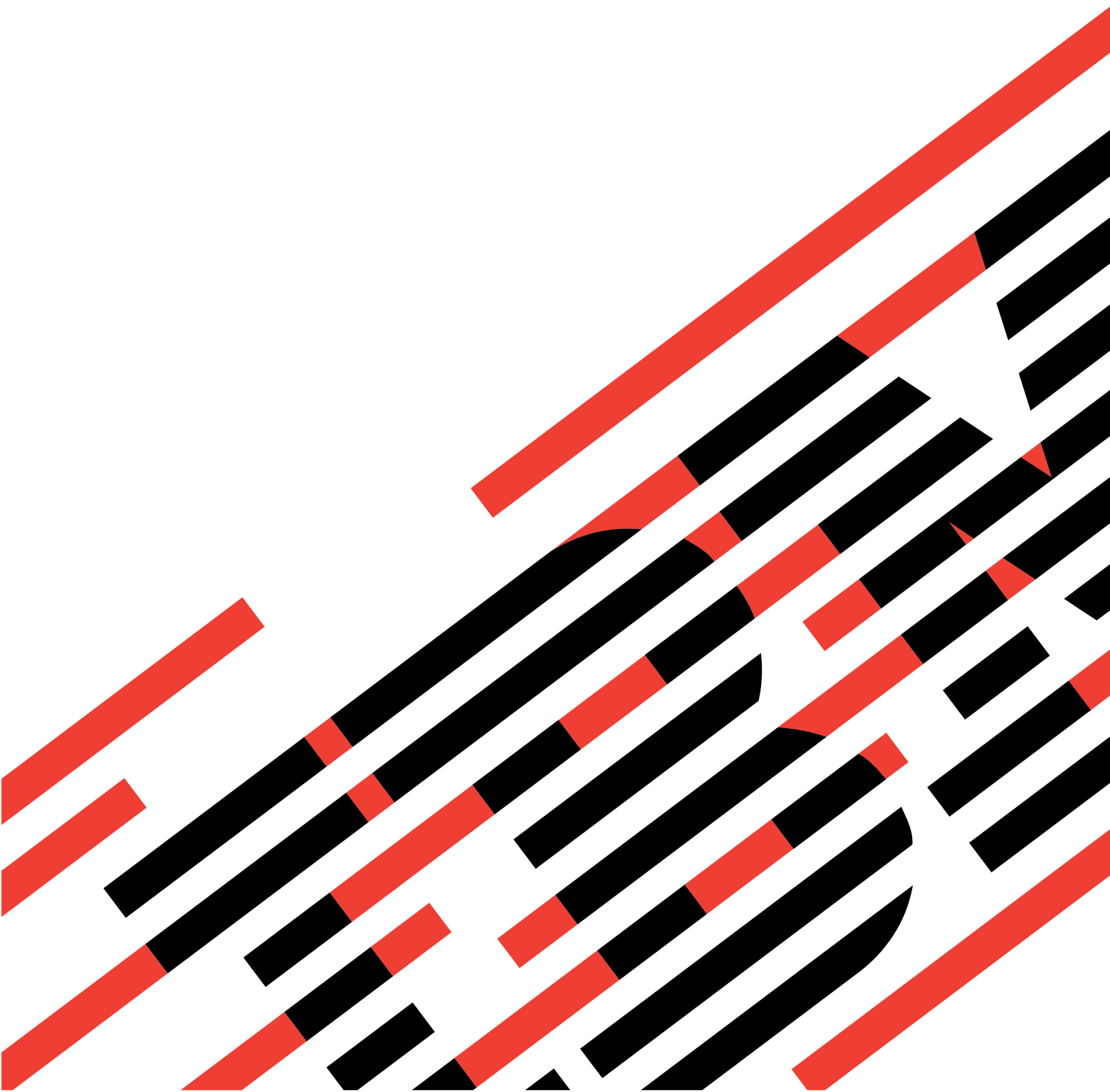




@server

xSeries 455

Option Installation Guide





@server

xSeries 455

Option Installation Guide

SC88-P919-80

Note: Before using this information and the product it supports, read the general information in “Notices”, on page 63.

First Edition (November 2003)

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Safety

Before installing this product, read the Safety Information.

قبل تركيب هذا المنتج، يجب قراءة الملاحظات الأمنية

Antes de instalar este produto, leia as Informações de Segurança.

在安装本产品之前，请仔细阅读 **Safety Information** (安全信息)。

安裝本產品之前，請先閱讀「安全資訊」。

Prije instalacije ovog produkta obavezno pročitajte Sigurnosne Upute.

Před instalací tohoto produktu si přečtěte příručku bezpečnostních instrukcí.

Læs sikkerhedsforskrifterne, før du installerer dette produkt.

Lees voordat u dit product installeert eerst de veiligheidsvoorschriften.

Ennen kuin asennat tämän tuotteen, lue turvaohjeet kohdasta Safety Information.

Avant d'installer ce produit, lisez les consignes de sécurité.

Vor der Installation dieses Produkts die Sicherheitshinweise lesen.

Πριν εγκαταστήσετε το προϊόν αυτό, διαβάστε τις πληροφορίες ασφάλειας (safety information).

לפני שתתקינו מוצר זה, קראו את הוראות הבטיחות.

A termék telepítése előtt olvassa el a Biztonsági előírásokat!

Prima di installare questo prodotto, leggere le Informazioni sulla Sicurezza.

製品の設置の前に、安全情報をお読みください。

본 제품을 설치하기 전에 안전 정보를 읽으십시오.

Пред да се инсталира овој продукт, прочитајте информацијата за безбедност.

Les sikkerhetsinformasjonen (Safety Information) før du installerer dette produktet.

Przed zainstalowaniem tego produktu, należy zapoznać się z książką "Informacje dotyczące bezpieczeństwa" (Safety Information).

Antes de instalar este produto, leia as Informações sobre Segurança.

Перед установкой продукта прочтите инструкции по технике безопасности.

Pred inštaláciou tohto zariadenia si pečítajte Bezpečnostné predpisy.

Pred namestitvijo tega proizvoda preberite Varnostne informacije.

Antes de instalar este producto, lea la información de seguridad.

Läs säkerhetsinformationen innan du installerar den här produkten.

Statement 1:



DANGER

Electrical current from power, telephone, and communication cables is hazardous.

To avoid a shock hazard:

- **Do not connect or disconnect any cables or perform installation, maintenance, or reconfiguration of this product during an electrical storm.**
- **Connect all power cords to a properly wired and grounded electrical outlet.**
- **Connect to properly wired outlets any equipment that will be attached to this product.**
- **When possible, use one hand only to connect or disconnect signal cables.**
- **Never turn on any equipment when there is evidence of fire, water, or structural damage.**
- **Disconnect the attached power cords, telecommunications systems, networks, and modems before you open the device covers, unless instructed otherwise in the installation and configuration procedures.**
- **Connect and disconnect cables as described in the following table when installing, moving, or opening covers on this product or attached devices.**

To Connect:	To Disconnect:
1. Turn everything OFF.	1. Turn everything OFF.
2. First, attach all cables to devices.	2. First, remove power cords from outlet.
3. Attach signal cables to connectors.	3. Remove signal cables from connectors.
4. Attach power cords to outlet.	4. Remove all cables from devices.
5. Turn device ON.	

Statement 2:



CAUTION:

When replacing the lithium battery, use only IBM Part Number 33F8354 or an equivalent type battery recommended by the manufacturer. If your system has a module containing a lithium battery, replace it only with the same module type made by the same manufacturer. The battery contains lithium and can explode if not properly used, handled, or disposed of.

Do not:

- Throw or immerse into water
- Heat to more than 100°C (212°F)
- Repair or disassemble

Dispose of the battery as required by local ordinances or regulations.

Statement 3:



CAUTION:

When laser products (such as CD-ROMs, DVD drives, fiber optic devices, or transmitters) are installed, note the following:

- Do not remove the covers. Removing the covers of the laser product could result in exposure to hazardous laser radiation. There are no serviceable parts inside the device.
- Use of controls or adjustments or performance of procedures other than those specified herein might result in hazardous radiation exposure.

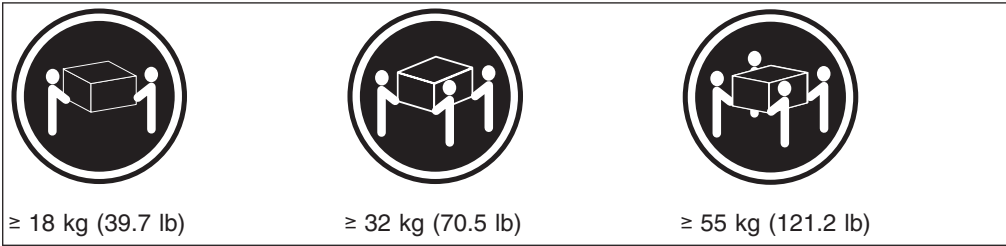


DANGER

Some laser products contain an embedded Class 3A or Class 3B laser diode. Note the following.

Laser radiation when open. Do not stare into the beam, do not view directly with optical instruments, and avoid direct exposure to the beam.

Statement 4:

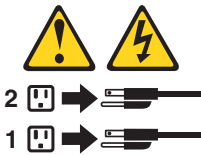


CAUTION:
Use safe practices when lifting.

Statement 5:



CAUTION:
The power control button on the device and the power switch on the power supply do not turn off the electrical current supplied to the device. The device also might have more than one power cord. To remove all electrical current from the device, ensure that all power cords are disconnected from the power source.



Statement 8:



CAUTION:

Never remove the cover on a power supply or any part that has the following label attached.



Hazardous voltage, current, and energy levels are present inside any component that has this label attached. There are no serviceable parts inside these components. If you suspect a problem with one of these parts, contact a service technician.

Statement 10:



CAUTION:

Do not place any object weighing more than 82 kg (180 lb) on top of rack-mounted devices.



WARNING: Handling the cord on this product or cords associated with accessories sold with this product, will expose you to lead, a chemical known to the State of California to cause cancer, and birth defects or other reproductive harm. ***Wash hands after handling.***

ADVERTENCIA: El contacto con el cable de este producto o con cables de accesorios que se venden junto con este producto, pueden exponerle al plomo, un elemento químico que en el estado de California de los Estados Unidos está considerado como un causante de cancer y de defectos congénitos, además de otros riesgos reproductivos. ***Lávese las manos después de usar el producto.***

Chapter 1. Introduction

This *Option Installation Guide* contains instructions for installing, removing, and connecting optional devices that your server supports.

Related publications

In addition to this *Option Installation Guide*, the following documentation comes with your server:

- *User's Guide*

This publication is in Portable Document Format (PDF) on the IBM® *xSeries™ Documentation CD*. It contains general information about your server.

- *Installation Guide*

This printed publication contains instructions for setting up your server and basic instructions for installing some options.

- *Safety Information*

This publication is in PDF on the IBM *xSeries Documentation CD*. It contains translated caution and danger statements. Each caution and danger statement that appears in the documentation has a number that you can use to locate the corresponding statement in your language in the *Safety Information* book.

- *Rack Installation Instructions*

This printed publication contains instructions for installing your server in a rack.

- *Hardware Maintenance Manual and Troubleshooting Guide*

This publication is in PDF on the IBM *xSeries Documentation CD*. It contains information to help you solve problems yourself, and it contains information for service technicians.

Depending on your server model, additional publications might be included on the IBM *xSeries Documentation CD*.

Your server might have features that are not described in the documentation that you received with the server. The documentation might be updated occasionally to include information about those features, or technical updates might be available to provide additional information that is not included in your server documentation. These updates are available from the IBM Web site. Complete the following steps to check for updated documentation and technical updates:

1. Go to <http://www.ibm.com/pc/support/>.
2. In the **Learn** section, click **Online publications**.
3. On the "Online publications" page, in the **Brand** field, select **Servers**.
4. In the **Family** field, select **xSeries 455**.
5. Click **Display documents**.

Notices and statements used in this book

The caution and danger statements that appear in this book are also in the multilingual *Safety Information* book, which is on the IBM *xSeries Documentation* CD. Each statement is numbered for reference to the corresponding statement in the *Safety Information* book.

The following notices and statements are used in the documentation:

- **Notes:** These notices provide important tips, guidance, or advice.
- **Important:** These notices provide information or advice that might help you avoid inconvenient or problem situations.
- **Attention:** These notices indicate potential damage to programs, devices, or data. An attention notice is placed just before the instruction or situation in which damage could occur.
- **Caution:** These statements indicate situations that can be potentially hazardous to you. A caution statement is placed just before the description of a potentially hazardous procedure step or situation.
- **Danger:** These statements indicate situations that can be potentially lethal or extremely hazardous to you. A danger statement is placed just before the description of a potentially lethal or extremely hazardous procedure step or situation.

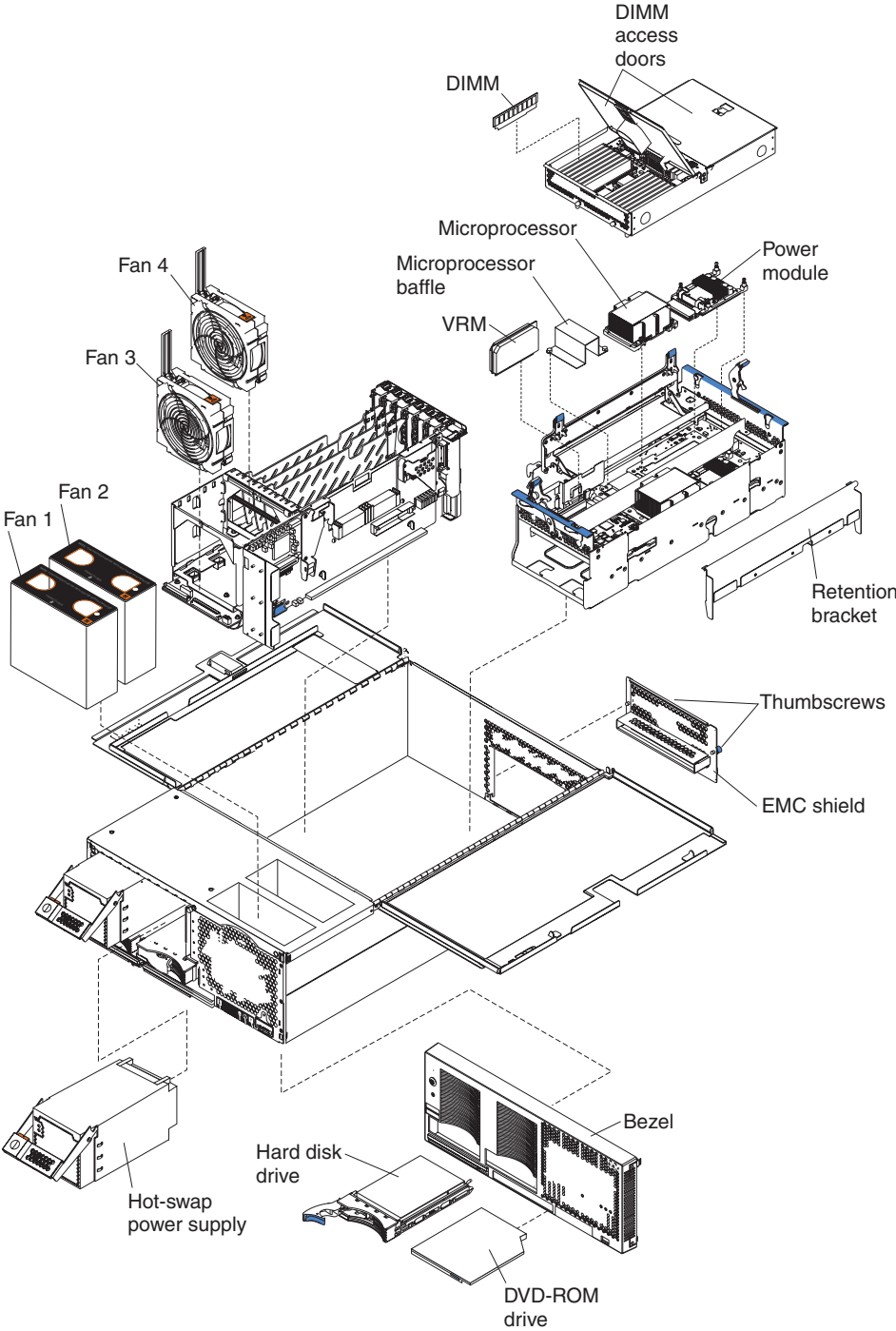
Major components of the xSeries 455 server

The orange color on components and labels in the server indicates hot-swap or hot-plug components. You can install or remove these components while the server is running, provided that the server is configured to support hot-swap and hot-plug features.

The blue color on components and labels indicates touch points, where a component can be gripped, a latch moved, and so on.

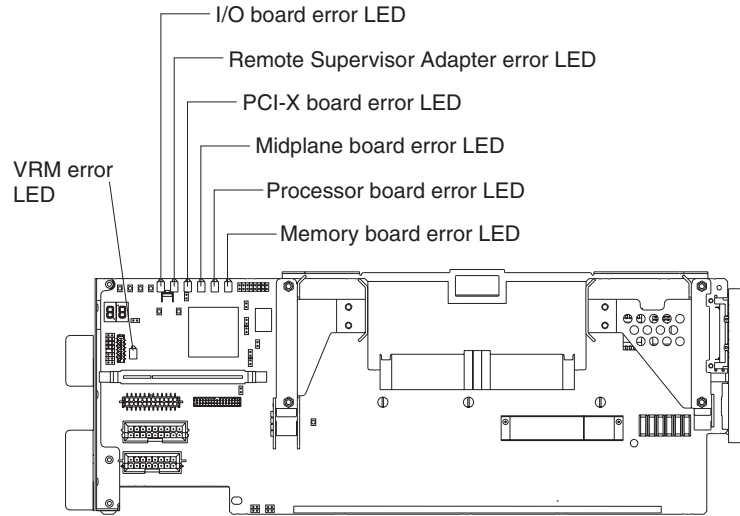
The following illustration shows the location of major components in your server.

Note: The illustrations in this document might differ slightly from your hardware.



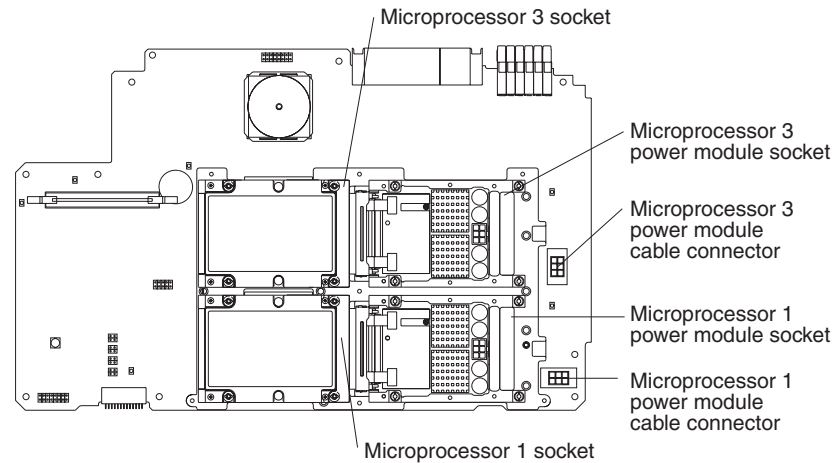
Midplane board LEDs

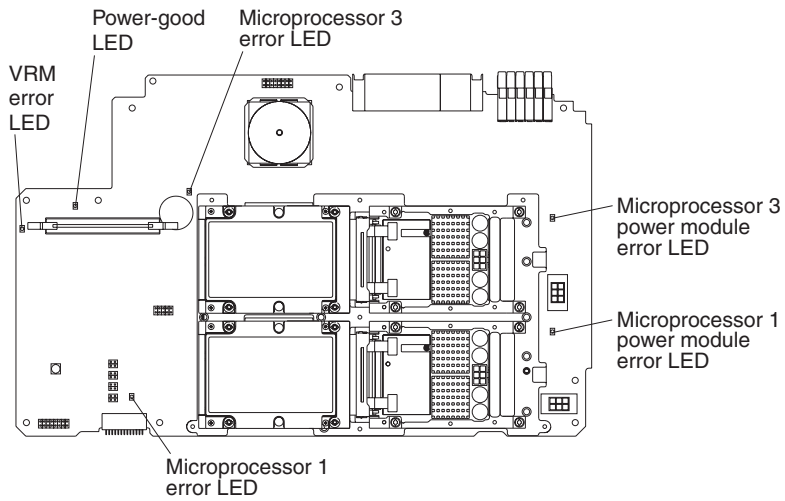
The following illustration shows the LEDs on the midplane board.



