

PIC and Transceiver Installation Instructions

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This document describes how to remove and replace Physical Interface Cards (PICs) and transceivers in Juniper Networks Internet routers and routing nodes.

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PIC Description

PICs provide the physical connection to various network media types. PICs receive incoming packets from the network and transmit outgoing packets to the network. During this process, each PIC performs framing and line-speed signaling for its media type. Before transmitting outgoing data packets, the PICs encapsulate the packets received from other router components. Each PIC is equipped with a media-specific ASIC that performs control functions tailored to the PIC's media type.

On the M7i and M10i routers, PICs are installed directly into FPCs that are built in to the chassis. (These FPCs cannot be removed from the chassis.) On the M40e, M120, M320, and T320 routers and the T640 and T1600 routing nodes, PICs are installed into Flexible PIC Concentrators (FPCs) that are plugged into the chassis.

PIC Compatibility

Each Juniper Networks routing platform supports only certain types of PICs. For more information, see the PIC guide for each routing platform.

You can install supported PICs of different media types on the same FPC. For example, you can install a four-port SONET/SDH OC3 PIC, a SONET/SDH OC12 PIC, an ATM OC12 PIC, and a DS3 PIC on the same FPC.

Transceiver Description

A transceiver contains both a receiver and a transmitter. It converts serial electrical signals to external serial optical or electrical signals. Juniper Networks routing platforms support these transceivers:

- Small form-factor pluggables (SFPs). Fiber-optic and copper SFPs are supported.
- 10-gigabit small form-factor pluggables (XFPs). An XFP is a type of SFP that allows transfer rates up to 10 gigabits per second.
- XENPAK modules

For additional information about the transceivers supported for each PIC, see the PIC guide for your router or routing node.

Tools and Parts Required

To remove and replace a PIC, you need the following tools and parts:

- Phillips (+) screwdriver, numbers 1 and 2
- Electrostatic bag or antistatic mat, one for each FPC and PIC removed
- ESD grounding wrist strap
- Rubber safety caps to cover each cable and transceiver on PICs that use fiber-optic cables

PICs for the M7i and M10i Routers

This section describes how to install or replace a PIC on the M7i and M10i routers. The PICs on M7i and M10i routers are installed directly into FPCs that are built in to the chassis. (These FPCs cannot be removed from the chassis.)

On the M7i routers, the PICs are arranged in one row of four slots labeled 0/3, 0/2, 0/1, and 0/0 from left to right.

On the M10i routers, the PICs are arranged in two rows of four slots. The slots in the upper row are labeled 0/3, 0/2, 0/1, and 0/0, and the slots in the lower row are labeled 1/3, 1/2, 1/1, and 1/0 from left to right.

The PICs are hot-insertable and hot-removable, so you can remove and replace them without powering off the router. When you remove a PIC, forwarding halts briefly, and then resumes. The PIC itself no longer receives or transmits data.

Removing a PIC from an M7i or M10i Router

To remove a PIC from an M7i or M10i router (see Figure 1 on page 5):

1. Place an electrostatic bag or antistatic mat on a flat, stable surface to receive the PIC. If the PIC uses fiber-optic cable, have ready a rubber safety cap for each transceiver and cable.
2. Attach an ESD wrist strap to your bare wrist and connect the wrist strap to one of the ESD points on the chassis.
3. If the PIC has multiple ports, label the cable connected to each port so that you can reconnect the cables correctly.
4. Take the PIC offline by using one of the following methods:
 - Press and hold the PIC offline button for about 5 seconds. On the M7i router, the PIC offline buttons are located on the Fixed Interface Card (FIC). On the M10i router, the PIC offline buttons are located on the High-Availability Chassis Manager (HCM).
 - Issue the following CLI command:

```
user@host> request chassis pic fpc-slot pic-slot offline
```

For more information, see the *JUNOS System Basics and Services Command Reference*.

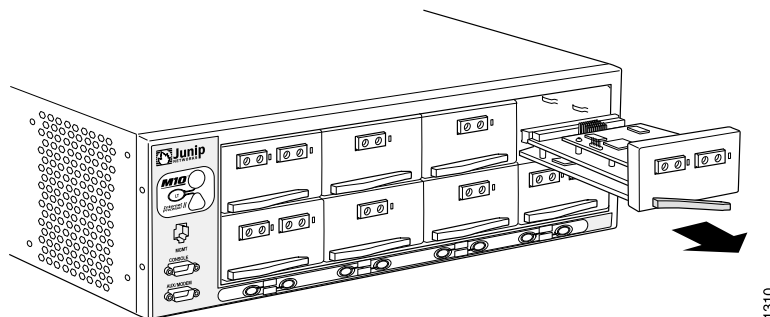


CAUTION: If you do not take the PIC offline before removing it, the router might lose data.

5. Disconnect the cables from the PIC. If the PIC uses fiber-optic cable, immediately cover each transceiver and the end of each cable with a rubber safety cap. Arrange the disconnected cables in the cable management system.

6. Pull the right end of the PIC ejector lever away from the PIC faceplate. This disconnects the PIC from the midplane.
7. Grasp both sides of the PIC and slide it out of the chassis. Do not use the ejector lever as a handle. Place the PIC in the electrostatic bag or on the antistatic mat that you prepared in Step 1.

Figure 1: Removing a PIC from an M7i or M10i Router



Installing a PIC in an M7i or M10i Router

To install a PIC in an M7i or M10i router (see Figure 2 on page 6):

1. Attach an ESD strap to your bare wrist and connect the strap to one of the ESD points on the chassis.
2. Pull the ejector lever away from the PIC faceplate and hold it out while you insert the PIC.
3. Align the rear of the PIC with the guides located at the bottom corners of the PIC slot.
4. Slide the PIC into the card cage until about 0.5 in. (1 cm) of the PIC remains outside the slot and you feel some resistance. Release the ejector lever.



CAUTION: Be careful to insert the PIC straight into the slot to avoid damaging the components on the PIC.

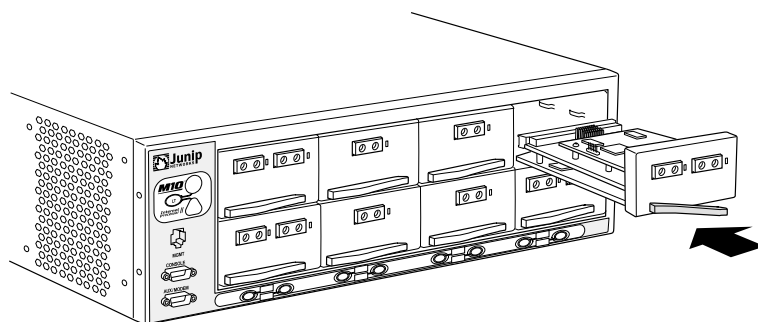
5. Continue pushing the PIC until it contacts the midplane and you hear a click. The ejector lever engages and closes automatically.
6. If the PIC uses fiber-optic cable, remove the rubber safety cap from each transceiver and the end of each cable.
7. Insert the appropriate cables into the ports on the PIC and arrange the cables in the cable management system.
8. Bring the PIC online by using one of the following methods:
 - Press and hold the PIC offline button for about 5 seconds. On the M7i router, the PIC offline buttons are located on the Fixed Interface Card (FIC). On the M10i router, the PIC offline buttons are located on the High-Availability Chassis Manager (HCM).

- Issue the following CLI command:

```
user@host> request chassis pic fpc-slot pic-slot online
```

For more information, see the *JUNOS System Basics and Services Command Reference*.

Figure 2: Installing a PIC in an M7i or M10i Router



When a PIC is functioning normally, its status LED lights green. Some PICs have a single status LED and others have one LED per port. For more information, see the *M7i PIC Guide*, and the *M10i PIC Guide*.

You can also use the following CLI command to confirm correct PIC functioning:

```
user@host> show chassis fpc pic-status fpc-slot
```

For more information, see the *JUNOS System Basics and Services Command Reference*.



NOTE: For a PIC to function, you must add the necessary statements for it to the router configuration. For instructions, see the *JUNOS Network Interfaces Configuration Guide*.

PICs for the M40e Router

This section describes how to install or replace a PIC on the M40e router. The procedure for replacing a PIC in an M40e router depends on the type of FPC into which it is installed:

- To replace a PIC installed in an M40e FPC, you must first remove the M40e FPC from the chassis. M40e FPCs are hot-insertable and hot-removable, so you can remove and replace them without powering off the router. However, you must take an M40e FPC offline before you remove it from the router. When you remove an M40e FPC, the router continues to function, but the PICs installed on the FPC do not receive or transmit data.

- To replace a PIC installed in an M40e Type 1 FPC or M40e Type 2 FPC, you do not need to remove the FPC from the chassis. The PICs installed into these two FPC types are hot-removable and hot-insertable, so you can remove them from the FPC without powering off the router. Removing a PIC from one of these FPCs does not affect router function, except that the PIC no longer receives or transmits data.

Installing or Replacing PICs in an M40e FPC

This section describes how to install or replace a PIC in an M40e FPC.

Removing an M40e FPC

To remove an M40e FPC:

1. Place an antistatic foam mat on a flat, stable surface to receive the M40e FPC. If a foam mat is not available, use a standard flat antistatic mat but use extra care when laying the FPC on it to avoid damaging the electrical components. If any of the PICs on the FPC use fiber-optic cable, also have ready a rubber safety cap for each transceiver and cable.
2. Attach an ESD strap to your bare wrist and connect the strap to one of the ESD points on the chassis.
3. Label the cables connected to each PIC on the FPC so that you can later reconnect the cables to the correct PICs.
4. Take the M40e FPC offline by pressing and holding down its offline button for about 5 seconds or until the red **FAIL** LED next to the button lights. The offline button for each FPC is located on the craft interface directly above the FPC slot.
5. Disconnect the cables from the PICs on the M40e FPC. If a PIC uses fiber-optic cable, immediately cover each transceiver and the end of each cable with a rubber safety cap. Arrange the disconnected cables in the cable management system.
6. Unscrew the thumbscrews at the top and bottom of the FPC.
7. Pull the ends of the ejector levers, which are adjacent to the thumbscrews, away from the face of the M40e FPC until they are nearly perpendicular to it (see Figure 3 on page 8).
8. Grasp the M40e FPC with both hands and slide it about halfway out of the card cage.
9. Place one hand under the M40e FPC to support it and slide it completely out of the chassis. Set the M40e FPC on the antistatic foam mat that you prepared in Step 1, component-side down and with the PIC faceplates facing you.



