter	0.05 UI maximum with jitter-free input clock per AT&T TR54014
Output Pulse	Per ITU-T G.703

E3 Framer Level

For line framing, the E3 operation of the FRSM-2T3E3 complies with ITU-T G.751.

FRSM-2T3E3 Line Alarms

For line alarms, the 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

See the section titled "Counters and Statistics for FRSM-2CT3, FRSM-2T3E3, and FRSM-HS2" for lists of applicable statistics and counters.

FRSM-HS2 Specifications

The 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 (Table A-15)
- General physical attributes of the card, such as LEDs on the faceplate (Table A-16)
- Line and framer characteristics (Table A-17)

For lists of the counters and statistics that are available on the FRSM-VHS series of cards, see the section titled "Counters and Statistics for FRSM-2CT3, FRSM-2T3E3, and FRSM-HS2."

Table A-15 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 ITU-T I.363
FR-Cell Interworking	Per ITU-T I.555 and I.36x.1, as summarized in *ATM-to-Frame Relay Interoperability Implementation Agreement* v 1.0

Table A-16 FRSM-HS2 Physical Characteristics

Feature	Significance or Value
Power	–48V, 75W (estimated) The SCSI2-2HSSI back card consumes 5 watts at 5 VDC and 6 watts at -5 VDC.
Card Status Indicator LEDs	Active (Green), Failed (Red), Standby (Yellow)
Line Status Indicator LEDs	Active & Okay (Green), Active & Local Alarm (Red), Active & Remote Alarm (Yellow)
Reliability	> 85000 hours MTBF (target)
Card Size	Front card: 7.25 inches by 15.83 inches (18.42 cm by 42.75 cm) Back cards: 7.25 inches by 4.125 inches (18.42 cm by 10.48 cm)

Table A-17 FRSM-HS2 Line Characteristics

Feature	Significance or Value
Number of HSSI Lines	Two
Connector Type	SCSI-2
Signaling Rate	52 Mbps max
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)
Electrical Interchange Characteristics	ITU-T V.12

Counters and Statistics for FRSM-2CT3, FRSM-2T3E3, and FRSM-HS2

This section lists counters and statistics that apply to most types of cards in the FRSM-VHS group.

Table A-18 Counters per Line

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
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-19 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

Table A-19 Service-Related Statistics (continued)

Service Statistic
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
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-20 ATM Cell-Related Statistics

ATM Cell Statistic
Number of cells transmitted to PXM
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-to-end loop back cells transmitted
Number of segment loop back cells transmitted
Number of cells received from PXM

Table A-20 ATM Cell-Related Statistics (continued)

ATM Cell Statistic
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-to-end loopback cells received
Number of segment loopback cells received
Number of OAM cells discarded due to CRC-10 error

Table A-21 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-22 Troubleshooting Statistics

Troubleshooting Statistic
ECN current queue depth, per channel

FRSM-HS1/B X.21

Interfaces

- Four X.21 lines
- DCE/DTE selection on a per-port basis
- As DCE, clock speeds of 48 Kbps, 56 Kbps, n x 64 Kbps up to 2 Mbps, n x 1.5 Mbps and n x 2 Mbps, up to 10 Mbps, are supported
- As DTE, obtains clock from line, up to 10 Mbps
- Supports 1000 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-8T1 Specification

This section provides information on the T1 operation of the FRSM-8T1E1 card set. Topics are:

- General physical information about the card set (Table A-23)
- Information about the Frame Relay service (Table A-24)
- System-level interface (Table A-25)
- Statistics and counters (Table A-26)

Table A-23 General Card Specifications

Category	Description
Indicators per card	Active (Green), Standby (Yellow), Fail (Red)
Indicators per line	Active & Okay (Green) Active & Local Alarm (Red) Active & 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	Front card: 7.25 inches by 15.83 inches (18.42 cm by 42.75 cm) Back cards: 7.25 inches by 4.125 inches (18.42 cm by 10.48 cm) Power: –48 VDC, 30W with 8 active T1 lines

Table A-24 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 ITU-T G.824
Output Jitter Generation	Per ITU-T G.824 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	Either of the following: • 56 Kbps • *N* x 64 Kbps (where *N* is the number of consecutive time slots)
Frame Relay Interface	Per ANSI T1.618, 2-octet header