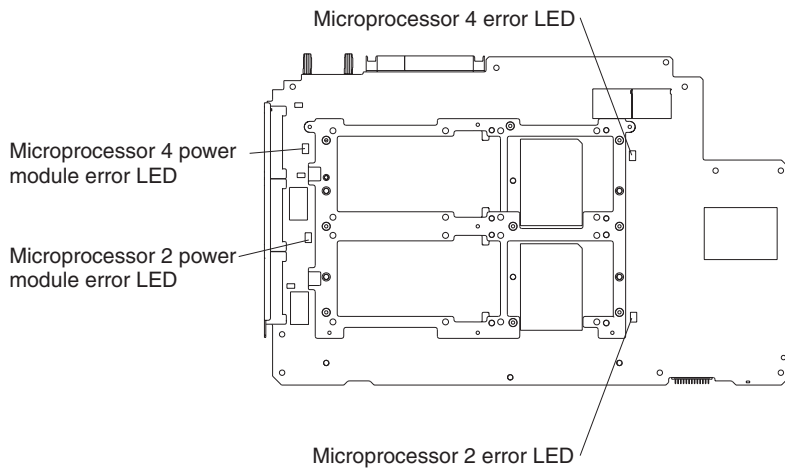
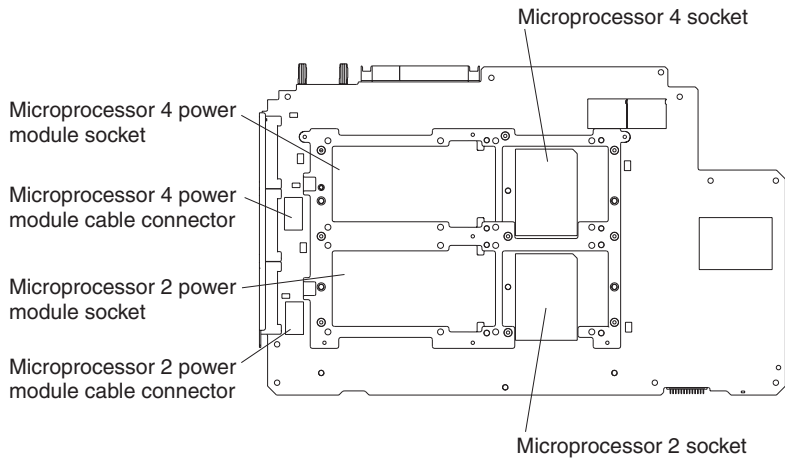
Processor board internal connectors and LEDs

The following illustrations show the internal connectors and LEDs on the processor board.



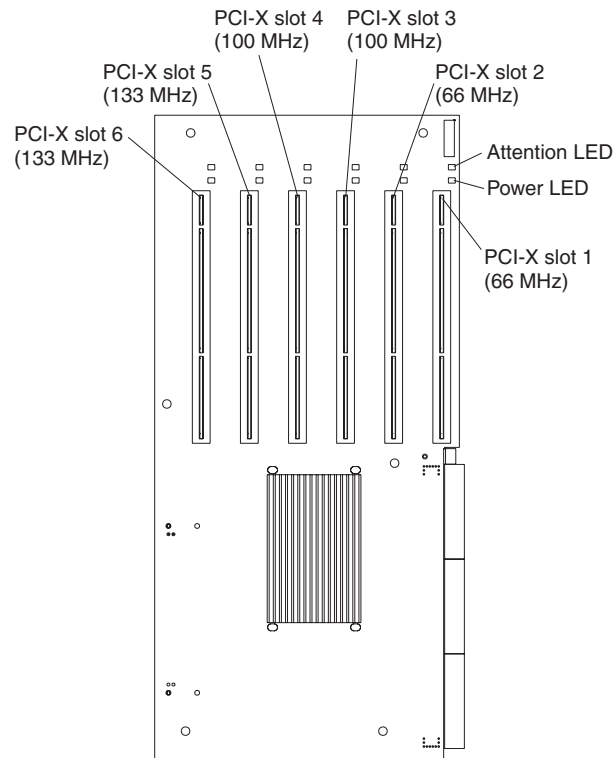


Reverse side



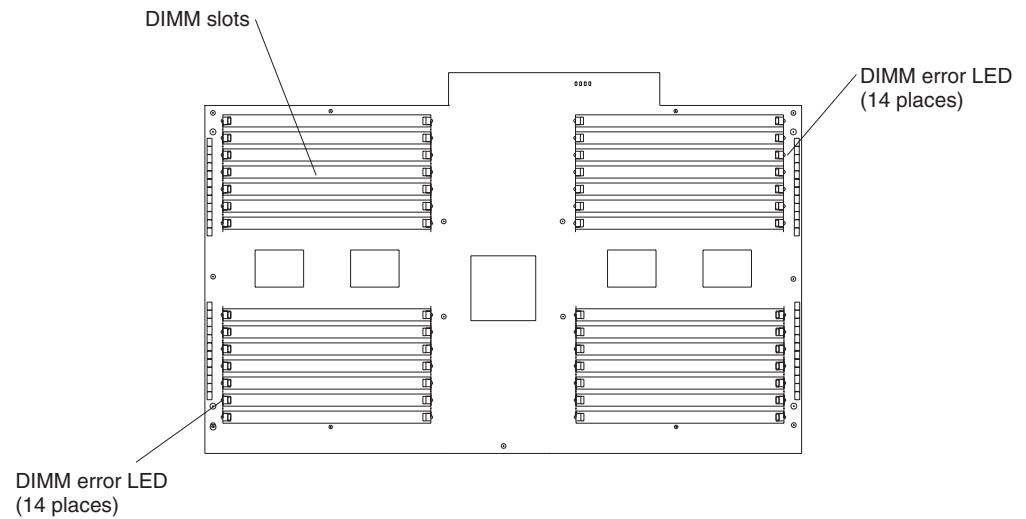
PCI-X board internal connectors and LEDs

The following illustration shows the internal connectors and LEDs on the PCI-X board.



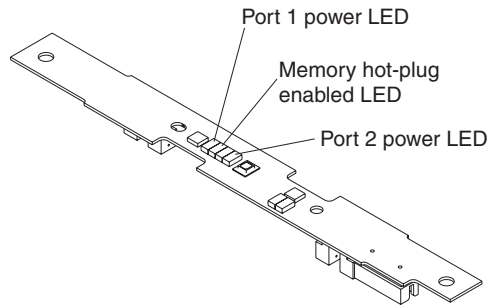
Memory board internal connectors and LEDs

The following illustration shows the internal connectors and LEDs on the memory board.



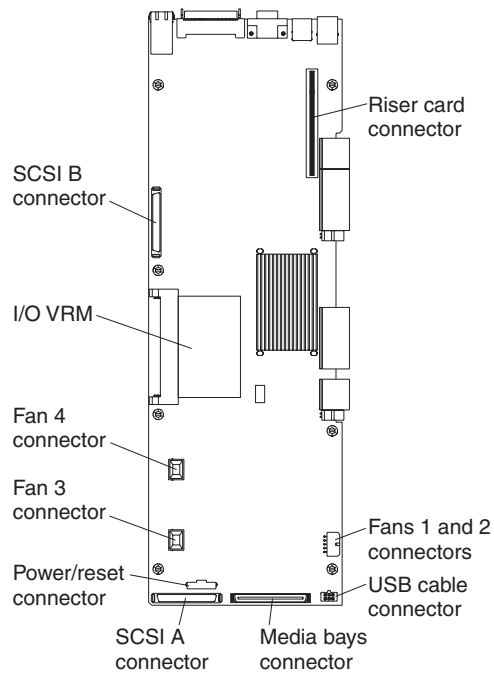
Memory switch card LEDs

The following illustration shows the LEDs on the memory switch card.



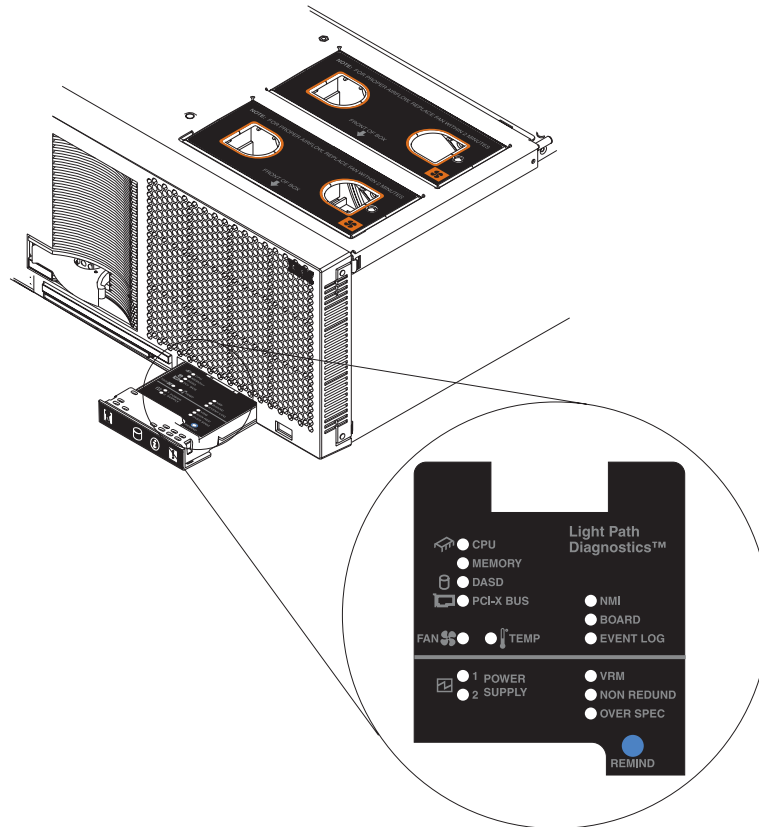
I/O-board internal connectors

The following illustration shows the internal connectors on the I/O board.



Light path diagnostics panel

The following illustration shows the light path diagnostics panel.



To access the light path diagnostics panel, press on the front of the panel.

For more information about light path diagnostics, see the *Hardware Maintenance Manual and Troubleshooting Guide* on the IBM xSeries Documentation CD.

The following table describes the LEDs on the light path diagnostics panel.

Table 1. Light path diagnostics

LED	Problem	Action
None	An error has occurred and cannot be diagnosed, or the ASM processor has failed. The error is not represented by a Light Path Diagnostic LED.	Check the system error log for more information about the error.
CPU	A microprocessor has failed.	<ul style="list-style-type: none"> Check the microprocessor failure LEDs on the system board. Note: If you have installed more than one microprocessor, check the reverse side of the processor board for lit microprocessor failure LEDs. If a microprocessor error LED is lit, make sure that the microprocessor is installed correctly. See "Installing and replacing a microprocessor and power module" on page 30 for installation instructions. <p>If the problem remains, call for service.</p>

Table 1. Light path diagnostics (continued)

LED	Problem	Action
MEMORY	A memory error occurred.	<ul style="list-style-type: none"> Check the DIMM failure LEDs on the memory board. Replace the DIMM indicated by the lit DIMM failure LED.
DASD	A hard disk drive error occurred.	Check the LEDs on the hard disk drives and replace the indicated drive.
PCI-X BUS	An error occurred on a PCI bus.	<ul style="list-style-type: none"> Check the error log for additional information. If you cannot isolate the failing adapter from the information in the error log, try to determine the failing adapter by removing one adapter at a time from the failing PCI-X bus and restarting the server after each adapter is removed. <p>If the problem remains, call for service.</p>
FAN	A fan has failed or is operating too slowly. A failing fan can also cause the TEMP LED to be lit.	Check the LEDs on the fans and replace the indicated fan.
TEMP	The system temperature has exceeded a threshold level.	<ul style="list-style-type: none"> Determine whether a fan has failed. If it has, replace it. Make sure that air vents are not blocked. Make sure that the room temperature is not too high. (See the <i>User's Guide</i> on the IBM xSeries Documentation CD for temperature information.) <p>If the problem remains, call for service.</p>
NMI	A machine check error has occurred.	Check the error log to identify the condition.
BOARD	A system board has failed.	<ul style="list-style-type: none"> Check the LEDs on the top of the server to determine which of the boards failed. Remove ac power from the server; then, reconnect the server to ac power and restart the server. <p>If the problem remains, call for service.</p>
EVENT LOG	A system warning has occurred.	Check the error log to diagnose the condition.
PS1 and PS2	The indicated power supply has failed.	<p>Replace the power supply.</p> <p>If the problem remains, call for service.</p>
VRM	One of the VRMs has failed.	<ul style="list-style-type: none"> Remove ac power from the server; then, reconnect the server to ac power and restart the server. Check the error log for additional information. <p>If the problem remains, call for service.</p>
NON REDUND	The power supplies are no longer redundant, or a power supply has failed.	<ul style="list-style-type: none"> Determine whether a power supply has failed. If it has, replace it. Use a higher voltage ac power source, or remove optional devices from the server until redundancy is restored, if redundancy is required.

Table 1. Light path diagnostics (continued)

LED	Problem	Action
OVER SPEC	The power supplies are using more power than the maximum rating.	Replace the failed power supply, or remove optional devices from the server.

Chapter 2. Installing options

This chapter provides detailed instructions for installing hardware options in your server.

Installation guidelines

Before you begin to install options in your server, read the following information:

- Read the safety information beginning on page v and the guidelines in “Handling static-sensitive devices” on page 14. This information will help you work safely with your server or options.
- Make sure that you have an adequate number of properly grounded electrical outlets for your server, monitor, and any other devices that you will connect to the server.
- Back up all important data before you make changes to disk drives.
- You do not need to turn off the server to install or replace hot-swap or hot-plug components, or hot-plug Universal Serial Bus (USB) devices.
- The orange color on components and labels identifies hot-swap or hot-plug components. You can install or remove hot-swap and hot-plug components while the server is running, provided that the server is configured to support this capability. See the instructions in this chapter for more information about removing and installing hot-swap and hot-plug components.
- For a list of supported options for your server, go to <http://www.ibm.com/pc/us/compat/>.

Note: Some preconfigured servers have a unique list of supported options. See the software documentation that comes with those servers for more information.

System reliability considerations

To help ensure proper cooling and system reliability, make sure that:

- The top cover is closed during normal operation.
- Each of the drive bays has either a drive or a filler panel installed.
- There is space around the server to allow the cooling system to work properly.
- Cables for optional adapters are routed according to the instructions that are provided with the adapters.
- All microprocessors have the same cache size and type, and the same clock speed.
- For proper cooling, do not leave the cover open for more than 15 minutes.
- A failed fan is replaced within 48 hours.
- Do not remove a defective power supply until a replacement is available.
- For redundant and hot-swappable operation, the power supplies are connected to 200-240 V ac.
- If you replace a hot-swap drive, remove the defective drive and wait 15 seconds before you install a new drive.

Working inside a server with power on

Your server supports hot-swap devices and is designed to operate safely while turned on with the cover removed. Follow these guidelines when you work inside a server that is turned on:

- Avoid loose-fitting clothing on your forearms. Button long-sleeved shirts before working inside the server; do not wear cuff links while you are working inside the server.
- Do not allow your necktie or scarf to hang inside the server.
- Remove jewelry, such as bracelets, rings, necklaces, and loose-fitting wrist watches.
- Remove items from your shirt pocket (such as pens or pencils) that could fall into the server as you lean over it.
- Avoid dropping any metallic objects, such as paper clips, hair pins, or screws, into the server.

Handling static-sensitive devices

Attention: Static electricity can damage electronic devices and your system. To avoid damage, keep static-sensitive devices in their static-protective package until you are ready to install them.

To reduce the possibility of electrostatic discharge, observe the following precautions:

- Limit your movement. Movement can cause static electricity to build up around you.
- Handle the device carefully, holding it by its edges or its frame.
- Do not touch solder joints, pins, or exposed printed circuitry.
- Do not leave the device where others can handle and damage it.
- While the device is still in its anti-static package, touch it to an unpainted metal part of the system unit for at least 2 seconds. This drains static electricity from the package and from your body.
- Remove the device from its package and install it directly into the system unit without setting down the device. If it is necessary to set down the device, place it in its static-protective package. Do not place the device on your system unit cover or on a metal surface.
- Take additional care when handling devices during cold weather. Heating reduces indoor humidity and increases static electricity.
- Wear a properly grounded wrist strap against your skin to help eliminate static electricity from your body.

Server power features

When the server is connected to an ac power source but is not turned on, the operating system does not run, and all core logic except for the service processor is shut down; however, the server can respond to requests from the service processor, such as a remote request to turn on the server. The power-on LED flashes to indicate that the server is connected to ac power but is not turned on.

Turning on the server

Approximately 20 seconds after the server is connected to ac power, the power-control button becomes active, and you can turn on the server and start the operating system by pressing the power-control button. The server can also be turned on in any of the following ways:

- If a power failure occurs while the server is turned on, the server will restart automatically when power is restored.

- If ac power is present, the server can be turned on from the Remote Supervisor Adapter user interface.
- The Wake on LAN[®] feature can turn on the server.

Notes:

1. The power supplies are hot-swappable and redundant only at 200-240 V ac.
2. Both power supplies must be connected to the power source for operation at 100-127 V ac.
3. During normal operation, both power supplies must be installed for proper operation.
4. While the server is powering up, the power-on LED on the front of the server is lit. When the server is connected to ac power but is not turned on, the power-on LED on the front of the server flashes.
5. When you press the power-control button on any server in a scalable partition, all servers in the scalable partition will be turned on. If the servers do not turn on when the power-control button is pressed, see the *Hardware Maintenance Manual and Troubleshooting Guide* on the IBM xSeries Documentation CD.

Turning off the server

When you turn off the server and leave it connected to ac power, the server can respond to requests from the service processor, such as a remote request to turn on the server. To remove all power from the server, you must disconnect it from the power source.

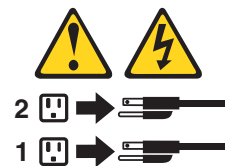
Some operating systems require an orderly shutdown before you turn off the server. See your operating-system documentation for information about shutting down the operating system.

Statement 5:



CAUTION:

The power control button on the device and the power switch on the power supply do not turn off the electrical current supplied to the device. The device also might have more than one power cord. To remove all electrical current from the device, ensure that all power cords are disconnected from the power source.



The server can be turned off in any of the following ways:

- You can turn off the server from the operating system, if your operating system supports this feature. After an orderly shutdown of the operating system, the server will be turned off automatically.
- You can press the power-control button to start an orderly shutdown of the operating system and turn off the server, if your operating system supports this feature.

- If the operating system stops functioning, you can press and hold the power-control button for more than 4 seconds to turn off the server.
- If the server is connected to an Advanced System Management interconnect network, the server can be turned off from the Remote Supervisor Adapter user interface.

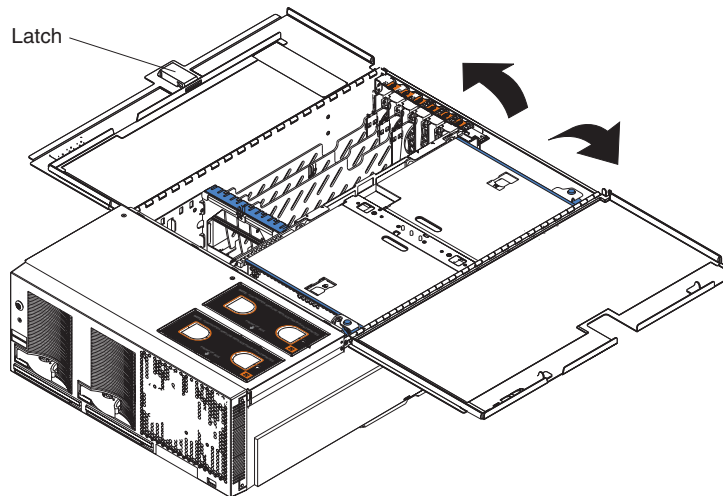
Notes:

1. You might need to press and hold the power-control button for more than 4 seconds to cause an immediate shutdown of the server. You can use this feature if the operating system stops functioning.
2. If you disconnect the server from the power source, wait approximately 15 seconds for the server to stop running before you open the cover. Watch for the power-on LED on the front of the server to stop flashing.
3. When you press the power-control button on any server in a scalable partition, all servers in the scalable partition will be turned off. If the servers do not turn off when the power-control button is pressed, see the *Hardware Maintenance Manual and Troubleshooting Guide* on the IBM xSeries Documentation CD.