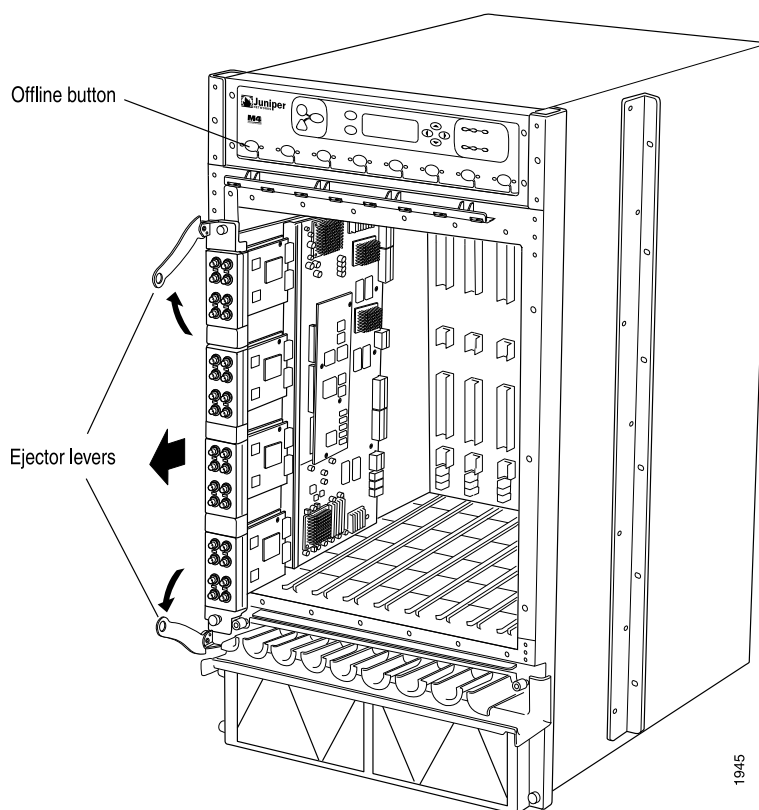
CAUTION: The weight of the M40e FPC is concentrated in the back end. Be prepared to accept the full weight—up to 15 lb (6.8 kg)—as you slide the FPC out of the chassis.

Do not hold the M40e FPC by the ejector levers, bus bars, or edge connectors. They cannot support its weight.

To avoid damaging any components, use extra care when laying the M40e FPC component-side down on the antistatic mat, particularly if the mat is not made of foam.

Do not stack the M40e FPC on top of or under any other component.

Figure 3: Removing an M40e FPC



Removing a PIC from an M40e FPC

Before removing a PIC from an M40e FPC, you must first remove the M40e FPC from the chassis (see “Removing an M40e FPC” on page 7). Then follow this procedure:

1. Place an electrostatic bag or antistatic mat on a flat, stable surface to receive the PIC.
2. Attach an ESD strap to your bare wrist and connect the strap to one of the ESD points on the chassis.
3. With the M40e FPC lying component-side down and with the PIC faceplates facing you, use a screwdriver to loosen the two screws that secure the PIC to the FPC.

4. Carefully turn over the M40e FPC and lay it on the mat component-side up with the PIC faceplates facing you.
5. Arrows on the M40e FPC indicate the position of metal bars that are attached to the PIC circuit board near the front end. To remove the PIC from the slot, place a finger behind each bar and pull the PIC toward you gently but firmly.



CAUTION: Do not grasp the PIC anywhere other than at the metal bars described in the instructions. Do not touch or apply force to the PIC's heat sinks, circuit boards (even at the edges), or other electronic components.

You might need to rock the PIC back and forth to loosen it from the connector in the M40e FPC slot. To avoid bending the pins on the connector, use the smallest and gentlest motion possible.

-
6. Place the PIC in the electrostatic bag or on the antistatic mat that you prepared in Step 1.

Installing a PIC in an M40e FPC

To install a PIC in an M40e FPC:

1. Attach an ESD wrist strap to your bare wrist and connect the wrist strap to one of the two ESD points on the chassis.
2. With the FPC lying on an antistatic foam mat component-side up and with the PIC faceplates facing you, push the PIC part way into the slot. Carefully align the tabs on the PIC connector with the notches in the connector at the rear of the M40e FPC slot, and push the PIC in until the connectors join.



CAUTION: If the pins on the FPC connector are not aligned properly with the holes in the PIC connector, the pins might be bent or the holes damaged. Either kind of damage can prevent the PIC and FPC from functioning correctly.

-
3. Carefully turn over the M40e FPC and lay it on the mat component-side down with the PIC faceplates facing you.
 4. Using a Phillips screwdriver, tighten the two screws that secure the PIC in the FPC.

Installing an M40e FPC

To install an M40e FPC:

1. Attach an ESD strap to your bare wrist and connect the strap to one of the ESD points on the chassis.
2. Verify that the ends of the ejector levers, which are located at the ends of the M40e FPC, are pushed outward, nearly perpendicular to the face of the FPC.

3. Grasp the front of the M40e FPC with one hand and place the other hand under the FPC to support it.



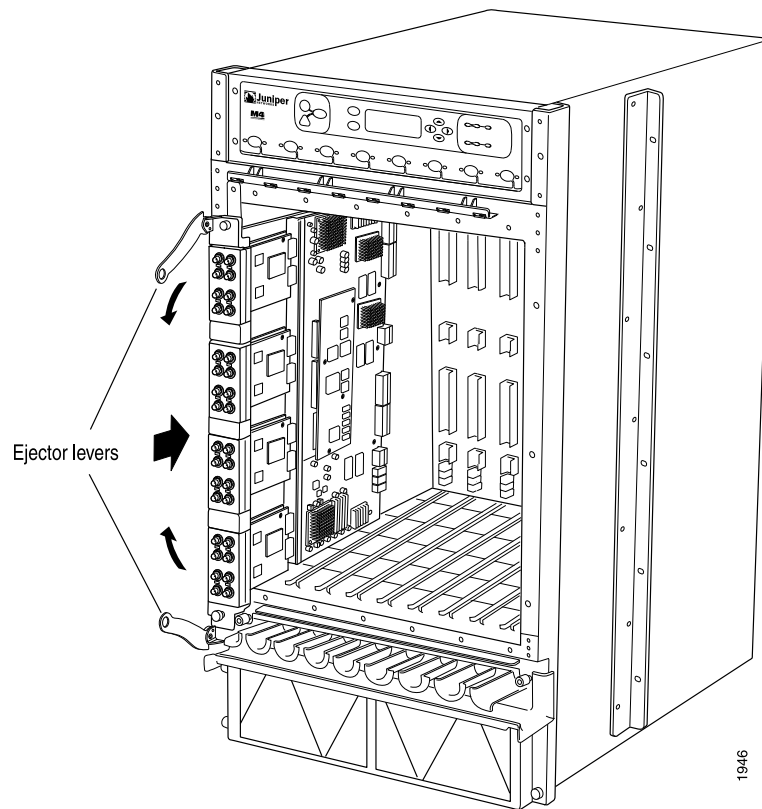
CAUTION: Do not hold the M40e FPC by the ejector levers, bus bars, or edge connectors. They cannot support its weight.

4. Align the rear bottom corners of the M40e FPC with the guides at the bottom of the desired FPC slot. Slide the M40e FPC all the way into the card cage until it contacts the midplane.



NOTE: The lettering on the faceplates of the PICs is upside down when the FPC is installed in the chassis.

5. Push the ends of the ejector levers inward until they are nearly flush with the face of the M40e FPC (see Figure 4 on page 11).
6. If any of the PICs on the FPC connect to fiber-optic cable, remove the rubber safety cap from each transceiver and cable.
7. Insert the appropriate cable into the ports on each PIC on the FPC. Secure the cables so that they are not supporting their own weight. Place excess cable out of the way in a neatly coiled loop, using the cable management system. Placing fasteners on a loop helps to maintain its shape.
8. Press and hold the FPC offline button on the craft interface above the slot that houses the M40e FPC to bring the M40e FPC and PICs online. When the M40e FPC is online, the FPC LED labeled **OK** on the craft interface lights steadily and you can release the offline button.

Figure 4: Installing an M40e FPC

When a PIC is functioning normally, its status LED lights green. Some PICs have a single status LED and others have one LED per port. For more information, see the *M40e PIC Guide*.

You can also use the following CLI command to confirm correct PIC functioning:

```
user@host> show chassis fpc pic-status fpc-slot
```

For more information, see the *JUNOS System Basics and Services Command Reference*.



NOTE: For a PIC to function, you must add the necessary statements for it to the router configuration. For instructions, see the *JUNOS Network Interfaces Configuration Guide*.

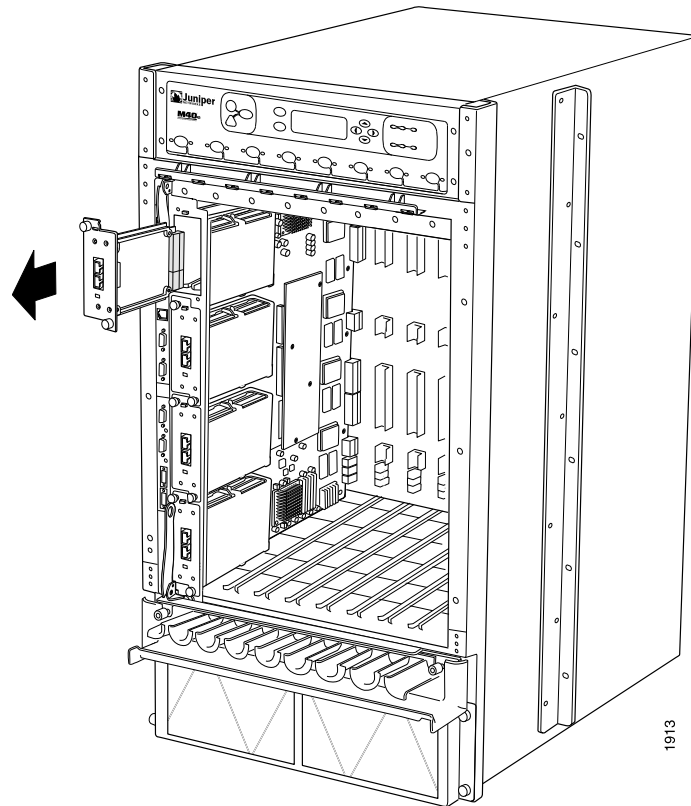
Installing or Replacing PICs in an M40e Type 1 FPC or M40e Type 2 FPC

This section describes how to install or replace a PIC in an M40e Type 1 FPC or M40e Type 2 FPC.

Removing a PIC from an M40e Type 1 FPC or M40e Type 2 FPC

To remove a PIC from an M40e Type 1 FPC or M40e Type 2 FPC:

1. Place an electrostatic bag or antistatic mat on a flat, stable surface to receive the PIC. If the PIC uses fiber-optic cable, also have ready a rubber safety cap for each transceiver and cable.
2. Attach an ESD strap to your bare wrist and connect the strap to one of the ESD points on the chassis.
3. If the PIC has multiple ports, label the cable connected to each port so that you can later reconnect the cables correctly.
4. Take the PIC offline by pressing and holding its offline button until the PIC status LED lights red to indicate failure, which usually takes about 5 seconds. Some PICs have a single status LED and others have one LED per port; for more information, see the *M40e PIC Guide*. The offline buttons for the PICs on an M40e Type 1 FPC are on the FPC itself. The offline button for a PIC on an M40e Type 2 FPC is on the PIC faceplate.
5. Disconnect the cables from the PIC. If the PIC uses fiber-optic cable, immediately cover each transceiver and the end of each cable with a rubber safety cap. Arrange the disconnected cables in the cable management system.
6. Unscrew the thumbscrews at the top and bottom of the PIC faceplate simultaneously and at about the same rate (unscrewing the two screws alternately or at very different rates can cause the PIC to become lodged in the FPC slot, making it difficult to turn the screws).
7. Slide the PIC out of the FPC (see Figure 5 on page 13, which shows an M40e Type 1 FPC) and place it in an electrostatic bag or on an antistatic mat that you prepared in Step 1.

