ASR 5000 Installation Guide

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About this Guide

This Installation Guide pertains to system features and functionality that run on the Cisco® ASR 5000 platform.

It describes how to unpack, install and initially configure the system. This guide also includes technical specifications and guidelines for monitoring system operation.

Conventions Used

The following tables describe the conventions used throughout this documentation.

Notice Type	Description
Information Note	Provides information about important features or instructions.
Caution	Alerts you of potential damage to a program, device, or system.
Warning	Alerts you of potential personal injury or fatality. May also alert you of potential electrical hazards.

Typeface Conventions	Description
Text represented as a `screen display`	This typeface represents displays that appear on your terminal screen, for example: `Login:`

Typeface Conventions	Description
Text represented as **commands**	This typeface represents commands that you enter, for example: **show ip access-list** This document always gives the full form of a command in lowercase letters. Commands are not case sensitive.
Text represented as a **command** *variable*	This typeface represents a variable that is part of a command, for example: **show card** *slot_number* *slot_number* is a variable representing the desired chassis slot number.
Text represented as menu or sub-menu names	This typeface represents menus and sub-menus that you access within a software application, for example: Click the **File** menu, then click **New**

Dimensions

Dimensions such as size, weight and temperature are first presented in their primary measurements (imperial or metric) followed by the converted measurement (metric or imperial) in parentheses.

Related Documentation

The most up-to-date information for this product is available in the product *Release Notes* provided with each product release.

The following documents are available:

- *ASR 5000 Installation Guide*
- *ASR 5000 System Administration Guide*
- *Command Line Interface Reference*
- *SNMP MIB Reference*
- *Statistics and Counters Reference*
- *Thresholding Configuration Guide*
- Product-specific and feature-specific Administration guides

Contacting Customer Support

Use the information in this section to contact customer support.

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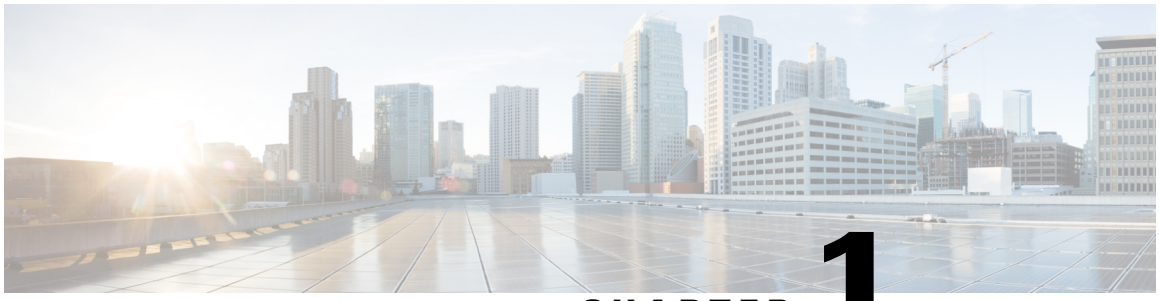


CHAPTER 1

ASR 5000 Hardware Platform Overview

This chapter describes the hardware components that comprise the ASR 5000.

It includes the following sections:

The ASR 5000 Platform

The ASR 5000 multimedia core platform is designed for deployment in multimedia-enabled core networks. It features a distributed architecture that allows all tasks and services to be allocated across the entire platform. This platform allows operators to deploy more efficient mobile networks that support a greater number of concurrent calls, optimize resource usage, and deliver enhanced services, while providing scalability.

ASR 5000 hardware components support the following features:

- 1:1 redundancy for all hardware elements
- Hot-swappable sub-components
- Inter-chassis session recovery (ICSR)
- CLI support for telnet, SSH, and local login through a console port

- SNMP support for event notification

Figure 1: ASR 5000 Chassis

Chassis Configurations

The system is designed to scale from a minimum configuration, as shown in the table below, to a fully-loaded redundant configuration containing a maximum of 48 cards.

If session recovery is enabled, the minimum number of packet processing cards per chassis increases from one to four cards. Three packet processing cards are active and one packet processing card is standby (redundant). This minimal configuration is designed to protect against software failures only.

Table 1: Minimum Card Configurations

Component	Supported ASR 5000 Product	Redundant HW Configuration (Note 1)	Redundant HW + SW Configuration (Note 2)	Maximum per Chassis
Application Cards				
System Management Card (SMC)	All	2	2	2
Packet Services Card (PSC)	End of Life (not supported in Release 16.0+)			
Packet Services Card Type A (PSCA)	End of Life (not supported in Release 16.0+)			

Component	Supported ASR 5000 Product	Redundant HW Configuration (Note 1)	Redundant HW + SW Configuration (Note 2)	Maximum per Chassis
Packet Services Card 2 (PSC2)	All	3 (2 active +1 standby)	4 (3 active +1 standby) See Note 3 below.	14
Packet Services Card 3 (PSC3)				
Packet Processing Card (PPC)	End of Life (not supported in Release 16.0+)			
Chassis Subcomponents				
Power Filter Unit (PFU)	All	2	2	2
Upper Fan Tray Assembly	All	1	1	1
Lower Fan Tray Assembly	All	1	1	1
Line Cards				
Switch Processor I/O (SPIO) Card	All	2	2	2
Redundancy Crossbar Card (RCC)	All	2	2	2
Fast Ethernet Line Card (FELC)	End of Life (replaced by FLC2)			
Fast Ethernet Line Card 2 (FLC2)	All	2	See Note 4 below.	28*
Gigabit Ethernet Line Card (GELC)	End of Life (replaced by GLC2)			
Gigabit Ethernet Line Card 2 (GLC2)	All	2	See Note 4 below.	28*
Quad Gigabit Ethernet Line Card (QGLC)	All	2		28*
10 Gigabit Ethernet Line Card (XGLC)	All	2		14**
Optical Line Card 2 (OLC2)	SGSN only	2		28*
Channelized Line Card 2 (CLC2)	SGSN only	2		28*

Notes:

1. These numbers represent the minimum number of components for hardware redundancy. Additional components are required if Session Recovery is to be supported.

2. These numbers represent the minimum number of components for: a) hardware and software redundancy; b) platforms with combined services. Additional components are required if Session Recovery is to be supported.

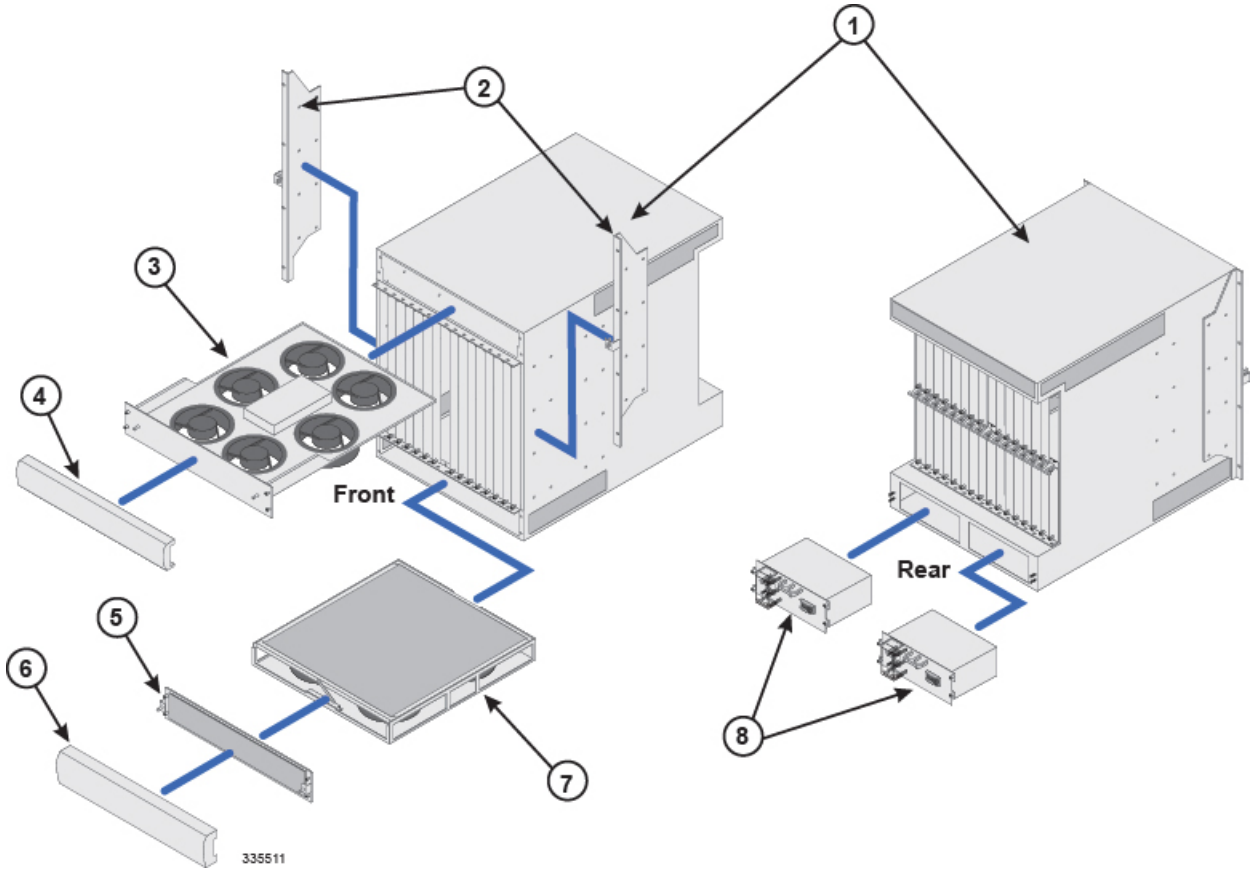
3. This is the minimum configuration for redundant SGSN service and MME service.

4. This number varies based on network deployment requirements.

*The maximum number of half-height line cards you can install is 28. However, redundant configurations may use fewer than the physical maximum number of line cards since they are inactive behind standby packet service cards.

**The 10 Gigabit Ethernet Line Card (XGLX) is a full-height line card that takes up the upper and lower slots in the back of the chassis. When referring to an installed XGLC, use the upper slot number only. Slot numbering for other installed half-height cards is maintained: 17 to 32 and 33 to 48, regardless of the number of installed XGLCs.

Figure 2: Chassis Components (front and rear views)



This diagram shows exploded views of the front and rear chassis components. They are described below.

Table 2: Chassis and Sub-component Identification Key

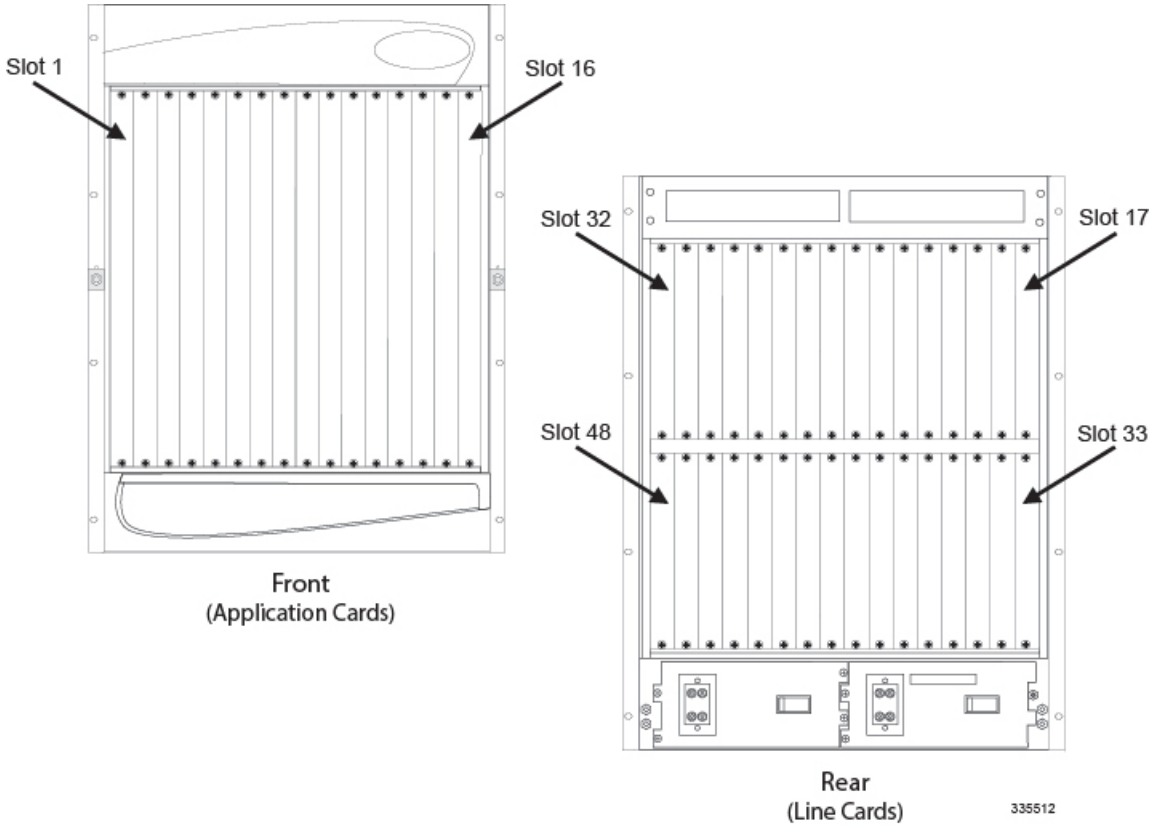
Item	Description
1	**Chassis:** Supports 16 front-loading slots for application cards and 32 rear-loading slots for line cards. To support the XGLC, a full-height line card, remove the half-height guide from the rear slots. The chassis ships with blanking panels over every slot except the following: 1, 8, 17, and 24. These are intentionally left uncovered for initial installation of application and line cards.
2	**Mounting brackets:** Support installation in a standard 19-inch rack or telecommunications cabinet. Flush and mid-mount options are supported. In addition, each bracket contains an electrostatic discharge jack for use when handling equipment.
3	**Upper fan tray:** Draws air through the chassis for cooling and ventilation. It then exhausts warmed air through the vents at the upper-rear of the chassis.
4	**Upper bezel:** Covers the upper fan tray bay.
5	**Lower fan tray cover/EMI shield:** Secures the lower fan tray assembly in place and serves as an EMI shield. The cover also provides an air baffle allowing air to enter into the chassis.
6	**Lower bezel:** Covers the lower fan tray bay.
7	**Lower fan tray assembly:** Draws ambient air through the chassis' front and sides for cooling and ventilation. It is equipped with a particulate air filter to prevent dust and debris from entering the system.
8	**Power Filter Units (PFUs):** Each of the system's two PFUs provides -48 VDC power to the chassis and its associated cards. Each load-sharing PFU operates independently of the other to ensure maximum power feed redundancy.

Chassis Description

Slot Numbering

The ASR 5000 chassis features a 48-slot design with 16 front-loading slots for application cards and 32 rear-loading slots (16 upper and 16 lower) for line cards. ASR 5000.

Figure 3: Chassis Slot Numbers



The following table shows the front slot numbers and their corresponding rear slot numbers.

Table 3: Front and Rear Slot Numbering Relationship

Position	Slot Number															
Front	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Rear Top Slots	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17

Position	Slot Number															
Rear Bottom Slots	48	47	46	45	44	43	42	41	40	39	38	37	36	35	34	33

Rear Slot Numbering for Half-Height Line Cards

Rear-installed line cards must be installed directly behind their respective front-loaded application card. For example, an application card in Slot 1 must have a corresponding line card in Slot 17. The redundant line card for this configuration would be placed in Slot 33. This establishes a directly mapped communication path through the chassis midplane between the application and line cards.

To help identify which rear slot corresponds with the front-loaded application card, the upper rear slot numbers are equal to the slot number of the front-loaded card plus 16. For example, to insert a line card to support an application card installed in slot 1, add 16 to the slot number of the front-loaded application card (Slot 1 + 16 slots = Slot 17). Slot 17 is the upper right-most slot on the rear of the chassis, directly behind Slot 1.

For lower rear slot numbers, add 32. Again, a redundant line card for an application card in Slot 1 would be (Slot 1 + 32 = Slot 33). Slot 33 is the lower right-most slot on the rear of the chassis, also behind Slot 1.

Rear Slot Numbering with Full-height Line Cards

ASR 5000 systems may be configured with 10 Gigabit Ethernet Line Cards (XGLCs). These are full-height line cards that require the removal of the half-height card guides to accommodate the cards. In this case, only the upper slot number is used to refer to the XGLC. For half-height cards installed with the XGLCs, the half-height slot numbering scheme is maintained.

For example, XGLCs installed in slots 17 and 32 also take up slots 33 and 48, but are referred to as cards in slots 17 and 32 only. The slots in which the SPIOs and RCCs are installed in the same configuration, are slots 24 and 25, and 40 and 41, respectively.

Mounting Options

The chassis is designed for installation in a standard (EIA-310-D, IEC 60297) 19-inch wide (482.6 mm) equipment rack or telco cabinet. Additional rack hardware (such as extension brackets) may be used to install the chassis in a 23-inch (584.2 mm) rack. Each chassis is 24.50 inches (62.23 cm) high. This equates to 14 Rack Units (1 RU = 1.75 in. [44.5 mm]).

You can mount a maximum of three ASR 5000 chassis in a 2- or 4-post equipment rack, or telco cabinet, provided that all system cooling and ventilation requirements are met. Three stacked chassis will occupy a minimum of 42 RUs.

There are two options for mounting the chassis in an equipment rack or telco cabinet:

- **Flush mount**: In this configuration, the flanges of the mounting brackets are flush with the front of the chassis. This method is typically used with 4-post racks and telco equipment cabinets. This is the default configuration as shipped.

- **Mid-mount**: In this configuration, the flanges of the mounting brackets are recessed from the front of the chassis. This method is typically used with 2-post racks. You must remove and re-install the mounting brackets in the middle of the chassis on both sides.

Caution The equipment rack or cabinet hardware must not hinder air flow at any of the intake or exhaust vents. The ambient environment (conditioned space) must allow the system to function within its specified operating limits.

Midplane Architecture

The midplane separates the front and rear chassis slots. The connectors on the midplane provide intra-chassis communications, power connections, and data transport paths between the various installed cards.

The midplane also contains two independent -48 VDC busses (not shown) that distribute redundant power to each card within the chassis.

Figure 4: Midplane/Switch Fabric Architecture

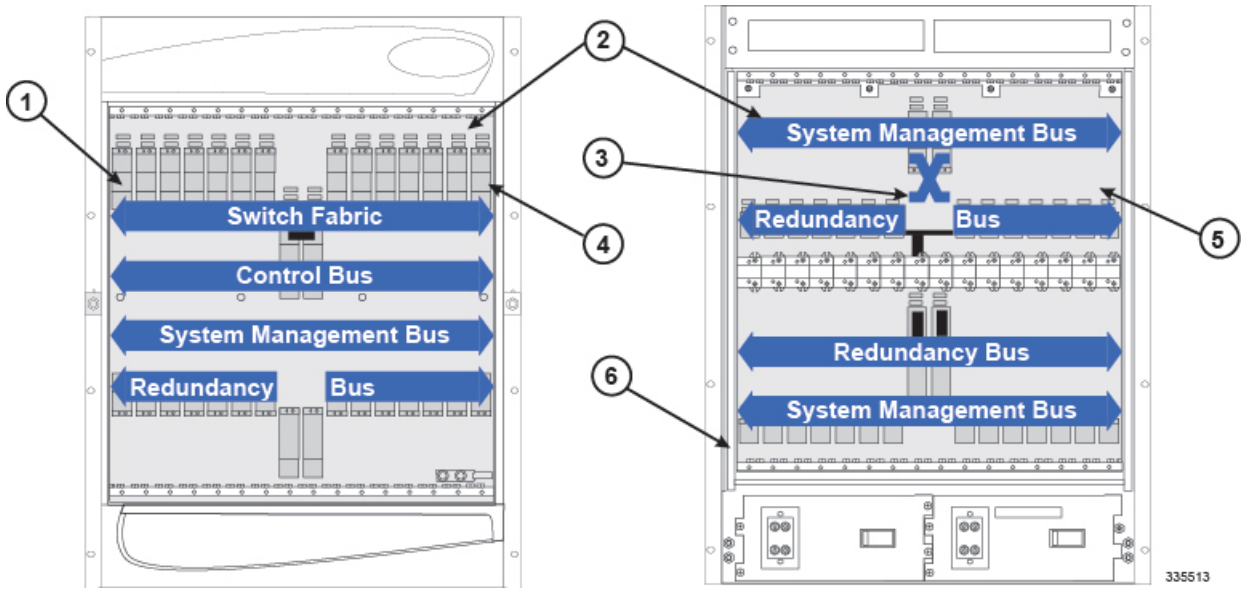


Table 4: Midplane and Bus Descriptions

Item	Description
1	Slot number 1 (left-most application card slot)
2	Chassis midplane: provides intra-chassis communications and data transport paths between the various installed cards
3	SPIO cross-connect bus
4	Chassis slot number 16: right-most application card slot

Item	Description
5	Chassis slot number 17: upper right-most line card slot. The 10 Gigabit Ethernet Line Card (XGLC) is a full-height line card that takes up the upper and lower slots in the back of the chassis. Use the upper slot number only when referring to installed XGLCs. Slot numbering for other half-height lines cards is maintained: 17 to 32 and 33 to 48, regardless of the number of installed XGLCs.
6	Chassis slot number 48: lower left-most line card slot

The following subsections describe each bus.

320 Gbps Switch Fabric

The System Management Card (SMC) is an IP-based (packetized) switch fabric that provides a transport path for user data throughout the system. Its 320 Gbps switch fabric establishes inter-card communication between the SMCs and other application cards within the chassis along with their associated line cards.

32 Gbps Control Bus

The Control Bus features redundant 32 Gbps Ethernet paths that interconnect all control and management processors within the system. The bus uses a full-duplex Gigabit Ethernet (GigE) switching hierarchy from both SMCs to each of the 14 application card slots in the chassis. Each application card is provisioned with a GigE switch to meet its specific needs. This bus also interconnects the two SMC modules.

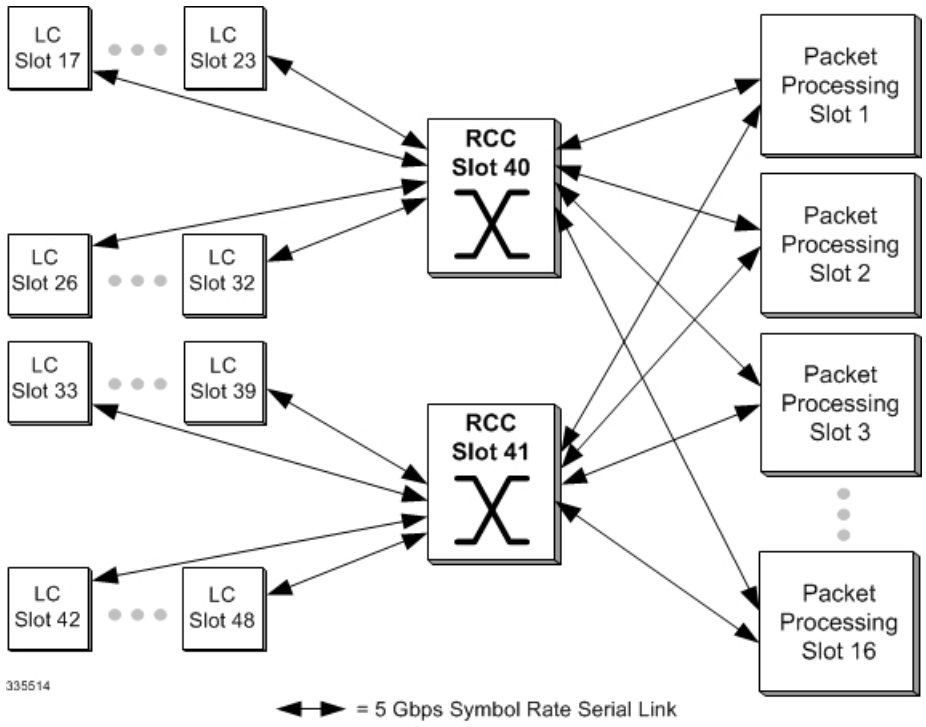
System Management Bus

The System Management Bus supports management access to each component within the chassis. It provides a communication path from each SMC to every card in the system with a 1 Mbps transfer rate to each card. This allows the SMCs to manage several low-level system functions (such as, supplying power, monitoring temperature, board status, pending card removals, data path errors, redundant/secondary path switchovers, card resets and failovers). Additionally, the System Management Bus monitors and controls the fan trays, PFUs, and alarming functions.

280 Gbps Redundancy Bus

The Redundancy Bus consists of multiple, full-duplex serial links providing packet processing card-to-line card redundancy through the chassis' Redundancy Crossbar Cards (RCCs) as shown below.

Figure 5: RCC Logical View



Each RCC facilitates 28 links:

- One link with each of the 14 packet processing card slots
- One link with each of the line card slots
  - The RCC in slot 40 supports line card slots 17-23 and 26-32 (upper-rear slots)
  - The RCC in slot 41 supports line card slots 33-39 and 42-48 (lower-rear slots)

Each serial link facilitates up to 5 Gbps symbol rate, equivalent to 4 Gbps of user data traffic, in each direction. Therefore, the Redundancy Bus provides 140 Gbps symbol rate (112 Gbps user data) of throughput per RCC, 280 Gbps symbol rate (224 Gbps user data) total for both.

OC-48 TDM Bus

The system also hosts a dual OC-48 TDM bus consisting of 128 independent TDM paths each consisting of 512 DS0 channels. This bus supports voice services on the system. Higher speed TDM traffic requirements are addressed using the system's data fabric.

SPIO Cross-Connect Bus

To provide redundancy between Switch Processor I/O (SPIO) cards, the system possesses a physical interconnect between the ports on the SPIOs. This cross-connect allows management traffic or alarm outputs to be migrated from an active SPIO experiencing a failure to the redundant SPIO.

While an SPIO should be installed directly behind its corresponding SMC, this bus allows either SMC to utilize either SPIO.

Power Filter Units

Located at the bottom rear of the chassis are slots for two 165-amp Power Filter Unit (PFU) assemblies. Each PFU provides DC power from the site's power distribution frame (PDF) to the chassis and its associated cards. Each load-sharing PFU operates independently of the other to ensure maximum power feed redundancy. The maximum input operating voltage range of the PFU is -40 VDC to -60 VDC; the nominal range is -48 VDC to -60 VDC.

Important The ASR 5000 does not offer an AC power supply option. If only AC power is available at the installation site, an adequately sized AC-to-DC converter will be required to supply -48 VDC power to the chassis.

The following drawing shows the PFU and its connectors.

Figure 6: PFU Components

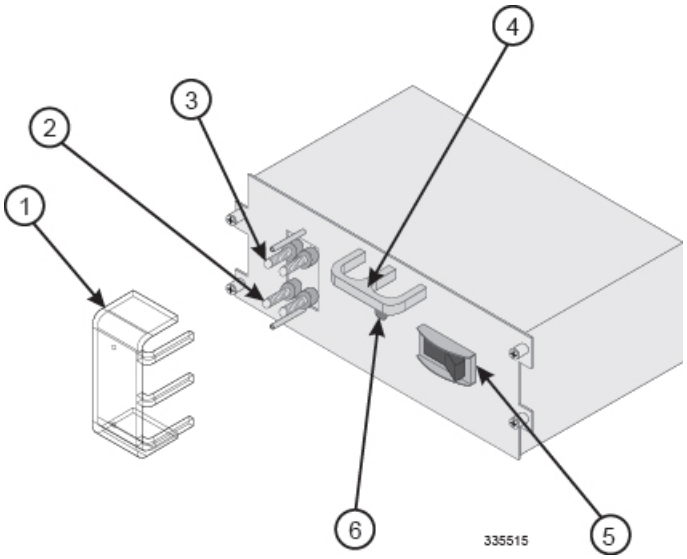


Table 5: Power Filter Unit Component Descriptions

Item	Description
1	Plastic terminal cover

Item	Description
2	VDC (-48 VDC input terminals)
3	RTN (voltage return terminals)
4	PFU handle
5	Circuit breaker (On/Off) rated at 165A
6	Power LED

Fan Tray Assemblies

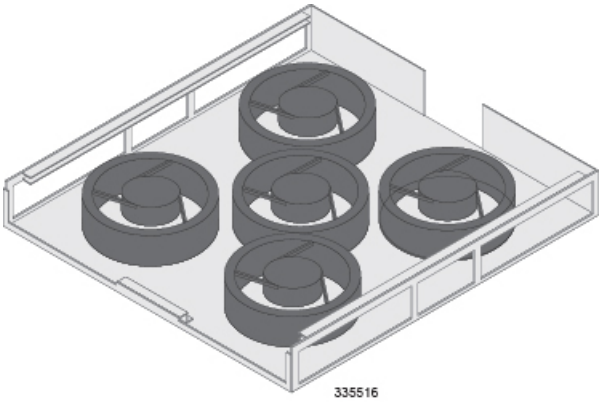
There are two fan tray assemblies within the chassis. A lower fan tray intakes ambient air and an upper fan tray exhausts warmed air from the chassis. Each fan tray is connected to both PFUs to ensure power feed redundancy. Both fan tray assemblies are variable speed units that automatically adjust fan speed based on temperature or failover situations.

Thermal sensors monitor temperatures within the chassis. In the event of a fan failure or other temperature-related condition, the SMC notifies all operable fans in the system to switch to high speed, and generates an alarm.

Lower Fan Tray

The lower fan tray assembly contains multiple fans and pulls ambient air into the chassis from the lower front and sides of the chassis. The air is then pushed upward across the cards and midplane to support vertical convection cooling.

Figure 7: Lower Fan Tray

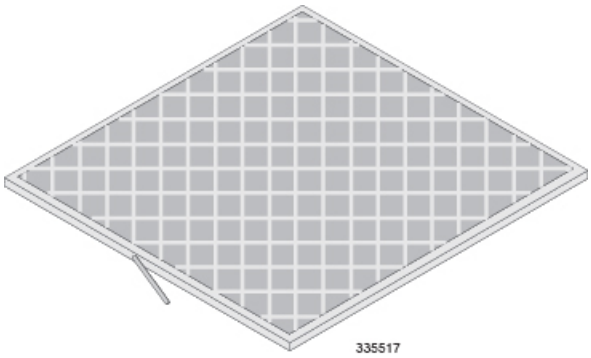


Air Filter Assembly

The chassis supports a replaceable particulate air filter that meets UL 94-HF-1 standards for NEBS-compliant electronics filtering applications. This filter mounts above the lower fan tray assembly and removes contaminants

before they enter the system. Temperature sensors measure the temperature at various points throughout the chassis. The system monitors this information, and generates a maintenance alarm, if necessary.

Figure 8: Particulate Air Filter

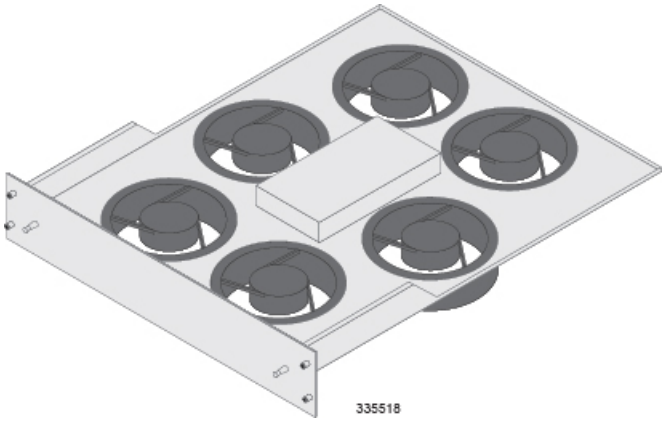


Important A replacement air filter is shipped with each chassis. A minimum of one replacement air filter for each deployed chassis should be kept on site. This allows qualified service personnel to quickly replace the filter when necessary.

Upper Fan Tray

The upper fan tray unit contains multiple fans that exhaust air from the upper rear and sides of the chassis.

Figure 9: Upper Fan Tray



Chassis Airflow

Airflow within the chassis complies with Telcordia recommendations to ensure proper vertical convection cooling of the system.

Application Cards

The following application cards are supported by the system.

System Management Card (SMC)

The SMC serves as the primary system controller, initializing the entire system and loading the software's configuration image into other cards in the chassis as applicable.

SMCs are installed in the chassis slots 8 and 9. During normal operation, the SMC in slot 8 serves as the primary card and the SMC in slot 9 serves as the secondary. Each SMC has a dual-core central processing unit (CPU) and 4 GB of random access memory (RAM).

There is a single PC-card slot on the front panel of the SMC that supports removable ATA Type I or Type II PCMCIA cards. Use these cards to load and store configuration data, software updates, buffer accounting information, and store diagnostic or troubleshooting information.

There is also a Type II CompactFlash™ slot on the SMC that hosts configuration files, software images, and the session limiting/feature use license keys for the system.

The SMC provides the following major functions:

- Non-blocking low latency inter-card communication
- 1:1 or 1:N redundancy for hardware and software resources
- System management control
- Persistent storage via CompactFlash and PCMCIA cards (for field serviceability), and a hard disk drive for greater storage capabilities
- Internal gigabit Ethernet switch fabrics for management and control plane communication

The front panel of the SMC with its major components is shown below:

Figure 10: System Management Card (SMC)

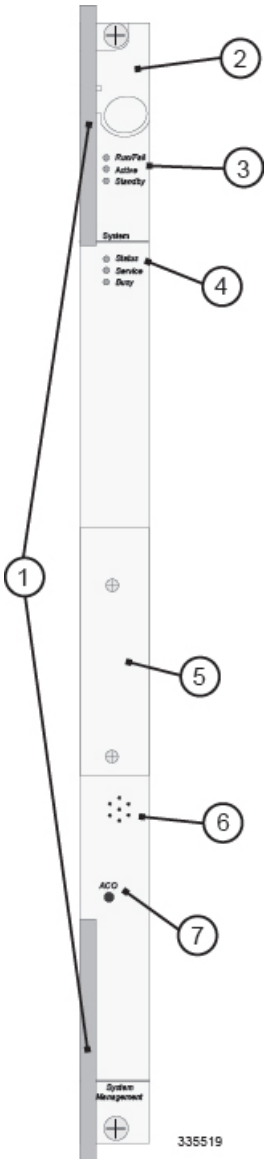


Table 6: SMC Callouts

Item	Description
1	**Card Ejector Levers —**Use to insert/remove card to/from chassis.
2	**Interlock Switch —**Sliding this switch downward on an active SMC initiates an immediate switchover to the standby SMC.

Item	Description
3	**Card Level Status LEDs—**Show the status of the card. See *Applying Power and Verifying Installation* for definitions.
4	**System Level Status LEDs—**Show the status of overall system health and/or maintenance requirements. See *Applying Power and Verifying Installation* for definitions.
5	**PC-Card/PCMCIA Slot—**Stores or moves software, diagnostics, and other information.
6	**System Alarm Speaker—**Sounds an audible alarm when specific system failures occur.
7	**Alarm Cut-Off (ACO) —**Press and release this recessed toggle switch to reset the system alarm speaker and other audible or visual alarm indicators connected to the CO Alarm interface on the SPIO.

SMC RAID Support

Each SMC is equipped with a hard disk, commonly referred to as a Small Form Factor (SFF) disk.

Important The hard disk is not physically accessible. Disk failure constitutes an SMC failure.

If there is a redundant SMC in the chassis, the standby disk mirror the disk in the active SMC, forming an active Redundant Array of Inexpensive Disks (RAID).

HD RAID ids configurable via CLI commands. RAID control mechanisms allow xDR charging data to be written to the hard disks on both the active and standby SMCs for later upload to a suitable local or remote storage server.

Event logs related to disk and RAID include disk name, serial number and RAID UUID for reference. They are generated at the Critical, Error, Warning, and Informational levels.

Event logs at the Critical level are generated for service-affecting events such as:

- RAID failure, including failures during runtime and various cases of initial RAID discovery and disk partition failures
- File system failure when the system fails to initialize or mount file systems
- Network failure for NFS server-related errors

Event logs at the Error level are generated for important failures:

- RAID disk failure, including failures during runtime
- Internal errors, including forking process failures

Event logs at Warning level are generated for important abnormal cases:

- Overwriting a valid or invalid disk partition, RAID image, and file system
- RAID construction in progress and possible failure
- Low disk space

- Files deleted to free up disk space

Event logs at the Informational level are generated for normal situations:

- Disk partition completion
- RAID discovery results without overwriting
- RAID construction completion
- RAID disk added or removed
- File system initialization
- NFS service start
- Files copied/removed from CDR module to RAID disk

The hard disk supports SNMP notifications which are described in the *SNMP MIB Reference*.

Important When the hard-disk is filled, dynamically created records files in the folder **/hd-raid/record** will be deleted to free up space. Other user-created files on the disk should be cleaned up manually.

Packet Processing Cards: PSC2 and PSC3

The packet processing cards provide packet processing and forwarding capabilities within a system. Each card type supports multiple contexts, which allows an operator to overlap or assign duplicate IP address ranges in different contexts.

Caution You cannot mix packet processing card types in the same chassis.

Specialized hardware engines support parallel distributed processing for compression, classification, traffic scheduling, forwarding, packet filtering, and statistics.

The packet processing cards use control processors to perform packet-processing operations, and a dedicated high-speed network processing unit (NPU). The NPU does the following:

- Provides "Fast-path" processing of frames using hardware classifiers to determine each packet's processing requirements
- Receives and transmits user data frames to and from various physical interfaces
- Performs IP forwarding decisions (both unicast and multicast)
- Provides per interface packet filtering, flow insertion, deletion, and modification
- Manages traffic and traffic engineering
- Modifies, adds, or strips datalink/network layer headers
- Recalculates checksums
- Maintains statistics
- Manages both external line card ports and the internal connections to the data and control fabrics

To take advantage of the distributed processing capabilities of the system, you can add packet processing cards to the chassis without their supporting line cards, if desired. This results in increased packet handling and transaction processing capabilities. Another advantage is a decrease in CPU utilization when the system performs processor-intensive tasks such as encryption or data compression.

Packet processing cards can be installed in chassis slots 1 through 7 and 10 through 16. Each card can either Active (available to the system for session processing) or redundant (a standby component available in the event of a failure).

The front panel of a packet processing card with its major components is shown below.

Figure 11: Packet Processing Card (Generic)

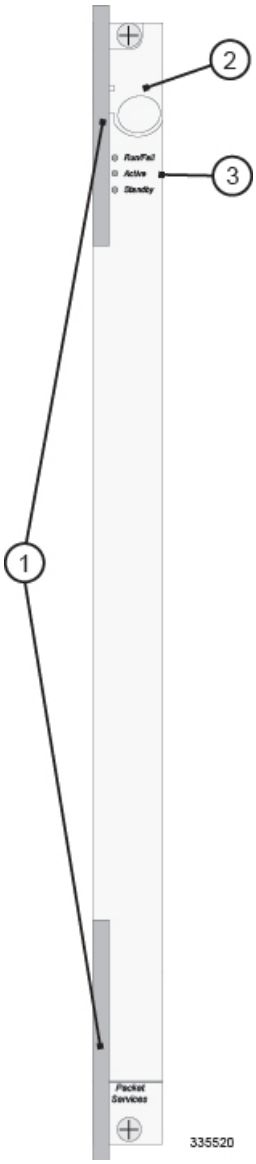


Table 7: Packet Processing Card (Generic) Callouts

Item	Description
1	**Card Ejector Levers —**Use to insert/remove card to/from chassis.
2	**Interlock Switch —**In its Down position the interlock switch notifies the system to safely power down the card prior to its removal.
3	**Card Level Status LEDs —**Show the current status of the card. See *Applying Power and Verifying Installation* for definitions.
4	**Card Identification Label —**Indicates the type of packet processing card. See the table at the end of this chapter.

Packet Services Card (PSC)

The PSC has reached its end of life and is no longer available for purchase. It is not supported in StarOS Release 16.0 and higher.

Packet Services Card Type A (PSCA)

The PSCA has reached its end of life and is no longer available for purchase. It is not supported in StarOS Release 16.0 and higher.

Packet Services Card 2 (PSC2)

The PSC2 uses a fast network processor unit, featuring two quad-core x86 CPUs and 32 GB of RAM. These processors run a single copy of the operating system. The operating system running on the PSC2 treats the two dual-core processors as a 4-way multi-processor.

The PSC2 has a dedicated security processor that provides the highest performance for cryptographic acceleration of next-generation IP Security (IPSec), Secure Sockets Layer (SSL) and wireless LAN/WAN security applications with the latest security algorithms.

PSC2s should not be mixed with PSC3s. Due to the different processor speeds and memory configurations, the PSC2 cannot be combined in a chassis with other packet processing card types.

The PSC2 can dynamically adjust the line card connection mode to support switching between XGLCs and non-XGLCs with minimal service interruption.

PSC2 is fully redundant with a spare PSC2.

Packet Services Card 3 (PSC3)

The PSC3 provides increased aggregate throughput and performance and a higher number of subscriber sessions than the PSC2. Specialized hardware engines support parallel distributed processing for compression, classification, traffic scheduling, forwarding, packet filtering, and statistics.

The PSC3 features two 6-core CPUs and 64 GB of RAM. These processors run a single copy of the operating system. The operating system running on the PSC3 treats the two core processors as a 6-way multi-processor.

To optimize network efficiency and minimize down time, the system supports 1:n redundancy for PSC3s. If session recovery is enabled, the minimum number of PSC3s per chassis increases from one to four cards. Three PSC3s are active and one PSC3 is standby (redundant). This minimum configuration protects against software failures only. In addition to increased hardware requirements, Session Recovery may reduce subscriber session capacity, performance, and data throughput.

In the event of PSC3 failure, tasks are migrated from the active PSC3 to the standby card. The line card installed behind the PSC3 that was formerly active maintains the interfaces to the external network equipment. Redundancy Crossbar Cards (RCCs) provide a path for signaling and data traffic between the line card and the now active packet processing card.

PSC3s must not be mixed with PSC2s.

The PSC3 is fully redundant with a spare PSC3.

Packet Processor Card (PPC) Description

The PSCA has reached its end of life and is no longer available for purchase. It is not supported in StarOS Release 16.0 and higher.

Line Cards

The following rear-loaded cards are currently supported by the system.

Switch Processor I/O (SPIO) Card

The SPIO card provides connectivity for local and remote management, CO alarming, and Building Integrated Timing Supply (BITS) timing input. SPIOs are installed in chassis slots 24 and 25, behind SMCs. During normal operation, the SPIO in slot 24 works with the active SMC in slot 8. The SPIO in slot 25 serves as a redundant component. In the event that the SMC in slot 8 fails, the redundant SMC in slot 9 becomes active and works with the SPIO in slot 24. If the SPIO in slot 24 should fail, the redundant SPIO in slot 25 takes over.

The following shows the front panel of the SPIO card, its interfaces, and other major components.

Figure 12: Switch Processor I/O (SPIO) Card

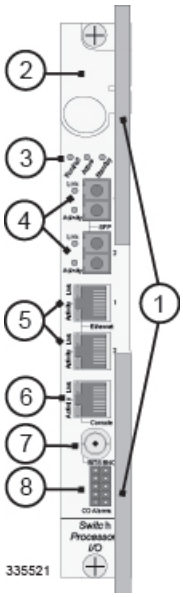


Table 8: SPIO Callouts

Item	Description
1	**Card Ejector Levers—**Use to insert/remove card to or from the chassis.
2	**Interlock Switch—**In its Down position the interlock switch notifies the system to safely power down the card prior to its removal.
3	**Card Level Status LEDs—**Show the status of the card. See *Applying Power and Verifying Installation* for definitions.
4	**Optical Gigabit Ethernet Management LAN Interfaces—**Two Small Form-factor Pluggable (SFP) optical Gigabit Ethernet interfaces to connect optical transceivers.
5	**10/100/1000 Mbps Ethernet Management LAN Interfaces—**Two RJ-45 interfaces, supporting 10/100 Mbps or 1 Gbps Ethernet.
6	**Console Port—**RJ-45 interface used for local connectivity to the command line interface (CLI). See *Cabling the Switch Processor Input/Output Line Card* for more information.
7	**BITS Timing Interface** (Optional) **—**Either an analog E1 BNC coaxial connector or T1 (DS-1) 3-pin wire-wrap connector. Used for application services that use either the OLC2 or CLC2 line cards.
8	**CO Alarm Interface—**Dry contact relay switches, allowing connectivity to central office, rack, or cabinet alarms. See *Applying Power and Verifying Installation* for more information.

Management LAN Interfaces

SPIO management LAN interfaces connect the system to the carrier's management network and applications, normally located remotely in a Network Operations Center (NOC). You can use the RJ-45 copper 10/100/1000 Mbps Ethernet interfaces or optical SFP Gigabit Ethernet interfaces to connect to the management network.

When using the RJ-45 interfaces, use CAT5 shielded twisted pair (STP) cabling.

Important Use shielded cabling whenever possible to further protect the chassis and its installed components from ESD or other transient voltage damage.

Table 9: SFP Interface Supported Cable Types

Module Type	Card Identification	Interface Type	Cable Specifications
1000Base-SX	Ethernet 1000 SX	Fiber, LC duplex female connector	**Fiber Type:** Multi-mode fiber (MMF), 850 nm wavelength **Core Size (microns)/Range:** • 62.5/902.23 feet (275 meters) • 50/1640.42 feet (500 meters) **Minimum Tx Power:** -9.5 dBm **Rx Sensitivity:** -17 dBm

Console Port

The console uses an RS-232 serial communications port to provide local management access to the command line interface (CLI). A 9-pin-to-RJ-45 console cable is supplied with each SPIO card. The console cable must provide carrier-detect when attached in a null modem configuration.

Should connection to a terminal server or other device requiring a 25-pin D-subminiature connector be required, a specialized cable can be constructed to support DB-25 to RJ-45 connectivity. The baud rate for this interface is configurable between 9600 bps and 115,200 bps (default is 9600 bps).

BITS Timing

The Building Integrated Timing Supply (BITS) timing interface is optional and required only when the system is used in support of non-data applications. A BITS module is available on two versions of the SPIO: one supports an analog E1 BNC coaxial interface (for 2048 kHZ clocking), and the other a T1 (DS1) 3-pin wire-wrap interface (for 1544 kHz clocking).

If your system is equipped with OLC2 or CLC2 line cards for SDH/SONET, you can configure it to derive system clocking from a port on either card. This functionality requires that the SPIO includes the optional Stratum 3 clocking module to distribute clocking to all line cards in the chassis.

Central Office Alarm Interface

The CO alarm interface is a 10-pin connector for up to three dry-contact relay switches for connection to a CO alarm monitoring panel. The three Normally Closed alarm relays can be wired to support Normally Open or Normally Closed devices, indicating minor, major, and critical alarms.

A CO alarm cable is shipped with the product so you can connect the CO Alarm interfaces on the SPIO card to your alarming devices. The "Y" cable design ensures CO alarm redundancy by connecting to both primary and secondary SPIO cards.

Redundancy Crossbar Card (RCC)

The RCC uses 5 Gbps serial links to ensure connectivity between rear-mounted line cards and every non-SMC front-loaded application card slot in the system. This creates a high availability architecture that minimizes data loss and ensures session integrity. If a packet processing card were to experience a failure, IP traffic would be redirected to and from the LC to the redundant packet processing card in another slot. Each RCC connects up to 14 line cards and 14 packet processing cards for a total of 28 bidirectional links or 56 serial 2.5 Gbps bidirectional serial paths.

The RCC provides each packet processing card with a full-duplex 5 Gbps link to 14 (of the maximum 28) line cards placed in the chassis. This means that each RCC is effectively a 70 Gbps full-duplex crossbar fabric, giving the two RCC configuration (for maximum failover protection) a 140 Gbps full-duplex redundancy capability.

The RCC located in slot 40 supports line cards in slots 17 through 23 and 26 through 32 (upper rear slots). The RCC in slot 41 supports line cards in slots 33 through 39 and 42 through 48 (lower rear slots):

Figure 13: Redundancy Crossbar Card (RCC)

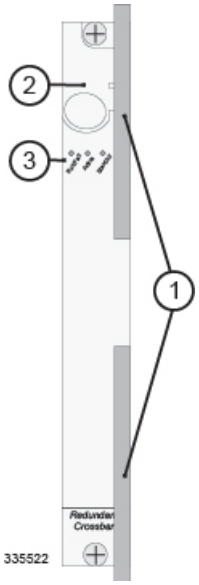


Table 10: RCC Callouts

Item	Description
1	**Card Ejector Levers—**Use to insert/remove a card to and from the chassis.
2	**Interlock Switch—**In its Down position the interlock switch notifies the system to safely power down the card prior to its removal.
3	**Card Level Status LEDs—**Show the status of the card.

Fast Ethernet Line Card (FLC2)

The FLC2 installs directly behind its respective packet processing card, providing network connectivity to the RAN interface and the packet data network. Each FLC2 (Ethernet 10/100) has eight RJ-45 interfaces. Each of these IEEE 802.3-compliant interfaces supports auto-sensing 10/100 Mbps Ethernet. Allowable cabling includes:

Important The FELC has reached its end of life and is no longer available for purchase. It has been replaced by the FLC2.

- 100Base-Tx —full or half duplex Ethernet on CAT 5 shielded twisted pair (STP) or unshielded twisted pair (UTP) cable
- 10Base-T —full or half duplex Ethernet on CAT 3, 4, or 5 STP or UTP cable

Important Use shielded cabling whenever possible to further protect the chassis and its installed components from ESD or other transient voltage damage.

The FLC2 supports the Star Channel (1 Gbps) for faster FPGA upgrades and is Restriction of Hazardous Substances (RoHS) 6/6 compliant.

The FLC2 can be installed in chassis slots 17 through 23, 26 through 39, and 42 through 48. These cards are always installed directly behind their respective packet processing cards, but are not required to be placed behind any redundant packet processing cards (those operating in Standby mode).

The following shows the panel of the FLC2 with its interfaces and major components.

Figure 14: Fast Ethernet Line Card (FLC2)

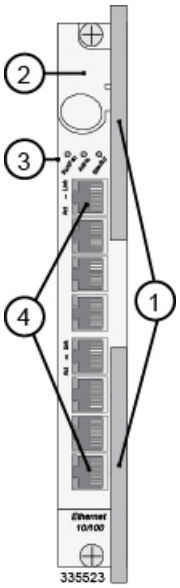


Table 11: FLC2 Callouts

Item	Description
1	**Card Ejector Levers—**Use to insert/remove card to/from chassis.
2	**Interlock Switch—**In its Down position the interlock switch notifies the system to safely power down the card prior to its removal.
3	**Card Level Status LEDs—**Show the status of the card.
4	**RJ-45 10/100 Ethernet Interfaces—**Eight auto-sensing RJ-45 interfaces for R-P interface connectivity carrying user data. Ports are numbered 1 through 8 from top to bottom.

Gigabit Ethernet Line Card (GLC2)

The GLC2 installs directly behind its respective packet processing card, providing network connectivity to the packet data network. The GLC2 (Ethernet 1000) supports a variety of 1000 Mbps optical and copper interfaces based on the type of Small Form-factor Pluggable (SFP) modules installed on the card.

Important The GELC has reached its end of life and is no longer available for purchase. It has been replaced by the GLC2.

Table 12: SFP Modules Supported by the GLC2

Module Type	Card Identification	Interface Type	Cable Specifications
1000Base-SX	Ethernet 1000 SX	Fiber, LC duplex female connector	**Fiber Type:** Multi-mode fiber (MMF), 850 nm wavelength **Core Size (microns)/Range:** • 62.5/902 feet (275 meters) • 50/1640 feet (500 meters) **Minimum Tx Power:** -9.5 dBm **Rx Sensitivity:** -17 dBm
1000Base-LX	Ethernet 1000 LX	Fiber, LC duplex female connector	**Fiber Type:** Single-mode fiber (SMF), 1310 nm wavelength **Core Size (microns)/Range:** 9/32808 feet (10 kilometers) **Minimum Tx Power:** -9.5 dBm **Rx Sensitivity:** -19 dBm
1000Base-T	Ethernet 1000 Copper	RJ-45	Operates in full-duplex up to 100 meters of CAT-5 Shielded Twisted Pair (STP) cable with BER less than 10e-10.

Important This product has been tested and found to comply with the limits for Class 1 laser devices for IEC825, EN60825, and 21CFR1040 specifications.

The GLC2 supports the Star Channel (1 Gbps) for faster FPGA upgrades and is Restriction of Hazardous Substances (RoHS) 6/6 compliant.

The GLC2s can be installed in chassis slots 17 through 23, 26 through 39, and 42 through 48. These cards are always installed directly behind their respective or packet processing cards, but they are not required behind any redundant packet processing cards (those operating in Standby mode).

The following diagram shows the front panel of the GLC2 with an optical connector, identifying its interfaces and major components.

Figure 15: Gigabit Ethernet Line Card (GLC2)

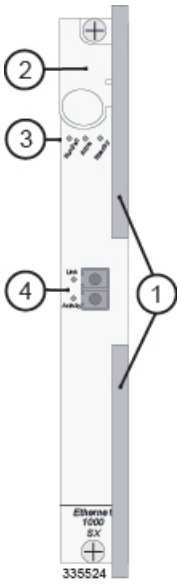


Table 13: GLC2 Callouts

Item	Description
1	**Card Ejector Levers—**Use to insert/remove card to/from chassis.
2	**Interlock Switch—**In its Down position, the interlock switch notifies system to safely power down card prior to removal.
3	**Card Level Status LEDs—**Show the status of the card. See *Applying Power and Verifying Installation* for definitions.
4	**Gigabit Ethernet Interface—**Gigabit Ethernet (GE) SFP modules. 1000Base-SX, 1000Base-LX, and 1000Base-T interfaces are supported depending on the SFP module installed.

Quad Gigabit Ethernet Line Card (QGLC)

The QGLC is a 4-port Gigabit Ethernet line card that installs directly behind its associated packet processing card to provide network connectivity to the packet data network. There are several different versions of Small Form-factor Pluggable (SFP) modules available for the QGLC.

Table 14: SFP Modules Supported by the QGLC

Module Type	Card Identification	Interface Type	Cable Specifications
1000Base-SX	Ethernet 1000 SX	Fiber, LC duplex female connector	**Fiber Type:** Multi-mode fiber (MMF), 850 nm wavelength **Core Size (microns)/Range:** • 62.5/902 feet (275 meters) • 50/1640 feet (500 meters) **Minimum Tx Power:** -9.5 dBm **Rx Sensitivity:** -17 dBm
1000Base-LX	Ethernet 1000 LX	Fiber, LC duplex female connector	**Fiber Type:** Single-mode fiber (SMF), 1310 nm wavelength **Core Size (microns)/Range:** 9/32808 feet (10 kilometers) **Minimum Tx Power:** -9.5 dBm **Rx Sensitivity:** -19 dBm
1000Base-T	Ethernet 1000 Copper	RJ-45	Operates in full-duplex up to 100 meters of CAT-5 Shielded Twisted Pair (STP) cable with BER less than 10e-10.

Important This product has been tested and found to comply with the limits for Class 1 laser devices for IEC825, EN60825, and 21CFR1040 specifications.

The QGLC supports the Star Channel (1 Gbps) for faster FPGA upgrades and is Restriction of Hazardous Substances (RoHS) 6/6 compliant.

Install QGLCs in chassis slots 17 through 23, 26 through 39, and 42 through 48. Always install these cards directly behind their respective packet processing cards. They are not required behind any redundant packet processing cards (those operating in Standby mode).

The following shows the front panel of the QGLC, identifying its interfaces and major components:

Figure 16: Quad Gigabit Ethernet Line Card (QGLC)

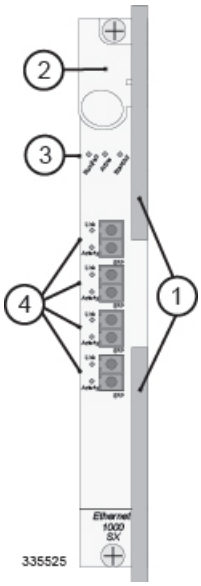


Table 15: QGLC Callouts

Item	Description
1	**Card Ejector Levers—**Use to insert/remove card to/from chassis.
2	**Interlock Switch—**In its Down position the interlock switch notifies system to safely power down the card prior to its removal.
3	**Card Level Status LEDs—**Show the status of the card. See *Applying Power and Verifying Installation* for definitions.
4	**Gigabit Ethernet Interface(s) —**Gigabit Ethernet (GE) SFP modules. 1000Base-SX, 1000Base-LX, and 1000Base-T interfaces are supported depending on the SFP module installed.

10 Gigabit Ethernet Line Card (XGLC)

The XGLC supports higher speed connections to packet core equipment, increases effective throughput between the ASR 5000 and the packet core network, and reduces the number of physical ports needed on the ASR 5000.

The XGLC (10G Ethernet) is a full-height line card, unlike the other line cards, which are half height. To install an XGLC, you must remove the half-height card guide to create a full-height slot.

The single-port XGLC supports the IEEE 802.3-2005 revision which defines full duplex operation of 10 Gigabit Ethernet. PSC2s or PSC3s are required to achieve maximum sustained rates with the XGLC.

The XGLC use a Small Form Factor Pluggable Plus (SFP+) module. The modules support one of two media types: 10GBASE-SR (Short Reach) 850nm, 300m over multimode fiber (MMF), or 10GBASE-LR (Long Reach) 1310nm, 10km over single mode fiber (SMF).

The XGLC is configured and monitored by the SMC via the system's control bus. If the firmware needs to be upgraded. the XGLC uses the Star Channel for a faster download.

Install XGLCs in chassis slots 17 through 23 and 26 through 32. These cards should always be installed directly behind their respective packet processing cards, but they are not required behind any redundant packet processing cards (those operating in Standby mode).

The supported redundancy schemes for XGLC are L3, Equal Cost Multi Path (ECMP) and 1:1 side-by-side redundancy.

Side-by-side redundancy allows two XGLC cards installed in neighboring slots to act as a redundant pair. Side-by-side pair slots are 17-18, 19-20, 21-22, 23-26, 27-28, 29-30, and 31-32.

Side-by-side redundancy only works with XGLC cards. When configured for non-XGLC cards, the cards are brought offline. If the XGLCs are not configured for side-by-side redundancy, they run independently without redundancy.

When you first configure side-by-side redundancy, the higher-numbered slot's configuration is erased and then duplicated from the lower-numbered slot. The lower-numbered top slot retains all other configuration settings. While side by side redundancy is configured, all other configuration commands work as if the side by side slots were top-bottom slots. Configuration commands directed at the bottom slots either fail with errors or are disallowed.

When you unconfigure side-by-side redundancy, the configuration for the higher-numbered top and bottom slots are initialized to the defaults. The configuration for the lower-numbered slot retains all other configuration settings. If you install non-XGLC cards in the slots, you may bring them back online.

Table 16: SFP Modules Supported by the XGLC

Module Type	Card Identification	Interface Type	Cable Specifications
10GBase-SR	Ethernet 10G SR	Fiber, LC duplex female connector	**Fiber Type:** Multi-mode fiber (MMF), 850 nm wavelength **Core Size (microns)/Range:** • 62.5/902.23 feet (275 meters) • 50/1640.42 feet (500 meters) • 62.5um/33m (OM1) • 50um 500MHz-km/82m (OM2) • 50um 2000MHz-km/300m (OM3) **Minimum Tx Power:** -7.3 dBm **Rx Sensitivity:** -11.1 dBm
10GBase-LR	Ethernet 10G LR	Fiber, LC duplex female connector	**Fiber Type:** Single-mode fiber (SMF), 1310 nm wavelength **Core Size (microns)/Range:** 9/32808.4 feet (10 Kilometers) **Minimum Tx Power:** -11.0 dBm **Rx Sensitivity:** -19 dBm

Important This product has been tested and found to comply with the limits for Class 1 laser devices for IEC825, EN60825, and 21CFR1040 specifications.

The following shows the front panel of the XGLC, identifying its interfaces and major components.

