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QFX10002 Switch Hardware Guide

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The information in this document is current as of the date on the title page.

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About This Guide

Use this guide to plan, install, perform initial software configuration, perform routine maintenance, and to troubleshoot QFX10002 switches.

After completing the installation and basic configuration procedures covered in this guide, refer to the Junos OS documentation for further software configuration.

CHAPTER 1

Overview

QFX10002 System Overview

IN THIS SECTION

The Juniper Networks QFX10002 fixed configuration switch builds a strong underlay foundation for flexible, high-performance, standards-based fabrics and routing that improve network reliability and agility. As part of the QFX10000 line of switches, the QFX10002 models provide the flexibility of 10-Gbps, 40-Gbps, and 100-Gbps port speeds in a 2 U fixed configuration. For more information, see the following topics:

QFX10002 Switch Description

IN THIS SECTION

The Juniper Networks QFX10002 is a fixed configuration switch that offers a variety of port densities and network port configurations. This topic covers:

Benefits of the QFX10002 Switch

- Combats application latency by using a deep buffer with hybrid memory cube (HMC) technology to absorb network traffic spikes. Deep buffers are important at the edge of data center networks where typically there is a speed mismatch between WAN-facing interfaces and data center-facing interfaces.
- Operates as a universal platform that can be positioned in multiples roles –data center, data center interconnect, or data center edge, as well as campus and routing use cases because of its high logical scale.
- Enables cloud providers to collapse multiple layer in the network (spine and data center interconnect) that offer capital and operational expenditure savings.
- Saves on power with an optimized power profile per 100 Gigabit Ethernet.

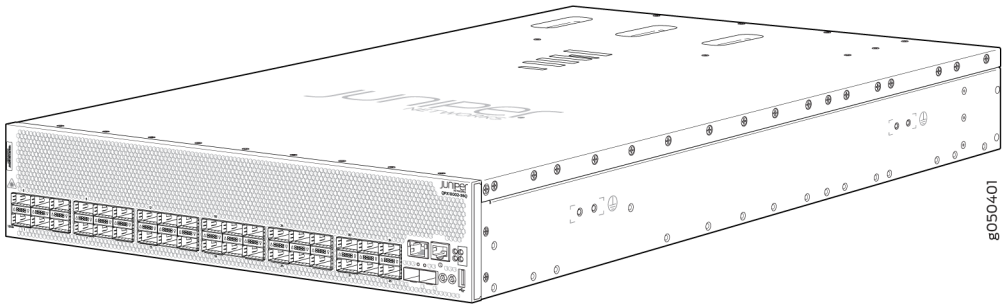
QFX10002 Models

The QFX10002 line of switches are deep-buffer fixed-chassis switches in a 2 U form factor for fixed core and spine deployments. All models of the QFX10002 support port densities of 10 Gigabit Ethernet, 40 Gigabit Ethernet and 100 Gigabit Ethernet. In addition, all switches are available with either an AC or DC power supply and with port to field replaceable unit (FRU) cooling. This type of cooling is also known as *airflow out (AFO)* or *front-to-back cooling*. The QFX10002 is available in three port configurations:

- QFX10002-36Q
- QFX10002-72Q
- QFX10002-60C

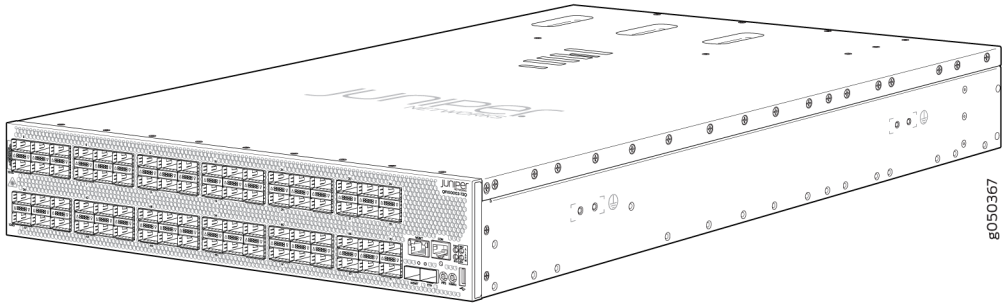
The QFX10002-36Q offers 36 40-Gbps capable quad small-form factor pluggable (QSFP+) ports. Of the 36 ports, 12 ports (0 through 35 every third port) supports 100-Gbps capable Quad Small Form-Factor Pluggable 28 (QSFP28) optical transceiver. Using the break-out cables any of the 36 40-Gbps ports can be configured to operate as four 10-Gigabit Ethernet interfaces. The QFX10002-36Q has up to 2.88 terabits per second (Tbps) of throughput and 1 billion packets per second (Bpps) of forwarding capacity. This model ships with redundant 1600 W AC or DC power supplies and three fan modules. See Figure 1 on page 4.

Figure 1: QFX10002-36Q Port Panel



The QFX10002-72Q offers 72 40-Gbps capable quad small-form factor pluggable (QSFP+) ports. Of the 72 ports, 24 ports (0 through 71 every third port) supports 100-Gbps capable Quad Small Form-Factor Pluggable 28 (QSFP28) optical transceiver. Using the break-out cables any of the 72 40-Gbps ports can be configured to operate as four 10-Gigabit Ethernet interfaces. It has up to 5.76 Tbps of throughput and 2 Bpps of forwarding capacity. This model ships with 4 redundant 1600 W AC or DC power supplies and three fan modules. See Figure 2 on page 4.

Figure 2: QFX10002-72Q Port Panel



The QFX10002-60C offers flexible configuration of the 60 QSFP28 ports. Each port can be configured as either 100 Gbps, 40 Gbps, or 4 by 10 Gbps. It has up to 12 Tbps of throughput and 4 Bpps of forwarding capacity. The QFX10002-60C ships with four 1600 W AC or DC power supplies and three fan modules. See Figure 3 on page 5.

Figure 3: QFX10002-60C Port Panel

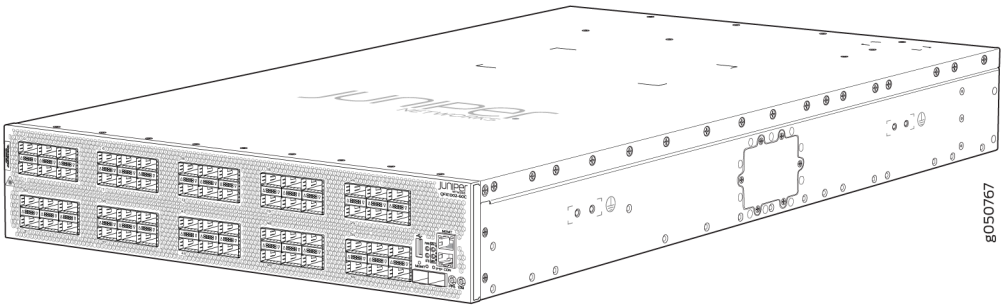


Table 1 on page 5 lists the ordering numbers for QFX10002 devices. See Figure 1 on page 4 through Figure 3 on page 5 for illustrations of the models.

Table 1: QFX10002 Switch Product Numbers

Product Numbers	Ports	Power Supply
QFX10002-72Q	72 QSFP+	AC
QFX10002-72Q-DC	72 QSFP+	DC
QFX10002-60C	60 QSFP28	AC
QFX10002-60C-DC	60 QSFP28	DC
QFX10002-36Q	36 QSFP+	AC
QFX10002-36Q-DC	36 QSFP+	DC

The QFX10002 models feature PHY-less interfaces to save on power and to lower latency. The ports on all models support quad small-form factor pluggable (QSFP+) transceivers and the 28-Gbps QSFP+ Pluggable Solution (QSFP28) transceivers. The interfaces on a QFX10002 can be configured to support 10-Gbps, 40-Gbps, and 100-Gbps port speeds. See Table 2 on page 6.

Table 2: Port Capacities

	QFX10002-36Q	QFX10002-60C	QFX10002-72Q
10 Gigabit Ethernet	144	192	288
40 Gigabit Ethernet	36	60	72
100 Gigabit Ethernet	12	60	24

System Architecture

The system architecture cleanly separates control operations from packet forwarding operations. This design eliminates processing and traffic bottlenecks, permitting the QFX10002 to achieve high performance.

- Control operations are performed by the Routing Engine, which runs the Juniper Networks Junos operating system (Junos OS). The Routing Engine handles routing protocols, traffic engineering, policy, policing, monitoring, and configuration management. Junos OS is installed on the QFX10002 internal solid-state drives (SSDs). QFX10002-36Q and QFX10002-72Q have 2 x 25-GB SSD and the QFX10002-60C has 2 x 64-GB SSDs. The Routing Engine has a 2.5-GHz quad core Intel CPU and has 16 GB of SDRAM on the QFX10002-36Q and QFX10002-72Q. There is 32 GB of SDRAM on the QX10002-60C.
- Forwarding operations are performed by the Packet Forwarding Engines, which include custom ASICs designed by Juniper Networks. The *Q5* ASICs enable the QFX10002 to provide up to 2.88 terabits per second (Tbps) of throughput on the QFX10002-36Q, 5.76 Tbps on the QFX10002-72Q and 12 Tbps on the QFX10002-60C. The Q5 ASICs are connected to Hybrid Memory Cubes (HMCs). These high-efficiency memory modules provide packet buffering, virtual output queue (VOQ) memory, and improved logical system scale.

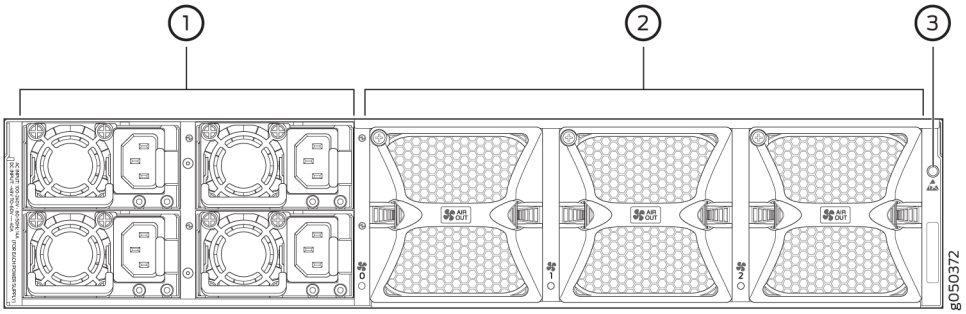
Cooling and Power

The cooling system in a QFX10002 consists of three 80-W fan modules that operate at 150 cubic feet per minute (CFM) at full speed as well as fans housed in the power supplies. Each fan modules has dual counter-rotating fans. These fan modules can be hot-swapped and hot-inserted, meaning that– you do not need to power off the switch or disrupt the switching function to replace a module.

in the QFX10002 cooling system, cool air enters through the vents in the port panel and hot air exhausts through the field-replaceable unit (FRU) panel. This type of airflow is known as *airflow out* or *port-to-FRU airflow*.

The four AC or DC 1600-W power supplies are installed by the factory in the QFX10002-72Q and QFX10002-60C; two power supplies are installed in the QFX10002-36Q. See Figure 4 on page 7 for an example of the QFX10002-72Q FRU panel. Each power supply provides 12 VDC output with a standby voltage of 12-VDC.The AC or DC power supplies in a QFX10002 are hot-removable and hot-insertable FRUs.

Figure 4: QFX10002 FRU Panel



1– Power supply modules (4) for QFX10002-72Q and QFX10002-60C. Two power supply modules are provided for QFX10002-36Q.	3– ESD point
2– Fan modules (3)	

CAUTION: Mixing different types (AC and DC) of power supplies in the same chassis is not supported.

The power supply bays on the QFX10002-72Q and QFX10002-36Q are numbered horizontally from the top left to the bottom right. The QFX10002-60C power supply bays are numbered vertically from the top left to the bottom right, which matches CLI output.

System Software

QFX Series devices use the Junos operating system (OS), which provides Layer 2 and Layer 3 switching, routing, and security services. Junos OS is installed on a QFX10002 switch's 25-gigabyte (GB) internal NAND solid state flash drive. The same Junos OS code base that runs on QFX10002 switches also runs on all Juniper Networks EX Series switches, and M Series, MX Series, and T Series routers.

For more information about which features are supported on QFX Series devices, see Feature Tracker.

You manage the switch using the Junos OS command-line interface (CLI), which is accessible through the console and out-of-band management ports on the device.

QFX10002 Hardware Component Overview

The QFX10002 supports the components in listed in alphabetic order. See "QFX10002 Chassis Physical Specifications" on page 70 for the dimensions and weight of the QFX10002 models.

Table 3: QFX10002 Hardware Components

Component	Spare Juniper Model Number	CLI Output

Chassis	QFX10002-72Q-CHAS-S
	JNP10002-60C
	QFX10002-36Q-CHAS-S
		`QFX10002-72Q`
		`QFX10002-60C`
		`QFX10002-36Q`

Fan module	QFX10002-FAN-S JNP10002-FAN1	`QFX10002-xxx Fan Tray` *n*`, Front to Back Airflow - AFO` for QFX10002-72Q and QFX10002-36Q `QFX10002-60C Fan Tray, Front to Back Airflow - AFO`
Power supplies	JPSU-1600W-AC-AFO JPSU-1600W-DC-AFO	`AC AFO 1600W PSU` for QFX10002-72Q and QFX10002-36Q `DC AFO 1600W PSU` for QFX10002-72Q and QFX10002-36Q `AC AFO 1600W PSU` for QFX10002-60C

QFX10002 Component Redundancy

The following hardware components provide redundancy on QFX10002 models:

- Power supplies

  As shown in Table 4 on page 9, the QFX10002-72Q and QFX10002-60C can operate with a single DC input power supply or a single AC input power supply for 220VAC operation. A minimum of two AC power supplies are required to operate the QFX10002-72Q and QFX10002-60C at 110VAC. The QFX1002-36Q can operate with a single DC input power supply or it can operate with a single AC power supply at 110VAC and 220VAC.

CAUTION: When running the switch in non-redundant mode, install a power supply cover (QFX10002-PWR-BLNK) in any unused power bays for safety, cooling, and emissions control.

The recommended configuration is to run the switch with twice as much power as needed, also called *2N*, for full power redundancy. To provide additional power for switch redundancy or feed-redundancy, see Table 4 on page 9.

Table 4: Available Power Redundancy Options

Model	Power	Non-redundant (N)	2N or Dual Feed
QFX10002-72Q	220 VAC	1	2 For power feed redundancy, connect power source feed A to power supplies **0** or **1** and connect power source feed B to power supplies **2** or **3.** The remaining slots should be covered with a power supply blank cover.
	110 VAC	2	4 For power feed redundancy, connect power source feed A to power supplies **0** and **1** and connect power source feed B to power supplies **2** and **3.**
QFX10002-72Q-DC	DC	1	2 For power feed redundancy, connect power source feed A to power supplies **0** or **1** and connect power source feed B to power supplies **2** or **3.** The remaining slots should be covered with a power supply blank cover.
QFX10002-60C	220 VAC	1	2 For power feed redundancy, connect power source feed A to power supplies **0** or **1** and connect power source feed B to power supplies **2** or **3.** The remaining slots should be covered with a power supply cover.

Table 4: Available Power Redundancy Options *(Continued)*

Model	Power	Non-redundant (N)	2N or Dual Feed
	110 VAC	2	4 For power feed redundancy, connect power source feed A to power supplies **0** and **1** and connect power source feed B to power supplies **2** and **3.**
QFX10002-60C-DC	DC	1	2 For power feed redundancy, connect power source feed A to power supplies **0** or **1** and connect power source feed B to power supplies **2** or **3.** The remaining slots should be covered with a power supply blank cover.
QFX10002-36Q	220 VAC	1	2 For power feed redundancy, connect power source feed A to power supplies **0** or **1** and connect power source feed B to power supplies **2** or **3.** The remaining slots should be covered with a power supply cover.
	110 VAC	1	2 For power feed redundancy, connect power source feed A to power supplies **0** or **1** and connect power source feed B to power supplies **2** or **3.** The remaining slots should be covered with a power supply cover.
QFX10002-36Q-DC	DC	1	2 For power feed redundancy, connect power source feed A to power supplies **0** or **1** and connect power source feed B to power supplies **2** or **3.** The remaining slots should be covered with a power supply cover.

- Cooling system—All models of the QFX10002 have three fan modules. Each fan module is a redundant unit containing two fans. If a fan module fails and is unable to keep the QFX10002 within the desired temperature thresholds, chassis alarms occur and the QFX10002 device might shut down.

QFX10002 Field-Replaceable Units

Field-replaceable units (FRUs) are components that you can replace at your site. The QFX10002 FRUs are hot-removable and hot-insertable: you can remove and replace them without powering off the switch or disrupting the switching function.

CAUTION: Replace a failed fan module with a new fan module within one minute of removal to prevent chassis overheating.

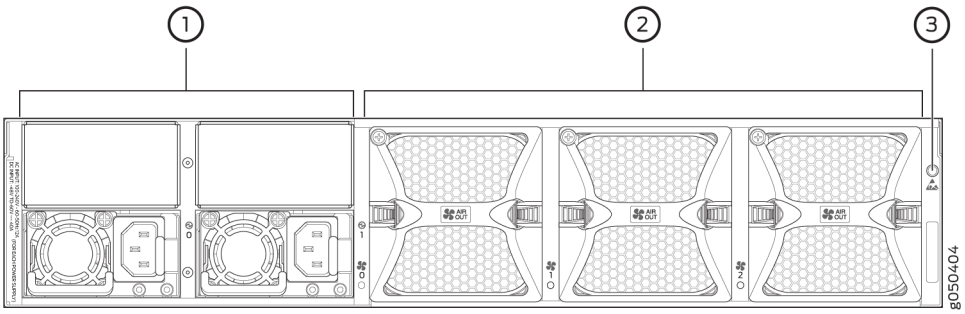
Table 5 on page 11 lists the FRUs for the QFX10002-72Q and actions to take before removing them.

Table 5: FRUs in a QFX10002 Device

FRU	Required Action
Power supplies: QFX10002-72Q and QFX10002-60C (4), QFX10002-36Q (2)	Remove the power cord for the power supply unit.
Fan modules (3)	None.
Optical transceivers	None. We recommend that you disable the interface using the **set interfaces *interface-name* disable** command before you remove the transceiver. See "Disconnect a Fiber-Optic Cable" on page 137.

See Figure 5 on page 11 for an example of the FRU panel on a QFX10002-36Q.

Figure 5: QFX10002-36Q FRU Panel



1– Power supplies (2)	3– ESD point

2– Fan modules (3)	

NOTE: If you have a Juniper Care service contract, register any addition, change, or upgrade of hardware components at https://www.juniper.net/customers/support/tools/updateinstallbase/ . Failure to do so can result in significant delays if you need replacement parts. This note does not apply if you replace existing components with the same type of component.

RELATED DOCUMENTATION

- QFX10002 Cooling System | 45
- QFX10002 Power System | 50
- QFX10002 Chassis Physical Specifications | 70
- Installing and Removing QFX10002 Hardware Components | 122

QFX10002 Port Panels

IN THIS SECTION

QFX10002-36Q Port Panel

IN THIS SECTION

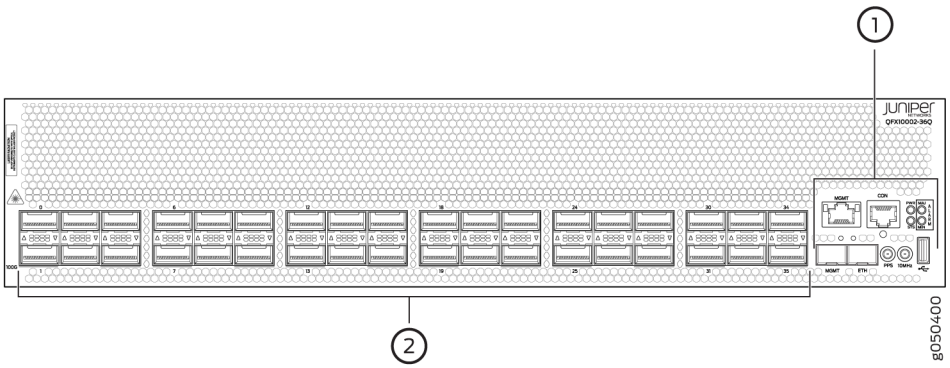
The port panel of the QFX10002-36Q consists of 36 quad small-form factor pluggable plus (QSFP+) ports that support 10-Gbps, 40-Gbps and 100-Gbps port speeds. Of these 36 ports, 12 ports accept QSFP28 transceivers, which are dual speed 40- or 100-Gigabit Ethernet optical transceivers.

This topic describes:

Overview

Any of the 36 ports **0** through **35** can be configured as either uplink or network ports. See Figure 6 on page 13.

Figure 6: QFX10002-36Q Port Panel



1– Management panel	2– Port panel with QSFP+ network interface or uplink ports (36)

The default configuration is independent 40-Gigabit Ethernet for all 36 ports. For 100-Gbps or 10-Gbps channelization operation, the ports operate within port groups. Every three ports compose a port group. See Table 6 on page 14 and Figure 7 on page 15 through Figure 10 on page 17.

Table 6: QFX10002-36Q Port Capacities

Per Port Group	Per Switch
1 x100 Gbps	12 x 100 Gbps
3 x 40 Gbps	36 x 40 Gbps
12 x 10 Gbps	144 x 10 Gbps

The second and sixth port in each 6XQSFP+ socket can be configured to support:

- 100-Gigabit Ethernet using 28-Gbps QSFP28 optical transceivers and 100-Gbps active optical cables (AOCs). When a QSFP28 transceiver is inserted into the ports marked with a fine black line underneath the socket and the port is configured for 100-Gigabit Ethernet, the two adjacent ports are disabled and the QSFP28 is enabled for 100-Gigabit Ethernet.
- 40-Gigabit Ethernet using QSFP+ optical transceivers or 40-Gbps direct attach copper (DAC) cables.
- 10-Gigabit Ethernet using DAC breakout cables (DACBO). When configured for channelization, a breakout cable converts the 40-Gigabit Ethernet port into 4 independent 10-Gigabit Ethernet ports. The two adjacent QSFP+ ports in the port group are also configured for channelization at the same time. You cannot configure a single port for channelization.

Network Ports

Each of the 12 QSFP28 ports support:

- 100-Gigabit Ethernet QSFP28 transceivers
- 100-Gigabit Ethernet active optical cables (AOCs)
- 40-Gigabit Ethernet QSFP+ transceivers
- 40-Gigabit Ethernet QSFP+ DAC cables
- 40-Gigabit Ethernet QSFP+ to 10-Gigabit Ethernet SFP+ direct attach copper breakout (DACBO) cables

The remaining ports support:

- 40-Gigabit Ethernet QSFP+ transceivers
- 40-Gigabit Ethernet QSFP+ DAC cables

- 40-Gigabit Ethernet QSFP+ to 10-Gigabit Ethernet SFP+ DACBO cables
- 10-Gigabit Ethernet SFP+ transceivers
- 10-Gigabit Ethernet DAC cables

100-Gbps Operation and Configuration

Every second and sixth port in a 6XQSFP cage on a QFX10002 supports 100-Gigabit Ethernet using QSFP28 transceivers. These 100-Gigabit Ethernet ports work either as 100-Gigabit Ethernet or as 40-Gigabit Ethernet, but are recognized as 40-Gigabit Ethernet by default. See Figure 7 on page 15 for a close up view of a 6XQSFP+ cage. The 100-Gigabit Ethernet are designated by a fine black line underneath the port. See Figure 8 on page 16. When a 40-Gigabit Ethernet transceiver is inserted into a 100-Gigabit Ethernet port, the port recognizes the 40-Gigabit Ethernet port speed. However, when an 100-Gigabit Ethernet transceiver is inserted into the port, the transceiver is not automatically recognized and is not seen in the output of the `show chassis hardware` command. To enable 100-Gigabit Ethernet on the marked ports, use the `set chassis fpc` command. For example, to enable port 11 for 100 Gbps speeds:

```
[edit]
user@switch#
set chassis fpc 0 pic 0 port 11 speed 100g
```

The port then recognizes the 100-Gigabit Ethernet speed and disables two adjacent 40-Gigabit Ethernet ports. See Figure 9 on page 16.

Figure 7 on page 15 shows one of the six 6XQSFP+ cages on a QFX10002-36Q.

Figure 7: All Ports are 40-Gigabit Ethernet by Default

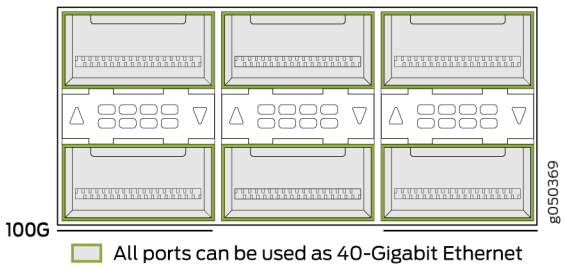


Figure 8: 100-Gigabit Ethernet Ports Are Indicated by a Black Line Underneath the Port

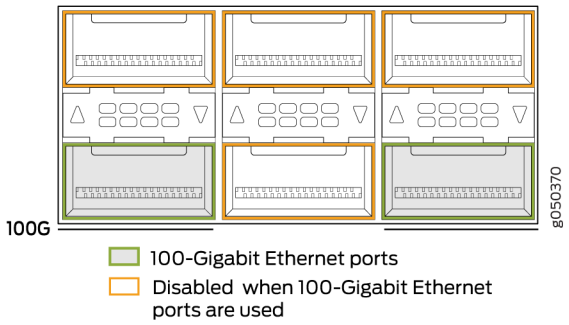
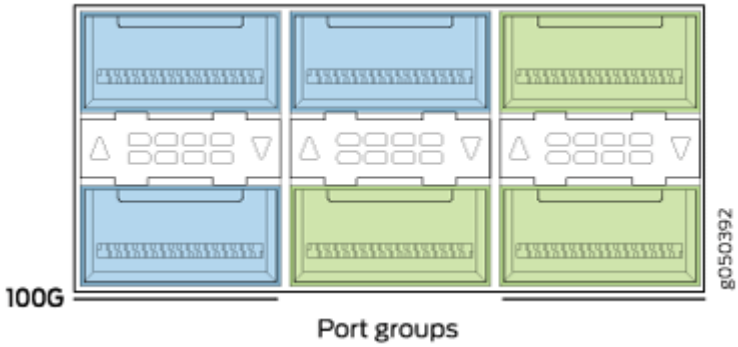


Figure 9: 100-Gigabit Ethernet Port Disables Two Associated 40-Gigabit Ethernet Ports in the Port Group

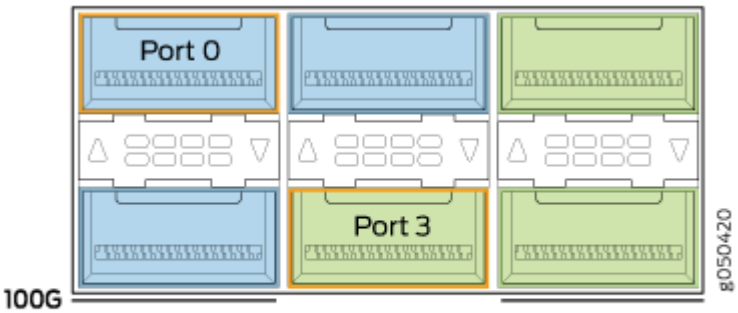


40-Gbps Channelization

The 40-Gigabit Ethernet ports can operate independently or be bundled with the next two consecutive ports and channelized into twelve 10-Gigabit Ethernet ports as a port group. Like 100-Gigabit channelization, only the first and fourth port in each 6XQSFP cage are available to channelize a port group (see Figure 10 on page 17. The port group must be configured using the `set chassis fpc pic port channel-speed` command. For example, to channelize the first switch port, use the `set chassis fpc 0 pic 0 port 0 channel-speed 10g` command.

NOTE: You cannot channelize an individual port. Channelizing configures all three ports in the port range to four independent 10-Gigabit Ethernet.

Figure 10: Use the First and Fourth Port in Each 6XQSFP Cage to Channelize a Port Group



Use every third port to create a port range for 40-Gigabit Channelization.

Port Mapping

Table 7 on page 17 shows the available combinations for the ports. Most 100-Gigabit Ethernet transceiver ports are used as uplinks. On the QFX10002 device, the ports are enabled by default and the default config adds the ports to the default VLAN.

Table 7: QFX10002-36Q Port Mapping

Port Number	4X10 Gigabit Channelized Port	4X10 Gigabit Channelized Port Group	40 Gigabit Ethernet	100 Gigabit Ethernet	100 Gigabit Ethernet Disables
0	✓	✓	✓	–	–
1	✓		✓	✓	0, 2
2	✓		✓	–	–
3	✓	✓	✓	–	–
4	✓		✓	–	–
5	✓		✓	✓	3, 4
6	✓	✓	✓	–	–

Table 7: QFX10002-36Q Port Mapping *(Continued)*

Port Number	4X10 Gigabit Channelized Port	4X10 Gigabit Channelized Port Group	40 Gigabit Ethernet	100 Gigabit Ethernet	100 Gigabit Ethernet Disables
7	✓		✓	✓	6, 8
8	✓		✓	–	–
9	✓	✓	✓	–	–
10	✓		✓	–	–
11	✓		✓	✓	9, 10
12	✓	✓	✓	–	–
13	✓		✓	✓	12, 14
14	✓		✓	–	–
15	✓	✓	✓	–	–
16	✓		✓	–	–
17	✓		✓	✓	15, 16
18	✓	✓	✓	–	–
19	✓		✓	✓	18, 20
20	✓		✓	–	–
21	✓	✓	✓	–	–

Table 7: QFX10002-36Q Port Mapping *(Continued)*

Port Number	4X10 Gigabit Channelized Port	4X10 Gigabit Channelized Port Group	40 Gigabit Ethernet	100 Gigabit Ethernet	100 Gigabit Ethernet Disables
22	✓		✓	–	–
23	✓		✓	✓	21, 22
24	✓	✓	✓	–	–
25	✓		✓	✓	24, 26
26	✓		✓	–	–
27	✓	✓	✓	–	–
28	✓		✓	–	–
29	✓		✓	✓	27, 28
30	✓	✓	✓	–	–
31	✓		✓	✓	30, 32
32	✓		✓	–	–
33	✓	✓	✓	–	–
34	✓		✓	–	–
35	✓		✓	✓	33, 34

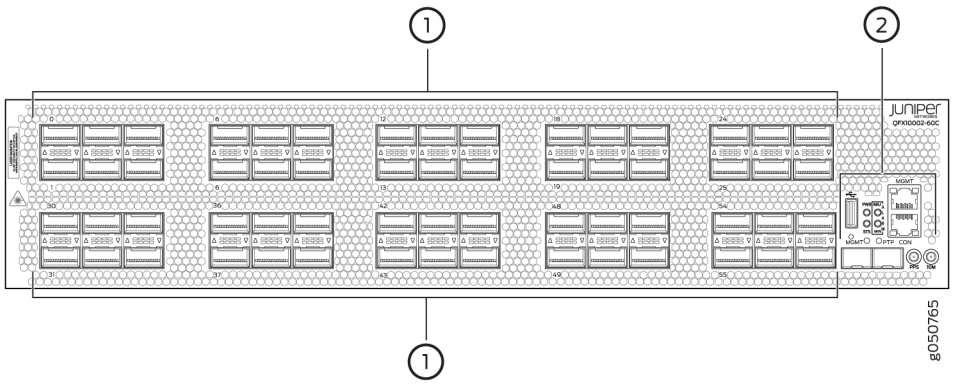
NOTE: Only channelized ports can be configured as 10-G ports.

QFX10002-60C Port Panel

IN THIS SECTION

The port panel of the QFX10002-60C consists of 60 high-density 100-Gigabit Ethernet quad small form-factor pluggable solution (QSFP28) ports and the management panel. The highly-flexible ports support 10-Gbps, 40-Gbps and 100-Gbps port speeds. See Figure 11 on page 20.

Figure 11: QFX10002-60C Port Panel



1– Port panel with QSFP28 access interface or uplink ports (60)	2– Management panel

This topic describes:

Overview

The QFX10002-60C ports support the flexible configuration of 100-Gbps, 40-Gbps, and 10-Gbps. Each port auto-senses a 100-Gbps QSFP28 or 40-Gbps QSFP transceiver and sets the speed accordingly. Any of the 60 ports, **0** through **59**, can be configured as either uplink or access ports. See Table 8 on page 21.

Table 8: QFX10002-60C Port Capacities

Per Port	Per Switch	Channelization
1 x100 Gbps	60 x 100 Gbps	Non-channelized
1 x 40 Gbps	60 x 40 Gbps	Non-channelized
4 x 10 Gbps	192 x 10 Gbps	

Network Ports

The QFX10002-60C supports the following types of optics and cables:

- 100-Gigabit Ethernet using 28-Gbps QSFP28 optical transceivers and 100-Gbps active optical cables (AOCs).
- 40-Gigabit Ethernet using QSFP+ optical transceivers, 40-Gbps AOCs, or 40-Gbps direct attach copper (DAC) cables.
- 10-Gigabit Ethernet using DAC breakout cables (DACBO). When configured for channelization, a breakout cable converts the 40-Gigabit Ethernet port into 4 independent 10-Gigabit Ethernet ports.

For a detailed list of supported optical transceivers and electrical cables, see The Hardware Compatibility Tool.

Channelization

Although the QFX10002-60C autosenses the speed of a transceiver and sets the speed to either 40 Gbps or 100 Gbps, for channelization you must manually configure the port speed. Any of the 60 physical ports that are configured for 40 Gbps speeds can be channelized to 4 independent 10-Gigabit Ethernet interfaces using copper or fiber breakout cables. You can channelize an individual port or a create a port range.

Port behavior is tied to the ASIC associated with the port. You must configure each port individually, in order to channelize a 40-Gigabit Ethernet port to 4 independent 10-Gigabit Ethernet ports. The first time a port for an associated ASIC is changed from the default configuration mode (mode D) to the channelization mode (mode A), the FPC reboots. Subsequent channelization of the ports for that ASIC does not cause the FPC to reboot. However if one of the channelized ports is changed back to the default, the FPC will again reboot. See Table 9 on page 22 for the list of available ports and the associated ASIC.

NOTE: Beginning in Junos OS 18.3R1, when the default configuration mode changes to the channelization mode, only the associated ASIC reboots.

The switch, as a whole, does not have port groups. However, there are five ports per ASIC, and within each ASIC, the fourth port cannot be channelized. When one of the other four ports is channelized, the forth port will be disabled, and the remaining three ports will continue to support 40-Gbps or 100-Gbps speeds. If ports in all 12 ASICs of the switch are channelized, the switch will have a maximum of 192 10-Gigabit Ethernet interfaces.

CAUTION: Changing the channelization mode (mode D to mode A or mode A to mode D) causes the FPC to reboot. Because there can be a slight loss of data while the FPC reboots, we recommend that you only configure the changes during a maintenance window.

Table 9: Port Mapping for Channelization (QFX10002-60C)

ASIC	**Physical Ports available in each PFE**	Physical Ports Available for Channelization	Physical Ports that Become Disabled
PE0	30,32,34,36,38	30,32,34,38	36
PE1	31,33,35,37,39	31,33,35,39	37
PE2	40,42,44,46,48	40,42,44,48	46
PE3	41,43,45,47,49	41,43,45,49	47
PE4	50,52,54,56,58	50,52,54,58	56

Table 9: Port Mapping for Channelization (QFX10002-60C) ***(Continued)***

ASIC	**Physical Ports available in each PFE**	Physical Ports Available for Channelization	Physical Ports that Become Disabled
PE5	51,53,55,57,59	51,53,55,59	57
PE6	0,2,4,6,8	0,2,4,8	6
PE7	1,3,5,7,9	1,3,5,9	7
PE8	10,12,14,16,18	10,12,14,18	16
PE9	11,13,15,17,19	11,13,15,19	17
PE10	20,22,24,26,28	20,22,24,28	26
PE11	21,23,25,27,29	21,23,25,29	27

To change from the default mode to 40-Gigabit Ethernet channelized mode, use the Junos OS operational command **set chassis fpc** ***slot-number*** **pic 0 port** ***port number*** **speed** ***10g***.

Table 10: Port Mapping for Channelization (QFX10002-30C)

ASIC	**Physical Ports available in each PFE**	Physical Ports Available for Channelization	Physical Ports that Become Disabled
PE0	0,2,4,6,8	0,2,4,8	6
PE1	1,3,5,7,9	1,3,5,9	7
PE2	10,12,14,16,18	10,12,14,18	16
PE3	11,13,15,17,19	11,13,15,19	17
PE4	20,22,24,26,28	20,22,24,28	26

Table 10: Port Mapping for Channelization (QFX10002-30C) *(Continued)*

ASIC	**Physical Ports available in each PFE**	Physical Ports Available for Channelization	Physical Ports that Become Disabled
PE5	21,23,25,27,29	21,23,25,29	27

QFX10002-72Q Port Panel

IN THIS SECTION

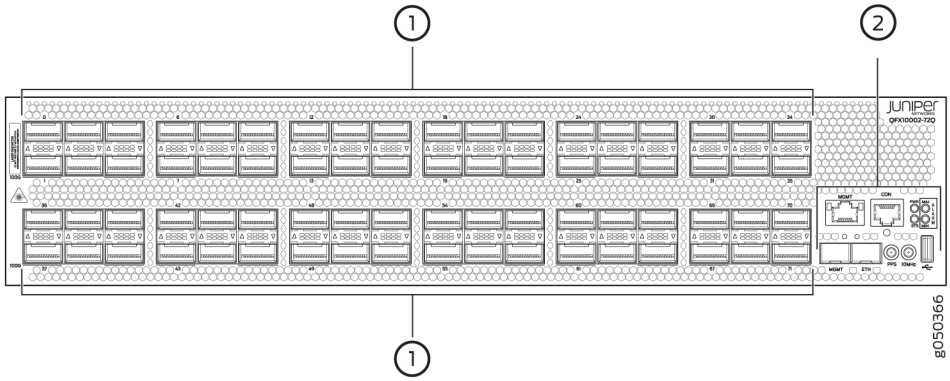
The port panel of the QFX10002-72Q consists of 72 quad small-form factor pluggable plus (QSFP+) ports that support 10-Gbps, 40-Gbps and 100-Gbps port speeds. Of these 72 ports, 24 ports accept QSFP28 transceivers, which are dual speed 40- or 100-Gigabit Ethernet optical transceivers.