Figure 5: Removing a PIC from an M40e Type 1 FPC**Installing a PIC in an M40e Type 1 FPC or M40e Type 2 FPC**

To install a PIC in an M40e Type 1 FPC or M40e Type 2 FPC:

1. Attach an ESD strap to your bare wrist and connect the strap to one of the ESD points on the chassis.
2. Remove the PIC from its electrostatic bag and place it on an antistatic mat. If it connects to fiber-optic cable, verify that there is a rubber safety cap on each transceiver.
3. Align the notches in the connector at the rear of the PIC with the notches in the PIC slot in the FPC and then slide the PIC in until it lodges firmly in the FPC (see Figure 6 on page 15, which shows an M40e Type 1 FPC).



CAUTION: Be careful to insert the PIC straight into the FPC slot to avoid damaging the components on the bottom of the PIC.

4. Tighten the thumbscrews at the top and bottom of the PIC faceplate simultaneously and at about the same rate (tightening the two screws alternately or at very different rates can cause the PIC to become lodged in the FPC slot, making it difficult to turn the screws). Verify that the PIC is seated properly.

5. If any of the PICs on the FPC connect to fiber-optic cable, remove the rubber safety cap from each transceiver and cable.
6. Insert the appropriate cable into the ports on the PIC. Secure the cables so that they are not supporting their own weight. Place excess cable out of the way in a neatly coiled loop, using the cable management system. Placing fasteners on a loop helps to maintain its shape.
7. Press and hold the PIC offline button until the PIC status LED lights green to indicate normal functioning, which usually takes about 5 seconds. Some PICs have a single status LED and others have one LED per port; for more information, see the *M40e PIC Guide*. PICs in an M40e Type 1 FPC have their offline buttons on the FPC and PICs on an M40e Type 2 FPC have their offline buttons on the PIC faceplate.

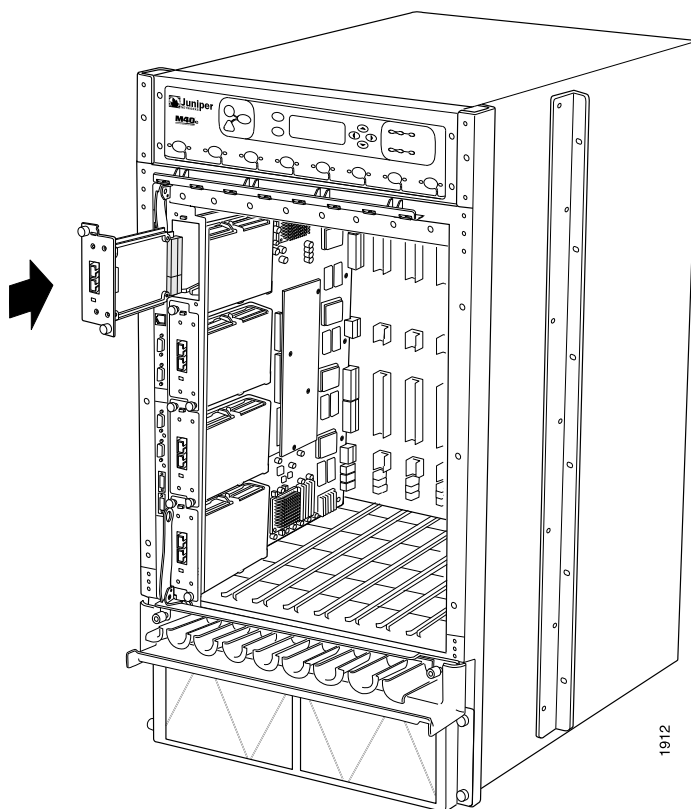
You can also use the following CLI command to confirm correct PIC functioning:

```
user@host> show chassis fpc pic-status fpc-slot
```

For more information, see the *JUNOS System Basics and Services Command Reference*.



NOTE: For a PIC to function, you must add the necessary statements for it to the router configuration. For instructions, see the *JUNOS Network Interfaces Configuration Guide*.

Figure 6: Installing a PIC in an M40e Type 1 FPC

PICs for the M120 Router

PICs on the M120 router are hot-insertable and hot-removable. Removing a PIC does not affect router function, except that the PIC no longer receives or transmits data.

Replacing a PIC

PICs are hot-insertable and hot-removable. When you remove a PIC, the router continues to function, although the PIC interfaces being removed no longer function. This section discusses the following topics:

- Removing a PIC on page 15
- Installing a PIC on page 17

Removing a PIC

The PICs are located in the FPCs installed in the front of the router. A PIC weighs less than 2 lb (0.9 kg).

To remove a PIC (see Figure 7 on page 17):

1. Place an electrostatic bag or antistatic mat on a flat, stable surface to receive the PIC. If the PIC connects to fiber-optic cable, have ready a rubber safety cap for each transceiver and cable.
2. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist and connect the strap to one of the ESD points on the chassis.
3. Use one of the following methods to take the PIC offline:
 - Press its online/offline button. For a PIC installed in an FPC1, use a tool—such as a flat-blade screwdriver—to press the button slightly beneath the faceplate of the PIC. For a PIC installed in an FPC2 or FPC3, use a narrow-ended tool that fits inside the opening that leads to the button. Press and hold the button until the PIC LED goes out (about 5 seconds).
 - Issue the following CLI command:

```
user@host> request chassis pic fpc-slot fpc-slot pic-slot pic-slot offline
```

For more information about the command, see the *JUNOS System Basics and Services Command Reference*.

4. Label the cables connected to the PIC so that you can later reconnect each cable to the correct PIC.
5. Disconnect the cables from the PIC. If the PIC uses fiber-optic cable, immediately cover each transceiver and the end of each cable with a rubber safety cap.



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 prevents accidental exposure to laser light.

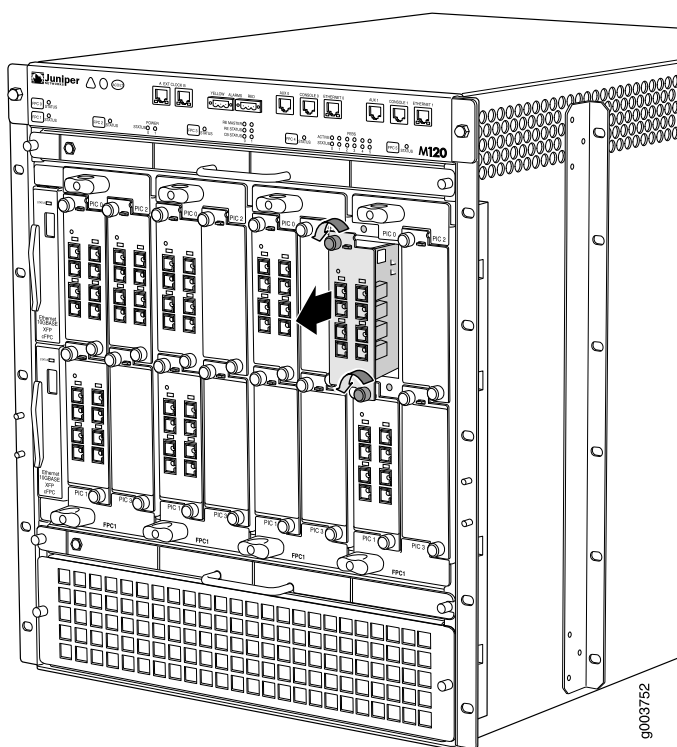
6. Arrange the cable in the cable management system to prevent it from dislodging or developing stress points. Secure the cable so that it is not supporting its own weight as it hangs to the floor. Place excess cable out of the way in a neatly coiled loop in the cable management system. Placing fasteners on the loop helps to maintain its shape.
-



CAUTION: 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.

7. For an FPC3 PIC, loosen the captive screw at the bottom of the PIC faceplate, and then twist the ejector handle at the top of the faceplate counterclockwise to unseat the PIC. For an FPC1 or FPC2 PIC, loosen the captive screws at the top and bottom of the faceplate.
8. Slide the PIC out of the FPC card carrier and place it in the electrostatic bag or on the antistatic mat.
9. If you are not reinstalling a PIC into the emptied PIC slot within a short time, install a blank PIC panel over the slot to maintain proper airflow in the FPC card cage.

Figure 7: Removing a PIC



Installing a PIC

To install a PIC (see Figure 8 on page 19):

1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist and connect the strap to one of the ESD points on the chassis.
2. If the PIC uses fiber-optic cable, verify that there is a rubber safety cap over each transceiver on the faceplate. Install a cap if necessary.
3. Align the notches in the connector at the rear of the PIC with the notches in the PIC slot in the FPC and then slide the PIC in until it lodges firmly in the FPC.



CAUTION: Slide the PIC straight into the slot to avoid damaging the components on the bottom of the PIC.

4. For an FPC3 PIC, turn the ejector handle at the top of the PIC faceplate clockwise, and then tighten the captive screw at the bottom of the faceplate to secure the PIC in the FPC. For an FPC 1 or FPC2 PIC, tighten the captive screws at the top and bottom of the faceplate.
5. If the PIC uses fiber-optic cable, remove the rubber safety cap from each transceiver and the end of each cable.



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 prevents accidental exposure to laser light.

6. Insert the appropriate cables into the cable connectors on the PIC.
7. Arrange each cable in the cable management system to prevent the cable from dislodging or developing stress points. Secure the cable so that it is not supporting 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 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.

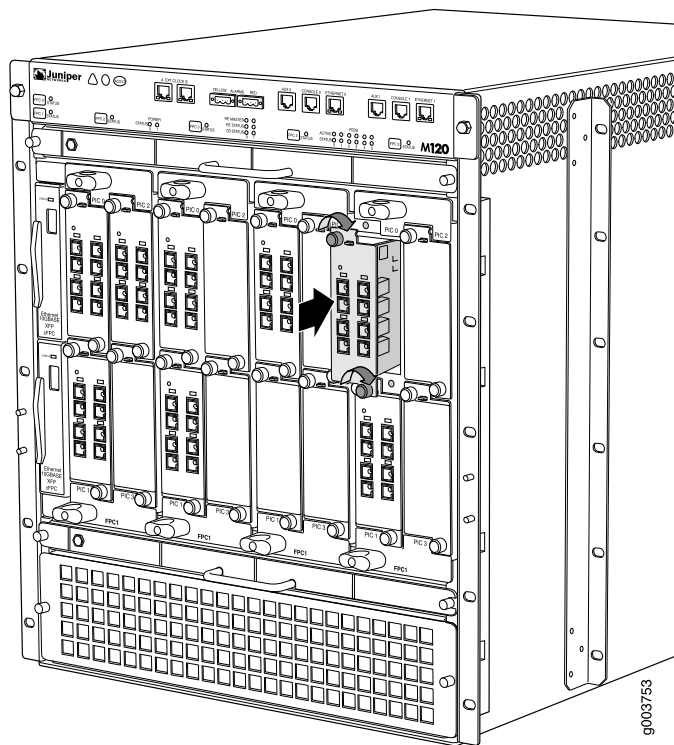
8. Use one of the following methods to bring the PIC online:
 - Press and hold the PIC offline button until the status LED on the PIC faceplate indicates normal functioning, which usually takes about 5 seconds. The LED is usually green; for more information, see the *M120 PIC Guide*. For the PICs that install on an FPC1, the offline button for each PIC is next to it on the FPC card carrier. For the PICs that install on an FPC2 or FPC3, the offline button is on the PIC faceplate.
 - Issue the following CLI command:

```
user@host> request chassis pic fpc-slot fpc-slot pic-slot pic-slot online
```

For more information about the command, see the *JUNOS System Basics and Services Command Reference*.

