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 MGX 8230 Edge Concentrator Overview.*

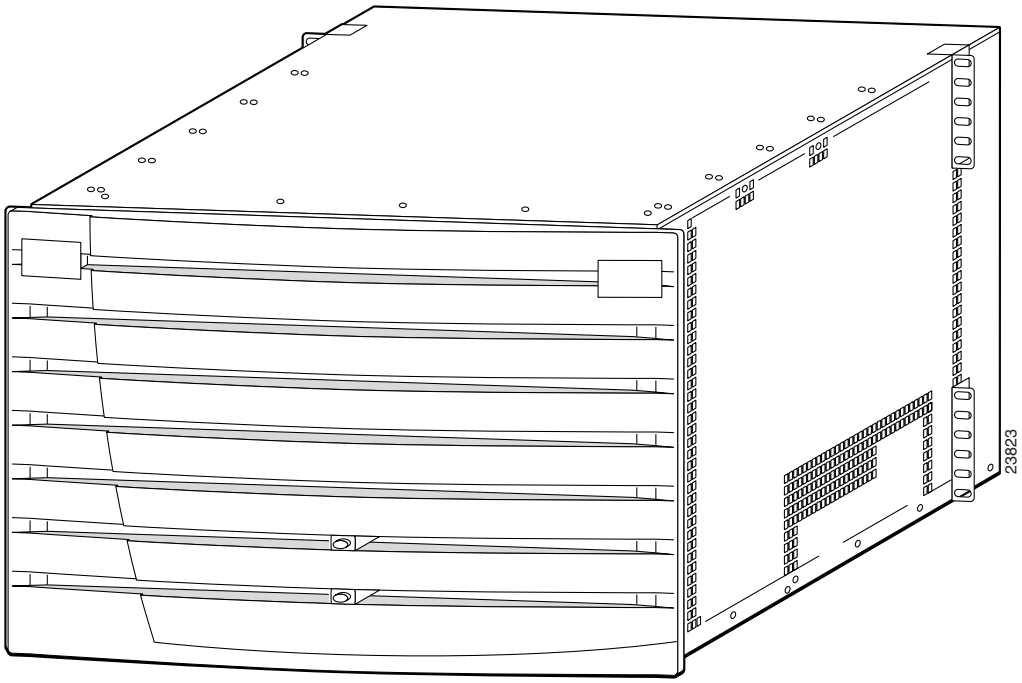
# MGX 8230 System Overview

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 8230 supports the following services:

- IP VPNs using Cisco IOS software-based MPLS/label switching.
- 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***



# Applications of the MGX 8230

The MGX 8230 operates in the following 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. 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.

**Note** Refer to the Cisco *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 the MGX 8230 applications.

# 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 MGX 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 (see Figure 1-2).