Opening the cover

Complete the following steps to open the server cover:

1. Read the safety information beginning on page v and “Installation guidelines” on page 13.
2. Slide the server out from the rack.



3. Pull the release latch on the left side of the top cover to the right.
4. Using the finger hole in the release latch, open the left side of the cover; then, open the right side of the cover.

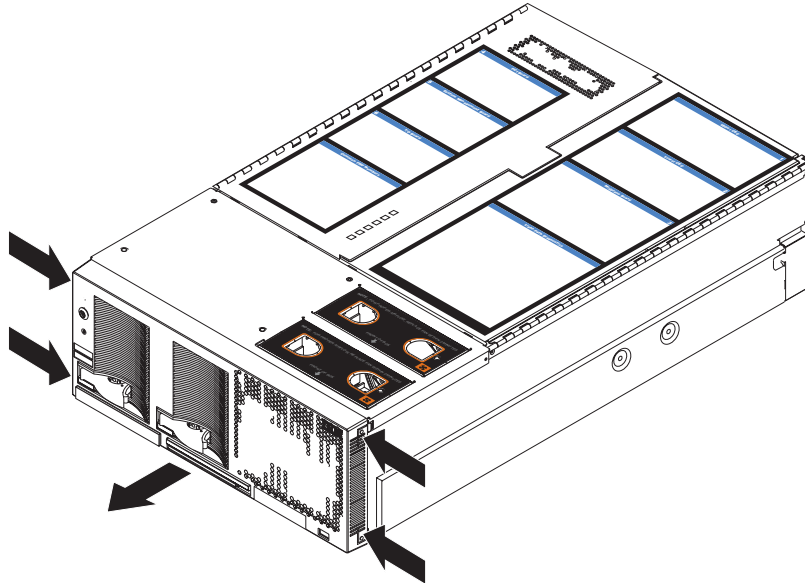
Attention: For proper cooling and airflow, close the cover before turning on the server. Operating the server for extended periods of time (over 15 minutes) with the cover open might damage server components.

Removing and replacing the bezel

Complete the following steps to remove the bezel:

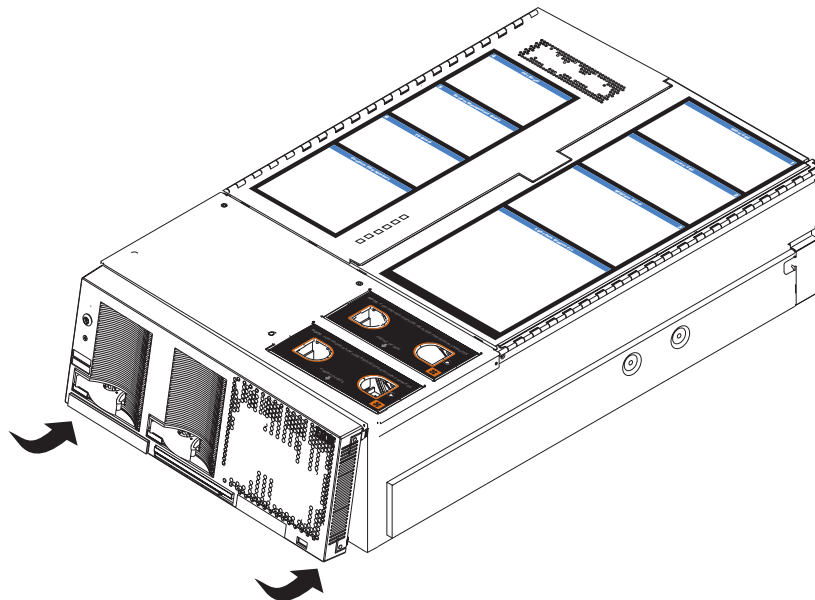
1. Press on the two tabs at the top edge of the bezel, and pull the top of the bezel slightly away from the server.

2. Press on the two tabs at the bottom edge of the bezel, and pull the bezel off the server. Store the bezel in a safe place.



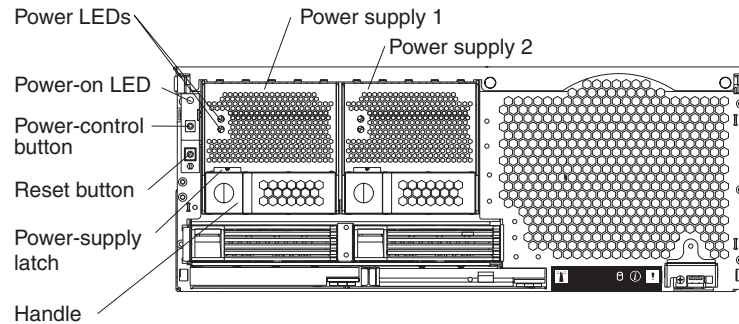
Complete the following steps to replace the bezel:

1. Align the four tabs on the bezel with the slots in the server chassis.
2. Press firmly against the front of the bezel until it snaps into place.



Removing and replacing a hot-swap power supply

Your server comes with two hot-swap power supplies, which you can remove and replace without turning off the server. The following illustration shows the locations of the power supplies on the front of the server.



Before you remove or replace a power supply, review the following information.

Notes:

1. The power supplies are hot-swappable and redundant only at 200-240 V ac.
2. Both power supplies must be connected to the power source for operation at 100-127 V ac.
3. During normal operation, both power supplies must be installed for proper operation and cooling.

If you install or remove a power supply, observe the following precautions.

Statement 8:



CAUTION:

Never remove the cover on a power supply or any part that has the following label attached.

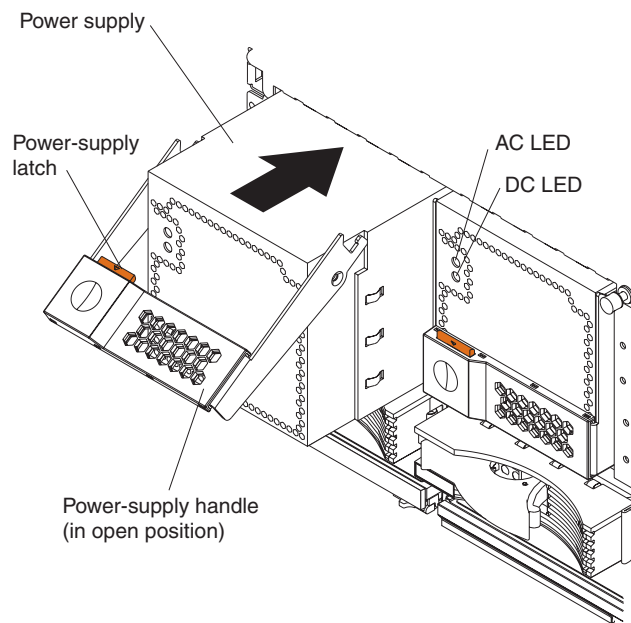


Hazardous voltage, current, and energy levels are present inside any component that has this label attached. There are no serviceable parts inside these components. If you suspect a problem with one of these parts, contact a service technician.

Complete the following steps to remove and replace a power supply:

1. Read the safety information beginning on page v and “Installation guidelines” on page 13.
2. Remove the front bezel (see “Removing and replacing the bezel” on page 16).

3. To remove the power supply from the server, press the latch; then, lift the handle on the power supply to the open position and pull the power supply out from the server.
4. Install the new power supply.



- a. Place the handle on the power supply in the open position.
 - b. Slide the power supply into the chassis and press the handle to the closed position.
5. Verify that the dc power LED and the ac power LED on the power supply are lit, indicating that the power supply is operating correctly.
 6. Replace the front bezel on the server (see “Removing and replacing the bezel” on page 16).

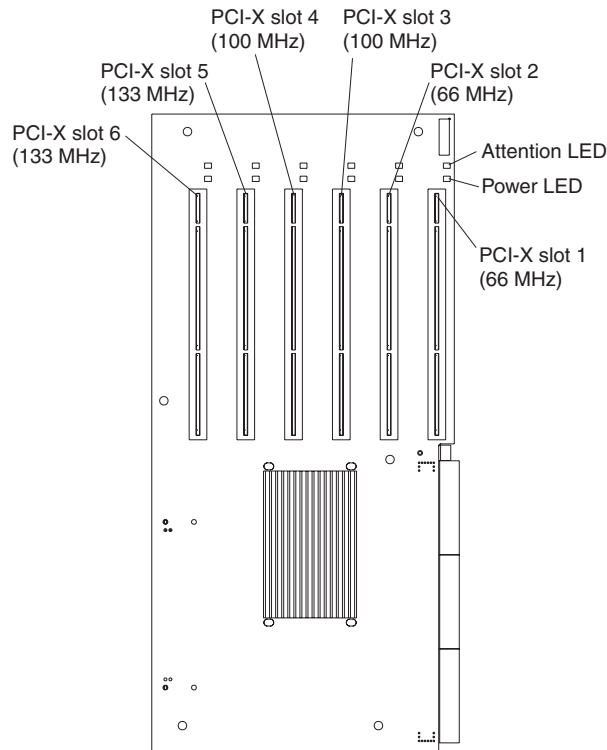
Installing an adapter

Attention: Before you remove or replace the Remote Supervisor Adapter or clear the nonvolatile random access memory (NVRAM), be sure to make a backup copy of the nonvolatile EFI variables. See “Backing up and restoring the nonvolatile variables” on page 56 for more information.

The following notes describe the types of adapters that your server supports and other information that you must consider when installing an adapter:

- The following illustration shows the location and bus speeds of the PCI-X expansion slots on the PCI-X board.

Note: The illustrations in this publication might differ slightly from your hardware.



- Locate the documentation that comes with the adapter and follow those instructions in addition to the instructions in this section. If you need to change the switch settings or jumper settings on your adapter, follow the instructions that come with the adapter.
- Video adapters are not supported.
- Some full-length adapters have extension handles or brackets installed. Before installing the adapter, you must remove the extension handle or bracket.
- Your server supports six hot-plug 64-bit adapters in the expansion slots on the PCI-X board, as shown in the following table.

Bus	Slot	Supported adapter speed (MHz)
A	1	66
A	2	66
B	3	100 (133 if slot 4 is empty)
B	4	100 (133 if slot 3 is empty)
C	5	133
D	6	133

- You can install both PCI and PCI-X adapters on the same bus. However, if you install a PCI adapter and a PCI-X adapter on the same bus, the PCI-X features of the PCI-X adapter will be disabled, and the adapter will function as a PCI adapter.
- You can install PCI or PCI-X adapters of speeds faster than what is labeled for a particular PCI-X bus. For example, if you install two 133 MHz adapters into slots that are labeled as 100 MHz slots, the adapters will operate at 100 MHz.
- If you install a 33 MHz and a 66 MHz adapter on the same bus, the bus speed will match that of the slower adapter.

- If a single 133 MHz adapter is installed on PCI-X bus B (slots 3 and 4) and the other slot on PCI-X bus B is empty, the adapter will operate at 133 MHz.
- Your server supports 3.3 V and universal adapters; it does not support 5.0 V adapters.
- The system scans PCI-X slots to assign system resources. The system attempts to start the first device found. The search order is: PCI-X slots 1, 2, 6, 5, 3, and 4. If an optional remote I/O enclosure is attached, the scan continues with PCI-X slots 11, 12, 9, 10, 7, 8, 17, 18, 15, 16, 13, and 14.

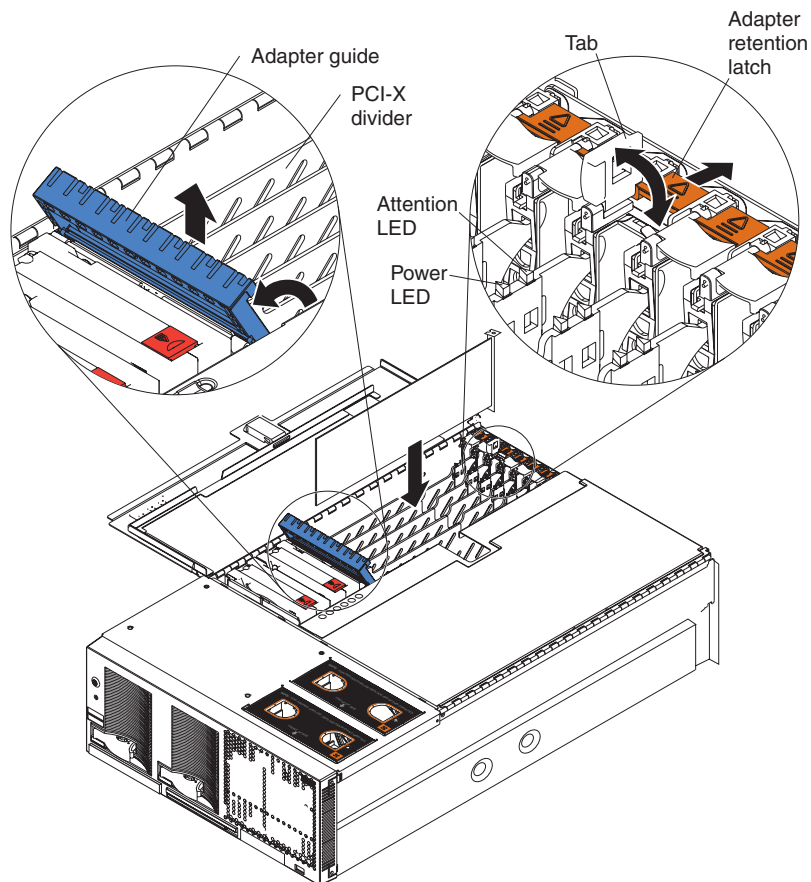
Complete the following steps to install an adapter.

Attention: When you handle static-sensitive devices, take precautions to avoid damage from static electricity. For details about handling these devices, see “Handling static-sensitive devices” on page 14.

1. Read the safety information beginning on page v and “Installation guidelines” on page 13.
2. Disable the PCI-X slot through your operating system before you insert or remove a PCI or PCI-X adapter.

Note: Some operating systems do not support the enabling and disabling of a PCI-X slot. If your operating system does not support this function, turn off the server and peripheral devices, and disconnect the power cords and all external devices from the back of the server before proceeding.

3. Open the top cover.



4. Follow the cabling instructions, if any, that come with the adapter. Route the adapter cables before you install the adapter.

5. Follow the instructions that come with the adapter to set jumpers or switches, if any.
6. Install the adapter:
 - a. If you are installing a full-length adapter, open the blue adapter guide by lifting the front edge, as shown in the illustration.
 - b. Push the orange adapter-retention latch toward the rear of the server and open the tab.
 - c. Remove the expansion-slot cover.
 - d. Carefully grasp the adapter by its top edge or upper corners, and align it with the connector on the PCI-X board.

Note: Some long adapters have extension handles or brackets. Before installing a long adapter, you must remove the extension handle or bracket.
 - e. Press the adapter *firmly* into the adapter connector.

Attention: When you install an adapter, make sure that the adapter is correctly seated in the connector. Improperly seated adapters might cause damage to the PCI-X board or to the adapter.
 - f. Push down on the blue adapter guide to keep the adapter steady.
 - g. Close the tab; then, push down on the blue adapter-retention latch until it clicks into place, securing the adapter.
7. Connect the internal cables to the adapter.
8. If you disabled the slot in step 1, enable the slot.

If you have other options to install or remove, do so now. Otherwise, go to “Completing the installation” on page 41.

Cabling a ServeRAID adapter

Some xSeries 455 models come with an optional IBM ServeRAID™ adapter installed to control hard disk drives. If you are installing an optional IBM ServeRAID adapter, see the ServeRAID documentation and the cabling information in this section to install the ServeRAID adapter.

Servers that do not come with an IBM ServeRAID adapter installed come with two SCSI cables:

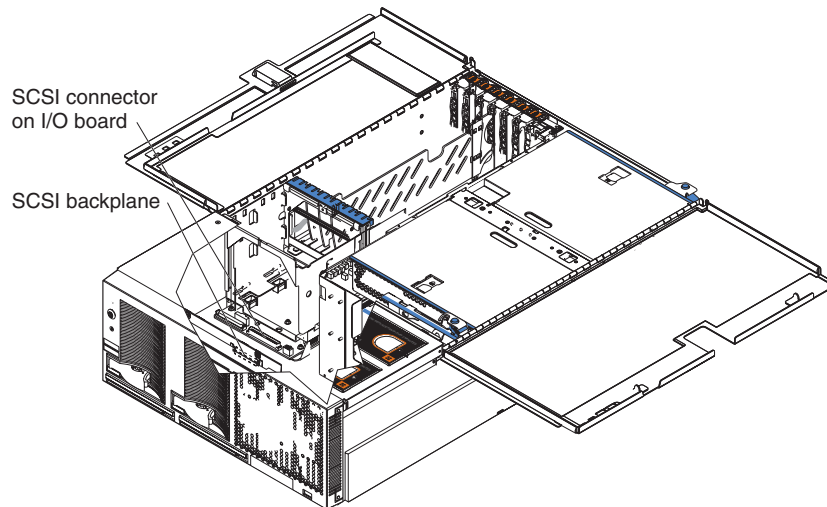
- One end of the first SCSI cable is attached to a SCSI connector on the I/O board, and the other end is attached to the SCSI backplane behind fans 3 and 4.
- The second SCSI cable is preinstalled along the inside of the server and both ends are loose inside the server. When you install a ServeRAID adapter, you can optionally connect this cable to the adapter and to the SCSI backplane to control the internal hard disk drives.

The following procedure describes the internal cabling for installing a ServeRAID adapter.

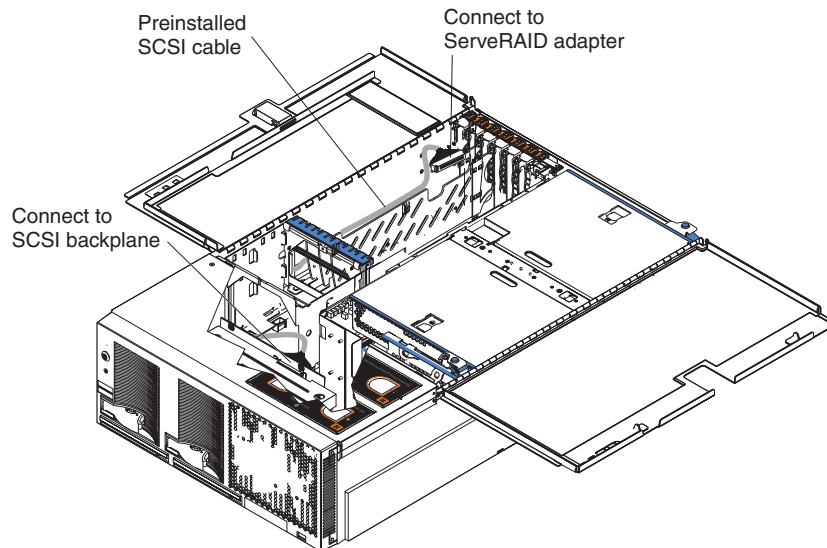
Complete the following steps to cable the ServeRAID adapter:

1. Read the safety information beginning on page v and “Installation guidelines” on page 13.
2. Turn off the server and peripheral devices, and disconnect the power cords and all external cables; then, open the cover.

3. Remove fans 3 and 4, which are located just behind the PCI-X slots (see “Major components of the xSeries 455 server” on page 3 for the locations of the fans).
4. Disconnect the short SCSI cable from the SCSI backplane and the SCSI connector on the I/O board; then, store this short cable in a safe place for future use.



5. Install the ServeRAID adapter in a PCI-X slot (see “Installing an adapter” on page 19). Install the ServeRAID adapter in PCI-X slot 6, if the adapter will control the internal hard disk drives.



6. Locate the preinstalled SCSI cable; then, attach the connector on the cable to the ServeRAID adapter.
7. Locate the connector on the opposite end of the SCSI cable and connect it to the SCSI backplane.
8. Reinstall fans 3 and 4.

If you have other options to install or remove, do so now. Otherwise, go to “Completing the installation” on page 41.