The normal functioning status LED confirms that the PIC is online. You can also verify correct PIC functioning by issuing the `show chassis fpc pic-status` command described in the *M120 Internet Router Hardware Guide*.

Figure 8: Installing a PIC



PICs for the M320 Router, the T320 Router, the T640 Routing Node, and the T1600 Routing Node

PICs on the M320 and T320 routers and the T640 and T1600 routing nodes are hot-insertable and hot-removable, so you can remove and replace them without powering off the router. Removing a PIC does not affect router function, except that the PIC no longer receives or transmits data.

Removing a PIC from an M320 Router, a T320 Router, a T640 Routing Node, or a T1600 Routing Node

To remove a PIC from an M320 router, a T320 router, a T640 routing node, or a T1600 routing node (see Figure 9 on page 21, Figure 10 on page 22, Figure 11 on page 23, or Figure 12 on page 24, respectively):

1. Place an electrostatic bag or antistatic mat on a flat, stable surface to receive the PIC. If the PIC uses fiber-optic cable, have ready a rubber safety cap for each transceiver and cable.
2. Attach an ESD wrist strap to your bare wrist and connect the wrist strap to one of the ESD points on the chassis.
3. Take the PIC offline. Press and hold the button until the PIC LED turns off (about 5 seconds). On the M320 and T320 routers, the offline button for PICs installed in a Type 1 FPC is located on the FPC faceplate.
4. Label the cables connected to the PIC so that you can later reconnect each cable to the correct PIC.
5. Remove the cable connector plugged into the PIC and immediately place a rubber safety cap over the transceiver.
6. Carefully drape the disconnected cable over the bobbins in the cable management system below the FPC card cage to prevent the cable from developing stress points.
7. For a PIC installed in a Type 1 FPC or Type 2 FPC, loosen the captive screws at the top and bottom of the faceplate. For a Type 3 FPC PIC, loosen the captive screw at the bottom of the PIC faceplate, and then twist the ejector handle at the top of the faceplate counterclockwise to unseat the PIC.
8. Slide the PIC out of the FPC.
9. Place the removed PIC on the antistatic mat or electrostatic bag that you prepared in Step 1.

Figure 9: Removing a PIC from an M320 Router

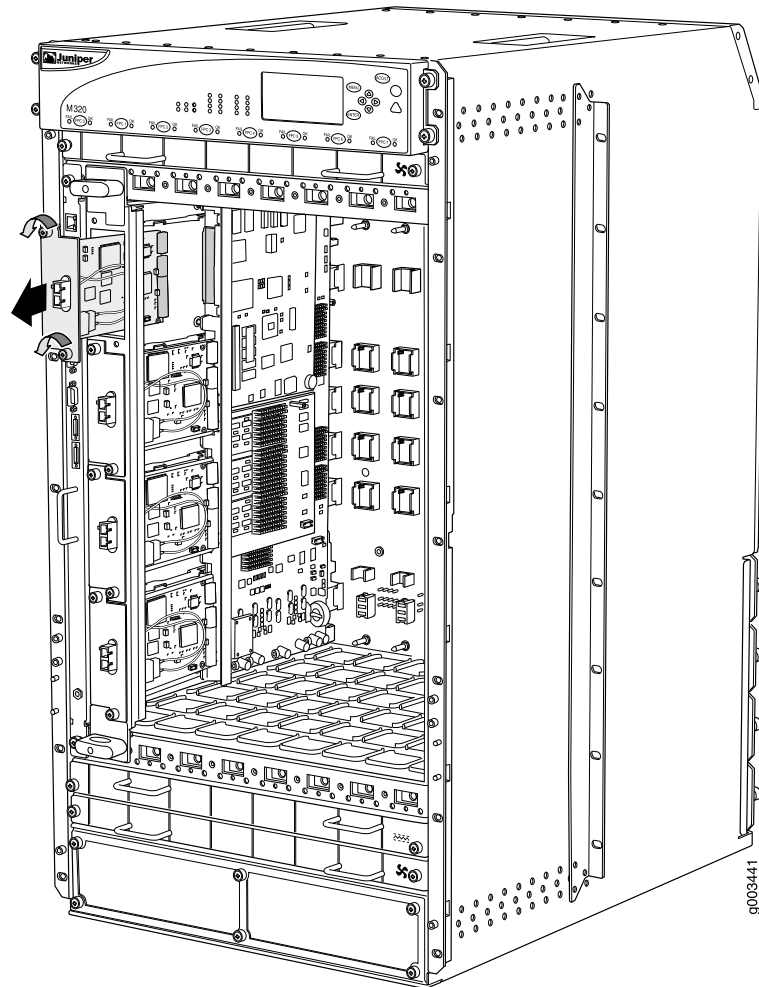


Figure 10: Removing a PIC from a T320 Router

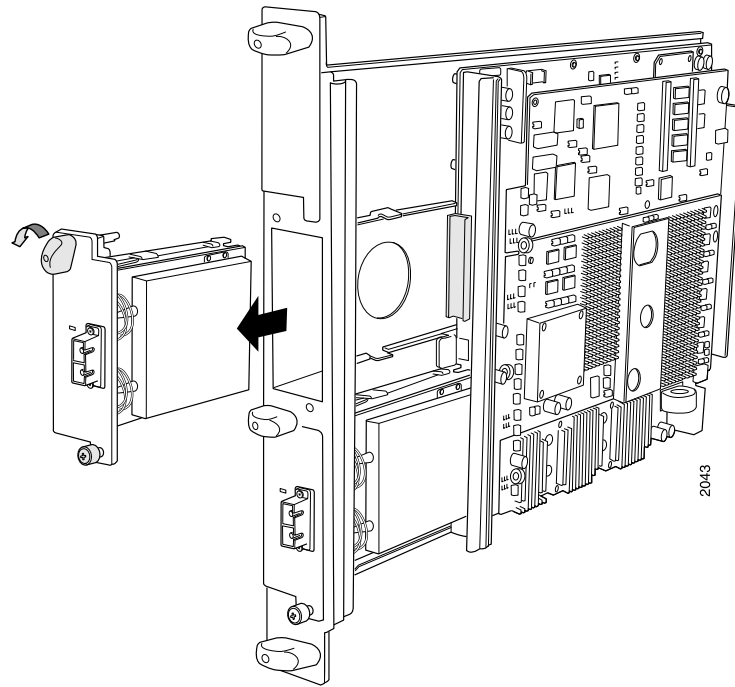


Figure 11: Removing a PIC from a T640 Routing Node

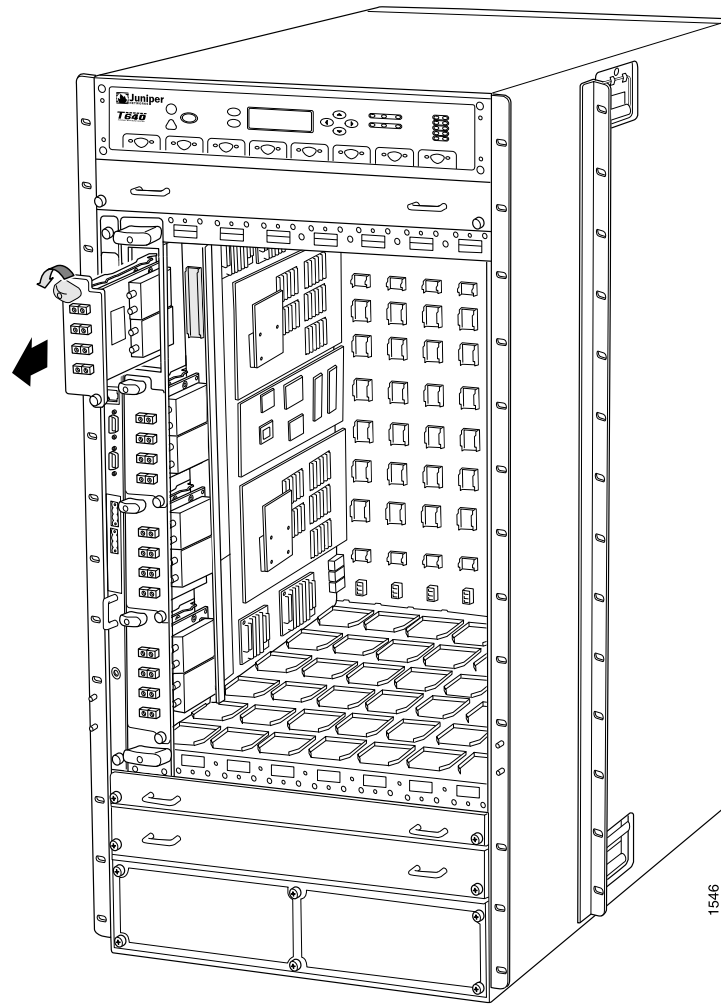
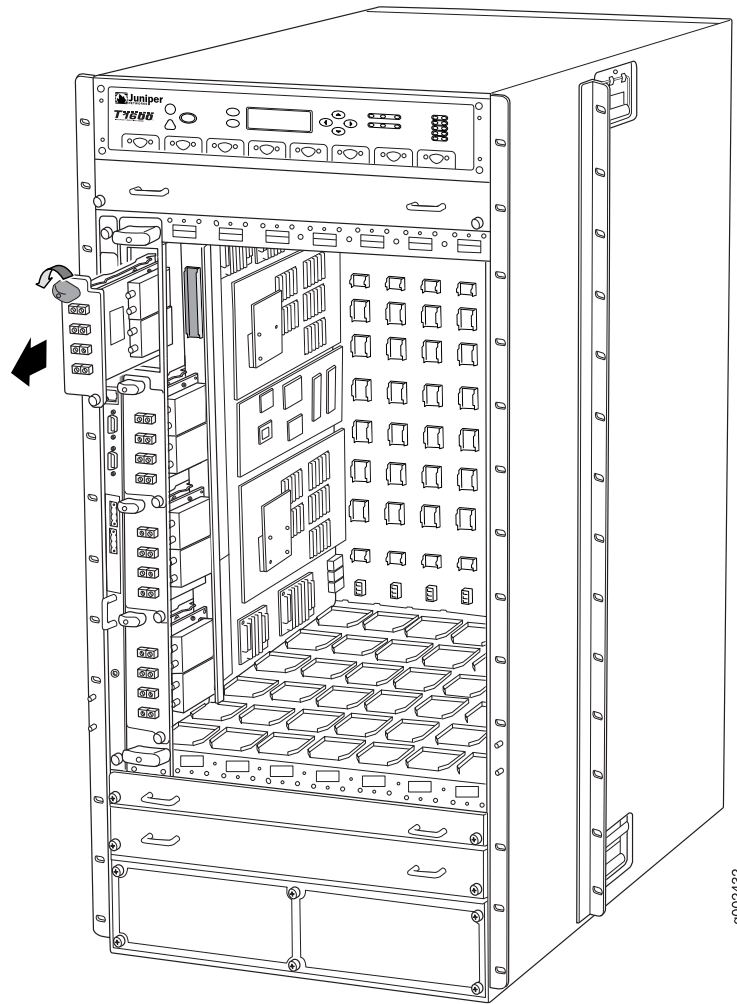


Figure 12: Removing a PIC from a T1600 Routing Node

Installing a PIC in an M320 Router, a T320 Router, a T640 Routing Node, or a T1600 Routing Node

To install a PIC in an M320 router, a T320 router, a T640 routing node, or a T1600 routing node (see Figure 13 on page 26, Figure 14 on page 27, Figure 15 on page 28, or Figure 16 on page 29, respectively):

1. Attach an ESD wrist strap to your bare wrist and connect the wrist strap to one of the ESD points on the chassis.
2. Take the replacement PIC out of its electrostatic bag and place it on an antistatic mat.
3. Each PIC with a fiber-optic transceiver should have a rubber safety cap covering the transceiver. If it does not, place a safety cap over the transceiver.
4. Slide each PIC into the appropriate slot in the FPC, aligning the notches at the rear connector on the PIC with the notches in the FPC.



