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

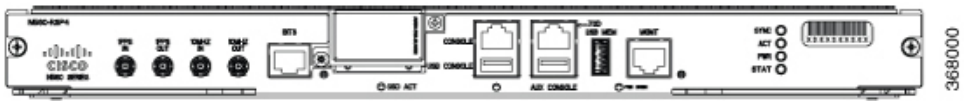
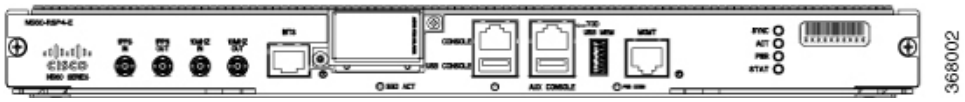


Figure 2: N560-RSP4-E Front Panel



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 LED Details.

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	—

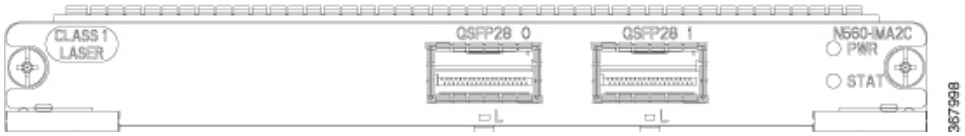
Slot	N560-IMA-2C N560-IMA-2C-DD	A900-IMA-8Z A900-IMA-8Z-L	A900-IMA-8CS1Z-M	N560-IMA-1W
013	—	Yes	Yes - 16 x 1G and 1 x 10G	—
014	—	—	Yes - 8 x 1G and 1 x 10G	—
015	—	—	Yes - 8 x 1G and 1 x 10G	—

[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)

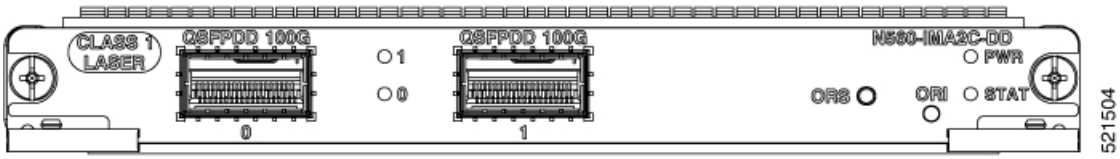
Supported Optics on this IM

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

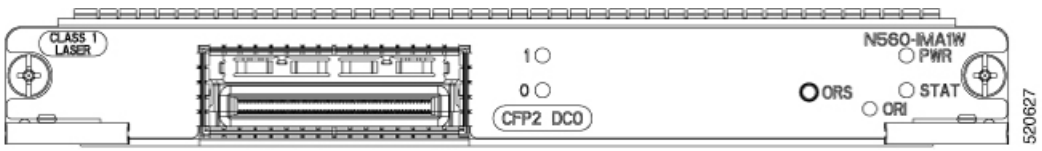
The N560-IMA-2C-DD IM supports QSFP-DD 100G ZF1 optics, such as:

- 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.

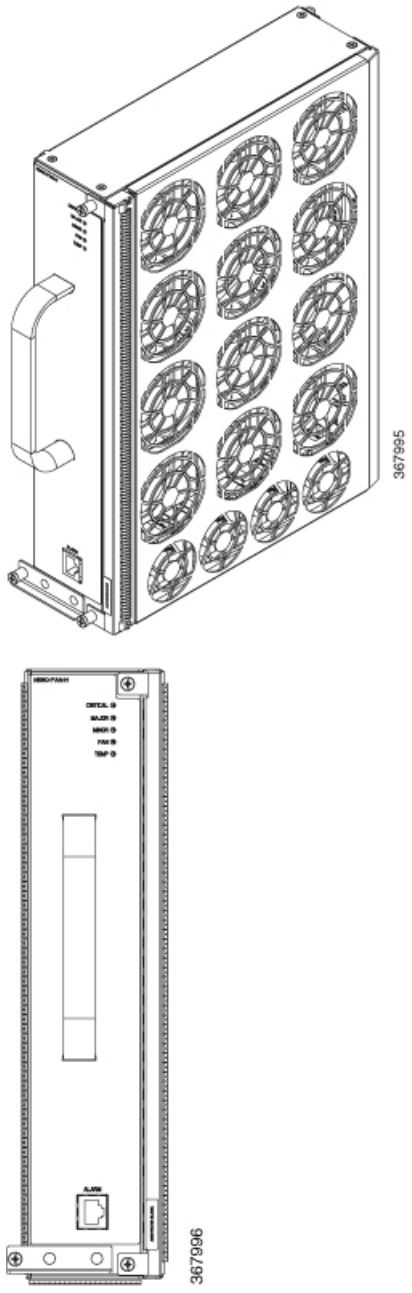
Supported Optics on this IM

- 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.