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QFX5100 Switch Hardware Guide

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QFX5100 Switch Hardware Guide

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

YEAR 2000 NOTICE

Juniper Networks hardware and software products are Year 2000 compliant. Junos OS has no known time-related limitations through the year 2038. However, the NTP application is known to have some difficulty in the year 2036.

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About This Guide

Use this guide to plan, install, perform initial software configuration, perform routine maintenance, and to troubleshoot QFX5100 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

QFX5100 System Overview

IN THIS SECTION

QFX5100 Device Hardware Overview

IN THIS SECTION

The QFX5100 line of 10/40GbE switches delivers low latency, flexible deployment options, and rich automation features. QFX5100 Switches build a strong underlay foundation for flexible, high-performance, standards-based fabrics and routing that improve network reliability and agility.

QFX5100 Hardware

QFX5100 line of switches offer two compact 1 U models and a 2 U model that provide wire-speed packet performance, very low latency, and rich set of Layer 2 and Layer 3 features. In addition to a high-throughput Packet Forwarding Engine, the performance of the control plane running on all the QFX5100 switches is enhanced by the 1.5 Ghz dual-core Intel CPU with 8 GB of memory and 32 GB of solid-state drive (SSD) storage.

The QFX5100-24Q-AA switch has a 2.5 GHz 4-core Intel CPU with 32 GB of memory and 128 GB of SSD storage.

The QFX5100 line of switches include both 10GE and 40GE fixed-configurations:

- QFX5100-48S

  As shown in Figure 1 on page 3, the QFX5100-48S is a 10-Gigabit Ethernet Enhanced Small Form-Factor Pluggable (SFP+) top-of-rack switch with 48 SFP+ ports and 6 Quad SFP+ (QSFP+) ports. Each SFP+ port can operate as a native 10 Gigabit port, when 10 Gbps optics are used. The SFP+ ports can also run at 1 Gbps, or at 100 Mbps speeds when 1_Gigabit optics are inserted. Each QSFP+ port (**48** through **53**) can operate as uplink ports or four QSFP+ port (**50** through **53**) can operate at native 40-Gigabit speed or as 4 independent 10-Gigabit port speeds. The 6 QSFP+ ports can be used as either access ports or as uplinks. The QFX5100-48S provides full duplex throughput of 1.44 Tbps. The QFX5100-48S has a 1 U form factor and comes standard with redundant fans and redundant power supplies. The switch can be ordered with either ports-to-FRUs or FRUs-to-ports airflow and with AC or DC power supplies.

Figure 1: QFX5100-48S Port Panel

The QFX5100-48S can be used as:

- A standalone switch.
- A Node device in a QFabric system.

  The QFX5100-48S is supported on both the QFX3000-G and QFX3000-M QFabric systems.
- A primary, backup, or line card in a QFX Virtual Chassis.

  A QFX Virtual Chassis allows you to interconnect up to 10 QFX3500, QFX3600, or QFX5100 switches into one logical device and manage the device as a single chassis using a ring topology.
- A line card in a QFX5110 Virtual Chassis.

  A QFX5110 Virtual Chassis must have a QFX5110-32Q as the primary. Only QFX5110 and select models of QFX5100 can participate in a QFX5110 Virtual Chassis.
- A spine or leaf device in a standard QFX5100 Virtual Chassis Fabric (VCF).

  VCF uses Virtual Chassis technology to interconnect multiple devices into a single logical device and manage that device as a single logical device inside of a fabric architecture. VCF architecture

supports up to 20 total devices in a spine and leaf topology. Out of the 20 total devices, you can configure a maximum of 4 spine devices.

A QFX5100 VCF uses QFX5100 devices as spines or leaf devices. You can also use QFX3500, QFX3600, and EX4300 models as leaf devices in a QFX5100 VCF.

Whenever possible, configure the QFX5100-24Q as the spine device in a QFX5100 VCF. You can use the QFX5100-48S as the spine in an all QFX5100-48S VCF or when EX4300 devices are used as leaf devices.

- A leaf device in a QFX5110 VCF.

  A QFX5110 VCF must have a minimum of two QFX5110-32Q as spine devices. Junos OS Release 17.3R1 or later is required for QFX5110 VCF.

- A satellite device in a Junos Fusion system.

  Junos OS Release 14.2.3 or later is required for Junos Fusion.

- QFX5100-48SH

  As shown in Figure 2 on page 4, the QFX5100-48SH is the same form factor and port configuration as the QFX5100-48S. The QFX5100-48SH is specifically designed for Junos Fusion and comes pre-configured with Satellite Network Operational System (SNOS) instead of Juniper Networks Junos OS. The switch may not be converted to Junos OS without an additional license. The switch can be ordered with either ports-to-FRUs or FRUs-to-ports airflow and with AC power supplies.

  The QFX5100-48SH can only be used as a satellite device in a Junos Fusion system.

Figure 2: QFX5100-48SH Port Panel

- QFX5100-48T

  As shown in Figure 3 on page 5, the QFX5100-48T is a tri-speed 100/1000/10GBASE-T top-of-rack switch with 48 10GBASE-T access ports and 6 QSFP+ ports. Each 40-Gigabit QSFP+ port (**48** through **53**) can operate either as uplink ports or four QSFP+ ports (**50** through **53**) can operate at

native 40-Gigabit port or be channelized into 4 independent 10 Gigabit ports. The 6 QSFP+ ports can be used as either access ports or as uplinks. The QFX5100-48T provides full duplex throughput of 720 Gbps. The QFX5100-48T has a 1 U form factor and comes standard with redundant fans and redundant power supplies. The switch can be ordered with either ports-to-FRUs or FRUs-to-ports airflow and with AC or DC power supplies.

Figure 3: QFX5100-48T Port Panel

The QFX5100-48T can be used as:

- A standalone switch.
- A Node device in a QFabric system.

  The QFX5100-48T is supported on both the QFX3000-G and QFX3000-M QFabric systems.
- A primary, backup, or line card in a QFX Virtual Chassis.

  A QFX Series Virtual Chassis allows you to interconnect up to ten QFX5100, QFX3500, or QFX3600, switches into one logical device and manage the device as a single chassis using a ring topology.
- A line card in a QFX5110 Virtual Chassis.

  You can configure up to ten QFX5110 and QFX5100 switches into one logical device and manage the device as a single chassis using a ring topology. In a QFX5110 Virtual Chassis, configure QFX5110-32Q as the primary and backup. Junos OS Release 17.3R2 or later is required on all members for QFX5110 VCF with QFX5100-48T leaf devices.
- A leaf device in a standard QFX5100 Virtual Chassis Fabric (VCF).

  VCF uses Virtual Chassis technology to interconnect multiple devices into a single logical device and manage that device as a single logical device inside of a fabric architecture. VCF architecture supports up to 20 total devices in a spine and leaf topology. Of those 20 devices, four QFX5100 devices can be configured as spine devices.

  In a QFX5100 VCF, the QFX5100-48T is always a leaf device and a QFX5100-24Q is the spine device.

- A leaf device in a QFX5110 VCF.

  A QFX5110 VCF must have a minimum of two QFX5110-32Q as spine devices. Junos OS Release 17.3R2 or later is required on all VCF devices for QFX5100-48T leaf devices to operate in a QFX5110 VCF.

- A satellite device in a Junos Fusion system.

  Junos OS Release 14.2.3 or later is required for Junos Fusion.

- QFX5100-48TH

  As shown in Figure 4 on page 6, the QFX5100-48TH is the same form factor and port configuration as the QFX5100-48T. The QFX5100-48TH is specifically designed for Junos Fusion and comes pre-configured with Satellite Network Operational System (SNOS) instead of Juniper Networks Junos OS. The switch may not be converted to Junos OS without an additional license. The switch can be ordered with either ports-to-FRUs or FRUs-to-ports airflow and with AC power supplies.

  The QFX5100-48TH can only be used as a satellite device in a Junos Fusion system.

Figure 4: QFX5100-48THPort Panel

- QFX5100-24Q

  As shown in Figure 5 on page 7, the QFX5100-24Q is a 40-Gigabit Ethernet QSFP+ switch with 24 high-density QSFP+ ports. Each QSFP+ port can operate as a native 40 Gbps port or as 4 independent 10 Gbps ports. The QFX5100-24Q switch has a 1 U form factor and comes standard with redundant fans and redundant power supplies. The switch can be ordered with either ports-to-FRUs or FRUs-to-ports airflow and with AC or DC power supplies.

  The QFX5100-24Q switch has two module bays for the optional expansion module, QFX-EM-4Q, which can add a total of 8 additional QSFP+ ports to the chassis. When operating as a standalone switch and fully populated with QFX-EM-4Q Expansion Modules, the QFX5100-24Q switch is equivalent to 80 10 Gbps interfaces and 4 40-Gbps interfaces. Of these total ports, 104 logical ports are available for 10G port channelization. For full details on the different port channelization modes,

see "Port Panel of a QFX5100-24Q Device" on page 20. All ports on the QFX5100-24Q and QFX-EM-4Q can be configured as either access ports or as uplinks. The QFX5100-24Q switch provides full duplex throughput of 2.56 Tbps.

Figure 5: QFX5100-24Q Port Panel

The QFX5100-24Q can be used as:

- A standalone switch.
- An interconnect device in a QFX3000-M QFabric system.
- A Node device in a QFabric system.

  The QFX5100-24Q is supported on both the QFX3000-G and QFX3000-M QFabric systems. A QFX5100-24Q Node device is equivalent to 80 10-Gbps interfaces and 4 40-Gbps interfaces.

- A primary, backup, or line card in a QFX Virtual Chassis.

  A QFX Series Virtual Chassis allows you to interconnect up to 10 QFX3500, QFX3600, or QFX5100 switches into one logical device and manage the device as a single chassis in a ring topology.

  Use QFX5100-24Q switches as the primary and backup in a QFX Virtual Chassis.

- A line card in a QFX5110 Virtual Chassis.

  A QFX5110 Virtual Chassis must have a QFX5110-32Q as the primary. Only QFX5110 switches and select models of QFX5100 can participate in a QFX5110 Virtual Chassis. Junos OS Release 17.3R1 or later is required for QFX5110 Virtual Chassis.

- A spine or leaf device in a standard QFX5100 Virtual Chassis Fabric (VCF).

  VCF uses Virtual Chassis technology to interconnect multiple devices into a single logical device and manage that device as a single logical device inside of a fabric architecture. VCF architecture supports up to 20 total devices in a spine and leaf topology. Out of the 20 total devices, you can configure a maximum of 4 spine devices.

A QFX5100 VCF uses QFX5100 devices as spines or leaf devices. You can also use QFX3500, QFX3600, and EX4300 models as leaf devices in a QFX5100 VCF.

Whenever possible, configure the QFX5100-24Q as the spine device in a QFX5100 VCF.

- A leaf device in a QFX5110 VCF.

  A QFX5110 VCF must have a minimum of two QFX5110-32Q as spine devices. Junos OS Release 17.3R1 or later is required for QFX5110 VCF.

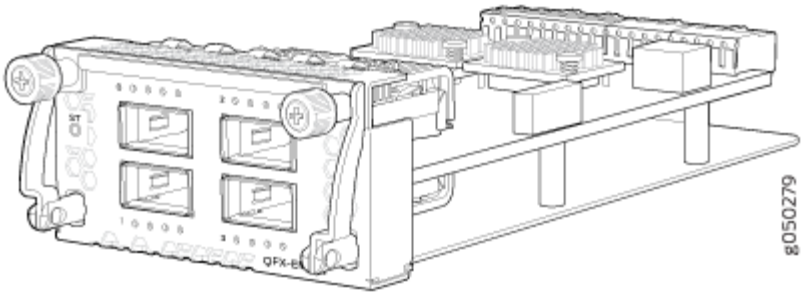
- A satellite device in a Junos Fusion system.

  Junos OS Release 14.2.3 or later is required for Junos Fusion.

The QFX5100-24Q switch has two bays on the port panel for optional expansion modules. The QFX5100-24Q supports two expansion modules to increase port density:

- QFX-EM-4Q, which provides four additional 40-Gigabit Quad SFP+ (QSFP+) ports. See Figure 6 on page 8.

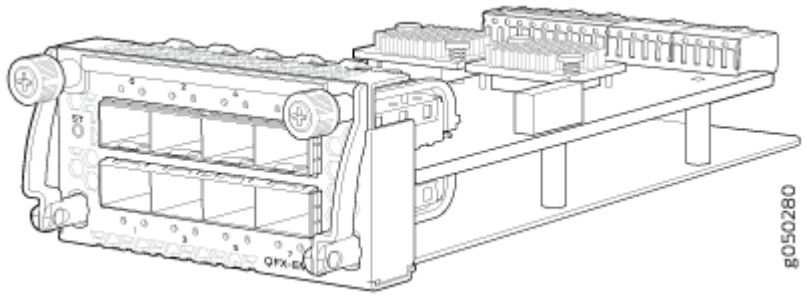
Figure 6: QFX-EM-4Q Expansion Module



- EX4600-EM-8F, which provides eight additional 10-Gigabit Ethernet Enhanced Small Form-Factor Pluggable (SFP+) or four 1-Gigabit Ethernet ports. See Figure 7 on page 9.

> ⚠ **CAUTION**: Use only the top four ports or the bottom four ports for SFP transceivers. Because SFP transceivers are larger than SFP+ transceivers, attempting to stack SFP transceivers can cause internal damage to the module.

Figure 7: EX4600-EM-8F Expansion Module



NOTE: The EX4600-EM-8F is not supported on the QFX5100-24Q running in QFabric systems.

The QFX5100-24Q is configured for the QFX-EM-4Q by default, but any combination of the two modules is supported. Expansion modules can be hot-inserted or hot-removed. However, when an EX4600-EM-8F is inserted instead of the default QFX-EM-4Q, the new configuration causes the interfaces to temporarily go down. Likewise, when an EX4600-EM-8F is running on the QFX5100-24Q and it is swapped with a QFX-EM-4Q, the interfaces temporarily go down, which can cause a short disruption in traffic.

- QFX5100-24Q-AA

  As shown in Figure 8 on page 10, the QFX5100-24Q-AA is a 1 U, top-of-rack, 40-Gigabit Ethernet QSFP+ switch with 24 high-density QSFP+ ports. Each QSFP+ port can be configured to support 40-Gigabit Ethernet or as a set of 4 independent 10-Gigabit Ethernet ports. The QFX5100-24Q-AA can also be configured to support twenty-four 40-Gigabit Ethernet interfaces or ninety-six 10-Gigabit Ethernet interfaces using breakout cables (channelization mode) with 1280 Gbps output. The switch can be ordered with either ports-to-FRUs or FRUs-to-ports airflow and with AC or DC power supplies. The QFX5100-24Q switch provides full duplex throughput of 2.56 Tbps.

  The QFX5100-24Q-AA module bay can accommodate a single Packet Flow Accelerator (PFA) double-wide expansion module (QFX-PFA-4Q) or two single-wide optional expansion modules (two or one each of QFX-EM-4Q and EX4600-EM-8F). The QFX-PFA-4Q, which features a high-performance field-programmable gate array (FPGA), provides four additional QSFP+ ports to the chassis. Each QFX-EM-4Q adds four QSFP+ ports to the chassis and each EX4600-EM-8F adds eight 10-Gigabit SFP+ ports to the chassis. The QFX-EM-4Q ports can also be configured as either access ports or uplink ports, but only ports 0 and 2 can be channelized using port mode. For full details on the different port channelization modes, see "Port Panel of a QFX5100-24Q Device" on page 20. All ports on the QFX5100-24Q and QFX-EM-4Q can be configured as either access ports or uplink ports.

This switch provides the hardware support to enable PTP boundary clocks by using the QFX-PFA-4Q module. The QFX5100-24Q-AA also supports GPS in and out signals when QFX-PFA-4Q is installed.

The CPU subsystem of this switch includes a 2-port 10-Gigabit Ethernet network interface card (NIC) to provide a high bandwidth path or to alternate traffic path to guest VMs directly from the Packet Forwarding Engine.

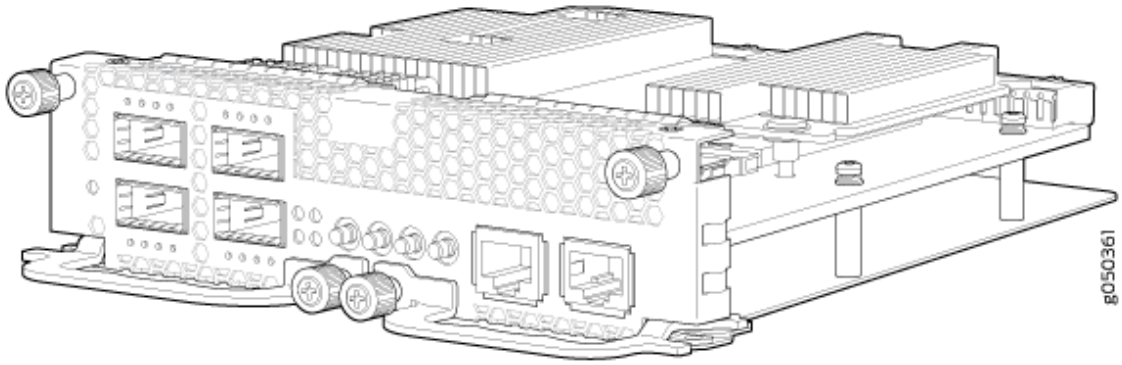
Figure 8: QFX5100-24Q-AA Port Panel with QFX-PFA-4Q

The QFX5100-24Q-AA can be used as a standalone switch that supports high frequency statistics collection. Working with Juniper Networks Cloud Analytics Engine, this switch monitors and reports the workload and application behavior across the physical and virtual infrastructure.

The QFX5100-24Q-AA supports the following expansion modules to increase port density:

- QFX-PFA-4Q (double-wide), which provides four additional QSFP+ ports. See Figure 9 on page 10.

Figure 9: QFX-PFA-4Q Expansion Module



- QFX-EM-4Q (single-wide), which provides 4 additional 40-Gigabit Ethernet QSFP+ ports. See Figure 6 on page 8.

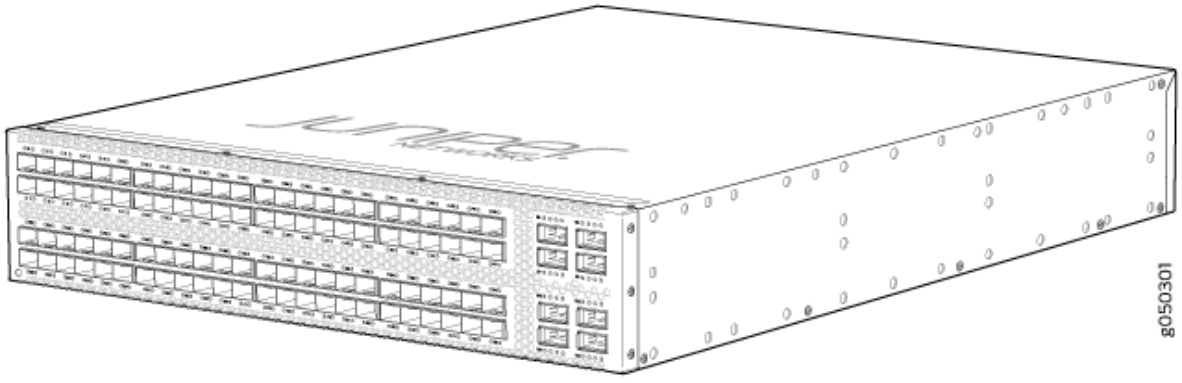
- EX4600-EM-8F (single-wide), which provides 8 additional 10-Gigabit Ethernet SFP+ ports. See Figure 7 on page 9.

The QFX5100-24Q switch supports the QFX-PFA-4Q and you must take the switch offline before replacing the expansion module. Any combination of EX4600-EM-8F and QFX-EM-4Q is also supported. These two expansion modules can be hot-inserted or hot-removed. However, when an EX4600-EM-8F is inserted instead of a QFX-EM-4Q, the new configuration causes the interfaces to temporarily go down. Likewise, when an EX4600-EM-8F is running on the QFX5100-24Q and is swapped with a QFX-EM-4Q, the interfaces temporarily go down, which can cause a short disruption in traffic.

- QFX5100-96S

As shown in Figure 10 on page 11, the QFX5100-96S switch is a is a 10-Gigabit Ethernet Enhanced Small Form-Factor Pluggable (SFP+) top-of-rack switch with 96 SFP+ ports and 8 Quad SFP+ (QSFP+) ports. Each SFP+ port can operate as a native 10 Gigabit port, when 10 Gbps optics are used. The SFP+ ports can also run at 1 Gbps, or at 100 Mbps speeds when 1_Gigabit optics are inserted. QSFP+ ports 96 and 100 can operate at native 40 Gbps speed or can be channelized to 4 independent 10 Gbps port speeds. The 8 QSFP+ ports can be used as either access ports or as uplinks. The QFX5100-96S switch has a 2 U form factor and comes standard with redundant fans and redundant power supplies. The switch can be ordered with either ports-to-FRUs or FRUs-to-ports airflow and with AC or DC power supplies.

Figure 10: QFX5100-96S Port Panel



The QFX5100-96S can be used as:

- A standalone switch.
- A member in a QFX Virtual Chassis.

  A QFX Series Virtual Chassis allows you to interconnect up to ten QFX3500, QFX3600, or QFX5100 switches into one logical device and manage the device as a single chassis in a ring topology.

- A spine or leaf device in a Virtual Chassis Fabric (VCF).

  VCF uses Virtual Chassis technology to interconnect multiple devices into a single logical device and manage that device as a single logical device inside of a fabric architecture. VCF architecture supports up to 20 total devices in a spine and leaf topology. Of those 20 devices, 4 QFX5100 devices can be configured as spine devices.

  In a mixed environment with QFX5100-24Q, QFX5100-98S and EX4300, use the QFX5100-24Q as the spine device and the QFX5100-96S and EX4300 as a leaf devices. You may use the QFX5100-96S as a spine in an all QFX5100-96S VCF or in a VCF that has a mixture of QFX5100-96S and EX4300.

- A line card in a mixed QFX5110 Virtual Chassis.

  A QFX5110 Virtual Chassis must have a QFX5110-32Q as the primary. Only QFX5110 switches and select models of QFX5100 switches can participate in a QFX5110 Virtual Chassis. Junos OS Release 17.3R1 or later is required for QFX5110 Virtual Chassis.

- A spine or leaf device in a standard QFX5100 Virtual Chassis Fabric (VCF).

  VCF uses Virtual Chassis technology to interconnect multiple devices into a single logical device and manage that device as a single logical device inside of a fabric architecture. VCF architecture supports up to 20 total devices in a spine and leaf topology. Out of the 20 total devices, you can configure a maximum of 4 spine devices.

  A QFX5100 VCF uses QFX5100 devices as spines or leaf devices. You can also use QFX3500, QFX3600, and EX4300 models as leaf devices in a QFX5100 VCF.

  Whenever possible, configure the QFX5100-24Q as the spine device in a QFX5100 VCF.

- A leaf device in a QFX5110 VCF.

  A QFX5110 VCF must have a minimum of two QFX5110-32Q as spine devices. Junos OS Release 17.3R1 or later is required for QFX5110 VCF.

- A satellite device in a Junos Fusion system.

  Junos OS Release 14.2.3 or later is required for Junos Fusion.

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 QFX5100 switch's 32-gigabyte (GB) internal solid state flash drive. The same Junos OS code base that runs on QFX5100 switches also runs on all Juniper Networks EX Series switches, M Series, MX Series, and T Series routers.

Participation in a QFX5110 Virtual Chassis or a QFX5110 VCF requires the same Junos OS image on all devices in the Virtual Chassis or VCF. Junos OS 17.3R1 or later is the minimum software release for QFX5110 Virtual Chassis or QFX5110 VCF.

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

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

SEE ALSO

Plan a Virtual Chassis Fabric Deployment | 88

QFX5100 Device Models

The QFX5100 switches have 24, 48, or 96 port configurations. The 24 port switches can be expanded to a maximum of 32 QSFP+ ports using expansion modules. All switches are available with either AC or DC power supply and with either airflow-in or airflow-out cooling. In legacy switches, or switches with an LCD, this air flow is called front-to-back and back-to-front.

Table 1 on page 13 lists the ordering numbers for QFX5100 switch product SKUs.

Table 1: QFX5100 Switch Product Numbers

P roduct Numbers	Ports	Number of Expansion Modules	Power Supply	Numbe r of Mgt. Ports	Airflow
QFX5100-24Q-AA	24 QSFP+	Supports 3 expansion modules and has 2 expansion module slots	AC	2	Air In (FRUs-to-ports) and Air Out (ports-to-FRUs)
QFX5100-24Q-AFI	24 QSFP+	2	AC	2	Air In (FRUs-to-ports)

Table 1: QFX5100 Switch Product Numbers *(Continued)*

P roduct Numbers	Ports	Number of Expansion Modules	Power Supply	Numbe r of Mgt. Ports	Airflow
QFX5100-24Q-3AFI	24 QSFP+	2	AC	3	Air In (FRUs-to-ports)
QFX5100-24Q-AFO	24 QSFP+	2	AC	2	Air Out (ports-to-FRUs)
QFX5100-24Q-3AFO	24 QSFP+	2	AC	3	Air Out (ports-to-FRUs)
QFX5100-24Q-DC-AFI	24 QSFP+	2	DC	2	Air In (FRUs-to-ports)
QFX5100-24Q-D-3AFI	24 QSFP+	2	DC	3	Air In (FRUs-to-ports)
QFX5100-24Q-DC-AFO	24 QSFP+	2	DC	2	Air Out (ports-to-FRUs)
QFX5100-24Q-D-3AFO	24 QSFP+	2	DC	3	Air Out (ports-to-FRUs)
QFX5100-48S-AFI	48 small form-factor pluggable plus (SFP+) and 6 QSFP+ transceivers		AC	2	Air In (FRUs-to-ports)
QFX5100-48S-3AFI	48 small form-factor pluggable plus (SFP+) and 6 QSFP+ transceivers		AC	3	Air In (FRUs-to-ports)

Table 1: QFX5100 Switch Product Numbers *(Continued)*

P roduct Numbers	Ports	Number of Expansion Modules	Power Supply	Numbe r of Mgt. Ports	Airflow
QFX5100-48S-AFO	48 SFP+ and 6 QSFP+ transceivers		AC	2	Air Out (ports-to-FRUs)
QFX5100-48S-3AFO	48 SFP+ and 6 QSFP+ transceivers		AC	3	Air Out (ports-to-FRUs)
QFX5100-48S-DC-AFI	48 SFP+ and 6 QSFP+ transceivers		DC	2	Air In (FRUs-to-ports)
QFX5100-48S-DC-AFO	48 SFP+ and 6 QSFP+ transceivers		DC	2	Air Out (ports-to-FRUs)
QFX5100-48SH-AFI	48 SFP+ and 6 QSFP+ transceivers		AC	3	Air In (FRUs-to-ports)
QFX5100-48SH-AFO	48 SFP+ and 6 QSFP+ transceivers		AC	3	Air Out (ports-to-FRUs)
QFX5100-48T-AFI	48 10GBASE-T and 6 QSFP+ transceivers		AC	3	Air In (FRUs to ports)
QFX5100-48T-AFO	48 10GBASE-T and 6 QSFP+ transceivers		AC	3	Air Out (ports to FRUs)
QFX5100-48T-DC-AFI	48 10GBASE-T and 6 QSFP+ transceivers		DC	3	Air In (FRUs to ports)
QFX5100-48T-DC-AFO	48 10GBASE-T and 6 QSFP+ transceivers		DC	3	Air Out (ports to FRUs)

Table 1: QFX5100 Switch Product Numbers *(Continued)*

P roduct Numbers	Ports	Number of Expansion Modules	Power Supply	Numbe r of Mgt. Ports	Airflow
QFX5100-48TH-AFI	48 10GBASE-T and 6 QSFP+ transceivers		AC	3	Air In (FRUs to ports)
QFX5100-48TH-AFO	48 10GBASE-T and 6 QSFP+ transceivers		AC	3	Air Out (ports to FRUs)
QFX5100-96S-AFI	96 SFP+ and 8 QSFP+ transceivers		AC	2	Air In (FRUs-to-ports)
QFX5100-96S-AFO	96 SFP+ and 8 QSFP+ transceivers		AC	2	Air Out (ports-to-FRUs)
QFX5100-96S-DC-AFI	96 SFP+ and 8 QSFP+ transceivers		DC	2	Air In (FRUs-to-ports)
QFX5100-96S-DC-AFO	96 SFP+ and 8 QSFP+ transceivers		DC	2	Air Out (ports-to-FRUs)

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

SEE ALSO

QFX5100 Management Panel | 43

Understanding Hardware Redundancy of QFX5100 Device Components and Functionality

The following hardware components provide redundancy on a QFX5100 switch:

- Power supplies—The QFX5100 switch has one or two power supplies. Each power supply provides power to all components in the switch. If two power supplies are installed, the two power supplies provide full power redundancy to the device. If one power supply fails or is removed, the second power supply balances the electrical load without interruption.

  To provide power redundancy to the system both power supplies must be installed. Connect power source feed A to one power supply and power source feed B to the second power supply.

  CAUTION: Do not connect feed A and feed B to the same power supply input terminal.

- Cooling system—The 1 U models of QFX5100 line of switches have five fan modules; the 2 U QFX5100-96S has three fan modules. If a fan module fails and is unable to keep the QFX5100 switch within the desired temperature thresholds, chassis alarms occur and the QFX5100 switch can shut down.

SEE ALSO

QFX5100 Power System | 53

QFX5100 Cooling System | 65

Field-Replaceable Units in a QFX5100 Device

Field-replaceable units (FRUs) are components that you can replace at your site. The QFX5100 device FRUs are hot-insertable and hot-removable: you can remove and replace one of them without powering off the switch or disrupting the switching function.

CAUTION: Replace a failed power supply with a blank panel or new power supply within one minute of removal to prevent chassis overheating. The switch continues to operate with only one power supply running. Replace a failed fan module with a new

fan module within one minute of removal to prevent chassis overheating. Do not operate the switch with missing FRUs for longer than one minute.

Table 2 on page 18 lists the FRUs for the QFX5100 device and actions to take before removing them.

Table 2: FRUs in a QFX5100 Switch

FRU	Required Action
Power supplies	None.
Expansion modules	None
Fan modules	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 *Disconnecting a Fiber-Optic Cable from a QFX Series Device*.

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

QFX5100 Management Panel | 43

QFX5100 Chassis Description and Port Panels

IN THIS SECTION

Chassis Physical Specifications for a QFX5100 Device

The QFX5100 switch chassis is a rigid sheet-metal structure that houses the hardware components. Table 3 on page 19 summarizes the physical specifications of the QFX5100 chassis.

Table 3: Physical Specifications for the QFX5100 Switch Chassis

Product SKU	Height	Width	Depth	Weight
QFX5100-24Q	1.72 in. (4.3 cm)	17.36 in. (44.1 cm)	20.48 in. (52 cm)	With FRUs installed: 22 lbs (9.97 kg)
QFX5100-24Q-AA	1.72 in. (4.3 cm)	17.36 in. (44.1 cm)	20.48 in. (52 cm)	With FRUs installed: 25 lbs (11.4 kg)
QFX5100-48S and QFX5100-48SH	1.72 in. (4.3 cm)	17.36 in. (44.1 cm)	20.48 in. (52 cm)	With FRUs installed: 21.8 lbs (9.8 kg)

Table 3: Physical Specifications for the QFX5100 Switch Chassis *(Continued)*

Product SKU	Height	Width	Depth	Weight
QFX5100-48Tand QFX5100-48TH	1.72 in. (4.3 cm)	17.36 in. (44.1 cm)	21.47 in. (54.5 cm)	With FRUs installed: 24.79 lbs (11.2 kg)
QFX5100-96S	3.46 in. (8.8 cm)	17.36 in. (44.1 cm)	22.44 in. (57 cm) (not including handles for Fans and PSUs)	With FRUs installed: 32 lbs (14.5 kg)

SEE ALSO

QFX5100 Site Guidelines and Requirements | **80**

Mount a QFX5100 Device in a Rack or Cabinet | **114**

QFX5100 Standalone Installation Overview | **109**

Installing and Removing QFX5100 Device Hardware Components | **176**

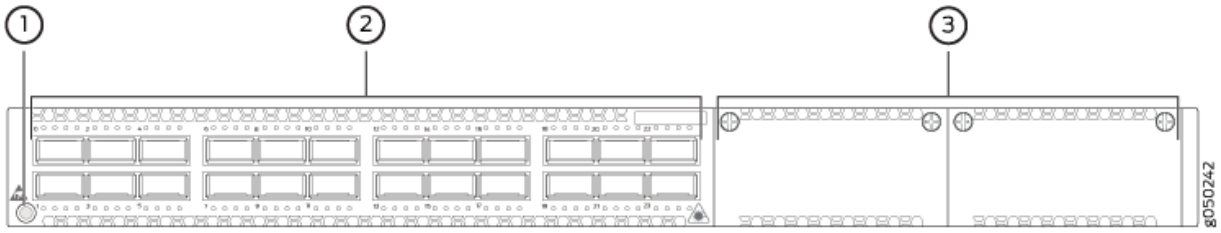
Port Panel of a QFX5100-24Q Device

IN THIS SECTION

The port panel of the QFX5100-24Q device consists of 24 quad small-form factor pluggable plus (QSFP+) ports. Each QSFP+ socket can be configured to support 40 GbE or as a set of 4 independent 10 GbE ports using breakout cables (channelization mode). In standalone mode, any of the 24 ports **0** through **23** can be configured as either uplink or access ports. The QFX5100-24Q device has two module bays

for the optional expansion modules, QFX-EM-4Q or EX4600-EM-8F. The QFX-EM-4Q, can add a total of 8 additional QSFP+ ports to the chassis and the EX4600-EM-8F can provide 8 additional 10-Gigabit Ethernet Enhanced Small Form-Factor Pluggable (SFP+) ports. The QFX-EM-4Q ports can also be configured as either access ports or as uplinks, but only ports 0 and 2 can be channelized using port mode. Figure 11 on page 21 shows the port panel of the QFX5100-24Q device.

Figure 11: QFX5100-24Q Device Port Panel



1– Electrostatic Discharge (ESD) terminal	3– Expansion module bays with cover panels (2)
2– QSFP+ access interface or uplink ports (24)	

Switch Ports

The QFX5100-24Q device ports, (**0** through **23**) support:

- 40 Gbps QSFP+ transceivers
- QSFP+ to QSFP+ direct attach copper (DAC) cables
- QSFP+ to SFP+ direct attach copper break out (DACBO) cables
- QSFP+ to QSFP+ active optical cables (AOC)
- QSFP+ to SFP+ active optical breakout cable (AOCBO)
- Access ports

  You can use 40-Gigabit Ethernet QSFP+ transceivers and QSFP+ direct attach copper cables in any downstream port. See "Determining Interface Support for the QFX5100 Device" on page 92.

- Uplink ports

  You can configure up to 4 of the 40 GbE ports as uplinks. Each additional QFX-EM-4Q, Expansion Module adds the switch uplink capacity by 2 for a total of 8 uplinks.

  To connect a QFX5100-24Q switch as a Node device in a QFabric system, you need:

  - Four QSFP+ uplink ports on each QFX5100-24Q Node device to connect to the data plane network through the QFX3008-I or QFX5100-24Q Interconnect devices.

- Two additional QSFP+ uplink ports on each QFX5100-24Q Node device connect to the data plane network through the QFX3008-I or QFX5100-24Q Interconnect devices. .

QFabric Systems

The QFX5100-24Q operates as a Node device in both the QFX3000-G and QFX3000-M QFabric systems. Additionally, the QFX5100-24Q can be configured as an Interconnect Device in QFX3000-M QFabric systems allowing a maximum of 16 Node devices. The QFX5100-24Q may not be mixed with QFX3600-I Interconnect devices in the same QFabric system.

When operating as a Node device, ports **0** through **7** are default FTE ports; ports **8** through **15** can be configured as either uplink (FTE) or access ports (XLE). In the port range **8** through **23**, only 12 ports can be channelized when the 2 QFX-EM-4Q are installed.

NOTE: The EX4600-EM-8S expansion module is not supported on the QFX5100-24Q device in a QFabric system.

Channelizing Interfaces (Non-QFabric)

When fully populated with 2 QFX-EM-4Q Expansion Modules, the QFX5100-24Q device has 128 physical ports. However, only 104 logical ports can be used for port channelization. Depending on the system mode you configure for channelization, different ports are restricted. If you attempt to channelize a restricted port, the configuration is ignored. The following system modes are available on the QFX5100-24Q device:

- Default mode

  All 24 QSFP+ ports on the switch (PIC 0) are channelized by default (96 ports). With QFX-EM-4Q Expansion Modules (PIC 1) and (PIC 2), the QSFP+ ports are supported for access or uplink ports, but cannot be channelized. Ports are over-subscribed In this mode and could be subject to packet-loss. You can have one of two port combinations: 32 40-Gbps QSFP+ ports, or 96 10-Gigabit Ethernet ports plus 8 40-Gbps QSFP+ ports.

- 104 port mode

  All 24 QSFP+ ports on the switch (PIC 0) are channelized (96 ports). Two ports on QFX-EM-4Q Expansion Module (PIC 1) are also channelized (8 additional). In this mode, ports 0 and 2 are channelized by default and ports 1 and 3 are disabled. If additional QSFP+ ports are detected in an expansion module (PIC 2), those ports are ignored.

- Flexi-pic mode

Ports 0 through 3 of the switch cannot be channelized; ports 4 through 24 are channelized by default (80 ports). With QFX-EM-4Q Expansion Modules (PIC 1) and (PIC 2), the QSFP+ ports are supported for access or uplink ports, but cannot be channelized. With EX4600-EM-8F Expansion Modules installed (PIC 1) and (PIC 2), the 16 SFP+ ports of SFP are recognized for a total of 96 logical ports.

- Non-oversubscribed mode

  All 24 QSFP+ ports on the switch (PIC 0) are channelized (96 ports). Expansion modules on PIC 1 and PIC 2 are not supported and cannot be channelized. There is no packet loss for packets of any size in this mode.

Virtual Chassis and Virtual Chassis Fabric

The QFX5100-24Q device operates as a standalone switch, a member of a QFX Virtual Chassis, or as a spine or leaf device in a QFX5100 Virtual Chassis Fabric (VCF). QFX Virtual Chassis support up to 10 members. QFX5100 VCF supports 20 QFX5100 and EX4300 devices, of which 4 QFX5100 devices can be configured as spines.