CAUTION: Be careful to insert the PIC straight into the FPC to avoid damaging the exposed components on the PIC.

5. For a PIC installed in a Type 3 FPC, turn the ejector handle at the top of the PIC faceplate clockwise, and then tighten the captive screw at the bottom of the faceplate to secure the PIC in the FPC. For a PIC installed in a Type 1 FPC or Type 2 FPC, tighten the captive screws at the top and bottom of the faceplate.
 6. Remove the rubber safety cap from the transceiver.
 7. Connect the appropriate cable connector to the transceiver.
 8. Carefully drape the PIC cable over the bobbins of the cable management system below the FPC card cage to prevent the cables from developing stress points.
 9. To bring the PIC online, press the PIC offline button until the PIC LED lights green. The offline button for PICs installed in a Type 1 FPC is located on the FPC faceplate.
-



NOTE: For a PIC to function, you must add the necessary statements for it to the router configuration. For instructions, see the *JUNOS Network Interfaces Configuration Guide*.

Figure 13: Installing a PIC in an M320 Router

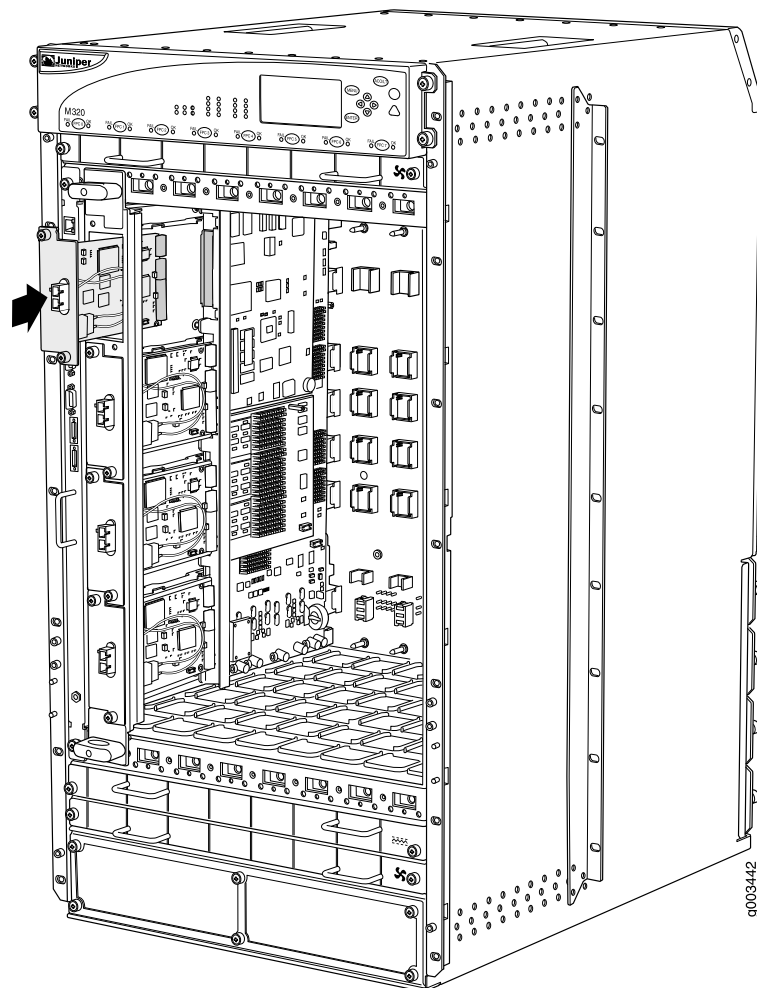


Figure 14: Installing a PIC in a T320 Router

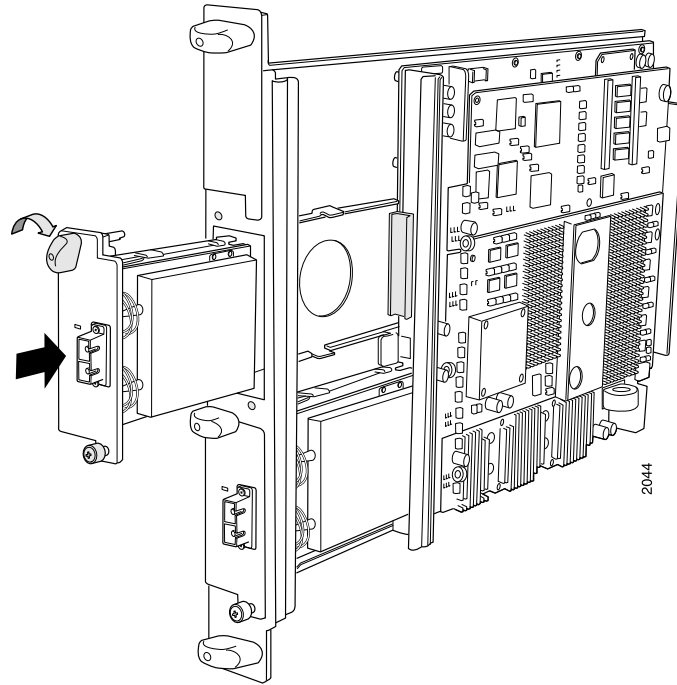


Figure 15: Installing a PIC in a T640 Routing Node

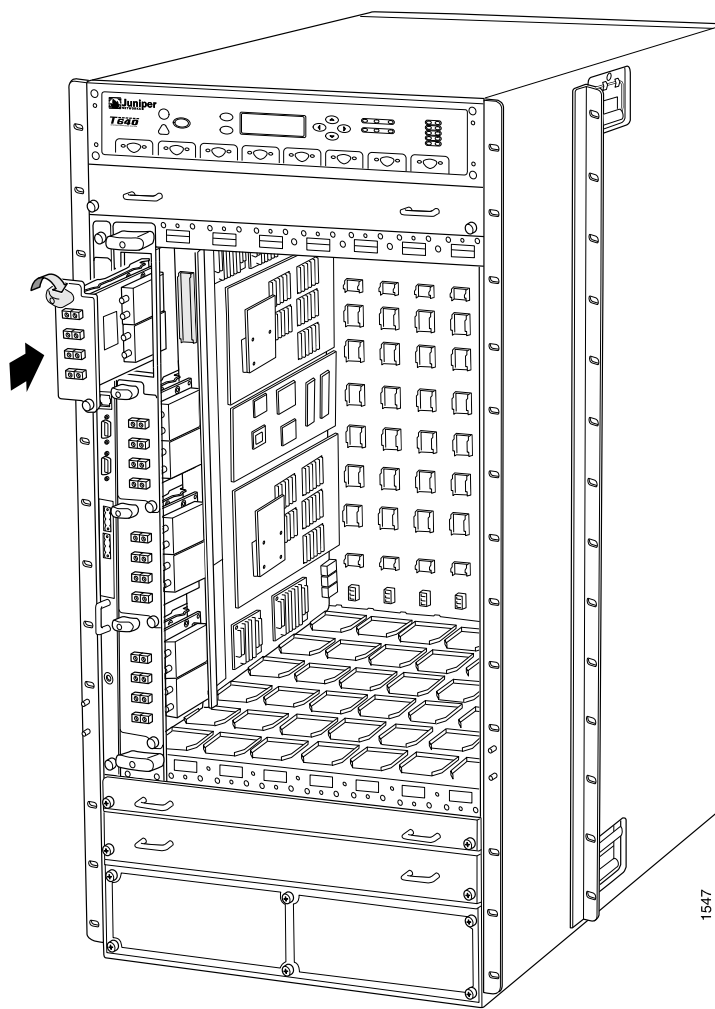
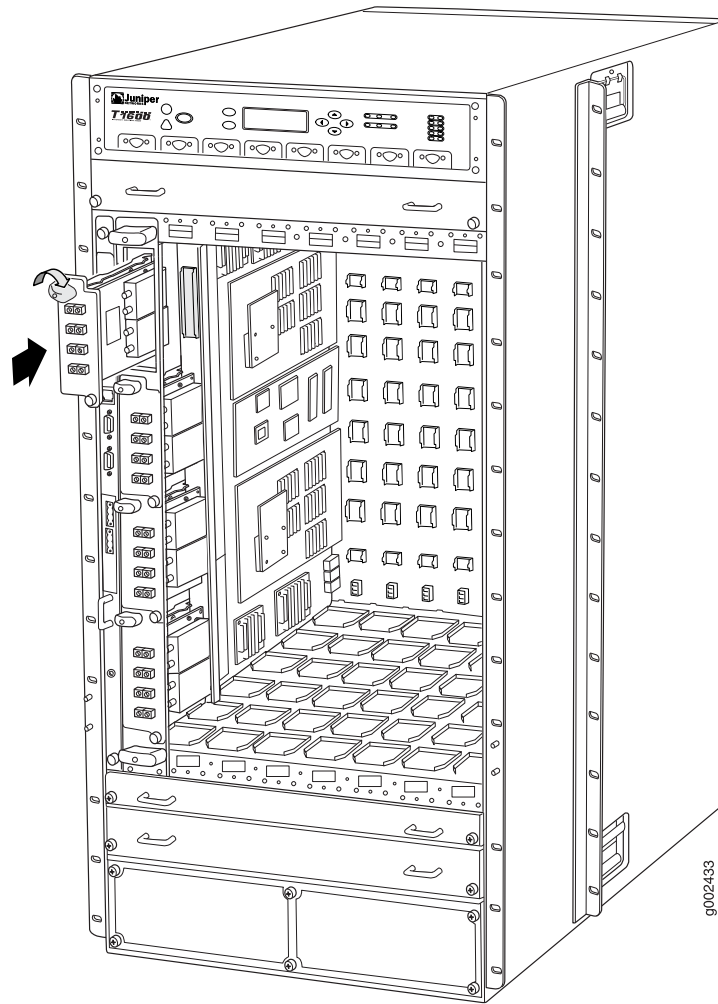


Figure 16: Installing a PIC in a T1600 Routing Node

Attenuation and Interoperability for SONET/SDH PICs

The following sections provide information about attenuation and interoperability for SONET/SDH PICs.