Figure 17: 10 Gigabit Ethernet Line Card (XGLC)

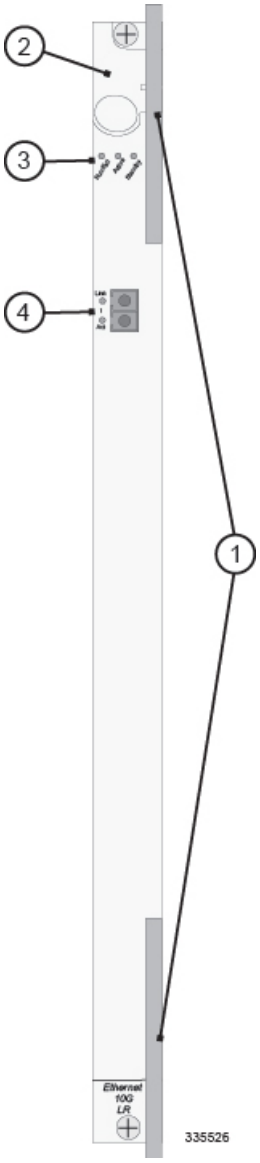


Table 17: XGLC Callouts

Item	Description
1	**Card Ejector Levers—**Use to insert/remove card to/from chassis.
2	**Interlock Switch—**In its Down position the interlock switch notifies system to safely power down the card prior to its removal.
3	**Card Level Status LEDs—**Show the status of the card. See *Applying Power and Verifying Installation* for definitions.
4	**Gigabit Ethernet Interface(s)—10** Gigabit Ethernet (GE) SFP+ modules. 10Base-SR and 10Base-LR interfaces are supported, depending on the SFP+ module installed.

Optical Line Card (OLC2)

The OLC2 is labeled OLC2 OC-3/STM-1 Multi Mode (or Single Mode depending on SFP type). The OLC2 supports either OC-3 or STM-1 signaling and ATM.

The OLC2 support both SDH and SONET. The basic unit of framing in SDH is STM-1 (Synchronous Transport Module level - 1), which operates at 155.52 Mbps. SONET refers to this basic unit as STS-3c (Synchronous Transport Signal - 3, concatenated), but its high-level functionality, frame size, and bit-rate are the same as STM-1.

SONET offers an additional basic unit of transmission, STS-1 (Synchronous Transport Signal - 1), operating at 51.84 Mbps—exactly one third of an STM-1/STS-3c. The OLC2 concatenates three STS-1 (OC-1) frames to provide transmission speeds up to 155.52 Mbps with payload rates of 149.76 Mbps and overhead rates of 5.76 Mbps.

The OLC2 optical fiber line card supports network connectivity through Iu or IuPS interfaces to the UMTS Terrestrial Radio Access Network (UTRAN). These interfaces are commonly used with our SGSN products to provide either non-IP 3G traffic or all IP 3G traffic (for all-IP packet-based networking) over ATM (Asynchronous Transfer Mode).

Each OLC2 provides four physical interfaces (ports) that are populated by Small Form-factor Pluggable (SFP) modules which include LC-type connectors. The Optical (ATM) line card supports two types of SFP modules (ports) and applicable cabling, but each card supports only one type at-a-time, as indicated in the following table.

Table 18: SFP Modules Supported by the OLC2

Module Type	Card Identification	Interface Type	Cable Specifications
Single-mode Optical Fiber	ATM/POS OC-3 SM IR-1	Single-mode Fiber, LC duplex female connector	**Fiber Types:** Single-mode optical fiber **Wavelength:** 1310 nm **Core Size:** 9 micrometers **Cladding Diameter:** 125 micrometers **Range:** Intermediate/21 kilometers **Attenuation:** 0.25 dB/KM **Min/Max Tx Power:** -15 dBm/-8 dBm **Rx Sensitivity:** -28 dBm
Multi-mode Optical Fiber	ATM/POS OC-3 Multi-Mode	Multi-mode Fiber, LC duplex female connector	**Fiber Types:** Multi-mode optical fiber **Wavelength:** 1310 nm **Core Size:** 62.5 micrometers **Cladding Diameter:** 125 micrometers **Range:** Short/2 kilometers **Min/Max Tx Power:** -19 dBm/-14 dBm **Rx Sensitivity:** -30 dBm

The OLC2 supports the Star Channel (1 Gbps) for faster FPGA upgrades and is Restriction of Hazardous Substances (RoHS) 6/6 compliant.

Install the OLC2 directly behind its respective (active) packet processing card. As with other line cards, install the Optical (ATM) Line Card in slots 17 through 23, 26 through 39, and 42 through 48.The following figures show the panel of the OLC2, indicating its ports and major components.

Figure 18: Optical Line Card (OLC2)

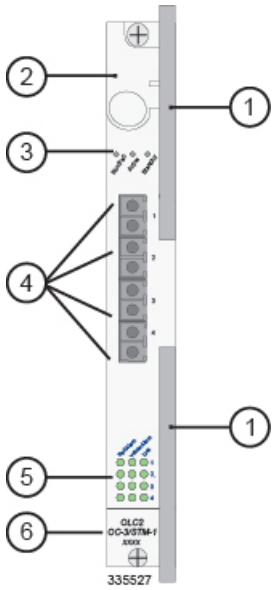


Table 19: OLC2 (ATM) Callouts

Item	Description
1	**Card Ejector Levers—**Use to insert/remove card to/from chassis.
2	**Interlock Switch—**In its Down position, the interlock switch notifies the system to safely power down the card prior to its removal.
3	**Card Level Status LEDs—**Show the status of the card.
4	**Port connectors—**Fiber LC duplex female connector.
5	**Port Level Status LEDs—**Show the status of a port.
6	**Line Card Label—**Identifies the type of SFP modules and cabling supported: • OLC2, OC-3/STM-1, Single Mode • OLC2, OC-3/STM-1, Multi-Mode

Channelized Line Card (CLC2)

The CLC2 is also referred to as the Frame Relay line card. It provides frame relay over SONET or SDH. The CLC2 supports network connectivity through a gigabit interface to connect to the Packet Control Unit (PCU)

of the base station subsystem (BSS) in a mobile network. These interfaces are commonly used with the SGSN product to support frame relay.

In North America, the card supplies ANSI SONET STS-3 (optical OC-3) signaling. In Europe, the card supplies SDH STM-1 (optical OC-3). The transmission rate for the card is 155.52 Mbps with 336 SONET channels for T1 and 252 SDH channels for E1.

Each CLC2 provides four optical fiber physical interfaces (ports). The ports are populated by a Small Form-factor Pluggable (SFP) modules which include an LC-type connector. The ports of the CLC2 supports two types of SFP modules and cabling, as shown in the following table.

Table 20: SFP Modules supported by the CLC2

Module Type	Card Identification	Interface Type	Cable Specifications
Single-mode Optical Fiber	Channelized (STM-1/OC-3) SM IR-1	Single-mode Fiber, LC duplex female connector	**Fiber Types:** Single-mode optical fiber **Wavelength:** 1310 nm **Core Size:** 9 micrometers **Cladding Diameter:** 125 micrometers **Range:** Intermediate/21 kilometers **Attenuation:** 0.25 dB/KM **Min/Max Tx Power:** -15 dBm/-8 dBm **Rx Sensitivity:** -28 dBm
Multi-mode Optical Fiber	Channelized (STM-1/OC-3) Multi-Mode	Multi-mode Fiber, LC duplex female connector	**Fiber Types:** Multi-mode optical fiber **Wavelength:** 1310 nm **Core Size:** 62.5 micrometers **Cladding Diameter:** 125 micrometers **Range:** Short/2 kilometers **Min/Max Tx Power:** -19 dBm/-14 dBm **Rx Sensitivity:** -30 dBm

The CLC2 supports the Star Channel (1 Gbps) for faster FPGA upgrades and is Restriction of Hazardous Substances (RoHS) 6/6 compliant.

Install the CLC2 directly behind its respective (Active) packet processing card. You may optionally install CLC2s behind a redundant (Standby) packet processing card. As with other line cards, install the Channelized Line Cards in slots 17 through 23, 26 through 39, and 42 through 48.

The following figures show the panel of the CLC2 Channelized Line Cards, identifying their interfaces and major components.

Figure 19: Channelized Line Card (CLC2)

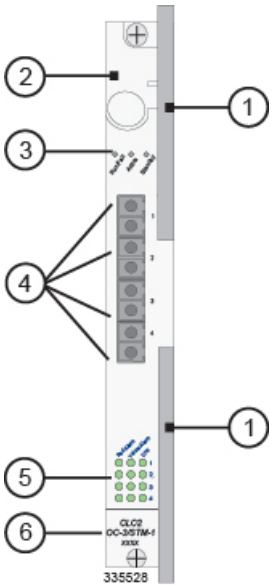


Table 21: CLC2 (Frame Relay) Callouts

Item	Description
1	**Card Ejector Levers—**Use to insert/remove card to/from chassis.
2	**Interlock Switch—**In its Down position the interlock switch notifies the system to safely power down the card prior to its removal.
3	**Card Level Status LEDs—**Show the status of the card.
4	**Port connectors—**Fiber LC duplex female connector.
5	**Port Level Status LEDs—**Show the status of a port.
6	**Line Card Label—**Identifies the type of SFP modules and cabling supported: • CLC2, OC-3/STM-1, Single Mode • CLC2, OC-3/STM-1, Multi-Mode

The Channelized Line Card (CLC2) was developed in compliance with the following standards:

- ITU-T - Recommendation G.704 - Synchronous Frame Structures Used at 1544, 6312, 2048, 8448 and 44736 kbps Hierarchical Levels, October, 1998.
- ITU-T - Recommendation G.706 - Frame Alignment and Cyclic Redundancy Check (CRC) Procedures Relating to Basic Frame Structures Defined in Recommendation G.704, April 1991.

- ITU-T - Recommendation G.707 Network Node Interface for the Synchronous Digital Hierarchy (SDH), December 2003.
- ITU-T - Recommendation G.747 Second Order Digital Multiplex Equipment Operating at 6312 kbps and Multiplexing Three Tributaries at 2048 kbps, 1993.
- ITU-T - Recommendation G.751 Digital Multiplex Equipment Operating at the Third Order Bit Rate of 34 368 kbps and the Fourth Order Bit Rate of 139 264 kbps and Using Positive Justification, 1993.
- ITU-T - Recommendation G.775, - Loss of Signal (LOS) and Alarm Indication Signal (AIS) Defect Detection and Clearance Criteria, November 1994.
- ITU-T - Recommendation G.783 Characteristics of Synchronous Digital Hierarchy (SDH) Equipment Functional Blocks, February 2004.
- ITU-T - Recommendation G.823, -The Control of Jitter and Wander within Digital Networks which are based on the 2048 kbps Hierarchy, March 2000.
- ITU-T - Recommendation G.824 The Control of Jitter and Wander within Digital Networks which are based on the 1544 kbps Hierarchy, March 2000.
- ITU-T - Recommendation G.825 Control of Jitter and Wander within Digital Networks Which are Based on the Synchronous Digital Hierarchy (SDH) Series G: Transmission Systems and Media, Digital Systems and Networks Digital Networks - Quality and Availability Targets, March 2000.
- ITU-T - Recommendation G.832 Transport of SDH elements on PDH networks Frame and multiplexing structures, October 1998.
- ITU-T - Recommendation G.957 Optical interfaces for equipment and systems relating to the Synchronous Digital Hierarch, March 2006.
- ITU-T - Recommendation I.431 - Primary Rate User-Network Interface Layer 1 Specification, March 1993.
- ITU-T - Recommendation O.150 - General Requirements for Instrumentation Performance Measurements on Digital Transmission Equipment, May 1996.
- ITU-T - Recommendation O.151 - Error Performance Measuring Equipment Operating at the Primary Rate and Above, October 1992.
- ITU-T - Recommendation O.152 - Error Performance Measuring Equipment for Bit Rates of 64 kbps and N x 64 kbps, October 1992.
- ITU-T - Recommendation O.153 - Basic Parameters for the Measurement of Error Performance at Bit Rates below the Primary Rate, October 1992.
- ITU-T - Recommendation Q.921 - ISDN User-Network Interface - Data Link Layer Specification, September 1997.
- ITU-T - Recommendation Q.922 - ISDN data link layer specification for frame mode bearer services.
- ITU-T - Recommendation Q.933 Annex E.
- Frame Relay Forum - FRF 1.2 - User-to-Network Interface (UNI).
- Frame Relay Forum - FRF 2.1 - Frame Relay Network-to-Network Interface (NNI).
- Frame Relay Forum - FRF 5.0 - Network Interworking.
- Frame Relay Forum - FRF 8.1 - Service Interworking.

- Frame Relay Forum - FRF 12.0 - Frame Relay Fragmentation.

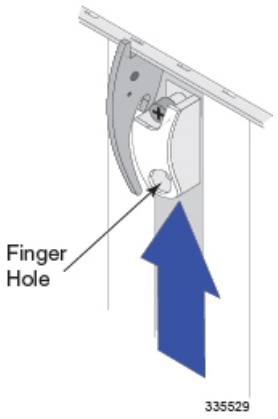
Card Interlock Switch

Each card has a switch interlock mechanism that is integrated with the upper card ejector lever. The interlock ensures proper notification to the system before a card is removed. You cannot configure or place a card into service until you slide the card interlock switch upward. This locks the upper ejector lever in place and signals the system that the card is ready for use.

Sliding the interlock downward to the unlocked position allows you to operate the upper ejector lever. This sliding lock mechanism notifies the system to migrate various processes on the card prior to its removal.

The following figure shows how the card interlock switch works in conjunction with the ejector lever.

Figure 20: Card Interlock Switch in the Lever-locked Position



Card Identifiers

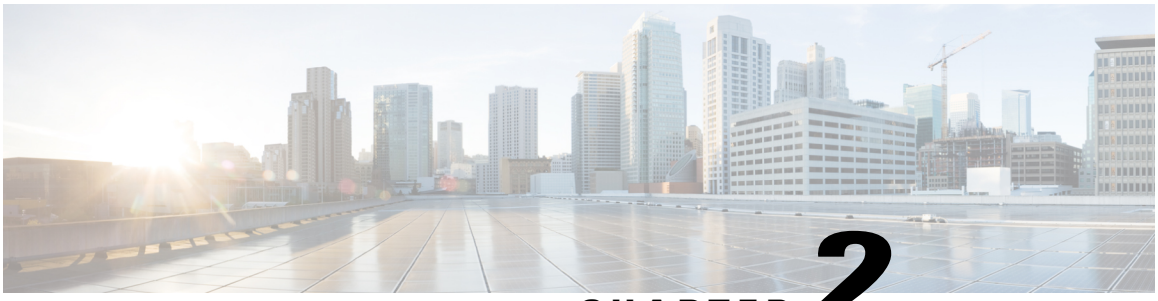
The table below cross-references ASR 5000 application and line cards by acronym, label, variant, and Cisco part identifier (PID).

Table 22: ASR 5000 Component References

Descriptor	Acronym	Label	Variant
Application Cards			
System Management Card	SMC	System Management	None
Packet Services Card 16GB	PSCA	End of Life (not supported in Release 16.0+)	
Packet Services Card 32GB	PSC2	Packet Services 2 32GB	None

Descriptor	Acronym	Label	Variant
Packet Services Card 64GB	PSC3	Packet Services 3 64GB	None
Packet Processing Card 16GB	PPC	End of Life (not supported in Release 16.0+)	
Switch Processor Input/Output	SPIO	Switch Processor I/O	SPIO, E1 BNC BITS
			SPIO, T1 3-Pin BITS
			SPIO, E1 BNC BITS with Stratum 3 module
			SPIO, T1 3-Pin BITS with Stratum 3 module
Line Cards			
Redundancy Crossbar	RCC	Redundancy Crossbar	None
FELC Ethernet 10/100 Line Card	End of life (replaced by FLC2)		
FELC Ethernet 10/100 Line Card 2	FLC2	Ethernet 10/100	None
GELC Ethernet 1000 Line Card	End of life (replaced by GLC2)		
GLC2 Ethernet 1000 Line Card	GLC2	Ethernet 1000 SX	with SX MM Short Haul SFP
		Ethernet 1000 LX	with LX SM SFP
		Ethernet 1000 T	with copper SFP
QGLC 4-Port Ethernet 1000 Line Card	QGLC	Ethernet 1000 SX	with SX MM Short Haul SFP
		Ethernet 1000 LX	with LX SM SFP
		Ethernet 1000 T	with copper SFP
QGLC Rev2 4-Port Ethernet 1000 Line Card	QGLC	Ethernet 1000 SX	with SX MM Short Haul SFP
		Ethernet 1000 LX	with LX SM SFP
		Ethernet 1000 T	with copper SFP
XGLC 1-Port 10 Gigabit Ethernet Line Card	XGLC	Ethernet 10G SR	with MM SFP+
		Ethernet 10G LR	with SM SFP+
Channelized 4-port Line Card	CLC2	CLC2 OC-3/STM-1	with MM SFP
			with SM SFP

Descriptor	Acronym	Label	Variant
Optical 4-port (ATM) Line Card	OLC2	OLC2 OC-3/STM-1	with MM SFP
			with SM SFP



CHAPTER 2

Installation Procedure Overview

This chapter briefly describes the steps and tools that are required for the physical installation of the chassis. It includes the following sections:

Chassis Components

The following graphic and table illustrate the chassis and describe its subcomponents.

Figure 21: ASR 5000 Chassis and Sub-components

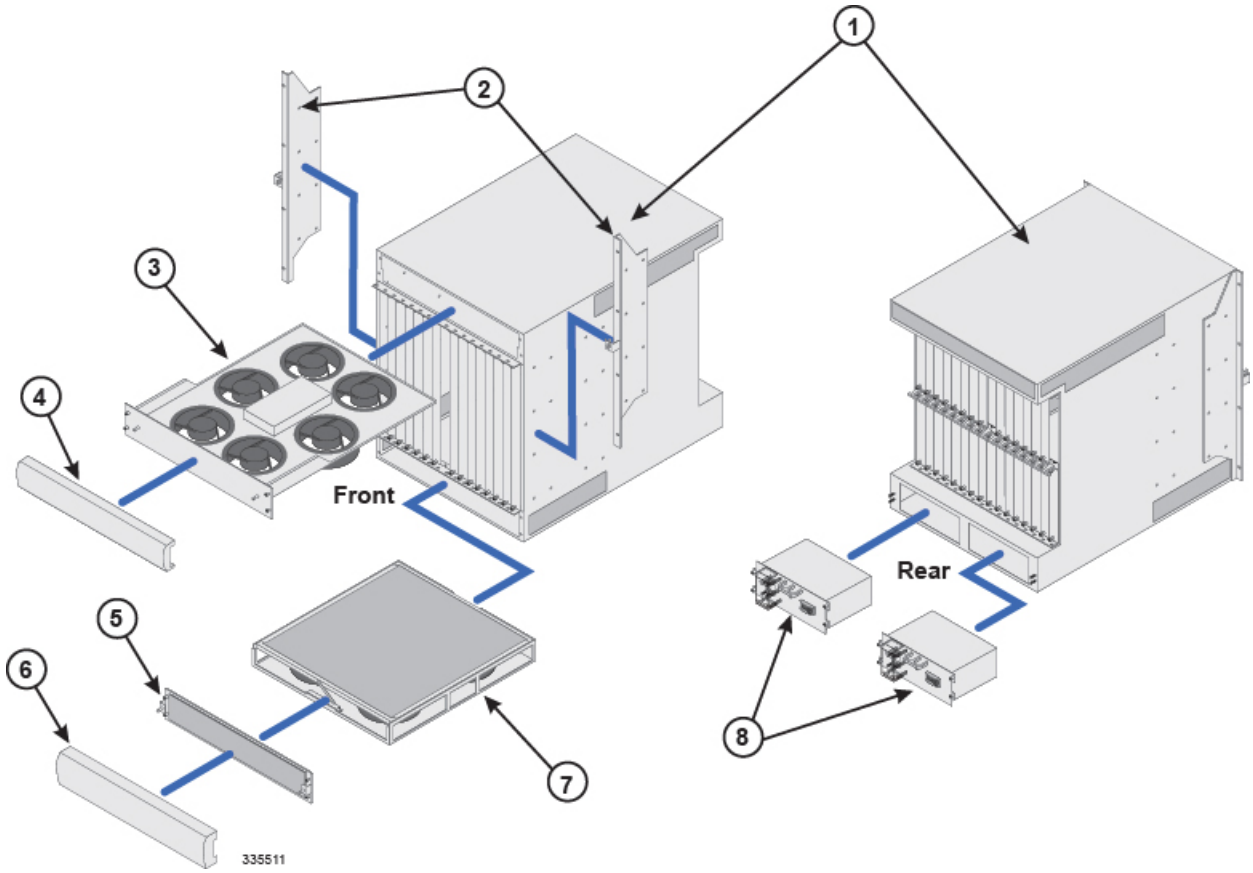


Table 23: Chassis and Sub-component Identification Key

Item	Description
1	**Chassis:** Supports 16 front-loading slots for application cards and 32 rear-loading slots for line cards. The chassis ships with blanking panels over every slot except the following: 1, 8, 17, and 24. These are intentionally left uncovered for the initial installation of system components.
2	**Mounting brackets:** Supports installation in a standard 19-inch rack or telecommunications cabinet. Standard and mid-mount options are supported. In addition, each bracket contains an electro-static discharge jack for use when handling equipment.
3	**Upper fan tray: D**raws air up through the chassis for cooling and ventilation and exhausts the air through the vents at the upper-rear of the chassis.

Item	Description
4	**Upper bezel:** Covers the upper fan tray bay.
5	**Lower fan tray cover/EMI shield:** Secures the lower fan tray assembly in place and serves as an EMI shield. The cover also provides an air baffle allowing air to enter into the chassis.
6	**Lower bezel:** Covers the lower fan tray bay.
7	**Lower fan tray assembly:** Draws air into the chassis through the chassis' front and sides for cooling and ventilation. It is equipped with a particulate air filter to prevent dust and debris from entering the system.
8	**Power Filter Units (PFUs):** Each of the system's two 165 amp PFUs provides -48 VDC power to the chassis and its associated cards. Each load-sharing PFU operates independently from the other to ensure maximum power feed redundancy.

Installation at a Glance

The list below summarizes the installation process for the chassis.

Note Unpacking instructions are not provided in this document. Please refer to the *Unpacking the ASR 5000 Chassis* document shipped with the system, for information and instructions on this topic. The chassis and cards are shipped separately.

- Unpack the chassis and cards
- Determine which chassis mounting option to use: standard or mid-mount.
- Install the chassis into a standard 19-inch equipment rack or telecommunications cabinet.
- Connect the chassis to earth ground.
- Install application cards into the front of the chassis.
- Install line cards into the rear of the chassis.
- Connect data cables to the line cards.
- Connect power cables to the chassis.
- Apply power to the chassis.
- Verify that the installation was successful.

Once the installation has been validated, you will be directed to the *System Administration Guide* for instructions on how to configure the system for operation.

Required Tools and Equipment

This section lists the tools and equipment needed for installation.

Hand Tools

The following hand tools are required for installation of the chassis, application and line cards, fan tray assemblies, and power filter units:

- Phillips #1 and #2 hand screwdrivers. Used to tighten thumb-screws on cards, fan tray assemblies, PFUs, and mounting brackets.

Caution The inappropriate use of electric or pneumatic torque drivers, or power drill/impact drivers to loosen or tighten fasteners may result in damage to system components.

- 9/16-inch nut driver or ratchet and socket set. Used to connect power and return cables.
- 3/8-inch nut driver or ratchet and socket set. Used to connect grounding cables.
- Torque wrench (rated 50 in-lb [5.65 N-m]) with 9/16-inch socket for tightening lugs to power terminals.
- Grounding wrist and/or heel straps. Used to prevent Electro-Static Discharge (ESD) as discussed in the *Protecting Against Electro-static Discharge* section that follows.

Caution During installation, maintenance, and/or removal, wear grounding wrist and/or heel straps to avoid ESD damage to the components. Failure to do so could result in damage to sensitive electronic components and potentially void your warranty.

Equipment

The following equipment is necessary to install the chassis and verify that it is ready for configuration:

- Standard 19-inch (48.26 cm) equipment rack or telecommunications cabinet with mounting hardware. Additional hardware, such as extension brackets (not supplied), may be used to install the chassis in a standard 23-inch (58.42 cm) cabinet or rack.
- Voltmeter to measure input voltages at the PFU terminals.
- Heat gun for installing shrink wrap tubing over power cable lugs.
- Console cable supplied with the Switch Processor I/O (SPIO) line card.
- A computer or terminal server with a 9-pin RS-232C serial port, or 25-to-9-pin male RS-232C adapter. It will be connected to the SPIO's Console port for accessing the command line interface (CLI) for initial system configuration.

- Pallet jack and/or chassis lift to move and position the ASR 5000 chassis. Without such mechanical assistance, moving and positioning the chassis will require multiple craftpersons trained to safely handle heavy rack-mounted units.

Site Prerequisites

This section summarizes power, grounding, environment, and clearance requirements that must be met prior to installing and operating the ASR 5000. For detailed information, refer to the *Technical Specifications* chapter.

Power and Grounding

Each PFU requires a power feed of 160A @ -48VDC (nominal). The feeds should be routed to the installation rack from the site power supply using adequately sized conductors and circuit breakers in accordance with local electrical codes.

The chassis must be grounded to a site ground point using the recommended conductors and lugs. The ground point should be in close proximity to the ASR 5000 chassis to assure adequate conductivity.

Environment

The site's heating ventilation and air conditioning (HVAC) systems must be sized to maintain the operating temperatures and relative humidity specified in the *Technical Specifications* chapter. HVAC capacity requirements will vary based on the system configuration and associated power draw, as well as the operational characteristics of other equipment installed at the site.

Clearance

Adequate clearance must be maintained at the front and rear of the ASR 5000 chassis to assure proper air flow and allow maintenance access for the installation, removal and replacement of components. The recommended clearance is 30 to 36 inches (76 to 92 centimeters) at the front and rear of the chassis.

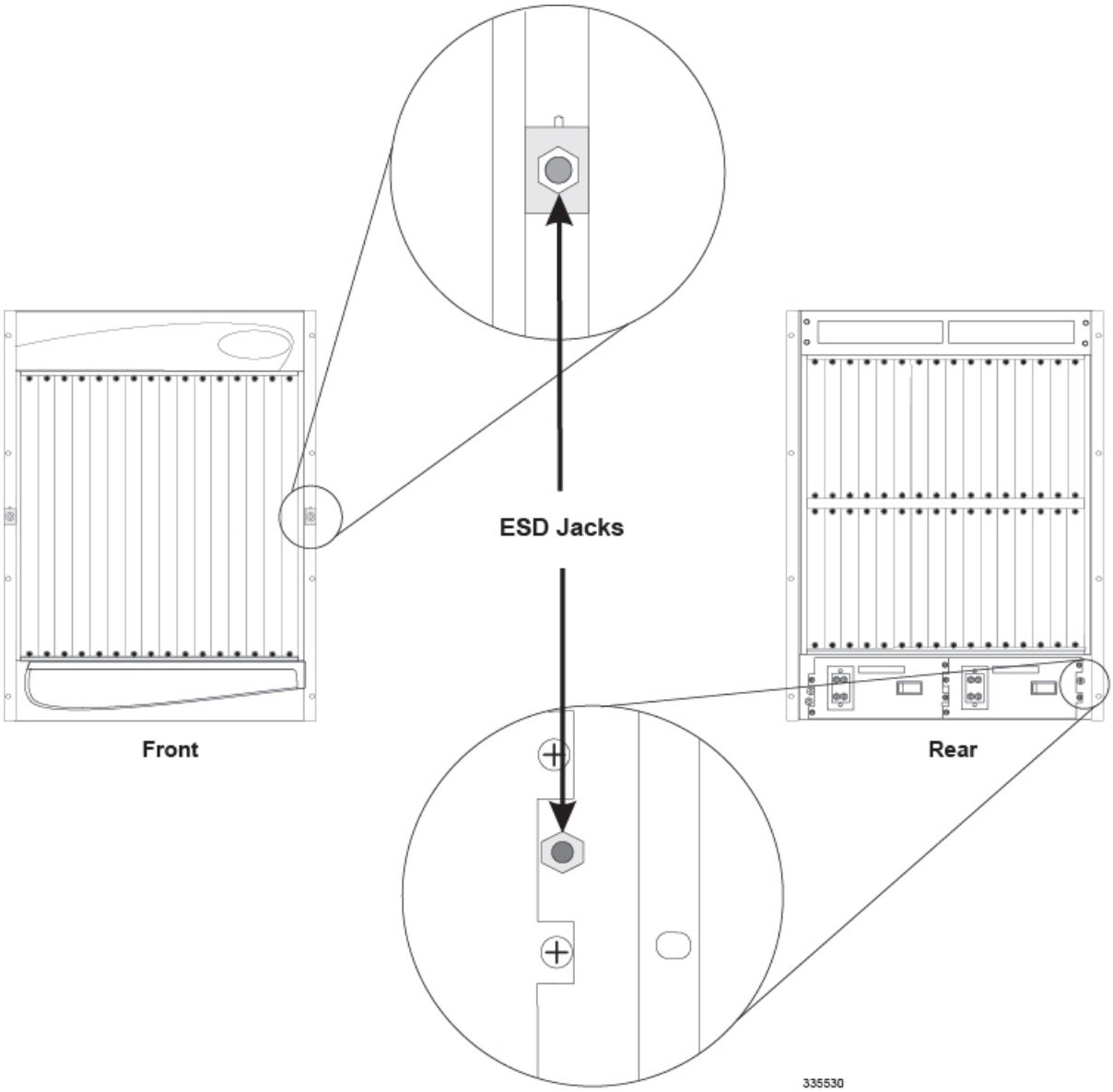
Protecting Against Electro-static Discharge

Electro-Static Discharge (ESD) can cause serious damage to sensitive components on the chassis, its sub-components, and/or the cards installed in the chassis. To prevent damage from ESD, you must take proper grounding precautions before handling the chassis or any of its components.

To aid in the prevention of ESD damage, the chassis and its mounting brackets are equipped with ESD jacks. Use the jacks in conjunction with grounding wrist straps when handling the chassis and/or its components. The following figure shows the location of the jacks.

Important Before using the ESD jacks on the chassis and its mounting brackets to provide protection, you must first connect the chassis to earth ground as described in the *Chassis Installation* chapter of this document.

Figure 22: Location of Chassis ESD Jacks



Federal Communications Commission Warning

This device complies with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules and Regulations. Operation is subject to the following two conditions:

- This device may not cause harmful interference.
- This device must withstand any interference received, including interference that may cause undesired operation.

The system platform has been tested and found to comply with the limits for a Class A digital device pursuant to Part 15 of the FCC Rules and Regulations. These limits are designed to provide reasonable protection against harmful interference when this equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio-frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio and television communications. Operation of this equipment in a residential area is likely to cause interference in which case the user will be required to correct the interference at his or her own expense.

Modifications to this product not authorized by Cisco could void the FCC approval and negate your authority to operate the product.

Shielded cables must be used with this unit to ensure compliance with the FCC Class A limits.

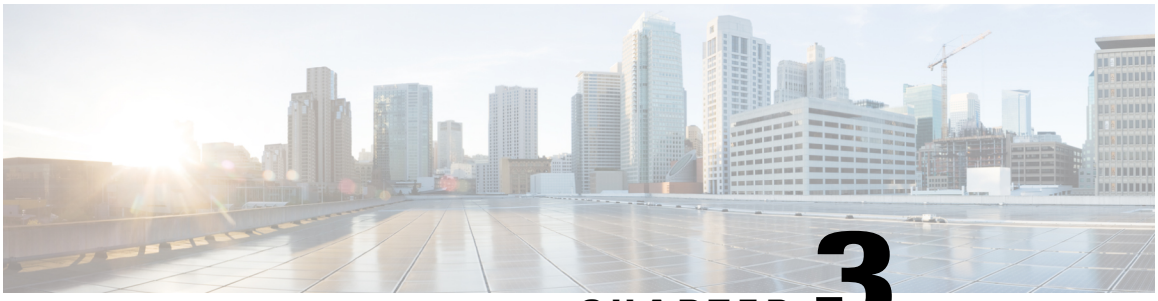
ICS Notice

This Class A digital apparatus complies with Canadian ICES-003.

Cet appareil numérique de la classe A est conforme à la norme NMB-003 du Canada.

Laser Notice

The lasers in this equipment are Class 1 devices. Class 1 laser devices are not considered to be hazardous.



CHAPTER 3

Chassis Installation

This chapter provides information on rack configurations and instructions for installing and removing the chassis and its sub-components – the upper and lower fan trays and the Power Filter Units (PFUs).

Important Prior to installation, personnel should review and be familiar with all recommendations for Central Office installations, as found in Telcordia GR-1275-CORE Central Office Environment Installation/Removal Generic Requirements, Issue 3, December 2001.

This chapter includes the following sections:

Equipment Rack Configuration

The chassis is designed for installation in a standard 19-inch (48.26 cm) equipment rack. Additional rack hardware, such as extension brackets, may be used to install the chassis in a standard 23-inch (58.42 cm) rack. Each chassis is 24.50 inches (62.23 cm) high. This equates to roughly 14 Rack Mount Units (RMUs: 1 RMU = 1.75 in (4.45 cm).

You can mount a maximum of three chassis in a standard 48 RMU (7 ft.) equipment rack or telco cabinet provided that all system cooling and ventilation requirements are met. A fully-loaded rack with three chassis installed has approximately 5.5 inches (13.97 cm, 3.14 RMUs) of vertical space remaining.

Caution When planning chassis installation, take care to ensure that the equipment rack or cabinet hardware does not hinder air flow at any of the intake or exhaust vents. Additionally, ensure that the environmental control system (HVAC) allows the system to function within the required limits.

Ventilation Considerations

Airflow within the system is designed per Telcordia recommendations to ensure the proper vertical convection cooling of the system.

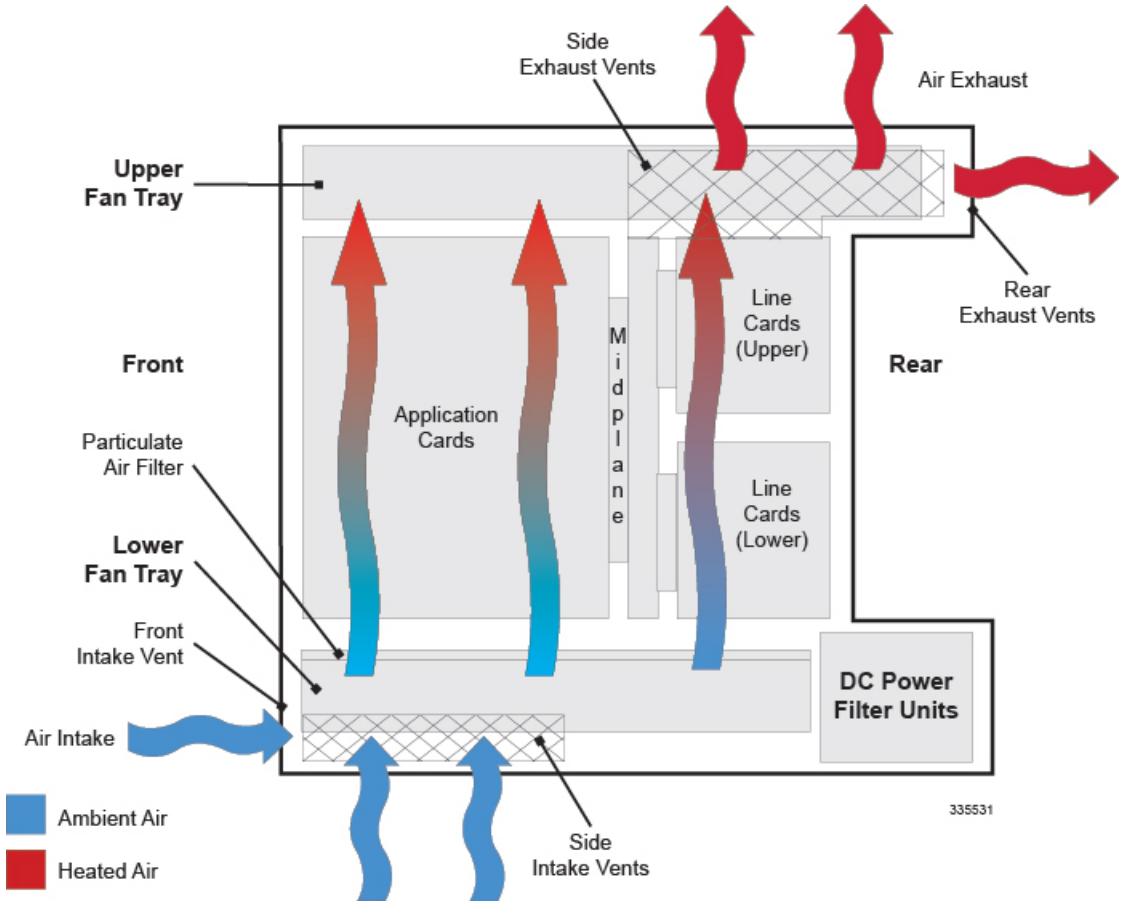
As shown in the figure below, the lower fan tray pulls ambient air inward from the front and side intake vents located at the bottom of the chassis. The air is pushed upwards through the system and absorbs heat as it passes over system components.

Total air flow exiting the chassis is approximately:

- 275CFM (7.8 cubic meters/minute) – Low fan speed
- 565CFM (16 cubic meters/minute) – High fan speed

The upper fan tray pulls the heated air up through the chassis. The heated air exits through the side and rear exhaust vents located at the top of the chassis.

Figure 23: System Airflow and Ventilation



Proper ventilation and cooling must allow the chassis to operate within the temperature and humidity levels described in the following table.

Table 24: Operating Temperature and Humidity Recommendations

Operating Temperature	0 degrees C to +55 degrees C 32 degrees F to +131 degrees F
Operating Humidity	20 percent to 80 percent, non-condensing

Mounting Options

There are two options for mounting the chassis in a standard equipment rack or telecommunications cabinet:

- **Flush Mount**: In this configuration, the flanges of the mounting brackets are flush with the front of the chassis. This is the default configuration as shipped as is commonly used with 4-post racks and equipment cabinets. Refer to Flush Mount Installation of the Chassis, on page 57.
- **Mid-mount**: In this configuration, the flanges of the mounting brackets are recessed from the front of the chassis. This configuration is required when mounting the chassis in a 2-post rack. To do this, install the mounting brackets toward the middle of the chassis on either side. Refer to Mid-Mount Installation of the Chassis, on page 58.

Weight Considerations

The shipping weight of the chassis is approximately 160 pounds (72.57 kg). Please consider the following recommendations before proceeding:

- If available, use an equipment lift to lift and move the chassis during the installation process.
- If no lift is available, reduce the weight according to the instructions in the Reducing the Weight of the Chassis Prior to Installation, on page 54. These procedures reduces the weight of the chassis to approximately 125 lbs. (56.7 kg).
- At least two people are required to perform the installation. These individuals should be physically able to lift and control the weight of the chassis.
- When lifting any heavy object, it is important to remember to bend at the knees and lift with your legs. Bending at the waist and lifting with your back could cause personal injury.

Unpacking the ASR 5000 Chassis

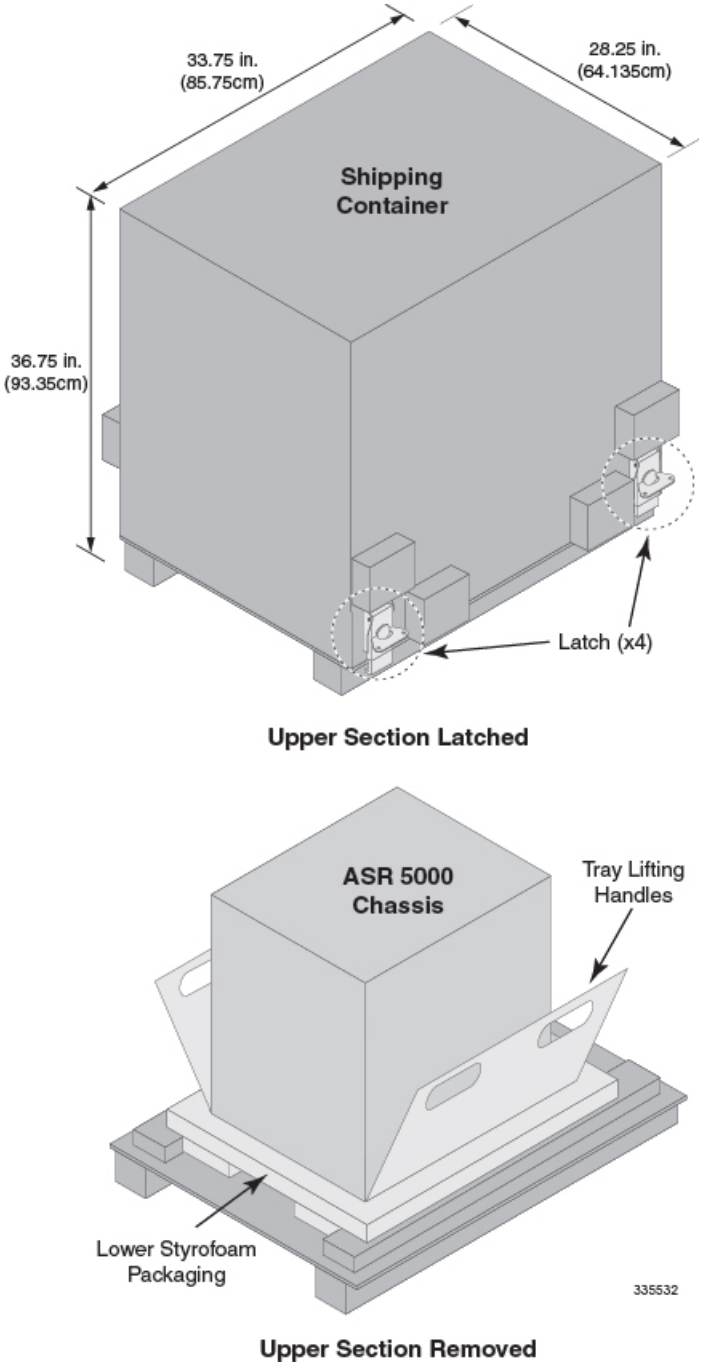
Important Before unpacking the chassis, use a pallet jack to move the container as close to the final installation site as possible.

The chassis ships in a wooden container that is 28.25 in. (64.135cm) wide by 36.75 in. (93.35cm) high by 33.75 in. (85.75cm) deep. The container consists of an upper and lower section. The upper section forms the sides and top of the container. The lower section serves as the bottom of the container. The upper and lower

sections are secured together for shipping via four locking mechanisms located near the bottom corners of the container.

Important Refer to the printed instructions that come with the shipment for detailed unpacking procedures.

Figure 24: ASR 5000 Shipping Container



Installing the Chassis

Important If you are installing more than one chassis in an equipment rack, to ensure an easier installation, begin by installing the first chassis near the bottom of the rack.

Caution When handling or moving the chassis, lift the chassis from the bottom only. Lifting it by any other part could result in damage to the chassis.

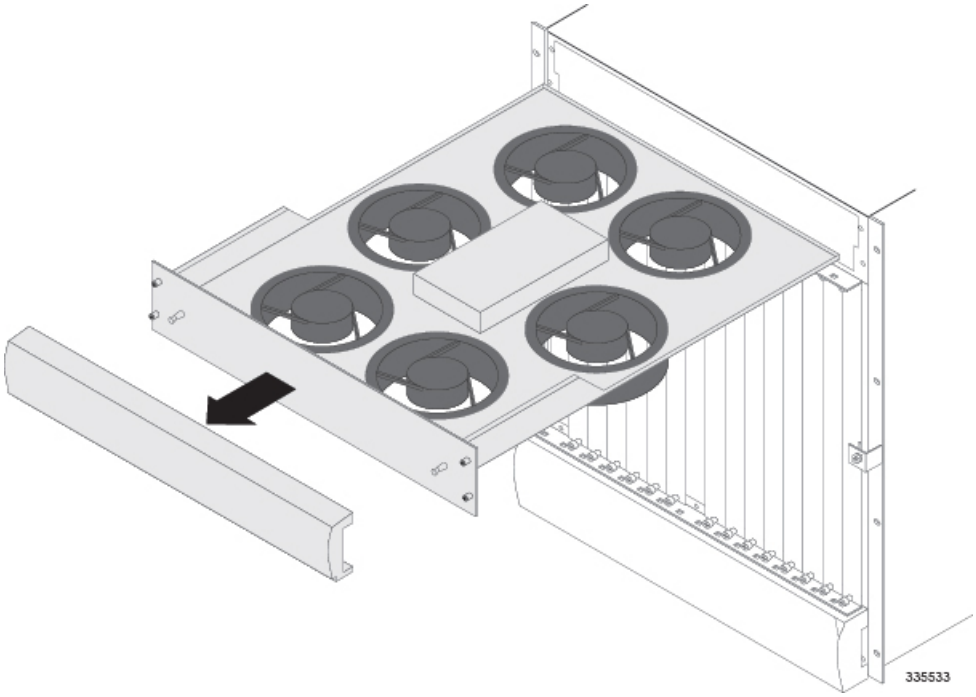
Caution During installation, maintenance, and/or removal, wear grounding wrist and/or heel straps to avoid ESD damage to the components. Failure to do so could result in damage to sensitive electronic components and potentially void your warranty.

Reducing the Weight of the Chassis Prior to Installation

To make the installation process easier, you can reduce the weight of the chassis prior to installation by removing the upper and lower fan trays and the PFUs. Follow the instructions below to safely remove these components prior to installation.

Caution During installation, maintenance, and/or removal, wear grounding wrist and/or heel straps to avoid ESD damage to the components. Failure to do so could result in damage to sensitive electronic components and potentially void your warranty.

Step 1 Remove the upper fan tray.

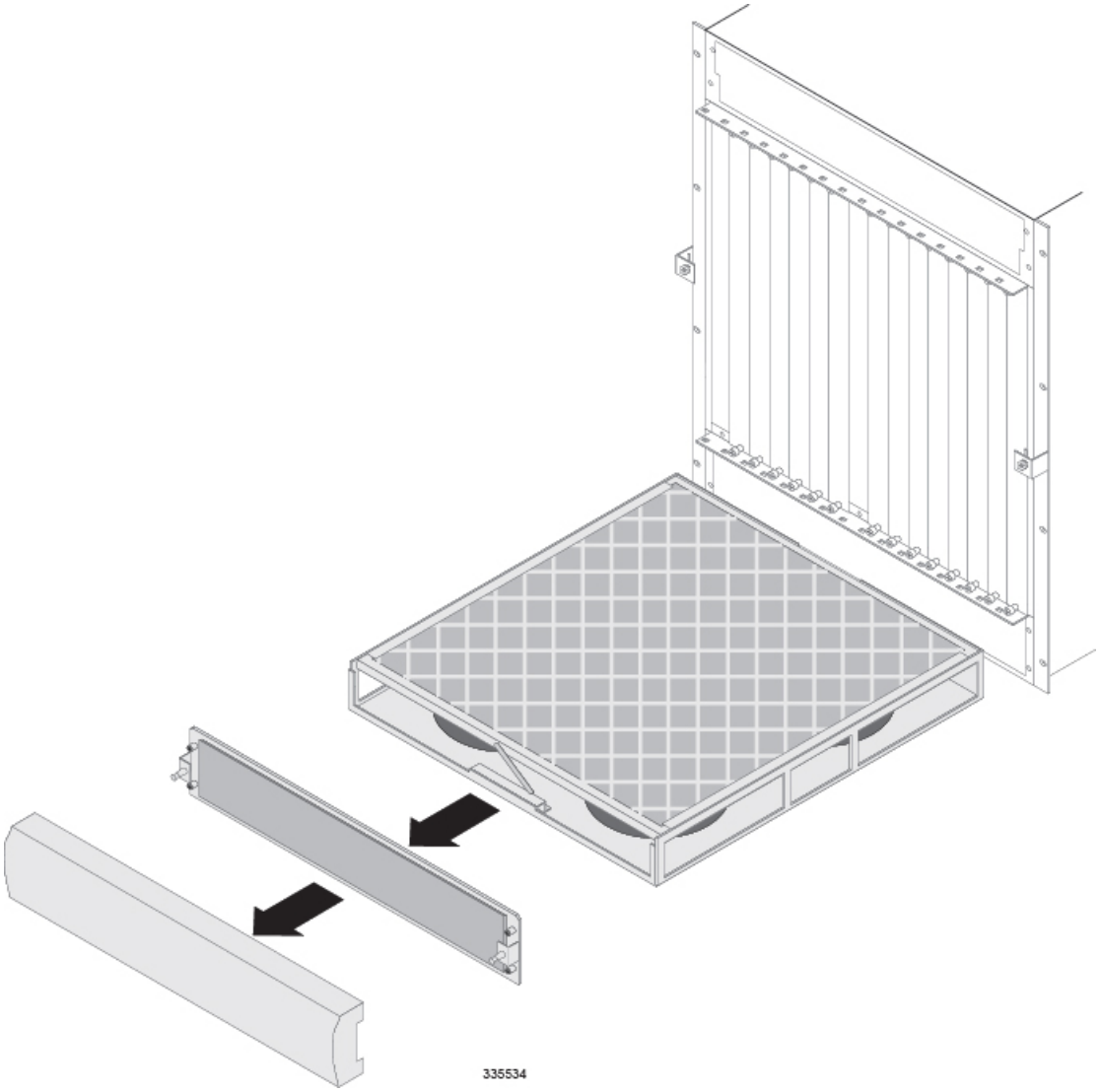


a) Remove the plastic bezel from the upper-front of the chassis by placing your fingers in the notches on the sides of the bezel and pulling it toward you. Place it to the side for re-installation later.
b) Loosen the four screws that secure the fan tray in place using a Phillips #1 screwdriver.
c) Grasp the two bezel mounts on the front of the fan tray and pull. The fan tray should easily slide out of the chassis. Place it to the side for re-installation later.

   To avoid personal injury and/or damage to the fan tray, be sure to support the weight of the fan tray from its front and back as you slide it completely out of the chassis.

   Vorsicht beim Herausziehen der Luefter-Schublade: um eine Beschaedigung des Moduls und eventuelle Verletzungen zu vermeiden, sollte diese hinten und vorne unterstuetzt werden.

Step 2 Remove the lower fan tray assembly.

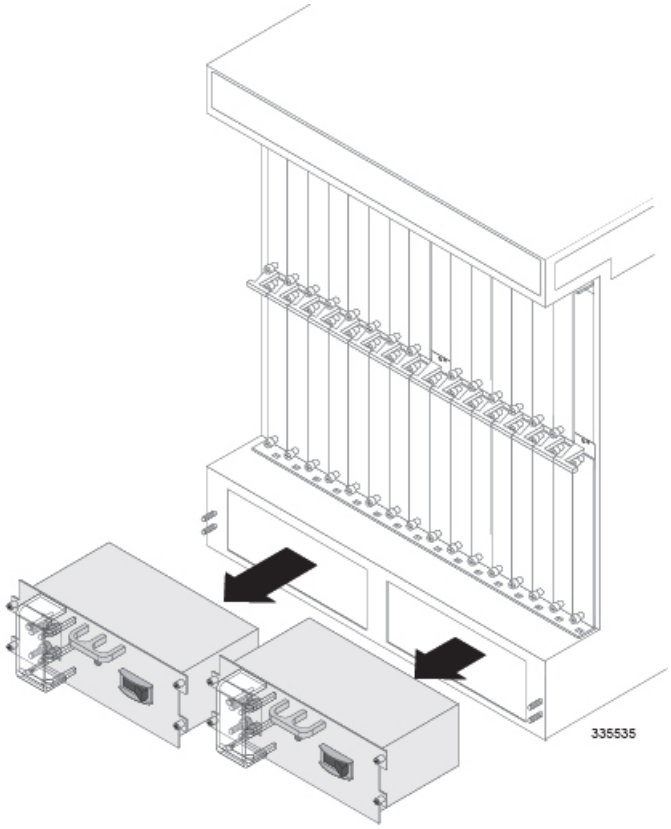


a) Unsnap the plastic bezel from the lower-front of the chassis by placing your fingers in the notches on the sides of the bezel and pulling it toward you. Place it to the side for re-installation later.
b) Use a Phillips #1 screwdriver to loosen the four captive screws that hold the fan tray cover/EMI shield in place. Pull the cover away from the chassis. **Do NOT use an electric or pneumatic torque driver to loosen these screws.**
c) Pull the fan tray toward you using the handle. The fan tray should easily slide out of the chassis. Place it to the side for re-installation later.

   To avoid personal injury and/or damage to the fan tray, be sure to support the fan tray's weight from its front and back as you slide it completely out of the chassis.

   Vorsicht beim Herausziehen der Luefter-Schublade: um eine Beschaedigung des Moduls und eventuelle Verletzungen zu vermeiden, sollte diese hinten und vorne unterstuetzt werden.

Step 3 Remove the PFUs located in the lower-rear of the chassis.



a) Locate the PFU bay labeled Power Filter Unit 1 on the lower-left rear of the chassis.
b) Use a Phillips #2 screwdriver to loosen the four screws that secure the PFU in to the chassis.
c) Grasp the handle on the PFU and gently pull the PFU toward you. The PFU should slide easily out of the chassis. Place it to the side for re-installation later.
d) Repeat step b and step c for the PFU located in the bay labeled Power Filter Unit 2 located on the lower-right side of the chassis.

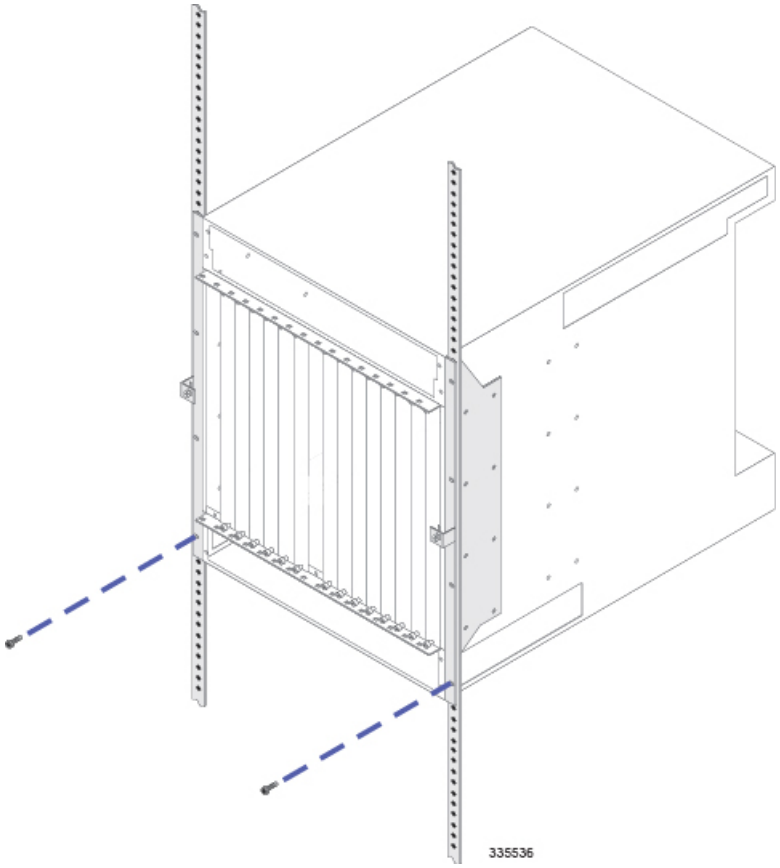
Step 4 Proceed to either the Flush Mount Installation of the Chassis, on page 57 or Mid-Mount Installation of the Chassis, on page 58, based on the mounting option you are using.

Flush Mount Installation of the Chassis

Follow the instructions below to perform the flush mount installation of the chassis.

Step 1 Position the chassis in the equipment rack so that the flanges of the mounting brackets at the front of the chassis are flush with the mounting rails of the equipment rack.

Step 2 Mount the chassis to the rails of the equipment rack. Use the hardware that was supplied with the equipment rack. Begin with the two bottom holes and work your way up until all four holes on each flange are secured.



Step 3 Repeat step 1 and step 2 for any additional chassis you are installing in the equipment rack.

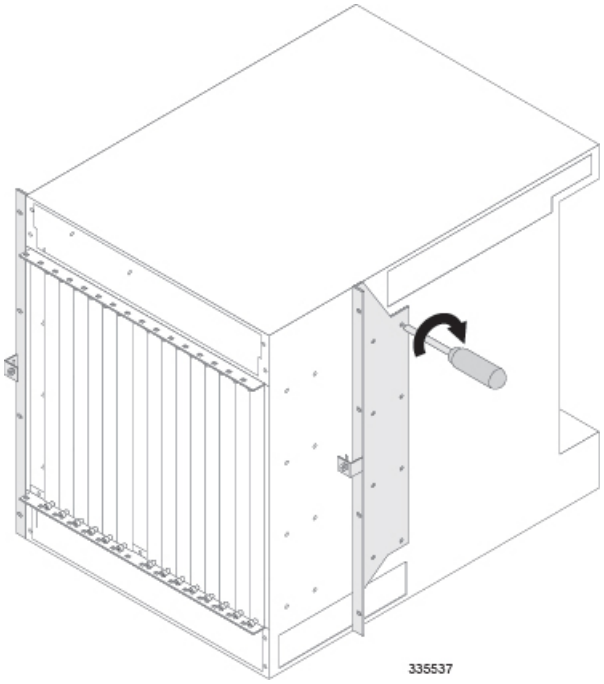
Step 4 Proceed to the Grounding the Chassis, on page 60 section and ground the chassis.

Mid-Mount Installation of the Chassis

Follow the instructions below to perform the mid-mount installation of the system.

Step 1 On the side of the chassis, unfasten the eight Phillips #2 screws that secure the mounting bracket to the chassis.

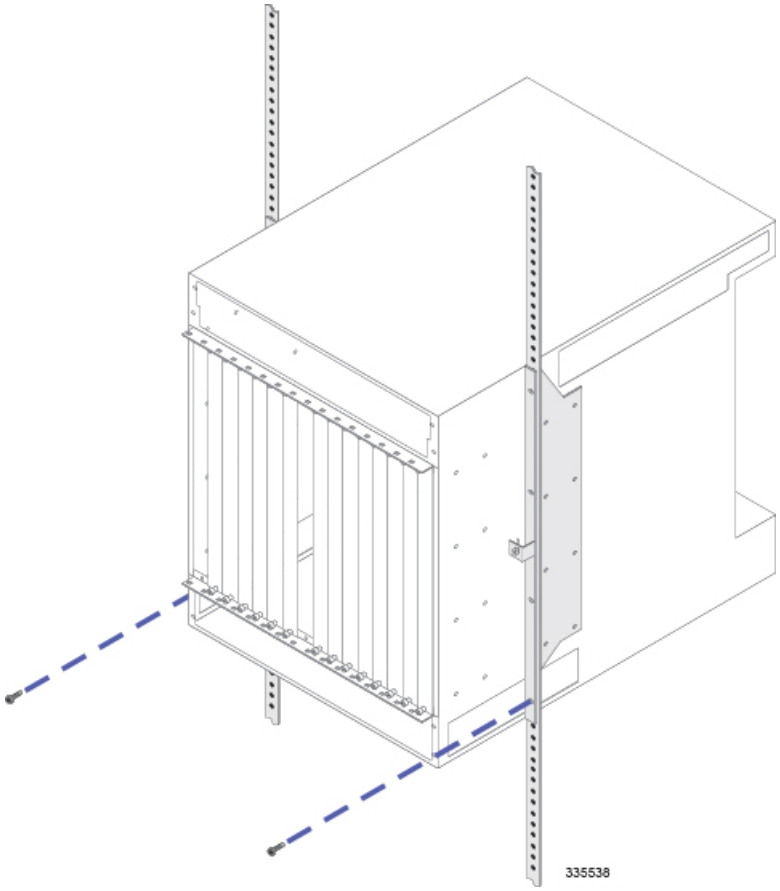
Step 2 Place the mounting bracket over the middle set of mounting holes on the side of the chassis and secure it to the chassis with the screws you removed in step 1.



