Reference Guide
ATCA SC6300 Series Chassis

Clavister AB
Sjögatan 6J
SE-89160 Örnsköldsvik
SWEDEN

Phone: +46-660-299200
Fax: +46-660-12250

www.clavister.com

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Table of Contents

List of Figures

Preface

Target Audience

The target audience for this guide is the user who has taken delivery of a packaged Clavister SC6300 Series Chassis and going through the installation phase. The guide takes the user from unpacking and installation to power-up and initial network connection.

Notes to the Main Text

Special sections of text which the reader should pay special attention to are indicated by icons on the left hand side of the page followed by a short paragraph in italicized text. There are the following types of such sections:

Note
This indicates some piece of information that is an addition to the preceding text. It may concern something that is being emphasised or something that is not obvious or explicitly stated in the preceding text.

Tip
This indicates a piece of non-critical information that is useful to know in certain situations but is not essential reading.

Caution
This indicates where the reader should be careful with their actions as an undesirable situation may result if care is not exercised.

Important
This is an essential point that the reader should read and understand.

Warning
This is essential reading for the user as they should be aware that a serious situation may result if certain actions are taken or not taken.

Chapter 1: Overview

The Clavister ATCA Platform

The Clavister ATCA platform is a high-performance system that can be configured for diverse applications in the carrier-class communications infrastructure. Its adherence to the PICMG 3.0 AdvancedTCA (ATCA) standard supports HA (high-availability) and provides design scalability and flexibility.

The SC6300 Series Chassis is the chassis for the platform and includes a card cage and a backplane. Each chassis houses up to six modules that provide processing, storage, and communications functions for any given platform configuration. The chassis is designed to support the platform chassis management architecture, which includes hot-swapping and cooling support, while powering and providing thermal management for the PICMG 3.0 modules.

Figure 1.1. The SC6300 Series Chassis

Installation Components

A typical installation consists of the following:

- 19-inch rackmount chassis — Base hardware element of the platform, which holds all the components together.

- A Card cage — The portion of the chassis that holds the modules that plug into the backplane.
- Modules — Provide the core functionality of the chassis, such as switching, processing, and storage.
- 2 x Fan tray modules — Provide cooling to components on the front of the chassis.
- 2 x DC power entry modules (PEMs) — Supply system power to the chassis and its components and provide cooling to the rear of the chassis.
- The Backplane — Supports 6 slots and provides dual star Base interface, Fabric interface, and triple replicated mesh interface connections to the ATCA modules, and direct mating to the PEMs and fan trays.
- Inlet air filter — Keeps the airflow free of dust and particles.
- Front cable guide.

Chassis Details

The SC6300 Series Chassis is the base element for the Clavister ATCA platform.

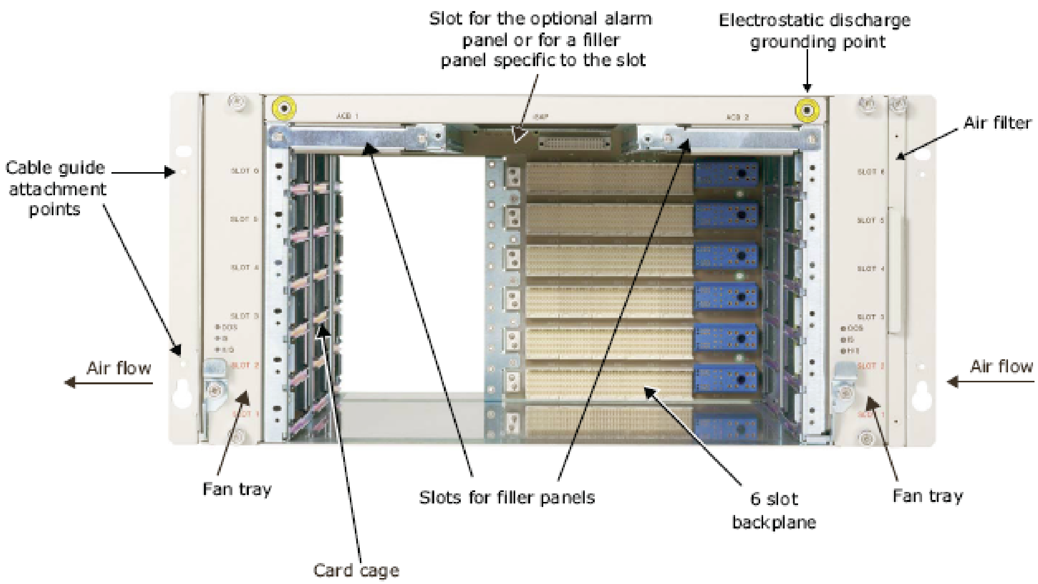

Figure 1.2. Chassis Front View

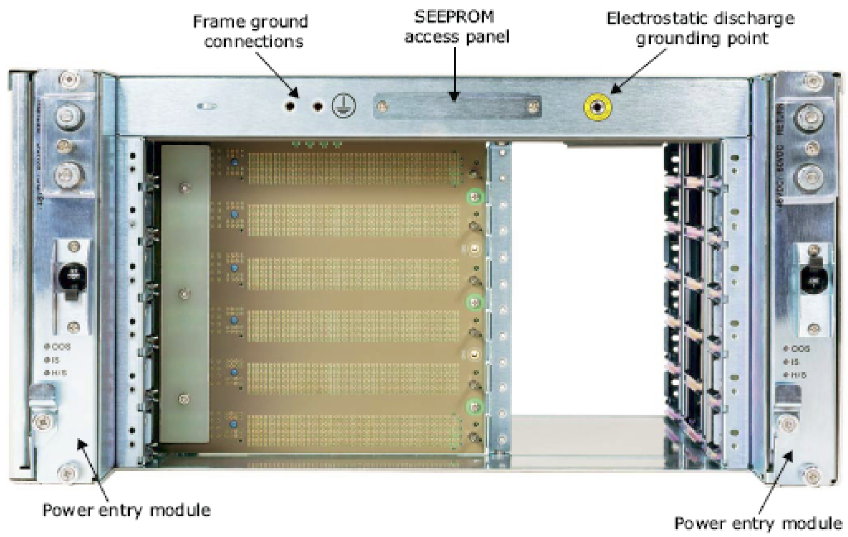

Figure 1.3. Chassis Rear View

The chassis is a sheet metal frame that forms a card cage, which provides a means for joining the various elements of the platform together into a coherent assembly ready to receive the modules required by the specific enduse application. The card cage is mechanically compliant with all aspects of PIMG 3.0 Revision 2.0.

The components of the chassis include:

- 6 x horizontal slots with full rear transition module (RTM) support
- A backplane providing dual star Ethernet signaling environment on a Base interface.
- A fault tolerant and hot-swappable cooling subsystem with up to:
  1. 200W front slot cooling.
  2. 15W RTM slot cooling.
- 2 redundant and hot-swappable –48 VDC PEMs.
- 2 redundant and hot-swappable fan trays.

The chassis is designed to be:

- NEBS compliance capable for central office applications.
- FCC Class B compliance capable.
- FCC Class A compliant.

The Card Cage

The card cage is the portion of the chassis that includes the backplane plus right and left guide rails to hold the modules that plug into the backplane. The card cage supports 6 x 8U front modules and 6 x 8U RTMs.

The guide rails in the card cage incorporate electrostatic discharge (ESD) clips. These clips contact a circuit-board trace at the right edge of each front module and the left edge of each RTM.

When you insert a module into the card cage, the ESD clips contact three separate circuit-board traces that produce the following sequence of discharge actions:

1. The module's face plate discharges to the ESD clips through a resistor.
2. The module's logical ground discharges to the ESD clips through a resistor.
3. The module's face plate discharges directly to the chassis's ground.

Size and Weight

The table below shows the chassis size and weight.

Characteristic	Value
Height	5U (8.719 inches; 221.46 mm nominal)
Width excluding mounting lugs	17.645 inches (448.18 mm nominal)
Windth including mounting lugs	19 inches (482.6 mm nominal)
Wgt+2xPEMs+2xFan Trays+6 slot BP	41.9 pounds (19.0 kg)
Wgt with lugs in front position	19.525 inches (495.53 mm)

The basic chassis depth from the primary mounting surface (behind lugs) is 17.72 inches (450 mm). The front extension from the mounting plane is approximately 2.36 inches (60 mm). The front cable guide extends out 3.54 inches (90 mm) from the primary mounting surface.

The card cage is capable of supporting 6 front modules and 6 RTMs with a total system weight of 108 pounds (49 kg) with no front slot exceeding 8.8 pounds (4.0 kg) and no rear slot exceeding 1.65 pounds (0.75 kg).

Airflow Management Panels

Depending on the configuration ordered, the chassis may come with empty slots. Airflow management panels must be installed in empty slots to maintain the integrity of the system airflow and to ensure proper thermal and emissions profiles. Any additional airflow management panels required for empty slots can be ordered separately.

Airflow management panels restrict airflow from passing into unused front module slots and RTM slots on the chassis. The panels direct the airflow toward the occupied front module slots. Front and rear airflow management panels fit in the card cage slots and have thumbscrews consistent with a standard module, but do not have injector/ejector latches.

Four types of airflow management panels are available for the empty slots on the chassis. These include airflow management panels specifically designed for:

- Empty front module slots.
- Empty RTM slots.
- An empty alarm panel slot.
- Other empty slots.

Modules

The modules that plug into the backplane provide the core functionality of the chassis. These modules, which are also called *blades*, are multi-layer printed circuit boards populated with integrated circuits (ICs), mezzanine modules, and other components that provide functionality such as switching, processing, and storage. Firmware and other embedded software that runs on the module are important elements of each module.

For information about a particular module, refer to that module's documentation.

Slot Identification

The chassis is compliant with and accepts modules compliant with PICMG 3.0 R2.0.

The locations of the module slot allocations when viewed from the front are shown below. The physical and the logical slot allocations are the same for this chassis – the slots are numbered 1 to 6 from bottom to top.

Physical	Logical
Node slot 1	Node slot 1
Node slot 2	Node slot 2
Node slot 3	Node slot 3
Node slot 4	Node slot 4
Node slot 5	Node slot 5
Node slot 6	Node slot 6

The hub slots are allocated to slots 1 and 2 in the chassis.

Installing Modules

The chassis backplane supports up to 6 PICMG 3.0 modules. There is no preset order to installing modules into the chassis. Slots 1 and 2 are hub slots and slots 3 through 6 are node slots. The hub slots accept the switch and control modules. For installation information on whether a module is for a hub or a node slot, refer to the module's reference manual.

Individual Module Slot Environmental Specifications

Specifications for individual slots are as follows:

- **Temperature (room ambient at inlet to chassis)**

State	Value
Operating	+5° C to +40° C
Short-term Operating	–5° C to +55° C
Storage	–40° C to +70° C

- **Altitude**

  Operating - Up to 5,905 feet (1,800 meters), +55° C
  > 5,905 feet up to 13,123 feet (4,000 meters), derated linearly to +45° C

- **Relative humidity**

State	Value
Operating	5% to 85% RH non-condensing

State	Value
Short-term operating (maximum 96 hours and no fan faults)	5% to 90% RH non-condensing at +30° C
Storage	5% to 90% RH non-condensing at +40° C
Short-term storage	5% to 95% RH non-condensing at +40° C

- **Cooling - worst case slot**

> ### *Note*
> *All conditions assume the following: NEBS compliant filter in place, Front Cable management in place with 8 CAT-5 equivalent cables.*

State	Value
Normal Operation (with maximum cooling and 1 fan fault maximum)	Slot Total 200W @ 40C and 1800 m Front Slot 200W @ 40C and 1800 m RTM Slot 15W @ 40C and 1800 m
Short-term Operating (maximum 96 hours and no fan faults)	Slot Total 200W @ 55C and 1800 m Front Slot 200W @ 55C and 1800 m RTM Slot 15W @ 55C and 1800 m
Pressure drop	0.15 inches H20/slot

Power Distribution

The chassis is a high-power (–48V DC) system, which provides power to the backplane, the installed modules, the fan trays, the ShMCs, and any IPMC expansion connectors. This power source manifests itself in the form of one set of redundant interconnects called the power entry modules (PEMs). Redundant filtered 48 volt power is supplied through the PEMs to the backplane. The backplane then routes the power to the module slots.

