Cisco N560-RSP4 and Cisco N560-RSP4-E Route Processor Hardware Installation Guide

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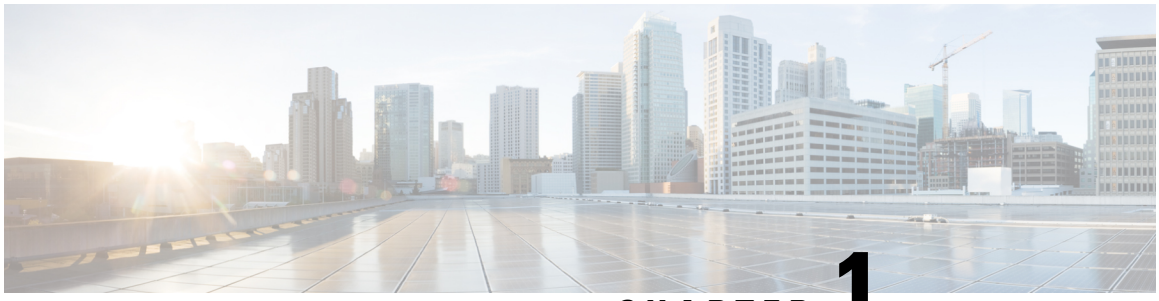


CHAPTER 1

Overview

This hardware installation guide describes the following components:

- Route processors, N560-RSP4 and N560-RSP4-E
- The supported interface modules
- High-speed fan to meet NEBS and I-Temp compliance requirements – N560-FAN-H

For more information on its features and benefits, see the Cisco NCS 560 Series Routers Interface Modules Data Sheet.

N560-RSP4 and N560-RSP4-E

N560-RSP4 route processor is a medium-scale route processor with 800 Gbps throughput, maximum 700MPPS packet processing rate, and wide form factor.

N560-RSP4-E route processor is a large-scale route processor with 800 Gbps throughput, maximum 700MPPS packet processing rate, and wide form factor.

For more information on N560-RSP4 and N560-RSP4-E route processors, see Product specifications.

The N560-RSP4 and N560-RSP4-E route processors (RSPs) increase the system capacity, interface density and scale of the routers they are installed in. These RSPs operate on the 64-bit IOS-XR (eXR) operating system and are designed to support 1:1 redundancy for the data plane. Both RSPs receive and forward traffic; however, only the active data plane forwards traffic to the external network.

The N560-RSP4 and N560-RSP4-E are supported on the Cisco ASR 907 Routers (which effectively turns the Cisco ASR-907 Router into an NCS560-7 Router, running the Cisco IOS-XR software) and can be installed in any available route processor slot in these chassis.

Note Do not use the N560-RSP4 and N560-RSP4-E route processors together in the same router.

Figure 1: N560-RSP4 Front Panel

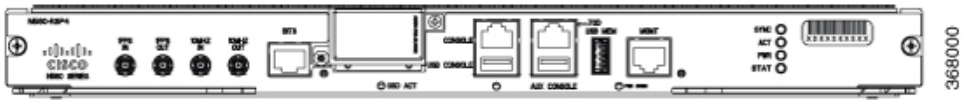
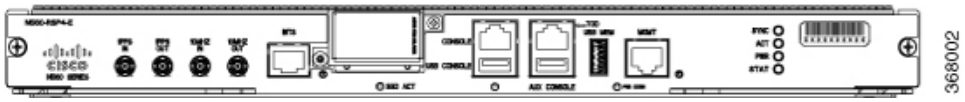


Figure 2: N560-RSP4-E Front Panel



RSP Redundancy

When two RSPs are installed in a router, one RSP is the active RSP and the other is a backup, or standby, RSP. If the active RSP fails or is removed from the system, the standby RSP detects the failure and initiates a switchover. During a switchover, the standby RSP assumes control of the router, connects with the network interfaces, and activates the local network management interface and system console.

Note If your system includes redundant RSPs, both RSPs should be of the same type and have the same memory size. We strongly recommend that you avoid configuring your router using mixed route processor cards.

External Interfaces

Network Interfaces

The N560-RSP4 and N560-RSP4-E modules support the following network interfaces through the pluggable IMs:

- GE SFP ports – supporting 1000/1GE modes with A900-IMA-8CS1Z-M
- GE C-SFP ports – supporting 1000/1GE BASE-BX modes with A900-IMA-8CS1Z-M
- 10GE SFP+ ports – supporting 10GE mode with A900-IMA-8CS1Z-M, A900-IMA-8Z, and A900-IMA-8Z-L IMs
- 100GE QSFP-28/QSFP-DD 100G ZF1/QSFP+ Ethernet ports using 2 x 100GE IM – supporting both 100GE and 40GE with N560-IMA-2C. Effective Cisco IOS XR Release 7.3.2, only 100GE is supported on the N560-IMA-2C-DD. Effective Cisco IOS XR Release 7.8.1 Quad Small Form-Factor Pluggable Double Density (QSFP-DD 100G ZF1) is supported on the interface module. Only 100GE is supported in a single fixed wavelength mode.

Network Timing Interfaces

The following network timing interfaces are located on the RSP:

- BITS simultaneous input and output (T1/E1)—RJ48 jack
- 1PPS input—mini-coaxial connector
- 1PPS output—mini-coaxial connector
- 2.048/10MHz input—mini-coacoaxialx connector
- 2.048/10MHz output—mini-coax connector
- ToD input or output—shielded RJ45 jack
- GNSS RF input port—To support high availability, an RSP GPS support with single antenna, external passive splitter is required to split output while maintaining the minimum RF power input required by GNSS receiver.

The network interfaces are sources and destinations of frequency (for example, SyncE, T1/E1, SONET/SDH) and phase/ToD (for example, IEEE 1588-2008 PTP).

Management Interfaces

- Copper 10/100/1000Base-T LAN management port—RJ45 jack
- Console/Aux RS232 serial ports—RJ45 jacks
- Console—USB 2.0 type A receptacle
- Mass Storage—USB 2.0 or 3.0 type A receptacle

Indicators

Status LEDs are present on the RSP. For more information on LED, see N560-RSP4 and N56-RSP4-E LEDs.

Licensing

The Cisco NCS 560 router with RSP4/RSP4-E utilizes Cisco's IOS-XR Software Flexible Consumption Licensing Model. For information on the IOS-XR Flexible Consumption License, see:

- Cisco IOS XR Software Flexible Consumption Model Data Sheet
- Cisco Platform Suite

For the NCS 560 with RSP4 RSP4-E, the Flexible Consumption Model comprises two software suites:

- The Essentials software suite is required for active ports in the system and is a per-100-Gbps capacity license.
- The Advanced software suite is required when one or more of the Advanced software suite features are used (for example, L2VPN, L3VPN, and E-VPN Services), and is on a per-100-Gbps capacity license.

The Essentials software suite supports the following features on a per-100-Gbps capacity license:

- Routing: IP, ISIS, OSPF, BGP, MPLS, SR, basic Multicast (PIM) ICMP
- L2 and Interface: mLACP and MC-LAG, Dot1Q, QinQ, VLAN
- Management: Yang models, CLI and SSH, SNMP, up to eight management VRFs

- QOS: QoS and H-QoS (two-level/three-level)
- E-OAM (Link-level Fault-Management)
- High Availability: ISSU, ISIS GR/NSF, BFD, BGP PIC, SR TI-LFA FRR
- Security: ACLs, CoPP (LPTS), SSH, Radius and TACACS, PBR
- PTP timing: G.8275.1, G.8275.2, G.8265.1, and default profile

The Advanced software suite supports the following features on a per-100-Gbps capacity license:

- Traffic Engineering: MPLS-TE and RSVP-TE, SR-TE, TI-LFA
- L3VPN: MPLS IPv4/v6 VPN, VRF-Lite
- L2VPN: VPWS, VPLS, Pseudowire (PW)
- EVPN: EVPN VPWS, EVPN ELAN, EVPN IRB
- Multicast VPN, Multicast PIM-SM, PIM-SSM v4 andv6, IGMP v2 and v3
- Lawful Intercept, Netflow

The Essentials software suite PIDs/SKUs are:

- ESS-AC-100G-RTU-1 = Access Network Essentials SW Right to Use (RTU), per-100-Gbps capacity license
- ESS-AC-100G-SIA-3 = Access Network Essentials SW Innovation Access - 3 Year Subscription, per-100-Gbps capacity license
- ESS-AC-100G-SIA-5 = Access Network Essentials SW Innovation Access - 5 Year Subscription, per-100-Gbps capacity license

The Advanced software suite PIDs/SKUs are:

- ADV-AC-100G-RTU-1 = Access Network Advanced SW Right to Use (RTU), per-100-Gbps capacity license
- ADV-AC-100G-SIA-3 = Access Network Advanced SW Innovation Access - three-year subscription, per-100-Gbps capacity license
- ADV-AC-100G-SIA-5 = Access Network Advanced SW Innovation Access - five-year subscription, per-100-Gbps capacity license

Supported Interface Modules

Starting with Cisco IOS XR Release 7.5.1, 1G mode is supported on A900-IMA8Z-L IM. Use the following command to configure A900-IMA8Z-L interface module in 1G mode:

hw-module quad *1* **slot** *0* **mode** *1g*

The A900-IMA-8CS1Z-M interface module is supported on 0-15 slots of the chassis. Out of the nine physical ports, the first eight are CSFP ports, thus a total of 17 ports are present in the interface module. Out of these 17 ports of the interface module, ports 0-15 are 1G CSFP ports and port 16 is 10G SFP+ port. However, for

slots 0, 1, 14, and 15, you can only use the even ports of the interface module. This is because the odd ports are unusable due to bandwidth restrictions.