Attenuating Power to Prevent Saturation at SONET/SDH PICs

SONET/SDH transceivers in the different reach classes—short reach (SR), intermediate reach (IR), and long reach (LR)—generate different output power levels and tolerate different input power levels. Transceivers that have a longer reach can transmit enough power to saturate the receivers on PICs that have a shorter reach. Specifically, LR transceivers can saturate IR PICs, and both IR and LR transceivers can saturate SR PICs. Transceivers in the same reach class can also potentially saturate one another.

To prevent saturation, you might need to attenuate power at the PIC receiver, particularly if you know that it has a shorter reach than the transceiver that is sending the signal. Determine the amount of attenuation needed by measuring the power level at each receiver. Attenuate the power to bring it within the allowable range; for short lengths of fiber, with fiber and connector loss close to zero, an attenuator of 5 to 10 dB should be sufficient.

For example, if you use an intermediate-reach (IR) PIC in one router, and a short-reach (SR) PIC in another router, the IR transceiver might transmit more power than the SR PIC can receive without experiencing saturation, so you might need to attenuate power at the SR receiver. The IR receiver should not require attenuation, because the SR transmit levels do not exceed the IR transceiver's reception levels.

For information about the maximum and minimum input and output levels for various transceiver types, see *Synchronous Optical Network (SONET) Transport Systems: Common Generic Criteria*, document number GR-253-CORE, published by Telcordia Technologies (formerly Bellcore).

Ensuring Interoperability Between Juniper Networks and Third-Party OC192 PICs

The SONET/SDH OC192 transceiver is an SR-2 transceiver, with a transmit wavelength of 1550 nm. Some OC192 transceivers from other vendors are SR-1 transceivers, which have a transmit wavelength of 1310 nm. The OC192 transceiver can receive at both 1310 nm and 1550 nm.

To ensure interoperability with other vendors' SR-1 and SR-2 transceivers, follow these guidelines:

- Be sure the power levels of the send and receive transceivers are matched by checking that the actual power at the receiver is within the range of acceptable power levels.
- When connecting SR-2 and SR-1 transceivers, allow an extra 1 dB of margin in the power budget to account for minor variations in receiver sensitivity at different wavelengths.

Attenuating the Receiving End When Using Direct Fiber Connections Between OC192 PICs

The receiver of a SONET/SDH OC192 PIC has very high sensitivity and low minimum and maximum allowable power. A direct fiber connection from transmitter to receiver, whether end-to-end or loopback, can easily overload the receiver. To prevent the receiver from overloading, you need to attenuate the receiving end.

When connecting two OC192 transceivers, follow these guidelines:

- Determine the minimum and maximum for both the transmit power and the allowable receive power.
- Measure the transmitted power at the receiver to account for all connector and fiber cable losses.
- Add attenuation before the receiver to bring the power levels within the allowable range.

When connecting two OC192 transceivers in the same room, you would use a short length of fiber, and the connector and fiber cable loss would be close to zero. In this situation, a 15-dB attenuator inserted before the receiver should be sufficient to bring the receiver within the allowable range.

Installing or Replacing Transceivers

This section describes how to install or replace SFPs, XFPs, and XENPAK module transceivers.

Installing or Replacing SFP or XFP Transceivers

SFPs and XFPs are hot-insertable and hot-removable transceivers. A PIC supports either SFPs or XFPs, but not both. A compact FPC (cFPC) supports only one XFP. For PICs with multiple ports, you can install any combination of transceivers supported for that PIC.

Transceivers that you remove from a PIC or cFPC can no longer transmit or receive data, but the other transceivers in PICs with multiple ports remain operational. When replacing an SFP or XFP, make sure that you open the ejector handle completely before gently pulling it out of the PIC or cFPC.

Tools and Parts Required

To remove and replace an SFP or XFP, you need the following tools and parts:

- Needlenose pliers (required only for the 10-port Gigabit Ethernet PIC)
- Electrostatic bag or antistatic mat, one for each transceiver removed
- ESD grounding wrist strap
- Rubber safety caps to cover each unused cable and transceiver

Removing an SFP or XFP

To remove an SFP or XFP (see Figure 17 on page 32):

1. Have ready a replacement transceiver, or a transceiver slot plug, an antistatic mat, and a rubber safety cap for the transceiver.
2. Attach an ESD wrist strap to your bare wrist and connect the wrist strap to one of the ESD points on the chassis.
3. Label the cables connected to the transceiver so that you can reconnect them correctly later.



WARNING: Do not look directly into a fiber-optic transceiver or into the end of a fiber-optic cable. Fiber-optic transceivers contain laser light sources that can damage your eyes.

4. Remove the cable connector plugged into the transceiver.

5. Carefully drape the disconnected cable over the bobbins in the cable management system below the FPC card cage to prevent the cable from developing stress points.



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.

6. Pull the ejector handle out from the transceiver to unlock the transceiver.



CAUTION: Make sure that you open the ejector handle completely (you will hear it click). This prevents damage to the transceiver.

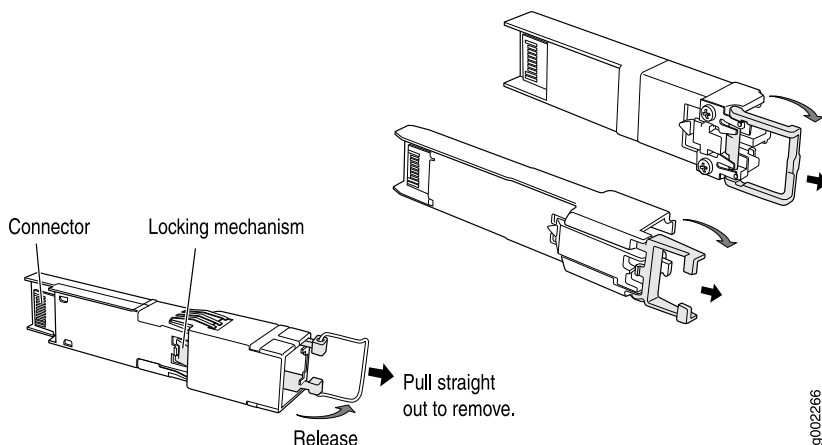
For the 10-port Gigabit Ethernet PIC, use needlenose pliers to pull the ejector handle out from the SFP.

7. Grasp the transceiver ejector handle and pull the transceiver approximately 0.5 in (1.3 cm) out of the PIC or cFPC.

For the 10-port Gigabit Ethernet PIC, use needlenose pliers to grasp the SFP ejector and pull the SFP approximately 0.5 in (1.3 cm) out of the PIC.

8. Using your fingers, grasp the body of the transceiver and pull it the rest of the way out of the PIC or cFPC.

Figure 17: Removing SFPs or XFPs



9. Place a rubber safety cap over the transceiver.
10. Place the removed transceiver on an antistatic mat or in an electrostatic bag.

Installing an SFP or XFP

To install an SFP or XFP (see Figure 17 on page 32):

1. Attach an ESD wrist strap to your bare wrist and connect the wrist strap to one of the ESD points on the chassis.
2. Take each transceiver to be installed out of its electrostatic bag and identify the slot on the PIC or cFPC where it will be installed.
3. Verify that each transceiver is covered by a rubber safety cap. If it is not, cover the transceiver with a safety cap.
4. Carefully align the transceiver with the slots in the PIC or cFPC. The connectors should face the PIC or cFPC.
5. Slide the transceiver until the connector is seated in the PIC or cFPC slot. If you are unable to fully insert the transceiver, make sure the connector is facing the right way.
6. Remove the rubber safety cap from the transceiver and the end of the cable. Insert the cable into the transceiver.

Installing or Replacing a XENPAK Module

XENPAK modules are hot-insertable and hot-removable. Removing a XENPAK module does not interrupt PIC functioning, but the removed transceiver no longer receives or transmits data.

Tools and Parts Required

To remove and replace a XENPAK module, you need the following tools and parts:

- Electrostatic bag or antistatic mat, one for each XENPAK module removed
- ESD grounding wrist strap
- Rubber safety caps to cover each unused cable and transceiver
- Small slotted screwdriver

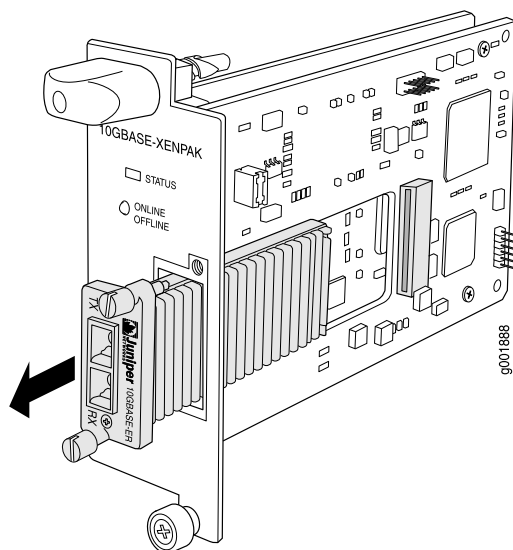
Removing a XENPAK Module

To remove a XENPAK module (see Figure 18 on page 34):

1. Place an electrostatic bag or antistatic mat on a flat, stable surface to receive the XENPAK module. Have ready a rubber safety cap for the XENPAK module and the cable.
2. Attach an ESD grounding strap to your bare wrist and connect the strap to one of the ESD points on the chassis.
3. Label the cable connected to the XENPAK module so that you can later reconnect it to the correct transceiver.
4. Disconnect the cable from the XENPAK module. Immediately cover the transceiver and the end of the cable with a rubber safety cap.

5. Arrange the cable in the cable management system to prevent it from dislodging or developing stress points. Secure the cable so that it is not supporting its own weight as it hangs to the floor. Place excess cable out of the way in a neatly coiled loop in the cable management system. Placing fasteners on the loop helps to maintain its shape.
6. Use the screwdriver to unscrew the thumbscrews at the top and bottom of the XENPAK module.
7. Slide the transceiver out of the PIC and place it in the electrostatic bag or on the antistatic mat.

Figure 18: Removing a XENPAK Module



Installing a XENPAK Module

To install a replacement XENPAK module (see Figure 19 on page 35):

1. Attach an ESD grounding strap to your bare wrist and connect the strap to one of the ESD points on the chassis.
2. Verify that a rubber safety cap covers the XENPAK module. Install one if necessary.
3. Orient the XENPAK module so that the optical port faces out and the transmit (TX) port is above the receive (RX) port.