This topic describes:

Overview

Any of the 72 ports **0** through **71** can be configured as either uplink or access ports. See Figure 12 on page 25.

Figure 12: QFX10002-72Q Port Panel



1– Port panel with QSFP+ access interface or uplink ports (72)	2– Management panel

The default configuration is independent 40-Gigabit Ethernet for all 72 ports. For 100-Gbps or 10-Gbps channelization operation, the ports operate within port groups. Every 3 ports compose a port group. See Table 11 on page 25 and Figure 13 on page 27 through Figure 16 on page 28.

Table 11: QFX10002-72Q Port Capacities

Per Port Group	Per Switch
1 x100 Gbps	24 x 100 Gbps
3 x 40 Gbps	72 x 40 Gbps
12 x 10 Gbps	288 x 10 Gbps

The second and sixth port in each 6XQSFP+ socket can be configured to support:

- 100-Gigabit Ethernet using 28-Gbps QSFP28 optical transceivers and 100-Gbps active optical cables (AOCs). When a QSFP28 transceiver is inserted into the ports marked with a fine black line underneath the socket and the port is configured for 100-Gigabit Ethernet, the two adjacent ports are disabled and the QSFP28 is enabled for 100-Gigabit Ethernet.
- 40-Gigabit Ethernet using QSFP+ optical transceivers or 40-Gbps direct attach copper (DAC) cables.
- 10-Gigabit Ethernet using DAC breakout cables (DACBO). When configured for channelization, a breakout cable converts the 40-Gigabit Ethernet port into 4 independent 10-Gigabit Ethernet ports.The two adjacent QSFP+ ports in the port group are also configured for channelization at the same time. You cannot configure a single port for channelization.

Switch Ports

Each of the 24 QSFP28 ports support:

- 100-Gigabit Ethernet QSFP28 transceivers
- 100-Gigabit Ethernet active optical cables (AOCs)
- 40-Gigabit Ethernet QSFP+ transceivers
- 40-Gigabit Ethernet QSFP+ DAC cables
- 40-Gigabit Ethernet QSFP+ to 10-Gigabit Ethernet SFP+ direct attach copper breakout (DACBO) cables

The remaining ports support:

- 40-Gigabit Ethernet QSFP+ transceivers
- 40-Gigabit Ethernet QSFP+ DAC cables
- 40-Gigabit Ethernet QSFP+ to 10-Gigabit Ethernet SFP+ DACBO cables
- 10-Gigabit Ethernet SFP+ transceivers
- 10-Gigabit Ethernet DAC cables

100-Gbps Operation and Configuration

Every second and sixth port in a 6XQSFP cage on a QFX10002 supports 100-Gigabit Ethernet using QSFP28 transceivers. These 100-Gigabit Ethernet ports work either as 100-Gigabit Ethernet or as 40-Gigabit Ethernet, but are recognized as 40-Gigabit Ethernet by default. See Figure 13 on page 27 for a close up view of a 6XQSFP+ cage. The 100-Gigabit Ethernet are designated by a fine black line underneath the port. See Figure 14 on page 27. When a 40-Gigabit Ethernet transceiver is inserted into a 100-Gigabit Ethernet port, the port recognizes the 40-Gigabit Ethernet port speed. However, when an 100-Gigabit Ethernet transceiver is inserted into the port, the transceiver is not automatically recognized and is not seen in the output of the `show chassis hardware` command. To enable 100-Gigabit Ethernet on the marked ports, use the `set chassis fpc` command. For example, to enable port 71 for 100 Gbps speeds:

```
[edit]
user@switch#
set chassis fpc 0 pic 0 port 71 speed 100g
```

The port then recognizes the 100-Gigabit Ethernet speed and disables two adjacent 40-Gigabit Ethernet ports. See Figure 15 on page 27.

Figure 13 on page 27 shows the location of QSFP+ ports for the QFX10002-72Q.

Figure 13: All Ports are 40-Gigabit Ethernet by Default

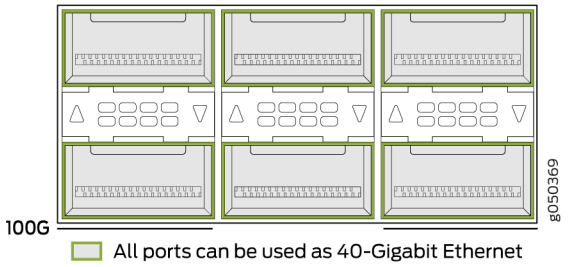


Figure 14: 100-Gigabit Ethernet Ports Are Indicated by a Black Line Underneath the Port

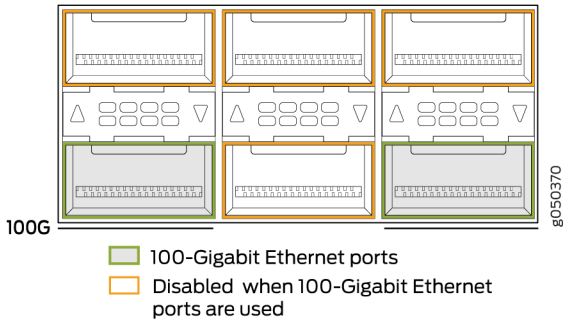
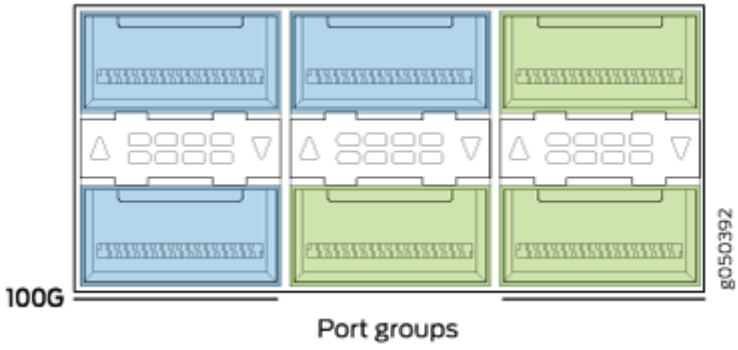


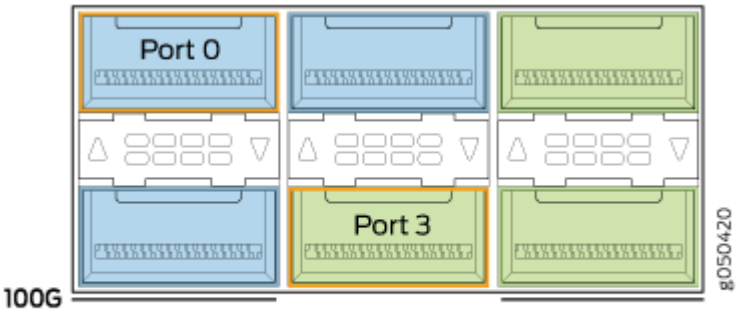
Figure 15: 100-Gigabit Ethernet Port Disables Two Associated 40-Gigabit Ethernet Ports in the Port Group



40-Gbps Channelization

The 40-Gigabit Ethernet ports can operate independently or bundled with the next two consecutive ports and channelized into twelve 10-Gigabit Ethernet ports as a port group. Like 100-Gigabit channelization, only the first and fourth port in each 6XQSFP cage are available to channelize a port group (see Figure 16 on page 28). The port group must be configured using the `set chassis fpc pic port channel-speed` command. For example, to channelize the first switch port, use the `set chassis fpc 0 pic 0 port 1 channel-speed 10g` command.

Figure 16: Use the First and Fourth Port in Each 6XQSFP Cage to Channelize a Port Group



Port Mapping

Table 12 on page 28 shows the available combinations for the ports. Most 100-Gigabit Ethernet transceiver ports are used as uplinks . On the QFX10002, the ports are enabled by default and the default configuration adds the ports to the default VLAN.

Table 12: QFX10002-72Q Port Mapping

Port Number	4X10 Gigabit Channelized Port	4X10 Gigabit Channelized Port Group	40 Gigabit Ethernet (Default)	100 Gigabit Ethernet	100 Gigabit Ethernet Disables
0	✓	✓	✓	–	–
1	✓		✓	✓	0, 2

Table 12: QFX10002-72Q Port Mapping *(Continued)*

Port Number	4X10 Gigabit Channelized Port	4X10 Gigabit Channelized Port Group	40 Gigabit Ethernet (Default)	100 Gigabit Ethernet	100 Gigabit Ethernet Disables
2	✓		✓	–	–
3	✓	✓	✓	–	–
4	✓		✓	–	–
5	✓		✓	✓	3, 4
6	✓	✓	✓	–	–
7	✓		✓	✓	6, 8
8	✓		✓	–	–
9	✓	✓	✓	–	–
10	✓		✓	–	–
11	✓		✓	✓	9, 10
12	✓	✓	✓	–	–
13	✓		✓	✓	12, 14
14	✓		✓	–	–
15	✓	✓	✓	–	–
16	✓		✓	–	–

Table 12: QFX10002-72Q Port Mapping *(Continued)*

Port Number	4X10 Gigabit Channelized Port	4X10 Gigabit Channelized Port Group	40 Gigabit Ethernet (Default)	100 Gigabit Ethernet	100 Gigabit Ethernet Disables
17	✓		✓	✓	15, 16
18	✓	✓	✓	–	–
19	✓		✓	✓	18, 20
20	✓		✓	–	–
21	✓	✓	✓	–	–
22	✓		✓	–	–
23	✓		✓	✓	21, 22
24	✓	✓	✓	–	–
25	✓		✓	✓	24, 26
26	✓		✓	–	–
27	✓	✓	✓	–	–
28	✓		✓	–	–
29	✓		✓	✓	27, 28
30	✓	✓	✓	–	–
31	✓		✓	✓	30, 32

Table 12: QFX10002-72Q Port Mapping *(Continued)*

Port Number	4X10 Gigabit Channelized Port	4X10 Gigabit Channelized Port Group	40 Gigabit Ethernet (Default)	100 Gigabit Ethernet	100 Gigabit Ethernet Disables
32	✓		✓	–	–
33	✓	✓	✓	–	–
34	✓		✓	–	–
35	✓		✓	✓	33, 34
36	✓	✓	✓	–	–
37	✓		✓	✓	36, 38
38	✓		✓	–	–
39	✓	✓	✓	–	–
40	✓		✓	–	–
41	✓		✓	✓	39, 40
42	✓	✓	✓	–	–
43	✓		✓	✓	42, 44
44	✓		✓	–	–
45	✓	✓	✓	–	–
46	✓		✓	–	–

Table 12: QFX10002-72Q Port Mapping *(Continued)*

Port Number	4X10 Gigabit Channelized Port	4X10 Gigabit Channelized Port Group	40 Gigabit Ethernet (Default)	100 Gigabit Ethernet	100 Gigabit Ethernet Disables
47	✓		✓	✓	45, 46
48	✓	✓	✓	–	–
49	✓		✓	✓	48, 50
50	✓		✓	–	–
51	✓	✓	✓	–	–
52	✓		✓	–	–
53	✓		✓	✓	51, 52
54	✓	✓	✓	–	–
55	✓		✓	✓	54, 56
56	✓		✓	–	–
57	✓	✓	✓	–	–
58	✓		✓	–	–
59	✓		✓	✓	57, 58
60	✓	✓	✓	–	–
61	✓		✓	✓	60, 62

Table 12: QFX10002-72Q Port Mapping *(Continued)*

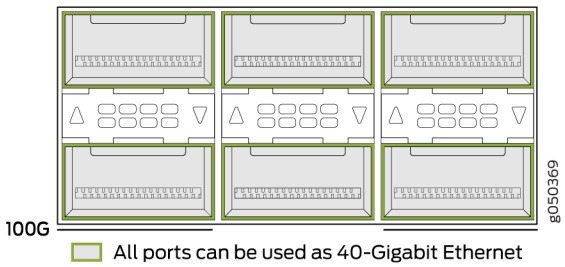
Port Number	4X10 Gigabit Channelized Port	4X10 Gigabit Channelized Port Group	40 Gigabit Ethernet (Default)	100 Gigabit Ethernet	100 Gigabit Ethernet Disables
62	✓		✓	–	–
63	✓	✓	✓	–	–
64	✓		✓	–	–
65	✓		✓	✓	63, 64
66	✓	✓	✓	–	–
67	✓		✓	✓	66, 68
68	✓		✓	–	–
69	✓	✓	✓	–	–
70	✓		✓	–	–
71	✓		✓	✓	69, 70

NOTE: Only channelized ports can be configured as 10-G ports.

QFX10002 Network Port LEDs

Each QFX10002 QSFP+ port uses a single bi-colored LED to indicate link status and activity. See Figure 17 on page 34 for an example of these triangle shaped LEDs.

Figure 17: Port LEDs



The same single bi-colored LED also indicates when the interface is configured and connected using an optical split cable or a copper DACBO cable to a 10-Gigabit Ethernet port.

There are some slight differences in the amber LED behavior depending on the firmware level of the complex programmable logic device (CPLD) in your switch and the Junos release level running on the switch. To determine the Junos release level, use the `show version` command. To determine the CPLD of your switch, use the `show chassis firmware` command. For example:

```
root@> show chassis firmware
Part                    Type       Version
FPC 0                   U-Boot      ***
                        loader           FreeBSD/i386 bootstrap loader 1.2
                        BIOS       V0018.2U
                        EC FPGA    2.3
                        MAIN_CPLD  1.10
                        MEZZ_CPLD  1.10
                        RE FPGA    2.4
root@>
```

See Table 13 on page 34 for how to interpret the QSFP+ LEDs.

Table 13: Network Port LEDs on QSFP+ Ports on a QFX10002

Color	State	Description
Unlit	Off	The port is administratively disabled, there is no power, the link is down, or a transceiver is not present. All sub-channels are disabled.

Table 13: Network Port LEDs on QSFP+ Ports on a QFX10002 *(Continued)*

Color	State	Description
Green	On steadily	A link is established. When channelized, all sub-channels are up. When not channelized, it indicates no activity.
	Slow blinking (250 ms on and 1750 ms off)	The beacon function was enabled on the port.
	Blinking (500 ms on and 500 ms off)	When channelized, all four channels are up and active. When not channelized, it indicates the port is up and active in either 40-Gigabit or 100-Gigabit mode.
Amber	On steadily	**For Junos Release 15.1X53-D21 or later and CPLD version V1.16 or later:** One or more breakout connections (sub-channels) are up. However not all sub-channels are up and there is no port activity.
		For Junos Release 15.1X53-D10 to 15.1X53-D20 and CPLD version V1.10: Solid yellow LED is not available.
	Blinking	One or more breakout connections (sub-channels) are up. At least one sub-channel has activity, but not all connections are active.

RELATED DOCUMENTATION

QFX10002 Field-Replaceable Units | **11**

Channelizing Interfaces on QFX3500, QFX3600, QFX5100, QFX10002, QFX10008, QFX10016, and EX4600 Switches

Installing and Removing QFX10002 Hardware Components | **122**

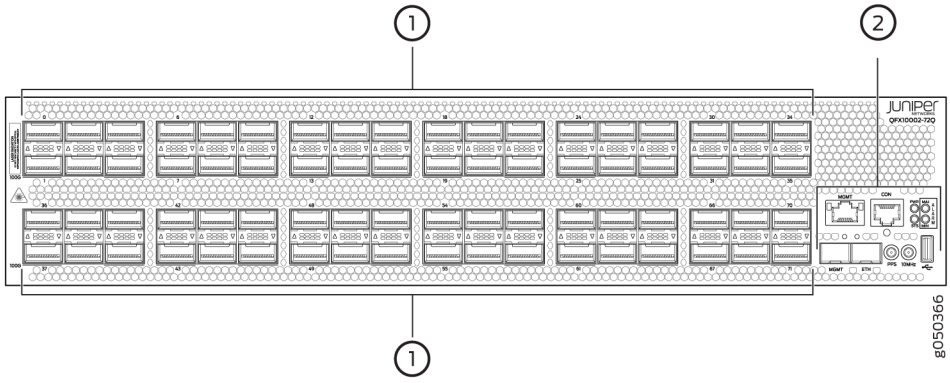
QFX10002 Management Panel

IN THIS SECTION

QFX10002 Management Panel

The QFX10002 management panel is found next to the ports as shown in Figure 18 on page 36 through Figure 20 on page 37. See Figure 21 on page 38 and Figure 22 on page 39 for management panel detail.

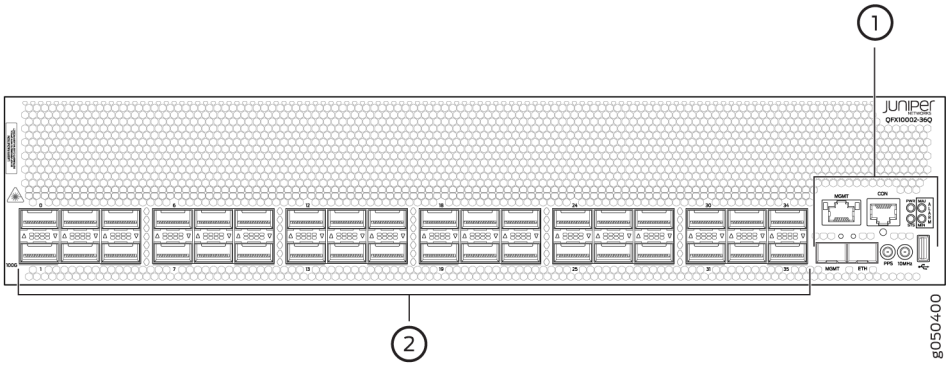
Figure 18: QFX10002-72Q Port Panel and Management Panel



1– Port panel

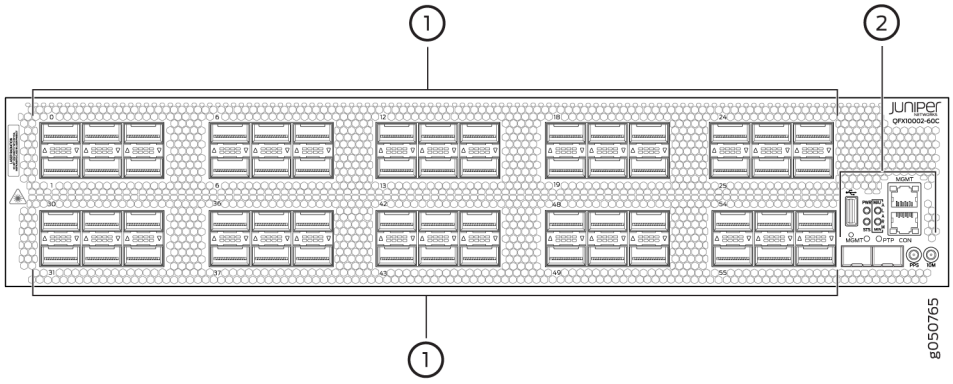
2– Management panel

Figure 19: QFX10002-36Q Port Panel and Management Panel



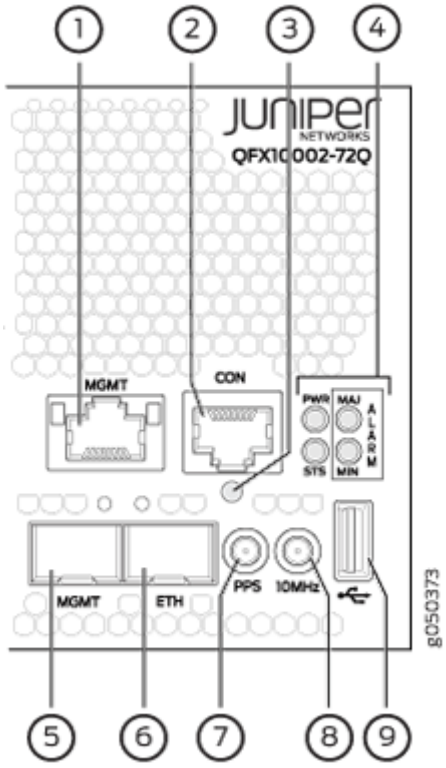
1– Management panel	2– Port panel with QSFP+ network interface or uplink ports (36)

Figure 20: QFX10002-60C Port Panel and Management Panel



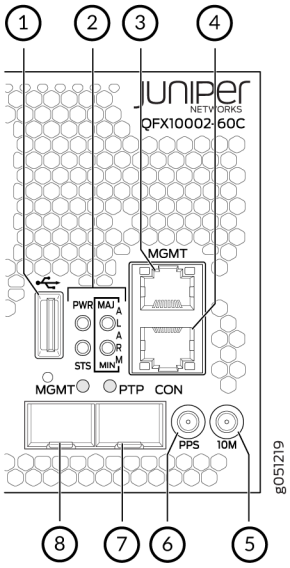
1– Port panel	2– Management panel

Figure 21: QFX10002 72Q and QFX20002-36Q Management Panel Components



1– em0–RJ-45 (1000BASE-T) management Ethernet port (**MGMT**).	6– PTP Ethernet–SFP (1000BASE-T) port (**ETH**)
2– RJ-45 console port (**CON**) to support RS-232 serial ports. The LED below the port indicates status and link.	7– 10 Hz pulses-per-second (**PPS**) SubMiniature B (SMB) connector for input and output measuring of the timing drift to and from a grandmaster clock
3– Reset button. Press and hold 5 seconds to reset the hardware. Clock functions and FPGA status registers are not reset.	8– 10 MHz SMB timing connector (**10MHz**)
4– Status LEDs–Power (**PWR**), status (**STA**), major alarm (**MJR**), and minor alarm (**MIN**).	9– USB port
5– em1–SFP management Ethernet port (**MGMT**).	

Figure 22: QFX10002 60C Management Panel Components



1– USB port	5– 10 MHz SMB timing connector (**10MHz**)
2– Status LEDs–Power (**PWR**), status (**STA**), major alarm (**MJR**), and minor alarm (**MIN**).	6– 10 Hz pulses-per-second (**PPS**) SubMiniature B (SMB) connector for input and output measuring of the timing drift to and from a grandmaster clock
3– em0–RJ-45 (1000BASE-T) management Ethernet port (**MGMT**).	7– PTP Ethernet–SFP (1000BASE-T) port (**ETH**)
4– RJ-45 console port (**CON**) to support RS-232 serial ports.	8– em1–SFP management Ethernet port (**MGMT**).

SEE ALSO

USB Port Specifications for the QFX Series | **95**

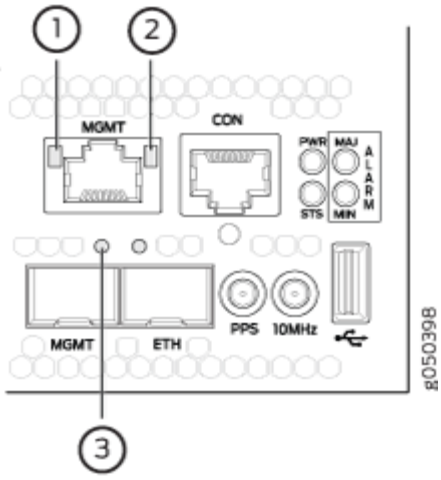
Connecting a QFX10002 to a Management Ethernet Device | **109**

QFX10002 Management Port LEDs

There are two managements ports on a QFX10002 that have LEDs that indicate link status and link activity. These two ports, located on the management panel next to the access ports, are both labeled **MGMT**. The top management port is for 10/100/1000 BASE-T connections and the lower port is for 10/100/1000 BASE-T and small-form pluggable (SFP) 1000 BASE-X connections (see Figure 23 on page

40). The copper, RJ45, port has separate LEDs for status and activity. The fiber, SFP, port has a combination link and activity LED.

Figure 23: Management Port LEDs on a QFX10002 Switch



1– Status LED (RJ45)	3– Green indicates the link is up; blinking indicates activity (SFP)
2– Activity LED (RJ45)	

Table 14 on page 40 and Table 15 on page 41 describes the management port LEDs.

Table 14: RJ-45 Management Port LEDs on a QFX10002 Switch

LED	Color	State	Description
Link/Activity	Unlit	Off	No link is established, there is a fault, or the link is down.
	Yellow	Blinking or flickering	A link is established, and there is link activity.
Status	Unlit	Off	Either the port speed is 10 M or the link is down.
	Green	On steadily	The port speed is 1000 M.

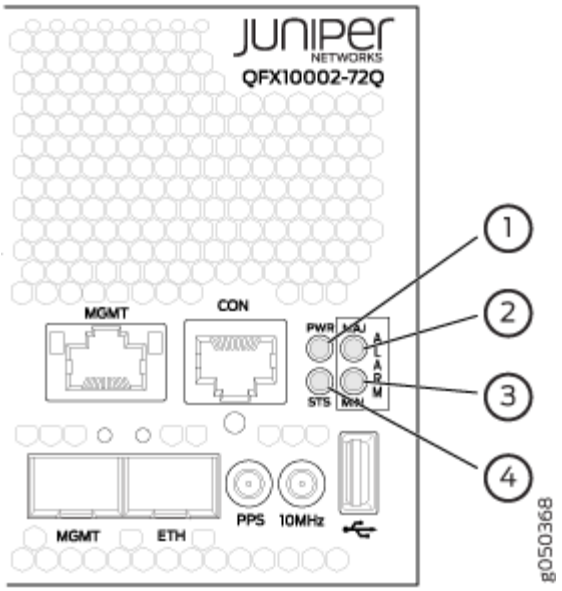
Table 15: SFP Management Port LEDs on a QFX10002 Switch

LED	Color	State	Description
Link/Activity	Unlit	Off	No link is established or the link is down.
	Green	On steadily	Link is up and there is no activity.
	Green	Blinking	A link is established, and there is link activity.

QFX10002 Chassis Status LEDs

The QFX10002 has four status LEDs on the port side of the chassis, next to the access ports (see Figure 24 on page 41).

Figure 24: Chassis Status LEDs on QFX10002 Models



1– PWR	3– MIN
2– MJR	4– STA

Table 16 on page 42 describes the chassis status LEDs on a QFX10002, their colors and states, and the status they indicate.

Table 16: Chassis Status LEDs on a QFX10002 Switch

Name	Color	State	Description
PWR–Alarm	Unlit	Off	The switch is powered off; no power to the device.
	Green	On steadily	Power is working correctly.
	Yellow	Blinking	There is a problem with chassis power. Power off the QFX10002 by setting the AC power source outlet to the OFF (O) position, or unplugging the AC power cords. Correct any voltage issues. Power on the QFX10002 and monitor the power supply and fan LEDs to help determine where the error is occurring. If there is any CPU power failure, the system will not boot.
STA–Status	Unlit	Off	The switch is powered off or halted.
	Green	On steadily	Junos OS for QFX Series is loaded on the switch.
	Green	Blinking	The beacon feature is enabled on the switch. This feature is enabled using the `request chassis beacon` command.
	Yellow	Blinking	The switch detects a fault.
MJR–Major alarm	Unlit	Off	There are no major alarms.
	Red	On steadily	A major hardware fault has occurred, such as a temperature alarm or power failure, and the switch has halted.

Table 16: Chassis Status LEDs on a QFX10002 Switch *(Continued)*

Name	Color	State	Description
MIN–Minor alarm	Unlit	Off	There are no minor alarms.
	Yellow	On steadily	A minor alarm has occurred, such as a software error.

For power and temperature alarms, you can use the `show chassis environment fpc` operational mode command to get detailed information on the internal state of the chassis. For example:

```
user@device> show chassis environment fpc

FPC 0 status:
  State                       Online
  Temperature                 51 degrees C / 123 degrees F
  Voltage:
    PE0 VDD Core 0.9V            949 mV
    PE0 AVDD 1.0V               1000 mV
    PE0 HMC VDD 0.9V             897 mV
    PE0 HMC AVDD 1.2V           1197 mV
    PE01 HMC VDD 1.2V           1197 mV
    PE1 VDD Core 0.9V            949 mV
    PE1 AVDD Core 1.0V           999 mV
    PE1 HMC VDD 0.9V             899 mV
    PE1 HMC AVDD 1.2V           1197 mV
    PE2 VDD Core 0.9V            950 mV
    PE2 AVDD Core 1.0V           999 mV
    PE2 HMC VDD 0.9V             897 mV
    PE2 HMC AVDD 1.2V           1197 mV
    PE23 HMC AVDD 1.2V          1197 mV
    PE3 VDD Core 0.9V            949 mV
    PE3 AVDD Core 1.0V           999 mV
    PE3 HMC VDD 0.9V             899 mV
    PE3 HMC AVDD 1.2V           1200 mV
    PE4 VDD Core 0.9V            949 mV
    PE4 AVDD Core 1.0V           999 mV
    PE4 HMC VDD 0.9V             899 mV
    PE4 HMC AVDD 1.2V           1197 mV
    PE45 HMC AVDD 1.2V          1197 mV
```

```
PE5 VDD Core 0.9V            949 mV
PE5 AVDD Core 1.0V          1000 mV
PE5 HMC VDD 0.9V             899 mV
PE5 HMC AVDD 1.2V           1200 mV
XMB VDD 3.3V                3316 mV
MAIN VDD 3.3V               3298 mV
RT VDD 1.0V                  999 mV
MAIN VDD 2.5V               2502 mV
MAIN PFE 1.5V               1502 mV
PE6 VDD Core 0.9V            949 mV
PE6 AVDD 1.0V               1000 mV
PE6 HMC VDD 0.9V             897 mV
PE6 HMC AVDD 1.2V           1204 mV
PE67 HMC VDD 1.2V           1197 mV
PE7 VDD Core 0.9V            949 mV
PE7 AVDD Core 1.0V           999 mV
PE7 HMC VDD 0.9V             897 mV
PE7 HMC AVDD 1.2V           1197 mV
PE8 VDD Core 0.9V            949 mV
PE8 AVDD Core 1.0V           999 mV
PE8 HMC VDD 0.9V             897 mV
PE8 HMC AVDD 1.2V           1200 mV
PE78 HMC AVDD 1.2V          1197 mV
PE9 VDD Core 0.9V            950 mV
PE9 AVDD Core 1.0V           999 mV
PE9 HMC VDD 0.9V             897 mV
PE9 HMC AVDD 1.2V           1200 mV
PE10 VDD Core 0.9V           949 mV
PE10 AVDD Core 1.0V          999 mV
PE10 HMC VDD 0.9V            899 mV
PE10 HMC AVDD 1.2V          1200 mV
PE910 HMC AVDD 1.2V         1200 mV
PE11 VDD Core 0.9V           950 mV
PE11 AVDD Core 1.0V          999 mV
PE11 HMC VDD 0.9V            899 mV
PE11 HMC AVDD 1.2V          1200 mV
PF0 VDD Core 0.9V            950 mV
PF0 AVDD Core 1.0V           999 mV
PF1 VDD Core 0.9V            950 mV
PF1 AVDD Core 1.0V           999 mV
XDB VDD 3.3V                3298 mV
XDB RT VDD 1.0V              999 mV
MEZZ VDD 2.5V               2502 mV
```

```
    MEZZ PFE 1.5V              1502 mV
    MEZZ GEX 1.0V               999 mV
    VCC 1.0V                   1009 mV
    VCC 0.85V                   862 mV
    VDD RAIL 12.0V                0 mV
    VCC 1.8V                   1793 mV
    VDD 1.2V                   1215 mV
    PCH VCC 1.0V                999 mV
    CPU VCC 1.8V               1803 mV
    BIAS 1 3.3V                3312 mV
    AUX VCC 5.0V               4165 mV
    DDR VDD 1.5V               1499 mV
    VTT SA CPU 0.8V             803 mV
    VTT CPU 1.05V              1048 mV
    CORE CPU 1.0V               940 mV
    PCH VCC 1.5V               1509 mV
    PCH VCC 1.05V              1058 mV
    VDD 2.5V                   2508 mV
```

SEE ALSO

show chassis alarms

request chassis beacon

RELATED DOCUMENTATION

Connecting a QFX10002 to a Management Ethernet Device | **109**

QFX10002 Cooling System

IN THIS SECTION

QFX10002 Cooling System and Airflow

IN THIS SECTION

The cooling system in a QFX10002 consists of three 80-W fan modules in a fan tray and two counter-rotating fans housed in each of the power supplies.

The QFX10002 brings air into the vents in the port panel and exhausts warmed air through the field-replaceable units (FRU) panel. This type of airflow is known as *airflow out* or *port-to-FRU* airflow.

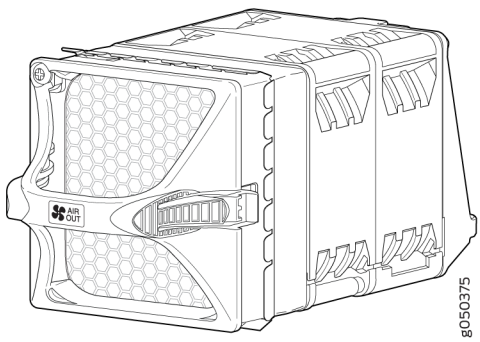
This topic describes:

Fan Modules

The fan modules in a QFX10002 are hot-removable and hot-insertable FRUs designed for port-to-FRU airflow. The fan modules numbered **0** through **2** are installed in the fan tray located next to the power supplies. Each fan module slot has a fan icon next to it.

Figure 25 on page 46 shows the 2-U fan module for the QFX10002 models.

Figure 25: Fan Module for the QFX10002



You remove and replace a fan module from the FRU end of the chassis. The switch continues to operate for a limited period of time (30 seconds) during the replacement of the fan module without thermal shutdown.

NOTE: All fan modules must be installed for optimal operation of the switch.

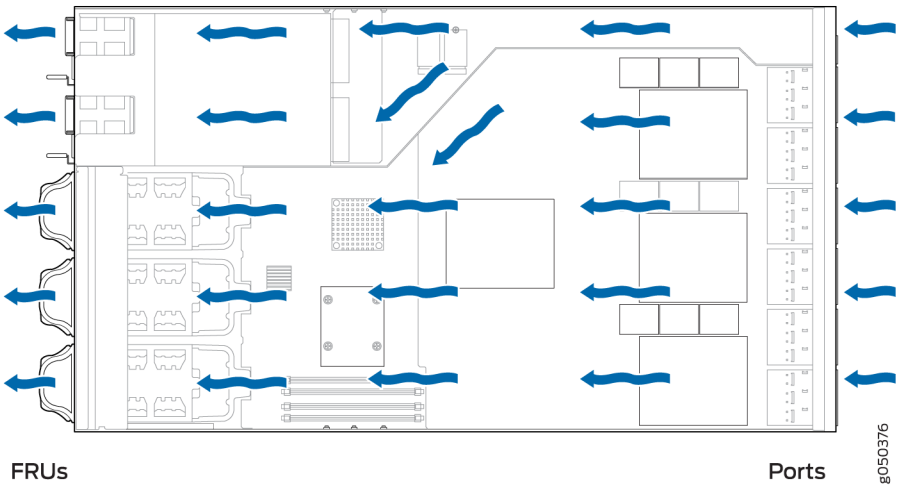
Table 17 on page 47 lists the fan module details.

Table 17: Fan Modules in the QFX10002

Fan Module	Airflow Diagram	Label on the Fan Module	Color of Fan Module Handle	Direction of Airflow in the Fan Module	Power Supplies
QFX10002-FAN	Figure 26 on page 47	**AIR OUT**	Juniper Gold	Port-to-FRU airflow is where air enters on the end with the ports and exits on the end with fans (also known as *airflow out*).	All models only use power supplies that have gold-colored handles with **AIR OUT** labels.

In data center deployments, position the switch in such a manner that the **AIR OUT** labels on switch components are next to the hot aisle. Figure 26 on page 47 shows the airflow through the chassis.

Figure 26: Air Out Airflow Through the QFX10002 Chassis



Fan Module Status

You can check the status of fan modules through the `show system alarms` command or `show chassis fan` commands or by looking at the LEDs next to each fan module. For example:

```
user@device> show chassis fan
Item                      Status   RPM     Measurement
      Tray 0 Fan 0              Absent
      Tray 0 Fan 1              Absent
      Tray 1 Fan 0              OK       5000    Spinning at normal speed
      Tray 1 Fan 1              OK       4400    Spinning at normal speed
      Tray 2 Fan 0              OK       5000    Spinning at normal speed
      Tray 2 Fan 1              OK       4400    Spinning at normal speed
```

Each switch has a status LED (labeled **ST**) for each fan module on the left side of the corresponding fan module slot. It indicates the status of all the fan modules. Table 18 on page 48 describes the status LED on the fan module in a QFX10002.

Table 18: Fan Module Status LED

LED State	Description
Solid Green	Indicates the individual fan module is present. After the hardware senses the fan module, software ensures the airflow is consistent with the other fan modules and that it is functioning correctly.
Solid Amber	Indicates one of the following: • The fan module is not present. • The fan module is not functioning normally.

Under normal operating conditions, the fan modules operate at a moderate speed. Temperature sensors in the chassis monitor the temperature within the chassis.

The system raises an alarm if a fan module fails or if the ambient temperature inside the chassis rises above the acceptable range. If the temperature inside the chassis rises above the threshold temperature, the system shuts down automatically.

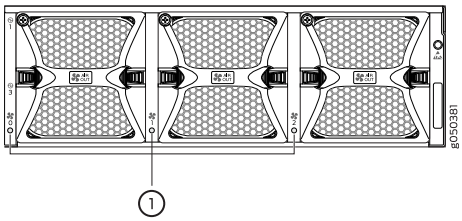
SEE ALSO

- QFX10002 Field-Replaceable Units | 11
- Prevention of Electrostatic Discharge Damage | 190
- QFX10002 Switch Description | 2
- Installing a Fan Module in a QFX10002 | 125
- Removing a Fan Module from a QFX10002 | 123

QFX10002 Fan Module LED

Figure 27 on page 49 shows the location of the LED next to the QFX10002 fan module.

Figure 27: Fan Module LED in a QFX10002



1– Fan LED

Use Table 19 on page 49 to interpret the state of the fan module LED.

Table 19: QFX10002 Fan Module LED

Name	Color	State	Description
Fan	Green	On steadily	The fan module is operating normally. The system has verified that the module is engaged, and that the fan is operating correctly.