Starting with Cisco IOS XR Release 7.4.2, the A900-IMA-8CS1Z-IM interface module is supported on slots 0, 1, 14, and 15 in 8 x 1G and 1 x 10 mode by disabling the odd 1G ports. You can achieve this by using the following command to disable the eight unused odd ports (1, 3, 5, 7, 9, 11, and 15) within the slots:

- **hw-module slot** <*0-15* >**im-mode** *1*

Out of the nine even ports of the interface module, ports 0, 2, 4, 6, 8, 10, 12, and 14 can be used as 1G ports and port 16 can be used as 10G port. Disabling the odd ports of the interface module helps increase the router's port density by optimizing hardware resource utilization.

Table 1: Supported Interface Modules and Part Numbers for N560-RSP4 and N560-RSP4-E

RSP Module	Interface Modules	Part Number	Slot
N560-RSP4 and N560-RSP4-E	8-port Gigabit Ethernet SFP Interface Module (8 x 1GE)	A900-IMA8S	Not Supported
	8-port Gigabit Ethernet RJ45 (Copper) Interface Module (8 x 1GE)	A900-IMA8T	Not Supported
	1-port 10 Gigabit Ethernet XFP Interface Module (1 x 10GE)	A900-IMA1X	Not Supported
	SFP Combo IM—8-port Gigabit Ethernet (8 x 1GE) and 1-port 10 Gigabit Ethernet (1 x 10GE)	A900-IMA-8S1Z	Not Supported
	Copper Combo IM—8-port Gigabit Ethernet (8 x 1GE) and 1-port 10 Gigabit Ethernet Interface Module (1 x 10GE)	A900-IMA-8T1Z	Not Supported
	2-port 10 Gigabit Ethernet Interface Module (2 x 10GE)	A900-IMA2Z	Not Supported
	2-port 100 Gigabit Ethernet Interface Module (2 x 100GE)	N560-IMA-2C	[1] [2]7,9
	2-port 100 Gigabit Ethernet Interface Module (2 x 100GE)	N560-IMA-2C-DD	
	8-port SFP/8-port CSFP Gigabit Ethernet (8/16 x 1GE) and 1-port 10 Gigabit Ethernet (1 x 10GE) Interface Module	A900-IMA-8CS1Z-M	0,1,2,3,4,5,6,7,8,9,10,11,12,13,14 and 15
	8-port 10 Gigabit Ethernet Interface Module (8 x 10GE)	A900-IMA-8Z	4,5,7,9,10,11 2,3,12,13[3] [4]
	8-port 10 Gigabit Ethernet SFP+ Interface Module (8 x 10GE)	A900-IMA-8Z-L	
	1-port 100 Gigabit Ethernet / 200 Gigabit Ethernet CFP2 DCO Module (1 x 100/200GE)	N560-IMA-1W	[5]0, 1, 2, 3

1 Starting with Cisco IOS XR Release 7.2.1, 40G optics are supported on both slots.
2 Slots 7 and 9 are supported on 200G mode with 4 x 100G, 2 x 100G and 2 x 40G, and 4 x 40G combinations.
3 Starting with Cisco IOS XR Release 7.4.1, A900-IMA-8Z and A900-IMA-8Z-L IMs are supported on slots 2,3,12, and 13 as well. In these slots, only 4 ports will be supported. If an IM is inserted in these slots, then ports 0-3 are created on A900-IMA-8Z and ports 4-7 are created in case of A900-IMA-8Z-L.

[4] Starting with Cisco IOS XR Release 7.5.1, 1G mode is supported on A900-IMA8Z-L. Slots 2, 3, 4, 5 can be in 10G or 1G mode. 2,3,12, and 13 are partial port slots where 0 to 3 ports are disabled. For the port combination 4,5,6,and 7 both 10G and 1G modes are supported.

For slots 7 and 9, all the ports support 10G or 1G mode.

For slots 4,5,10, and 11, only 10G mode is supported for port combination 0,1,2, and 3. Both 1G and 10G modes are supported for port combination 4,5,6, and 7.

[5] 100G mode is enabled by default. Slots 0 and 1 are supported on 100G and 200G mode. Slots 2 and 3 are supported only on 100G mode.

Note Maximum number of supported IMs depends on the configuration. Also, there may be restrictions to use some IM combinations. Contact your sales support for more information.

Table 2: Slot and Port Support for A900-IMA8Z-L for 1G Mode

Slot	Port 0	Port 1	Port 2	Port 3	Port 4	Port 5	Port 6	Port 7
2	-	-	-	-	10G/1G CU SFP	10G/1G CU SFP	10G/1G CU SFP	10G/1G CU SFP
3	-	-	-	-	10G/1G CU SFP	10G/1G CU SFP	10G/1G CU SFP	10G/1G CU SFP
4	10G	10G	10G	10G	10G/1G CU SFP	10G/1G CU SFP	10G/1G CU SFP	10G/1G CU SFP
5	10G	10G	10G	10G	10G/1G CU SFP	10G/1G CU SFP	10G/1G CU SFP	10G/1G CU SFP
7	All	All	All	All	All	All	All	All
9	All	All	All	All	All	All	All	All
10	10G	10G	10G	10G	10G/1G CU SFP	10G/1G CU SFP	10G/1G CU SFP	10G/1G CU SFP
11	10G	10G	10G	10G	10G/1G CU SFP	10G/1G CU SFP	10G/1G CU SFP	10G/1G CU SFP
12	-	-	-	-	10G/1G CU SFP	10G/1G CU SFP	10G/1G CU SFP	10G/1G CU SFP

Table 3: Supported Slots for Interface Modules

Slot	N560-IMA-2C N560-IMA-2C-DD	A900-IMA-8Z A900-IMA-8Z-L	A900-IMA-8CS1Z-M	N560-IMA-1W
0/0	—	—	Yes - 8 x 1G and 1 x 10G	On the NCS560-4 Router—Yes (100 and 200 G modes) On the ASR 907 Router—No
0/1	—	—	Yes - 8 x 1G and 1 x 10G	On the NCS560-4 Router—Yes (100 and 200 G modes) On the ASR 907 Router—No
0/2	—	Yes[6]	Yes - 16 x 1G and 1 x 10G	On the NCS560-4 Router—Yes (100 G mode only) On the ASR 907 Router—No
0/3	—	Yes	Yes - 16 x 1G and 1 x 10G	On the NCS560-4 Router—Yes (100 G mode only) On the ASR 907 Router—No
0/4	—	Yes	Yes - 16 x 1G and 1 x 10G	—
0/5	—	Yes	Yes - 16 x 1G and 1 x 10G	—
0/6	—	—	Yes - 16 x 1G and 1 x 10G	—
0/7	Yes	Yes	Yes - 16 x 1G and 1 x 10G	On the NCS560-4 Router—No On the ASR 907 Router—Yes (100 and 200 G modes)
0/8	—	—	Yes - 16 x 1G and 1 x 10G	—
0/9	Yes	Yes	Yes - 16 x 1G and 1 x 10G	On the NCS560-4 Router—No On the ASR 907 Router—Yes (100 and 200 G modes)
0/10	—	Yes	Yes - 16 x 1G and 1 x 10G	—
0/11	—	Yes	Yes - 16 x 1G and 1 x 10G	—
0/12	—	Yes	Yes - 16 x 1G and 1 x 10G	—

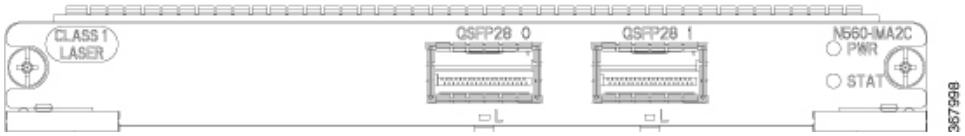
Slot	N560-IMA-2C N560-IMA-2C-DD	A900-IMA-8Z A900-IMA-8Z-L	A900-IMA-8CS1Z-M	N560-IMA-1W
013	—	Yes	Yes - 16 x 1G and 1 x 10G	—
014	—	—	Yes - 8 x 1G and 1 x 10G	—
015	—	—	Yes - 8 x 1G and 1 x 10G	—

[6] Starting with Cisco IOS XR Release 7.4.1, A900-IMA-8Z and A900-IMA-8Z-L IMs are supported on slots 2,3,12, and 13 as well. In these slots, only 4 ports will be supported. If an IM is inserted in these slots, then ports 0-3 are created on A900-IMA-8Z and ports 4-7 are created in case of A900-IMA-8Z-L.