***Figure 1-2 MGX 8230 Slot Placement***

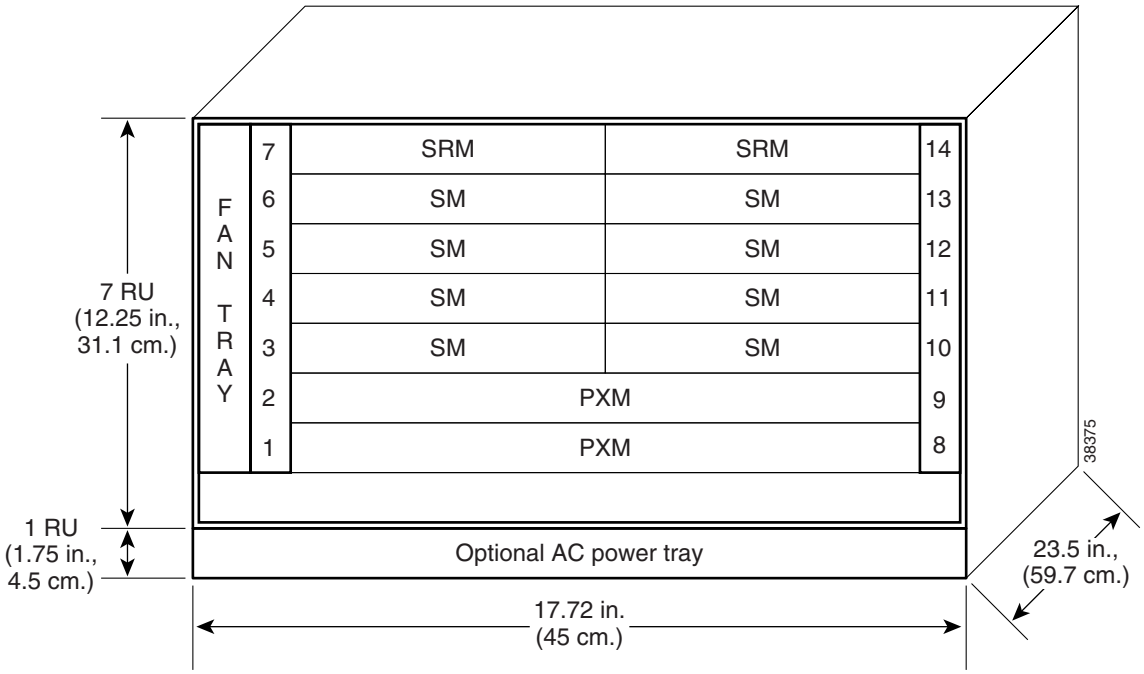
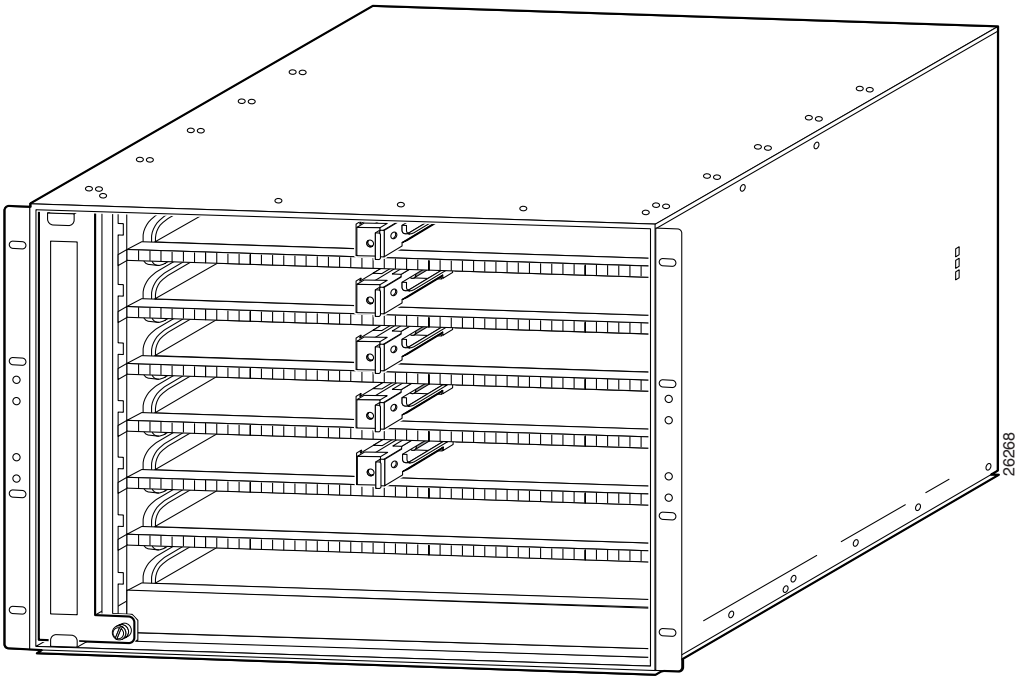


*Figure 1-3 MGX 8230 Card Cage—Font View*




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

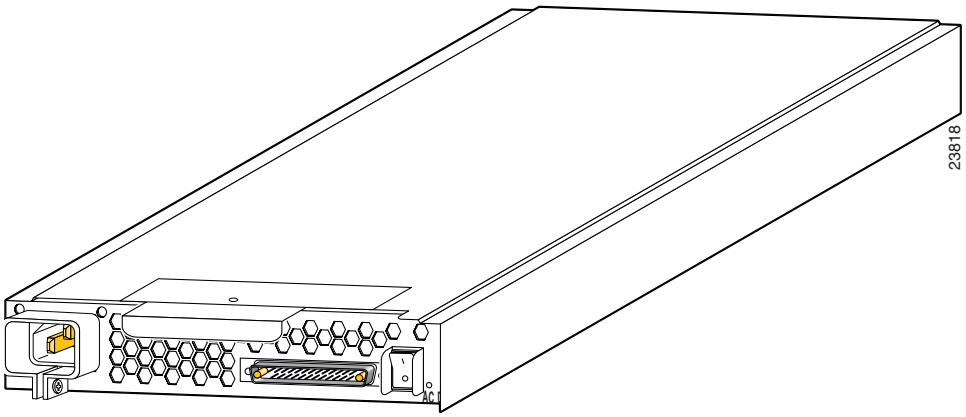
## MGX 8230 Power System

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
- Output Capacity of 1200 watts at -48 VDC
- O-ring diode
- EMI filtering
- Cooling fan
- Power switch
- DC and AC status LEDs