Table A-24 Frame Relay Service With T1 Lines (continued)

Category	Description
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 errors (s) Received frames discarded due to alignment errors (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 frames (s) Received bytes (s) Transmit frames discarded due to underrun Transmit frames discarded due to Abort Transmit frames discarded due to egress Q-depth exceeded (s) Transmit bytes discarded due to egress Q-depth exceeded (s) Transmit frames discarded due to egress DE threshold exceeded Transmit frames (s)
	Transmit bytes(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-25 System Interface

Category	Description
ATM Layer	Per ITU-T I.361 and ATM UNI v3.1
AAL Layer	AAL5 per ITU-T I.363
FR-Cell Interworking	Per ITU-T I.555 and I.36x.1, as summarized in *Frame Relay Forum, FR/ATM PVC Interworking Implementation Agreement FRF.5*

Table A-26 List of Counters

Category	Description
Channels (endpoints) per card	256, which you can allocate across any of the interfaces
Service Counters Note that an (s) at the end of the description means the data in the counter is usable as a statistic.	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 PXM 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-to-end loopback cells transmitted (s) Number of OAM segment loopback cells transmitted Number of cells received from PXM 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-to-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-26 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

FRSM-8E1 Specification

This section provides information on the E1 operation of the FRSM-8T1E1 card set. Topics are:

- General physical information about the card set (Table A-27)
- Information about the Frame Relay service (Table A-28)
- System-level interface (Table A-29)
- Statistics and counters (Table A-30)

Table A-27 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 ITU-T G.823
Output Jitter Generation	Per ITU-T G.823
Physical Layer Alarms	LOS, OOF, AIS, RAI
Indicators per card	Active (Green), Standby (Yellow), Fail (Red)
Indicators per line	Active & Okay (Green) Active & Local Alarm (Red) Active & Remote Alarm (Yellow)
Maintenance/Serviceability Features	Internal Problem Isolation Loopbacks Hot-pluggable cards
Reliability, MTBF	> 65000 hours
Card Size	Front card: 7.25 inches by 15.83 inches (18.42 cm by 42.75 cm) Back cards: 7.25 inches by 4.125 inches (18.42 cm by 10.48 cm)
Power	–48 VDC, 30W with 8 active E1 lines

Table A-28 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 orN x 64 Kbps, where N is the same as defined in the preceding item the preceding item “Number of Frame Interfaces.”
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; 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 errors (s) Received frames discarded due to alignment errors (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 frames (s) Received bytes (s)

Table A-28 Frame Relay Service With E1 Lines (continued)

Category	Description
	Transmit frames discarded due to underrun Transmit frames discarded due to Abort Transmit frames discarded due to egress Q-depth exceeded (s) Transmit bytes discarded due to egress Q-depth exceeded (s) Transmit frames discarded due to egress DE threshold exceeded Transmit frames (s) Transmit bytes(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-29 System Interface

Category	Description
ATM Layer	Per ITU-T I.361 and ATM UNI v3.1
AAL Layer	AAL5 per ITU-T I.363
FR-Cell Interworking	Per ITU-T I.555 and I.36x.1, as summarized in *Frame Relay Forum, FR/ATM PVC Interworking Implementation Agreement FERF.5*

Table A-30 List of Counters

Category	Description
Channels (Endpoints)	256 per card—can be allocated across any of the Frame Relay interfaces
Counters	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

Table A-30 List of Counters (continued)

Category	Description
	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 PXM 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-to-end loopback cells transmitted (s) Number of OAM segment loopback cells transmitted Number of cells received from PXM 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-to-end loopback cells received (s) 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: Last unknown LCN received Cells with unknown LCN count Card General

Circuit Emulation Service Module for T1 Operation

This section contains operational details for the CESM 8T1E1 with the RJ48-8T1 back card.