Step 3 Repeat step 1 and step 2 for the bracket on the opposite side of the chassis.

Step 4 Position the chassis in the equipment rack so that the flanges of the mounting brackets are flush with the mounting rails of the equipment rack.

Step 5 Mount the chassis to the rails of the equipment rack with the hardware that was supplied with the equipment rack. Begin with the two bottom holes and work your way up until all holes on each flange are secured.



Step 6 Repeat step 1 through step 5 for any additional chassis you are installing in the equipment rack.

Step 7 Proceed to the Grounding the Chassis, on page 60 and ground the chassis.

Grounding the Chassis

Make sure that the chassis is properly grounded prior to installing any chassis sub-components or cards. The chassis and the equipment rack or telecommunications cabinet that it is installed in must be connected to the same ground.

⚠

Caution Failure to properly ground the chassis could result in personal injury and/or damage to the chassis and its components.

There are two sets of grounding terminals located at the lower-rear of the chassis. The following figure and the table that follows show the location of these terminals and provide specifications for the appropriate lug and cable size.

Figure 25: Chassis Ground Terminals

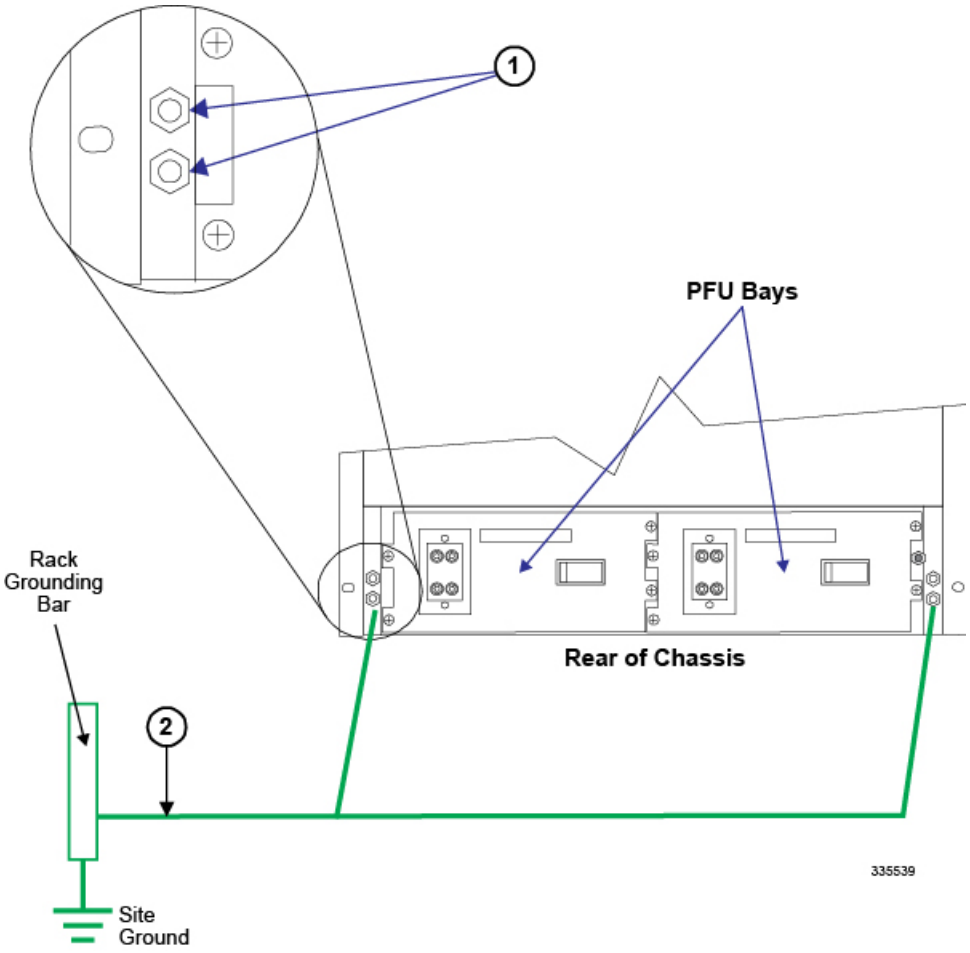


Table 25: Terminal and Cable specifications

Item	Description
1	Ground Terminal: 2-hole lug (0.186-inch posts, spaced 0.630-inch on center). The method of connection is: chassis - lug - flat washer - nut (3/8-inch). The nut(s) must be torqued to 50 in-lb (5.65 N-m).
2	Ground Cable: Cable length: Not more than 70 feet (21.336 meters) one way. Cable size: 6 AWG (minimum), stranded copper.

Follow the instructions below to connect the chassis to earth ground.

Step 1 Locate the chassis ground terminal on the lower-left corner of the rear of the chassis next to Power Filter Unit 1.

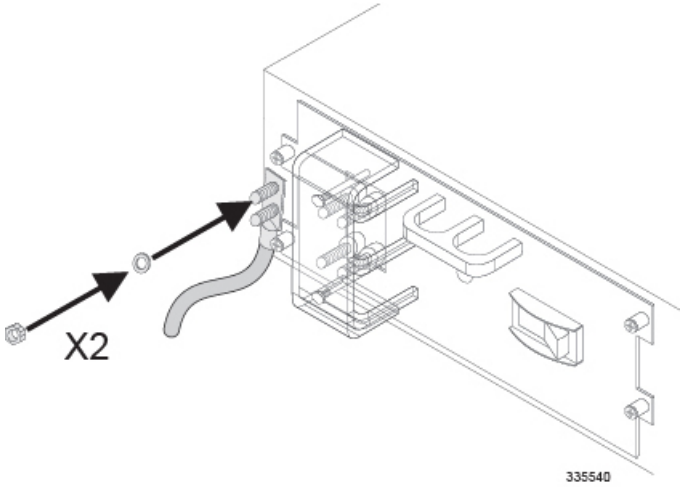
Step 2 Route the stranded copper ground cable to the chassis ground terminal.

Step 3 Crimp a 2-hole lug (Panduit type LCC6-10A-L) to the end of the ground cable using Panduit crimp tool part number CT-1700 (die color: blue 24).

Step 4 Use a 3/8-inch nut driver or socket wrench to remove the nuts and washers from each of the two posts.

Step 5 Insert the lug connected to the grounding cable over the two posts.

Step 6 Secure the lug to the ground terminals with the nuts and washers you removed in step 4. The nuts should be torqued to 50 in-lb (5.65 N-m).



Step 7 Repeat step 2 through step 6 to connect the second ground cable to the chassis ground terminal on the lower-right corner at the rear of the chassis next to Power Filter Unit 2.

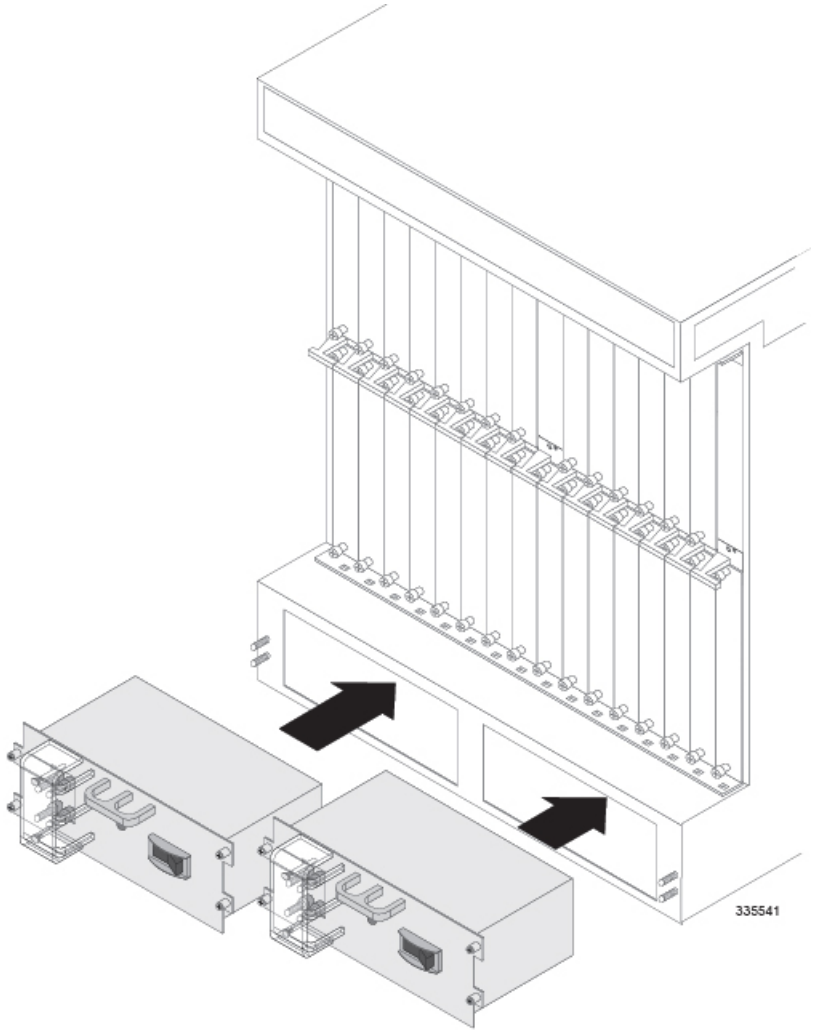
Step 8 If you took steps to reduce the weight of the chassis prior to installation, refer to the instructions in the Re-Installing Chassis Sub-components, on page 62 to re-install the components. Otherwise, proceed to the *Application Card Installation* chapter.

Re-Installing Chassis Sub-components

If you performed the procedure in the Reducing the Weight of the Chassis Prior to Installation, on page 54 section, complete the procedures described below to re-install the sub-components of the chassis.

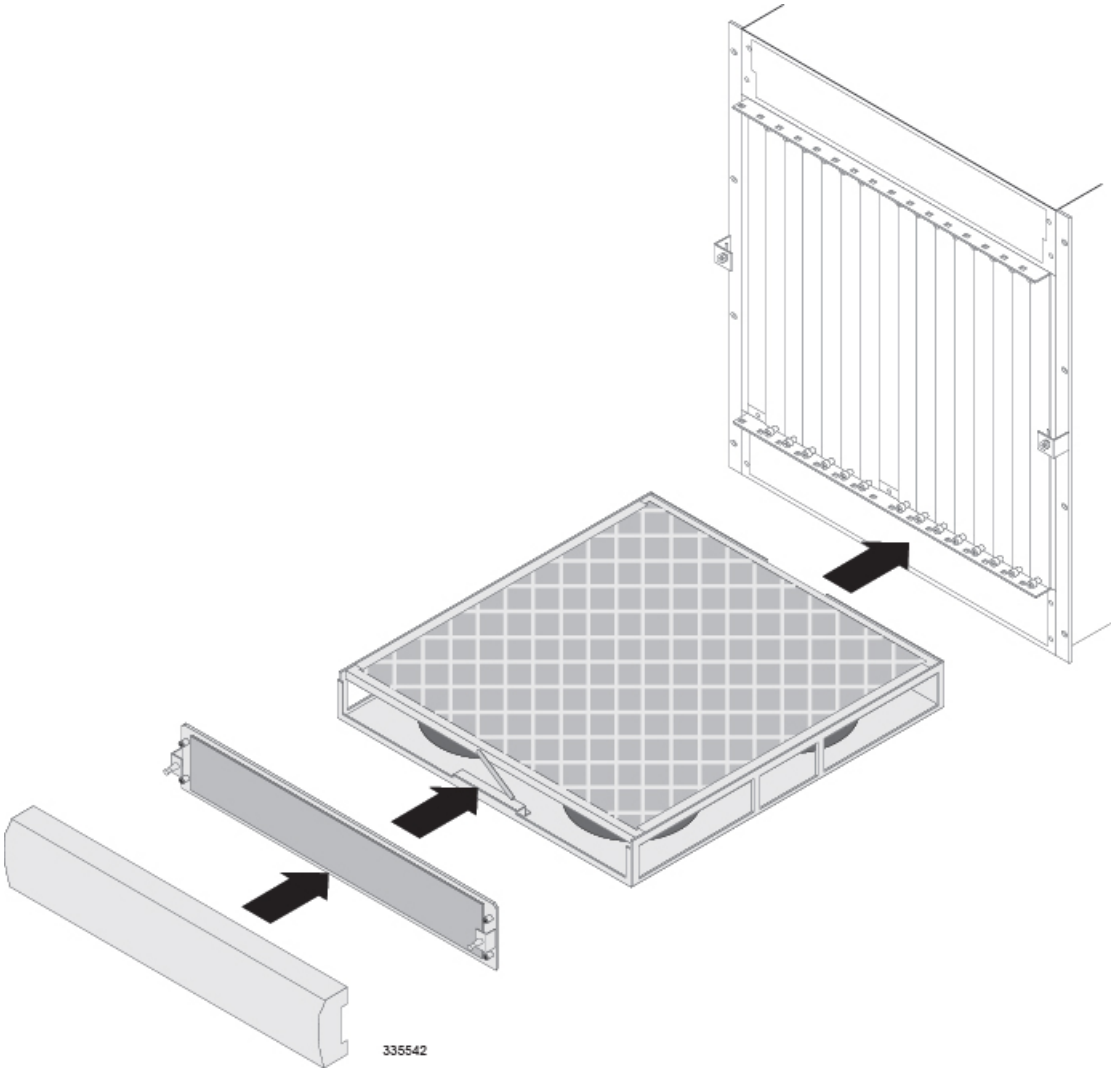
Caution During installation, maintenance, and/or removal, wear grounding wrist straps to avoid ESD damage to the components. Failure to do so could result in damage to sensitive electronic components and potentially void your warranty.

Step 1 Re-install the PFUs into the chassis.

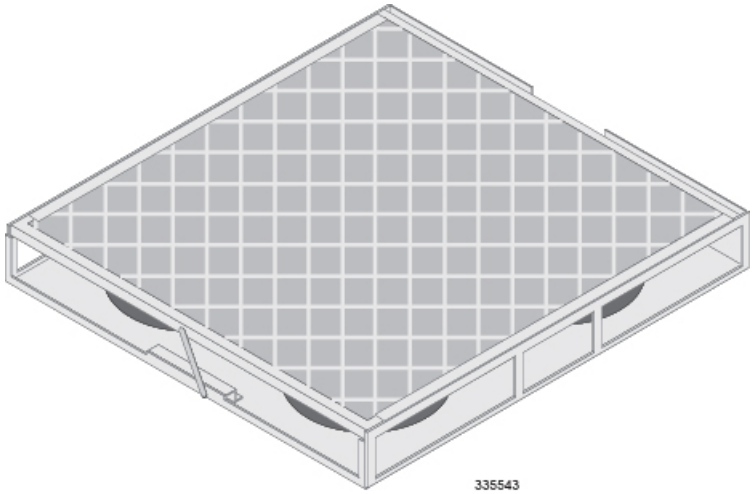


a) Locate the PFU bays at the lower-rear of the chassis. The bays are labeled from left to right Power Filter Unit 1 and Power Filter Unit 2.
b) Slide the PFU assembly into the PFU bay labeled Power Filter Unit 1 until it is flush against the chassis.
c) Use a Phillips #2 screwdriver to tighten each of the four screws on the PFU to secure it to the chassis.
d) Re-install the second PFU in the PFU bay labeled Power Filter Unit 2 by repeating step b and step c.

Step 2 Re-install the lower fan tray assembly into the chassis.



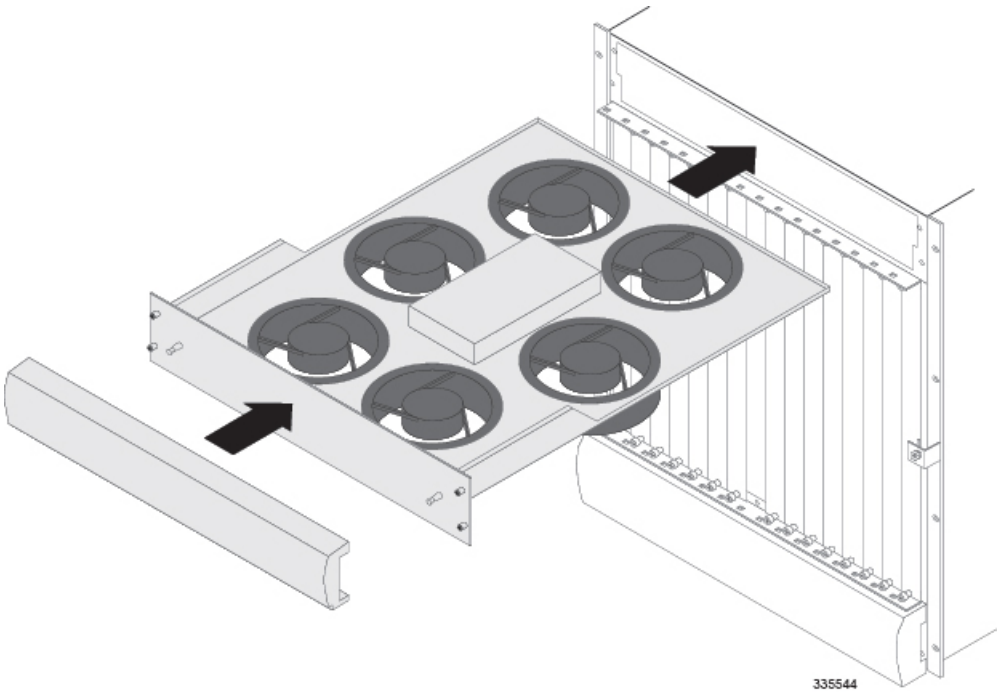
a) Hold the front of the fan tray by its handle with one hand and use your other hand to align it with the lower fan tray bay of the chassis. The lower fan tray bay is located at the bottom front of the chassis.
b) Slowly slide the fan tray into the chassis along the guides using its handle until it is seated firmly in the chassis and can go no further.
c) Verify that the particulate filter is securely in place. Its front should be flush with the front of the fan tray assembly and its tab should be lowered to keep it in place.



d) Replace the fan tray bay cover/EMI shield. The perpendicular tabs on the cover should face away from the chassis and be positioned at the bottom. Use a Phillips #1 screwdriver to hand tighten the four captive screws in an alternating pattern – upper left, lower right, lower left, upper right (5 inch-lb, 0.5 N-m). **Do NOT use an electric or pneumatic torque driver to tighten these screws.**

e) Replace the lower plastic bezel: align it over the bezel mounts that protrude from the fan tray bay cover and snap it in place.

Step 3 Re-install the upper fan tray.



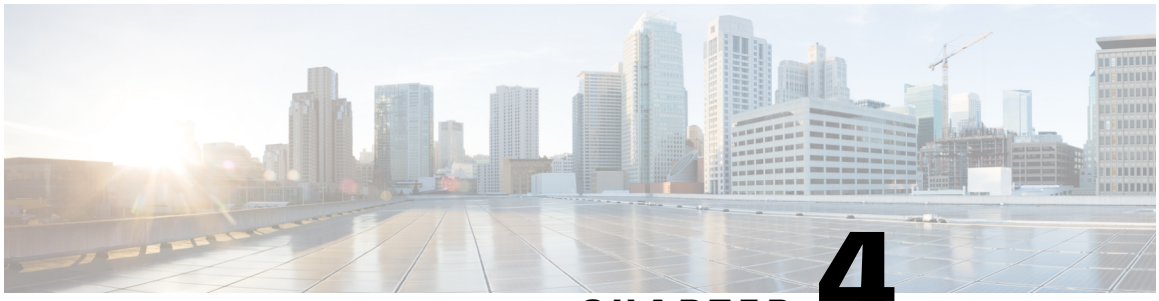
a) Hold the front of the fan tray by its sides and align it with the upper fan tray bay of the chassis. The upper fan tray bay is located at the upper-front of the chassis.

b) Slowly slide the fan tray into the chassis along the guides until its face plate is firmly against the chassis.

c) Use a Phillips #1 screwdriver to tighten the four screws on the face of the fan tray to secure it.

d) Replace the upper plastic bezel: align it over the bezel mounts that protrude from the face of the fan tray and snap it in place.

Step 4 Proceed to the *Application Card Installation* chapter.



CHAPTER 4

Application Card Installation

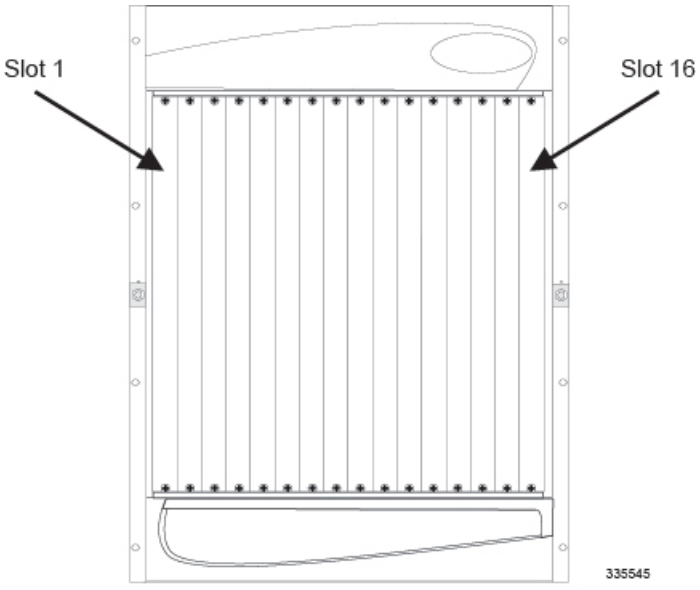
This chapter provides information on chassis configurations and instructions for installing application cards. Line cards are discussed in the Line Card Installation chapter.

This chapter includes the following sections:

Chassis Slot Numbering and Assignments

The chassis has 16 front-loading slots that host application cards. This allows the installation of redundant components and provides ample room for expanding the system. Chassis slots are labeled 1 through 16 from left to right.

Figure 26: Chassis Front Slot Numbering



ASR 5000 Platform

The following application cards are supported for use in the ASR 5000 chassis:

- **System Management Card (SMC):** The Session Management Card (SMC) is used with the packet processing cards (PSC2 or PSC3) in the ASR 5000 hardware platform. It serves as the primary controller, initializes the entire system, and loads the software's configuration image into other cards in the chassis. Up to two SMCs can be installed in the chassis: one primary and one redundant "hot-standby" card. Chassis slots 8 and 9 are reserved for the SMC only. By default, when the chassis' power is on, the SMC in slot 8 is active. The other SMC is automatically placed into standby mode.

  Caution Do not place any card other than an SMC into slots 8 or 9 of the ASR 5000. Doing so will cause damage to the card and possibly the chassis' mid-plane.

- **Packet Processing Cards:** The packet services cards provide the packet processing and forwarding capabilities within a system. Each packet processing card type supports multiple contexts, which allows you to overlap or assign duplicate IP address ranges in different contexts. The minimum recommended redundancy for packet services cards is one redundant card for up to 13 active cars.

The following table details the specific ASR 5000 chassis slot assignments for each of the above card types.

Table 26: Application Card Slot Assignments

Application Card Type	Chassis Slot Number(s)	Description
System Management Card (SMC)	8	Primary SMC
	9	Redundant SMC
Packet Processing Cards	1 through 7 and 10 through 16	Active or redundant packet processing cards all of the same type

Important To achieve optimal airflow performance in minimum system deployments, populate packet services cards within the chassis from the middle of the chassis outward. Leave an empty slot between the cards, when possible. For example, for four PSC2s, use slots 3, 5, 12, and 14. For two PSC2s, use slots 5 and 12. For more detailed information on SMCs and packet processing card types, refer to the *Hardware Platform Overview* chapter.

Packet Processing Card Redundancy

To optimize network efficiency and minimize down time, the system supports 1:n redundancy for packet processing cards of the same type.

When the system boots up, all packet processing cards enter standby mode, which means that the cards are available for use but offline. Installed components are made active through the software configuration process. Cards that are not configured to enter active mode, which brings them online, remain in standby mode as redundant components. Packet processing cards that normally operate in standby mode do not require line cards to be installed directly behind them, as these line cards are not used.

In the event of packet processing card failure, tasks are migrated from the active packet processing card to the standby card. The line card installed behind the packet processing card that was formerly active maintains the interfaces to the external network equipment. Redundancy Crossbar Cards (RCCs) provide a path for signalling and data traffic between the line card and the now active packet processing card.

Important For additional information about RCCs, refer to *Line Card Installation* in this guide.

Recommended Minimum Chassis Configuration

The recommended minimum chassis configuration for application cards, including redundancy, is as follows:

Slot Number	Card	Card State
8	SMC	Active
9	SMC	Standby
2 and 4 (see Note 1) 2, 3 and 4 (see Note 2)	PSC2 or PSC3	Active
11 (see Notes 1 and 2)	PSC2 or PSC3	Standby

Notes:

1. Minimum requirement for hardware redundancy.

2. Minimum requirement for hardware + software redundancy, MME service, SGSN service, as well as combined services on a single platform.

Install additional cards in the remaining chassis slots as required.

If you use the session recovery feature, a minimum of three active packet processing cards and one standby (redundant) packet processing card are required.

Installing Application Cards

The installation procedure is identical for all application cards. This section provides the instructions for installing application cards in the chassis.

Caution During installation, maintenance, and/or removal, wear grounding wrist and/or heel straps to avoid ESD damage to the components. Failure to do so could result in damage to electrical components and could potentially void your warranty.

Step 1 Determine the type of application card you are installing. Each application card is identified by the text near the bottom of its front panel.

Step 2 Determine which chassis slot to install the card in based on the information in Chassis Slot Numbering and Assignments, on page 67..

Step 3 Remove the blanking panel, if one is installed, covering the slot.

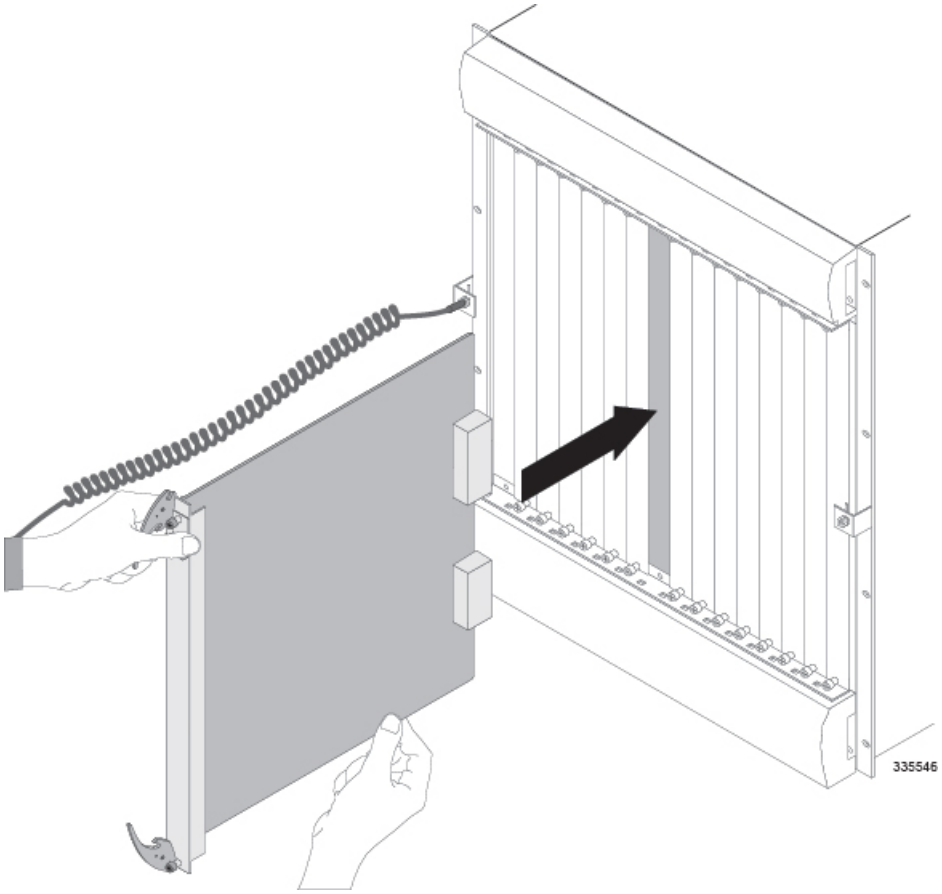
a) Use a Phillips #2 screwdriver to loosen the screws at the top and bottom of the blanking panel.

b) Holding the screws on the blanking panel, pull the blanking panel away from the chassis to expose the chassis slot.

Step 4 Slide the interlock switch on the card fully downward and flip both ejector levers fully outward and away from the front panel.

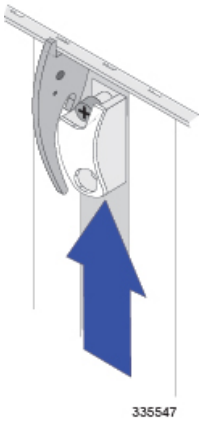
Step 5 Properly support the weight of the card and align it with the upper and lower card guides of the chassis slot. Gently slide the card into the slot until the levers touch the chassis frame.

Caution Take extra caution when installing packet processing cards. These cards contain heat sinks that could become loose or be damaged if they come into contact with another card while it is being inserted in the chassis slot.



Step 6 Push the ejector levers inward firmly and straight until the card is seated in the chassis midplane and you cannot push the ejector levers in any further. Press firmly on the card's faceplate to ensure that it is fully seated. The card's front panel should be flush against the chassis' upper and lower card mounts for the slot.

Step 7 Slide the interlock switch on the front panel of the application card upward to lock the ejector tab in place. The flange on the left-side of the interlock switch prevents movement of the ejector tab when raised completely.



Important You must slide the interlock switch upward before securing the card's top screw to the mounting rail.

Step 8 Use a Phillips #2 screwdriver to tighten the screws at the top and bottom of the application card's front panel to secure the card to the chassis.

Step 9 Repeat step 1 through step 8 for every application card you are installing.

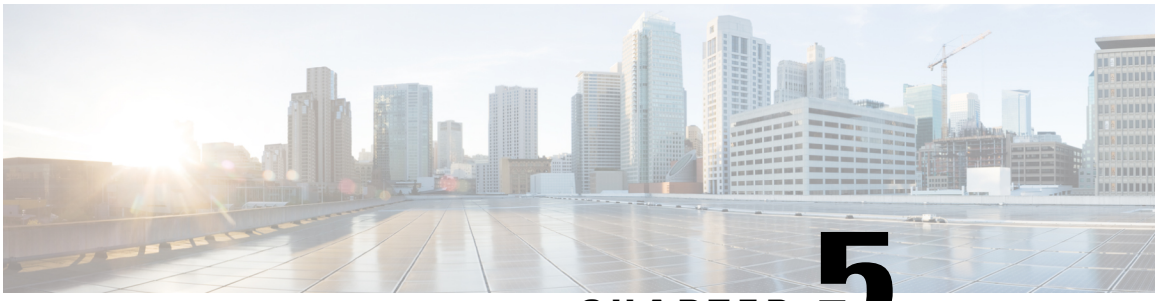
Step 10 Install blanking panels over any unused chassis slots.

To reduce the risk of electric shock and to ensure proper ventilation, blanking panels must be used to cover any chassis slot that is not occupied by an application card.

Leere Steckplaetze muessen mit der dafuer vorgesehenen Abdeckplatte geschlossen werden, um die Luftzirkulation innerhalb des Geraets zu gewaehrleisten und um einen elektrischen Schlag zu vermeiden.

a) Position the blanking panel over the unused chassis slot.
b) Use a Phillips #2 screwdriver to tighten the screws at the top and bottom of the blanking panel to secure the panel to the chassis.
c) Repeat step a and step b for any additional unused chassis slots.

Step 11 Proceed to the *Line Card Installation* chapter.



CHAPTER 5

Line Card Installation

This chapter provides information on chassis configurations and instructions for installing line cards.

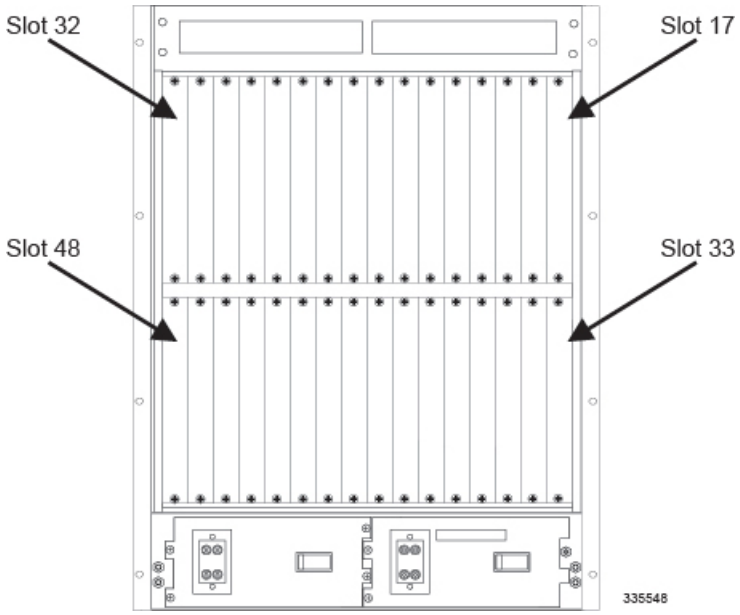
It includes the following sections:

Chassis Slot Numbering and Assignments

The chassis has 32 rear-loaded slots for line cards. This allows for the installation of redundant components and provides ample space for expanding the system.

There are two rows of slots on the rear of the chassis. The upper row of slots is labeled 17 through 32 from right to left. The lower row of slots is labeled 33 through 48 from right to left.

Figure 27: Chassis Slot Numbers (Rear)



Important The 10 Gigabit Ethernet Line Card is a full-height line card that occupies the upper and lower slots in the chassis. When referring to installed XGLCs, use the upper slot number only. Slot numbering for other installed half-height cards is maintained: 17 to 32 and 33 to 48, regardless of the number of installed XGLCs

The following table shows the front slot numbers and their corresponding rear slot numbers.

Table 27: Front and Rear Slot Numbering Relationship

Position	**Slot Number**															
Front	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Rear Top Slots	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17
Rear Bottom Slots	48	47	46	45	44	43	42	41	40	39	38	37	36	35	34	33

The following line cards are available for the chassis:

- **Switch Processor Input/Output (SPIO) Card:** SPIOs are installed in chassis slots 24 and 25 behind SMCs. SPIOs provide interfaces for local and remote management, Central Office (CO) alarming, and eventually, Building Integrated Timing Supply (BITS) timing.
- **Fast Ethernet Line Card (FLC2):** FLC2s are installed directly behind their corresponding packet processing cards. Each card provides eight 10/100Base-T RJ-45 Ethernet interfaces that are used as either the R-P or the Pi interfaces for the 3G wireless data application.
- **Gigabit Ethernet Line Card (GLC2):** GLC2s are installed directly behind their corresponding packet processing cards. Each card provides a single 802.3z-compliant gigabit Ethernet converter with a Small Form-factor Pluggable (SFP) module. Supported modules provide optical or copper interfaces.
- **Quad Gigabit Ethernet Line Card (QGLC):** QGLCs are installed directly behind their corresponding packet processing cards. Each card provides four 802.3z-compliant gigabit Ethernet interfaces with a Small Form-factor Pluggable (SFP) module. Supported modules provide fiber or copper connectors.
- **10 Gigabit Ethernet Line Card (XGLC):** XGLCs are a single-port full-height line card installed directly behind their corresponding packet processing cards. The cards support 10 gigabit Ethernet interfaces using industry-standard SFP+ modules. Various fiber types may be used as required.
- **Optical (ATM) Line Cards (OLC 2)**: Four-port OLC2s are installed directly behind their corresponding packet processing cards. Each card provides four LC duplex ports that accept small SFP modules and supports either single-mode or multi-mode fiber optic cable.
- **Channelized (STM-1/OC-3) Line Cards (CLC2)**: Four-port CLC2s are installed directly behind their corresponding packet processing cards. The CLC2 provides four LC duplex ports. The ports accept one of two types of Small Form-factor Pluggable (SFP) modules. The SFP type relates to the type of fiber optic cable—single-mode or multi-mode.
- **Redundant Crossbar Card (RCC):** RCCs are installed in the lower-middle two slots, directly behind the SMCs. RCCs provide a redundant data and control path link between each line card and all packet processing cards. There are no external interfaces on the RCC. Internally, it provides redundant 5 Gbps serial links to each packet processing card and line card.

The following table provides information for the specific chassis slot assignments for each of the card types.

Table 28: Line Card Slot Assignments

Line Card Type	Chassis Slot Number	Description
Switch Processor Input/Output (SPIO)	24	Resides behind Primary SMC in slot 8.
	25	Resides behind Redundant SMC in slot 9.
Redundancy Crossbar Card (RCC)	40	Resides behind Primary SMC in slot 8. It provides redundancy for all packet processing application cards and for line cards installed in the upper-rear chassis, slots 17 through 23 and 26 through 32.
	41	Resides behind Redundant SMC in slot 9. It provides redundancy for all SMC application cards and for line cards installed in the lower-rear chassis, slots 33 through 39 and 42 through 48.

Line Card Type	Chassis Slot Number	Description
Ethernet 10/100 (FLC2)	17 through 23, 26 through 39, or 42 through 48	Resides directly behind its corresponding packet processing card. Each packet processing card can support up to two FLC2s. The active card is installed in the upper rear chassis slot. The redundant card is installed in the lower rear chassis slot.
Ethernet 1000 (GLC2)	17 through 23, 26 through 39, or 42 through 48	Resides directly behind its corresponding packet processing card. Each packet processing card can support up to two GLC2s. The active card is installed in the upper rear chassis slot. The redundant card is installed in the lower rear chassis slot.
Quad Gig-E (QGLC)	17 through 23, 26 through 39, or 42 through 48	Resides directly behind its corresponding packet processing card. Each packet processing card can support up to two QGLCs. The active card is installed in the upper rear chassis slot. The redundant card is installed in the lower rear chassis slot.
10 Gigabit Ethernet Card (XGLC)	17 through 23 and 26 through 32	Resides directly behind its corresponding packet processing card. The XGLC is a full-height line card that occupies the upper and lower slots in the ASR 5000.
Optical (ATM) (OLC2)	17 through 23, 26 through 39, or 42 through 48	Resides directly behind its corresponding packet processing card. Each packet processing card can support up to two OLC2s. The active card is installed in the upper rear chassis slot. The redundant card is installed in the lower rear chassis slot.
Channelized (CLC2)	7 through 23, 26 through 39, or 42 through 48	Resides directly behind its corresponding packet processing card. Each packet processing card can support up to two CLC2s. The active card is installed in the upper rear chassis slot. The redundant card is installed in the lower rear chassis slot.

Line Card Redundancy

To optimize network efficiency and minimize down time, the system supports 1:1 redundancy for OLC2s, CLC2s, FLC2s, GLC2s, and QGLCs.

With the exception of the XGLC, line cards are installed in the half-height slots at the rear of the chassis. This design allows two Ethernet or two Optical (ATM) or two Channelized line cards directly behind (one top, one bottom) every packet processing card that normally operates in active mode.

When two line cards are installed, the card in the upper-rear chassis slot is automatically the active card. The card in the lower-rear chassis slot is automatically placed in standby mode. In the event that the active card experiences a failure, the system automatically migrates traffic to the standby card in the lower slot.

Side-by-side Redundancy for the XGLC

The XGLC is a full-height card that requires both top and bottom line card slots for a single 10-Gigabit port. To achieve one-to-one line card redundancy, you must install two XGLCs in adjacent slots. Otherwise, you configure port and card redundancy for the XGLCs in the same way as other line cards. There are no restrictions that prevent the side-to-side 1:1 XGLC redundant arrangement from functioning with other Ethernet line card types.

An active packet processing card must always be installed behind an XGLC. Monitoring functions occur in a distributed fashion. Select the XGLCs that act as a redundant pair via the CLI. Configure the redundant pairs prior to configuring the interface bindings so that proper parallel physical and logical port configurations are established. The card redundancy and monitoring begins as soon as the packet processing card in front is active.

Important The packet processing cards behind a pair of redundant XGLCs must always be in Active mode.

Requirement Summary

There must be a direct connection to a packet processing card behind each side-by-side redundant XGLC pair.

Configure the XGLC Ethernet line cards in a chassis as redundant pairs with cards in the following adjacent slots:

- 17 – 18
- 19 – 20
- 21 – 22
- 23 – 26 (SPIOs 24 and 25 are skipped in this line card redundancy model)
- 27 – 28
- 29 – 30
- 31 – 32

Important Use only the top line card slot numbers to configure XGLC 1:1 redundancy.

CLI Commands for XGLC Redundancy

Side-by-side 1:1 redundancy only operates on top line card slot numbers: cards 17 through 23 and 26 through 32. Make sure that both packet processing cards in front of the line cards are of the same type, configured as a redundant pair, and active.The CLI configuration to support this redundancy mode is specified at the card level as follows:

```
[local]asr5000# config
[local]asr5000(config)#  card 17
[local]asr5000(config-card-17)# redundant with 18
```

To remove this configuration, set the redundant card back to the default bottom line card:

```
[local]asr5000(config-card-17)# redundant with 33
```

Recommended Minimum Chassis Configuration

An absolute minimum chassis configuration consists of one packet processing card and their respective line cards. However, it is strongly recommended that redundant components be used to minimize the risk of system outage.

Therefore, the recommended minimum chassis configuration consists of the following:

Table 29: ASR 5000 Recommended Minimum Chassis Configuration

Application Card	Application Card Slot Number	Associated Interface Card	Line Card Slot Number
SMC	8	SPIO	24
		RCC	40
Redundant SMC	9	SPIO	25
		RCC	41
PSCA, PSC2, PSC3 or PPC Note that for Release 9.0, only PDSN and HA are supported on the PPC. Note that for Release 10.0, only PDSN, HA, and GGSN are supported on the PPC.	2	FLC2 **or** QGLC	18 and 34
		Redundant FLC2 **or** QGLC	
		XGLC	17 and 32
PSCA, PSC2, PSC3 or PPC	3*	None required	N/A
PSCA, PSC2, PSC3 or PPC	4	None required	N/A
Redundant PSCA, PSC2, PSC3 or PPC	11	None required	N/A

* Minimum requirement for hardware + software redundancy or combined services on a single platform.

Installing Half-Height Line Cards

This section provides instructions for adding half-height line cards to the chassis.

Caution During installation, maintenance, and/or removal, wear a grounding wrist strap to avoid ESD damage to the components. Failure to do so could result in damage to sensitive electronic components and potentially void your warranty.

Important The XGLC is a full-height line card that takes up the upper and lower slots in the back of the chassis.

Step 1 Determine the type of line card you are installing. Each line card is identified by the text near the bottom of its front panel.

Step 2 Determine which chassis slot to install the card in based on the information in Chassis Slot Numbering and Assignments, on page 73.

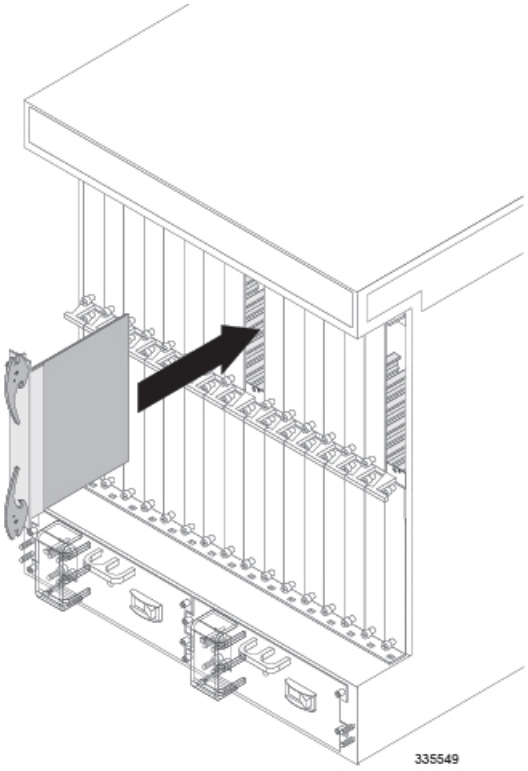
Step 3 Remove the blanking panel covering the slot, if one is installed.

a) Use a Phillips #2 screwdriver to loosen the screws at the top and bottom of the blanking panel.

b) Hold the screws on the blanking panel, and pull the blanking panel away from the chassis to expose the chassis slot.

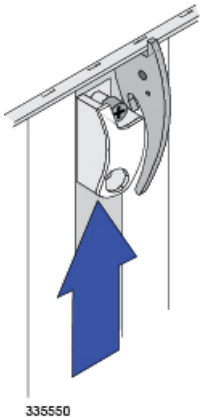
Step 4 Slide the interlock fully downward on the card. Flip the ejector levers outward and away from the face plate.

Step 5 Hold the card by its ejector levers and align the card with the upper and lower card guides of the chassis slot. Gently slide it into the slot until the levers touch the chassis frame.



Step 6 Push the ejector levers inward firmly until the card is firmly seated in the chassis midplane and the ejector levers can be pushed in no further. Press firmly on the card's faceplate to ensure that it is fully seated. The card's front panel should be flush against the chassis' upper and lower card mounts for the slot.

Step 7 Slide the interlock switch on the front panel of the line card upward to lock the ejector tab in place. The flange on the left-side of the interlock switch prevents movement of the ejector tab when raised completely.



Important You must slide the interlock switch upward before securing the card's top screw to the mounting rail.

Step 8 Use a Phillips #2 screwdriver to tighten the screws at the top and bottom of the line card's front panel to secure the card to the chassis.

Step 9 Repeat step 1 through step 7 to install other line cards.

Step 10 Install blanking panels over any unused chassis slots.

To reduce the risk of electric shock and to ensure proper ventilation, blanking panels must be used to cover any chassis slot that is not occupied by an application card.

Leere Steckplaetze muessen mit der dafuer vorgesehenen Abdeckplatte geschlossen werden, um die Luftzirkulation innerhalb des Geraets zu gewaehrleisten und um einen elektrischen Schlag zu vermeiden.

a) Position the blanking panel over the unused chassis slot.
b) Use a Phillips #2 screwdriver to tighten the screws at the top and bottom of the blanking panel to secure the panel to the chassis.
c) Repeat step a and step b for any additional unused chassis slots.

Step 11 Proceed to the appropriate chapter for information on connecting data cables to the line cards.

Installing the 10 Gigabit Ethernet Line Card (XGLC)

The XGLC is a full-height line card that gets installed in the rear slots of the ASR 5000 chassis. It provides a single Small Form-factor Pluggable+ (SFP+) 10 Gigabit Ethernet interface for network connectivity.

There are two versions of the XGLC:

- **XGLC SR** accepts a 10GBase-SR module that drives optical fiber with a center wavelength of 850nm terminated by an LC optical connector. The module can drive optical signals up to 300 meters using 50/125um fiber (MMF), and up to 33 meters using 62.5/125um fiber (MMF).
- **XGLC LR** accepts a 10GBase-LR module that drives optical fiber with a center wavelength of 1310nm terminated by an LC optical connector. This module can drive optical signals up to 10 kilometers using 50/125um fiber (SMF).

XGLCs are installed behind packet processing cards. You can install a maximum of twelve XGLCs in the chassis.

Preparing a Full-height Line Card Slot

The full-height XGLC requires two line card slots: an upper chassis slot and the lower chassis slot directly beneath it. For example, if a PSC2 is installed in slot 1, its corresponding XGLC would be installed in slots 17 and 33.

Important When entering the slot location of an XGLC in a CLI command use the upper slot number only.

The procedure for modifying two half-height card slots to accept the full-height XGLC is described in the *Preparing A Full-Height Card Slot* appendix. Complete the procedures described in that appendix before attempting to install the XGLC in the ASR 5000 chassis.

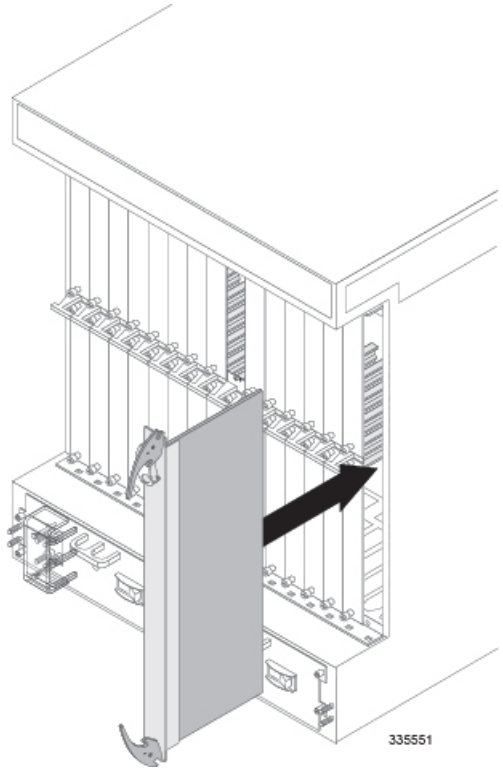
Installing the XGLC

Caution During installation, maintenance, and/or removal, wear a grounding wrist strap to avoid ESD damage to the components. Failure to do so could result in damage to sensitive electronic components and potentially void your warranty.

Step 1 identify the full-height chassis slot in which the line card will be installed.

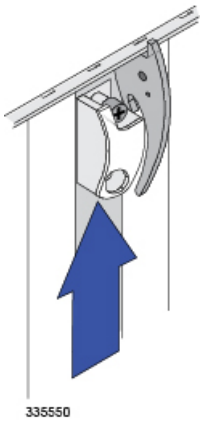
Step 2 Slide the interlock switch fully downward on the card. Flip the ejector levers outward and away from the card's front panel.

Step 3 Properly support the weight of the card and align it with the upper and lower card guides of the chassis slot. Gently slide the card into the slot until the levers touch the chassis frame.



Step 4 Push the ejector levers inward firmly until the card is firmly seated in the chassis midplane and the ejector levers can be pushed in no further. Press firmly on the card's faceplate to ensure that it is fully seated. The card's front panel should be flush against the chassis' upper and lower card mounts for the slot.

Step 5 Slide the interlock switch on the front panel of the line card upward to lock the ejector tab in place. The flange on the left-side of the interlock switch prevents movement of the ejector tab when raised completely.

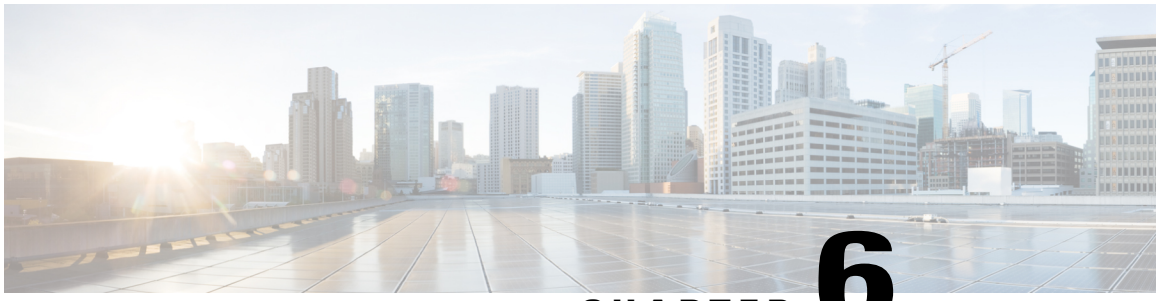


Important You must slide the interlock switch upward before securing the card's top screw to the mounting rail.

Step 6 Use a Phillips #2 screwdriver to tighten the screws at the top and bottom of the front panel to secure the card to the chassis.

Step 7 Repeat step 1 through step 10 for every other line card that to be installed.

Step 8 Proceed to the appropriate chapter for information on connecting data cables to the line cards.



CHAPTER 6

Cabling the Switch Processor Input/Output Line Card

This chapter provides information on the Switch Processor Input/Output (SPIO) line card interfaces and instructions for installing the cables.

Important **Class 1 Laser Compliance Notice** Because of the SFP interfaces, this product has been tested and found to comply with the limits for Class 1 laser devices for IEC825, EN60825, and 21CFR1040 specifications.

This chapter includes the following sections:

SPIO Interfaces

The SPIO is available with the following types of interfaces:

- Two Gigabit Ethernet, fiber optical (SFP)
- Two 1000Base-T Ethernet, copper (RJ-45)
- One RS-232 interface (RJ-45)
- One Central Office alarms (10-pin Molex))
- One BITS (BNC or 3-pin connector)

E1 BNC BITS Interface Version

The figure and table that follow provide information on the various interfaces in this version of the SPIO.

Figure 28: SPIO BITS BNC Interface Callouts

Table 30: SPIO BITS BNC Interface Descriptions

Item	Label	Connector Type	Description
1	SFP 1	Optical fiber, Small Form-factor Pluggable	Gigabit Ethernet interface for connecting to management LAN
2	SFP 2	Optical fiber, Small Form-factor Pluggable	Gigabit Ethernet interface for connecting to management LAN
3	Ethernet 1	RJ-45	10/100/1000 Ethernet interface for connecting to management LAN
4	Ethernet 2	RJ-45	10/100/1000 Ethernet for connecting to management LAN
5	Console	RJ-45	RS-232 interface for local administration of the system

Item	Label	Connector Type	Description
6	BITS BNC	75W BNC	Building Integrated Timing Supply (BITS) interface for analog E1 clock source [software selectable] **NOTE:** This interface is not used for systems supporting data applications.
7	CO Alarms	10-pin Molex	Isolated dry-contact relay interfaces for connection to Central Office (CO) alarm monitoring panel

T1 3-Pin BITS Interface Version

The figure and table that follow provide information on the various interfaces in this version of the SPIO.

Figure 29: SPIO BITS 3-Pin Interface Callouts

Table 31: SPIO 3-Pin BITS Interface Descriptions

Item	Label	Connector Type	Description
1	SFP 1	Optical fiber, Small Form-factor Pluggable	Gigabit Ethernet interface for connecting to management LAN
2	SFP 2	Optical fiber, Small Form-factor Pluggable	Gigabit Ethernet interface for connecting to management LAN

Item	Label	Connector Type	Description
3	Ethernet 1	RJ-45	10/100/1000 Ethernet for connecting to management LAN
4	Ethernet 2	RJ-45	10/100/1000 Ethernet for connecting to management LAN
5	Console	RJ-45	RS-232 interface for local administration of the system
6	BITS 3-Pin	3-pin Wire Wrap	BITS interface for T1 (DS1) clock source [software selectable] **NOTE:** This interface is not used for systems supporting data applications.
7	CO Alarms	10-pin Molex ®	Isolated dry-contact relay interfaces for connection to Central Office (CO) alarm monitoring panel

Connecting to the Management LAN

The SPIO provides two types of interfaces for physical connection to the management LAN: the fiber optic SFP and the Ethernet (RJ-45) interfaces.

When you cable these interfaces, make sure you do only one of the following:

- **Both SFP interfaces**
- **Both Ethernet interfaces**
- SFP 1 and Ethernet 2
- SFP 2 and Ethernet 1

Important Be sure to label the interface cables with their destination prior to connecting them to the SPIO. This will assure proper reconnection should the card need to be serviced.

Using the SFP Interfaces

The two optical 1000Base-SX SFP interfaces are hot-pluggable 802.3z-compliant Gigabit Ethernet interfaces that take their configuration from the inserted cable type. Refer to the following table for information about supported cable specifications.

Table 32: 1000Base-SX SFP Connector and Fiber Optic Cable Types

Module Type	Connector Type	Cable Specifications
1000Base-SX	Fiber, LC duplex female connector	**Fiber Type:** Multi-mode fiber (MMF), 850 nm wavelength **Core Size (microns)/Range:** • 62.5/902.23 feet (275 meters) • 50/1640.42 feet (500 meters) **Minimum Tx Power:** -9.5 dBm **Rx Sensitivity:** -17 dBm

Important The SFP interface is only certified to work with SFP transceiver modules purchased from Cisco for use with the SPIO card.

Important Be sure to label the interface cables with their destination prior to connecting them to the SPIO card. This will assure proper reconnection should the card need to be serviced.

Class 1 Laser Device

Only trained and qualified personnel should be allowed to install, replace, or service this equipment.

Invisible laser radiation may be emitted from the aperture of the port when no cable is connected. Avoid exposure to laser radiation and do not look into open apertures. **Be sure to keep the cover on the interface when it is not in use.**

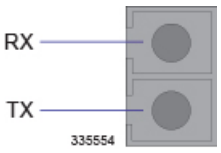
Laser Klasse 1 - nur speziell ausgebildetes Personal darf dieses Geraet warten.

Nicht in den Laser schauen, um Augenverletzungen zu vermeiden.

Nicht genutzte Buchsen mit der entsprechenden Kappe verschliessen.

Each optical SFP interface is equipped with a transmit (TX) port and a receive (RX) port as shown in the following figure.

Figure 30: SPIO Optical SFP Interface Connector



Additionally, the SPIO provides two light emitting diode (LED) status indicators for this interface:

- **Link:** This green LED shows whether or not the line card is connected to the network. The LED is illuminated when the card is connected.

- **Activity:** This green LED shows when data is transmitted or received. The LED is illuminated when data is passing through the interface.

Connect to the SFP interfaces by following the instructions below.

Step 1 To ensure full connectivity, use your thumb to firmly press the SFP transceiver module into its socket on the front panel of the card.

Step 2 Remove the cover from the SFP module.

Step 3 Inspect and clean the connector's fiber-optic end-faces.

Step 4 Insert the fiber-optic cable from the network device into the interface and ensure that it locks in place.

Step 5 Repeat step 1 through step 5 to connect a fiber-optic cable to the other port.

Using the Ethernet RJ-45 Interfaces

The two RJ-45 interfaces are auto-sensing 10/100/1000Base-TX Ethernet interfaces. Refer to the figure and table that follow for pinouts for the RJ-45 Ethernet ports.

Important To comply with GR-1089 intra-building, lightning-immunity requirements and ensure compliance with Radiated Emissions Criteria, you must use shielded-twisted pair (STP) copper cable and ensure that it is properly terminated at both ends.

Important The 1000Base-TX (RJ-45) management ports of the SPIO are suitable for connection to intra-building or unexposed wiring or cabling only. These intra-building ports MUST NOT be metallically connected to interfaces that connect to the outside plant (OSP) or its wiring. These interfaces are designed for use as intra-building interfaces only (Type 2 or Type 4 ports as described in GR-1089-CORE, Issue 5) and require isolation from the exposed OSP cabling. The addition of Primary Protectors is not sufficient protection in order to connect these interfaces metallically to OSP wiring.

Important Be sure to label the interface cables with their destination prior to connecting them to the SPIO card. This will assure proper reconnection should the card need to be serviced.

Figure 31: SPIO Ethernet RJ-45 Interface

Table 33: SPIO Ethernet RJ-45 Interface Pinout

Pin	100Base-TX 100Mbps Cat5	1000Base-TX 1Gbps Cat5+
1	TX+	BI DA+
2	TX-	BI DA-
3	RX+	BI DB+
4	No used	BI DC+
5	No used	BI DC-
6	RX-	BI DB-
7	No used	BI DD+
8	No used	BI DD-
RX = Receive Data TX = Transmit Data BI = BI directional data DA, DB, DC, DD = Data Pair A, B, C, and D		

Each of these interfaces is equipped with two light emitting diode (LED) status indicators:

- **Link:** This green LED shows whether or not the line card is connected to the network. The LED is illuminated when the card is connected.
- **Activity:** This green LED shows when data is transmitted or received. The LED is illuminated when data is passing through the interface.

To use the RJ-45 interfaces, simply plug the Ethernet cable into either the Ethernet 1 or Ethernet 2 interface.

Connecting to the Serial Console Port

The Console port is an RJ-45 RS-232 interface that provides access to the system's command line interface (CLI). This serial interface communicates at 9600 to 115200 bps (default = 115200 bps).

The RJ-45 pinout of tis interface is described in the figure and table that follow.

Important To ensure compliance with Radiated Emissions Criteria, you must use shielded-twisted pair (STP) copper cable and ensure that it is properly terminated at both ends.

