IBM

eserver

xSeries 445
Type 8870

Installation Guide

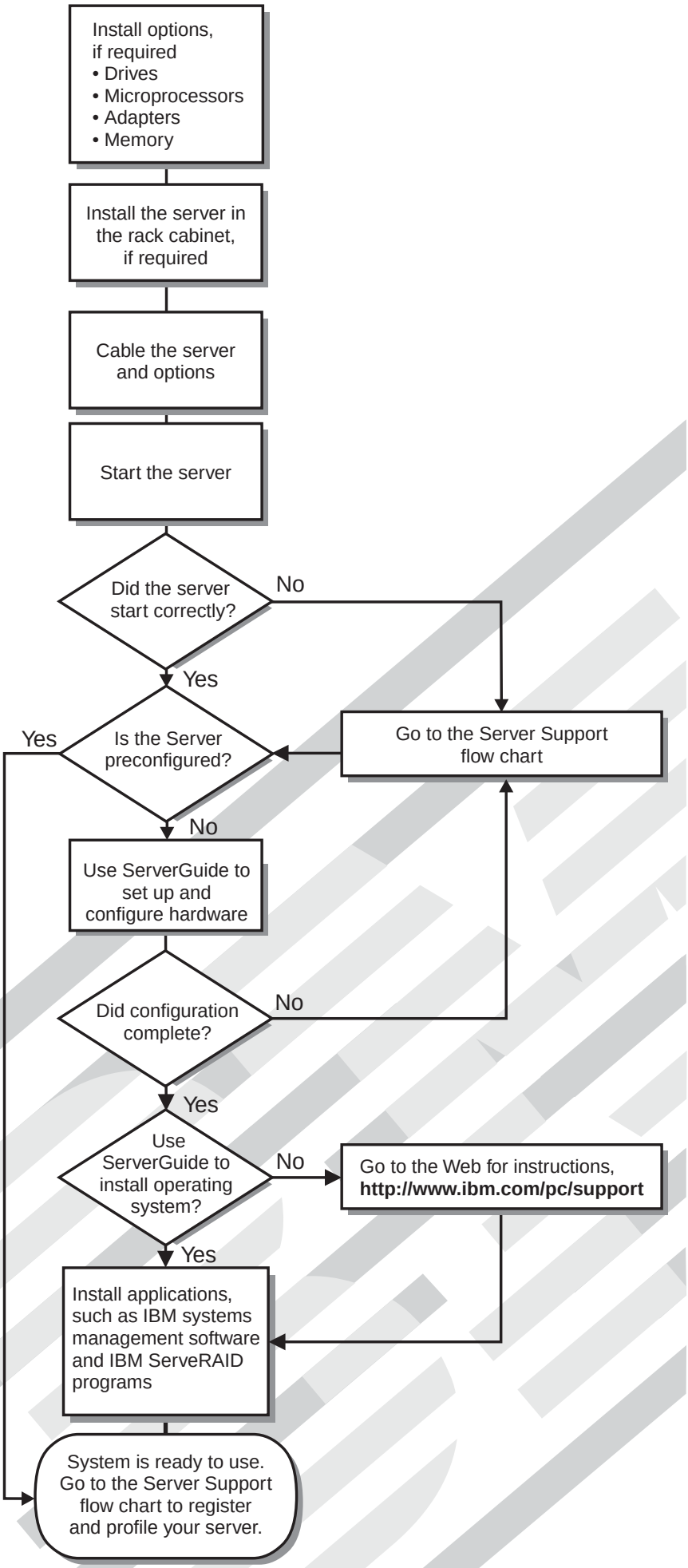
Welcome. . .

Thank you for buying an IBM xSeries server. Your server is based on the X-Architecture technology, and it features superior performance, availability, and scalability.