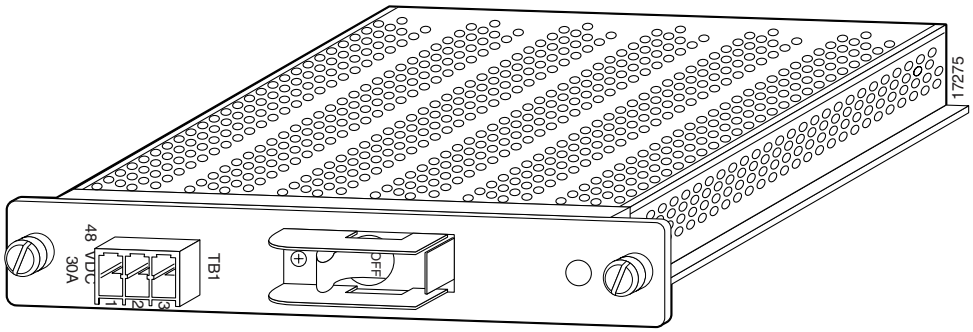
## DC-Powered MGX 8230

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*

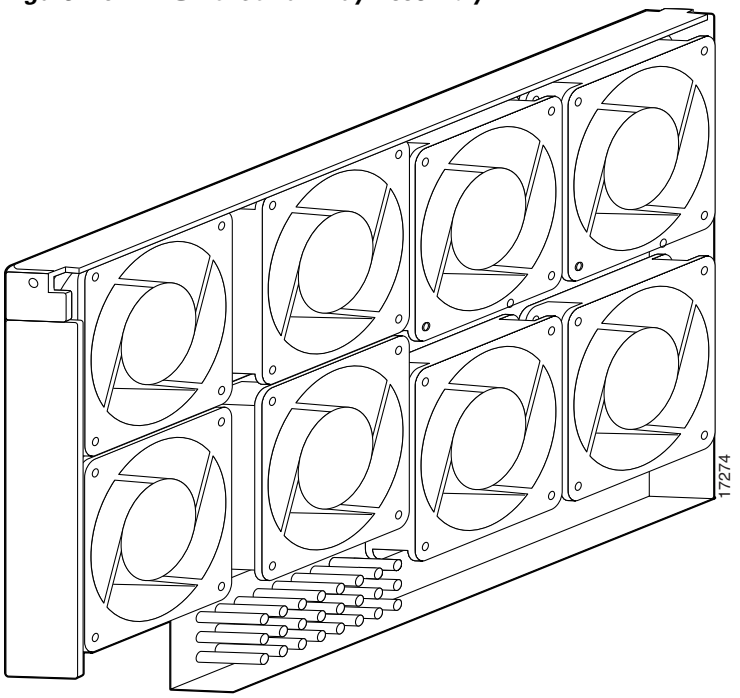



# Cooling System

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*



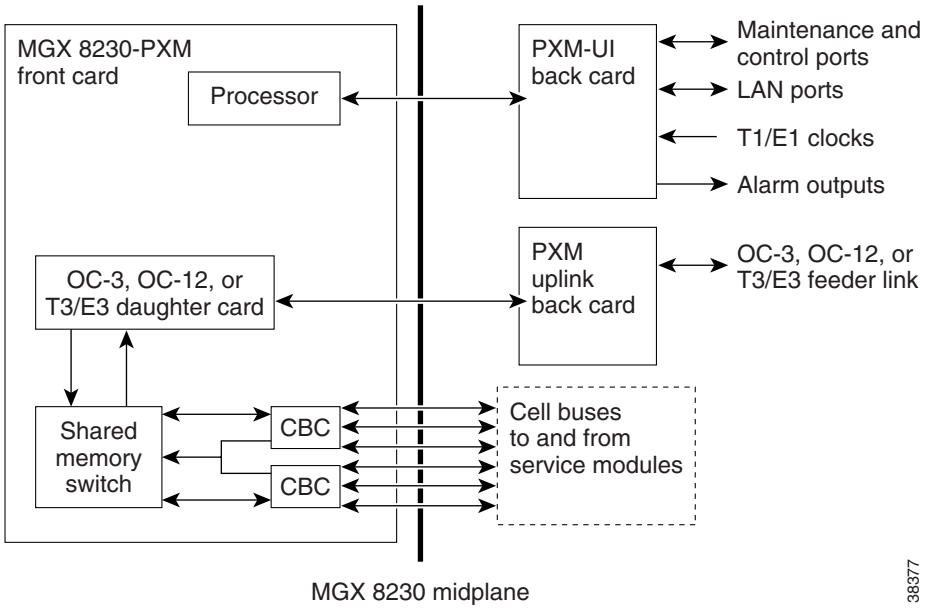

## MGX 8230 Architecture

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 PXM. 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*

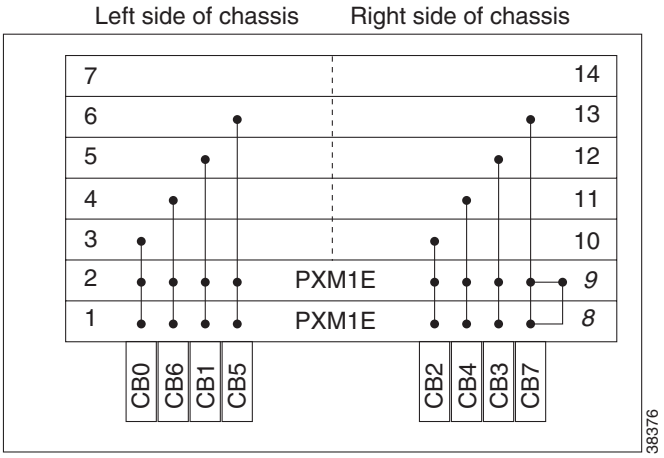



*Table 1-1 Cell Bus Distribution*

| | 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) is a Graphical User Interface (GUI) application for connection management. This application enables operations, administration, and maintenance of WAN-multiservice networks.
- CiscoView is a GUI application for hardware configuration.

- Command line interface (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" section on page 5-1 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

- Front card contains the processing intelligence.
- Daughter card contains the firmware that distinguishes the interface (OC-3, T3, E3, and so on).
- 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, the terms *card* and *module* are often used interchangeably in the field.

## Processor Switching Module (PXM1)

Processor Switching Module (PXM1) front card controls the MGX 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.

## Interface Cards and Back Cards

The switch supports the following interface and back cards:

### Interface 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.

#### 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)

## Service Modules

The MGX 8230 supports the following service modules. Refer to table 1-2

*Table 1-2 MGX 8230 Service Modules*

| Service Modules | Card | Description |
|---|---|---|
| **Service Resource Module (SRM)** | 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. |

*Table 1-2 MGX 8230 Service Modules (continued)*

| Service Modules | Card | Description |
|---|---|---|
| **Frame Relay Service Modules (FRSM)** | 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. |
| | 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. |
| | 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. |