To connect a QFX5100-24Q device as a member in a QFX Virtual Chassis, you need to cable a pair of ports to link each member in the Virtual Chassis into a ring topology. Each member in the ring has at least one direct Virtual Chassis port (VCP) connection to each directly connected member. QFX5100-24Q devices are recommended in the primary, backup, or line card role. When mixed with QFX3500 or QFX3600 devices, configure the QFX5100-24Q device in the primary and backup roles. See *Connecting QFX Series and EX Series Switches in a QFX Virtual Chassis* for cabling diagrams. The Virtual Chassis feature is not applicable to QFX devices in a QFabric.

To connect a QFX5100-24Q device as a spine or leaf device in a QFX5100 VCF, you need to cable a set of ports as VCP connections that link each spine device and leaf device. All spine devices have at least one direct VCP connection to each leaf device in the VCF. Non-channelized DAC cables can be configured as VCP connections. See "Connecting a QFX5100 Device in a Virtual Chassis Fabric" on page 130 for a cabling diagram.

> **BEST PRACTICE**: Whenever possible use the QFX5100-24Q device as a spine device. By using the QFX5100-24Q device in a maximum configuration of 20 total devices, four QFX5100-24Q devices may be used as spine devices. All members can be connected to the spine using QSFP+ ports.

As of Junos OS release 17.3R1, you can also connect a QFX5100-24Q as a leaf device in a QFX5110 VCF or as a member in a QFX5110 Virtual Chassis.

Port LEDs

The bi-color LEDs labeled Link/Activity LED in Figure 12 on page 24 indicate link activity or faults.

Figure 12: LEDs on the QSFP+ Uplink Ports

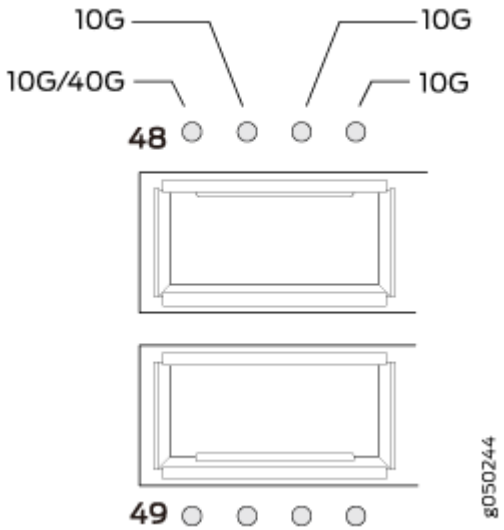


Table 4 on page 24 describes the SFP+ access port LEDs.

Table 4: Port LEDs on a QFX5100-24Q Switch

Color	State	Description
Unlit	Off	The port is administratively disabled, there is no power, or there is a fault. **NOTE**: When configured for channelized 10-Gigabit Ethernet, the LED remains unlit only if all four of the 10-Gigabit Ethernet SFP+ breakout links are down.
Green	On steadily	A link is established, but there is no link activity. **NOTE**: When configured for channelized 10-Gigabit Ethernet, the LED is lit green when at least one of the four 10-Gigabit Ethernet SFP+ breakout links is established.

Table 4: Port LEDs on a QFX5100-24Q Switch *(Continued)*

Color	State	Description
	Blinking	A link is established, and there is link activity. **NOTE**: When configured for channelized 10-Gigabit Ethernet, the LED is lit green when at least one of the four 10-Gigabit Ethernet SFP+ breakout links is established.
Amber	Blinking	All four LEDs blink to indicate the beacon function was enabled on the port.

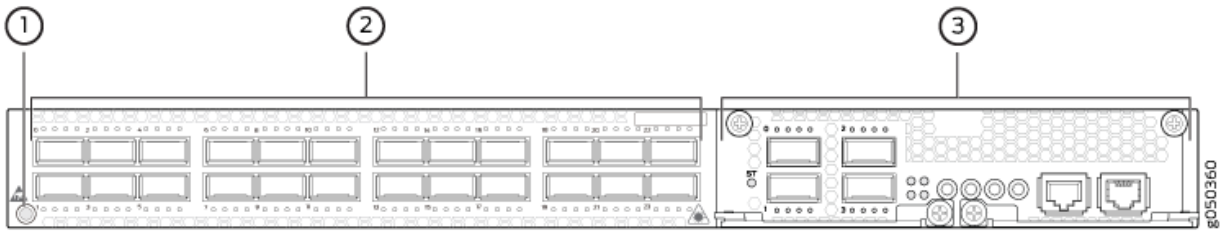
Port Panel of a QFX5100-24Q-AA Device

The port panel of the QFX5100-24Q-AA switch consists of 24 quad small-form factor pluggable plus (QSFP+) 40-Gigabit Ethernet ports. Each QSFP+ socket can be configured to support 40-Gigabit Ethernet or as a set of four independent 10-Gigabit Ethernet ports using breakout cables (channelization mode). The QFX5100-24Q-AA can also be configured to support 96 10-Gigabit Ethernet ports using breakout cables (channelization mode) with 1280 Gbps output. Any of the 24 ports can be configured as either an uplink port or an access port.

The expansion module bay of the QFX5100-24Q switch is located on the port panel. In the expansion module bay, you can install a single double-wide expansion module (QFX-PFA-4Q) or two single-wide optional expansion modules (QFX-EM-4Q and EX4600-EM-8F, in any combination). When you install two single-wide expansion modules, the slot on your left hand side is slot 1 (QIC0), and the slot on your right hand side is slot 2 (QIC1).

The QFX-PFA-4Q module adds four QSFP+ ports to the chassis. The QFX-EM-4Q module adds four QSFP+ ports to the chassis and the EX4600-EM-8F module adds eight 10-Gigabit SFP+ ports to the chassis. The QFX-EM-4Q ports can be configured as either access ports or as uplinks ports, but only ports 0 and 2 can be channelized by using port mode. The QFX-EM-4Q ports can also be configured as either access ports or uplink ports, but only ports 0 and 2 can be channelized by using port mode. Figure 13 on page 26 shows the port panel of the QFX5100-24Q-AA device.

Figure 13: Port Panel of a QFX5100-24Q-AA Switch



1– Electrostatic discharge (ESD) terminal	3– Expansion module bay (with a QFX-PFA-4Q expansion module installed)
2– QSFP+ ports (24)	

For details on port LEDs, see "Port Panel of a QFX5100-24Q Device" on page 20.

Port Panel of QFX5100-48S and QFX5100-48SH Devices

The port panel of the QFX5100-48S and QFX5100-48SH switches supports up to a maximum of 72 logical 10 GbE ports when operating as a standalone switch. Forty-eight physical ports(**0** through **47**) support 10 Gigabit Ethernet small form-factor pluggable plus (SFP+) transceivers. These ports can also support 1 Gigabit SFP transceivers and can be configured at either 1 Gbps or 1 Gbps speeds using the `set interface speed` command. All 48 of these ports can be used for SFP+ transceivers or SFP+ direct attach copper (DAC) cables. You can use 1-Gigabit Ethernet SFP+, 10-Gigabit Ethernet SFP+ transceivers and SFP+ DAC cables in any access port.

The remaining 24 logical ports are the six 40 GbE physical ports (**48** through **53**) that support up to 6 quad small-form factor pluggable plus (QSFP+) transceivers . Each QSFP+ socket can operate either as a single 40 Gbps port or as a set of 4 independent 10 Gbps ports using QSFP+ breakout cables. The 40 GbE ports can be configured as either access ports or as uplinks.

> ⚠ **CAUTION**: When you use the latest OEM part number FCLF8521P2BTL (printed on the transceiver label), you can install 1GbE transceivers (such as QFX-SFP-1GE-T) in any port with no restrictions. The same applies for devices that support 10GbE copper transceivers. However, if you are using the older OEM part number SP7041-M1-JN (not shipped in last 3+ years) instead, do not install 1GbE copper transceivers (such as QFX-SFP-1GE-T) directly above or below another 1GbE copper transceiver. Use only the top row or bottom row to avoid damage to the device caused when the transceivers are installed above or below each other.

To connect a QFX5100-48S switch as a node device in a QFabric system, you need:

- Four QSFP+ uplink ports on each QFX5100-48S Node device to connect to the data plane network through the QFX3008-I or QFX5100-24Q Interconnect devices.
- The two remaining QSFP+ uplink ports on each QFX5100-48S Node device connect to the data plane network through the QFX3008-I or QFX5100-24Q Interconnect devices. See "Determining Interface Support for the QFX5100 Device" on page 92.

To connect a QFX5100-48S switch as a member in a QFX Virtual Chassis, you need a pair of dedicated ports and cables that link each member in the Virtual Chassis into a ring topology. Each member in the ring has at least one direct Virtual Chassis port (VCP) connection to a upstream and downstream member. QFX5100-48S switches are recommended in the primary, backup, or line card role. When mixed with QFX3500 or QFX3600 devices, configure the QFX5100-48S in the primary and backup roles. See *Connecting QFX Series and EX Series Switches in a QFX Virtual Chassis* for cabling diagrams.

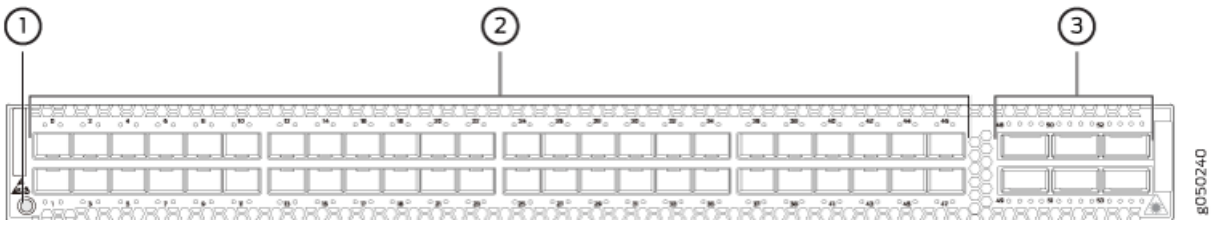
To connect a QFX5100-48S switch as a spine or leaf device in a QFX5100 Virtual Chassis Fabric (VCF), you need a pair of dedicated ports and cables that link each spine device and leaf device in the VCF. All spine devices have at least one direct VCP connection to each leaf device in the VCF. See "Connecting a QFX5100 Device in a Virtual Chassis Fabric" on page 130 for a cabling diagram.

BEST PRACTICE: In a mixed QFX5100 VCF environment with multiple models of QFX5100 and the EX4300, use QFX5100-24Q as spine devices. In the maximum configuration of 20 total devices, up to four QFX5100-24Q devices may be used as spine devices. All members can be connected to the spine using QSFP+ ports. You can configure the QFX5100-96S as a spine in an all QFX5100-96S VCF or in a mixed VCF comprised of EX4300 and QFX5100-96S.

As of Junos OS release 17.3R1, you can also connect a QFX5100-48S as a leaf device in a QFX5110 VCF or as a member in a QFX5110 Virtual Chassis.

Figure 14 on page 27 shows the port panel of a QFX5100-48S switch.

Figure 14: QFX5100-48S Switch Port Panel



1– Electrostatic Discharge (ESD) terminal	3– 40 GbE ports (6)
2– 10 G ports (48)	

The QFX5100-48S and QFX5100-48SH device ports, (**0** through **47**) support:

- SFP transceivers that can run at either 100 Mbps or 1 Gbps speed
- SFP+ transceivers at 10 Gbps speed
- SFP to SFP direct attach copper (DAC) cables
- SFP+ to SFP+ DAC cables
- SFP+ to SFP+ active optical cables (AOC)

The QFX5100-48S and QFX5100-48SH 40 G uplink or data ports (**48** through **53**) support:

- QSFP+ transceivers
- QSFP+ to QSFP+ direct attach copper (DAC) cables
- QSFP+ to SFP+ DAC breakout cables (DACBO)
- QSFP+ to QSFP+ active optical cables (AOC)
- QSFP+ to SFP+ AOC breakout cables (AOCBO)

Port Panel of QFX5100-48T and QFX5100-48TH Devices

The port panel of the QFX5100-48T and QFX5100-48TH devices supports 48 10GBASE-T ports and 6 quad small-form factor pluggable (QSFP+) ports. Forty-eight copper physical ports (**0** through **47**) are tri-speed and support up to 10-Gigabit Ethernet. These 10GbE/1GbE/100 Mbps ports can be configured as access ports. See "Determining Interface Support for the QFX5100 Device" on page 92.

The remaining six ports (**48** through **53**), support 40 GbE QSFP+ transceivers. Each QSFP+ socket can operate either as a single 40 Gbps port or as a set of 4 independent 10 Gbps ports using QSFP+ breakout cables. The 40 GbE ports can be configured as either access ports or as uplinks.

To connect a QFX5100-48T device as a member in a QFX Virtual Chassis, you need a pair of dedicated ports and cables that link each member in the Virtual Chassis into a ring topology. Each member in the ring has at least one direct Virtual Chassis port (VCP) connection to a upstream and downstream member. QFX5100-48T switches are recommended in the primary, backup, or line card role. When mixed with QFX3500 or QFX3600 devices, configure the QFX5100-48T device in the primary and backup roles. See *Connecting QFX Series and EX Series Switches in a QFX Virtual Chassis* for cabling diagrams.

To connect a QFX5100-48T device as a leaf device in a Virtual Chassis Fabric (VCF), you need a pair of dedicated ports and cables that link each spine device and leaf device in the VCF. All spine devices have

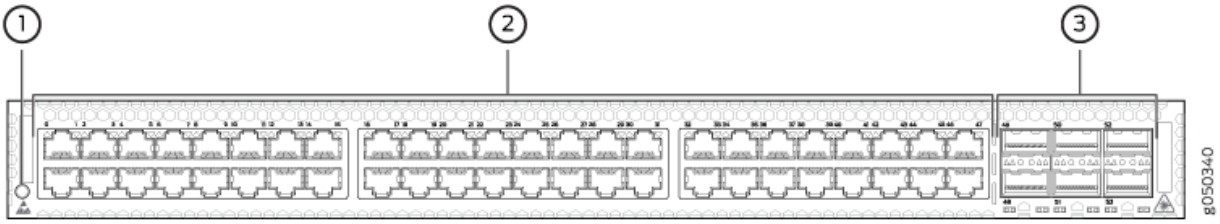
at least one direct VCP connection to each leaf device in the VCF. See "Connecting a QFX5100 Device in a Virtual Chassis Fabric" on page 130 for a cabling diagram.

The QFX5100-48T device operates as a standalone switch, a member of a QFX Virtual Chassis, a member of a QFX5110 Virtual Chassis, act as a leaf device in a Juniper Networks Virtual Chassis Fabric (VCF). QFX Virtual Chassis and QFX5100 Virtual Chassis both support up to 10 members. VCF supports 20 total devices, of which 4 QFX5100-24Q devices can be configured as spine devices.

BEST PRACTICE: Use the QFX5100-24Q as a spine device and any QFX5100 device (except QFX5100-24Q-AA, QFX5100-48TH, or QFX510048SH) as leaf devices.

Figure 15 on page 29 shows the port panel of a QFX5100-48T or QFX5100-48TH device.

Figure 15: QFX5100-48T or QFX5100-48TH Switch Port Panel



1– Electrostatic Discharge (ESD) terminal	3– 40 GbE ports (6)
2– 10GBASE-T ports (48)	

The QFX5100-48T and QFX5100-48TH device ports, (**0** through **47**) support RJ45 connectors. The 40 G uplink or data ports (**48** through **53**) support:

- QSFP+ transceivers
- QSFP+ to QSFP+ direct attach copper (DAC) cables
- QSFP+ to SFP+ DAC breakout cables (DACBO)
- QSFP+ to QSFP+ active optical cables (AOC)
- QSFP+ to SFP+ AOC breakout cables (AOCBO)

To connect a QFX5100-48T switch as a Node device in a QFabric system, you need:

- Four QSFP+ uplink ports on each QFX5100-48T Node device to connect to the data plane network through the QFX3008-I or QFX5100-24Q Interconnect devices.
- The two remaining QSFP+ uplink ports on each QFX5100-48T Node device connect to the data plane network through the QFX3008-I or QFX5100-24Q Interconnect devices.

Access port pinouts for the QFX5100-48T switch are the same as the management port connector pinouts for the QFX Series. For more information, see "RJ-45 Management Port Connector Pinout Information" on page 103.

SEE ALSO

Connect the QFX5100 in a Virtual Chassis or Virtual Chassis Fabric | 122

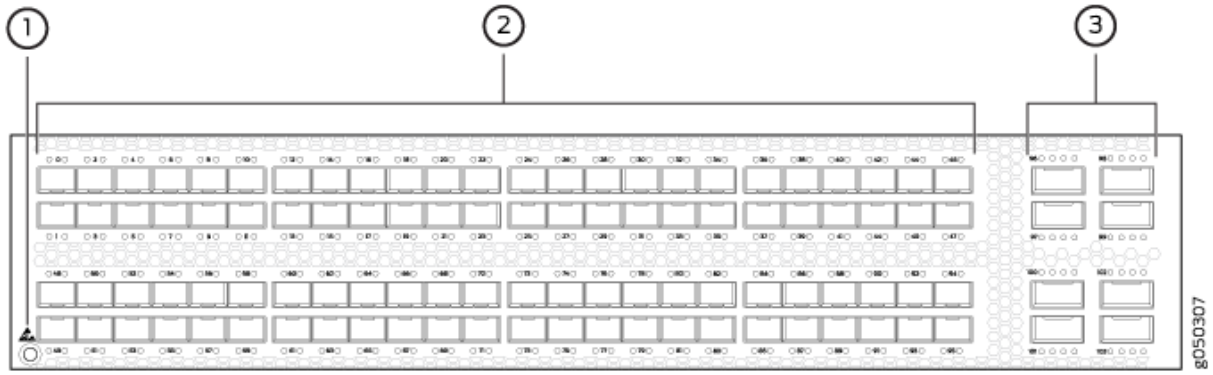
Port Panel of a QFX5100-96S Device

IN THIS SECTION

The port panel of the QFX5100-96S switch consists of 96 small form-factor pluggable plus (SFP+) and 8 quad small-form factor pluggable plus (QSFP+) ports that are normally configured as access ports. Physical ports(**0** through **95**) support 10 Gbps SFP+ transceivers and 1 Gbps transceivers. The eight 40-Gigabit ports (**96** through **104**) support QSFP+ transceivers and are normally configured as uplinks or Virtual Chassis ports (VCPs). Although the 104 physical ports of the QFX5100-96S would map to 128 logical ports using channelization, only 104 logical ports are supported.

Figure 16 on page 31 shows the port panel of a QFX5100-96S switch.

Figure 16: QFX5100-96S Switch Port Panel



1– Electrostatic Discharge (ESD) terminal	3– 40 Gigabit Ethernet ports (8)
2– 10 Gigabit Ethernet ports (96)	

This topic describes:

Switch Ports

The QFX5100-96S switch ports, (**0** through **95**) support:

- SFP transceivers that can run at either 100 Mbps or 1 Gbps speed
- SFP+ transceivers at 10 Gbps speed
- SFP to SFP direct attach copper (DAC) cables
- SFP+ to SFP+ DAC cables
- SFP+ to SFP+ active optical cables (AOC)

Ports **96** through **104** support:

- 40 Gbps QSFP+ transceivers

Additionally ports **96** and **100** support:

- SFP+ transceivers
- QSFP+ to QSFP+ direct attach copper (DAC) cables
- QSFP+ to SFP+ DAC breakout cables (DACBO)
- QSFP+ to QSFP+ active optical cables (AOC)
- QSFP+ to SFP+ AOC breakout cables (AOCBO)

CAUTION: When you use the latest OEM part number FCLF8521P2BTL (printed on the transceiver label), you can install 1GbE transceivers (such as QFX-SFP-1GE-T) in any port with no restrictions. The same applies for devices that support 10GbE copper transceivers. However, if you are using the older OEM part number SP7041-M1-JN (not shipped in last 3+ years) instead, do not install 1GbE copper transceivers (such as QFX-SFP-1GE-T) directly above or below another 1GbE copper transceiver. Use only the top row or bottom row to avoid damage to the device caused when the transceivers are installed above or below each other.

Channelizing Interfaces

The port panel of the QFX5100-96S switch supports up to a maximum of 104 logical 10 GbE ports that can be distributed over 96 small form-factor pluggable plus (SFP+) and 8 quad small-form factor pluggable plus (QSFP+) transceivers . Because of an 104 port restriction, only two of the eight QSFP+ can be channelized. Depending on how you set the system mode for channelization, the behavior of channelization for the QSFP+ changes. The following system modes are available for the QFX5100-96S switch:

- Non-oversubscribed

  All 96 SFP+ ports on the switch (PIC 0) are supported. In this mode, the eight QSFP+ ports are not supported and cannot be channelized. There is no packet loss for packets of any size in this mode.

- Default mode

  All 96 SFP+ ports on the switch (PIC 0) are supported. QSFP+ ports **96** and **100** can be channelized. If ports **96** and **100** are channelized, the interfaces on ports **97**, **98**, **99**, **101**, **102**, and **103** are disabled.

Virtual Chassis and Virtual Chassis Fabric Support

The QFX5100-96S switch operates as a standalone switch, as a member in a QFX Virtual Chassis, as a member in a QFX5110 Virtual Chassis, as a spine or leaf device in a QFX5100 Virtual Chassis Fabric (VCF), or as a leaf device in a QFX5110 VCF. QFX Virtual Chassis support up to 10 members; QFX5100 VCF supports a total of 20 devices, of which 4 QFX5100 devices can be configured as spines. A QFX Virtual Chassis is cabled in a ring topology, where a VCF is cabled in a spine and leaf topology.

Virtual Chassis

In a QFX Virtual Chassis, you can connect up to 10 standalone QFX5100-96S switches into a QFX Series Virtual Chassis and manage the interconnected switches as a single chassis. The advantages of connecting multiple switches into a Virtual Chassis include better-managed bandwidth at a network layer, simplified configuration and maintenance because multiple devices can be managed as a single

device, increased fault tolerance and high availability (HA) because a Virtual Chassis can remain active and network traffic can be redirected to other member switches when a single member switch fails, and a flatter, simplified Layer 2 network topology that minimizes or eliminates the need for loop prevention protocols such as Spanning Tree Protocol (STP).

As of Junos OS release 17.3R1, you can also connect a QFX5100-96S as a member in a QFX5110 Virtual Chassis.

Virtual Chassis Fabric

The VCF provides a low-latency, high-performance fabric architecture that can be managed as a single device. VCF is an evolution of the Virtual Chassis feature, which allows you to interconnect multiple devices into a single logical device, inside of a fabric architecture. The VCF architecture is optimized to support small and medium-sized data centers that contain a mix of 1-Gpbs, 10-Gpbs, and 40-Gbps Ethernet interfaces.

A VCF is constructed using a spine-and-leaf architecture and topology. In the spine-and-leaf architecture, each spine device is interconnected to each leaf device. A VCF supports up to 20 devices, of which 4 QFX5100 devices can be configured into spine devices. In a mixed environment with QFX5100-24Q, QFX5100-98S and EX4300, use the QFX5100-24Q as the spine device and the QFX5100-96S and EX4300 as a leaf devices. You may use the QFX5100-96S as a spine in an all QFX5100-96S VCF or in a VCF that has a mixture of QFX5100-96S and EX4300.

As of Junos OS release 17.3R1, you can also connect a QFX5100-24Q as a leaf device in a QFX5110 VCF.

Expansion Modules for QFX5100 Devices

IN THIS SECTION

The QFX5100-24Q and QFX5100-24Q-AA devices have two bays on the port panel for optional expansion modules. These expansion modules can be hot-inserted or hot-removed. Expansion modules and transceivers are not shipped with the switch and must be ordered separately.

The QFX5100-24Q and QFX5100-24Q-AA support these expansion modules up to the 104-port limitation:

- Two EX4600-EM-8F, which provides a total of 16 additional 10-Gigabit Ethernet Enhanced Small Form-Factor Pluggable (SFP+) ports or 8 additional 1-Gigabit SFP ports. When both bays (PIC 1 and PIC 2) are populated with EX4600-EM-8F modules, you must configure the system mode as Flexi-pic. In this mode, port **0** to **3** of PIC 0 are disabled, which allows the devices to operate within the 104-port limitation.
- Two QFX-EM-4Q, which provides a total of 8 additional 40-Gigabit Quad SFP+ (QSFP+) ports.
- One EX4600-EM-8F and one QFX-EM-4Q, which provides 8 additional 10-Gigabit Ethernet SFP+ (or 8 additional 1-Gigabit SFP ports) and 4 additional 40-Gigabit (QSFP+) ports. This combination requires the system mode to be configured as Flexi-pic.

Additionally, the QFX5100-24Q-AA supports the QFX-PFA-4Q expansion module, which provides 4 additional QSFP+ ports.

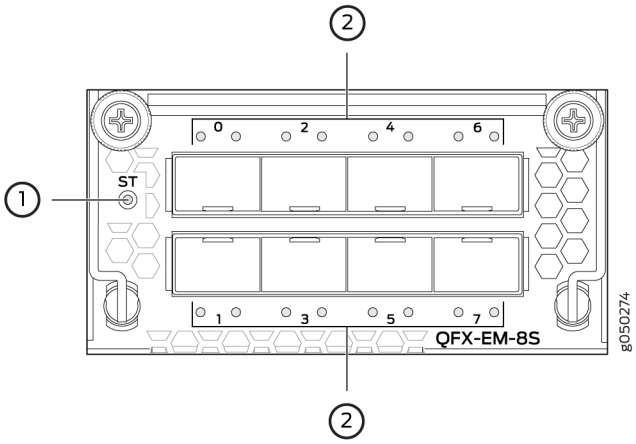
NOTE: In order to run the orchestration diagnostics, Precision Time Protocol (PTP) and synchronization diagnostics, and utilities contained in the Packet Flow Accelerator Diagnostics software, you must have Junos OS Release 14.1X53-D27 or later software with enhanced automation installed on your QFX5100-24Q-AA.

EX4600-EM-8F

The EX4600-EM-8F is a MACsec-capable expansion module that inserts into one of the device bays of a QFX5100-24Q, QFX5100-24Q-AA, or an EX4600 switch. It provides 8 additional 10-Gigabit Ethernet SFP+ ports or 8 additional 1-Gigabit SFP ports to each bay. Figure 7 shows the ports and LEDs on the expansion module.

CAUTION: Copper SFP transceivers (1000BASE-T) are restricted to the top four ports or the bottom four ports; fiber SFP transceivers (1000BASE-X) can be used in any of the eight ports. Attempting to stack copper SFP transceivers causes internal damage to the module.

Figure 17: EX4600-EM-8F Faceplate and LEDs



1– Expansion module status LED	2– SFP+ port LEDs

When the expansion module is inserted into the expansion bay, the chassis detects the additional ports, recognizes them as 10GbE ports, and lights the Status LED. The QFX5100-24Q device is configured for the QFX-EM-4Q by default, but any combination of the two modules is supported. Expansion modules can be hot-inserted or hot-removed. However, when an EX4600-EM-4Q is inserted instead of the default QFX-EM-4Q, the Packet Forwarding Engine reboots that can cause some temporary disruption in traffic.

NOTE: MACsec is supported on the 10-Gigabit Ethernet ports with the EX-QFX-MACSEC-AGG license.

Table 3 describes the Status LED on the EX4600-EM-8F.

Table 5: EX4600-EM-8F Status LED

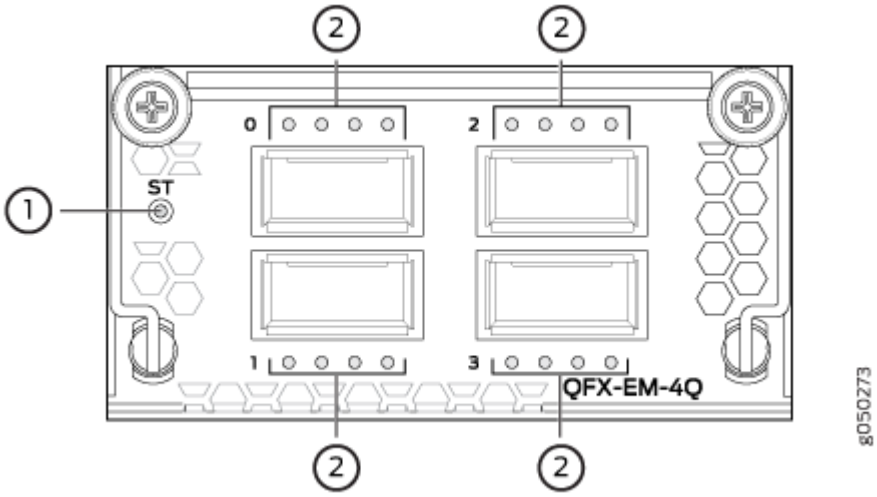
LED	State	Description
ST	Unlit	• The expansion module is offline. • The chassis is powered off.
	Green	• The expansion module is online and functioning normally.

QFX-EM-4Q

The QFX-EM-4Q, provides 4 additional 40-Gigabit Ethernet QSFP+ ports to one of the bays in the QFX5100-24Q or QFX5100-24Q-AA. Port 0 and port 2 can be used for port channelization by configuring the system mode for 104 port mode.

Figure 18 on page 36 shows the QFX-EM-4Q ports and LEDs.

Figure 18: QFX-EM-4Q Faceplate and LEDs



1– Expansion module status LED	2– QSFP+ port LEDs

When the expansion module is inserted into the expansion bay, the chassis detects the additional ports, recognizes them as 40 GbE ports, and lights the Status LED.

NOTE: If a QFX-EM-4Q is installed in PIC1 and EX4600-EM-8F is installed in PIC2, you must configure the system mode to be Flexi-PIC. Otherwise, only the EQF-EM-4Q is recognized by the software.

Table 6 on page 37 describes the Status LED on the QFX-EM-4Q expansion module.

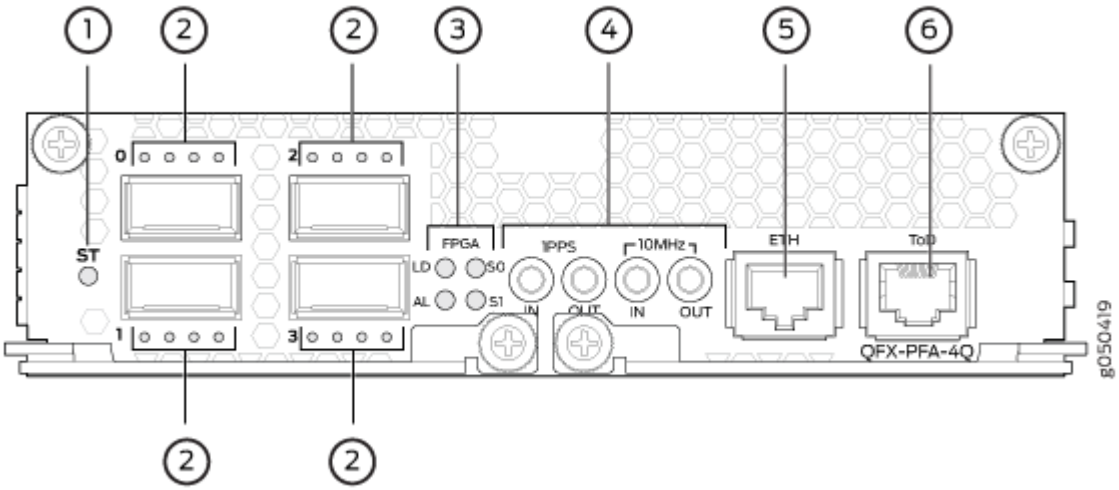
Table 6: Expansion Module Status LED

LED	State	Description
ST	Unlit	• The expansion module is offline. • The chassis is powered off.
	Green	• The expansion module is online and functioning normally.

QFX-PFA-4Q

The QFX-PFA-4Q, which features a high-performance field-programmable gate array (FPGA), provides four additional QSFP+ ports to the QFX5100-24Q-AA switch. The QFX-PFA-4Q is a double-wide expansion module. Figure 19 on page 37 shows the ports and LEDs on the expansion module.

Figure 19: QFX-PFA-4Q Faceplate and LEDs



1– Expansion module status LED	4– 1-PPS and 10-MHz GPS input and output
2– QSFP+ ports and LEDs	5– RJ-45 Ethernet port
3– FPGA LEDs	6– Time-of-day (TOD) RS-232 port

Table 7 on page 38 describes the status and FPGA LEDs on the QFX-PFA-4Q.

Table 7: QFX-PFA-4Q Status and FPGA LEDs

LED	State	Description
ST	Unlit	• The expansion module is offline. • The chassis is powered off.
	Green	• The expansion module is online and functioning normally.
FPGA		
LD	Off	FPGA not configured.
	Amber	FPGA configuration in progress or failed.
	Green	FPGA configured successfully.
AL	Off	No FPGA alarms.
	Amber	Minor FPGA alarm.
	Red	Major FPGA alarm.
S0 and **S1**	Off	Application-specific status is off.
	Green	Application-specific status is on.

RELATED DOCUMENTATION

Install and Remove Expansion Modules in a QFX5100-Device | **157**

Access Port and Uplink Port LEDs on a QFX5100 Device

The Link/Activity and Status LED configuration for QFX5100 switches use bi-colored LEDs. The link LED indicates link activity or a fault. The status LED indicates transceiver presence. See Table 8 on page 39 to locate the position and type of LED for your QFX5100 model.

Table 8: QFX5100 Access Port and Uplink LED Locations

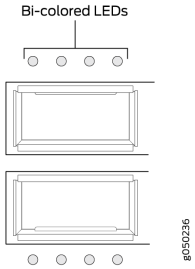
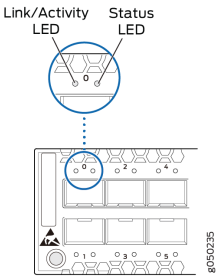
Model	Port Type	Indicators	Location
QFX5100-24Q	QSFP+	Link Status	
QFX5100-48S and QFX5100-48SH	SFP+	Link Status	

Table 8: QFX5100 Access Port and Uplink LED Locations *(Continued)*

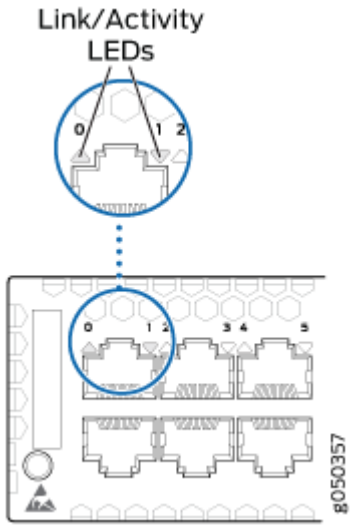
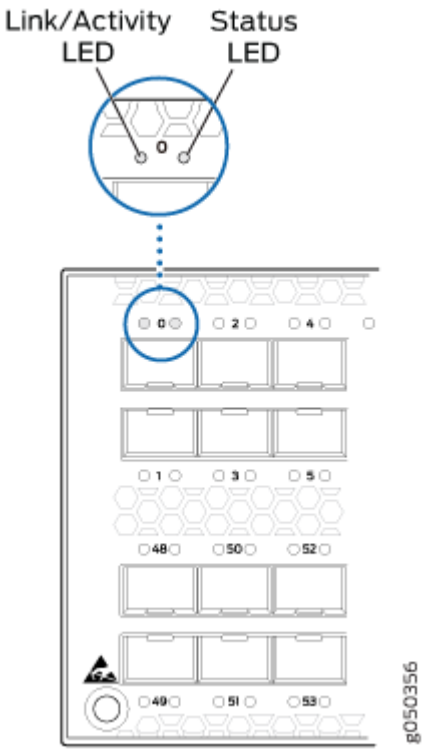
Model	Port Type	Indicators	Location
QFX5100-48T and QFX5100-48TH	10GBASE-T	Link	
QFX5100-96S	SFP+	Link Status	

Table 9 on page 41 describes how to interpret the SFP+ port LEDs.

Table 9: Network Port LEDs on SFP+ Ports on a QFX5100 Switch

LED	Color	State	Description
Link/Activity	Unlit	Off	The port is administratively disabled, there is no power, the link is down, or there is a fault.
	Green	On steadily	A link is established, but there is no link activity.
		Blinking	A link is established, and there is link activity.
	Amber	Blinking	The beacon is enabled on the port. On QFX5100-48T, it indicates a fault.
Status **NOTE**: Not applicable for QFX5100-48T or QFX5100-48TH.	Unlit	Off	The link is down.
	Amber	Blinking	The beacon function is enabled on the port.
	Green	Blinking	A 1-Gigabit Ethernet transceiver is installed in the port and the link is established.
	Green	On steadily	A 10-Gigabit Ethernet transceiver is installed in the port and link is established.

As shown in Table 8 on page 39, there are four bi-color LEDs for each QSFP+ port. The first LED is used and the remaining LEDs are not used when the interface is configured for 40-Gigabit Ethernet and connected to a QSFP+ transceiver. All four LEDs are used when the interface is configured for 10-Gigabit Ethernet and the port is connected using an optical split cable or a copper DACBO cable. Table 10 on page 42 describes how to interpret the QSFP+ LEDs.

Table 10: Network Port LEDs on QSFP+ Ports on a QFX5100 Switch

Color	State	Description
Unlit	Off	The port is administratively disabled, there is no power, the link is down, or there is a fault. **NOTE**: When configured for 10-Gigabit Ethernet, the LED remains unlit only if all four of the 10-Gigabit Ethernet SFP + breakout links are down.
Green	On steadily	A link is established, but there is no link activity. **NOTE**: When configured for 10-Gigabit Ethernet, the LED is lit green when at least one of the four 10-Gigabit Ethernet SFP+ breakout links is established.
	Blinking	A link is established, and there is link activity. **NOTE**: When configured for 10-Gigabit Ethernet, the LED is lit green when at least one of the four 10-Gigabit Ethernet SFP+ breakout links is established.
Amber	Blinking	All four LEDs blink to indicate the beacon function was enabled on the port.