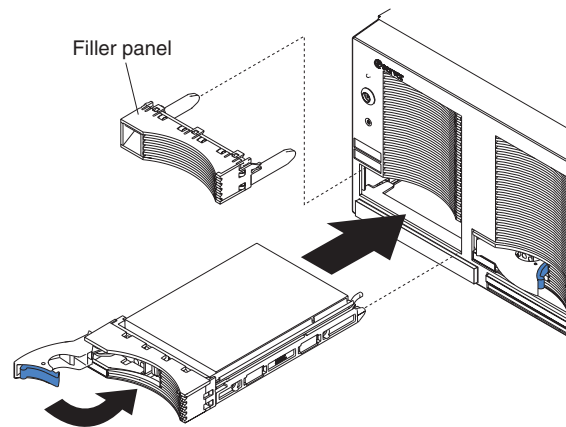
Installing a hot-swap hard disk drive

Complete the following steps to install or replace a hot-swap hard disk drive.

Attention:

- When you handle static-sensitive devices, take precautions to avoid damage from static electricity. For details about handling these devices, see “Handling static-sensitive devices” on page 14.
 - Before you hot-swap a drive, make sure that it is defective. If you partially or completely remove a good drive instead of a defective one, your server might lose data.
 - If you replace a hot-swap drive, remove the defective drive and wait 15 seconds before you install a new drive.
1. Inspect the drive for any signs of damage.
 2. Read the safety information beginning on page v and “Installation guidelines” on page 13.
 3. Check the instructions that come with the drive for more information about installing the drive.
 4. Remove the filler panel or defective hard disk drive from the hard disk drive bay.

Attention: Only replace a hard disk drive if the amber hard disk drive error LED is lit continuously.



5. Install the new hard disk drive in the drive bay:
 - a. Make sure that the handle on the hard disk drive tray is in the open position.
 - b. Slide the drive into the bay until it stops.
 - c. Push the handle on the front of the hard disk drive closed.
 - d. Check the hard disk drive status LED to verify that the hard disk drive is operating properly.

If the amber hard disk drive error LED for a drive is lit continuously, that individual drive is faulty and needs to be replaced. If the green hard disk drive activity LED is flashing, the drive is being accessed.

If you have other options to install or remove, do so now. Otherwise, go to “Completing the installation” on page 41.

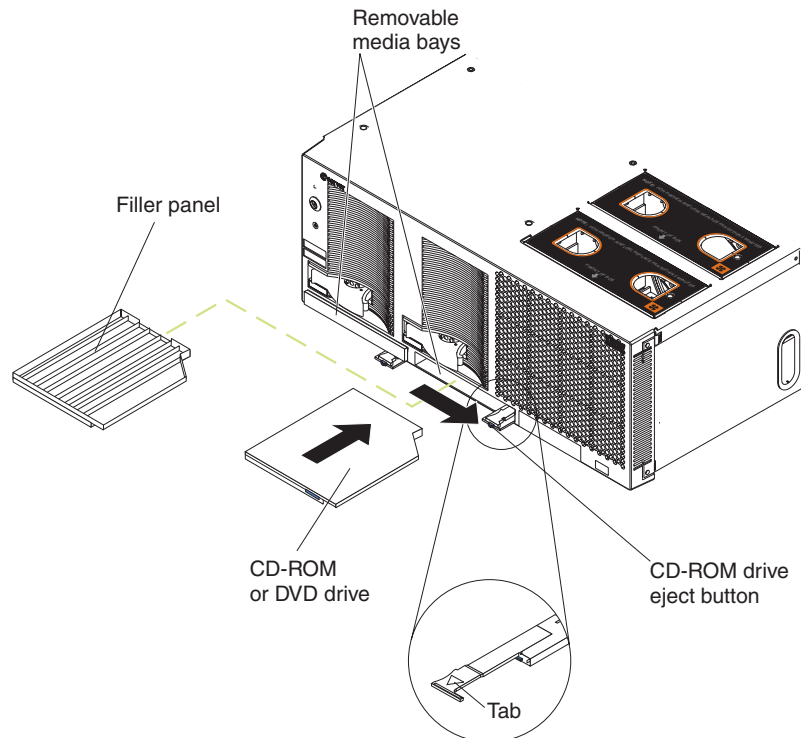
Installing a CD-ROM or DVD-ROM drive

The following notes describe the types of CD-ROM or DVD-ROM drives that your server supports and other information that you must consider when installing a CD-ROM or DVD-ROM drive:

- Your xSeries 455 server supports up to two CD-ROM drives, or two DVD-ROM drives, or a combination.
- If you have only one IDE device installed, it must be installed in the right removable-media bay. CD-ROM or DVD-ROM drives can be installed in either removable-media bay.

Complete the following steps to install a CD-ROM or DVD-ROM drive in your server:

1. Read the safety information beginning on page v and “Installation guidelines” on page 13.
2. Turn off the server and peripheral devices, and disconnect the power cords and all external devices from the back of the server.
3. Push the drive-eject button to the right.
4. Remove the filler panel or defective drive from the drive bay.
5. Inspect the drive for any signs of damage.
6. Slide the CD-ROM or DVD-ROM drive into the drive bay until it stops.



If you have other options to install or remove, do so now. Otherwise, go to “Completing the installation” on page 41.

Complete the following steps to remove a CD-ROM or DVD-ROM drive in your server:

1. Read the safety information beginning on page v and “Installation guidelines” on page 13.

2. Turn off the server and peripheral devices, and disconnect the power cords and all external devices from the back of the server.
3. Push the drive-eject button to the right.
4. Using the tab, pull the CD-ROM or DVD-ROM drive partially out of the server; then, grasp the drive and remove it from the server.
5. Install a filler panel or drive in the drive bay.

If you have other options to install or remove, do so now. Otherwise, go to “Completing the installation” on page 41.

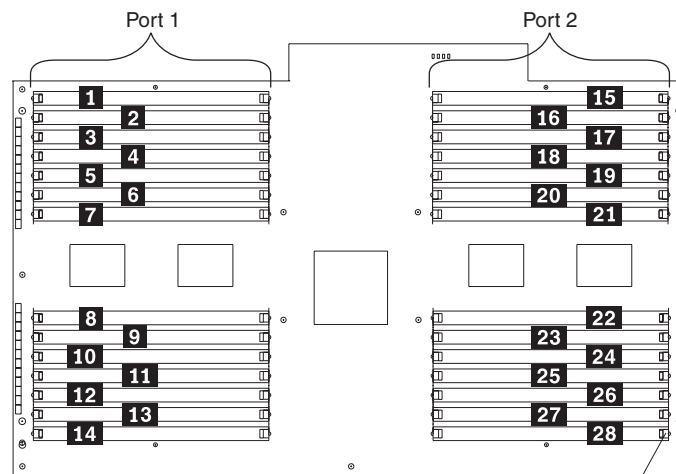
Installing memory

The following notes describe the types of dual inline memory modules (DIMMs) that your server supports and other information that you must consider when installing DIMMs:

- Your server supports 512 MB, 1 GB, and 2 GB DIMMs, for a maximum of 56 GB of system memory. Your server supports up to twenty-eight 2.5 V, 184 pin, PC2100, ECC DDR SDRAM, 133 MHZ DIMMs. Go to the ServerProven® list at <http://www.ibm.com/pc/compat/> for a list of memory modules you can use with your server.
- Your server comes with a minimum of two 512 MB DIMMs, installed in slots 1 and 14. When installing additional DIMMs, you must install two DIMMs at a time, in the order shown in the following table to maintain performance.

Table 2. DIMM installation sequence

Pair	DIMM connectors (port 1)	Pair	DIMM connectors (port 2)
1	1 and 14	2	15 and 28
3	2 and 13	4	16 and 27
5	3 and 12	6	17 and 26
7	4 and 11	8	18 and 25
9	5 and 10	10	19 and 24
11	6 and 9	12	20 and 23
13	7 and 8	14	21 and 22



DIMM error LEDs are built into each handle

- Each DIMM in a pair must be of the same size and technology to ensure that the server will operate properly.
- You can configure your server to use memory mirroring and memory scrubbing. For detailed information about configuring your server and using these features, see the *User's Guide* on the IBM xSeries Documentation CD.
- When using memory mirroring, you must install two pairs of DIMMs at a time. The four DIMMs in each bank must be identical. The following table shows the pairs that are in each bank. See Table 2 on page 26 for the DIMM connector pair assignments.

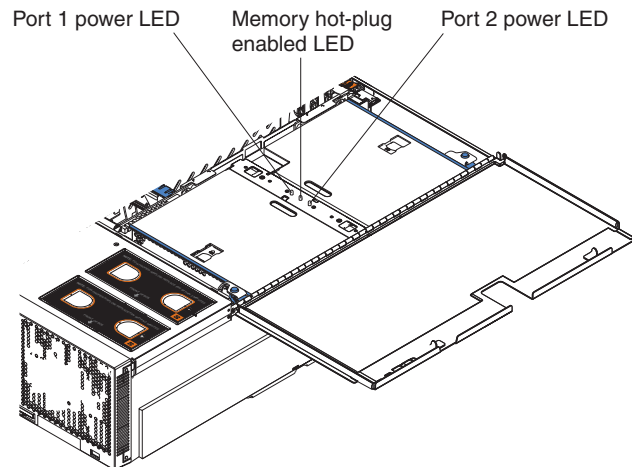
Table 3. Memory mirroring DIMM installation sequence

Bank	DIMM pairs	Bank	DIMM pairs
1	1 and 2	5	9 and 10
2	3 and 4	6	11 and 12
3	5 and 6	7	13 and 14
4	7 and 8		

- You can replace a failed DIMM while the server is on, provided that you have enabled memory mirroring and that you have installed all DIMMs in the sequence to support memory mirroring.

If a problem with a DIMM is detected, light path diagnostics will light the system-error LED on the front of the server, indicating that there is a problem and guide you to the defective DIMM. When this occurs, first identify the defective DIMM; then, remove and replace the DIMM. See “Hot-replacing DIMMs” on page 29 for instructions.

The following illustration shows the LEDs on the DIMM access door:



Port 1 power LED: When this LED is off, it indicates that power is removed from the port and that you can replace a failed DIMM.

Memory hot-plug enabled LED: When this LED is lit, it indicates that hot-swap memory is enabled. When this LED is flashing, it indicates that data is being mirrored on the replacement DIMMs.

Port 2 power LED: When this LED is off, it indicates that power is removed from the port and that you can replace a failed DIMM.

- When you install or remove DIMMs, the server configuration information changes. When you restart the server, the server displays a message indicating that the memory configuration has changed.

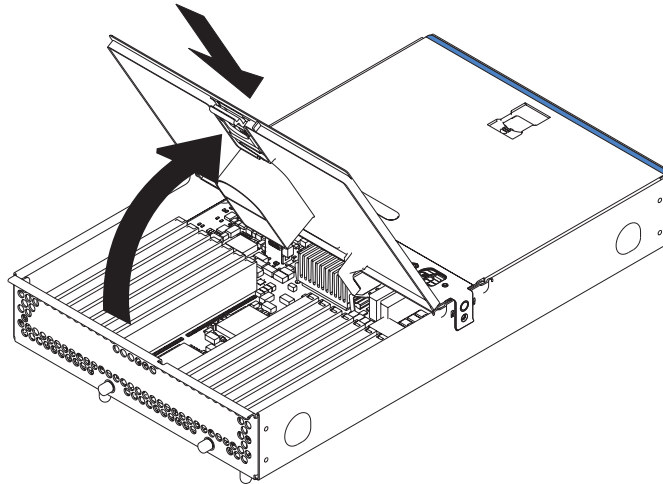
Removing and replacing DIMMs

Complete the following steps to install a DIMM in your server with the server turned off:

1. Read the safety information beginning on page v and “Installation guidelines” on page 13.
2. Turn off the server and peripheral devices, and disconnect the power cords and all external cables; then, open the server cover.

Attention: When you handle static-sensitive devices, take precautions to avoid damage from static electricity. For details about handling these devices, see “Handling static-sensitive devices” on page 14.

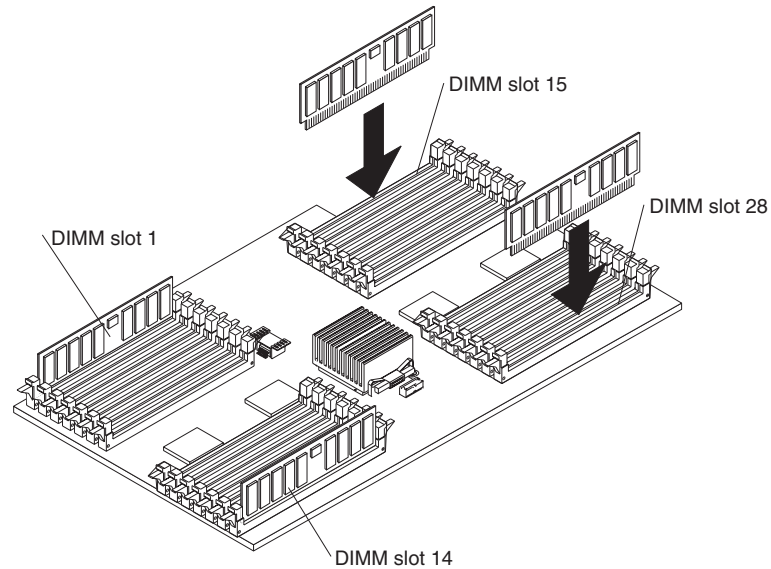
3. Open the DIMM access door that covers the DIMM connector into which you will be installing the DIMM.



4. Install the new DIMM:
 - a. Open the retaining clip on each end of the DIMM connector.
 - b. Touch the static-protective package containing the DIMM to any unpainted metal surface on the server. Then, remove the DIMM from the package.

Attention: To avoid breaking the retaining clips or damaging the DIMM connectors, open and close the clips gently.
 - c. Turn the DIMM so that the DIMM keys align correctly with the slot.
 - d. Insert the DIMM into the connector by aligning the edges of the DIMM with the slots at the ends of the DIMM connector. Firmly press the DIMM straight down into the connector by applying pressure on both ends of the DIMM simultaneously. The retaining clips snap into the locked position when the DIMM is firmly seated in the connector. If there is a gap between the DIMM and the retaining clips, the DIMM has not been correctly inserted; open the

retaining clips, remove the DIMM, and then reinsert it.



5. Close the DIMM access door.

If you have other options to install or remove, do so now. Otherwise, go to “Completing the installation” on page 41.

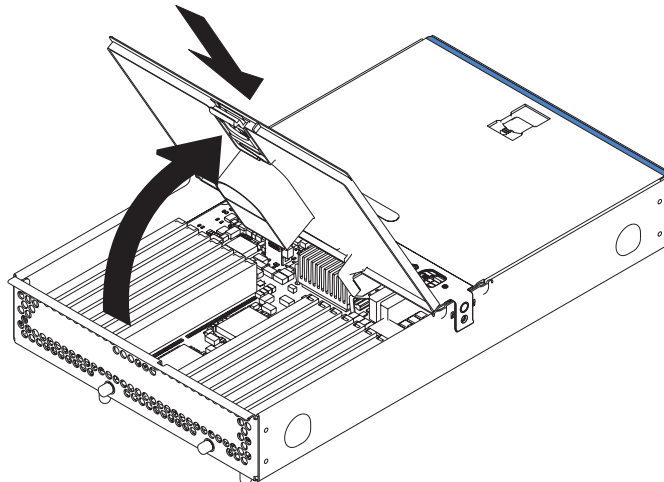
Hot-replacing DIMMs

Complete the following steps to install a DIMM in your server with the server turned on:

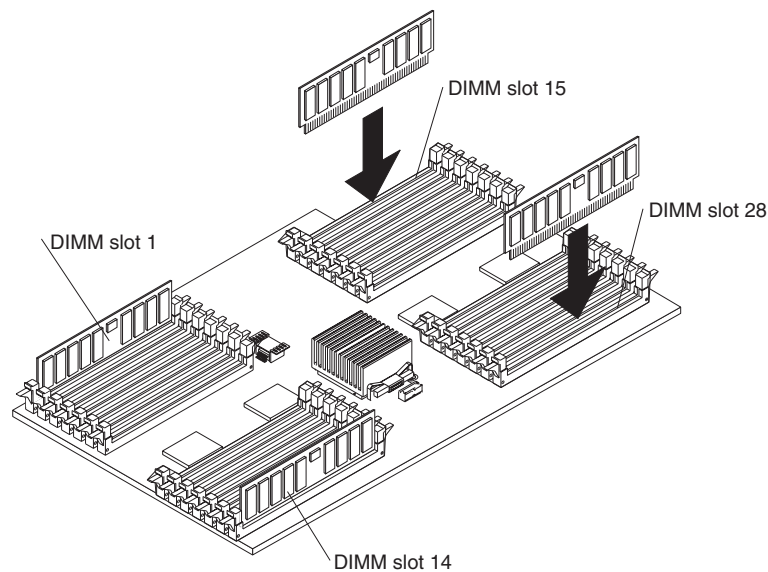
1. Read the safety information beginning on page v and “Installation guidelines” on page 13.
2. Open the top cover and verify that the memory hot-plug enabled LED on the DIMM access door is lit before removing and replacing the DIMM.

Attention: When you handle static-sensitive devices, take precautions to avoid damage from static electricity. For details about handling these devices, see “Handling static-sensitive devices” on page 14.

3. Open the DIMM access door and verify that the memory port power LED is off before replacing a DIMM. Then, open the retaining clip on each end of the DIMM connector and remove the DIMM from the server.



4. Install the new DIMM:
 - a. Open the retaining clip on each end of the DIMM connector.
 - b. Touch the static-protective package containing the DIMM to any unpainted metal surface on the server. Then, remove the DIMM from the package.
Attention: To avoid breaking the retaining clips or damaging the DIMM connectors, open and close the clips gently.
 - c. Turn the DIMM so that the DIMM keys align correctly with the slot.
 - d. Insert the DIMM into the connector by aligning the edges of the DIMM with the slots at the ends of the DIMM connector. Firmly press the DIMM straight down into the connector by applying pressure on both ends of the DIMM simultaneously. The retaining clips snap into the locked position when the DIMM is firmly seated in the connector. If there is a gap between the DIMM and the retaining clips, the DIMM has not been correctly inserted; open the retaining clips, remove the DIMM, and then reinsert it.



5. Close the DIMM access door and verify that the memory port power LED is lit.

Note: The memory hot-plug enabled LED flashes to indicate that data is being mirrored on the replacement DIMMs. Wait until the LED stops flashing before you hot-replace DIMMs again.

If you have other options to install or remove, do so now. Otherwise, go to “Completing the installation” on page 41.

Installing and replacing a microprocessor and power module

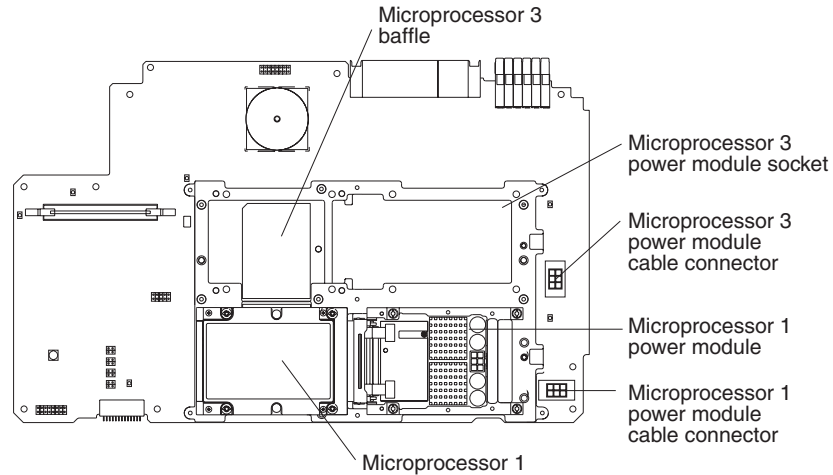
The following notes describe the type of microprocessor that your server supports and other information that you must consider when installing and replacing a microprocessor:

- Your server supports up to four Intel® Itanium 2 microprocessors.
- Update the server system abstraction layer/extensible firmware interface (SAL/EFI) code. To download the most current level of SAL/EFI code for the server, go to <http://www.ibm.com/pc/support/>.
- You will need the following tools:
 - 2.5-mm hex (Allen) wrench (provided with the microprocessor option)
 - T15 Torx wrench (provided with the microprocessor option)

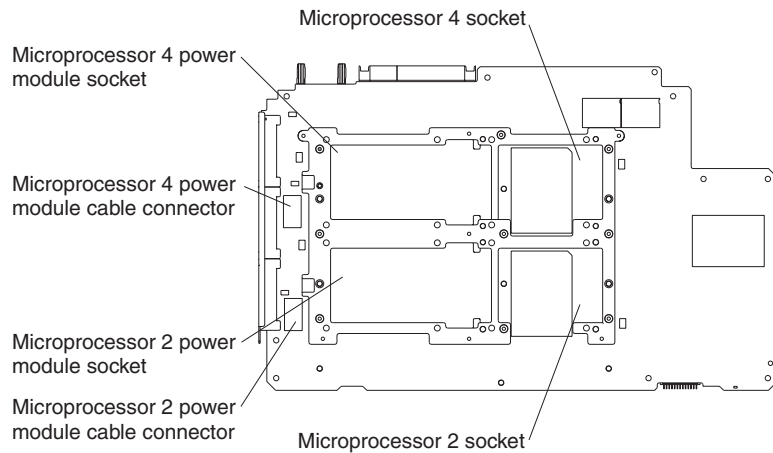
- To order additional microprocessor options, contact your IBM marketing representative or authorized reseller.
- Populate the microprocessor sockets in numeric order. Install the first microprocessor in microprocessor socket 1, the second microprocessor in microprocessor socket 2, and so on.
- The following illustrations show the locations of the microprocessor connectors on the processor board.