Figure 32: SPIO Serial Console RJ-45 Interface Pinouts

Table 34: SPIO Serial Console RJ-45 Interface Pinouts 0

RJ-45 Pin	Signal Description	Signal Type
1	Clear to Send (CTS)	Input
2	Data set Ready (DSR)	Input
3	Receive Data (RX)	Input
4	Signal Ground (SGND)	N/A
5	Ready to Send (RTS)	Output
6	Transmit Data (TX)	Output
7	Data Carrier Detect (DCD)	Input
8	Data Terminal Ready (DTR)	Output

DB-9 to RJ-45 Adapter

SPIOs are shipped with an RJ-45-to-RJ-45 serial cable and an RJ-45-to-DB-9 adapter. The DB-9S conductor on the adapter is female. If you use the cable and adaptor together, refer to the following figure and table.

Important If the console cable is to be used in a null-modem configuration, the workstation or terminal server must provide a carrier-detect signal.

Figure 33: SPIO Console Cable and DB-9 Adapter Pinouts

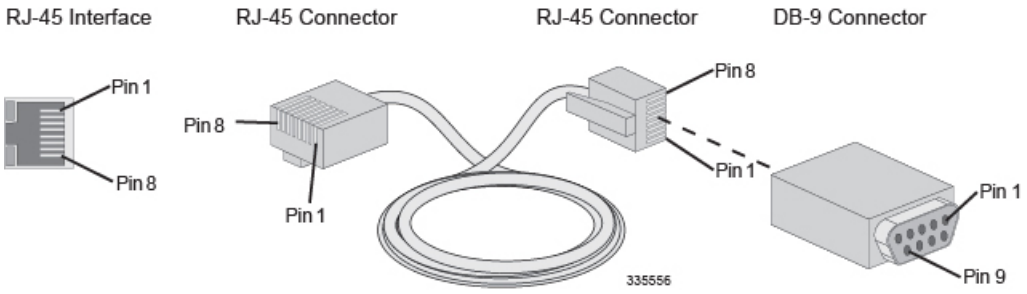


Table 35: SPIO Console Cable Pinouts

SPIO Console Port Interface		Console Cable		RJ-45-to-DB-9 Adapter	
Signal	**Signal Type**	**RJ-45 Pin**	**RJ-45 Pin**	**DB-9S Pin**	**Signal**
Clear to Send (CTS)	Input	1	1	7	RTS
Data Set Ready (DSR)	Input	2	2	4	DTR
Receive Data (RxD)	Input	3	3	3	TxD
Signal Ground (SGND)	N/A	4	4	5	SGND
Ready To Send (RTS)	Output	5	5	8	CTS
Transmit Data (TxD)	Output	6	6	2	RxD
Data Carrier Detect (DCD)	Input	7	7	1	DCD
Data Terminal Ready (DTR)	Output	8	8	6	DSR

USB to DB-9 Adapter

A USB to Serial DB-9 adapter is supplied with each system. The DB-9 connector on the adapter is male and can be used in conjunction with the Console RJ-45 Cable and DB-9 Adapter to connect a laptop or workstation to the R-J45 port on the SPIO.

Figure 34: USB to Serial DB-9 Adapter

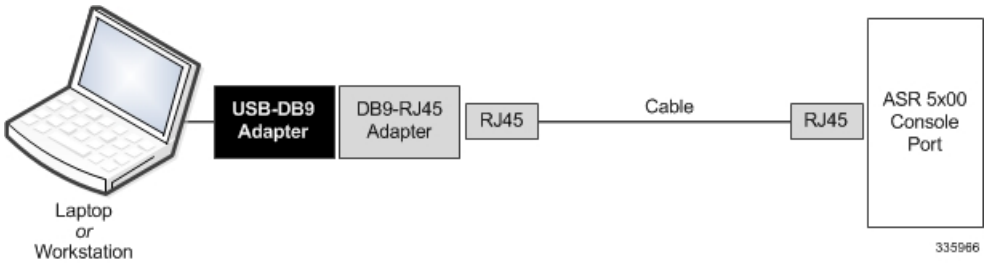
1	USB 1.1 Type B connector	2	DB-9 connector (male)

Table 36: USB to DB-9 Adapter - DB-9 Pinouts

DB-9 Pin	Signal Description	Signal type	Console Port
1	Data Carrier Detect (DCD)	Input	Unused
2	Receive Data (RxD)	Input	TxD
3	Transmit Data (TxD)	Output	RxD
4	Data Terminal Ready (DTR)	Output	Unused
5	Signal Ground (SGND)	Ground	Ground
6	Data Set Ready (DSR)	Input	Unused
7	Request To Send (RTS)	Output	Unused
8	Clear To Send (CTS)	Input	Unused
9	Ring Indicator (RI)	Input	Unused

This adapter provides a serial port on a laptop or workstation that does not have one. It draws power from the USB port.

Figure 35: USB to Console Port Interconnection



Connecting to the Console Port

Important The following instructions assume that you are using the RJ-45-to-RJ-45 cable with the RJ-45-to-DB-9 serial (EIA-232) adapter shipped with the SPIO to connect to the Console port. Use these components to connect to a workstation running a communications application that can access the workstation's serial port, such as Minicom for Linux® or HyperTerminal® for Windows.

To connect to the Console port, follow the instructions below.

Step 1 Connect the RJ-45 end of the cable to the port labeled Console on the SPIO.

Step 2 Connect one end of the RJ-45-to-RJ-45 cable into the DB-9 adapter.

Step 3 Connect the DB-9S (female) end of the cable assembly to the DB-9P (male) serial port on the workstation.

Step 4 Configure the communications application on the workstation to support the following settings: 115200 bps, 8 data bits, no parity, 1 stop bit, no flow control.

Connecting to a BITS Timing Source

The SPIO can be optionally equipped with a BITS interface that derives a 1544 kHz (SONET T1 framing) or 2048 kHz (SDH E1 framing) clock signal from an external Building Integrated Timing Supply to synchronize line card timing. The BITS source derives its timing from a primary reference source (PRS), such as a Stratum 1 clock or Global Positioning System (GPS) signal.

Connection to the BITS is via a BNC coaxial cable (E1) or 3-pin wire-wrap connector (T1).

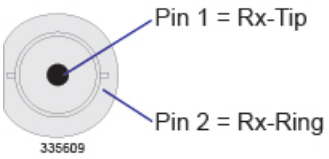
Important External BITS timing is an alternative to using clock signals derived from an ATM port on an OLC2, or an ANSI SONET STS-3/SDH STM-1 port on a CLC2. (Line-derived clocking requires that the SPIO be equipped with the optional Stratum 3 clock module.) For additional information, refer to the *ATM Port Configuration Mode Commands* and *Channelized Port Configuration Mode Commands* chapters of the *Command Line Interface Reference*.

Important Always refer to the interface and signaling specifications in the OEM documentation supplied with the BITS source. Your NOC may also have detailed specifications for distributing the BITS clock signals to network devices such as the ASR 5000.

BITS E1 BNC Interface

The BNC version of the SPIO employs a 75-ohm coaxial BNC connector that accepts an analog E1 BITS signal. The following figure shows the BITS BNC timing interface.

Figure 36: SPIO E1 BITS BNC Pinout

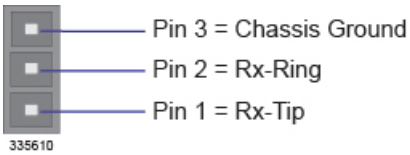


Use 75-ohm coaxial cable (RG-59/U) between the BITS and the SPIO BNC interface to carry the E1 signal.At the SPIO, terminate the cable with a 75-ohm BNC male connector.

BITS T1 3-Pin Interface

The 3-pin version of the SPIO employs a wire-wrap connector that accepts a T1 (DS1) BITS data signal (all ones). The following figure shows the BITS timing interface wire-wrap pin-out.

Figure 37: SPIO T1 BITS Wire-Wrap Pinout



Use 22 AWG, twisted-pair, 100-ohm shielded cable between the BITS and SPIO wire-wrap interface to carry the DS1 signal.

BITS Timing Configuration

After connecting the BITS interface to the BITS, you must use the CLI to configure the type of timing signal being supplied to the SPIO. Options include:

- E1 Frame Alignment Signal (FAS)
- E1 Multiframe with CRF (FAS+CRC)
- T1 Extended Superframe Format (ESF)
- T1 Superframe Format (D4)

For additional information on BITS configuration, refer to the *BITS Port Configuration Mode Commands* chapter of the *Command Line Interface Reference*.

Connecting to the CO Alarm Interface

The Central Office (CO) Alarm interface utilizes a 10-pin Molex female-connector fro interconnection with the three normally closed dry-contact relays. These relays trigger external audio and/or visual indicators for the following three alarm levels:

- **Minor Alarm:** This alarm is triggered when a high temperature is detected on a card, causing the fan tray to switch its fans to high speed.
- **Major Alarm:** This alarm is triggered by a:
  - Hardware failure that places a card in an off-line state
  - Power filter unit failure or removal from the chassis
  - Failure of one or more fans on either the upper or lower fan tray
  - Fan tray failure or either fan tray assembly is removed from the chassis
- **Critical Alarm:** This alarm is triggered when a severe degradation in service is detected. For example, if the system is supporting a large number of subscribers and packet processing cards are removed thus significantly reducing the amount of available CPU and memory resources.

The CO alarm interface pinout is provided in the following figure and table.

Figure 38: SPIO CO Alarm Interface Pinouts

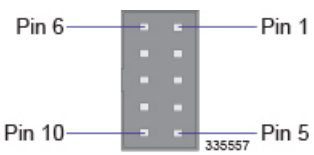


Table 37: SPIO CO Alarm Interface Pinouts 1

Pin	Signal
1	Major Alarm - Normally closed
2	Major Alarm - Common
3	Major Alarm - Normally open
4	Minor Alarm - Normally closed
5	Minor Alarm - Common
6	Minor Alarm - Normally open
7	Signal
8	Major Alarm - Normally closed
9	Major Alarm - Common
10	Major Alarm - Normally open

The 8-foot (2.4 meter) CO alarm cable shipped with the chassis supports redundant SPIO card installations. This "Y" cable has two Molex connectors on one end that are keyed to fit into the CO Alarm interfaces in one direction only. Each connector mates with one of the side-by-side SPIO cards. On the opposite end is a 9-pin terminal block that you can mount to the telco cabinet or equipment rack frame.

The following figure and table display this cable assembly and its pinouts.

Figure 39: SPIO CO Alarms Cable Assembly

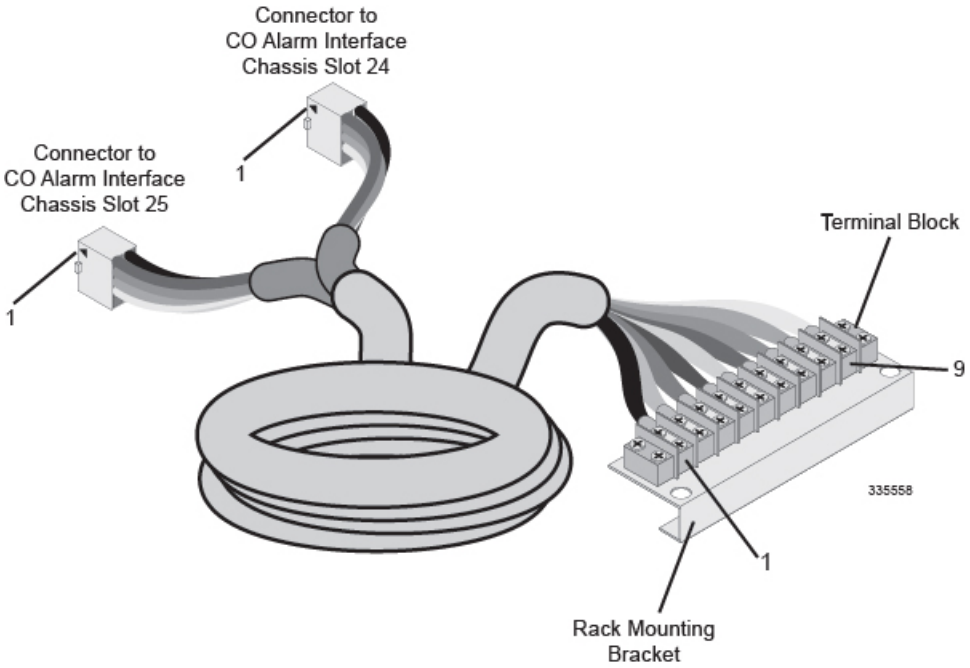


Table 38: SPIO CO Alarms Cable Assembly Pinout

SPIO CO Alarms IF Pin Number	Cable Wire Color	Terminal Block Position No.	Signal
1	Black	1	Major Alarm - Normally closed
2	Orange	2	Major Alarm - Common
3	Red	3	Major Alarm - Normally open
4	Brown	4	Minor Alarm - Normally closed
5	Yellow	5	Minor Alarm - Common
6	Green	6	Minor Alarm - Normally open
7	Blue	7	Critical Alarm - Normally closed
8	Violet	8	Critical Alarm - Common
9	Gray	9	Critical Alarm - Normally open
10	Not wired	Not equipped	Unused

Electrical Characteristics

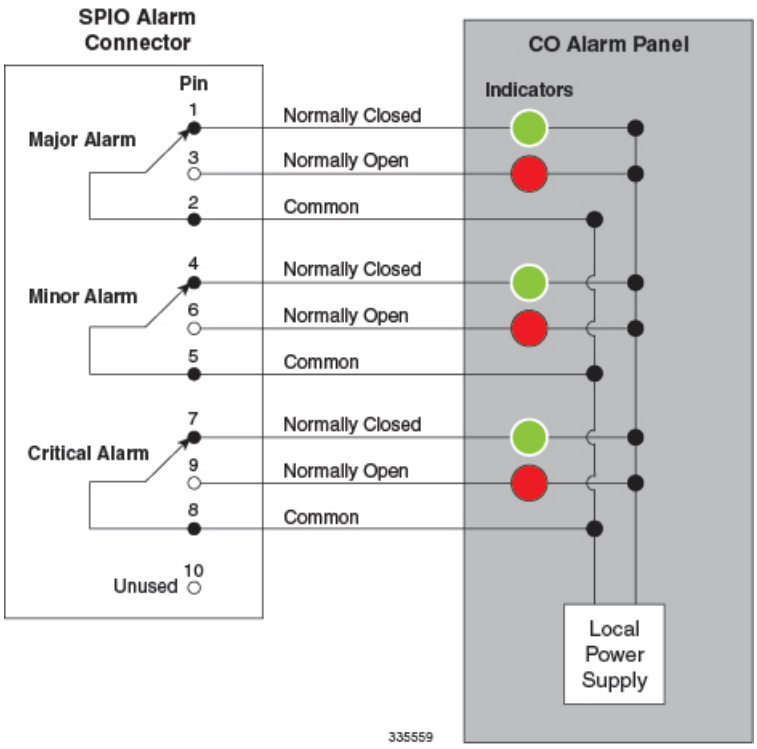
Each of the three dry-contact relay switches is rated to support a maximum switching current of 1A@30VDC. The relay contacts should not directly connected to high current devices such as sirens and flashing lamps.

Important The CO alarm interface of the SPIO is suitable for connection to intra-building or unexposed wiring or cabling only. This interface MUST NOT be metallically connected to interfaces that connect to the outside plant (OSP) or its wiring. This interface is designed for use as an intra-building interface only (Type 2 or Type 4 ports as described in GR-1089-CORE, Issue 5) and requires isolation from the exposed OSP cabling. The addition of Primary Protectors is not sufficient protection in order to connect these interfaces metallically to OSP wiring.

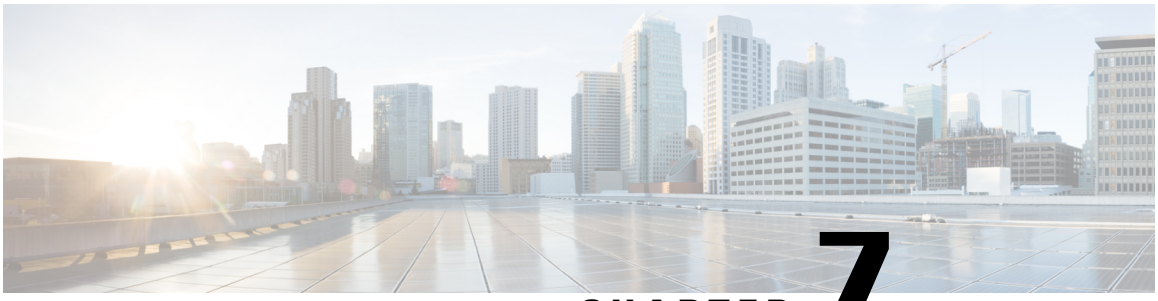
Central Office Alarm Wiring Example

The following figure depicts how the dry-contact relays can each control up to two external alarm indicators. In this example, the CO alarm interface is connected to a CO Alarm Panel, where green LEDs are wired to indicate normal operation, and red LEDs are wired to indicate an alarm condition.

Figure 40: CO Alarm Interface Schematic



With all relays de-energized (normally closed), the green LED is illuminated. If an alarm relay is energized, the NO (normally open) contact closes and the red LED is illuminated.



CHAPTER 7

Cabling the Fast Ethernet (10/100) Line Card

This chapter provides information on the Fast Ethernet Line Card (FLC2) interfaces and instructions for installing the cables.

This chapter includes the following section:

FLC2 Interfaces

The Fast Ethernet Line Card (FLC2, Ethernet 10/100) has eight RJ-45 interfaces, as shown in the figure below. Each of these is an auto-sensing 10Base-T/100Base-TX Ethernet interface that terminates a shielded twisted-pair (STP) copper cable. The interfaces are labeled 1 through 8 from top to bottom.

Important To comply with GR-1089 intra-building, lightning-immunity requirements and ensure compliance with FCC Radiated Emissions Criteria, you must use shielded-twisted pair (STP) cable and ensure that it is properly terminated at both ends.

The 10/100Base-TX ports of the FLC2 are suitable for connection to intra-building or unexposed wiring or cabling only. These intra-building ports MUST NOT be metallically connected to interfaces that connect to the outside plant (OSP) or its wiring. These interfaces are designed for use as intra-building interfaces only (Type 2 or Type 4 ports as described in GR-1089-CORE, Issue 5) and require isolation from the exposed OSP cabling. The addition of Primary Protectors is not sufficient protection in order to connect these interfaces metallically to OSP wiring.

Figure 41: Fast Ethernet Line Card Interface Connectors

The system uses these interfaces to connect to other elements in the packet data network.

Each of these interfaces is equipped with two light emitting diodes (LEDs):

- **Link:** This green LED shows whether or not the line card is connected to the network. The LED is illuminated when the card is connected.
- **Activity:** This green LED shows when data is transmitted or received. The LED is illuminated when data is passing through the interface.

Refer to the following figure and table for pinouts for the RJ-45 Ethernet ports.

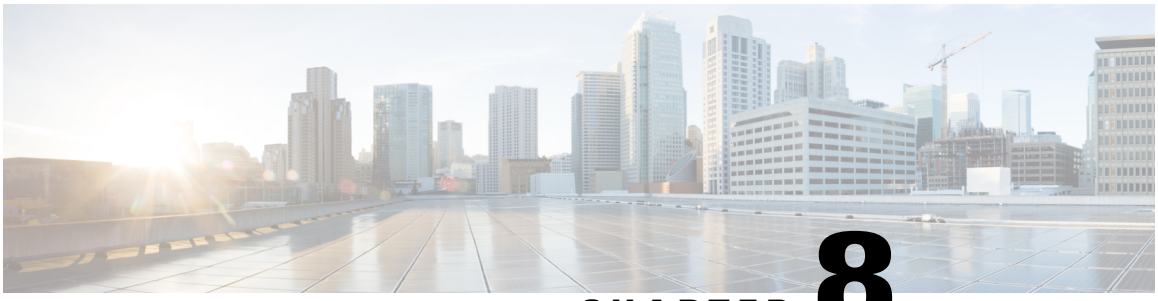
Figure 42: 10/100 Ethernet Interface Pinouts

Table 39: 10/100 Ethernet Interface Pinouts 0

Pin	100Base-T 100Mbps Cat5
1	TX+
2	TX-
3	RX+
4	Not applicable
5	Not applicable
6	RX-
7	Not applicable
8	Not applicable
RX = Receive Data TX = Transmit Data	

Important Be sure to label the interface cables with their destinations prior to connecting them to the FLC2. This will assure proper reconnection should the card need to be serviced.

To cable the FLC2, simply plug an STC Ethernet cable from a network device into the desired port.



CHAPTER 8

Cabling the Gigabit Ethernet Line Cards

This chapter provides cabling instructions and information for the interfaces on the Gigabit Ethernet Line Card (GLC2), the four-port Quad Gigabit Ethernet Line Card (QGLC), and 10 Gigabit Ethernet Line Card (XGLC).

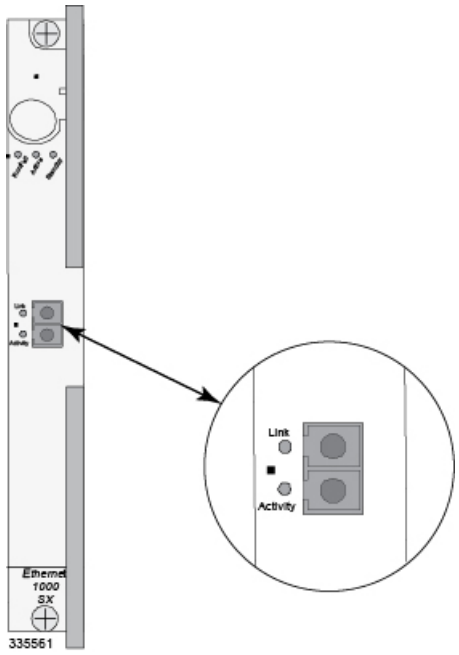
These cards support 802.3z-compliant Gigabit Ethernet interface(s) which connect the chassis to other elements in the packet data network.

This chapter includes the following sections:

Gigabit Ethernet Line Card (GLC2)

The following figure shows the single-port GLC2. The front panel of this card is labeled "Ethernet 1000". This card supports a single fiber or copper Small Form-factor Plugin (SFP) transceiver module as described below:

Figure 43: GLC2 Fiber Optic Interface



Important The following SFP modules are hot-pluggable.

Table 40: SFP Modules Supported by the GLC2

Module Type	Card Identification	Interface Type	Cable Specifications
1000Base-SX	Ethernet 1000 SX	Fiber, LC duplex female connector	**Fiber Type:** Multi-mode fiber (MMF), 850 nm wavelength **Core Size (microns)/Range:** • 62.5/902.23 feet (275 meters) • 50/1640.42 feet (500 meters) **Minimum Tx Power:** -9.5 dBm **Rx Sensitivity:** -17 dBm

Module Type	Card Identification	Interface Type	Cable Specifications
1000Base-LX	Ethernet 1000 LX	Fiber, LC duplex female connector	**Fiber Type:** Single-mode fiber (SMF), 1310 nm wavelength **Core Size (microns)/Range:** 9/32808.4 feet (10 Kilometers) **Minimum Tx Power:** -9.5 dBm **Rx Sensitivity:** -19 dBm
1000Base-T	Ethernet 1000 Copper	RJ-45	Operates in full-duplex up to 100 meters of CAT-5 shielded twisted pair (STP) cable with BER less than 10e-10. **NOTE:** To comply with GR-1089 intra-building, lightning-immunity requirements and ensure compliance with Radiated Emissions Criteria, you must use shielded-twisted pair cable and ensure that it is properly terminated at both ends.

Important The SFP interface is only certified to work with SFP transceiver modules purchased from Cisco for use with the GLC2.

Important **Class 1 Laser Compliance Notice**

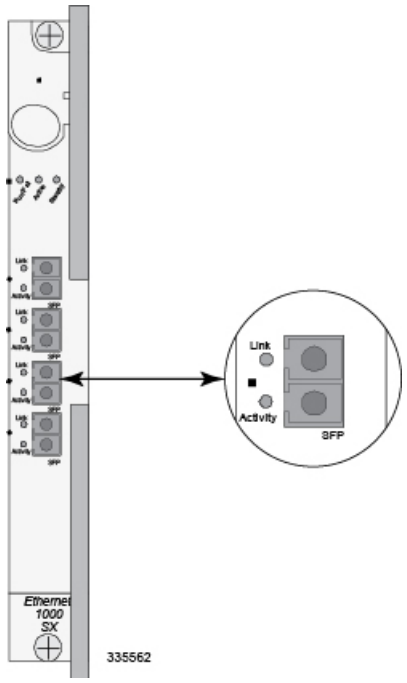
Because of the optical SFP interface, this product has been tested and found to comply with the limits for Class 1 laser devices for IEC825, EN60825, and 21CFR1040 specifications.

Quad Gigabit Ethernet Line Card (QGLC)

The following figure shows the four-port Quad Gigabit Ethernet Line Card (QGLC). The front panel of this card is labeled "Ethernet 1000".

Important If you enter the **show card table** CLI command, the QGLC is listed as a Quad 1000 Ethernet Line Card.

Figure 44: QGLC Fiber Optic Interfaces



Important The QGLC supports four fiber or copper SFP transceiver modules as described below. The modules are hot-pluggable. However, they must all be the same type. You cannot mix-and-match SFP modules in one QGLC.

Table 41: SFP Modules Supported by the QGLC

Module Type	Card Identification	Interface Type	Cable Specifications
1000Base-SX	Ethernet 1000 SX	Fiber, LC duplex female connector	**Fiber Type:** Multi-mode fiber (MMF), 850 nm wavelength **Core Size (microns)/Range:** • 62.5/902.23 feet (275 meters) • 50/1640.42 feet (500 meters) **Minimum Tx Power:** -9.5 dBm **Rx Sensitivity:** -17 dBm

Module Type	Card Identification	Interface Type	Cable Specifications
1000Base-LX	Ethernet 1000 LX	Fiber, LC duplex female connector	**Fiber Type:** Single-mode fiber (SMF), 1310 nm wavelength **Core Size (microns)/Range:** 9/32808.4 feet (10 Kilometers) **Minimum Tx Power:** -9.5 dBm **Rx Sensitivity:** -19 dBm
1000Base-T	Ethernet 1000 Copper	RJ-45	Operates in full-duplex up to 100 meters of CAT-5 shielded twisted pair (STP) cable with BER less than 10e-10. **NOTE:** To comply with GR-1089 intra-building, lightning-immunity requirements and ensure compliance with Radiated Emissions Criteria, you must use shielded-twisted pair cable and ensure that it is properly terminated at both ends.

Important The SFP interface is only certified to work with SFP transceiver modules purchased from Cisco for use with the QGLC.

Important Because of the optical SFP interface, this product has been tested and found to comply with the limits for Class 1 laser devices for IEC825, EN60825, and 21CFR1040 specifications.

RJ-45 SFP Module Detail

The following describes the RJ-45 (copper) SFP module for the GLC2 and the QGLC with pinouts and definitions.

Important To comply with GR-1089 intra-building, lightning-immunity requirements and ensure compliance with FCC Radiated Emissions Criteria, you must use shielded-twisted pair (STP) cable and assure that it is properly terminated at both ends.

The 1000Base-TX interface is suitable for connection to intra-building or unexposed wiring or cabling only. These intra-building ports MUST NOT be metallically connected to interfaces that connect to the outside plant (OSP) or its wiring. These interfaces are designed for use as intra-building interfaces only (Type 2 or Type 4 ports as described in GR-1089-CORE, Issue 5) and require isolation from the exposed OSP cabling. The addition of Primary Protectors is not sufficient protection in order to connect these interfaces metallically to OSP wiring.

Figure 45: RJ-45 Interface Pinout

Table 42: RJ-45 Interface Pinout

Pin	1000Base-Tx 1Gbps Cat5+
1	BI DA+
2	BI DA-
3	BI DB+
4	BI DC+
5	BI DC-
6	BI DB-
7	BI DD+
8	BI DD-
RX = Receive Data TX = Transmit Data BI = BI directional data DA, DB, DC, DD = Data Pair A, B, C, and D	

The following light emitting diode (LED) status indicators are provided on the Gigabit Ethernet line cards:

- **Link:** This green LED shows whether or not the line card is connected to the network. The LED is illuminated when the card is connected.
- **Activity:** This green LED shows when data is transmitted or received. The LED is illuminated when data is passing through the interface.

Cabling the Optical SFP+ Interface

To interconnect the optical SFP+ interface on the XGLC, follow the instructions below.

Important Be sure to label the interface cable with its destination prior to connecting it to the XGLC. This will assure proper reconnection should the card need to be serviced.

Only trained and qualified personnel should install, replace, or service this equipment.

Invisible laser radiation may be emitted from the aperture of the port when no cable is connected. Avoid exposure to laser radiation and do not look into open apertures. **Be sure to keep the cover on the interface when it is not in use.**

Laser Klasse 1 - nur speziell ausgebildetes Personal darf dieses Geraet warten.

Nicht in den Laser schauen, um Augenverletzungen zu vermeiden.

Nicht genutzte Buchsen mit der entsprechenden Kappe verschliessen.

Step 1 Remove the cover from the SFP interface.

Step 2 Insert the optical cable from a network device into the interface and ensure that it is securely in place.

10 Gigabit Ethernet Line Card (XGLC)

The 10 Gigabit Ethernet Line Card or XGLC, is a full-height line card. The XGLC uses industry standard SFP+ transceiver modules to support various fiber types as required. The following diagram shows the XGLC's single SFP+ interface.

Figure 46: XGLC Fiber Optic Interface

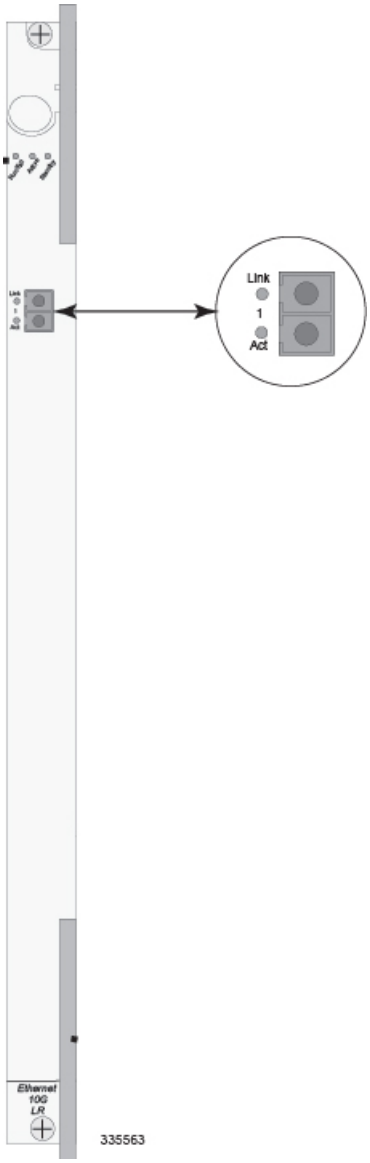


Table 43: SFP+ Modules Supported by the XGLC

Module Type	Card Identification	Interface Type	Cable Specifications
10G Base-SR	Ethernet 10G SR	Fiber, LC duplex female connector	**Fiber Type:** Multi-mode fiber (MMF), 850 nm wavelength **Core Size (microns)/Range:** • 62.5/902.23 feet (275 meters) • 50/1640.42 feet (500 meters) • 62.5um/33m (OM1) • 50um 500MHz-km/82m (OM2) • 50um 2000MHz-km/300m (OM3) **Minimum Tx Power:** -7.3 dBm **Rx Sensitivity:** -11.1 dBm
10G Base-LR	Ethernet 10G LR	Fiber, LC duplex female connector	**Fiber Type:** Single-mode fiber (SMF), 1310 nm wavelength **Core Size (microns)/Range:** 9/32808.4 feet (10 Kilometers) **Minimum Tx Power:** -11.0 dBm **Rx Sensitivity:** -19 dBm

XGLCs can be installed in chassis slots 17 through 23 and 26 through 32. These cards should always be installed directly behind their respective PSCs, PSC2s, or PPCs, but they are not required behind any redundant packet processing cards (those operating in Standby mode).

The following Light Emitting Diodes (LEDs) are provided on the Gigabit Ethernet line cards:

- **Link:** This green LED shows whether or not the line card is connected to the network. The LED is illuminated when the card is connected.
- **Activity:** This green LED shows when data is transmitted or received. The LED is illuminated when data is passing through the interface.

Important Because of the optical SFP interface, this product has been tested and found to comply with the limits for Class 1 laser devices for IEC825, EN60825, and 21CFR1040 specifications.

Cabling the Optical SFP+ Interface

To interconnect the optical SFP+ interface on the XGLC, follow the instructions below.

Important Be sure to label the interface cable with its destination prior to connecting it to the XGLC. This will assure proper reconnection should the card need to be serviced.

Only trained and qualified personnel should install, replace, or service this equipment.

Invisible laser radiation may be emitted from the aperture of the port when no cable is connected. Avoid exposure to laser radiation and do not look into open apertures. **Be sure to keep the cover on the interface when it is not in use.**

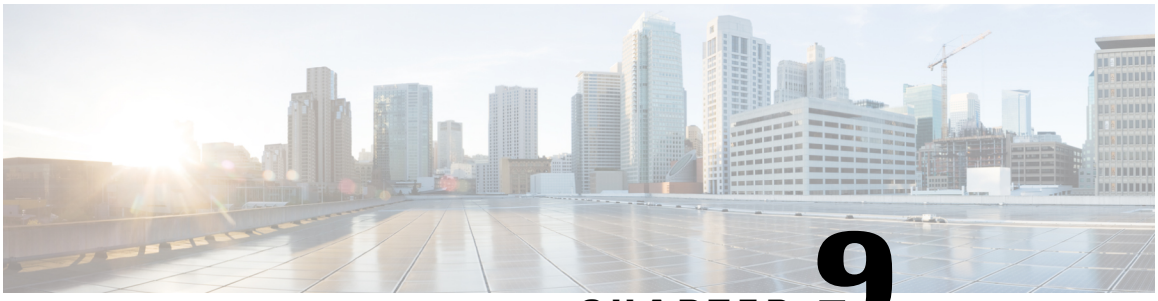
Laser Klasse 1 - nur speziell ausgebildetes Personal darf dieses Geraet warten.

Nicht in den Laser schauen, um Augenverletzungen zu vermeiden.

Nicht genutzte Buchsen mit der entsprechenden Kappe verschliessen.

Step 1 Remove the cover from the SFP interface.

Step 2 Insert the optical cable from a network device into the interface and ensure that it is securely in place.



CHAPTER 9

Cabling the Optical (ATM) Line Cards

This chapter provides information on physical interfaces and instructions for installing the cables on the Optical Line Card (OLC2).

This chapter includes the following sections:

Optical (ATM) Line Card Interfaces

The OLC2 has four optical fiber interfaces (ports) that support IP or Broadband-SS7 over ATM (Asynchronous Transfer Mode). These ports connect our SGSN products via IuPS interfaces to other elements in the packet data network.

The type of optical fiber interface on the line card is dictated by the Small Form-factor Pluggable (SFP) transceiver modules installed on the line card. The OLC2 supports two versions of SFP modules. SFP modules are hot-pluggable.

Table 44: SFP Modules Supported by the OLC2 Optical (ATM) Line Card

Module Type	Card Identification	Interface Type	Cable Specifications
Single-mode Optical Fiber	ATM/POS OC-3 SM IR-1	Single-mode Fiber, LC duplex female connector	**Fiber Types:** Single-mode optical fiber **Wavelength:** 1310 nm **Core Size:** 9 micrometers **Cladding Diameter:** 125 micrometers **Range:** Intermediate/21 kilometers **Attenuation:** 0.25 dB/KM **Min/Max Tx Power:** -15 dBm/-8 dBm **Rx Sensitivity:** -28 dBm

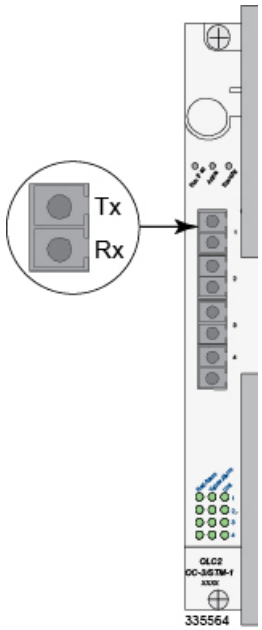
Module Type	Card Identification	Interface Type	Cable Specifications
Multi-mode Optical Fiber	ATM/POS OC-3 Multi-Mode	Multi-mode Fiber, LC duplex female connector	**Fiber Types:** Multi-mode optical fiber **Wavelength:** 1310 nm **Core Size:** 62.5 micrometers **Cladding Diameter:** 125 micrometers **Range:** Short/2 kilometers **Min/Max Tx Power:** -19 dBm/-14 dBm **Rx Sensitivity:** -30 dBm

Important The SFP interface is only certified to work with SFP transceiver modules purchased from Cisco for use with the OLC2.

Important Because of the optical SFP interface, this product has been tested and found to comply with the limits for Class 1 laser devices for IEC825, EN60825, and 21CFR1040 specifications.

The following figure shows the optical interface, labelled ATM/POS OC-3, for the optical (ATM) line card. Each SFP fiber interface is equipped with a transmit (TX) port and a receive (RX) port.

Figure 47: OLC-Optical (ATM) Line Card Fiber Interfaces



Cabling the Optical SFP Interface

To use the optical SFP interfaces on the OLC2 (ATM), follow the instructions below.

Important Be sure to label the interface cables with their destination prior to connecting them to the OLC/OLC2. This will assure proper reconnection should the card need to be serviced.

Only trained and qualified personnel should install, replace, or service this equipment.

Invisible laser radiation may be emitted from the aperture of the port when no cable is connected. Avoid exposure to laser radiation and do not look into open apertures. **Be sure to keep the cover on the interface when it is not in use.**

Laser Klasse 1 - nur speziell ausgebildetes Personal darf dieses Geraet warten.

Nicht in den Laser schauen, um Augenverletzungen zu vermeiden.

Nicht genutzte Buchsen mit der entsprechenden Kappe verschliessen.

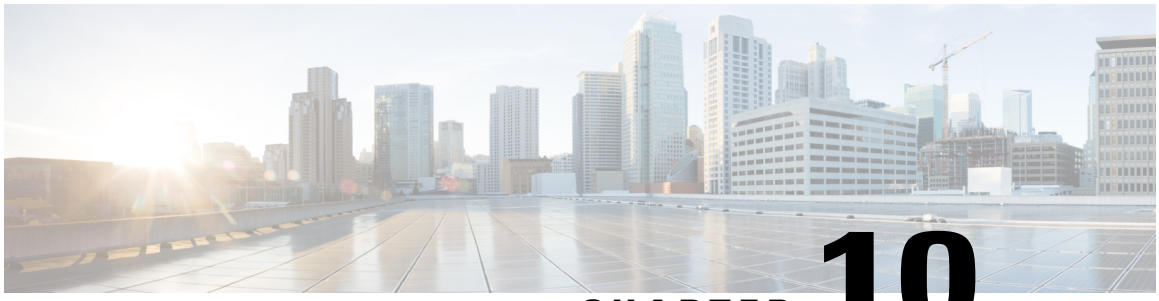
Step 1 To ensure full connectivity, use your thumb to firmly press the SFP transceiver module into its socket on the front panel of the card.

Step 2 Remove the cover from the SFP interface.

Step 3 Inspect and clean the connector's fiber-optic end-faces.

Step 4 Insert the optical cable from a network device into the interface and ensure that it is securely in place.

Step 5 Repeat step 1 through step 4 to connect a fiber-optic cable to other ports.



CHAPTER 10

Cabling the Channelized Line Cards

This chapter provides information about the physical interfaces and instructions for installing the cables on the CLC2 (STM-1/OC-3).

This chapter includes the following sections:

Channelized Line Card Interfaces

The CLC2 card supports two types of Small Form-factor Pluggable (SFP) transceiver modules. The type of optical fiber interface on the line card is dictated by the SFP modules installed on the card. The SFP modules are hot-pluggable.

Table 45: SFP Modules Supported by the CLC2

Module Type	Card Identification	Interface Type	Cable Specifications
Single-mode Optical Fiber	Channelized (STM-1/OC-3) SM IR-1	Single-mode Fiber, LC duplex female connector	**Fiber Types:** Single-mode optical fiber **Wavelength:** 1310 nm **Core Size:** 9 micrometers **Cladding Diameter:** 125 micrometers **Range:** Intermediate/21 kilometers **Attenuation:** 0.25 dB/KM **Min/Max Tx Power:** -15 dBm/-8 dBm **Rx Sensitivity:** -28 dBm

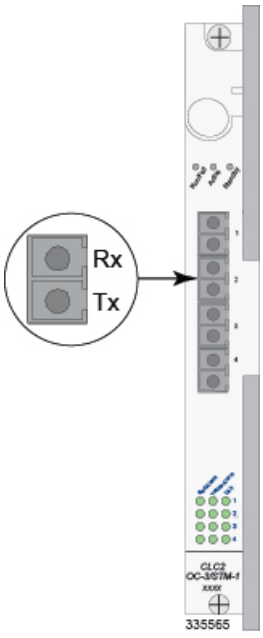
Module Type	Card Identification	Interface Type	Cable Specifications
Multi-mode Optical Fiber	Channelized (STM-1/OC-3) Multi-Mode	Multi-mode Fiber, LC duplex female connector	**Fiber Types:** Multi-mode optical fiber **Wavelength:** 1310 nm **Core Size:** 62.5 micrometers **Cladding Diameter:** 125 micrometers **Range:** Short/2 kilometers **Min/Max Tx Power:** -19 dBm/-14 dBm **Rx Sensitivity:** -30 dBm

Important The SFP interface is only certified to work with SFP transceiver modules purchased from Cisco for use with the CLC2.

Important Because of the optical SFP interface, this product has been tested and found to comply with the limits for Class 1 laser devices for IEC825, EN60825, and 21CFR1040 specifications.

The following figure shows the LC-connectors for the CLC2. Each SFP fiber interface provides both transmit (TX) and receive (RX) on the port.

Figure 48: CLC2 Fiber Optic Interfaces



Cabling the Optical SFP Interface

To use the optical SFP interface on the a channelized line card, follow the instructions below.

Important Be sure to label the interface cables with their destination prior to connecting them to the CLC2. This will assure proper reconnection should the card need to be serviced.

Only trained and qualified personnel should install, replace, or service this equipment.

Invisible laser radiation may be emitted from the aperture of the port when no cable is connected. Avoid exposure to laser radiation and do not look into open apertures. **Be sure to keep the cover on the interface when it is not in use.**

Laser Klasse 1 - nur speziell ausgebildetes Personal darf dieses Geraet warten.

Nicht in den Laser schauen, um Augenverletzungen zu vermeiden.

Nicht genutzte Buchsen mit der entsprechenden Kappe verschliessen.

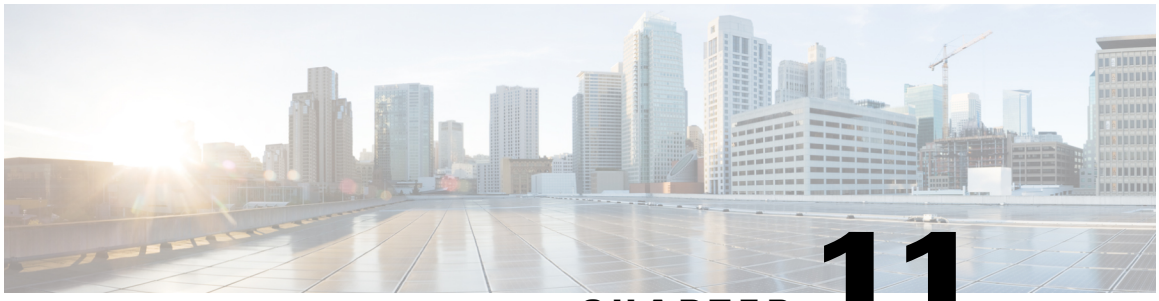
Step 1 To ensure full connectivity, use your thumb to firmly press the SFP transceiver module into its socket on the front panel of the card.

Step 2 Remove the cover from the SFP interface.

Step 3 Inspect and clean the connector's fiber-optic end-faces.

Step 4 Insert the fiber-optic optical cable from a network device into the interface and ensure that it is securely in place.

Step 5 Repeat step 1 through step 4 to connect a fiber-optic cable to other ports, if so equipped.



CHAPTER 11

Cabling the Power Filter Units

This chapter provides information and instructions for applying the power supply and return cables to the Power Filter Units (PFUs) .

This chapter includes the following sections:

Power Considerations

Each chassis supports one or two 165-amp PFUs.

The following table describes the power requirements for the chassis.

Note These requirements are guidelines to assure that the cabling for your system meets safety requirements.

Table 46: Chassis Power Requirements

Characteristic	Value
Input Voltage	**Maximum range:** -40VDC to -60VDC **Nominal range:** -48VDC to -60 VDC
TUV Rated Peak Current Load	165A @ -48 VDC
Maximum Peak Power Load	5760W
Empty Chassis Maximum Power Load (includes fan trays)	800W

Characteristic	Value
Line Card (rear-installed) Maximum Power Load	**SPIO:** 15W **FLC2:** 13.5W **GLC2:** 10.5W **RCC:** 20W **QGLC:** 15W **XGLC:** 25W **OLC2:** 23W **CLC2:** 23W
Application Card (front-installed) Maximum Power Load	**SMC:** 130W **PSC:** 250W **PSC2:** 325W **PSC3:** 330W **PPC:** 275W
Power Feed	**PFU:** 165 Amps

Estimating Power Requirements

Use the following formula to estimate the total power consumption for each deployed chassis:

(Total Application Card Maximum Power Load) + (Total Line Card Maximum Power Load) + (Chassis Maximum Power Load)

The calculation for estimating the power required for an ASR 5000 installation with 3 PSCs, 2 SMCs, 2 SPIOs, 2 RCCs, and 4 Ethernet 1000 line cards is as follows:

(250W x 3) + (130W x 2) + ((20W x 2) + (13.5W x 4)) + 800W = 1934W

Power Cable Requirements

You can install up to three chassis in an equipment rack or telecommunications cabinet. Typically power cabling is run from the office Power Distribution Frame (PDF) to a Power Distribution Panel (PDP) installed in the rack or cabinet and then to each of the chassis. Due to the required bending radius at each of the system's PFUs, distributing power through a PDP allows you to use a smaller, more flexible cable for each chassis.

The following table identifies the recommended gauges for power cables.

Table 47: Recommended Cable Gauge Information

Termination	Conductor Sizing Information
PDF to Fuse Panel	Assuming an 80-foot (24 meter) loop length, each cable between the PDF and PDP must be the equivalent of 350,000 circular mils or greater. Calculations assume a 0.3 volt drop from the PDF to the PDP, and a 0.3 volt drop from the PDP to the chassis. This is a total voltage drop of 0.6 volts.
Fuse Panel to ASR 5000	Assuming an 18-foot (5.5 meter) loop length, each cable between the PDP and the chassis must be the equivalent of 83,690 circular mils (1 AWG) or greater. Use high-flex cable. Calculations assume a 0.3 volt drop from the PDF to the PDP, and 0.3 volt drop from the fuse panel to the chassis. This is a total voltage drop of 0.6 volts. The following figure and table provide details for wiring the PFUs.

Figure 49: PFU Wiring Diagram

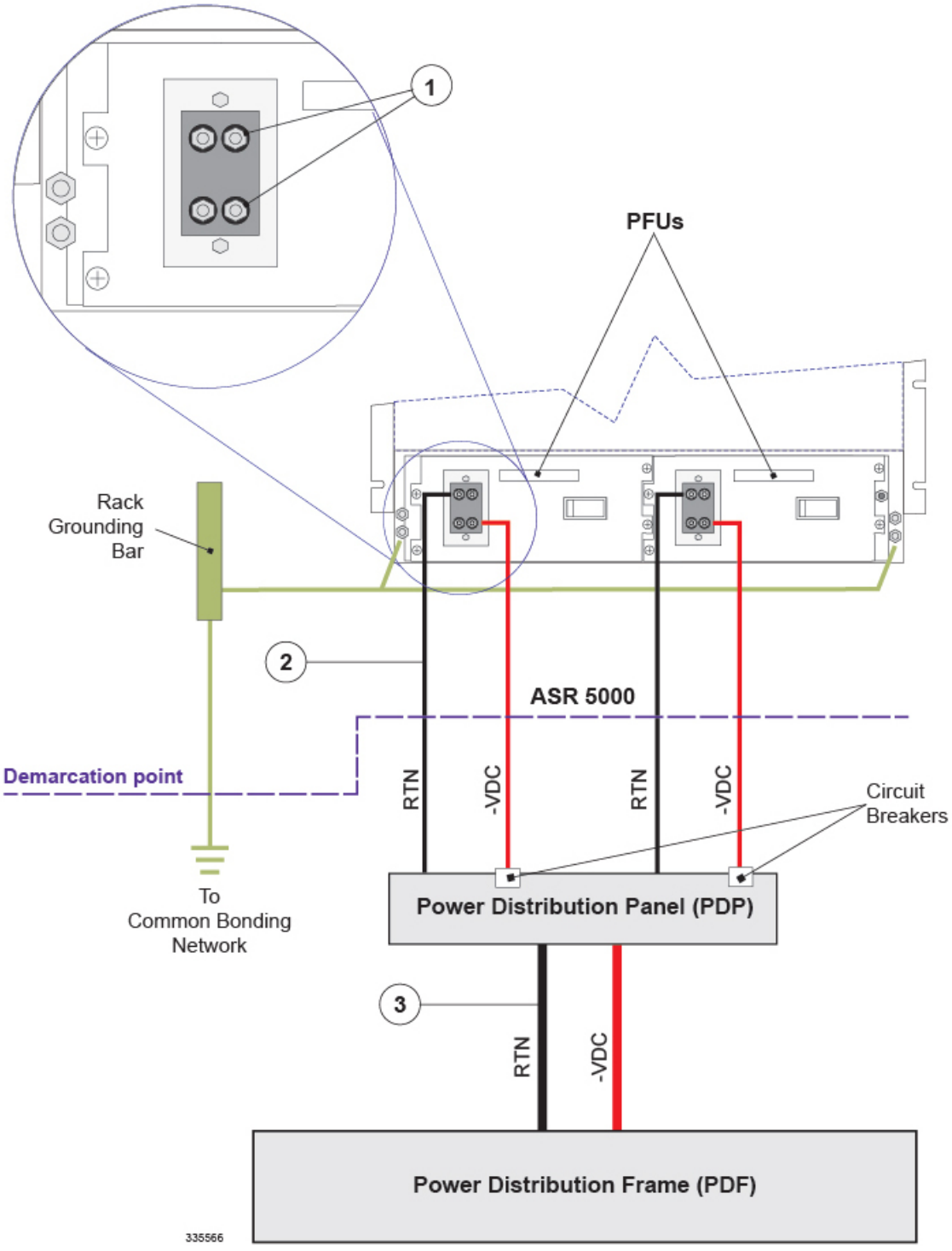
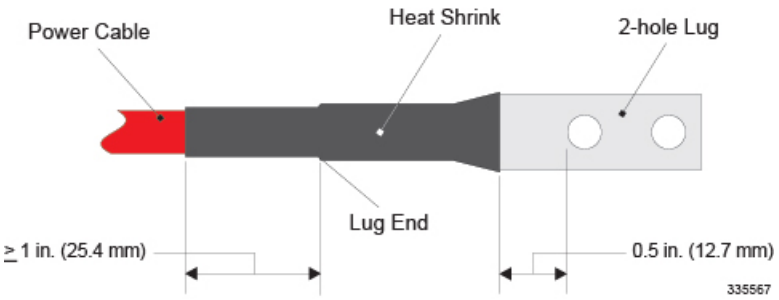


Table 48: ASR 5000 PFU Wiring Diagram Descriptions

Item	Description
1	Two 2-hole lugs are required: one for return (RTN) and one for power (-VDC). The PFU 0.3125-inch posts spaced 0.88-inch on center. Method of connection: PFU - Flat Washer - Lug - Lock-Washer - Nut (9/16-inch). The nut(s) must be torqued to 50 in-lb. (5.65 N-m). The lug must be covered with heat shrink tubing. The heat shrink tubing should begin approximately 1 inch (25.4 mm) before the lug and extend to within 0.5 inch (12.7 mm) of the lugs first hole. Slide the tubing over the cable end before crimping the lug to the cable. Refer to the following figure. Use the Panduit® lugs supplied with the chassis (LCD1-56C-E). Crimp them to the cable ends with a Panduit crimp tool part number CT-920 (die color: green P37 (CD-920-1). The plastic terminal cover **must** be installed over power and return lugs at all times. Die angeschlossenen Kabelschuhe muessen mit der Plastikabdeckung gesichert sein.
2	Power Cables (PDP-to-Chassis): Cable length: Not more than 9 feet (2.7 meters) one way Voltage drop: 0.3v Cable size: 1 AWG or greater
3	Power Cables (PDF-to-PDP): Cable length: not more than 40 feet (12.2 meters) one way Voltage drop: 0.3v Cable size: 350,000 Circular Mils

Figure 50: Power Lug



Connecting the PFU to the Power Source

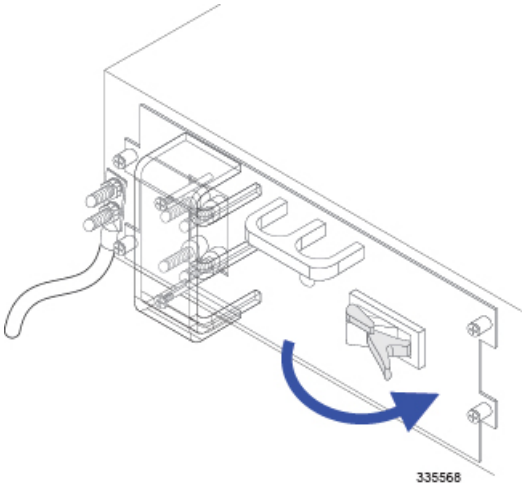
Follow the instructions in this section to connect the PFU(s) to the power source.

Each of the four power terminals is shipped with nuts and washers. The PFU has one lock-washer and one flat washer.

Verify that the power source from the fuse panel is OFF before attaching power cables to the PFU(s) installed in the chassis.

Spannungsversorgung abschalten vor Anschluss der Kabel an die Netzteile, um einen elektrischen Schlag zu vermeiden.

Step 1 Flip the circuit breaker actuator on the PFU installed in the bay labeled Power Filter Unit 1 to the OFF position. If the circuit breaker on the PFU is equipped with a locking clip, lock the circuit breaker in place by moving the breaker's locking clip to the right until the clip's inside tang is recessed in the breaker's actuator opening.



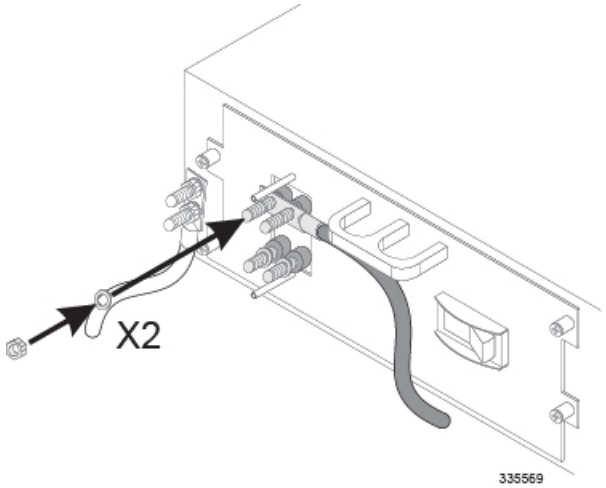
Step 2 Remove the plastic cover from the power terminals with a #2 Phillips head screw driver.

Step 3 Use a 9/16-inch nut driver or socket wrench to remove the nuts and the lock-washers from each of the four terminals.

Step 4 Connect the lug attached to the power return cable to the PFU:

a) Insert the lug over the two terminals labeled RTN. These are the two top terminals on the PFU.

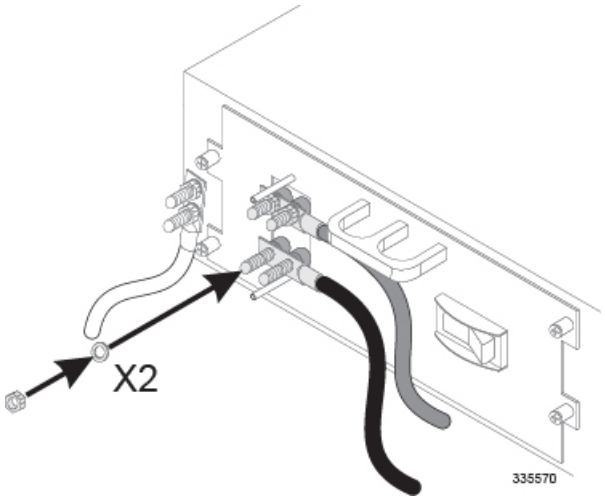
b) Secure the lug to the RTN terminals with two of the four washers and two of the four nuts that you removed in step 3. The nuts should be torqued to 50 in-lb. (5.65 N-m).



Step 5 Connect the lug attached to the power feed cable to the PFU:

a) Insert the lug over the two terminals labeled -VDC. These are the two bottom terminals on the PFU.

b) Secure the lug to the -VDC terminals with the remaining two washers and nuts that you removed in step 3. The nuts should be torqued to 50 in-lb. (5.65 N-m).



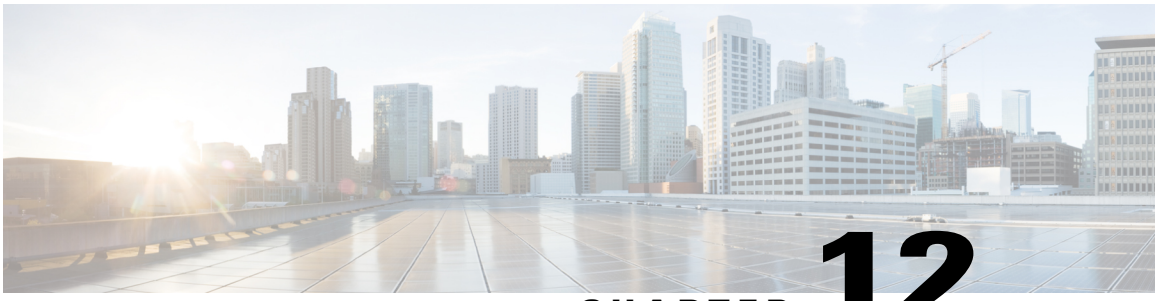
To avoid the risk of fire, take proper precautions to ensure that the power feed and return lugs are not touching. Um einen Kurzschluss zu vermeiden, duerfen sich die beiden Stromkabel nicht beruehren. Kabelschuhe duerfen sich nicht beruehren und muessen unbedingt auseinander gehalten werden.

Step 6 Reinstall the plastic terminal cover.

Caution To avoid the risk of potential damage to the system, never operate the chassis without the plastic terminal cover installed. Make sure that the power and return lugs do not protrude past the edge of the plastic terminal covers. Any portion of the lug that is exposed must be covered with heat shrink tubing.

Step 7 Repeat step 1 through step 6 for the PFU installed in the bay labeled Power Filter Unit 2.

Step 8 Proceed to the next chapter for information and instructions on applying power to the chassis and verifying that the installation was successful.



CHAPTER 12

Applying Power and Verifying the Installation

This chapter provides information and instructions for understanding the boot process, applying power to the chassis, and verifying that the installation was successful.

Important This chapter assumes that the ASR 5000 chassis, its sub-components, as well as application and line cards have been physically installed. The system has also been cabled to interoperate with management and traffic networks.