SEE ALSO

Management Panel of a QFX5100 Device | **43**

Install and Remove Transceivers and Fiber Optic Cables on QFX5100 Devices | **164**

RELATED DOCUMENTATION

Field-Replaceable Units in a QFX5100 Device | **17**

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

Installing and Removing QFX5100 Device Hardware Components | **176**

Plan a Virtual Chassis Fabric Deployment | **88**

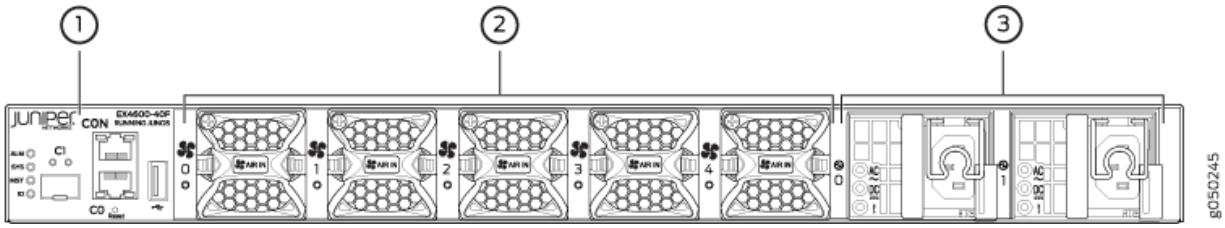
QFX5100 Management Panel

IN THIS SECTION

Management Panel of a QFX5100 Device

The management panel of the QFX5100 switch is found on the Field Replaceable Unit (FRU) end of the switch as shown in Figure 20 on page 43 for 1 U switches and Figure 21 on page 44 for the 2 U , QFX5100-96S switch. See Figure 22 on page 44 and Figure 23 on page 45 for FRUs and management panel detail.

Figure 20: QFX5100 Switch, FRU End 1 U Product SKUs



1– Management panel	3– Power supply units
2– Fan modules	

Figure 21: QFX5100-96S, FRU End

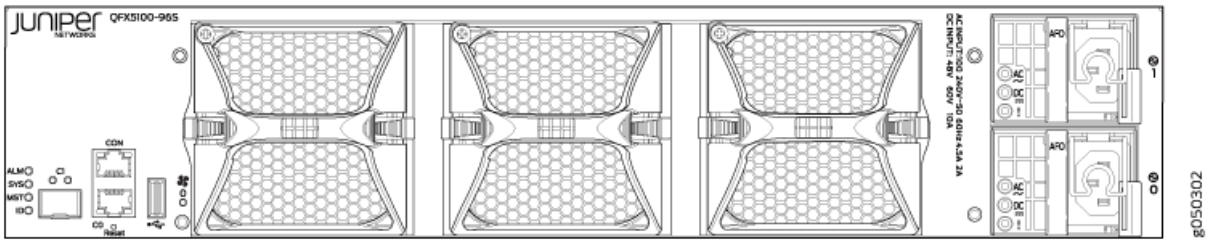
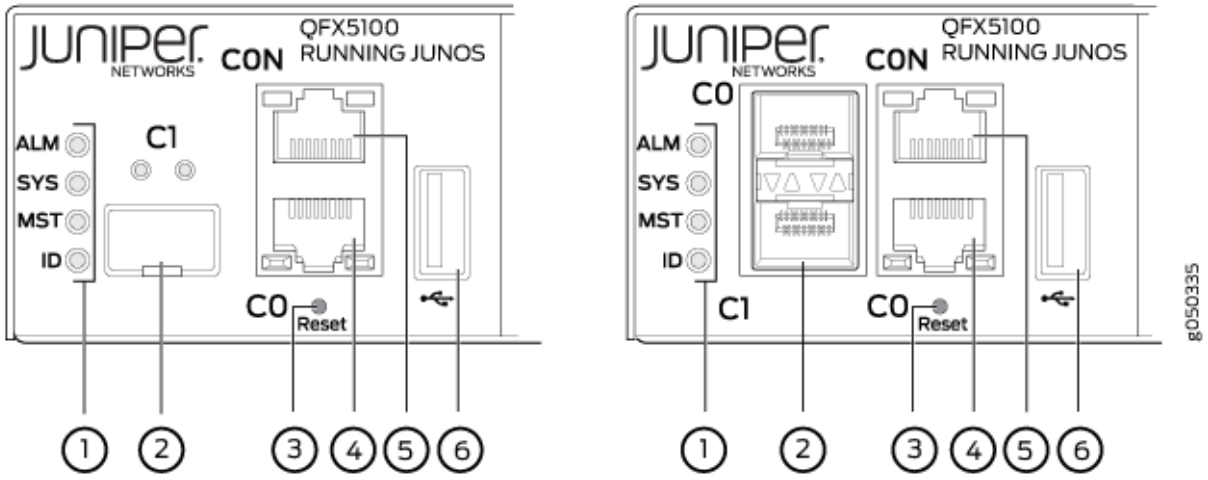


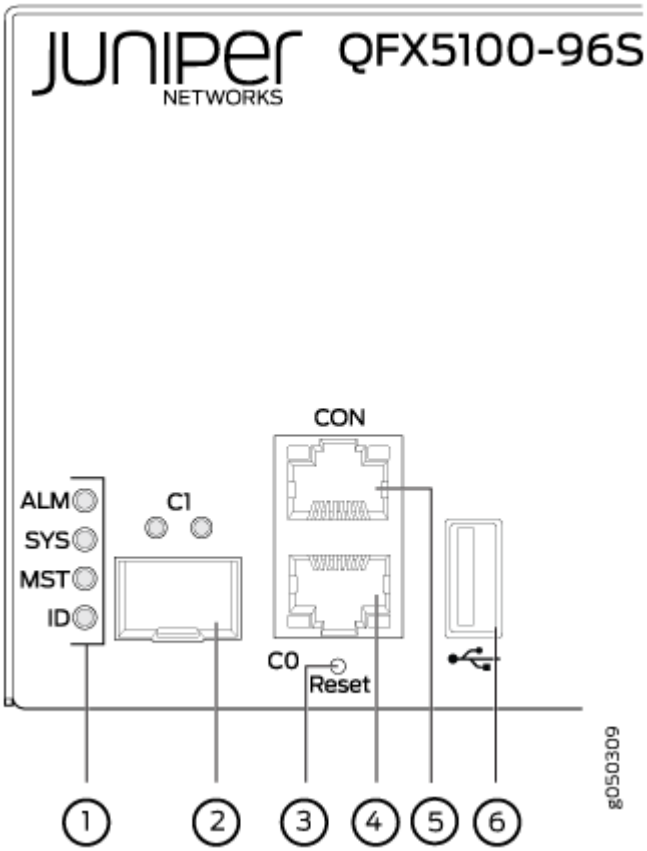
Figure 22: Management Panel Components on 1 U QFX5100



1– Status LEDs	4– em0–RJ-45 (1000 Base-T) management Ethernet port (**C0**) Some SKUs have an additional SFP management Ethernet port (second **C0**)
2– em1–SFP management Ethernet port (**C1**) Cage (socket for either 1 GbE copper SFP or fiber SFP)	5– RJ-45 console port (**CON**))
3– **Reset** button, see caution statement below	6– USB port

CAUTION: Do not use the **Reset** button to restart the power sequence unless under the direction of Juniper Networks Technical Assistance Center (JTAC).

Figure 23: Management Panel Components on the QFX5100-96S



1– Status LEDs	4– em0–RJ-45 (1000 Base-T) management Ethernet port (C0)
2– em1–SFP management Ethernet port (C1) Cage (socket for either 1 GbE copper SFP or fiber SFP)	5– RJ-45 console port (C0N))
3– **Reset** button, see caution statement above	6– USB port

The management panel consists of the following components:

- Status LEDs
  - ALM–Alarm
    - Unlit indicates the switch is halted or that there is no alarm.
    - Red indicates a hardware fault, such as a power failure or a system shutdown due to system over-heating.
    - Amber indicates a major or minor alarm.
  - SYS–System

    - Unlit indicates the switch is powered off or halted.
    - Solid green indicates that Junos OS for QFX Series is loaded on the switch.
    - Blinking green indicates the switch is:
        - A participating member in a Virtual Chassis.
        - A participating leaf device in a Virtual Chassis Fabric (VCF).
        - A participating spine device in a VCF.
        - A Routing Engine Primary in a VCF.
        - A Routing Engine Backup in a VCF.
- MST–Primary in a QFX Virtual Chassis or Routing Engine Primary in a VCF
    - Unlit indicates the switch is a line card member in a Virtual Chassis.
    - Solid green indicates the switch is:
        - A standalone switch
        - In the primary role in a QFX Virtual Chassis
        - Is the routing engine primary in a VCF
    - Blinking green indicates the switch is the backup primary in a Virtual Chassis or the backup routing engine in a VCF.
- ID–Identification or beacon
    - Unlit indicates the beacon feature is not enabled.
    - Blinking blue indicates the beacon feature is enabled. This feature is enabled using the `request chassis beacon` command.
- Switch product number
- Management Ports C0 and C1
    - C0–Use the RJ-45 connectors for 10/100/1000 BaseT or to cable a virtual management Ethernet (VME) interface for spine members in a VCF. See "Connect a Device to a Network for Out-of-Band Management" on page 119.

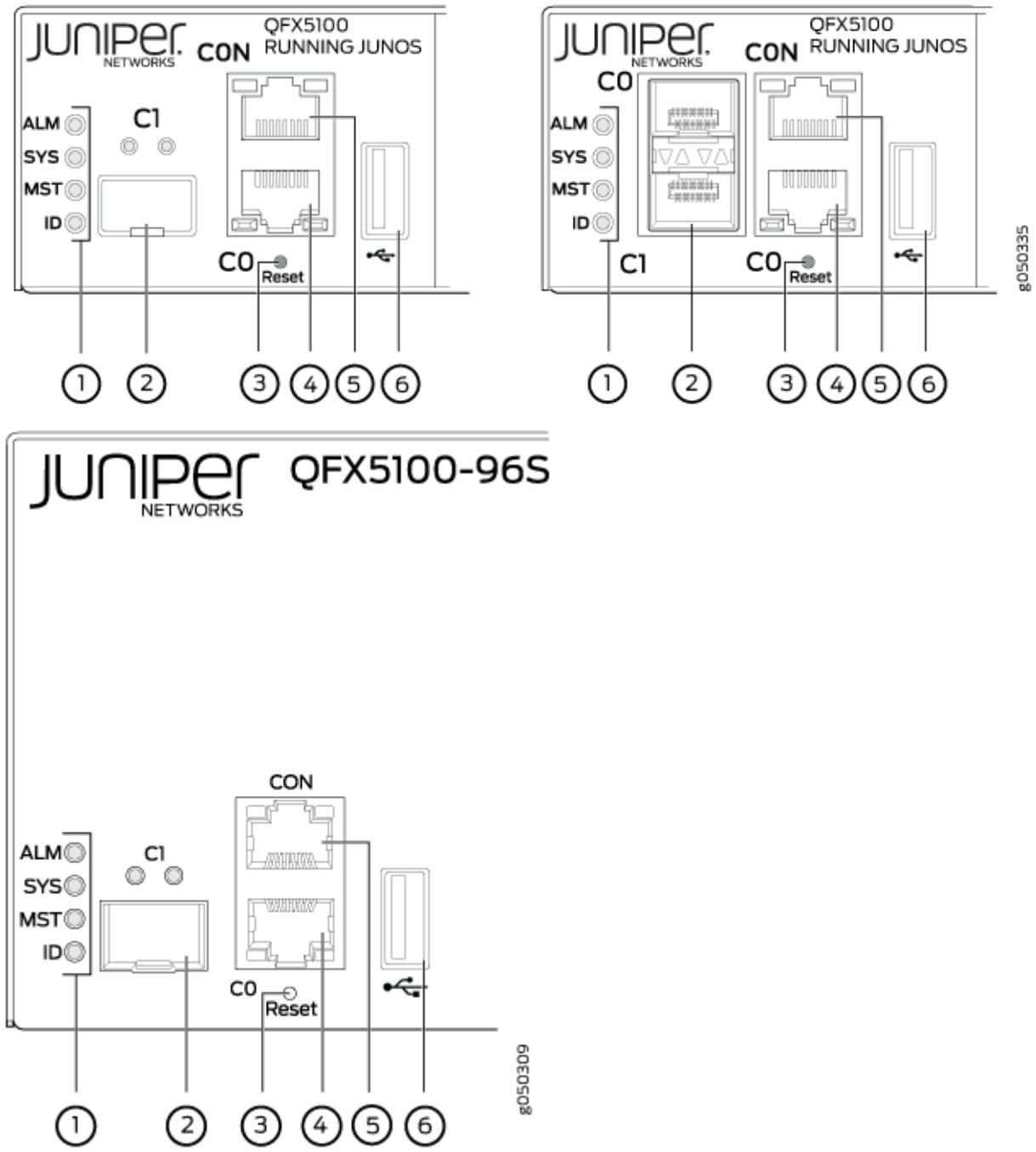
      NOTE: For product SKUs with C0 available in both copper and fiber, the copper C0 has priority over fiber C0.

  - C1–Use the SFP connector for 1000 BaseX.
- USB port for image updates.
- Console port (RJ-45) to support RS-232 serial ports. The LEDs above the port indicate status and link.

Management Port LEDs on a QFX5100 Device

The management ports (labeled **C0** for 10/100/1000 Base-T and **C1** for 10/100/1000 Base-T and SFP 1000 Base-X connections) on a QFX5100 switch have two LEDs that indicate link status and link activity (see Figure 24 on page 48). The left LED indicates status; the right LED indicates link/activity.

Figure 24: Management Port LEDs on a QFX5100 Switch



1– Status LEDs	4– em0–RJ-45 (10/100/1000 Base-T) management Ethernet port (C0)
2– em1–SFP management Ethernet port (C1) Cage (socket for either 10/100/1000 Base-T RJ45 SFP or 1GbE fiber SFP)	5– RJ-45 console port (CON)

3– **Reset** button, see caution statement below	6– USB port

CAUTION: Do not use the **Reset** button to restart the power sequence unless under the direction of Juniper Networks Technical Assistance Center (JTAC).

Table 11 on page 49 describes the management port LEDs.

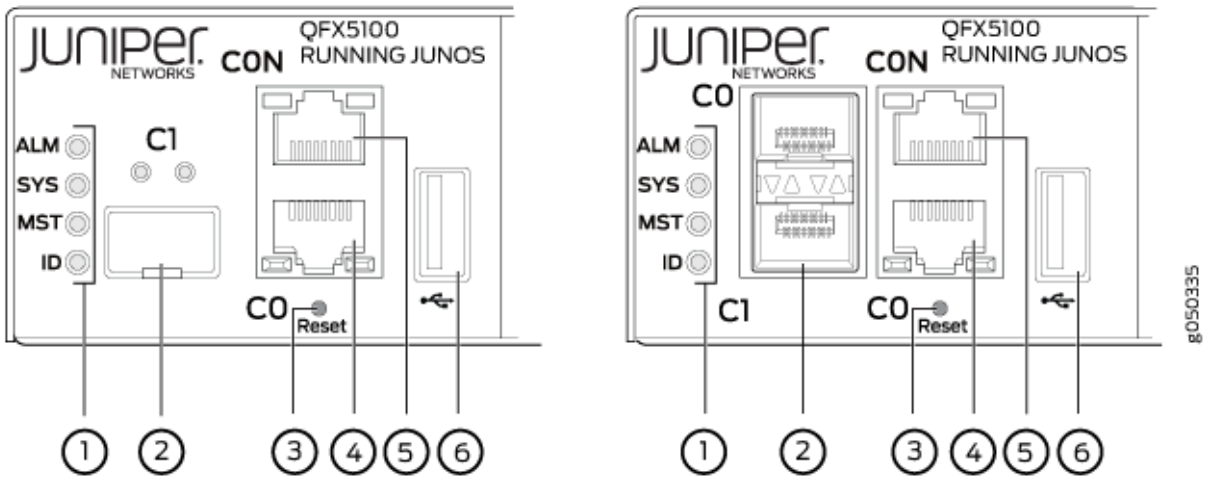
Table 11: Management Port LEDs on a QFX5100 Switch

LED	Color	State	Description
Link/Activity	Unlit	Off	No link is established, there is a fault, or the link is down.
	Green	On steadily	A link is established, but there is no link activity.
		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.
	Amber	On steadily	The port speed is 100 M.

Chassis Status LEDs on a QFX5100 Device

The QFX5100 switch series has four status LEDs on the FRU side of the chassis, next to the management ports (see Figure 25 on page 50).

Figure 25: Chassis Status LEDs on a QFX5100 Switch



1– Status LEDs	4– em0–RJ-45 (10/100/1000 Base-T) management Ethernet port (C0)
2– em1–SFP management Ethernet port (C1) Cage (socket for either 10/100/1000 Base-T RJ45 SFP or 1GbE fiber SFP)	5– RJ-45 console port (CON)
3– **Reset** button, see caution statement below	6– USB port

CAUTION: Do not use the **Reset** button to restart the power sequence unless under the direction of Juniper Networks Technical Assistance Center (JTAC).

Table 12 on page 50 describes the chassis status LEDs on a QFX5100 switch, their colors and states, and the status they indicate. You can view the colors of the three LEDs remotely through the CLI by issuing the operational mode command `show chassis led`.

Table 12: Chassis Status LEDs on a QFX5100 Switch

Name	Color	State	Description
ALM–Alarm or beacon	Unlit	Off	The switch is halted or there is no alarm.

Table 12: Chassis Status LEDs on a QFX5100 Switch *(Continued)*

Name	Color	State	Description
	Red	On steadily	A major hardware fault has occurred, such as a temperature alarm or power failure, and the switch has halted. Power off the QFX5100 switch by setting the AC power source outlet to the OFF (O) position, or unplugging the AC power cords. Correct any voltage or site temperature issues, and allow the switch to cool down. Power on the QFX5100 switch and monitor the power supply and fan LEDs to help determine where the error is occurring.
	Amber	On steadily	A minor alarm has occurred, such as a software error. Power off the QFX5100 switch by setting the AC power source outlet to the OFF (O) position, or unplugging the AC power cords. Power on the QFX5100 switch and monitor the status LEDs to ensure that Junos OS boots properly.
SYS–System	Unlit	Off	The switch is powered off or halted.
	Green	On steadily	Junos OS for QFX Series is loaded on the switch.

Table 12: Chassis Status LEDs on a QFX5100 Switch *(Continued)*

Name	Color	State	Description
	Green	Blinking	The switch is participating as: • A member in a QFX Virtual Chassis • A leaf device in a Virtual Chassis Fabric (VCF) • A spine device in a VCF • A Routing Engine Primary in a VCF • A Routing Engine Backup in a VCF
MST–Primary in a QFX Virtual Chassis or Routing Engine Primary in a VCF	Unlit	Off	The switch is a linecard member in a QFX Virtual Chassis.
	Green	On steadily	The switch is one of the following: • A standalone switch • In the primary role in a QFX Virtual Chassis • Is the routing engine primary in a VCF
	Green	Blinking	The switch is the backup primary in a QFX Virtual Chassis or the backup routing engine in a VCF.
ID–Identification	Unlit	Off	The beacon feature is not enabled on the switch. This feature is enabled using the `request chassis beacon` command.

Table 12: Chassis Status LEDs on a QFX5100 Switch *(Continued)*

Name	Color	State	Description
	Blue	Blinking	The beacon feature is enabled on the switch. This feature is enabled using the `request chassis beacon` command.

SEE ALSO

show chassis alarms

request chassis beacon

RELATED DOCUMENTATION

QFX5100 Cable and Pinout Specifications | **102**

Installing and Removing QFX5100 Device Hardware Components | **176**

Connect a Device to a Network for Out-of-Band Management | **119**

QFX5100 Power System

IN THIS SECTION

AC Power Supply for a QFX5100 Device

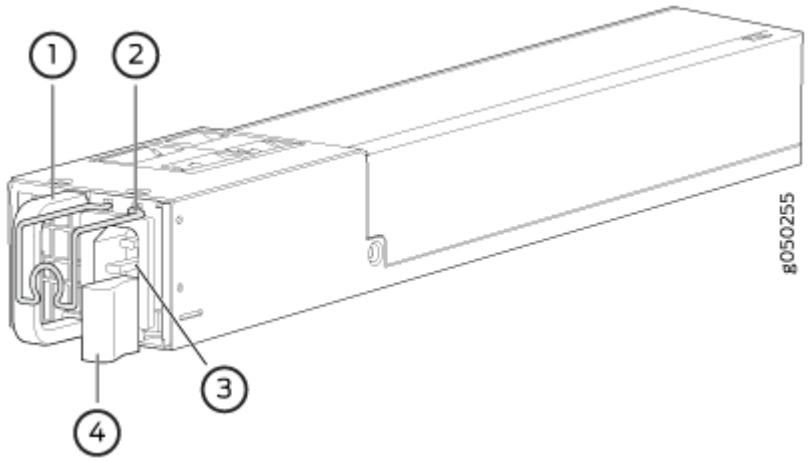
The two power supplies in QFX5100 switches are hot-removable and hot-insertable field-replaceable units (FRUs). The power supplies are installed in the switch at the factory. You can install replacement power supplies from the management panel without powering off the switch or disrupting the switching function.

The AC power supply in 1 U QFX5100 switches is 650 W; the AC power supply in the 2 U, QFX5100-96S switch, is 850 W. Both power supplies look identical. Be sure to use the correct power supply for your chassis product SKU (see Table 13 on page 56).

> **CAUTION**: Do not mix power supplies with different airflow or different wattage. The system raises an alarm when a power supply having a different airflow or wattage is inserted into the chassis.

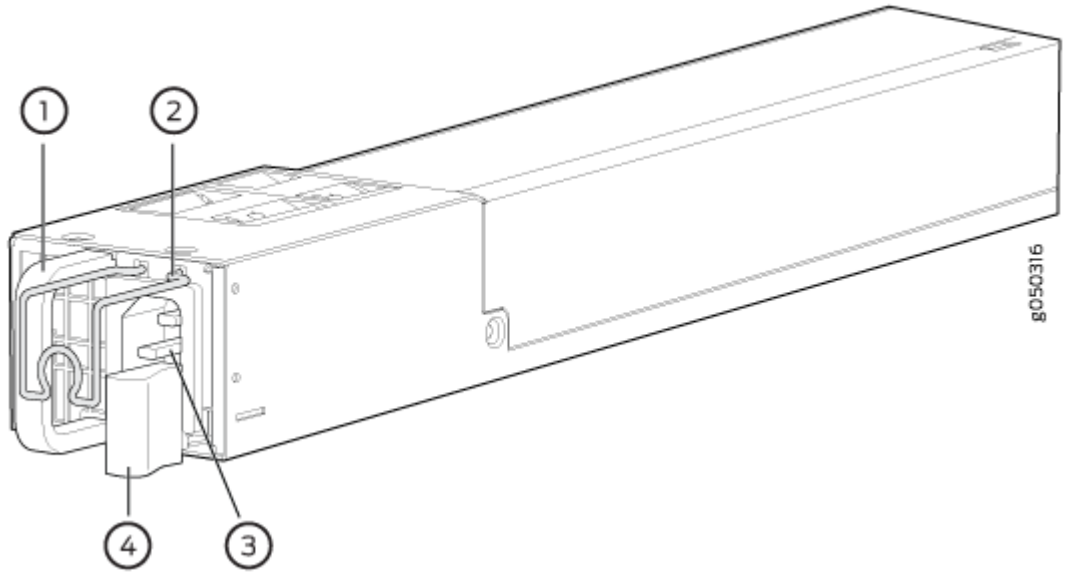
See Figure 26 on page 54 for an example of the 1 U design and Figure 27 on page 55 for an example of the 2 U power supply.

Figure 26: 1 U AC Power Supply in QFX5100 Switches



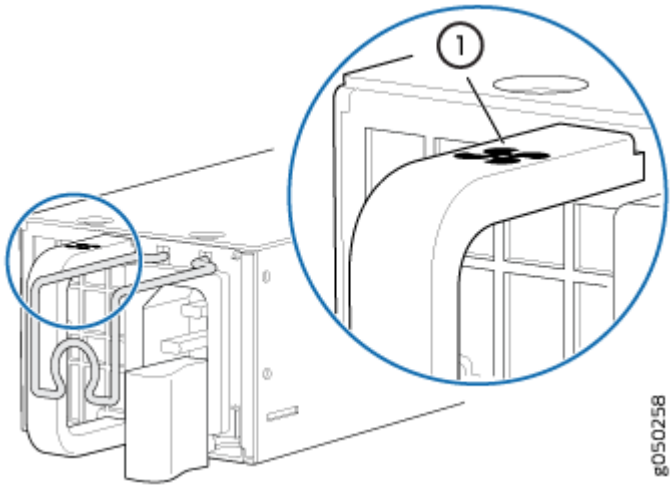
1– Handle	3– AC appliance inlet
2– Security latch	4– Ejector lever

Figure 27: 2 U AC Power Supply in a QFX5100-96S Switch



The power supply provides FRU-to-port or port-to-FRU airflow depending on the product SKU you purchase. On legacy switches, or switches with an LCD, this airflow is called back-to-front and front-to-back. The power supplies have color-coded handles with a fan icon. See Figure 28 on page 55 for an example of the power supply. A power supply with a blue handle denotes FRU-to-port airflow; a power supply with a gold-colored handle denotes port-to-FRU airflow.

Figure 28: Power Supply Handle Detail



1– Fan icon on handle	

CAUTION: Verify that the airflow direction on the power supply handle matches the direction of airflow in the chassis. Ensure that each power supply you install in the chassis has the same airflow direction. If you install power supplies with two different airflow directions, Junos OS raises an alarm. If you need to convert the airflow pattern on a chassis, you must change out all the fans and power supplies at one time to use the new direction.

Table 13 on page 56 shows the different power supplies and their direction of airflow.

Table 13: Airflow Direction in QFX5100 AC Power Supplies

QFX5100 Product SKUs	Wattage	Product Number	Direction of Airflow	Color of Power Supply Handle
QFX5100-24Q QFX5100-48S QFX5100-48SH QFX5100-48T QFX5100-48TH	650 W	JPSU-650W-AC-AFI QFXC01-PWRACI-650A (older version)	FRU-to-port	Juniper Azure Blue
QFX5100-96S	850 W	JPSU-850W-AC-AFI		
QFX5100-24Q QFX5100-48S QFX5100-48SH QFX5100-48T QFX5100-48TH	650 W	JPSU-650W-AC-AFO QFXC01-PWRACO-650A (older version)	Port-to-FRU	Juniper Gold
QFX5100-96S	850 W	JPSU-850W-AC-AFO		

To avoid electrical injury, carefully follow instructions in "Connecting AC Power to a QFX5100 Device" on page 134.

AC Power Specifications for a QFX5100 Device

Table 14 on page 57 describes the AC power specifications for a QFX5100 device.

Table 14: AC Power Specifications for a QFX5100 Device

Item	
AC input voltage	
AC input line frequency	
AC input current rating	
Typical power consumption	
QFX5100-24Q	230 W
QFX5100-48S and QFX5100-48SH	230 W
QFX5100-48T and QFX5100-48TH	322 W
QFX5100-96S	315 W
Maximum power consumption	
QFX5100-24Q	365 W
QFX5100-48S and QFX5100-48SH	365 W
QFX5100-48T and QFX5100-48TH	395 W
QFX5100-96S	470 W

AC Power Cord Specifications for a QFX5100 Device

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.

CAUTION: The AC power cord for the device is intended for use with that chassis only and not for any other use.

NOTE: In North America, AC power cords must not exceed 4.5 meters (approximately 14.75 feet) 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 QFX5100 devices are in compliance.

Table 15 on page 58 lists AC power cord specifications provided for each country or region.

Table 15: AC Power Cord Specifications

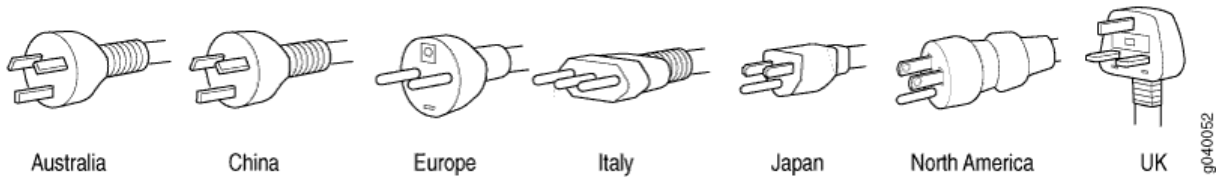
Country/Region	Electrical Specifications	Plug Standards
Australia	250 VAC, 10 A, 50 Hz	AS/NZ 3112-1993
China	250 VAC, 10 A, 50 Hz	GB2099.1 1996 and GB1002 1996 (CH1-10P)
Europe (except Italy, Switzerland, and United Kingdom)	250 VAC, 10 A, 50 Hz	CEE (7) VII
Italy	250 VAC, 10 A, 50 Hz	CEI 23-16/VII
Japan	125 VAC, 12 A, 50 Hz or 60 Hz	JIS 8303
North America	125 VAC, 13 A, 60 Hz	NEMA 5-15
South Korea	250 VAC, 10 A, 60 Hz	KSC 8305

Table 15: AC Power Cord Specifications *(Continued)*

Country/Region	Electrical Specifications	Plug Standards
Switzerland	250 VAC, 10 A, 50 Hz	SEV 1011 SEV 6534/2
United Kingdom	250 VAC, 10 A, 50 Hz	BS 1363A

Figure 29 on page 59 illustrates the plug on the power cord for some of the countries or regions listed in Table 15 on page 58.

Figure 29: AC Plug Types



AC Power Supply LEDs on a QFX5100 Device

Figure 30 on page 59 shows the location of the LEDs on the power supply.

Figure 30: AC Power Supply LEDs on a QFX5100 Switch

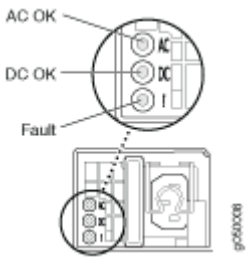


Table 16 on page 60 describes the LEDs on the AC power supplies.

Table 16: AC Power Supply LEDs on a QFX5100 Switch

LED	Color	State	Description
AC OK	Unlit	Off	The power supply is disconnected from power, or power is not coming into the power supply.
	Green	On steadily	Power is coming into the power supply.
DC OK	Unlit	Off	The power supply is disconnected from power, or the power supply is not sending out power correctly.
	Green	On steadily	The power supply is sending out power correctly.
Fault	Amber	On steadily	An error has been detected in the power supply. 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.

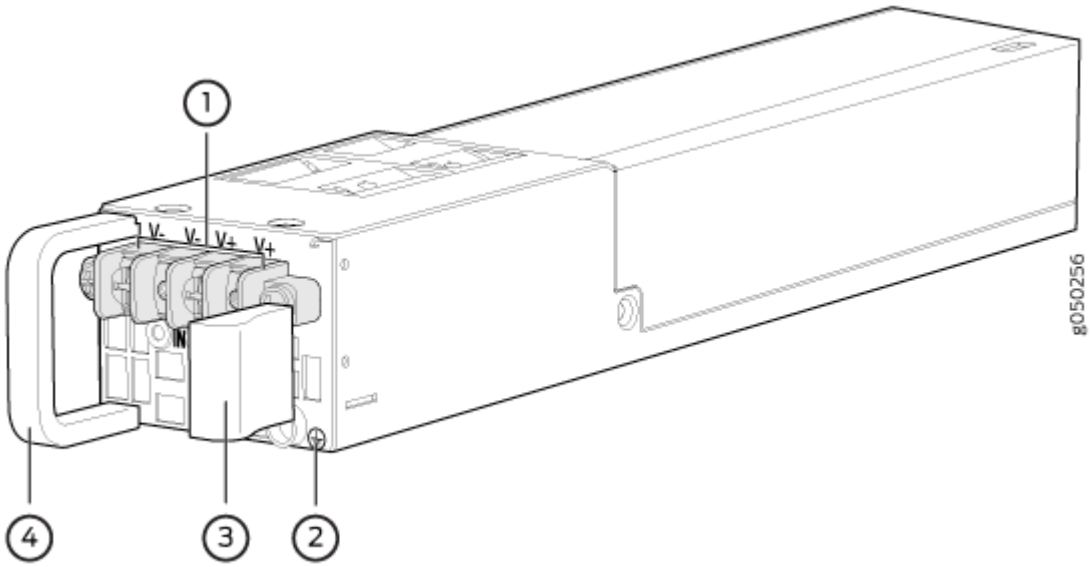
NOTE: If the **AC OK** LED and the **DC OK** LED are unlit, either the AC power cord is not installed properly or the power supply fuse has failed. If the **AC OK** LED is lit and the **DC OK** LED is unlit, the AC power supply is installed properly, but the power supply has an internal failure.

DC Power Supply in a QFX5100 Device

The power supplies in QFX5100 devices (see Figure 31 on page 61) are hot-removable and hot-insertable field-replaceable units (FRUs) that you can install in 1 U DC product SKUs of QFX5100 devices without powering off the device or disrupting the switching function.

The DC power supply in 1 U product SKUs of QFX5100 is 650 W with dual feeds for power resiliency. The DC power supply in the 2 U product SKU, QFX5100-96S, is 850 W with dual feeds for power resiliency. Both power supplies have a similar design. See Figure 31 on page 61 for an example of the 1 U design and Figure 32 on page 61 for an example of the 2 U power supply.

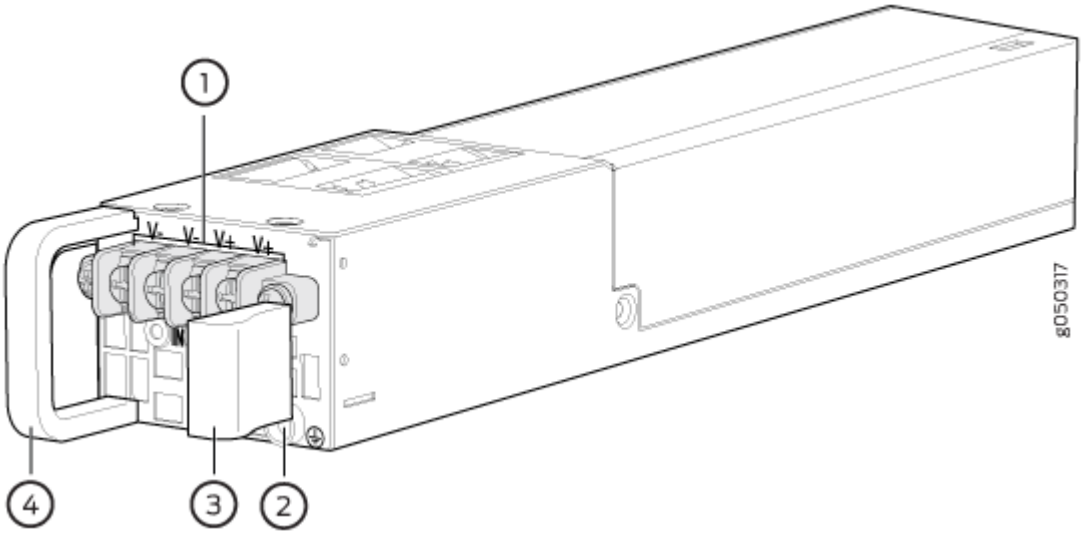
Figure 31: DC Power Supply in QFX5100 Devices



1– Terminal block	3– Ejector lever
2– ESD grounding point	4– Handle

To supply sufficient power for 1 U models, terminate the DC input wiring on a facility DC source that is capable of supplying a minimum of 7 A at –48 VDC.

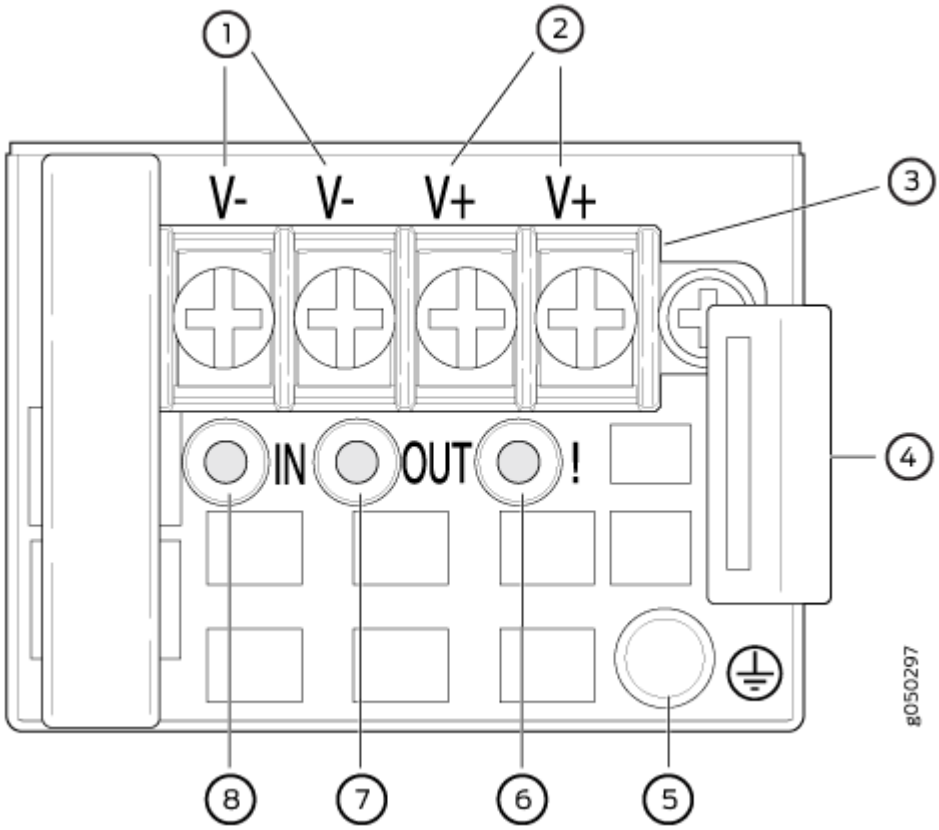
Figure 32: DC Power Supply for QFX5100-96S Devices



1– Terminal block	3– Ejector lever
2– ESD grounding point	4– Handle

NOTE: The DC power supply in the switch has four terminals labeled V-, V-, V+, and V+ (see Figure 33 on page 62) for connecting DC power source cables labeled positive (+) and negative (–).

Figure 33: DC Power Supply Faceplate in QFX5100 Devices



1– Shunt negative input terminals (-48V)	5– ESD grounding point
2– Shunt positive input terminals (+RTN)	6– Fault LED
3– Terminal block	7– Output LED
4– Ejector lever	8– Input LED

To avoid electrical injury, carefully follow instructions in "Install and Remove QFX5100 Power Supplies" on page 153.