2-Port 100 Gigabit Ethernet Interface Module (N560-IMA-2C)

The 2 x 100 Gigabit Ethernet interface module (N560-IMA-2C) is a single-height and single-width card with 100 Gigabit Ethernet port density support.

Figure 3: Cisco N560-IMA-2C Interface Module



Supported Modes

- 2 x 100 Gigabit Ethernet (fully subscribed)

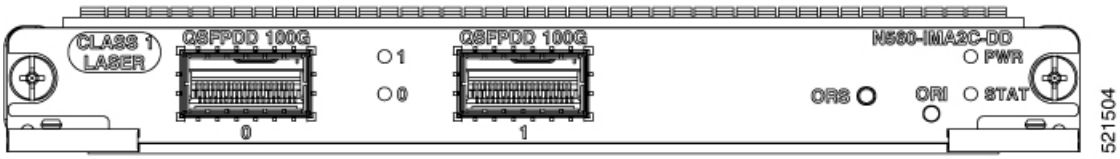
Supported Optics on this IM

The N560-IMA-2C IM supports QSFP-28 optics, such as:

- QSFP-100GE-SR4
- QSFP-100GE-LR4
- QSFP-100GE-ER4L
- QSFP-40G-LR4
- QSFP-40G-SR4
- QSFP-40G-ER4

The 2 x 100 Gigabit Ethernet interface module (N560-IMA-2C-DD) is a single-height and single-width card with 100 Gigabit Ethernet port density support. Effective Cisco IOS XR Release 7.8.1, Quad Small Form-Factor Pluggable Double Density (QSFP-DD 100G ZF1) transceiver module is supported.

Figure 4: Cisco N560-IMA-2C-DD Interface Module



The N560-IMA-2C-DD has an online removal switch (ORS) push button and an online removal indicator (ORI) LED on the front panel. When pressed, the ORS triggers the command to stop all access to the optics. The ORI LED indicates that the system is ready for optics removal. See the Interface Module LEDs section for more details.

Supported Modes

- 2 x 100 Gigabit Ethernet (fully subscribed)

Supported Optics on this IM

The N560-IMA-2C-DD IM supports QSFP-28 optics, such as:

- QSFP-100G-LR4-S
- QSFP-100G-SR4-S
- QSFP-100G-CWDM4-S
- QSFP-100G-SM-SR
- QSFP-100G-ER4L-S
- QSFP-100G-PSM4-S

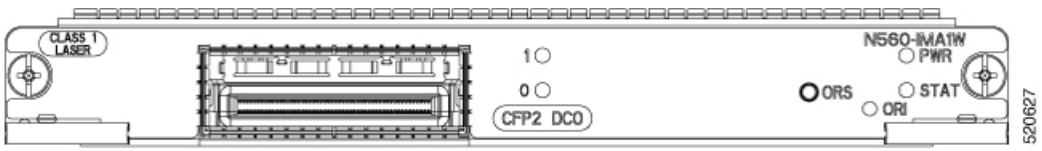
The N560-IMA-2C-DD IM supports QSFP-DD 100G ZF1 optics, such as:

- DP01QSDD-ZF1

1-Port 100GE / 200 Gigabit Ethernet CFP2 DCO Module (N560-IMA-1W)

The 1-port 100GE/200GE CFP2 DCO Interface Module (N560-IMA-1W) is a single-width-single-height IM for the Cisco NCS 560-4 router and Cisco ASR 907 router with RSP4. This IM supports provides 2 virtual ports, under single physical port. One CFP2 Digital Coherent Optics (DCO) at 100G/200G (Ethernet/OTU4) capacity.

Figure 5: 1-port 100GE/200GE CFP2 DCO Interface Module



Note The N560-IMA-1W IM is designed to support industrial temperature operating range with industrial-temperature optics only. However, if commercial-temperature optics are used, the IM operates at commercial temperature only.

The N560-IMA-1W has an online removal switch (ORS) push button and an online removal indicator (ORI) LED on the front panel. When pressed, the ORS triggers the command to stop all access to the CFP2-DCO optics. The ORI LED indicates that the system is ready for optics removal. See the *Interface Module LEDs* section for more details.

Note ORS push button and ORI LED functionalities and ISSU are supported on the N560-IMA-1W only from Cisco IOS XR Release 7.2.2.

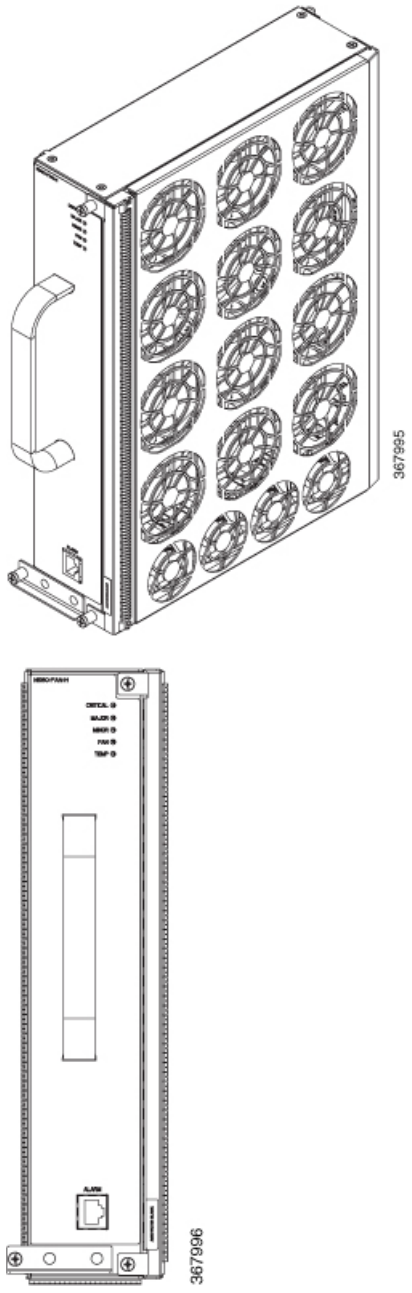
Supported Optics on this IM

- CFP2-WDM-DET-1HL=
- CFP2-WDM-D-1HL=
- CFP2-WDM-DS100-HL=
- CFP2-WDM-DETS-1HL=
- CFP2-WDM-DS-1HL=

Fan Tray (FAN-H)

FAN-H enhances the thermal performance of the chassis. It supports industrial temperature ambient condition with industrial temperature optics in the chassis.

Figure 6: Fan Tray Views



For information about the installation of the fan tray, see the *Installing the Fan Tray* section.

Fan Tray (A907-FAN-E)

The A907-FAN-E has:

- Four dual rotor fans—for the PSU area cooling

- 12 fans (three columns for four fans)—60x60x38mm fans for the RSP and interface modules

This fan tray has redundant fans and provides side-to-side forced air cooling. A907-FAN-E is a field replaceable unit (FRU).

The following table describes the fan speed when used with the N560-RSP4 route processor.

Table 4: Ambient Temperature and Fan Speed

No.	Temperature (℃) at 1800m		System Fan Speed (% PWM)	PSU Fan Speed (% PWM)
	Minimum	Maximum		
1	-40	-11	30	30
2	-10	15	40	40
3	16	30	55	55
4	31	40	80	80
5	41	50	100	100

Note The system considers the temperature of the fan inlet for the appropriate fan speed.

For information about the installation of the fan tray, see the *Installing the Fan Tray* section.

Online Insertion and Removal

The Cisco routers, interface modules, and FAN-H are designed to support online insertion and removal (OIR). However, time-to-OIR for FAN-H fan tray is dependent on the temperature of the chassis. At room temperature of up to 30° C, fan tray OIR should be done within two minutes.

Note Before replacing the card, you must perform a graceful shutdown of the card to avoid disk corruption.

Table 5: Ambient Teperature and Fan Tray OIR

Ambient Temperature (in Celsius)	Fan Operation	Time	Remarks
30°	All fans are working	2 minutes	Fans working as expected
40°	All fans are working	1 minute 30 seconds	Fans working as expected
40°	Single fan failure	2 minutes	Single fan failure and all other fans running at maximum speed

Note It is not recommended to perform fan tray OIR above the ambient temperature of 40° C.