Note: The illustrations in this publication might differ slightly from your hardware.

Front



Back



Important: To ensure proper server operation after you install replacement or additional microprocessors, install only microprocessors that have the same cache size and type, and the same clock speed. For a list of microprocessors supported by your server, go to the ServerProven list at <http://www.ibm.com/pc/us/compat/>.

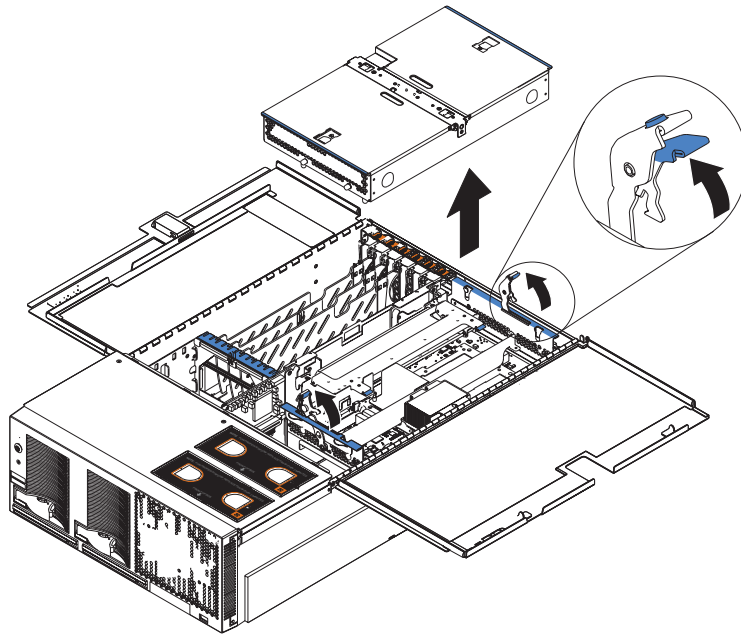
Complete the following steps in the prescribed order to install and replace a microprocessor.

Attention: Failure to complete the following steps in the prescribed order might cause damage to the microprocessor pins and cause the microprocessor to fail.

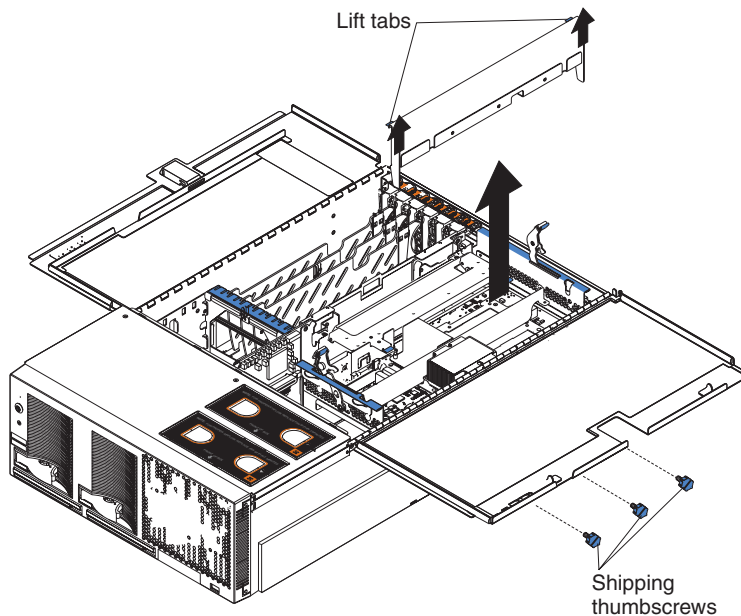
1. Read the safety information beginning on page v and “Installation guidelines” on page 13.
2. Turn off the server and peripheral devices, and disconnect the power cords and all external cables; then, open the cover.
3. Remove the memory-board assembly from the server.

Attention: When you handle static-sensitive devices, take precautions to avoid damage from static electricity. For details about handling these devices, see “Handling static-sensitive devices” on page 14.

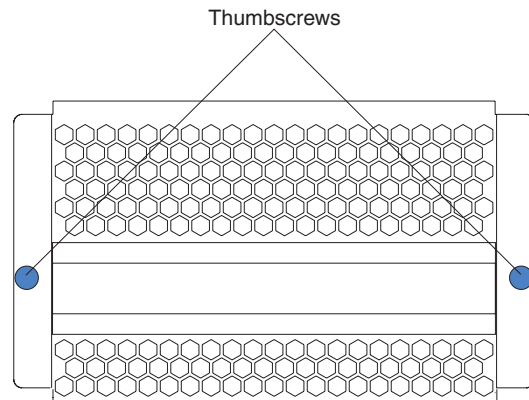
- a. Pull up on the levers to detach the memory-board assembly.
- b. Carefully remove the memory-board assembly from the server and set it aside.



4. Remove the shipping thumbscrews from the right side of the server.
5. Lift the retention bracket from the server.



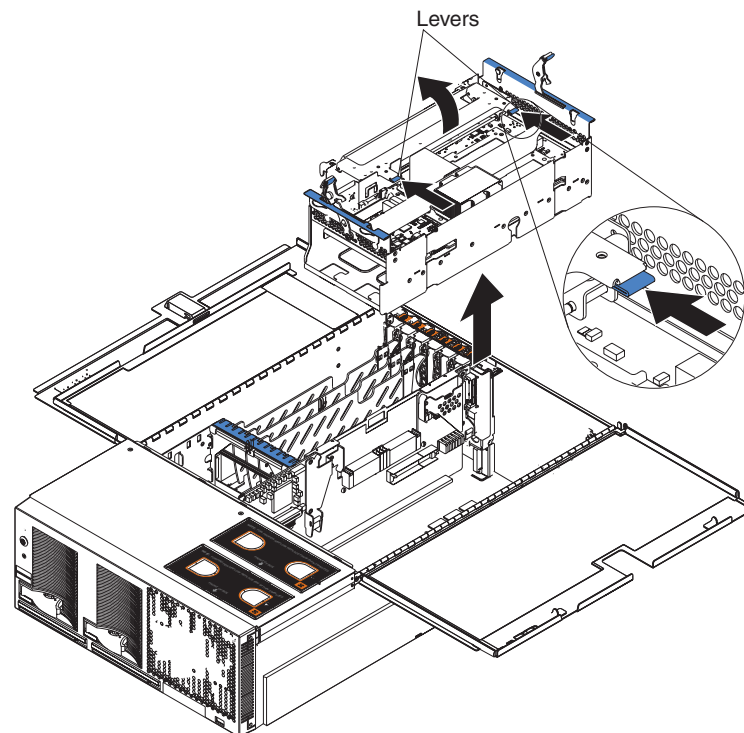
6. Loosen the blue thumbscrews securing the EMC shield; then, remove the EMC shield from the server.



7. Remove the processor-board assembly from the server.

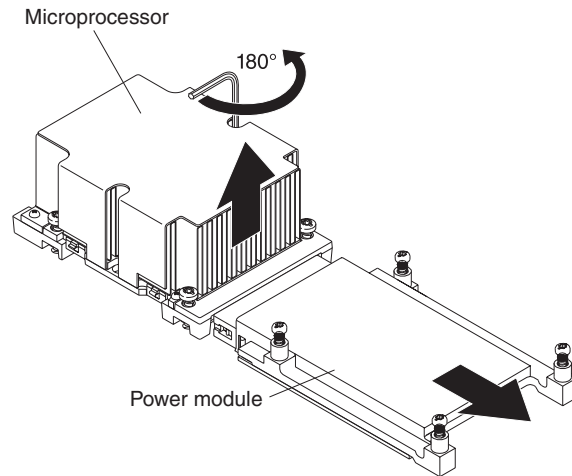
Attention: When you handle static-sensitive devices, take precautions to avoid damage from static electricity. For details about handling these devices, see “Handling static-sensitive devices” on page 14.

- a. Press to unlock the levers securing the processor-board assembly and pull up on the levers to release the processor-board assembly.
- b. Slide the assembly toward the right side of the server.
- c. Carefully remove the processor-board assembly from the server and place it on a flat, level surface.

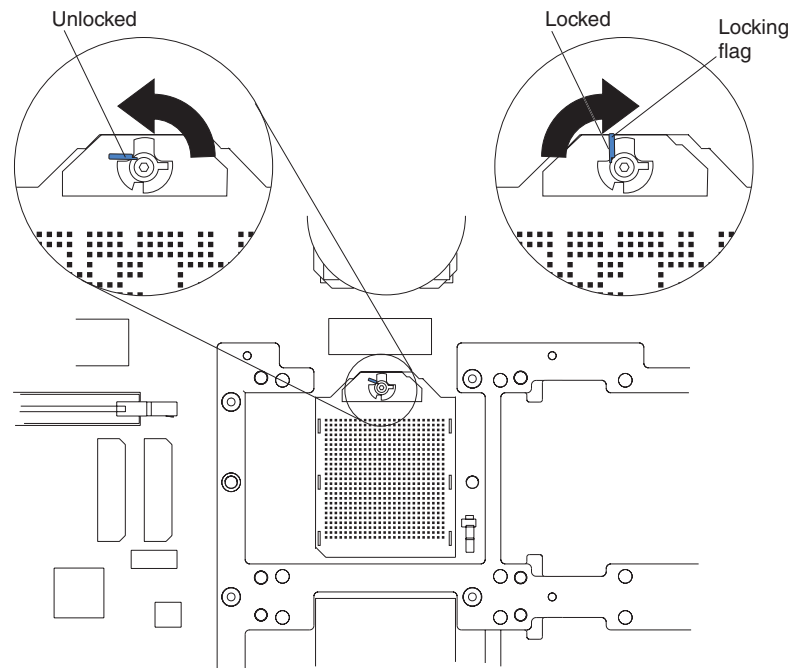


8. If you are installing a new microprocessor, go to step 9 on page 34; otherwise, continue.

Attention: Failure to complete the instructions in the prescribed order might cause damage to the microprocessor pins and cause the microprocessor to fail.

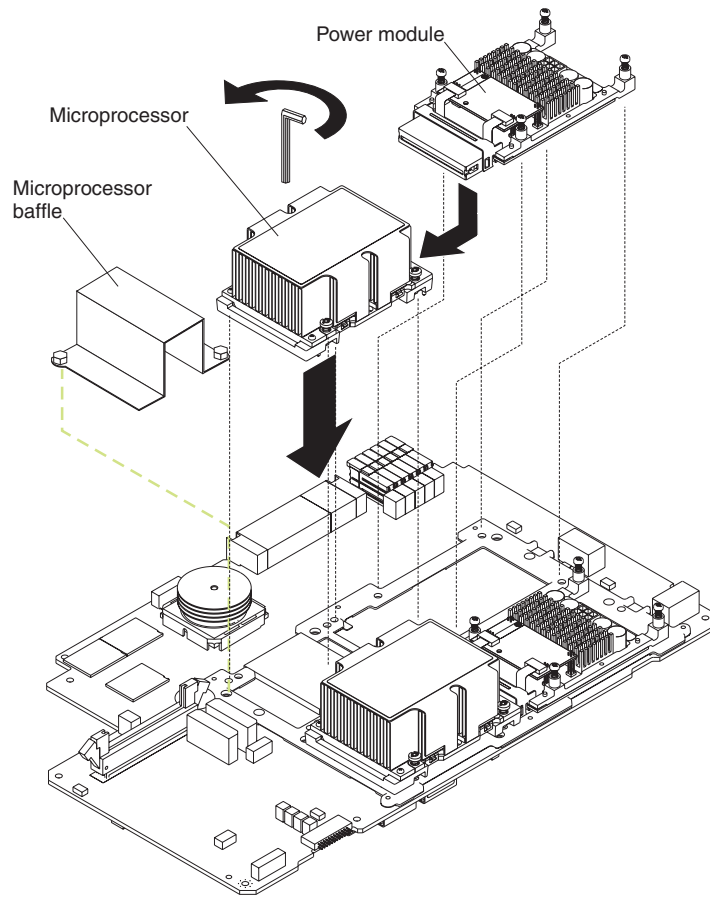


- a. Using the T-handled Torx wrench provided with the microprocessor option, completely loosen the power-module screws.
- b. Slide the power module from the microprocessor and remove the power module.
- c. Completely loosen the heat-sink screws.
- d. Use the hex wrench provided with the microprocessor option to open the socket lock and remove the microprocessor.



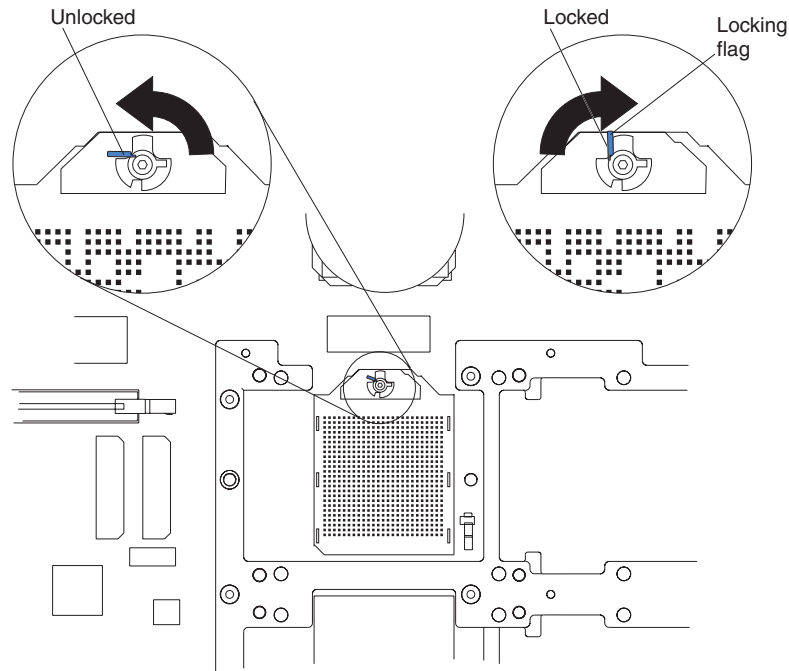
9. Install the microprocessor and power module:
 - a. Remove the microprocessor baffle from the microprocessor socket. Keep the microprocessor baffle for future use.
 - b. Remove the protective tape covering the microprocessor socket, if there is any.

Attention: Inserting the microprocessor in a locked connector might damage the pins and cause the microprocessor to fail.



- c. Make sure that the socket lock is in the fully open (unlocked) position to permit inserting the microprocessor. Use the hex wrench that is provided with the microprocessor option to open the lock, if necessary.

Note: Examine the socket lock of an installed microprocessor to identify the locking flag in the locked position.



Attention: When you handle static-sensitive devices, take precautions to avoid damage from static electricity. For details about handling these devices, see “Handling static-sensitive devices” on page 14.

- d. Touch the static-protective package containing the microprocessor to any unpainted metal surface on the server. Then, remove the microprocessor and power module from the package.

Attention:

- 1) Forcing the microprocessor socket lock clockwise beyond the closed position might damage the socket locking mechanism. Before you install a microprocessor in the socket, use the hex wrench that is provided with the microprocessor option to close and open the socket lock to observe the locking flag in the closed position. Also, note the resistance of the locking mechanism in the closed position. When installing the microprocessor, do not force the socket lock clockwise beyond the closed position. If you need to see the microprocessor socket lock clearly, shine a flashlight over the microprocessor connector.
 - 2) Make sure that the microprocessor is aligned and seated correctly before you proceed. To avoid bending the pins on the microprocessor, do not use excessive force when pressing it into the socket.
- e. Insert the microprocessor gently into the connector. The microprocessor rests flat on the retention mechanism when properly seated.
 - f. Lock the socket lock, using the hex wrench that is provided with the microprocessor option.
 - g. Tighten the heat-sink screws to secure the microprocessor, using the T-handled Torx wrench that is provided with the microprocessor option.
 - h. Slide the power module gently into the microprocessor.
 - i. Tighten the power-module screws to secure the power module.

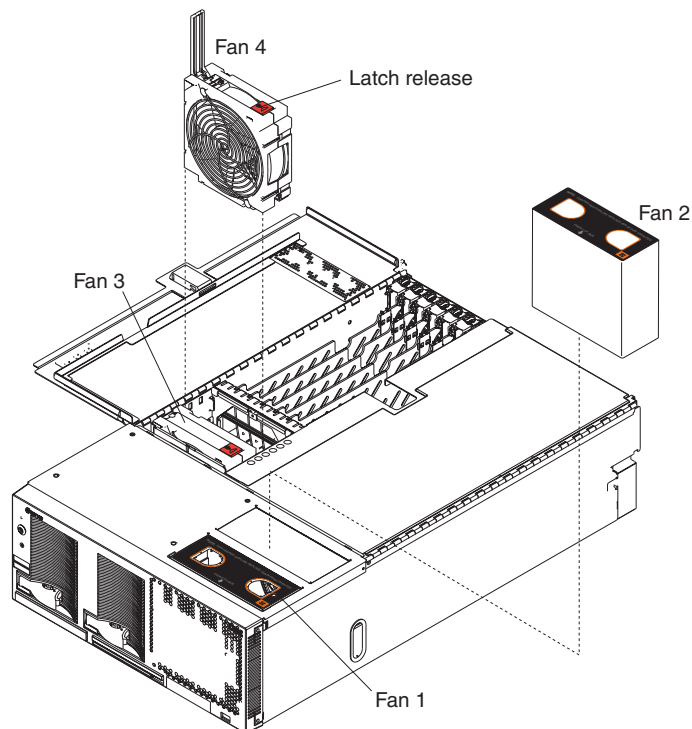
- j. Connect the power-module cable to the power module and to the adjacent power-module cable connector.
10. Carefully install the processor-board assembly and retention bracket.
11. Install the EMC shield on the rear of the server; then, hand-tighten the blue thumbscrews to secure the EMC shield.
12. Carefully install the memory-board assembly.

If you have other options to install or remove, do so now. Otherwise, go to “Completing the installation” on page 41.

Replacing and troubleshooting fans

Your xSeries 455 server has four hot-swap fan assemblies, two 150 mm x 51 mm fans and two 150 mm x 38 mm fans. The two 150 mm x 51 mm fans (fan 1 and fan 2) are located toward the front of the server and are used to cool the memory board and processor board. The two 150 mm x 38 mm fans (fan 3 and fan 4) are located just behind the PCI-X board and are used to cool the power supplies, PCI-X slots, and other components.

Note: The illustrations in this document might differ slightly from your hardware.



Each fan has an LED to help you detect a problem. When the fan is operating correctly, this LED is off. If a fan stops working, light path diagnostics will light the system-error LED on the front of the server, indicating that there is a problem, and guide you to the defective fan; then, using the applicable procedure, remove and replace the fan.