Table 19: QFX10002 Fan Module LED *(Continued)*

Name	Color	State	Description
	Amber	On steadily	An error has been detected in the fan module. Replace the fan module as soon as possible. Either the fan has failed or it is seated incorrectly. To maintain proper airflow through the chassis, leave the fan module installed in the chassis until you are ready to replace it.

SEE ALSO

- QFX10002 Cooling System and Airflow | **46**
- Installing a Fan Module in a QFX10002 | **125**
- Removing a Fan Module from a QFX10002 | **123**

RELATED DOCUMENTATION

- Maintaining QFX10002 Cooling System Components | **123**

QFX10002 Power System

IN THIS SECTION

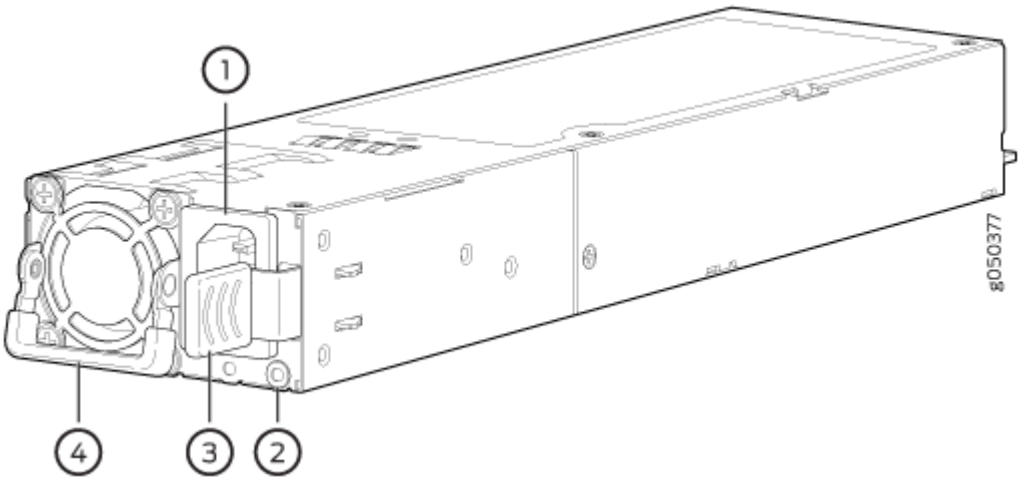
QFX10002 Power Supply LED | 60

QFX10002 AC Power Supply Description

The AC power supplies in QFX10002 models (see Figure 28 on page 51) are hot-removable, and hot-insertable field-replaceable units (FRUs) that you can install without powering off the switch or disrupting the switching function. The QFX10002-36Q switch has two power supplies; the QFX10002-60C and QFX10002-72Q have four power supplies. All of the power supplies are installed at the factory.

Each of the 1600-W power supplies has a single AC input. A QFX10002 has double the amount of power supplies needed to power all of the components in the switch, which is known as *2N redundancy*. When the switch has all of the power supplies installed, the switch has full power redundancy. If a power supply fails or is removed, a second power supply balances the electrical load without interruption. For more on redundancy configuration options, see "QFX10002 Component Redundancy" on page 8. Each power supply provides 12-VDC output with a standby voltage of 12 VDC.

Figure 28: 1600-W AC Power Supply in a QFX10002 Models



1– Power connector	3– Ejection lever
2– Power LED	4– Handle

The fan in the power supply provides port-to-FRU airflow, which is also known as *airflow out (AFO)*. A power supply with the label **AFO** or a gold-colored handle denotes port-to-FRU airflow.

Table 20 on page 52 shows the characteristics of the power supply.

Table 20: QFX10002 AC Power Supply

Wattage	Product Number	Direction of Airflow	Color of Power Supply Handle
1600-W	JPSU-1600W-AC-AFO	Port-to-FRU	Juniper Gold

To avoid electrical injury, carefully follow instructions in "Connecting AC Power to a QFX10002" on page 111 and "Removing a Power Supply from a QFX10002" on page 127.

QFX10002 AC Power Specifications

Table 21 on page 52 describes the AC power specifications for a QFX10002 switch.

Table 21: AC Power Specifications for a QFX10002 Switch

Item	Specification
AC input voltage	Operating range: 100V-127 VAC and 200V-240 VAC
AC input line frequency	50–60 Hz
AC input current rating	• 12.9 A at 100–120 VAC for QFX10002-72Q • 11.5 A at 100–120 VAC for QFX10002-60C • 9.5 A at 100–120 VAC for QFX10002-36Q
Typical power consumption	• 1050 W for QFX10002-72Q • 1728 W for QFX10002-60C • 560 W for QFX10002-36Q

Table 21: AC Power Specifications for a QFX10002 Switch *(Continued)*

Item	Specification
Maximum power consumption	• 1425 W for QFX10002-72Q • 1824 W for QFX10002-60C • 800 W for QFX10002-36Q

AC Power Cord Specifications for QFX10002 Switches

Detachable AC power cords are shipped with the chassis, if you include them as part of your order. The coupler is type C13 as described by International Electrotechnical Commission (IEC) standard 60320. The plug end of the power cord fits into the power source outlet that is standard for your geographical location.

NOTE: In North America, AC power cords must not exceed 14.75 feet (approximately 4.5 meters) in length, to comply with National Electrical Code (NEC) Sections 400-8 (NFPA 75, 5-2.2) and 210-52, and Canadian Electrical Code (CEC) Section 4-010(3). The cords that can be ordered for the QFX Series switches are in compliance.

The following tables list AC power cord specifications provided for each country or region.

Table 22: AC Power Cord Specifications for QFX10002-60C Switches

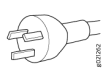
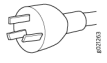
Country/ Region	Electrical Specifications	Plug Standards	Shipped Juniper Model Number	Spare Juniper Model Number	Graphic
Australia	250 VAC, 10 A, 50 Hz	AS/NZ 3109-1996	CG_CBL-C13-09-AU	CBL-EX-PWR-C13-AU	
China	250 VAC, 10 A, 50 Hz	GB 1002-1996	CG_CBL-C13-09-CH	CBL-EX-PWR-C13-CH	

Table 22: AC Power Cord Specifications for QFX10002-60C Switches *(Continued)*

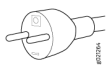
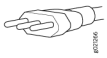
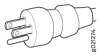
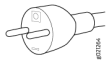
Country/ Region	Electrical Specifications	Plug Standards	Shipped Juniper Model Number	Spare Juniper Model Number	Graphic
Europe (except Italy, Switzerland, and United Kingdom)	250 VAC, 10 A, 50 Hz	CEE (7) VII	CG_CBL-C13-09-EU	CBL-EX-PWR-C13-EU	
Italy	250 VAC, 10 A, 50 Hz	CEI 23-16/VII	CG_CBL-C13-09-IT	CBL-EX-PWR-C13-IT	
Japan	125 VAC, 12 A, 50 Hz or 60 Hz	JIS C8303	CG_CBL-C13-09-JP	CBL-EX-PWR-C13-JP	
North America	(QFX10002-36Q, QFX10002-72Q only) 125 VAC, 13 A, 60 Hz (all models) 250 VAC, 13 A, 60 Hz (all models) 250 VAC, 13 A, 60 Hz	CAN/CSA No. 49-92 NEMA L6-15 NEMA 6-15	CG_CBL-C13-09-US	CBL-PW-C13-250L-US (default) CBL-PWR-C13-250-US	
South Korea	250 VAC, 10 A, 60 Hz 250 VAC, 13 A, 60 Hz	KSC 8305; K60884-1	CG_CBL-C13-09-KR	CBL-EX-PWR-C13-KR	
Switzerland	250 VAC, 10 A, 50 Hz	SEV 1011 SEV 1991; EN 60320 C13	CG_CBL-C13-09-SZ	CBL-EX-PWR-C13-SZ	
United Kingdom	250 VAC, 10 A, 50 Hz	BS 1363/A	CG_CBL-C13-09-UK	CBL-EX-PWR-C13-UK	

Table 23: AC Power Cord Specifications for QFX10002-36Q and QFX10002-72Q Switches

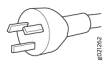
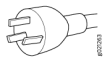
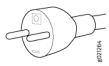
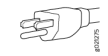
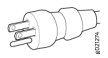
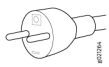
Country/ Region	Electrical Specifications	Plug Standards	Shipped Juniper Model Number	Spare Juniper Model Number	Graphic
Australia	250 VAC, 10 A, 50 Hz	AS/NZ 3109-1996	CG_CBL-C13-06-AU	CBL-EX-PWR-C13-AU	
China	250 VAC, 10 A, 50 Hz	GB 1002-1996	CG_CBL-C13-06-CH	CBL-EX-PWR-C13-CH	
Europe (except Italy, Switzerland, and United Kingdom)	250 VAC, 10 A, 50 Hz	CEE (7) VII	CG_CBL-C13-06-EU	CBL-EX-PWR-C13-EU	
Italy	250 VAC, 10 A, 50 Hz	CEI 23-16/VII	CG_CBL-C13-06-IT	CBL-EX-PWR-C13-IT	
Japan	125 VAC, 12 A, 50 Hz or 60 Hz	JIS C8303	CG_CBL-C13-06-JP	CBL-EX-PWR-C13-JP	
North America	(QFX10002-36Q, QFX10002-72Q only) 125 VAC, 13 A, 60 Hz (all models) 250 VAC, 13 A, 60 Hz (all models) 250 VAC, 13 A, 60 Hz	CAN/CSA No. 49-92 NEMA L6-15 NEMA 6-15	CG_CBL-C13-06-US	CBL-EX-PWR-C13-US CBL-PW-C13-250-US CBL-PWR-C13-250-US	
South Korea	250 VAC, 10 A, 60 Hz 250 VAC, 13 A, 60 Hz	KSC 8305; K60884-1	CG_CBL-C13-06-KR	CBL-EX-PWR-C13-KR	

Table 23: AC Power Cord Specifications for QFX10002-36Q and QFX10002-72Q Switches *(Continued)*

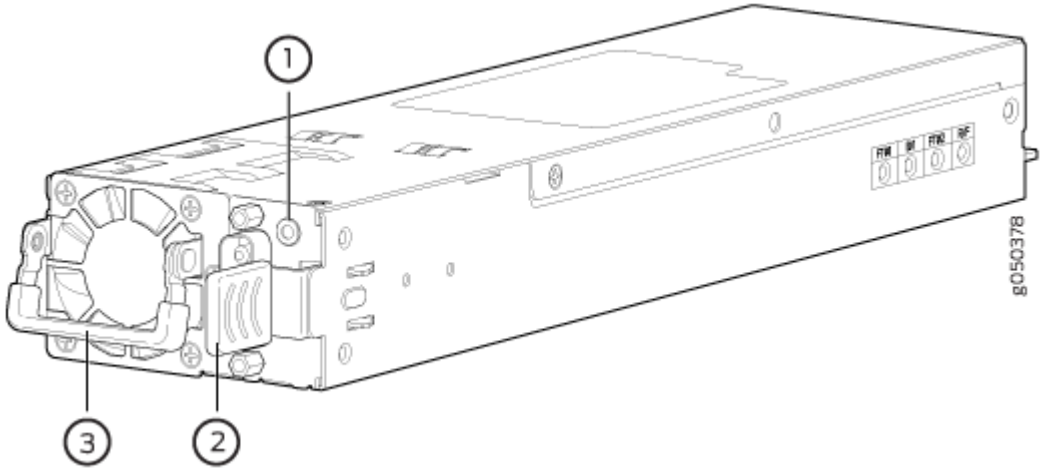
Country/ Region	Electrical Specifications	Plug Standards	Shipped Juniper Model Number	Spare Juniper Model Number	Graphic
Switzerland	250 VAC, 10 A, 50 Hz	SEV 1011 SEV 1991; EN 60320 C13	CG_CBL-C13-06-SZ	CBL-EX-PWR-C13-SZ	
United Kingdom	250 VAC, 10 A, 50 Hz	BS 1363/A	CG_CBL-C13-06-UK	CBL-EX-PWR-C13-UK	

QFX10002 DC Power Supply Description

The DC power supplies in QFX10002 models (see Figure 29 on page 57) are hot-removable and hot-insertable field-replaceable units (FRUs) that install without powering off the device or disrupting the switching function. The two 1600-W power supplies in a QFX10002-36Q are installed at the factory and supply 1200 W of power to the chassis. Likewise, the four 1600-W power supplies in a QFX10002-72Q switch are installed at the factory and supply 2400 W of power to the chassis.

A QFX10002 has double the amount of power supplies needed to power all of the components in the switch, which is known as *2N redundancy*. When the switch has all of the power supplies installed, the switch has full power redundancy. If a power supply fails or is removed, a second power supply balances the electrical load without interruption. For more on redundancy features, see "QFX10002 Component Redundancy" on page 8. Each power supply provides 12-VDC output with a standby voltage of 12 VDC.

Figure 29: DC Power Supply in QFX10002 Models



1– Power LED	3– Handle
2– Ejector lever	

The fan in the power supply provides port-to-FRU airflow, which is also known as *airflow out (AFO)*. A power supply with the label **AFO** or a gold-colored handle denotes port-to-FRU airflow.

Table 24 on page 57 shows the characteristics of the power supply.

Table 24: QFX10002 DC Power Supply

Wattage	Product Number	Direction of Airflow	Color of Power Supply Handle
1600-W	JPSU-1600W-DC-AFO	Port-to-FRU	Juniper Gold

We recommend that the 48 VDC facility DC source be equipped with a circuit breaker rated at 40 A (–48 VDC) minimum, or as required by local code.

To avoid electrical injury, carefully follow instructions in "Maintaining QFX10002 Power Supplies" on page 127 .

QFX10002 DC Power Specifications

Table 25 on page 58 describes the DC power specifications for the DC version of a QFX10002 switch.

Table 25: DC Power Specifications for a QFX10002

Item	Specifications
DC input voltage	• Rated operating voltage: VDC -48 VDC to -60 VDC • Operating voltage range: –40 VDC through -72 VDC
DC input current rating	40 A maximum for QFX10002-36Q and QFX10002-72Q 57.5 A maximum for QFX10002-60C
Typical power consumption	• 1050 W for QFX10002-72Q • 1642 W for QFX10002-60C • 560 W for QFX10002-36Q
Maximum power consumption	• 1425 W for QFX10002-72Q • 1857 W for QFX10002-60C • 800 W for QFX10002-36Q

We recommend that the 48 VDC facility DC source be equipped with a circuit breaker rated at 40 A (–48 VDC) minimum, or as required by local code.

QFX10002 DC Power Cable Specifications

QFX10002 DC power supplies require a D-Sub 3W3-type connector. The three pins on the connector provide –48 VDC input (–), return (+), and ground connections to the power supply.

NOTE: The optional right-angle DC power cables, CBL-JNP-PWR-DSUB2 and CBL-JNP-PWR-DSUB3, do not include a ground connection wire. See "Connecting the QFX10002 to Ground" on page 106.

DC power cables, each 4 m (approximately 13.1 ft) long, are supplied with the QFX10002. The provided cables include the three-pin connector on one end and three insulated wires at the opposite end, for connection to the site's DC power distribution system.

Table 26 on page 59 lists the specifications for the QFX10002 DC power cables.

Table 26: QFX10002 DC Power Cable Specifications

Juniper Model Number	Wire Function	Insulation Color	Wire Size
CBL-JNP-PWR-DSUB Straight cable	–48 VDC input (–)	Blue	8 AWG (8.4 mm^2), 90° C
	Return (+)	Black	8 AWG (8.4 mm^2), 90° C
	Ground	Green and yellow	8 AWG (8.4 mm^2), 90° C
CBL-JNP-PWR-DSUB2 (Optional) right-angle cable	–48 VDC input (–)	Blue	8 AWG (8.4 mm^2), 90° C
	Return (+)	Black	8 AWG (8.4 mm^2), 90° C
CBL-JNP-PWR-DSUB3 (Optional) FT4 vertical-flame rated, right-angle cable	–48 VDC input (–)	Gray	8 AWG (8.4 mm^2), 90° C
	Return (+)	Gray	8 AWG (8.4 mm^2), 90° C

NOTE: The optional right-angle DC power cables, CBL-JNP-PWR-DSUB2 and CBL-JNP-PWR-DSUB3, do not include a ground connection wire.

WARNING: For field-wiring connections, use copper conductors only.

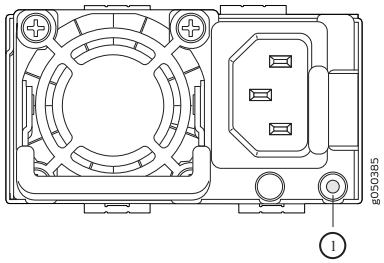
WARNING: Power cables must not block access to QFX10002 components or drape where people could trip on them.

CAUTION: You must ensure that power connections maintain the proper polarity. The power source cables might be labeled **(+)** and **(–)** to indicate their polarity. There is no standard color coding for DC power cables. The color coding used by the external DC power source at your site might be different from the color coding for the leads on the DC power cable provided with the chassis.

QFX10002 Power Supply LED

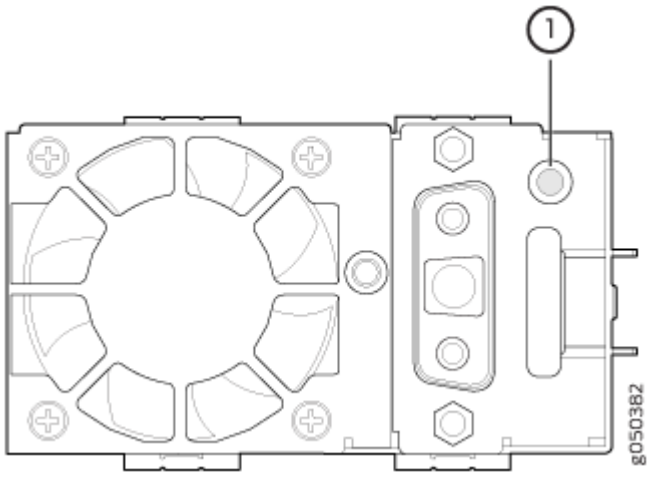
Figure 30 on page 60 shows the location of the status LED on the QFX10002 AC power supply and Figure 31 on page 60 shows the location of the status LED on the QFX10002 DC power supply.

Figure 30: AC Power Supply LED



1– Status LED

Figure 31: DC Power Supply LED



1– Status LED	

Table 27 on page 61 describes the status LED behavior on QFX10002 power supplies.

Table 27: Power Supply LEDs on a QFX10002 Switch

Color	State	Description
Green Amber	On steadily Off	The power supply is on and operating correctly.
Green Amber	Slow blinking (1 Hz) Off	The power supply is in cold standby mode; only the 12 V DC input is present.
Green Amber	Blinking (2 Hz) Off	The power supply is uploading firmware.
Green Amber	Off Blinking	Warning events are being detected; the power supply continues to operate. Often these events are because of rising temperatures. Check the fans and ensure there is proper airflow through the chassis.
Green Amber	Off On steadily	Either the power cord is unplugged or a major error is detected in the power supply. Examples of a major error are: power supply failure, an over voltage protection error, an over current protection error, or a fan failure. • If the power cord is unplugged or missing, reattach the power cord appropriate for your country. • If a major error is occurring, Replace the power supply as soon as possible. To maintain proper airflow through the chassis, leave the power supply installed in the chassis until you are ready to replace it.
Green Amber	Off Off	There is no AC power to any of the power supplies.

You can get additional information about the status of the power modules using the `show chassis environment pem` command. For example:

```
user@device> show chassis environment pem

PEM 0:
  State:     Online
  Capacity:  1600 W (maximum 1600 W)
  DC output: 372 W (zone 0, 31 A at 12 V, 23% of capacity)

PEM 1:
  State:     Online
  Capacity:  1600 W (maximum 1600 W)
  DC output: 324 W (zone 0, 27 A at 12 V, 20% of capacity)

PEM 2:
  State:     Online
  Capacity:  1600 W (maximum 1600 W)
  DC output: 312 W (zone 0, 26 A at 12 V, 19% of capacity)

PEM 3:
  State:     Online
  Capacity:  1600 W (maximum 1600 W)
  DC output: 312 W (zone 0, 26 A at 12 V, 19% of capacity)

System:
  Zone 0:
      Capacity:          6400 W (maximum 6400 W)
      Allocated power:   1320 W (5080 W remaining)
      Actual usage:      1320 W
  Total system capacity: 6400 W (maximum 6400 W)
  Total remaining power: 5080 W
```

RELATED DOCUMENTATION

- Connecting the QFX10002 to Ground | **106**
- Connecting AC Power to a QFX10002 | **111**
- Connecting DC Power to a QFX10002 | **113**

CHAPTER 2

Site Planning, Preparation, and Specifications

QFX10002 Site Preparation Checklist

The checklist in Table 28 on page 64 summarizes the tasks you need to perform when preparing a site for a QFX10002 installation.

Table 28: Site Preparation Checklist

Item or Task	For More Information	Performed By	Date
Environment			
Verify that environmental factors such as temperature and humidity do not exceed switch tolerances.	"QFX10002 Environmental Requirements and Specifications" on page 66		
Power			
Measure the distance between external power sources and the switch installation site.			
Calculate the power consumption and requirements.	"QFX10002 AC Power Specifications" on page 52 "QFX10002 DC Power Specifications" on page 57		
Rack			

Table 28: Site Preparation Checklist *(Continued)*

Item or Task	For More Information	Performed By	Date
Verify that your rack meets the minimum requirements for the installation of the switch.	"QFX10002 Rack Requirements" on page 72		
Plan rack location, including required space clearances.	"QFX10002 Clearance Requirements for Airflow and Hardware Maintenance" on page 69		
Secure the rack to the floor and building structure.			
Cables			
Acquire cables and connectors: • Determine the number of cables needed based on your planned configuration. • Review the maximum distance allowed for each cable. Choose the length of cable based on the distance between the hardware components being connected.	See The Hardware Compatibility Tool.		

Table 28: Site Preparation Checklist *(Continued)*

Item or Task	For More Information	Performed By	Date
Plan the cable routing and management.			

RELATED DOCUMENTATION

- QFX10002 Installation Overview | **98**

QFX10002 Site Guidelines and Requirements

IN THIS SECTION

QFX10002 Environmental Requirements and Specifications

The QFX10002 must be installed in a rack. It must be housed in a dry, clean, well-ventilated, and temperature-controlled environment.

Follow these environmental guidelines:

- The site must be as dust-free as possible, because dust can clog air intake vents and filters, reducing the efficiency of the switch cooling system.
- Maintain ambient airflow for normal switch operation. If the airflow is blocked or restricted, or if the intake air is too warm, the switch might overheat, leading to the switch temperature monitor shutting down the device to protect the hardware components.

Table 29 on page 67 provides the required environmental conditions for normal switch operation.

Table 29: QFX10002 Environmental Tolerances

Description	Tolerance
Altitude	No performance degradation to 6000 feet (1828.8 meters).
Relative humidity	Normal operation ensured in relative humidity range of 5% through 90%, noncondensing. • Short-term operation ensured in relative humidity range of 5% through 93%, noncondensing. **NOTE**: As defined in NEBS GR-63-CORE, Issue 3, short-term events can be up to 96 hours in duration but not more than 15 days per year.
Temperature	• Normal operation ensured in temperature range of 32° F through 104° F (0° C through 40° C). • Nonoperating storage temperature in shipping container: –40° F through 158° F (–40° C through 70° C).
Seismic	Designed to comply with Zone 4 earthquake requirements per NEBS GR-63-CORE, Issue 3.

NOTE: Install QFX Series devices only in restricted areas, such as dedicated equipment rooms and equipment closets, in accordance with Articles 110-16, 110-17, and 110-18 of the National Electrical Code, ANSI/NFPA 70.

SEE ALSO

QFX10002 Clearance Requirements for Airflow and Hardware Maintenance | 69

QFX10002 Installation Overview | 98

General Site Guidelines

Efficient device operation requires proper site planning and maintenance. It also requires proper layout of the equipment, rack or cabinet, and wiring closet.

To plan and create an acceptable operating environment for your device and prevent environmentally caused equipment failures:

- Keep the area around the chassis free from dust and conductive material, such as metal flakes.
- Follow the prescribed airflow guidelines to ensure that the cooling system functions properly. Ensure that the exhaust from other equipment does not blow into the intake vents of the device.
- Follow the prescribed electrostatic discharge (ESD) prevention procedures to prevent damaging the equipment. Static discharge can cause components to fail completely or intermittently over time.
- Install the device in a secure area, so that only authorized personnel can access the device.

QFX10002 Chassis Grounding Cable and Lug Specifications

To ground a QFX10002, connect a grounding cable to earth ground and then attach it to the chassis grounding points. See "Connecting the QFX10002 to Ground" on page 106.

WARNING: To comply with GR-1089 requirements, all intra-building copper cabling used for SFP+, QSFP+, and QSFP28 ports must be shielded and grounded at both ends.

CAUTION: Before switch installation begins, a licensed electrician must attach a cable lug to the grounding cables that you supply. A cable with an incorrectly attached lug can damage the switch.

Before connecting the switch to earth ground, review the following information:

- The grounding lug required is a Panduit LCD6-14BH-L or equivalent (not provided). The grounding lug accommodates 14-6 AWG (2-13.3 mm^2) stranded wire.

- The grounding cable that you provide for a QFX10002 must be the same size or heavier than the input wire of each power supply. Minimum recommendations are 8 AWG (8.4 mm^2) stranded copper wire, 90° C wire, or as permitted by local code.

SEE ALSO

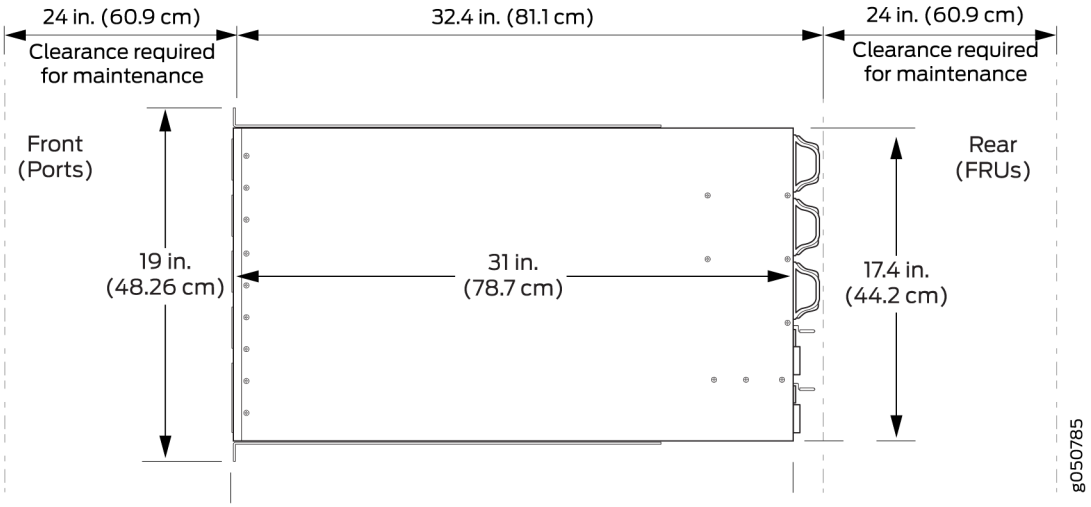
QFX10002 Power System | **50**

Connecting the QFX10002 | **106**

QFX10002 Clearance Requirements for Airflow and Hardware Maintenance

When planning the site for a QFX10002 installation, you must allow sufficient clearance around the installed chassis. See Figure 32 on page 69.

Figure 32: Clearance Requirements for Airflow and Hardware Maintenance for a QFX10002



Follow these guidelines:

- For the cooling system to function properly, the airflow around the chassis must be unrestricted. See "QFX10002 Cooling System and Airflow" on page 46 for more information about the airflow through the chassis.
- If you are mounting a QFX10002 in a rack with other equipment, ensure that the exhaust from other equipment does not blow into the intake vents of the chassis.
- You must leave at least 24 in. (61 cm) both in front of and behind the QFX10002. For service personnel to remove and install hardware components, you must leave adequate space at the front and back of the switch. NEBS GR-63 recommends that you allow at least 30 in. (76.2 cm) in front of the rack and 24 in. (61 cm) behind the rack. See Figure 32 on page 69.

SEE ALSO

Rack-Mounting and Cabinet-Mounting Warnings | 173

QFX10002 Chassis Physical Specifications

The QFX10002 switch chassis is a rigid sheet-metal structure that houses the hardware components. Table 30 on page 70 summarizes the physical specifications of the QFX10002.

Table 30: Physical Specifications for the QFX10002

Models	Fans and Power	Height	Width	Depth	Weight
QFX10002-72Q	3 fans and 4 AC power supplies installed	3.46 in. (8.8 cm)	17.36 in. (44.1 cm)	31 in. (78.7 cm) without handles for fans or power supplies.	With FRUs installed: 68.6 lbs (31.1 kg)
QFX10002-72Q -DC	3 fans and 4 DC power supplies installed	3.46 in. (8.8 cm)	17.36 in. (44.1 cm)	31 in. (78.7 cm) without handles for fans or power supplies.	With FRUs installed: 67.8 lbs (30.8 kg)
QFX10002-60C	3 fans and 4 AC power supplies installed	3.46 in. (8.8 cm)	17.36 in. (44.1 cm)	31 in. (78.7 cm) without handles for fans or power supplies.	With FRUs installed: 90.39 lbs (41 kg)

Table 30: Physical Specifications for the QFX10002 *(Continued)*

Models	Fans and Power	Height	Width	Depth	Weight
QFX10002-60C	3 fans and 4 DC power supplies installed	3.46 in. (8.8 cm)	17.36 in. (44.1 cm)	31 in. (78.7 cm) without handles for fans or power supplies.	With FRUs installed: 90.39 lbs (41 kg)
QFX10002-36Q	3 fans and 2 AC power supplies installed, 2 blanks	3.46 in. (8.8 cm)	17.36 in. (44.1 cm)	31 in. (78.7 cm) without handles for fans or power supplies.	With FRUs installed: 54 lbs (24.5 kg)
QFX10002-36Q -DC	3 fans and 2 DC power supplies installed, 2 blanks	3.46 in. (8.8 cm)	17.36 in. (44.1 cm)	31 in. (78.7 cm) without handles for fans or power supplies.	With FRUs installed: 53.6 lbs (24.3 kg)

Site Electrical Wiring Guidelines

Table 31 on page 72 describes the factors you must consider while planning the electrical wiring at your site.

WARNING: You must provide a properly grounded and shielded environment and use electrical surge-suppression devices.

Avertissement Vous devez établir un environnement protégé et convenablement mis à la terre et utiliser des dispositifs de parasurtension.

Table 31: Site Electrical Wiring Guidelines

Site Wiring Factor	Guidelines
Signaling limitations	If your site experiences any of the following problems, consult experts in electrical surge suppression and shielding: • Radio frequency interference (RFI) because of improperly installed wires • Damage from lightning strikes occuring when wires exceed recommended distances or pass between buildings • Electromagnetic pulses (EMPs) caused by lightning damaging unshielded conductors and electronic devices
Radio frequency interference	To reduce or eliminate RFI from your site wiring, do the following: • Use a twisted-pair cable with a good distribution of grounding conductors. • To exceed the recommended distances, use a high-quality twisted-pair cable with one ground conductor for each data signal, when applicable.
Electromagnetic compatibility	If your site is susceptible to problems with electromagnetic compatibility (EMC), particularly from lightning or radio transmitters, seek expert advice. Strong sources of electromagnetic interference (EMI) can cause: • Destruction of the signal drivers and receivers in the device. • Electrical hazards as a result of power surges conducted over the lines into the equipment.

QFX10002 Rack Requirements

The QFX10002 fixed-chassis is designed to be installed on four-post racks.

Rack requirements consist of:

- Rack type
- Mounting bracket hole spacing
- Rack size and strength

- Rack connection to the building structure

Table 32 on page 73 provides the rack requirements and specifications for the QFX10002.

Table 32: Rack Requirements for the QFX10002

Rack Requirement	Guidelines
Rack type: four-post	Use a four-post rack that provides bracket holes or hole patterns spaced at 1-U (1.75 in. or 4.45 cm) increments and that meets the size and strength requirements to support the weight. A U is the standard rack unit defined in *Cabinets, Racks, Panels, and Associated Equipment* (document number EIA-310–D) published by the Electronics Industry Association.
Mounting bracket hole spacing	The holes in the mounting brackets are spaced at 1 U (1.75 in. or 4.45 cm), so that the switch can be mounted in any rack that provides holes spaced at that distance.
Rack size and strength	• Ensure that the rack complies with the standards for a 19-in. or 23-in. rack as defined in *Cabinets, Racks, Panels, and Associated Equipment* (document number EIA-310–D) published by the Electronics Industry Association. • Use a 600-mm rack as defined in the four-part *Equipment Engineering (EE); European telecommunications standard for equipment practice* (document numbers ETS 300 119-1 through 119-4) published by the European Telecommunications Standards Institute (https://www.etsi.org). The horizontal spacing between the rails in a rack that complies with this standard is usually wider than the device's mounting brackets, which measure 19 in. (48.26 cm) from outer edge to outer edge. Use approved wing devices to narrow the opening between the rails as required. • Ensure that the rack rails are spaced widely enough to accommodate the switch chassis' external dimensions. The outer edges of the front-mounting brackets extend the width to 19 in. (48.26 cm). • Ensure that the front and rear rack rails are spaced between 28 in. (71.1 cm) and 31 in. (78.7 cm) front-to-back. • Ensure that the rack is strong enough to support the weight of the switch. • Ensure that the spacing of rails and adjacent racks allows for proper clearance around the switch and rack.

Table 32: Rack Requirements for the QFX10002 *(Continued)*

Rack Requirement	Guidelines
Rack connection to building structure	• Secure the rack to the building structure. • If earthquakes are a possibility in your geographical area, secure the rack to the floor. • Secure the rack to the ceiling brackets as well as wall or floor brackets for maximum stability.

QFX10002 Cabinet Requirements

You can mount QFX10002 models in a cabinet that contains a four-post 19-in. rack as defined in *Cabinets, Racks, Panels, and Associated Equipment* (document number EIA-310-D) published by the Electronics Industry Association.

Cabinet requirements consist of:

- Cabinet size and clearance
- Cabinet airflow requirements

Table 33 on page 74 provides the cabinet requirements and specifications for the QFX10002.

Table 33: Cabinet Requirements for the QFX10002

Cabinet Requirement	Guidelines
Cabinet size and clearance	The minimum cabinet size for accommodating a QFX10002 is 36 in. (91.4 cm) deep. Large cabinets improve airflow and reduce the chance of overheating.

Table 33: Cabinet Requirements for the QFX10002 *(Continued)*

Cabinet Requirement	Guidelines
Cabinet airflow requirements	When you mount the switch in a cabinet, ensure that ventilation through the cabinet is sufficient to prevent overheating. • Ensure that the cool air supply you provide through the cabinet adequately dissipates the thermal output of the switch (or switches). • Ensure that the cabinet allows the chassis hot exhaust air to exit the cabinet without recirculating into the switch. An open cabinet (without a top or doors) that employs hot air exhaust extraction from the top allows the best airflow through the chassis. If the cabinet contains a top or doors, perforations in these elements assist with removing the hot air exhaust. • Install the switch in the cabinet in a way that maximizes the open space on the FRU side of the chassis. This maximizes the clearance for critical airflow. The QFX10002 fans exhaust hot air through the fans and power supplies. • Route and dress all cables to minimize the blockage of airflow to and from the chassis. • Ensure that the spacing of rails and adjacent cabinets allows for the proper clearance around the switch and cabinet.

RELATED DOCUMENTATION

Overview of Installing the QFX10002 | **98**

Installing and Removing QFX10002 Hardware Components | **122**

Mounting a QFX10002 in a Rack | **102**

QFX10002 Network Cable and Transceiver Planning

IN THIS SECTION

Before installing the QFX10002, review the following topics to understand the optical and interface requirements for the system.

Determining Transceiver Support for the QFX10002

The QFX10002 has quad small form-factor pluggable plus (QSFP+) ports for use as uplinks, downlinks, or as access ports. These 40-Gigabit Ethernet ports support QSFP+ transceivers, QSFP28 transceivers, QSFP+ direct-attach copper (DAC) cables, and DAC breakout cables (DACBO). Each QSFP+ port on either a QFX10002-72Q or a QFX10002-36Q can be configured to operate as a 10-Gigabit Ethernet interface by using a breakout cable or as a single 40-Gigabit Ethernet interface.

The QFX10002 also supports using small form-factor pluggable (SFP) and small form-factor pluggable plus (QSFP+) transceivers to connect the management ports. These transceivers are not supported for use in the uplinks, downlinks, or access ports.

You can find information about the optical transceivers supported on your Juniper device by using the Hardware Compatibility Tool. In addition to transceiver and connection type, the optical and cable characteristics–where applicable–are documented for each transceiver. The Hardware Compatibility Tool enables you to search by product, displaying all the transceivers supported on that device, or category, by interface speed or type. The list of supported transceivers for the QFX10002 is located at the Hardware Compatibility Tool.

CAUTION: The Juniper Networks Technical Assistance Center (JTAC) provides complete support for Juniper-supplied optical modules and cables. However, JTAC does not provide support for third-party optical modules and cables that are not qualified or

supplied by Juniper Networks. If you face a problem running a Juniper device that uses third-party optical modules or cables, JTAC may help you diagnose host-related issues if the observed issue is not, in the opinion of JTAC, related to the use of the third-party optical modules or cables. Your JTAC engineer will likely request that you check the third-party optical module or cable and, if required, replace it with an equivalent Juniper-qualified component.

Use of third-party optical modules with high-power consumption (for example, coherent ZR or ZR+) can potentially cause thermal damage to or reduce the lifespan of the host equipment. Any damage to the host equipment due to the use of third-party optical modules or cables is the users' responsibility. Juniper Networks will accept no liability for any damage caused due to such use.

Cable Specifications for QSFP+, QSFP28, and QSFP-DD Transceivers

The 40-Gigabit Ethernet QSFP+, 100-Gigabit Ethernet QSFP28, and 400G (QDD-400G-DR4 and QDD-400G-SR4P2) transceivers that are used in QFX Series switches use 12-ribbon multimode fiber crossover cables with socket MPO-12 (UPC/APC) connectors. The fiber can be either OM3 or OM4. These cables are not sold by Juniper Networks.