DC Power Specifications for a QFX5100 Device

Table 17 on page 63 describes the DC power specifications for DC product SKUs of the QFX5100 device.

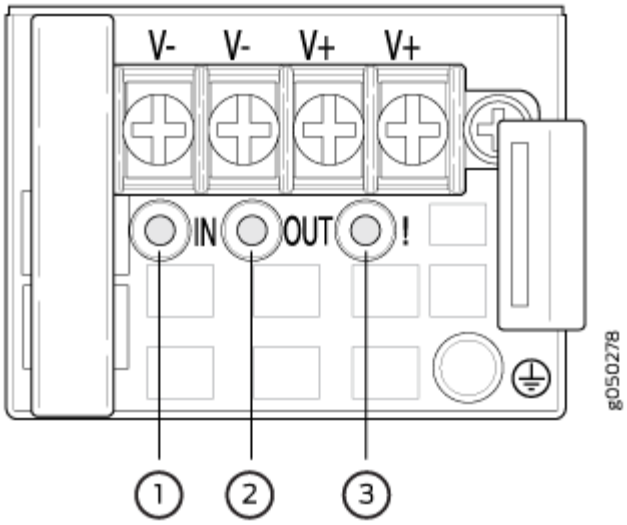
Table 17: DC Power Specifications for a QFX5100 Device

Item	Product SKUs	Specifications
DC input voltage	QFX5100-24Q QFX5100-48S QFX5100-48T	• Rated operating voltage: –48 VDC to -60 VDC • Operating voltage range: -40 VDC through –72 VDC
	QFX5100-96S	• Rated operating voltage: VDC -48 VDC to -60 VDC • Operating voltage range: –40 VDC through -72 VDC
DC input current rating	QFX5100-24Q QFX5100-48S QFX5100-48T QFX5100-96S	10 A maximum
Typical power consumption	QFX5100-48S QFX5100-48T QFX5100-24Q	300 W
	QFX5100-96S	315 W
Maximum power consumption	QFX5100-24Q QFX5100-48S QFX5100-48T	385 W
	QFX5100-96S	470 W

DC Power Supply LEDs on a QFX5100 Device

Figure 34 on page 64 shows the location of the LEDs on the DC power supply.

Figure 34: DC Power Supply Faceplate on a QFX5100 Switch



1– Input LED	3– Fault LED
2– Output LED	

CAUTION: The V+ terminals are shunted internally together, as are the V- terminals. The same polarity terminal can be wired together from the same source to provide an additional current path in a higher power chassis. Do not connect the terminals to different sources.

Table 18 on page 64 describes the LEDs on the DC power supplies.

Table 18: DC Power Supply LEDs on a QFX5100 Switch

Name	Color	State	Description
Input	Unlit	Off	The power supply is disconnected from power, or power is not coming into the power supply.

Table 18: DC Power Supply LEDs on a QFX5100 Switch *(Continued)*

Name	Color	State	Description
	Green	On steadily	Power is coming into the power supply.
Output	Unlit	Off	The power supply is disconnected from power, or the power supply is not sending out power correctly.
	Green	On steadily	The power supply is sending out power correctly.
Fault	Amber	On steadily	An error has been detected in the power supply. 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.

RELATED DOCUMENTATION

Connect the QFX5100 to Power | 132

Prevention of Electrostatic Discharge Damage | 228

QFX5100 Cooling System

IN THIS SECTION

Cooling System and Airflow in a QFX5100 Device

IN THIS SECTION

The cooling system in an QFX5100 device consists of fan modules and a single fan in each power supply. The number of fan modules vary depending whether the size of the switch is 1 U or 2 U high. All switches can be set up to work in one of two airflow directions:

- Airflow In–Air comes into the switch through the vents in the field-replaceable units (FRUs)
- Airflow Out–Air comes into the switch through the vents in the port panel.

CAUTION: Airflow In and Airflow Out fans and power supplies cannot be mixed in the same chassis.

Fan Modules

The fan modules in QFX5100 devices are hot-insertable and hot-removable field-replaceable units (FRUs). These fan modules are designed for one of the two available airflow directions (Airflow In or Airflow Out). Some fan modules are also color-coded for the airflow direction as well. The fan modules are installed in the fan module slots on the management panel of the switch next to the power supplies.

Both the 1 U and 2 U versions of QFX5100 fan modules have a similar design with different dimensions. The 1 U QFX5100 devices have 5 fan modules numbered 0 through 4 from left to right, where the 2 U, QFX5100-96S device, has 3 fan modules numbered 0 through 2. On all QFX5100 devices, each fan module slot has a fan icon next to it.

Figure 35 on page 67 shows the 1 U fan module and Figure 36 on page 67 shows the 2 U fan module.

Figure 35: 1 U Fan Module Used in QFX5100 Switches

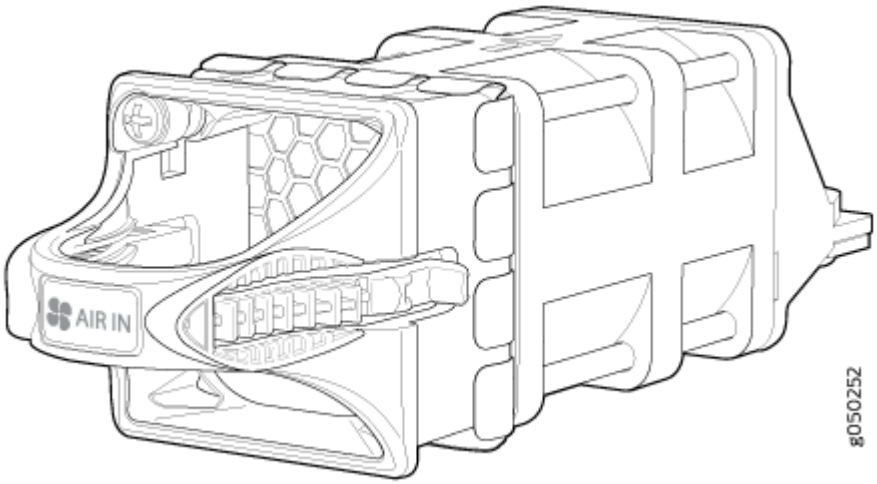
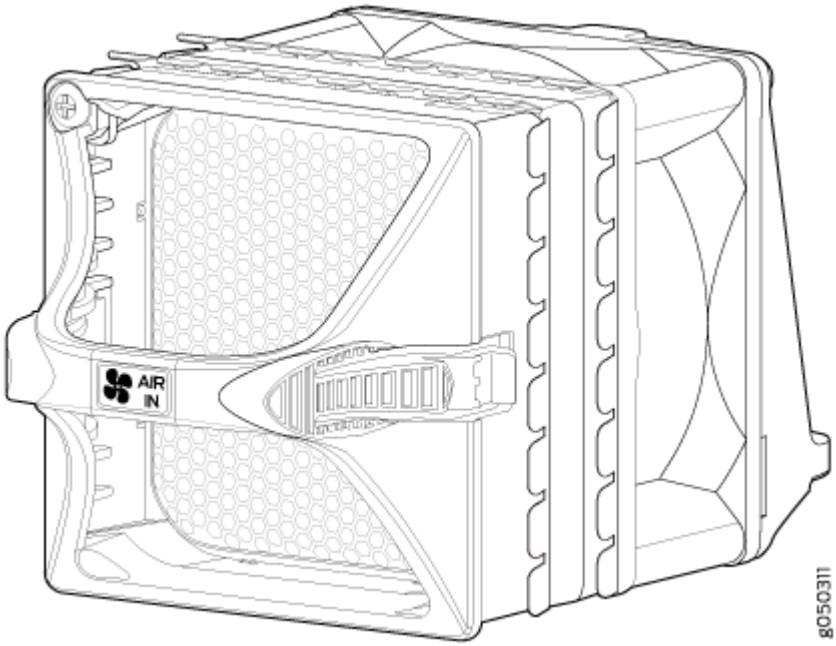


Figure 36: 2 U Fan Module Used in QFX5100-96S Switches



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.

The fan modules are available in two product SKUs that have different airflow directions—FRU-to-port airflow, indicated on some units by the azure blue color or a label. FRU-to-port airflow versions of the fan module that have labels are marked **AIR IN** . Likewise, port-to-FRU airflow is indicated by either a gold color or the label **AIR OUT** . On legacy switches or switches with LCDs, this airflow is also called front-to-back and back-to-front. Table 19 on page 68 lists the available fan module product SKUs and the direction of airflow in them:

Table 19: Fan Modules in QFX5100 Switches

Fan Module	Product SKUs	Airflow Diagram	Label on the Fan Module	Color of Fan Module	Direction of Airflow in the Fan Module	Power Supplies
QFX5100-FAN-AFI	QFX5100-24Q QFX5100-48S QFX5100-48SH QFX5100-48T QFX5100-48TH	Figure 37 on page 69	**AIR IN**	Juniper Azure Blue	FRU-to-port, that is, air comes in from the end of the switch with the fans; air exhausts from the switch end with ports (also known as back-to-front airflow).	You must install only power supplies that have **AIR IN** labels in switches in which the fan modules have **AIR IN** labels.
QFX5100-96S-FANAFI	QFX5100-96S	Figure 38 on page 70				
QFX5100-FAN-AFO	QFX5100-24Q QFX5100-48S QFX5100-48SH QFX5100-48T QFX5100-48TH	Figure 39 on page 71	**AIR OUT**	Juniper Gold	Port-to-FRU, that is, air comes in through vents on the end with ports; air exhausts out the end with the fans (also known as	You must install only power supplies that have **AIR OUT** labels in switches in which

Table 19: Fan Modules in QFX5100 Switches *(Continued)*

Fan Module	Product SKUs	Airflow Diagram	Label on the Fan Module	Color of Fan Module	Direction of Airflow in the Fan Module	Power Supplies
QFX5100-96S-FANAFO	QFX5100-96S	Figure 40 on page 72			front-to-back airflow).	the fan modules have **AIR OUT** labels.

In data center deployments, position the switch in such a manner that the **AIR IN** labels on switch components are next to the cold aisle, and **AIR OUT** labels on switch components are next to the hot aisle.

Figure 37: Air In Airflow Through 1 U QFX5100 Switch Chassis

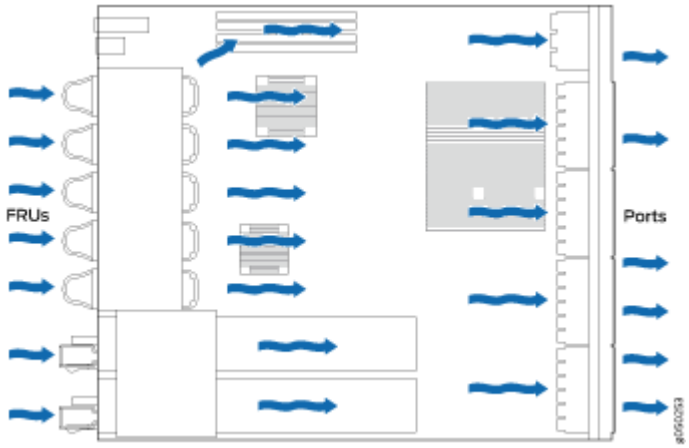


Figure 38: Air In Airflow Through 2 U QFX5100 Switch Chassis

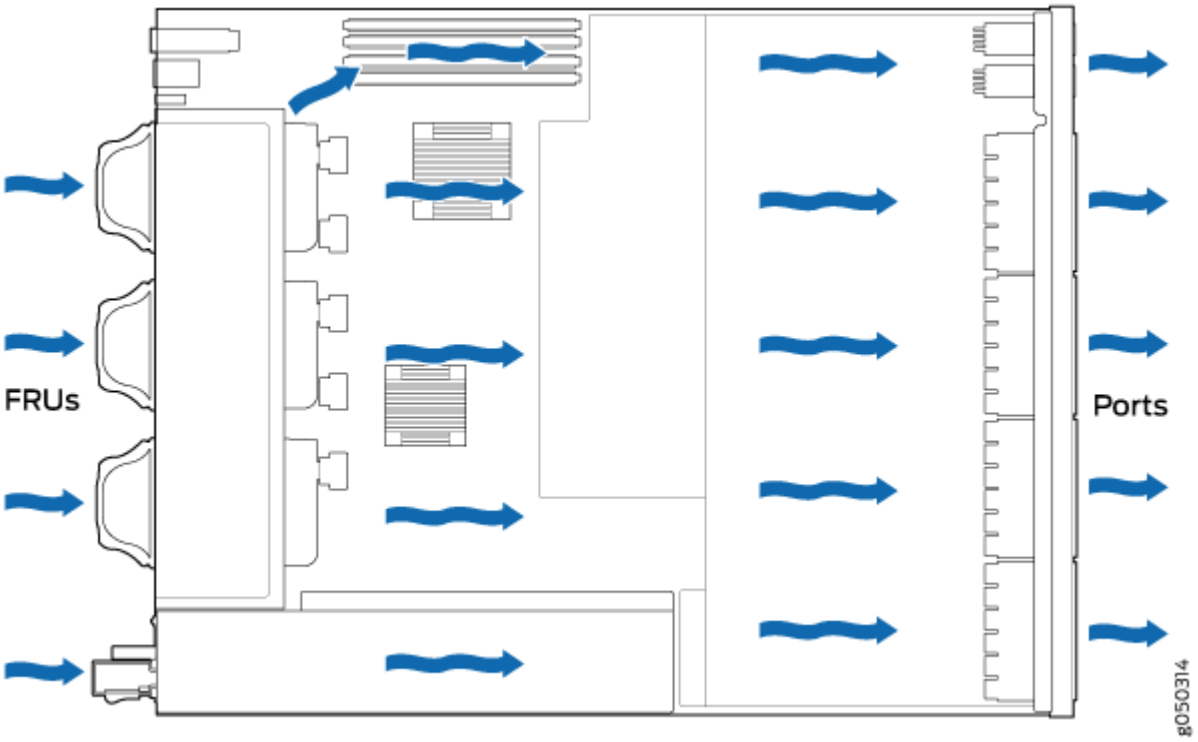


Figure 39: Air Out Airflow Through 1 U QFX5100 Switch Chassis

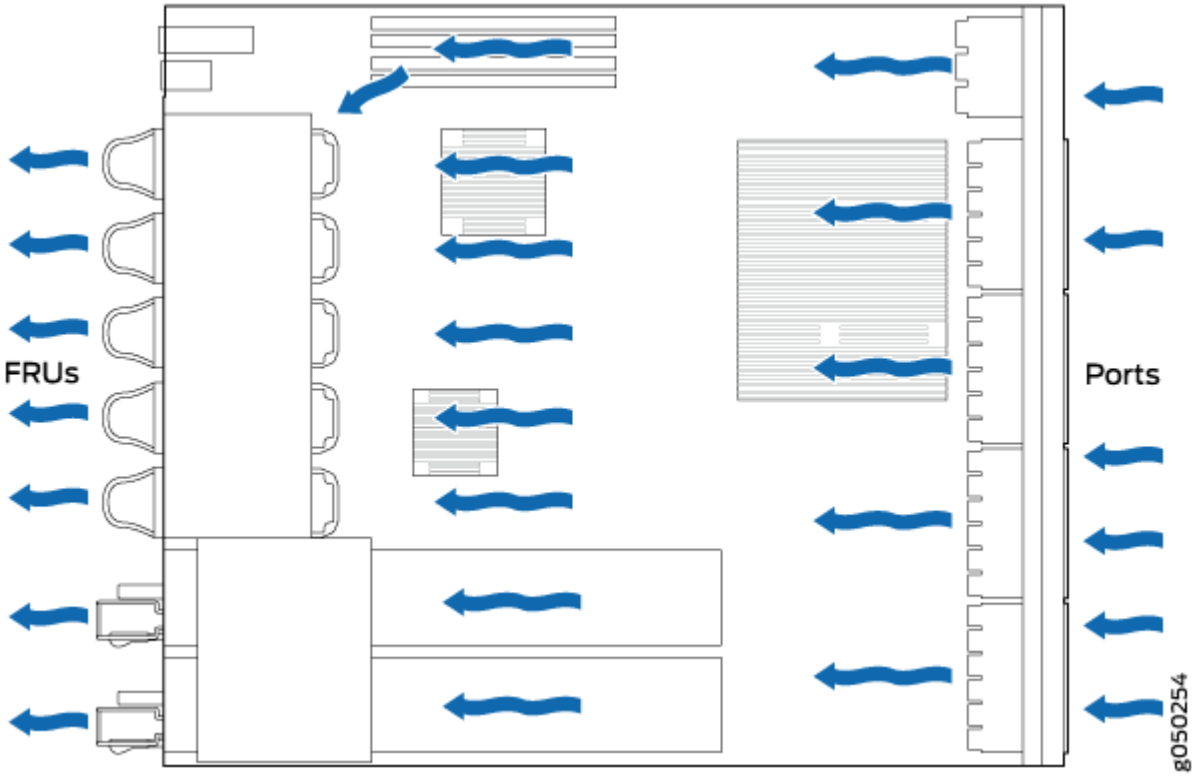
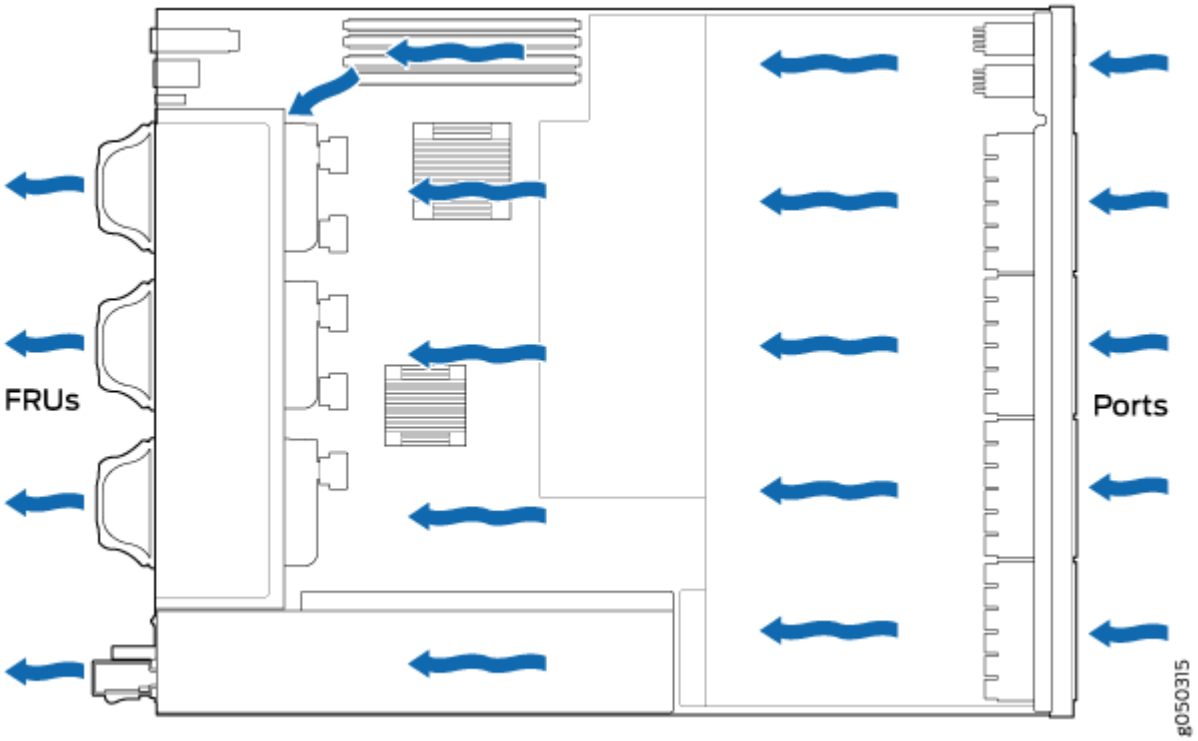


Figure 40: Air Out Airflow Through 2 U QFX5100 Switch Chassis



Do Not Install Components with Different Airflow or Wattage in the Switch

Do not mix power supplies with different airflow. If the power supplies are color-coded, ensure they are either all azure blue for airflow in models or all gold for airflow out models. If the power supplies are not color-coded but have a label, ensure that the chassis is either using all airflow in (**AFI**) or all airflow out (**AFO**). Likewise, ensure that all fan modules have the same airflow and match the airflow of the power supplies. Fan modules are also either color-coded azure blue for airflow in or gold for airflow out. If the fan module has a label instead of being color-coded, ensure that labels (**AIR IN** and **AIR OUT**) are not mixed. If the fan modules have **AIR IN** labels, the power supplies must also have **AIR IN** labels; if the fan modules have **AIR OUT** labels, the power supplies must also have **AIR OUT** labels.

Mixing components with different airflows in the same chassis hampers the performance of the cooling system of the switch and leads to overheating of the chassis.

CAUTION: 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.

Do not mix fan modules with different wattage. Only use the replacement fan modules that are designed for use with your product number. See Table 19 on page 68 for the correct part number for your QFX5100 device.

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

However if you need to convert a QFX5100 device to have a different airflow, you can change the airflow pattern. To convert an **AIR IN** product SKU to an **AIR OUT** product SKU or an **AIR OUT** product SKU to a **AIR IN** product SKU, you must replace all of the fans and power supplies at one time to use the new direction. The system raises an alarm when the system is converted, which is normal.

Fan Module Status

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

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 20 on page 73 describes the Status LED on the fan module in a QFX5100 device.

Table 20: Fan Module LED

LED State	Description
Solid Green	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.
Blinking 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

Field-Replaceable Units in a QFX5100 Device | **17**

Prevention of Electrostatic Discharge Damage

QFX5100 Device Hardware Overview | **2**

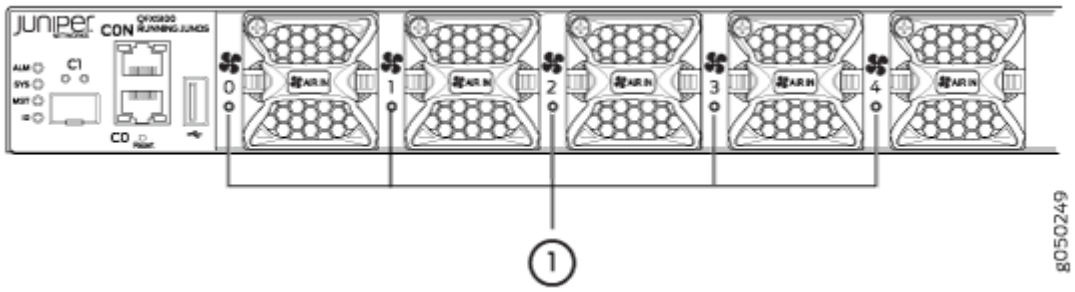
Installing a Fan Module in a QFX5100 Device | **149**

Removing a Fan Module from a QFX5100 Device | **151**

Fan Module LED on a QFX5100 Device

Figure 41 on page 74 shows the location of the LED next to the fan module.

Figure 41: Fan Module LED in a QFX5100 Switch



1– Fan LED

Table 21 on page 74 describes the function of the fan tray LED.

Table 21: Fan Tray LED in a QFX5100 Switch

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

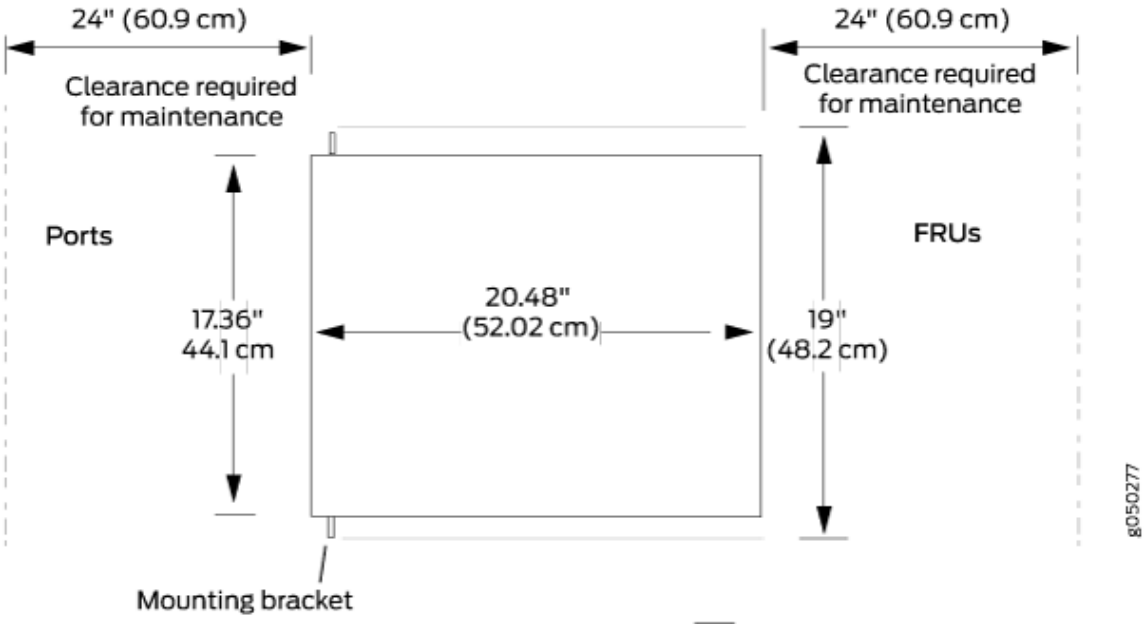
Table 21: Fan Tray LED in a QFX5100 Switch *(Continued)*

Name	Color	State	Description
	Amber	Blinking	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.

Clearance Requirements for Airflow and Hardware Maintenance for a QFX5100 Device

When planning the site for installing a QFX5100 device, you must allow sufficient clearance around the installed chassis (see Figure 42 on page 75).

Figure 42: Clearance Requirements for Airflow and Hardware Maintenance for a QFX5100 Device



- For the cooling system to function properly, the airflow around the chassis must be unrestricted. See "Cooling System and Airflow in a QFX5100 Device" on page 66 for more information about the airflow through the chassis.
- If you are mounting a QFX5100 device in a rack or cabinet with other equipment, ensure that the exhaust from other equipment does not blow into the intake vents of the chassis.
- Leave at least 24 in. (61 cm) both in front of and behind the QFX5100 device. 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 or cabinet and 24 in. (61 cm) behind the rack or cabinet.

RELATED DOCUMENTATION

Install and Remove QFX5100 Fan Modules | **149**

General Site Guidelines | **82**

Rack-Mounting and Cabinet-Mounting Warnings | **211**

2

CHAPTER

Site Planning, Preparation, and Specifications

Site Preparation Checklist for a QFX5100 Device

The checklist in Table 22 on page 78 summarizes the tasks you need to perform when preparing a site for QFX5100 deviceinstallation.

Table 22: Site Preparation Checklist

Item or Task	For More Information	Performed By	Date
Architecture			
Determine whether the QFX5100 device will operate: • standalone • as a member in a Virtual Chassis • as a spine or leaf in a Virtual Chassis Fabric (VCF) • as a node in a QFabric	• "Plan a Virtual Chassis Fabric Deployment" on page 88 • *Planning a QFX3000-G QFabric System Deployment* • *Planning a QFX3000-M QFabric System Deployment*		
Environment			
Verify that environmental factors such as temperature and humidity do not exceed switch tolerances.	"Environmental Requirements and Specifications for a QFX5100 Device" on page 80		
Power			
Measure the distance between external power sources and switch installation site.			
Calculate the power consumption and requirements.	"AC Power Specifications for a QFX5100 Device" on page 57		
Rack or Cabinet			

Table 22: Site Preparation Checklist *(Continued)*

Item or Task	For More Information	Performed By	Date
Verify that your rack or cabinet meets the minimum requirements for the installation of the switch.	"Rack Requirements for a QFX5100 Device" on page 84 "Cabinet Requirements for a QFX5100 Device" on page 87		
Plan rack or cabinet location, including required space clearances.	"Clearance Requirements for Airflow and Hardware Maintenance for a QFX5100 Device" on page 75		
Secure the rack or cabinet 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.	• "Port Panel of a QFX5100-24Q Device" on page 20 • "Port Panel of a QFX5100-24Q-AA Device" on page 25 • "Port Panel of QFX5100-48S and QFX5100-48SH Devices" on page 26 • "Port Panel of QFX5100-48T and QFX5100-48TH Devices" on page 28 • "Port Panel of a QFX5100-96S Device" on page 30		
Plan the cable routing and management.			

RELATED DOCUMENTATION

General Safety Guidelines and Warnings

QFX5100 Standalone Installation Overview | **109**

QFX5100 Site Guidelines and Requirements

IN THIS SECTION

Environmental Requirements and Specifications for a QFX5100 Device

The switch must be installed in a rack or cabinet. 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 23 on page 81 provides the required environmental conditions for normal switch operation.

Table 23: QFX5100 Switch Environmental Tolerances

Description	Tolerance
Altitude	No performance degradation to 6,562 feet (2000 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) **NOTE**: Customers with QFX5100-48T switches should ensure the room temperature does not exceed a 2° C increase or decrease per minute. • 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

Clearance Requirements for Airflow and Hardware Maintenance for a QFX5100 Device

QFX5100 Standalone Installation Overview

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 prescribed airflow guidelines to ensure that the cooling system functions properly. Ensure that 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.

Site Electrical Wiring Guidelines

Table 24 on page 83 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 24: 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: • Improperly installed wires cause radio frequency interference (RFI). • Damage from lightning strikes occurs when wires exceed recommended distances or pass between buildings. • Electromagnetic pulses (EMPs) caused by lightning damage 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. • If you must 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.

Grounding Cable and Lug Specifications for a QFX5100 Device

For installations that require a separate grounding conductor to the chassis, the switch must be adequately grounded before power is connected to ensure proper operation and to meet safety and electromagnetic interference (EMI) requirements. To ground a QFX5100 device, connect a grounding cable to earth ground and then attach it to the chassis grounding points.

WARNING: The switch is pluggable type A equipment installed in a restricted-access location. It has a separate protective earthing terminal provided on the chassis in addition to the grounding pin of the power supply cord. This separate protective earthing terminal must be permanently connected to earth ground for installations that require a separate grounding conductor to the chassis.

WARNING: To comply with GR-1089 requirements, all intra-building copper cabling used for SFP+ and QSFP+ 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. See "Connecting Earth Ground to a QFX5100 Device" on page 132. A cable with an incorrectly attached lug can damage the switch.

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

- A protective earthing terminal bracket is provided in the accessory kit for connecting the switch to earth ground. This L-shaped bracket attaches to the side of the QFX5100 chassis through the mounting bracket, providing a protective earthing terminal for the switch.
- The grounding lug required is a Panduit LCD10-10A-L or equivalent (not provided).. The grounding lug should accommodates 14–10 AWG (2–5.3 mm^2) stranded wire.
- The grounding cable that you provide for a QFX5100 device must be 14 AWG (2 mm^2), minimum 60° C wire, or as permitted by the local code.
- Ensure you have two SAE 10-32 washers and screws to attach the cable and bracket (not provided).

SEE ALSO

QFX5100 Power System | 53

Connect the QFX5100 to Power | 132

Rack Requirements for a QFX5100 Device

All QFX5100 devices are designed to be installed on four-post racks. The QFX5100-96S device can also be installed on two-post racks.

Rack requirements consist of:

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

Table 25 on page 85 provides the rack requirements and specifications for the QFX5100 device.

Table 25: Rack Requirements for the QFX5100 Device

Rack Requirement	Guidelines
Rack type (all product SKUs)	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.
Rack type (QFX5100-96S only)	Use a two-post or 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.
Mounting bracket hole spacing (all product SKUs)	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.

Table 25: Rack Requirements for the QFX5100 Device *(Continued)*

Rack Requirement	Guidelines
Rack size and strength (all product SKUs)	• 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. • 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. 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 28.5 in. (72.4 cm) to 31.5 in. (80 cm). • For four-post installations, the front and rear rack rails must be spaced between 28.5 in. (72.4 cm) to 31.5 in. (80 cm) front-to-back. • The rack must be 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.
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.

SEE ALSO

Chassis Physical Specifications for a QFX5100 Device | 19

Rack-Mounting and Cabinet-Mounting Warnings

Clearance Requirements for Airflow and Hardware Maintenance for a QFX5100 Device | 75

Mount a QFX5100 Device in a Rack or Cabinet | 114

Cabinet Requirements for a QFX5100 Device

You can mount the QFX5100 device in an enclosure or cabinet that contains a four-post 19-in. open 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 26 on page 87 provides the cabinet requirements and specifications for the QFX5100 device.

Table 26: Cabinet Requirements for the QFX5100 Device

Cabinet Requirement	Guidelines
Cabinet size and clearance	The minimum cabinet size for accommodating a QFX5100 device is 36 in. (91.4 cm) deep. Large cabinets improve airflow and reduce the chance of overheating.

Table 26: Cabinet Requirements for the QFX5100 Device *(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. • The QFX5100 device fans exhaust hot air either through the vents on the port panel or through the fans and power supplies. 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. • 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

Rack-Mounting and Cabinet-Mounting Warnings | **211**

Clearance Requirements for Airflow and Hardware Maintenance for a QFX5100 Device | **75**

Mount a QFX5100 Device in a Rack or Cabinet | **114**

Plan a Virtual Chassis Fabric Deployment

A Virtual Chassis Fabric (VCF) architecture supports up to 20 interconnected devices that are managed as a logical single device. Supported platforms vary depending on the QFX Series switch chosen for the spine. See *Understanding Virtual Chassis Fabric Components* and *Virtual Chassis Fabric Hardware*

Overview for supported configurations. Although the architecture has a powerful auto-provisioning option, which allows you to plug and play the devices, careful planning of the deployment can avoid unexpected results.

For example, if you perform any configuration level commands on one of the devices (including assigning IP addresses or host names) you no longer can use auto-provisioning.

Use the following checklist to plan your deployment:

Table 27: Deployment Checklist

Item or Task	For More Information	Performed By	Date
Components			
Determine the number of devices in the VCF and the role of each device. **NOTE**: A VCF is not constrained to a single building; the limits for the optic cable are the only consideration.	*Understanding Virtual Chassis Fabric Components*		
Environment			
Evaluate the provisioning options and determine the configuration method that applies to your deployment.	*Understanding Virtual Chassis Fabric Configuration*		
Power			
Measure the distance between external power sources and switch installation site.			

Table 27: Deployment Checklist *(Continued)*

Item or Task	For More Information	Performed By	Date
Calculate the power consumption and requirements.	*QFX5110 AC Power Specifications* "AC Power Specifications for a QFX5100 Device" on page 57 *AC Power Specifications for a QFX3600 or QFX3600-I Device* *AC Power Specifications for a QFX3500 Device* *AC Power Supply Specifications for EX4300 Switches*		
Rack or Cabinet			
Verify that your rack or cabinet meets the minimum requirements for the installation of the switch.	*QFX5110 Rack Requirements* "Rack Requirements for a QFX5100 Device" on page 84 "Cabinet Requirements for a QFX5100 Device" on page 87 *Rack Requirements for a QFX3600 or QFX3600-I Device* *Cabinet Requirements for a QFX3600 or QFX3600-I Device* *Rack Requirements for a QFX3500 Device* *Cabinet Requirements for a QFX3500 Device* *Rack Requirements for EX4300 Switches* *Cabinet Requirements for EX4300 Switches*		

Table 27: Deployment Checklist *(Continued)*

Item or Task	For More Information	Performed By	Date
Plan rack or cabinet location, including required space clearances.	*QFX5110 Clearance Requirements for Airflow and Hardware Maintenance* "Clearance Requirements for Airflow and Hardware Maintenance for a QFX5100 Device" on page 75 *Clearance Requirements for Airflow and Hardware Maintenance for a QFX3600 or QFX3600-I Device* *Clearance Requirements for Airflow and Hardware Maintenance for a QFX3500 Device* *Clearance Requirements for Airflow and Hardware Maintenance for EX4300 Switches*		
Secure the rack or cabinet 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.	*Cable Specifications for QSFP+ and QSFP28 Transceivers* *Cable Specifications for Console and Management Connections for the QFX Series*		
Plan the cable routing and management.			

QFX5100 Network Cable and Transceiver Planning

IN THIS SECTION

Determining Interface Support for the QFX5100 Device

All product SKUs of the QFX5100 supply quad small form-factor pluggable plus (QSFP+) ports for use as uplinks, as access ports, or as Virtual Chassis ports (VCPs). These 40 GbE ports support QSFP+ transceivers, QSFP+ direct-attach copper (DAC) cables, and DAC breakout cables (DACBO). The QFX5100-48S has 6 QSFP+ ports; the QFX5100-96S has 8 QSFP+ ports; the QFX5100-24Q has 24 built-in QSFP+ ports that can all be used as uplinks. The You can also add two QFX-EM-4Q expansion modules to the QFX5100-24Q for additional QSFP+ uplink ports. Each QSFP+ port on a QFX5100-24Q can be configured to operate as 10-Gigabit Ethernet interface by using a breakout cable or as a single 40-Gigabit Ethernet interface. See *Configuring the QSFP+ Port Type on QFX5100 Devices* for more information.

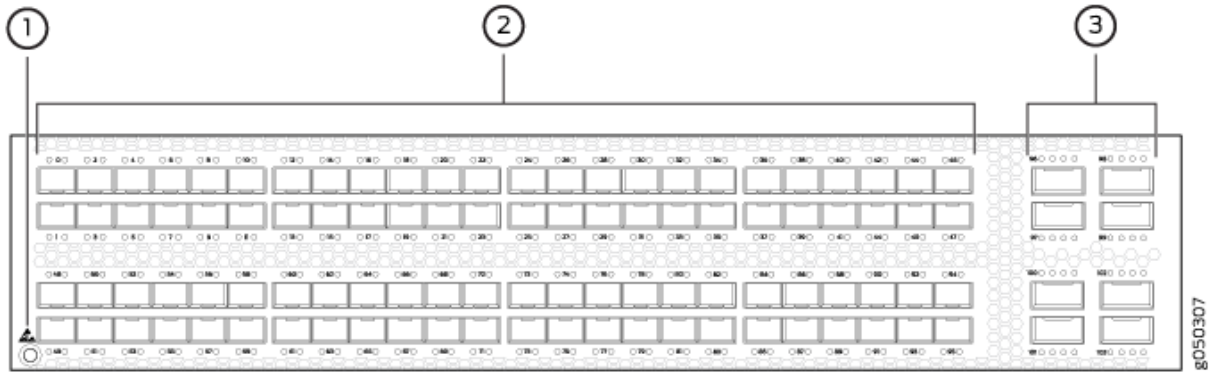
On all QFX5100 product SKUs, the ports are enabled by default and the default config adds the ports to the default VLAN.