Table A-31 CESM 8T1 Card Information

Category	Description
Back Card	RJ48-8T1
Line Rate	T1: 1.544 Mbps ±50 bps
Transmit Clocking	Normal clock or SRTS generated
Line Coding	B8ZS

Table A-31 CESM 8T1 Card Information (continued)

Category	Description
Frame mode	ESF
Line alarms	Loss or Signal (LOS) Loss of Frame (LOF) Loss of multiframe (LOMF) Remote loss of signal or frame (RAI) All ones received (AIS) Bi-polar 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
LED Indicators Per Card	Active (green), Failed (red), Standby (yellow)
BERT	Active (green), Errors (yellow)
1:N Redundancy	Active (green)
Indicator for each T1	Active (green)
Reliability, MTBF	
Card Size	Front card: 7.25 inches by 15.83 inches (18.42 cm by 42.75 cm) Back cards: 7.25 inches by 4.125 inches (18.42 cm by 10.48 cm)
Power	48 VDC, 30W
Loopbacks	On or Off

Circuit Emulation Service Module for E1 Operation

This section contains operational details for the CESM-8T1E1 with an E1 back card.

Table A-32 CESM 8E1 Card Set Details

Category	Description
Back Card	RJ48-8E or SMB-8E1
Line Rate	E1: 2.048 Mbps ± 100 bps (50 ppm)

Table A-32 CESM 8E1 Card Set Details (continued)

Category	Description
Transmit Clocking	Normal clock or SRTS generated
Line Coding	HDB3
Frame mode	single-frame multi-frame
Line alarms	Loss or Signal (LOS) Loss of Frame (LOF) Loss of multi-frame (LOMF) Remote loss of signal or frame (RAI) All ones received (AIS) Bi-polar 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:N Redundancy	Active (green)
Indicator for each T1	Active (green)
Reliability, MTBF	
Card Size	Front card: 15.65 inches by 15.83 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	-48VDC, 30 W
Loopbacks	On or Off

Physical and Electrical Characteristics for Cards

For quick reference, Table A-33 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-33 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
FRSM-8T1 FRSM-8E1 FRSM-8T1c FRSM-8E1c	8 T1, 8 E1	7.25 x 15.83	7.00 x 4.50	1.74 lbs/ 0.76 lbs	30 Watts
FRSM-2CT3	2 T3	7.25 x 16.25	7.00 x 4.50	1.74 lbs/ 0.76 lbs	60 Watts
FRSM-2T3E3	2 T3, 2 E3	7.25 x 16.25	7.00 x 4.50	1.74 lbs/ 0.76 lbs	60 Watts
FRSM-HS2	2 HSSI	7.25 x 16.25	7.00 x 4.50	1.74 lbs/ 0.6 lbs	75 Watts
CESM-8T1E1	8 T1, 8 E1	7.25 x 16.25	7.00 x 4.50	1.74 lbs 0.76 lbs	30 Watts
AUSM/B-8T1E1	8-T1, 8-E1	7.25 x 16.25	7.00 x 4.50	1.74 lbs 0.76 lbs	30 Watts
PXM1	OC-3c/STM-1	15.65 x 15.83	7.00 x 4.5	4.80 lbs	100 Watts

Electromagnetic Compatibility

This section lists the national and international standards for electromagnetic compatibility to which the MGX 8230 complies. It consists of a list of reference documents, a table (Table A-34) that indicates applicability of the standards, and the test levels for CE mark immunity.

The applicable standards for electromagnetic compatibility are

- NEBS Systems Requirements (GR-1089-CORE)
- EN 55022/08.94
- EN 50081-1/01.92 and EN 50082-1/01.92 (Generic Immunity Requirements), International Electromechanical Commission (IEC 61000-4-2 through IEC 61000-4-5) European Norm designation EN 61000-4-2 through EN 61000-4-5

Details on how each standard applies in this Cisco product appear in Table A-34.

Table A-34 Electromagnetic Compatibility and Immunity

Category	AC-Powered (110/220 VAC	DC-Powered (-48V)
U.S.A EMC	FCC Part 15, Class A	not applicable
Japan EMC	Austel 3548 Class A	not applicable

Table A-34 Electromagnetic Compatibility and Immunity (continued)

Category	AC-Powered (110/220 VAC	DC-Powered (-48V)
Australia EMC	VCCI Class A	not applicable
CE mark Immunity	EMC: EN 55022 Class A • EN 50082-1 (generic immunity) • EN 61000-4-2 through -5	not applicable
NEBS (EMC)	not applicable	EMC: GR-1089-CORE Class A (radiated and magnetic fields) and line conductance. 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)

The levels for the mandatory CE mark immunity tests are

- For IEC 61000-4-2 (ESD), the test level is 4.
- For IEC 61000-4-3 (RS), the test level is 3.
- For IEC 61000-4-4 (EFT), the test level is 4.
- For IEC 61000-4-5 (Surge), the test level is 3.