The following table describes the parameters for the OIR of the various modules in the router.

Note Before replacing the card, you must perform a graceful shutdown of the card to avoid disk corruption.

Table 6: Online Insertion and Removal - Parameters

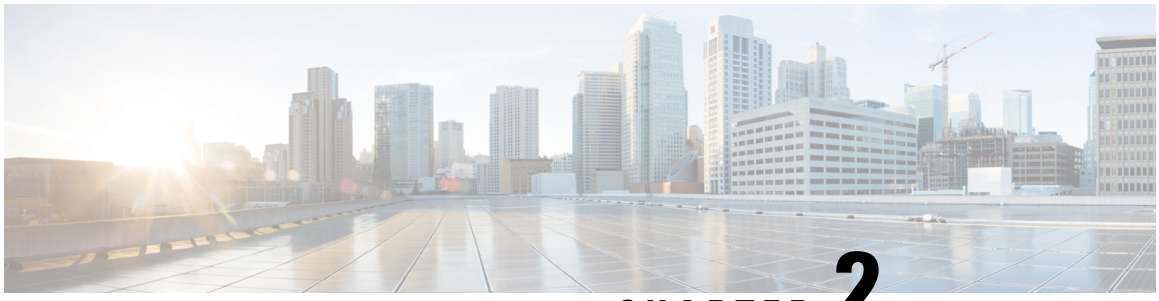
OIR Module	Ambient[7]	Fan Speed	OIR Time	Comments
Fan Tray[8]	30°C	100% PWM	5 mins	Single Fan Fail, Other Fans running at 100% PWM
	40°C	100% PWM	3 mins	
PSU	40°C	As per the fan algorithm	5 mins	Fans running at normal speed
Interface Module[9]				
RSP				

[7] It is not recommended to perform OIR of any module above 40°C ambient
[8] Fan Tray OIR should be performed only when a fan's failed condition is encountered and other fans are spinning at max speed.
[9] It is recommended to shut down the interface modules before attempting to remove them from the chassis.

Note Consecutive IMs insertions, consecutive IMs reload or removal, and subsequent IM re-oinsertion should be done while waiting at least 180s between the actions.

Power Supply Requirement

As the N560-RSP4 supports various interface modules, there are system configurations that require wattage higher than 1200W to support the chassis power. In this case, (2+1) configuration is recommended for 1200W DC or 1200W AC power supply unit (PSU), where the two PSUs are required for system operations and one PSU is redundant. In this case, all three PSUs are in load sharing mode and the system continues to operate with one PSU failure. For more details on system power, see the CPC tool or get in touch with your Cisco Sales contact.



CHAPTER 2

Preparing for Installation

The following sections describe how to prepare for the installation of the route processor, interface module, and fan tray at your site:

General Precautions

Observe the following general precautions when using and working with your chassis:

- Keep your system components away from radiators and heat sources, and do not block cooling vents.
- Do not spill food or liquids on your system components, and never operate the product in a wet environment.
- Do not push any objects into the openings of your system components. Doing so can cause fire or electric shock by shorting out interior components.
- Position system cables and power supply cable carefully. Route system cables and the power supply cable and plug so that they are not stepped on or tripped over. Ensure that nothing is rests on your system component cables or power cable.
- Do not modify power cables or plugs. Consult a licensed electrician or your power company for site modifications. Always follow your local and national wiring rules.
- If you turn off your system to avoid damage to the system components, wait at least 30 seconds before turning it on again.

Site Planning Checklist

Use the following checklist to carry out all site planning tasks:

- The site meets environmental requirements.
- The site's air conditioning system can compensate for the heat dissipation of the chassis.
- The floor space that the chassis occupies can support the weight of the system.
- Electrical service to the site complies with the safety with electricity requirements.
- The electrical circuit servicing the chassis complies with the power supply requirements.
- Console port wiring and cabling limitations have been considered in accordance to TIA/EIA-232F.
- The chassis Ethernet cabling distances are within prescribed limits.
- The equipment rack where the chassis is to be installed complies with prescribed requirements.
- The following factors have been carefully considered when selecting rack: location, safety, ease of maintenance, and proper airflow.

Site Power Guidelines

The Cisco ASR 907 Router has specific power and electrical wiring requirements. Adhering to these requirements ensures reliable operation of the system. Follow these precautions and recommendations when planning your site power for the Cisco ASR 907 Router:

- The redundant power option provides a second, identical power supply to ensure that power to the chassis continues uninterrupted if one power supply fails or input power on one line fails.
- In systems configured with the redundant power option, connect each of the two power supplies to a separate input power source. If you fail to do this, your system might be susceptible to total power failure due to a fault in the external wiring or a tripped circuit breaker.
- To prevent a loss of input power, be sure that the total maximum load on each circuit supplying the power supplies is within the current ratings of the wiring and the breakers.
- Check the power at your site before installation and periodically after installation to ensure that you are receiving clean power. Install a power conditioner if necessary.
- Provide proper grounding to avoid personal injury and damage to the equipment due to lightning striking power lines or due to power surges. The chassis ground must be attached to a central office or other interior ground system.

Caution This product requires short-circuit (overcurrent) protection, to be provided as part of the building installation. Install only in accordance with national and local wiring regulations.

Note The Cisco ASR 907 Router installation must comply with all the applicable codes and is approved for use with copper conductors only. The ground bond fastening hardware should be of compatible material and preclude loosening, deterioration, and electrochemical corrosion of hardware and joined material. Attachment of the chassis ground to a central office or other interior ground system must be made with a 6 AWG gauge wire, copper ground conductor at a minimum.

The maximum power draw of the Cisco ASR 907 Router chassis and its configurable hardware components are listed in the following table. The maximum power draw values are not affected by whether the router chassis contains two or thress power supplies and either AC or DC.

Hardware component(s)	Maximum power draw value
N560-RSP4-E (Active)	264 W
N560-RSP4-E (Standby)	240 W
N560-RSP4 (Active)	204 W
N560-RSP4 (Standby)	192 W
N560-FAN-H	475 W
A900-IMA-8Z (8-port 10 GE SFP interface module)	56 W
A900-IMA-8Z-L (8-port 10 GE SFP+ interface module)	24 W
N560-IMA-2C (2-port 100 GE interface module)	60 W
N560-IMA-2C-DD (2-port 100 GE interface module)	75 W
A900-IMA-8CS1Z-M (8/16 E SFP interface)	50 W

Electrical Circuit Requirements

Each chassis requires a dedicated electrical circuit. If you equip the device with dual-power feeds, provide a separate circuit for each power supply to avoid compromising the power redundancy feature.

The chassis supports both DC source or an AC source. Ensure that equipment grounding is present and observe power-strip ratings. Make sure that the total ampere rating of all the products plugged into the power strip does not exceed 80% of the rating.

Site Cabling Guidelines

This section contains guidelines for wiring and cabling at your site. When preparing your site for network connections to the chassis, consider the type of cable that is required for each component and cable limitations. Consider the distance limitations for signaling, electromagnetic interference (EMI), and connector compatibility. Possible cable types are fiber, thick or thin coaxial, foil twisted-pair, or unshielded twisted-pair cabling.

Also, consider any additional interface equipment that you need, such as transceivers, hubs, switches, modems, channel service units (CSU), or data service units (DSU).

Before you install the chassis, have on hand all additional external equipment and cables. For information about ordering, contact a Cisco customer service representative.

The extent of your network and the distances between the network interface connections depend, in part, on the following factors:

- Signal type
- Signal speed

- Transmission medium

The distance and rate limits that are referenced in the following sections are the IEEE-recommended maximum speeds and distances for signaling purposes. Use this information as a guideline when planning your network connections *before* installing the chassis.

If wires exceed the recommended distances, or if wires pass between buildings, give special consideration to the possibility of a lightning strike in your vicinity. The electromagnetic pulse due to lightning or other high-energy phenomena can easily couple enough energy into unshielded conductors to destroy electronic devices. If you have had problems of this sort in the past, you may want to consult experts in electrical surge suppression and shielding.

Asynchronous Terminal Connections

The chassis provides a console port to connect a terminal or computer for local console access. The port has an RJ-45 connector and supports RS-232 asynchronous data with distance recommendations that are specified in the IEEE RS-232 standard. The available baud rate is 115200 bauds.

Interference Considerations

When wires are run for any significant distance, there is a risk of receiving stray signals on the wires as interference. If interference signals are strong, it results in data errors or equipment damage.

The following sections describe the sources of interference and how to minimize their effects on the chassis.