Replacing fan 1 or 2

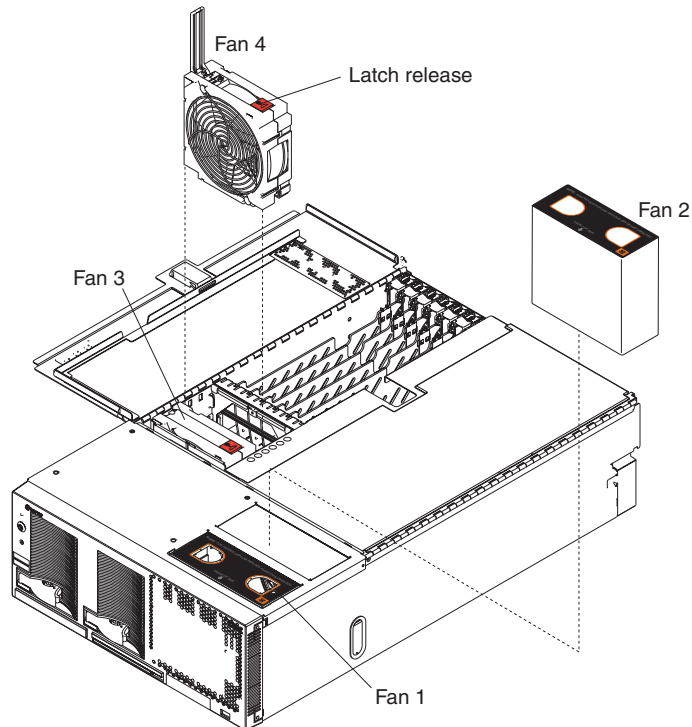
As shown in the illustration, fans 1 and 2 are located on the right side of the server. These fans are redundant; if one fails, the remaining fan will temporarily speed up to properly cool the server components.

Attention: A fan must be replaced within 48 hours of failing.

Complete the following steps to replace fan 1 or 2:

1. Read the safety information beginning on page v and “Installation guidelines” on page 13.
2. Remove the fan from the server:
 - a. Place your fingers into the two finger holes on the top of the fan and squeeze them together.

Note: The illustrations in this document might differ slightly from your hardware.



- b. Lift the fan out of the server.
3. Turn the new fan so that the LED on the top of the fan is to the right side of the server.
 4. Push the replacement fan assembly into the server until it clicks into place.

If you have other options to install or remove, do so now. Otherwise, go to “Completing the installation” on page 41.

Replacing fan 3 or 4

As shown in the illustration, fan 3 and fan 4 are located in front of the PCI-X slots. These fans are redundant; if one fails, the remaining fan will temporarily speed up to properly cool server components.

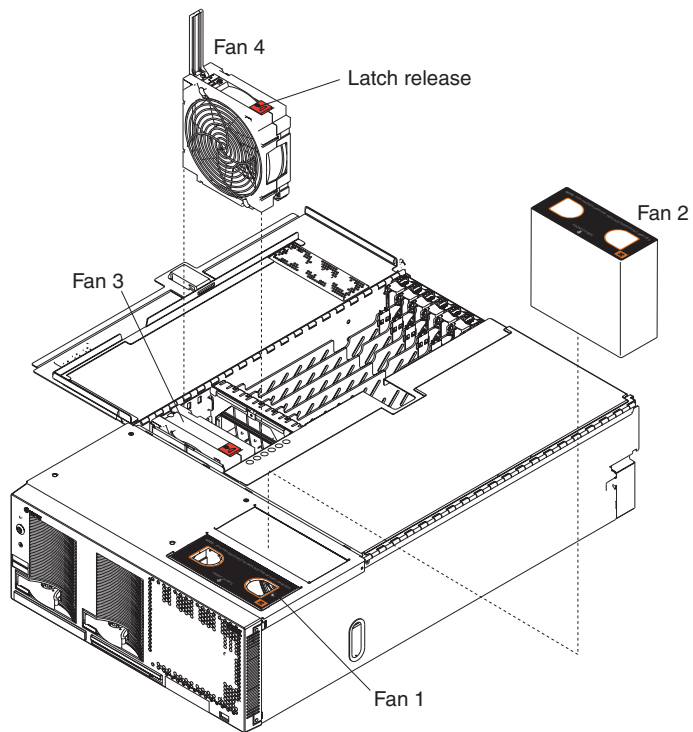
Attention: A fan must be replaced within 48 hours of failing.

Complete the following steps to replace fan 3 or 4:

1. Read the safety information beginning on page v and “Installation guidelines” on page 13.
2. Remove the fan from the server:

- a. Press the latch release to the right and let the handle come up.

Note: The illustrations in this document might differ slightly from your hardware.



- b. Grasp the handle and lift the fan out of the server.
3. Turn the new fan so that the latch release on the top of the fan is to the right side of the server.
4. With the handle raised, push the replacement fan assembly into the server until it clicks into place.
5. Push the handle down until it clicks into place under the latch release.

If you have other options to install or remove, do so now. Otherwise, go to “Completing the installation” on page 41.

Replacing the battery

When replacing the battery you must replace it with a lithium battery of the same type, from the same manufacturer. To avoid possible danger, read and follow the safety statement below.

To order replacement batteries, call 1-800-772-2227 within the United States, and 1-800-465-7999 or 1-800-465-6666 within Canada. Outside the U.S. and Canada, call your IBM reseller or IBM marketing representative.

Note: After you replace the battery, you must reconfigure your server and reset the system date and time.

Statement 2:



CAUTION:

When replacing the lithium battery, use only IBM Part Number 33F8354 or an equivalent type battery recommended by the manufacturer. If your system has a module containing a lithium battery, replace it only with the same module type made by the same manufacturer. The battery contains lithium and can explode if not properly used, handled, or disposed of.

Do not:

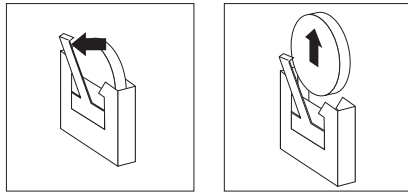
- **Throw or immerse into water**
- **Heat to more than 100°C (212°F)**
- **Repair or disassemble**

Dispose of the battery as required by local ordinances or regulations.

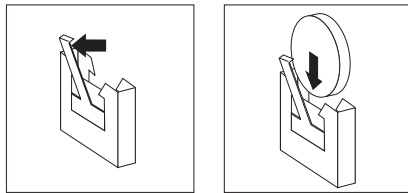
Complete the following steps to replace the battery:

1. Read the safety information beginning on page v and “Installation guidelines” on page 13. Follow any special handling and installation instructions supplied with the replacement battery.
2. Turn off the server and peripheral devices, and disconnect the power cords and all external cables from the server; then, open the cover (see “Opening the cover” on page 16 for details).
3. Remove fans 3 and 4 from the server (see “Replacing fan 3 or 4” on page 38 for details).

4. Remove the battery:
 - a. Use one finger to press the top of the battery clip away from the battery.
 - b. Lift and remove the battery from the socket.



5. Insert the new battery:
 - a. Use one finger to press the top of the battery clip away from the battery.
 - b. Press the battery into the socket until it clicks into place. Make sure that the battery clip holds the battery securely.



6. Install fans 3 and 4 in the server (see “Replacing fan 3 or 4” on page 38 for details).
7. Close the server cover, and connect the cables.
8. Turn on the server.
9. Start the Configuration/Setup Utility program and set configuration parameters.
 - Set the system date and time.
 - Set the power-on password.
 - Reconfigure your server.

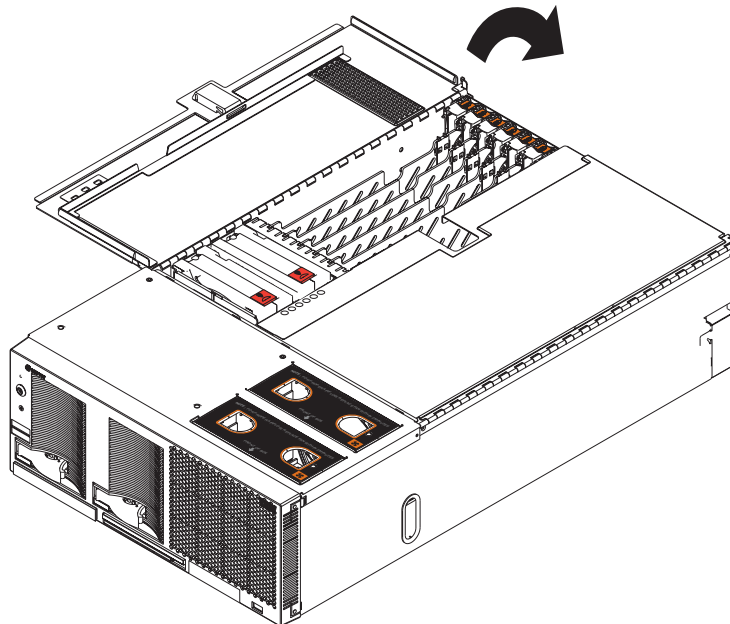
Completing the installation

To complete your installation, close the server cover, install your server in a rack, reconnect all cables that you disconnected earlier, and for certain options, run the Configuration/Setup Utility program. Follow the instructions in this section.

Attention: For proper cooling and airflow, close the server cover before or shortly after turning on the server. Operating the server for extended periods of time (over 15 minutes) with the server cover open might damage server components.

Closing the cover

Close the cover by first closing the right side; then, close the left side and press down to latch the two halves of the cover in place.



Installing the server in a rack

Detailed cabling instructions, including the use of the cable management arm (which comes with the server) are in the *Rack Installation Instructions* that come with the server.

Connecting the cables

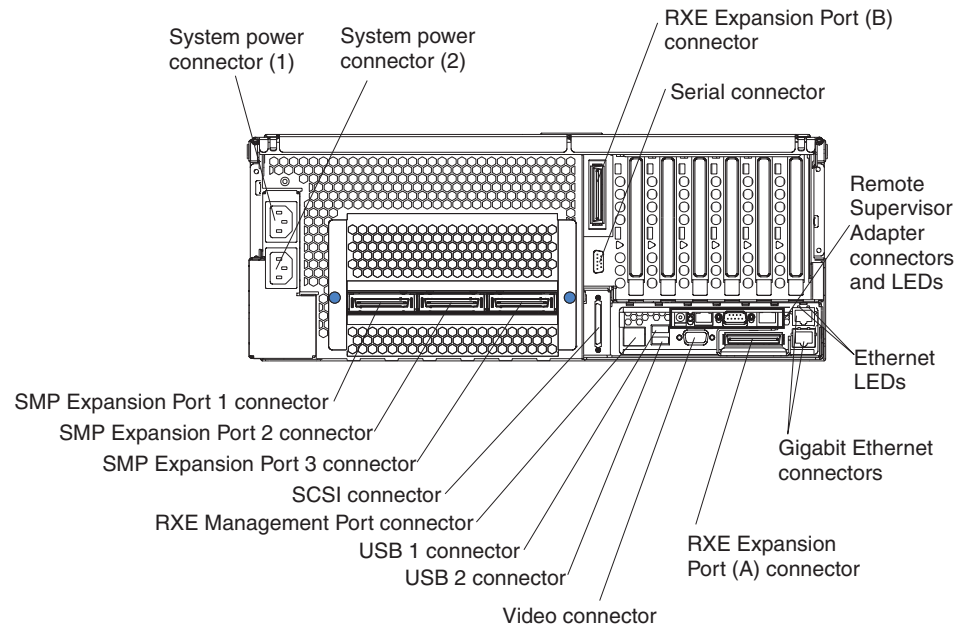
The following illustration shows the locations of the input and output connectors on your server.

Notes:

1. You must turn off the server before connecting or disconnecting cables from your server.
2. See the documentation that comes with your external devices for additional cabling instructions. It might be easier for you to route cables before you connect the devices to the server.
3. Cable identifiers are printed on the cables that come with your server and options. Use these identifiers to connect the cables to the correct connectors.
4. There are two optional IBM @server xSeries 455 SMP Expansion cable kits available to connect the SMP Expansion Port connectors.
 - 4-way to 8-way Scalability Kit (comes with two 2.5 m (8.2 feet) SMP Expansion cables).
 - 8-way to 16-way Supplemental Kit (comes with three 2.5 m (8.2 feet) SMP Expansion cables and one 3.5 m (11.6 feet) SMP Expansion cable).
5. If your server comes with an operating system installed, see the documentation that comes with your software for additional cabling instructions.
6. To effectively manage the cables on your server, keep groups of cables secured together, and do not run cables across the back of the server. Use cable ties to

bundle similar cables together. Use hook-and-loop fasteners to secure the cable bundles to the vertical rails of the rack cabinet.

Attention: Do not secure cables too tightly. Overtightening can cause internal damage to the cables.



SMP Expansion cabling

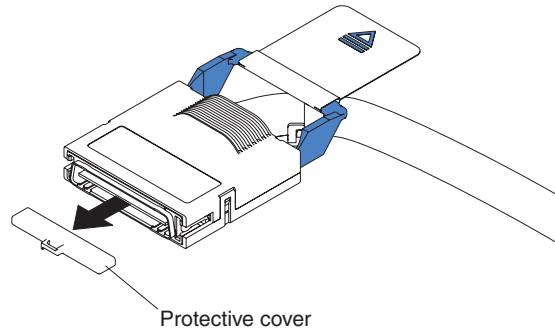
The cabling information in this section is for multi-node configurations using two or four servers. A node is one of multiple servers in a configuration interconnected through the SMP Expansion Ports to share system resources.

Complete the following steps to configure and cable a multi-node configuration:

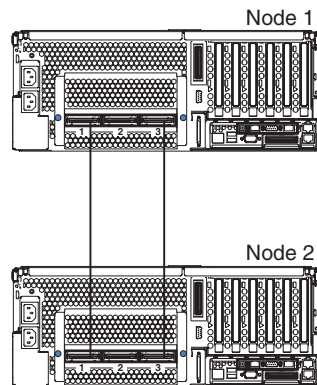
1. Update the SAL/EFI code and the service processor firmware. To download the most current level of SAL/EFI code and service processor firmware, go to <http://www.ibm.com/pc/support/>. For more information:
 - Read the release notes included with the SAL/EFI code.
 - See the *Remote Supervisor Adapter User's Guide* on the IBM xSeries Documentation CD.
2. Configure the nodes using the Configuration/Setup Utility program. See the *User's Guide* on the IBM xSeries Documentation CD.
3. Cable the configuration using the instructions in this section.
4. Configure the scalable partition. See "Configuring a scalable partition" in the *User's Guide* on the IBM xSeries Documentation CD.
5. Make sure the service processor on each node is configured and connected to the network. See the *Remote Supervisor Adapter User's Guide* on the IBM xSeries Documentation CD.

Two-node configuration: A two-node configuration requires the 4-way to 8-way Scalability Kit option. Complete the following steps to cable a two-node configuration for up to 8-way operation:

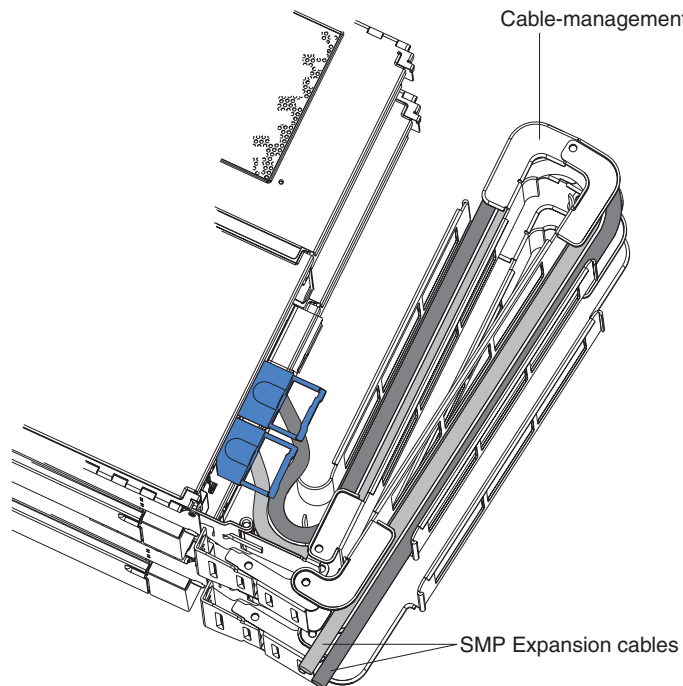
1. Remove the protective covers from the connectors on the ends of the cables.



2. Label each end of the SMP Expansion cables according to where they will be connected to each server. See the following illustration.



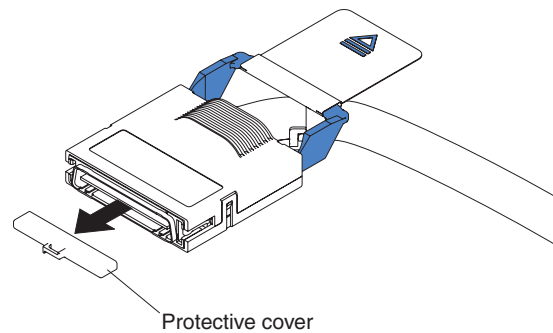
3. Connect the SMP Expansion cables to node 1:
 - a. Connect one end of an SMP Expansion cable to port 1 on node 1; then, route the cable through the node 1 cable-management arm.
 - b. Connect one end of an SMP Expansion cable to port 3 on node 1; then, route the cable through the node 1 cable-management arm.



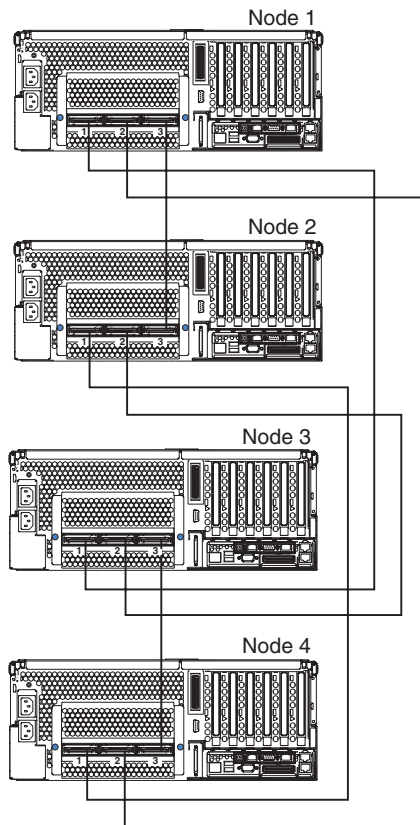
4. Connect the SMP Expansion cables to node 2:
 - a. Locate the SMP Expansion cable that is connected to port 1 on node 1; then, connect the opposite end of the cable to port 1 of node 2. Next, route the cable through the node 2 cable-management arm.
 - b. Locate the SMP Expansion cable that is connected to port 3 on node 1; then, connect the opposite end of the cable to port 3 of node 2. Next, route the cable through the node 2 cable-management arm.
5. Connect the Remote Supervisor Adapter Ethernet connector on each server to a network or to each other with an Ethernet crossover cable. This connection is needed so that the Remote Supervisor Adapters can communicate and manage scalable partitions.
6. Route any remaining cables through the cable-management arms.
7. Secure the cables in the cable-management arms with the hook-and-loop straps that come with your server.
8. Go to “RXE Expansion cabling” on page 48 and complete that procedure, if you are connecting the configuration to a remote I/O enclosure.

Four-node configuration: A four-node configuration requires one 4-way to 8-way Scalability Kit option and one 8-way to 16-way Supplemental Kit option. Complete the following steps to cable a four-node configuration for up to 16-way operation:

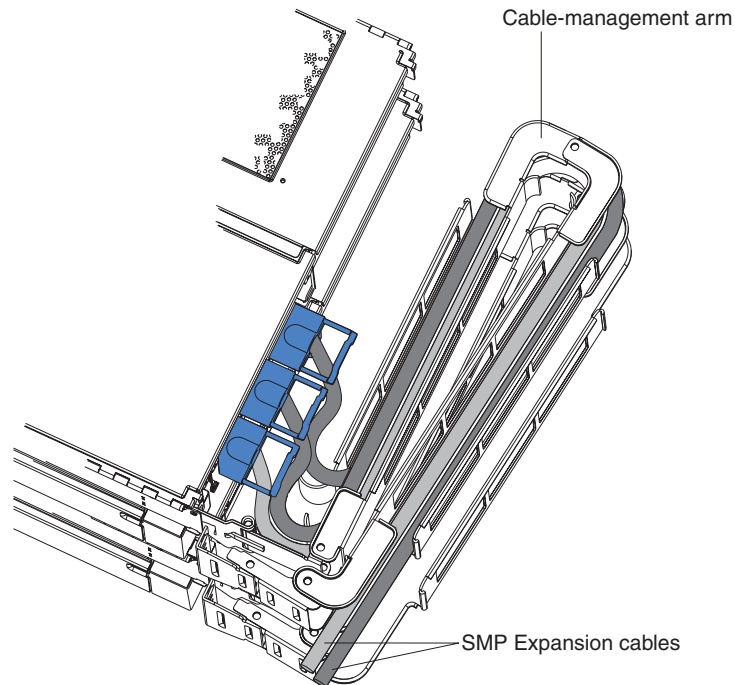
1. Remove the protective covers from the connectors on the ends of the cables.