Conformance

This section contains standards compliance information for features on the MGX 8230.

ATM UNI

The ATM specifications for the User-Network Interface to which the MGX 8850 complies are

- ATM Forum–ATM UNI, V3.1, 1995.
- ITU Recommendation I.361–B-ISDN ATM Layer Specification, March 1993.
- ITU Recommendation I.371–Traffic Control and Congestion Control in B-ISDN, March 1993.
- ITU Recommendation I.432–B-ISDN User Network Interface—Physical Interface Specification, March 1993.
- ANSI T1E1.2/94-002R1, Draft–B-ISDN and DS1/ATM User Network Interfaces: Physical Layer Specification.
- ANSI T1E1.2/94-020, Draft–B-ISDN Customer Installation Interfaces, Physical Media Dependent Specification.

SONET/SDH

The standards and responsible organizations with which MGX 8850 SONET technology complies are as follows:

- Bell Communications Research–SONET Transport Systems: Common Generic Criteria, GR-253-CORE, Issue 2, 1995.
- Bell Communications Research–Broadband Switching System Generic Requirements, GR-1110-CORE, Issue 1, Sept. 1994.
- Bell Communications Research–ATM and ATM AAL Protocols, GR-1113-CORE, Issue 1, July 1994.
- Bell Communications Research–Generic Requirements for Operations of Broadband Switching Systems, GR-1248-CORE, Issue 2, Rev 1.
- ITU-T G.707–Network Node Interface for the Synchronous Digital Hierarchy.
- ITU Recommendation G.782–Types and General Characteristics of Synchronous Digital Hierarchy (SDH) Equipment, January 1994.
- ITU Recommendation G.783–Characteristics of Synchronous Digital Hierarchy (SDH) Equipment Functional Blocks, January 1994.
- ITU Recommendation G.832–Transport of SDH Elements on PDH Networks: Frame and Multiplexing Structures, November 1993.
- ITU Recommendation G.958–Digital Line Systems based on the Synchronous Digital Hierarchy for use on Optical Fibre Cables, November 1994.
- ANSI T1.105–Digital Hierarchy–Optical Interface Rates and Formats Specifications (SONET), 1991.
- ANSI T1.231–Digital Hierarchy–Layer 1 In-Service Digital Transmission Performance Monitoring (SONET), 1993.

Frame Relay

The standards and responsible organizations with which MGX 8230 Frame Relay technology complies are as follows:

- FRF.1.1
- FRF.2.1
- FRF.5
- FRF.8

Circuit Emulations Service

ATM Forum CES 2.0.

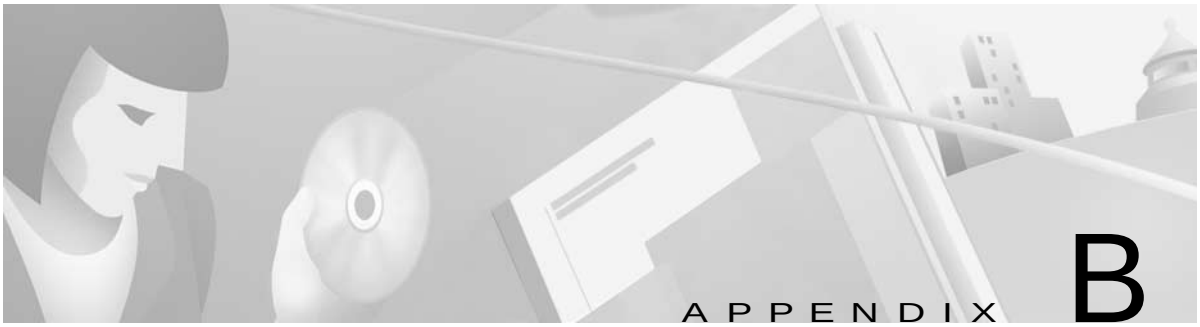
Safety

The MGX 8230 enclosure meets all applicable regulatory agency Product Safety requirements.