Electromagnetic Interference

All the equipment that is powered by AC current can propagate electrical energy that can cause EMI and possibly affect the operation of other equipment. The typical sources of EMI are equipment power cords and power service cables from electric utilities.

Strong EMI can destroy the signal drivers and receivers in the chassis. It can even create an electrical hazard by causing power surges through the power lines into installed equipment. These problems are rare, but could be catastrophic.

To resolve these problems, you need specialized knowledge and equipment that could consume substantial time and money. However, you can ensure that you have a properly grounded and shielded electrical environment, paying special attention to the need for electrical surge suppression.

Radio Frequency Interference

When electromagnetic fields act over a long distance, radio frequency interference (RFI) may be propagated. Building wiring can often act as an antenna, receiving the RFI signals and creating more EMI on the wiring.

If you use a twisted-pair cable in your plant wiring with a good distribution of grounding conductors, the plant wiring is unlikely to emit radio interference. If you exceed the recommended distances, use a high-quality twisted-pair cable with one ground conductor for each data signal.

Lightning and AC Power Fault Interference

If signal wires exceed the recommended cabling distances, or if signal wires pass between buildings, you may encounter a lightning strike on the chassis.

The electromagnetic pulse (EMP) generated by lightning or other high-energy phenomena can couple enough energy into unshielded conductors and damage or destroy electronic equipment. For such problems, you must consult with RFI and EMI experts to ensure adequate electrical surge suppression and shielding of signal cables in your operating environment.

Warning This product requires surge protection as part of the building installation. To comply with the Telcordia GR-1089 NEBS standard for electromagnetic compatibility and safety, an external surge protective device (SPD) is required at the AC or DC power service equipment.

Tools and Equipment

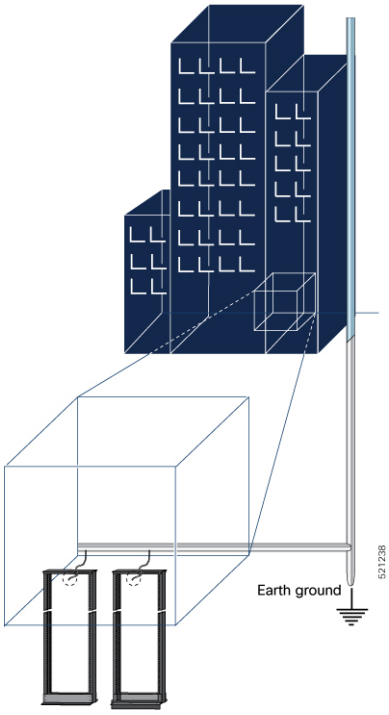
You need the following tools and equipment to install and upgrade the device and its components:

- ESD-preventive cord and wrist strap
- Antistatic mat or antistatic foam
- Number 1 and Number 2 Phillips-head screwdrivers
- #12-24 pan-head screws to secure the device to the equipment rack
- Cables for connecting to network ports (based on the configuration)
- Ethernet hub, switch, or PC with a network interface card for connecting to the Ethernet ports
- Console terminal that is configured for 115200 baud, 8 data bits, no parity, no flow control, and 2 stop bits
- Console cable for connecting to the console port
- Ratcheting torque screwdriver with a Phillips head that exerts up to 30-pound force per square inch (0.02-kilograms force per square millimeter (kgf/mm2)) of pressure
- Crimping tool as specified by the ground lug manufacturer
- Wire-stripping tools for stripping both 6 and 14-AWG wires
- Tape measure and level
- Ratcheting torque screwdriver with a Phillips head that exerts up to 15 inch-pounds (1.69 newton meters) of torque for attaching the ground wire to the device

Prepare Your Location

This section illustrates how the building that houses the chassis must be properly grounded to the earth ground.

Figure 7: Building with Rack Room Connected to Earth Ground

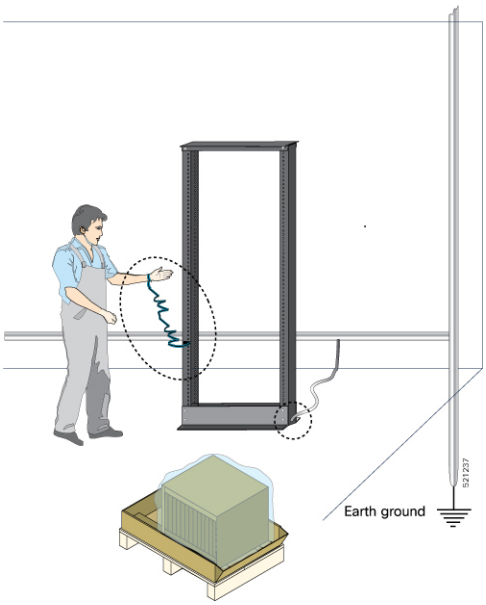


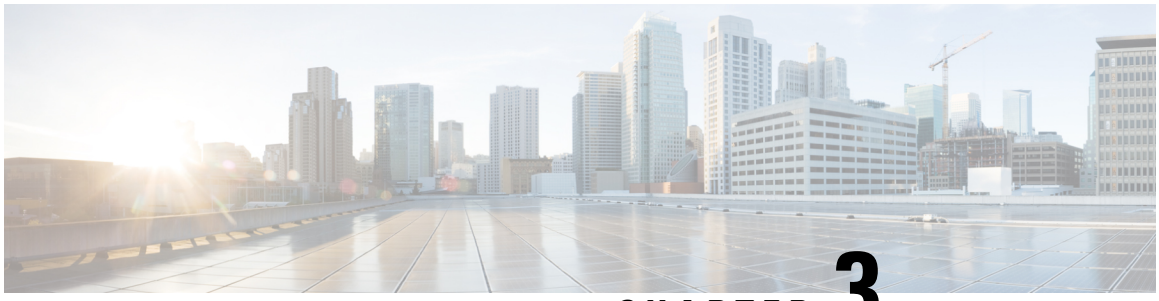
Prepare Yourself

This section illustrates how to prepare yourself before removing the chassis from the sealed antistatic bag. The figures show how to wear the ESD strap around the wrist and how to connect the other end of the strap to the ground. ESD wrist straps are the primary means of controlling static charge on personnel.

Note: These images are for only representation purposes. The chassis' actual appearance and size would vary.

Figure 8: Wearing the ESD Strap





CHAPTER 3

Installing the Components

This chapter describes the installation procedures for the route processor, interface module and the fan tray.

For information on installing the other components in the Cisco ASR 907 router, see the *Cisco ASR 907 Router Hardware Installation Guide*.

Installing the Route Processor

Note Do not use the N560-RSP4 and N560-RSP4-E route processors together in the same router.

Procedure

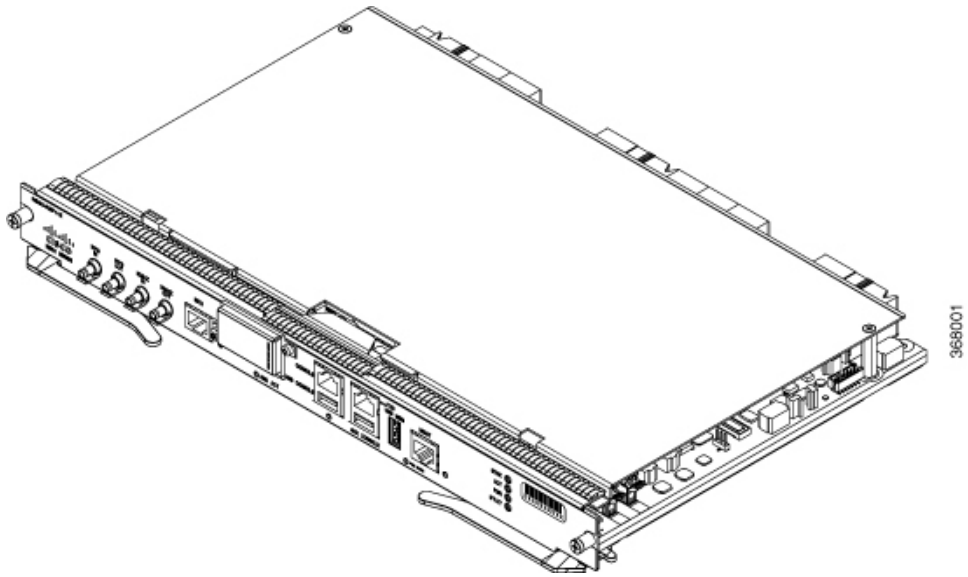
Step 1 Choose a slot for the module. Make sure that there is enough clearance to accommodate any equipment that will be connected to the ports on the module. If a blank module filler plate is installed in the slot in which you plan to install the module, remove the plate by removing its 2 Phillips pan-head screws.

Step 2 Fully open both the ejector levers on the new module, as shown in the figure below.