Downlink ports are product SKU-specific:

- *QFX5100-96S*–has 96 small form-factor pluggable plus (SFP+) ports that support SFP and SFP+ transceivers, as well as DAC cables.
- *QFX5100-48S*–has 48 SFP+ ports that support SFP and SFP+ transceivers, as well as DAC cables.
- *QFX5100-48T*–has 6 QSFP+ uplink ports.
- *QFX5100-24Q*–has 24 QSFP+ access ports that can be configured to operate as 10-Gigabit Ethernet interfaces or as a single 40-Gigabit Ethernet interface.
- *QFX5100-24Q-AA*–has 24 QSFP+ access ports that can be configured to operate as 10-Gigabit Ethernet interfaces or as a single 40-Gigabit Ethernet interface.

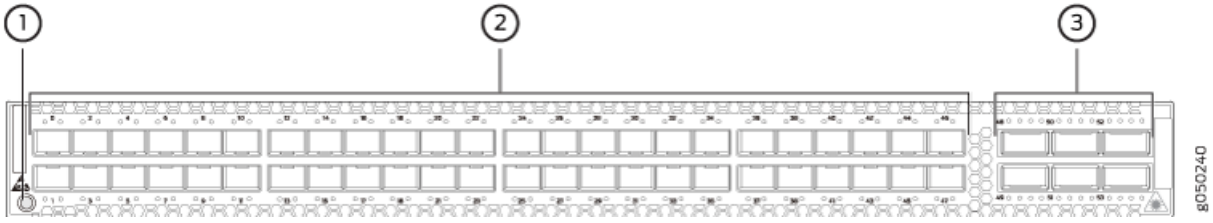
Figure 43 on page 93 shows the location of SFP+ and QSFP+ ports for the QFX5100-96S, Figure 44 on page 93 shows these ports for the QFX5100-48S device, Figure 45 on page 94 shows the RJ45 and QSFP+ ports for the QFX5100-48T device, and Figure 46 on page 94 shows the location of QSFP + ports for the QFX5100-24Q device.

Figure 43: Port Panel QFX5100-96S Device



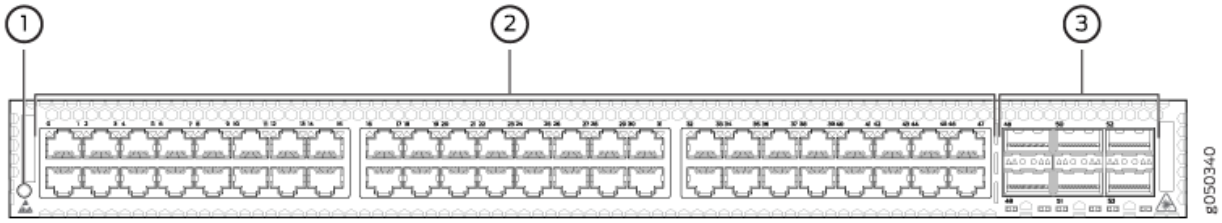
1– Electrostatic discharge (ESD) terminal	3– QSFP+ uplink ports (8)
2– SFP+ access ports (96)	

Figure 44: Port Panel QFX5100-48S Device



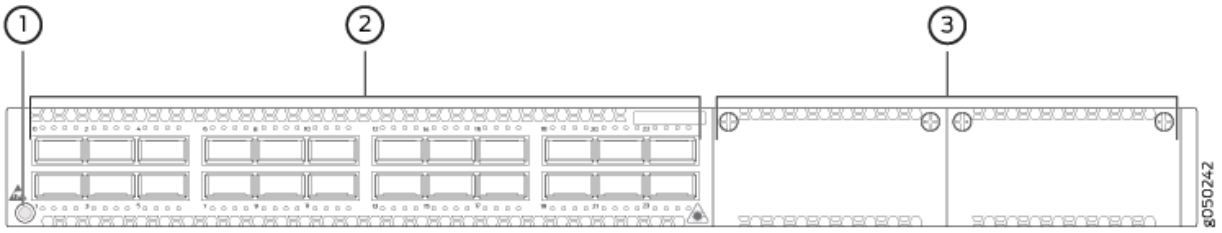
1– Electrostatic discharge (ESD) terminal	3– QSFP+ uplink ports (6)
2– SFP+ access ports (48)	

Figure 45: Port Panel QFX5100-48T Device



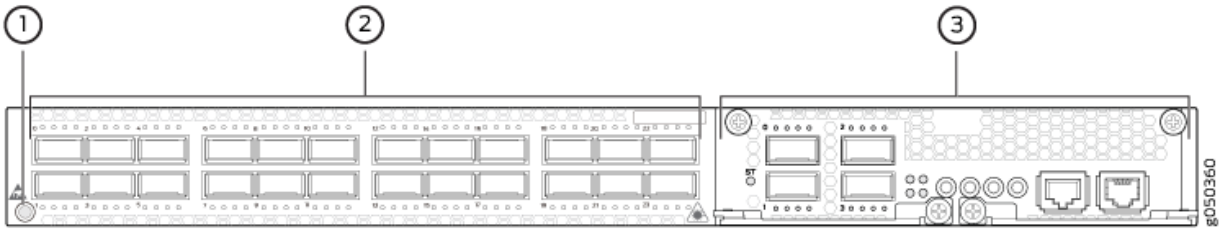
1– Electrostatic discharge (ESD) terminal	3– QSFP+ uplink ports (6)
2– RJ45 access ports (48)	

Figure 46: Port Panel QFX5100-24Q Device



1– Electrostatic discharge (ESD) terminal	3– Expansion module bays with cover panels (2)
2– QSFP+ access or uplink ports (24)	

Figure 47: Port Panel QFX5100-24Q-AA Device



1– Electrostatic discharge (ESD) terminal	3– Expansion module bay (shows a QFX-PFA-4Q installed)
2– QSFP+ access or uplink ports (24)	

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 QFX5100 is located at https://pathfinder.juniper.net/hct/product/#prd=QFX5100.

CAUTION: If you face a problem running a Juniper Networks device that uses a third-party optic or cable, the Juniper Networks Technical Assistance Center (JTAC) can help you diagnose the source of the problem. Your JTAC engineer might recommend that you check the third-party optic or cable and potentially replace it with an equivalent Juniper Networks optic or cable that is qualified for the device.

Cable Specifications for QSFP+ and QSFP28 Transceivers

The 40-Gigabit Ethernet QSFP+ and 100-Gigabit Ethernet QSFP28 transceivers that are used in QFX Series switches use 12-ribbon multimode fiber crossover cables with socket MPO/UPC 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 28 on page 95 describes the signals on each fiber. Table 29 on page 96 shows the pin-to-pin connections for proper polarity.

Table 28: QSFP+ and QSFP28 Optical Module Receptacle Pinouts

Fiber	Signal
1	Tx0 (Transmit)
2	Tx1 (Transmit)
3	Tx2 (Transmit)

Table 28: QSFP+ and QSFP28 Optical Module Receptacle Pinouts *(Continued)*

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

Table 29: QSFP+ MPO Fiber-Optic Crossover Cable Pinouts

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

Table 29: QSFP+ MPO Fiber-Optic Crossover Cable Pinouts *(Continued)*

Pin	Pin
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:

How to 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, 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 power budget (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 power budget, you can calculate the power margin (P_M), which represents the amount of power available after subtracting attenuation or link loss (LL) from the power budget (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 30 on page 100 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 30: 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
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 power budget (P_B) of 13 dB uses the estimated values from Table 30 on page 100. This example calculates link loss (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 power margin (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 power budget (P_B) of 13 dB uses the estimated values from Table 30 on page 100. This example calculates link loss (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 power margin (P_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 examples, the calculated power margin is greater than zero, indicating that the link has sufficient power for transmission and does not exceed the maximum receiver input power.

RELATED DOCUMENTATION

QFX5100 Chassis Description and Port Panels | 19

QFX5100 Power System | 53

QFX5100 Cable and Pinout Specifications

IN THIS SECTION

Cable Specifications for Console and Management Connections for the QFX Series

Table 31 on page 102 lists the specifications for the cables that connect the QFX Series switch to a management device.

NOTE: The QFX Series can be configured with SFP management ports that support 1000BASE-SX transceivers. See the Hardware Compatibility Tool for more on the fiber-optic cables required for use with these transceivers.

Table 31: Cable Specifications for Console and Management Connections for the QFX Series

Port on QFX Series Device	Cable Specification	Cable Supplied	Maximum Length	Device Receptacle
Console port	RS-232 (EIA-232) serial cable	One 7-foot (2.13-meter) long RJ-45 patch cable and RJ-45 to DB-9 adapter	7 feet (2.13 meters)	RJ-45

Table 31: Cable Specifications for Console and Management Connections for the QFX Series *(Continued)*

Port on QFX Series Device	Cable Specification	Cable Supplied	Maximum Length	Device Receptacle
Management port	Category 5 cable or equivalent suitable for 1000BASE-T operation	One 7-foot (2.13-meter) long RJ-45 patch cable	328 feet (100 meters)	RJ-45

RJ-45 Management Port Connector Pinout Information

Table 32 on page 103 provides the pinout information for the RJ-45 connector for the management port on Juniper Networks devices.

Table 32: 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
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 Pinouts for the QFX Series

The console port (labeled **CON**, or **CONSOLE**) 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 33 on page 104 provides the pinout information for the RJ-45 console connector. An RJ-45 cable and RJ-45 to DB-9 adapter are supplied with the QFX Series device.

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

Table 33: Console Port Connector Pinouts for the QFX Series

Pin	Signal	Description
3	TxD Output	Transmit data
4	Signal Ground	Signal ground
5	Signal Ground	Signal ground
6	RxD Input	Receive data

Copper Cable Specifications for QFX5100-48T and QFX5100-48TH Switches

The QFX5100-48T and QFX5100-48TH switches have 10GBASE-T interfaces that use various types of copper network cables. To achieve optimal performance, you must use cables that conform to IEEE 802.3-2012 specifications for connections for 10GBASE-T network ports. Table 34 on page 105 lists the cable specifications for 10GBASE-T port on QFX5100-48T and QFX5100-48TH switches.

Table 34: Cable Specification for 10GBASE-T Network Ports

Ports on Switches	IEEE Cable Standard	Shield or Unshielded Twisted Pair (STP/UTP)	Cable Standard Specification	Maximum Reach	Frequency (MHz)	Additional Information
10GBASE-T	Class F/ CAT 7	STP	ISO/IEC 11801:2002	328 ft (100 m)	1–600	
	Class EA/ CAT 6A	STP/UTP	ANSI/TIA/ EIA-568-B2-10	328 ft (100 m)	1–500	
	Class E/ CAT 6	UTP	ANSI/TIA/EIA 568-B.2-1	98 ft (30 m)	1–250	CAT 6 cables are defined to perform at frequencies up to 250 MHz and are sensitive to alien crosstalk. To use such cables to connect to 10GBASE-T ports, you must ensure that the cable installation is tested and is certified for 500 MHz as per TIA TSB-155 standard.
	Class E/ CAT 6	STP	ANSI/TIA/EIA 568-B.2-1	98 ft (30 m)	1–250	
1000BASE-T	CAT 5e CAT 6 CAT 6A (STP/UTP)	STP/UTP	ANSI/TIA/ EIA-568-A ANSI/TIA/ EIA-568-B.2-1 ANSI/TIA/ EIA-568-B2-10	328 ft (100 m)	1-100 1-250 1-500	

Table 34: Cable Specification for 10GBASE-T Network Ports *(Continued)*

Ports on Switches	IEEE Cable Standard	Shield or Unshielded Twisted Pair (STP/UTP)	Cable Standard Specification	Maximum Reach	Frequency (MHz)	Additional Information
100BASE-TX	CAT 5e CAT 6 CAT 6A (STP/UTP)	STP/UTP	ANSI/TIA/ EIA-568-A ANSI/TIA/ EIA-568-B.2-1 ANSI/TIA/ EIA-568-B2-10	328 ft (100 m)	1-100 1-250 1-500	

SEE ALSO

QFX5100 Chassis Description and Port Panels | 19

QFX5100 Device Hardware Overview | 2

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.

CHAPTER 3

Initial Installation and Configuration

QFX5100 Installation Overview

IN THIS SECTION

QFX5100 Standalone Installation Overview

You can mount a QFX5100 device:

- 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 QFX5100 device:

1. Follow the instructions in Unpack a QFX5100 Device.
2. Determine how the device is to be mounted.

   Flush or recessed mounted in a rack or cabinet, see Mount a QFX5100 Device in a Rack or Cabinet.
3. Follow the instructions in:

   a. Connecting Earth Ground to a QFX5100 Device

   b. Connecting AC Power to a QFX5100 Device or Connecting DC Power to a QFX5100 Device

   c. *Register Products—Mandatory to Validate SLAs*
4. Depending on how you plan to use the QFX5100 device, do one of the following:

   - If you are using the QFX5100 device as a standalone switch, follow the instructions in Configure a QFX5100 Device.
   - If you are using the QFX5100 device as a Node device in a QFX3000-G QFabric system, see *QFX3000-G QFabric System Installation Overview* for information about the steps to install and configure your QFX3000-G QFabric system.

- If you are using the QFX5100 device as a Node device in a QFX3000-M QFabric system, see *QFX3000-M QFabric System Installation Overview* for information about the steps to install and configure your QFX3000-M QFabric system.
- If you are using a QFX5100-24Q as an Interconnect device in a QFX3000-M QFabric system, see *Connecting a QFX5100 Node Device to a QFX5100-24Q Interconnect Device*.
- If you are using the QFX5100 device in a Virtual Chassis Fabric, see Connecting a QFX5100 Device in a Virtual Chassis Fabric.

Virtual Chassis Fabric Installation Overview

For best results, ensure you review and understand the Virtual Chassis Fabric (VCF) configuration options. These configuration options are explained in *Virtual Chassis Fabric Hardware Overview* and *Understanding Virtual Chassis Fabric Configuration*. Do not interconnect the switches with cables until directed in the procedure.

1. Install the individual switches in a rack or cabinet following the guidelines in "Plan a Virtual Chassis Fabric Deployment" on page 88.

   BEST PRACTICE: Install spine devices at the top of the rack or cabinet in order of primary routing engine (RE), backup RE, and then other leaf devices.

2. Make a list of all of the serial numbers of the devices.
3. Log into each device and configure into fabric mode and mixed mode, if needed. Mixed mode is only necessary for QFX5100 VCF when QFX5100-96S, QFX5100-48T, QFX3500, QFX3600, or EX4300 devices are present as leaf devices in the configuration. If a spine device is not properly configured in fabric and mixed mode for QFX5100 mixed VCF, the VCF devices reboot to commit the mixed mode or fabric settings. When fabric and mixed mode are not set, you might need to manually correct any issues that are related to the VCF not forming correctly because the device did not immediately join the VCF.

   WARNING: Only configure operational-level commands. If you commit any configuration-level commands (including assigning IP address), the Virtual Chassis Fabric cannot form and the switch must be zeroed.

4. Configure the VCF into mixed mode if it is a QFX5100 VCF and the switch models span different lines of switches.

5. Configure each device for one of the provisioning modes: autoprovision, preprovision, or nonprovision. See:
   - *Autoprovisioning a Virtual Chassis Fabric*
   - *Preprovisioning a Virtual Chassis Fabric*
   - *Configuring a Nonprovisioned Virtual Chassis Fabric*
6. Connect and configure one of the management ports (C0) or (C1) to a management switch as the Virtual Management Ethernet interface. Using this interface, you can configure and manage the devices in the VCF. See *Connect a Device to a Network for Out-of-Band Management*.
7. Commit your changes.
8. Cable the ports that you will use as VCPs. For cabling examples, see *Connecting QFX5110 in a QFX5110 Virtual Chassis Fabric*, "Connecting a QFX5100 Device in a Virtual Chassis Fabric" on page 130, *Connecting a QFX3500 or QFX3600 Switch in a QFX5100 Virtual Chassis Fabric*, and *Connecting EX Series Switches in a QFX5100 Virtual Chassis Fabric*.

   If you configured your devices as either autoprovisioned or preprovisioned, the Virtual Chassis ports (VCP) are automatically configured. If you configure the devices as nonprovisioned, you must manually configure the VCPs.

QFX5100 Installation Safety Guidelines

The weight of a 1 U fully loaded QFX5100 switch chassis is approximately 30.8 lb (14 kg); the 2 U product SKU is approximately 32 lbs (14.5 kg). Observe the following guidelines for lifting and moving a QFX5100 switch:

CAUTION: If you are installing the QFX5100 switch above 60 in. (152.4 cm) from the floor, either remove the power supplies, fan modules, and any expansion modules before attempting to install the switch, or ask someone to assist you during the installation.

- Before installing a QFX5100 switch, read the guidelines in *Site Preparation Checklist for a QFX5100 Device* to verify that the intended site meets the specified power, environmental, and clearance requirements.
- Before lifting or moving the QFX5100 switch, disconnect all external cables.
- 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.

SEE ALSO

General Safety Guidelines and Warnings

Installation Instructions Warning

RELATED DOCUMENTATION

QFX5100 Site Guidelines and Requirements | 80

Clearance Requirements for Airflow and Hardware Maintenance for a QFX5100 Device | 75

Unpack and Mount the QFX5100 Switch

IN THIS SECTION

Unpack a QFX5100 Device

The QFX5100 switch chassis is a rigid sheet-metal structure that houses the hardware components. A QFX5100 device is shipped in a cardboard carton, secured with foam packing material. The carton also contains an accessory box and quick start instructions.

CAUTION: QFX5100 devices are maximally protected inside the shipping carton. Do not unpack the switch until you are ready to begin installation.

To unpack a QFX5100 device:

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 35 on page 113 lists the inventory of components supplied with a QFX5100 device.
5. Pull out the packing material holding the switch in place.
6. Verify the chassis components received:
   - Two power supplies
   - Fan modules
     - Five fan modules for 1 U devices
     - Three fan modules for 2 U devices

   NOTE: Product SKU QFX5100-24Q: If you ordered the optional high-speed uplink modules, they are packaged as components and must be installed in the switch
7. Save the shipping carton and packing materials in case you need to move or ship the switch later.

Table 35: Inventory of Components Supplied with a QFX5100 Device

Component	Quantity
Chassis with five fan modules and two power supplies. The QFX5100-96S has three fan modules.	1
Rear mounting blades	2
Front mounting brackets	2
Extension brackets	2
RJ-45 cable and RJ-45 to DB-9 adapter	1
Power cords (AC systems only)	2

SEE ALSO

Mount a QFX5100 Device in a Rack or Cabinet

QFX5100 Standalone Installation Overview

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 service-level agreement 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.

Mount a QFX5100 Device in a Rack or Cabinet

IN THIS SECTION

You can mount all QFX5100 switches on a four post 19-in. rack or cabinet using the mounting kit provided with the device.

For four post rack or cabinet installations, 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 remainder of this topic uses “rack” to mean “rack or cabinet.”) The front and rear rack rails must be spaced between 28.5 in. (72.4 cm) to 31.5 in. (80 cm) front to back.

Before You Begin Rack Installation

Before you begin mounting a QFX5100 switch in the rack or cabinet:

1. Ensure that you understand how to prevent electrostatic discharge (ESD) damage. See *Prevention of Electrostatic Discharge Damage*.

2. Verify that the site meets the requirements described in Site Preparation Checklist for a QFX5100 Device.
3. Place the rack in its permanent location, allowing adequate clearance for airflow and maintenance, and secure it to the building structure.
4. Read *General Site Guidelines*, with particular attention to QFX5100 Installation Safety Guidelines.
5. Remove the switch from the shipping carton (see Unpack a QFX5100 Device).
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 (provided).
                - Twelve screws for 1 U chassis
                - Twenty-four screws for QFX5100-96S
            - Eight screws to secure the chassis and rear installation blades to the rack (not provided).
    - Appropriate screwdriver for the mounting screws (not provided).
    - Two power cords with plugs appropriate to your geographical location (provided).
    - RJ-45 cable and RJ-45 to DB-9 serial port adapter (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: The 1 U versions of QFX5100 switches must be supported at all four corners. Mounting the chassis using only the front brackets will damage the chassis and can result in serious bodily injury.

CAUTION: All QFX5100 switches require two people for installation, one person to lift the switch into place and another person to attach the switch to the rack. If you are

installing the QFX5100 switch above 60 in. (152.4 cm) from the floor, you can remove the power supplies and fan modules to minimize the weight before attempting to install the switch.

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 IN** labels on components are next to the cold aisle and **AIR OUT** labels on components are next to the hot aisle.
3. Align the holes in the mounting rail with the holes on the side of the chassis. See Figure 48 on page 116 through Figure 50 on page 117 for examples the proper alignment of 1 U and 2 U chassis systems.

Figure 48: Attaching Mounting Rails to the QFX5100-24Q

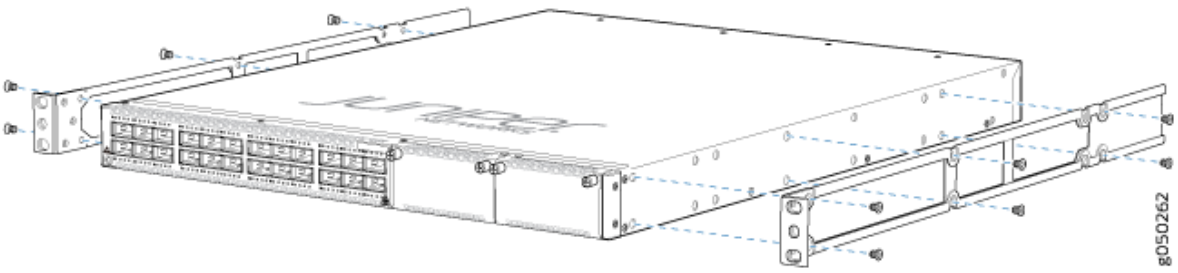


Figure 49: Attaching Mounting Rails to the QFX5100-48S

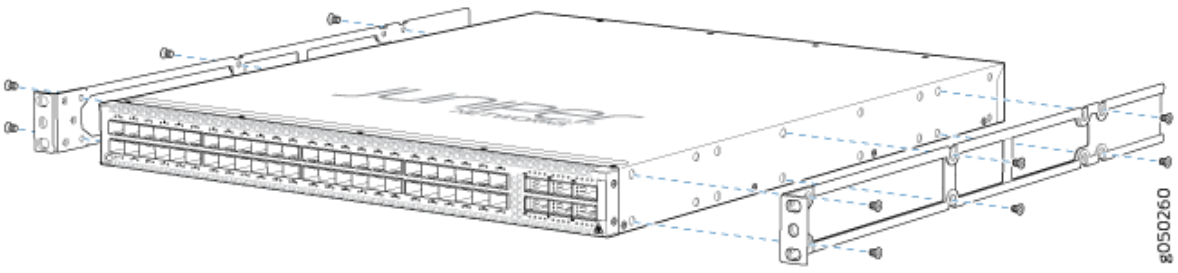
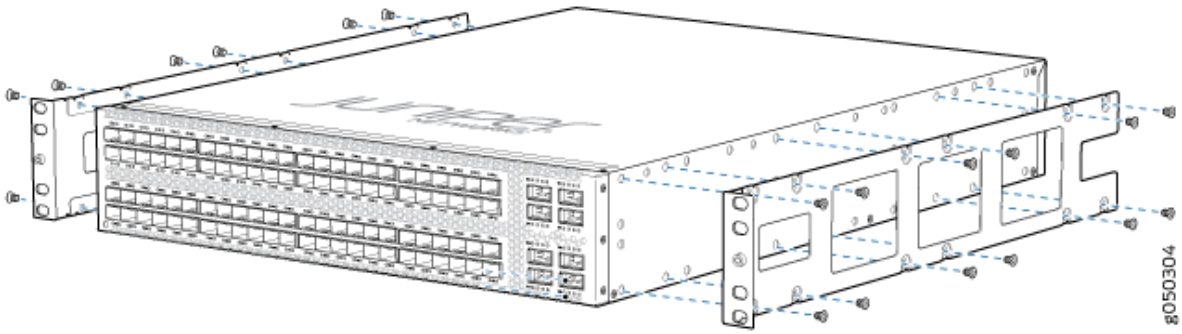


Figure 50: Attaching Mounting Rails to the QFX5100-96S



4. Attach the mounting rail to the switch using the mounting screws (and cage nuts and washers if your rack requires them). Tighten the screws.
5. Repeats steps 4 and 5 on the opposite side of the switch.
6. Have one person 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.
7. Have a second person secure the front of the switch to the rack using four mounting screws (and cage nuts and washers if your rack requires them.) Tighten the screws. See Figure 51 on page 117 and Figure 52 on page 118 for examples of connecting the mounting rails and blades.

Figure 51: Attach 1 U Switch to Rack

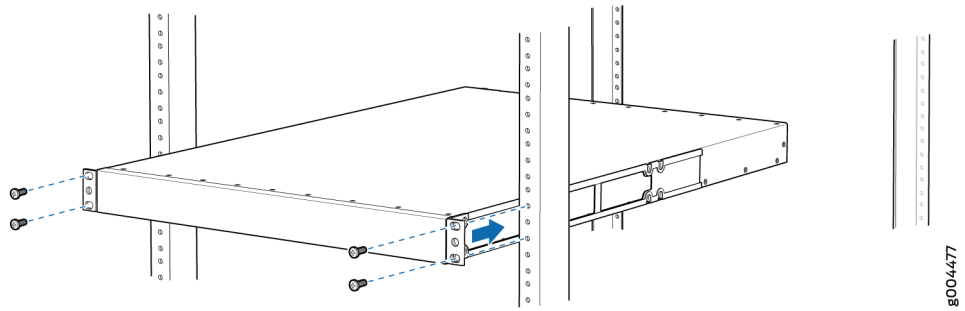
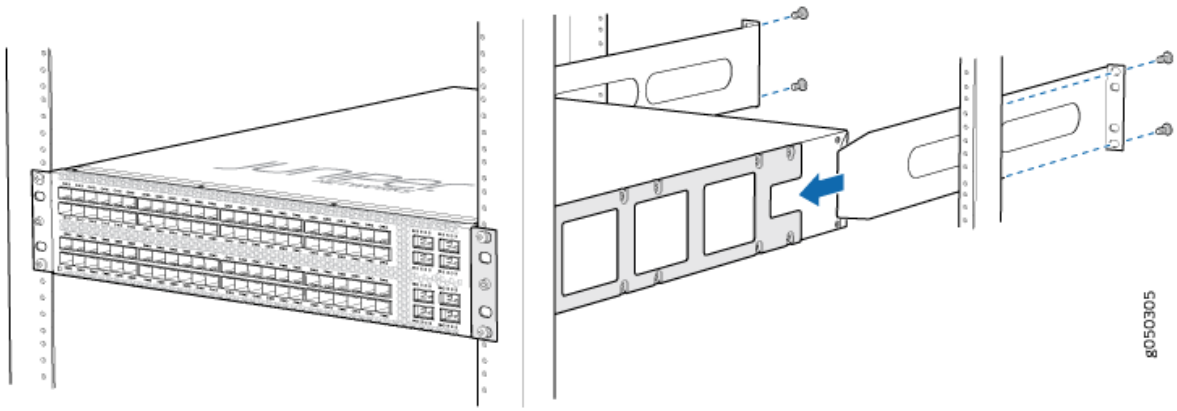
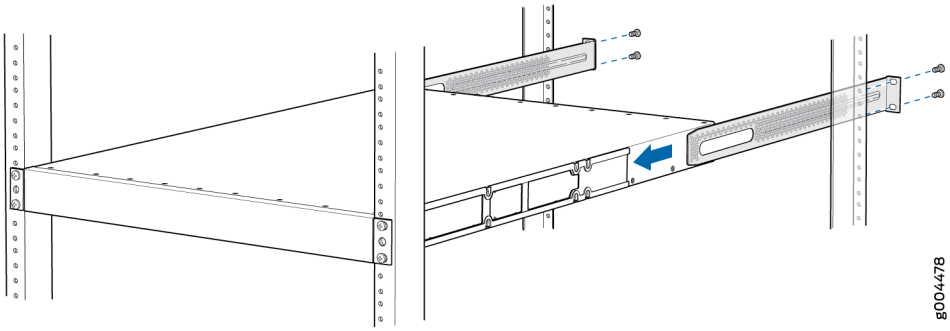


Figure 52: Slide Mounting Rail onto the QFX5100-96S Rear Mounting Blade



8. 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 four mounting screws (and cage nuts and washers if your rack requires them) to attach each blade to the rack. (Use eight front-mounting screws for the QFX5100-96S.) Tighten the screws. See Figure 53 on page 118.

Figure 53: Slide Mounting Blade into 1 U Mounting Rail



9. 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 | 211

Connect the QFX5100 to Power | 132

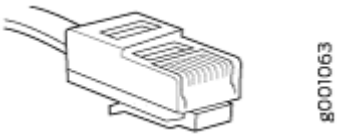
Connect the QFX5100 to External Devices

IN THIS SECTION

Connect a Device to a Network for Out-of-Band Management

Ensure that you have an Ethernet cable that has an RJ-45 connector at either end. Figure 54 on page 119 shows the RJ-45 connector of the Ethernet cable supplied with the device.

Figure 54: RJ-45 Connector on an Ethernet Cable

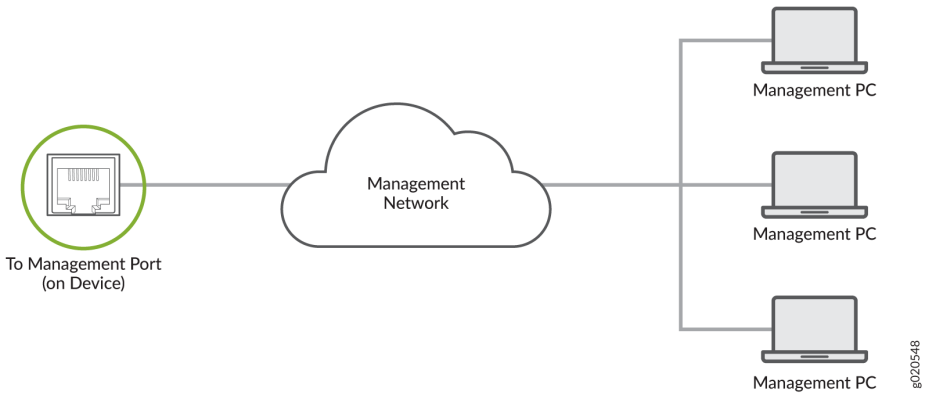


You can monitor and manage these devices by using a dedicated management channel. Each device has a management port to which you can connect an Ethernet cable with an RJ-45 connector. Use the management port to connect the device to the management device.

To connect a device to a network for out-of-band management (see Figure 55 on page 120):

1. Connect one end of the Ethernet cable to the management port on the device.
2. Connect the other end of the Ethernet cable to the management device.

Figure 55: Connect a Device to a Network for Out-of-Band Management

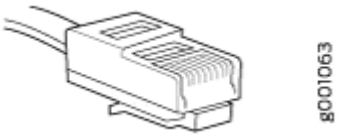


Connect a Device to a Management Console Using an RJ-45 Connector

Ensure that you have an Ethernet cable that has an RJ-45 connector at either end. One such cable and an RJ-45-to-DB-9 serial port adapter are supplied with the device.

Figure 56 on page 120 shows the RJ-45 connector on the Ethernet cable.

Figure 56: RJ-45 Connector on an Ethernet Cable



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 the device, use a combination of the RJ-45-to-DB-9 socket adapter supplied with the device and a USB-to-DB-9 plug adapter. You must provide the USB-to-DB-9 plug adapter.

You can configure and manage devices using a dedicated management channel. Each device has a console port that you can connect to using an Ethernet cable with an RJ-45 connector. Use the console port to connect the device to the console server or management console. The console port accepts a cable that has an RJ-45 connector.

To connect the device to a management console (see Figure 57 on page 121 and Figure 58 on page 121):

1. Connect one end of the Ethernet cable to the console port (labeled **CON**, **CONSOLE**, or **CON1**) on the device.
2. Connect the other end of the Ethernet cable to the console server (see Figure 57 on page 121) or management console (see Figure 58 on page 121).

Figure 57: Connect a Device to a Management Console Through a Console Server

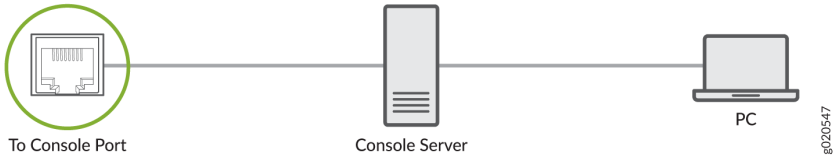


Figure 58: Connect a Device Directly to a Management Console

RELATED DOCUMENTATION

General Safety Guidelines and Warnings | **203**

Grounded Equipment Warning | **215**

Connect the QFX5100 in a Virtual Chassis or Virtual Chassis Fabric

IN THIS SECTION

Connecting QFX Series and EX Series Switches in a QFX Virtual Chassis

IN THIS SECTION

In a QFX Virtual Chassis, you can connect up to 10 standalone QFX5100, QFX3600, QFX3500, and EX4300 switches except EX4300-48MP and EX4300-48MP-S switches into a QFX Series Virtual Chassis and manage the interconnected switches as a single chassis. Unlike a Virtual Chassis Fabric (VCF), which is cabled in a spine and leaf topology, the QFX Virtual Chassis is cabled in a ring topology. For Virtual Chassis Fabric cabling examples, see Connecting a QFX5100 Device in a Virtual Chassis Fabric.

As of Junos Release 17.3R1, you can also connect select models of the QFX5100 in the line card role in a QFX5110 Virtual Chassis. See Connecting QFX5110 and QFX5100 Members in a QFX5110 Virtual Chassis.

This topic describes how to cable QFX Series switches and EX4300 switches into a QFX Virtual Chassis.

Before You Start

You configure a QFX Series Virtual Chassis by configuring the switch interfaces into Virtual Chassis ports (VCPs). VCPs connect switches together to form a Virtual Chassis, and are responsible for passing all data and control traffic between member switches in the Virtual Chassis. All non-channelized QSFP+ uplink interfaces on standalone QFX5100 switches can be configured into VCPs. All fixed SFP+ interfaces on QFX5100-96S switches can also be configured into VCPs.

Use the following interfaces to create VCPs:

- On QFX5100, non-channelized QSFP+ uplink interfaces. All fixed SFP+ interfaces on the QFX5100-96S switches are also available.
- On EX4300 switches, the built-in QSFP+ ports are dedicated VCPs by default. In 48-port EX4300 switches except EX4300-48MP and EX4300-48MP-S switches, you can use the QSFP+ ports as network ports or as VCPs. You can also use the SFP+ uplink module ports as VCPs by configuring these ports as VCPs.

  In EX4300-48MP and EX4300-48MP-S switches, you can use only the built-in QSFP+ ports as VCPs. You cannot configure the ports on the uplink module in EX4300-48MP and EX4300-48MP-S switches to Virtual Chassis ports (VCPs).
- On QFX3500 and QFX3600, all non-channelized QSFP+ and fixed SFP+ interfaces.

BEST PRACTICE: Use the 40-Gigabit QSFP+ interfaces for the VCPs.

The advantages of connecting multiple switches into a Virtual Chassis include better-managed bandwidth at a network layer, simplified configuration and maintenance because multiple devices can be managed as a single device, increased fault tolerance and high availability (HA) because a Virtual Chassis can remain active and network traffic can be redirected to other member switches when a single member switch fails, and a flatter, simplified Layer 2 network topology that minimizes or eliminates the need for loop prevention protocols such as Spanning Tree Protocol (STP).

You can increase VCP bandwidth between member switches by configuring multiple interfaces between the same two switches into VCPs. When multiple VCPs are interconnecting the same two member switches, a Link Aggregation Group (LAG) bundle is automatically formed when the VCPs are on interfaces supporting identical speeds. For instance, if you have two 40-Gigabit QSFP+ interfaces configured as VCPs between member switches, a LAG with two member links with 80 Gbps of total bandwidth is formed. 10-Gigabit SFP+ and 40-Gigabit QSFP+ interfaces configured as VCPs cannot be members of the same LAG, however. The Virtual Chassis feature is not applicable to QFX devices in a QFabric.

Virtual Chassis can be installed in a single rack, multiple racks, or in wire closets.

Valid Configurations

Valid configurations are:

- All QFX5100 members–in a ring topology this is Virtual Chassis; in a spine and leaf topology this is a Virtual Chassis Fabric (VCF). For a cabling example of spine and leaf, see Connecting a QFX5100 Device in a Virtual Chassis Fabric.
- All QFX3600 members
- All QFX3500 members
- A mixture of QFX3600 and QFX3500 members
- A mixture of QFX5100, QFX3600, and QFX3500 members–use the QFX5100 switches as primary and backup whenever possible.
- A mixture of QFX5100, QFX3600, QFX3500, and EX4300 members except EX4300-48MP and EX4300-48MP-S switches. EX4300 switches as the primary or backup is not supported; use QFX5100 switches in these roles whenever possible.

An all EX4300 member is simply considered an EX4300 Virtual Chassis (see Understanding EX Series Virtual Chassis).

If the QSFP+ interfaces are not available for VCP, 10-Gigbit interfaces can be used.

All members of the Virtual Chassis are required to run the same Junos OS Release. You can check the version and release by issuing the `show chassis version` CLI command.

Cabling QFX3500 Switches in a QFX5100 Virtual Chassis

Figure 59 on page 125 is the preferred cabling method using the 40-Gigabit QSFP ports. See Figure 60 on page 126 for an alternative method using the 10-Gigabit SFP+ ports.