- UL 1950, Third Edition (Standard for Safety, Information Technology Equipment, Including Electrical Business Equipment).
- CSA C22.2-#950- M95, (Standard for Safety, Information Technology Equipment, Including Electrical Business Equipment).
- EN 60 950 (Safety of Information Technology Equipment, Including Electrical Business Equipment).
- TS001 Austel-Safety Requirements for Customer Equipment. (Including AS3260, Safety of Information Technology Equipment)-Australia.
- EN 41003 (European Product Safety Standard for Telecommunications Equipment).

Environmental

The MGX 8230 adheres to the Bellcore GR-63-CORE environmental standard.



Cable Specifications

This appendix contains details on the MGX 8230 cabling. It includes the following sections:

- T3 Trunk Cabling
- Frame Relay Cabling
- DC Power Cabling
- AC Power Cabling
- Control and Clock Cabling
- External Alarm Cabling

Note In all cable references, the transmit direction is away from the MGX 8230, and the receive direction is toward the MGX 8230.

T3 Trunk Cabling

A trunk cable connects each T3 port on the BNC-2T3 back card to a T3 port on other equipment. 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 maximum between the MGX 8230 and other equipment.
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

T1 Cabling

Trunk cables connect the customer DSX-1 cross-connect point or T1 Channel Service Unit (CSU) to the MGX 8230 at the T1 back card. See to Figure B-1 and Table B-3 for details.

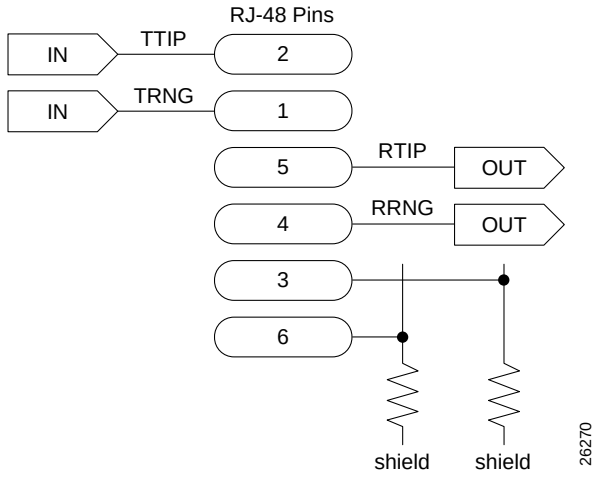
Cable Parameter	Description
Cable Type	Western Electric 22 AWG, ABAM individually shielded twisted pair (100 ohm balanced). Two pair per T1 line (1 transmit and 1 receive).
Cable Connector	RJ-48C male. (Figure B-1 illustrates the RJ-48 connector pin out.)
Max. Cable Length	655 ft. (199.664 m) maximum between the MGX 8230 node and the first repeater or CSU. Selection of cable length equalizers.

Table B-3 RJ-48C T1/E1 Connector Pin Assignments

Pin No.	Description
1	Transmit Tip
2	Transmit Ring
3	Transmit Shield
4	Receive Tip
5	Receive Ring
6	Receive Shield

Note Transmit direction is toward the T1 trunk.

Figure B-1 RJ-48 Connectors



E1 Cabling

SMB 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 (SMB-8E1). See Table B-4 and Table B-5.

Table B-4 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	16 female SMB for unbalanced connection. See Tables A-2 and A-4 for pinouts.
Max. Cable Length	Approximately 100 meters maximum between the MGX 8230 node and the first repeater or CSU. Equalizer for cable length.

Table B-5 E1 Connector Pin Assignments (unbalanced)

Connector	Description
Rx BNC	Receive E1 from trunk
Tx BNC	Transmit E1 to 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-7 and Table B-8. The tables show the signal acronym, signal name, and signal source. The signal depends whether the backcard connector is either DTE or DCE and whether the backcard has been set as either X.21 or V.35 as shown in Table B-6. For the part numbers of the standard and non-standard versions of the 12IN1 cables, see Table B-9.