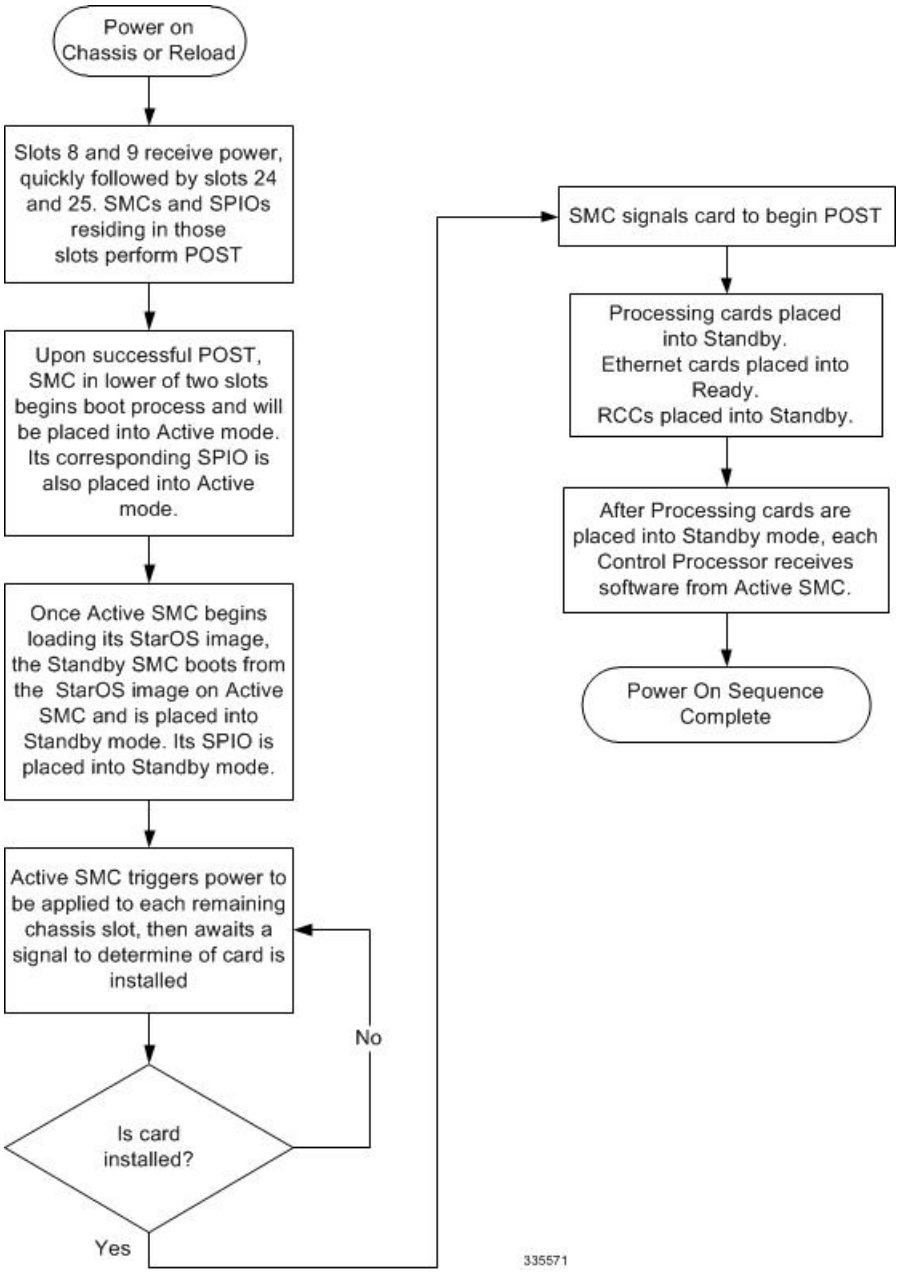
This chapter includes the following sections:

Understanding the System Boot Process

Before you apply power to the system, it is important that you understand the boot process and how the hardware components are brought on line.

The following figure provides a flowchart that explains each step in the startup process.

Figure 51: Boot Process Flowchart



Step 1 When power is first applied to the chassis, or after a reboot, only the SMC in slots 8 and 9 receive power. Therefore, the SMCs are the first cards to boot and their LEDs are the first to light up. Once the system confirms that cards are located in slots 8 and 9, power is quickly applied to the SPIOs in slots 24 and 25.

Step 2 During the startup process, each card performs a series of Power-On Self Tests (POSTs) to ensure that the hardware is

operational.

Step 3 If the SMC in slot 8 successfully executes all POSTs, it becomes the active SMC for the system. The SMC in slot 9 becomes the standby. Note that if there is a problem with the SMC in slot 8, the card in slot 9 becomes the active SMC.

Step 4 Once the active and standby order is determined, the SPIO cards in slots 24 and 25 are placed into active and standby mode, determined by the direct mapping of the active and standby SMCs.

Step 5 The active SMC begins loading the operating system software image designated in the boot stack. The boot stack entries are contained in the boot.sys file that resides on the SMC's CompactFlash device.

Step 6 The standby SMC observes the active card's startup. If the file on the active card is loading normally, the standby SMC boots from the active card's image. If the active SMC experiences a problem during this phase, the standby card loads its software image, designated by its own boot stack entry in its boot.sys file, and takes control of the system as the active card.

Step 7 After the software image is loaded into the SMCs' RAM, the active card determines if other cards are installed in the chassis by applying power to the other slots and signalling them. If the chassis slot contains an application or line card, power is left on to that slot. All empty slots are powered off.

Important If no SMCs are installed, or if they are installed incorrectly, no other card installed in the system will boot.

Step 8 When power is applied to the installed packet processing cards and line cards, they each perform their own series of POSTs.

Step 9 After successful completion of the POSTs, each of the packet processing cards enter standby mode.
Note that the redundant card for an XGLC in slot 17 would be installed in slot 32. Use only the upper slot number when referring to this card. Installed line cards remain in ready mode until their corresponding packet processing card is made active via configuration. Once the packet processing card is active, the line card installed in the upper-rear chassis slot behind the card is also made active. The line card installed in the lower-rear chassis slot behind the card enters the standby mode.

Step 10 After entering the standby mode, each of the packet processing card's control processors communicate with the SMC to receive the appropriate code.

Step 11 Upon successful loading of the software image, the system loads a configuration file designated in the boot stack (boot.sys file). If this is the first time the system is powered on and there is no configuration file, the active SMC invokes the system's Quick Setup Wizard. Use the Quick Setup Wizard to configure basic system parameters that enable the system to communicate across the management network.

Step 12 The Wizard creates a configuration file, saved as system.cfg, that can be used as a starting point for subsequent configurations. The system is configured by automatically applying the configuration file during any subsequent boot. For additional information about system configuration files, refer to the *System Administration Guide*.

Caution Never operate the chassis if any slots are uncovered. This reduces airflow through the chassis and could cause it to overheat. Make sure a card or blanking panel is installed in every chassis slot at all times.

After the system successfully boots and the initial configuration is applied, the system is ready to be configured or offer services.

Applying Power to the Chassis

Once you have properly connected all power and ground cables to the chassis according to the instructions in "Cabling the Power Filter Units", follow the instructions below to apply power to the system.

Step 1 Connect a terminal to the Console port of the primary SPIO.

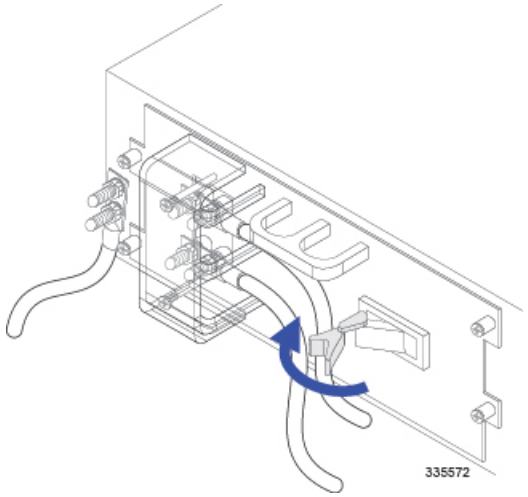
Step 2 Ensure that the circuit breakers on the system's Power Filter Units (PFUs) are in the OFF position.

Step 3 Turn the power source on.

Step 4 Check the voltage level and polarity at the terminals for each PFU. Place the positive probe of a voltage meter on the -VDC terminal and the common probe of the meter on the RTN terminal. The meter should display a voltage approximately equal to that of power source.

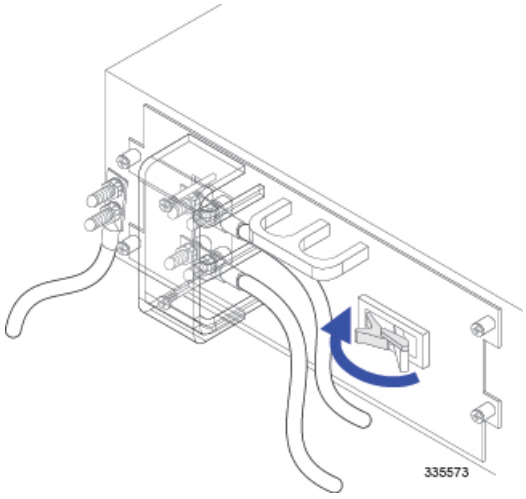
Step 5 Power on the system PFUs.

a) Optional. If the circuit breaker on your PFU is equipped with a locking clip, move the clip to the left unlocking the circuit breaker's actuator.



b) Flip the circuit breaker on the PFU to the ON position.

c) Optional. If the circuit breaker on your PFU is equipped with a locking clip, lock the circuit breaker in place. Move the breaker's locking clip to the left until the clip's inside tang is recessed in the breaker's actuator opening.



d) Repeat step a through step c for the second PFU.

Verifying the Installation

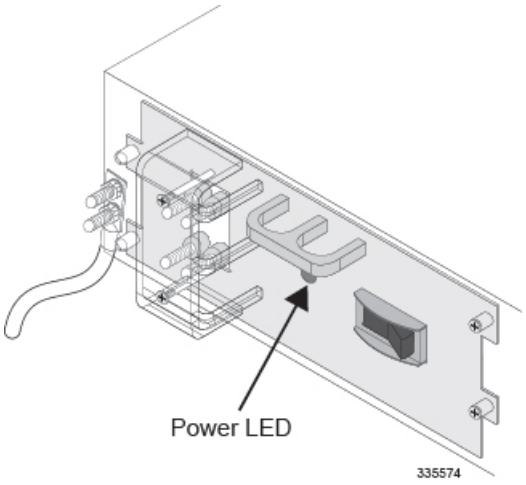
When power is applied to the chassis, power is provided to the upper and lower fan trays, and every installed application and line card.

Each PFU, application card, and line card installed in the chassis has light emitting diodes (LEDs) that indicate its status. This section describes how to interpret the LEDs to verify that all of the installed components are functioning properly.

Important As the system progresses through its boot process, some cards may have no immediate LED activity. Line cards have sporadic Link and Activity LED activity. It is recommended that you allow several minutes to elapse prior to checking the LEDs on the various cards to verify the installation.

Checking the LED on the PFU

Each PFU has a single status LED labeled POWER. This LED is green during normal operating conditions.



If the LED is not green, use the following troubleshooting information to diagnose the problem.

Table 49: PFU Power LED States

Color	Description	Troubleshooting
Green	PFU powered with no errors detected	None needed.
None	PFU is not receiving power	Verify that the power switch is in the ON position.
		Verify that the RTN and -VDC lugs are attached properly according to the instructions provided in this document.
		Verify that the ground lug is attached properly.
		Verify that the power source is on and is supplying the correct voltage and sufficient current.
		Check the cables from the power source to the rack for continuity.
		If a fuse panel is installed between the Power Distribution Frame (PDF) and the chassis, verify that the fuses are intact.
		If a fuse panel is installed between the PDF and the chassis, check the cables from the fuse panel to the chassis for continuity.
		If all of the above suggestions have been verified, then it is likely that the PFU is not functional. Please contact your service representative.

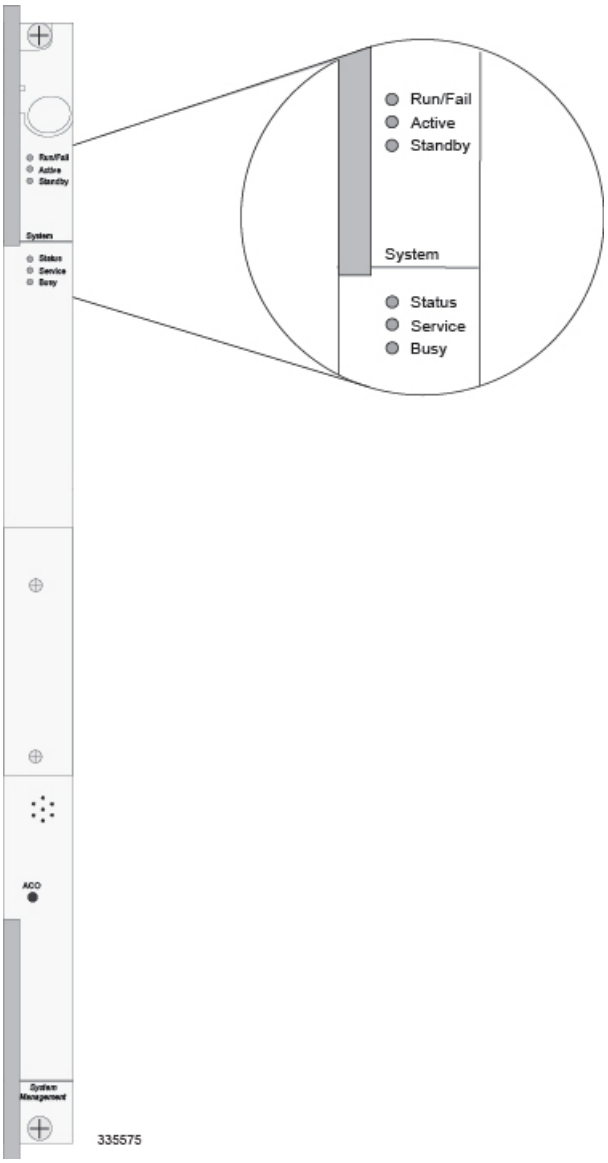
Checking the LEDs on the SMC(s)

Each SMC is equipped with the following LEDs as shown in the following figure:

- Run/Fail
- Active
- Standby
- Status
- Service
- Busy

The possible states for all SMC LEDs are described in the sections that follow.

Figure 52: SMC LEDs



SMC Run/Fail LED States

The SMC's Run/Fail LED indicates the overall status of the card. This LED is illuminated steady green for normal operation.

If the LED is not green, use the troubleshooting information in the table to diagnose the problem.

Table 50: SMC Run/Fail LED States

Color	Description	Troubleshooting
Green	Card powered with no errors detected	None needed.
Blinking Green	Card is initializing and/or loading software	This is normal operation during boot-up.
Red	Card powered with error(s) detected	Errors were detected during the POSTs. It is likely that the errors were logged to the system's command line interface during boot. Refer to the *System Administration Guide* for troubleshooting information.
None	Card is not receiving power	Verify that the POWER LEDs on the PFUs are green. If they are not, refer to Checking the LED on the PFU, on page 137 for troubleshooting information.
		Verify that the power source is supplying ample voltage and current to the chassis.
		Verify that the card is properly installed per the instructions in this document.
		If all of the above suggestions have been verified, it is possible that the SMC is not functional. Please contact your service representative.

SMC Active LED States

The Active LED on the SMC indicates that the software is loaded on the card and it is ready for operation. For the SMC installed in slot 8, this LED is illuminated green during normal operation. For the SMC installed in slot 9, this LED is off during normal operation.

The possible states for this LED are described in the following table. If the LED is not green, use the troubleshooting information in the table to diagnose the problem.

Table 51: SMC Active LED States

Color	Description	Troubleshooting
Green	Card is active	None needed for the SMC in slot 8. If green for the SMC in slot 9, verify that the SMC in slot 8 is installed properly according to the instructions in this document.

Color	Description	Troubleshooting
Blinking Green	Tasks or processes being migrated from the active SMC to the redundant/secondary SMC	Verify that the Standby LED on the redundant SMC is also blinking green. If so, there is an issue with the active SMC.
None	Card is not receiving power **OR** Card in Standby Mode	Verify that the Run/Fail LED is green. If so, the card is receiving power and POST test results are positive. If it is off, refer to SMC Run/Fail LED States, on page 140 for troubleshooting information.
		Check the state of the Standby LED. If it is green, the card is in standby mode.

SMC Standby LED States

The Standby LED on the SMC indicates that software is loaded on the card and it is serving as a redundant component. For the SMC installed in slot 9, this LED is illuminated steady green during normal operation. For the SMC installed in slot 8, this LED is off during normal operation.

If the LED is not green, use the troubleshooting information in the table to diagnose the problem.

Table 52: SMC Standby LED States

Color	Description	Troubleshooting
Green	Card is in redundant mode	None needed for the SMC in slot 9. If green for the SMC in slot 8, then verify it is installed properly according to the instructions in this document.
Blinking Green	Tasks or processes are being migrated from the active SMC to the redundant/secondary SMC	Verify that the Active LED on the redundant SMC is also blinking green. If so, there is an issue with the active SMC.
None	Card is not receiving power **OR** Card in Active Mode	Verify that the Run/Fail LED is green. If so, the card is receiving power and POST test results are positive. If it is off, refer to SMC Run/Fail LED States, on page 140 for troubleshooting information.
		Check the state of the Active LED. If it is green, the card is in active mode.

SMC Status LED States

The Status LEDs on the SMC indicate the status of system level hardware, such as installed cards, fans, and PFUs. This LED is illuminated steady green during normal operation.

If the LED is not green, use the troubleshooting information also provided to diagnose the problem.

Table 53: SMC Status LED States

Color	Description	Troubleshooting
Green	No system errors detected	None needed.
Red	Failures Detected	Check the Run/Fail LEDs for all installed application cards, and line cards. If any are red or off, refer to the troubleshooting information in this chapter pertaining to that device.
None	Card is not receiving power	Verify that the Run/Fail LED is green. If so, the card is receiving power and POST test results are positive. If it is off, refer to SMC Run/Fail LED States, on page 140 for troubleshooting information.

SMC Service LED States

The Service LEDs on the SMCs indicate that the system requires maintenance or service. Examples are that the system could not locate a a valid software image at boot-up, or that a high temperature condition exists.

This LED is off during normal operation.

The possible states for this LED are described in the following table. Use the troubleshooting information in the table to diagnose the problem.

Table 54: SMC Service LED States

Color	Description	Troubleshooting
Yellow	System requires maintenance (fan filter, temperature warning, PFU outage etc.)	Refer to the appropriate section of this guide for troubleshooting information.
None	Card is not receiving power	No maintenance needed.

SMC Busy LED States

The Busy LEDs on the SMCs indicate that there is activity on one of their memory devices:

- CompactFlash module

- PCMCIA device
- Nand Flash (used to store SMC firmware)
- Hard drive

The possible states for this LED are described in the following table. If the LED is not green, use the troubleshooting information in the table to diagnose the problem.

Table 55: SMC Busy LED States

Color	Description	Troubleshooting
Green/ Blinking Green	Data is being read from or written to one of the memory devices.	No maintenance needed.
		NOTE: If you are removing an SMC from the chassis, it is recommended that you wait until this LED is off to ensure the integrity of all data being transferred to or from the memory device.
None	The memory devices are not in use.	No maintenance needed.

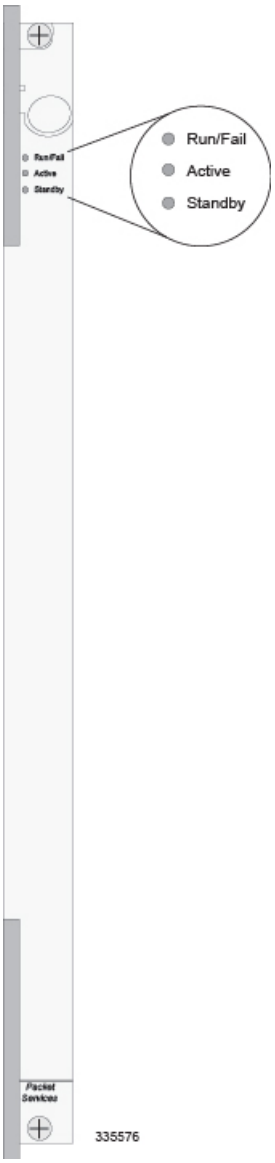
Checking the LEDs on Packet Processing Cards

Each packet processing card is equipped with status LEDs as shown in the following figure:

- Run/Fail
- Active
- Standby
- Status
- Service

The possible states for all of the packet processing card's LEDs are described in the sections that follow.

Figure 53: Packet Processing Card LEDs



PSCA, PSC2, PSC3 and PPC Run/Fail LED States

The packet processing card's Run/Fail LED indicates the overall status of the card. This LED is illuminated steady green during normal operation.

If the LED is not green, use the troubleshooting information in the table to diagnose the problem.

Table 56: Packet Processing Card Run/Fail LED States

Color	Description	Troubleshooting
Green	Card powered with no errors detected	None needed.
Blinking Green	Card is initializing and/or loading software	None needed.
Red	Card powered with error(s) detected	Errors were detected during the POSTs. It is likely that the errors were logged to the system's command line interface during the boot process.
None	Card is not receiving power	Verify that the POWER LEDs on the PFUs are green. If they are not, refer to Checking the LED on the PFU, on page 137 for troubleshooting information.
		Verify that the power source is supplying ample voltage and current to the chassis.
		Verify that the card is properly installed per the instructions in this document.
		If all of the above suggestions have been verified, it is possible that the packet processing card is not functional. Please contact your service representative.

PSCA, PSC2, PSC3 and PPC Active LED States

The Active LED on the packet processing card indicates that the software is loaded on the card and that the card is ready for operation. When the system first boots up, all installed packet processing cards are booted into standby mode. You must then configure the system to designate which packet processing cards are to serve as redundant components (in standby mode) and which are to function as active components.

If the LED is not green, use the troubleshooting information in the table to diagnose the problem.

Table 57: Packet Processing Card Active LED States

Color	Description	Troubleshooting
Green	Card is active	The first time power is applied to the system, all of the packet processing cards should be booted into the standby mode. Therefore, this LED should be off.

Color	Description	Troubleshooting
Blinking Green	Tasks or processes are being migrated from an active packet processing card to a redundant/secondary packet processing card	Verify that the Standby LED on a redundant packet processing card is also blinking green. If so, there is an issue with the packet processing card that was active and is transferring its processes.
None	Card is not receiving power **OR** Card in Standby Mode	Verify that the Run/Fail LED is green. If so, the card is receiving power and POST test results are positive. If it is off, refer to the PSCA, PSC2, PSC3 and PPC Run/Fail LED States, on page 145 for troubleshooting information.
		Check the state of the Standby LED. If it is green, the card is in standby mode. This is normal operation for the initial power-up.

PSCA, PSC2, PSC3 and PPC Card Standby LED States

The Standby LED on the packet processing card indicates that software is loaded on the card and the card is serving as a redundant component. When the system first boots up, all installed packet processing cards are booted into standby mode. You must then configure the system to designate which packet processing cards are to serve as redundant components (in standby mode) and which are to function as active components.

If the LED is not green, use the troubleshooting information in the table to diagnose the problem.

Table 58: PSCA, PSC2, PSC3 and PPC Standby LED States

Color	Description	Troubleshooting
Green	Card is in redundant mode	The first time power is applied to the system, all of the packet processing cards should be booted into the standby mode. This is normal operation.
Blinking Green	Tasks or processes being migrated from the active SMC to the redundant/secondary SMC	Verify that the Active LED on the redundant packet processing card is also blinking green. If so, there is an issue with the active packet processing card and the system is transferring its processes.
None	Card is not receiving power **OR** Card is in Active Mode	Verify that the Run/Fail LED is green. If so, the card is receiving power and POST test results are positive. If it is off, refer to PSCA, PSC2, PSC3 and PPC Run/Fail LED States, on page 145 for troubleshooting information.
		Check the state of the Active LED. If it is green, the card is in active mode.

Checking the LEDs on the SPIO(s)

Each SPIO is equipped with status LEDs:

- Run/Fail
- Active
- Standby

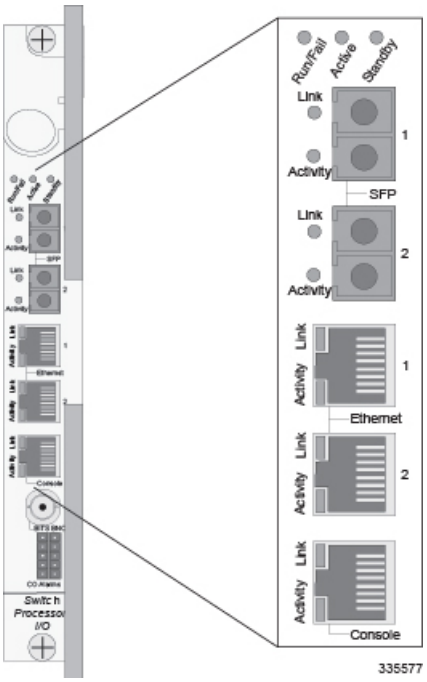
In addition to the status LEDs, each the RJ-45 and SFP interfaces to the management network are equipped with the following LEDs:

- Link
- Activity

The following figure shows the LEDs on the SPIO.

The possible states for all of the SPIO's LEDs are described in the sections that follow.

Figure 54: SPIO LEDs



SPIO Run/Fail LED States

The SPIO's Run/ Fail LED indicates the overall status of the card. This LED is illuminated steady green for normal operation.

If the LED is not green, use the troubleshooting information in the table to diagnose the problem.

Table 59: SPIO Run/Fail LED States

Color	Description	Troubleshooting
Green	Card powered with no errors detected	None needed.
Red	Card powered with error(s) detected	Errors were detected during the POSTs. It is likely that the errors were logged to the system's command line interface during the boot process. Refer to the *System Administration Guide* for troubleshooting information.
None	Card is not receiving power	Verify that the POWER LEDs on the PFUs are green. If they are not, refer to Checking the LED on the PFU, on page 137 for troubleshooting information.
		Verify that the power source is supplying ample voltage and current to the chassis.
		Verify that the card is properly installed per the instructions in this document.
		If all of the above suggestions have been verified, it is possible that the SPIO is not functional. Please contact your service representative.

SPIO Active LED States

The Active LED on the SPIO indicates that the software is loaded on the card and that the card is ready for operation. For the SPIO installed in chassis slot 24, this LED is steady green during normal operation. For the SPIO installed in slot 25, this LED is off during normal operation.

If the LED is not green, use the troubleshooting information in the table to diagnose the problem.

Table 60: SPIO Active LED States

Color	Description	Troubleshooting
Green	Card is active	None needed for SPIO in slot 24. If green for SPIO in slot 25, verify that SPIO in slot 24 is installed according to the instructions in this document.

Color	Description	Troubleshooting
None	Card is not receiving power. **OR** Card is in Standby Mode.	Verify that the Run/Fail LED is green. If so, the card is receiving power and POST test results are positive. If it is off, refer to SPIO Run/Fail LED States, on page 148 for troubleshooting information.
		Check the state of the Standby LED. If it is green, the card is in standby mode. Refer to the *System Administration Guide* for information on making the card active

SPIO Standby LED States

The Standby LED on the SPIO indicates that software is loaded on the card and that it is serving as a redundant component. For the SPIO installed in slot 25, this LED is illuminated steady green during normal operation. For the SPIO installed in slot 24, this LED is off during normal operation.

If the LED is not green, use the troubleshooting information in the table to diagnose the problem.

Table 61: SPIO Standby LED States

Color	Description	Troubleshooting
Green	Card is in redundant mode	None needed for SPIO in slot 25. If green for SPIO in slot 24, check the status of the SMC installed in slot 8. If the SMC in slot 8 is in standby mode, it is possible that there is a configuration problem.
None	Card is not receiving power. **OR** Card is in Active Mode.	Verify that the Run/Fail LED is green. If so, the card is receiving power and POST test results are positive. If it is off, refer to SPIO Run/Fail LED States, on page 148 for troubleshooting information.
		Check the state of the Active LED. If it is green, the card is in active mode.

SPIO Interface Link LED States

The Link LED, associated with a particular SPIO interface indicates the status of the network link. This LED is illuminated steady green during normal operation.

If the LED is not green, use the troubleshooting information in the table to diagnose the problem.

Important During system startup, some Link and/or Activity LEDs may momentarily illuminate. This activity is normal and does not indicate any network link or data transfer status. The line card has not yet been initialized and placed into a stable operational state by the system.

Table 62: SPIO Interface Link LED States

Color	Description	Troubleshooting
Green	Link is up	None needed. **NOTE:** This LED will not indicate the presence of a network link until the interface parameters are set during the software configuration process.
None	No power to card **OR** Link is down.	Verify that the Run/Fail LED is green. If so, the card is receiving power. If it is off, refer to SPIO Run/Fail LED States, on page 148 for troubleshooting information.
		Verify that the device on which the interface is located is cabled and powered properly.

SPIO Interface Activity LED States

The Activity LED associated with a particular SPIO interface indicates the presence of traffic on the network link. This LED is illuminated steady green when data is being transmitted or received over the interface.

If the LED is not green, use the troubleshooting information in the table to diagnose the problem.

Important During system startup, some Link and/or Activity LEDs may momentarily illuminate. This activity is normal and does not indicate any network link or data transfer status. The line card has not yet been initialized and placed into a stable operational state by the system.

Table 63: SPIO Interface Activity LED States 6

Color	Description	Troubleshooting
Flashing Green	Traffic is present on the link	None needed.
None	No traffic is present on the link	None needed if there is no activity on the link. Prior to configuration, this is normal operation.

Checking the LEDs on the Ethernet Line Cards

This section describes the LEDs for the following Ethernet cards:

- Fast Ethernet 10/100 Line Card (FLC2)
- Gigabit Ethernet 1000 (GLC2)
- Quad Gigabit Ethernet Line Card (QGLC)

- 10 Gigabit Ethernet Line Card (XGLC)

Each Ethernet card is equipped with status LEDs:

- Run/Fail
- Active
- Standby

In addition to the status LEDs, each network interface is equipped with:

- Link
- Activity

The possible states for all LEDs on the Ethernet line cards are described in the sections that follow.

Ethernet Line Card Run/Fail LED States

The Run/Fail LEDs on the Ethernet Line Cards indicate the overall status of the cards. These LEDs are illuminated steady green during normal operation.

If the LED is not green, use the troubleshooting information in the table to diagnose the problem.

Table 64: Ethernet Line Card Run/Fail LED States 7

Color	Description	Troubleshooting
Green	Card powered with no errors detected	None needed.
Red	Card powered with error(s) detected	Errors were detected during the POSTs. It is likely that the errors were logged to the system's command line interface during the boot process. Refer to the *System Administration Guide* for troubleshooting information.
None	Card is not receiving power	Verify that the POWER LEDs on the PFUs are green. If they are not, refer to Checking the LED on the PFU, on page 137 for troubleshooting information.
		Verify that the power source is supplying ample voltage and current to the chassis.
		Verify that the card is properly installed per the instructions in this document.
		If all of the above suggestions have been verified, it is possible that the line card is not functional. Please contact your service representative.

Ethernet Line Card Active LED States

The Active LEDs on the Ethernet Line Cards indicate that the operating software is loaded on the card and that the card is ready for operation.

The line cards installed remain in ready mode until their corresponding packet processing card is activated during configuration. While in ready mode, the Active LED is off. When the packet processing card is activated, the line card installed in the upper-rear chassis slot behind the packet processing card is also activated. The line card installed in the lower-rear chassis slot behind the packet processing card enters standby mode.

If the LED is not green, use the troubleshooting information in the table to diagnose the problem.

Table 65: Ethernet Line Card Active LED States 8

Color	Description	Troubleshooting
Green	Card is active	None needed for line cards installed in slots 17 through 23 and 26 through 32 after configuration. If green for line cards in slots 33 through 39 and 42 through 48, verify that the corresponding line card installed in the upper-rear chassis slot is installed properly according to the instructions in this document. For example, if this LED is green for a line card in slot 33, verify that the line card in slot 17 is installed properly.
None	Card is in Ready Mode OR Card is not receiving power **OR** Card is in Standby Mode	This is normal prior to configuration. Neither the Active or the Standby LED on the card will be on.
		Verify that the Run/Fail LED is green. If so, the card is receiving power and POST test results are positive. If it is off, refer to Ethernet Line Card Run/Fail LED States, on page 152 for troubleshooting information.
		Check the state of the Standby LED. If it is green, the card is in standby mode. Refer to the *System Administration Guide* for information on making the card active.

Ethernet Line Card Standby LED States

The Standby LEDs on the Ethernet Line Cards indicate that software is loaded on the cards and that they are serving as redundant components.

The line cards remain in ready mode until their corresponding packet processing card is activated during configuration. While in ready mode, the Active LED is off. After the packet processing card activated, the line card installed in the upper-rear chassis slot behind the packet processing card is also activated. The line card installed in the lower-rear chassis slot behind the packet processing card enters standby mode.

If the LED is not green, use the troubleshooting information in the table to diagnose the problem.

Table 66: Ethernet Line Card Standby LED States 9

Color	Description	Troubleshooting
Green	Card is in redundant mode	None needed for line cards installed in slots 33 through 39 and 42 through 48 after configuration. If green for line cards installed in slots 17 through 23 and 26 through 32, refer to the *System Administration Guide* for troubleshooting information.
None	Card in Ready Mode OR Card is not receiving power **OR** Card in Active Mode	This is normal prior to configuration. Neither the Active nor Standby LEDs on the card will be on.
		Verify that the Run/Fail LED is green. If so, the card is receiving power and POST test results are positive. If it is off, refer to Ethernet Line Card Run/Fail LED States, on page 152 for troubleshooting information.
		Check the state of the Active LED. If it is green, the card is in standby mode.

Ethernet Line Card Interface Link LED States

The Link LEDs, associated with a particular network interface on the Ethernet Line Cards, show the status of the network link. These LEDs are illuminated steady green for normal operation.

If the LED is not green, use the troubleshooting information in the table to diagnose the problem.

Important During system startup, some Link and/or Activity LEDs may momentarily illuminate. This activity is normal and does not indicate any current network link or data transfer status. The line card has not yet been initialized and placed into a stable operational state by the system.

Table 67: Ethernet Line Card Interface Link LED States 10

Color	Description	Troubleshooting
Green	Link is up	None needed. **NOTE:** This LED will not indicate the presence of a network link until the interface parameters are set during the software configuration process.

Color	Description	Troubleshooting
None	No power to card **OR** Link is down	Verify that the Run/Fail LED is green. If so, the card is receiving power. If it is off, refer to *Ethernet Line Card Run/Fail LED States* section for troubleshooting information.
		Verify that the interface is cabled properly.
		Verify that the device where the interface is connected to is cabled and powered properly.
		Check the cable for continuity.

Ethernet Line Card Activity LED States

The Activity LEDs are associated with a particular network interface on the Ethernet line cards. The LEDs are illuminated steady green when data is being transmitted or received on the network link.

If the LED is not green, use the troubleshooting information in the following table to diagnose the problem.

Important During system startup, some Link and/or Activity LEDs may momentarily illuminate. This activity is normal and does not indicate any current network link or data transfer status. The line card has not yet been initialized and placed into a stable operational state by the system.

Table 68: Ethernet Line Card Activity LED States 11

Color	Description	Troubleshooting
Flashing Green	Traffic is present on the link	None needed.
None	No traffic is present on the link	None needed if there is no activity on the link. Prior to configuration, this is normal operation.

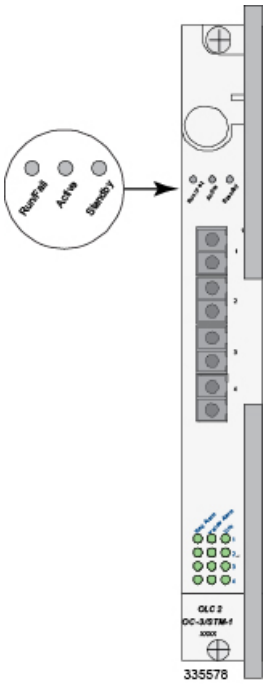
Checking the Card-Level LEDs on the Optical (ATM) Line Card

Each Optical (ATM) line card (OLC2) is equipped with card-level status LEDs:

- Run/Fail
- Active
- Standby

The location of these LEDs is displayed in the figure below and the various states are described in the following three tables.

Figure 55: Card-Level Status LEDs for the Optical (ATM) Line Card



Optical (ATM) Line Card Run/Fail LED States

The Run/Fail LED on the ATM line card indicates the overall status of the card. These LEDs are illuminated steady green for normal operation.

If the LED is not green, use the troubleshooting information in the table to diagnose the problem.

Table 69: Optical (ATM) Line Card Run/Fail LED States

Color	Description	Troubleshooting
Green	Card powered with no errors detected	None needed.
Red	Card powered with error(s) detected	Errors were detected during the POSTs. It is likely that the errors were logged to the system's command line interface during the boot process. Refer to the *System Administration Guide* for troubleshooting information.

Color	Description	Troubleshooting
None	Card is not receiving power	Verify that the POWER LEDs on the PFUs are green. If they are not, refer to Checking the LED on the PFU, on page 137 for troubleshooting information.
		Verify that the power source is supplying ample voltage and current to the chassis.
		Verify that the card is properly installed per the instructions in this document.
		If all of the above suggestions have been verified, it is possible that the line card is not functional. Please contact your service representative.

Optical ATM Line Card Active LED States

The Active LED on the Optical (ATM) line card indicates that the operating software is loaded on the card and that the card is ready for operation.

The line cards installed will remain in a ready mode until their corresponding packet processing card is made active via configuration. While in ready mode the Active LED is off. After the packet processing card is made active, the line card installed in the upper-rear chassis slot behind the packet processing card is also active. The line card installed in the lower-rear chassis slot behind the packet processing card enters standby mode.

The possible states for this LED are described in the following table. If the LED is not green, use the troubleshooting information in the table to diagnose the problem.

Table 70: Optical (ATM) Line Card Active LED States

Color	Description	Troubleshooting
Green	Card is active	None needed for line cards installed in slots 17 through 23 and 26 through 32 after configuration. If green for line cards in slots 33 through 39 and 42 through 48, verify that the corresponding line card installed in the upper-rear chassis slot is installed properly according to the instructions in this document. For example, if this LED is green for a line card in slot 33, verify that the line card in slot 17 is installed properly.

Color	Description	Troubleshooting
None	Card in Ready Mode **OR** Card is not receiving power **OR** Card in Standby Mode	This is normal prior to configuration. Neither the Active or the Standby LED on the card will be on.
		Verify that the Run/Fail LED is green. If so, the card is receiving power and POST test results are positive. If it is off, refer toOptical (ATM) Line Card Run/Fail LED States, on page 156 for troubleshooting information.
		Check the state of the Standby LED. If it is green, the card is in standby mode.

Standby LED States

The Standby LED on the Optical (ATM) line card indicates that software is loaded on the card, but that it is serving as a redundant component.

The installed line cards remain in ready mode until their corresponding packet processing card is activated during configuration. While in ready mode, the Active LED is off. After the packet processing card is activated, the line card installed in the upper-rear chassis slot behind the packet processing card is also activated. The line card installed in the lower-rear chassis slot behind the packet processing card enters standby mode.

If the LED is not green, use the troubleshooting information in the table to diagnose the problem.

Table 71: Optical (ATM) Line Card Standby LED States

Color	Description	Troubleshooting
Green	Card is in Redundant mode	None needed for line cards installed in slots 33 through 39 and 42 through 48 after configuration. If green for line cards installed in slots 17 through 23 and 26 through 32, refer to the *System Administration Guide* for troubleshooting information.
None	Card is in Ready Mode **OR** Card is not receiving power **OR** Card is in Active Mode	This is normal prior to configuration. Neither the Active nor Standby LEDs on the card will be on.
		Verify that the Run/Fail LED is green. If so, the card is receiving power and POST test results are positive. If it is off, refer toOptical (ATM) Line Card Run/Fail LED States, on page 156 for troubleshooting information.
		Check the state of the Active LED. If it is green, the card is in standby mode. Refer to the *System Administration Guide* for information configuring the card to serve as a redundant component.

Checking the Alarm and Link LEDs on the Optical (ATM/POS OC-3) Line Card

Each Optical (ATM) line card provides alarm LEDs for each of its four ports. These LEDs are located directly below the fourth port, as illustrated in the figure below.

Figure 56: Alarm and Link LEDs on the Optical (ATM) Line Card

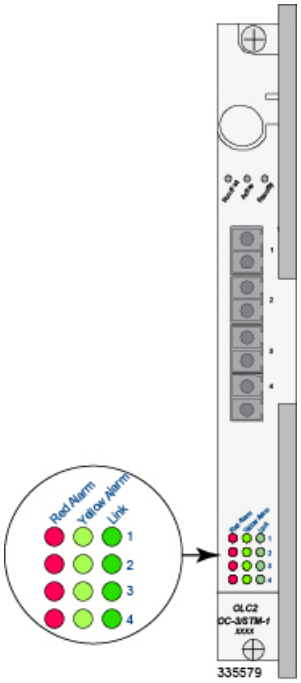


Table 72: Alarm/Link States for Optical (ATM) Line Card

LED	LED Color	Description
Red Alarm	Red (ON) OFF	Illuminates when the port is in a fault condition, such as LOS or LOF. Off when there is no alarm for this port.
Yellow Alarm	Yellow (ON) OFF	Illuminates when the port is receiving a signal indicating a problem at the remote end, for example, RDI. Off when there is no alarm for this port.

LED	LED Color	Description
Link	Green (On) Yellow (On) OFF	Illuminates Green when a fiber optic cable is plugged into the port and the receive signal is detected by the SFP module. Illuminates Yellow when an SFP module is plugged into the port. Off indicates that there is no SFP module plugged into the port.

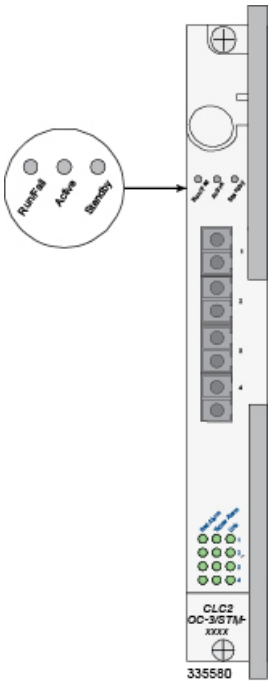
Card-Level LEDs on the Channelized (STM-1/OC-3) Line Card

Each Channelized line card (CLC2) is equipped with card-level status LEDs:

- Run/Fail
- Active
- Standby

The location of these LEDs is displayed in the figure below. The various states are described in the following three tables.

Figure 57: Card-Level Status LEDs for the Channelized Line Card



Channelized Line Card Run/Fail LED States

The Run/Fail LED on the Channelized line card indicates the overall status of the card. These LEDs are illuminated steady green during normal operation.

If the LED is not green, use the troubleshooting information in the table to diagnose the problem.

Table 73: Channelized Line Card Run/Fail LED States

Color	Description	Troubleshooting
Green	Card powered with no errors detected	None needed.
Red	Card powered with error(s) detected	Errors were detected during the POSTs. It is likely that the errors were logged to the system's command line interface during the boot process.
None	Card is not receiving power	Verify that the POWER LEDs on the PFUs are green. If they are not, refer to Checking the LED on the PFU, on page 137 for troubleshooting information.
		Verify that the power source is supplying ample voltage and current to the chassis.
		Verify that the card is properly installed per the instructions in this document.
		If all of the above suggestions have been verified, it is possible that the line card is not functional. Please contact your service representative.

Channelized Line Card Active LED States

The Active LED on the channelized line card indicates that the operating software is loaded on the card and that the card is ready for operation.

Installed line cards remain in ready mode until their corresponding packet processing card is activated during configuration. While in ready mode the Active LED is off. After the packet processing card is activated, the line card installed in the upper-rear chassis slot behind the packet processing card is also activated. The line card installed in the lower-rear chassis slot behind the packet processing card enters standby mode.

If the LED is not green, use the troubleshooting information in the table to diagnose the problem.

Table 74: Channelized Line Card Active LED States

Color	Description	Troubleshooting
Green	Card is active	None needed for line cards installed in slots 17 through 23 and 26 through 32 after configuration. If green for line cards in slots 33 through 39 and 42 through 48, verify that the corresponding line card installed in the upper-rear chassis slot is installed properly according to the instructions in this document. For example, if this LED is green for a line card in slot 33, verify that the line card in slot 17 is installed properly.
None	Card in Ready Mode **OR** Card is not receiving power **OR** Card in Standby Mode	This is normal prior to configuration. Neither the Active or the Standby LED on the card will be on.
		Verify that the Run/Fail LED is green. If so, the card is receiving power and POST test results are positive. If it is off, refer to Channelized Line Card Run/Fail LED States, on page 161 for troubleshooting information.
		Check the state of the Standby LED. If it is green, the card is in standby mode. Refer to the *System Administration Guide* for information on making the card active.

Channelized Line Card Standby LED States

The Standby LED on the channelized line card indicates that software is loaded on the card and it is serving as a redundant component.

The installed line cards remain in ready mode until their corresponding packet processing card is activated via configuration. While in ready mode, the Active LED is off. After the packet processing card is activated, the line card installed in the upper-rear chassis slot behind the packet processing card is activated. The line card installed in the lower-rear chassis slot behind the packet processing card enters standby mode.

If the LED is not green, use the troubleshooting information in the table to diagnose the problem.

Table 75: Channelized Line Card Standby LED States

Color	Description	Troubleshooting
Green	Card is in redundant mode	None needed for line cards installed in slots 33 through 39 and 42 through 48 after configuration. If green for line cards installed in slots 17 through 23 and 26 through 32, refer to the *System Administration Guide* for troubleshooting information.

Color	Description	Troubleshooting
None	Card in Ready Mode **OR** Card is not receiving power **OR** Card in Active Mode	This is normal prior to configuration. Neither the Active nor Standby LEDs on the card will be on.
		Verify that the Run/Fail LED is green. If so, the card is receiving power and POST test results are positive. If it is off, refer to Channelized Line Card Run/Fail LED States, on page 161 for troubleshooting information.
		Check the state of the Active LED. If it is green, the card is in standby mode.

Checking the Alarm and Link LEDs on the Channelized Line Card 2

Each CLC2 provides alarm and link LEDs that indicate the status of each port. These LEDs are located at the bottom of the front panel, as illustrated in the figure below.

Figure 58: Alarm/Link LEDs for the Channelized Line Card

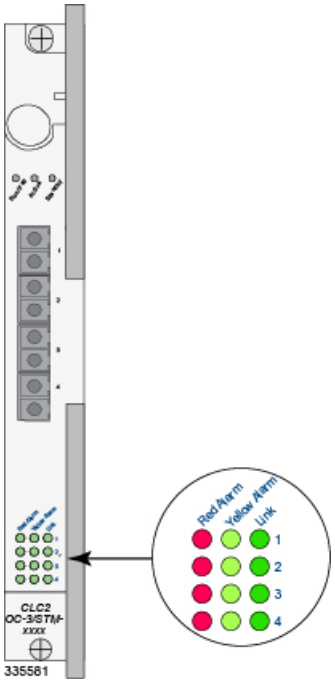


Table 76: Alarm/Link States for Channelized Line Card

LED	LED Color	Description
Red Alarm	Red (ON) OFF	Illuminates when the port is in a fault condition, such as LOS or LOF. Off when there is no alarm for this port.
Yellow Alarm	Yellow (ON) OFF	Illuminates when the port is receiving a signal experiences a problem at the remote end, such as RDI. Off when there is no alarm for this port.
Link	Green (ON) Yellow (ON) OFF	Illuminates Green when a fiber optic cable is plugged into the port and the receive signal is detected by the SFP module. Illuminates Yellow when an SFP module is plugged into the port. Off indicates that there is no SFP module plugged into the port.

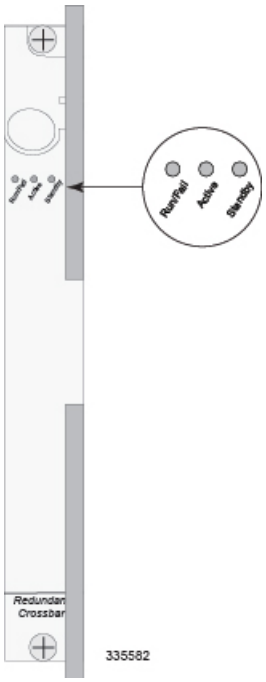
Checking the LEDs on the RCC(s)

Each RCC is equipped with status LEDs shown in the following figure:

- Run/Fail
- Active
- Standby

The possible states for all of the SPIO's LEDs are described in the sections that follow.

Figure 59: RCC LEDs



RCC Run/Fail LED States

The RCC Run/Fail LED indicates the overall status of the card. This LED is illuminated steady green during normal operation.

If the LED is not green, use the troubleshooting information in the table to diagnose the problem.

Table 77: RCC Run/Fail LED States

Color	Description	Troubleshooting
Green	Card powered with no errors detected	None needed.
Red	Card powered with error(s) detected	Errors were detected during the POSTs. It is likely that the errors were logged to the system's command line interface during the boot process.

Color	Description	Troubleshooting
None	Card powered with error(s) detected	Verify that the POWER LEDs on the PFUs are green. If they are not, refer to Checking the LED on the PFU, on page 137 for troubleshooting information.
		Verify that the power source is supplying ample voltage and current to the chassis.
		Verify that the card is properly installed per the instructions in this document.
		If all of the above suggestions have been verified, it is possible that the RCC is not functional. Please contact your service representative.

RCC Active LED States

The Active LED on the RCC indicates that the card is being used. During normal operation, this LED is off on both RCCs.

If the LED is not green, use the troubleshooting information in the table to diagnose the problem.

Table 78: RCC Active LED States

Color	Description	Troubleshooting
Green	Card is active	The RCC is actively routing traffic from a line card installed behind a packet processing card that has failed to a redundant packet processing card. The RCC installed in chassis slot 40 processes traffic for the line cards in chassis slots 17 through 23 and 26 through 32. The RCC installed in chassis slot 41 processes traffic for the line cards in slots 33 through 39 and 42 through 48. See Checking the LEDs on Packet Processing Cards, on page 144 to determine which packet processing card has failed. Information on determining the cause of the failure can be found in the *System Administration Guide*.
None	Card is not receiving power **OR** Card in Standby Mode	Verify that the Run/Fail LED is green. If so, the card is receiving power and POST test results are positive. If it is off, refer to RCC Run/Fail LED States, on page 165 for troubleshooting information.
		Check the state of the Standby LED. If it is green, the card is in standby mode. This is the normal operating mode.

RCC Standby LED States

The Standby LED on the RCC indicates that software is loaded on the card. The card is ready to provide a path for data or signalling traffic from a line card to a redundant packet processing card. This LED is on during normal operation for both installed RCCs.

If the LED is not green, use the troubleshooting information in the table to diagnose the problem.

Table 79: RCC Standby LED States

Color	Description	Troubleshooting
Green	Card is in standby mode	This is the normal operating mode.
None	Card is not receiving power **OR** Card in Active Mode	Verify that the Run/Fail LED is green. If so, the card is receiving power and POST test results are positive. If it is off, refer to RCC Run/Fail LED States, on page 165 for troubleshooting information.
		Check the state of the Active LED. If it is green, the card is in active mode and the RCC is actively routing traffic from a line card installed behind a packet processing card that has failed. See Checking the LEDs on Packet Processing Cards, on page 144 to determine which packet processing card has failed.

Completing Initial System Configuration

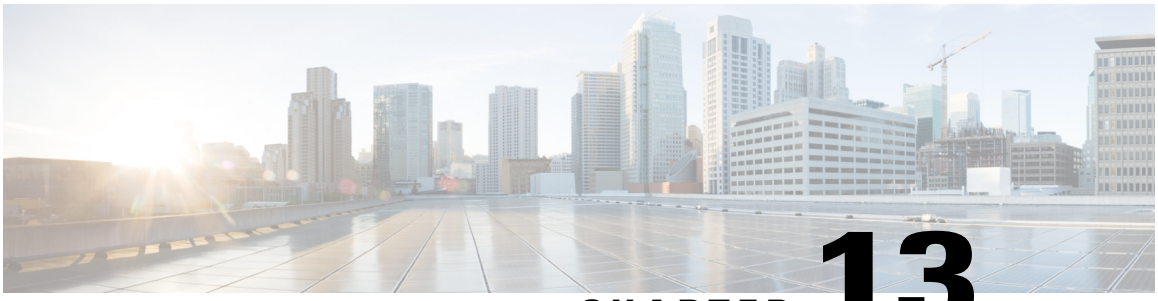
After power is applied to the chassis and the ASR 5000 has successfully booted, the command line interface (CLI) appears on a terminal connected to the Console port of the SPIO.

The initial configuration requires completing the following tasks via the CLI:

- Configuring the system for remote access
- Configuring the management interface with a second IP Address (optional)
- Configuring system timing
- Enabling CLI timestamping
- Configuring system administrative users
- Configuring TACACS+ for system administrative users (optional)
- Configuring a chassis key
- Configuring virtual MAC addresses
- Configuring packet processing and line card availability
- Configuring line card and SPIO port redundancy
- Configuring ASR 5000 link aggregation (optional)
- Configuring ORBEM and the Web Element Manager (optional)

- Configuring SNMP support and trap generation

The *Getting Started*, *Configuring System Settings* and *Configuring Management Settings* chapters of the *System Administration Guide* provide detailed procedures for completing the above tasks.



CHAPTER 13

System Monitoring

This chapter describes how to use the command line interface (CLI) **show** commands to monitor system status and performance. These commands allow an operator to obtain information on all aspects of the system, from current software configuration to call activity and status.

The selection of commands described in this chapter provides useful and in-depth information for monitoring the hardware. For additional information on these and other **show** command keywords, refer to the CLI on-line Help and the *Command Line Interface Reference*.

This chapter includes the following sections:

Monitoring

This section contains commands used to monitor system performance and the status of tasks, managers, applications, and various other software components. Most of the procedure commands are useful for both maintenance and diagnostics. There is no limit to the frequency that any of the individual commands or procedures can be implemented.

Important All of the commands listed below can be run from the Exec mode prompt of the Command Line Interface (CLI).

Daily - Standard Health Check

The standard health check is divided into independent procedures:

- Hardware Status
- Physical Layer Status
- System Status and Performance

Table 80: Health Checks

To do this:	Enter this command:
Hardware	
All hardware problems generate alarms that generate SNMP traps. Review the trap history.	**show snmp trap history**
Check the status of the PFUs. the command output indicates the power level for the cards in the chassis. All active cards should be in an "ON" state.	**show power chassis**
Check the power status of an individual chassis.	**show power all**
View the status of the fan trays.	**show fans**
View the LED status for all installed cards. All LEDs for active cards should be green.	**show leds all**
Checking the temperatures confirms that all cards and fan trays are operating within safe ranges to ensure hardware efficiency.	**show temperature**
Physical Layer	
View mapping of the line cards-to-controlling application cards.	**show card mappings**
View a listing of all installed application cards in a chassis. Determine if all required cards are in active or standby state and not offline. Displays include slot numbers, card type, operational state, and attach information.	**show card table** **show card table all**
Display a listing of installed line cards with card type, state, and attach information. Run this command to ensure that all required cards are in Active/Standby state. No card should be in OFFLINE state.	**show linecard table**
View the number and status of physical ports on each line card. Output indicates Link and Operation state for all interfaces – Up or Down.	**show port table all**
Verify CPU usage and memory.	**show cpu table** **show cpu info**
System Status and Performance	
Check a summary of CPU state and load, memory and CPU usage.	**show cpu table**
Check NPU utilization within the chassis.	**show npu table**
Check availability of resources for sessions.	**show resources utilization table**

To do this:	Enter this command:
Review session statistics, such as connects, rejects, hand-offs, collected in 15-minute intervals.	**show session counters historical**
View duration, statistics, and state for active call sessions.	**show session duration** **show session progress**
Display statistics for the Session Manager.	**show session subsystem facility sessmgr all**
Check the amount of time that the system has been operational since the last downtime (maintenance or other). This confirms that the system has not rebooted recently.	**show system uptime**
Verify the status of the configured NTP servers. Node time should match the correct peer time with minimum jitter.	**show ntp status**
Check the current time of a chassis to compare network-wide times for synchronisation or logging purposes. Ensure network accounting and/or event records appear to have consistent timestamps.	**show clock universal**
View both active and inactive system event logs.	**show logs**
Check SNMP trap information. The trap history displays up to 400 time-stamped trap records that are stored in a buffer. Through the output, you can observe any outstanding alarms on the node and contact the relevant team for troubleshooting or proceed with SGSN troubleshooting guidelines.	**show snmp trap history**
Check the crash log. Use this command to determine if any software tasks have restarted on the system.	**show crash list**
Check current alarms to verify system status	**show alarm outstanding all** **show alarm all**
View system alarm statistics to gain an overall picture of the system's alarm history.	**show alarm statistics**
If enabled, view statistics associated with Inter-Chassis Session Recovery (ICSR).	**show srp info** **show srp monitor all** **show srp checkpoint statistics**

Periodic Status Checks

Depending upon system usage and performance, you may want to perform these tasks more frequently than recommended.

Table 81: Periodic Status Checks

To do this:	Enter this command:
Monthly	
Check for unused or unneeded file on the CompactFlash.	**dir /flash**
Delete unused or unneeded files to conserve space using the **delete** command. You should also perform the next action in list. See Note below.	**delete /flash/**<filename>
Synchronize the contents of the CompactFlash on both SMCs to ensure consistency between the two (Exec mode command).	**filesystem synchronize all**
Generate a crash list (and other **show** command information) and save the output as a tar file.	**show support details** <to location and filename>
	Flash: [file:]{ /flash | /pcmcia1 | /hd }[/directory]/file_name
	TFTP: tftp://{ host[:port#] }[/directory]/file_name
	SFTP: [ftp: | sftp:]//[username[:password]@] { host }[:port#][/directory]/file_name **NOTE:** In release 20.0 and higher Trusted StarOS builds, FTP is not supported.
NOTE: If there is an issue with space, you can remove alarm and crash information from the system; however, this practice is not recommended. Support and engineering personnel use these records for troubleshooting if a problem should develop. You should request assigned support personnel to remove these files after storing the information for possible future use.	
Every 6 Months	
View a listing of all cards installed in the chassis with hardware revision, part, serial, assembly, and fabrication numbers.	**show hardware card** **show hardware inventory** **show hardware system**
View all cards installed in the chassis with hardware revision, and the firmware version of the on-board Field Programmable Gate Array (FPGAs).	**show hardware version board**
You should replace the particulate air filter installed directly above the lower fan tray in the chassis. Refer to the *Replacing the Chassis Air Filter* section of this guide for detailed instructions.	

Counters and Bulkstats

The ASR 5000 maintains many counters for gathering statistics and troubleshooting. In general you should not regularly clear the counters, just let them increment over time. Counters track events since the chassis booted (unless cleared), unlike **show** commands that give the current state (for example, the current number of calls). See the on-line help for a list of choices. A partial list of counters to choose from are:

- **show port datalink counters**
- **show port npu counters**
- **show radius counters all**
- **show l2tp full statistics**
- **show session disconnect reasons**
- **show session counters historical all** (This is an excellent command to see the call volume history for past three days.)

You may clear the counters via CLI **clear** commands.

A bulk statistics feature allows you to push a very large array of statistical data to a remote server. Bulkstats provide detailed information about the chassis' condition, particularly over extended periods of time.

See *Configuring Bulk Statistics* section in the *System Administration Guide* for more information.

Summary of Maintenance Tasks

This section contains a quick reference for when to perform various maintenance operations on the ASR 5000 chassis. These operations include, but are not limited to:

- Load on the chassis
- The number of operators regularly accessing it
- The placement of the chassis within your network
- Available staff to perform maintenance tasks
- Support level agreements within your organization
- The specifics of your chassis configuration
- Your organization's experience with the types of issues, such as subscriber or network, that you encounter over time

Constant Attention

- Watch SNMP traps for alarms/thresholds and take appropriate action. The traps inform you of serious problems that can occur on the system, including those that do not involve the ASR 5000.
- If you have an Element Management System (EMS) server that relies on bulkstats and other data, pay attention to alarms and call load.