2. Label each end of the SMP Expansion cables according to where they will be connected to each server. See the following illustration.



3. Connect the SMP Expansion cables to node 1:
 - a. Connect one end of an SMP Expansion cable to port 1 on node 1; then, route the cable through the node 1 cable-management arm. Use a 2.5 m (8.2 feet) SMP Expansion cable for this connection.
 - b. Connect one end of an SMP Expansion cable to port 2 on node 1; then, route the cable through the node 1 cable-management arm. Use a 3.5 m (11.6 feet) SMP Expansion cable for this connection.
 - c. Connect one end of an SMP Expansion cable to port 3 on node 1; then, route the cable through the node 1 cable-management arm. Use a 2.5 m (8.2 feet) SMP Expansion cable for this connection.



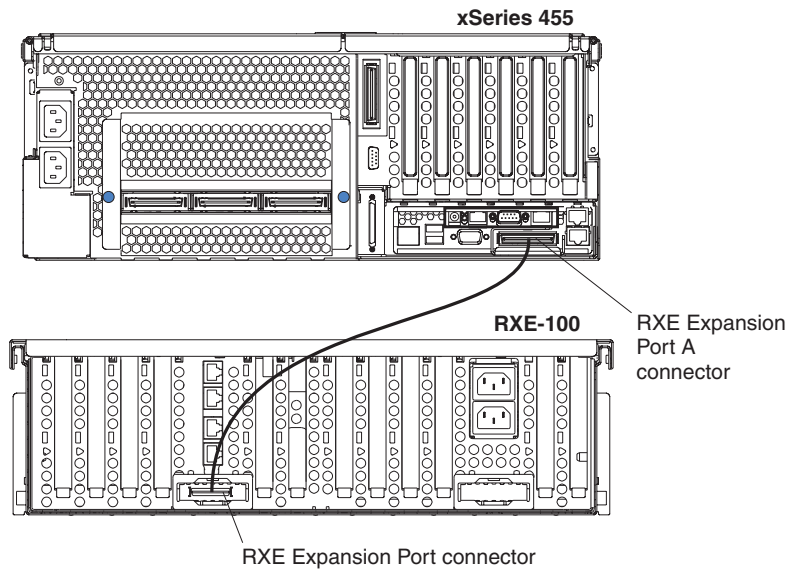
4. Connect the SMP Expansion cables to node 2:
 - a. Connect one end of an SMP Expansion cable to port 1 on node 2; then, route the cable through the node 2 cable-management arm. Use a 2.5 m (8.2 feet) SMP Expansion cable for this connection.
 - b. Connect one end of an SMP Expansion cable to port 2 on node 2; then, route the cable through the node 2 cable-management arm. Use a 2.5 m (8.2 feet) SMP Expansion cable for this connection.
 - c. Locate the SMP Expansion cable that is connected to port 3 on node 1; then, connect the opposite end of the cable to port 3 of node 2. Next, route the cable through the node 2 cable-management arm.
5. Connect the SMP Expansion cables to node 3:
 - a. Locate the SMP Expansion cable that is connected to port 1 on node 1; then, connect the opposite end of the cable to port 1 of node 3. Next, route the cable through the node 3 cable-management arm.
 - b. Locate the SMP Expansion cable that is connected to port 2 on node 2; then, connect the opposite end of the cable to port 2 of node 3. Next, route the cable through the node 3 cable-management arm.
 - c. Connect one end of an SMP Expansion cable to port 3 on node 3; then, route the cable through the node 3 cable-management arm. Use a 2.5 m (8.2 feet) SMP Expansion cable for this connection.
6. Connect the SMP Expansion cables to node 4:
 - a. Locate the SMP Expansion cable that is connected to port 1 on node 2; then, connect the opposite end of the cable to port 1 of node 4. Next, route the cable through the node 4 cable-management arm.
 - b. Locate the SMP Expansion cable that is connected to port 2 on node 1; then, connect the opposite end of the cable to port 2 of node 4. Next, route the cable through the node 4 cable-management arm.
 - c. Locate the SMP Expansion cable that is connected to port 3 on node 3; then, connect the opposite end of the cable to port 3 of node 4. Next, route the cable through the node 4 cable-management arm.

7. Connect the Remote Supervisor Adapter Ethernet connector on each server to the network. This connection is needed so that the Remote Supervisor Adapters can communicate and manage scalable partitions.
8. Route any remaining cables through the cable-management arms.
9. Secure the cables in the cable-management arms with the hook-and-loop straps that come with your server.
10. Go to “RXE Expansion cabling” and complete that procedure, if you are connecting the configuration to one or more remote I/O enclosures.

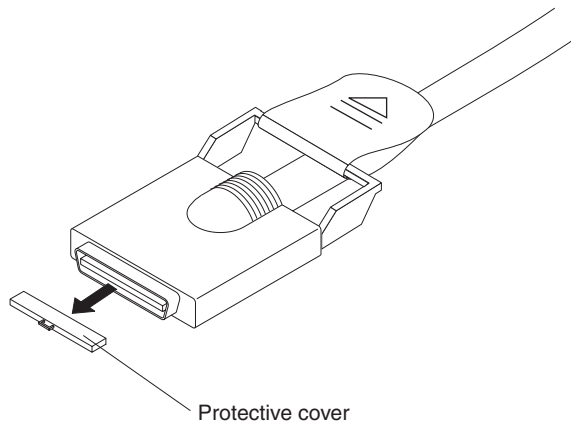
RXE Expansion cabling

There are two RXE Expansion Port connectors on the rear of the server. Use these ports to connect the server to a remote I/O enclosure and to expand the number of PCI-X slots that are available for use by the server. For detailed information about cabling the RXE Expansion Port connectors, see the documentation that comes with the remote I/O enclosure.

One server: Complete the following steps to connect the server to a remote I/O enclosure with one expansion kit installed.



1. Remove the protective covers from the connectors on the ends of the cables.

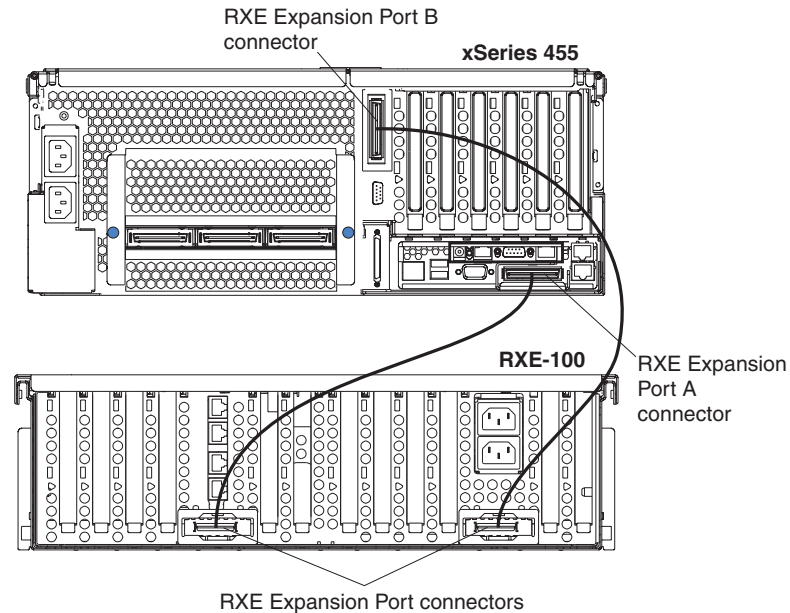


2. Using an RXE Expansion cable, connect one end of the cable to the RXE Expansion Port A connector on the server.

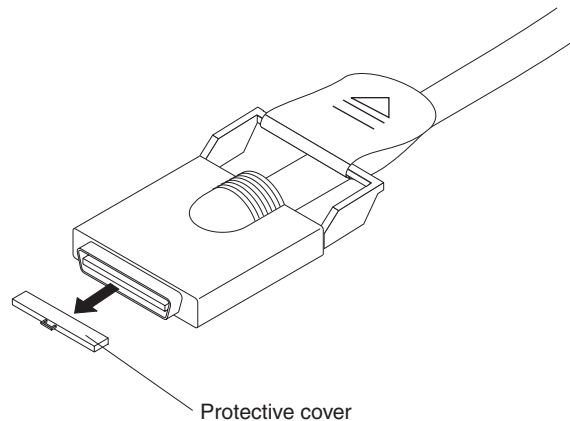
3. Connect the opposite end of the cable to an RXE Expansion Port connector on the remote I/O enclosure.

Go to “RXE Management cabling” on page 52.

Complete the following steps to connect the server to a remote I/O enclosure with two expansion kits installed.



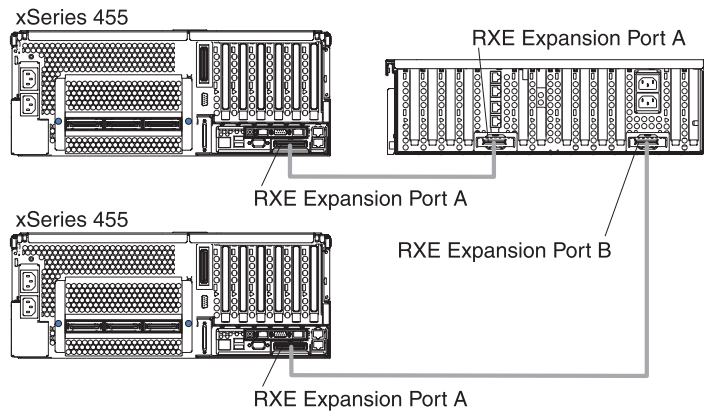
1. Remove the protective covers from the connectors on the ends of the cables.



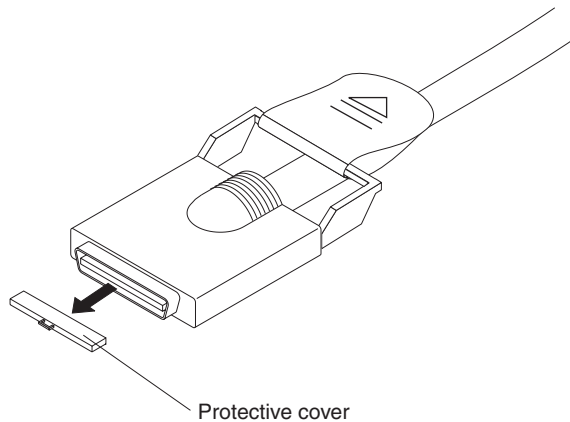
2. Using an RXE Expansion cable, connect one end of the cable to the RXE Expansion Port A connector on the server.
3. Connect the opposite end of the cable to an RXE Expansion Port connector on the remote I/O enclosure.
4. (Optional) Using an RXE Expansion cable, connect one end of the cable to the RXE Expansion Port B connector on the server. Connect the opposite end to an RXE Expansion Port connector on the remote I/O enclosure. This cable connection provides fail-over support.

Go to “RXE Management cabling” on page 52.

Two stand-alone servers: Complete the following steps to connect two stand-alone servers sharing one remote I/O enclosure.



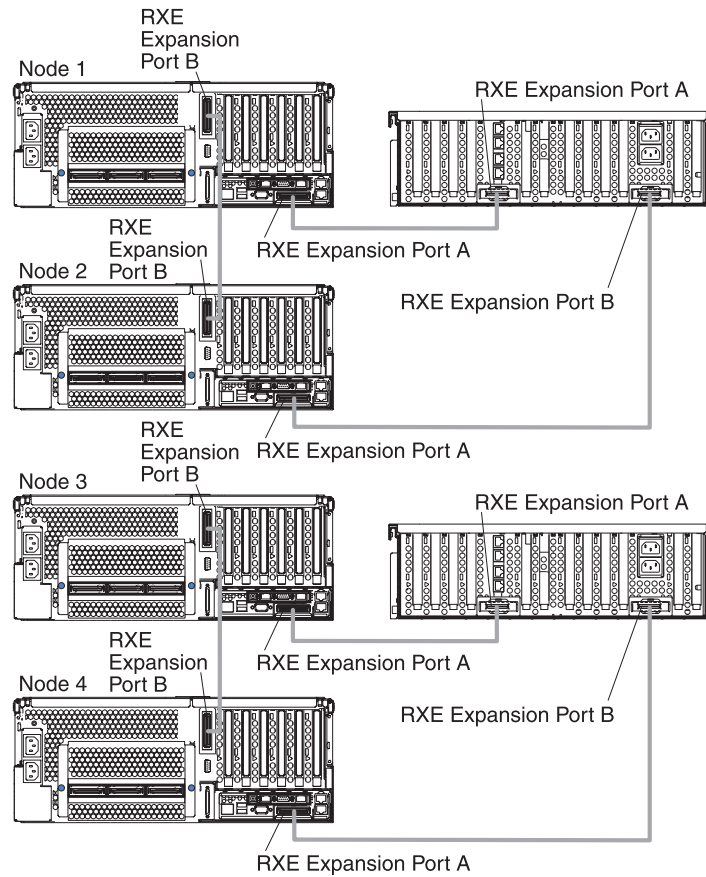
1. Determine which server will be connected to port A of the remote I/O enclosure and which will be connected to port B.
2. Remove the protective covers from the connectors on the ends of the cables.



3. Using an RXE Expansion cable, connect one end of the cable to the RXE Expansion Port A connector on the remote I/O enclosure.
4. Connect the opposite end of the cable to the RXE Expansion Port A connector on the applicable server.
5. Using an RXE Expansion cable, connect one end of the cable to the RXE Expansion Port B connector on the remote I/O enclosure.
6. Connect the opposite end of the cable to the RXE Expansion Port A connector on the applicable server.

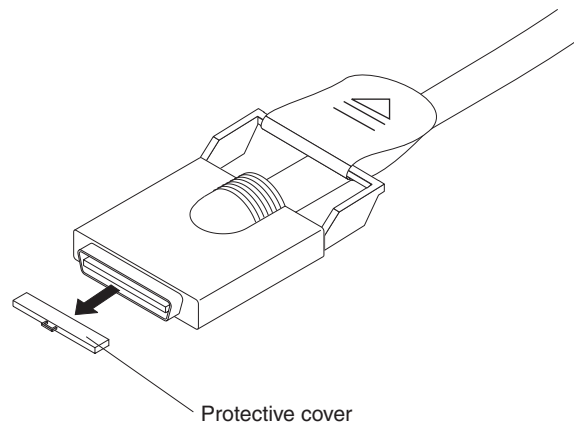
Go to “RXE Management cabling” on page 52.

Multi-node configurations: Complete the following steps to connect a remote I/O enclosure to a two-node or four-node configuration. For information about cabling the RXE Management Port connectors, see “RXE Management cabling” on page 52



Notes:

1. You can connect a remote I/O enclosure to both nodes of a two-node configuration. If the remote I/O enclosure has only one expansion kit installed, you can connect the RXE Expansion Port A connector on the primary server to the remote I/O enclosure.
2. You can connect a remote I/O enclosure to nodes 1 and 2 *or* nodes 3 and 4 of a four-node configuration. You can also connect remote I/O enclosures to both nodes 1 and 2 *and* nodes 3 and 4 of a four-node configuration.
1. Remove the protective covers from the connectors on the ends of the cables.



- Using an RXE Expansion cable, connect the RXE Expansion Port A connector on one server to the remote I/O enclosure.
- Using an RXE Expansion cable, connect the RXE Expansion Port A connector on the other server to the remote I/O enclosure.
- (Optional) Using an RXE Expansion cable, connect the RXE Expansion Port B connector on one server to the RXE Expansion Port B connector on the other server. This cable connection provides fail-over support.

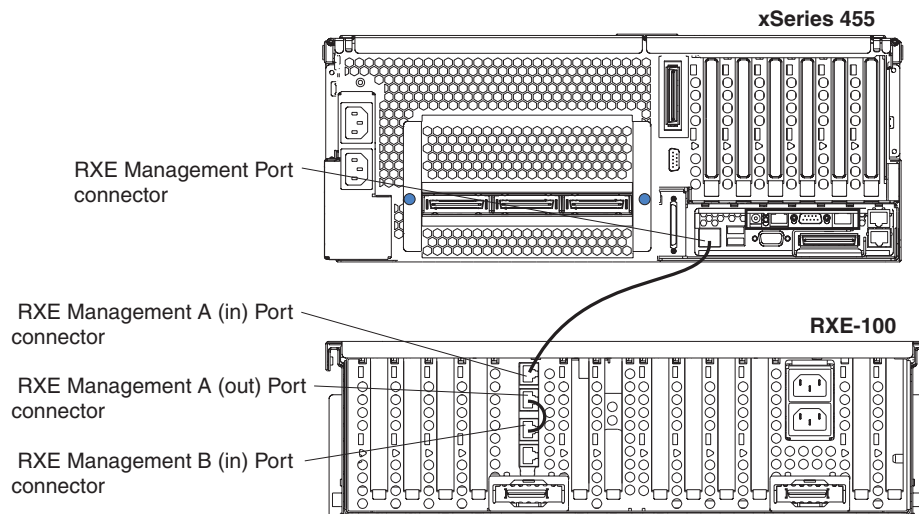
Go to “RXE Management cabling”.

RXE Management cabling

There is one RXE Management Port connector on the back of the server. Use this port to connect the server to the management port of an optional remote I/O enclosure. This port is used to manage the PCI-X slots in a remote I/O enclosure, including slot assignments and managing access. For details about how the server and remote I/O enclosure work together, see the documentation that comes with the enclosure.

One server: Complete the following steps to connect the server RXE Management Port connector to a remote I/O enclosure.

Note: Use the following instructions regardless of whether your remote I/O enclosure has one or two expansion kits installed.

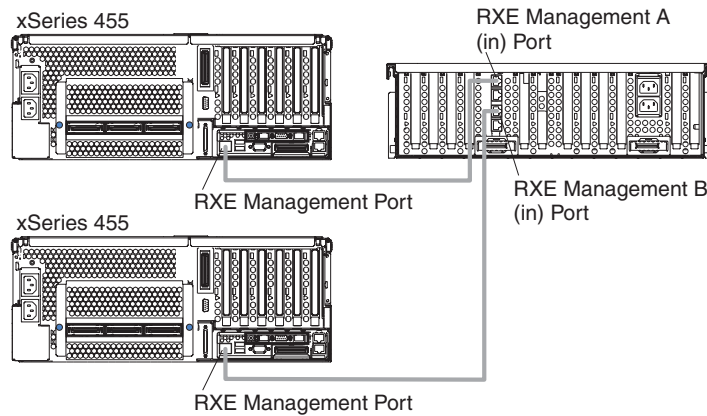


- Using an RXE Management cable, connect one end of the cable to the RXE Management Port connector on the server.
- Connect the opposite end of the cable to the RXE Management A (in) Port connector on the remote I/O enclosure.
- Using a jumper cable, connect the RXE Management A (out) Port on the remote I/O enclosure to the RXE Management B (in) Port on the remote I/O enclosure.

Two stand-alone servers: Complete the following steps to connect the RXE Management Port connectors of two stand-alone servers to a remote I/O enclosure.

Note: The configuration shown in the following illustration is two servers that are independent of each other. Notice that there are no interconnecting cables

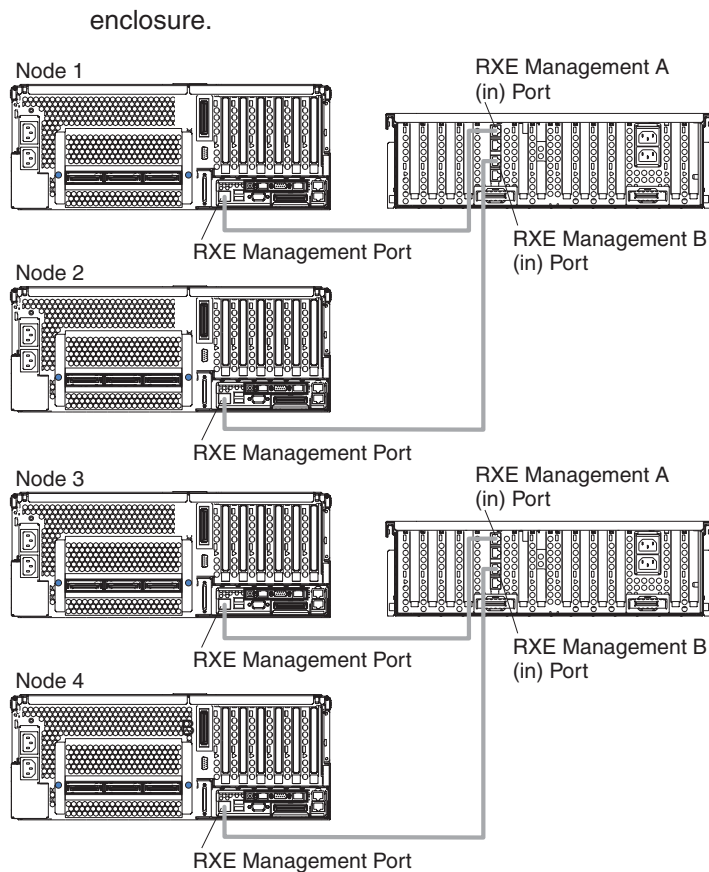
between the two servers.