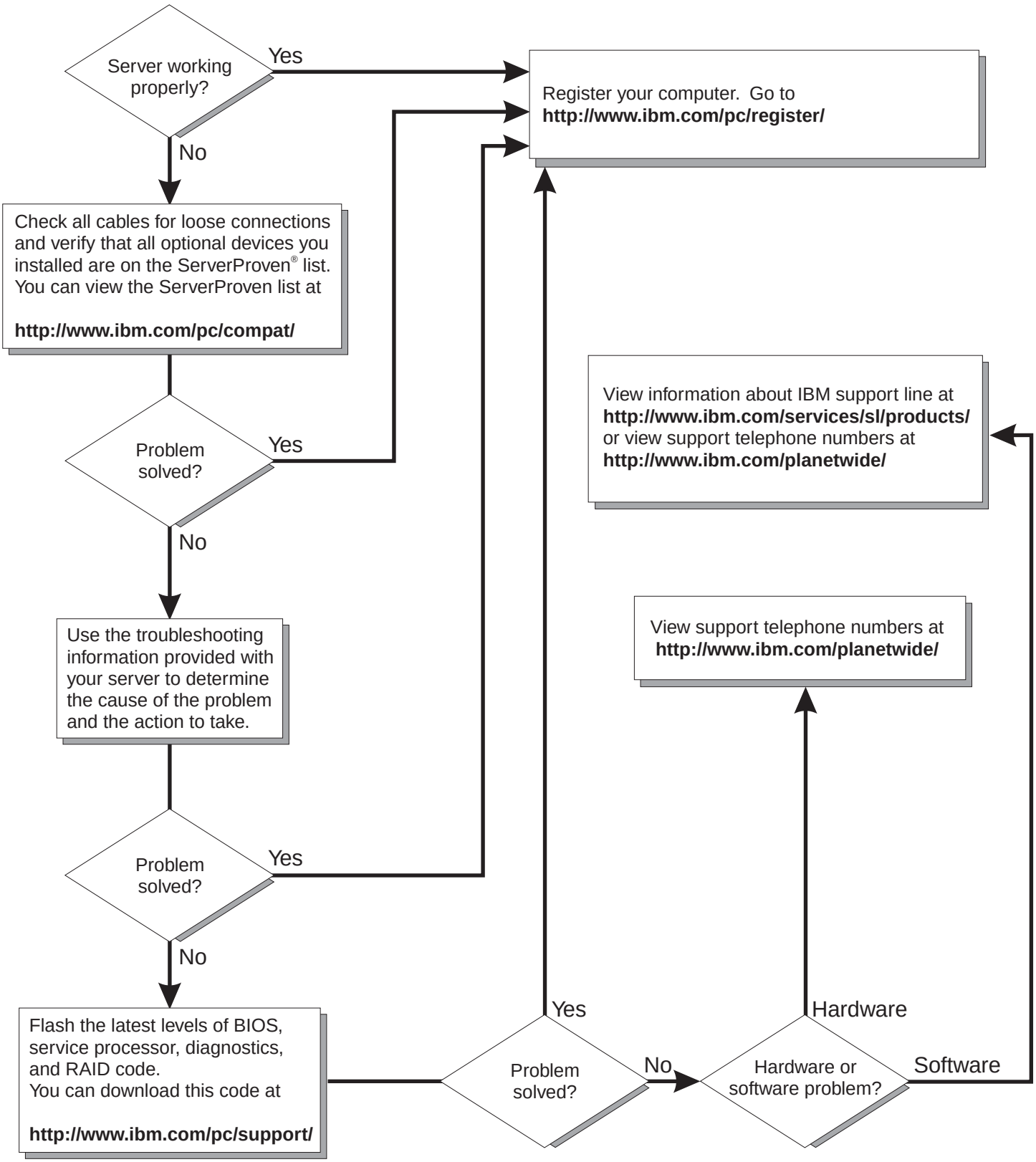
This server *Installation Guide* contains information for setting up and configuring your server.

For detailed information about your server, view the publications on the Documentation CD.

You can also find the most current information about your server on the IBM Web site at: http://www.ibm.com/pc/support



Server Support



IBM

@server

xSeries 445 Type 8870

Installation Guide

Note: Before using this information and the product it supports, read the general information in Appendix A, “Getting help and technical assistance”, on page 79, Appendix B, “Warranty information”, on page 81, and Appendix C, “Notices”, on page 93.

First Edition (June 2003)

Contents

Safety

Before installing this product, read the Safety Information.

قبل تركيب هذا المنتج، يجب قراءة الملاحظات الآمنية

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 pečítaje 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:

≥ 18 kg (39.7 lb)

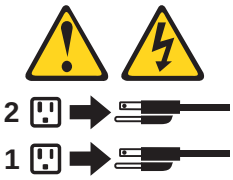
≥ 32 kg (70.5 lb)

≥ 55 kg (121.2 lb)

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.

>82 kg (180 lb)

Statement 13:

DANGER

Overloading a branch circuit is potentially a fire hazard and a shock hazard under certain conditions. To avoid these hazards, ensure that your system electrical requirements do not exceed branch circuit protection requirements. Refer to the information that is provided with your device for electrical specifications.

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 *Installation Guide* contains basic instructions for setting up your IBM® @server xSeries™ 445 Type 8870 server. Complete instructions are in the *Option Installation Guide* on the IBM *xSeries Documentation* CD, which comes with your server. This publication contains information about:

- Setting up and cabling your server
- Starting and configuring your server
- Installing your operating system

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 445**.
5. Click **Display documents**.

Your server comes with an IBM *ServerGuide™ Setup and Installation* CD to help you configure the hardware, install device drivers, and install the operating system.