Table B-6 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-7 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-8 X.21 Signals

Signal	Name
Mode_2	Local connections
Mode_DCE	Local connections
Gournd	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-9 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	fremale	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-10 for the pinouts.

Table B-10 Pinouts for SCSI-II Connector

Pin No.	Name	Signal Function	Polarity	Signal Source
11	SD	Send Data	+	DTE
36			-	

Table B-10 Pinouts for SCSI-II Connector

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			-	
	SG	Signal Ground		

DC Power Cabling

DC Power connections are made to the DC Power Entry Modules at the rear of the MGX 8230. See Table B-11 and Table B-12 for acceptable cable and wire types. Cisco normally does not provide wiring for DC-powered systems. See Table B-11 for details on DC wiring.

Table B-11 DC Power Wiring

Cable Parameter	Description
Wiring	Three conductor, 10 AWG recommended wire gauge, min. 60°C insulation rating, copper conductors only. Solid or stranded wires. Wire insulation stripped back 0.25” (6 mm) at the MGX 8230 connector end.
Connection	EURO Block.

AC Power Cabling

Either Cisco Systems or the customer can provide the AC power cord. See Table B-12 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 (C-14) 10/15A male receptacle on the back of the AC power module.

Table B-12 AC Power Cables

Cable Parameter	Description
Cable	Provided with 8 feet (2.3 m) of 3-conductor wire with plug.
Plug (customer end)	20 A NEMA L620, 3-prong plug (domestic U.S.) Need 15A NEMA 5-15 for US and Canada. 13 A 250 Vac BS1363, 3-prong fused plug (UK, Ireland) CEE 7/7 (Continental Europe) AS3112 (Australia/New Zealand) CEI23-16/VII (Italy) 125V/15A North America

Control and Clock Cabling

This section describes the cables that can connect to the PXM-UI card.

Maintenance and Control Ports

The Maintenance (or Modem) port and the Control (or Console) port connect an MGX 8230 to an ASCII terminal, workstation, or modem for remote alarm reporting or system monitoring. Refer to Table B-13 for a description of the cabling and Table B-14 for the pinout of the associated RJ45 connector.

Table B-13 Maintenance and Control Port Cabling

Cable Parameter	Description
Interface	EIA/TIA-232—both are DTE ports.
Suggested Cable	24 AWG, 8-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	RJ45, subminiature, male. Table B-14 contains a list of the port pin assignments.
Max. Cable Length	50 feet (15 m)

Table B-14 RJ-45 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	Signal Ground
5	GND	Signal Ground
6	RxD	Receive Data
7	DSR	Data Set Ready
8	CTS	Clear to Send

External Clock Input Cabling

The MGX 8230 has two external clock input connectors: a T1 RJ-45 connector and E1 SMB connector.

T1 Clock Cabling

The clock port can accept a T1 or E1 BITS clock input. (See Table B-15)

Table B-15 7T1 Clock Cabling

Pin No.	Name
1	Tx ring out
2	Tx tip out
3	Ground
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 PXM-UI card. See Table B-16 for physical characteristics of the cable and Table B-17 for the pinouts.

Table B-16 External Alarm Cabling

Cable Parameter	Description
Interface	Dry-contact relay closure.

Table B-16 External Alarm Cabling

Cable Parameter	Description
Wire	24 AWG, shielded, 6-pair.
Connector	DB-15, Subminiature, male.

Table B-17 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.

A

ABR — Available Bit Rate is a Class of Service defined for ATM connections by the ATM Forum. Devices using ABR are guaranteed no more than a certain rate of throughput. This rate dynamically changes and the current value is relayed to the sending device by way of Resource Management (RM) cells.

B

BCC — The switch control card in the BPX is the Broadband Control Card, which has a 68040 processor.

BPX switch — The Broadband Packet Exchange (BPX) is Cisco's high-end ATM switch developed for the service provider market. The BPX 8600 series switch is a carrier-quality switch, with trunk and CPU hot-standby redundancy.

BXM — The Broadband Switch Module (BXM) cards are ATM port cards for the BPX switch that use the Monarch chip set.

C

Cell bus — The cell bus in the MGX 8230 is the way that the service modules exchange data with the switching fabric on the PXM.