1. Using an RXE Management cable, connect one end of the cable to the RXE Management Port connector on one of the servers.
2. Connect the opposite end of the cable to the RXE Management A (in) Port connector on the remote I/O enclosure.
3. Using an RXE Management cable, connect one end of the cable to the RXE Management Port connector on the other server.
4. Connect the opposite end of the cable to the RXE Management A (in) Port connector on the remote I/O enclosure.

Multi-node configurations: Complete the following steps to connect a remote I/O enclosure to a two-node or four-node configuration.

Note: You can connect a remote I/O enclosure to both nodes of a two-node configuration. If the remote I/O enclosure has only one expansion kit installed, you can connect the RXE Management Port connector on the primary server to the RXE Management A (in) Port on the remote I/O



1. Using an RXE Management cable, connect the RXE Management Port connector on one server to the remote I/O enclosure.
2. Using an RXE Management cable, connect the RXE Management Port connector on the other server to the remote I/O enclosure.

Power cabling

Your server comes with two power cords that can be connected to an external source, such as a properly grounded electrical outlet. Your server can also use two power cords that can be connected to a primary power unit inside the rack cabinet, such as a properly grounded power distribution unit or uninterruptible power supply.

Complete the following steps to connect the power cords:

1. Connect the power cords to the system power connectors on the rear of the server.

Notes:

- a. The power supplies are hot-swappable and redundant only at 200-240 V ac.
 - b. Both power supplies must be connected to the power source for operation at 100-127 V ac.
 - c. During normal operation, both power supplies must be installed for proper operation.
2. Connect the other end of the power cord to a properly grounded electrical outlet or a power distribution unit inside the rack cabinet.

Note: Connecting the power cords into an electrical outlet might cause the server to start automatically. This is an acceptable action.

3. See “Turning on the server” on page 14 for detailed information about turning on the server.

SCSI cabling

There is one SCSI connector on the back of the server. Use this connector to connect the server to an optional SCSI device such as a storage enclosure. For information about how to connect the option to your server, see the documentation that comes with the option.

USB cabling

There are three USB connectors, one on the front and two on the back of the server. Use these connectors to connect the server to an optional USB device. For information about how to connect the option to your server, see the documentation that comes with the device.

Serial cabling

There is one serial connector on the back of the server. Use this connector to connect the server to a modem or other optional serial device. For information about how to connect this device to your server, see the documentation that comes with the device.

Video cabling

There is one video connector on the back of the server. Use this connector to connect the server to a monitor or optional console switch. For information about how to connect this device to your server, see the documentation that comes with the device.

Gigabit Ethernet cabling

There are two Ethernet connectors on the back of the server. Use these connectors to connect the server to a LAN.

Note: A third Ethernet connector is on the Remote Supervisor Adapter. This connector is used for specific supervisory functions; do not confuse it with the Gigabit Ethernet connectors.

Remote Supervisor Adapter cabling

Your server comes with a Remote Supervisor Adapter. For information about cabling the Remote Supervisor Adapter connectors, see the *User's Guide* on the IBM *xSeries Documentation CD*.

Updating your server configuration

When you start your server for the first time after you add or remove an internal option or an external SCSI device, you might see a message telling you that the configuration has changed. See the *User's Guide* on the IBM *xSeries Documentation CD* for more information about the Configuration/Setup Utility program.

Some options have device drivers that you need to install. See the documentation that comes with the device for information about installing any required device drivers.

If your server comes with two microprocessors or if your server comes with one microprocessor and you have installed one or more additional microprocessors, your server can now operate as an SMP server. Therefore, you might need to upgrade your operating system to support SMP. See the *User's Guide* on the IBM *xSeries Documentation CD* and your operating-system documentation for additional information.

If you have a RAID configuration on your server using the integrated SCSI controller and you have installed or removed a hard disk drive, you might need to reconfigure your disk arrays. See the RAID documentation on the IBM *xSeries Documentation* CD for more information about reconfiguring your disk arrays.

If you install a different type of RAID adapter in your server, see the documentation that comes with the adapter for information about viewing and changing SCSI settings for attached devices.

Backing up and restoring the nonvolatile variables

The Extensible Firmware Interface (EFI) code in the xSeries 455 server stores its variables with nonvolatile attributes in NVRAM on the Remote Supervisor Adapter. Before you remove or replace the Remote Supervisor Adapter or clear the NVRAM, be sure to make a backup copy of the nonvolatile EFI variables. After you install a new Remote Supervisor Adapter, you must restore the EFI variables that were previously stored in NVRAM. The following EFI variables are stored in NVRAM on the Remote Supervisor Adapter:

- Console definitions
- Boot options / Drivers
- Boot order / Timeout

You can use the xSeries 455 Backup and Restore utilities to back up or restore the nonvolatile EFI variables that are stored in NVRAM.

Creating a backup copy of the nonvolatile EFI variables

Complete the following steps to create a backup copy of the EFI variables:

1. Make sure that the formatted media where you plan to store the backup file is inserted in the drive.
2. Start the server.
3. Select **EFI Shell** from the EFI Firmware Boot Manager.

Note: If EFI shell is not a choice in the list, the server has a customized startup configuration. Contact your system administrator for instructions.

4. Change to the file system for the formatted media where you want to store the backup copy.
5. Type the following EFI command to create a backup copy of the EFI variables:

```
backup filename
```

where *filename* is the name you want to assign to the backup copy, for example, `efibckup.001`

6. Type `dir` or `ls` to verify that the backup file was created successfully.

The backup procedure is now completed.

Restoring the nonvolatile EFI variables

Complete the following steps to restore the nonvolatile EFI variable settings:

1. Make sure that the formatted media that contains the backup copy of the EFI variables is inserted in the drive.
2. Start the server.
3. Select **EFI Shell** from the EFI Firmware Boot Manager.

Note: If EFI shell is not a choice on the list, the server has a customized startup configuration. Contact your system administrator for instructions.

4. Change to the file system that contains the backup copy of the EFI variables.
5. Type `dir` or `ls` to verify that the backup file was created successfully.
6. Type the following EFI command to restore the EFI variables:
`restore filename`
where *filename* is the name you assigned to the backup copy
7. When the message Delete existing non-volatile efi variables [y/n] appears, type Y.
8. Type `reset` to reset the system.

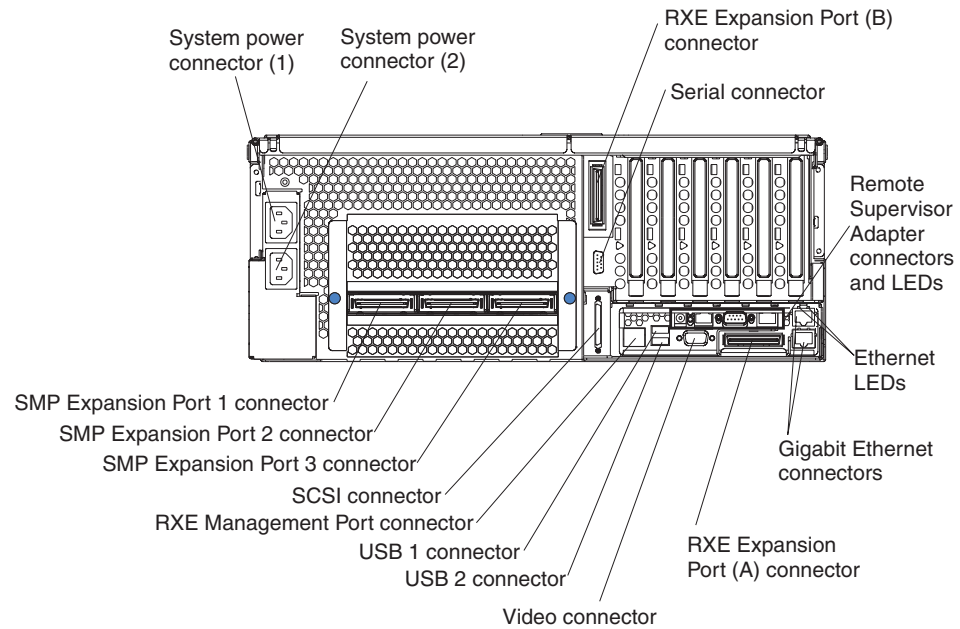
The restore procedure is now completed.

Chapter 3. Input/output connectors

Your server has the following input/output connectors:

- Two Gigabit Ethernet (RJ-45)
- Two RXE Expansion Port
- One RXE Management Port
- One SCSI
- One serial
- Three SMP Expansion Port
- Three Universal Serial Bus (USB)
- One video

The following illustration shows the locations of these connectors.

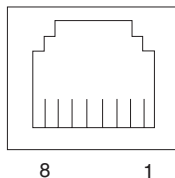


The following sections describe these connectors.

Your server also has an additional Ethernet connector, an additional serial connector, and an Advanced System Management (ASM) Interconnect connector on the Remote Supervisor Adapter. See the Remote Supervisor Adapter documentation on the IBM *xSeries Documentation* CD for more information.

Gigabit Ethernet connectors

The following illustration shows a Gigabit Ethernet connector.

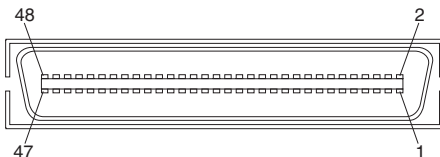


Connect a Category 3, 4, or 5 unshielded twisted-pair cable to this connector. The 100BASE-TX and 1000BASE-T Fast Ethernet standards require Category 5 or higher cabling.

See the *User's Guide* on the IBM *xSeries Documentation* CD for more information about the Ethernet controller.

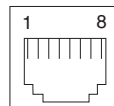
RXE Expansion Port connectors

Use the RXE Expansion Port connectors to connect your server to a remote I/O enclosure. The following illustration shows an RXE Expansion Port connector.



RXE Management Port connector

Use the RXE Management Port connector to connect your server to a remote I/O enclosure. The following illustration shows an RXE Management Port connector.



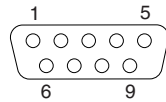
SCSI connector

The integrated dual-channel Ultra320 small computer system interface (SCSI) controller supports one internal and one external independent SCSI connector. The internal connector is integrated on the I/O board. The external connector is on the rear of the server. The following illustration shows an external SCSI connector.



Serial connector

Use a serial connector to connect a serial device. The following illustration shows a serial connector.

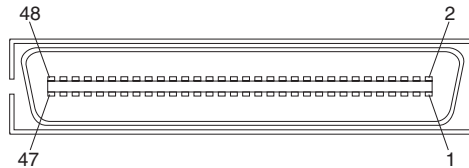


Configure a serial console device to accept the following settings:

Baud rate	115200
Data bit	8
Parity	None
Stop bits	1
Flow control	None

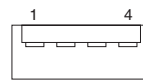
SMP Expansion Port connectors

Use an SMP Expansion Port connector to connect nodes for multi-node configurations. The following illustration shows an SMP Expansion Port connector.



Universal Serial Bus connectors

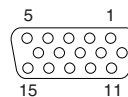
Use a Universal Serial Bus (USB) connector to connect a USB device. USB technology transfers data at up to 12 Mb per second (Mbps) with a maximum of 127 devices and a maximum signal distance of 5 meters (16 ft) per segment. Using Plug and Play technology, USB devices are configured automatically. The following illustration shows a USB connector.



Use a 4-pin cable to connect devices to USB 1, USB 2, and USB 3. If you plan to attach more than three USB devices, you must use a hub to connect the devices.

Video connector

The integrated video controller provides the video connector. The connector is on the rear of the server. The following illustration shows a video connector.



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Processor speeds indicate the internal clock speed of the microprocessor; other factors also affect application performance.

CD-ROM drive speeds list the variable read rate. Actual speeds vary and are often less than the maximum possible.

When referring to processor storage, real and virtual storage, or channel volume, KB stands for approximately 1000 bytes, MB stands for approximately 1 000 000 bytes, and GB stands for approximately 1 000 000 000 bytes.

When referring to hard disk drive capacity or communications volume, MB stands for 1 000 000 bytes, and GB stands for 1 000 000 000 bytes. Total user-accessible capacity may vary depending on operating environments.

Maximum internal hard disk drive capacities assume the replacement of any standard hard disk drives and population of all hard disk drive bays with the largest currently supported drives available from IBM.

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This unit contains materials such as circuit boards, cables, electromagnetic compatibility gaskets, and connectors which may contain lead and copper/beryllium alloys that require special handling and disposal at end of life. Before this unit is disposed of, these materials must be removed and recycled or discarded according to applicable regulations. IBM offers product-return programs in several countries. Information on product recycling offerings can be found on IBM's Internet site at <http://www.ibm.com/ibm/environment/products/prp.shtml>.

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In the United States, IBM has established a collection process for reuse, recycling, or proper disposal of used IBM sealed lead acid, nickel cadmium, nickel metal hydride, and battery packs from IBM equipment. For information on proper disposal of these batteries, contact IBM at 1-800-426-4333. Have the IBM part number listed on the battery available prior to your call.

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Federal Communications Commission (FCC) statement

Note: This equipment 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.

Properly shielded and grounded cables and connectors must be used in order to meet FCC emission limits. Properly shielded and grounded cables and connectors must be used in order to meet FCC emission limits. IBM is not responsible for any radio or television interference caused by using other than recommended cables and connectors or by using other than recommended cables and connectors or by unauthorized changes or modifications to this equipment. Unauthorized changes or modifications could void the user's authority to operate the equipment.

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Industry Canada Class A emission compliance statement

This Class A digital apparatus complies with Canadian ICES-003.

Avis de conformité à la réglementation d'Industrie Canada

Cet appareil numérique de la classe A est conforme à la norme NMB-003 du Canada.

Australia and New Zealand Class A statement

Attention: 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.

United Kingdom telecommunications safety requirement

Notice to Customers

This apparatus is approved under approval number NS/G/1234/J/100003 for indirect connection to public telecommunication systems in the United Kingdom.

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This product is in conformity with the protection requirements of EU Council Directive 89/336/EEC on the approximation of the laws of the Member States relating to electromagnetic compatibility. IBM cannot accept responsibility for any failure to satisfy the protection requirements resulting from a nonrecommended modification of the product, including the fitting of non-IBM option cards.

This product has been tested and found to comply with the limits for Class A Information Technology Equipment according to CISPR 22/European Standard EN 55022. The limits for Class A equipment were derived for commercial and industrial environments to provide reasonable protection against interference with licensed communication equipment.

Attention: 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.

Taiwanese Class A warning statement

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
求採取某些適當的對策。

Chinese Class A warning statement

聲 明
此為 A 級產品。在生活環境中，
該產品可能會造成無線電干擾。
在這種情況下，可能需要用戶對其
干擾採取切实可行的措施。

Japanese Voluntary Control Council for Interference (VCCI) statement

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されることがあります。

Power cords

For your safety, IBM provides a power cord with a grounded attachment plug to use with this IBM product. To avoid electrical shock, always use the power cord and plug with a properly grounded outlet.

IBM power cords used in the United States and Canada are listed by Underwriter's Laboratories (UL) and certified by the Canadian Standards Association (CSA).

For units intended to be operated at 115 volts: Use a UL-listed and CSA-certified cord set consisting of a minimum 18 AWG, Type SVT or SJT, three-conductor cord, a maximum of 15 feet in length and a parallel blade, grounding-type attachment plug rated 15 amperes, 125 volts.

For units intended to be operated at 230 volts (U.S. use): Use a UL-listed and CSA-certified cord set consisting of a minimum 18 AWG, Type SVT or SJT, three-conductor cord, a maximum of 15 feet in length and a tandem blade, grounding-type attachment plug rated 15 amperes, 250 volts.

For units intended to be operated at 230 volts (outside the U.S.): Use a cord set with a grounding-type attachment plug. The cord set should have the appropriate safety approvals for the country in which the equipment will be installed.

IBM power cords for a specific country or region are usually available only in that country or region.

IBM power cord part number	Used in these countries and regions
02K0546	China
13F9940	Australia, Fiji, Kiribati, Nauru, New Zealand, Papua New Guinea
13F9979	Afghanistan, Albania, Algeria, Andorra, Angola, Armenia, Austria, Azerbaijan, Belarus, Belgium, Benin, Bosnia and Herzegovina, Bulgaria, Burkina Faso, Burundi, Cambodia, Cameroon, Cape Verde, Central African Republic, Chad, Comoros, Congo (Democratic Republic of), Congo (Republic of), Cote D'Ivoire (Ivory Coast), Croatia (Republic of), Czech Republic, Dahomey, Djibouti, Egypt, Equatorial Guinea, Eritrea, Estonia, Ethiopia, Finland, France, French Guyana, French Polynesia, Germany, Greece, Guadeloupe, Guinea, Guinea Bissau, Hungary, Iceland, Indonesia, Iran, Kazakhstan, Kyrgyzstan, Laos (People's Democratic Republic of), Latvia, Lebanon, Lithuania, Luxembourg, Macedonia (former Yugoslav Republic of), Madagascar, Mali, Martinique, Mauritania, Mauritius, Mayotte, Moldova (Republic of), Monaco, Mongolia, Morocco, Mozambique, Netherlands, New Caledonia, Niger, Norway, Poland, Portugal, Reunion, Romania, Russian Federation, Rwanda, Sao Tome and Principe, Saudi Arabia, Senegal, Serbia, Slovakia, Slovenia (Republic of), Somalia, Spain, Suriname, Sweden, Syrian Arab Republic, Tajikistan, Tahiti, Togo, Tunisia, Turkey, Turkmenistan, Ukraine, Upper Volta, Uzbekistan, Vanuatu, Vietnam, Wallis and Futuna, Yugoslavia (Federal Republic of), Zaire
13F9997	Denmark
14F0015	Bangladesh, Lesotho, Maceo, Maldives, Namibia, Nepal, Pakistan, Samoa, South Africa, Sri Lanka, Swaziland, Uganda
14F0033	Abu Dhabi, Bahrain, Botswana, Brunei Darussalam, Channel Islands, China (Hong Kong S.A.R.), Cyprus, Dominica, Gambia, Ghana, Grenada, Iraq, Ireland, Jordan, Kenya, Kuwait, Liberia, Malawi, Malaysia, Malta, Myanmar (Burma), Nigeria, Oman, Polynesia, Qatar, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines, Seychelles, Sierra Leone, Singapore, Sudan, Tanzania (United Republic of), Trinidad and Tobago, United Arab Emirates (Dubai), United Kingdom, Yemen, Zambia, Zimbabwe
14F0051	Liechtenstein, Switzerland
14F0069	Chile, Italy, Libyan Arab Jamahiriya

IBM power cord part number	Used in these countries and regions
14F0087	Israel
1838574	Antigua and Barbuda, Aruba, Bahamas, Barbados, Belize, Bermuda, Bolivia, Brazil, Caicos Islands, Canada, Cayman Islands, Costa Rica, Colombia, Cuba, Dominican Republic, Ecuador, El Salvador, Guam, Guatemala, Haiti, Honduras, Jamaica, Japan, Mexico, Micronesia (Federal States of), Netherlands Antilles, Nicaragua, Panama, Peru, Philippines, Taiwan, United States of America, Venezuela
24P6858	Korea (Democratic People's Republic of), Korea (Republic of)
34G0232	Japan
36L8880	Argentina, Paraguay, Uruguay
49P2078	India
49P2110	Brazil
6952300	Antigua and Barbuda, Aruba, Bahamas, Barbados, Belize, Bermuda, Bolivia, Caicos Islands, Canada, Cayman Islands, Colombia, Costa Rica, Cuba, Dominican Republic, Ecuador, El Salvador, Guam, Guatemala, Haiti, Honduras, Jamaica, Mexico, Micronesia (Federal States of), Netherlands Antilles, Nicaragua, Panama, Peru, Philippines, Saudi Arabia, Thailand, Taiwan, United States of America, Venezuela

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