CAUTION: To maintain agency approvals, use only a properly constructed, shielded cable.

TIP: Ensure that you order cables with the correct polarity. Vendors refer to these crossover cables as *key up to key up*, *latch up to latch up*, *Type B*, or *Method B*. If you are using patch panels between two QSFP+ or QSFP28 transceivers, ensure that the proper polarity is maintained through the cable plant.

Table 34 on page 77 describes the signals on each fiber. Table 35 on page 78 shows the pin-to-pin connections for proper polarity.

Table 34: QSFP+ and QSFP28 Optical Module Receptacle Pinouts

Fiber	Signal
1	Tx0 (Transmit)

Table 34: QSFP+ and QSFP28 Optical Module Receptacle Pinouts *(Continued)*

Fiber	Signal
2	Tx1 (Transmit)
3	Tx2 (Transmit)
4	Tx3 (Transmit)
5	Unused
6	Unused
7	Unused
8	Unused
9	Rx3 (Receive)
10	Rx2 (Receive)
11	Rx1 (Receive)
12	Rx0 (Receive)

Table 35: QSFP+ MPO Fiber-Optic Crossover Cable Pinouts

Pin	Pin
1	12
2	11
3	10

Table 35: QSFP+ MPO Fiber-Optic Crossover Cable Pinouts *(Continued)*

Pin	Pin
4	9
5	8
6	7
7	6
8	5
9	4
10	3
11	2
12	1

Understanding QFX Series Fiber-Optic Cable Signal Loss, Attenuation, and Dispersion

IN THIS SECTION

To determine the power budget and power margin needed for fiber-optic connections, you need to understand how signal loss, attenuation, and dispersion affect transmission. The QFX Series uses various types of network cables, including multimode and single-mode fiber-optic cables.

Signal Loss in Multimode and Single-Mode Fiber-Optic Cables

Multimode fiber is large enough in diameter to allow rays of light to reflect internally (bounce off the walls of the fiber). Interfaces with multimode optics typically use LEDs as light sources. However, LEDs are not coherent light sources. They spray varying wavelengths of light into the multimode fiber, which reflect the light at different angles. Light rays travel in jagged lines through a multimode fiber, causing signal dispersion. When light traveling in the fiber core radiates into the fiber cladding (layers of lower refractive index material in close contact with a core material of higher refractive index), higher-order mode loss occurs. Together, these factors reduce the transmission distance of multimode fiber compared to that of single-mode fiber.

Single-mode fiber is so small in diameter that rays of light reflect internally through one layer only. Interfaces with single-mode optics use lasers as light sources. Lasers generate a single wavelength of light, which travels in a straight line through the single-mode fiber. Compared to multimode fiber, single-mode fiber has a higher bandwidth and can carry signals for longer distances. It is consequently more expensive.

For information about the maximum transmission distance and supported wavelength range for the types of single-mode and multimode fiber-optic cables that are connected to the QFX Series, see the Hardware Compatibility Tool. Exceeding the maximum transmission distances can result in significant signal loss, which causes unreliable transmission.

Attenuation and Dispersion in Fiber-Optic Cable

An optical data link functions correctly provided that modulated light reaching the receiver has enough power to be demodulated correctly. *Attenuation* is the reduction in strength of the light signal during transmission. Passive media components such as cables, cable splices, and connectors cause attenuation. Although attenuation is significantly lower for optical fiber than for other media, it still occurs in both multimode and single-mode transmission. An efficient optical data link must transmit enough light to overcome attenuation.

Dispersion is the spreading of the signal over time. The following two types of dispersion can affect signal transmission through an optical data link:

- Chromatic dispersion, which is the spreading of the signal over time caused by the different speeds of light rays.
- Modal dispersion, which is the spreading of the signal over time caused by the different propagation modes in the fiber.

For multimode transmission, modal dispersion, rather than chromatic dispersion or attenuation, usually limits the maximum bit rate and link length. For single-mode transmission, modal dispersion is not a factor. However, at higher bit rates and over longer distances, chromatic dispersion limits the maximum link length.

An efficient optical data link must have enough light to exceed the minimum power that the receiver requires to operate within its specifications. In addition, the total dispersion must be within the limits specified for the type of link in the Telcordia Technologies document GR-253-CORE (Section 4.3) and International Telecommunications Union (ITU) document G.957.

When chromatic dispersion is at the maximum allowed, its effect can be considered as a power penalty in the power budget. The optical power budget must allow for the sum of component attenuation, power penalties (including those from dispersion), and a safety margin for unexpected losses.

Calculating Power Budget and Power Margin for Fiber-Optic Cables

IN THIS SECTION

Use the information in this topic and the specifications for your optical interface to calculate the power budget and power margin for fiber-optic cables.

TIP: You can use the Hardware Compatibility Tool to find information about the pluggable transceivers supported on your Juniper Networks device.

To calculate the power budget and power margin, perform the following tasks:

Calculate Power Budget for Fiber-Optic Cables

To ensure that fiber-optic connections have sufficient power for correct operation, you need to calculate the link's power budget (P_B), which is the maximum amount of power it can transmit. When you calculate the power budget, you use a worst-case analysis to provide a margin of error, even though all the parts of an actual system do not operate at the worst-case levels. To calculate the worst-case estimate of P_B, you assume minimum transmitter power (P_T) and minimum receiver sensitivity (P_R):

$P_B = P_T - P_R$

The following hypothetical power budget equation uses values measured in decibels (dB) and decibels referred to one milliwatt (dBm):

$P_B = P_T - P_R$

$P_B = -15$ dBm $- (-28$ dBm)

$P_B = 13$ dB

How to Calculate Power Margin for Fiber-Optic Cables

After calculating a link's P_B, you can calculate the power margin (P_M), which represents the amount of power available after subtracting attenuation or link loss (LL) from the P_B) A worst-case estimate of P_M assumes maximum LL:

$P_M = P_B - LL$

P_M greater than zero indicates that the power budget is sufficient to operate the receiver.

Factors that can cause link loss include higher-order mode losses, modal and chromatic dispersion, connectors, splices, and fiber attenuation. Table 36 on page 82 lists an estimated amount of loss for the factors used in the following sample calculations. For information about the actual amount of signal loss caused by equipment and other factors, refer to vendor documentation.

Table 36: Estimated Values for Factors Causing Link Loss

Link-Loss Factor	Estimated Link-Loss Value
Higher-order mode losses	Single mode—None Multimode—0.5 dB
Modal and chromatic dispersion	Single mode—None Multimode—None, if product of bandwidth and distance is less than 500 MHz-km
Faulty connector	0.5 dB
Splice	0.5 dB

Table 36: Estimated Values for Factors Causing Link Loss *(Continued)*

Link-Loss Factor	Estimated Link-Loss Value
Fiber attenuation	Single mode—0.5 dB/km Multimode—1 dB/km

The following sample calculation for a 2-km-long multimode link with a P_B of 13 dB uses the estimated values from Table 36 on page 82. This example calculates LL as the sum of fiber attenuation (2 km @ 1 dB/km, or 2 dB) and loss for five connectors (0.5 dB per connector, or 2.5 dB) and two splices (0.5 dB per splice, or 1 dB) as well as higher-order mode losses (0.5 dB). The P_M is calculated as follows:

$P_M = P_B - LL$

$P_M = 13\ dB - 2\ km\ (1\ dB/km) - 5\ (0.5\ dB) - 2\ (0.5\ dB) - 0.5\ dB$

$P_M = 13\ dB - 2\ dB - 2.5\ dB - 1\ dB - 0.5\ dB$

$P_M = 7\ dB$

The following sample calculation for an 8-km-long single-mode link with a P_B of 13 dB uses the estimated values from Table 36 on page 82. This example calculates LL as the sum of fiber attenuation (8 km @ 0.5 dB/km, or 4 dB) and loss for seven connectors (0.5 dB per connector, or 3.5 dB). The pP_M is calculated as follows:

$P_M = P_B - LL$

$P_M = 13\ dB - 8\ km\ (0.5\ dB/km) - 7(0.5\ dB)$

$P_M = 13\ dB - 4\ dB - 3.5\ dB$

$P_M = 5.5\ dB$

In both the examples, the calculated P_M is greater than zero, indicating that the link has sufficient power for transmission and does not exceed the maximum receiver input power.

RELATED DOCUMENTATION

QFX10002 Port Panels | 12

QFX10002 Management Cable Specifications and Pinouts

IN THIS SECTION

Cable Specifications for Console and Management Connections for the QFX Series

Table 37 on page 84 lists the specifications for the cables that connect the QFX Series switch to a management device.

NOTE: The QFX Series can be configured with small form-factor pluggable (SFP) management ports that support 1000BASE-SX transceivers. QFX5130 switches come with a RJ-45 management port, and support 10-Gbps speed. See the Hardware Compatibility Tool for more information about the fiber-optic cables required for use with these transceivers.

Table 37: Cable Specifications for Console and Management Connections for the QFX Series

Port on QFX Series Device	Cable Specification	Maximum Length	Device Receptacle
Console port	RS-232 (EIA-232) serial cable	7 feet (2.13 meters)	RJ-45

Table 37: Cable Specifications for Console and Management Connections for the QFX Series *(Continued)*

Port on QFX Series Device	Cable Specification	Maximum Length	Device Receptacle
Management port	Category 5 cable or equivalent suitable for 1000BASE-T operation	328 feet (100 meters)	RJ-45

NOTE: We no longer include the RJ-45 console cable with the DB-9 adapter as part of the device package. If the console cable and adapter are not included in your device package, or if you need a different type of adapter, you can order the following separately:

- RJ-45 to DB-9 adapter (JNP-CBL-RJ45-DB9)
- RJ-45 to USB-A adapter (JNP-CBL-RJ45-USBA)
- RJ-45 to USB-C adapter (JNP-CBL-RJ45-USBC)

If you want to use RJ-45 to USB-A or RJ-45 to USB-C adapter you must have X64 (64-Bit) Virtual COM port (VCP) driver installed on your PC. See, https://ftdichip.com/drivers/vcp-drivers/ to download the driver.

RJ-45 Management Port Connector Pinout Information

Table 38 on page 85 provides the pinout information for the RJ-45 connector for the management port on Juniper Networks devices.

Table 38: RJ-45 Management Port Connector Pinout Information

Pin	Signal	Description
1	TRP1+	Transmit/receive data pair 1
2	TRP1-	Transmit/receive data pair 1
3	TRP2+	Transmit/receive data pair 2

Table 38: RJ-45 Management Port Connector Pinout Information *(Continued)*

Pin	Signal	Description
4	TRP3+	Transmit/receive data pair 3
5	TRP3-	Transmit/receive data pair 3
6	TRP2-	Transmit/receive data pair 2
7	TRP4+	Transmit/receive data pair 4
8	TRP4-	Transmit/receive data pair 4

Console Port Connector Pinout Information

The console port on a Juniper Networks device is an RS-232 serial interface that uses an RJ-45 connector to connect to a console management device. The default baud rate for the console port is 9600 baud.

Table 39 on page 87 provides the pinout information for the RJ-45 console connector.

NOTE: We no longer include the RJ-45 console cable with the DB-9 adapter as part of the device package. If the console cable and adapter are not included in your device package, or if you need a different type of adapter, you can order the following separately:

- RJ-45 to DB-9 adapter (JNP-CBL-RJ45-DB9)
- RJ-45 to USB-A adapter (JNP-CBL-RJ45-USBA)
- RJ-45 to USB-C adapter (JNP-CBL-RJ45-USBC)

If you want to use RJ-45 to USB-A or RJ-45 to USB-C adapter you must have X64 (64-Bit) Virtual COM port (VCP) driver installed on your PC. See, https://ftdichip.com/drivers/vcp-drivers/ to download the driver.

NOTE: If your laptop or desktop PC does not have a DB-9 plug connector pin and you want to connect your laptop or desktop PC directly to a device, use a combination of the RJ-45-to-DB-9 socket adapter and a USB-to-DB-9 plug adapter. You must provide the USB-to-DB-9 plug adapter.

Table 39: Console Port Connector Pinout Information

Pin	Signal	Description
1	NC	No connect
2	NC	No connect
3	TxD Output	Transmit data
4	GND	Signal ground
5	GND	Signal ground
6	RxD Input	Receive data
7	DCD Input	Data carrier detect
8	NC	No connect

RJ-45 to DB-9 Serial Port Adapter Pinout Information

The console port on a Juniper Networks device is an RS-232 serial interface that uses an RJ-45 connector to connect to a management device such as a laptop or a desktop PC. If your laptop or desktop PC does not have a DB-9 plug connector pin and you want to connect your laptop or desktop PC to the device, use a combination of the RJ-45 to DB-9 socket adapter along with a USB to DB-9 plug adapter.

Table 40 on page 88 provides the pinout information for the RJ-45 to DB-9 serial port adapter.

Table 40: RJ-45 to DB-9 Serial Port Adapter Pinout Information

RJ-45 pin	Signal	DB-9 pin	Signal
1	NC	8	CTS
2	NC	6	DSR
3	TxD	2	RxD
4	GND	5	GND
6	RxD	3	TxD
7	DCD	4	DTR
8	NC	7	RTS

RJ-45 Port, SFP Port, SFP+ Port, QSFP+ Port, and QSFP28 Port Connector Pinout Information

The tables in this topic describe the connector pinout information for the RJ-45, QSFP+, QSFP28, SFP+, and SFP ports.

- Table 41 on page 89—10/100/1000BASE-T Ethernet network port connector pinout information
- Table 42 on page 89—SFP network port connector pinout information
- Table 43 on page 91—SFP+ network port connector pinout information
- Table 44 on page 92—QSFP+ and QSFP28 network module ports connector pinout information

Table 41: 10/100/1000BASE-T Ethernet Network Port Connector Pinout Information

Pin	Signal	Description
1	TRP1+	Transmit/receive data pair 1 Negative Vport (in PoE models)
2	TRP1-	Transmit/receive data pair 1 Negative Vport (in PoE models)
3	TRP2+	Transmit/receive data pair 2 Positive Vport (in PoE models)
4	TRP3+	Transmit/receive data pair 3
5	TRP3-	Transmit/receive data pair 3
6	TRP2-	Transmit/receive data pair 2 Positive Vport (in PoE models)
7	TRP4+	Transmit/receive data pair 4
8	TRP4-	Transmit/receive data pair 4

Table 42: SFP Network Port Connector Pinout Information

Pin	Signal	Description
1	VeeT	Module transmitter ground
2	TX_Fault	Module transmitter fault
3	TX_Disable	Transmitter disabled

Table 42: SFP Network Port Connector Pinout Information *(Continued)*

Pin	Signal	Description
4	SDA	2-wire serial interface data line
5	SCL-	2-wire serial interface clock
6	MOD_ABS	Module absent
7	RS	Rate select
8	RX_LOS	Receiver loss of signal indication
9	VeeR	Module receiver ground
10	VeeR	Module receiver ground
11	VeeR	Module receiver ground
12	RD-	Receiver inverted data output
13	RD+	Receiver noninverted data output
14	VeeR	Module receiver ground
15	VccR	Module receiver 3.3 V supply
16	VccT	Module transmitter 3.3 V supply
17	VeeT	Module transmitter ground
18	TD+	Transmitter noninverted data input

Table 42: SFP Network Port Connector Pinout Information *(Continued)*

Pin	Signal	Description
19	TD-	Transmitter inverted data input
20	VeeT	Module transmitter ground

Table 43: SFP+ Network Port Connector Pinout Information

Pin	Signal	Description
1	VeeT	Module transmitter ground
2	TX_Fault	Module transmitter fault
3	TX_Disable	Transmitter disabled
4	SDA	2-wire serial interface data line
5	SCL-	2-wire serial interface clock
6	MOD_ABS	Module absent
7	RS0	Rate select 0, optionally controls SFP+ module receiver
8	RX_LOS	Receiver loss of signal indication
9	RS1	Rate select 1, optionally controls SFP+ transmitter
10	VeeR	Module receiver ground
11	VeeR	Module receiver ground
12	RD-	Receiver inverted data output

Table 43: SFP+ Network Port Connector Pinout Information *(Continued)*

Pin	Signal	Description
13	RD+	Receiver noninverted data output
14	VeeR	Module receiver ground
15	VccR	Module receiver 3.3-V supply
16	VccT	Module transmitter 3.3-V supply
17	VeeT	Module transmitter ground
18	TD+	Transmitter noninverted data input
19	TD-	Transmitter inverted data input
20	VeeT	Module transmitter ground

Table 44: QSFP+ and QSFP28 Network Port Connector Pinout Information

Pin	Signal
1	GND
2	TX2n
3	TX2p
4	GND
5	TX4n
6	TX4p

Table 44: QSFP+ and QSFP28 Network Port Connector Pinout Information *(Continued)*

Pin	Signal
7	GND
8	ModSelL
9	LPMode_Reset
10	VccRx
11	SCL
12	SDA
13	GND
14	RX3p
15	RX3n
16	GND
17	RX1p
18	RX1n
19	GND
20	GND
21	RX2n

Table 44: QSFP+ and QSFP28 Network Port Connector Pinout Information *(Continued)*

Pin	Signal
22	RX2p
23	GND
24	RX4n
25	RX4p
26	GND
27	ModPrsL
28	IntL
29	VccTx
30	Vcc1
31	Reserved
32	GND
33	TX3p
34	TX3n
35	GND
36	TX1p

Table 44: QSFP+ and QSFP28 Network Port Connector Pinout Information *(Continued)*

Pin	Signal
37	TX1n
38	GND

USB Port Specifications for the QFX Series

The following Juniper Networks USB flash drives have been tested and are officially supported for the USB port in the QFX Series:

- RE-USB-1G-S—1-gigabyte (GB) USB flash drive (except QFX3100 Director device)
- RE-USB-2G-S—2-GB USB flash drive (except QFX3100 Director device)
- RE-USB-4G-S—4-GB USB flash drive

CAUTION: Any USB memory product not listed as supported for the QFX Series has not been tested by Juniper Networks. The use of any unsupported USB memory product could expose your device to unpredictable behavior. Juniper Networks Technical Assistance Center (JTAC) can provide only limited support for issues related to unsupported hardware. We strongly recommend that you use only supported USB flash drives.

CAUTION: Remove the USB flash drive before upgrading Junos OS or rebooting a QFX Series device. Failure to do so could expose your device to unpredictable behavior.

NOTE: Executing the `request system snapshot` CLI command on a QFX3500 device requires an external USB flash drive with at least 4 GB of free space. We recommend using the RE-USB-4G-S flash drive.

NOTE: USB flash drives used with the QFX Series device must support USB 2.0 or later.

RELATED DOCUMENTATION

Connecting the QFX10002 | **106**

CHAPTER 3

Initial Installation and Configuration

QFX10002 Installation Overview

IN THIS SECTION

Overview of Installing the QFX10002

Before you begin to install and connect a QFX10002, ensure that you have reviewed the information in "QFX10002 Installation Safety Guidelines" on page 99.

You can mount a QFX10002:

- Flush with the front of a 19-in. four-post rack. Use the standard mounting brackets provided with the switch for this configuration.
- Recessed 2 in. (5 cm) from the front of a 19-in. four-post rack. Use the extension bracket provided in the standard mounting kit for this configuration. Recessed mounting is primarily used in enclosed cabinets.

To install and connect a QFX10002:

1. Follow the instructions in "Unpacking a QFX10002" on page 100.
2. Determine how the device is to be mounted.

   Flush or recessed mounted in a rack or cabinet, see "Mounting a QFX10002 in a Rack" on page 102.
3. Follow the instructions in:
   a. "Connecting the QFX10002 to Ground" on page 106
   b. "Connecting AC Power to a QFX10002" on page 111 or "Connecting DC Power to a QFX10002" on page 113
   c. "Register Products—Mandatory to Validate SLAs" on page 117
4. Initially configure Junos OS following the instructions in "Performing an Initial Configuration of a QFX10000 " on page 117
5. Set the management options for the QFX10002 device by following:
   a. "Connecting a QFX Series Device to a Management Console" on page 109

b. "Connecting a QFX10002 to a Management Ethernet Device" on page 109

QFX10002 Installation Safety Guidelines

IN THIS SECTION

Observe the following guidelines before and during QFX10002 installation:

General Installation Safety Guidelines

Before installing or moving the QFX10002, verify that the intended site meets the specified power, environmental, and clearance requirements. See the following documentation:

- "QFX10002 Site Preparation Checklist" on page 64
- "QFX10002 Clearance Requirements for Airflow and Hardware Maintenance" on page 69
- "QFX10002 Rack Requirements" on page 72
- "QFX10002 Cabinet Requirements" on page 74
- "QFX10002 Environmental Requirements and Specifications" on page 66
- "QFX10002 AC Power Specifications" on page 52 or "QFX10002 DC Power Specifications" on page 57

QFX10002 Chassis Lifting Guidelines

The weight of a fully-loaded QFX10002-72Q is approximately 68.6 lbs (31.1 kg) with AC power supplies and 67.8 lbs (30.8 kg) with DC power supplies installed. The weight of a QFX10002-36Q is 54 lbs (24.5 kg). (Observe the following guidelines for lifting and moving a QFX10002:

CAUTION: If you are installing the QFX10002 above 60 in. (152.4 cm) from the floor, remove the power supplies and fan modules before attempting to install the switch.

Unless you are using a mechanical lift, at least three people are required to perform the rack or cabinet installation.

- Before installing a QFX10002, read the guidelines in "QFX10002 Site Preparation Checklist" on page 64 to verify that the intended site meets the specified power, environmental, and clearance requirements.
- Before lifting or moving the QFX10002, disconnect all external cables.
- When raising the QFX10002 into the rack, have two people lift and align the switch with the rack while another person secures the switch to the rack. As when lifting any heavy object, lift most of the weight with your legs rather than your back. Keep your knees bent and your back relatively straight and avoid twisting your body as you lift. Balance the load evenly and be sure that your footing is solid.

RELATED DOCUMENTATION

QFX10002 Site Guidelines and Requirements | 66

Unpacking and Mounting the QFX10002

IN THIS SECTION

Use the following topics for instructions on how to unpack and mount the switch:

Unpacking a QFX10002

The QFX10002 switch chassis is a rigid sheet-metal structure that houses the hardware components. A QFX10002 device is shipped in a cardboard carton, secured with foam packing material. The carton also contains an accessory box and quick start instructions.

CAUTION: QFX10002 switches are maximally protected inside the shipping carton. Do not unpack the switch until you are ready to begin installation.

To unpack a QFX10002:

1. Move the shipping carton to a staging area as close to the installation site as possible, but where you have enough room to remove the system components.
2. Position the carton so that the arrows are pointing up.
3. Open the top flaps on the shipping carton.
4. Remove the accessory box and verify the contents against the inventory included in the box. Table 45 on page 101 lists the inventory of components supplied with a QFX10002.
5. Pull out the packing material holding the switch in place.
6. Verify the chassis components received:
   - Two power supplies for QFX10002-36Q and four power supplies for QFX10002-60C and QFX10002-72Q
   - Three fan modules
7. Save the shipping carton and packing materials in case you need to move or ship the switch later.

Table 45: Inventory of Components Supplied with a QFX10002

Component	Quantity
Chassis with three fan modules and two power supplies (QFX10002-36Q) or four power supplies (QFX10002-60C or QFX10002-72Q).	1
Rack mount kit • Rear mounting blades • Front mounting brackets • 4x6 mm flathead screws **NOTE**: Spare rack mount kits are ordered as EX4500-4PST-RMK.	1 • 2 • 2 • 24
Documentation roadmap card	1
Warranty	1

NOTE: We no longer include the RJ-45 console cable with the DB-9 adapter as part of the device package. If the console cable and adapter are not included in your device package, or if you need a different type of adapter, you can order the following separately:

- RJ-45 to DB-9 adapter (JNP-CBL-RJ45-DB9)
- RJ-45 to USB-A adapter (JNP-CBL-RJ45-USBA)
- RJ-45 to USB-C adapter (JNP-CBL-RJ45-USBC)

If you want to use RJ-45 to USB-A or RJ-45 to USB-C adapter you must have X64 (64-Bit) Virtual COM port (VCP) driver installed on your PC. See, https://ftdichip.com/drivers/vcp-drivers/ to download the driver.

SEE ALSO

QFX10002 Installation Overview | 98

Mounting a QFX10002 in a Rack

IN THIS SECTION

You can mount QFX10002 models on a four post 19-in. rack using the mounting kit provided with the switch.

For four post rack installation, the mounting kit contains two front mounting rails with two matching rear mounting blades. This configuration allows either end of the switch to be mounted flush with the rack and still be adjustable for racks with different depths.

The front and rear rack rails must be spaced between 28 in. (71.1 cm) and 31 in. (78.7 cm) front-to-back.

This topic describes:

Before You Begin Rack Installation

Before you begin mounting a QFX10002 in the rack or cabinet:

1. Ensure that you understand how to prevent electrostatic discharge (ESD) damage. See "Prevention of Electrostatic Discharge Damage" on page 190.
2. Verify that the site meets the requirements described in "QFX10002 Site Preparation Checklist" on page 64.
3. Place the rack in its permanent location, allowing adequate clearance for airflow and maintenance, and secure it to the building structure.
4. Read the generic "General Site Guidelines" on page 68 and the "QFX10002 Installation Overview" on page 98, which include QFX10002-specifc guidelines for lifting and moving a QFX10002:

   The weight of a fully-loaded QFX10002-72Q is approximately 68.6 lbs (31.1 kg) with AC power supplies and 67.8 lbs (30.8 kg) with DC power supplies installed. The weight of a QFX10002-36Q is 54 lbs (24.5 kg) and the weight of a QFX10002-60C is 80.5 lbs (36.5 kgs).

   > ⚠ **CAUTION**: If you are installing the QFX10002 above 60 in. (152.4 cm) from the floor, remove the power supplies and fan modules before attempting to install the switch. Unless you are using a mechanical lift, at least three people are required to perform the rack installation.

   When raising the QFX10002 into the rack, have two people lift and align the switch with the rack while another person secures the switch to the rack. As when lifting any heavy object, lift most of the weight with your legs rather than your back. Keep your knees bent and your back relatively straight and avoid twisting your body as you lift. Balance the load evenly and be sure that your footing is solid.
5. Remove the switch from the shipping carton.
6. Ensure that you have the following parts and tools available to mount the switch in a rack:
   - ESD grounding strap (not provided).
   - Blades, rails, or brackets (provided).
     - For four-post installations:
       - One pair of rear mounting blades. These mounting blades support the rear of the chassis and must be installed (provided).
       - One pair of front mounting rails. The mounting blades slide into the mounting rails to support the switch (provided).
       - Screws to secure the mounting rails to the chassis (12 provided).

    - Screws to secure the chassis and rear installation blades to the rack (16 not provided).
- Appropriate screwdriver for the mounting screws (not provided).
- Two power cords (QFX10002-36Q) or four power cords (QFX10002-60C and QFX10002-72Q) with plugs appropriate to your geographical location (provided).
- RJ-45 cable and RJ-45 to DB-9 serial port adapter (not provided).
- Management host, such as a PC laptop, with a serial port (not provided).

Optional equipment: Grounding cable kit with bracket, lug, and three nuts with integrated washers.

WARNING: QFX10002 devices must be supported at all four corners for four-post installations. Mounting the chassis using only the front brackets will damage the chassis and can result in serious bodily injury.

CAUTION: QFX10002 switches require at least three people for installation, two people to lift the switch into place and another person to attach the switch to the rack. You can remove the power supplies and fan modules to minimize the weight before attempting to install the switch. If you are installing the QFX10002 device above 60 in. (152.4 cm) from the floor, we recommend using a mechanical lift for over head installation.

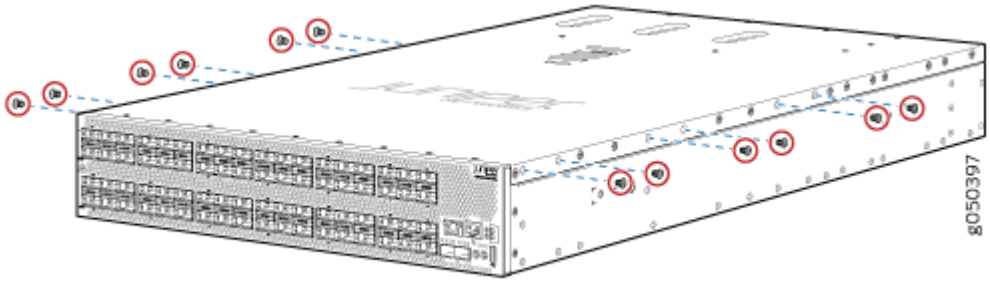
CAUTION: If you are mounting multiple switches on a rack, mount the switch in the lowest position of the rack first. Proceed to mount the rest of the switches from the bottom to the top of the rack to minimize the risk of the rack toppling.

Four Post Procedure

To mount the switch on four posts in a rack using the provided mounting kit:

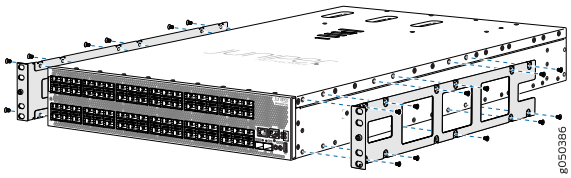
1. Attach the ESD grounding strap to your bare wrist and to a site ESD point.
2. Decide whether the Field Replaceable Unit (FRU) end of the switch or the port end is to be placed at the front of the rack. Position the switch in such a manner that the **AIR OUT** labels on components are next to the hot aisle.
3. Using a Philips screwdriver, remove the six screws on each side of the chassis that holds the cover to the chassis. See Figure 33 on page 105 for the location of these screws. Set the screws aside.

Figure 33: Removing the Screws Holding the Cover



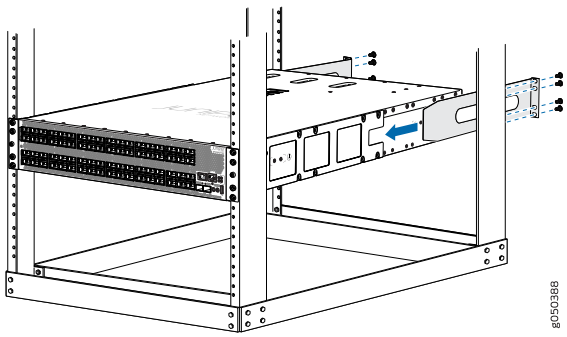
4. Align the holes in the mounting rail with the holes on one side of the chassis. See Figure 34 on page 105 for the proper position and alignment of the rail for the QFX10002 device.

Figure 34: Attaching Mounting Rails to the QFX10002 Switch Chassis



5. Attach the mounting rail to the switch using 11 mounting screws. You may either use the screws from the mounting kits or the screws that were removed from the cover. Tighten the screws.
6. Repeats steps 4 and 5 on the opposite side of the switch. A few mounting screws are extra.
7. Either use a mechanical lift or have two people grasp both sides of the switch, lift it, and position it in the rack so that the front bracket is aligned with the rack holes.
8. Have a another person secure the front of the switch to the rack using 8 chassis screws (and cage nuts and washers if your rack requires them.) Tighten the screws. See Figure 35 on page 105 for an example of connecting the mounting rails and blades.

Figure 35: Attach Switch to Rack



9. Continue to support the switch while sliding the rear mounting-blades into the channel of the side mounting-rails and securing the blades to the rack. Use the 8 mounting screws (and cage nuts and washers if your rack requires them) to attach each blade to the rack. Tighten the screws. See Figure 35 on page 105.
10. Ensure that the switch chassis is level by verifying that all the screws on the front of the rack are aligned with the screws at the back of the rack.

RELATED DOCUMENTATION

Rack-Mounting and Cabinet-Mounting Warnings | 173

Connecting the QFX10002 | 106

Connecting the QFX10002

IN THIS SECTION

Use the following topics to connect external devices and power to the QFX10002:

Connecting the QFX10002 to Ground

You must install the QFX10002 in a restricted-access location and ensure that the chassis is always properly grounded. The QFX10002 has a two-hole protective grounding terminal provided on the chassis. See Figure 36 on page 108. Under all circumstances, use this grounding connection to ground the chassis. For AC-powered systems, you must also use the grounding wire in the AC power cord along with the two-hole grounding lug connection. This tested system meets or exceeds all applicable EMC regulatory requirements with the two-hole protective grounding terminal.

CAUTION: Ensure a licensed electrician has attached an appropriate cable lug to the grounding cable that your supply. A cable with an incorrectly attached lug can damage the switch (for example, by causing a short circuit).

NOTE: Mount your switch in the rack or cabinet before attaching the grounding lug to the switch. See "Mounting a QFX10002 in a Rack" on page 102.

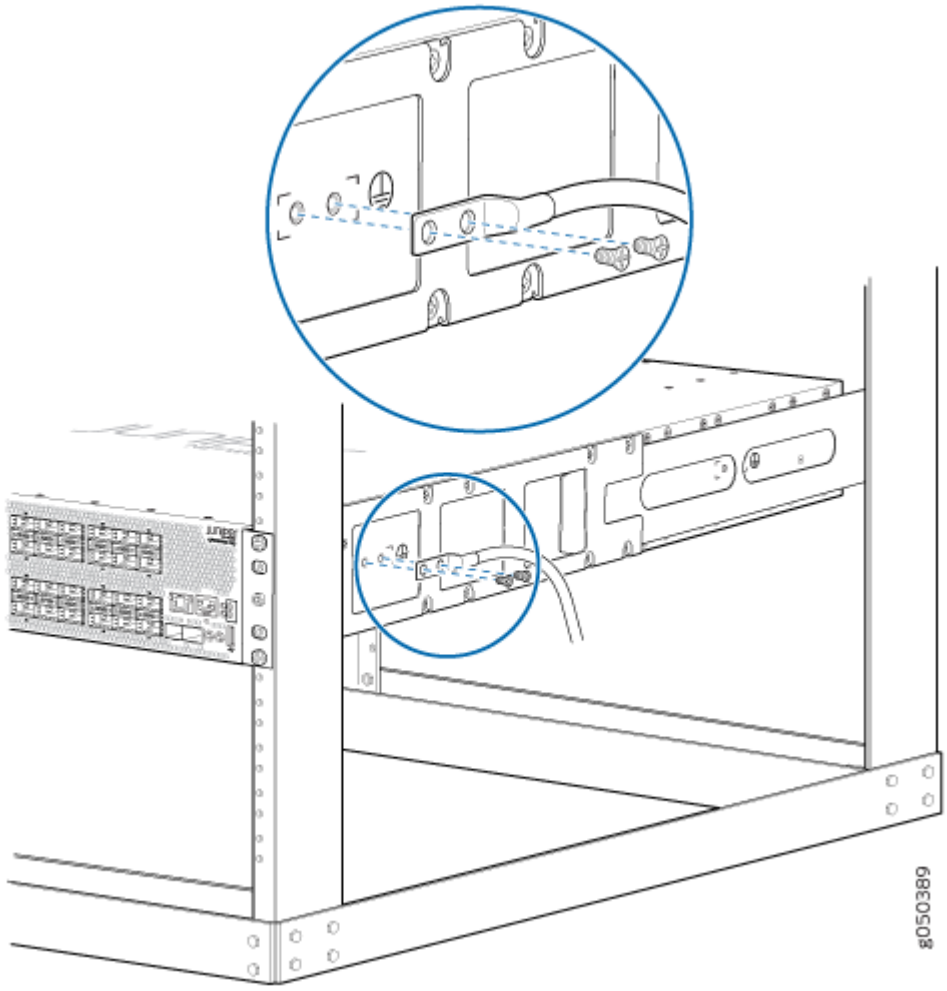
Ensure that you have the following parts and tools available:

- Grounding cable and lug, see "QFX10002 Chassis Grounding Cable and Lug Specifications" on page 68
- Two 10-32 UNF x .25 in. screws with #10 split-lock washer
- Two #10 flat washers
- Phillips (+) number 2 screwdriver

To connect earth ground to a QFX10002:

1. Connect one end of the grounding cable to a proper site earth ground, such as the rack in which the switch is mounted.
2. Place the grounding lug, which is attached to the grounding cable, over the protective earthing terminal on the chassis. See Figure 36 on page 108.

Figure 36: Connecting a Grounding Cable to the QFX10002



3. Secure the grounding lug to the protective earthing terminal with the washers and screws.
4. Dress the grounding cable and ensure that it does not touch or block access to other device components and that it does not drape where people could trip over it.

SEE ALSO

General Safety Guidelines and Warnings | **165**

Grounded Equipment Warning | **177**

Connecting a QFX10002 to a Management Ethernet Device

Ensure that you have an appropriate cable available. See "Cable Specifications for Console and Management Connections for the QFX Series" on page 84.

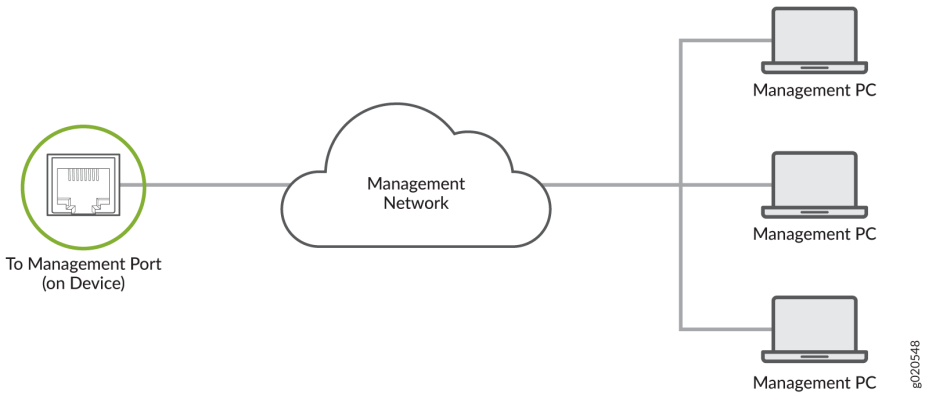
You can monitor and manage the QFX10002 using a dedicated management channel. The QFX10002 has two management ports: a 10/100/1000BASE-T RJ-45 port for copper connections and a 1-Gigabit SFP ports for fiber connections. Use the management ports to connect the QFX10002 to a network for out-of-band management.