Daily

- Analyze system logs for any unusual entries.
- Look at call volume and throughput for consistency and expected patterns.

Weekly

- Check the system clock if NTP is not enabled.

Monthly

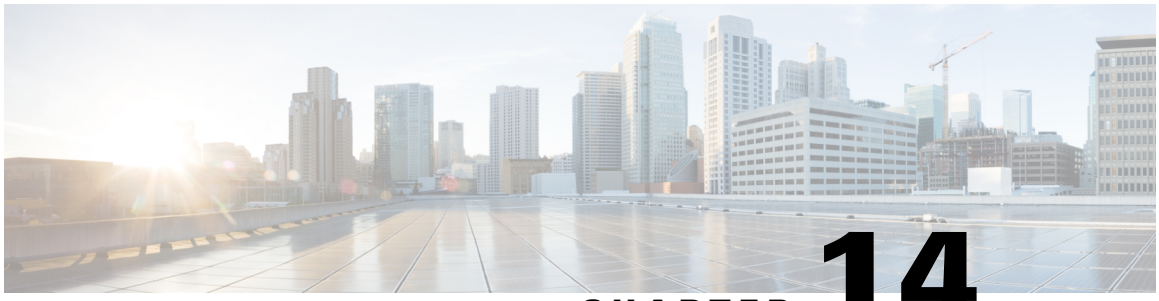
- Clear the /flash filesystem of files that are not needed.

6 Months

- Change the air filter.

No Specific Time Frame

- If you make a config change that you want to be permanent, synchronize filesystems between SMCs and save the configuraiton to /flash.
- For an expired password, re-enable the operator as soon as possible.
- If the boot system priority is approaching a low value, reset it to a higher priority.
- When you finish troubleshooting with runtime logging, remove the logging commands from the config.
- Maintain your SNMP trap server.
- Maintain your syslog server.



CHAPTER 14

Adding Application and Line Cards to an Existing Installation

This chapter provides instructions for installing additional application and line cards in an installed chassis that is processing calls (a production system).

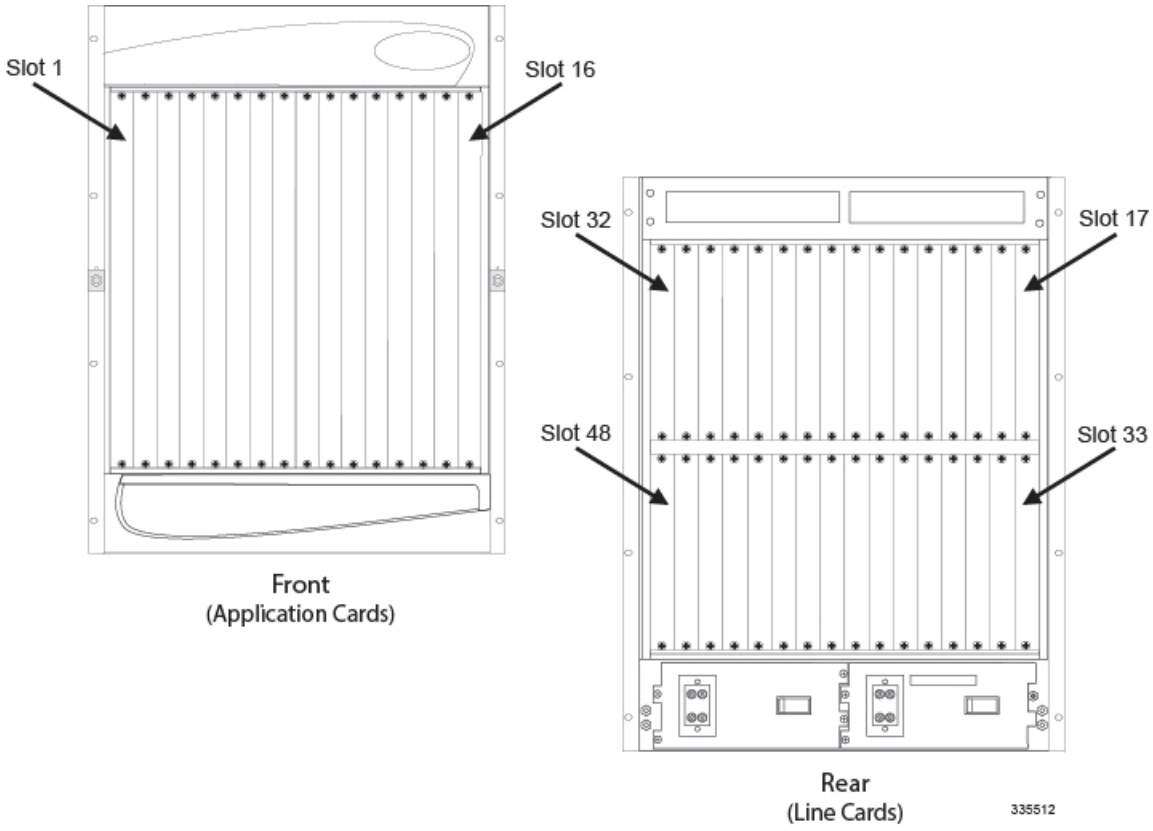
Important All application and line cards are hot swappable. You can install or remove cards from the chassis without powering the chassis down. However, it is strongly recommended that you add system components during a maintenance window.

This chapter includes the following sections:

Chassis Slot Numbering and Assignments

The following figure shows the front and rear chassis slots.

Figure 60: Chassis Slot Numbers



Important You must install the System Management Cards (SMCs) in slots 8 and 9. Their associated line cards are the Switch Processor Input Output card (SPIO) and the Redundant Crossbar Card (RCC). Assure that the SPIOs are installed in slots 24 and 25, and the RCCs are installed in slots 40 and 41 to prevent damage to the cards or the chassis midplane.

Important The 10 Gigabit Ethernet Line Card (XGLC) is a full-height line card that takes up the upper and lower slots in the back of the chassis. When referring to installed XGLCs, use the upper slot number only. Slot numbering for other installed half-height cards is maintained: 17 to 32 and 33 to 48, regardless of the number of installed XGLCs

Adding Application Cards

The installation procedure is identical for all application cards. This section provides the instructions for adding application cards to the chassis.

Important You can add single packet processing cards to a production system. However, you must reboot the system to ensure optimal operation and capacity. For this reason Cisco Systems suggests that you perform the installation during a maintenance window when a reboot will have minimal impact.

Caution During installation, maintenance, and/or removal, wear a grounding wrist strap to avoid ESD damage to the components. Failure to do so could result in damage to sensitive electronic components and potentially void your warranty.

Step 1 Determine the type of application card you are installing. Each application card is identified by the label near the bottom of its front panel.

Step 2 Determine which chassis slot to install the card in based on the information in Chassis Slot Numbering and Assignments, on page 176..

Important To achieve optimal airflow performance in minimal system deployments, populate packet processing cards from the middle of the chassis outward, leaving an empty slot between them. For example, with four packet processing cards use slots 3, 5, 12, and 14. For two packet processing cards, place them in slots 5 and 12.

Step 3 Remove the blanking panel, if one is installed, covering the slot.

a) Use a Phillips #2 screwdriver to loosen the screws at the top and bottom of the blanking panel.

b) Holding the screws on the blanking panel, pull the blanking panel away from the chassis to expose the chassis slot.

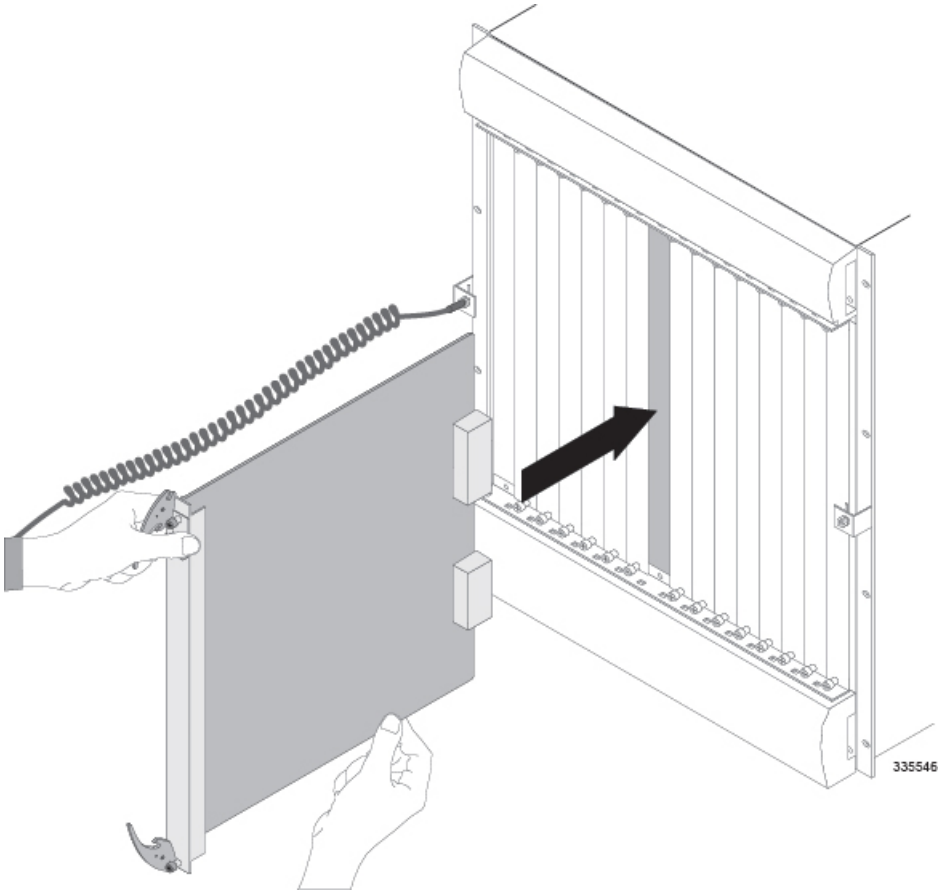
Caution Do not leave chassis slots uncovered for extended periods of time. This reduces airflow through the chassis and could cause it to overheat. Make sure there is a circuit card or blanking panel in every chassis slot at all times.

Step 4 Slide the interlock switch on the card fully downward. Flip the ejector levers outward and away from the card's front panel.

Step 5 Properly support the weight of the card and align it with the upper and lower card guides of the chassis slot. Gently slide the card into the slot until the levers touch the chassis frame.

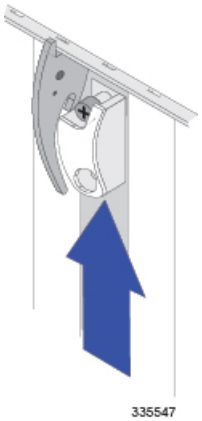
Caution Take extra care when you install packet processing cards. These cards contain heat sinks that could become loose or damaged if they come into contact with an adjacent card while the packet processing card is being inserted in the chassis slot.

Important If you are installing PSCAs in a chassis that contains PSCs, refer to the *Chassis Hybrid Mode Operation* appendix for additional configuration information.



Step 6 Push the ejector levers inward firmly until the card is seated in the chassis midplane and you cannot push the ejector levers in any further. Press firmly on the card's faceplate to ensure that it is fully seated. The card's front panel should be flush against the chassis' upper and lower card mounts for the slot.

Step 7 Slide the interlock switch on the front panel of the application card upward to lock the ejector tab in place. The flange on the left-side of the interlock switch prevents movement of the ejector tab when raised completely.



Important You must slide the interlock switch upward before securing the card's top screw to the mounting rail.

Step 8 Use a Phillips #2 screwdriver to tighten the screws at the top and bottom of the application card's front panel to secure the card to the chassis.

Step 9 Repeat step 1 through step 7 for every application card you are installing.

Step 10 Install blanking panels over any unused chassis slots.

To reduce the risk of electric shock and ensure proper ventilation, blanking panels must be used to cover any chassis slot not occupied by an application card.

Leere Steckplaetze muessen mit der dafuer vorgesehenen Abdeckplatte geschlossen werden, um die Luftzirkulation innerhalb des Geraets zu gewaehrleisten und um einen elektrischen Schlag zu vermeiden.

a) Position the blanking panel over the unused chassis slot(s).
b) Position the blanking panel over the unused chassis slot.
c) Use a Phillips #2 screwdriver to tighten the screws at the top and bottom of the blanking panel to secure the panel to the chassis.
d) Repeat step a through step c for any additional unused chassis slots.

Step 11 Proceed to the next sections of this chapter for instructions on adding the respective line card(s) for every application card just installed.

Adding Half-Height Line Cards

This section provides instructions for adding half-height line cards to the chassis.

Caution During installation, maintenance, and/or removal, wear a grounding wrist strap to avoid ESD damage to the components. Failure to do so could result in damage to sensitive electronic components and potentially void your warranty.

Step 1 Determine the type of line card you are installing. Each line card is identified by the label near the bottom of its front panel.

Step 2 Determine which chassis slot to install the card in based on the information in Chassis Slot Numbering and Assignments, on page 176.

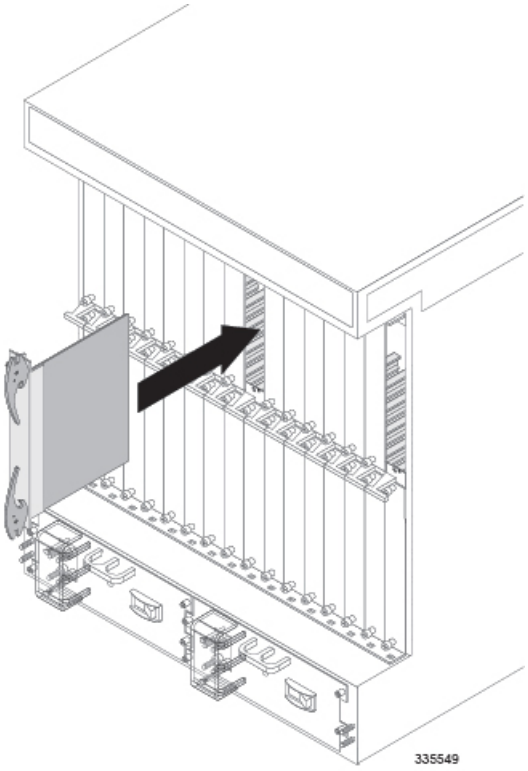
Step 3 Remove the blanking panel covering the slot:

a) Use a Phillips #2 screwdriver to loosen the screws at the top and bottom of the blanking panel.
b) Hold the screws on the blanking panel, and pull the blanking panel away from the chassis to expose the chassis slot.

Caution Do not leave chassis slots uncovered for extended periods of time. This reduces airflow through the chassis, which could cause it to overheat. Install a card or a blanking panel s in every chassis slot.

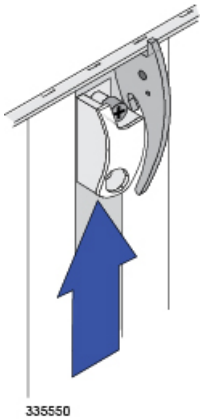
Step 4 Slide the interlock switch on the card fully downward. Flip the ejector levers outward and away from the card's front panel.

Step 5 Hold the card by its ejector levers and align the card with the upper and lower card guides of the chassis slot. Gently slide it into the slot until the levers touch the chassis frame.



Step 6 Push the ejector levers inward firmly until the card is firmly seated in the chassis midplane and the ejector levers can be pushed in no further. Press firmly on the card's faceplate to ensure that it is fully seated. The card's front panel should be flush against the chassis' upper and lower card mounts for the slot.

Step 7 Slide the interlock switch on the front panel of the line card upward to lock the ejector tab in place. The flange on the left-side of the interlock switch prevents movement of the ejector tab when raised completely.



Step 8 Use a Phillips #2 screwdriver to tighten the screws at the top and bottom of the line card's front panel to secure the card to the chassis.

Step 9 Repeat step 1 through step 7 for every other line card that to be installed.

Step 10 Install blanking panels over any unused chassis slots.

To reduce the risk of electric shock and to ensure proper ventilation, blanking panels must be used to cover any chassis slot that is not occupied by an application card.

Leere Steckplaetze muessen mit der dafuer vorgesehenen Abdeckplatte geschlossen werden, um die Luftzirkulation innerhalb des Geraets zu gewaehrleisten und um einen elektrischen Schlag zu vermeiden.

a) Position the blanking panel over the unused chassis slot(s).
b) Use a Phillips #2 screwdriver to tighten the screws at the top and bottom of the blanking panel to secure the panel to the chassis.

Step 11 Refer to one of the following chapters in this guide for information on cabling the line cards you just installed.

Line Card	Chapter
Switch Processor Input/Output (SPIO)	Cabling the Switch Processor Input/Output Line Card
Fast Ethernet Line Card (FLC2)	Cabling the Ethernet 10/100 Line Card
Gigabit Ethernet Line Card (GLC2)	Cabling the Gigabit Ethernet Line Cards
Quad Gigabit Ethernet Line Card (QGLC)	
10 Gigabit Ethernet Line Card (XGLC)	
Optical (ATM) (OLC2)	Cabling the Optical (ATM) Line Card
Channelized Line Card Interfaces (CLC2)	Cabling the Channelized Line Card

Adding a 10 Gigabit Ethernet Line Card

The 10 Gigabit Ethernet Line Card (XGLC) is a full-height line card that occupies two half-height slots in the rear of the ASR 5000 chassis. It accepts a single Small Form-factor Pluggable+ (SFP+) transceiver module for network connectivity.

There are two versions of the XGLC:

- **XGLC SR:** Accepts a 10GBase-SR module for a fiber optical cable with a center wavelength of 850nm terminated by an LC connector. It can drive an optical signal up to 300 meters using 50/125um fiber (MMF), and up to 33 meters using 62.5/125um fiber (MMF).
- **XGLC LR:** Accepts a 10GBase-LR module for a fiber optical cable with a center wavelength of 1310nm terminated by an LC connector. It can drive an optical signal up to 10 kilometers using 50/125um fiber (SMF).

Install XGLCs behind packet processing cards. You can install a maximum of twelve XGLCs in the chassis.

Preparing a Full-height Line Card Slot

The full-height XGLC requires two line card slots: an upper chassis slot and the lower chassis slot directly beneath it. For example, if a PSC2 is installed in slot 1, its corresponding XGLC would be installed in slots 17 and 33.

Important When entering the slot location of an XGLC in a CLI command use the upper slot number only.

The procedure for modifying two half-height card slots to accept the full-height XGLC is described in the *Preparing A Full-Height Card Slot* appendix. Complete the procedures described in that appendix before attempting to install the XGLC in the ASR 5000 chassis.

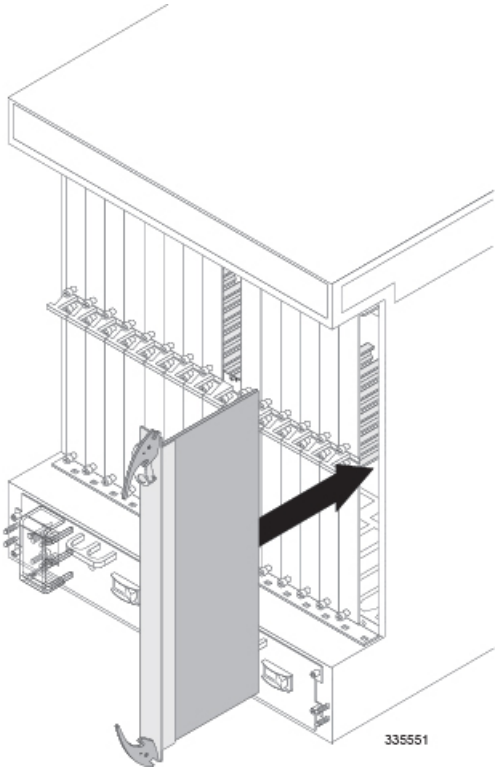
Installing the XGLC

Caution During installation, maintenance, and/or removal, wear a grounding wrist strap to avoid ESD damage to the components. Failure to do so could result in damage to sensitive electronic components and potentially void your warranty.

Step 1 Identify the full-height chassis slot in which the line card will be installed.

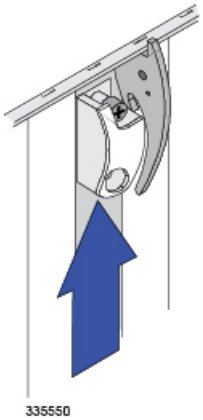
Step 2 Slide the interlock switch fully downward on the card. Flip the ejector levers outward and away from the card's front panel.

Step 3 Properly support the weight of the card and align it with the upper and lower card guides of the chassis slot. Gently slide the card into the slot until the levers touch the chassis frame.



Step 4 Push the ejector levers inward firmly until the card is firmly seated in the chassis midplane and the ejector levers can be pushed in no further. Press firmly on the card's faceplate to ensure that it is fully seated. The card's front panel should be flush against the chassis' upper and lower card mounts for the slot.

Step 5 Slide the interlock switch on the front panel of the line card upward to lock the ejector tab in place. The flange on the left-side of the interlock switch prevents movement of the ejector tab when raised completely.

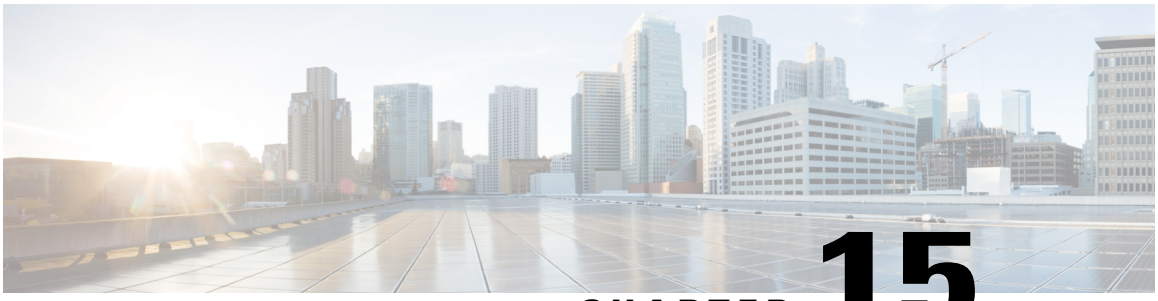


Important You must slide the interlock switch upward before securing the card's top screw to the mounting rail.

Step 6 Use a Phillips #2 screwdriver to tighten the screws at the top and bottom of the front panel to secure the card to the chassis.

Step 7 Repeat step 1 through step 10 for every other line card that to be installed.

Step 8 Proceed to the appropriate chapter for information on connecting data cables to the line cards.



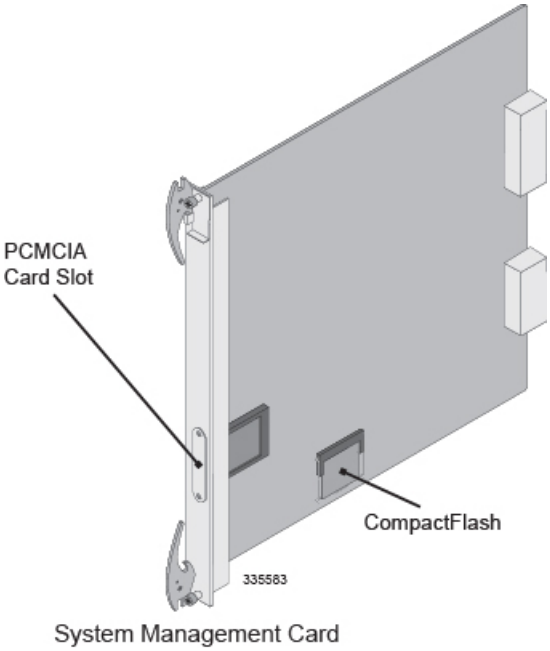
CHAPTER 15

Removing and Installing SMC PC Cards

The ASR 5000 supports the use of PC Cards, also known as PCMCIA cards. These cards store software images, configuration files, and other data. Each SMC incorporates a single PCMCIA slot on its front panel.

PC Cards are optional components. If your deployment requires the use of PC Cards, follow these instructions to safely install and remove the cards. The card slot accepts one ATA Type I or Type II PCMCIA card. Location of PCMCIA Slot

Figure 61: Location of PCMCIA Card on SMC



This chapter provides information and instructions for removing and installing the SMC's PCMCIA memory cards. It includes the following sections:

Installing PC Cards

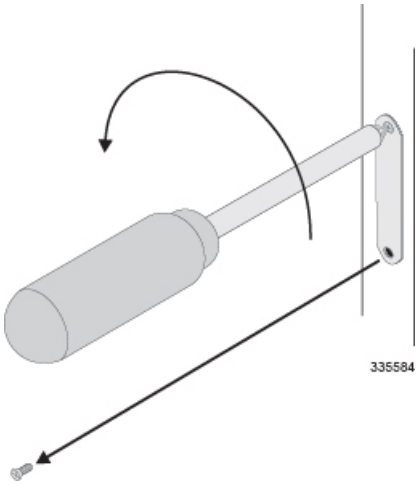
This section provides instructions for installing a PC Card in the SMC.

If you are performing an initial installation of a PC Card, begin with step 1. If you are replacing a PC Card that you have removed according to the procedures in Removing PC Cards, on page 187, begin with step 4.

Caution During installation, maintenance, and/or removal, wear a grounding wrist strap to avoid ESD damage to the components. Failure to do so could result in damage to sensitive electronic components and potentially void your warranty

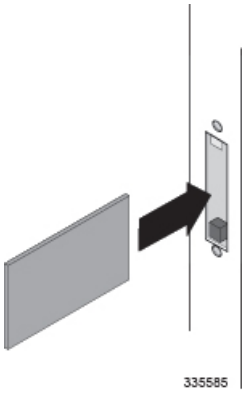
Step 1 Identify the slot where you are installing the PC Card.

Step 2 Use a Phillips #1 screwdriver to remove the two screws securing the PC Card slot cover.

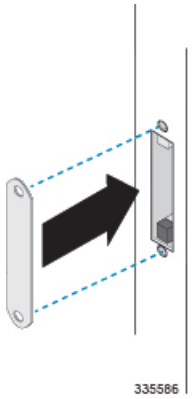


Step 3 Remove the PC Card slot cover.

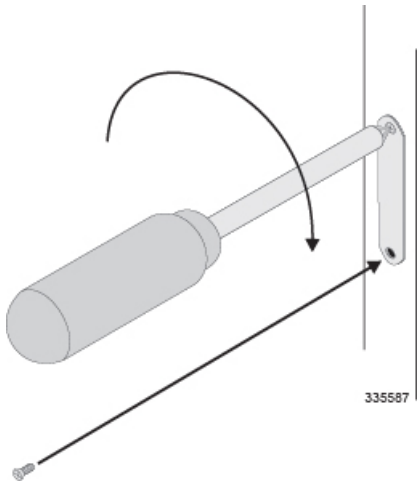
Step 4 Align the PC Card with the slot's upper and lower card guides and slide the card into the slot until it can go no further. The face/top of the PC Card, typically where the manufacturer's brand name information is located on the label, should be facing to the right side of the card.



Step 5 Align the PC Card slot cover over the open slot.



Step 6 Use the two screws that you removed in step 2 and a Phillips #1 screwdriver to secure the PC Card slot cover.



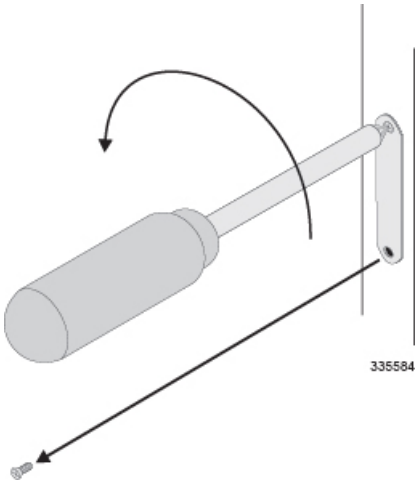
Removing PC Cards

Follow these instructions to remove a PC Card from the SMC.

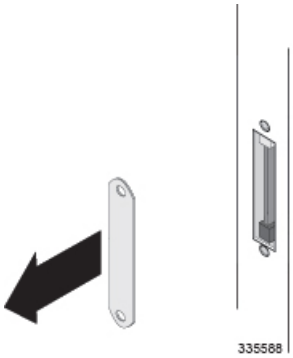
Caution During installation, maintenance, and/or removal, wear a grounding wrist strap to avoid ESD damage to the components. Failure to do so could result in damage to sensitive electronic components and potentially void your warranty.

Step 1 Identify the slot from which the PC Card will be removed.

Step 2 Use a Phillips #1 screwdriver to remove the two screws securing the PC Card slot cover.

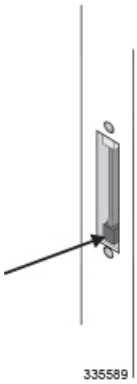


Step 3 Remove the PC Card slot cover.

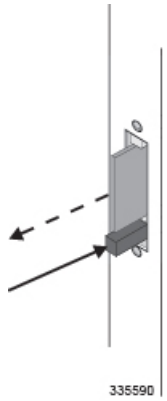


Step 4 Eject the PC Card from the slot.

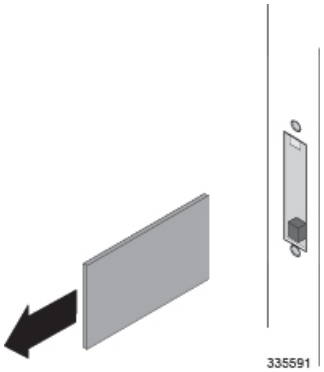
a) Press and release the PC Card ejector button once to release and fully extend it.



b) Firmly press the PC Card ejector button a second time to eject the card.

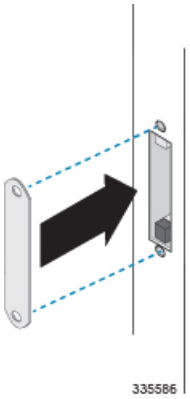


Step 5 Grasp the PC Card and pull it out of the slot.

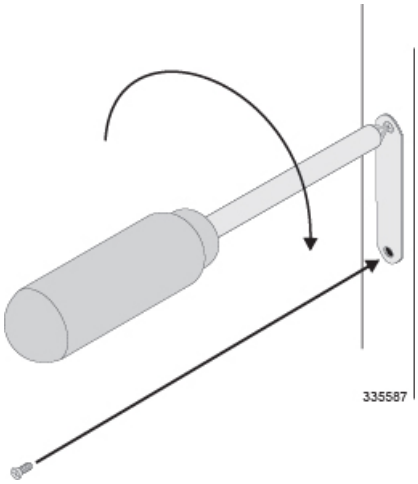


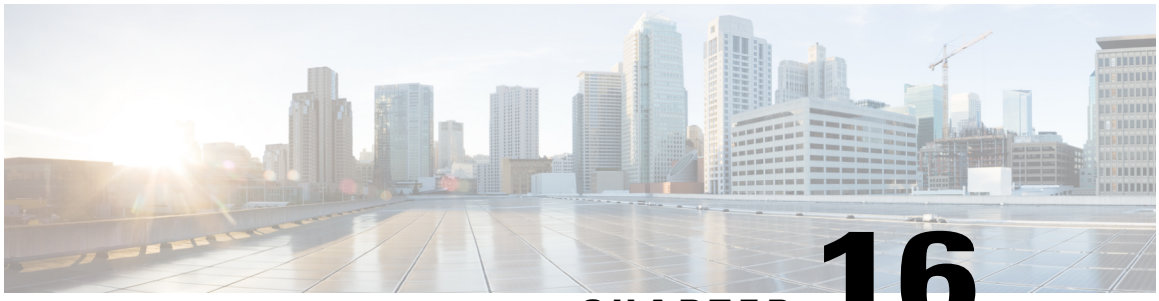
Important If you are installing a replacement PC Card, follow the instructions in Installing PC Cards.

Step 6 Align the PC Card slot cover over the open slot.



Step 7 Use the two screws that you removed in step 2 of this procedure and a Phillips #1 screwdriver to fasten the PC Card slot cover.


335587



CHAPTER 16

Replacing the Chassis Air Filter

The lower fan tray draws air into the chassis. It is equipped with a particulate air filter to prevent dust and debris from entering the system. The air filter must be changed periodically to ensure proper ventilation and air flow through the chassis.

Important The air filter (ASR5K-FLTR-AIR=) should be replaced at least every six months. Keep a minimum of one replacement air filter on site for each deployed chassis. This ensures that qualified service personnel can quickly replace the filter when needed. The filter should be replaced during a maintenance window.

Caution During installation, maintenance, and/or removal, wear a grounding wrist strap to avoid ESD damage to the components. Failure to do so could result in damage to sensitive electronic components and potentially void your warranty.

This chapter includes the following sections:

Determining When an Air Filter Needs Replacing

If the air filter is replaced at least every six months as preventive maintenance, there should be no need for out-of-cycle replacement. However, under certain conditions the air filter may need replacement between maintenance periods.

One possible indication that an air filter needs to be replaced is if the chassis temperature remains high for extended periods of time. This condition causes the dual-speed fans to run at high speed. A clogged and dirty air filter hinders air flow through the chassis resulting in higher operating temperatures.

To monitor chassis temperature and fan speed, issue the following CLI command in the Exec mode:

show fans

The following is a sample output for this command:

```
Upper Fan Controller: State=All Running      Speed=Normal Temp=20 (C)
Lower Fan Controller: State=All Running      Speed=Normal Temp=20 (C)
```

To monitor the temperature of individual cards, enter the following CLI command in the Exec mode. [Enter the upper slot number for an XGLC.]

show card info *slot_#*

This command displays operational information, including the temperature for the card installed in chassis *slot_#*, which can be any integer value between 1 and 48.

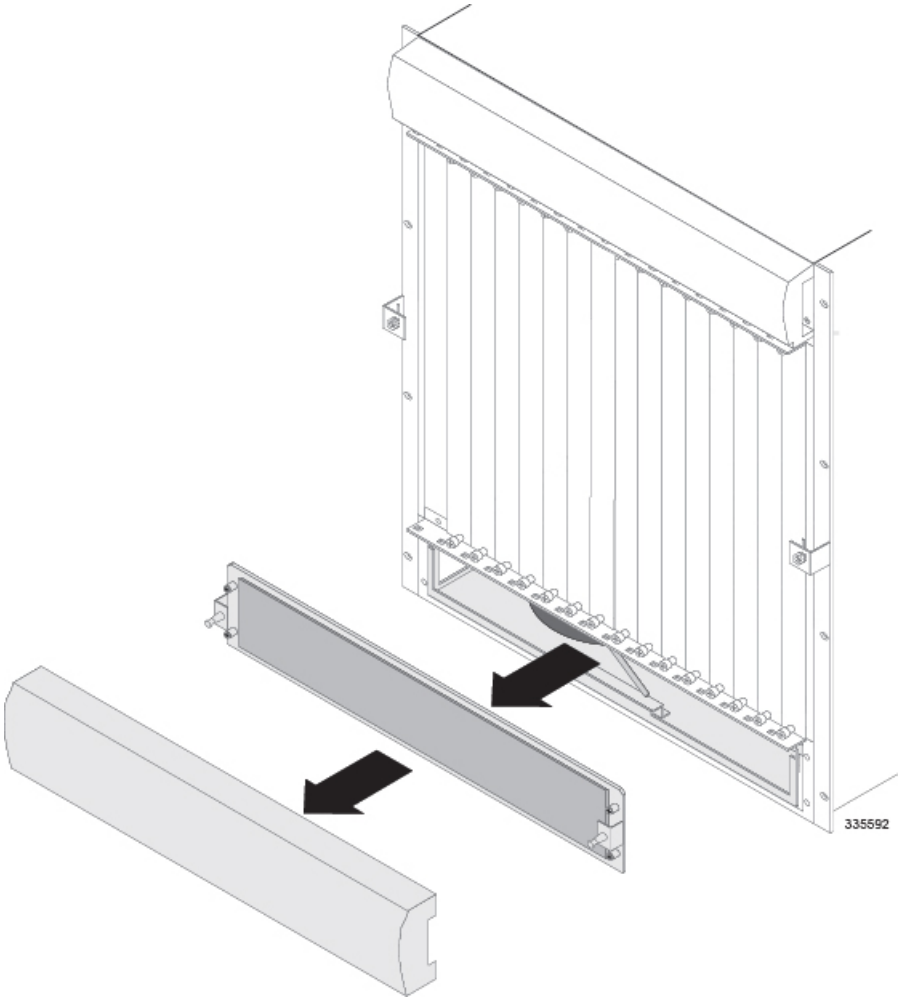
The system supports Simple Network Management Protocol (SNMP) traps that are triggered for conditions that may indicate the need to change the air filter:

SNMP Trap	Description
starFanSpeed	The speed of the fans controlled by this fan controller. The value normal(1) indicates the normal operating speed of the fans. The value high(2) indicates that the fans are running at a higher rate of speed. Fans running at a higher temperature may be the result of a dirty air filter.
showCardTemperature	The temperature, in degrees Celsius, as measured on the card. A value of 0 indicates that the temperature cannot be read or that the card is not present. The maximum measurable temperature is 70°C. The safe operating temperature range for the chassis and its sub-components is between 0 and 55°C.
starCardTempOverheat	The card has reached a temperature beyond its safe operating range. The safe operating temperature range for the chassis and its sub-components is between 0 and 55°C.
starCardTempOK	The temperature of the card is currently within its safe operating range. This notification is only generated if the card has previously generated a starCardTempOverheat notification.

Removing the Air Filter

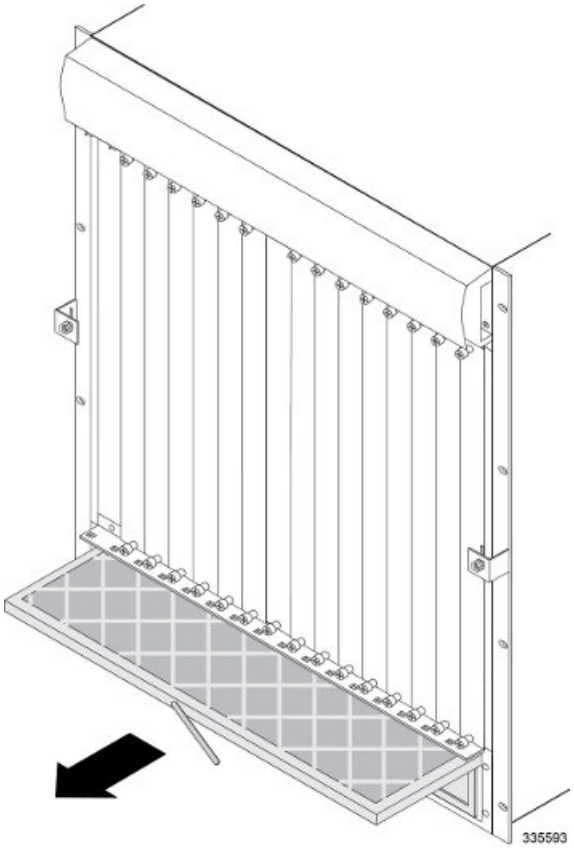
Follow the instructions below to remove the air filter.

Step 1 Access the chassis' lower fan tray assembly.



a) Remove the plastic bezel from the lower-front of the chassis by placing your fingers in the notches on its sides and pulling it toward you.
b) Use a Phillips #1 screwdriver to remove the fan tray cover. Loosen the four screws that secure it in place and pull it away from the chassis.

Step 2 Raise the plastic tab above the face of the fan tray assembly and gently pull it toward you until the air filter is free from the fan tray assembly.



Caution Do not operate the chassis without the air filter installed for extended periods of time. Doing so will cause dust to build up within the system, possibly hindering air flow and clogging open connector ports.

Step 3 Discard the used air filter.

Step 4 Proceed to Installing the Air Filter, on page 194.

Installing the Air Filter

Follow the instructions below to install an air filter.

Step 1 Verify that the arrows located on the sides of the air filter point upwards. The arrows indicate the direction of the airflow into the chassis through the filter.

Caution Installing the air filter incorrectly may cause over-temperature conditions within the chassis.

Step 2 Slide the air filter into the lower fan tray assembly along the guides located on the lower fan tray until the front of the air filter is flush with the front of the assembly.

Step 3 Lower the plastic tab over the front of the fan tray assembly to secure it in place.

Step 4 Remove any dust build-up that may have accumulated on the chassis front air intake. This should be done as part of routine maintenance to continue optimum airflow into the chassis. The front air intake is located on the lower fan tray cover.

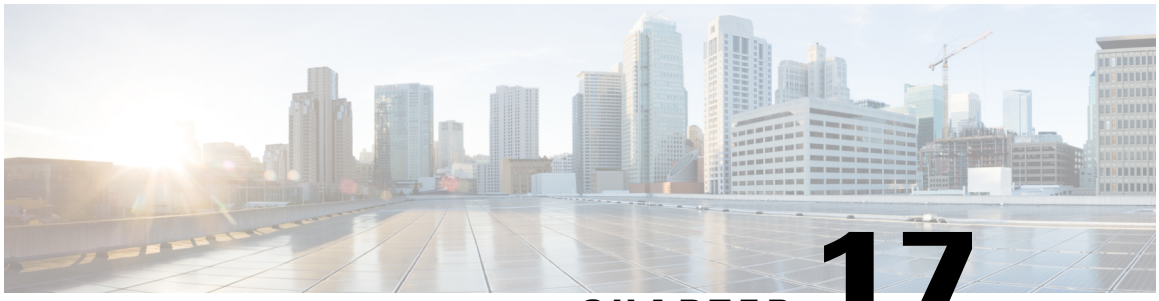
Step 5 Replace the fan tray bay cover and tighten each of the four screws to secure it to the chassis.

Important The fan tray cover is keyed and can only be installed in one direction.

Step 6 Replace the plastic bezel over the fan tray bay.

a) Align the bezel over the bezel mounts that protrude from the fan tray bay cover.

b) Snap the bezel in place.



CHAPTER 17

Replacing a Power Filter Unit

Up to two -48 VDC Power Filter Unit (PFU) assemblies can be installed in the ASR 5000 chassis. Two PFUs provide load-balancing and redundancy. The PFUs are located in the lower-rear of the chassis.

Caution Although a single PFU can provide power for a fully loaded chassis, it is strongly recommended that two PFUs always remain installed for load-balancing and redundancy.

Caution During installation, maintenance, and/or removal, wear a grounding wrist strap to avoid ESD damage to the components. Failure to do so could result in damage to sensitive electronic components and potentially void your warranty.

This chapter provides instructions for replacing a PFU in the event of failure. It includes the following sections:

Determining that a PFU has Failed

The chassis can use one of several mechanisms to indicate a PFU failure. The first indicator is when the POWER LED on the PFU is off. If the LED is off and a starPowerState SNMP trap is generated with a value of Failed (2), the PFU must be replaced.

If you do not receive this trap, try the following suggestions to diagnose the cause:

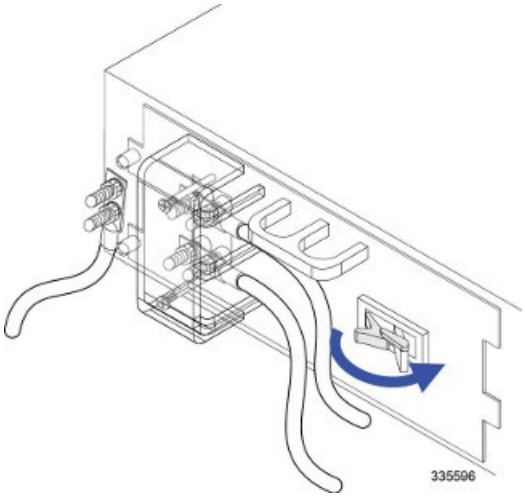
- Verify that the power switch is in the ON position.
- Verify that the RTN and -VDC lugs are attached according to the instructions provided in this document.
- Verify that the ground lug is attached according to the instructions provided in this document.
- Verify that the power source is on and is supplying the correct voltage and sufficient current.

- Check the cables from the power source to the rack for continuity.
- If a fuse panel is installed between the Power Distribution Frame (PDF) and the chassis, verify that the fuses are intact.
- If a fuse panel is installed between the PDF and the chassis, check the cables from the fuse panel to the chassis for continuity.

Removing the Failed PFU

In the event of a PFU failure, follow these instructions to safely remove the PFU from the chassis.

Step 1 Power down the PFU by flipping the circuit breaker on the PFU to the OFF position. If the circuit breaker on your PFU is equipped with a locking clip, move the clip to the right to unlock the circuit breaker's actuator.



Step 2 Shut down the power source to the failed PFU.

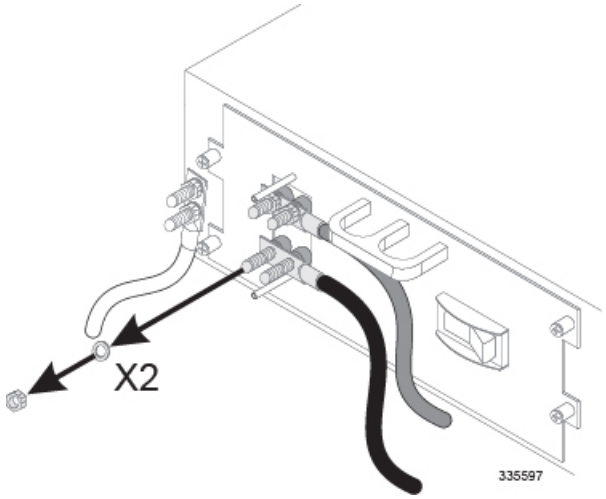
To avoid the risk of electric shock, verify that the power source is completely shut down before proceeding to the next step.

Vor dem naechsten Schritt Spannungsversorgung abschalten, um einen elektrischen Schlag zu vermeiden.

Step 3 Use a Phillips #2 screwdriver to remove the plastic cover from the power terminals.

Step 4 Remove the cable from the -VDC terminals as described below. The -VDC terminals are the two terminals located at the bottom of the PFU.

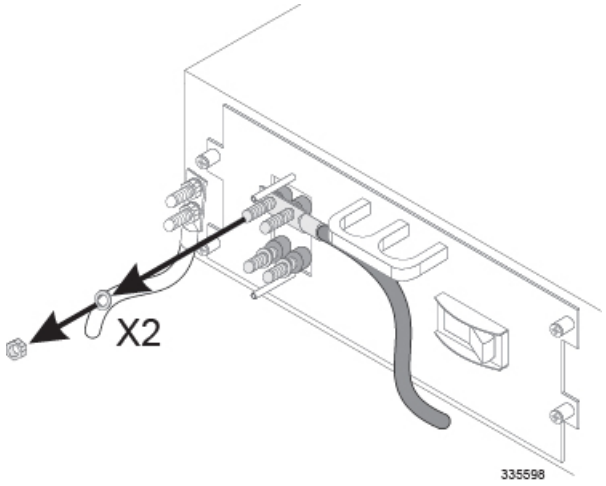
a) Use a 9/16-inch nut driver or socket wrench to remove the nuts and washers that secure the cable to the PFU.



b) Slide the power cable off the terminals.

Step 5 Remove the cables from both RTN terminals as described below. The RTN terminals are the two terminals located directly above the -VDC terminals.

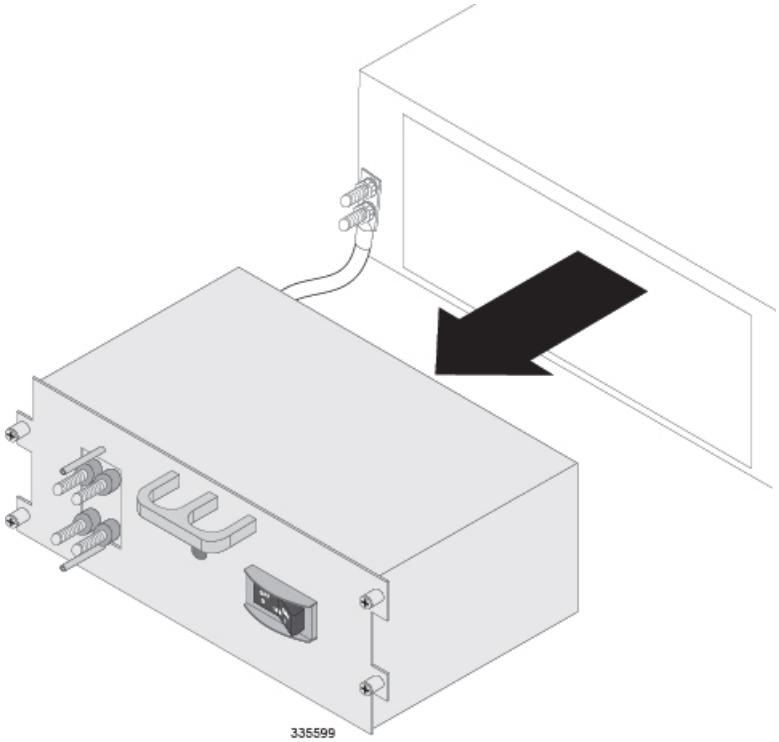
a) Use a 9/16-inch nut driver or socket wrench to remove the nuts and washers that secure the cable to the PFU.



b) Slide the return cable off the terminals.

Step 6 Use a Phillips #2 screwdriver to loosen the four screws that secure the PFU to the chassis.

Step 7 Grasp the handle on the PFU and gently pull it toward you. The PFU should easily slide out of the chassis.

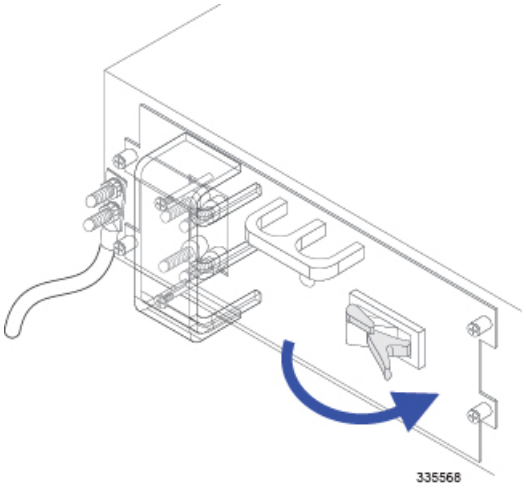


Step 8 Proceed to Installing the Replacement PFU, on page 200.

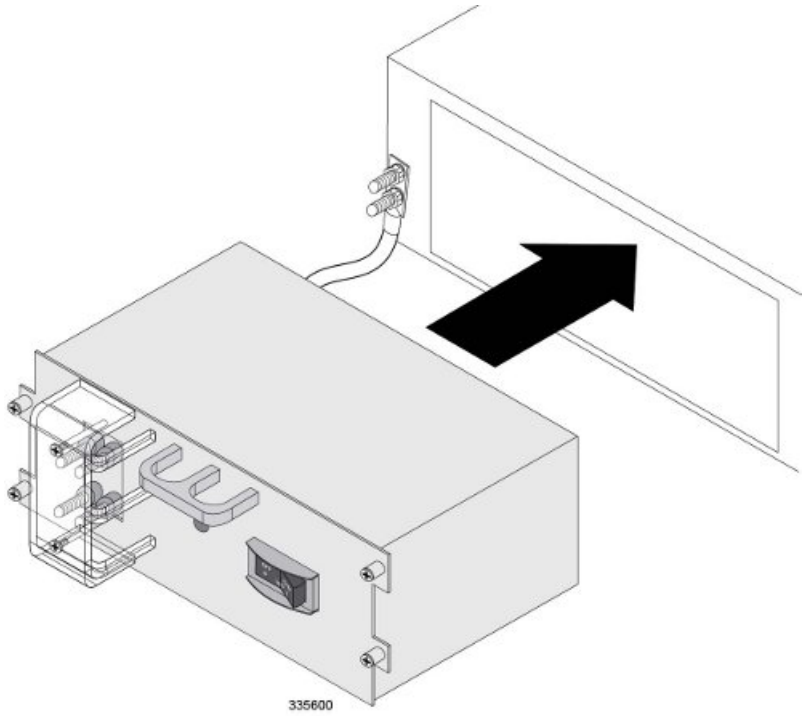
Installing the Replacement PFU

Follow the instructions below to install the replacement PFU in the chassis.

Step 1 Flip the circuit breaker actuator on the replacement PFU to the OFF position. If the circuit breaker on your PFU is equipped with a locking clip, lock the circuit breaker in place. Move the breaker's locking clip to the right until the clip's inside tang is recessed in the breaker's actuator opening.



Step 2 Slide the PFU assembly into the PFU bay until it is flush against the chassis.



Step 3 Use a Phillips #2 screwdriver to tighten each of the four screws on the PFU to secure it to the chassis.

Step 4 Use a Phillips #2 screwdriver to remove the plastic cover from the power terminals.
Each of the four power terminals is shipped with one nut and two washers. The 165A PFU has one lock-washer and one flat washer.

To avoid electric shock, ensure that the power source is off before attaching power cables to the PFU(s) installed in the chassis.

Spannungsversorgung abschalten vor Anschluss der Kabel an die Netzteile, um einen elektrischen Schlag zu vermeiden.

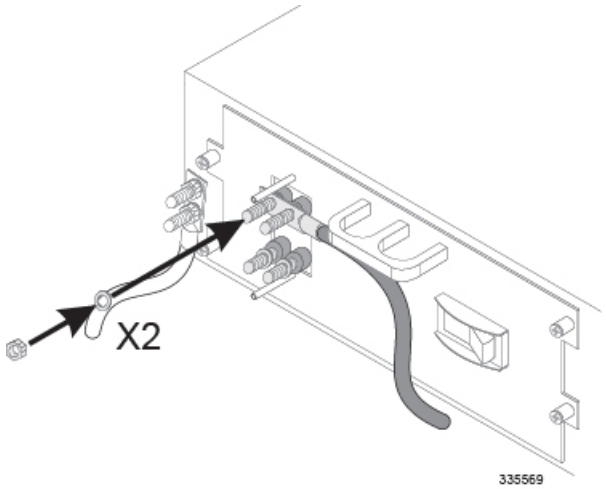
Step 5 Use a Phillips #2 screw driver to remove the plastic cover from the power terminals.

Step 6 Use a 9/16-inch nut driver or socket wrench to remove the nut and the lock-washer on the PFU from each of the four terminals.

Step 7 Fasten the lug attached to the power return cable to the PFU:

a) Insert the lug over the two terminals labeled RTN. These are the two top terminals on the PFU.

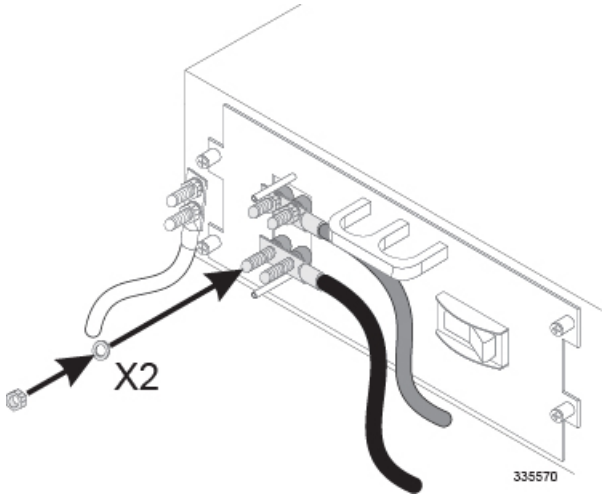
b) Secure the lug to the RTN terminals using two of the four washers and two of the four nuts that were removed in step 3. The nuts on the PFU should be torqued to 50 in-lb. (5.65 N-m).



Step 8 Fasten the lug attached to the power feed cable to the PFU:

a) Insert the lug over the two terminals labeled -VDC. These are the two bottom terminals on the PFU.

b) Secure the lug to the -VDC terminals with the remaining two washers and nuts you removed in step 7. The nuts on the PFU should be torqued to 50 in-lb. (5.65 N-m).



To avoid the risk of fire, take proper precautions to ensure that the power feed and return lugs are not touching.

Um einen Kurzschluss zu vermeiden, duerfen sich die beiden Stromkabel nicht beruehren.

Step 9 Reinstall the plastic terminal cover.

Caution To avoid the risk of electric shock and/or potential damage to the system, never operate the chassis without the plastic terminal cover.

In addition, the power and return lugs must not protrude past the edge of the plastic terminal covers. Any portion of the lug that is exposed must be covered with shrink wrap.

Step 10 Apply power to the PFUs using the information and instructions in the *Applying Power to the Chassis* section of the *Applying Power and Verifying the Installation* chapter of this guide.

What to do with the Failed PFU

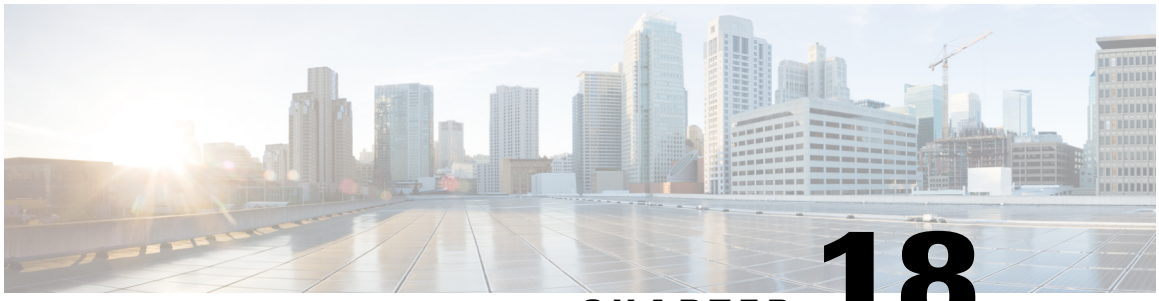
If the failed PFU is still under warranty, return it to the vendor for repair.

If the failed PFU is out of warranty, contact Cisco to determine if it can be sent in for repair at an additional cost.

Important Disposal of this product should be performed in accordance with all national laws and regulations.

Refer to the support area of http://www.cisco.com for up-to-date product documentation pertaining to installation, configuration, and maintenance. A valid username and password is required to use this site. Please contact your local sales or service representative for additional information.

Important For additional information on the RMA process, see the *RMA Shipping Procedures* appendix.



CHAPTER 18

Replacing Upper or Lower Fan Tray

The upper fan tray draws air up through the chassis for cooling and ventilation. It then exhausts the heated air through the vents at the upper-rear of the chassis.

The lower fan tray draws air from the front and sides and pushes it through the chassis for cooling and ventilation.

Caution Do not operate the chassis without the fan tray(s) installed. Doing so even for short periods of time may cause the system to overheat and result in component damage.

This chapter provides instructions for the removal and replacement of the upper and lower fan tray assemblies should there be a partial or complete failure of either one.

Caution During installation, maintenance, and/or removal, wear a grounding wrist strap to avoid ESD damage to the components. Failure to do so could result in damage to sensitive electronic components and potentially void your warranty.

This chapter includes the following sections:

Determining Whether a Fan Tray Needs Replacing

The system has several ways to indicate a fan tray failure. The first indicator is that the Status LED on the System Resource Card (SRC) turns red to indicate the failure of a chassis component.

If you see a red Status LED on the SRC, you can determine whether it is a fan tray failure via the CLI or by checking the Simple Network Management Protocol (SNMP) traps.

Using the CLI

To monitor chassis temperature and fan speed, issue the following CLI command in the Exec mode:

`[local]`*host_name*`#` **show fans**

The following is a sample output for this command:

```
Upper Fan Controller: State=All Running      Speed=Normal Temp=20 (C)
Lower Fan Controller: State=All Running      Speed=Normal Temp=20 (C)
```

Using SNMP Traps and MIB Objects

The system supports SNMP traps that are triggered for conditions that may indicate the need to change the fan tray. The system provides the traps listed in the table below.