Each installed module converts the 48V down using DC to DC converters. The DC to DC converters then supply power to the chassis. Power is supplied to installed RTMs via the associated front-slot modules through the Zone 3 connector.

Modules that need DC voltages other than -48 VDC must derive those voltages from the -48 VDC. The Shelf Manager establishes the current limit for each module, but does not monitor how much power each module is using. Modules use current limiting to limit the current being drawn. Fuses that protect against a short or a failure of the current-limiting circuitry are also present on the modules.

Frame Ground Connection

A dual hole ground connection is located at the rear of the chassis in the upper left. Connect this point to the high-quality ground (minimum size #8 AWG) used by the other equipment in your facility (or in the same rack).

The frame ground connections do not internally connect to either power-feed return line, so the chassis is compatible with both mesh (2-wire) and single-point-return (3-wire) grounding strategies.

- The mesh grounding strategy ties the frame ground to the –48 VDC power-feed return lines (A and B) at equalization plates throughout a facility.
- The single-point-return grounding strategy connects shelves to a ground connection at the battery plant, and otherwise keeps the ground wiring separate from the power-feed return

lines.

See the chassis installation guide for safety precautions and instructions on attaching the frame ground connections to the chassis.

Front Cable Guide

The chassis includes a detachable cable guide at the front of the chassis to direct cables to and from the modules to the sides of the chassis and out of the path of serviceable field replaceable units (FRUs).

Inlet Air Filter

The chassis includes a NEBS-compliant air filter that prevents dust and particles from getting into the platform system. The filter is an open cell polyurethane foam, which is specially coated to provide improved fire retardation and fungi resistance. It features deep loading, large dust holding capacity, and low air resistance.

The filter is easily accessible from front right side of the card cage. When installed, the filter's presence in the chassis is detected by a chassis-based micro-switch and is reported to the Shelf Manager.

Air Intake and Cooling

The cooling system consists of eighteen high performance fans. The two fan trays each contain six fans and the two PEMs each contain three fans. The fans in the trays provide cooling for the front card cage and the fans in the PEM provide cooling for the rear card cage. The air comes in from the right side and exits through the left side of the chassis. The fault tolerant design is optimized for airflow up to 200W per module.

The industry typically uses a 10°C air temperature rise as a rule of thumb when estimating the required airflow for electronics cooling. In the PICMG 3.0 standard, this method treats the chassis as a simple thermodynamic black box. The resulting calculation is a generally conservative prediction and does not take into account local heat transfer effects on critical components. The delta T of 10°C is the air temperature differential between the chassis intake and chassis exhaust. The calculation below does not account for the temperature of the chip which is the most critical design parameter in electronics cooling. Therefore the equation below should only be used as a rule of thumb. In depth studies of heat sink design and local airflow need to be performed via simulation or empirical results.

$$P = \rho V C_{\rho} \Delta T$$

Where P is the power dissipated and is proportional to the air's density, the air's heat capacity, and the temperature rise from intake to exhaust.

The telecommunications industry accepts 10°C based on a thermal budget. A device with a 70° C case temperature, which is placed downstream of air heated 10°C, will have a 5°C margin when the maximum ambient temperature is 55°C for central office environments (70°C max - 55°C ambient -10°C rise = 5°C margin).

Due to the high performance nature of ATCA, you must be aware of the above equation when configuring modules in the chassis. A correct thermal layout places high power components on the leading edge of the card, which results in a larger thermal budget for each component (70°Cmax-55°C ambient=15°C margin).

The chart below can be used as a guide in determining the amount of CFM the fan trays should generate to cool the front modules of the chassis. It shows the estimated heat removed, by airflow rate, for various air temperature rise values (prelininary: for Q = (CFM x delta-T) / 1.756 / No. boards)

Each fan is capable of producing 67 CFM at zero pressure. The actual airflow through the system under typical conditions is 220 CFM at 0.55" inches of water pressure, which averages to approximately 37 CFM per front slot.

Total System Environmental Specifications

Specifications for individual slots are as follows:

- **Temperature (room ambient at inlet to chassis)**

State	Value
Operating (with maximum one fan fault)	+5° C to +40° C
Short-term Operating (maximum cooling, no fan faults maximum 96 hours operation)	–5° C to +55° C
Storage	–40° C to +70° C

- **Altitude**

  Operating - Up to 5,905 feet (1,800 meters), +55° C
  > 5905 feet up to 13,123 feet (4,000 meters), derated linearly to +45° C

  Non-operating - 45,932 feet (14,000 meters)

- **Relative humidity**

State	Value
Operating	5% to 85% RH non-condensing
Short-term operating (no fan faults, maximum 96 hours operation)	5% to 90% RH non-condensing at +30° C
Storage	5% to 90% RH non-condensing at +40° C
Short-term storage	5% to 95% RH non-condensing at +40° C

- **Shock (drop)**

State	Value
Unpacked (free fall, corners & edges)	< 25kg = 75 mm drop 25 to < 50kg = 50 mm drop 50kg or greater = 25 mm drop
Packaged (not palletized) (free fall, corners & edges)	< 50kg = 525 mm drop 50 to < 100kg = 450 mm drop
Palletized	300 mm free fall drop

- **Vibration**

  In each direction for each of three mutually perpendicular axes.

State	Value
Operating	0.1g, 5 to 100 Hz and back, 0.1 octave/min sine sweep
Transportation (packaged)	0.5g, 5 to 50 Hz and back, 0.1 octave/min sine sweep 3.0g, 50 to 500 Hz and back, 0.25 octave/min sine sweep

- **Seismic**

State	Value
Operating	Per Zone 4 test method, GR-63-CORE

- **Acoustic**

State	Value
Operating (normal)	Per GR-63-CORE (60dBA) and ETS 300 753, Class 3.1 (7.2 bels)
Short-term Operating	Excursion past the limits above may be allowed during events that drive room ambient temperature beyond 45° C or during fan failure events.

Safety and EMC Specifications

- UL/EN/IEC 60950-1 Information Technology Equipment – Safety – Part 1: General Requirements, 2001.
- EN 300 386 V1.3.3 Electromagnetic compatibility and radio spectrum matters (ERM); Telecommunication network equipment; Electromagnetic compatibility (EMC) requirements.
- GR-1089-Core Electromagnetic Compatibility and Electrical Safety - Generic Criteria for Network Telecommunications Equipment.
- EN55022: 1994 + A1 + A2, 1998 + A1: 2000, + A2: 2003 Limits and methods of measurement of radio disturbance characteristics of information technology equipment.
- EN55024: 1998 +A1: 2001, +A2:2003 Limits and methods of measurement of radio disturbance characteristics of information technology equipment.
- FCC Part 15 Subpart B (Digital Devices).

Chapter 2: Architecture and Topology

Connectivity is achieved through many advanced features, including:

- Switch Fabric Blades (SFBs) that provide a 1 Gigabit Base Ethernet interface and a 10 Gigabit Fabric Ethernet.
- Dual star topology for the Base and the Fabric interfaces. Each channel can use a dedicated bus to prevent collisions that would slow down a shared bus. This topology supports a total of four paths between two modules (with each path passing through an SFB).
- A Shelf Manager, which monitors and controls the behavior of the components within the chassis. The Shelf Manager also communicates with the intelligent platform management controllers (IPMCs) on the field replaceable units (FRUs). The SFBs can be configured as the Shelf Managers for the platform.
- Processing module blades, which support dual high performance processors that have their own cache memory and RAM.
- Platform and module-specific software which supports the Shelf Manager and the Base and Fabric interfaces of the platform.

Base Interface

When SFBs are installed on the platform, they provide a Base Ethernet interface that supports the 10/100/1000Base-T Ethernet standard on the backplane. Each SFB also provides 10/100/1000Base-T Ethernet uplinks on its front panel.

The topology of the Base Ethernet interface forms a dual star. Each SFB acts as a switch that connects to every node (non-SFB) module to form the star topology.

- Channel 1 from each node module connects to the SFB in physical slot 1.
- Channel 2 from each node module connects to the SFB in physical slot 2.

The dual nature of the star topology occurs because each node module connects to both SFBs. This redundant topology provides an alternate path if one Ethernet path fails, or if one SFB fails. The diagram below illustrates this topology, showing the relationship between the node and the hub blades. The abbreviation SCM (switch and control module) refers to the SFB.

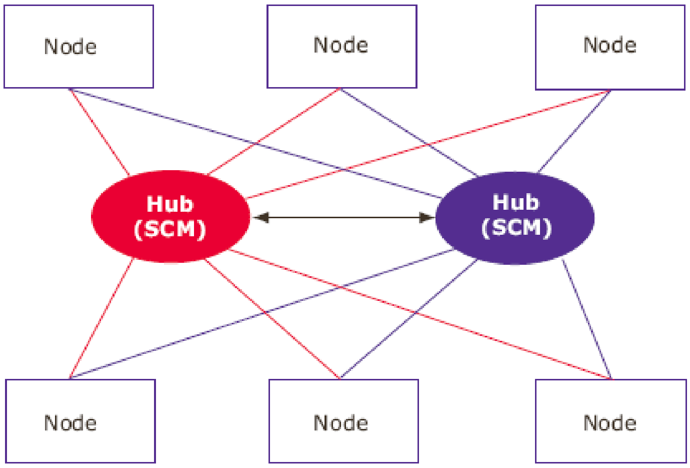

Figure 2.1. Dual Star Topology

The diagram below illustrates this topology in terms of the backplane connections between modules. Each Ethernet backplane link consists of four differential signal pairs. The red lines represent the 10/100/1000Base-T Ethernet base interface. The number of uplinks on the hub slots is SFB-independent.

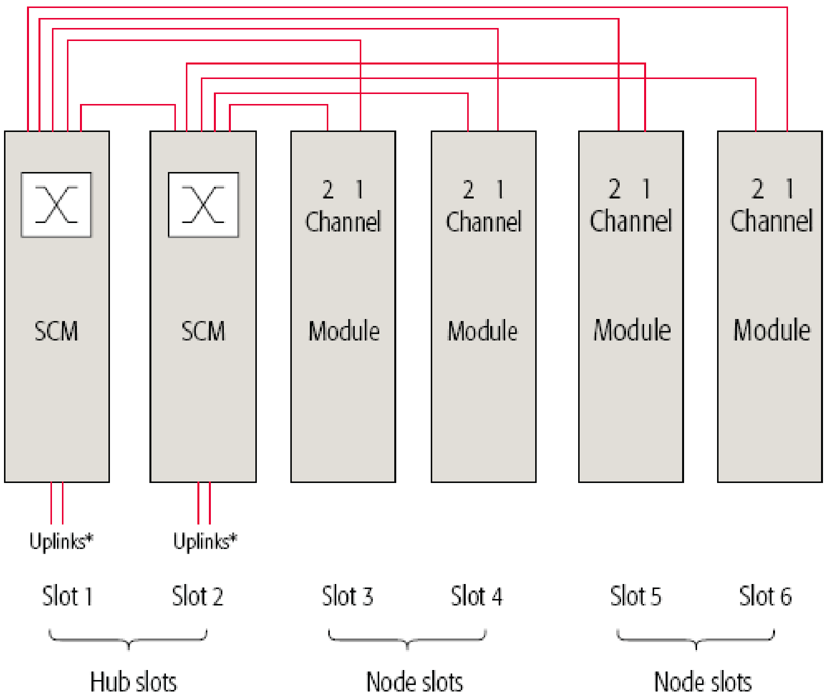

Figure 2.2. Dual Star Topology

The SFBs connect to each other through an Ethernet connection named the F-Link, which the high-level chassis management software uses. Traffic through the SFB-to-SFB link is controlled by the Base Ethernet interface switch, so the link also can be used for user traffic.