Caution To prevent ESD damage, handle the module as per ESD guidelines. Avoid direct contact to all electronics components.

Step 3 Position the module in the slot. Make sure that you align the sides of the module with the guides on each side of the slot, as shown in the figure below.

Figure 9: Installing the RSP



Step 4 Carefully slide the module into the slot until the EMI gasket on the module makes contact with the module in the adjacent slot and both the ejector levers have closed to approximately 45 degrees with respect to the module faceplate.

Caution If the top slot already has an RSP module installed, and you install a second RSP module in the slot below it, be careful not to damage the EMI gasket of the bottom RSP module against the ejector levers of the top RSP during insertion.

Step 5 While pressing down, simultaneously close both the ejector levers to fully seat the module in the backplane connector. The ejector levers are fully closed when they are flush with the module faceplate.

Step 6 Tighten the two captive installation screws on the module. The recommended maximum torque is 5.5 in.-lb (.62 N-m).

Note Make sure that the ejector levers are fully closed before tightening the captive installation screws.

Step 7 Verify that the captive installation screws are tightened on all of the modules installed in the chassis. This step ensures that the EMI gaskets on all the modules are fully compressed in order to maximize the opening space for the new or replacement module.

Note If the captive installation screws are loose, the EMI gaskets on the installed modules will push adjacent modules toward the open slot, which reduces the size of the opening and makes it difficult to install the new module.

Caution Blank module filler plates (Cisco part number A90X-RSPA-BLANK-W) should be installed in any empty chassis slots to keep dust out of the chassis and to maintain consistent airflow through the chassis.

Note When installing the cabling to an RSP, we recommend that you leave a service loop of extra cabling sufficient to allow for fan tray removal.

Caution Close all unused RJ-45 and USB ports on the RSP module using the appropriate dust caps to prevent dust from accumulating inside the cage.

Removing the Route Processor

Before you begin

Before you remove an RSP from the router, you should save the current configuration on a TFTP server or an external USB flash drive, using the **copy running-config {ftp | tftp | harddisk:}** command. This saves you time when bringing the module back online.

Use the **commit** command to save the current running configuration.

Warning Hazardous voltage or energy is present on the backplane when the system is operating. Use caution when servicing. Statement 1034

Warning Invisible laser radiation may be emitted from disconnected fibers or connectors. Do not stare into beams or view directly with optical instruments. Statement 1051

Procedure

Step 1 Disconnect any cables attached to the ports on the module.

Step 2 Verify that the captive installation screws on all the modules in the chassis are tight. This step ensures that the space created by the removed module is maintained.

Note If the captive installation screws are loose, the EMI gaskets on the installed modules will push the modules toward the open slot, which in turn reduces the size of the opening and makes it difficult to remove the module.

Step 3 Loosen the two captive installation screws on the module you plan to remove from the chassis.

Step 4 Place your thumbs on the ejector levers and simultaneously rotate the ejector levers outward to unseat the module from the backplane connector.

Step 5 Grasp the front edge of the module and slide the module straight out of the slot. If the chassis has horizontal slots, place your hand under the module to support its weight as you slide it out from the slot. Do not touch the module circuitry.

Caution To prevent ESD damage, handle modules by the carrier edges only.

Step 6 Place the module on an antistatic mat or antistatic foam, or immediately reinstall the module in another slot.

Step 7 Install blank module filler plates (Cisco part number A90X-RSPA-BLANK-W) in empty slots, if any.

Warning Blank faceplates and cover panels serve three important functions: they prevent exposure to hazardous voltages and currents inside the chassis; they contain electromagnetic interference (EMI) that might disrupt other equipment; and they direct the flow of cooling air through the chassis. Do not operate the system unless all cards, faceplates, front covers, and rear covers are in place. Statement 1029

Hot Swapping the Route Processor

you can remove and replace a redundant RSP module without powering down the router. This feature, called hot-swapping or OIR, allows you to remove and replace a redundant module without disrupting router operation.

When two redundant modules are installed in the router, only one of the modules is active. The other one runs in standby mode, ready to take over processing if the active module fails.

When you remove or insert a redundant module while the router is powered on and running, the router does the following:

1. Determines if there is sufficient power for the module.
2. Scans the backplane for configuration changes.
3. Initializes the newly inserted module. In addition, the system notes any removed modules and places those modules in the administratively shutdown state.
4. Places any previously configured interfaces on the module back to the state they were in when they were removed. Any newly inserted interfaces are put in the administratively shutdown state as if they were present (but unconfigured) at boot time. If you insert the same type of module into a slot, its ports are configured and brought online up to the port count of the original module.

The router runs diagnostic tests on any new interfaces and the test results indicate the following:

- If the tests pass, the router is operating normally.
- If the new module is faulty, the router resumes normal operation but leaves the new interfaces disabled.
- If the diagnostic tests fail, the router stops operating, which usually indicates that the new module has a problem in the bus and should be removed.

Use the following guidelines when performing an OIR on an IM:

- Allow at least 2 minutes for the system to reinitialize before inserting a new IM.
- Avoid inserting a new IM during bootup until the active and standby RSPs have reached an OK state.
- When inserting multiple IMs into the chassis, wait until each IM reaches an OK state before inserting the next IM.

Installing the Interface Module

Before you begin

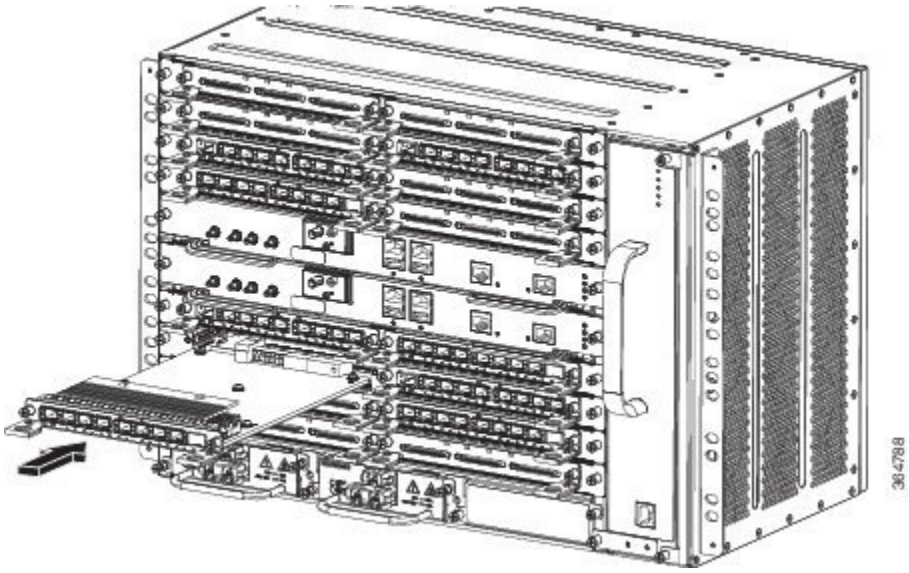
Ensure that the chassis is grounded.

Procedure

Step 1 To insert the interface module, carefully align the edges of the interface module between the upper and lower edges of the router slot.

Step 2 Carefully slide the interface module into the router slot until the interface module makes contact with the backplane. The figure below shows how to install the interface module.

Figure 10: Installing an Interface Module



Step 3 Tighten the locking thumbscrews on both sides of the interface module. The recommended maximum torque is 5.5 in.-lb (.62 N-m).

Step 4 Connect all the cables to each interface module.

What to do next

Caution Do not use the interface module ejector handles to lift the chassis; using the handles to lift the chassis can deform or damage the handles.

Note Close all unused RJ-45, SFP, XFP, and QSFP ports on the interface module using the appropriate dust caps to prevent dust from accumulating inside the cage.

Removing the Interface Module

Procedure

Step 1 Disconnect all the cables from each interface module.

Step 2 Press the ORS (online removal switch) button available on the front panel to shut down the IM.

Note This step is applicable *only* if the router is running Cisco IOS XR Release 7.2.2 and later release.

Note Effective Cisco IOS XR Release 7.2.2, the ORS functionality is available on the N560-IMA-1W interface module.

Note Effective Cisco IOS XR Release 7.3.1, the ORS functionality is available on the N560-IMA-2C-DD interface module.

Step 3 Loosen the locking thumbscrews on both sides of the interface module.

Step 4 Slide the interface module out of the router slot by pulling on the handles. If you are removing a blank filler plate, pull the blank filler plate completely out of the router slot using the captive screws.