NOTE: You cannot use the management ports to perform the initial configuration of the QFX10002. You must configure the management ports before you can successfully connect to the QFX10002 using these ports. See "Performing an Initial Configuration of a QFX10000 " on page 117.

To connect a QFX10002 to a network for out-of-band management (see Figure 37 on page 109):

1. Connect one end of the cable to one of the two management ports (labeled **MGMT**) on the QFX10002.
2. Connect the other end of the cable to the management switch.

Figure 37: Connecting a QFX10002 to a Network for Out-of-Band Management



Connecting a QFX Series Device to a Management Console

Ensure that you have an RJ-45 to DB-9 rollover cable available.

NOTE: We no longer include the RJ-45 console cable with the DB-9 adapter as part of the device package. If the console cable and adapter are not included in your device package, or if you need a different type of adapter, you can order the following separately:

- RJ-45 to DB-9 adapter (JNP-CBL-RJ45-DB9)
- RJ-45 to USB-A adapter (JNP-CBL-RJ45-USBA)
- RJ-45 to USB-C adapter (JNP-CBL-RJ45-USBC)

If you want to use RJ-45 to USB-A or RJ-45 to USB-C adapter you must have X64 (64-Bit) Virtual COM port (VCP) driver installed on your PC. See, https://ftdichip.com/drivers/vcp-drivers/ to download the driver.

The QFX Series has a console port with an RJ-45 connector. Use the console port to connect the device to a management console or to a console server.

To connect the QFX Series to a management console (see Figure 38 on page 110 and Figure 39 on page 111):

1. Connect one end of the Ethernet cable to the console port (labeled **CON**).
2. Connect the other end of the Ethernet cable into the console server (see Figure 38 on page 110) or management console (see Figure 39 on page 111).

Figure 38: Connecting the QFX Series to a Management Console Through a Console Server

Figure 39: Connecting the QFX Series Directly to a Management Console

SEE ALSO

- Console Port Connector Pinout Information
- Configuring Junos OS to Set Console and Auxiliary Port Properties

Connecting AC Power to a QFX10002

Ensure that you have a power cord appropriate for your geographical location available to connect AC power to the switch.

Before you begin connecting AC power to the switch:

- Ensure that you have taken the necessary precautions to prevent electrostatic discharge (ESD) damage, (see "Prevention of Electrostatic Discharge Damage" on page 190).
- Ensure that you have connected the switch chassis to earth ground, see "Connecting the QFX10002 to Ground" on page 106.
- Install the power supply in the chassis following the instructions in "Installing a Power Supply in a QFX10002" on page 129.

The power supply in a QFX10002 is a hot-removable and hot-insertable field-replaceable unit (FRU). After removing the power cord from an individual power supply, you can remove and replace it without powering off the switch or disrupting switch functions.

NOTE: Each power supply must be connected to a dedicated power source outlet.

To connect AC power to a QFX10002:

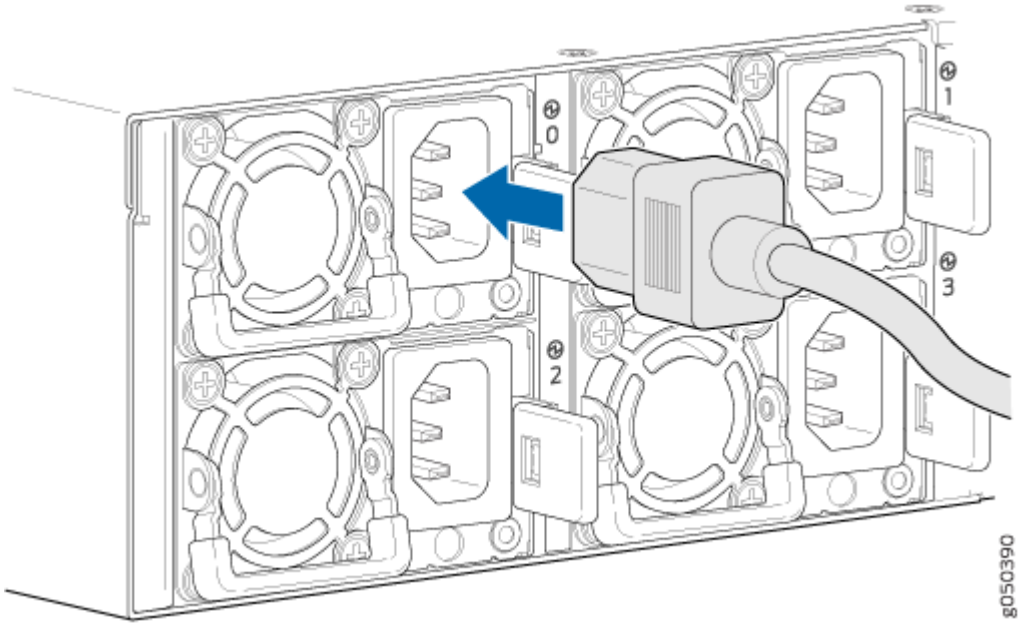
1. Attach the grounding strap to your bare wrist and to a site ESD point.
2. Ensure that the power supplies are fully inserted in the chassis and the latches are secure.

3. Locate the power cord or cords shipped with the switch; the cords have plugs appropriate for your geographical location. See "QFX10002 AC Power Specifications" on page 52 .

   WARNING: Ensure that the power cord does not block access to device components or drape where people can trip on it.

4. Connect each power supply to the power sources. Insert the coupler end of the power cord into the AC power cord inlet on the AC power supply faceplate (see Figure 40 on page 112).

Figure 40: Connecting an AC Power Cord to an AC Power Supply in a QFX10002-72Q



5. If the AC power source outlet has a power switch, set it to the OFF (O) position.

   NOTE: The switch powers on as soon as power is provided to the power supply. There is no power switch on the device.

6. Insert the power cord plug into an AC power source outlet.
7. If the AC power source outlet has a power switch, set it to the ON (|) position.
8. Verify that the AC and DC LEDs on each power supply are lit green.

   If the amber fault LED is lit, remove power from the power supply, and replace the power supply (see "Removing a Power Supply from a QFX10002" on page 127). Do not remove the power supply until you have a replacement power supply ready: the power supplies or a blank cover panel must be installed in the switch to ensure proper airflow.

CAUTION: Replace a failed power supply with a blank panel or new power supply within 1 minute of removal to prevent chassis overheating.

Connecting DC Power to a QFX10002

Before you begin connecting DC power to the switch:

- Ensure that you have taken the necessary precautions to prevent electrostatic discharge (ESD) damage (see "Prevention of Electrostatic Discharge Damage" on page 190).
- Ensure that you have connected the switch chassis to earth ground. See "Connecting the QFX10002 to Ground" on page 106.
- Install the power supply in the chassis. For instructions, follow the instructions in "Installing a Power Supply in a QFX10002" on page 129.

  The battery returns of the DC power supply must be connected as an isolated DC return (DC-I).
- Ensure that you have the following parts and tools available:
  - ESD grounding strap
  - Slotted (–) screwdriver, 1/4-in., with a torque range between 6 lb-in (0.68 Nm) to 7 lb-in (0.79 Nm)

    CAUTION: You must use an appropriate torque-controlled tool to tighten the screws on the DC power cable connector. Do not overtighten the screws. Applying excessive torque damages the terminal block and the wiring tray. The absolute maximum torque that may be applied to this screw is 10 lb-in (1.13 Nm).
  - Power cables appropriate for your geographical location available to connect DC power to the QFX10002. There are two types of DC power cables–a straight DC power cable (CBL-JNP-PWR-DSUB) and a right-angle DC power cable (CBL-JNP-PWR-DSUB2) or (CBL-JNP-PWR-DSUB3). See "QFX10002 DC Power Specifications" on page 57.

CAUTION: Do not mix AC and DC power supplies in the same chassis.

NOTE: Each power supply must be connected to a dedicated power source outlet.

The power supply in a QFX10002 is a hot-removable and hot-insertable field-replaceable unit (FRU). You can remove and replace it without powering off the switch or disrupting switch functions. You do, however, need to remove power from the power supply before attempting to remove the unit.

WARNING: DC-powered QFX10002 models are intended for installation only in a restricted access location.

To connect DC power to a QFX10002:

1. To prevent damage to the equipment caused by static discharge, attach an ESD grounding strap to your bare wrist, and connect the strap to an approved site ESD grounding point.
2. Ensure that the power supplies are fully inserted in the chassis and that the latches are secure.
3. If you are using the straight DC power cable (CBL-JNP-PWR-DSUB), connect the green grounding wire in each DC power cable to ground. Right angled DC cables, do not have a grounding wire.
4. Connect each power supply to the power source by inserting the DC connector into the power supply. See Figure 41 on page 114 for straight DC power cables and Figure 42 on page 115 and Figure 43 on page 115 for right-angle DC power cables.

Figure 41: Connecting a Straight DC Power Cable to a DC Power Supply (CBL-JNP-PWR-DSUB)

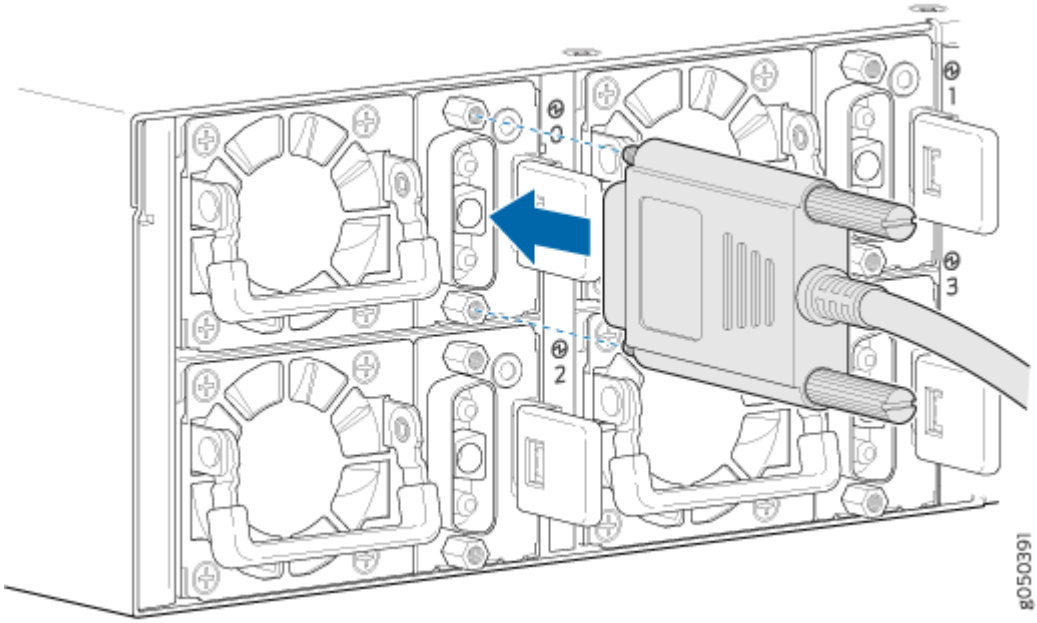


Figure 42: Connecting a Right-Angle DC Power Cable to a DC Power Supply (CBL-JNP-PWR-DSUB2)

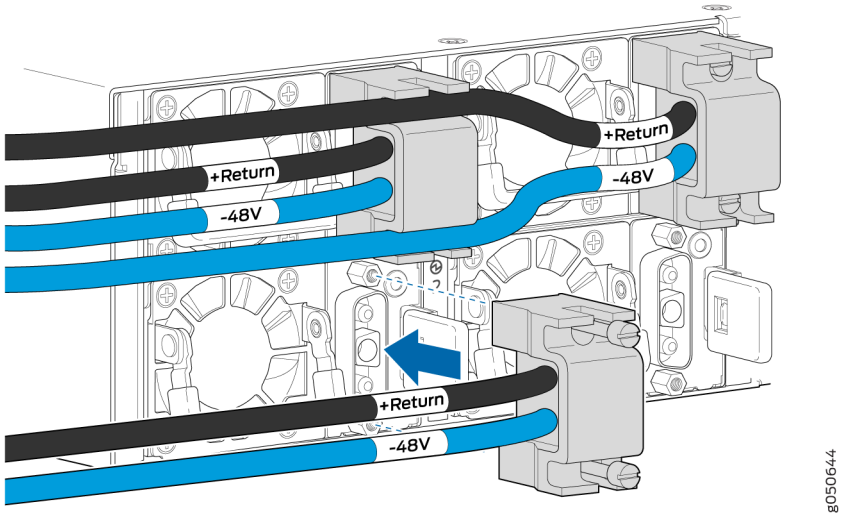
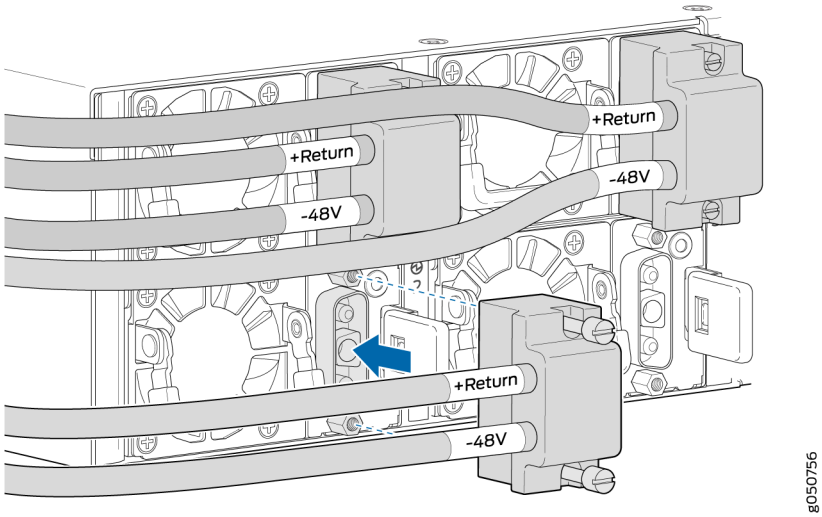


Figure 43: Connecting a Right-Angle DC Power Cable to a DC Power Supply (CBL-JNP-PWR-DSUB3)



WARNING: Ensure that the power cables do not block access to device components or drape where people can trip on them.

5. Using the slotted screwdriver, tighten the screws on the power cable connector to between 6 lb-in (0.68 Nm) to 7 lb-in (0.79 Nm).

   CAUTION: You must use an appropriate torque-controlled tool to tighten the screws. Applying excessive torque damages the terminal block and the wiring tray. The absolute maximum torque that may be applied to this screw is 10 lb-in (1.13 Nm).

6. Repeat 4 through 5 for each power supply that you are connecting to power.
7. Close the input circuit breaker.

   We recommend that the 48 VDC facility DC source be equipped with a circuit breaker rated at 40 A (–48 VDC) minimum, or as required by local code.

   NOTE: We recommend that the 48-VDC facility DC source be equipped with a circuit breaker rated at 40A (-48 VDC) minimum, or as required by local code.

   NOTE: The switch powers on as soon as power is provided to the power supply. There is no power switch on the device.

8. Verify that the LED on the power supply is lit green and is on steadily.

   If the status LED is lit amber, remove power from the power supply, and replace the power supply (see "Removing a Power Supply from a QFX10002" on page 127). Do not remove the power supply until you have a replacement power supply ready. The power supplies must be installed in the QFX10002 to ensure proper airflow.

   CAUTION: Replace a failed power supply with a new power supply within 30 seconds of removal to prevent chassis overheating.

RELATED DOCUMENTATION

QFX10002 Management Panel | **36**

QFX10002 Power System | **50**

Register Products—Mandatory to Validate SLAs

Register all new Juniper Networks hardware products and changes to an existing installed product using the Juniper Networks website to activate your hardware replacement service-level agreements (SLAs).

CAUTION: Register product serial numbers on the Juniper Networks website. Update the installation base data if any addition or change to the installation base occurs or if the installation base is moved. Juniper Networks is not responsible for not meeting the hardware replacement SLA for products that do not have registered serial numbers or accurate installation base data.

Register your product(s) at https://tools.juniper.net/svcreg/SRegSerialNum.jsp.
Update your installation base at https://www.juniper.net/customers/csc/management/updateinstallbase.jsp.

Performing an Initial Configuration of a QFX10000

Before you begin connecting and configuring the switch, set the following parameter values on the console server or PC:

- Baud Rate—9600
- Flow Control—None
- Data—8
- Parity—None
- Stop Bits—1
- DCD State—Disregard

You must perform the initial configuration of a QFX10000 modular switch through the console port using the command-line interface (CLI) or through Zero Touch Provisioning (ZTP). On QFX10002 fixed-chassis models, in addition to using the CLI, you may also use ZTP. In order to provision the QFX10002 using ZTP, you must have access to a Dynamic Host Control Protocol (DHCP) server and a File Transfer Protocol (anonymous FTP), Hypertext Transfer Protocol (HTTP), or Trivial File Transfer Potocol (TFTP) server on which the software image and configuration files are stored. For more information about using ZTP for provisioning the device, see *Zero Touch Provisioning Overview*.

The following procedure sets up the QFX10000 using the command-line interface (CLI).

To connect and configure the switch from the console:

1. Connect the console port to a laptop or PC using an RJ-45 cable and RJ-45 to DB-9 adapter. The console (**CON**) port is located on the port panel of the switch.
2. Log in as **root**. There is no password. If the software booted before you connected to the console port, you might need to press the Enter key for the prompt to appear.

```
login: root
```

3. Start the CLI.

```
root@% cli
```

4. Enter configuration mode.

```
root> configure
```

5. Add a password to the root administration user account.

```
[edit]
root@# set system root-authentication plain-text-password
New password: password
Retype new password: password
```

6. (Optional) Configure the name of the switch. If the name includes spaces, enclose the name in quotation marks (“ ”).

```
[edit]
root@# set system host-name host-name
```

7. Configure the default gateway.

```
[edit]
root@# set routing-options static route default next-hop address
```

8. Configure the IP address and prefix length for the switch management interface.

```
[edit]
root@# set interfaces em0 unit 0 family inet address address/prefix-length
```

> **CAUTION**: Although the CLI permits you to configure two management Ethernet interfaces within the same subnet, only one interface is usable and supported.

> **NOTE**: The management ports, `em0` (**MGMT** for RJ-45 connections) and `em1` (also labeled **MGMT** for fiber connections), are found on the port panel of the QFX10002 and on each of the Routing and Control Boards of the QFX10008 and QFX10016.

> **NOTE**: We no longer include the RJ-45 console cable with the DB-9 adapter as part of the device package. If the console cable and adapter are not included in your device package, or if you need a different type of adapter, you can order the following separately:
>
> - RJ-45 to DB-9 adapter (JNP-CBL-RJ45-DB9)
> - RJ-45 to USB-A adapter (JNP-CBL-RJ45-USBA)
> - RJ-45 to USB-C adapter (JNP-CBL-RJ45-USBC)
>
> If you want to use RJ-45 to USB-A or RJ-45 to USB-C adapter you must have X64 (64-Bit) Virtual COM port (VCP) driver installed on your PC. See, https://ftdichip.com/drivers/vcp-drivers/ to download the driver.

9. (Optional) Configure the static routes to remote prefixes with access to the management port.

```
[edit]
root@# set routing-options static route remote-prefix next-hop destination-ip retain no-readvertise
```

10. Enable Telnet service.

```
[edit]
root@# set system services telnet
```

> **NOTE**: When Telnet is enabled, you cannot log in to a QFX10000 through Telnet using root credentials. Root login is allowed only for SSH access.

11. Commit the configuration to activate it on the switch.

```
[edit]
root@# commit
```

RELATED DOCUMENTATION

QFX10008 Installation Overview

QFX10002 System Overview | 2

CHAPTER 4

Maintaining Components

Installing and Removing QFX10002 Hardware Components

The QFX10002 switch chassis is a rigid sheet-metal structure that houses the hardware components. The field-replaceable units (FRUs) in QFX10002 devices are:

- Power supply
- Fan module
- SFP+ transceiver
- QSFP+ transceiver
- QSFP28 transceiver

All of the QFX10002 FRUs are hot-insertable and hot-removable: you can remove and replace them without powering off the switch or disrupting switch functions.

CAUTION: Replace a failed power supply with a new power supply within 1 minute of removal to prevent chassis overheating. Replace a failed fan module with a new fan within 1 minute of removal to prevent chassis overheating.

For detailed instruction on how to:

- Install a power supply in a QFX10002 , follow the instructions in "Installing a Power Supply in a QFX10002" on page 129.
- Remove a power supply from a QFX10002, follow the instructions in "Removing a Power Supply from a QFX10002" on page 127.
- Install a fan module in a QFX10002, follow the instructions in "Installing a Fan Module in a QFX10002" on page 125.
- Remove a fan module from a QFX10002, follow the instructions in "Removing a Fan Module from a QFX10002" on page 123.
- Install an SFP+, QSFP+, or QSFP28 transceiver in a QFX10002, follow the instructions in "Install a Transceiver" on page 134.
- Remove an SFP+, QSFP+, or QSFP28 transceiver from a QFX10002, follow the instructions in "Remove a Transceiver" on page 131.

- Connect a fiber-optic cable to an SFP+, QSFP+, or QSFP28 transceiver in a QFX10002 , follow the instructions in "Connect a Fiber-Optic Cable" on page 138.
- Disconnect a fiber-optic cable from an SFP+, QSFP+, QSFP28 transceiver from a QFX10002 , follow the instructions in "Disconnect a Fiber-Optic Cable" on page 137.

RELATED DOCUMENTATION

QFX10002 Power System | 50

QFX10002 Cooling System | 45

Maintaining QFX10002 Cooling System Components

IN THIS SECTION

Use the following procedures to replace a fan module in a QFX10002:

Removing a Fan Module from a QFX10002

Before you remove a fan module from a QFX10002, ensure that you have taken the necessary precautions to prevent electrostatic discharge (ESD) damage (see "Prevention of Electrostatic Discharge Damage" on page 190).

Ensure that you have the following parts and tools available to remove a fan module from a QFX10002:

- ESD grounding strap
- Antistatic bag or an antistatic mat

The fan modules in QFX10002 models are hot-removable and hot-insertable field-replaceable units (FRUs): you can remove and replace them without powering off the switch or disrupting switch functions.

CAUTION: Replace a failed fan module with a new fan module within one minute of removal to prevent chassis overheating. Before removing the fan module, ensure you have a replacement fan module at hand.

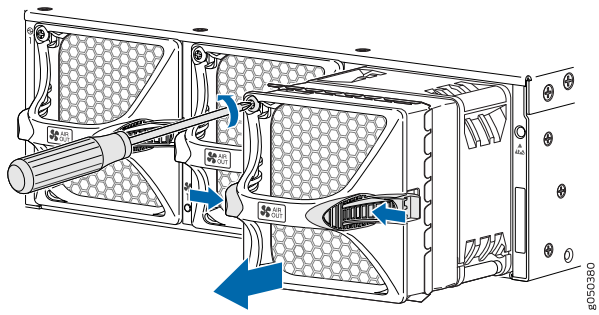
To remove a fan module from a QFX10002 switch (see Figure 44 on page 124):

1. Place the antistatic bag or the antistatic mat on a flat, stable surface.
2. Attach the ESD grounding strap to your bare wrist, and connect the strap to the ESD point on the chassis.
3. Using a Phillips screwdriver, loosen the locking screw (3 or 4 turns).
4. Grasp the handle on the fan module and squeeze the outside of the handle to release the module.

WARNING: To avoid injury, do not touch the fan with your hands or any tools as you slide the fan module out of the chassis—the fan might still be running.

5. Pull firmly to slide the fan module halfway out of the chassis.
6. When the fan stops spinning, slide the fan module completely out of the chassis.
7. Place the fan module in the antistatic bag or on the antistatic mat placed on a flat, stable surface.

Figure 44: Removing a Fan Module from QFX10002 Models



NOTE: When a fan module is removed, the CLI message **Fan/Blower is Absent** is logged in the system log, and the system raises a minor alarm.

Installing a Fan Module in a QFX10002

Before you install a fan module in a QFX10002 device, ensure that you have taken the necessary precautions to prevent electrostatic discharge (ESD) damage (see "Prevention of Electrostatic Discharge Damage" on page 190).

The fan modules in QFX10002 are hot-removable and hot-insertable field-replaceable units (FRUs): you can remove and replace them without powering off the switch or disrupting switch functions.

CAUTION: Replace a failed fan module with a new fan module within 1 minute of removal to prevent chassis overheating. Before removing the fan module, ensure you have a replacement fan module at hand.

NOTE: The fan module provides airflow out, which is also known as *port-to-FRU* airflow . In legacy switches, or switches with an LCD, this airflow is called front-to-back airflow.

To install a fan module in QFX10002 models :

1. Attach the ESD grounding strap to your bare wrist, and connect the strap to the ESD point on the chassis.
2. Taking care not to touch the connectors, remove the fan module from its bag.
3. Align the module with the open slot with the label right-side up to ensure the correct orientation. See Figure 45 on page 126 and Figure 46 on page 126.

   NOTE: The QFX10002-60C uses a different fan module that has a different orientation than the QFX10002-72Q and QFX10002-36Q.

4. Slide the module into the bay until it is fully seated.
5. Using a Phillips screwdriver, turn the locking screw until it is tight.

Figure 45: Installing a Fan Module in a QFX10002-36Q or QFX10002-72Q

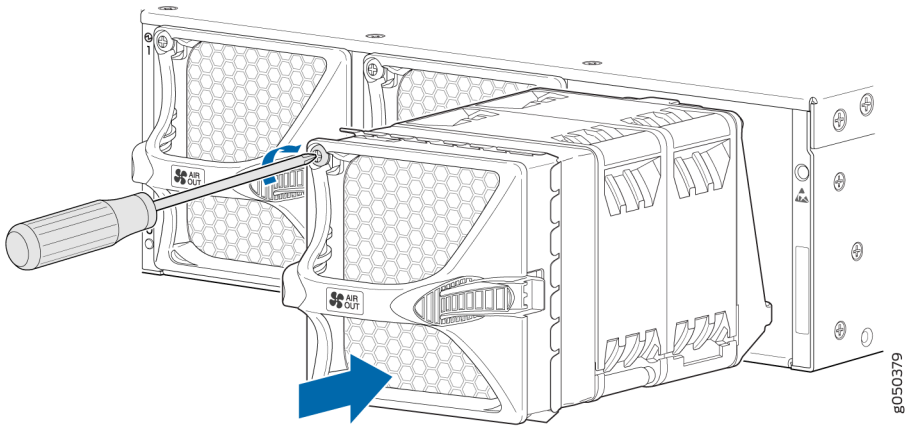
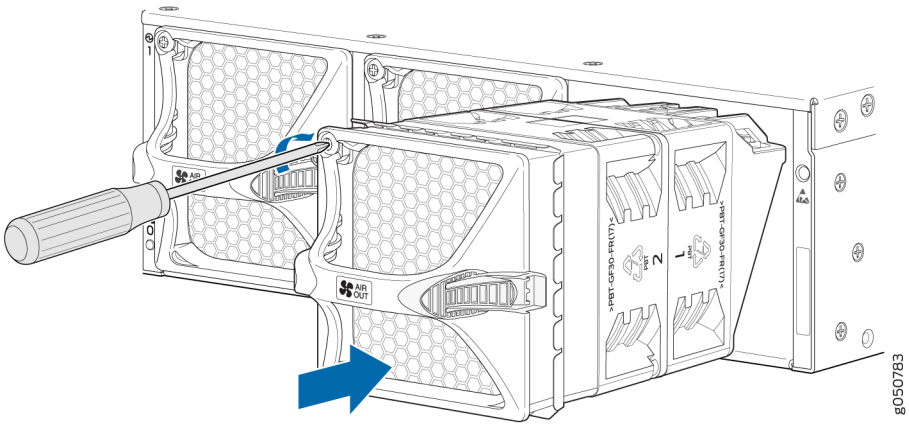


Figure 46: Installing a Fan Module in a QFX10002-60C



RELATED DOCUMENTATION

QFX10002 Cooling System | 45

QFX10002 Field-Replaceable Units | 11

Maintaining QFX10002 Power Supplies

IN THIS SECTION

Use the following procedures to replace a power supply in a QFX10002:

Removing a Power Supply from a QFX10002

Before you remove a power supply from a QFX10002, ensure that you have taken the necessary precautions to prevent electrostatic discharge (ESD) damage (see "Prevention of Electrostatic Discharge Damage" on page 190).

Ensure that you have the following parts and tools available to remove a power supply from a QFX10002:

- ESD grounding strap
- Antistatic bag or an antistatic mat
- Phillips (+) screwdriver, number 2 (DC power supply)

If you are removing a redundant power supply and do not plan to replace it with another immediately, have a power supply cover for the opening.

The power supplies in a QFX10002 are hot-removable and hot-insertable field-replaceable units (FRUs): you can remove and replace them without powering off the switch or disrupting switch functions after the power cord is disconnected.

CAUTION: Replace the power supply with a new power supply within 1 minute of removal to prevent chassis overheating.

To remove a power supply from a QFX10002 (see Figure 47 on page 128):

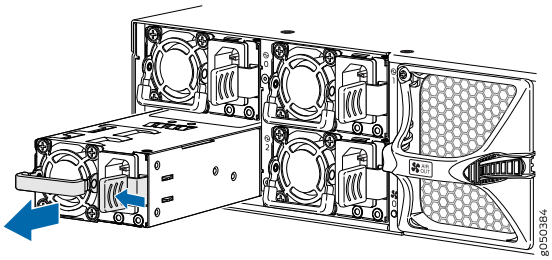
1. Place the antistatic bag or the antistatic mat on a flat, stable surface.

2. Attach the ESD grounding strap to your bare wrist, and connect the strap to the ESD point on the chassis.

> **NOTE**: If only one power supply is installed in your QFX10002 device, you need to power off the switch before removing the power supply. See "Powering Off a QFX10002" on page 140.

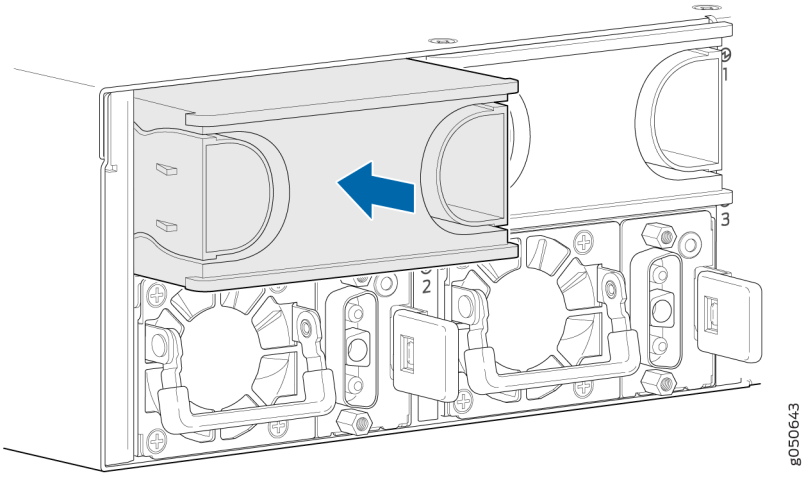
3. Disconnect power to the switch:
   - AC power supply—If the AC power source outlet has a power switch, set it to the OFF (O) position. If the AC power source outlet does not have a power switch, gently pull out the plug end of the power cord connected to the power source outlet.
   - DC power supply—Switch the circuit breaker on the panel board that services the DC circuit to the OFF position.
4. Remove the power source cable from the power supply faceplate:
   - AC power supply—Remove the power cord from the power supply faceplate by detaching the power cord retainer and gently pulling out the socket end of the power plug connected to the power supply faceplate.
   - DC power supply—Loosen the thumb screws for the power cord. Gently pull out the socket end of the power plug connected to the power supply faceplate.
5. Slide the locking lever toward the handle until it stops.
6. Grasp the power supply handle and pull firmly to slide the power supply halfway out of the chassis.

Figure 47: Removing a Power Supply from a QFX10002-72Q



7. Place one hand under the power supply to support it and slide it completely out of the chassis. Take care not to touch power supply components, pins, leads, or solder connections.
8. Place the power supply in the antistatic bag or on the antistatic mat placed on a flat, stable surface.
9. Either replace with another power supply or insert a PSU blank cover (QFX10002-PWR-BLNK).

Figure 48: Inserting a Power Supply Blank Cover



Installing a Power Supply in a QFX10002

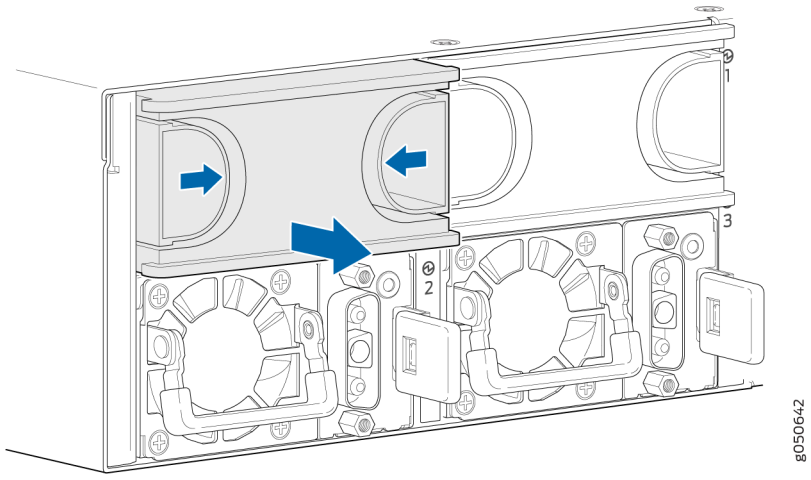
- Before you install a power supply in a QFX10002, ensure that you have taken the necessary precautions to prevent electrostatic discharge (ESD) damage (see "Prevention of Electrostatic Discharge Damage" on page 190).
- Ensure that the airflow direction of the power supply is the same as the chassis. Labels on the power supply handle indicate the direction of airflow. See "QFX10002 Cooling System" on page 45.

The power supplies in a QFX10002 are hot-removable and hot-insertable field-replaceable units (FRUs): you can remove and replace them without powering off the switch or disrupting switch functions.

To install a power supply in a QFX10002 (see Figure 50 on page 130):

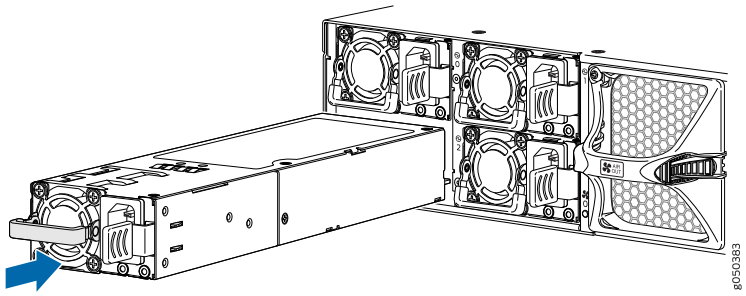
1. Attach the ESD grounding strap to your bare wrist, and connect the strap to the ESD point on the chassis.
2. If the power supply is being installed in an empty slot, remove the blank cover by squeezing the finger holds and pulling the cover straight out.

Figure 49: Removing a Power Supply Blank Cover



3. Taking care not to touch power supply components, pins, leads, or solder connections, remove the power supply from its bag.
4. If the power supply has protective plastic wrap, peel and remove the plastic wrap from all four sides of the power supply.
5. Using both hands, place the power supply in the power supply slot on the FRU panel of the switch and slide it in until it is fully seated and the locking lever slides into place.

Figure 50: Installing a Power Supply in a QFX10002-72Q



NOTE: Each power supply must be connected to a dedicated power source outlet.

NOTE: If you have a Juniper Care service contract, register any addition, change, or upgrade of hardware components at https://www.juniper.net/customers/support/tools/updateinstallbase/ .

Failure to do so can result in significant delays if you need replacement parts. This note does not apply if you replace existing components with the same type of component.

RELATED DOCUMENTATION

QFX10002 Power System | 50

Connecting the QFX10002 | 106

QFX10002 Field-Replaceable Units | 11

Maintaining Transceivers and Fiber-Optic Cables on QFX10002

IN THIS SECTION

Remove a Transceiver

Before you remove a transceiver from a device, ensure that you have taken the necessary precautions for the safe handling of lasers (see *Laser and LED Safety Guidelines and Warnings*).

Ensure that you have the following parts and tools available:

- An antistatic bag or an antistatic mat
- Rubber safety caps to cover the transceiver and fiber-optic cable connector

- A dust cover to cover the port or a replacement transceiver

The transceivers for Juniper Networks devices are hot-removable and hot-insertable field-replaceable units (FRUs). You can remove and replace the transceivers without powering off the device or disrupting device functions.

NOTE: After you remove a transceiver, or when you change the media-type configuration, wait for 6 seconds for the interface to display the operational commands.

Figure 51 on page 133 shows how to remove a quad small form-factor pluggable plus (QSFP+) transceiver. The procedure is the same for all types of transceivers except the QSFP28 and C form-factor pluggable (CFP) transceivers.

To remove a transceiver from a device:

1. Place the antistatic bag or antistatic mat on a flat, stable surface.
2. Wrap and fasten one end of the ESD wrist strap around your bare wrist, and connect the other end of the strap to the ESD point on the rack.
3. Label the cable connected to the transceiver so that you can reconnect it correctly.

LASER WARNING: Do not look directly into a fiber-optic transceiver or into the ends of fiber-optic cables. Fiber-optic transceivers and fiber-optic cables connected to transceivers emit laser light that can damage your eyes.

LASER WARNING: Do not leave a fiber-optic transceiver uncovered except when inserting or removing a cable. The rubber safety cap keeps the port clean and protects your eyes from accidental exposure to laser light.

CAUTION: Do not bend fiber-optic cables beyond their minimum bend radius. An arc smaller than a few inches in diameter can damage the cables and cause problems that are difficult to diagnose.

4. Remove the cable connected to the transceiver (see *Disconnect a Fiber-Optic Cable*). Cover the transceiver and the end of each fiber-optic cable connector with a rubber safety cap immediately after disconnecting the fiber-optic cables.
5. If there is a cable management system, arrange the cable in the cable management system to prevent it from dislodging or developing stress points. Secure the cable so that it does not support its own

weight as it hangs to the floor. Place excess cable out of the way in a neatly coiled loop in the cable management system. Placing fasteners on the loop helps to maintain its shape.