Fabric Interface

The Fabric interface is dependent on the type of SFB used in your platform configuration.

Other types of SFB deployments support a 10 Gigabit Ethernet (10GbE) switch fabric for the Fabric interconnect. As specified in PICMG 3.1, the switch fabric uses the full Fabric Ethernet interface channel in a 10GbE Attachment Unit Interface (XAUI) configuration.

The Fabric interface also implements a dual star topology, which is very similar to the one implemented by the Base Ethernet interface. The difference being that the backplane includes a Fabric interface connection between the two SFBs, but the SFBs do not make use of this backplane connection. Thus, there is no direct Fabric switch to Fabric switch link.

The diagram below illustrates the Fabric interface topology in terms of the channels between blade modules.

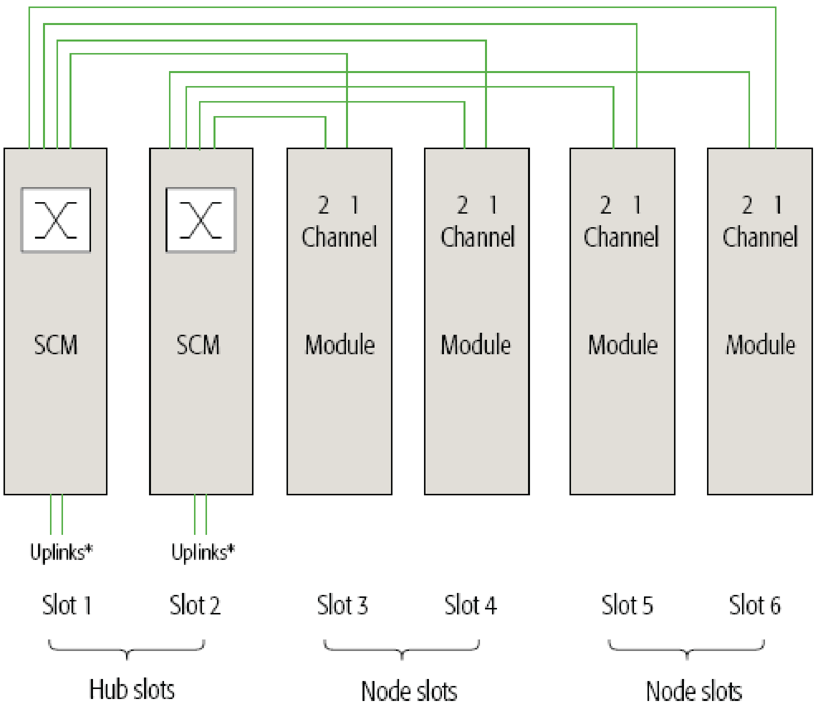

Figure 2.3. Fabric Interface

Chassis Management

The Shelf Manager, typically the SFB, oversees the chassis management tasks of the platform. Chassis management handles the following tasks, which relate to monitoring and controlling the hardware in the platform:

- Responds to external chassis management requests, such as powering down in preparation for a software upgrade.
- Monitors significant chassis events, especially failures, overheating, and the installation and removal of FRUs.
- Handles power management, including setting limits on the current drawn by each FRU, and shutting down or powering up a FRU during a hot swap.
- Handles electronic keying.
- Handles thermal management, by:

    - Monitoring air temperatures and controlling air flow.
    - Monitoring module and chassis temperatures.
    - Controlling fan trays and monitoring fan operation.
- Controls condition indicators such as the LEDs and, if installed, the audible alarm generated by the alarm panel.
- Controls the alarm interface, which includes relays whose contacts may connect to an external alarm panel.

The high-level aspects of chassis management are handled by the Shelf Manager software. Many low-level aspects of chassis management are handled by the components and firmware.

Intelligent Platform Management

Intelligent platform management (IPM) is a subset of chassis management. IPM handles aspects of chassis management that involve communication between some kinds of FRUs.

Two SFBs are installed on the chassis for redundancy purposes. Each SFB contains a shelf management controller (ShMC), which includes firmware that performs IPM and low-level chassis management services. Only one ShMC is active at any time. The SFB that has the active chassis Manager also has the active ShMC.

The active Shelf Manager — through its ShMC — communicates with the Intelligent Platform Management Controllers (IPMCs). Each intelligent FRU contains an IPMC.

The active Shelf Manager and all the IPMCs communicate through the Intelligent Platform Management Bus (IPMB). This communication uses the Intelligent Platform Management Interface (IPMI) protocol. The diagram below illustrates the architecture of the IPMBs and how the ShMCs and IPMCs connect to them.

To implement full redundancy, the IPMB is implemented as two inter-integrated circuit (I2C) buses. This dual-bus architecture prevents chassis management from being interrupted by the failure of either bus. Each ShMC and each IPMC connects to both I2C buses, so if one bus becomes unavailable, communication takes place on the other bus. To prevent a failed ShMC or IPMC from significantly disrupting either or both buses, each IPMC and ShMC has associated circuitry that isolates the ShMC or IPMC from both buses if its associated watchdog timer fails to be reset periodically.

Each intelligent FRU contains non-volatile (NV) storage (such as flash memory) that stores information about the FRU, including:

- Part number.
- Manufacturer.
- Date and time of manufacture.
- Product name.
- Engineering change revision level.
- FRU capabilities.
- Point-to-point connectivity records for blade modules that plug into the backplane (which are used for electronic keying).

The chassis, which is not a FRU, contains two NV storage devices called SEEPROMs. The SEEPROMs store the chassis specific information, the capabilities of the system, and other user configurable options. The PEMs act as a proxy FRU to make the SEEPROM information available to the Shelf Manager.

The active Shelf Manager retrieves this FRU information from the IPMCs and stores this information. To provide redundancy the active Shelf Manager also sends the FRU information to the inactive Shelf Manager, which also stores the FRU information.

The active Shelf Manager also obtains dynamic information from each FRU, such as sensor readings and hot-swap states.

As needed, a FRU's IPMC sends requests to the Shelf Manager. For example, a request to consume additional power.

Software Architecture

The software aspects of the platform are an important element of the platform's overall architecture.

Depending on the configuration, the possible interfaces are:

- Base-interface management CLI
- Fabric-interface management CLI

These software interfaces are described in detail in the relevant manuals.

Hot-swappable Field Replaceable Units (FRUs) and Alarms

All the active components in the platform—including integrated circuits, laser units, relays, and powered mezzanine modules—are mounted on (or housed in) field replaceable units (FRUs) that you can remove and replace. Every FRU is designed for high reliability and uses highly reliable components. The subrack, backplane, and other non-FRUs do not contain active components. All the platform's FRUs are hot-swappable. This means you can remove and insert a FRU without shutting down any other part of the platform, and without disrupting service in any other part of the platform. Hot swapping facilitates planned maintenance activities and FRU replacement.

The platform includes an audible alarm and front panel LEDs, which can be configured to activate when a hardware or software failure occurs. If an external alarm system is connected to the platform, it will also be activated for the alarm condition. The alarms alert an operator or technician to replace a failed FRU or perform some other maintenance operation.

When inserting a module into the platform on a hot-swap basis, the following events occur. Similar events, but without any ejector-latch activity, occur when a module powers up.

1. The IPMC powers up, the blue hot-swap LED is lit.
2. Close both ejector latches. Push each thumbscrew in and tighten.
3. IPMC announces the module's presence to the (active) Shelf Manager, and the blue LED blinks at a slow rate.
4. The Shelf Manager queries the IPMC, builds a sensor data record (SDR) repository, and begins periodically monitoring the presence of the module.
5. The Shelf Manager activates the module.

6. The module acknowledges activation.

7. The Shelf Manager determines the power and cooling budget, and sets the module's power level.

8. The Shelf Manager, based on electronic keying, enables compatible backplane ports.

9. The module notifies the Shelf Manager that it is active, and the blue hot-swap LED turns off.

10. The Shelf Manager continues periodically monitoring the presence of the module.

When removing a module on a hot-swap basis, the following events occur.

1. Partially open the module's right ejector latch to activate the module's hot-swap switch.

2. The module's IPMC sends to the Shelf Manager a request to deactivate, and the blue hotswap LED blinks at a fast rate.

3. The Shelf Manager determines whether the module can be extracted. If it can, the Shelf Manager grants permission to the IPMC.

4. The IPMC disables the interfaces that are controlled by electronic keying, and shuts down the module's operations.

5. The IPMC notifies the Shelf Manager the deactivation is complete.

6. The blue LED remains lit.

7. The module can now be extracted.

8. The Shelf Manager reclaims the module's power budget. Also, as part of electronic keying, the Shelf Manager disables—on other modules—the interfaces that are only shared with the deactivated module.

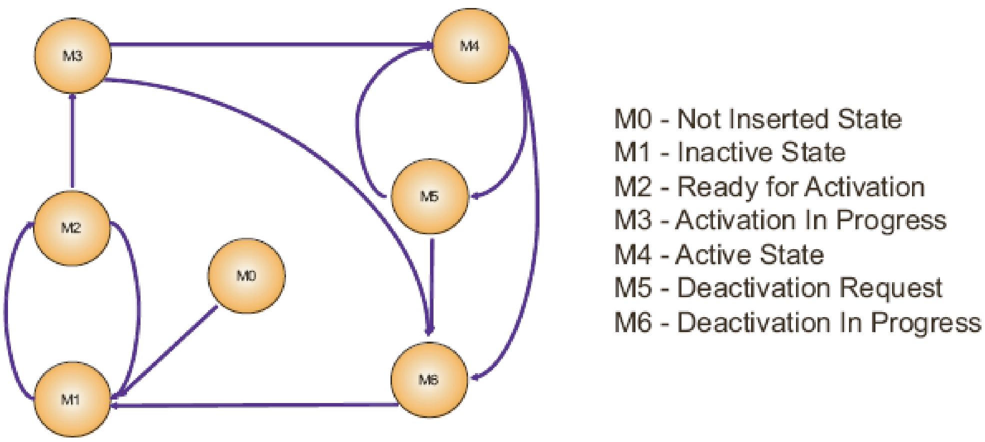

Figure 2.4. Hot Swap Transitions

Redundancy

Duplication of the platform components allows for redundancy—a means of providing continuing functionality even if a failure occurs on one of the components.

- **Dual switches**

Each SFB contains switches for both the Base Ethernet interface and the Fabric interface. If either SFB fails or is hot-swapped, the other SFB switches all the traffic for both the Base interface and Fabric interface.