Installing the Fan Tray

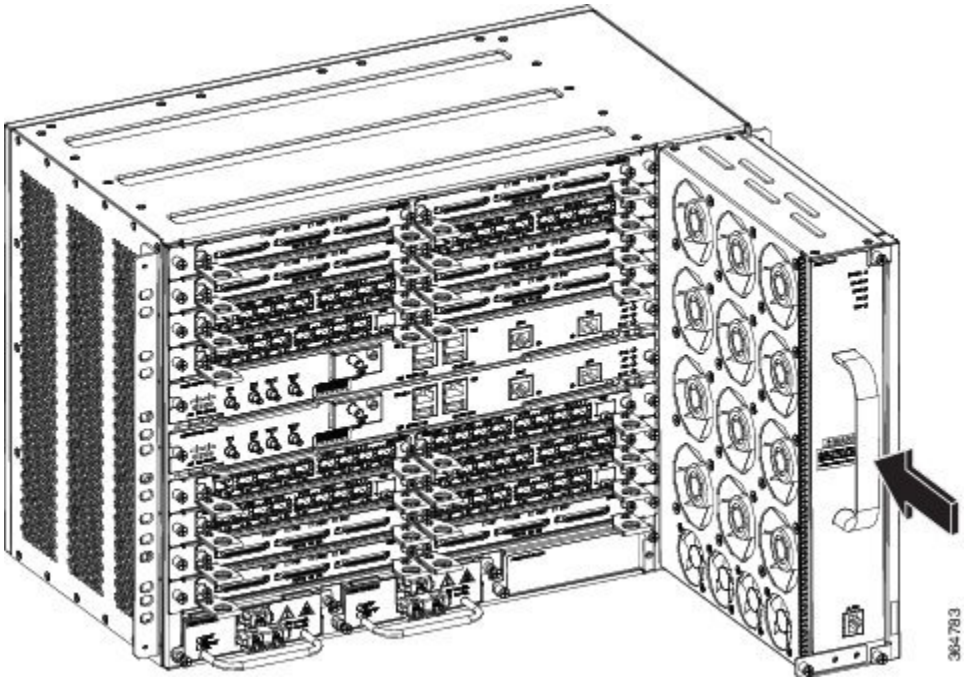
The fan tray is a modular unit that provides cooling to the router.

Note Do not introduce body parts or objects in the fan tray slot when installing or removing the fan tray module. Exposed circuitry is an energy hazard.

Procedure

Step 1 Orient the fan tray so that the captive screws are on the right side of the fan tray's front panel. The figure below shows how to orient the fan tray.

Figure 11: Installing the Fan Tray



Step 2 Guide the fan tray into the chassis until it is fully seated.

Caution The fans are exposed on the left side of the fan tray. Keep your fingers, clothing, and jewelry away from the fans. Always handle the fan tray by the handle.

Note When installing the cabling to the RSPs, we recommend that you leave a service loop of extra cabling sufficient to allow for fan tray removal.

Step 3 Secure the fan tray to the chassis using the attached captive installation screws. The recommended maximum torque is 5.5 in.-lb (.62 N-m).

For information about connecting cables to the fan tray alarm port, see the *Connecting the Fan Tray Alarm Port* section. For a summary of the LEDs on the fan tray, see the *LED Details* section.

Removing the Fan Tray

Before you begin

The fan tray supports online insertion and removal (OIR). There is no need to power down the Cisco router to remove or replace the fan tray. However, the router will shut down depending upon the fan speed and ambient temperature. See the Fan Tray OIR table in the *Online Insertion and Removal* section.

Note If a fan tray is removed and not replaced within the stipulated time the system will automatically power-off. There should be a minimum time period of 15 seconds between fan tray removal and re-insertion of the fan trays during the operation of the system. If the system is powered with PSUs other than 1200W AC and if the system is powered off, then the system should be completely powered off for 30 seconds with all the PSU in the system simultaneously, and then turned on for the system to power on.

Note Do not introduce body parts or objects in the fan tray slot when installing or removing the fan tray module. Exposed circuitry is an energy hazard.

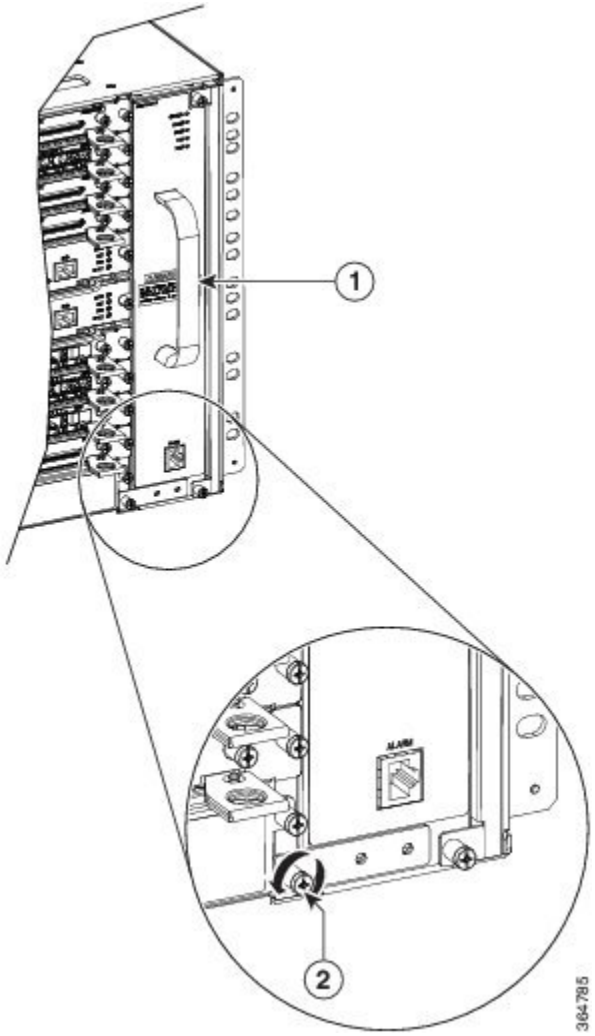
Caution In the event of an overtemperature alarm, the router can shut down in less than 60 seconds. In the event of a critical temperature alarm, the router shuts down immediately.

Caution To avoid erroneous failure messages, allow at least 2 minutes for the system to reinitialize after the fan tray has been replaced.

Procedure

Step 1 Using a No. 2 Phillips screwdriver or your fingers, loosen the captive installation screw that secures the fan tray to the chassis. The figure below shows the front of the fan tray, including the captive installation screws.

Figure 12: Removing the Fan Tray Screw



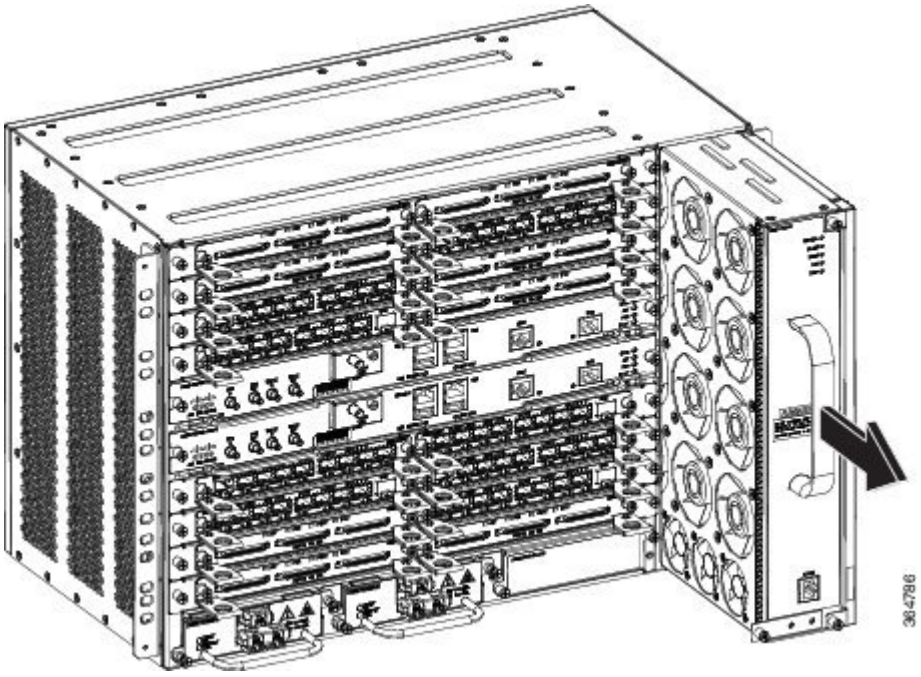
1	Fan tray handle	2	Captive screw

Step 2 Grasp the fan tray handle with one hand and the outside of the chassis with the other hand. The figure above shows the front of the fan tray, including the handle.

Caution The fans are exposed on the left side of the fan tray. Keep your fingers, clothing, and jewelry away from the fans. Always handle the fan tray by the handle.

Step 3 Pull the fan tray toward you no more than 1 inch to disengage it from the power receptacle on the midplane, as shown in the figure below.