6. To remove an SFP56-DD, SFP, SFP+, XFP, a QSFP+, or QSFP56-DD transceiver:

   a. Using your fingers, pull open the ejector lever on the transceiver to unlock the transceiver.

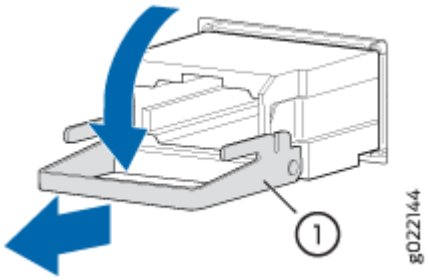
      Note that QSFP-DD and SFP-DD transceivers don't have ejector levers, instead they have a pull tab which can be used to unlock and remove the transceiver.

      CAUTION: Before removing the transceiver, make sure that you open the ejector lever completely until you hear it click. This precaution prevents damage to the transceiver.

   b. Grasp the transceiver ejector lever and gently slide the transceiver approximately 0.5 in. (1.3 cm) straight out of the port.

      CAUTION: To prevent ESD damage to the transceiver, do not touch the connector pins at the end of the transceiver.

Figure 51: Remove a QSFP+ Transceiver



1– Ejector lever

To remove a CFP transceiver:

a. Using your fingers, loosen the screws on the transceiver.

b. Grasp the screws on the transceiver and gently slide the transceiver approximately 0.5 in. (1.3 cm) straight out of the port.

CAUTION: To prevent ESD damage to the transceiver, do not touch the connector pins at the end of the transceiver.

7. Using your fingers, grasp the body of the transceiver and pull it straight out of the port.
8. Place the transceiver in the antistatic bag or on the antistatic mat placed on a flat, stable surface.
9. Place the dust cover over the empty port, or install the replacement transceiver.

Install a Transceiver

Before you install a transceiver in a device, ensure that you have taken the necessary precautions for safe handling of lasers (see Laser and LED Safety Guidelines and Warnings).

Ensure that you have a rubber safety cap available to cover the transceiver.

The transceivers for Juniper Networks devices are hot-removable and hot-insertable field-replaceable units (FRUs). You can remove and replace the transceivers without powering off the device or disrupting the device functions.

NOTE: After you insert a transceiver or after you change the media-type configuration, wait for 6 seconds for the interface to display operational commands.

NOTE: We recommend that you use only optical transceivers and optical connectors purchased from Juniper Networks with your Juniper Networks device.

CAUTION: The Juniper Networks Technical Assistance Center (JTAC) provides complete support for Juniper-supplied optical modules and cables. However, JTAC does not provide support for third-party optical modules and cables that are not qualified or supplied by Juniper Networks. If you face a problem running a Juniper device that uses third-party optical modules or cables, JTAC may help you diagnose host-related issues if the observed issue is not, in the opinion of JTAC, related to the use of the third-party optical modules or cables. Your JTAC engineer will likely request that you check the third-party optical module or cable and, if required, replace it with an equivalent Juniper-qualified component.

Use of third-party optical modules with high-power consumption (for example, coherent ZR or ZR+) can potentially cause thermal damage to or reduce the lifespan of the host equipment. Any damage to the host equipment due to the use of third-party optical modules or cables is the users' responsibility. Juniper Networks will accept no liability for any damage caused due to such use.

Figure 52 on page 137 shows how to install a QSFP+ transceiver. The procedure is the same for all types of transceivers except the QSFP28 and CFP transceivers.

To install a transceiver:

CAUTION: To prevent electrostatic discharge (ESD) damage to the transceiver, do not touch the connector pins at the end of the transceiver.

1. Wrap and fasten one end of the ESD wrist strap around your bare wrist, and connect the other end of the strap to a site ESD point or to the ESD point on the device.
2. Remove the transceiver from its bag.
3. Check to see whether the transceiver is covered with a rubber safety cap. If it is not, cover the transceiver with a rubber safety cap.

   LASER WARNING: Do not leave a fiber-optic transceiver uncovered except when inserting or removing a cable. The rubber safety cap keeps the port clean and protects your eyes from accidental exposure to laser light.

4. If the port in which you want to install the transceiver is covered with a dust cover, remove the dust cover and save it in case you need to cover the port later. If you are hot-swapping a transceiver, wait for at least 10 seconds after removing the transceiver from the port before installing a new transceiver.
5. Using both hands, carefully place the transceiver in the empty port. The connectors must face the chassis.

   CAUTION: Before you slide the transceiver into the port, ensure that the transceiver is aligned correctly. Misalignment might cause the pins to bend, making the transceiver unusable.

6. Slide the transceiver in gently until it is fully seated. If you are installing a CFP transceiver, use your fingers to tighten the captive screws on the transceiver.
7. Remove the rubber safety cap from the transceiver and the end of the cable, and insert the cable into the transceiver.

LASER WARNING: Do not look directly into a fiber-optic transceiver or into the ends of fiber-optic cables. Fiber-optic transceivers and fiber-optic cable connected to a transceiver emit laser light that can damage your eyes.

CAUTION: Do not leave a fiber-optic transceiver uncovered except when inserting or removing cable. The safety cap keeps the port clean and protects your eyes from accidental exposure to laser light.

8. If there is a cable management system, arrange the cable in the cable management system to prevent the cable from dislodging or developing stress points. Secure the cable so that it does not support its own weight as it hangs toward the floor. Place excess cable out of the way in a neatly coiled loop in the cable management system. Placing fasteners on the loop helps to maintain its shape.

CAUTION: Do not let fiber-optic cable hang free from the connector. Do not allow fastened loops of cable to dangle, which stresses the cable at the fastening point.

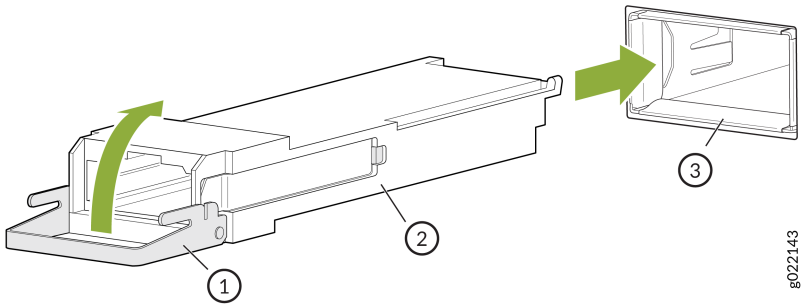
CAUTION: Avoid bending the fiber-optic cable beyond its minimum bend radius. An arc smaller than a few inches in diameter can damage the cable and cause problems that are difficult to diagnose.

NOTE: When you install SFP-DD transceivers, push it hard until you hear a click sound. Use a long nose plier to pull the SFP-DD transceiver connected on the top and bottom rows of the chassis where the pull tabs face each other.

NOTE: Make sure to use a dust cap to cover ports that are unused.

NOTE: While using Finisar AOC SFP+ optical module with the QFX5130-48C switch, you may need to pull the module upwards to pull out the module smoothly from the cage.

Figure 52: Install a Transceiver



1– Ejector lever	3– Port
2– Transceiver	

Disconnect a Fiber-Optic Cable

Before you disconnect a fiber-optic cable from an optical transceiver, ensure that you have taken the necessary precautions for safe handling of lasers. See *Laser and LED Safety Guidelines and Warnings*.

Ensure that you have the following parts and tools available:

- A rubber safety cap to cover the transceiver
- A rubber safety cap to cover the fiber-optic cable connector

Juniper Networks devices have optical transceivers to which you can connect fiber-optic cables.

To disconnect a fiber-optic cable from an optical transceiver installed in the device:

1. Disable the port in which the transceiver is installed by issuing the following command:

```
[edit interfaces]
user@device# set interface-name disable
```

> **LASER WARNING**: Do not look directly into a fiber-optic transceiver or into the ends of fiber-optic cables. Fiber-optic transceivers and fiber-optic cables connected to transceivers emit laser light that can damage your eyes.

2. Carefully unplug the fiber-optic cable connector from the transceiver.

3. Cover the transceiver with a rubber safety cap.

> **LASER WARNING**: Do not leave a fiber-optic transceiver uncovered except when inserting or removing a cable. The rubber safety cap keeps the port clean and protects your eyes from accidental exposure to laser light.

4. Cover the fiber-optic cable connector with the rubber safety cap.

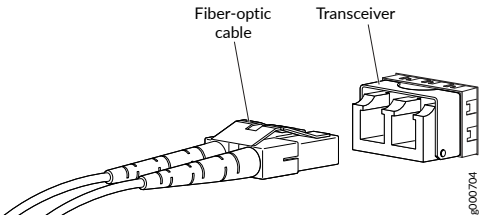
Connect a Fiber-Optic Cable

Before you connect a fiber-optic cable to an optical transceiver installed in a device, ensure that you have taken the necessary precautions for safe handling of lasers (see *Laser and LED Safety Guidelines and Warnings*).

To connect a fiber-optic cable to an optical transceiver installed in a device:

> **LASER WARNING**: Do not look directly into a fiber-optic transceiver or into the ends of fiber-optic cables. Fiber-optic transceivers and fiber-optic cables connected to transceivers emit laser light that can damage your eyes.

1. If the fiber-optic cable connector is covered with a rubber safety cap, remove the cap. Save the cap.
2. Remove the rubber safety cap from the optical transceiver. Save the cap.
3. Insert the cable connector into the optical transceiver.



4. Secure the cables so that they do not support their own weight. Place excess cable out of the way in a neatly coiled loop. Placing fasteners on a loop helps cables maintain their shape.

> **CAUTION**: Do not bend fiber-optic cables beyond their minimum bend radius. An arc smaller than a few inches in diameter can damage the cables and cause problems that are difficult to diagnose.

> Do not let fiber-optic cables hang free from the connector. Do not allow fastened loops of cables to dangle, which stresses the cables at the fastening point.

How to Handle Fiber-Optic Cables

Fiber-optic cables connect to optical transceivers that are installed in Juniper Networks devices.

Follow these guidelines when handling fiber-optic cables:

- When you unplug a fiber-optic cable from a transceiver, place rubber safety caps over the transceiver and on the end of the cable.
- Anchor fiber-optic cables to prevent stress on the connectors. When attaching a fiber-optic cable to a transceiver, be sure to secure the fiber-optic cable so that it does not support its own weight as it hangs to the floor. Never let a fiber-optic cable hang free from the connector.
- Avoid bending the fiber-optic cables beyond their minimum bend radius. Bending fiber-optic cables into arcs smaller than a few inches in diameter can damage the cables and cause problems that are difficult to diagnose.
- Frequent plugging and unplugging of fiber-optic cables in and out of optical instruments can damage the instruments, which are expensive to repair. To prevent damage from overuse, attach a short fiber extension to the optical equipment. The short fiber extension absorbs wear and tear due to frequent plugging and unplugging. Replacing the short fiber extension is easier and cost efficient compared with replacing the instruments.
- Keep fiber-optic cable connections clean. Microdeposits of oil and dust in the canal of the transceiver or cable connector can cause loss of light, reduction in signal power, and possibly intermittent problems with the optical connection.
  - To clean the transceiver canal, use an appropriate fiber-cleaning device such as RIFOCS Fiber Optic Adaptor Cleaning Wands (part number 946). Follow the instructions in the cleaning kit you use.
  - After cleaning the transceiver, make sure that the connector tip of the fiber-optic cable is clean. Use only an approved alcohol-free fiber-optic cable cleaning kit such as the Opptex Cletop-S®Fiber Cleaner. Follow the instructions in the cleaning kit you use.

RELATED DOCUMENTATION

Laser and LED Safety Guidelines and Warnings | 178

Rebooting or Powering Off a QFX10002

IN THIS SECTION

Rebooting a QFX10002

If you need to restart your QFX10002, use the appropriate CLI operational command for your model. For models QFX10002-36Q and QFX10002-72Q, use the `request system reboot` command. The `request system reboot` is not supported on the QFX10002-60C platform. Starting from Junos OS Release 19.1R1 and later, the `request system reboot` command is deprecated from the QFX10002-60C switch platform. Instead, use the `request vmhost reboot` command to reboot the QFX10002-60C device.

Powering Off a QFX10002

Before you power off a QFX10002:

- Ensure that you have taken the necessary precautions to prevent electrostatic discharge (ESD) damage. See "Prevention of Electrostatic Discharge Damage" on page 190.
- Ensure that you do not need to forward traffic through the switch.

NOTE: Use the following procedure to turn off power on a QFX10002.

Ensure that you have the following parts and tools available to power off the switch:

- An ESD grounding strap
- An external management device such as a PC
- An RJ-45 to DB-9 rollover cable to connect the external management device to the console port

To power off a QFX10002:

1. Connect to the switch using one of the following methods:

   - Connect a management device to the console (**CON**) port on a QFX10002 by following the instructions in "Connecting a QFX Series Device to a Management Console" on page 109.

   - Connect a management device to one of the two management (**MGMT**) ports by following the instructions in "Connecting a QFX10002 to a Management Ethernet Device" on page 109.

2. Shut down Junos OS from the external management device by issuing the `request system halt` operational mode CLI command. This command shuts down the switch gracefully and preserves system state information. A message appears on the console, confirming that the operating system has halted.

   You see the following output (or something similar, depending on the hardware being shut down) after entering the command:

```
Shutdown NOW!
System going down IMMEDIATELY


Terminated
Poweroff for hypervisor to respawn
Oct 25 10:35:05 init: event-processing (PID 1114) exited with status=1
Oct 25 10:35:05 init: packet-forwarding-engine (PID 1424) exited with status=8
.
Waiting (max 60 seconds) for system process `vnlru_mem' to stop...done
Waiting (max 60 seconds) for system process `vnlru' to stop...done
Waiting (max 60 seconds) for system process `bufdaemon' to stop...done
Waiting (max 60 seconds) for system process `syncer' to stop...
Syncing disks, vnodes remaining...0 0 0 0 done

syncing disks... All buffers synced.
Uptime: 11h0m30s
Normal shutdown (no dump device defined)
unloading fpga driver
unloading fx-scpld
Powering system off using ACPI
kvm: 28646: cpu0 disabled perfctr wrmsr: 0xc1 data 0xabcd
pci-stub 0000:01:00.2: transaction is not cleared; proceeding with reset anyway
pci-stub 0000:01:00.1: transaction is not cleared; proceeding with reset anyway
hub 1-1:1.0: over-current change on port 1
Stopping crond: [  OK  ]
Stopping libvirtd daemon: [  OK  ]
Shutting down ntpd: [  OK  ]
Shutting down system logger: [  OK  ]
```

```
Shutting down sntpc: [  OK  ]
Stopping sshd: [  OK  ]
Stopping vehostd: [  OK  ]
Stopping watchdog: [  OK  ]
Stopping xinetd: [  OK  ]
Sending all processes the TERM signal... [  OK  ]
Sending all processes the KILL signal... [  OK  ]
Saving random seed:  [  OK  ]
Syncing hardware clock to system time [  OK  ]
Turning off swap:  [  OK  ]
Unmounting file systems:  [  OK  ]
init: Re-executing /sbin/init
Halting system...
System halted.
```

CAUTION: The final output of any version of the `request system halt` command is the "The operating system has halted." Although traffic and the operating system have stopped, the QFX10002 power module LEDs are still lit and a fan continues to run. Wait at least 60 seconds after first seeing this message before following the instructions in Step 4 and Step 5 to remove power from the switch.

3. Attach the grounding strap to your bare wrist and to a site ESD point.
4. Disconnect power to the switch by performing one of the following tasks:
   - AC power supply—If the AC power source outlet has a power switch, set it to the OFF (O) position. If the AC power source outlet does not have a power switch, gently pull out the coupler for the power cord from the faceplate.
   - DC power supply—Switch the circuit breaker on the panel board that services the DC circuit to the OFF position.
5. Remove the power source cable from the power supply faceplate:
   - AC power supply—Remove the power cord from the power supply faceplate by detaching the power cord retainer and gently pulling out the plug end of the power cord connected to the power supply faceplate.
   - DC power supply—Loosen and the thumbscrews securing the DC power connector on the power source cables. Remove the power source cables from the power supply.
6. Uncable the switch before removing it from the rack or cabinet.

SEE ALSO

Connecting the QFX10002 | **106**

RELATED DOCUMENTATION

request system reboot

request vmhost reboot

Removing a QFX10002 from a Rack

Before removing a QFX10002 from a rack:

Ensure that you have the following parts and tools available:

- A Phillips (+) screwdriver, number 2 or number 3, depending on the size of your rack mounting screws, for mounting the QFX10002 on the rack.

If you need to relocate an installed QFX10002 device, use the procedure described in this topic.

NOTE: When you remove multiple devices from a rack, remove the device in the top of the rack first and proceed to remove the rest of the devices from top to bottom to avoid toppling the rack.

- Ensure that the rack is stable and secured to the building.
- Ensure that there is enough space to place the removed QFX10002 in its new location and along the path to the new location.
- Read "General Safety Guidelines and Warnings" on page 165.
- Powered off the device, see "Powering Off a QFX10002" on page 140.
- Disconnect the power cords.
- Ensure that you have disconnected any cables or wires attached to the QFX10002 switch ports.

To remove a QFX10002 from a rack or cabinet:

1. Position a mechanical lift under the device. If a mechanical lift is not available, have two people support the weight of the switch while another person uses the screwdriver to remove the front mounting screws that attach the chassis mounting brackets to the rack or cabinet.
2. Remove the QFX10002 from the rack.
3. Use the screwdriver to remove the mounting screws that attach the mounting blades attached to the rear of the rack or cabinet.
4. Place the removed screws and mounting blades in a labeled bag. You will need them when you reinstall the chassis.
5. Transport the QFX10002 to your desired new location.

RELATED DOCUMENTATION

Mounting a QFX10002 in a Rack | **102**

5
CHAPTER

Troubleshooting

Troubleshooting QFX10002 Components

IN THIS SECTION

QFX10002 Troubleshooting Resources Overview

To troubleshoot problems on a QFX10002, use the Juniper Junos OS command-line interface (CLI), and the LEDs on the field -replaceable unit (FRU) and the management panel.

- CLI—The CLI is the primary tool for controlling and troubleshooting hardware, Junos OS, routing protocols, and network connectivity. CLI commands display information from routing tables, information specific to routing protocols, and information about network connectivity derived from the ping and traceroute utilities. For information about using the CLI to troubleshoot the Junos OS, see the Junos OS software documentation.
- LEDs—When the switch detects an alarm condition, it lights the red or yellow status alarm LED on the management panel. In addition, the individual fans and power supplies also have status indicators.
- JTAC—If you need assistance during troubleshooting, you can contact the Juniper Networks Technical Assistance Center (JTAC) by using the Web or by telephone. If you encounter software problems, or problems with hardware components not discussed here, contact JTAC.

SEE ALSO

QFX10002 Chassis Status LEDs | 41

QFX Series Alarm Messages Overview

When a QFX Series switch detects an alarm condition, it lights the red or yellow alarm LED on the management panel as appropriate. To view a more detailed description of the alarm cause, issue the `show chassis alarms` CLI command:

```
user@host> show chassis alarms
6 alarms currently active
Alarm time               Class  Description
2018-02-07 12:12:18 PST  Major  FPC Management1 Ethernet Link Down
2018-02-07 12:11:54 PST  Minor  FPC0: LED 3:Alarm LED Read Error
2018-02-07 12:11:54 PST  Minor  FPC0: LED 3:Alarm LED Write Error
2018-02-07 12:11:54 PST  Major  FPC0: PEM 1 Not Supported
2018-02-07 12:11:54 PST  Major  FPC0: PEM 0 Not Supported
2018-02-07 12:11:54 PST  Major  FPC0: PEM 0 Not Powered
```

For Junos OS Evolved systems, `show system alarms` CLI command indicates major and minor alarms on the system. In this example from a Junos OS Evolved system, a fan tray error is shown in slot **4**.

```
user@host> show system alarms
2 alarms currently active
Alarm time               Class  Description
2018-11-15 11:52:22 PST  Major  Fan Tray 4 Failure   <<<<<
2018-11-15 10:40:08 PST  Minor  Host 0 Disk 2 Labelled incorrectly
```

Chassis Alarm Messages on QFX10002 Switches

Chassis alarms indicate a failure on the device or one of its components. Chassis alarms are preset and cannot be modified.

Chassis alarms on QFX10002 switches have two severity levels:

- Major (red)—Indicates a critical situation on the device that has resulted from one of the conditions described in Table 46 on page 148. A red alarm condition requires immediate action.
- Minor (yellow or amber)—Indicates a noncritical condition on the device that, if left unchecked, might cause an interruption in service or degradation in performance. A yellow alarm condition requires monitoring or maintenance.

Table 46 on page 148 describes the chassis alarm messages on QFX10002 devices.

Table 46: QFX10002 Chassis Alarm Messages

Component	Alarm Type	CLI Message	Recommended Action
Fans	Major (red)	`Fan Failure`	Replace the fan module and report the failure to customer support.
		`Fan I2C Failure`	Check the system log for one of the following messages and report the error message to customer support: • `CM ENV Monitor: Get fan speed failed.` • *`fan-number`* `is NOT spinning @ correct speed`, where *`fan-number`* can be 1, 2, or 3.
		`Fan` *`fan-number`* `Not Spinning`	Remove and check the fan module for obstructions, and then reinsert the fan module. If the problem persists, replace the fan module.
	Minor (yellow)	`Fan/Blower Absent`	Check the system log for the message *`fan-number`* `Absent`, where *`fan-number`* can be 1, 2, or 3. Install the fan module.
Power supplies	Major (red)	`PEM` *`pem-number`* `Airflow not matching Chassis Airflow`	Replace the power supply with a power supply that supports the same airflow direction as the chassis.

Table 46: QFX10002 Chassis Alarm Messages *(Continued)*

Component	Alarm Type	CLI Message	Recommended Action
		PEM *pem-number* I2C Failure	Check the system log for one of the following messages and report the error message to customer support: • I2C Read failed for device *number*, where *number* may be from 123 to 125. • PS *number*: Transitioning from online to offline, where power supply (PS) *number* may be 1 or 2.
		PEM *pem-number* is not powered	Check the power cord connection and reconnect, if necessary.
		PEM *pem-number* is not supported	Replace the power supply with a supported power supply.
		PEM *pem-number* Not OK	Indicates a problem with the incoming AC power or outgoing DC power. Report the error to customer support.
	Minor (yellow)	PEM *pem-number* Absent	Reboot the switch after removing a power supply. The switch can continue to operate with a single power supply.
		PEM *pem-number* Power Supply Type Mismatch	Check if there is a mix of AC and DC power supplies in the same chassis. Reboot the switch with only AC or only DC power supplies.
		PEM *pem-number* Removed	Replace the removed power supply or reboot the switch. The switch can continue to operate with a single power supply.

Table 46: QFX10002 Chassis Alarm Messages *(Continued)*

Component	Alarm Type	CLI Message	Recommended Action
Temperature sensors	Major (red)	*sensor-location* Temp Sensor Fail	Check the system log for the following message and report it to customer support: Temp sensor *sensor-number* failed, where *sensor-number* ranges from 1 through 10.
		sensor-location Temp Sensor Too Hot	Check environmental conditions and alarms on other devices. Ensure that environmental factors (such as hot air blowing around the equipment) do not affect the temperature sensor. If the condition persists, the device might shut down.
	Minor (yellow)	*sensor-location* Temp Sensor Too Warm	For information only. Check environmental conditions and alarms on other devices. Ensure that environmental factors (such as hot air blowing around the equipment) do not affect the temperature sensor.
Routing Engine	Minor (yellow)	RE *RE number* /var partition usage is high	Clean up the system file storage space on the switch. For more information, see *Cleaning Up the System File Storage Space*.
	Major (red)	RE *RE number* /var partition is full	Clean up the system file storage space on the switch. For more information, see *Cleaning Up the System File Storage Space*.

Table 46: QFX10002 Chassis Alarm Messages *(Continued)*

Component	Alarm Type	CLI Message	Recommended Action
	Minor (yellow)	`Rescue configuration is not set`	Use the **`request system configuration rescue save`** command to set the rescue configuration. For more information, see *Setting or Deleting the Rescue Configuration*.
		`Feature` `usage requires a license` or `License for` *`feature`* `expired`	Install the required license for the feature specified in the alarm. For more information, see *Software Features That Require Licenses on the QFX Series*.
Management Ethernet interface	Major (red)	`Management Ethernet 1 Link Down`	Check whether a cable is connected to the management Ethernet interface, or whether the cable is defective. Replace the cable, if required. If the problem cannot be resolved, open a support case by using the Case Manager link at https://www.juniper.net/support/ or call 1-888-314-5822 (toll free, US and Canada)or 1-408-745-9500 (from outside the United States).

RELATED DOCUMENTATION

Configuring Junos OS to Determine Conditions That Trigger Alarms on Different Interface Types

alarm

CHAPTER 6

Contacting Customer Support and Returning the Chassis or Components

Contact Customer Support

You can contact Juniper Networks Technical Assistance Center (JTAC) 24 hours a day, 7 days a week in one of the following ways:

- On the Web, using the Service Request Manager link at:

  https://support.juniper.net/support/

- By telephone:
  - From the US and Canada: 1-888-314-JTAC
  - From all other locations: 1-408-745-9500

> **NOTE**: If contacting JTAC by telephone, enter your 12-digit service request number followed by the pound (#) key if this is an existing case, or press the star (*) key to be routed to the next available support engineer.

When requesting support from JTAC by telephone, be prepared to provide the following information:

- Your existing service request number, if you have one
- Details of the failure or problem
- Type of activity being performed on the device when the problem occurred
- Configuration data displayed by one or more `show` commands
- Your name, organization name, telephone number, fax number, and shipping address

The support representative validates your request and issues an RMA number for return of the component.

Returning the Chassis or Components

IN THIS SECTION

Locating the Serial Number on a QFX10002 or Component

IN THIS SECTION

If you are returning a switch or component to Juniper Networks for repair or replacement, you must locate the serial number of the switch or component. You must provide the serial number to the Juniper Networks Technical Assistance Center (JTAC) when you contact them to obtain a Return Materials Authorization (RMA). S

If the switch is operational and you can access the command-line interface (CLI), you can list serial numbers for the switch and for some components with a CLI command. If you do not have access to the CLI or if the serial number for the component does not appear in the command output, you can locate the serial number ID label on the switch or component.

NOTE: If you want to find the serial number ID label on a component, you need to remove the component from the switch chassis, for which you must have the required parts and tools available.

Listing the Chassis and Component Details Using the CLI

To list the QFX10002 and components and their serial numbers, use the `show chassis hardware` CLI operational mode command.

```
user@device> show chassis hardware

Hardware inventory:
Item             Version  Part number  Serial number     Description
Chassis                               UNDEFINED         QFX10002-72Q
Pseudo CB 0
Routing Engine 0          BUILTIN      BUILTIN           QFX Routing Engine
FPC 0            REV 05   750-055415   ACAM4157          QFX10002-72Q
  CPU                     BUILTIN      BUILTIN           FPC CPU
  PIC 0                   BUILTIN      BUILTIN           72X40G
    Xcvr 0       REV 01   740-032986   QB350182          QSFP+-40G-SR4
    Xcvr 10      REV 01   740-038623   MOC12456230055    QSFP+-40G-CU1M
    Xcvr 11      REV 01   740-032986   QB510226          QSFP+-40G-SR4
    Xcvr 12      REV 01   740-032986   QB440609          QSFP+-40G-SR4
    Xcvr 16      REV      740-038624   APF14260038RA4    QSFP+-40G-CU3M
    Xcvr 17      REV      740-038624   APF14260030150    QSFP+-40G-CU3M
    Xcvr 18      REV      740-038624   APF14260038RAR    QSFP+-40G-CU3M
    Xcvr 19      REV 01   740-038624   1414600Q          QSFP+-40G-CU3M
    Xcvr 20      REV 01   740-038623   MOC13156230239    QSFP+-40G-CU1M
    Xcvr 21      REV 01   740-032986   QB510219          QSFP+-40G-SR4
    Xcvr 23      REV 01   740-032986   QC470754          QSFP+-40G-SR4
    Xcvr 30      REV 01   740-038623   MOC13046230019    QSFP+-40G-CU1M
    Xcvr 31      REV 01   740-032986   QC261385          QSFP+-40G-SR4
    Xcvr 34      REV 01   740-032986   QC261445          QSFP+-40G-SR4
    Xcvr 35      REV 01   740-032986   QA500044          QSFP+-40G-SR4
    Xcvr 40      REV 01   740-038623   MOC13046230090    QSFP+-40G-CU1M
    Xcvr 41      REV 01   740-032986   QC270406          QSFP+-40G-SR4
    Xcvr 50      REV 01   740-038623   MOC13156230526    QSFP+-40G-CU1M
    Xcvr 51      REV 01   740-032986   QB120441          QSFP+-40G-SR4
    Xcvr 60      REV 01   740-038624   MOC13046240143    QSFP+-40G-CU3M
    Xcvr 61      REV 01   740-032986   QB341320          QSFP+-40G-SR4
    Xcvr 70      REV 01   740-032986   QB190181          QSFP+-40G-SR4
    Xcvr 71      REV 01   740-032986   QA480159          QSFP+-40G-SR4
  Mezz           REV 05   711-053333   ACAM4115          Mezzanine Board
Power Supply 2   REV 01   740-054405   1EDN4470094       JPSU-1600W-AC-AFO
Power Supply 3   REV 01   740-054405   1EDN4470121       JPSU-1600W-AC-AFO
Fan Tray 0                                              QFX10002 Fan Tray 0, Front to Back
```

```
Airflow - AFO
Fan Tray 1                                              QFX10002 Fan Tray 1, Front to Back
Airflow - AFO
Fan Tray 2                                              QFX10002 Fan Tray 2, Front to Back
Airflow - AFO

{master:0}
```

NOTE: You must remove the fan module to read the fan serial number from the serial number ID label. The fan module serial number cannot be viewed through the CLI. **Fan Tray 2** refers to the third module from the left, counting from 0.

Locating the Chassis Serial Number ID Label on a QFX10002 Switch

The serial number ID label is located on a label on the top cover.

Locating the Serial Number ID Labels on FRU Components

The power supplies and fan modules installed in a QFX10002 are field-replaceable units (FRUs). For each FRU, you must remove the FRU from the switch chassis to see the FRU serial number ID label.

- AC power supply—The serial number ID label is on the top of the AC power supply.
- Fan module—The serial number ID label is on the top of the fan module.

Removing the Solid State Drives for RMA

The QFX10002 has two solid-state drives (SSDs) that store the software images, system logs, and the configuration files. Before returning a chassis to Juniper Networks as part of a Return Merchandise Authorization (RMA), you have the option of removing the SSDs and disposing them according to your own company's security procedures. Before you begin this procedure, ensure you have the following tools:

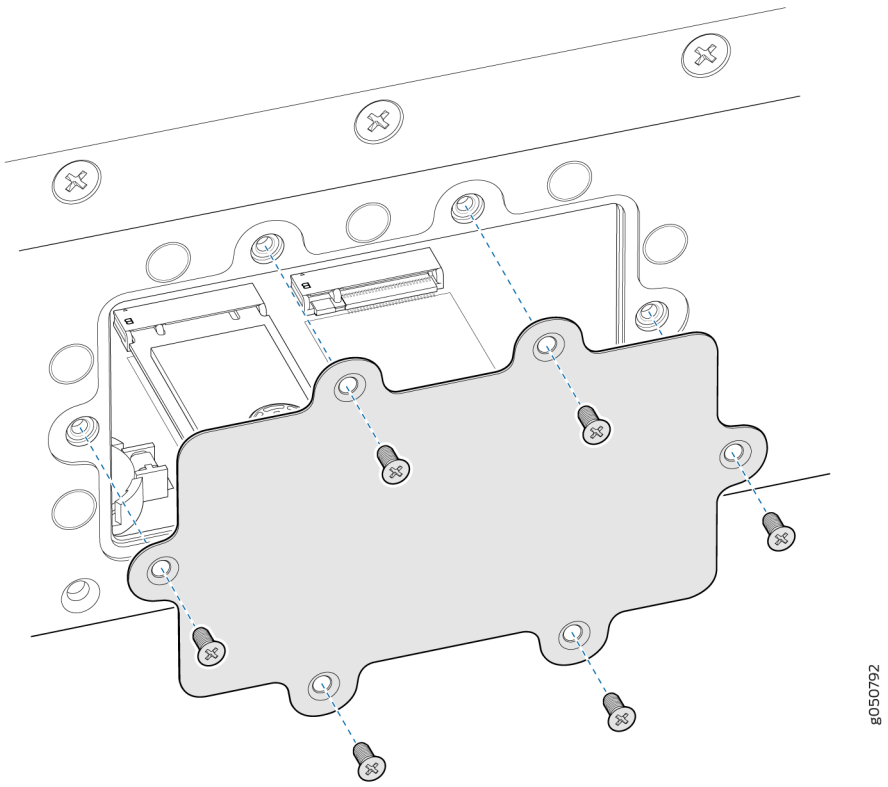
- ESD grounding strap (not provided)
- Number 2 Phillips screwdriver

Use this optional procedure to remove the drives from the QFX10002 after the device has shutdown and removed from the rack or cabinet.

1. Attach the ESD grounding strap to your bare wrist and to a site ESD point.

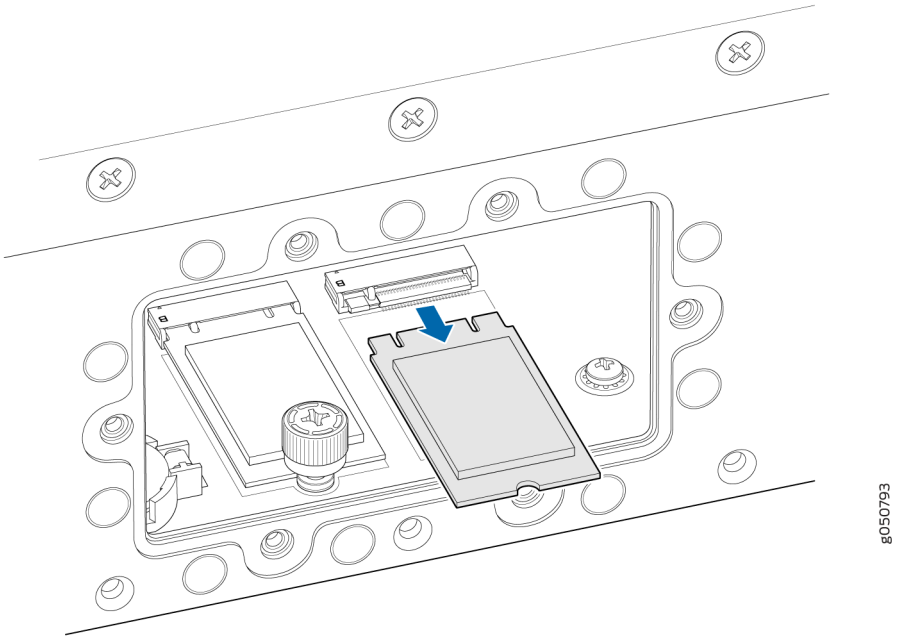
2. Place the device on a firm surface such as a workbench or a table.
3. Using the number 2 Phillips screwdriver, remove the six flat-head screws that secure the access door on the right-side of the device. Retain the screws for later use.

Figure 53: Removing or Replacing Flat-head Screws in the Access Door



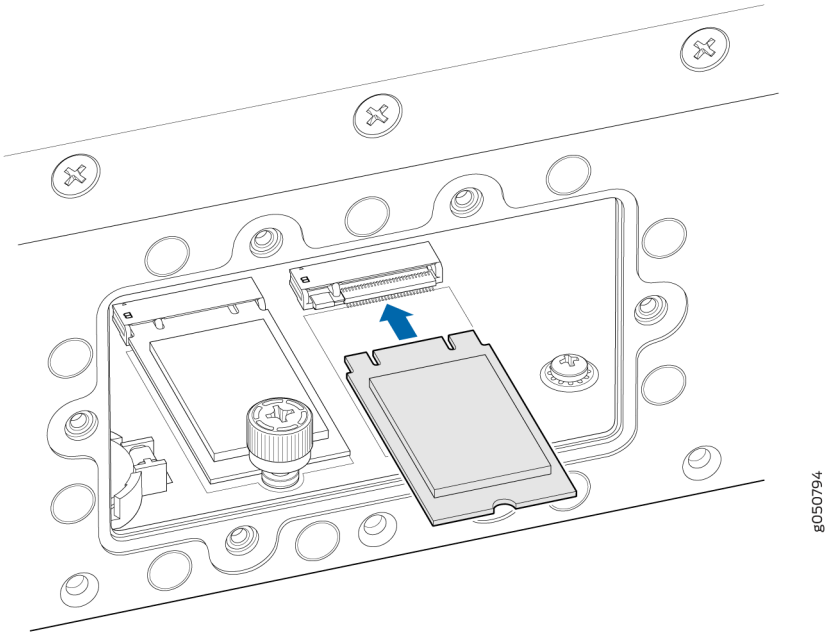
4. Reach inside of the cavity and unscrew the two thumb-screw fasteners and set aside with the screws.

Figure 54: Remove or Replacing the Thumb-screw Fasteners



5. Slide the SSD out of the slot and set aside; repeat with the second SSD.

Figure 55: Removing the SSDs



6. Replace the two thumbscrews and hand-tighten.
7. Replace the six flat-head screws and hand tighten using the number 2 Phillips screwdriver.
8. Dispose of the SSDs according to your site security procedures.

SEE ALSO

Powering Off a QFX10002 | **140**

Removing a QFX10002 from a Rack | **143**

Returning a QFX10002 or Component for Repair or Replacement

If you need to return a QFX10002 or component to Juniper Networks for repair or replacement, follow this procedure:

1. Determine the serial number of the component. For instructions.
2. Obtain a Return Materials Authorization (RMA) number from the Juniper Technical Assistance Center (JTAC) as described in "Contact Customer Support" on page 153.

NOTE: Do not return any component to Juniper Networks unless you have first obtained an RMA number. Juniper Networks reserves the right to refuse shipments that do not have an RMA. Refused shipments are returned to the customer through collect freight.

3. Pack the switch or component for shipping.

For more information about return and repair policies, see the customer support page at https://www.juniper.net/support/guidelines.html .