The switches in the SFBs operate on an active/active basis, which means the switches in both SFBs are active. Typically both SFBs are configured to operate simultaneously, rather than being configured as a redundant pair in which only one SFB is active at a time.

Both SFBs run a copy of the switch configuration and management software, and that software controls the switches on the same SFB. If one SFB is removed or fails, the copy in the other SFB continues to control the switches in the remaining active SFB.

- **Shelf Manager**

  Each SFB has a Shelf Manager, so that if one SFB is removed or fails, the Shelf Manager in the other SFB operates as the active Shelf Manager. The dual Shelf Managers operate on an active/standby basis, which means only one Shelf Manager is active at any time.

- **Modules**

  The platform provides hardware support for two modules to operate as a redundant pair. If you choose to support any redundant module pairs, you must write application software that supports this application-specific capability.

- **Dual backplane connections**

  The backplane contains redundant connections. This redundancy ensures that if a failure disables the functionality of a backplane connection, a functionally equivalent path continues to be available.

- **PEMs**

  Power to the platform is supplied through two PEMs that operate redundantly. The PEMs also provide cooling to the rear slots of the platform. If either PEM fails, or if the power to either PEM fails, the platform continues to operate using the power supplied through the functioning PEM.

- **Fan Trays**

  Two fan trays cool the front slots of the platform. If a fan tray fails, the platform continues to be cooled by the other fan tray.

Slot Numbers and Addresses

The Shelf Manager identifies modules according to slot numbers and hardware addresses.

Synchronization Clock Interface

The backplane supports a set of synchronization clock buses that can exchange synchronization timing information. This synchronization can be used for system-wide and intersystem synchronization purposes, which are important in some applications, such as involving synchronous time division multiplex (TDM).

Chapter 3: Deployment Planning

Before installation, some planning is required. This chapter provides information on the details you should prepare for prior to the installation. For detailed instructions, refer to the individual installation guides.

Component Selection

The first planning step is to choose the application-specific components needed for your system. Selection is usually straightforward. If you are unsure about this, contact your Clavister sales representative.

Cable Routing

Before installion, you must plan the routing of the cables that will connect the system to the equipment with which it will communicate. These cables do not need to be available when you first install the platform, but you must know in advance how these cables will be routed.

To properly notify an operator of any failure, an appropriate cable should connect a centrally located alarm panel to the alarm interface connector. This connection is optional, but the lack of a centrally located alarm panel typically delays the response to an alarm condition. The increased delay can occur because an operator may need to listen to, and look at, multiple shelves to find the source of an audible alarm.

Rack Mounting

The chassis 5U height lets it easily fit into a standard 19-inch rack (or cabinet). The entire chassis weight must be supported on angle brackets that attach to the interior sides of the rack. Check with the manufacturer of the rack to see what type of angle brackets to use and how to properly install them. Verify the brackets you choose can support the full chassis weight when it is fully loaded.

The chassis front mounting lugs (or flanges) have two holes on each side. Screws attached at these holes hold the lugs to the rack's front vertical rails. The type of screws you need depends on your rack's attachment method, which is manufacturer-specific. If your rack does not have pre-tapped holes, separate nuts are needed. If you do not already have the needed screws (or nuts), acquire what you need.

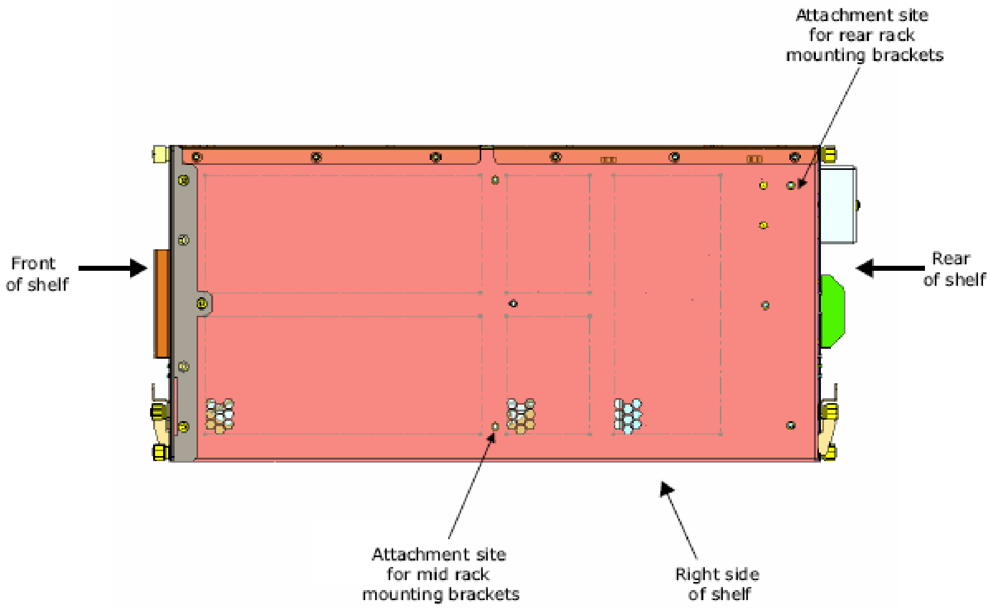

Figure 3.1. The SC6300 Series Chassis Attachment Sites

Grounding and Power Connections

A dual hole ground connection is located at the rear of the chassis in the upper left. For proper chassis operation, a ground cable must connect this connection to the high-quality ground used by the other equipment in the rack and the facility.

> ***Warning***
> *The installation guides include important safety information regarding the connection of frame-ground and power cables. Also included are details on grounding, power, and the required types of cables, connectors, and screw types. Follow the instructions in the guide when attaching and connecting the frame-ground and power cables.*

The chassis should be grounded using the same grounding strategy as other systems at your facility. If a grounding strategy has not already been established at your facility, you should consult with an electrician who has experience providing high-quality grounding for carrier-class electronic equipment.

Within each module the DC resistance between logic ground and chassis ground is greater than 9 MOhms (megohms). If an application requires it, a low-impedance connection between logic ground and chassis ground can be installed in each module. The documentation for each module describes how to make this change.

Two PEMs are located at the rear of the chassis. Each PEM has connection studs for the –VDC and Return power connections. A readily accessible disconnect device must be incorporated into the building's wiring between the chassis PEM input terminals and the power source. Refer to the installation guides for instructions on preparing the installation site and connecting cables to the power connections.

Cooling Requirements

Proper operation of the chassis requires that the air entering the chassis meet the requirements explained later for air intake and cooling.

Note

Ensure that the air entering the chassis remains within the specified maximum temperature limit. If the air temperature exceeds the specified maximum and the two fan trays operating at full speed are unable to maintain the FRUs within their recommended temperature limits, the platform may begin to reduce the thermal load, which may reduce platform performance. This response to excessive temperatures protects the modules from physical damage caused by overheating.

If the surrounding temperature exceeds the non-operating temperature limit, the platform may begin to reduce thermal load through shutdown of system modules.

The chassis expels heated air at the left side of the chassis, and this temperature increase must be considered when designing the placement of both the chassis and surrounding equipment. In most cases other equipment that needs cooling air should not be installed directly to the left chassis if the equipment will take in heated exhaust from the chassis. Conversely, the chassis should not be installed where preheated air is being brought into its intake side (the right side of the chassis).

A chassis operating at full power can consume as much as 1.35 KW of power, and move as much as 6.2 m3/min (275 CFM). The placement within a rack must accommodate this airflow, and the heating effect must be considered when planning or confirming the capacity of your facility cooling system.

Electromagnetic Interference

The chassis emits electromagnetic waves that may interfere with nearby equipment. Conversely, nearby electronic equipment may emit electromagnetic waves that interfere with the chassis. The EMC, EMI, and RFI specifications of the chassis and all nearby equipment should be considered when choosing the placement of the platform and surrounding equipment.

In the chassis and most other equipment, the use of airflow management fillers in otherwise unoccupied slots is necessary to keep the product's emissions within their specified limits. Install front and rear airflow management fillers into any empty slots. Do not use blank faceplates in place of fillers. Keep slots populated with active modules directly next to each other and fillers directly adjacent to the outermost active modules, leaving no empty slots in the final chassis configuration.

If the chassis experiences unexpected and intermittent data errors, carefully consider the possibility of electromagnetic interference from nearby equipment as a possible source of the problem.

Identifying and measuring errors caused by electromagnetic interference can be challenging and may require the assistance of engineering personnel with experience in this field.

If your system configuration does not populate all front slots with active blades, you must fill those empty slots with additional blades or slot flow blocker blades to maintain system airflow and electromagnetic shielding integrity. Flow blocker blades can be ordered separately.

Chapter 4: Backplane

Features

The backplane is monolithic and conforms to the PICMG 3.0 R2.0 AdvancedTCA Base Specification. The backplane provides the system with the following:

- 6 slots.
- Fabric interface with dual star interconnect over triple replicated full mesh.
- Dual star Ethernet signaling environment on the Base interface.
- Bussed IPM interface.
- Four node slots.
- Two hub slots.
- Two serial electrically erasable programmable ROMs (SEEPROMs) for non-volatile storage of shelf FRU data.

Backplane Components

The backplane is functionally divided into two parts: right and center left:

- **Right backplane (consists of Zone 1 connectors)** – the Zone 1 connectors include dual power connections, which means the power connections from the two PEMs are independently supplied to each module plugged into the backplane, and module connectivity to the two intelligent platform management interface buses (IPMBs). The modules use diodes to combine the two power connections so that the failure of one power feed or PEM does not interrupt the supply of power to the module. The modules also include fuses that protect the backplane power connections from an electrical short on a module.
- **Center left backplane (consists of Zone 2 connectors)** – the Zone 2 connectors provide connectivity for the Base, Fabric, and update-channel interface. The Zone 2 portion of the backplane supports a dual star topology for both the Base and the Fabric interfaces. The backplane connections for slots 1 and 2 accommodate the extra connections required for the SCMs, which serve as switches for the Base and the Fabric interfaces.

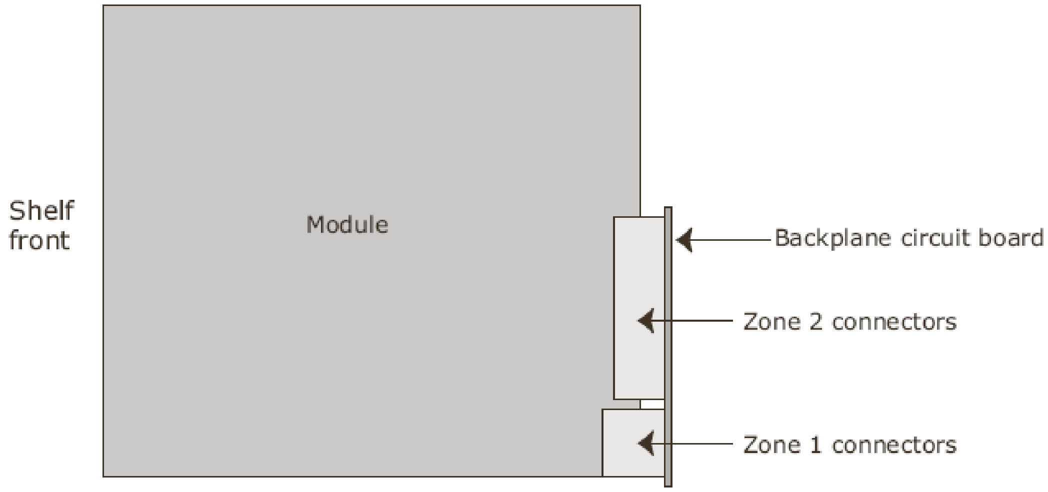

Figure 4.1. Zone 1 and 2 Connectors

The figure above shows the location of Zone 1 and Zone 2 connectors. Note that this representation shows the shelf in a vertical alignment. The backplane on the platform will actually lay in a horizontal alignment.