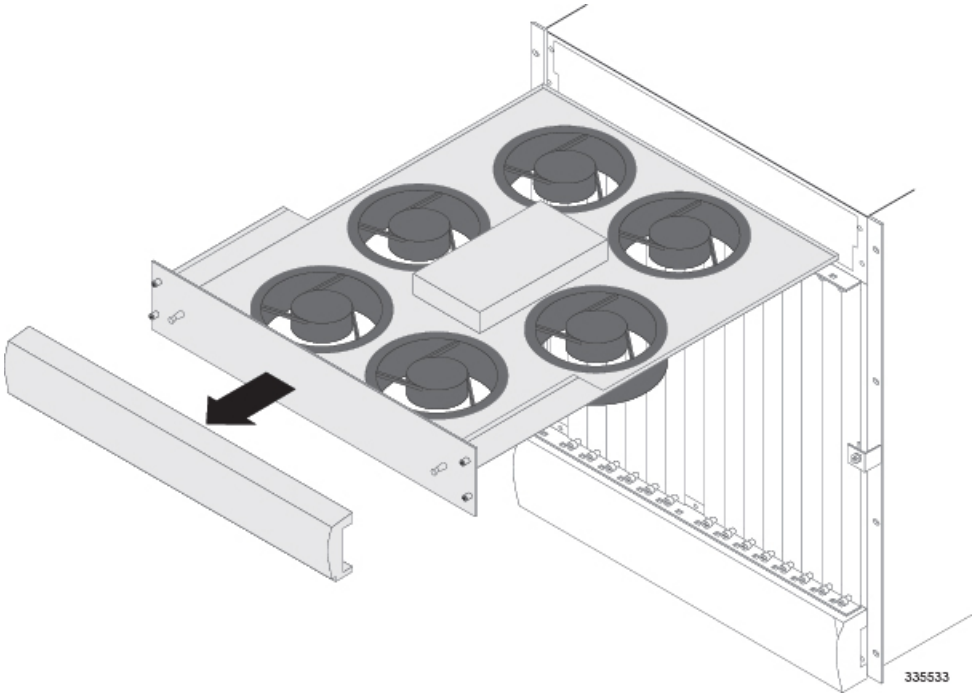
Table 82: SNMP Traps for Fan Trays

SNMP Trap	Description
starFanFailed	One or more fans have failed on the indicated fan controller.
starFanRemoved	A fan tray has been removed.
starFanLocation	The physical location of the fan controller, upper or lower.
starFanFailures	The type of failure experienced:
	0: There are no errors. This is the normal operating condition.
	2: Multiple fans on the fan tray have failed.
	4: A single fan on the fan tray has failed.
	8: The redundant fan controller on the fan tray did not respond to the heartbeat signal.
	10: An error has occurred on the primary fan controller bus for the fan tray.
	20: An error has occurred on the redundant fan controller bus for the fan tray.
	40: An inter-bus communication error was experienced between the primary and redundant fan controllers on the fan tray.
	80: The fan tray is not present.

SNMP Trap	Description
starFanSpeed	The speed of the fans controlled by this fan controller. The value normal(1) represents the normal operating speed of the fans. The value high(2) represents that the fans are running at a higher rate of speed.

Removing an Upper Fan Tray

Follow the instructions below to remove an upper fan tray from the chassis.



Step 1 Remove the plastic bezel from the upper-front of the chassis by placing your fingers in the notches on the sides of the bezel and pulling it toward you.

Step 2 Use a Phillips #1 screwdriver to loosen the four screws securing the fan tray.

Step 3 Grasp the two bezel mounts on the front of the fan tray and pull toward you. The fan tray should easily slide out of the chassis.

The upper fan tray assembly contains multiple fans that are spinning at a high rate of speed when the system is powered on. If system is powered on, do not touch moving fans. To minimize the risk of personal injury and potential damage to equipment, follow these instructions.

1. Pull the fan tray towards you until the fan tray extends out of the chassis approximately two inches (5 cm).
2. Wait 30 seconds to allow fans to stop spinning.
3. Fully remove fan tray.

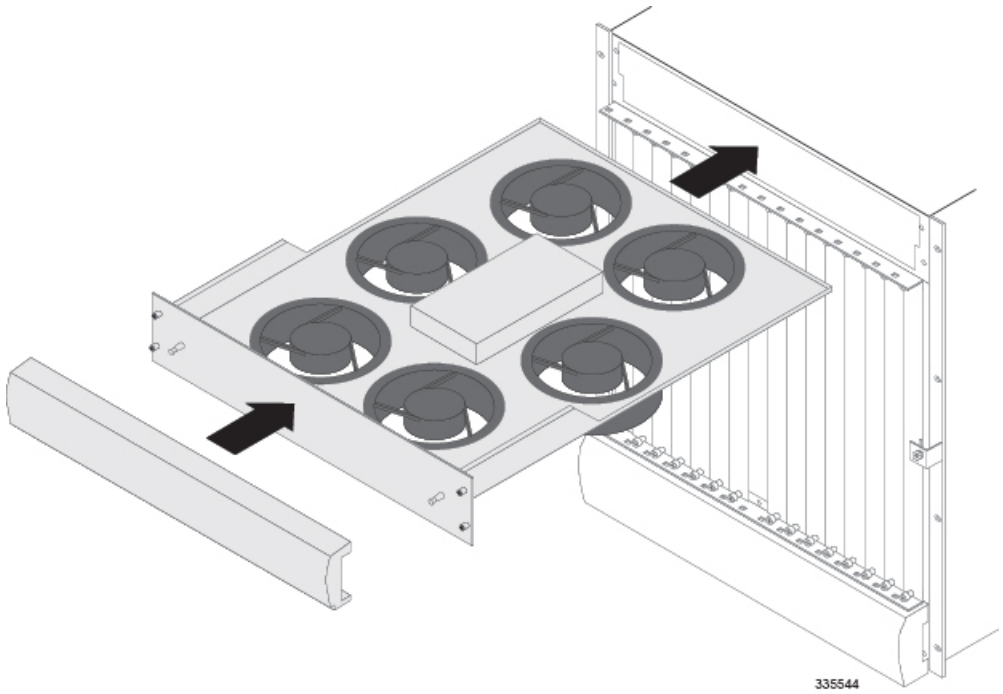
Die obere Lüfter Schublade enthaelt mehrere Lüfter. Verletzungsgefahr bei Beruehrung der Lüfter.Hohe Umdrehungszahl der Lüfter unter Stromanschluss.Vorsicht nicht beruehren. Um persoenliche Verletzungen und Geraeteschaden zu verhueten bitte Anleitungen beachten.

1. Schublade ca. 5cm herausziehen.
2. 30 Sekunden warten bis die Luefter zum stehen kommen.
3. Schublade erst jetzt komplett herausziehen.

Step 4 Proceed to Installing an Upper Fan Tray, on page 208.

Installing an Upper Fan Tray

Follow the instructions below to install an upper fan tray.



Step 1 Hold the front of the fan tray by its sides and align it with the upper fan tray bay of the chassis.

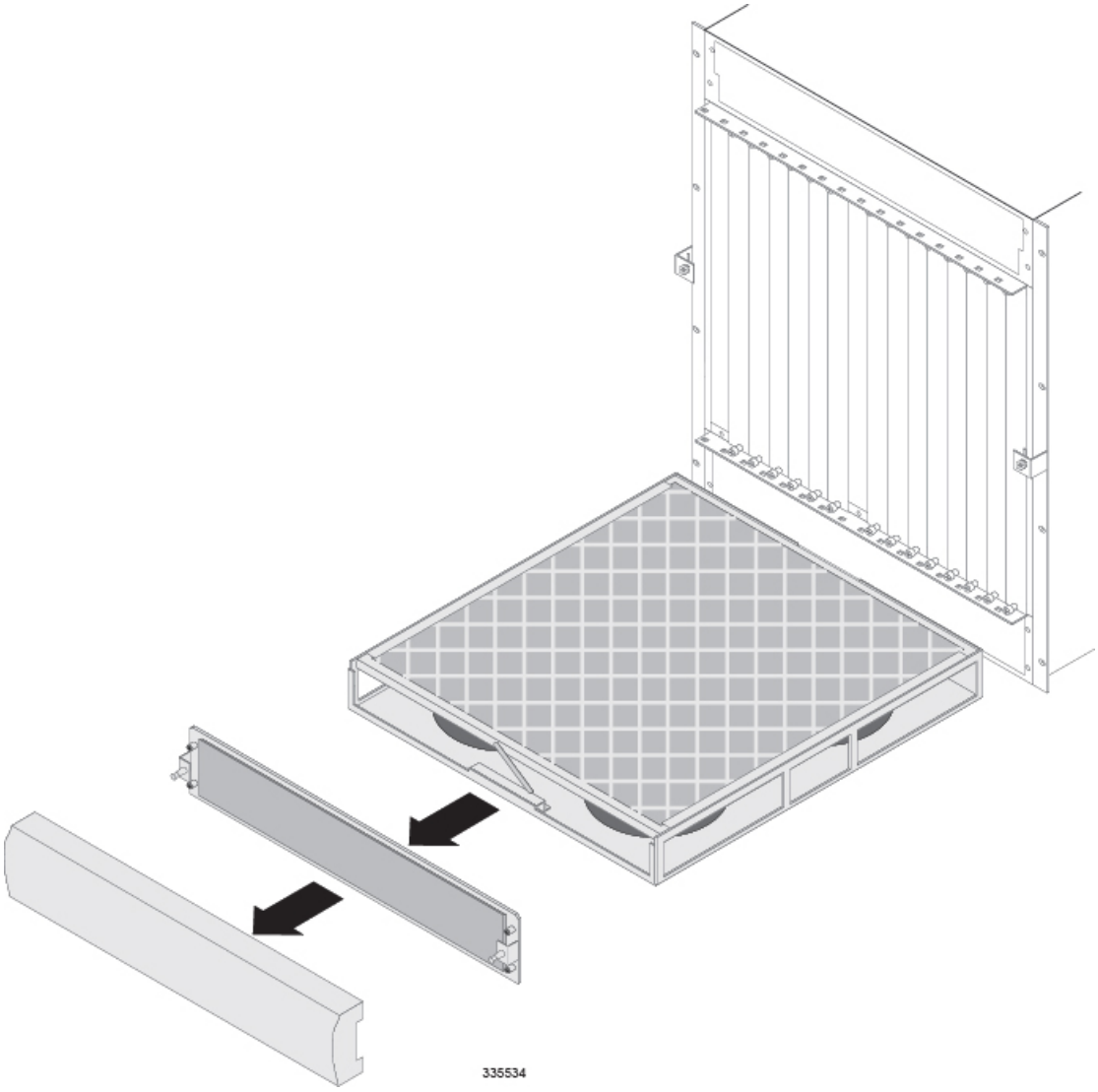
Step 2 Slowly slide the fan tray into the chassis along the guides until its face plate is flush against the chassis.

Step 3 Use a Phillips #1 screwdriver to tighten the four screws on the face plate to secure the fan.

Step 4 Replace the plastic bezel by aligning it over the bezel mounts that protrude from the fan tray and snapping the bezel in place.

Removing a Lower Fan Tray Assembly

Follow the instructions below to remove a lower fan tray assembly from the chassis.



Step 1 Unsnap the plastic bezel from the lower-front of the chassis by placing your fingers in the notches on its sides and pulling it toward you.

Step 2 Use a Phillips #1 screwdriver to loosen the four captive screws that hold the fan tray cover/EMI shield in place. Pull the cover away from the chassis. **Do NOT use an electric or pneumatic torque driver to loosen these screws.**

Step 3 Pull the fan tray toward you with the handle cut-out on the front of the fan tray assembly. The fan tray assembly should easily slide out of the chassis.

The upper fan tray assembly contains multiple fans that are spinning at a high rate of speed when the system is powered on. If system is powered on, do not touch moving fans. To minimize the risk of personal injury and potential damage to equipment, follow these instructions.

1. Pull the fan tray towards you until the fan tray extends out of the chassis approximately two inches (5 cm).
2. Wait 30 seconds to allow fans to stop spinning.
3. Fully remove the fan tray.

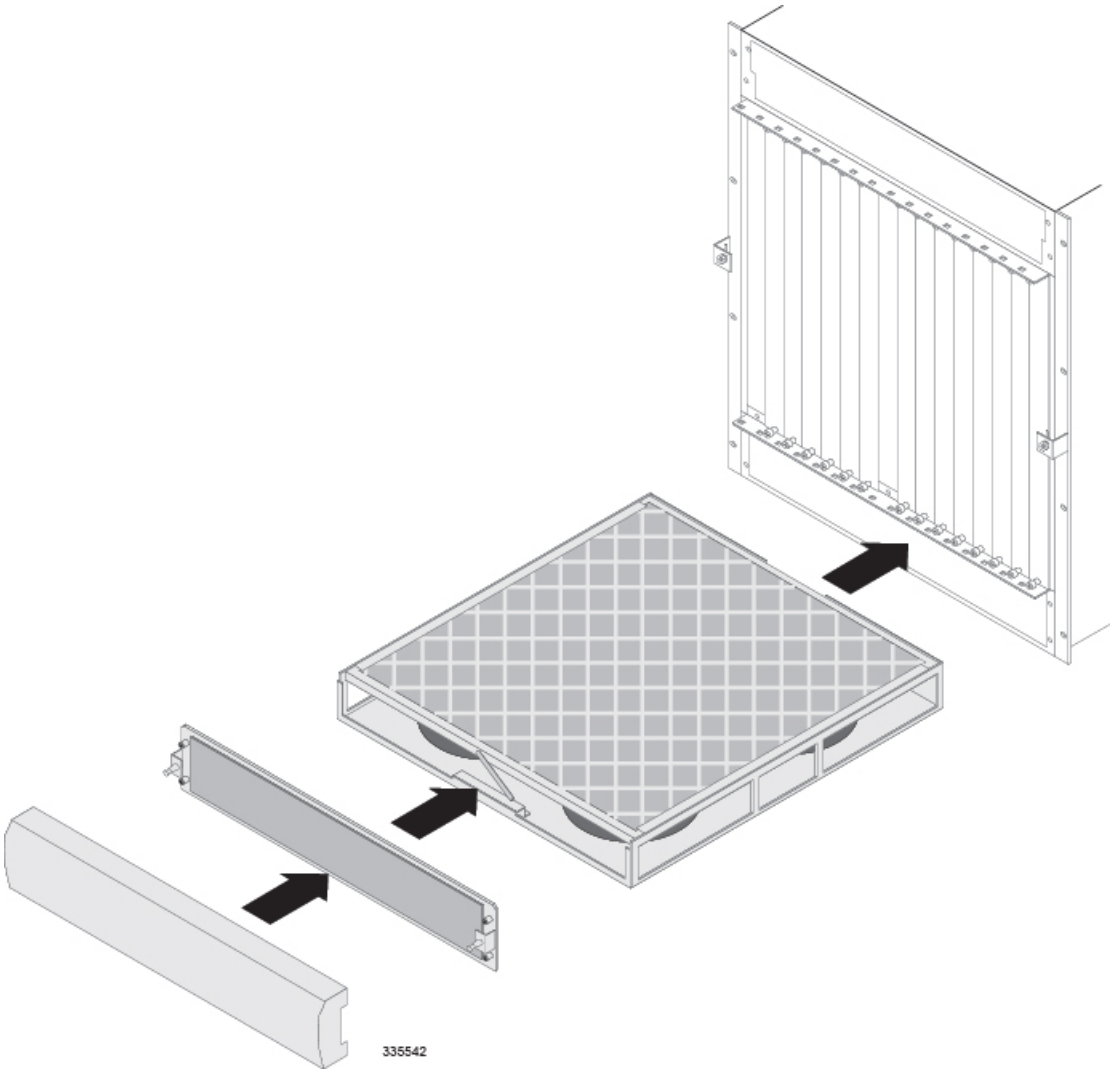
Die obere Lüfter Schublade enthaelt mehrere Lüfter. Verletzungsgefahr bei Beruehrung der Lüfter. Hohe Umdrehungszahl der Lüfter unter Stromanschluss. Vorsicht nicht beruehren. Um persoenliche Verletzungen und Geraeteschaden zu verhueten bitte Anleitungen beachten.

1. Schublade ca. 5cm herausziehen.
2. 30 Sekunden warten bis die Luefter zum stehen kommen.
3. Schublade erst jetzt komplett herausziehen.

Step 4 Proceed to Installing a Lower Fan Tray Assembly, on page 210.

Installing a Lower Fan Tray Assembly

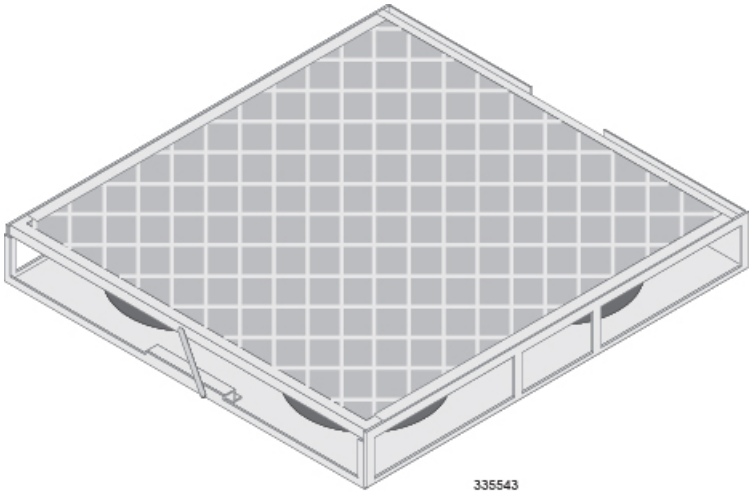
Follow the instructions below to install a lower fan tray.



Step 1 Hold the front of the fan tray by its handle with one hand and use your other hand to align it with the lower fan tray bay of the chassis. The lower fan tray bay is located at the bottom front of the chassis.

Step 2 Slowly slide the fan tray into the chassis along the guides until it is seated firmly in the chassis and can go no further.

Step 3 Verify that the particulate filter is securely in place. Its front should be flush with the front of the fan tray assembly and its tab should be lowered to keep it in place.



Step 4 Replace the fan tray bay cover/EMI shield. The perpendicular tabs on the cover should face away from the chassis and be positioned at the bottom. Use a Phillips #1 screwdriver to hand tighten the four captive screws in an alternating pattern – upper left, lower right, lower left, upper right (5 inch-lbf, 0.5 N-m). **Do NOT use an electric or pneumatic torque driver to tighten these screws.**

Step 5 Replace the lower plastic bezel by aligning it over the bezel mounts that protrude from the fan tray bay cover and snapping the it in place.

What to do with the Failed Fan Tray

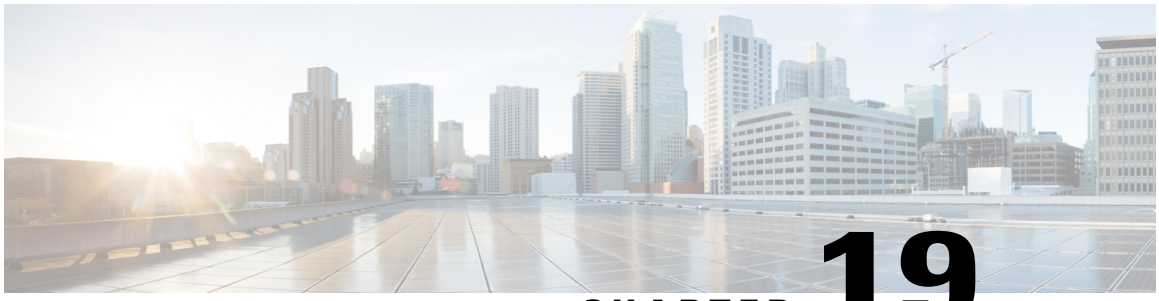
If the failed fan tray is still under warranty, return it to the vendor for repair.

If the failed fan tray is out of warranty, contact Cisco to determine if it can be sent in for repair at an additional cost.

Important Disposal of this product should be performed in accordance with all national laws and regulations.

Refer to the support area of http://www.cisco.com for up-to-date product documentation pertaining to installation, configuration, and maintenance. A valid username and password is required to use this site. Please contact your local sales or service representative for additional information.

Important For additional information on the RMA process, see the *RMA Shipping Procedures* appendix.



CHAPTER 19

Replacing Application Cards

This chapter provides information on replacing a failed application card.

Caution During installation, maintenance, and/or removal, wear a grounding wrist strap to avoid ESD damage to the components. Failure to do so could result in damage to sensitive electronic components and potentially void your warranty.

This chapter includes the following sections:

Determining Whether an Application Card has Failed

The system has several ways to indicate an application card failure. The first indicator is that the Status LED on the System Management Card (SMC) turns red to indicate the failure of a chassis component. Another indicator is the Run/Fail LED on an application card is red or turns off if that card has a problem.

If you see either of these indicators, you can determine the nature of the problem via the CLI or by checking the Simple Network Management Protocol (SNMP) traps.

Using the CLI

Monitor application cards in the chassis by executing the following CLI commands in Exec mode:

show card diag *slot_#*

slot_# is the chassis slot number in which the particular card that you wish to monitor is installed. For application cards, slot_# is any integer between 1 and 16. The following is a sample output for this command to monitor the card in chassis slot 8:

```
Card 8:
  Card Usable : Yes
  Card Tests  : Pass
  Boot Mode   : Normal
```

show card info *slot_#*

The following is a sample output for this command issued to monitor the card in chassis slot 8:

```
Card 8:
    Slot Type                       : SMC
    Card Type                       : System Management Card
    Operational State               : Active
    Last State Change               : Thursday January 27 16:00:32 EST 2008
    Administrative State            : Enabled
    Card Lock                       : Locked
    Reboot Pending                  : No
    Upgrade In Progress             : No
    Card Usable                     : Yes
    Single Point of Failure : No
    Attachment                      : 24 (System Processor I/O Card)
    Attachment                      : 25 (System Processor I/O Card)
    Temperature                     : 24 C (limit 101 C)
    Voltages:                       : Good
    Card LEDs                       : Run/Fail: Green | Active: Green | Standby: Off
    System LEDs                     : Status: Green | Service: Off
    CPU 0                           : Kernel Running, Tasks Running
```

If any of this information appears to be erroneous, such as the operational state or an LED state, check for any of the SNMP alarms listed in Using SNMP Traps, on page 214.

Using SNMP Traps

The system supports SNMP traps that are triggered when conditions indicate the need to replace an application card. The system provides the traps listed in the table below.

Table 83: SNMP Traps for Application Cards

SNMP Trap	Description
starCardVoltageFailure	A voltage regulation failure has been detected in a card.
starCardBootFailed	A card has failed to start up properly. The card is not operational.
starCardFailed	The card has failed and is no longer operational.
starCardSWFailed	An unrecoverable software error has occurred on the card.
starCardPSCMigrateStart	A packet processing card migration operation has begun. The first varbind identifies the packet processing card whose tasks are being migrated from; the second varbind identifies the packet processing card where the tasks are being migrated to. If a migration is taking place, it is likely that there is a problem with the original packet processing card.

SNMP Trap	Description
starCardPSCMigrateComplete	A packet processing card migration operation has successfully completed. The first varbind identifies the packet processing card whose tasks are being migrated from; the second varbind identifies the packet processing card to which the tasks are being migrated.
starCardPSCMigrateFailed	A packet processing card migration operation has failed. The first varbind identifies the packet processing card whose tasks are being migrated from; the second varbind identifies the packet processing card to which the tasks are being migrated.
starCardSMCSwitchoverStart	An SMC switchover operation has begun. The first varbind identifies the SMC whose tasks are being switched from; the second varbind identifies the SMC where the tasks are being switched to. If a migration is taking place, it is likely that there is a problem with the original SMC.
starCardSMCSwitchoverComplete	An SMC Switchover has completed successfully. The starSlotNum varbind identifies the new primary SMC.
starCardSMCSwitchoverFailed	An SMC switchover operation has failed. The first varbind identifies the SMC whose tasks are being switched from; the second varbind identifies the SMC to which the tasks are being switched.

If any of the above traps have been generated, it is likely that an application card needs to be replaced.

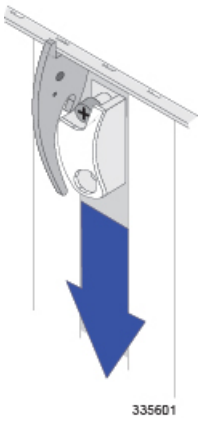
Removing the Application Card

This section describes how to remove an application card.

Important Before you remove and replace an application card on an active system, refer to the *System Administration Guide* for instructions on how to migrate or switch processes and services to a redundant (standby) card.

Step 1 Use a Phillips #2 screwdriver to loosen the screws at the top and bottom of the failed application card's front panel.

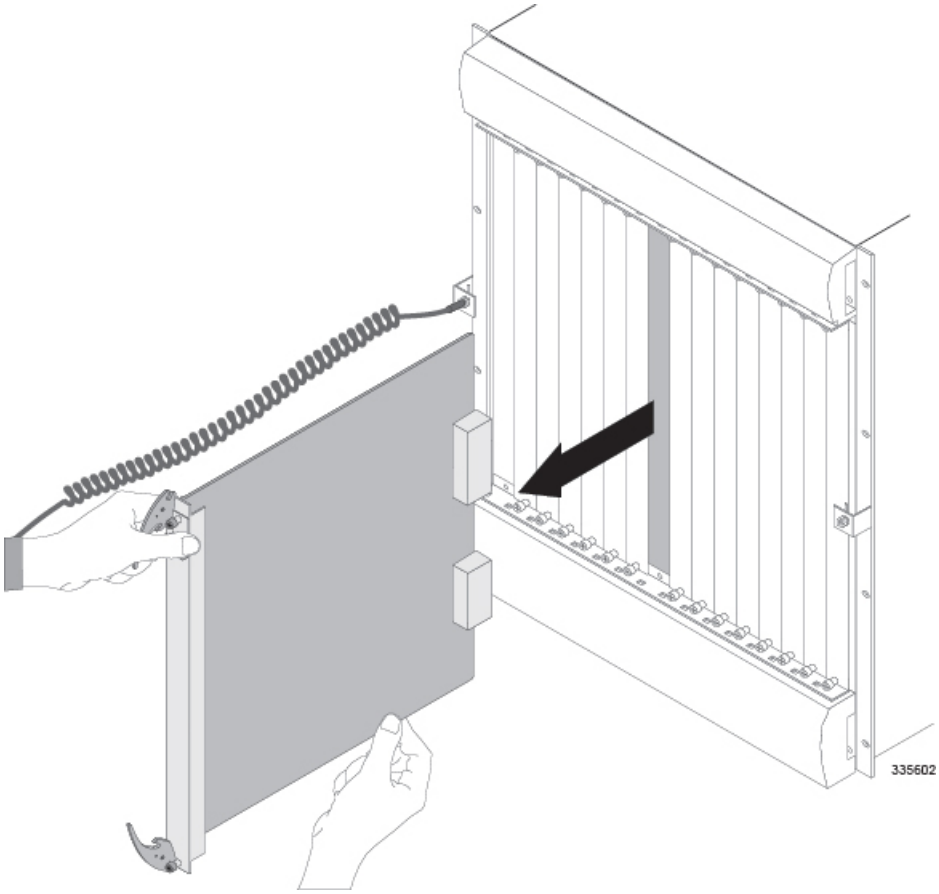
Step 2 Slide the interlock switch on the front panel of the application card downward.



Caution To minimize the risk of data loss, ensure that all LEDs on the packet processing card are Off (extinguished) and that SMCs have stopped blinking prior to removing the card from the chassis.

Step 3 Pull the ejector levers outward, firmly and straight, until the card is unseated from the chassis.

Step 4 Holding the card by its ejector levers, gently slide the card out of the chassis by pulling the card toward you.



Caution Do not leave chassis slots uncovered for extended periods of time. This reduces airflow through the chassis and could cause it to overheat. Make sure a card or a blanking panel is installed in every chassis slot at all times.

Step 5 Proceed to Installing the Application Card, on page 217.

Important If the card just removed from the chassis was an SMC, proceed to Replacing the CompactFlash on an SMC, on page 220.

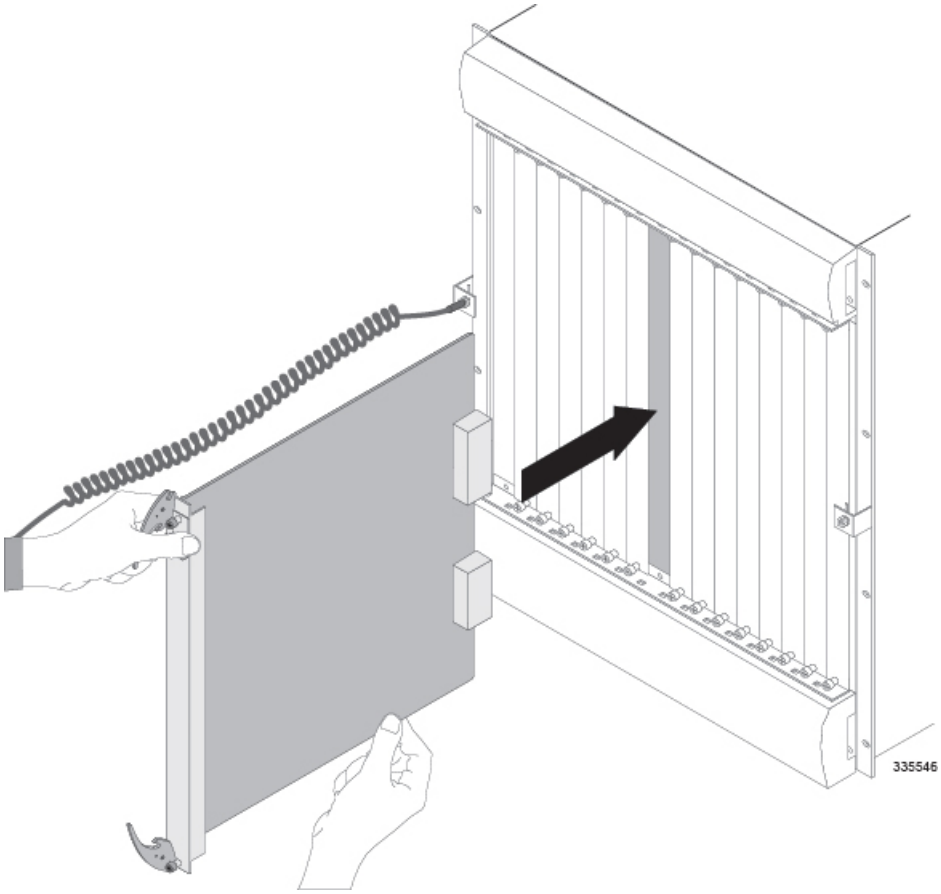
Installing the Application Card

This section describes how to install an application card.

Step 1 Slide the interlock switch on the card fully downward. Flip the ejector levers outward and away from the card's faceplate.

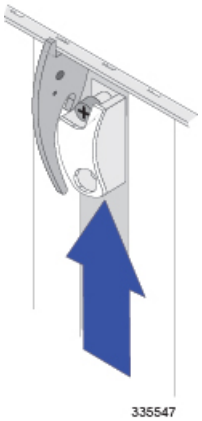
Step 2 Holding the card by its ejector levers, align the card with the upper and lower card guides of the appropriate chassis slot and gently slide the card into the slot until the levers touch the chassis frame.

Caution Take extra caution when installing packet processing cards. These cards contain heat sinks that could become loose or damaged if they come into contact with an adjacent card while the packet processing card is being inserted in the chassis slot.



Step 3 Push the ejector levers inward firmly and straight until the card is firmly seated in the chassis midplane and the ejector levers can be pushed in no further. Press firmly on the card's faceplate to ensure that it is fully seated. The card's front panel should be flush against the chassis' upper and lower card mounts for the slot.

Step 4 Slide the interlock switch on the front panel of the application card upward to lock the ejector tab in place. The flange on the left-side of the interlock switch prevents movement of the ejector tab when raised completely.



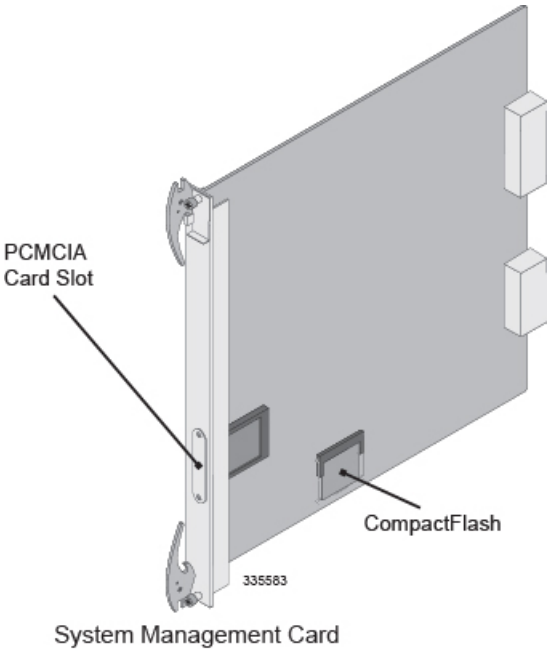
Important You must slide the interlock switch upward before securing the card's top screw to the mounting rail.

Step 5 Use a Phillips #2 screwdriver to tighten the screws at the top and bottom of the application card's front panel to secure the card.

Replacing the CF Memory Card on SMCs

SMC cards ship with a CompactFlash (CF) memory card that stores configuration files, software images, and session capacity/feature licensing keys for the system. The following figure displays the location of the CompactFlash memory card on the SMC.

Figure 62: Location of CompactFlash Card



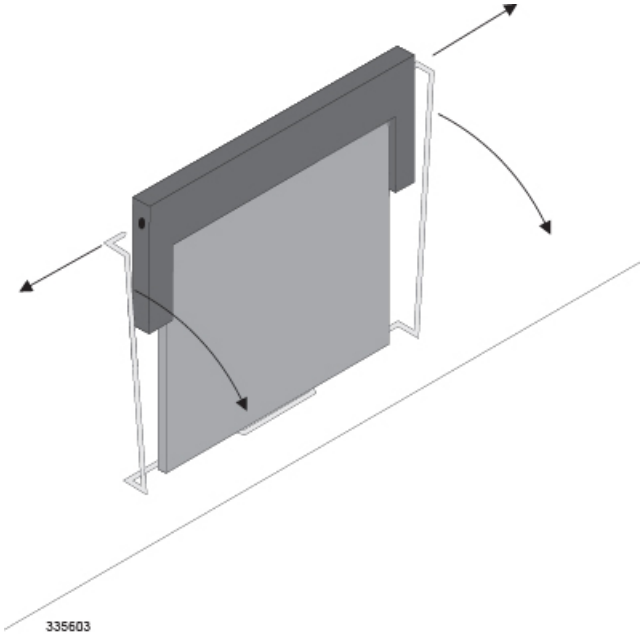
In the event of an SMC hardware failure, you must remove the CompactFlash from the failed card and install it on the replacement SMC. This ensures that the proper software image, configuration files, and license keys are loaded as the system boots.

Caution To reduce the risk of damage, handle the CompactFlash memory card only when necessary as part of the maintenance process.

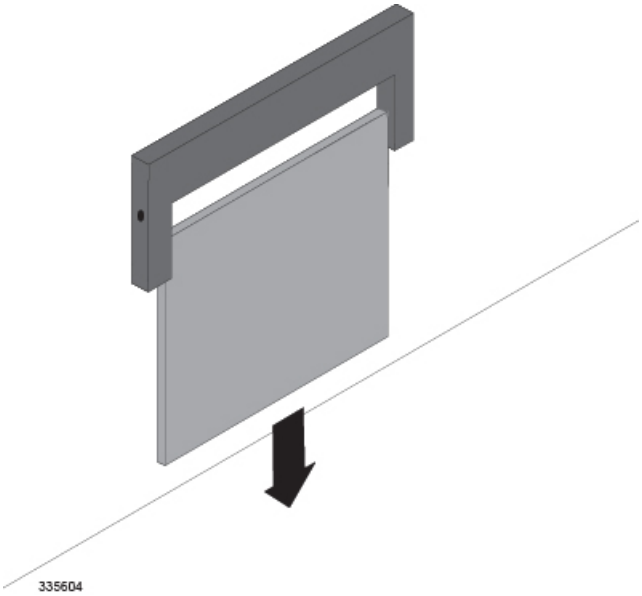
Replacing the CompactFlash on an SMC

This section provides instructions for the removal of the CompactFlash card from the failed SMC and its safe insertion in the replacement SMC.

Step 1 On the failed SMC, remove the card retainer clip that secures the CompactFlash module in the socket by pulling the ends of the card retainer clips out and away from the socket.

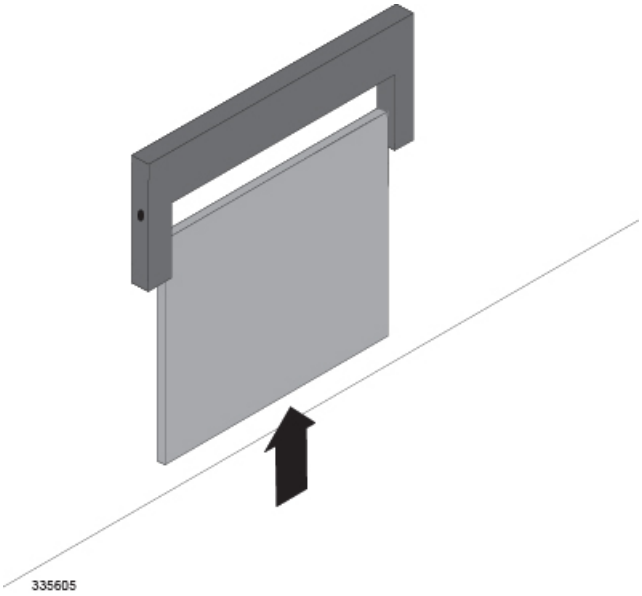


Step 2 Gently pull the module out of the socket.



Step 3 Repeat step 1 and step 2 to remove the module on the replacement SMC.

Step 4 Gently insert the module removed in step 1 into the socket on the replacement SMC.



Step 5 Replace the card retainer clip to secure the CompactFlash module in place.

Step 6 Proceed to Installing the Application Card, on page 217 for instructions on installing the replacement SMC.

What to do with the Failed Application Card

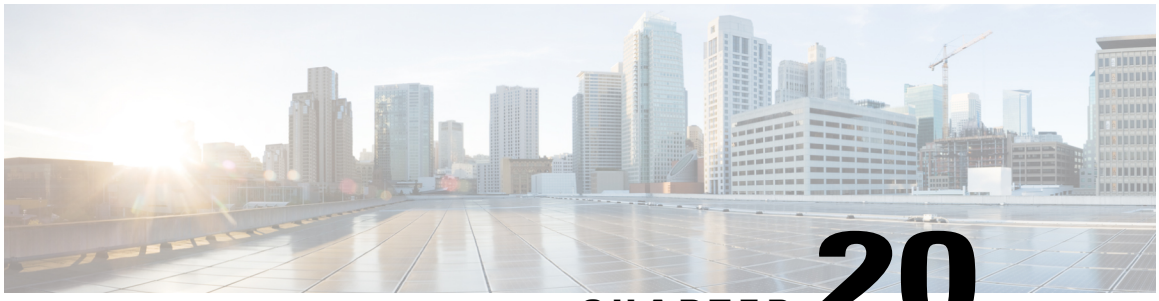
If the failed application card is still under warranty, return it to the vendor for repair.

If the failed application card is out of warranty, contact Cisco to determine if it can be sent in for repair at an additional cost.

Important Disposal of this product should be performed in accordance with all national laws and regulations.

Refer to the support area of http://www.cisco.com for up-to-date product documentation pertaining to installation, configuration, and maintenance. A valid username and password is required to use this site. Please contact your local sales or service representative for additional information.

Important For additional information on the RMA process, see the *RMA Shipping Procedures* appendix.



CHAPTER 20

Replacing Line Cards

This chapter provides information on replacing a failed line card.

Caution During installation, maintenance, and/or removal, wear a grounding wrist strap to avoid ESD damage to the components. Failure to do so could result in damage to sensitive electronic components and potentially void your warranty.

This chapter includes the following sections:

Determining Whether a Line Card has Failed

There are several ways the chassis indicates a line card failure. The first indicator is that the Status LED on the System Management Card (SMC) turns red to indicate the failure of a chassis component. Another is that the Run/Fail LED turns red or turns off on a line card that has a problem.

If you see either of these indicators, use the CLI or check the Simple Network Management Protocol (SNMP) traps to determine the nature of the problem.

Using the CLI

Enter the following CLI commands in Exec mode to monitor line cards:

show card diag *slot_#*

slot_# is the chassis slot number in which a particular card that you wish to monitor is installed. For line cards, *slot_#* would is an integer between 17 and 48. The following is a sample output for this command issued to monitor the card in chassis slot 24:

```
Card 24:
    Card Usable                     : Yes
    Card Tests                      : Pass
```

show card info *slot_#*

Important Use the upper slot number to specify the location of an XGLC. Slot numbering for other installed half-height cards is maintained: 17 to 32 and 33 to 48, regardless of the number of installed XGLCs.

```
Card 24:
    Slot Type               : SPIO
    Card Type               : Switch Processing I/O Card
    Operational State       : Active
    Redundancy Mode         : Port Mode
    Last State Change       : Thursday January 27 16:28:49 EST 2011
    Administrative State    : Enabled
    Card Lock               : Locked
    Halt Issued             : No
    Reboot Pending          : No
    Upgrade In Progress     : No
    Card Usable             : Yes
    Single Point of Failure : No
    Attachment              : 8 (Switch Management Card)
    Temperature             : 32 C (limit 85 C)
    Voltage:                : Good
    Card LEDs               : Run/Fail: Green | Active: Green | Standby: Off
```

If any of the above information appears to be erroneous such as the operational state or an LED state, check for any of the SNMP alarms listed in Using SNMP Traps, on page 224.

Using SNMP Traps

The system supports SNMP traps that are triggered for conditions that may indicate the need to replace a line card. The system provides the traps listed in the table below.

Table 84: SNMP Traps for Line Cards

SNMP Trap	Description
starCardVoltageFailure	A voltage regulation failure has been detected in a card.
starCardBootFailed	A card has failed to start up properly. The card is not operational.
starCardFailed	The card has failed and is no longer operational.
starCardSWFailed	An unrecoverable software error has occurred on the card.
starCardRCCFailed	The RCC has failed.

Removing the Line Card

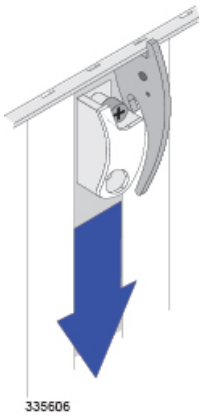
This section describes how to remove a line card.

Important Before removing and replacing a line card on an active system, refer to the *System Administration Guide* for instructions on how to switch services to a redundant (standby) card.

Step 1 Detach any cables that are attached to the line card. The end of each cable should be labelled with its destination. Replace any missing labels prior to removal.

Step 2 Use a Phillips #2 screwdriver to loosen the screws at the top and bottom of the line card's front panel.

Step 3 Slide the interlock switch on the front panel of the line card downward.

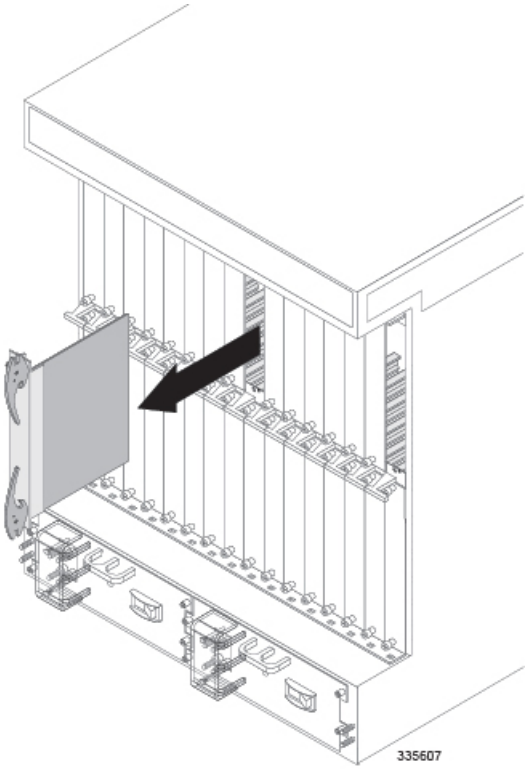


Caution To avoid damaging the card's interlock switch, ensure that it is completely down before proceeding.

To minimize the risk of data loss, ensure that all LEDs on the line card are Off (extinguished) prior to removing the card from the chassis.

Step 4 Pull the ejector levers outward, firmly and straight, until the card is unseated from the chassis.

Step 5 Holding the card by its ejector levers, gently slide the card out of the chassis.

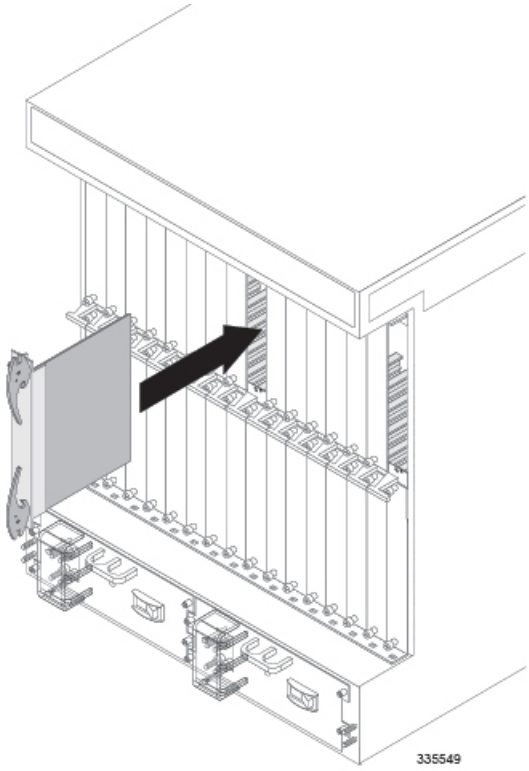


Caution Do not leave chassis slots uncovered for an extended period of time. This reduces airflow through the chassis and could cause it to overheat. Make sure that there is a card or blanking panel in every chassis slot at all times.

Installing the Line Card

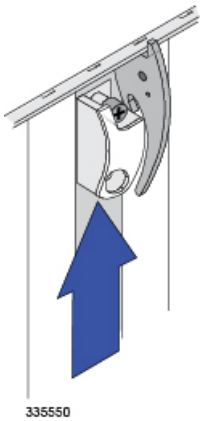
Step 1 Slide the interlock switch on the card fully downward. Flip the ejector levers outward and away from the card's faceplate.

Step 2 Hold the card by its ejector levers and align it with the upper and lower card guides of the chassis slot. Gently slide the card into the slot until the levers touch the chassis frame.



Step 3 Push the ejector levers inward firmly and straight until the card is firmly seated in the chassis midplane and the ejector levers can be pushed in no further. Press firmly on the card's faceplate to ensure that it is fully seated. The card's front panel should be flush against the chassis' upper and lower card mounts for the slot.

Step 4 Slide the interlock switch on the front panel of the line card upward to lock the ejector tab in place. The flange on the left-side of the interlock switch prevents movement of the ejector tab when raised completely.



Important You must slide the interlock switch upward before securing the card's top screw to the mounting rail.

Step 5 Use a Phillips #2 screwdriver to tighten the screws at the top and bottom of the line card's front panel to secure the card to the chassis.

Step 6 Refer to the destination label on each cable and re-attach the cables to the line card. Refer to the following table to locate the chapter of this guide that provides information and instructions on cabling the line card.

Line Card	Chapter
Switch Processor Input/Output (SPIO)	Cabling the Switch Processor Input/Output Line Card
Fast Ethernet Line Card (FLC2)	Cabling the Ethernet 10/100 Line Card
Gigabit Ethernet Line Card (GLC2)	Cabling the Gigabit Ethernet Line Cards
Quad Gigabit Ethernet Line Card (QGLC)	
10 Gigabit Ethernet Line Card (XGLC)	
Optical (ATM) Line Card [OLC2]	Cabling the Optical (ATM) Line Card
Channelized Line Card (CLC2)	Cabling the Channelized Line Card

What to do with the Failed Line Card

If the failed line card is still under warranty, return it to the vendor for repair.

If the failed line card is out of warranty, contact Cisco to determine if you can send it in for repair at an additional cost.

Important Disposal of this product should be performed in accordance with all national laws and regulations

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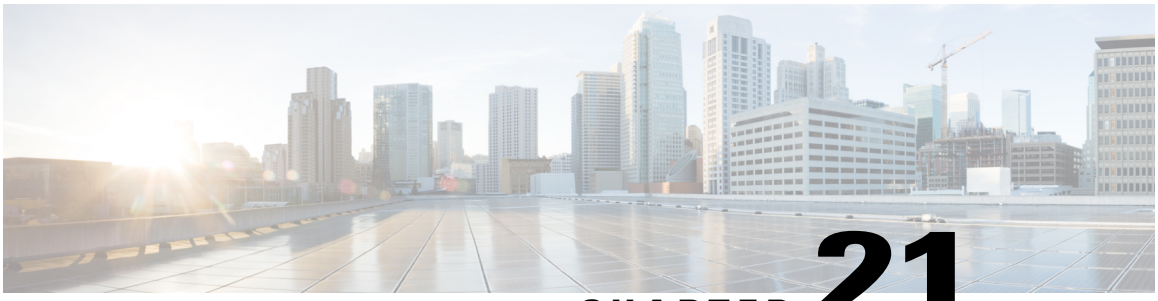
Important For additional information on the RMA process, see the *RMA Shipping Procedures* appendix.



CHAPTER 21

Technical Specifications

This chapter lists physical dimensions, power specifications, mounting requirements and interface specifications for ASR 5000 system components.

It includes the following sections:

Physical Dimensions

The ASR 5000 can be mounted in any standard (EIA-310-D, IEC 60297) 19-inch (482.6 mm) equipment cabinet or telecommunications rack. The table below lists the dimensions for the chassis and each component that can be placed within the chassis.

Table 85: Physical Dimensions - ASR 5000 Chassis and Components

Component	Height	Width	Depth
Chassis	24.50 in. (62.23 cm)	17.5 in. (44.45 cm)	24.0 in. (60.96 cm)
Application Card	17.05 in. (46.31 cm)	1.01in. (2.56 cm)	14.10 in. (35.81cm)
Line Card (half-height)	8.59 in. (21.82 cm)	1.01in. (2.56 cm)	5.24 in. (13.31cm)
XGLC (full-height)	17.48 in. (44.40 cm)	1.01in. (2.56 cm)	5.24 in. (13.31cm)
Fan Tray (Lower)	2.50 in. (6.35 cm)	16.25 in. (41.27 cm)	17.25 in. (43.82 cm)
Fan Tray (Upper)	2.875 in. (7.30 cm)	16.25 in. (41.27 cm)	19.375 in. (49.21 cm)

Component	Height	Width	Depth
Power Filtering Unit (PFU)	3.6 in. (9.14 cm)	8.25 in. (20.96 cm)	5.12 in. (13.00 cm)

Weights

The following table identifies the maximum weights for fully-loaded systems—cards installed in all slots and all other components installed.

Table 86: ASR 5000 Component Weights

Component	Weight
Chassis	
Empty	65 lbs. (29.48 kg)
As Shipped (empty chassis with PFUs, fan trays, bezels and blanking panels)	160 lbs. (72.57 kg)
Shipping (as shipped chassis, shipping container and packing materials)	251 lbs. (113.85 kg)
Fully loaded (as shipped chassis with all slots filled with cards)	307 lbs. (139.25 kg)
Packet Processing Cards	
Packet Services Card 2 (PSC2)	11.50 lbs. (5.22 kg)
Packet Service Card 3 (PSC3)	11.0 lbs. (4.95 kg)
Switch Process I/O Card (SPIO)	1.25 lbs. (0.57 kg)
System Management Card (SMC)	10.00 lbs. (4.54 kg)
Line Cards	
Channelized Line Card 2 (CLC2)	1.25 lbs. (0.57 kg)
Fast Ethernet (10/100) Line Card (FLC2)	1.00 lbs. (0.45 kg)
Gigabit Ethernet Line Card (GLC2)	1.00 lbs. (0.45 kg)
Optical Line Card (OLC2)	1.25 lbs. (0.57 kg)
Quad Gigabit Ethernet Line Card (QGLC)	1.25 lbs. (0.57 kg)

Component	Weight
Redundancy Crossbar Card (RCC)	1.00 lbs. (0.45 kg)
10 Gigabit Ethernet Line Card (XGLC)	2.25 lbs. (1.02 kg)

Power Specifications

The following table provides essential power specifications for the chassis and all associated cards within the system.

Table 87: Chassis Power Requirements

Characteristic	Value
Input Voltage	Maximum range: -40VDC to -60VDC Nominal range: -48VDC to -60 VDC
TUV Rated Peak Current Load	165A @ -48 VDC
Maximum Peak Power Load	5760W
Chassis Maximum Power Load	800W
Line Card (rear-installed) Maximum Power Load	**SPIO:** 15W **FLC2:** 13.5W **GLC2:** 10.5W **QGLC:** 15W **XGLC:** 25W **OLC2:**23W **CLC2:** 23W **RCC:** 20W
Application Card (front-installed) Maximum Power Load	**SMC:** 130W **PSC2:** 325W **PSC3:** 330W
Power Feed	**PFU:** 160A @ -48VDC

Estimating Power Requirements

Use the following formula to estimate total power consumption for each deployed chassis.

Note Use these estimates as a guide. Obey all cable and power safety regulations and assure that they are sufficient for your system's requirements.

(Total Application Card Maximum Power Load) + (Total Line Card Maximum Power Load) + Chassis Maximum Power Load = Total Power Consumption

For example, the calculation for estimating the power required for an ASR 5000 installation with (3) PSC2s, (2) SMCs, (2) SPIOs, (2) RCCs, and (4) GLC2s would be:

(325W x 3) + (130W x 2) + (20W x 2) + (13.5W x 4) + 800W = 2129W

Mounting Requirements

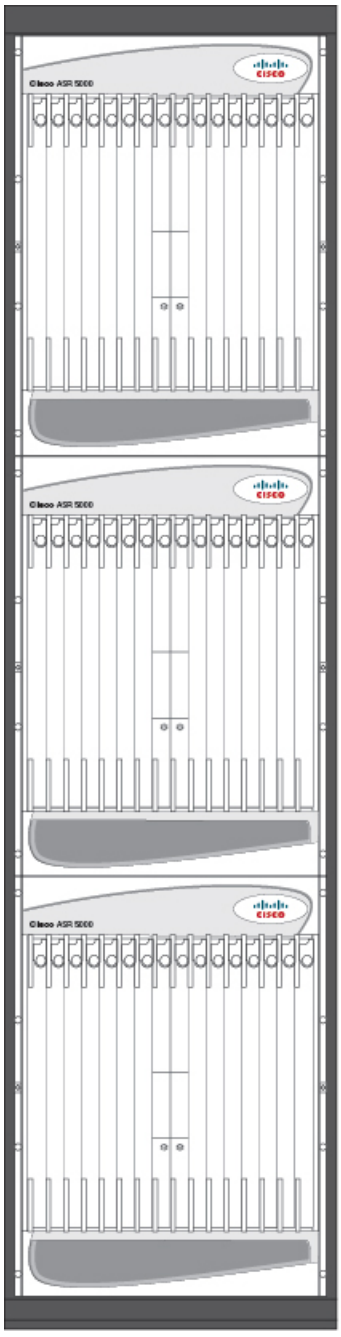
Each 24.5 in. (62.23 cm.) height chassis requires 14 Rack Units (RUs) of space. You can mount the system into any 19-inch (482.6 mm) equipment rack or telco cabinet with the mounting brackets supplied with the chassis. Additional hardware (not supplied), such as extension brackets, may be used to install the chassis in a standard 23-inch (584.2 mm) cabinet or rack. Both front and mid-mount installations are possible, depending on the position of the mounting brackets on the chassis.

You can mount a maximum of three ASR 5000 chassis in a 2- or 4-post equipment rack or telco cabinet, provided that all system cooling and ventilation requirements are met. Three stacked chassis will occupy a minimum of 42 RUs.

Caution When planning chassis installation, ensure that equipment rack or cabinet hardware does not hinder air flow at any of the intake or exhaust vents. Also, make sure that the rack/cabinet hardware, as well as the ambient environment, allow the system to function within the required limits. For more information, refer to *Environmental Specifications* in this guide.

Rack mounting requires the use of industry-standard (EIA-310-D, IEC 60297) equipment racks and cabinets, as well as supplier-recommended fasteners. The following figure depicts how three chassis can be mounted in a 42 RU equipment rack.

Figure 63: Three ASR 5000 Chassis in a 42 RU Rack



Interface Specifications

The table below lists the line card interfaces for use within the chassis.

Table 88: Line Card Interfaces

Card Type	Port	Quantity	Connector Type	Notes
SPIO	Console	1	RJ-45, RS-232 serial	—
	Console Cable Assembly	1	RJ-45 to DB-9	—
	Gigabit Ethernet	2	Optical SFP	—
	10/100 Mbps	2	RJ-45, Ethernet	1
	CO Alarm	1	10-pin, Molex	—
	CO Alarm cable Assembly	1	Dual 10-pin Molex to barrier terminal	—
	BITS BNC (optional)	1	BNC, coaxial cable	2
	BITS 3-Pin (optional)		3-pin, wire-wrap	
FLC2	10/100 Ethernet	8	RJ-45, Ethernet	1
GLC2	Gigabit Ethernet	1	SFP-SX	3
			SFP-LX	
			SFP-T, copper RJ-45	
QGLC	Gigabit Ethernet	4	SFP-SX	4
			SFP-LX	
			SFP-T, copper RJ-45	
XGLC	10 Gigabit Ethernet	1	10GBase-SR, SFP+	5
			10GBase-LR, SFP+	
OLC2	ATM/POS OC-3 SM IR-1	1	Single-mode Fiber, LC duplex	—
	ATM/POS OC-3 Multi-Mode		Multi-mode Fiber, LC duplex	
CLC2	Channelized (STM-1/OC-3) SM IR-1	1	Single-mode Fiber, LC duplex	—
	Channelized (STM-1/OC-3)Multi-Mode		Multi-mode Fiber, LC duplex	

Notes

1 An RJ-45 Ethernet interface may have more than one pin-out configuration, depending on the type of cable used.

2 An SPIO may be equipped with one type of BITS connector – BNC or 3-pin.
3 A Small Form-factor Pluggable transceiver is supplied with the GLC2 based on the customer-specified interface type.
4 Four Small Form-factor Pluggable transceivers are supplied with the QGLC based on the customer-specified interface type.
5 An enhanced SFP (SFP+) transceiver is supplied with the XGLC based on the customer-specified interface type.

SPIO Card Interfaces

Each interface on the SPIO card is described below. In each accompanying figure, the interface is shown in the same orientation as the way it appears on the card.

Console Port

The Console port is an RJ-45 RS-232 interface used to access the command line interface. The interface communicates at a baud rate of 9600 to 115,200 bps (115.2 Kbps). The default is 115,200 bps.

Table 89: SPIO Console RJ-45 Pinout

Pin	Signal Description	Signal Type
1	Clear to Send (CTS)	Input
2	Data set Ready (DSR)	Input
3	Receive Data (RX)	Input
4	Signal Ground (SGND)	N/A
5	Ready to Send (RTS)	Output
6	Transmit Data (TX)	Output
7	Data Carrier Detect (DCD)	Input
8	Data Terminal Ready (DTR)	Output

Console Cable Specifications

SPIO cards are shipped with a console cable assembly that includes a 7-foot (2 meter) serial cable with RJ-45 connectors on each end, and an RJ-45-to-DB-9 adapter. Use the RJ-45-to-DB-9 adapter to connect the console

cable to a terminal server or terminal emulation device such as a laptop computer. The cable's pin-out is provided in the following figure and table.