CiscoView — GUI-based device-management software application that provides dynamic status, statistics, and comprehensive configuration information for Cisco internetworking products, such as the MGX 8230, or IGX switch or BPX switch.

Cisco WAN Manager — The Cisco WAN Manager (CWM) is the network management application for the Cisco wide area switches, such as the BPX switch or the IGX switch. CWM was previously known as StrataView Plus.

Class of Service (CoS) Buffer — A buffer or queue which serves connections with similar QoS requirements.

Class of Service (CoS) Buffer Descriptor Template — A component of a Service Class Template that contains Class of Service Buffer configurations indexed by CosB number. Note: A Qbin is a platform-specific (BXM in this case) instance of the more general Class of Service Buffer (or CosB).

C

ComBus The ComBus is the BPX's internal messaging bus.

Community In the context of SNMP, a relationship between an agent and a set of SNMP managers that defines security characteristics. The community concept is a local one, defined at the agent. The agent establishes one community for each desired combination of authentication, access control, and proxy characteristics. Each community is given a unique (within this agent) community name, and the management stations within that community are provided with and must employ the community name in all get and set operations. The agent may establish a number of communities, with overlapping management station membership.

E

Enterprise MIB A MIB module defined in the enterprise-specific portion of the Internet management space

F

Feeder A feeder is a small switch which acts as an extension shelf, typically with lower-bandwidth interfaces, for a larger switch. The larger switch is referred to as the Routing Node for the Feeder(s). The MGX 8230 acts as a feeder to the IGX 8400 series switch.

I

IGX switch The Cisco IGX 8400 series wide area switch designed to provide backbone for enterprise data, voice, fax, and video applications. The Cisco IGX switch was formerly referred to as the Cisco StrataCom IGX switch.

M

Managed device A device containing a network management agent implementation.

MGX 8230 An 7-slot chassis build with MGX 8850 style architecture that currently is used as a feeder shelf for the IGX. Used as an IGX feeder, the MGX 8230 supports MGX 8850/MGX 8250 service modules.

MIB Management Information Base, a structured set of data variables, called objects, in which each variable represents some resource to be managed.

MIB-II Internet-standard MIB, RFC 1213

P

PXM — Processor Switch Module. The processor card used in MGX 8850 series switches. The PXM is the processor used in the MGX 8230 product. Although functionally equivalent to a PXM, the PXM is not interchangeable with a PXM and will not fit in an MGX 8850 card slot.

Q

Qbin — A Qbin is a platform-specific (BXM in this case) instance of the more general Class of Service Buffer (or CosB).

R

Routing Node — In tiered networks terminology, a Routing Node is a larger switch to which one or more feeders or controllers are attached. The IGX switch serves as the routing node for an MGX 8230 feeder.

S

SNMP — Simple Network Management Protocol.

U

UBR — Unspecified Bit Rate is a Class of Service for ATM networks defined by the ATM Forum. Traffic in the UBR class is not guaranteed any particular throughput or delay performance. In this regard, UBR is similar to “traditional” IP service.

Uplink back card — The back card that mates with PXM and provides ATM trunking. The MGX 8230 supports only an OC-3 uplink back card.

User interface back card — The back card (PXM-UI) that mates with the PXM and provides interfaces for control or maintenance terminals, LAN connections, T1 or E1 clock inputs, and alarm outputs.

V

Virtual Switch Interface — See VSI.

VSI — Virtual Switch Interface is a master/slave protocol that allows Cisco WAN switches, such as the BPX 8600 series switch or the MGX 8850/8250 node, to be controlled by more than one network application. MPLS, or AutoRoute are examples of network applications.

VSI Controller — A controller, such as a Tag Switch Controller, which controls a switch using the VSI.

V

VSI Master A VSI Master process implementing the master side of the VSI protocol in a VSI Controller. Sometimes the whole VSI Controller might be referred to as a "VSI Master," but this is not strictly correct.

VSI Platform A VSI Platform is a switch with one or more VSI Slaves allowing connections to be set up using the VSI.

VSI Slave A VSI Slave process implementing the slave side of the VSI protocol within a VSI Platform. Sometimes a whole VSI Platform might be referred to as a "VSI Slave," but this is not strictly correct.

Numerics

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