Note

The Zone 1 ground connections make contact before the other Zone 1 connections. All the Zone 1 connections make contact before the Zone 2 connections.

Rear Transition Modules (RTMs)

Each module that plugs into the backplane may have an associated RTM. When a module has an RTM, the RTM slides into the rear of the shelf and connects to the associated module in the corresponding front module slot.

Not every module that plugs into the backplane uses an RTM. See the documentation for a specific modules to determine if they use an RTM.

Every RTM has a set of Zone 3 connectors at its top. When you install an RTM and you view the RTM's connectors from the front of the shelf, the RTM's Zone 3 connectors are on left side (when viewed from the front of the shelf) of the Zone 2 and the Zone 1 connectors in the backplane. An RTM's Zone 3 connectors plug into the compatible Zone 3 connectors of the associated module in the corresponding front module slot. The connector provides communication between the module and the RTM, and it provides power to the RTM.

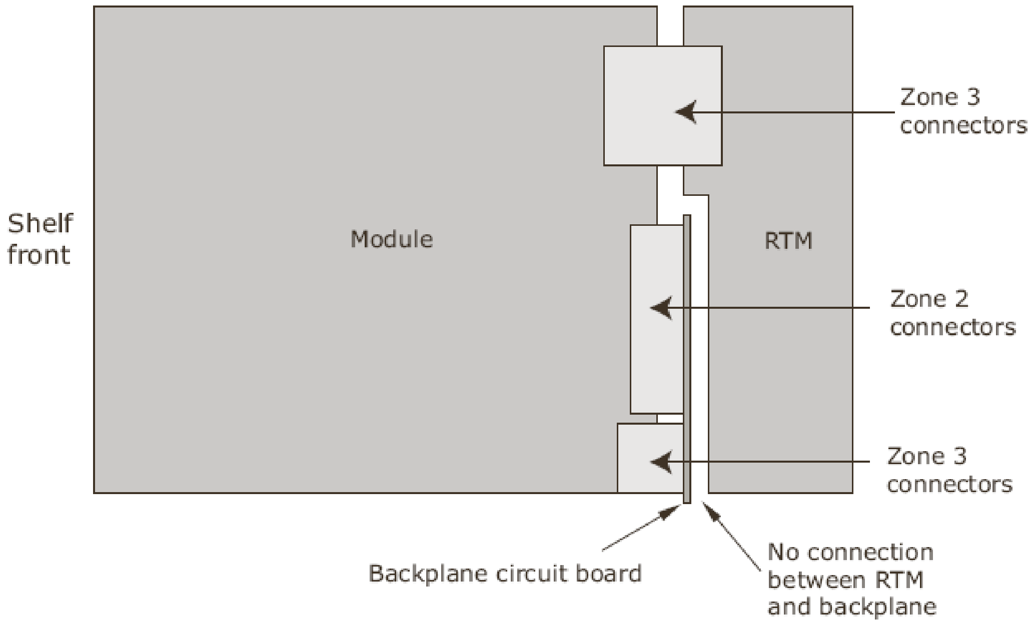

Figure 4.2. Zone 3 Connectors

Note

Ensure there is no Zone 3 airflow management panel in the target RTM slot prior to installing the RTM. Save the airflow management panel for later use if necessary to maintain airflow isolation between front and rear portions of the card cage and the shelf.

An RTM does not connect to the backplane. For this reason, power to the RTM must be supplied by its associated module. If an RTM requires a connection to a backplane signal, that connection must pass through its associated module.

Some compute and storage modules do not make use of an RTM. In such cases the module operates without the functionality provided by an RTM.

A module that uses an RTM uses it for either, or both, of these purposes:

- To put connectors at the rear of the shelf. These connectors, in conjunction with the cables that plug into them, enable the module to connect to external equipment.
- To expand the circuit-board surface area of a module to fit more components.

Note that this functionality typically applies to a specific module. For this reason an RTM typically only matches a single kind of module.

For detailed information about a module's RTM, see the documentation for that module.

Power

Power is supplied to the backplane through the PEMs. The backplane then routes the power to the module slots.

Shelf Management Support

Connectivity for shelf management is routed to RTM locations, which correspond to the hub slots where the SCMs are installed. The backplane connectors are wired to:

- IPMB_A and IPMB_B (I2C bus).
- Base interface channel 1, which is the shelf management controller of the Base interface hub slots (logical slots 1 and 2). This channel supports the Base Ethernet.
- Fan tray connectors.
- PEM connectors.

Shelf Management Controller (ShMC) Interface

Base interface channel 1 of logical slot 1 and 2 is cross connected to both dedicated shelf manager slots on the backplane.

Modules that require access to the IPMBs can attach to connectors J511, J512, J521, and J522. These connectors provide an interface point for the IPMB-A and the IPMB-B signals. The connectors also support the ShMC Ethernet signals, such as the shelf FRU device and dedicated ShMC, which are allocated from logical slots 1 and 2.

Chapter 5: Fan Trays

Overview

The chassis supports two field replaceable fan trays, which are installed on the right and the left sides of the card cage. The fan trays manage the airflow through the front of the chassis. Air is pulled in on the right side and then directed through the slots and out the left side of the chassis.

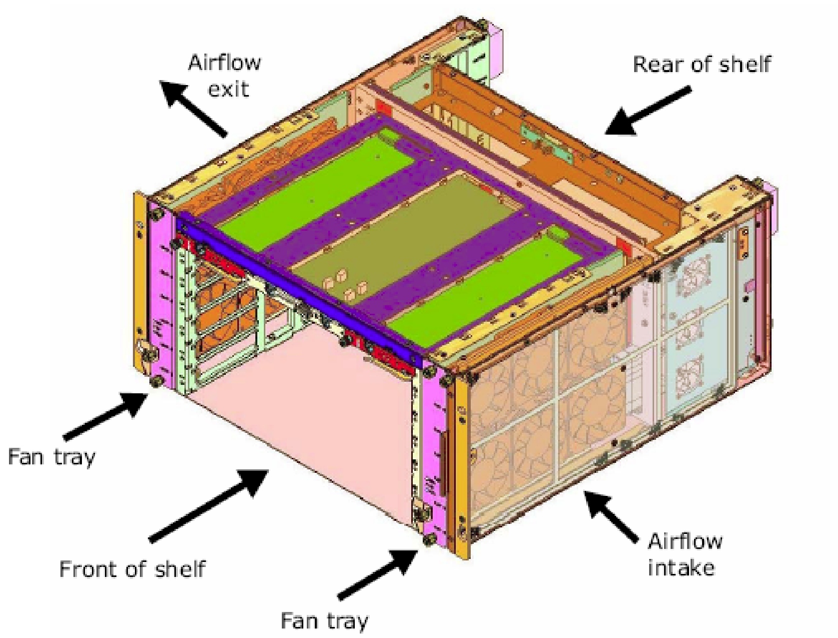

Figure 5.1. Chassis Air Flow

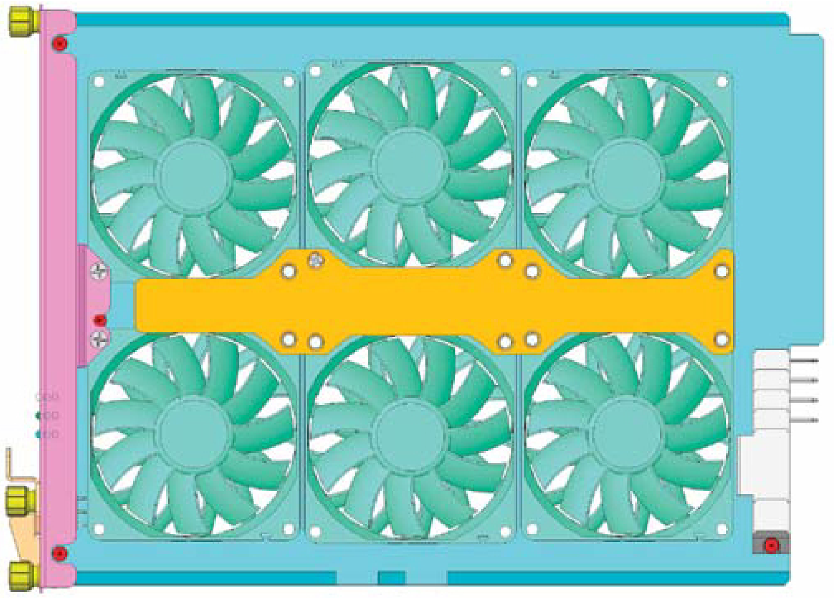

Figure 5.2. Fan Tray Side View

Each fan tray contains six high speed, high performance fans The fans are arranged on the tray in a side-by-side configuration for maximum volume air flow, even distribution, and fault resilience. The fan trays are capable of 67 cubic feet per minute (cfm) at zero pressure and are designed for a maximum power dissipation of 200W per front slot.

The fans on each fan tray are controlled as a group and managed by the Shelf Manager. The fan trays have a full IPMC implementation as defined by PICMIG 3.0, which enables the Shelf Manager to communicate with fans via IPMB connections routed through the backplane. The fan trays are identified to the Shelf Manager by their location on the chassis.

Fan Speed

When a fan tray is inserted into the chassis, the fans start at full speed and then decrease by increments of 25%. Under normal operating conditions, the fans run at 50% of full speed. The lower speed reduces the acoustic noise and increases the longevity of the fans. The circuitry on the fan trays uses a pulse-width modulation to control the speed of the fans.

The speed of each individual fan is monitored. If the speed of any of the fans drops below the desired fan speed, the other fans will speed up to compensate. The Shelf Manager logs such events in its system event log (SEL) as a fault condition. If this occurs, replace the fan tray as soon as possible to restore fault tolerance and redundancy.

The fans also speed up if no Shelf Manager is detected, there is a loss of signal with the Shelf Manager, or if an overtemp condition is received from any of the modules or FRUs in the system, or from the fan tray's own sensor.

Redundancy

The platform ensures the system's cooling is not interrupted by having two fan trays installed. If one fan tray fails, the fans on the other fan tray increase in speed to maintain the normal 200W cooling capacity.

> ***Note***
>
> *The chassis can be configured to continue to operate with only a single fan tray installed, but the chassis will operate at a reduced capability. If a fan tray fails and is removed, you must replace it with a replacement fan tray to maintain proper cooling and airflow through the chassis for the remaining modules.*

Redundancy also exists within each fan tray:

- Power is drawn from two power feeds that are individually fused. If power from one feed is lost, the other feed continues to power the fan tray.
- The control circuit is designed, so the fans default to full speed if the management circuitry does not provide the proper control signals.
- The fan tray has redundant IPMB connections for better communication reliability.
- The fan tray has sufficient cooling capacity to keep the chassis cooled even with one of the fans contained within the tray failing.

Power

Dual 48 V power is routed from the backplane to a switching regulator, which converts the input to a +12 V output that powers the fan trays. The IPMC on the fan tray is powered from a 48 V input through an isolating DC to DC converter that provides +5 V output. An output of +3.3 V power is also generated for the IPMC using a voltage regulator.

To ensure the fans start up immediately upon insertion, the fan trays do not negotiate with the Shelf Manager for power nor do they start at power level 0 as specified in the PIMC 3.0 power management mechanism.