Figure 64: SPIO Console Cable Assembly

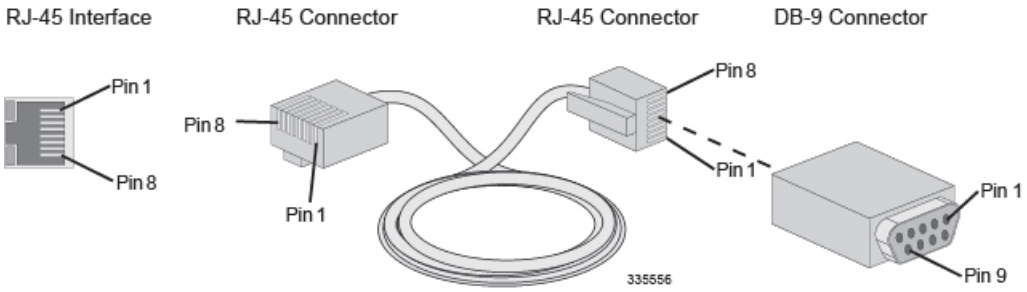


Table 90: RJ-45 to DB-9 Cable

Signal Description	Signal Type	RJ-45 Pin	DB-9 Pin	Signal
Clear to Send (CTS)	Input	1	7	RTS
Data set Ready (DSR)	Input	2	4	DTR
Receive Data (RxD)	Input	3	3	TxD
Signal Ground (SGND)	N/A	4	5	SGND
Ready to Send (RTS)	Output	5	8	CTS
Transmit Data (TxD)	Output	6	2	RxD
Data Carrier Detect (DCD)	Input	7	1	DCD
Data Terminal Ready (DTR)	Output	8	6	DSR

To construct a RJ-45 to DB-25 cable for modem connectivity, refer to the table that follows.

Table 91: RJ-45 to DB-25 Cable

Signal Description	Signal Type	RJ-45 Pin	DB-25 Pin	Signal
Clear to Send (CTS)	Input	1	5	CTS
Data set Ready (DSR)	Input	2	6	DSR
Receive Data (RX)	Input	3	3	RxD
Signal Ground (SGND)	-	4	7	SGND

Signal Description	Signal Type	RJ-45 Pin	DB-25 Pin	Signal
Ready to Send (RTS)	Output	5	4	RTS
Transmit Data (TX)	Input	6	2	TxD
Data Carrier Detect (DCD)	Output	7	8	DCD
Data Terminal Ready (DTR)	Output	8	20	DTR

Fiber SFP Interface

The fiber Small Form-factor Pluggable (SFP) interface has two host connectors that transmit and receive data.

Table 92: Fiber SFP Interface Transmit and Receive Levels

Signal	Level
Max TX:	0 dBm
Min TX:	-9.5 dBm
Max RX:	0 dBm (saturation average power)
Min RX:	-20 (typical) / -17 (max.) dBm (sensitivity average power)

10/100/1000 Mbps RJ-45 Interface

The two RJ-45 interfaces are auto-sensing 10/100/1000 Ethernet (10Base-T/100Base-TX/1000Base-T) that require unshielded twisted pair (UTP) copper cable.

Table 93: SPIO RJ-45 Ethernet Interface Pinouts

Pin	10Base-T 10Mbps Cat3	100Base-Tx 100Mbps Cat5	1000Base-Tx 1Gbps Cat5+
1	TX+	TX+	BI DA+
2	TX-	TX-	BI DA-
3	RX+	RX+	BI DB+
4	Not used	Not used	BI DC+
5	Not used	Not used	BI DC-
6	RX-	RX-	BI DB-

Pin	10Base-T 10Mbps Cat3	100Base-Tx 100Mbps Cat5	1000Base-Tx 1Gbps Cat5+
7	Not used	Not used	BI DD+
8	Not used	Not used	BI DD-

Central Office Alarm Interface

The Central Office (CO) alarm interface is a 10-pin Molex connector supporting three dry-contact relay switches. The three normally closed (NC) relays can support normally open (NO) or NC devices.

Table 94: SPIO CO Alarms Interface Pinout

Pin	Signal
1	Major Alarm - Normally closed
2	Major Alarm - Common
3	Major Alarm - Normally open
4	Minor Alarm - Normally closed
5	Minor Alarm - Common
6	Minor Alarm - Normally open
7	Critical Alarm - Normally closed
8	Critical Alarm - Common
9	Critical Alarm - Normally open
10	Not used

The 8-foot (2.4 meter) CO alarm cable shipped with the chassis supports redundant SPIO card installations. This "Y" cable has two Molex connectors on one end that are keyed to fit into the CO Alarm interfaces in one direction only. Each connector mates with one of the side-by-side SPIO cards. On the opposite end is a 9-pin terminal block that you can mount to the telco cabinet or equipment rack frame.

The following figure and table display this cable assembly and its pinouts.

Figure 65: SPIO CO Alarms Cable Assembly

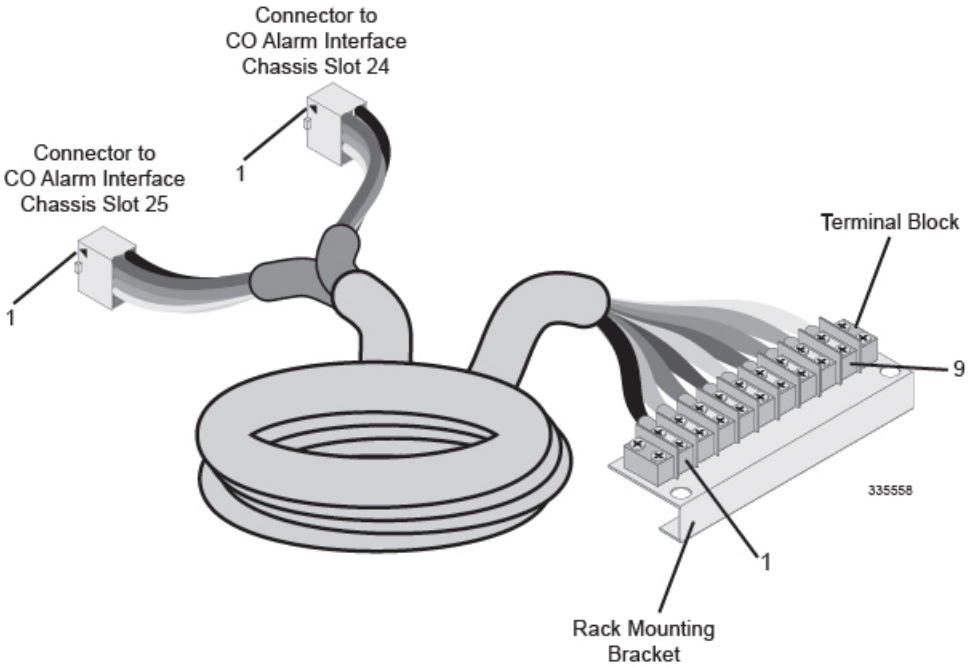


Table 95: CO Alarms Cable Pinout

CO Alarms IF Pin No.	Cable Wire Color	Cable Terminal Block Position No.	Signal
1	Black	1	Major Alarm - Normally closed
2	Orange	2	Major Alarm - Common
3	Red	3	Major Alarm - Normally open
4	Brown	4	Minor Alarm - Normally closed
5	Yellow	5	Minor Alarm - Common
6	Green	6	Minor Alarm - Normally open
7	Blue	7	Critical Alarm - Normally closed
8	Violet	8	Critical Alarm - Common
9	Gray	9	Critical Alarm - Normally open
10	Not wired	Not equipped	Not applicable

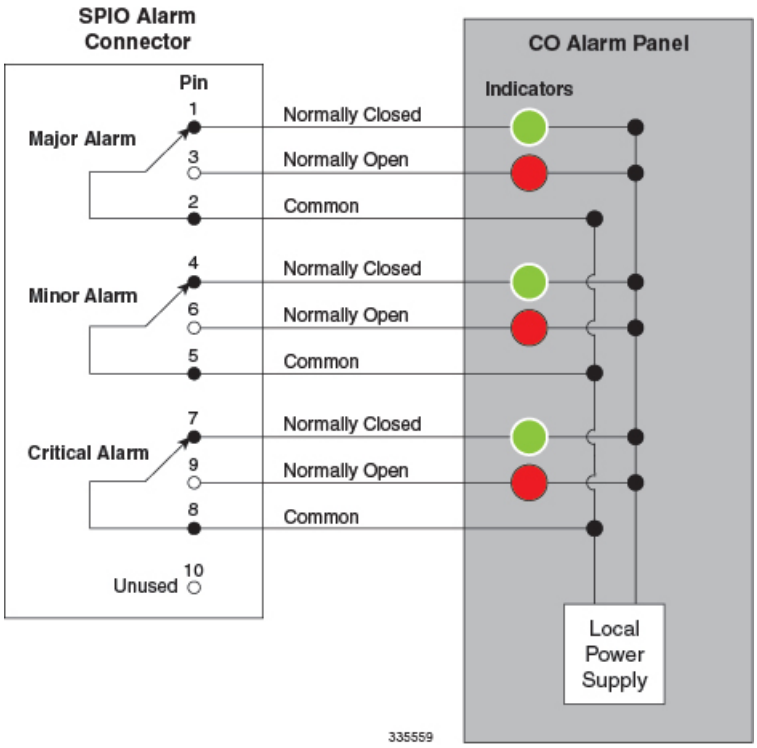
Electrical Characteristics

Each of the three dry-contact relay switches is rated to support a maximum switching current of 1A@30VDC. The relay contacts should not directly connected to high current devices such as sirens and flashing lamps.

Central Office Alarm Wiring Example

The following figure depicts how the dry-contact relays can each control up to two external alarm indicators. In this example, the CO alarm interface is connected to a CO Alarm Panel, where green LEDs are wired to indicate normal operation, and red LEDs are wired to indicate an alarm condition.

Figure 66: CO Alarm Interface Schematic



With all relays de-energized (normally closed), the green LED is illuminated. If an alarm relay is energized, the NO (normally open) contact closes and the red LED is illuminated.

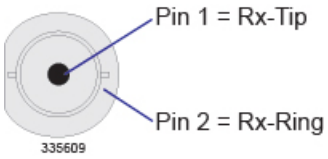
BITS Timing Interface

Important External Building Interface Timing Supply (BITS) timing is an alternative to using clock signals derived from an ATM port on an OLC/OLC2, or an ANSI SONET STS-3/SDH STM-1 port on a CLC/CLC2 to synchronize line card timing. (Line-derived clocking requires that the SPIO be equipped with the optional Stratum 3 clock module.)

BITS E1 BNC Interface

The BNC version of the SPIO employs a 75-ohm coaxial BNC connector that accepts an analog E1 BITS signal from which the SPIO derives a 2048 kHz clock. The following figure shows the BITS BNC timing interface.

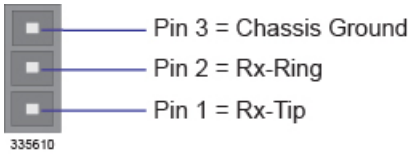
Figure 67: SPIO E1 BITS BNC Pinout



BITS T1 3-Pin Interface

The 3-pin version of the SPIO employs a wire-wrap connector that accepts a T1 (DS1) BITS data signal (all ones) from which the SPIO derives a 1544 kHz clock. The following figure shows the BITS 3-wire timing interface wire-wrap pin-out.

Figure 68: SPIO T1 BITS Wire-Wrap Pinout



Fast Ethernet Line Card (FLC2) Interfaces

Each of the eight RJ-45 interfaces available on the FLC2 supports auto-sensing 10Base-Tx or 100Base-Tx Ethernet interfaces.

10/100 Mbps RJ-45 Interface

The RJ-45 interfaces on the Fast Ethernet line card support the following cable types and transfer rates.

Table 96: FLC2 RJ-45 Ethernet Pinouts

Pin	10Base-T 10Mbps Cat3	100Base-TX 100Mbps Cat5
1	TX+	TX+
2	TX-	TX-
3	RX+	RX+
4	na	na
5	na	na
6	RX-	RX-
7	na	na
8	na	na

Gigabit Ethernet Card (GLC2/QGLC) SFP Interfaces

1000Base-SX

The 1000Base-SX fiber SFP interface on the Gigabit Ethernet Card (GLC2) has one pair of fiber connectors. The Quad Gigabit Ethernet Card (QGLC) has four pairs.

Table 97: 100Base-SX Fiber Transmit and Receive Levels

Signal	Level
Max TX:	0 dBm
Min TX:	-9.5 dBm
Max RX:	0 dBm (saturation average power)
Min RX:	-20 (typical) / -17 (max.) dBm (sensitivity average power)

1000Base-LX Interface

The 1000Base-LX fiber SFP interface on the Ethernet 1000 LX line card has one pair of host connectors. The QGLC has four pairs.

Table 98: 1000Base-LX Fiber Transmit and Receive Levels

Signal	Level
Max TX:	0 dBm
Min TX:	-9.5 dBm
Max RX:	0 dBm (saturation average power)
Min RX:	-20 (typical) / -19 (max.) dBm (sensitivity average power)

1000Base-T

The 1000Base-T SFP copper interfaces on the GLC2 and QGLC line cards require unshielded twisted pair (UTP) copper CAT-5 cable with a bit error rate (BER) less than 10e-10. Pinouts for the RJ-45 Ethernet ports are shown in the table below.

Table 99: 1000Base-T RJ-45 Ethernet Copper Pinouts

Pin	1000Base-Tx 1Gbps Cat5+
1	BI DA+
2	BI DA-
3	BI DB+
4	BI DC+
5	BI DC-
6	BI DB-
7	BI DD+
8	BI DD-
RX = Receive Data TX = Transmit Data BI = BI directional data DA, DB, DC, DD = Data Pair A, B, C, and D	

10 Gigabit Ethernet Line Card (XGLC) SFP+

10GBase-SR

The 10GBase-SR fiber SFP+ interface on the XGLC has one pair of fiber connectors.

Table 100: 10GBase-SR Fiber Transmit and Receive Levels

Signal	Level
Max TX:	-1.0 dBm
Min TX:	-7.3 dBm
Max RX:	-1.0 dBm (saturation average power)
Min RX:	-11.1 (max.) dBm (sensitivity average power)

10 Base-LR Interface

The 10GBase-LR fiber SFP+ interface on the XGLC has one pair of host connectors.

Table 101: 10GBase-LR Fiber Transmit and Receive Levels

Signal	Level
Max TX:	0.5 dBm
Min TX:	-8.2 dBm
Max RX:	0.5 dBm (saturation average power)
Min RX:	-12.6 (max.) dBm (sensitivity average power)

Fiber ATM/POS OC-3 (OLC2) Multi-Mode Interface

Fiber ATM/POS OC-3 SM IR-1 Interface

The fiber-optic SFP interface on OLC2 Optical ATM Line Cards with the SM IR-1 interface has one pair of host connectors.

Table 102: OC-3 SM IR-1 Fiber Transmit and Receive Levels

Signal	Level
Max TX:	-8 dBm
Min TX:	-15 dBm
Max RX:	-8 dBm (saturation average power)
Min RX:	-28 (max.) dBm (sensitivity average power)

The fiber-optic SFP interface on OLC2 Optical ATM Line Cards with the multi-mode interface has one pair of host connectors.

Table 103: Multi-Mode Fiber Transmit and Receive Levels

Signal	Level
Max TX:	-14 dBm
Min TX:	-19 dBm
Max RX:	-12 dBm (saturation average power)
Min RX:	-30 (max.) dBm (sensitivity average power)

Channelized Line Cards

Channelized Line Card (CLC2) with Single-Mode Interface

The optical SFP interface on the 4-port CLC2 with the single-mode interface has four pairs of connectors that accept SFP transceivers.

Table 104: Single-Mode Fiber Transmit and Receive Levels

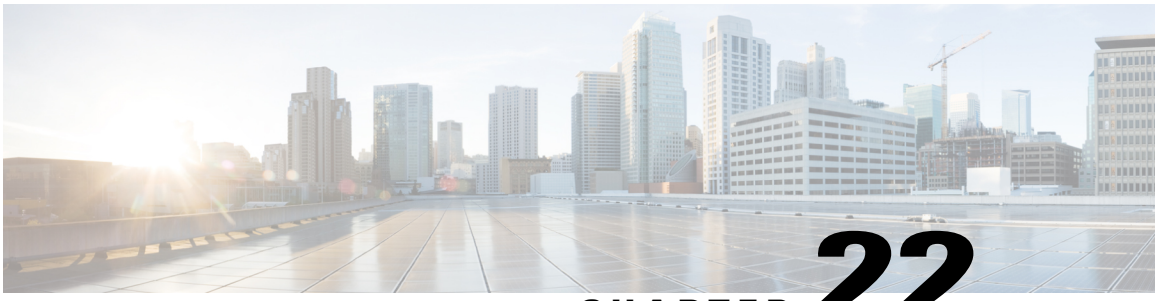
Signal	Level
Max TX:	-8 dBm
Min TX:	-15 dBm
Max RX:	-8 dBm (saturation average power)
Min RX:	-28 (max.) dBm (sensitivity average power)

Channelized Line Cards (CLC2) with Multi-Mode Interface

The fiber SFP interface on the 4-port CLC2 with the multi-mode interface has four pairs of connectors that receive SFP transceivers.

Table 105: Multi-Mode Fiber Transmit and Receive Levels 0

Signal	Level
Max TX:	-14 dBm
Min TX:	-19 dBm
Max RX:	-12 dBm (saturation average power)
Min RX:	-30 (max.) dBm (sensitivity average power)



CHAPTER 22

Safety, Electrical and EMC Certifications

This chapter lists FCC warnings, as well as safety, electrical and environmental certifications for the ASR 5000 system.

It includes the following sections:

Federal Communications Commission Warning

The ASR 5000 complies with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules and Regulations. Operation is subject to the following two conditions:

- This device must not cause harmful interference.
- This device must withstand any interference received, including interference that may cause undesired operation.

These limits provide reasonable protection against harmful interference when this equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio-frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio and television communications. Operation of this equipment in a residential area is likely to cause interference, in which case your organization is responsible for the expenses incurred to correct the interference.

Modifications to this product not authorized by Cisco could void the FCC approval and negate your authority to operate the product.

Important Shielded cables must be used with this unit to ensure compliance with the FCC Class A limits. Blanking panels must be installed in the chassis.

ICS Notice

This Class A digital apparatus complies with Canadian ICES-003.

Cet appareil numérique de la classe A est conforme à la norme NMB-003 du Canada.

Laser Notice

The lasers in this equipment are Class 1 devices. Class 1 laser devices are not considered to be hazardous.

Safety Certifications

The ASR 5000 complies with all safety certifications listed below.

- UL60950 - Standard for Safety for Information Technology Equipment, 3rd Edition
- European Union EN 60950 (CE Mark)

Electrical Certifications

The ASR 5000 complies with all electrical certifications listed below.

- Telcordia GR-1089-Core, Network Equipment-Building System (NEBS) Requirements: Electromagnetic Compatibility and Electrical Safety Criteria for Network Telecommunication Equipment
- FCC, Part 15 B, Class A Requirements for Non-residential Equipment
- ETSI EN 300 019
- ETSI 300 386
- ETSI/EN 300 386-2 Electrical Fast Transients
- SBC TP76200MP
- Taiwan - BMSI

Environmental Certifications

The ASR 5000 complies with all environmental certifications listed below.

- Telcordia GR-63-Core, Network Equipment-Building System (NEBS) Requirements: Physical Protection

- The chassis equipped with the 165A PFU is compliant to the European Union's RoHS Directive (Directive 2002/95/EC)
- Waste Electrical and Electronic Equipment (WEEE) Directive 2002/96/EC

Acoustic Noise

The maximum acoustic noise level for the ASR 5000 chassis is 76 dBA.

Caution The maximum acoustic noise level of the ASR 5000 exceeds 70 dBA.

Caution Maschinenlärminformations-Verordnung - 3. GPSGV, der höchste Schalldruckpegel beträgt 76 dB(A) gemäss EN ISO 7779.

Electromagnetic Compatibility (EMC) Compliance

Electromagnetic compatibility is the ability of electronic devices to operate as intended in proximity to other electronic devices or in the presence of electromagnetic fields. Unintentional radio frequency emissions from an electronic device and immunity of the device to radio frequency interference from other electromagnetic sources are included within electromagnetic compatibility.

Japan VCCI-A

The ASR 5000 has been registered for compliance with the Voluntary Council for Control of Interference, VCCI.

この装置は、クラスA情報技術装置です。この装置を家庭環境で使用すると電波妨害を引き起こすことがあります。この場合には使用者が適切な対策を講ずるよう要求されることがあります。 VCCI－A

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Korean EMC

Class A device (Broadcasting Communication Device for Office Use): This device obtained EMC registration for office use (Class A), and may be used in places other than home. Sellers and/or users need to take note of this.

A급 기기 (업무용 방송통신기기): 이 기기는 업무용(A급)으로 전자파적합등록을 한 기기이오니 판매자 또는 사용자는 이 점을 주의하시기 바라며, 가정외의 지역에서 사용하는 것을 목적으로 합니다.

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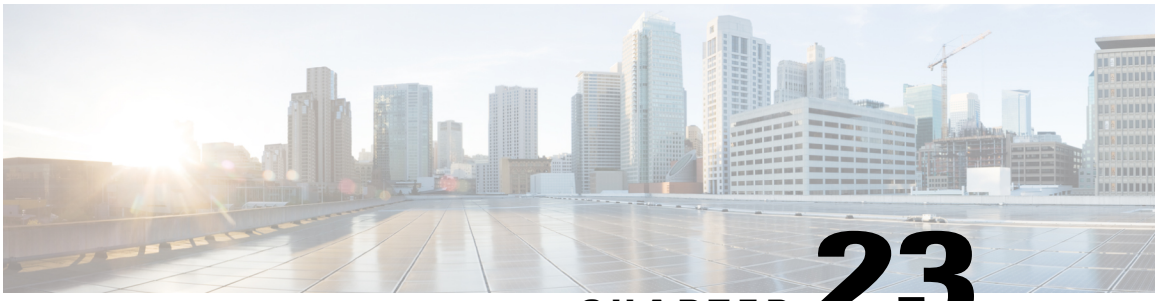


CHAPTER 23

Environmental Specifications

This chapter provides information related to environmental considerations and storage characteristics associated with the ASR 5000.

It includes the following sections:

Operating and Storage Parameters

Use the following information to plan your network installation for the ASR 5000 platform.

Table 106: Temperature, Humidity and Altitude Recommendations

Temperature	
Operating	0 degrees C to +55 degrees C (32 degrees F to +130 degrees F)
Storage	-40 degrees C to +70 degrees C (-40 degrees F to +158 degrees F)
Humidity	
Operating	20 to 80 percent non-condensing
Storage	10 to 95 percent non-condensing
Altitude	
Operating	197 ft. (60m) below to 13,123 ft. (4,000m) above sea level
Non-operating	197 ft. (60m) below to 49,212 ft. (15,000m) above sea level

Supported Environmental Standards

The system has been successfully tested against the following environmental standards:

- Operational Thermal, Operating Conditions - GR-63 Criteria [72, 73]
- Airborne Contaminants, Indoor Levels - GR-63 Criterion [125]
- Operational Thermal, Short-term Conditions - GR-63 Criteria [72, 73]
- Storage Environments, and Transportation and Handling - GR-63 Criteria [69-71, 107-109, 124]
- Earthquake Zone 4 - GR-63 Criteria [110-112, 114, 115, 117, 119]
- Airborne Contaminants, Outdoor Levels - GR-63 Criteria [126, 127]
- Altitude - GR-63 Criteria [74, 76]
- Thermal Heat Dissipation - GR-63 Criteria [77-79]
- Acoustic Noise - GR-63 Criterion [128]
- ESTI 300 019 - Environmental conditions and environmental tests for telecommunications equipment

Chassis Air Flow

Airflow within the ASR 5000 is designed per Telcordia recommendations to ensure the proper vertical convection cooling of the system.

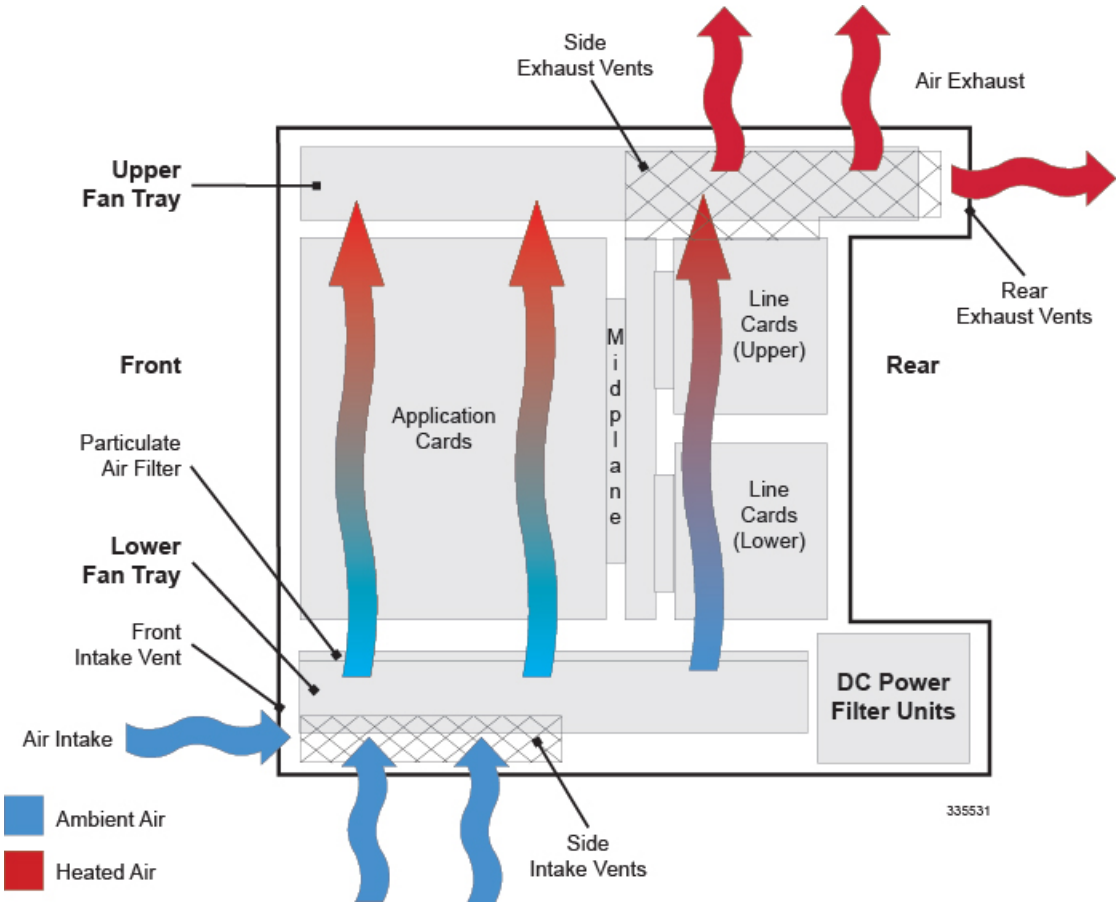
As shown in the figure below, the lower fan tray pulls ambient air into the chassis from the front and side intake vents located at the bottom of the chassis. The air is pushed upwards through the system and absorbs heat while passing over system components.

Total air flow exiting the chassis is approximately:

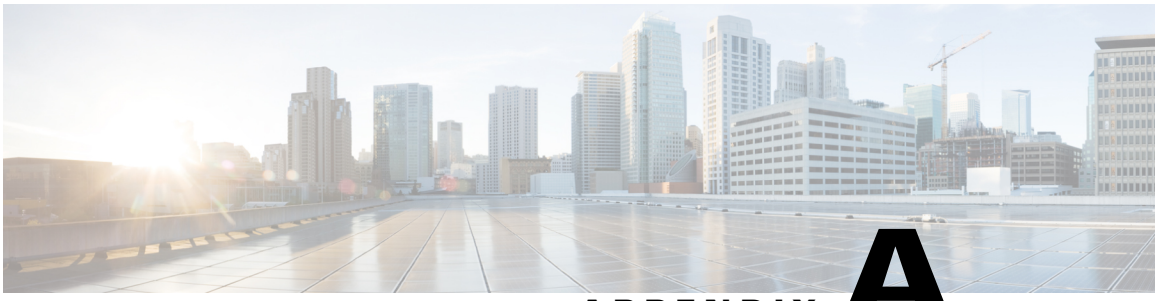
- 275CFM (7.8 cubic meters/minute) – Low fan speed
- 565CFM (16 cubic meters/minute) – High fan speed

The upper fan tray pulls the heated air up through the chassis. The heated air then exits through the side and rear exhaust vents located at the top of the chassis.

Figure 69: System Airflow and Ventilation



Caution When planning chassis installation, ensure that equipment rack or cabinet hardware does not hinder air flow at any of the intake or exhaust vents. Additionally, ensure that the rack/cabinet hardware, as well as the ambient environment, allow the system to function within the operating limits specified in this chapter.



APPENDIX A

Hardware Product Support Matrix

This appendix identifies the embedded services supported by the various types of ASR 5000 packet processing cards and line cards.

It includes the following sections:

Packet Processing Cards

The table below cross-references embedded services with the types of packet processing cards that are capable of running the service in this StarOS release.

Packet processing cards included in this matrix are:

- PSCA = Packet Service Card - Type A (interchangeable with PSC)
- PSC2 = Packet Service Card - Type 2
- PSC3 = Packet Service Card - Type 3
- PPC = Packet Processing Card

The products (embedded services) included in this matrix are:

- **CDMA**
  - PDSN/HA = Packet Data Serving Node/Home Agent
  - HSGW = HRPD Serving Gateway
  - PMIPv6 = Proxy Mobile IPv6
- **Femtocell**
  - CDMA = Code Division Multiple Access
  - LTE = Long Term Evolution
  - UMTS = Universal Mobile Telecommunications System (GSM)

- **LTE**
  - MME = Mobility Management Entity
  - PGW = Packet Data Network Gateway
  - SGW = Serving Gateway
- **Security Gateway**
  - ePDG = Enhanced Packet Data Gateway
  - PDIF = Packet Data Interworking Function
  - TTG/PDG = Tunnel Termination Gateway/Packet Data Gateway
- **Other**
  - GGSN = Gateway GPRS Support Node
  - IMS-MMD = IP Multimedia Subsystem/Multimedia Domain
  - IPCF = Intelligent Policy Control Function
  - IPSG = IP Services Gateway
  - MGW = Media Gateway
  - OGW = Offload Gateway
  - SGSN = Serving GPRS Support Node

Table 107: Packet Processing Card – Product Support Matrix

Embedded Service	PSCA	PSC2	PSC3	PPC
CDMA				
PDSN/HA	Yes	Yes	Yes	No
HSGW	Yes	Yes	Not Qualified	No
PMIPv6	No	Yes	Not Qualified	No
Femtocell				
CDMA	No	NA	Not Qualified	NA
LTE	No	Yes	Not Qualified	No
UMTS	No	Yes	Not Qualified	No
LTE				
MME	No	Yes	Yes	No
PGW	No	Yes	Yes	Yes
SGW	Yes	Yes	Yes	Yes

Embedded Service	PSCA	PSC2	PSC3	PPC
Security Gateway				
ePDG	No	Yes	Not Qualified	No
PDIF	No	NA	Not Qualified	NA
TTG/PDG	No	Yes	Yes	No
Other				
GGSN	Yes	Yes	Not Qualified	Yes
IMS-MMD	No	Yes	Yes	No
IPCF	No	Yes	Not Qualified	No
IPSG	No	Yes	Yes	No
MGW	No	Yes	Not Qualified	No
OGW	No	Yes	Not Qualified	NA
SGSN	No	Yes	Yes	No

Line Cards

The table below cross-references embedded services with the types of lines cards that interoperate with the service in this StarOS release.

Line cards included in this matrix are:

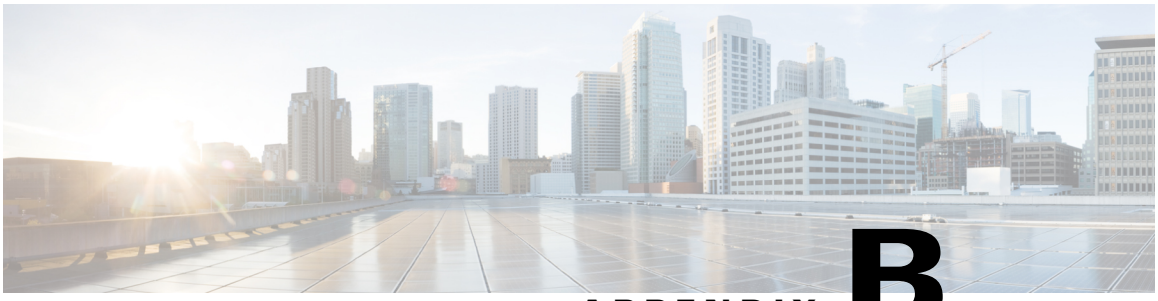
- SPIO = Switch Processor I/O
- RCC = Redundancy Crossbar Card
- FLC2 = Fast Ethernet Line Card
- GLC2 = Gigabit Ethernet Line Card
- QGLC = Quad Gigabit Ethernet Line Card
- XGLC = 10 Gigabit Ethernet Line Card
- CLC2 = Channelized Line Card (Frame Relay over SDH/SONET. STM-1, OC-3)
- OLC2 = Optical Line Card (ATM over SDH/SONET signaling, IPoA [PVC})

Table 108: Line Card – Product Support Matrix

Embedded Service	SPIO	RCC	FLC2	GLC2	QGLC	XGLC	CLC2	OLC2
CDMA								
PDSN/HA	Yes	Yes	Yes	Yes	Yes	Yes	No	No

Embedded Service	SPIO	RCC	FLC2	GLC2	QGLC	XGLC	CLC2	OLC2
HSGW	Yes	Yes	Yes	Yes	Yes	Yes	No	No
PMIPv6	Yes	Yes	Yes	Yes	Yes	Yes	No	No
Femtocell								
CDMA	Yes	Yes	Yes	Yes	Yes	Yes	No	No
LTE	Yes	Yes	Yes	Yes	Yes	Yes	No	No
UMTS	Yes	Yes	Yes	Yes	Yes	Yes	Yes Note 1	Yes Note 1
LTE								
MME	Yes	Yes	Yes	Yes	Yes	Yes	No	No
PGW	Yes	Yes	Yes	Yes	Yes	Yes	No	No
SGW	Yes	Yes	Yes	Yes	Yes	Yes	No	No
Security Gateway								
ePDG	Yes	Yes	Yes	Yes	Yes	Yes	No	No
PDIF	Yes	Yes	Yes	Yes	Yes	Yes	No	No
TTG/PDG	Yes	Yes	Yes	Yes	Yes	Yes	No	No
Other								
GGSN	Yes	Yes	Yes	Yes	Yes	Yes	No	No
IMS-MMD	Yes	Yes	Yes	Yes	Yes	Yes	No	No
IPCF	Yes	Yes	Yes	Yes	Yes	Yes	No	No
IPSG	Yes	Yes	Yes	Yes	Yes	Yes	No	No
MGW	Yes	Yes	Yes	Yes	Yes	Yes	No	No
OGW	Yes	Yes	Yes	Yes	Yes	Yes	No	No
SGSN	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Note 1. Home NodeB Gateway (HNB-GW) applications.



APPENDIX B

Preparing a Full-Height Line Card Slot

This appendix describes how to modify two vertical half-height line card slots to accept full-height line cards, such as the XGLC.

It includes the following sections:

Introduction

The ASR 5000 chassis ships with all rear line card slots configured for half-height line cards. If you are installing a full-height line card, such as the XGLC, you must prepare a full-height slot to receive it.

Full-height line cards occupy two half-height slots: an upper chassis slot and the lower chassis slot directly beneath it. For example, if a PSC2 is installed in slot 1, its corresponding XGLC would be installed in slots 17 and 33.

Important When entering the slot location of a full-height line card in a CLI command use the upper slot number only.

Caution During installation, maintenance, and/or removal, wear a grounding wrist strap to avoid ESD damage to the components. Failure to do so could result in damage to sensitive electronic components and potentially void your warranty.

Remove Blanking Panels

You must remove the half-height blanking panels covering the upper and lower chassis slots, if installed.

Step 1 Identify the chassis slots in which the full-height line card will be installed.

Step 2 Use a Phillips #2 screwdriver to loosen the screws at the top and bottom of the blanking panel. Hold the screws on the blanking panel, and pull the blanking panel away from the chassis to expose the chassis slot.

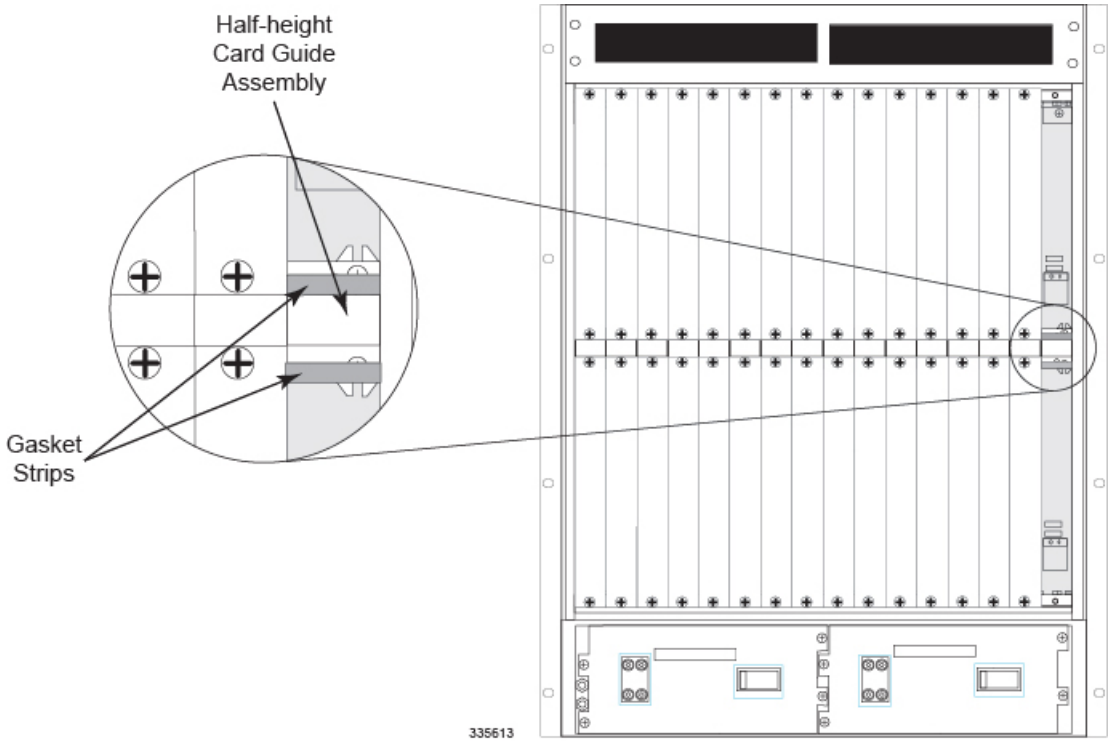
Step 3 Repeat step 2 to remove the half-height blanking panel covering the chassis slot directly below the slot exposed in the previous step.

Caution On a powered up chassis, do not leave chassis slots uncovered for extended periods of time. This reduces airflow through the chassis, which could cause it to overheat. Install a card or a blanking panel s in every chassis slot.

Remove the Half-Height Card Guide

You must next remove the half-height card guide separating the exposed upper and lower chassis slots.

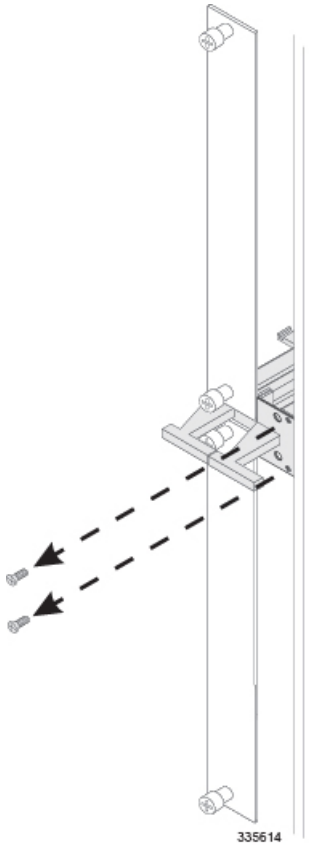
Figure 70: Half-height Card Guide



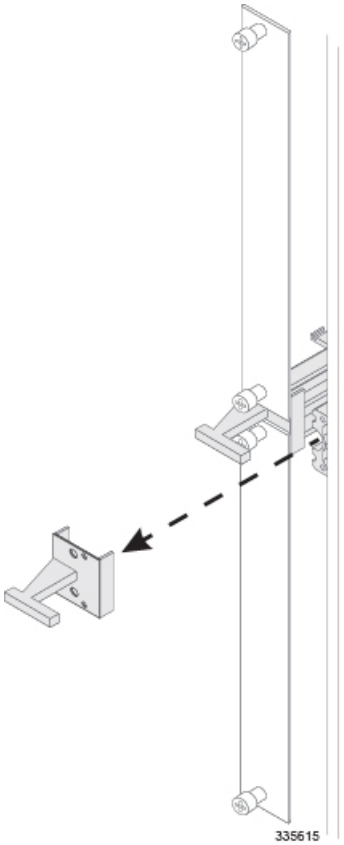
Important Save all of the items you remove in this step in the event that you wish to re-populate these slots with half-height cards at a later time.

Step 1 Remove the two gasket strips to allow access to the screws beneath. Save the gasket strips.

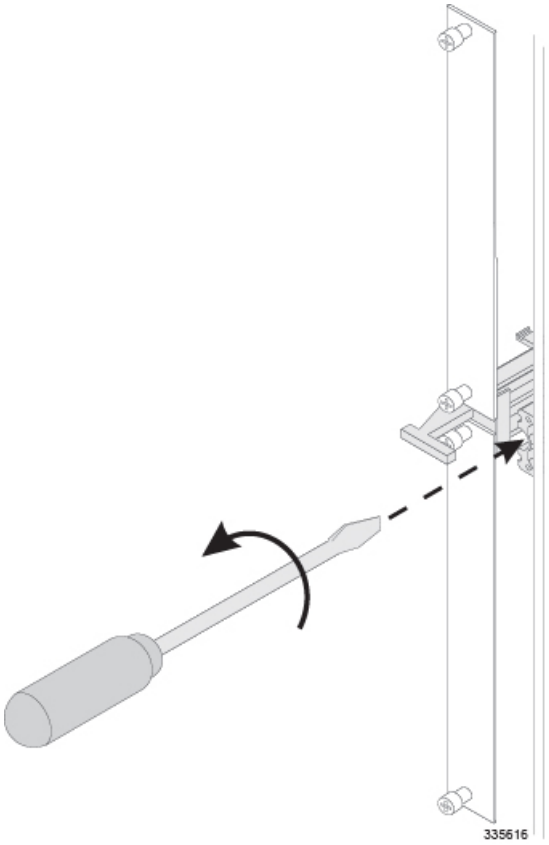
Step 2 Using a Phillips #1 screwdriver, loosen the two screws that secure the half-height card guide ejector rail/cap. Save the screws for later use.



Step 3 Remove the half-height card guide ejector rail/cap.

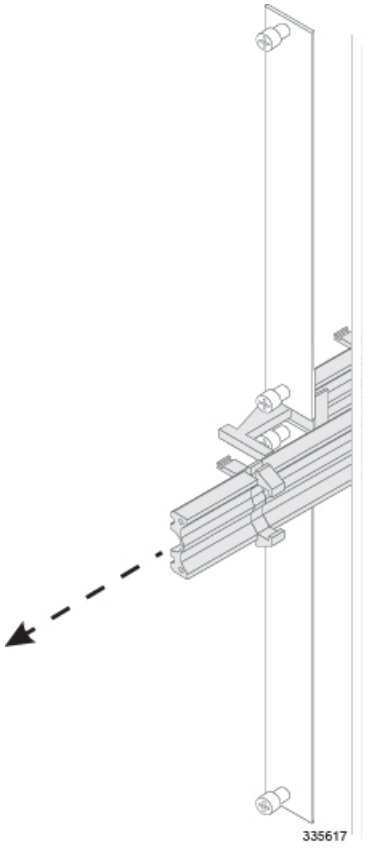


Step 4 Use the screwdriver provided with the full-height line card to loosen the screw that secures the half-height card guide to the chassis mid-plane.



Step 5 Gently pull the half-height card guide out of the chassis.

Important You may need to slightly angle the guide when you slide it out of the chassis to unlatch it.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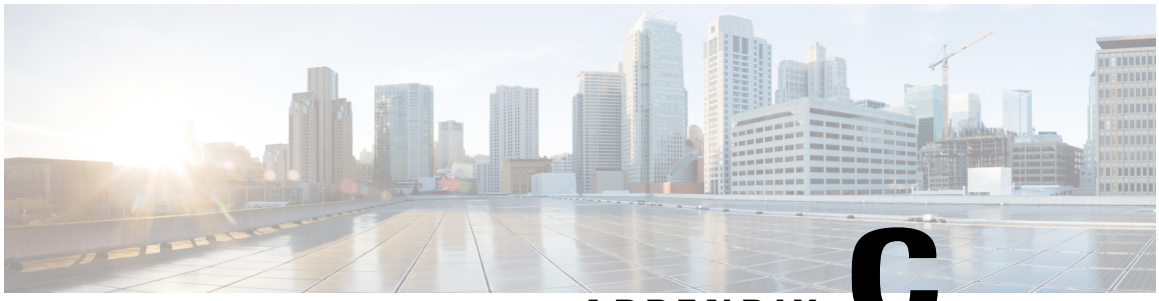


APPENDIX C

RMA Shipping Procedures

This appendix describes the procedures for packaging and returning ASR 5000 chassis components via the Cisco Return Material Authorization (RMA) process.

For detailed information on Cisco RMA policies (including detailed shipping instructions), go to the **Product Online Web Returns (POWR)** link on **www.cisco.com**.

Important To ensure warranty coverage, these procedures also apply to shipments between customer sites or parts depots.

This appendix includes the following sections:

RMA Overview

This section describes general requirements when packaging ASR 5000 components for shipment.

Important All components must be properly packaged to prevent damage in transit. Items should never be shipped without packaging foam, bubble wrap and a static bag. Crushed or damaged boxes/pallets should never be used for returning items.

The following general guidelines apply when packaging components:

- It is best to use the original Cisco box and packaging in which your equipment was sent and received. You can use a shipping carton saved when the system and its components were installed. You can also use the packaging for a replacement component to repackage the original component.
- If the original box is missing or damaged, you can request that Cisco send a suitable shipping carton when requesting an RMA.
- Items should be securely sealed and, if necessary, fixed onto pallets.
- Detailed ship-to instructions will be provided when you apply for the RMA from Cisco.

Re-packaging Your RMA

If using the original Cisco box and packaging, properly place the item within the packaging material.

If using a non-Cisco shipping carton and packing material, be sure the item is properly surrounded with bubble wrap or packaging foam to ensure restriction in movement during transport.

Important The use of anti-static packaging materials is highly recommended. At the very least, the item must be enclosed in a sealed anti-static envelope or bag to prevent damage to ESD sensitive devices.

Shipping Multiple Components

The preferred method for RMA shipping requires that each component be properly packed in an individual box.

If you must ship multiple items within the same box, be sure each part is protected in its own anti-static bag and padded carton, and is separated from other cartons with packing foam or bubble wrap. The shipping carton must be sturdy enough to handle the weight and size of the items within it.

Important Items should never be returned loosely packed and unprotected from ESD.

Sealing the Shipment

The box or shipping container must be securely sealed using appropriately reinforced packaging tape. Do not use masking or transparent (light duty) tape to secure or seal packaging.

Chassis or other large units must be covered and securely strapped down to a pallet. An unstrapped or loosely strapped item can easily tip during transit, resulting in expensive damage and repair costs.

Labeling the Shipment

All returned items must include the RMA number (and Quote Number for Trade-In Returns) on every box being returned. The RMA number can be obtained from the POWR link on www.cisco.com or your Cisco TAC advisor.

For Trade-In Returns, a POWR tool label must be placed on the outside of each box.

These reference numbers should also be listed on the shipper's air bill.

Important Mislabeled or unlabeled RMAs delay the receiving and crediting processes.

Cisco Return Locations

For a list of authorized Cisco return centers, go to the **Authorized Return Locations** link on **www.cisco.com**.

Packaging ASR 5000 Cards

This section provides detailed instructions for packaging ASR 5000 cards using Cisco shipping cartons.

Three types of cartons are used based on the card type being returned:

- Application Cards, on page 267
- Line Cards (except XGLC), on page 269
- 10 Gigabit Ethernet Card (XGL), on page 273

Application Cards

Application Card Types

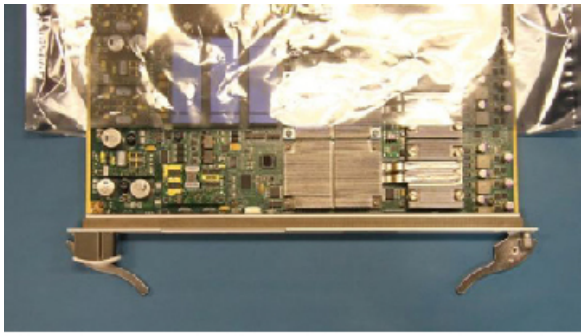
The packing instructions in this section apply to the following full-height SMC and packet processing cards:

- ASR5K-SMC-K9 – System Management Card (SMC)
- ASR5K-PSC-64G-K9 – Packet Services Card 3 (PSC3)
- ASR5K-PSC-32G-K9 – Packet Services Card 2 (PSC2)
- ASR5K-PSC-16G-K9 – Packet Services Card Type A (PSCA)
- ASR5K-PPC-K9 – Packet Processing Card 3 (PPC)

Packaging an Application Card

The packaging sequence is as follows:

Step 1 Place the card inside the ESD bag; fold over and seal the bag with an ESD Label or tape as shown in the photos.



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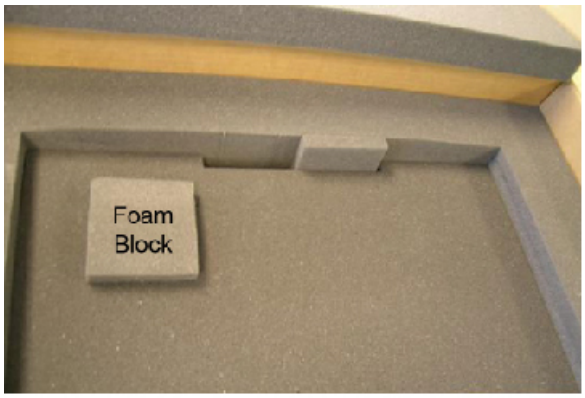
Step 2 If packing an SMC, a foam block must be removed from the bottom foam near the connector cut outs.



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Step 3 Place the card in the carton as shown in the photos.

Step 4 Place the top piece of foam over the card.

Step 5 Close the carton and seal it with packaging tape. See Sealing the Shipment for additional information.

Step 6 Place the shipping label on the outside of the carton. See Labeling the Shipment for additional information.

Line Cards (except XGLC)

Half-Height Line Card Types

The packing instructions in this section apply to the following half-height card types:

- ASR5K-C4OC3-MM-K9 – Channelized Line Card 2 (CLC2) [MM SFP]
- ASR5K-C4OC3-SM-K9 – Channelized Line Card 2 (CLC2) [SM SFP]
- ASR5K-01100E-K9 – Fast Ethernet Line Card (FELC)
- ASR5K-08100E-K9 – Fast Ethernet Line Card 2 (FLC2)
- ASR5K-4OC3C-MM-K9 – Optical Line Card 2 (OLC2) [MM SFP]
- ASR5K-4OC3C-SM-K9 – Optical Line Card 2 (OLC2) [SM SFP]
- ASR5K-041GE-SX-K9 – 4-Port Ethernet 1000 Line Card (QGLC) [SX MM SFP]

- ASR5K-041GE-LX-K9 – 4-Port Ethernet 1000 Line Card (QGLC) [LX SM SFP]
- ASR5K-041GE-T-K9 – 4-Port Ethernet 1000 Line Card (QGLC) [copper SFP]
- ASR5K-042GE-SX-K9 – Rev2 4-Port Ethernet 1000 Line Card (QGLC) [SX MM SFP]
- ASR5K-042GE-LX-K9 – Rev2 4-Port Ethernet 1000 Line Card (QGLC) [LX SM SFP]
- ASR5K-042GE-T-K9 – Rev2 4-Port Ethernet 1000 Line Card (QGLC) [copper SFP]
- ASR5K-011GE-SX-K9 – Gigabit Ethernet 1000 Line Card (GLC) [SX MM SFP]
- ASR5K-011GE-LX-K9 – Gigabit Ethernet 1000 Line Card (GLC) [LX SM SFP]
- ASR5K-011GE-T-K9 – Gigabit Ethernet 1000 Line Card (GLC) [copper SFP]
- ASR5K-011G2-SX-K9 – Gigabit Ethernet 1000 Line Card (GLC2) [SX MM SFP]
- ASR5K-011G2-LX-K9 – Gigabit Ethernet 1000 Line Card (GLC2) [LX SM SFP]
- ASR5K-011G2-T-K9 – Gigabit Ethernet 1000 Line Card (GLC2) [copper SFP]
- ASR5K-RCC-K9 – Redundancy Crossbar Card (RCC)
- ASR5K-SPIO-BNC-K9 – Switch Processor I/O, BNC BITS
- ASR5K-SPIO-3PN-K9 – Switch Processor I/O, 3-Pin BITS
- ASR5K-SPS3-BNC-K9 – Switch Processor I/O, BNC BITS with Stratum 3 module
- ASR5K-SPS3-3PN-K9 – Switch Processor I/O, 3-Pin BITS with Stratum 3 module

Packaging a Half-height Line Card

The packaging sequence is as follows:

Step 1 Place the card inside the ESD bag; fold over and seal the bag with an ESD Label or tape as shown in the photos.

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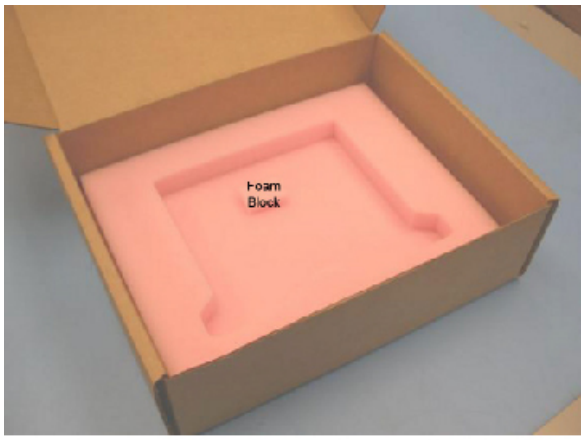
Step 2 Place the card within the bottom piece of foam as shown in the photos. If packing an RCC or SPIO, a foam block must be removed from the bottom foam near the connector cut outs.



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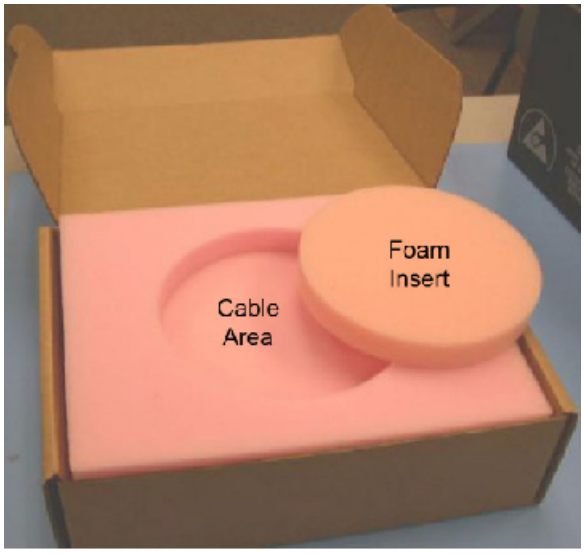
Step 3 Place the top piece of foam over the card.

Step 4 If you are returning the cable assembly with a SPIO, remove the round insert from the top piece of foam and place the cable assembly in the cutout.



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Step 5 Close the carton and seal it with packaging tape. See Sealing the Shipment for additional information.

Step 6 Place the shipping label on the outside of the carton. See Labeling the Shipment for additional information.

10 Gigabit Ethernet Card (XGL)

XGLC Card Types

The packing instructions in this section applying to the following full-height XGLCs:

- ASR5K-0110G-MM-K9 – 1-Port 10 Gigabit Ethernet Line Card (XGLC) [MM SFP+]
- ASR5K-0110G-SM-K9 – 1-Port 10 Gigabit Ethernet Line Card (XGLC) [SM SFP+]

Packaging a Full Height XGLC

The packaging sequence is as follows:

Step 1 Place the card inside the ESD bag; fold over and seal the bag with an ESD Label or tape as shown in the photos.

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Step 2 The XGLC shipping carton includes a bottom foam piece and two top foam pieces. Insert the XGLC in the bottom foam piece and place the two top pieces in the slots at either ends of the card as shown in the photos:

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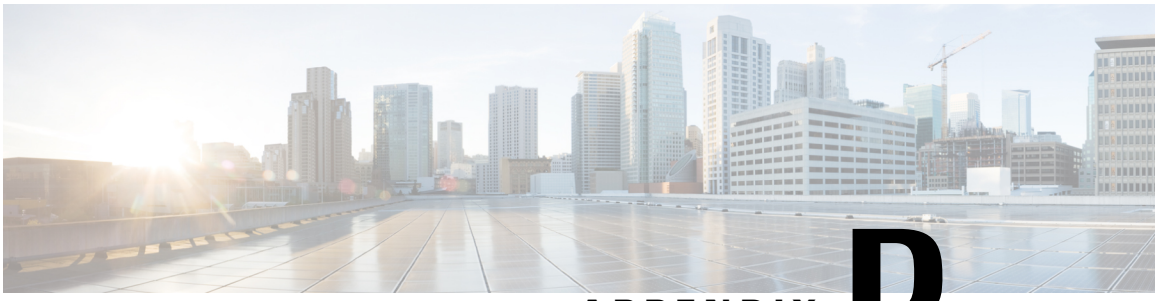
Step 3 Close the carton and seal it with packaging tape. See Sealing the Shipment for additional information.

Step 4 Place the shipping label on the outside of the carton. See Labeling the Shipment for additional information.



APPENDIX D

Spare Component Recommendations

This appendix provides a recommended quantity of spare components to be stocked as part of a sparing program for the ASR 5000. This information should only be used as a guideline for designing a sparing program that meets your company's design, deployment, and availability goals.

Important Only fully-trained personnel, on-site or field engineering resources should exchange the Field Replaceable Units (FRUs) listed below.

Based on industry-leading redundancy and failover features incorporated within the system, Cisco recommends that the following minimum spare parts levels for any ASR 5000 deployment.

Table 109: Recommended FRU Parts Sparing Quantities

Component Name	Minimum number of spares	For every "n" number of deployed components
ASR 5000 Chassis with Midplane	1	20
Power Filter Unit (165A)	1	30
System Management Card (SMC)	1	10
Packet Services Card (PSC2 or PSC3)	1	12
Ethernet 1000/Quad Gig-E (QGLC) Card	1	20
10 Gigabit Ethernet Line Card (XGLC)	1	20
Optical Line Card (OLC2)	1	20
Channelized Line Card (CLC2)	1	20
Switch Processor I/O Card (SPIO)	1	18
Redundancy Crossbar Card (RCC)	1	30
Ethernet 10/100 Line Card (FLC2)	1	25
Gigabit Ethernet Line Card (GLC2)	1	25

Component Name	Minimum number of spares	For every "n" number of deployed components
Upper Fan Tray Unit	1	8
Lower Fan Tray Unit	1	5
Particulate Air Filter	1	1

- Spare Component Recommendations, page 276

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10 Gigabit Ethernet Line Card (XGLC)	1	20
Optical Line Card (OLC2)	1	20
Channelized Line Card (CLC2)	1	20
Switch Processor I/O Card (SPIO)	1	18
Redundancy Crossbar Card (RCC)	1	30
Ethernet 10/100 Line Card (FLC2)	1	25
Gigabit Ethernet Line Card (GLC2)	1	25
Upper Fan Tray Unit	1	8

Component Name	Minimum number of spares	For every "n" number of deployed components
Lower Fan Tray Unit	1	5
Particulate Air Filter	1	1

Spare Component Recommendations