Figure 59: QFX3500 Using the 40G Ports as the VCPs

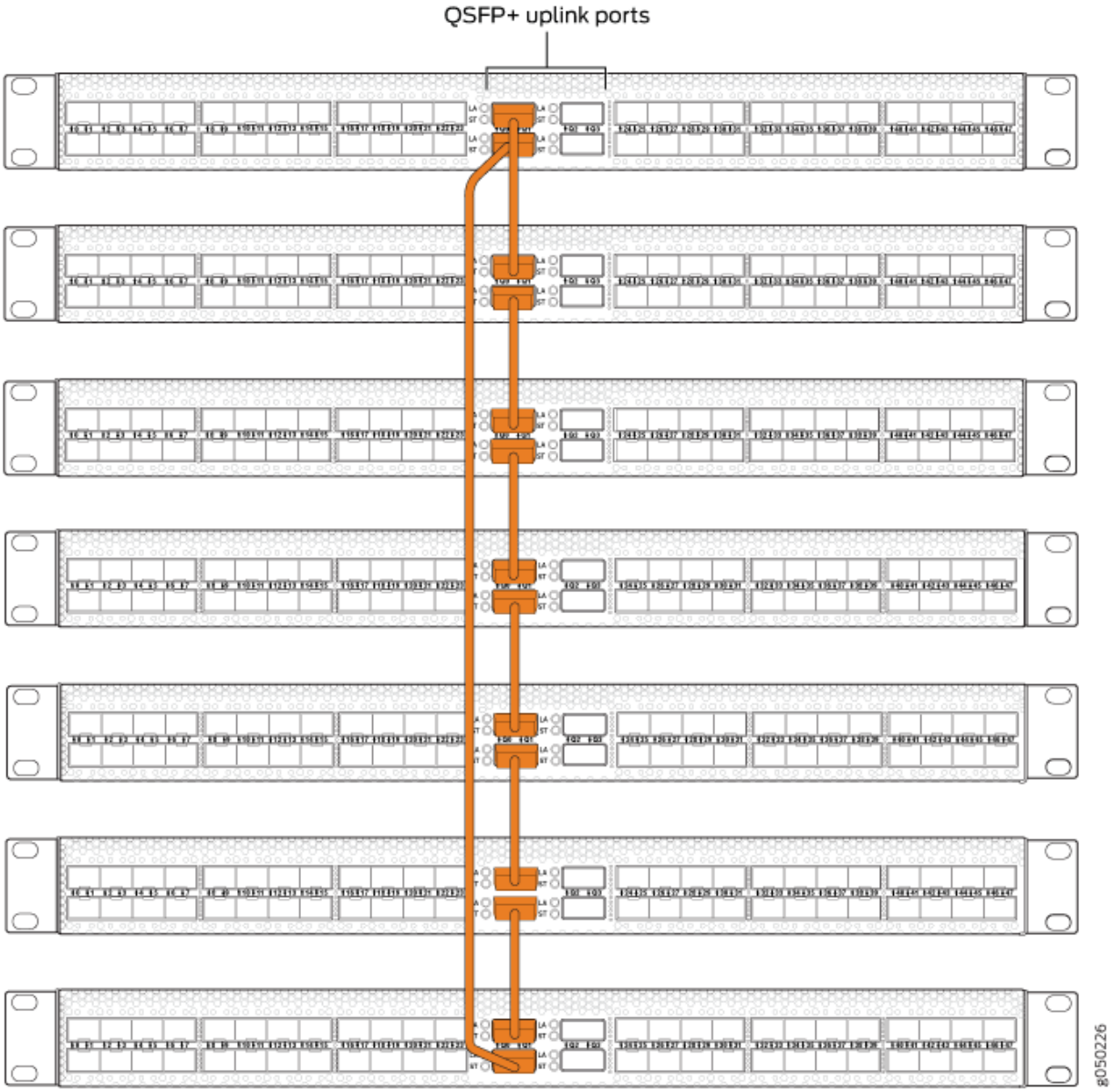
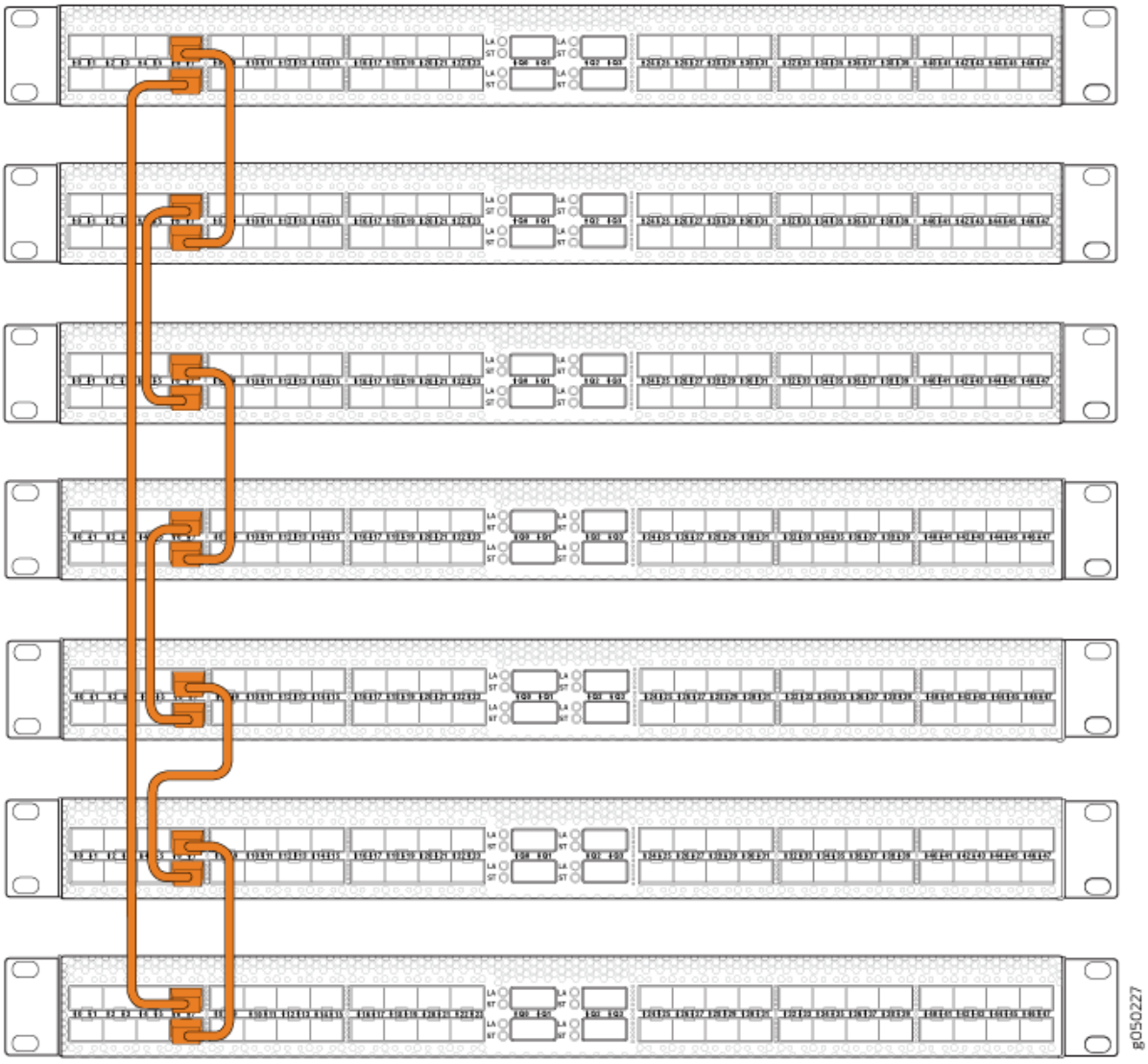


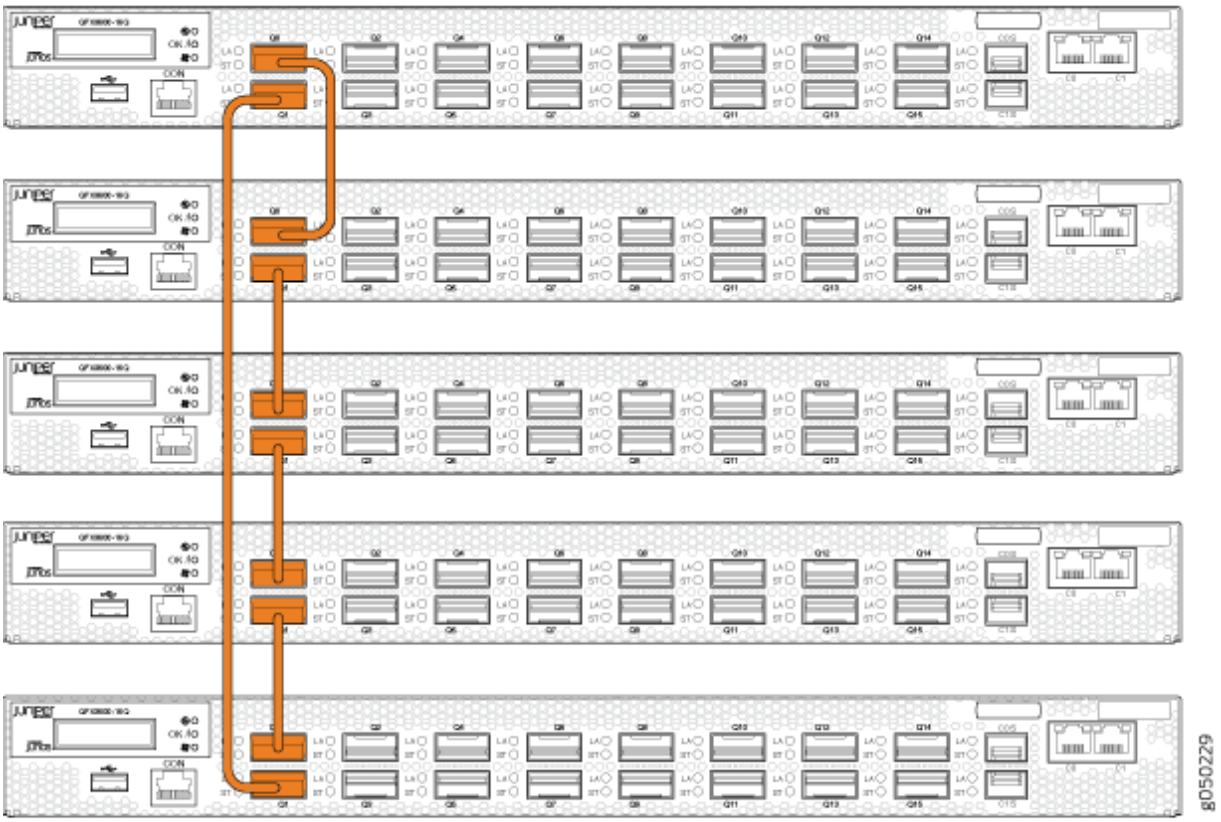
Figure 60: QFX3500 Using the 10G Ports as the VCPs



Cabling QFX3600 Switches in a QFX Virtual Chassis

See Figure 61 on page 127 for a diagram of configuring an exclusive QFX3600 Virtual Chassis.

Figure 61: QFX3600 Using the 40G Ports as the VCPs



Cabling a Mixed QFX Virtual Chassis

A mixed QFX Virtual Chassis is a mixture of QFX5100 , QFX3500, QFX3600, or EX4300 switches except EX4300-48MP and EX4300-48MP-S switches in a ring topology. Always configure a QFX5100 as the primary and backup devices when they are available. See Figure 62 on page 128 for an example using the 40-Gigabit QSFP+ ports and Figure 63 on page 128 for an example using both 40-Gigabit and 10-Gigabit SFP+ ports. Figure 64 on page 129 shows QFX5100-24Q switches as the primary and backup cabled in a ring to QFX3500 and QFX3600 switches.

Figure 62: QFX3500 and QFX3600 Mixed Using the 40G Ports as the VCPs

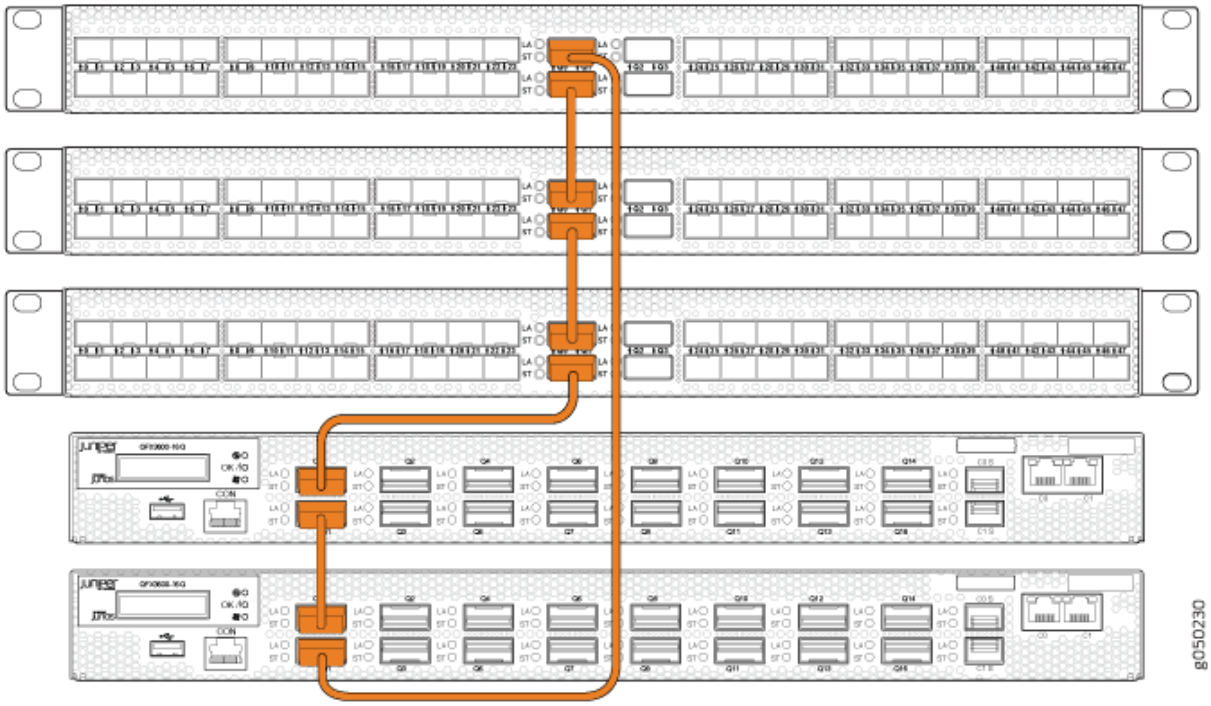


Figure 63: QFX3500 and QFX3600 Mixed Using Both 40G Ports and 10G Ports as the VCPs

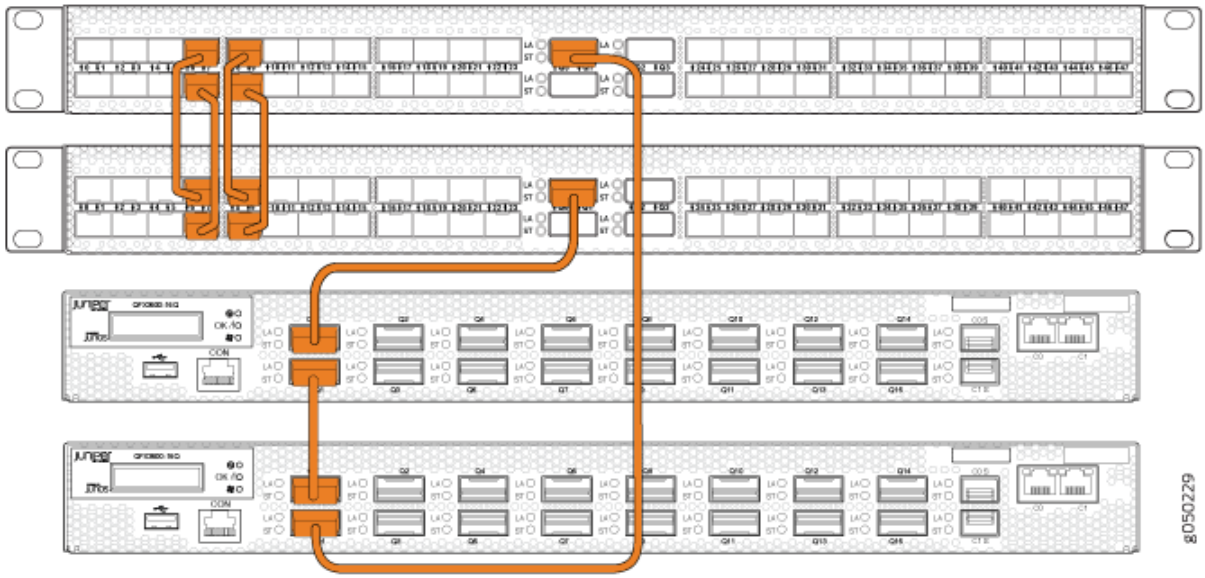
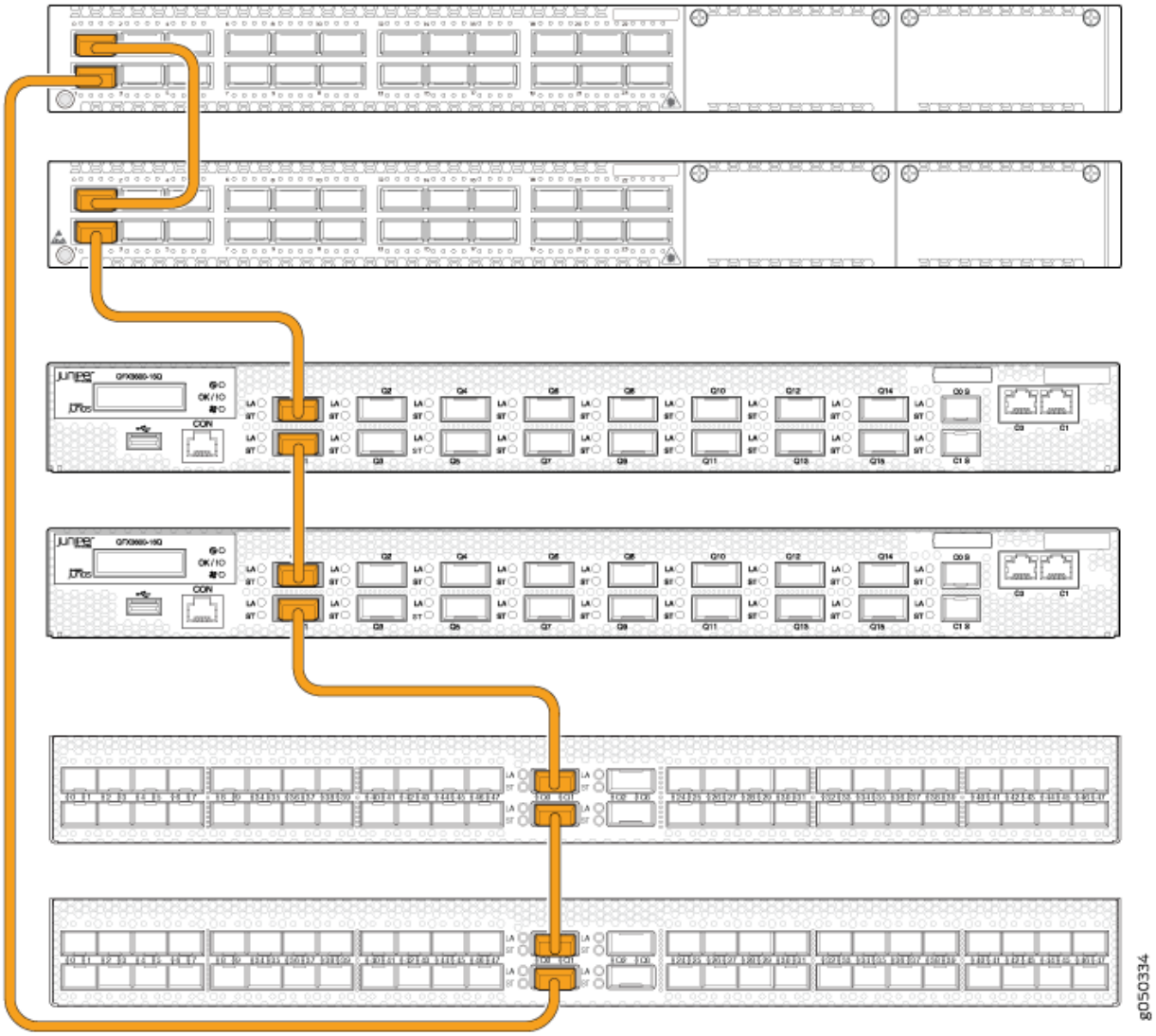


Figure 64: QFX5100 Primary Connecting QFX3600 and QFX3500 Using 40G Ports as VCPs



RELATED DOCUMENTATION

- Understanding QFX Series Virtual Chassis
- Connecting QFX5110 and QFX5100 Members in a QFX5110 Virtual Chassis
- Adding a New Switch to an Existing EX4650 or QFX Series Virtual Chassis
- Connecting a QFX5100 Device in a Virtual Chassis Fabric

Connecting a QFX5100 Device in a Virtual Chassis Fabric

The role of a QFX5100 device in a VCF is dependant on the other switch models used in the VCF configuration. To understand the different hardware configurations supported, see *Virtual Chassis Fabric Hardware Overview*.

You can install a VCF in a single rack, multiple racks, or in wire closets. You construct a QFX5100 VCF by cabling and then configuring SFP+ or QSFP+ interfaces into Virtual Chassis ports (VCPs). All non-channelized QSFP+ uplink interfaces on QFX5100 switches can be configured into VCPs. All fixed SFP+ interfaces on QFX5100-96S switches can also be configured into VCPs.

BEST PRACTICE: Use 40-Gigabit QSFP+ ports as VCPs.

Figure 65 on page 130 shows QFX5100 devices in the leaf role in a QFX5110 VCF, while Figure 66 on page 131 shows QFX5100-24Q in the spine role in a QFX5100 VCF. The cabling in these examples all used QSFP+ ports as VCPs.

Figure 65: QFX5100-24Q as a Leaf Device in a QFX5110 VCF

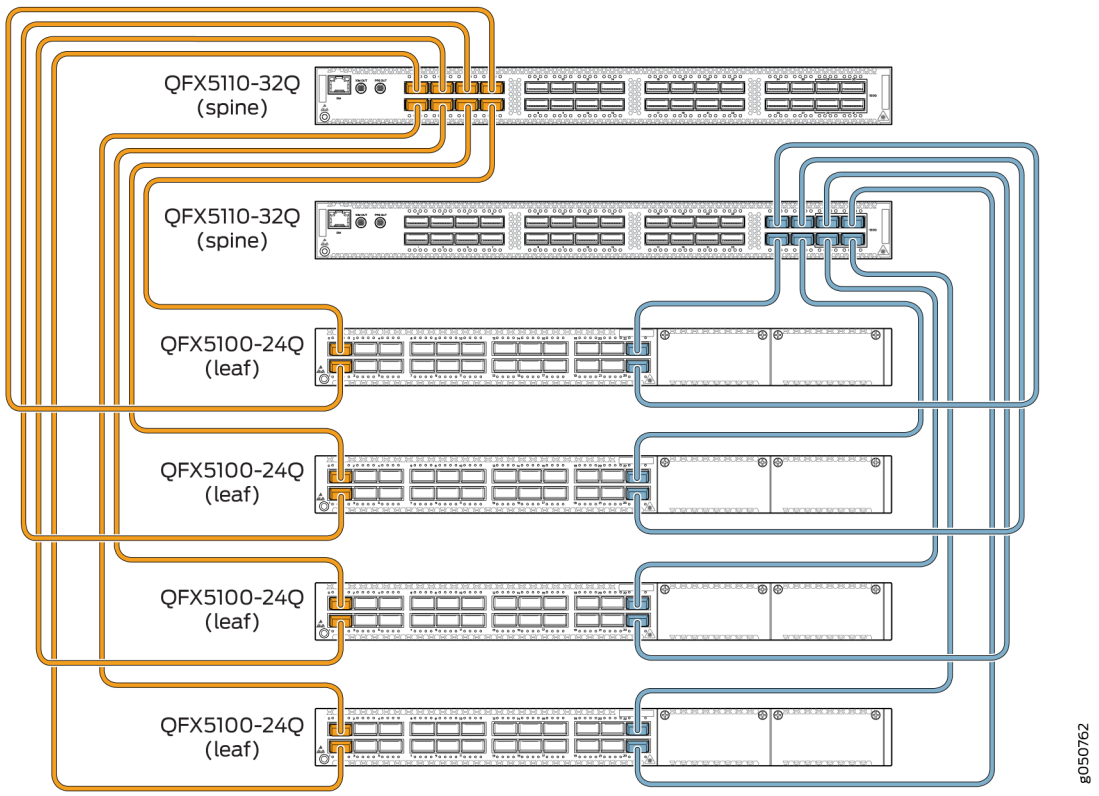
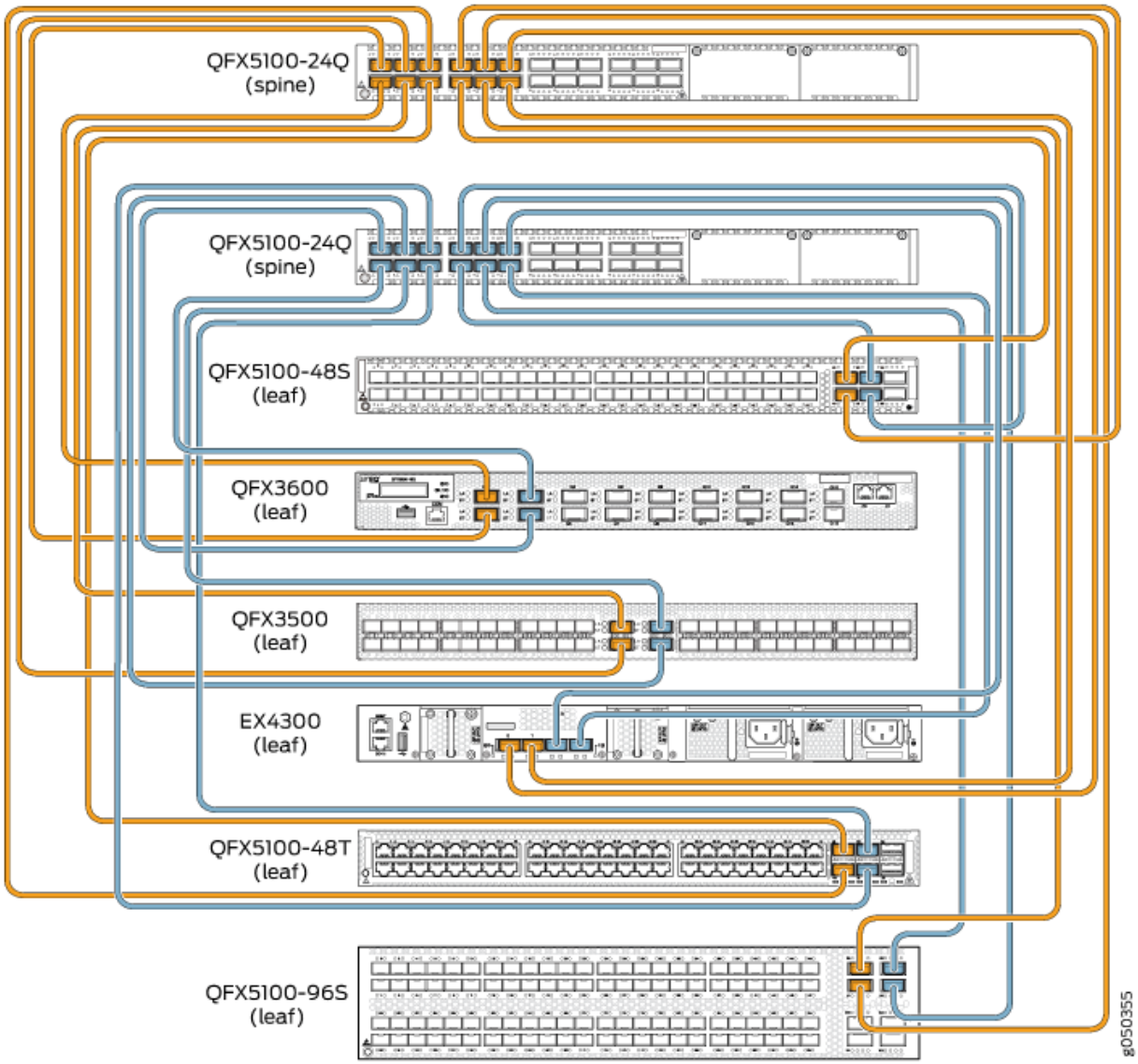


Figure 66: QFX5100-24Q as Spine and QFX5100-48S as Leaf Devices in a QFX5100 VCF



SEE ALSO

Virtual Chassis Fabric Hardware Overview

Plan a Virtual Chassis Fabric Deployment | 88

Connecting QFX5110 in a QFX5110 Virtual Chassis Fabric

Connect the QFX5100 to Power

IN THIS SECTION

Connecting Earth Ground to a QFX5100 Device

To meet safety and electromagnetic interference (EMI) requirements and to ensure proper operation, you must connect the QFX5100 device to earth ground before you connect it to power.

You must install the QFX5100 in a restricted-access location and ensure that the chassis is always properly grounded. The QFX5100 has a two-hole protective grounding terminal provided on the chassis. See Figure 67 on page 133. We recommend that you use this protective grounding terminal as the preferred method for grounding the chassis regardless of the power supply configuration. However, if additional grounding methods are available, you can also use those methods. For example, you can use the grounding wire in the AC power cord or use the grounding terminal or lug on a DC power supply. This tested system meets or exceeds all applicable EMC regulatory requirements with the two-hole protective grounding terminal.

Before you connect earth ground to the protective earthing terminal of a QFX5100 device, ensure that a licensed electrician has attached an appropriate grounding lug to the grounding cable.

CAUTION: Using a grounding cable with an incorrectly attached lug can damage the switch.

NOTE: Mount your switch in the rack or cabinet before attaching the grounding lug to the switch. See Mount a QFX5100 Device in a Rack or Cabinet.

Ensure that you have the following parts and tools available:

- Protective earthing terminal bracket—This bracket attaches to the QFX5100 switch chassis through the left front mounting bracket, providing a protective earthing terminal for the switch.

- Grounding cable for your QFX5100 device—The grounding cable must be 14 AWG (2 mm^2), minimum 90° C wire, or as permitted by the local code.
- Grounding lug for your grounding cable—The grounding lug required is a Panduit LCD10-10A-L or equivalent.
- Two SAE 10-32 washers and screws—To attach the grounding lug to the protective earthing terminal.
- Screwdriver to attach the screws.

An AC-powered QFX5100 switch chassis gains additional grounding when you plug the power supply in the switch into a grounded AC power outlet by using an AC power cord appropriate for your geographical location. See *AC Power Cord Specifications for a QFX Series Device*.

To connect earth ground to a QFX5100 device:

1. Attach one end of the grounding cable to an appropriate earth ground site, such as the mounting rack.
2. Position the grounding lug over the protective earthing terminal on the side of the chassis, which is visible through the mounting bracket.
3. Secure the grounding lug to the protective earthing terminal with the washers and screws. See Figure 67 on page 133 and Figure 68 on page 134.

Figure 67: Connecting a Grounding Cable to a 1 U QFX5100 Device

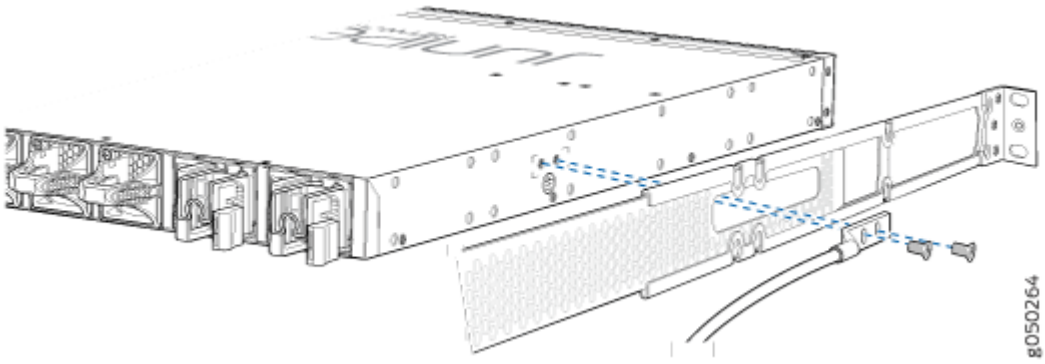
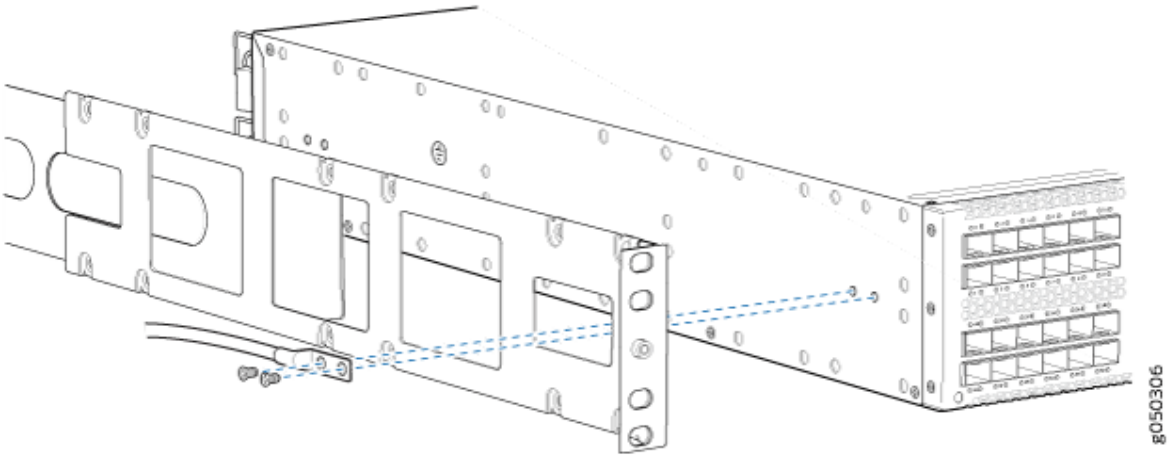


Figure 68: Connecting a Grounding Cable to the 2 U QFX5100-96S Device



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

Grounded Equipment Warning

Connecting AC Power to a QFX5100 Device

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*).
- Ensure that you have connected the switch chassis to earth ground.

> ⚠ **CAUTION**: Before you connect power to the switch, a licensed electrician must attach a cable lug to the grounding and power cables that you supply. A cable with an incorrectly attached lug can damage the switch (for example, by causing a short circuit).

To meet safety and electromagnetic interference (EMI) requirements and to ensure proper operation, you must connect the chassis to earth ground before you connect it to power. For installations that require a separate grounding conductor to the chassis, use the protective earthing terminal on the switch chassis to connect to the earth ground. For instructions on connecting earth ground, see Connecting Earth Ground to a QFX5100 Device. The switch gains additional grounding when you plug the power supply in the switch into a grounded AC power outlet by using the AC power cord appropriate for your geographical location (see AC Power Supply for a QFX5100 Device).

- Install the power supply in the chassis. For instructions on installing a power supply in a QFX5100 device, see Installing a Power Supply in a QFX5100 Device.

The QFX5100 is shipped from the factory with two power supplies. Each power supply is a hot-removable and hot-insertable field-replaceable unit (FRU) when the second power supply is installed and running. You can install replacement power supplies in the two slots next to the fan modules without powering off the switch or disrupting the switching function.

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

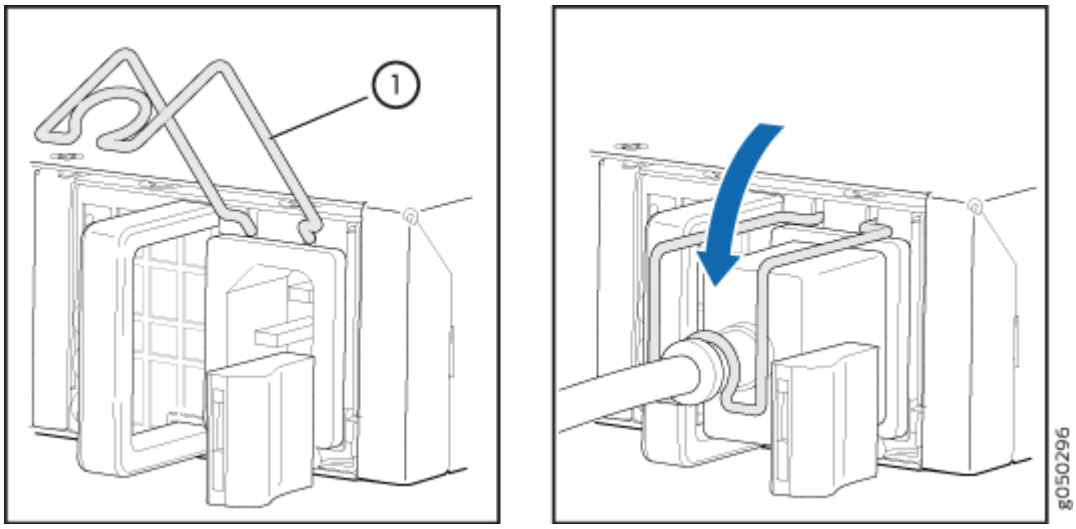
To connect AC power to a QFX5100 device:

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. If only one power supply is installed, ensure a that blank cover panel is installed over the second power supply slot.
3. Locate the power cord or cords shipped with the switch; the cords have plugs appropriate for your geographical location. See *AC Power Cord Specifications for a QFX Series Device*.

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

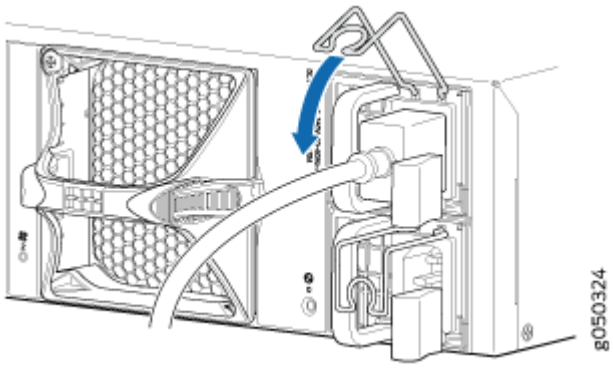
4. Connect each power supply to the power sources. Insert the coupler end of the power cord into the AC power cord inlet on the AC power supply faceplate.
5. Push the power cord retainer onto the power cord (see Figure 69 on page 136 and Figure 70 on page 136).

Figure 69: Connecting an AC Power Cord to an AC Power Supply in a 1 U QFX5100 Device



1– Power cord retainer

Figure 70: Connecting an AC Power Cord to an AC Power Supply in a 2 U QFX5100 Device



6. 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.

7. Insert the power cord plug into an AC power source outlet.
8. If the AC power source outlet has a power switch, set it to the ON (|) position.
9. 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 QFX5100 Device). 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.