LEDs

Each fan tray includes a front panel with LED indicators. The LEDs are as follows:

- Power OK

Color	Description
Solid green	Normal operation
Off	No power to chassis

- Out of Service 

Color	Description
Solid red or amber	Error condition
Off	No power to chassis

- Hot Swap 

Color	Description
Long blink	Searching for shelf manager
Short blink	Preparing for removal
Solid blue	Ready for removal
Off	In-use

Hot Swap

The fan trays are hot-swappable, which means a fan tray can be inserted or removed from the backplane while the system is operating. The hot-swap mechanism is activated when the thumbscrew on the hot-swap latch is unscrewed. The unscrewing of this latch prompts the Shelf Manager to shut down the fan tray. The Shelf Manager then increases the speed of the other fan tray to compensate for the fan tray that is in the process of being shutdown.

Conversely, when a fan tray is inserted and the thumbscrew on the ejector latch is screwed into position, the fan tray is identified to the Shelf Manager and resumes operation.

The hot-swap operating state is indicated by the hot-swap LED indicator. See the section on LEDs above for more information on the hot-swap operating states.

Chapter 6: Power Entry Modules

Features

Two power feeds supply all the power required by the platform. Each feed supplies -48 volts DC (VDC) to one of the two power entry modules (PEMs). The PEMS are redundant interconnects, which filter the 48 volt power from the power feeds through to the backplane, which in turn distributes power to all the module slots on the chassis. Each PEM location can supply 40 Amps of current.

Each PEM also has three fans, which provide cooling to the rear slots on the chassis. The fans are capable of 24 CFM and are designed for a maximum power dissipation of 15W per RTM slot.

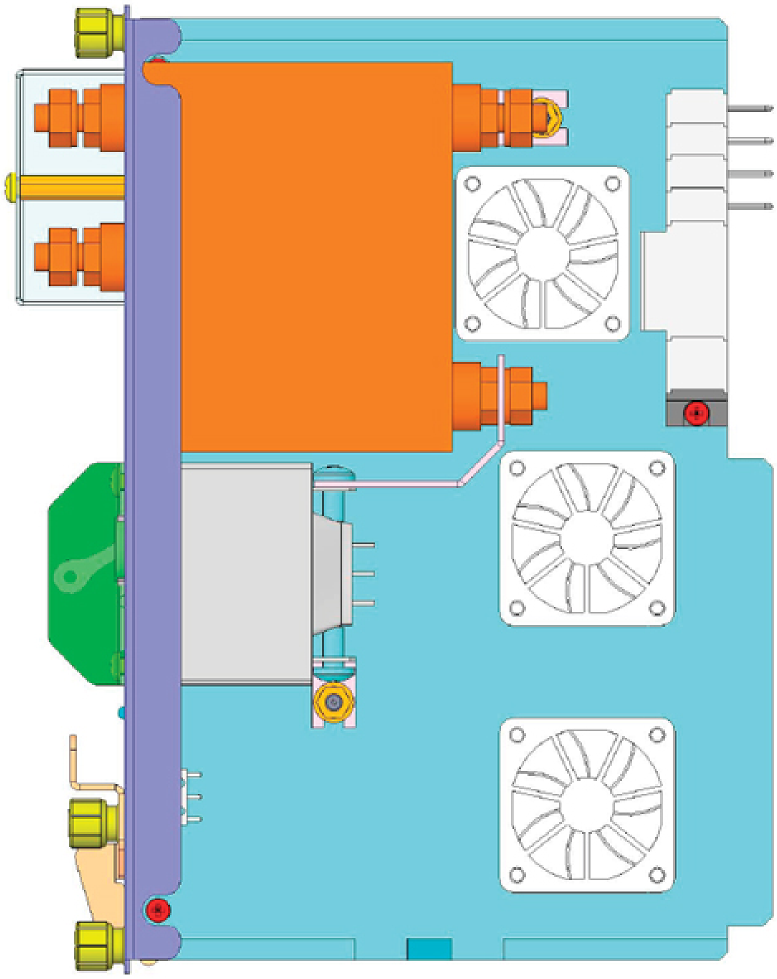

Figure 6.1. PEM Side View

The PEMs are controlled and managed by the Shelf Manager. The PEMs have a full IPMC implementation as defined by PICMG 3.0, which enables the Shelf Manager to communicate with PEMs via IPMB connections routed through the backplane. The PEMs are identified to the Shelf Manager by their location on the chassis.

Redundancy

In typical installations the –48 VDC feeds are independent of each other so that if one feed fails to supply adequate power, the other feed continues to supply power through just one PEM. The first feed (-48V_A1) is sourced from PEM-L, the PEM on the left side of the chassis (as viewed from the front of the chassis). The second feed (-48V_B1) is sourced from PEM-R on the right side of the chassis. Both feeds are individually routed to each FRU. The FRUs isolate the two sources to allow for redundancy.

If one PEM fails, the other PEM can provide all the power needed by the platform. The PEMs are hot-swappable FRUs, so a failed PEM can be replaced without disrupting platform operation.

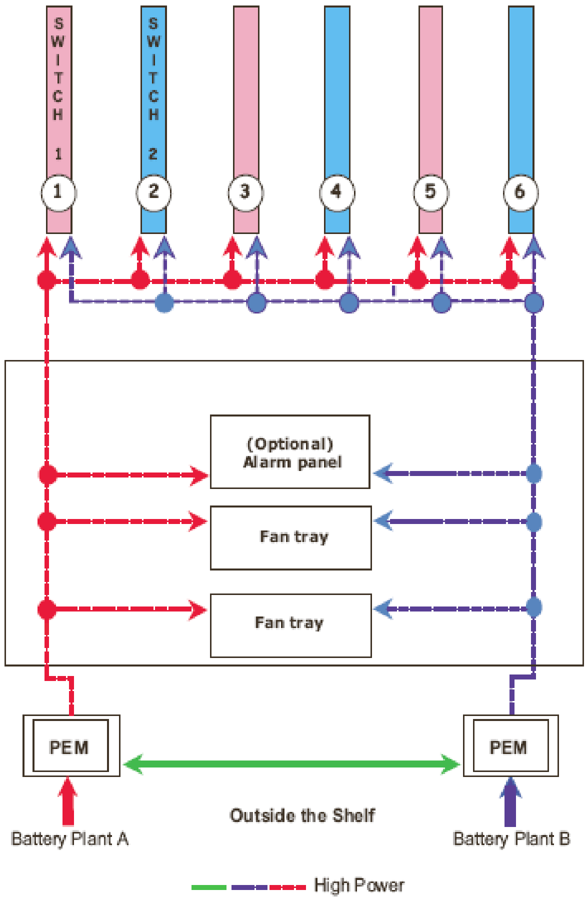

Figure 6.2. Power Distribution

Power

Each PEM conditions DC power in the following ways:

- Filters electrical noise. The filtering protects the platform from noise on the power feeds, and protects the power feeds from electrical noise generated inside the platform.
- Provides current interruption to protect the power feeds from excessive current consumption.

If the platform does not receive adequate power from the feeds and the PEMs, the Shelf Manager attempts to inform the application software so the software can try to implement an error-free transition to reduced power.

The PEM generates +12V power for each fan from the -48V power feeds inputs. The +12V fan input is produced by a redundant buck switching regulator. The -48V power feeds also provide power to the backplane connector for all the modules and additional FRU inputs. A single PEM is capable of supplying 200 Watts of power to each module slot.

An isolated DC-DC converter, within each PEM, generates 12V which is used to power the onboard IPMI circuitry along with backup power to the other PEM via backplane wiring. The backup power is shared between each PEM and allows the Shelf Manager the ability to communicate even if power is lost to that particular PEM. The generated 3.3V is also used to power the optional backplane mounted SEEPROMs.

The PEMs provide protection for the chassis against EN61000-4-5 surge transients. The PEMs reduce the surge transients to under -100V for a maximum duration of 10µs, and under -200V for a maximum duration of 5µs. Protection against EN610000-4-4 EFT transients is also provided.

Warning

Follow the instructions in the Installation Guide when connecting ground and power cables to the chassis.

A readily accessible disconnect device must be incorporated into the building's wiring between the chassis PEM input terminals and the power source. The installed breaker is determined by the voltage of the nominal input. The permitted nominal inputs and breaker ratings are:

Nominal Input	Breaker Rating
-48V	60VDC@40A
-60V	80VDC@40A

The supply circuit should be capable of delivering the equipment nameplate ratings of -48V@40A or -60V@40A.

The frame-ground cable must be a high-quality return and safety cable (with Panduit connector P/N LCD8-10A-L), no smaller than #8 AWG stranded for -48V. The cable are secured to the frame ground connectors with 10-32 x 3/8" pan head screws.

External power is connected the power connectors on the PEMs with power-feed cables (with Panduit connector P/N LCAX8-14-L or equivalent). The cables are secured to the power connectors with 1/4-20" top nuts and star washers.

LEDs

Each PEM has a front panel that includes LED indicators. The following table provides descriptions of the LED indicator states.

- Power OK

Color	Description
Solid green	Normal operation
Off	No power to chassis

- Out of Service

Color	Description
Solid red or amber	Error condition
Off	No power to chassis

- Hot Swap HS

Color	Description
Long blink	Searching for shelf manager

Color	Description
Short blink	Preparing for removal
Solid blue	Ready for removal
Off	In-use

Hot Swaps

The PEMs are hot-swappable, which means a PEM can be inserted or removed from the backplane while the system is operating. The hot-swap mechanism is activated when the thumbscrew on the hot-swap latch is unscrewed. This action informs the Shelf Manager the PEM is being removed intentionally and not to report the removal as an error event. The remaining installed PEM continues to power the chassis. The PEM being removed also continues to receive power until it is physically disconnected from the system or from the building's power source.

Conversely, when a PEM is inserted and the thumbscrew on the ejector latch is screwed into position, the Shelf Manager is informed the PEM has been inserted and is functioning. The PEM supplies power as soon as it is connected and turned on.

The hot-swap operating state is indicated by the H/S LED indicator. See the section on LEDs above for more information on the hot-swap operating states.

Chapter 7: Troubleshooting

Common Symptoms

When encountering a situation in which the shelf does not perform as expected, look for any symptoms that might reveal the cause. The following are especially useful:

- The state of the LEDs on modules and FRUs, especially the PEMs and the RTMs.
- The shelf management software logs events in the system event log (SEL), which is accessible through the Shelf Manager.
- Information about the Ethernet configuration, which can be generated using the show commands in the *base-interface* and the *fabric-interface* management CLI.

Symptoms and Recommended Actions

Look at the list below for a symptom that applies to your situation, then follow the recommended action (or actions) for the symptom. When an action reveals the cause of the problem, resolve the problem as indicated.

- **Power LED on one or both PEMs is not lit.**

  Verify that both PEM circuit breakers are turned ON. Verify that electrical power is present on the cables that supply power to the PEMs. If necessary, replace the cables or connect the cables to a power source that meets the platform requirements. If electrical power is reaching both PEMs and both circuit breakers are on, replace the PEM that has the power LED that is not lit.

- **None of the LEDs (especially the power LEDs) in any of the front-panel modules are lit.**

  Verify that the LEDs on both PEMs are lit. If not, see the symptom: *Power LED on one or both PEMs is not lit*.

- **The power LED on a module is not lit.**

  1. Verify that the module is fully inserted.
  2. Inspect the module connector pins for damage. If connector pins show no sign of damage, you can try the following:
     - Carefully insert the module into a different slot.