SEE ALSO

QFX10002 System Overview | 2

Packing a QFX10002 or Component for Shipping

IN THIS SECTION

If you are returning a QFX10002 or component to Juniper Networks for repair or replacement, pack the item as described in this topic.

Before you pack a QFX10002 or component:

- Ensure that you have taken the necessary precautions to prevent electrostatic discharge (ESD) damage. See "Prevention of Electrostatic Discharge Damage" on page 190.
- Retrieve the original shipping carton and packing materials. Contact your JTAC representative if you do not have these materials, to learn about approved packing materials. See "Contact Customer Support" on page 153.

Ensure that you have the following parts and tools available:

- ESD grounding strap.
- Antistatic bag, one for each component.

- If you are returning the chassis, an appropriate screwdriver for the mounting screws used on your rack or cabinet.

This topic describes:

Packing a QFX10002 Switch for Shipping

To pack a QFX10002 for shipping:

1. Power down the switch and remove the power cables. See "Powering Off a QFX10002" on page 140.
2. Remove the cables that connect the QFX100002 to all external devices.
3. Remove all field-replaceable units (FRUs) from the device.
4. Position a mechanical lift under the device. If a mechanical lift is not available, have two people support the weight of the switch while another person uses the screwdriver to remove the front mounting screws that attach the chassis mounting brackets to the rack or cabinet.
5. Remove the switch from the rack or cabinet (see "QFX10002 Installation Safety Guidelines" on page 99) and place the switch in an antistatic bag.
6. Place the switch in the shipping carton.
7. Place the packing foam on top of and around the switch.
8. If you are returning accessories or FRUs with the switch, pack them as instructed in "Packing a QFX10002 or Component for Shipping" on page 160.
9. Replace the accessory box on top of the packing foam.
10. Close the top of the cardboard shipping box and seal it with packing tape.
11. Write the RMA number on the exterior of the box to ensure proper tracking.

Packing QFX10002 Switch Components for Shipping

CAUTION: Do not stack switch components. Return individual components in separate boxes if they do not fit together on one level in the shipping box.

To pack and ship QFX10002 switch components:

- Place individual FRUs in antistatic bags.
- Ensure that the components are adequately protected with packing materials and packed so that the pieces are prevented from moving around inside the carton.
- Close the top of the cardboard shipping box and seal it with packing tape.
- Write the RMA number on the exterior of the box to ensure proper tracking.

RELATED DOCUMENTATION

Powering Off a QFX10002 | 140

CHAPTER 7

Safety and Compliance Information

General Safety Guidelines and Warnings

The following guidelines help ensure your safety and protect the device from damage. The list of guidelines might not address all potentially hazardous situations in your working environment, so be alert and exercise good judgment at all times.

- Perform only the procedures explicitly described in the hardware documentation for this device. Make sure that only authorized service personnel perform other system services.
- Keep the area around the device clear and free from dust before, during, and after installation.
- Keep tools away from areas where people could trip over them while walking.
- Do not wear loose clothing or jewelry, such as rings, bracelets, or chains, which could become caught in the device.
- Wear safety glasses if you are working under any conditions that could be hazardous to your eyes.
- Do not perform any actions that create a potential hazard to people or make the equipment unsafe.
- Never attempt to lift an object that is too heavy for one person to handle.
- Never install or manipulate wiring during electrical storms.
- Never install electrical jacks in wet locations unless the jacks are specifically designed for wet environments.
- Operate the device only when it is properly grounded.
- Follow the instructions in this guide to properly ground the device to earth.
- Replace fuses only with fuses of the same type and rating.
- Do not open or remove chassis covers or sheet-metal parts unless instructions are provided in the hardware documentation for this device. Such an action could cause severe electrical shock.
- Do not push or force any objects through any opening in the chassis frame. Such an action could result in electrical shock or fire.
- Avoid spilling liquid onto the chassis or onto any device component. Such an action could cause electrical shock or damage the device.
- Avoid touching uninsulated electrical wires or terminals that have not been disconnected from their power source. Such an action could cause electrical shock.

- Some parts of the chassis, including AC and DC power supply surfaces, power supply unit handles, SFB card handles, and fan tray handles might become hot. The following label provides the warning for hot surfaces on the chassis:

- Always ensure that all modules, power supplies, and cover panels are fully inserted and that the installation screws are fully tightened.

Definitions of Safety Warning Levels

The documentation uses the following levels of safety warnings (there are two *Warning* formats):

NOTE: You might find this information helpful in a particular situation, or you might overlook this important information if it was not highlighted in a Note.

CAUTION: You need to observe the specified guidelines to prevent minor injury or discomfort to you or severe damage to the device.

Attention Veillez à respecter les consignes indiquées pour éviter toute incommodité ou blessure légère, voire des dégâts graves pour l'appareil.

LASER WARNING: This symbol alerts you to the risk of personal injury from a laser.

Avertissement Ce symbole signale un risque de blessure provoquée par rayon laser.

WARNING: This symbol means danger. You are in a situation that could cause bodily injury. Before you work on any equipment, be aware of the hazards involved with electrical circuitry, and familiarize yourself with standard practices for preventing accidents.

Waarschuwing Dit waarschuwingssymbool betekent gevaar. U verkeert in een situatie die lichamelijk letsel kan veroorzaken. Voordat u aan enige apparatuur gaat werken, dient u zich bewust te zijn van de bij elektrische schakelingen betrokken risico's en dient u op de hoogte te zijn van standaard maatregelen om ongelukken te voorkomen.

Varoitus Tämä varoitusmerkki merkitsee vaaraa. Olet tilanteessa, joka voi johtaa ruumiinvammaan. Ennen kuin työskentelet minkään laitteiston parissa, ota selvää sähkökytkentöihin liittyvistä vaaroista ja tavanomaisista onnettomuuksien ehkäisykeinoista.

Avertissement Ce symbole d'avertissement indique un danger. Vous vous trouvez dans une situation pouvant causer des blessures ou des dommages corporels. Avant de travailler sur un équipement, soyez conscient des dangers posés par les circuits électriques et familiarisez-vous avec les procédures couramment utilisées pour éviter les accidents.

Warnung Dieses Warnsymbol bedeutet Gefahr. Sie befinden sich in einer Situation, die zu einer Körperverletzung führen könnte. Bevor Sie mit der Arbeit an irgendeinem Gerät beginnen, seien Sie sich der mit elektrischen Stromkreisen verbundenen Gefahren und der Standardpraktiken zur Vermeidung von Unfällen bewußt.

Avvertenza Questo simbolo di avvertenza indica un pericolo. La situazione potrebbe causare infortuni alle persone. Prima di lavorare su qualsiasi apparecchiatura, occorre conoscere i pericoli relativi ai circuiti elettrici ed essere al corrente delle pratiche standard per la prevenzione di incidenti.

Advarsel Dette varselsymbolet betyr fare. Du befinner deg i en situasjon som kan føre til personskade. Før du utfører arbeid på utstyr, må du vare oppmerksom på de faremomentene som elektriske kretser innebærer, samt gjøre deg kjent med vanlig praksis når det gjelder å unngå ulykker.

Aviso Este símbolo de aviso indica perigo. Encontra-se numa situação que lhe poderá causar danos físicos. Antes de começar a trabalhar com qualquer equipamento, familiarize-se com os perigos relacionados com circuitos eléctricos, e com quaisquer práticas comuns que possam prevenir possíveis acidentes.

¡Atención! Este símbolo de aviso significa peligro. Existe riesgo para su integridad física. Antes de manipular cualquier equipo, considerar los riesgos que entraña la corriente eléctrica y familiarizarse con los procedimientos estándar de prevención de accidentes.

Varning! Denna varningssymbol signalerar fara. Du befinner dig i en situation som kan leda till personskada. Innan du utför arbete på någon utrustning måste du vara medveten om farorna med elkretsar och känna till vanligt förfarande för att förebygga skador.

Qualified Personnel Warning

WARNING: Only trained and qualified personnel should install or replace the device.
Waarschuwing Installatie en reparaties mogen uitsluitend door getraind en bevoegd personeel uitgevoerd worden.

Varoitus Ainoastaan koulutettu ja pätevä henkilökunta saa asentaa tai vaihtaa tämän laitteen.

Avertissement Tout installation ou remplacement de l'appareil doit être réalisé par du personnel qualifié et compétent.

Warnung Gerät nur von geschultem, qualifiziertem Personal installieren oder auswechseln lassen.

Avvertenza Solo personale addestrato e qualificato deve essere autorizzato ad installare o sostituire questo apparecchio.

Advarsel Kun kvalifisert personell med riktig opplæring bør montere eller bytte ut dette utstyret.

Aviso Este equipamento deverá ser instalado ou substituído apenas por pessoal devidamente treinado e qualificado.

¡Atención! Estos equipos deben ser instalados y reemplazados exclusivamente por personal técnico adecuadamente preparado y capacitado.

Varning! Denna utrustning ska endast installeras och bytas ut av utbildad och kvalificerad personal.

Warning Statement for Norway and Sweden

WARNING: The equipment must be connected to an earthed mains socket-outlet.
Advarsel Apparatet skal kobles til en jordet stikkontakt.

Varning! Apparaten skall anslutas till jordat nätuttag.

Fire Safety Requirements

IN THIS SECTION

In the event of a fire emergency, the safety of people is the primary concern. You should establish procedures for protecting people in the event of a fire emergency, provide safety training, and properly provision fire-control equipment and fire extinguishers.

In addition, you should establish procedures to protect your equipment in the event of a fire emergency. Juniper Networks products should be installed in an environment suitable for electronic equipment. We recommend that fire suppression equipment be available in the event of a fire in the vicinity of the equipment and that all local fire, safety, and electrical codes and ordinances be observed when you install and operate your equipment.

Fire Suppression

In the event of an electrical hazard or an electrical fire, you should first turn power off to the equipment at the source. Then use a Type C fire extinguisher, which uses noncorrosive fire retardants, to extinguish the fire.

Fire Suppression Equipment

Type C fire extinguishers, which use noncorrosive fire retardants such as carbon dioxide and Halotron™, are most effective for suppressing electrical fires. Type C fire extinguishers displace oxygen from the point of combustion to eliminate the fire. For extinguishing fire on or around equipment that draws air from the environment for cooling, you should use this type of inert oxygen displacement extinguisher instead of an extinguisher that leaves residues on equipment.

Do not use multipurpose Type ABC chemical fire extinguishers (dry chemical fire extinguishers). The primary ingredient in these fire extinguishers is monoammonium phosphate, which is very sticky and

difficult to clean. In addition, in the presence of minute amounts of moisture, monoammonium phosphate can become highly corrosive and corrodes most metals.

Any equipment in a room in which a chemical fire extinguisher has been discharged is subject to premature failure and unreliable operation. The equipment is considered to be irreparably damaged.

NOTE: To keep warranties effective, do not use a dry chemical fire extinguisher to control a fire at or near a Juniper Networks device. If a dry chemical fire extinguisher is used, the unit is no longer eligible for coverage under a service agreement.

We recommend that you dispose of any irreparably damaged equipment in an environmentally responsible manner.

Installation Instructions Warning

WARNING: Read the installation instructions before you connect the device to a power source.

Waarschuwing Raadpleeg de installatie-aanwijzingen voordat u het systeem met de voeding verbindt.

Varoitus Lue asennusohjeet ennen järjestelmän yhdistämistä virtalähteeseen.

Avertissement Avant de brancher le système sur la source d'alimentation, consulter les directives d'installation.

Warnung Lesen Sie die Installationsanweisungen, bevor Sie das System an die Stromquelle anschließen.

Avvertenza Consultare le istruzioni di installazione prima di collegare il sistema all'alimentatore.

Advarsel Les installasjonsinstruksjonene før systemet kobles til strømkilden.

Aviso Leia as instruções de instalação antes de ligar o sistema à sua fonte de energia.

¡Atención! Ver las instrucciones de instalación antes de conectar el sistema a la red de alimentación.

Varning! Läs installationsanvisningarna innan du kopplar systemet till dess strömförsörjningsenhet.

Chassis and Component Lifting Guidelines

- Before moving the device to a site, ensure that the site meets the power, environmental, and clearance requirements.
- Before lifting or moving the device, disconnect all external cables and wires.
- As when lifting any heavy object, ensure that your legs bear most of the weight rather than your back. Keep your knees bent and your back relatively straight. Do not twist your body as you lift. Balance the load evenly and be sure that your footing is firm.
- Use the following lifting guidelines to lift devices and components:
  - Up to 39.7 lb (18 kg): One person.
  - From 39.7 lb (18 kg) to 70.5 lb (32 kg): Two or more people.
  - From 70.5 lb (32 kg) to 121.2 lb (55 kg): Three or more people.
  - Above 121.2 lb (55 kg): Use material handling systems (such as levers, slings, lifts, and so on). When this is not practical, engage specially trained persons or systems (such as riggers or movers).

Restricted Access Warning

WARNING: This unit is intended for installation in restricted access areas. A restricted access area is an area to which access can be gained only by service personnel through the use of a special tool, lock and key, or other means of security, and which is controlled by the authority responsible for the location.

Waarschuwing Dit toestel is bedoeld voor installatie op plaatsen met beperkte toegang. Een plaats met beperkte toegang is een plaats waar toegang slechts door servicepersoneel verkregen kan worden door middel van een speciaal instrument, een slot en sleutel, of een ander veiligheidsmiddel, en welke beheerd wordt door de overheidsinstantie die verantwoordelijk is voor de locatie.

Varoitus Tämä laite on tarkoitettu asennettavaksi paikkaan, johon pääsy on rajoitettua. Paikka, johon pääsy on rajoitettua, tarkoittaa paikkaa, johon vain huoltohenkilöstö pääsee jonkin erikoistyökalun, lukkoon sopivan avaimen tai jonkin muun turvalaitteen avulla ja joka on paikasta vastuussa olevien toimivaltaisten henkilöiden valvoma.

Avertissement Cet appareil est à installer dans des zones d'accès réservé. Ces dernières sont des zones auxquelles seul le personnel de service peut accéder en utilisant un outil spécial, un mécanisme de verrouillage et une clé, ou tout autre moyen de sécurité. L'accès aux zones de sécurité est sous le contrôle de l'autorité responsable de l'emplacement.

Warnung Diese Einheit ist zur Installation in Bereichen mit beschränktem Zutritt vorgesehen. Ein Bereich mit beschränktem Zutritt ist ein Bereich, zu dem nur Wartungspersonal mit einem Spezialwerkzeugs, Schloß und Schlüssel oder anderer Sicherheitsvorkehrungen Zugang hat, und der von dem für die Anlage zuständigen Gremium kontrolliert wird.

Avvertenza Questa unità deve essere installata in un'area ad accesso limitato. Un'area ad accesso limitato è un'area accessibile solo a personale di assistenza tramite un'attrezzo speciale, lucchetto, o altri dispositivi di sicurezza, ed è controllata dall'autorità responsabile della zona.

Advarsel Denne enheten er laget for installasjon i områder med begrenset adgang. Et område med begrenset adgang gir kun adgang til servicepersonale som bruker et spesielt verktøy, lås og nøkkel, eller en annen sikkerhetsanordning, og det kontrolleres av den autoriteten som er ansvarlig for området.

Aviso Esta unidade foi concebida para instalação em áreas de acesso restrito. Uma área de acesso restrito é uma área à qual apenas tem acesso o pessoal de serviço autorizado, que possua uma ferramenta, chave e fechadura especial, ou qualquer outra forma de segurança. Esta área é controlada pela autoridade responsável pelo local.

¡Atención! Esta unidad ha sido diseñada para instalarse en áreas de acceso restringido. Área de acceso restringido significa un área a la que solamente tiene acceso el personal de servicio mediante la utilización de una herramienta especial, cerradura con llave, o algún otro medio de seguridad, y que está bajo el control de la autoridad responsable del local.

Varning! Denna enhet är avsedd för installation i områden med begränsat tillträde. Ett område med begränsat tillträde får endast tillträdas av servicepersonal med ett speciellt verktyg, lås och nyckel, eller annan säkerhetsanordning, och kontrolleras av den auktoritet som ansvarar för området.

Ramp Warning

WARNING: When installing the device, do not use a ramp inclined at more than 10 degrees.

Waarschuwing Gebruik een oprijplaat niet onder een hoek van meer dan 10 graden.

Varoitus Älä käytä sellaista kaltevaa pintaa, jonka kaltevuus ylittää 10 astetta.

Avertissement Ne pas utiliser une rampe dont l'inclinaison est supérieure à 10 degrés.

Warnung Keine Rampen mit einer Neigung von mehr als 10 Grad verwenden.

Avvertenza Non usare una rampa con pendenza superiore a 10 gradi.

Advarsel Bruk aldri en rampe som heller mer enn 10 grader.

Aviso Não utilize uma rampa com uma inclinação superior a 10 graus.

¡Atención! No usar una rampa inclinada más de 10 grados.

Varning! Använd inte ramp med en lutning på mer än 10 grader.

Rack-Mounting and Cabinet-Mounting Warnings

Ensure that the rack or cabinet in which the device is installed is evenly and securely supported. Uneven mechanical loading could lead to a hazardous condition.

WARNING: To prevent bodily injury when mounting or servicing the device in a rack, take the following precautions to ensure that the system remains stable. The following directives help maintain your safety:

- Install the device in a rack that is secured to the building structure.
- Mount the device at the bottom of the rack if it is the only unit in the rack.
- When mounting the device on a partially filled rack, load the rack from the bottom to the top, with the heaviest component at the bottom of the rack.

- If the rack is provided with stabilizing equipment, install the stabilizers before mounting or servicing the device in the rack.

Waarschuwing Om lichamelijk letsel te voorkomen wanneer u dit toestel in een rek monteert of het daar een servicebeurt geeft, moet u speciale voorzorgsmaatregelen nemen om ervoor te zorgen dat het toestel stabiel blijft. De onderstaande richtlijnen worden verstrekt om uw veiligheid te verzekeren:

- De Juniper Networks switch moet in een stellage worden geïnstalleerd die aan een bouwsel is verankerd.
- Dit toestel dient onderaan in het rek gemonteerd te worden als het toestel het enige in het rek is.
- Wanneer u dit toestel in een gedeeltelijk gevuld rek monteert, dient u het rek van onderen naar boven te laden met het zwaarste onderdeel onderaan in het rek.
- Als het rek voorzien is van stabiliseringshulpmiddelen, dient u de stabilisatoren te monteren voordat u het toestel in het rek monteert of het daar een servicebeurt geeft.

Varoitus Kun laite asetetaan telineeseen tai huolletaan sen ollessa telineessä, on noudatettava erityisiä varotoimia järjestelmän vakavuuden säilyttämiseksi, jotta vältytään loukkaantumiselta. Noudata seuraavia turvallisuusohjeita:

- Juniper Networks switch on asennettava telineeseen, joka on kiinnitetty rakennukseen.
- Jos telineessä ei ole muita laitteita, aseta laite telineen alaosaan.
- Jos laite asetetaan osaksi täytettyyn telineeseen, aloita kuormittaminen sen alaosasta kaikkein raskaimmalla esineellä ja siirry sitten sen yläosaan.
- Jos telinettä varten on vakaimet, asenna ne ennen laitteen asettamista telineeseen tai sen huoltamista siinä.

Avertissement Pour éviter toute blessure corporelle pendant les opérations de montage ou de réparation de cette unité en casier, il convient de prendre des précautions spéciales afin de maintenir la stabilité du système. Les directives ci-dessous sont destinées à assurer la protection du personnel:

- Le rack sur lequel est monté le Juniper Networks switch doit être fixé à la structure du bâtiment.

- Si cette unité constitue la seule unité montée en casier, elle doit être placée dans le bas.
- Si cette unité est montée dans un casier partiellement rempli, charger le casier de bas en haut en plaçant l'élément le plus lourd dans le bas.
- Si le casier est équipé de dispositifs stabilisateurs, installer les stabilisateurs avant de monter ou de réparer l'unité en casier.

Warnung Zur Vermeidung von Körperverletzung beim Anbringen oder Warten dieser Einheit in einem Gestell müssen Sie besondere Vorkehrungen treffen, um sicherzustellen, daß das System stabil bleibt. Die folgenden Richtlinien sollen zur Gewährleistung Ihrer Sicherheit dienen:

- Der Juniper Networks switch muß in einem Gestell installiert werden, das in der Gebäudestruktur verankert ist.
- Wenn diese Einheit die einzige im Gestell ist, sollte sie unten im Gestell angebracht werden.
- Bei Anbringung dieser Einheit in einem zum Teil gefüllten Gestell ist das Gestell von unten nach oben zu laden, wobei das schwerste Bauteil unten im Gestell anzubringen ist.
- Wird das Gestell mit Stabilisierungszubehör geliefert, sind zuerst die Stabilisatoren zu installieren, bevor Sie die Einheit im Gestell anbringen oder sie warten.

Avvertenza Per evitare infortuni fisici durante il montaggio o la manutenzione di questa unità in un supporto, occorre osservare speciali precauzioni per garantire che il sistema rimanga stabile. Le seguenti direttive vengono fornite per garantire la sicurezza personale:

- Il Juniper Networks switch deve essere installato in un telaio, il quale deve essere fissato alla struttura dell'edificio.
- Questa unità deve venire montata sul fondo del supporto, se si tratta dell'unica unità da montare nel supporto.
- Quando questa unità viene montata in un supporto parzialmente pieno, caricare il supporto dal basso all'alto, con il componente più pesante sistemato sul fondo del supporto.
- Se il supporto è dotato di dispositivi stabilizzanti, installare tali dispositivi prima di montare o di procedere alla manutenzione dell'unità nel supporto.

Advarsel Unngå fysiske skader under montering eller reparasjonsarbeid på denne enheten når den befinner seg i et kabinett. Vær nøye med at systemet er stabilt. Følgende retningslinjer er gitt for å verne om sikkerheten:

- Juniper Networks switch må installeres i et stativ som er forankret til bygningsstrukturen.
- Denne enheten bør monteres nederst i kabinettet hvis dette er den eneste enheten i kabinettet.
- Ved montering av denne enheten i et kabinett som er delvis fylt, skal kabinettet lastes fra bunnen og opp med den tyngste komponenten nederst i kabinettet.
- Hvis kabinettet er utstyrt med stabiliseringsutstyr, skal stabilisatorene installeres før montering eller utføring av reparasjonsarbeid på enheten i kabinettet.

Aviso Para se prevenir contra danos corporais ao montar ou reparar esta unidade numa estante, deverá tomar precauções especiais para se certificar de que o sistema possui um suporte estável. As seguintes directrizes ajudá-lo-ão a efectuar o seu trabalho com segurança:

- O Juniper Networks switch deverá ser instalado numa prateleira fixa à estrutura do edificio.
- Esta unidade deverá ser montada na parte inferior da estante, caso seja esta a única unidade a ser montada.
- Ao montar esta unidade numa estante parcialmente ocupada, coloque os itens mais pesados na parte inferior da estante, arrumando-os de baixo para cima.
- Se a estante possuir um dispositivo de estabilização, instale-o antes de montar ou reparar a unidade.

¡Atención! Para evitar lesiones durante el montaje de este equipo sobre un bastidor, oeriormente durante su mantenimiento, se debe poner mucho cuidado en que el sistema quede bien estable. Para garantizar su seguridad, proceda según las siguientes instrucciones:

- El Juniper Networks switch debe instalarse en un bastidor fijado a la estructura del edificio.
- Colocar el equipo en la parte inferior del bastidor, cuando sea la única unidad en el mismo.

- Cuando este equipo se vaya a instalar en un bastidor parcialmente ocupado, comenzar la instalación desde la parte inferior hacia la superior colocando el equipo más pesado en la parte inferior.
- Si el bastidor dispone de dispositivos estabilizadores, instalar éstos antes de montar o proceder al mantenimiento del equipo instalado en el bastidor.

Varning! För att undvika kroppsskada när du installerar eller utför underhållsarbete på denna enhet på en ställning måste du vidta särskilda försiktighetsåtgärder för att försäkra dig om att systemet står stadigt. Följande riktlinjer ges för att trygga din säkerhet:

- Juniper Networks switch måste installeras i en ställning som är förankrad i byggnadens struktur.
- Om denna enhet är den enda enheten på ställningen skall den installeras längst ned på ställningen.
- Om denna enhet installeras på en delvis fylld ställning skall ställningen fyllas nedifrån och upp, med de tyngsta enheterna längst ned på ställningen.
- Om ställningen är försedd med stabiliseringsdon skall dessa monteras fast innan enheten installeras eller underhålls på ställningen.

Grounded Equipment Warning

WARNING: This device must be properly grounded at all times. Follow the instructions in this guide to properly ground the device to earth.

Waarschuwing Dit apparaat moet altijd goed geaard zijn. Volg de instructies in deze gids om het apparaat goed te aarden.

Varoitus Laitteen on oltava pysyvästi maadoitettu. Maadoita laite asianmukaisesti noudattamalla tämän oppaan ohjeita.

Avertissement L'appareil doit être correctement mis à la terre à tout moment. Suivez les instructions de ce guide pour correctement mettre l'appareil à la terre.

Warnung Das Gerät muss immer ordnungsgemäß geerdet sein. Befolgen Sie die Anweisungen in dieser Anleitung, um das Gerät ordnungsgemäß zu erden.

Avvertenza Questo dispositivo deve sempre disporre di una connessione a massa. Seguire le istruzioni indicate in questa guida per connettere correttamente il dispositivo a massa.

Advarsel Denne enheten på jordes skikkelig hele tiden. Følg instruksjonene i denne veiledningen for å jorde enheten.

Aviso Este equipamento deverá estar ligado à terra. Siga las instrucciones en esta guía para conectar correctamente este dispositivo a tierra.

¡Atención! Este dispositivo debe estar correctamente conectado a tierra en todo momento. Siga las instrucciones en esta guía para conectar correctamente este dispositivo a tierra.

Varning! Den här enheten måste vara ordentligt jordad. Följ instruktionerna i den här guiden för att jorda enheten ordentligt.

Laser and LED Safety Guidelines and Warnings

IN THIS SECTION

Juniper Networks devices are equipped with laser transmitters, which are considered a Class 1 Laser Product by the U.S. Food and Drug Administration and are evaluated as a Class 1 Laser Product per IEC/EN 60825-1 requirements.

Observe the following guidelines and warnings:

General Laser Safety Guidelines

When working around ports that support optical transceivers, observe the following safety guidelines to prevent eye injury:

- Do not look into unterminated ports or at fibers that connect to unknown sources.
- Do not examine unterminated optical ports with optical instruments.
- Avoid direct exposure to the beam.

LASER WARNING: Unterminated optical connectors can emit invisible laser radiation. The lens in the human eye focuses all the laser power on the retina, so focusing the eye directly on a laser source—even a low-power laser—could permanently damage the eye.

Avertissement Les connecteurs à fibre optique sans terminaison peuvent émettre un rayonnement laser invisible. Le cristallin de l'œil humain faisant converger toute la puissance du laser sur la rétine, toute focalisation directe de l'œil sur une source laser, —même de faible puissance—, peut entraîner des lésions oculaires irréversibles.

Class 1 Laser Product Warning

LASER WARNING: Class 1 laser product.
Waarschuwing Klasse-1 laser produkt.

Varoitus Luokan 1 lasertuote.

Avertissement Produit laser de classe I.

Warnung Laserprodukt der Klasse 1.

Avvertenza Prodotto laser di Classe 1.

Advarsel Laserprodukt av klasse 1.

Aviso Produto laser de classe 1.

¡Atención! Producto láser Clase I.

Varning! Laserprodukt av klass 1.

Class 1 LED Product Warning

LASER WARNING: Class 1 LED product.
Waarschuwing Klasse 1 LED-product.

Varoitus Luokan 1 valodiodituote.

Avertissement Alarme de produit LED Class I.

Warnung Class 1 LED-Produktwarnung.

Avvertenza Avvertenza prodotto LED di Classe 1.

Advarsel LED-produkt i klasse 1.

Aviso Produto de classe 1 com LED.

¡Atención! Aviso sobre producto LED de Clase 1.

Varning! Lysdiodprodukt av klass 1.

Laser Beam Warning

LASER WARNING: Do not stare into the laser beam or view it directly with optical instruments.
Waarschuwing Niet in de straal staren of hem rechtstreeks bekijken met optische instrumenten.

Varoitus Älä katso säteeseen äläkä tarkastele sitä suoraan optisen laitteen avulla.

Avertissement Ne pas fixer le faisceau des yeux, ni l'observer directement à l'aide d'instruments optiques.

Warnung Nicht direkt in den Strahl blicken und ihn nicht direkt mit optischen Geräten prüfen.

Avvertenza Non fissare il raggio con gli occhi né usare strumenti ottici per osservarlo direttamente.

Advarsel Stirr eller se ikke direkte p strlen med optiske instrumenter.

Aviso Não olhe fixamente para o raio, nem olhe para ele directamente com instrumentos ópticos.

¡Atención! No mirar fijamente el haz ni observarlo directamente con instrumentos ópticos.

Varning! Rikta inte blicken in mot strålen och titta inte direkt på den genom optiska instrument.

Radiation from Open Port Apertures Warning

LASER WARNING: Because invisible radiation might be emitted from the aperture of the port when no fiber cable is connected, avoid exposure to radiation and do not stare into open apertures.

Waarschuwing Aangezien onzichtbare straling vanuit de opening van de poort kan komen als er geen fiberkabel aangesloten is, dient blootstelling aan straling en het kijken in open openingen vermeden te worden.

Varoitus Koska portin aukosta voi emittoitua näkymätöntä säteilyä, kun kuitukaapelia ei ole kytkettynä, vältä säteilylle altistumista äläkä katso avoimiin aukkoihin.

Avertissement Des radiations invisibles à l'il nu pouvant traverser l'ouverture du port lorsqu'aucun câble en fibre optique n'y est connecté, il est recommandé de ne pas regarder fixement l'intérieur de ces ouvertures.

Warnung Aus der Port-Öffnung können unsichtbare Strahlen emittieren, wenn kein Glasfaserkabel angeschlossen ist. Vermeiden Sie es, sich den Strahlungen auszusetzen, und starren Sie nicht in die Öffnungen!

Avvertenza Quando i cavi in fibra non sono inseriti, radiazioni invisibili possono essere emesse attraverso l'apertura della porta. Evitate di esporvi alle radiazioni e non guardate direttamente nelle aperture.

Advarsel Unngå utsettelse for stråling, og stirr ikke inn i åpninger som er åpne, fordi usynlig stråling kan emiteres fra portens åpning når det ikke er tilkoblet en fiberkabel.

Aviso Dada a possibilidade de emissão de radiação invisível através do orifício da via de acesso, quando esta não tiver nenhum cabo de fibra conectado, deverá evitar an

EXposição à radiação e não deverá olhar fixamente para orifícios que se encontrarem a descoberto.

¡Atención! Debido a que la apertura del puerto puede emitir radiación invisible cuando no existe un cable de fibra conectado, evite mirar directamente a las aperturas para no exponerse a la radiación.

Varning! Osynlig strålning kan avges från en portöppning utan ansluten fiberkabel och du bör därför undvika att bli utsatt för strålning genom att inte stirra in i oskyddade öppningar.

Maintenance and Operational Safety Guidelines and Warnings

IN THIS SECTION

While performing the maintenance activities for devices, observe the following guidelines and warnings:

Battery Handling Warning

WARNING: Replacing a battery incorrectly might result in an explosion. Replace a battery only with the same or equivalent type recommended by the manufacturer. Dispose of used batteries according to the manufacturer's instructions.

Waarschuwing Er is ontploffingsgevaar als de batterij verkeerd vervangen wordt. Vervang de batterij slechts met hetzelfde of een equivalent type dat door de fabrikant aanbevolen is. Gebruikte batterijen dienen overeenkomstig fabrieksvoorschriften weggeworpen te worden.

Varoitus Räjähdyksen vaara, jos akku on vaihdettu väärään akkuun. Käytä vaihtamiseen ainoastaan saman- tai vastaavantyyppistä akkua, joka on valmistajan suosittelema. Hävitä käytetyt akut valmistajan ohjeiden mukaan.

Avertissement Danger d'explosion si la pile n'est pas remplacée correctement. Ne la remplacer que par une pile de type semblable ou équivalent, recommandée par le fabricant. Jeter les piles usagées conformément aux instructions du fabricant.

Warnung Bei Einsetzen einer falschen Batterie besteht Explosionsgefahr. Ersetzen Sie die Batterie nur durch den gleichen oder vom Hersteller empfohlenen Batterietyp. Entsorgen Sie die benutzten Batterien nach den Anweisungen des Herstellers.

Advarsel Det kan være fare for eksplosjon hvis batteriet skiftes på feil måte. Skift kun med samme eller tilsvarende type som er anbefalt av produsenten. Kasser brukte batterier i henhold til produsentens instruksjoner.

Avvertenza Pericolo di esplosione se la batteria non è installata correttamente. Sostituire solo con una di tipo uguale o equivalente, consigliata dal produttore. Eliminare le batterie usate secondo le istruzioni del produttore.

Aviso Existe perigo de explosão se a bateria for substituída incorrectamente. Substitua a bateria por uma bateria igual ou de um tipo equivalente recomendado pelo fabricante. Destrua as baterias usadas conforme as instruções do fabricante.

¡Atención! Existe peligro de explosión si la batería se reemplaza de manera incorrecta. Reemplazar la baterían EXclusivamente con el mismo tipo o el equivalente recomendado por el fabricante. Desechar las baterías gastadas según las instrucciones del fabricante.

Varning! Explosionsfara vid felaktigt batteribyte. Ersätt endast batteriet med samma batterityp som rekommenderas av tillverkaren eller motsvarande. Följ tillverkarens anvisningar vid kassering av använda batterier.

Jewelry Removal Warning

WARNING: Before working on equipment that is connected to power lines, remove jewelry, including rings, necklaces, and watches. Metal objects heat up when connected to power and ground and can cause serious burns or can be welded to the terminals.

Waarschuwing Alvorens aan apparatuur te werken die met elektrische leidingen is verbonden, sieraden (inclusief ringen, kettingen en horloges) verwijderen. Metalen voorwerpen worden warm wanneer ze met stroom en aarde zijn verbonden, en kunnen ernstige brandwonden veroorzaken of het metalen voorwerp aan de aansluitklemmen lassen.

Varoitus Ennen kuin työskentelet voimavirtajohtoihin kytkettyjen laitteiden parissa, ota pois kaikki korut (sormukset, kaulakorut ja kellot mukaan lukien). Metalliesineet kuumenevat, kun ne ovat yhteydessä sähkövirran ja maan kanssa, ja ne voivat aiheuttaa vakavia palovammoja tai hitsata metalliesineet kiinni liitäntänapoihin.

Avertissement Avant d'accéder à cet équipement connecté aux lignes électriques, ôter tout bijou (anneaux, colliers et montres compris). Lorsqu'ils sont branchés à l'alimentation et reliés à la terre, les objets métalliques chauffent, ce qui peut provoquer des blessures graves ou souder l'objet métallique aux bornes.

Warnung Vor der Arbeit an Geräten, die an das Netz angeschlossen sind, jeglichen Schmuck (einschließlich Ringe, Ketten und Uhren) abnehmen. Metallgegenstände erhitzen sich, wenn sie an das Netz und die Erde angeschlossen werden, und können schwere Verbrennungen verursachen oder an die Anschlußklemmen angeschweißt werden.

Avvertenza Prima di intervenire su apparecchiature collegate alle linee di alimentazione, togliersi qualsiasi monile (inclusi anelli, collane, braccialetti ed orologi). Gli oggetti metallici si riscaldano quando sono collegati tra punti di alimentazione e massa: possono causare ustioni gravi oppure il metallo può saldarsi ai terminali.

Advarsel Fjern alle smykker (inkludert ringer, halskjeder og klokker) før du skal arbeide på utstyr som er koblet til kraftledninger. Metallgjenstander som er koblet til kraftledninger og jord blir svært varme og kan forårsake alvorlige brannskader eller smelte fast til polene.

Aviso Antes de trabalhar em equipamento que esteja ligado a linhas de corrente, retire todas as jóias que estiver a usar (incluindo anéis, fios e relógios). Os objectos metálicos aquecerão em contacto com a corrente e em contacto com a ligação à terra, podendo causar queimaduras graves ou ficarem soldados aos terminais.

¡Atención! Antes de operar sobre equipos conectados a líneas de alimentación, quitarse las joyas (incluidos anillos, collares y relojes). Los objetos de metal se calientan cuando se conectan a la alimentación y a tierra, lo que puede ocasionar quemaduras graves o que los objetos metálicos queden soldados a los bornes.

Varning! Tag av alla smycken (inklusive ringar, halsband och armbandsur) innan du arbetar på utrustning som är kopplad till kraftledningar. Metallobjekt hettas upp när de kopplas ihop med ström och jord och kan förorsaka allvarliga brännskador; metallobjekt kan också sammansvetsas med kontakterna.

Lightning Activity Warning

WARNING: Do not work on the system or connect or disconnect cables during periods of lightning activity.

Waarschuwing Tijdens onweer dat gepaard gaat met bliksem, dient u niet aan het systeem te werken of kabels aan te sluiten of te ontkoppelen.

Varoitus Älä työskentele järjestelmän parissa äläkä yhdistä tai irrota kaapeleita ukkosilmalla.

Avertissement Ne pas travailler sur le système ni brancher ou débrancher les câbles pendant un orage.

Warnung Arbeiten Sie nicht am System und schließen Sie keine Kabel an bzw. trennen Sie keine ab, wenn es gewittert.

Avvertenza Non lavorare sul sistema o collegare oppure scollegare i cavi durante un temporale con fulmini.

Advarsel Utfør aldri arbeid på systemet, eller koble kabler til eller fra systemet når det tordner eller lyner.

Aviso Não trabalhe no sistema ou ligue e desligue cabos durante períodos de mau tempo (trovoada).

¡Atención! No operar el sistema ni conectar o desconectar cables durante el transcurso de descargas eléctricas en la atmósfera.

Varning! Vid åska skall du aldrig utföra arbete på systemet eller ansluta eller koppla loss kablar.

Operating Temperature Warning

WARNING: To prevent the device from overheating, do not operate it in an area that exceeds the maximum recommended ambient temperature. To prevent airflow restriction, allow at least 6 in. (15.2 cm) of clearance around the ventilation openings.