CAUTION: A system reboot with Routing Engine FPGA version 7.1 might not successfully boot the Junos OS software. In case of a system reboot failure, you need to power cycle the switch. To check the current FPGA version, issue the `show chassis firmware` command.

Connecting DC Power to a QFX5100 Device

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*).
- Ensure that you have connected the switch chassis to earth ground.

CAUTION: Before you connect power to the switch, a licensed electrician must attach a cable lug to the grounding and power cables that you supply. A cable with an incorrectly attached lug can damage the switch (for example, by causing a short circuit).

To meet safety and electromagnetic interference (EMI) requirements and to ensure proper operation, you must connect the chassis to earth ground before you connect it to power. For installations that require a separate grounding conductor to the chassis, use the protective earthing terminal on the switch chassis to connect to the earth ground. For instructions on connecting earth ground, see Connecting Earth Ground to a QFX5100 Device.

- Install the power supply in the chassis. For instructions on installing a power supply in a QFX5100 device, see Installing a Power Supply in a QFX5100 Device.

Ensure that you have the following parts and tools available:

- DC power source cables (14–16 AWG) with ring lug (Molex 190700069 or equivalent) (not provided)
- Phillips (+) screwdriver, number 2 (not provided)
- Multimeter (not provided)

The QFX5100 is shipped from the factory with two power supplies. Each power supply is a hot-removable and hot-insertable field-replaceable unit (FRU) when the second power supply is installed and running. You can install replacement power supplies in the two slots next to the fan modules without powering off the switch or disrupting the switching function.

WARNING: DC-powered QFX5100 devices are intended for installation only in a restricted access location.

NOTE: The battery returns of the DC power supply must be connected as an isolated DC return (DC-I).

To connect DC power to a QFX5100 device:

1. Attach the grounding strap to your bare wrist and to a site ESD point.
2. Verify that the DC power cables are correctly labeled before making connections to the power supply. In a typical power distribution scheme where the return is connected to chassis ground at the battery plant, you can use a multimeter to verify the resistance of the –48V and RTN DC cables to chassis ground:
   - The cable with very low resistance (indicating a closed circuit) to chassis ground is positive (+) and will be installed on the V+ (return) DC power input terminal.
   - The cable with very high resistance (indicating an open circuit) to chassis ground is negative (–) and will be installed on the V– (input) DC power input terminal.

   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 determines the color coding for the leads on the power cables that attach to the DC power input terminals on each power supply.
3. Install heat-shrink tubing insulation around the power cables.

   To install heat-shrink tubing:

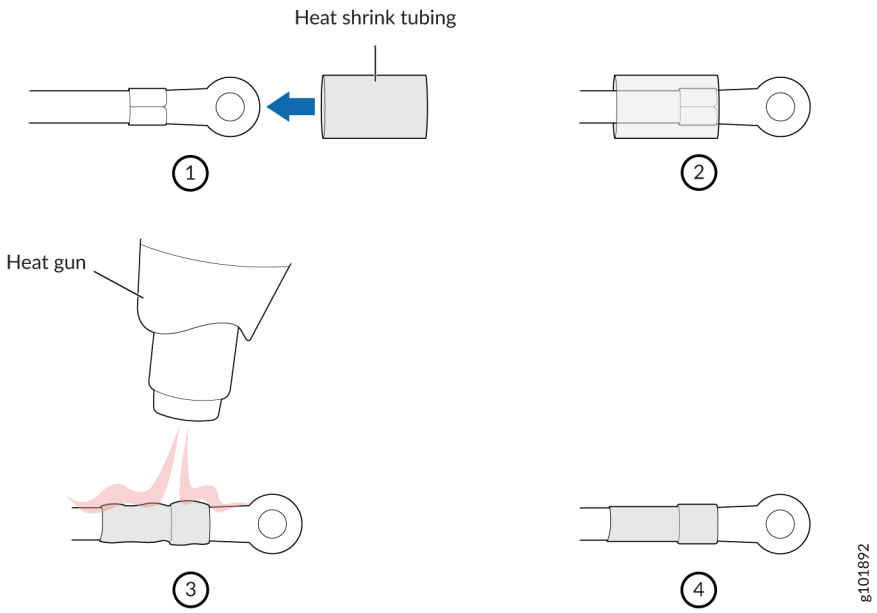
a. Slide the tubing over the portion of the cable where it is attached to the lug barrel. Ensure that tubing covers the end of the wire and the barrel of the lug attached to it.

b. Shrink the tubing with a heat gun. Ensure that you heat all sides of the tubing evenly so that it shrinks around the cable tightly.

Figure 71 on page 139 shows the steps to install heat-shrink tubing.

NOTE: Do not overheat the tubing.

Figure 71: How to Install Heat-Shrink Tubing



4. Ensure that the input circuit breaker is open so that the voltage across the DC power source cable leads is 0 V and that the cable leads do not become active while you are connecting DC power.

NOTE: The V+ terminals are referred to as +RTN, and V– terminals are referred to as –48 V in *DC Power Wiring Sequence Warning* and *DC Power Electrical Safety Guidelines*.

5. Ensure that the power supplies are fully inserted in the chassis.
6. Remove the terminal block cover. The terminal block cover is a piece of clear plastic that snaps into place over the terminal block (see Figure 72 on page 141).
7. Remove the screws on the terminals using the screwdriver. Save the screws.

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

8. Connect each power supply to the power sources. Secure power source cables to the power supplies by screwing the ring lugs attached to the cables to the appropriate terminals by using the screw from the terminals (see Figure 72 on page 141 and Figure 73 on page 142).

   The QFX5100 is designed to operate with a DC power supply that has a single, non-redundant, feed input. For source redundancy, two DC power supplies must be installed in QFX5100; connect source (A) to one power supply and connect source (B) to the second power supply. This configuration provides the commonly deployed A/B feed redundancy for the system.

   The terminal block of the power supply has four terminals labeled V+, V+, V–, and V– for connecting DC power source cables labeled positive (+) and negative (–). The V+ terminals are shunted internally together, as are the V- terminals.

   CAUTION: The connection between each power source and power supply must include a circuit breaker.

   Do not connect two sources to a single power supply because doing so can potentially cause circulating current in feed wires whenever there is any difference in the voltage of the two sources.

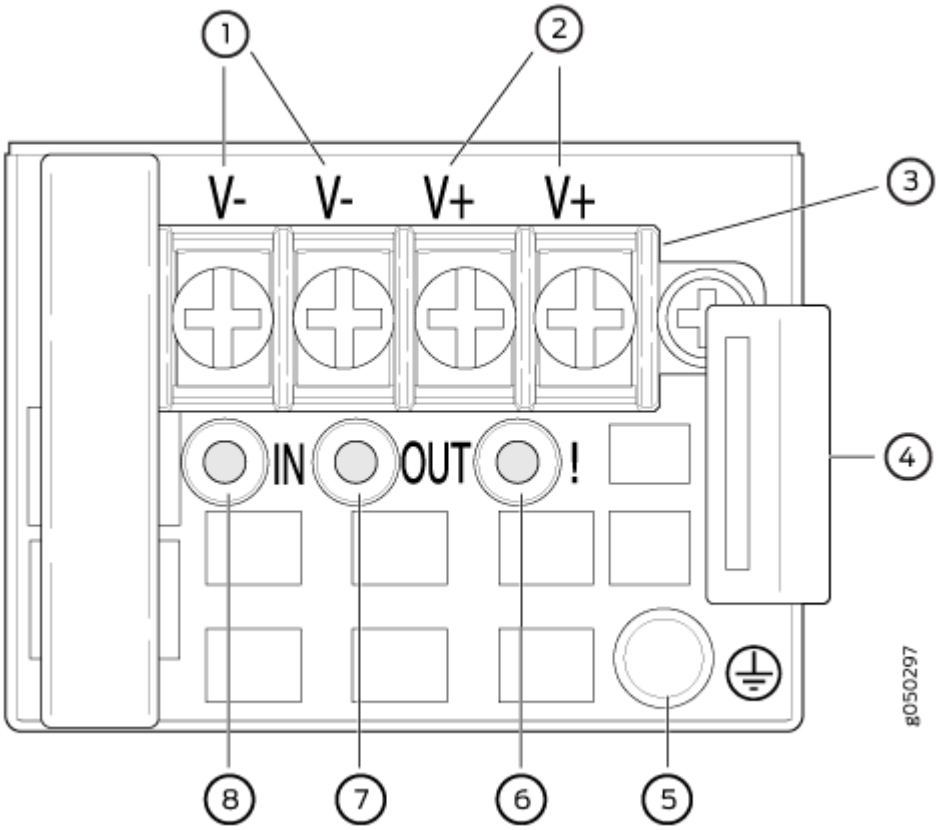
   NOTE: For QFX5100-96S installations using battery backup, a single 15 A circuit breaker is recommended.

   a. Secure the ring lug of the positive (+) DC power source cable to the V+ terminal on the DC power supply.

   b. Secure the ring lug of the negative (–) DC power source cable to the V– terminal on the DC power supply.

   c. Tighten the screws on the power supply terminals until snug using the screwdriver. Do not overtighten—apply between 5 in-lb (0.56 Nm) and 6 in-lb (0.68 Nm) of torque to the screws.

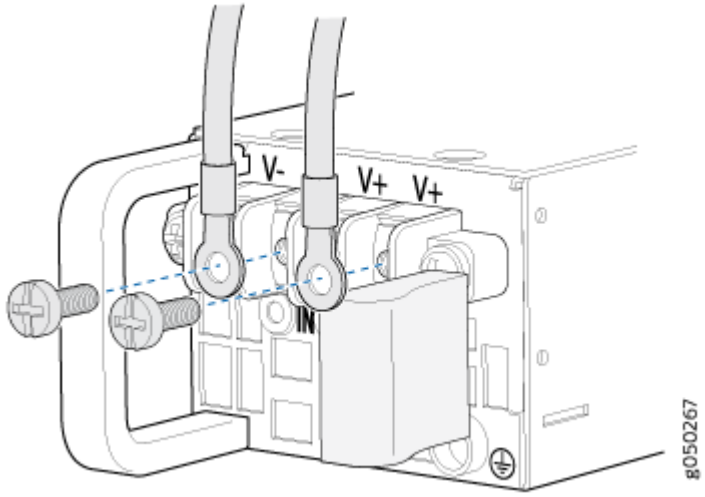
Figure 72: DC Power Supply Faceplate for a QFX5100 Device



1– Shunt negative input terminals (-48V)	5– ESD grounding point
2– Shunt positive input terminals (+RTN)	6– Fault LED
3– Terminal block	7– Output LED
4– Ejector lever	8– Input LED

CAUTION: The V+ terminals are shunted internally together, as are the V- terminals. The same polarity terminal can be wired together from the same source to provide an additional current path in a higher power chassis. Do not connect the terminals to different sources.

Figure 73: Securing Ring Lugs to the Terminals on the QFX5100 DC Power Supply



9. Replace the terminal block cover.
10. Close the input circuit breaker.

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

11. Verify that the **IN** and **OUT** LEDs on the power supply are lit green and are on steadily.

> ⚠ **CAUTION**: A system reboot with Routing Engine FPGA version 7.1 might not successfully boot the Junos OS software. In case of a system reboot failure, you need to power cycle the switch. To check the current FPGA version, issue the `show chassis firmware` command.

RELATED DOCUMENTATION

QFX5100 Power System | 53

Install and Remove QFX5100 Power Supplies | 153

Configure a QFX5100 Device

IN THIS SECTION

The initial configuration of QFX5100 switches running Juniper Networks Junos OS are configured through the console port using the command-line interface (CLI). QFX5100-48SH and QFX5100-48TH are preconfigured Satellite Network Operational System (SNOS) software. SNOS systems are configured at the aggregation device (AD). This topic covers:

Configuring a QFX5100 for Junos OS

Before you begin connecting and configuring a QFX5100 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

To connect and configure the switch from the console:

1. Connect the console port to a laptop or PC using the supplied RJ-45 cable and RJ-45 to DB-9 adapter. The console (**CON**) port is located on the management 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` (**C0**) and `em1` (**C1**) are found on the FRU end of the QFX5100 switch.

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 QFX5100 switch through Telnet using root credentials. Root login is allowed only for SSH access.

11. Enable SSH service for root login.

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

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

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

Configuring QFX10000 Switches for QFX5100-SH and QFX5100-TH as Satellite Devices

Satellite software is pre-installed on the device. All configuration for the QFX5100-48SH and QFX5100-48TH is performed at the QFX10000 aggregation device (AD).

To add the QFX5100-48SH or QFX5100-48TH to a Junos Fusion as a satellite device:

1. Log in to the Junos Fusion aggregation device (the QFX10000 switch).

   NOTE: The aggregation device must be configured with a Junos Fusion software license.

2. Configure the interface on the aggregation device that will connect to the satellite device as a cascade port. For a list of QFX10000 line cards that support having interfaces configured into cascade ports, and for the related OS Junos releases that support cascade ports, see the Junos Fusion documentation at https://www.juniper.net/documentation/.

   For example, to configure interface xe-0/0/1 as a cascade port interface:

   ```
   [edit]
   user@aggregation-device# set interfaces xe-0/0/1 cascade-port
   ```

3. Associate a line card slot ID (also known as a FPC slot ID) with the QFX5100-48SH or QFX5100-48TH.

   There are many ways to associate a line card with a satellite device. See the Junos OS for the QFX Series documentation at https://www.juniper.net/documentation/. The following are some examples.

   To map FPC slot ID 100 with the satellite device by using the interface xe-0/0/1, which is configured as the cascade port:

   ```
   [edit]
   user@aggregation device# set chassis satellite-management fpc 100 cascade-ports xe-0/0/1
   ```

   To map FPC slot ID 101 with the satellite device by using the serial number ABCDEFGHIJKL of the satellite device:

   ```
   [edit]
   user@aggregation-device# set chassis satellite-management fpc
   101 serial-number ABCDEFGHIJKL
   ```

To map FPC slot ID 102 with the satellite device by using the MAC address 12:34:56:AB:CD:EF of the satellite device:

```
[edit]
user@aggregation-device# set chassis satellite-management fpc
102 system-id 12:34:56:AB:CD:EF
```

4. Commit the configuration on the Routing Engines of the QFX10000.

```
[edit]
user@aggregation-device# commit synchronize
```

5. (Optional but recommended) Add the satellite device to a satellite software upgrade group that uses the same version of the satellite software that is installed on the QFX5100-48SH or QFX5100-48TH.

```
user@aggregation-device# set chassis satellite-management
upgrade-groups group1 satellite all
```

6. Connect the cascade port interface configured on the QFX10000 in step 2 to the QFX5100-48SH or QFX5100-48TH.

RELATED DOCUMENTATION

QFX5100 Standalone Installation Overview | 109

4

CHAPTER

Maintaining Components

Install and Remove QFX5100 Fan Modules

IN THIS SECTION

Installing a Fan Module in a QFX5100 Device

Before you install a fan module in a QFX5100 device, ensure that you have taken the necessary precautions to prevent electrostatic discharge (ESD) damage (see *Prevention of Electrostatic Discharge Damage*).

The fan modules in a QFX5100 device 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 FRU-to-port or port-to-FRU airflow depending on the switch product SKU you purchase. In legacy switches, or switches with an LCD, this airflow is called front to back and back to front.

To install a fan module in a QFX5100 device (see Figure 74 on page 150 and Figure 75 on page 150):

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 on the management panel of the chassis and slide it in until it is fully seated.

CAUTION: Damage can occur if you attempt to install a fan module into a chassis with a different airflow direction. Compare the switch product SKU with the airflow marking on the handle to ensure that you are installing a fan module with the same airflow direction as the chassis. The fan modules are designed so that they can only be inserted into the QFX5100 product SKU that supports the same airflow type. See "Cooling System and Airflow in a QFX5100 Device" on page 66 for more information.

4. Using a Phillips screwdriver, turn the locking screw until it is tight.

Figure 74: Installing a Fan Module in a 1 U QFX5100 Device

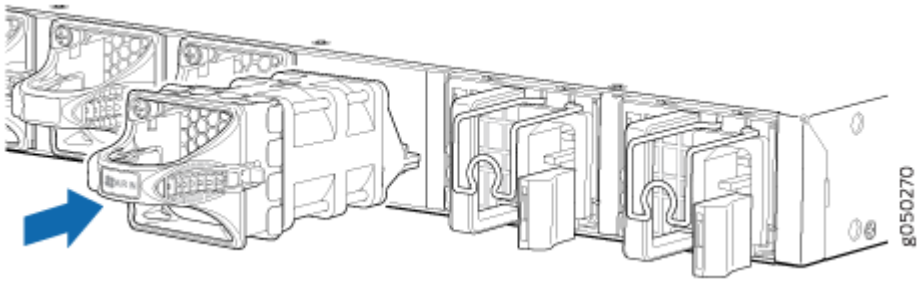
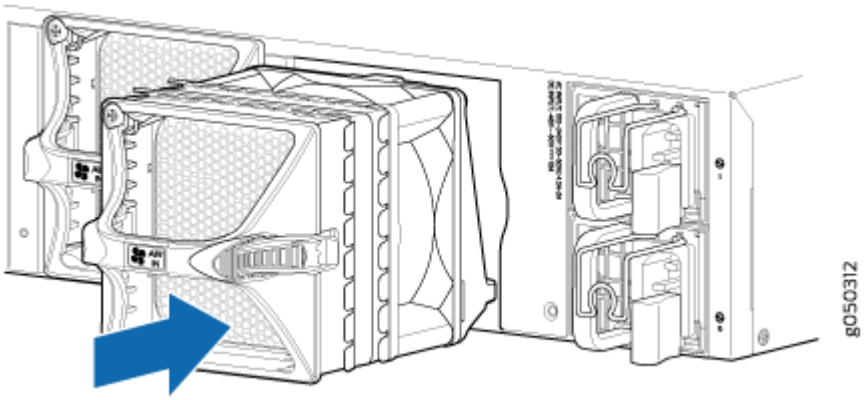


Figure 75: Installing a Fan Module in a 2 U QFX5100-96S Device



Removing a Fan Module from a QFX5100 Device

Before you remove a fan module from a QFX5100 device, ensure that you have taken the necessary precautions to prevent electrostatic discharge (ESD) damage (see *Prevention of Electrostatic Discharge Damage*).

Ensure that you have the following parts and tools available to remove a fan module from a QFX5100 device:

- ESD grounding strap
- Antistatic bag or an antistatic mat

The fan modules in QFX5100 devices 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.

To remove a fan module from a QFX5100 device (see Figure 76 on page 152 and Figure 77 on page 152):

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 stop 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 76: Removing a Fan Module from a 1 U QFX5100 Device

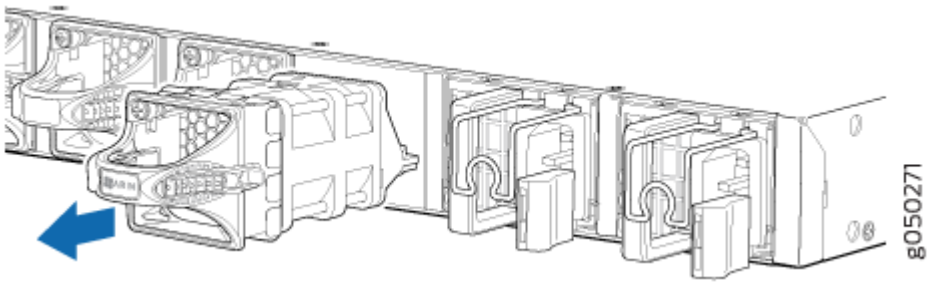
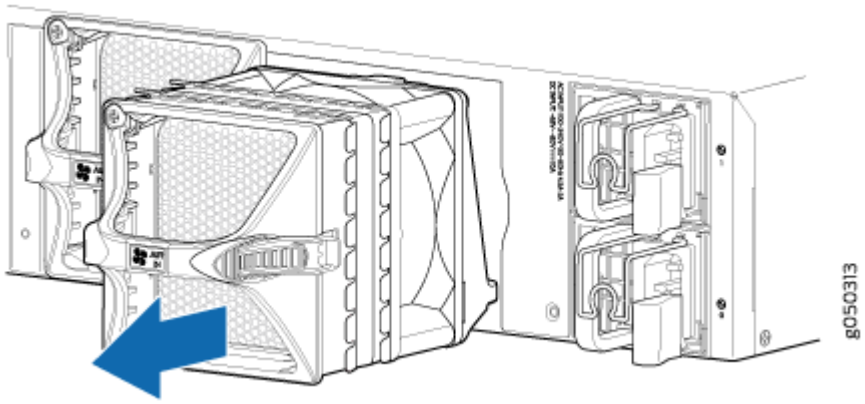


Figure 77: Removing a Fan Module from a 2 U QFX5100-96S Device



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.

RELATED DOCUMENTATION

QFX5100 Cooling System | **65**

QFX5100 Management Panel | **43**

Install and Remove QFX5100 Power Supplies

IN THIS SECTION

Installing a Power Supply in a QFX5100 Device

- Before you install a power supply in a QFX5100 device, ensure that you have taken the necessary precautions to prevent electrostatic discharge (ESD) damage (see *Prevention of Electrostatic Discharge Damage*).
- 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 "Cooling System and Airflow in a QFX5100 Device" on page 66 for more information.

The QFX5100 is shipped from the factory with two power supplies. Each power supply is a hot-removable and hot-insertable field-replaceable unit (FRU) when the second power supply is installed and running. You can install replacement power supplies in the two slots next to the fan modules without powering off the switch or disrupting the switching function.

To install a power supply in a QFX5100 device (see Figure 78 on page 154 and Figure 79 on page 154):

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 power supply components, pins, leads, or solder connections, remove the power supply from its bag.

   CAUTION: Verify that the direction of the arrow on the power supply handle matches the direction of airflow in the chassis. Ensure that each power supply you install in the chassis has the same airflow direction. If you install power supplies with two different airflow directions, Junos OS raises an alarm, and the status (**ALM**) LED blinks amber.
3. 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 78: Installing a Power Supply in a 1 U QFX5100 Device

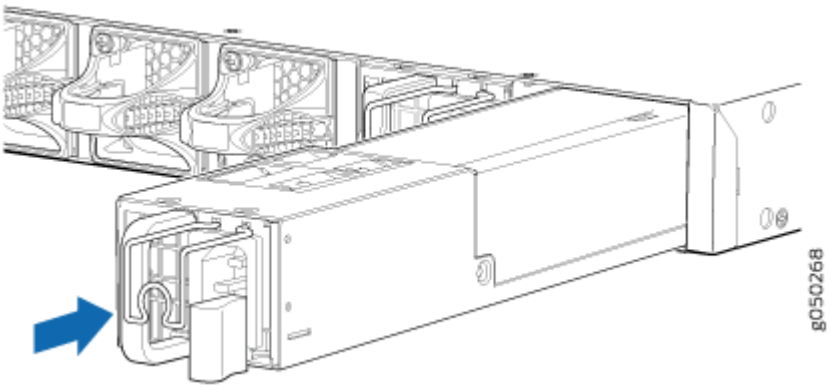
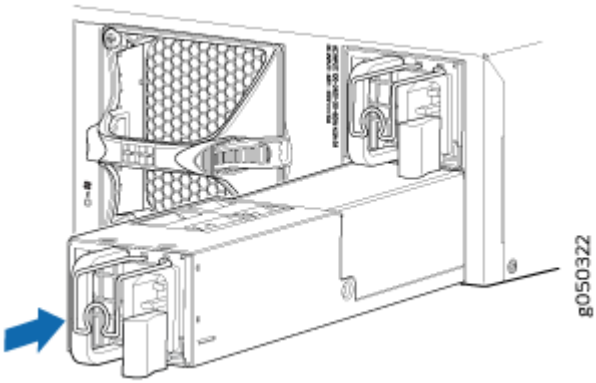


Figure 79: Installing a Power Supply in a QFX5100-96S Device



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.

Removing a Power Supply from a QFX5100 Device

Before you remove a power supply from a QFX5100 device, ensure that you have taken the necessary precautions to prevent electrostatic discharge (ESD) damage (see *Prevention of Electrostatic Discharge Damage*).

Ensure that you have the following parts and tools available to remove a power supply from a QFX5100 device:

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

The QFX5100 is shipped from the factory with two power supplies. Each power supply is a hot-removable and hot-insertable field-replaceable unit (FRU) when the second power supply is installed and running. You can install replacement power supplies in the two slots next to the fan modules without powering off the switch or disrupting the switching function.

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 QFX5100 device (see Figure 80 on page 156 and Figure 81 on page 157):

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 QFX5100 device, you need to power off the switch before removing the power supply. See "Power Off a QFX5100 Device" on page 173.

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 cord connected to the power supply faceplate.
- DC power supply—Remove the screws securing the ring lugs attached to the power source cables to the power supply using the screwdriver, and remove the power source cables from the power supply. Replace the screws on the terminals and tighten them.

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.
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.

Figure 80: Removing a Power Supply from a 1 U QFX5100 Device

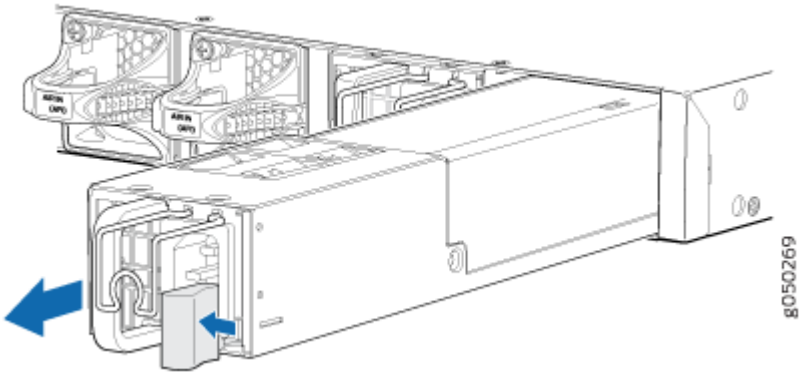
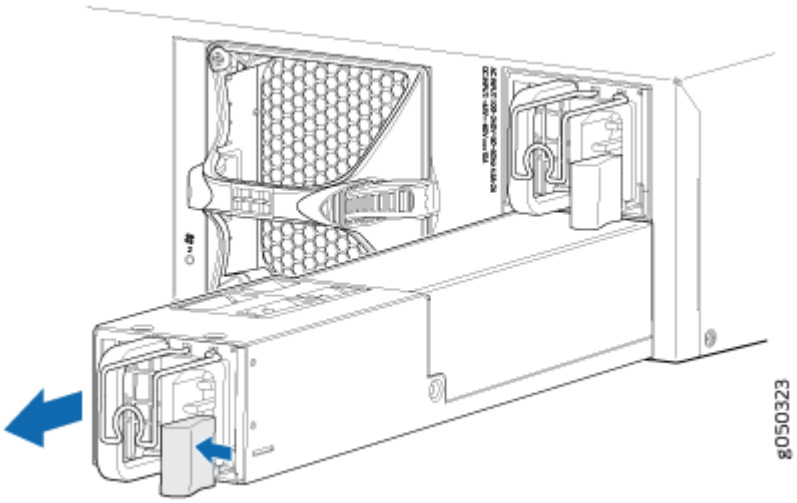


Figure 81: Removing a Power Supply from a QFX5100-96S Device



RELATED DOCUMENTATION

- QFX5100 Power System | **53**
- Connect the QFX5100 to Power | **132**
- Field-Replaceable Units in a QFX5100 Device | **17**
- QFX5100 Management Panel | **43**

Install and Remove Expansion Modules in a QFX5100-Device

IN THIS SECTION

Installing an Expansion Module in a QFX5100 Device

Before you begin installing an expansion module in the switch, ensure that you have taken the necessary precautions to prevent electrostatic discharge (ESD) damage (see *Prevention of Electrostatic Discharge Damage*).

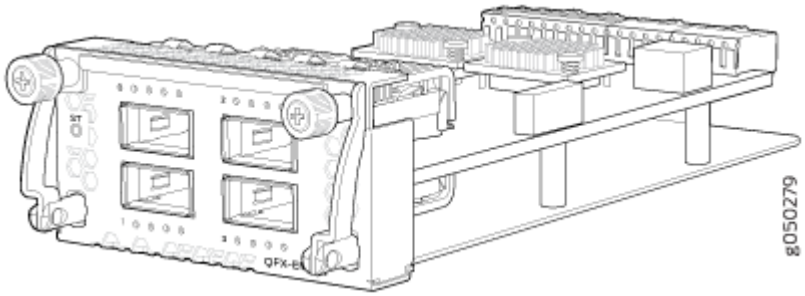
Ensure that you have the following parts and tools available:

- ESD grounding strap. If a grounding strap is not available, follow the alternative grounding method described in Step 1 of the following procedure.
- Phillips (+) screwdriver, number 2

The QFX5100-24Q device allows up to two expansion modules to be added to the port panel to increase port density. The QFX5100-24Q device holds two bays of expansion modules that can be mixed and matched as desired. The supported modules are:

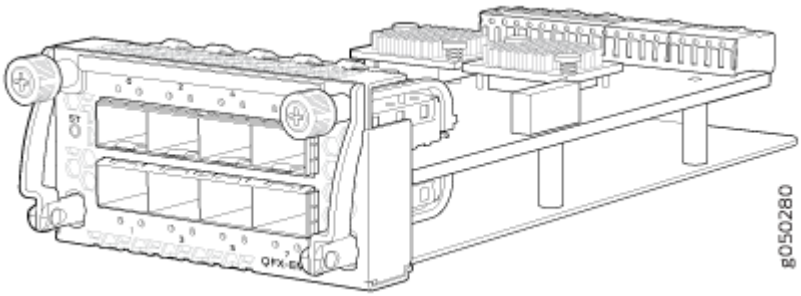
- QFX-EM-4Q–Each module adds four Quad Enhanced Small Form-Factor Pluggable (QSFP+) ports. See Figure 82 on page 158.

Figure 82: QFX-EM-4Q Expansion Module



- EX4600-EM-8F–Each module adds eight 10 Gigabit SFP+ ports. See Figure 83 on page 159.

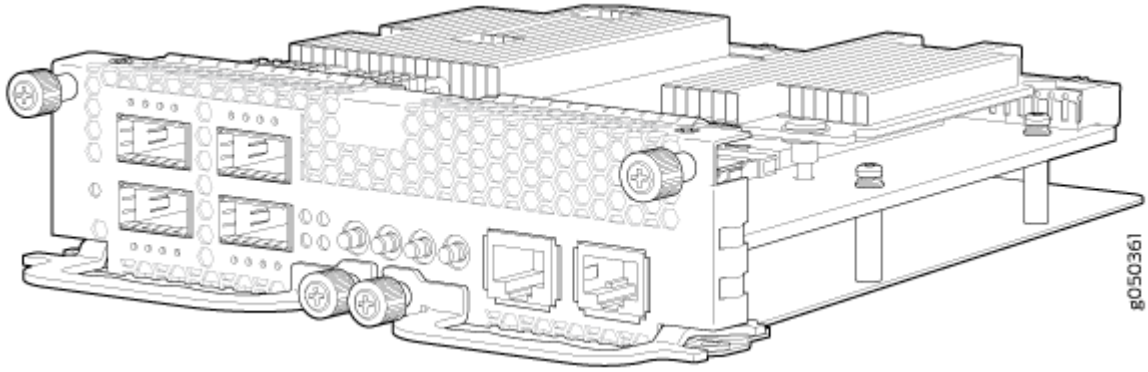
Figure 83: EX4600-EM-8F Expansion Module



The QFX5100-24Q device is configured for the QFX-EM-4Q by default, but any combination of the two modules is supported. Expansion modules can be hot-inserted or hot-removed. However, when an EX4600-EM-8F is inserted instead of the default QFX-EM-4Q, the new configuration causes the PFE to reboot and all of the interfaces to go down temporarily, causing a short disruption in traffic.

The QFX5100-24Q-AA switch supports the double-wide QFX-PFA-4Q expansion module, in addition to the QFX-EM-4Q (see Figure 82 on page 158) and the EX4600-EM-8F (see Figure 83 on page 159). The QFX-PFA-4Q module adds four 40-Gigabit Ethernet QSFP+ ports (see Figure 84 on page 159).

Figure 84: QFX-PFA-4Q Expansion Module



NOTE: When an expansion module is installed in the switch or an existing expansion module is replaced with another expansion module, the switch detects the ports on the expansion module. The switch creates the required interfaces when transceivers are installed in these ports.

To install an expansion module in a QFX5100-24Q or a QFX5100-24Q-AA device (see Figure 85 on page 160 and Figure 86 on page 161):

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

   If a grounding strap is not available, hold the expansion module in its antistatic bag in one hand and touch the exposed metallic part of the switch with the other hand to ground yourself and the component.
2. If the module slot has a cover panel on it, remove the cover panel by using the screwdriver and save it for later use.
3. Taking care not to touch module components, pins, leads, or solder connections, remove the expansion module from its bag.
4. Loosen the captive screws on the front faceplate of the expansion module by using your fingers. If you are unable to loosen the captive screws by using your fingers, use the screwdriver.
5. Using both hands, place the expansion module in the empty slot and slide it in gently until it is fully seated.

   NOTE: After you have removed an expansion module, wait for at least 5 seconds before you install an expansion module. If you do not wait for at least 5 seconds, the interfaces on the expansion module might not come up.
6. Raise the handle and tighten the captive screws by using your fingers or the screwdriver. For the QFX5100-24Q-AA, retract the ejector handles and tighten the captive screws by using your fingers or the screwdriver (see Figure 86 on page 161). When the **ST** LED turns green, the expansion module is ready for use.

Figure 85 on page 160 shows how to install a QSFP+ expansion module on the port panel of a QFX5100-24Q device.

Figure 85: Installing a QFX-EM-4Q Expansion Module in a QFX5100-24Q Device

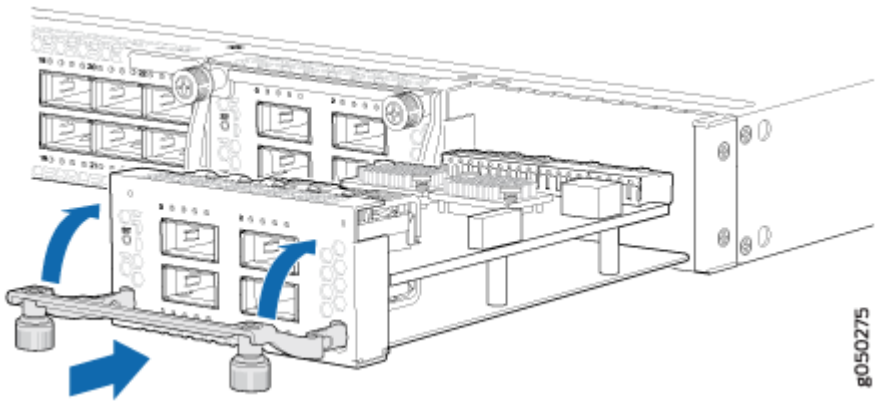
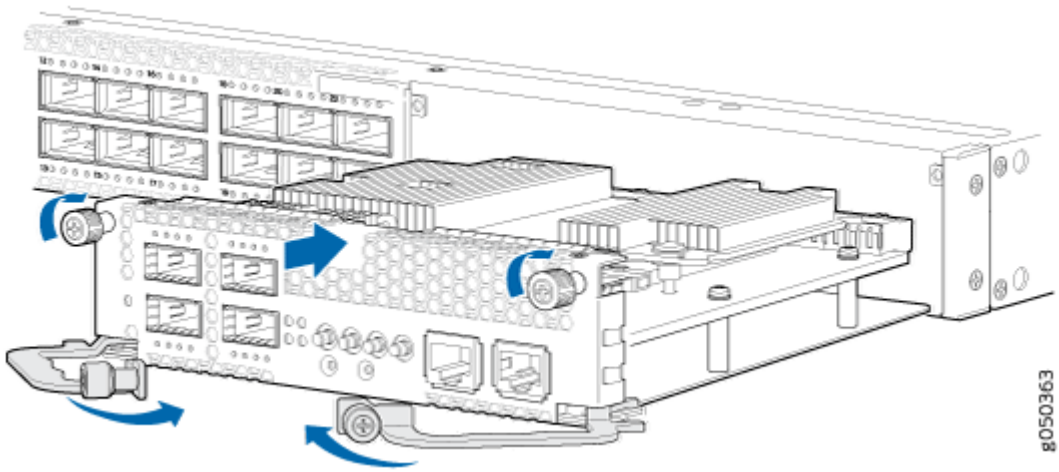


Figure 86 on page 161 shows how to install a QFX-PFA-4Q on the port panel of a QFX5100-24Q-AA switch.

Figure 86: Installing a QFX-PFA-4Q Expansion Module in a QFX5100-24Q-AA Device



NOTE: When you install the QFX-PFA-4Q expansion module in a QFX5100-24Q-AA switch and reboot the switch, the two NIC ports in the NIC inside the QFX5100-24Q-AA switch are enabled automatically. When you install other expansion modules (QFX-EM-4Q or EX4600-EM-8F), the NIC ports are enabled only when an EX4600-EM-8F is installed in slot 2 (QIC1), that is, the expansion module slot located on your right as you face the QFX5100-24Q-AA. To verify that the NIC ports are enabled, run the `show interfaces terse` command. For a QFX-PFA-4Q, the NIC interface names are displayed in the command output as, `xe-0/0/40` and `xe-0/0/41`. For an EX4600-EM-8F installed in slot 2 (QIC1), the NIC interfaces are displayed as `xe-0/0/24` and `xe-0/0/25`.

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 applies if you change the type of power supply or add a new type of expansion module. It does not apply if you replace these components with the same type of component.

Removing an Expansion Module from a QFX5100 Device

Before you begin removing an expansion module from the switch:

- Ensure that you have taken the necessary precautions to prevent electrostatic discharge (ESD) damage (see *Prevention of Electrostatic Discharge Damage*).
- If there are any transceivers installed in the expansion module, remove them before you remove the expansion module. For instructions on removing transceivers, see *Removing a Transceiver from a QFX Series Device*.

Ensure that you have the following parts and tools available:

- ESD grounding strap
- Phillips screwdriver, number 2
- A replacement optional module or cover panel
- An antistatic bag or antistatic mat

The expansion modules used in QFX5100-24Q and QFX5100-24Q-AA devices 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.

NOTE: You must take the QFX5100-24Q-AA switch offline, before replacing the QFX-PFA-4Q expansion module.

CAUTION: We recommend that you install either a replacement optional module or a cover panel in the empty module slot to avoid chassis overheating and dust accumulation.