- Carefully insert a different module in the original slot.

  Do not force modules during insertion. If insertion is not easy, the pins on the backplane connectors may be damaged, which could potentially damage the module connector pins.

- **Communication cannot be established between Ethernetnodes within the platform.**

  Use *base-interface* management CLI commands to diagnose the cause. In particular, verify that an IP address has been assigned to the node, an appropriate subnet mask is assigned to the node, the node is within a reachable VLAN, and routing instructions do not prevent the communication. If switch-control CLI commands fail to work with one of the nodes, check the system event log to verify that the node's Ethernet backplane interface was activated.

- **A module does not work correctly.**

  Check the system event log for significant events related to the module. In particular, verify that the module worked correctly when it was installed, and look for any events since then that would account for why the module stopped working correctly.

  If the log information does not reveal useful symptoms, power down the module, slide it out, move it to a different slot, slide it back in, and power it back up.

  If appropriate, install a different module of the same kind to help determine whether the module might be defective.

- **The out of service LED on the front panel of the fan tray indicates a problem.**

  Switch the fan tray's hot-swap switch to the open position by unscrewing the thumbscrew on its ejection handle. Once the fans have powered down, return the hot-swap switch to the closed position by screwing the thumbscrew back in.

- **A module's embedded software is corrupted or fails to work with newly upgraded software.**

  Install the latest version of the firmware or software.

- **Intermittently, the shelf experiences random data errors in more than one kind of module.**

  Verify that the shelf's frame-ground connection is properly connected to a high-quality earth-ground connection. Check for electrical noise at the backplane power connections and at the PEM power inputs. Check modules to see if any are malfunctioning and causing electrical noise on backplane connections.

- **After installing application-specific software the platform does not operate correctly.**

  Restore the platform to its original configuration.

- **A compute processing Module (CPM) does not boot.**

  Attach a USB-connected keyboard to the CPM, re-power or reboot the slot, and press the F12 key at the beginning of the boot cycle.

- **A module that previously worked now shows symptoms of not working correctly.**

  Unlatch the module, let it power down, pull it out and then slide it back in and re-latch it.

- **A module overheats.**

  1. Verify no cover plates are installed. Empty slots must have air management panels

installed to properly maintain airflow and emissions.

2. Use shelf management software to check temperatures at the air intake, on the module, and at the platform's air exhaust. Use the information to determine whether the overheating may be caused by warm facility air, a module failure, or a failed fan module.
3. Try moving the module to a different slot to see if that resolves the overheating.
4. Verify there is at least two inches of clearance between the side of the shelf and the side of the rack cabinet.
5. Check the air filter for obstructions and dirt.

- **The platform software does not correctly interpret a number.**

  Refer to the Module slot identification description for the correlation between physical slot numbers, logical slot numbers, and hexadecimal addresses.

  Remember that some numbers are in hexadecimal notation and other numbers are in decimal notation. Consult the appropriate documentation to determine which notation is used for a particular number.

- **A newly inserted module hot-swap LED remains solid blue or flashes.**

  If the hot-swap LED is solid blue, the board insertion may have failed. Verify that the ejector handle is completely closed. If the handle is closed, remove the module and reinsert it. If the LED still remains blue, try inserting the module into a different slot in the system.

  If the hot-swap LED is flashing, the Shelf Manager has not activated the module. Verify the Shelf Manager has sufficient power to activate the module. If sufficient power is available, check to see whether any temperature alarms are present in the system. If there are no temperature alarms, try opening the ejector latch, wait until the LED becomes solid blue, and then close the latch again.

Alarm and Trouble Clearing

If the optional shelf alarm panel is installed and a minor or a major alarm is detected, an alarm will sound.

You have the choice of clearing the alarm event or temporarily disabling the alarm.

- **Clear the events**

  To clear the alarm event, insert the end of a pen or a paperclip into the pinhole labeled "Clear" to press the button. This action will cause the following:

  1. Turns off the alarm LEDs on the panel.
  2. Turns off the buzzer for the critical and the major alarms.
  3. Clears the active state of the minor and the major telco alarm sensor signals.

- **Disable the alarm**

  To temporarily disable the alarm, insert the end of a pen or a paperclip into the pinhole labeled with the "alarm off" graphic (the bell with a line through it) to press the button.

  During the 20 second pause, the telco alarm sensor signals remain activated. After 20 seconds, the LED resumes blinking and the alarm buzzer resumes sounding.

1. Pauses the alarm LEDs from blinking for 20 seconds.
2. Pauses the alarm buzzer from sounding for 20 seconds.

- **Diagnose the alarm**

1. Check the LEDs on the alarm panel or connect your computer to the serial console interface port to see what type of alarm has been detected.
2. Take corrective action based on the type of alarm.
3. After you have taken corrective action, verify that the alarm panel no longer displays the alarms on the LEDs.

Chapter 8: Service

Servicing Modules and FRUs

This chapter explains how to remove and replace chassis components if they require service. The acronym FRU stands for *field replaceable unit* and refers to a module that can be replaced on-site.

Electrostatic Discharge (ESD) Precautions

Many of the chassis components are static-sensitive and should be handled with care to prevent them from being damaged by ESD. Avoid causing ESD damage by following these precautions:

- Keep replacement modules or FRUs in their ESD shielding bags until you are ready to install them.
- Before touching a module attach an ESD wrist strap to your wrist and connect its other end to the ESD friction-lock connector of a properly grounded chassis (or another known ground). There is an ESD friction-lock connector on both the front and rear of the chassis.
- Hold modules by their edges and mounting hardware. Avoid touching components and connector pins.

Remove and Replace a Front Module

The following are general instructions for removing and replacing front modules, such as the switch and control module (SCM).

1. Attach a grounding strap to your wrist and connect its other end at the front of the chassis.
2. Partially open the module's right ejector latch to activate the module's hot-swap switch.
3. Wait for the module's hot-swap LED to stop blinking and remain solid blue.
4. Unscrew the M3 thumbscrews on the modules, fully open the ejector latches, and slide out the module. Put the module into an ESD shielding bag.

   Some modules may have different ejector latches from what appears in the example above and may operate differently. Refer to the your module documentation if you are unsure of how they work.

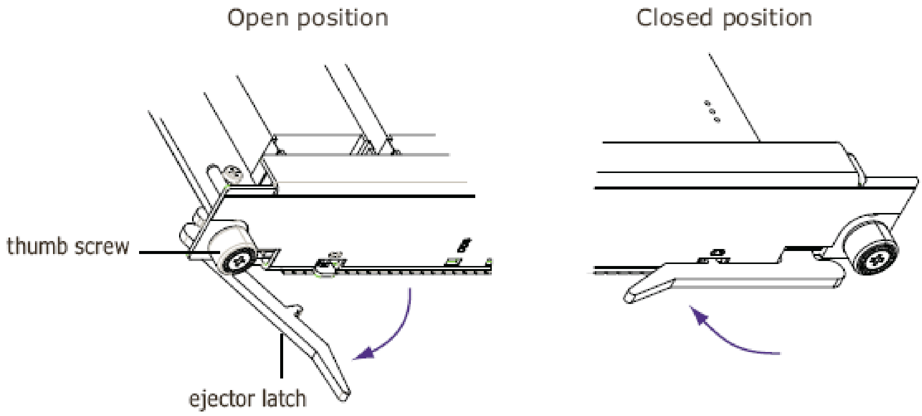

Figure 8.1. Ejector Latch and Thumb Screw

5. Remove the replacement module from its ESD shielding bag and slide it into the empty slot. Close both ejector latches. Push each M3 thumbscrew in and tighten. Torque the screws to 0.6 N•m (5.3 lbf-in).

   If you are not replacing the removed module with a replacement module, you must install an airflow management panel designed for the slot to maintain proper cooling and airflow through the chassis for the remaining modules.

6. Verify the following:

   - The module's power LED is solid green.
   - The module's hot-swap LED is off and not blinking (this typically occurs within a minute).
   - If the module has an attached RTM, verify the RTM's power LED is solid green.

7. Remove the grounding wrist strap.

8. Use the shelf management software to verify the module is available as a resource and operating correctly.

Remove and Replace an RTM

To remove and replace an RTM:

1. Identify which front-slot module is connected to the RTM. For example, if the RTM in physical slot number 3 is being replaced, the corresponding front slot module is in physical slot number 3.

2. Attach a grounding strap to your wrist and connect its other end to the front of the chassis.

3. Partially open the right ejector latch of the module connected to the RTM. Wait for the module's hot-swap LED to stop blinking and remain solid blue.

4. Unscrew the M3 thumbscrews on the module, fully open the ejector latches, and slide it out about 1" (2 cm.). The power to the RTM has now been disconnected (the RTM gets its power through the module).

5. Remove the grounding wrist strap from the front of the chassis. Move to the rear of the chassis and attach the wrist strap.

6. Verify the power LED is off for the RTM that was connected to the front module you just slid out.

7. Unscrew the thumbscrews on the RTM and open the ejector latches. Slide the RTM out and put it into an ESD shielding bag.

8. Remove the replacement RTM from its ESD shielding bag and slide it into the empty RTM slot. Close both ejector latches. Push each M3 thumbscrew in and tighten. Torque the screws to 0.6 N•m (5.3 lbf-in).

   If you are not replacing the removed RTM with a replacement RTM, you must install an airflow management panel designed for the slot to maintain proper cooling and airflow through the chassis.

9. Remove the grounding wrist strap from the rear of the chassis. Move to the front of the chassis and attach the wrist strap.

10. Slide the partially removed front module back into the slot. Close both ejector latches. Push each thumbscrew in and tighten.

11. Verify the following:

    - The module's power LED is solid green.
    - The module's hot-swap LED is off and not blinking (this typically occurs with a minute).
    - The RTM's power LED is solid green.

12. Remove the grounding wrist strap.

13. Use the shelf management software to verify the RTM and the corresponding module are available as a resource and operating correctly.

Remove and Replace a Fan Tray

Use care when handling the fan trays. Improper handling of the fan trays could cause damage to the connector pins. Never handle the fan tray from the connector.

1. Attach a grounding strap to your wrist and connect its other end to the front of the chassis.

2. Unscrew the fan tray's upper and lower 6-32 thumbscrews.

3. Unscrew the 6-32 thumbscrew on the hot-swap latch. This action tells the Shelf Manager to remove the fan tray from service. If it has not already done so, the Shelf Manager will then increase the speed of the other fan tray to compensate for the fan tray being hot swapped.

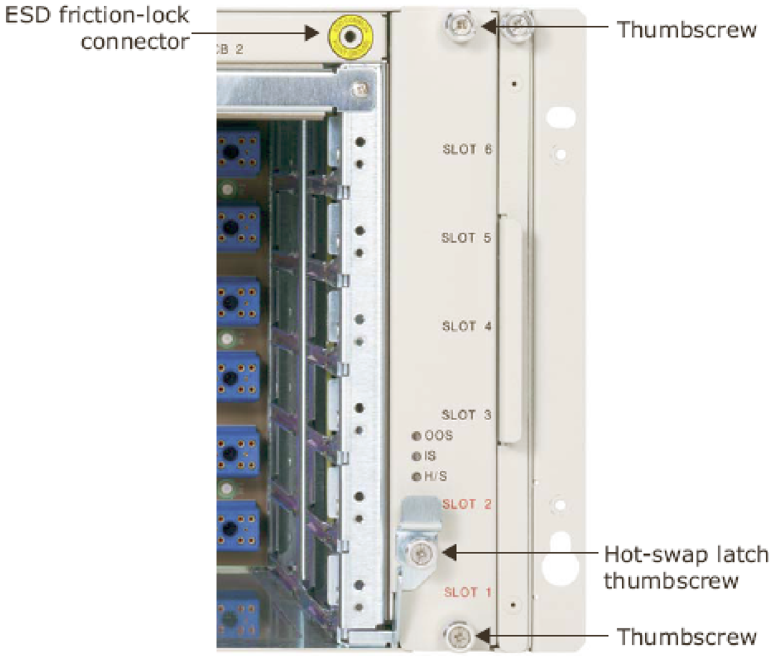

Figure 8.2. Fan Tray Detail (front of chassis)

4. Wait until the hot-swap LED is lit a solid blue and then rotate the hot-swap latch to eject the fan tray, which disconnects the fan tray from the power source. Wait approximately 10 seconds for all the fan blades to stop spinning before proceeding to the next step.