| | 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. |
| | MGX-FRSM-2E3T3 | 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. |
| | 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. |
| | MGX-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. |
| | 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)** | 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). |
| | 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). |

*Table 1-2 MGX 8230 Service Modules (continued)*

| Service Modules | Card | Description |
|---|---|---|
| **Circuit Emulation Service Modules (CESM)** | 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. |
| | 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. |
| | MGX-CESM-T3/E3 | 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<br><br>MGX-VISM-8E1 | Supports eight T1 or E1ports for transporting digitized voice signals across a packet network. The VISM provides toll-quality voice, fax and modem transmission and efficient utilization of wide-area bandwidth through industry standard implementations of echo cancellation, voice-compression and silence-suppression techniques. |

**Note** For configuration information on the Voice Interworking Service Module (VISM), refer to the *Voice Interworking Service Module Installation and Configuration.*

## Route Processor Module (RPM)

The Route Processor Module (RPM) is a Cisco 7200 series router redesigned as a double-height card. Each RPM uses two single-height back cards. The back card types are single-port Fast Ethernet, four-port Ethernet, and single-port (FDDI).

**Note** For information on availability and support of the MGX-RPM-128/B and MGX-RPM-PR, refer to the Release Notes for Cisco WAN MGX 8850, 8230, and 8250 Software.

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

# Redundancy for Service Modules

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

Refer to the *WAN CiscoView Release 3 for the MGX 8230 Edge Concentrator* 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.

Applicable service modules are

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

To determine the hot standby status of the system, enter 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