To remove an expansion module from the switch (see Figure 87 on page 163 and Figure 88 on page 164):

1. Attach the ESD grounding strap to your bare wrist, and connect the strap to the ESD point on the chassis.
2. Unscrew both captive screws on the faceplate of the expansion module by using your fingers. If you are unable to unscrew the captive screws by using your fingers, use the screwdriver.
3. Hold the handle and gently pull the expansion module toward you and out of the module slot. For a QFX5100-24Q-AA switch, unscrew the captive screws of the ejector handles and pull the expansion module toward you and out of the module slot (see Figure 88 on page 164).
4. Place the expansion module in an antistatic bag or on an antistatic mat placed on a flat, stable surface.
5. If you are not replacing the expansion module with an optional module, install the cover panel over the slot.

NOTE: After you have removed an expansion module, wait for at least 5 seconds before you install an expansion module. If you do not wait for at least 5 seconds, the interfaces on the expansion module might not come up.

Figure 87 on page 163 shows removing a QFX-EM-4Q expansion module from the port panel of a QFX5100-24Q device.

Figure 87: Removing a QFX-EM-4Q Expansion Module from a QFX5100-24Q Device

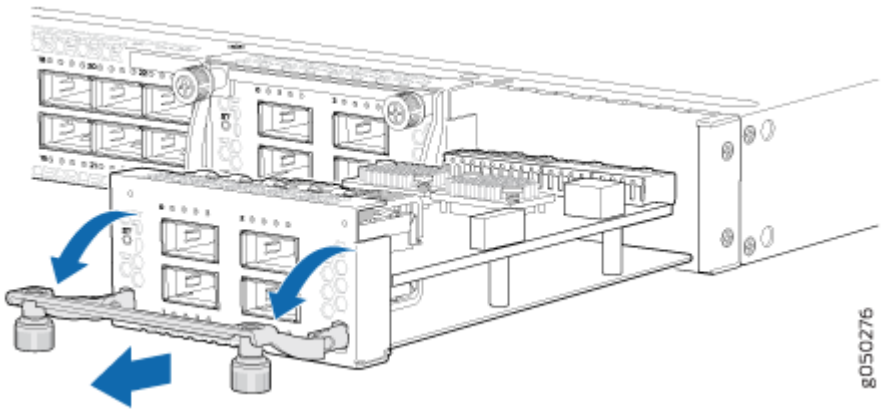
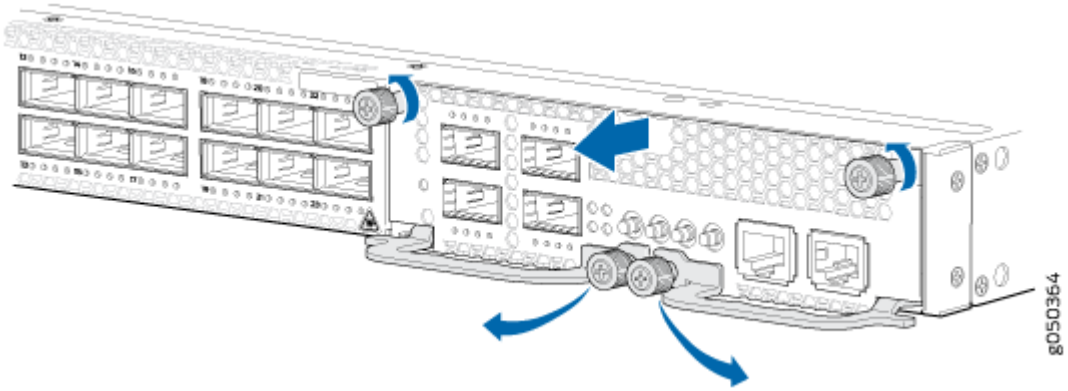


Figure 88 on page 164 shows removing a QFX-PFA-4Q expansion module from the port panel of a QFX5100-24Q-AA switch.

NOTE: You must take the QFX-PFA-4Q offline before replacing it.

Figure 88: Removing a QFX-PFA-4Q Expansion Module from a QFX5100-24Q-AA Device



RELATED DOCUMENTATION

- QFX5100 System Overview | **2**
- Port Panel of a QFX5100-24Q Device | **20**

Install and Remove Transceivers and Fiber Optic Cables on QFX5100 Devices

IN THIS SECTION

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 them 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 89 on page 167 shows how to install a QSFP+ transceiver. The procedure is the same for all types of transceivers except the QSFP28 and CFP transceivers. Note that this procedure is the same for SFP+ and SFP28 transceivers which will be used in EX4100.

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 the ESD point on the switch.
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, hand 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.

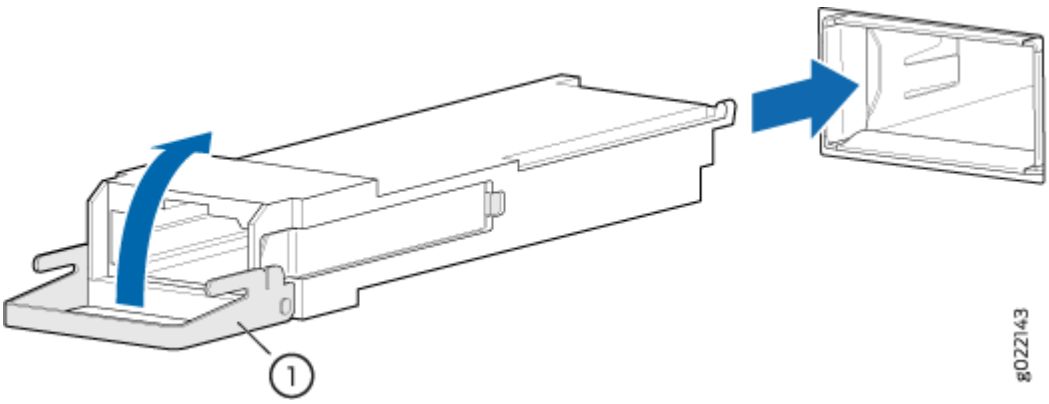
CAUTION: Do not leave a fiber-optic transceiver uncovered except when inserting or removing cable. The safety cap keeps the port clean and protects your eyes from accidental exposure to laser light.

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 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.

Figure 89: Install a Transceiver



1– Ejector lever	

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 them 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 90 on page 169 shows how to remove a QSFP+ transceiver. The procedure is the same for all types of transceivers except the QSFP28 and CFP transceivers. Note that this procedure is the same for SFP+ and SFP28 transceivers which will be used in EX4100.

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 switch.
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.

   CAUTION: Do not bend 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.

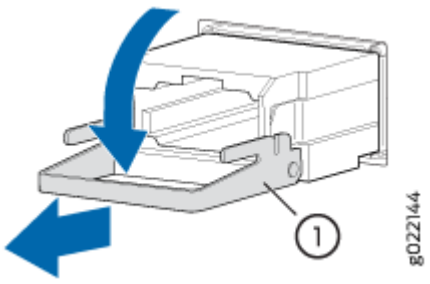
6. To remove an SFP, SFP+, XFP, or a QSFP+ transceiver:
   a. Using your fingers, pull open the ejector lever on the transceiver to unlock the transceiver.

      CAUTION: Before removing the transceiver, make sure that you open the ejector lever completely until you hear it click. This 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 90: 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.

Connect a Fiber-Optic Cable

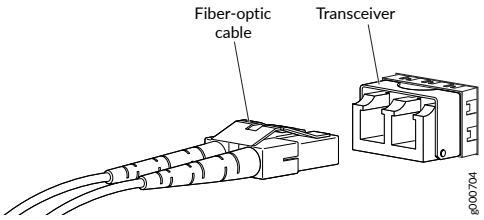
Before you connect a fiber-optic cable to an optical transceiver installed in a device, ensure that you have taken the necessary precautions for safe handling of lasers (see *Laser and LED Safety Guidelines and Warnings*).

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 (see Figure 91 on page 170).

Figure 91: Connect a Fiber-Optic Cable to an Optical Transceiver Installed in a Device



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.

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.

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 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, which is easier and less expensive to replace than 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

QFX5100 Chassis Description and Port Panels | 19

Power Off a QFX5100 Device

Before you power off a QFX5100 switch:

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

> **NOTE**: Use the following procedure to turn off power on a QFX5100 device that is in standalone mode, a member in a QFX Virtual Chassis, or either a spine device or a leaf device in a Virtual Chassis Fabric. QFX5100 devices that are configured either as Node devices or as an Interconnect device in a QFabric system running OS Junos release 14.1 or later, must use a different procedure and CLI to ensure there is no traffic loss. See *Adding or Replacing a Node Device in a QFabric Node Group* .

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 QFX5100 switch:

1. Connect to the switch using one of the following methods:
   - Connect a management device to the console (**CON**) port on a QFX5100 switch. For instructions about connecting a management device to the console (**CON**) port, see "Connect a Device to a Management Console Using an RJ-45 Connector" on page 120.
   - You can shut down the QFX5100 switch from a management device on your out-of-band management network. For instructions about connecting a management device to the management (**CO** or **C1**) port, see "Connect a Device to a Network for Out-of-Band Management" on page 119.
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:

```
System going down IMMEDIATELY

Terminated
Poweroff for hypervisor to respawn
Aug 26 16:49:04 init: event-processing (PID 1325) exited with status=1
Aug 26 16:49:04 init: packet-forwarding-engine (PID 1809) 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 0 done

syncing disks... All buffers synced.
Uptime: 11m7s
recorded reboot as normal shutdown
unloading fpga driver
Powering system off using ACPI
Stopping crond: [  OK  ]

Running guests on default URI: no running guests.
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... haveged: haveged: Stopping due to signal 15

[  OK  ]
Sending all processes the KILL signal... [  OK  ]
Saving random seed:  [  OK  ]
Syncing hardware clock to system time [  OK  ]
Unmounting file systems:  [  OK  ]
init: Re-executiRE-FPGA-DRV: reboot notifier called with 0x0003
ng /sbin/init
Halting system...
```

```
tmc-fpga: TMC FPGA driver shutdown called.
Power down.
```

CAUTION: The final output of any version of the `request system halt` command is "Power down." Wait at least 60 seconds after first seeing this message before following the instructions in Step 4 and Step 5 to power off 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 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.
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 socket end of the power cord connected to the power supply faceplate.
   - DC power supply—Remove the screws securing the ring lugs attached to the power source cables to the power supply using the screwdriver, and remove the power source cables from the power supply. Replace the screws on the terminals and tighten them.
6. Uncable the switch before removing it from the rack or cabinet.

RELATED DOCUMENTATION

Connect the QFX5100 to Power | 132

Remove a QFX5100 Device

IN THIS SECTION

Installing and Removing QFX5100 Device Hardware Components

The QFX5100 switch chassis is a rigid sheet-metal structure that houses the hardware components. The field-replaceable units (FRUs) in QFX5100 devices are:

- Power supply
- Fan module
- Expansion module (QFX5100-24Q and QFX5100-24Q-AA only)
- SFP+ transceiver
- QSFP+ transceiver

All of the QFX5100 device 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.

To install a power supply in a QFX5100 device, follow the instructions in "Installing a Power Supply in a QFX5100 Device" on page 153. To remove a power supply from a QFX5100 device, follow the instructions in "Removing a Power Supply from a QFX5100 Device" on page 155.

To install a fan module in a QFX5100 device, follow the instructions in "Installing a Fan Module in a QFX5100 Device" on page 149. To remove a fan module from a QFX5100 device, follow the instructions in "Removing a Fan Module from a QFX5100 Device" on page 151.

To install an SFP+ or QSFP+ transceiver in a QFX5100 device, follow the instructions in *Installing a Transceiver in a QFX Series Device*. To remove an SFP+ or QSFP+ transceiver from a QFX5100 device, follow the instructions in *Removing a Transceiver from a QFX Series Device*.

To connect a fiber-optic cable to an SFP+ or QSFP+ transceiver in a QFX5100 device, follow the instructions in *Connecting a Fiber-Optic Cable to a QFX Series Device*. To disconnect a fiber-optic cable from an SFP+ or QSFP+ transceiver from a QFX5100 device, follow the instructions in *Disconnecting a Fiber-Optic Cable from a QFX Series Device*.

Powering Off an Existing QFabric Node Device

Use this procedure to gracefully shut down an existing device in a server Node group, redundant server Node group, or network Node group. This orderly process reduces traffic loss on server Node devices and prevents traffic loss on redundant server Node devices and network member devices.

CAUTION: Do not use the `request system halt` command to shut down an existing Node device or traffic loss can occur.

1. Log into the QFabric default partition on the Director device and start the CLI.

```
[root@dg0] # cli
```

2. Discover the device connection status and the alias name (identifier) by issuing the `show fabric administration inventory` command.

```
user@qfabric> show fabric administration inventory
Item                    Identifier              Connection      Configuration
Node group
  NW-NG-0                                       Connected       Configured
  P5502-C                                       Disconnected
    P5502-C                                     Disconnected
  P8189-C                                       Connected       Configured
    P8189-C                                     Connected
  TA3713470056                                  Disconnected
    TA3713470056                                Disconnected
  TR0214080017                                  Disconnected
    TR0214080017                                Disconnected
Interconnect device
  IC-TB3713490033                               Connected       Configured
    TB3713490033/RE0                            Connected
  IC-TB3714010454                               Connected       Configured
    TB3714010454/RE0                            Connected
Fabric manager
  FM-0                                          Connected       Configured
Fabric control
  FC-0                                          Connected       Configured
  FC-1                                          Connected       Configured
Diagnostic routing engine
  DRE-0                                         Connected       Configured
```

```
Director group
  0281022011000011                          Connected
  0281032012000018                          Connected
```

The Node device must show as `connected` and `configured` to have an orderly shutdown.

3. Start the orderly shutdown of the Node device by issuing the `request fabric power-off node-device` operational mode command from the QFabric default partition CLI. This command systematically takes the node offline and gracefully shuts down the device while preserving system state information. A message appears on the console or console log, confirming that the operating system has stopped on the device.

   You see the following output after entering the command:

```
root@qfabric> request fabric administration power-off node-device
ED1491
STEP 1 of 8 (Acquiring lock):
Acquiring lock to perform this operation
Acquired lock to perform this operation
STEP 2 of 8 (Performing pre-checks):
node-device ED1491 is online
STEP 3 of 8 (Mastership switch-over):
node-device ED1491 is Server Node-group
STEP 4 of 8 (Gracefully offlining the node-device):
node-device is being offlined
node-device is successfully offlined
STEP 5 of 8 (Waiting for convergence):
Waiting for convergence(this will take few minutes)
Convergence complete
STEP 6 of 8 (Powering-off the node-device):
Now, powering-off the node-device
Powered-off the node-device
STEP 7 of 8 (Updating inventory):
Removing the node-device - ED1491 from inventory
node-device - ED1491 is removed from inventory
STEP 8 of 8 (Releasing lock):
Releasing the lock

root@qfabric>
```

CAUTION: The final output of the `request fabric power-off node-device` command is the following message: `The device is shutting down and can be removed when the LCDs are off.` Wait at least 3 to 4 minutes after first seeing this message before following the instructions in Step 5 and Step 6 to disconnect the switch.

4. Attach the grounding strap to your bare wrist and to a site ESD point.
5. 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 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.
6. 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 cord connected to the power supply faceplate.
   - DC power supply—Remove the screws securing the ring lugs attached to the power source cables to the power supply using the screwdriver, and remove the power source cables from the power supply. Replace the screws on the terminals and tighten them.

Removing a QFX5100 Device from a Rack or Cabinet

Before removing a QFX5100 device 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 QFX5100 device on the rack.

If you need to relocate an installed QFX5100 device, use the procedure described in this topic. (The remainder of this topic uses “rack” to mean “rack or cabinet.”)

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.

- Ensure that the rack is stable and secured to the building.

- Ensure that there is enough space to place the removed QFX5100 device in its new location and along the path to the new location.
- Read *General Safety Guidelines and Warnings*.
- Use the appropriate power off sequence for your configuration to safely powered off the device.
  - If the QFX5100 device is being used as a standalone switch, a member in a QFX Virtual Chassis, or either a spine device or a leaf device in a Virtual Chassis Fabric (VCF), see "Power Off a QFX5100 Device" on page 173.
  - If the QFX5100 device is configured as either a Node device or as a Interconnect device in a QFabric system, see *Adding or Replacing a Node Device in a QFabric Node Group* .
- Disconnect the power cords.
- Ensure that you have disconnected any cables or wires attached to the QFX5100 switch ports.

To remove a QFX5100 device from a rack or cabinet:

1. Have one person 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 QFX5100 device from the rack or cabinet.
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 QFX5100 device to your desired new location.

RELATED DOCUMENTATION

Mount a QFX5100 Device in a Rack or Cabinet | **114**

Connect the QFX5100 to Power | **132**

QFX5100 Cooling System | **65**

5
CHAPTER

Troubleshooting Hardware

Troubleshoot the QFX5100 Device

IN THIS SECTION

Alarm Types and Severity Levels

The QFX Series switches support different alarm types and severity levels. Table 36 on page 182 provides a list of alarm terms and definitions that may help you in monitoring the device.

Table 36: Alarm Terms and Definitions

Term	Definition
Alarm	Signal that alerts you to conditions that might prevent normal operation. On the device, alarm indicators might include an LCD panel and LEDs on the device. The LCD panel (if present on the device) displays the chassis alarm message count. Blinking amber or yellow LEDs indicate yellow alarm conditions for chassis components.
Alarm condition	Failure event that triggers an alarm.

Table 36: Alarm Terms and Definitions *(Continued)*

Term	Definition

Alarm severity levels	Seriousness of the alarm. The level of severity can be either major (red) or minor (yellow).
	• Major (red)—Indicates a critical situation on the device that has resulted from one of the following conditions. A red alarm condition requires immediate action.
	  • One or more hardware components have failed.
	  • One or more hardware components have exceeded temperature thresholds.
	  • An alarm condition configured on an interface has triggered a critical warning.
	• Minor (yellow or amber)—Indicates a noncritical condition on the device that, if left unchecked, might cause an interruption in service or a degradation in performance. A yellow alarm condition requires monitoring or maintenance. For example, a missing rescue configuration generates a yellow system alarm.

Alarm types	Alarms include the following types: • Chassis alarm—Predefined alarm triggered by a physical condition on the device such as a power supply failure or excessive component temperature. • Interface alarm—Alarm that you configure to alert you when an interface link is down. Applies to `ethernet`, `fibre-channel`, and `management-ethernet` interfaces. You can configure a red (major) or yellow (minor) alarm for the link-down condition, or have the condition ignored. • System alarm—Predefined alarm that might be triggered by a missing rescue configuration, failure to install a license for a licensed software feature, or high disk usage.

Interface Alarm Messages

Interface alarms are alarms that you configure to alert you when an interface is down.

To configure an interface link-down condition to trigger a red or yellow alarm, or to configure the link-down condition to be ignored, use the `alarm` statement at the [`edit chassis`] hierarchy level. You can specify the `ethernet`, `fibre-channel`, or `management-ethernet` interface type.

NOTE: Fibre Channel alarms are valid only on QFX3500 devices.

NOTE: When red alarms or major alarms are issued on QFX5100 or EX4600 switches, the alarm LED glows amber instead of red.

By default, major alarms are configured for interface link-down conditions on the control plane and management network interfaces in a QFabric system. The link-down alarms indicate that connectivity to the control plane network is down. You can configure these alarms to be ignored using the `alarm` statement at the [`edit chassis`] hierarchy level.

NOTE: If you configure a yellow alarm on the QFX3008-I Interconnect device, it is handled as a red alarm.

Chassis Alarm Messages

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

Chassis alarms on QFX5100, QFX5110, QFX5210, and QFX5120 devices have two severity levels:

- Major (red)—Indicates a critical situation on the device that has resulted from one of the conditions described in Table 37 on page 185. A red alarm condition requires immediate action.
- Minor (yellow)—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 37 on page 185 describes the chassis alarm messages on QFX5100, QFX5110, QFX5200, QFX5210, and QFX5120 devices.

Table 37: 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 error messages and report the 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, 3, 4, or 5.
		`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 error message *`fan-number`* `Absent`, where *`fan-number`* can be can be 1, 2, 3, 4, or 5. Install fan modules in the slots where they are absent.
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 supported by the chassis.

Table 37: 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 error messages and report the message to customer support: • I2C Read failed for device *number*, where *number* where number ranges from 123 through 125. • PS *number*: Transitioning from online to offline, where power supply *number* is 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 one of the power supply. The switch can continue to operate with a single power supply. OR Replace the removed power supply and reboot the switch.
		PEM *pem-number* Power Supply Type Mismatch	Check whether 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.

Table 37: Chassis Alarm Messages *(Continued)*

Component	Alarm Type	CLI Message	Recommended Action
		PEM *pem-number* Removed	Replace the removed power supply or reboot the switch. The switch can continue to operate with a single power supply.
Temperature sensors	Major (red)	*sensor-location* Temp Sensor Fail	Check the system log for the following error message and report the message 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	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 37: 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. On models that have both em0 and em1 management interfaces available, you must connect both interfaces. If both interfaces are not connected, the alarm is raised. However, the alarm has no service impact. If you are unable to resolve the problem, open a support case by using the Case Manager link at https://www.juniper.net/support/ or call 1-888-314-5822 (tollfree, US or 1-408-745-9500 (from outside the United States).

Creating an Emergency Boot Device for QFX Series Switches

Before you begin, you need to download the installation media image for your device and Junos OS release from https://www.juniper.net/customers/support/ .

If Junos OS on the device is damaged in some way that prevents the software from loading properly, you can use an emergency boot device to repartition the primary disk and load a fresh installation of Junos OS. Use the following procedure to create an emergency boot device.

NOTE: You can create the emergency boot device on another Juniper Networks switch or router, or any laptop or desktop PC that supports Linux. The steps you take to create the emergency boot device vary, depending on the device.

To create an emergency boot device:

1. Use FTP to copy the installation media image into the **/var/tmp** directory on the device.
2. Insert a USB storage device into the USB port.
3. From the Junos OS command-line interface (CLI), start the shell:

```
user@device> start shell
%
```

4. Use the gunzip command to unzip the image file.
5. Switch to the root account using the `su` command:

```
% su
Password: password
```

NOTE: The password is the root password for the device. If you logged in to the device as the root user, you do not need to perform this step.

6. Enter the following command on the device:

```
root@device% dd if=/var/tmp/filename of=/dev/da1 bs=1m
```

The device writes the installation media image to the USB storage device:

```
root@device% dd if=install-media-qfx-5e-15.1X53-D30.5-domestic.img of=/dev/da0 bs=1m
1399+0 records in
1399+0 records out
1466957824 bytes transferred in 394.081902 secs (3722469 bytes/sec)
```

7. Log out of the shell:

```
root@device% exit
% exit
user@device>
```

Recovering the Installation Using an Emergency Boot Device

If Junos OS on your device is damaged in some way that prevents the software from loading correctly, you may need to perform a recovery installation using an emergency boot device (for example, a USB flash drive) to restore the default factory installation. Once you have recovered the software, you need to restore the device configuration. You can either create a new configuration as you did when the device was shipped from the factory, or if you saved the previous configuration, you can simply restore that file to the device.

If at all possible, you should try to perform the following steps before you perform the recovery installation:

1. Ensure that you have an emergency boot device to use during the installation. See *Creating an Emergency Boot Device for QFX Series Switches* for information on how to create an emergency boot device.

2. Copy the existing configuration in the file **/config/juniper.conf.gz** from the device to a remote system, such as a server, or to an emergency boot device. For extra safety, you can also copy the backup configurations (the files named **/config/juniper.conf.*n***, where *n* is a number from 0 through 9) to a remote system or to an emergency boot device.

   You can use the system snapshot feature to complete this step. The system snapshot feature takes a "snapshot" of the files currently used to run the QFX Series switch—the complete contents of the **/config** and **/var** directories, which include the running Juniper Networks Junos OS, the active configuration, and the rescue configuration—and copies all of these files into a memory source. See *Creating a Snapshot and Using It to Boot a QFX Series Switch*.

NOTE: System snapshot is not supported on QFX10000 and QFX5200 switches.

CAUTION: The recovery installation process completely overwrites the entire contents of the internal flash storage.

3. Copy any other stored files to a remote system as desired.

To reinstall Junos OS:

1. Insert the emergency boot device into the device.
2. Power cycle the device.

   The emergency boot device is detected. At this time, you can load the Junos OS from the emergency boot device onto the internal flash storage.
3. The software prompts you with the following option if you have a snapshot saved on the emergency boot device:

```
Junos Snapshot Installer - (c) Juniper Networks 2013
          Reboot
          Install Junos Snapshot [14.1X53-D11_vjunos.61]
          Boot to host shell
[debug]
```

   Select **Install Junos Snapshot** to install the snapshot.

   The software prompts you with the following option if you have Junos OS software from the factory installed on the emergency boot device.

```
Juniper Linux Installer - (c) Juniper Networks 2014
            Reboot
            Install Juniper Linux Platform
            Boot to host shell [debug]
```

   Select **Install Juniper Linux Platform** to install the Junos OS software from the emergency boot device.

4. The device copies the software from the emergency boot device, occasionally displaying status messages. Copying the software can take up to 12 minutes.

   When the software is finished being copied from the emergency device to the device, the device reboots from the internal flash storage on which the software was just installed. When the reboot is complete, the device displays the Junos OS login prompt:

   ```
   root@switch#
   ```

5. Create a new configuration as you did when the device was shipped from the factory, or restore the previously saved configuration file to the device.

6. Remove the emergency boot device.

RELATED DOCUMENTATION

Configure a QFX5100 Device | 143

QFX5100 Chassis Description and Port Panels | 19

CHAPTER 6

Contacting Customer Support and Returning the Chassis or Components

Contact Customer Support to Obtain a Return Material Authorization

If you need to return a device or hardware component to Juniper Networks for repair or replacement, obtain a Return Material Authorization (RMA) number from Juniper Networks Technical Assistance Center (JTAC). You must obtain an RMA number before you attempt to return the component.

After locating the serial number of the device or hardware component you want to return, open a service request with the Juniper Networks Technical Assistance Center (JTAC) on the Web or by telephone.

Before you request an RMA number from JTAC, be prepared to provide the following information:

- Your existing service request number, if you have one
- Serial number of the component
- Your name, organization name, telephone number, fax number, and shipping address
- 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

You can contact JTAC 24 hours a day, seven days a week on the Web or by telephone:

- Service Request Manager: https://support.juniper.net/support
- Telephone: +1-888-314-JTAC (+1-888-314-5822), toll free in U.S., Canada, and Mexico

NOTE: For international or direct-dial options in countries without toll free numbers, see https://support.juniper.net/support.

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

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

Return the QFX5100 Chassis or Components

IN THIS SECTION

Locating the Serial Number on a QFX5100 Device 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). See *Contacting Customer Support to Obtain a Return Materials Authorization for a QFX Series Device or Component*.

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 QFX5100 switch and components and their serial numbers, use the `show chassis hardware` CLI operational mode command. If you are using the QFX5100 switch as a Node device in a QFabric system, you must first log in to the switch using the `request component login` CLI operational mode command.

```
user@device> show chassis hardware

Hardware inventory:
Item             Version  Part number  Serial number     Description
Chassis                                EL9270            QFX5100-24Q-2P
Pseudo CB 0
Routing Engine 0          BUILTIN      BUILTIN           QFX Routing Engine
FPC 0            REV 17   750-036931   P5331-C           QFX5100-24Q-2P
  CPU                     BUILTIN      BUILTIN           FPC CPU
  PIC 0                   BUILTIN      BUILTIN           24x 40G-QSFP
Power Supply 0   Rev 04   740-032091   VB02420           QFX3500-48S4Q
Power Supply 1
Fan Tray 1                                              QFX5100 Fan Tray 1, Bac
k to Front Airflow - AFI
Fan Tray 2                                              QFX5100 Fan Tray 2, Bac
k to Front Airflow - AFI
Fan Tray 3                                              QFX5100 Fan Tray 3, Bac
k to Front Airflow - AFI
Fan Tray 4                                              QFX5100 Fan Tray 4, Bac
k to Front Airflow - AFI
Fan Tray 5                                              QFX5100 Fan Tray 5, Bac
k to Front Airflow - AFI
```

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 QFX5100 Switch

The location for the chassis serial number ID label is product SKU-dependent. On the QFX5100-96S, QFX5100-48S, QFX5100-48SH, QFX5100-48T, and QFX5100-48TH product SKUs, the serial number ID label is located on the left side of the port panel. On legacy switches, or switches with an LCD, the port panel is referred to as the front panel. See Figure 92 on page 197 through Figure 94 on page 198

for examples of where to find the serial number ID. On the QFX5100-24Q, the serial number ID label is located next to the left expansion port on the port panel. See Figure 95 on page 198.

Figure 92: Location of the Serial Number ID Label on a QFX5100-96S Switch

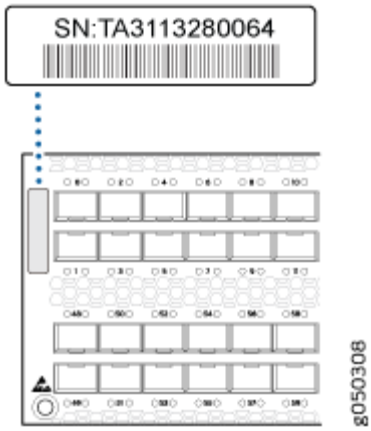


Figure 93: Location of the Serial Number ID Label on QFX5100-48S and QFX5100-48SH Switches

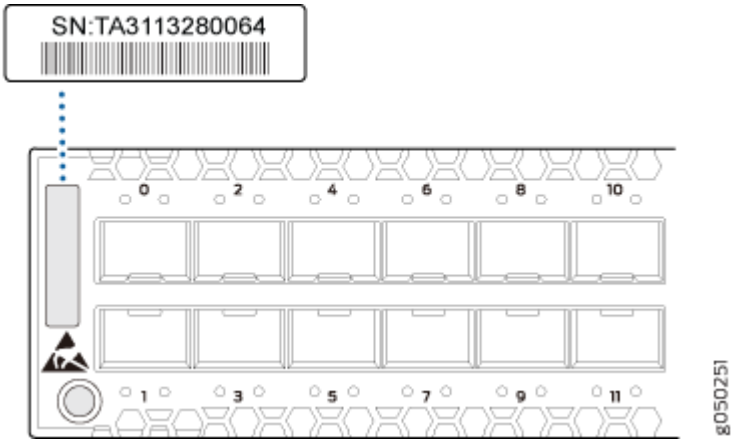


Figure 94: Location of the Serial Number ID Label on QFX5100-48T and QFX5100-48TH Switches

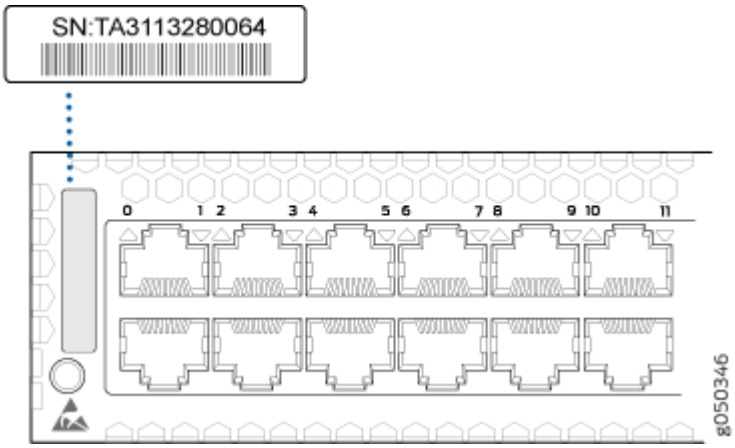
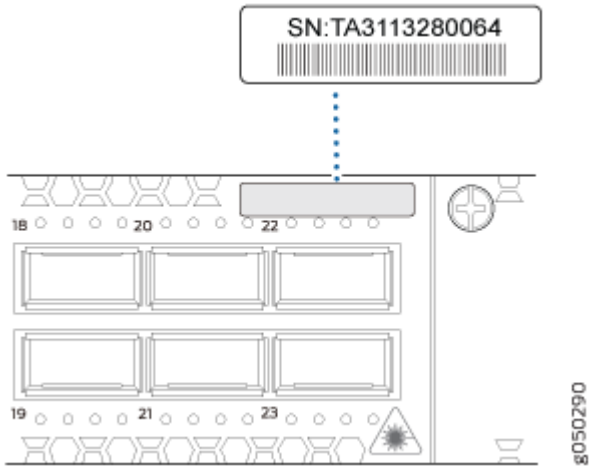


Figure 95: Location of the Serial Number ID Label on a QFX5100-24Q Switch



Locating the Serial Number ID Labels on FRU Components

The power supplies, fan module, and expansion modules installed in QFX5100 switches 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.
- Expansion module–The serial number ID label is in the middle of the printed circuit board (PCB).

RELATED DOCUMENTATION

Returning a QFX5100 Device or Component for Repair or Replacement

How to Return a Hardware Component to Juniper Networks, Inc.

If a hardware component fails, please contact Juniper Networks, Inc. to obtain a Return Material Authorization (RMA) number. This number is used to track the returned material at the factory and to return repaired or new components to the customer as needed.

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

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

For product problems or technical support issues, contact the Juniper Networks Technical Assistance Center (JTAC) by using the Service Request Manager link at https://support.juniper.net/support/ or at 1-888-314-JTAC (within the United States) or 1-408-745-9500 (from outside the United States).

To return a defective hardware component:

1. Determine the part number and serial number of the defective component.
2. Obtain an RMA number from the Juniper Networks Technical Assistance Center (JTAC). You can send e-mail or telephone as described above.
3. Provide the following information in your e-mail message or during the telephone call:
   - Part number and serial number of component
   - Your name, organization name, telephone number, and fax number
   - Description of the failure
4. The support representative validates your request and issues an RMA number for return of the component.
5. Pack the component for shipment.

Guidelines for Packing Hardware Components for Shipment

To pack and ship individual components:

- When you return components, make sure that they are adequately protected with packing materials and packed so that the pieces are prevented from moving around inside the carton.
- Use the original shipping materials if they are available.
- Place individual components in antistatic bags.
- Write the RMA number on the exterior of the box to ensure proper tracking.

CAUTION: Do not stack any of the hardware components.

RELATED DOCUMENTATION

Remove a QFX5100 Device | **175**

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 96 on page 229) 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).

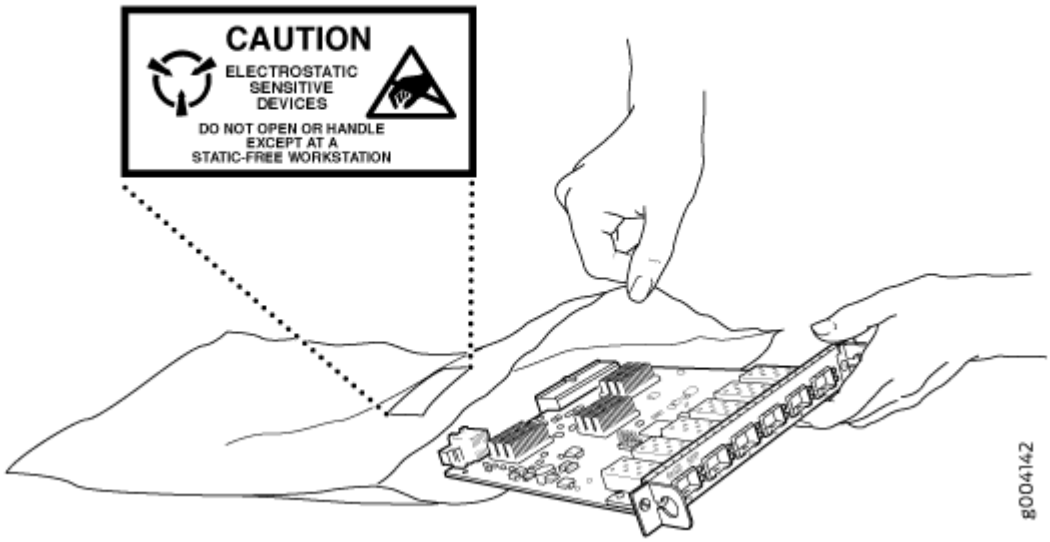
- When handling any component that is subject to ESD damage and that is removed from the device, make sure the equipment end of your ESD wrist strap is attached to the ESD point on the chassis.

  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 96 on page 229). If you are returning a component, place it in an antistatic bag before packing it.

Figure 96: 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.

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

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.

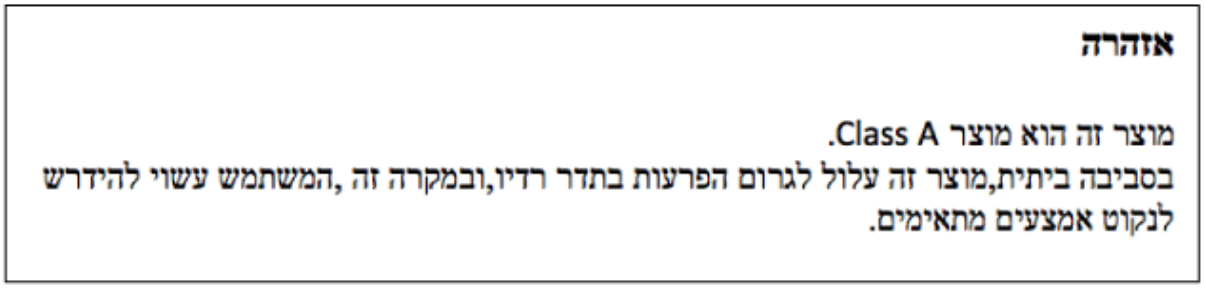
CAUTION: Users should not attempt to make electrical ground connections by themselves, but should contact the appropriate inspection authority or an electrician, as appropriate.

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

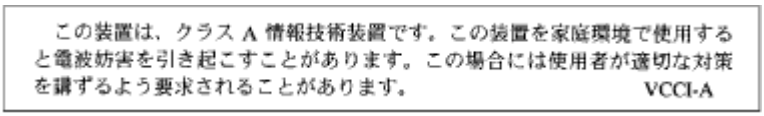
This is a Class A product. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

Israel



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



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

警告使用者：
這是甲類的資訊產品, 在居住的環境中使用 時, 可能會造成射頻干擾, 在這種情況下, 使用者會被要求采取某些適當的對策。

Chinese Class A warning g100090

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).

RELATED DOCUMENTATION

Agency Approvals for the QFX Series

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.