> ***Warning***
> *You may be injured if you attempt to remove a fan tray when the fans are still spinning.*

5. Slide the fan tray out and put it into an ESD shielding bag.

6. Remove the replacement fan tray from the shipping box and perform a thorough inspection. Verify all the connector pins are straight on the fan tray before attempting to install it.

7. Insert the fan tray, slide it into the empty slot until it is aligned and its connector properly mates with the connector on the backplane.

8. Close the hot-swap latch. Push the 6-32 thumbscrew in and tighten. Torque the screws to 0.96 N•m (8.5 lbf-in).

9. Push the upper and the lower 6-32 thumbscrews in and tighten. Torque the screws to 0.96 N•m (8.5 lbf-in).

10. Verify the following:

    - The module's power LED is solid green.

    - The hot-swap LED is off and not blinking (this typically occurs with a minute).

11. Remove the grounding wrist strap.

12. Use the shelf management software to verify the fan tray is available as a resource and

operating correctly.

Remove and Replace PEMs

To remove and replace PEMs:

1. If you are wearing a ground wrist strap take it off. For maximum safety, keep one hand behind your back and use tools with properly insulated handles.

> ***Warning***
>
> 1. *Do not use a grounding wrist strap while working with power cables because this increases the risk of electrical shock.*
> 2. *Ensure the power feed cabling is not powered while making or breaking connections to the PEM.*
> 3. *Do not touch a power cable when power is supplied.*
> 4. *Do not place wires, screwdrivers, meter probes, oscilloscope probes, or other electrically conducting material into contact with a live power cable or anything connected to a live power cable.*
> 5. *Do not wear any watches, bracelets, and rings when working with a live power cable or anything connected to a live power cable.*
>
> *Such actions may cause personal injury or damage electronic equipment. An electrical voltage of up to 75 VDC may be present at any power connection.*
>
> *For maximum safety, keep one hand behind your back and use tools with properly insulated handles.*

6. At the rear of the chassis, place the circuit breaker on the PEM to the OFF position. The switch displays the word "OFF" when in the OFF position.

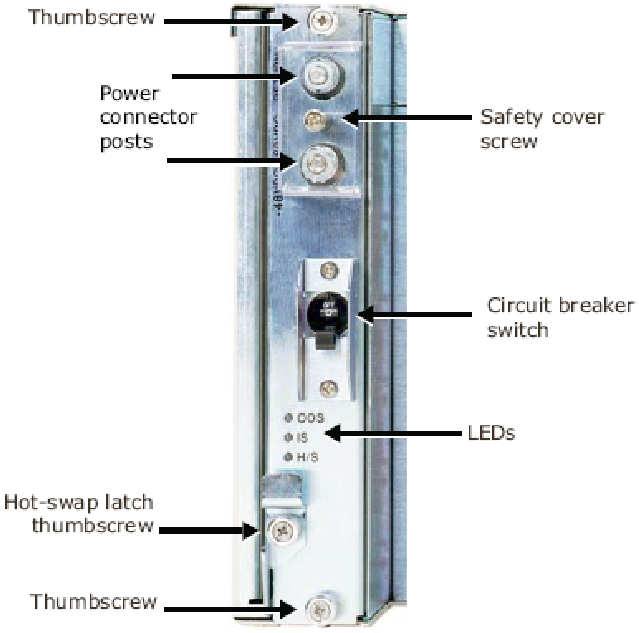

Figure 8.3. PEM Detail (rear of chassis)

7. Turn off your facility's main power to the PEM. Note the LEDs on the PEM may remain lit, since they are now receiving power from the redundant PEM.
8. Unscrew the PEM's upper and lower thumbscrews.
9. Unscrew the thumbscrew on the hot-swap latch to partially eject the PEM. The hot-swap LED will momentarily blink and then turn solid blue.
10. Using a Phillips screwdriver, unscrew the #6 screw on the PEM's safety cover. Remove the safety cover to expose the power connectors.
11. Remove the 1/4"-20 top nuts and washers using a 7/16" wrench from each of the connections on the PEM and set aside. Remove the power feed cables and place out of the way.
12. Slide the PEM out and put it into an ESD shielding bag.
13. Remove the replacement PEM from the shipping box and insert it into the empty slot.
14. Close the hot-swap latch. Push the hot-swap latch 6-32 thumbscrew in and tighten. Torque the screws to 0.96 N•m (8.5 lbf-in).
15. Push the upper and the lower 6-32 thumbscrews in and tighten. Torque the screws to 0.96 N•m (8.5 lbf-in).
16. Connect the power-feed cables (with Panduit connector P/N LCAX8-14-L or equivalent) to the appropriate connectors.
    - Check the labels next to the connectors for polarity.
    - Reattach the removed nuts and washers. Torque the nuts to 6.95 N•m (61.5 lbf-in).
17. Reattach safety cover with the #6 screw. Torque the screw to 0.90 N•m (8 lbf-in).
18. Turn on the facility's power to the PEM.

19. Flip the circuit breaker switch to the ON position. The switch displays the word "ON" when in the ON position.

20. Verify the following:

    - The power LED is solid green.
    - The hot-swap LED is off and not blinking (this typically occurs with a minute).

21. Use the shelf management software to verify the fan tray is available as a resource and operating correctly.

Install the Front Cable Guide

Use the optional front cable guide to direct cables to the side of the chassis and out of the way of serviceable modules and FRUs.

1. Line the cable guide up to the attachment points on the left rack mount ear of the chassis.

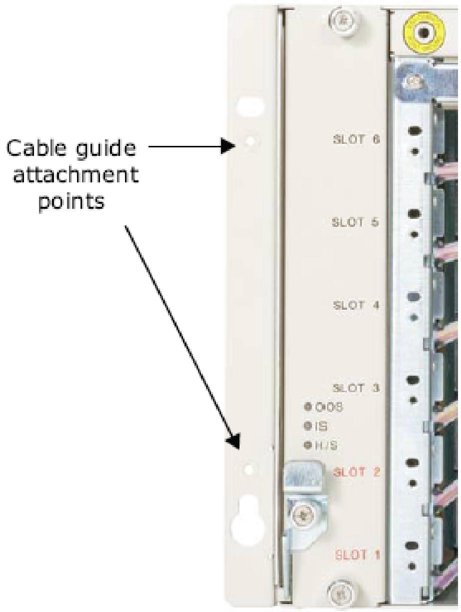

Figure 8.4. Cable Guide Attachment Points Detail (front of chassis)

2. Using a Phillips screwdriver, attach the two 8-32 x 0.25" screws that were included with cable guide. Torque the screws to 0.58 N•m (5.2 lbf-in).

Removing, Cleaning, or Replacing the Inlet Air Filter

Routine air filter maintenance is required to ensure the chassis operates efficiently. Depending on your environment, you may need to change the air filter every 30 days. Do not wait longer than 90 days to change the air filter.

Keep extra filters on hand for changing the inlet air filter. Filters can be stored for up to a year under these recommended storage conditions. The ideal storage for the polyurethane foam is a cool, dry, dark environment. High temperature, humidity, and ultraviolet light adversely affect the filter media. Foam also degrades when exposed to solvents and sulfates, such as engine exhaust. Controlling relative humidity between 40%–80% and temperature between 4.4° C–32.2° C (40° F–90° F) yields an acceptable environment. Covering the filters with dark plastic keeps the foam dry and protects it from ultraviolet light.

> ***Note***
> *If the recommended storage conditions cannot be met, keep the filters in storage for only a few months.*

The air filters can be cleaned to ensure effective filtration and airflow. How often you perform filter maintenance depends entirely on the platform's environment. Some environments may require more frequent maintenance than others.

Filters should be discarded and replaced either within a year of receipt or after three cleaning cycles, whichever comes first.

A. Remove the Inlet Air Filter

1. Unscrew the filter's thumbscrew.

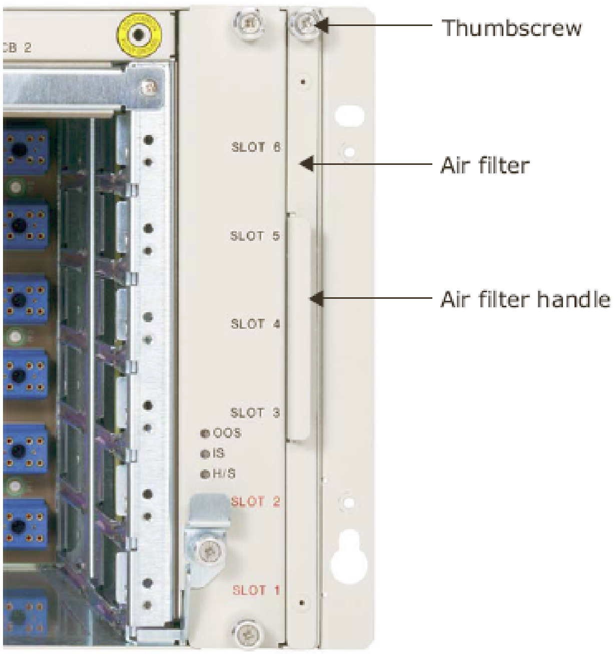

Figure 8.5. Air Filter Detail (front of chassis)

2. Using the air filter handle, gently pull the air filter from the chassis.

B. Clean the Inlet Air Filter

The inlet air filter can be cleaned using any of these methods:

- **Vacuum** — A few passes of a vacuum cleaner can remove accumulated dust and dirt.
- **Oil-free compressor air** — Point the compressed air nozzle in the opposite direction of the filter's operating airflow (blow from the filter's exhaust side toward the intake side).

- **Cold-water rinse** — Collected dirt can be washed away using just a standard hose nozzle with plain water. Let stand until completely dry before returning to service.
- **Immersion in warm soapy water** — Dip the filter in a solution of warm water and mild detergent. Then rinse the filter in clear water and let stand until completely dry before returning it to service.

C. Replace the Inlet Air Filter

- Insert and gently slide the new or the cleaned filter into the empty slot.
- Push the thumbscrew in and tighten.

Install Airflow Management Panels

If you are not replacing a removed module with a replacement module, you must install an airflow management panel or a cover plate that has been specifically designed for the slot to maintain proper cooling and airflow through the chassis for the remaining modules. Airflow management panels are available for front module and RTM slots.

- Remove the replacement airflow management panel from its packaging.
- Insert the panel into the empty slot.
- Push the thumbscrews in and tighten.

Clavister AB
Sjögatan 6J
SE-89160 Örnsköldsvik
SWEDEN

Phone: +46-660-299200
Fax: +46-660-12250

www.clavister.com