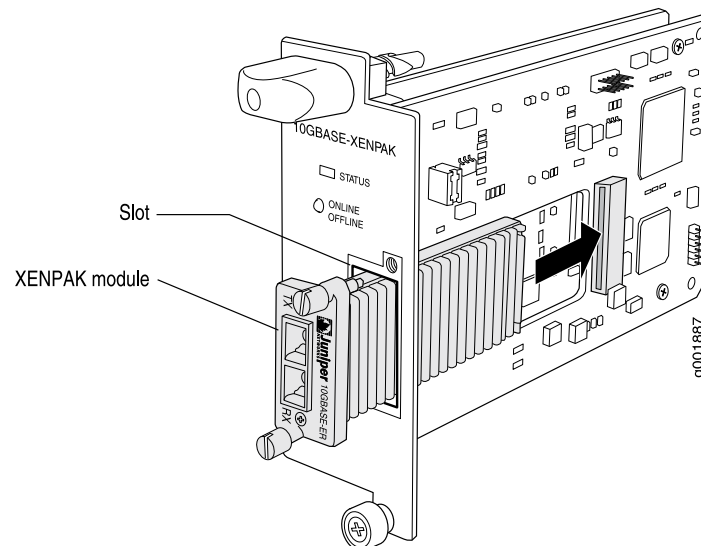


CAUTION: You must orient the XENPAK module in the slot so that the XENPAK module does not touch the sides of the faceplate opening (see Figure 19 on page 35).

4. Slide the XENPAK module into the slot.

5. Use the screwdriver to tighten the thumbscrews at the top and bottom of the XENPAK module. Verify that the transceiver is seated properly.
6. Remove the rubber safety cap from the transceiver and the end of the cable. Insert the cable into the transceiver.

Figure 19: Installing a XENPAK Module



NOTE: Orient the XENPAK module in the slot so it does not touch the faceplate opening.

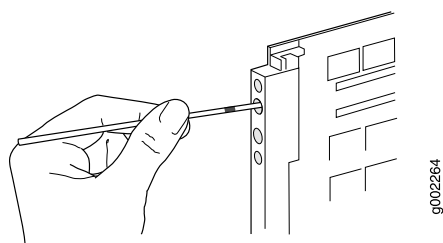
Cleaning Fiber-Optic Ports

For proper performance of PICs that use fiber-optic cable, you must clean the fiber-optic transceivers before inserting cable.

Because of the high sensitivity of fiber-optic PIC receivers, you must keep the PIC ports clean and free of dust. Small microdeposits of oil and dust in the canal of the port could cause loss of light, reducing signal power and possibly causing intermittent problems with the optical connection.

Keep the ports clean by using an appropriate fiber-cleaning device. Follow the directions for the cleaning kit you use. Some PICs may include fiber-cleaning swabs. See Figure 20 on page 36 for the proper cleaning procedure.

Figure 20: Cleaning the PIC Ports



After you have cleaned the optical transceiver area of the fiber-optic PIC, make sure that the connector tip of the fiber-optic cable is clean.

To clean the fiber-optic cable connectors, use only an approved alcohol-free fiber-optic cable cleaning kit. Follow the directions for the cleaning kit you use.

Safety Guidelines and Warnings

When removing and installing PICs that use fiber-optic cable on any Juniper Networks router, note the following warnings.



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 prevents accidental exposure to laser light.

When connecting and disconnecting cable at the ports on the PIC faceplate on any Juniper Networks router, note the following guidelines.



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.



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: Secure cables in the cable management system so that they are not supporting their own weight. Place excess cable out of the way in a neatly coiled

loop, using the cable management system. Placing fasteners on a loop helps to maintain its shape.

List of Technical Publications

Table 1 on page 37 lists the software and hardware guides and release notes for Juniper Networks J-series, M-series, MX-series, and T-series routing platforms and describes the contents of each document. Table 2 on page 41 lists the books included in the *Network Operations Guide* series. Table 3 on page 42 lists the manuals and release notes supporting JUNOS software with enhanced services. All documents are available at <http://www.juniper.net/techpubs/>.

Table 4 on page 43 lists additional books on Juniper Networks solutions that you can order through your bookstore. A complete list of such books is available at <http://www.juniper.net/books>.

Table 1: Technical Documentation for Supported Routing Platforms

Book	Description
JUNOS Software for Supported Routing Platforms	
<i>Access Privilege</i>	Explains how to configure access privileges in user classes by using permission flags and regular expressions. Lists the permission flags along with their associated command-line interface (CLI) operational mode commands and configuration statements.
<i>Class of Service</i>	Provides an overview of the class-of-service (CoS) functions of the JUNOS software and describes how to configure CoS features, including configuring multiple forwarding classes for transmitting packets, defining which packets are placed into each output queue, scheduling the transmission service level for each queue, and managing congestion through the random early detection (RED) algorithm.
<i>CLI User Guide</i>	Describes how to use the JUNOS command-line interface (CLI) to configure, monitor, and manage Juniper Networks routing platforms. This material was formerly covered in the <i>JUNOS System Basics Configuration Guide</i> .
<i>Feature Guide</i>	Provides a detailed explanation and configuration examples for several of the most complex features in the JUNOS software.
<i>High Availability</i>	Provides an overview of hardware and software resources that ensure a high level of continuous routing platform operation and describes how to configure high availability (HA) features such as nonstop active routing (NSR) and graceful Routing Engine switchover (GRES).
<i>MPLS Applications</i>	Provides an overview of traffic engineering concepts and describes how to configure traffic engineering protocols.
<i>Multicast Protocols</i>	Provides an overview of multicast concepts and describes how to configure multicast routing protocols.

Table 1: Technical Documentation for Supported Routing Platforms (*continued*)

Book	Description
<i>Multiplay Solutions</i>	Describes how you can deploy IPTV and voice over IP (VoIP) services in your network.
<i>MX-series Solutions Guide</i>	Describes common configuration scenarios for the Layer 2 features supported on the MX-series routers, including basic bridged VLANs with normalized VLAN tags, aggregated Ethernet links, bridge domains, Multiple Spanning Tree Protocol (MSTP), and integrated routing and bridging (IRB).
<i>Network Interfaces</i>	Provides an overview of the network interface functions of the JUNOS software and describes how to configure the network interfaces on the routing platform.
<i>Network Management</i>	Provides an overview of network management concepts and describes how to configure various network management features, such as SNMP and accounting options.
<i>Policy Framework</i>	Provides an overview of policy concepts and describes how to configure routing policy, firewall filters, and forwarding options.
<i>Routing Protocols</i>	Provides an overview of routing concepts and describes how to configure routing, routing instances, and unicast routing protocols.
<i>Secure Configuration Guide for Common Criteria and JUNOS-FIPS</i>	Provides an overview of secure Common Criteria and JUNOS-FIPS protocols for the JUNOS software and describes how to install and configure secure Common Criteria and JUNOS-FIPS on a routing platform.
<i>Services Interfaces</i>	Provides an overview of the services interfaces functions of the JUNOS software and describes how to configure the services interfaces on the router.
<i>Software Installation and Upgrade Guide</i>	Describes the JUNOS software components and packaging and explains how to initially configure, reinstall, and upgrade the JUNOS system software. This material was formerly covered in the <i>JUNOS System Basics Configuration Guide</i> .
<i>System Basics</i>	Describes Juniper Networks routing platforms and explains how to configure basic system parameters, supported protocols and software processes, authentication, and a variety of utilities for managing your router on the network.
<i>VPNs</i>	Provides an overview and describes how to configure Layer 2 and Layer 3 virtual private networks (VPNs), virtual private LAN service (VPLS), and Layer 2 circuits. Provides configuration examples.
JUNOS References	
<i>Hierarchy and RFC Reference</i>	Describes the JUNOS configuration mode commands. Provides a hierarchy reference that displays each level of a configuration hierarchy, and includes all possible configuration statements that can be used at that level. This material was formerly covered in the <i>JUNOS System Basics Configuration Guide</i> .
<i>Interfaces Command Reference</i>	Describes the JUNOS software operational mode commands you use to monitor and troubleshoot interfaces.

Table 1: Technical Documentation for Supported Routing Platforms (*continued*)

Book	Description
<i>Routing Protocols and Policies Command Reference</i>	Describes the JUNOS software operational mode commands you use to monitor and troubleshoot routing policies and protocols, including firewall filters.
<i>System Basics and Services Command Reference</i>	Describes the JUNOS software operational mode commands you use to monitor and troubleshoot system basics, including commands for real-time monitoring and route (or path) tracing, system software management, and chassis management. Also describes commands for monitoring and troubleshooting services such as class of service (CoS), IP Security (IPSec), stateful firewalls, flow collection, and flow monitoring.
<i>System Log Messages Reference</i>	Describes how to access and interpret system log messages generated by JUNOS software modules and provides a reference page for each message.
J-Web User Guide	
<i>J-Web Interface User Guide</i>	Describes how to use the J-Web graphical user interface (GUI) to configure, monitor, and manage Juniper Networks routing platforms.
JUNOS API and Scripting Documentation	
<i>JUNOScript API Guide</i>	Describes how to use the JUNOScript application programming interface (API) to monitor and configure Juniper Networks routing platforms.
<i>JUNOS XML API Configuration Reference</i>	Provides reference pages for the configuration tag elements in the JUNOS XML API.
<i>JUNOS XML API Operational Reference</i>	Provides reference pages for the operational tag elements in the JUNOS XML API.
<i>NETCONF API Guide</i>	Describes how to use the NETCONF API to monitor and configure Juniper Networks routing platforms.
<i>JUNOS Configuration and Diagnostic Automation Guide</i>	Describes how to use the commit script and self-diagnosis features of the JUNOS software. This guide explains how to enforce custom configuration rules defined in scripts, how to use commit script macros to provide simplified aliases for frequently used configuration statements, and how to configure diagnostic event policies.
Hardware Documentation	
<i>Hardware Guide</i>	Describes how to install, maintain, and troubleshoot routing platforms and components. Each platform has its own hardware guide.
<i>PIC Guide</i>	Describes the routing platform's Physical Interface Cards (PICs). Each platform has its own PIC guide.
<i>DPC Guide</i>	Describes the Dense Port Concentrators (DPCs) for all MX-series routers.
JUNOScope Documentation	

Table 1: Technical Documentation for Supported Routing Platforms (*continued*)

Book	Description
<i>JUNOScope Software User Guide</i>	Describes the JUNOScope software graphical user interface (GUI), how to install and administer the software, and how to use the software to manage routing platform configuration files and monitor routing platform operations.
Advanced Insight Solutions (AIS) Documentation	
<i>Advanced Insight Solutions Guide</i>	Describes the Advanced Insight Manager (AIM) application, which provides a gateway between JUNOS devices and Juniper Support Systems (JSS) for case management and intelligence updates. Explains how to run AI scripts on Juniper Networks devices.
J-series Routing Platform Documentation	
<i>Getting Started Guide</i>	Provides an overview, basic instructions, and specifications for J-series routing platforms. The guide explains how to prepare your site for installation, unpack and install the router and its components, install licenses, and establish basic connectivity. Use the <i>Getting Started Guide</i> for your router model.
<i>Basic LAN and WAN Access Configuration Guide</i>	Explains how to configure the interfaces on J-series Services Routers for basic IP routing with standard routing protocols, ISDN backup, and digital subscriber line (DSL) connections.
<i>Advanced WAN Access Configuration Guide</i>	Explains how to configure J-series Services Routers in virtual private networks (VPNs) and multicast networks, configure data link switching (DLSw) services, and apply routing techniques such as policies, stateless and stateful firewall filters, IP Security (IPSec) tunnels, and class-of-service (CoS) classification for safer, more efficient routing.
<i>Administration Guide</i>	Shows how to manage users and operations, monitor network performance, upgrade software, and diagnose common problems on J-series Services Routers.
Release Notes	
<i>JUNOS Release Notes</i>	Summarize new features and known problems for a particular software release, provide corrections and updates to published JUNOS, JUNOScript, and NETCONF manuals, provide information that might have been omitted from the manuals, and describe upgrade and downgrade procedures.
<i>Hardware Release Notes</i>	Describe the available documentation for the routing platform and summarize known problems with the hardware and accompanying software. Each platform has its own release notes.
<i>JUNOScope Release Notes</i>	Contain corrections and updates to the published JUNOScope manual, provide information that might have been omitted from the manual, and describe upgrade and downgrade procedures.
<i>AIS Release Notes</i>	Summarize AIS new features and guidelines, identify known and resolved problems, provide information that might have been omitted from the manuals, and provide initial setup, upgrade, and downgrade procedures.