Waarschuwing Om te voorkomen dat welke switch van de Juniper Networks router dan ook oververhit raakt, dient u deze niet te bedienen op een plaats waar de maximale aanbevolen omgevingstemperatuur van 40° C wordt overschreden. Om te voorkomen dat de luchtstroom wordt beperkt, dient er minstens 15,2 cm speling rond de ventilatie-openingen te zijn.

Varoitus Ettei Juniper Networks switch-sarjan reititin ylikuumentuisi, sitä ei saa käyttää tilassa, jonka lämpötila ylittää korkeimman suositellun ympäristölämpötilan 40° C. Ettei ilmanvaihto estyisi, tuuletusaukkojen ympärille on jätettävä ainakin 15,2 cm tilaa.

Avertissement Pour éviter toute surchauffe des routeurs de la gamme Juniper Networks switch, ne l'utilisez pas dans une zone où la température ambiante est supérieure à 40° C. Pour permettre un flot d'air constant, dégagez un espace d'au moins 15,2 cm autour des ouvertures de ventilations.

Warnung Um einen Router der switch vor Überhitzung zu schützen, darf dieser nicht in einer Gegend betrieben werden, in der die Umgebungstemperatur das empfohlene Maximum von 40° C überschreitet. Um Lüftungsverschluß zu verhindern, achten Sie darauf, daß mindestens 15,2 cm lichter Raum um die Lüftungsöffnungen herum frei bleibt.

Avvertenza Per evitare il surriscaldamento dei switch, non adoperateli in un locale che ecceda la temperatura ambientale massima di 40° C. Per evitare che la circolazione dell'aria sia impedita, lasciate uno spazio di almeno 15.2 cm di fronte alle aperture delle ventole.

Advarsel Unngå overoppheting av eventuelle rutere i Juniper Networks switch Disse skal ikke brukes på steder der den anbefalte maksimale omgivelsestemperaturen overstiger 40° C (104° F). Sørg for at klaringen rundt lufteåpningene er minst 15,2 cm (6 tommer) for å forhindre nedsatt luftsirkulasjon.

Aviso Para evitar o sobreaquecimento do encaminhador Juniper Networks switch, não utilize este equipamento numa área que exceda a temperatura máxima recomendada de 40° C. Para evitar a restrição à circulação de ar, deixe pelo menos um espaço de 15,2 cm à volta das aberturas de ventilação.

¡Atención! Para impedir que un encaminador de la serie Juniper Networks switch se recaliente, no lo haga funcionar en un área en la que se supere la temperatura ambiente máxima recomendada de 40° C. Para impedir la restricción de la entrada de aire, deje un espacio mínimo de 15,2 cm alrededor de las aperturas para ventilación.

Varning! Förhindra att en Juniper Networks switch överhettas genom att inte använda den i ett område där den maximalt rekommenderade omgivningstemperaturen på 40° C överskrids. Förhindra att luftcirkulationen inskränks genom att se till att det finns fritt utrymme på minst 15,2 cm omkring ventilationsöppningarna.

Product Disposal Warning

WARNING: Disposal of this device must be handled according to all national laws and regulations.

Waarschuwing Dit produkt dient volgens alle landelijke wetten en voorschriften te worden afgedankt.

Varoitus Tämän tuotteen lopullisesta hävittämisestä tulee huolehtia kaikkia valtakunnallisia lakeja ja säännöksiä noudattaen.

Avertissement La mise au rebut définitive de ce produit doit être effectuée conformément à toutes les lois et réglementations en vigueur.

Warnung Dieses Produkt muß den geltenden Gesetzen und Vorschriften entsprechend entsorgt werden.

Avvertenza L'eliminazione finale di questo prodotto deve essere eseguita osservando le normative italiane vigenti in materia

Advarsel Endelig disponering av dette produktet må skje i henhold til nasjonale lover og forskrifter.

Aviso A descartagem final deste produto deverá ser efectuada de acordo com os regulamentos e a legislação nacional.

¡Atención! El desecho final de este producto debe realizarse según todas las leyes y regulaciones nacionales

Varning! Slutlig kassering av denna produkt bör skötas i enlighet med landets alla lagar och föreskrifter.

General Electrical Safety Guidelines and Warnings

WARNING: Certain ports on the device are designed for use as intrabuilding (within-the-building) interfaces only (Type 2 or Type 4 ports as described in *GR-1089-CORE*) and require isolation from the exposed outside plant (OSP) cabling. To comply with NEBS (Network Equipment-Building System) requirements and protect against lightning surges and commercial power disturbances, the intrabuilding ports *must not* be metallically connected to interfaces that connect to the OSP or its wiring. The intrabuilding ports on the device are suitable for connection to intrabuilding or unexposed wiring or cabling only. The addition of primary protectors is not sufficient protection for connecting these interfaces metallically to OSP wiring.

Avertissement Certains ports de l'appareil sont destinés à un usage en intérieur uniquement (ports Type 2 ou Type 4 tels que décrits dans le document *GR-1089-CORE*) et doivent être isolés du câblage de l'installation extérieure exposée. Pour respecter les exigences NEBS et assurer une protection contre la foudre et les perturbations de tension secteur, les ports pour intérieur *ne doivent pas* être raccordés physiquement aux interfaces prévues pour la connexion à l'installation extérieure ou à son câblage. Les ports pour intérieur de l'appareil sont réservés au raccordement de câbles pour intérieur ou non exposés uniquement. L'ajout de protections ne constitue pas une précaution suffisante pour raccorder physiquement ces interfaces au câblage de l'installation extérieure.

CAUTION: Before removing or installing components of a device, connect an electrostatic discharge (ESD) grounding strap to an ESD point and wrap and fasten the other end of the strap around your bare wrist. Failure to use an ESD grounding strap could result in damage to the device.

Attention Avant de retirer ou d'installer des composants d'un appareil, raccordez un bracelet antistatique à un point de décharge électrostatique et fixez le bracelet à votre poignet nu. L'absence de port d'un bracelet antistatique pourrait provoquer des dégâts sur l'appareil.

- Install the device in compliance with the following local, national, and international electrical codes:
  - United States—National Fire Protection Association (NFPA 70), United States National Electrical Code.
  - Other countries—International Electromechanical Commission (IEC) 60364, Part 1 through Part 7.
  - Evaluated to the TN power system.

  - Canada—Canadian Electrical Code, Part 1, CSA C22.1.
  - Suitable for installation in Information Technology Rooms in accordance with Article 645 of the National Electrical Code and NFPA 75.

    Peut être installé dans des salles de matériel de traitement de l'information conformément à l'article 645 du National Electrical Code et à la NFPA 75.

- Locate the emergency power-off switch for the room in which you are working so that if an electrical accident occurs, you can quickly turn off the power.
- Make sure that you clean grounding surface and give them a bright finish before making grounding connections.
- Do not work alone if potentially hazardous conditions exist anywhere in your workspace.
- Never assume that power is disconnected from a circuit. Always check the circuit before starting to work.
- Carefully look for possible hazards in your work area, such as moist floors, ungrounded power extension cords, and missing safety grounds.
- Operate the device within marked electrical ratings and product usage instructions.
- To ensure that the device and peripheral equipment function safely and correctly, use the cables and connectors specified for the attached peripheral equipment, and make certain they are in good condition.

You can remove and replace many device components without powering off or disconnecting power to the device, as detailed elsewhere in the hardware documentation for this device. Never install equipment that appears to be damaged.

Action to Take After an Electrical Accident

If an electrical accident results in an injury, take the following actions in this order:

1. Use caution. Be aware of potentially hazardous conditions that could cause further injury.
2. Disconnect power from the device.
3. If possible, send another person to get medical aid. Otherwise, assess the condition of the victim, and then call for help.

Prevention of Electrostatic Discharge Damage

Device components that are shipped in antistatic bags are sensitive to damage from static electricity. Some components can be impaired by voltages as low as 30 V. You can easily generate potentially damaging static voltages whenever you handle plastic or foam packing material or if you move components across plastic or carpets. Observe the following guidelines to minimize the potential for electrostatic discharge (ESD) damage, which can cause intermittent or complete component failures:

- Always use an ESD wrist strap when you are handling components that are subject to ESD damage, and make sure that it is in direct contact with your skin.

  If a grounding strap is not available, hold the component in its antistatic bag (see Figure 56 on page 191) in one hand and touch the exposed, bare metal of the device with the other hand immediately before inserting the component into the device.

  WARNING: For safety, periodically check the resistance value of the ESD grounding strap. The measurement must be in the range 1 through 10 Mohms.

  Avertissement Par mesure de sécurité, vérifiez régulièrement la résistance du bracelet antistatique. Cette valeur doit être comprise entre 1 et 10 mégohms (Mohms).

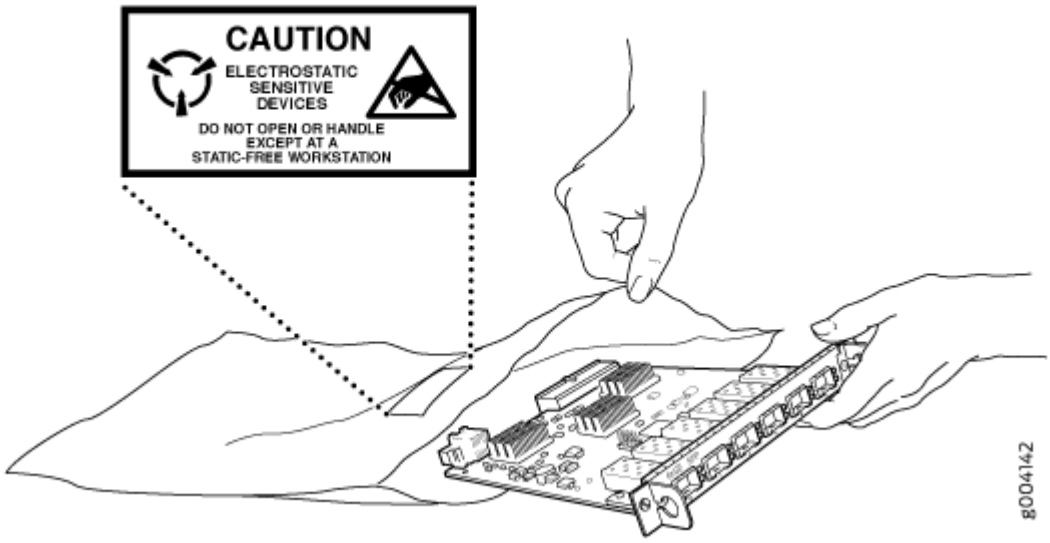
- When handling any component that is subject to ESD damage and that is removed from the device, make sure the equipment end of your ESD wrist strap is attached to the ESD point on the chassis.

  If no grounding strap is available, touch the exposed, bare metal of the device to ground yourself before handling the component.

- Avoid contact between the component that is subject to ESD damage and your clothing. ESD voltages emitted from clothing can damage components.

- When removing or installing a component that is subject to ESD damage, always place it component-side up on an antistatic surface, in an antistatic card rack, or in an antistatic bag (see Figure 56 on page 191). If you are returning a component, place it in an antistatic bag before packing it.

Figure 56: Placing a Component into an Antistatic Bag



CAUTION: ANSI/TIA/EIA-568 cables such as Category 5e and Category 6 can get electrostatically charged. To dissipate this charge, always ground the cables to a suitable and safe earth ground before connecting them to the system.

Attention Les câbles ANSI/TIA/EIA-568, par exemple Cat 5e et Cat 6, peuvent emmagasiner des charges électrostatiques. Pour évacuer ces charges, reliez toujours les câbles à une prise de terre adaptée avant de les raccorder au système.

AC Power Electrical Safety Guidelines

The following electrical safety guidelines apply to AC-powered devices:

- Note the following warnings printed on the device:

  "**CAUTION:** THIS UNIT HAS MORE THAN ONE POWER SUPPLY CORD. DISCONNECT ALL POWER SUPPLY CORDS BEFORE SERVICING TO AVOID ELECTRIC SHOCK."

  "**ATTENTION:** CET APPAREIL COMPORTE PLUS D'UN CORDON D'ALIMENTATION. AFIN DE PRÉVENIR LES CHOCS ÉLECTRIQUES, DÉBRANCHER TOUT CORDON D'ALIMENTATION AVANT DE FAIRE LE DÉPANNAGE."

- AC-powered devices are shipped with a three-wire electrical cord with a grounding-type plug that fits only a grounding-type power outlet. Do not circumvent this safety feature. Equipment grounding must comply with local and national electrical codes.
- You must provide an external certified circuit breaker (2-pole circuit breaker or 4-pole circuit breaker based on your device) rated minimum 20 A in the building installation.
- The power cord serves as the main disconnecting device for the AC-powered device. The socket outlet must be near the AC-powered device and be easily accessible.
- For devices that have more than one power supply connection, you must ensure that all power connections are fully disconnected so that power to the device is completely removed to prevent electric shock. To disconnect power, unplug all power cords (one for each power supply).

Power Cable Warning (Japanese)

WARNING: The attached power cable is only for this product. Do not use the cable for another product.

注意

附属の電源コードセットはこの製品専用です。
他の電気機器には使用しないでください。

AC Power Disconnection Warning

WARNING: Before working on the device or near power supplies, unplug all the power cords from an AC-powered device.

Waarschuwing Voordat u aan een frame of in de nabijheid van voedingen werkt, dient u bij wisselstroom toestellen de stekker van het netsnoer uit het stopcontact te halen.

Varoitus Kytke irti vaihtovirtalaitteiden virtajohto, ennen kuin teet mitään asennuspohjalle tai työskentelet virtalähteiden läheisyydessä.

Avertissement Avant de travailler sur un châssis ou à proximité d'une alimentation électrique, débrancher le cordon d'alimentation des unités en courant alternatif.

Warnung Bevor Sie an einem Chassis oder in der Nähe von Netzgeräten arbeiten, ziehen Sie bei Wechselstromeinheiten das Netzkabel ab bzw.

Avvertenza Prima di lavorare su un telaio o intorno ad alimentatori, scollegare il cavo di alimentazione sulle unità CA.

Advarsel Før det utføres arbeid på kabinettet eller det arbeides i nærheten av strømforsyningsenheter, skal strømledningen trekkes ut på vekselstrømsenheter.

Aviso Antes de trabalhar num chassis, ou antes de trabalhar perto de unidades de fornecimento de energia, desligue o cabo de alimentação nas unidades de corrente alternada.

¡Atención! Antes de manipular el chasis de un equipo o trabajar cerca de una fuente de alimentación, desenchufar el cable de alimentación en los equipos de corriente alterna (CA).

Varning! Innan du arbetar med ett chassi eller nära strömförsörjningsenheter skall du för växelströmsenheter dra ur nätsladden.

DC Power Electrical Safety Guidelines

- A DC-powered device is equipped with a DC terminal block that is rated for the power requirements of a maximally configured device.
- For permanently connected equipment, a readily accessible disconnect device shall be incorporated external to the equipment.
- For pluggable equipment, the socket-outlet shall be installed near the equipment and shall be easily accessible.
- Be sure to connect the ground wire or conduit to a solid central office earth ground.
- A closed loop ring is recommended for terminating the ground conductor at the ground stud.
- Run two wires from the circuit breaker box to a source of 48 VDC.
- A DC-powered device that is equipped with a DC terminal block is intended only for installation in a restricted-access location. In the United States, a restricted-access area is one in accordance with Articles 110-16, 110-17, and 110-18 of the National Electrical Code ANSI/NFPA 70.

NOTE: Primary overcurrent protection is provided by the building circuit breaker. This breaker must protect against excess currents, short circuits, and earth grounding faults in accordance with NEC ANSI/NFPA 70.

- Ensure that the polarity of the DC input wiring is correct. Under certain conditions, connections with reversed polarity might trip the primary circuit breaker or damage the equipment.
- The marked input voltage of –48 VDC for a DC-powered device is the nominal voltage associated with the battery circuit, and any higher voltages are only to be associated with float voltages for the charging function.
- Because the device is a positive ground system, you must connect the positive lead to the terminal labeled **RTN**, the negative lead to the terminal labeled –48 VDC, and the earth ground to the device grounding points.

DC Power Copper Conductors Warning

WARNING: Use copper conductors only.
Waarschuwing Gebruik alleen koperen geleiders.

Varoitus Käytä vain kuparijohtimia.

Attention Utilisez uniquement des conducteurs en cuivre.

Warnung Verwenden Sie ausschließlich Kupferleiter.

Avvertenza Usate unicamente dei conduttori di rame.

Advarsel Bruk bare kobberledninger.

Aviso Utilize apenas fios condutores de cobre.

¡Atención! Emplee sólo conductores de cobre.

Varning! Använd endast ledare av koppar.

DC Power Disconnection Warning

WARNING: Before performing any of the DC power procedures, ensure that power is removed from the DC circuit. To ensure that all power is off, locate the circuit breaker on the panel board that services the DC circuit, switch the circuit breaker to the OFF position, and tape the device handle of the circuit breaker in the OFF position.

Waarschuwing Voordat u een van de onderstaande procedures uitvoert, dient u te controleren of de stroom naar het gelijkstroom circuit uitgeschakeld is. Om u ervan te verzekeren dat alle stroom UIT is geschakeld, kiest u op het schakelbord de stroomverbreker die het gelijkstroom circuit bedient, draait de stroomverbreker naar de UIT positie en plakt de schakelaarhendel van de stroomverbreker met plakband in de UIT positie vast.

Varoitus Varmista, että tasavirtapiirissä ei ole virtaa ennen seuraavien toimenpiteiden suorittamista. Varmistaaksesi, että virta on KATKAISTU täysin, paikanna tasavirrasta huolehtivassa kojetaulussa sijaitseva suojakytkin, käännä suojakytkin KATKAISTU-asentoon ja teippaa suojakytkimen varsi niin, että se pysyy KATKAISTU-asennossa.

Avertissement Avant de pratiquer l'une quelconque des procédures ci-dessous, vérifier que le circuit en courant continu n'est plus sous tension. Pour en être sûr, localiser le disjoncteur situé sur le panneau de service du circuit en courant continu, placer le disjoncteur en position fermée (OFF) et, à l'aide d'un ruban adhésif, bloquer la poignée du disjoncteur en position OFF.

Warnung Vor Ausführung der folgenden Vorgänge ist sicherzustellen, daß die Gleichstromschaltung keinen Strom erhält. Um sicherzustellen, daß sämtlicher Strom abgestellt ist, machen Sie auf der Schalttafel den Unterbrecher für die Gleichstromschaltung ausfindig, stellen Sie den Unterbrecher auf AUS, und kleben Sie den Schaltergriff des Unterbrechers mit Klebeband in der AUS-Stellung fest.

Avvertenza Prima di svolgere una qualsiasi delle procedure seguenti, verificare che il circuito CC non sia alimentato. Per verificare che tutta l'alimentazione sia scollegata (OFF), individuare l'interruttore automatico sul quadro strumenti che alimenta il circuito CC, mettere l'interruttore in posizione OFF e fissarlo con nastro adesivo in tale posizione.

Advarsel Før noen av disse prosedyrene utføres, kontroller at strømmen er frakoblet likestrømkretsen. Sørg for at all strøm er slått AV. Dette gjøres ved å lokalisere strømbryteren på brytertavlen som betjener likestrømkretsen, slå strømbryteren AV og teipe bryterhåndtaket på strømbryteren i AV-stilling.

Aviso Antes de executar um dos seguintes procedimentos, certifique-se que desligou a fonte de alimentação de energia do circuito de corrente contínua. Para se assegurar que toda a corrente foi DESLIGADA, localize o disjuntor no painel que serve o circuito de corrente contínua e coloque-o na posição OFF (Desligado), segurando nessa posição a manivela do interruptor do disjuntor com fita isoladora.

¡Atención! Antes de proceder con los siguientes pasos, comprobar que la alimentación del circuito de corriente continua (CC) esté cortada (OFF). Para asegurarse de que toda la alimentación esté cortada (OFF), localizar el interruptor automático en el panel que alimenta al circuito de corriente continua, cambiar el interruptor automático a la posición de Apagado (OFF), y sujetar con cinta la palanca del interruptor automático en posición de Apagado (OFF).

Varning! Innan du utför någon av följande procedurer måste du kontrollera att strömförsörjningen till likströmskretsen är bruten. Kontrollera att all strömförsörjning är BRUTEN genom att slå AV det överspänningsskydd som skyddar likströmskretsen och tejpa fast överspänningsskyddets omkopplare i FRÅN-läget.

DC Power Grounding Requirements and Warning

An insulated grounding conductor that is identical in size to the grounded and ungrounded branch circuit supply conductors but is identifiable by green and yellow stripes is installed as part of the branch circuit that supplies the device. The grounding conductor is a separately derived system at the supply transformer or motor generator set.

WARNING: When you install the device, the ground connection must always be made first and disconnected last.

Waarschuwing Bij de installatie van het toestel moet de aardverbinding altijd het eerste worden gemaakt en het laatste worden losgemaakt.

Varoitus Laitetta asennettaessa on maahan yhdistäminen aina tehtävä ensiksi ja maadoituksen irti kytkeminen viimeiseksi.

Avertissement Lors de l'installation de l'appareil, la mise à la terre doit toujours être connectée en premier et déconnectée en dernier.

Warnung Der Erdanschluß muß bei der Installation der Einheit immer zuerst hergestellt und zuletzt abgetrennt werden.

Avvertenza In fase di installazione dell'unità, eseguire sempre per primo il collegamento a massa e disconnetterlo per ultimo.

Advarsel Når enheten installeres, må jordledningen alltid tilkobles først og frakobles sist.

Aviso Ao instalar a unidade, a ligação à terra deverá ser sempre a primeira a ser ligada, e a última a ser desligada.

¡Atención! Al instalar el equipo, conectar la tierra la primera y desconectarla la última.

Varning! Vid installation av enheten måste jordledningen alltid anslutas först och kopplas bort sist.

DC Power Wiring Sequence Warning

WARNING: Wire the DC power supply using the appropriate lugs. When connecting power, the proper wiring sequence is ground to ground, +RTN to +RTN, then –48 V to –48 V. When disconnecting power, the proper wiring sequence is –48 V to –48 V, +RTN to +RTN, then ground to ground. Note that the ground wire must always be connected first and disconnected last.

Waarschuwing De juiste bedradingsvolgorde verbonden is aarde naar aarde, +RTN naar +RTN, en –48 V naar – 48 V. De juiste bedradingsvolgorde losgemaakt is en –48 naar –48 V, +RTN naar +RTN, aarde naar aarde.

Varoitus Oikea yhdistettava kytkentajarjestys on maajohto maajohtoon, +RTN varten +RTN, –48 V varten – 48 V. Oikea irrotettava kytkentajarjestys on –48 V varten – 48 V, +RTN varten +RTN, maajohto maajohtoon.

Avertissement Câblez l'approvisionnement d'alimentation CC En utilisant les crochets appropriés à l'extrémité de câblage. En reliant la puissance, l'ordre approprié de câblage est rectifié pour rectifier, +RTN à +RTN, puis –48 V à –48 V. En débranchant la puissance, l'ordre approprié de câblage est –48 V à –48 V, +RTN à +RTN, a alors rectifié pour rectifier. Notez que le fil de masse devrait toujours être relié d'abord et débranché pour la dernière fois. Notez que le fil de masse devrait toujours être relié d'abord et débranché pour la dernière fois.

Warnung Die Stromzufuhr ist nur mit geeigneten Ringösen an das DC Netzteil anzuschliessen. Die richtige Anschlusssequenz ist: Erdanschluss zu Erdanschluss, +RTN zu +RTN und dann -48V zu -48V. Die richtige Sequenz zum Abtrennen der

Stromversorgung ist -48V zu -48V, +RTN zu +RTN und dann Erdanschluss zu Erdanschluss. Es ist zu beachten dass der Erdanschluss immer zuerst angeschlossen und als letztes abgetrennt wird.

Avvertenza Mostra la morsettiera dell alimentatore CC. Cablare l'alimentatore CC usando i connettori adatti all'estremità del cablaggio, come illustrato. La corretta sequenza di cablaggio è da massa a massa, da positivo a positivo (da linea ad L) e da negativo a negativo (da neutro a N). Tenere presente che il filo di massa deve sempre venire collegato per primo e scollegato per ultimo.

Advarsel Riktig tilkoples tilkoplingssekvens er jord til jord, +RTN til +RTN, –48 V til –48 V. Riktig frakoples tilkoplingssekvens er –48 V til – 48 V, +RTN til +RTN, jord til jord.

Aviso Ate con alambre la fuente de potencia cc Usando los terminales apropiados en el extremo del cableado. Al conectar potencia, la secuencia apropiada del cableado se muele para moler, +RTN a +RTN, entonces –48 V a –48 V. Al desconectar potencia, la secuencia apropiada del cableado es –48 V a –48 V, +RTN a +RTN, entonces molió para moler. Observe que el alambre de tierra se debe conectar siempre primero y desconectar por último. Observe que el alambre de tierra se debe conectar siempre primero y desconectar por último.

¡Atención! Wire a fonte de alimentação de DC Usando os talões apropriados nan EXtremidade da fiação. Ao conectar a potência, a seqüência apropriada da fiação é moída para moer, +RTN a +RTN, então –48 V a –48 V. Ao desconectar a potência, a seqüência apropriada da fiação é –48 V a –48 V, +RTN a +RTN, moeu então para moer. Anote que o fio à terra deve sempre ser conectado primeiramente e desconectado por último. Anote que o fio à terra deve sempre ser conectado primeiramente e desconectado por último.

Varning! Korrekt kopplingssekvens ar jord till jord, +RTN till +RTN, –48 V till –48 V. Korrekt kopplas kopplingssekvens ar –48 V till –48 V, +RTN till +RTN, jord till jord.

DC Power Wiring Terminations Warning

WARNING: When stranded wiring is required, use approved wiring terminations, such as closed-loop or spade-type with upturned lugs. These terminations must be the appropriate size for the wires and must clamp both the insulation and conductor.

Waarschuwing Wanneer geslagen bedrading vereist is, dient u bedrading te gebruiken die voorzien is van goedgekeurde aansluitingspunten, zoals het gesloten-lus type of het grijperschop type waarbij de aansluitpunten omhoog wijzen. Deze aansluitpunten dienen de juiste maat voor de draden te hebben en dienen zowel de isolatie als de geleider vast te klemmen.

Varoitus Jos säikeellinen johdin on tarpeen, käytä hyväksyttyä johdinliitäntää, esimerkiksi suljettua silmukkaa tai kourumaista liitäntää, jossa on ylöspäin käännetyt kiinnityskorvat. Tällaisten liitäntöjen tulee olla kooltaan johtimiin sopivia ja niiden tulee puristaa yhteen sekä eristeen että johdinosan.

Avertissement Quand des fils torsadés sont nécessaires, utiliser des douilles terminales homologuées telles que celles à circuit fermé ou du type à plage ouverte avec cosses rebroussées. Ces douilles terminales doivent être de la taille qui convient aux fils et doivent être refermées sur la gaine isolante et sur le conducteur.

Warnung Wenn Litzenverdrahtung erforderlich ist, sind zugelassene Verdrahtungsabschlüsse, z.B. für einen geschlossenen Regelkreis oder gabelförmig, mit nach oben gerichteten Kabelschuhen zu verwenden. Diese Abschlüsse sollten die angemessene Größe für die Drähte haben und sowohl die Isolierung als auch den Leiter festklemmen.

Avvertenza Quando occorre usare trecce, usare connettori omologati, come quelli a occhiello o a forcella con linguette rivolte verso l'alto. I connettori devono avere la misura adatta per il cablaggio e devono serrare sia l'isolante che il conduttore.

Advarsel Hvis det er nødvendig med flertrådede ledninger, brukes godkjente ledningsavslutninger, som for eksempel lukket sløyfe eller spadetype med oppoverbøyde kabelsko. Disse avslutningene skal ha riktig størrelse i forhold til ledningene, og skal klemme sammen både isolasjonen og lederen.

Aviso Quando forem requeridas montagens de instalação eléctrica de cabo torcido, use terminações de cabo aprovadas, tais como, terminações de cabo em circuito fechado e planas com terminais de orelha voltados para cima. Estas terminações de cabo deverão ser do tamanho apropriado para os respectivos cabos, e deverão prender simultaneamente o isolamento e o fio condutor.

¡Atención! Cuando se necesite hilo trenzado, utilizar terminales para cables homologados, tales como las de tipo "bucle cerrado" o "espada", con las lengüetas de conexión vueltas hacia arriba. Estos terminales deberán ser del tamaño apropiado para los cables que se utilicen, y tendrán que sujetar tanto el aislante como el conductor.

Varning! När flertrådiga ledningar krävs måste godkända ledningskontakter användas, t.ex. kabelsko av sluten eller öppen typ med uppåtvänd tapp. Storleken på dessa kontakter måste vara avpassad till ledningarna och måste kunna hålla både isoleringen och ledaren fastklämda.

Multiple Power Supplies Disconnection Warning

WARNING: The network device has more than one power supply connection. All connections must be removed completely to remove power from the unit completely.

Waarschuwing Deze eenheid heeft meer dan één stroomtoevoerverbinding; alle verbindingen moeten volledig worden verwijderd om de stroom van deze eenheid volledig te verwijderen.

Varoitus Tässä laitteessa on useampia virtalähdekytkentöjä. Kaikki kytkennät on irrotettava kokonaan, jotta virta poistettaisiin täysin laitteesta.

Avertissement Cette unité est équipée de plusieurs raccordements d'alimentation. Pour supprimer tout courant électrique de l'unité, tous les cordons d'alimentation doivent être débranchés.

Warnung Diese Einheit verfügt über mehr als einen Stromanschluß; um Strom gänzlich von der Einheit fernzuhalten, müssen alle Stromzufuhren abgetrennt sein.

Avvertenza Questa unità ha più di una connessione per alimentatore elettrico; tutte le connessioni devono essere completamente rimosse per togliere l'elettricità dall'unità.

Advarsel Denne enheten har mer enn én strømtilkobling. Alle tilkoblinger må kobles helt fra for å eliminere strøm fra enheten.

Aviso Este dispositivo possui mais do que uma conexão de fonte de alimentação de energia; para poder remover a fonte de alimentação de energia, deverão ser desconectadas todas as conexões existentes.

¡Atención! Esta unidad tiene más de una conexión de suministros de alimentación; para eliminar la alimentación por completo, deben desconectarse completamente todas las conexiones.

Varning! Denna enhet har mer än en strömförsörjningsanslutning; alla anslutningar måste vara helt avlägsnade innan strömtillförseln till enheten är fullständigt bruten.

TN Power Warning

WARNING: The device is designed to work with a TN power system.

Waarschuwing Het apparaat is ontworpen om te functioneren met TN energiesystemen.

Varoitus Koje on suunniteltu toimimaan TN-sähkövoimajärjestelmien yhteydessä.

Avertissement Ce dispositif a été conçu pour fonctionner avec des systèmes d'alimentation TN.

Warnung Das Gerät ist für die Verwendung mit TN-Stromsystemen ausgelegt.

Avvertenza Il dispositivo è stato progettato per l'uso con sistemi di alimentazione TN.

Advarsel Utstyret er utfomet til bruk med TN-strømsystemer.

Aviso O dispositivo foi criado para operar com sistemas de corrente TN.

¡Atención! El equipo está diseñado para trabajar con sistemas de alimentación tipo TN.

Varning! Enheten är konstruerad för användning tillsammans med elkraftssystem av TN-typ.

Agency Approvals and Compliance Statements for the QFX10002

IN THIS SECTION

The following topics describe the agency approvals and compliance information for the QFX10002:

Agency Approvals for the QFX Series

IN THIS SECTION

The QFX Series complies with the following standards:

- Safety
  - CAN/CSA-C22.2 No. 60950-1 Safety of Information Technology Equipment
  - UL 62368-1 Audio/Video, Information and Communication Technology Equipment- Safety
  - IEC 62368-1: 2014 Audio/Video, Information and Communication Technology Equipment–Safety
  - IEC 60950-1: 2005/A2:2013 Information Technology Equipment -Safety (All country deviations): CB Scheme
  - EN 60825-1 Safety of Laser Products - Part 1: Equipment Classification, Requirements and User's Guide
- Electromagnetic Compatibility (EMC)
  - EN 300 386 V1.6.1 (2012) Telecom Network Equipment–EMC requirements
  - EN 55024: 1998/A1:2001/A2:2003 Information Technology Equipment Immunity Characteristics
  - TEC/SD/DD/EMC-221—India EMC standard
  - EN 301 489-1 V1.92 (2011-09)–EMC and Radio spectrum Matters
  - EN 55024
  - CISPR 24
  - BSMI, Class A
  - CNS 13438
- Electromagnetic Interference (EMI)
  - FCC 47 CFR Part 15, Class A (2009) USA Radiated Emissions
  - EN 55022 Class A (2010) European Radiated Emissions

- VCCI Class A:(2010) Japanese Emissions
- BSMI CNS 13438 and NCC C6357 Class A Taiwan Radiated Emissions
- AS/NZS CISPR 22:2009: Class A, Australian/New Zealand Radiated Emissions

- Immunity
  - EN 55024: 1998/A1:2001/A2:2003 Information Technology Equipment Immunity Characteristics
  - EN-61000-3-2 (2006) Power Line Harmonics
  - EN-61000-3-3 (2013) Power Line Voltage Fluctuations
  - EN-61000-4-2 (2009) Electrostatic Discharge
  - EN-61000-4-3 (2007) Radiated Immunity
  - EN-61000-4-4 (2012) Electrical Fast Transients
  - EN-61000-4-5 (2006) Surge
  - EN-61000-4-6 (2009) Immunity to Conducted Disturbances
  - EN-61000-4-11 (2004) Voltage Dips and Sags

Compliance Statement for Argentina

EQUIPO DE USO IDÓNEO.

Compliance Statements for EMC Requirements for the QFX Series

IN THIS SECTION

Nonregulatory Environmental Standards | 206

This topic describes the EMC requirements for the QFX Series.

Canada

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.

The Industry Canada label identifies certified equipment. This certification means that the equipment meets certain telecommunications network protective, operational, and safety requirements. Industry Canada does not guarantee the equipment will operate to the users' satisfaction.

Before installing this equipment, users should ensure that it is permissible to connect the equipment to the facilities of the local telecommunications company. The equipment must also be installed using an acceptable method of connection. In some cases, the inside wiring associated with a single line individual service may be extended by means of a certified connector assembly. The customer should be aware that compliance with the above conditions may not prevent degradation of service in some situations.

Repairs to certified equipment should be made by an authorized Canadian maintenance facility designated by the supplier. Any repairs or alterations made by the user to this equipment, or equipment malfunctions, may give the telecommunications company cause to request the user to disconnect the equipment.

CAUTION: Users should not attempt to make electrical ground connections by themselves, but should contact the appropriate inspection authority or an electrician, as appropriate.

Users should ensure for their own protection that the electrical ground connections of the power utility, telephone lines, and internal metallic water pipe system, if present, are connected together. This precaution may be particularly important in rural areas.

European Community

This is a Class A product. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

Israel

אזהרה

מוצר זה הוא מוצר Class A.
בסביבה ביתית,מוצר זה עלול לגרום הפרעות בתדר רדיו,ובמקרה זה ,המשתמש עשוי להידרש לנקוט אמצעים מתאימים.

Translation from Hebrew–Warning: This product is Class A. In residential environments, the product may cause radio interference, and in such a situation, the user may be required to take adequate measures.

Japan

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

The preceding translates as follows:

This is a Class A product. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

VCCI-A

Korea

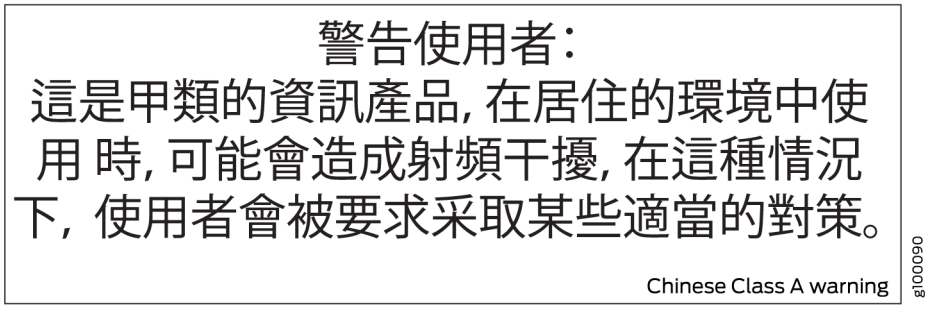
이 기기는 업무용(A급) 전자파적합기기로서 판매자 또는 사용자는 이 점을 주의하시기 바라며, 가정외의 지역에서 사용하는 것을 목적으로 합니다.

Korean Class A Warning g040913

The preceding translates as follows:

This equipment is Industrial (Class A) electromagnetic wave suitability equipment and seller or user should take notice of it, and this equipment is to be used in the places except for home.

Taiwan



The preceding translates as follows:

This is Class A product. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

United States

The QFX Series device has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the 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 communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Nonregulatory Environmental Standards

These QFX Series product SKUs are Network Equipment Building System (NEBS) compliant:

- QFX3008-I
- QFX3600-I
- QFX3600
- QFX3500
- QFX5100
- QFX5110
- QFX5200-32C
- QFX10002-36Q and QFX10002-72Q

- QFX10008
- QFX10016

Those device product SKUs meet the following NEBS compliance standards:

- SR-3580 NEBS Criteria Levels (Level 3 Compliance)
- GR-1089-CORE, Issue 6: EMC and Electrical Safety—Generic Criteria for Network Telecommunications Equipment
  - The equipment is suitable for installation in locations where the National Electrical Code (NEC) applies.
  - The battery return connection is to be treated as an Isolated DC return (DC-I), as defined in GR-1089-CORE.
- GR-63-CORE: NEBS, Physical Protection
  - The equipment is suitable for installation as part of the Common Bonding Network (CBN).
  - The equipment is suitable for installation in a central office (CO).

SEE ALSO

> *Agency Approvals for the QFX Series*

Compliance Statements for Acoustic Noise for the QFX Series

Maschinenlärminformations-Verordnung - 3. GPSGV, der höchste Schalldruckpegel beträgt 70 dB(A) oder weniger gemäss EN ISO 7779

Translation:

The emitted sound pressure is below 70 dB(A) per EN ISO 7779.