Figure 13: Removing the Fan Tray

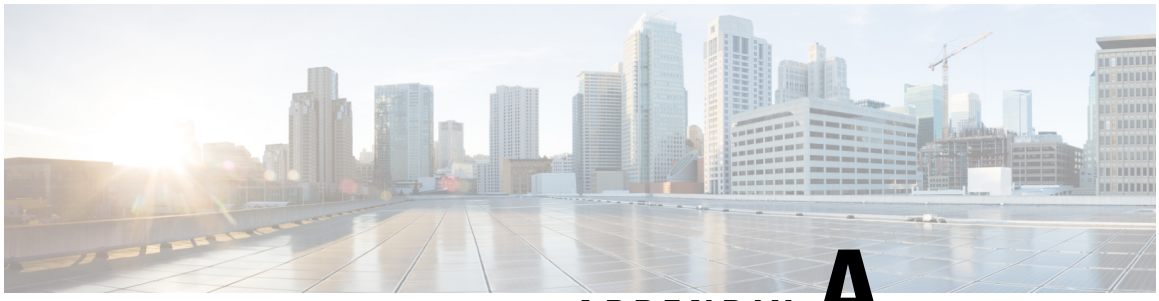


Warning When removing the fan tray, keep your hands and fingers away from the spinning fan blades. Let the fan blades completely stop before you remove the fan tray. Statement 258

Step 4 Wait at least 5 seconds to allow the fans to stop spinning. Then, pull the fan tray backward toward you and out of the chassis.

Note As the fan tray slides out of the chassis, support the bottom of the fan tray with one hand and keep your other hand on the fan tray handle.

Note The chassis must not be allowed to operate without functioning fans for more than 60 seconds.



APPENDIX A

LED Details

This appendix describes the LED details for:

N560-RSP4 and N56-RSP4-E LEDs

Table 7: N560-RSP4 and N560-RSP4-E LED Details

LED	Color/State	Description
Power (PWR)	Off	Disabled/no power to RSP
	Green	Power rails on RSP in range
Status (STAT)	Off	Disabled/power down
	Red	Failure to boot (lit at reset)
	Yellow	Rommon booted
	Green	IOS XR booted and running
Active (ACT)	Off	Not available
	Yellow	Standby (indicates standby RSP)
	Green	Active (indicates active RSP)
Management port (MGMT)	Off	No connection
	Green	Connected with no activity
	Flashing green	Connected with activity

LED	Color/State	Description
Sync status (SYNC)	Off	Not enabled
	Yellow	Free run
	Flashing yellow	Holdover
	Green	Locked to source
USB flash (MEM)	Flashing green	USB activity
BITS	Off	Out of service/not configured
	Amber	Fault or loop condition
	Green	In frame/working properly

The PWR and STAT LEDs are available on the front panel. These LEDs provide power on the board (PWR) and overall router health (STAT) status. During power up state, these LEDs provide booting status and report errors.

Note The digital code signing functionality validates the integrity and authenticity of the ROMMON image before booting it.

The PWR and STAT LEDs are available on the front panel. These LEDs provide power on the board (PWR) and overall router health (STAT) status. During power up state, these LEDs provide booting status and report errors.

Table 8: Power and Status LED Combination

Power (PWR) LED State	Status (STAT) LED State	Indication	Remarks
Light Green	Red	Power is OK and the field-programmable gate array (FPGA) is configured successfully, but FPGA image validation failed.	Image validation failed. System is in hung state.

Power (PWR) LED State	Status (STAT) LED State	Indication	Remarks
Flashing Light Green and Green alternatively	Off	FPGA configured and core validated successfully. FPGA image passed the control to micro-loader to boot ROMMON.	System is up with ROMMON. Both the FPGA image is validated successfully, but the booted ROMMON (primary or secondary) is undetermined.
	Amber	The digital code signing functionality reported upgrade FPGA image validation error and is continuing with the FPGA image.	System is up with ROMMON. FPGA image is validated successfully, but the booted ROMMON (primary or secondary) is undetermined.
	Red	The digital code signing functionality reported failure in the ROMMON image validation.	FPGA is up but both primary and secondary ROMMON failed. System is in hung state.
Green	Off	IOS XR is successfully booted	IOS XR writes into FPGA register to indicate that it has booted, FPGA stops flashing PWR LED and turns Green. Software now controls the STAT LED.

RSP4 LEDs

Table 9: RSP4 LED Details

PWR	STATS	Active/Standby	SYNC LED	PWR DWN LED	Indication
Light Green	—	—	—	—	Power OK
OFF	Flashing Red	—	—	—	Secure Jtag error
OFF	Amber	—	—	—	BIOS Image validation failure
—	OFF	Yellow	—	—	Micro-controller Sub-system not ready
—	OFF	Amber	—	—	TAM init failure

PWR	STATS	Active/Standby	SYNC LED	PWR DWN LED	Indication
OFF	OFF	Blinking Yellow	—	—	TAM not ready
OFF	Red	—	—	—	FPGA PLL failure
OFF	OFF	OFF	—	Flashing Yellow	Thermal Shutdown
OFF	OFF	OFF	—	Yellow	Software triggered shutdown
OFF	OFF	OFF	—	Green	Peer RSP shutdown

Interface Module LEDs

Table 10: Interface Module LED Details

LED	Color/State	Description (2x100G)	Description (8x10G / 8x25G / 8x50G)	Description (8/16x1G + 1x10G)	Description (1x100G / 200G)
—	—	N560-IMA-2C N560-IMA-2C-DD	A900-IMA-8Z A900-IMA-8Z-L	A900-IMA-8CS1Z-M	N560-IMA-1W
Power (PWR)	Off	Disabled / no power to IM	Disabled / no power to IM	Disabled / no power to IM	No power to IM
	Green	Enabled and power rails on IM in range	Enabled and power rails on IM in range	Enabled and power rails on IM in range	All power rails are in range
Status (STAT)	Off	Disabled / power-down	Disabled / power-down	Disabled / power-down	Disabled / Power down
	Red	—	—	—	IM failure
	Flashing Red	Booting (if local CPU), IM Failure, FPD upgrade in progress, FPD upgrade failure	Booting (if local CPU), IM Failure	Booting (if local CPU), IM Failure	—
	Green	Operational	Operational	Operational	Operational

LED	Color/State	Description (2x100G)	Description (8x10G / 8x25G / 8x50G)	Description (8/16x1G + 1x10G)	Description (1x100G / 200G)
Link Status (L)	Off	Inactive or no connection	Inactive or no connection	Inactive or no connection[10]	—
	Amber	Fault / loop condition	Fault / loop condition	Fault / loop condition	—
	Green	Ok with activity or no activity	Ok with activity or no activity	Ok with activity or no activity	—
Speed (S)	Off	Inactive port status	Inactive port status	Inactive port status**	—
	Green	Activity or no activity	Activity or no activity	Activity or no activity	—
CFP0	Off	—	—	—	Laser Off – Controller down / shutdown
	Yellow	—	—	—	Link Down – Controller / HuGig SubPort 0 is “Operational Down”
	Green	—	—	—	Link Up – Controller / HuGig SubPort 0 is “Operational Up”
CFP1	Off	—	—	—	Laser Off – Controller down / shutdown
	Yellow	—	—	—	Link Up – Controller / HuGig SubPort 1 is “Operational Down”
	Green	—	—	—	Link Up – Controller/HuGig SubPort 1 is “Operational Up”
ORI[11]	Off	Optics removal not initiated	—	—	Optics removal not initiated
	Yellow	Optics removal initiated	—	—	Optics removal initiated
	Green	Ready for optical removal in the next 15 seconds	—	—	Ready for optical removal in the next 15 seconds

[10] ** CSFP optics is not supported in the 10G port. So the LEDs on port 17 do not function and remain off.

[11] The ORI LED is functional on N560-IMA-1W only from Cisco IOS XR Release 7.2.2 and it is funcitional on N560-IMA-2C-DD only from Cisco IOS XR Release 7.3.1.

Fan Tray LEDs

Note A major alarm condition indicates the failure of a single fan in the fan tray; a critical alarm indicates the failure of multiple fans. In the event that a single fan fails, the Cisco ASR 907 Router software adjusts the fan speed to prevent excessive heat within the chassis.

Table 11: Fan Tray LED Details

LED	Color/State	Description
Status (TEMP)	Off	Disabled/power down
	Amber	Over temperature
	Green	OK
Fan (FAN)	Green	Fan rotation in range
	Amber	Fan fault
	Red	Two or more fan faults
Minor (MIN)	Off	No minor alarm
	Amber	Minor alarm
Major (MAJ)	Off	No major alarm
	Red	Major Alarm
Critical (CRIT)	Off	No critical alarm
	Red	Critical alarm (defaults to ON upon RSP reset)