Table 1: Technical Documentation for Supported Routing Platforms (*continued*)

Book	Description
<i>AIS AI Script Release Notes</i>	Summarize AI Scripts new features, identify known and resolved problems, provide information that might have been omitted from the manuals, and provide instructions for automatic and manual installation, including deleting and rolling back.
<i>J-series Services Router Release Notes</i>	Briefly describe Services Router features, identify known hardware problems, and provide upgrade and downgrade instructions.

Table 2: JUNOS Software Network Operations Guides

Book	Description
<i>Baseline</i>	Describes the most basic tasks for running a network using Juniper Networks products. Tasks include upgrading and reinstalling JUNOS software, gathering basic system management information, verifying your network topology, and searching log messages.
<i>Interfaces</i>	Describes tasks for monitoring interfaces. Tasks include using loopback testing and locating alarms.
<i>MPLS</i>	Describes tasks for configuring, monitoring, and troubleshooting an example MPLS network. Tasks include verifying the correct configuration of the MPLS and RSVP protocols, displaying the status and statistics of MPLS running on all routing platforms in the network, and using the layered MPLS troubleshooting model to investigate problems with an MPLS network.
<i>MPLS Log Reference</i>	Describes MPLS status and error messages that appear in the output of the <code>show mpls lsp extensive</code> command. The guide also describes how and when to configure Constrained Shortest Path First (CSPF) and RSVP trace options, and how to examine a CSPF or RSVP failure in a sample network.
<i>MPLS Fast Reroute</i>	Describes operational information helpful in monitoring and troubleshooting an MPLS network configured with fast reroute (FRR) and load balancing.
<i>Hardware</i>	Describes tasks for monitoring M-series and T-series routing platforms.

To configure and operate a J-series Services Router running JUNOS software with enhanced services, you must also use the configuration statements and operational mode commands documented in JUNOS configuration guides and command references. To configure and operate a WX Integrated Services Module, you must also use WX documentation.

Table 3: JUNOS Software with Enhanced Services Documentation

Book	Description
<i>JUNOS Software with Enhanced Services Design and Implementation Guide</i>	Provides guidelines and examples for designing and implementing IP Security (IPSec) virtual private networks (VPNs), firewalls, and routing on J-series routers running JUNOS software with enhanced services.
<i>JUNOS Software with Enhanced Services J-series Services Router Quick Start</i>	Explains how to quickly set up a J-series router. This document contains router declarations of conformity.
<i>JUNOS Software with Enhanced Services J-series Services Router Getting Started Guide</i>	Provides an overview, basic instructions, and specifications for J-series Services Routers. This guide explains how to prepare a site, unpack and install the router, replace router hardware, and establish basic router connectivity. This guide contains hardware descriptions and specifications.
<i>JUNOS Software with Enhanced Services Migration Guide</i>	Provides instructions for migrating an SSG device running ScreenOS software or a J-series router running the JUNOS software to JUNOS software with enhanced services.
<i>JUNOS Software with Enhanced Services Interfaces and Routing Configuration Guide</i>	Explains how to configure J-series router interfaces for basic IP routing with standard routing protocols, ISDN service, firewall filters (access control lists), and class-of-service (CoS) traffic classification.
<i>JUNOS Software with Enhanced Services Security Configuration Guide</i>	Explains how to configure and manage security services such as stateful firewall policies, IPSec VPNs, firewall screens, Network Address translation (NAT) and Router interface modes, Public Key Cryptography, and Application Layer Gateways (ALGs).
<i>JUNOS Software with Enhanced Services Administration Guide</i>	Shows how to monitor the router and routing operations, firewall and security services, system alarms and events, and network performance. This guide also shows how to administer user authentication and access, upgrade software, and diagnose common problems.
<i>JUNOS Software with Enhanced Services CLI Reference</i>	Provides the complete JUNOS software with enhanced services configuration hierarchy and describes the configuration statements and operational mode commands not documented in the standard JUNOS manuals.
<i>WXC Integrated Services Module Installation and Configuration Guide</i>	Explains how to install and initially configure a WXC Integrated Services Module in a J-series router for application acceleration.
<i>JUNOS Software with Enhanced Services Release Notes</i>	Summarize new features and known problems for a particular release of JUNOS software with enhanced services on J-series routers, including J-Web interface features and problems. The release notes also contain corrections and updates to the manuals and software upgrade and downgrade instructions for JUNOS software with enhanced services.

Table 4: Additional Books Available Through <http://www.juniper.net/books>

Book	Description
<i>Interdomain Multicast Routing</i>	Provides background and in-depth analysis of multicast routing using Protocol Independent Multicast sparse mode (PIM SM) and Multicast Source Discovery Protocol (MSDP); details any-source and source-specific multicast delivery models; explores multiprotocol BGP (MBGP) and multicast IS-IS; explains Internet Gateway Management Protocol (IGMP) versions 1, 2, and 3; lists packet formats for IGMP, PIM, and MSDP; and provides a complete glossary of multicast terms.
<i>JUNOS Cookbook</i>	Provides detailed examples of common JUNOS software configuration tasks, such as basic router configuration and file management, security and access control, logging, routing policy, firewalls, routing protocols, MPLS, and VPNs.
<i>MPLS-Enabled Applications</i>	Provides an overview of Multiprotocol Label Switching (MPLS) applications (such as Layer 3 virtual private networks [VPNs], Layer 2 VPNs, virtual private LAN service [VPLS], and pseudowires), explains how to apply MPLS, examines the scaling requirements of equipment at different points in the network, and covers the following topics: point-to-multipoint label switched paths (LSPs), DiffServ-aware traffic engineering, class of service, interdomain traffic engineering, path computation, route target filtering, multicast support for Layer 3 VPNs, and management and troubleshooting of MPLS networks.
<i>OSPF and IS-IS: Choosing an IGP for Large-Scale Networks</i>	Explores the full range of characteristics and capabilities for the two major link-state routing protocols: Open Shortest Path First (OSPF) and IS-IS. Explains architecture, packet types, and addressing; demonstrates how to improve scalability; shows how to design large-scale networks for maximum security and reliability; details protocol extensions for MPLS-based traffic engineering, IPv6, and multitopology routing; and covers troubleshooting for OSPF and IS-IS networks.
<i>Routing Policy and Protocols for Multivendor IP Networks</i>	Provides a brief history of the Internet, explains IP addressing and routing (Routing Information Protocol [RIP], OSPF, IS-IS, and Border Gateway Protocol [BGP]), explores ISP peering and routing policies, and displays configurations for both Juniper Networks and other vendors' routers.
<i>The Complete IS-IS Protocol</i>	Provides the insight and practical solutions necessary to understand the IS-IS protocol and how it works by using a multivendor, real-world approach.

Requesting Technical Support

Technical product support is available through the Juniper Networks Technical Assistance Center (JTAC). If you are a customer with an active J-Care or JNASC support contract, or are covered under warranty, and need postsales technical support, you can access our tools and resources online or open a case with JTAC.

- JTAC policies—For a complete understanding of our JTAC procedures and policies, review the JTAC User Guide located at <http://www.juniper.net/customers/support/downloads/710059.pdf>.
- Product warranties—For product warranty information, visit <http://www.juniper.net/support/warranty/>.
- JTAC Hours of Operation —The JTAC centers have resources available 24 hours a day, 7 days a week, 365 days a year.

Self-Help Online Tools and Resources

For quick and easy problem resolution, Juniper Networks has designed an online self-service portal called the Customer Support Center (CSC) that provides you with the following features:

- Find CSC offerings: <http://www.juniper.net/customers/support/>
- Search for known bugs: <http://www2.juniper.net/kb/>
- Find product documentation: <http://www.juniper.net/techpubs/>
- Find solutions and answer questions using our Knowledge Base: <http://kb.juniper.net/>
- Download the latest versions of software and review release notes: <http://www.juniper.net/customers/csc/software/>
- Search technical bulletins for relevant hardware and software notifications: <https://www.juniper.net/alerts/>
- Join and participate in the Juniper Networks Community Forum: <http://www.juniper.net/company/communities/>
- Open a case online in the CSC Case Manager: <http://www.juniper.net/cm/>

To verify service entitlement by product serial number, use our Serial Number Entitlement (SNE) Tool located at <https://tools.juniper.net/SerialNumberEntitlementSearch/>.

Opening a Case with JTAC

You can open a case with JTAC on the Web or by telephone.

- Use the Case Manager tool in the CSC at <http://www.juniper.net/cm/>.
- Call 1-888-314-JTAC (1-888-314-5822 toll-free in the USA, Canada, and Mexico).

For international or direct-dial options in countries without toll-free numbers, visit us at <http://www.juniper.net/support/requesting-support.html>.

Revision History

28 January 2008—530-017281-01. Revision 5. Added information about the T1600 routing node. Removed information about the EOL M20 router. Updated image for installing a XENPAK module.

19 October 2007—530-017281-01. Revision 4. Added a reminder that the M40e FPC must be taken offline before it can be removed from the router. Added caution for allowing clearance when installing a XENPAK module.

20 December 2006—530-017281-01. Revision 3. Added product reclamation and recycling section.

27 October 2006—530-017281-01. Revision 2. Removed information regarding the M5, M10, M40, and M160 routers.

6 October 2006—530-017281-01. Revision 1. Changed the title of the manual. Added replacement procedures for replacing XFP transceivers in PICs and cFPCs, and for replacing PICs in the M120 router.

19 January 2005—530-012691-01. Revision 1. Reorganized the document and updated the technical support information.

5 January 2004—530-009711-01. Revision 2. Added instructions for removing and replacing PICs in the M320 router. Added instructions for removing and replacing XENPAK modules.

22 September 2003—530-009711-01. Revision 1. Added instructions for removing and replacing PICs in the M7i and M10i routers. Added instructions for cleaning fiber-optic ports.

7 April 2003—530-009486-01. Revision 1.

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