Your server comes with a limited warranty. You can obtain up-to-date information about your server and other IBM server products at http://www.ibm.com/eserver/xseries/

Record information about your server in the following table. You will need this information when you register your server with IBM.

Product name	IBM @server xSeries 445 server
Machine type	8870
Model number	_____
Serial number	_____

The server model and serial numbers are on a label on the lower-left side of the bezel just above the hard disk drives.

See the *Rack Installation Instructions* publication for complete rack installation and removal instructions. For a list of supported options for your server, see the ServerProven® list at http://www.ib.com/pc/compat/.

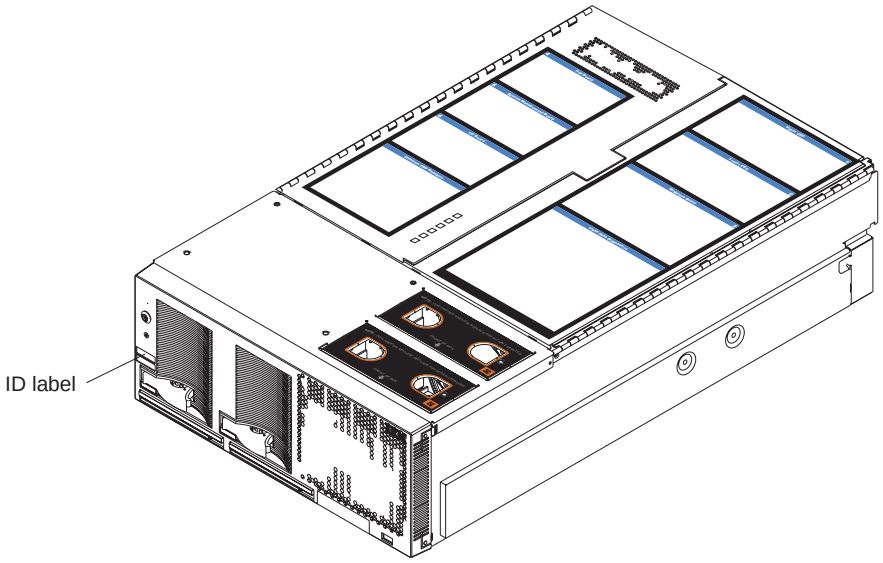


Figure 1. xSeries 445 server

The IBM xSeries Documentation CD

The IBM *xSeries Documentation* CD contains documentation for your server in Portable Document Format (PDF) and includes the IBM Documentation Browser to help you find information quickly.

Hardware and software requirements

The IBM *xSeries Documentation* CD requires the following minimum hardware and software:

- Microsoft Windows NT 4.0 (with Service Pack 3 or later), Windows 98, or Windows 2000.
- 100 MHz Intel Pentium microprocessor.
- 32 MB of RAM.
- Adobe Acrobat Reader 3.0 or later. Acrobat Reader software is included on the CD, and you can install it when you run the Documentation Browser.

Using the Documentation Browser

Use the Documentation Browser to browse the contents of the CD, read brief descriptions of the books, and view books using Adobe Acrobat Reader. The Documentation Browser automatically detects the regional settings in use in your system and displays the books in the language for that region (if available). If a book is not available in the language for that region, the English version is displayed.

Use one of the following procedures to start the Documentation Browser:

- If Autostart is enabled, insert the CD into your DVD-ROM or CD-ROM drive. The Documentation Browser starts automatically.
- If Autostart is disabled, insert the CD into your DVD-ROM or CD-ROM drive and click **Start --> Run**. In the **Open** field, type

  `e:\win32.bat`

where *e* is the drive letter of your DVD-ROM or CD-ROM drive, and click **OK**.

Select your server from the **Product** menu. The **Available Topics** list displays all the books for your server. Some books might be in folders. A plus sign (+) indicates each folder or book that has additional books under it. Click the plus sign to display the additional books.

When you select a book, a description of the book appears under **Topic Description**. To select more than one book, press and hold the Ctrl key while you select the books. Click **View Book** to view the selected book or books in Acrobat Reader. If you selected more than one book, all the selected books are opened in Acrobat Reader.

To search all the books, type a word or word string in the **Search** field and click **Search**. The books in which the word or word string appears are listed in order of the most occurrences. Click a book to view it, and press Crtl+F to use the Acrobat search function within the book.

Click **Help** for detailed information about using the Documentation Browser.

Notices and statements used in this publication

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

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.

Features and specifications

The following information is a summary of the features and specifications for your server.

Microprocessor:
- Supports the following microprocessors:
  - Up to 8 Intel Xeon MP microprocessors (16 in a 16-way configuration)

    OR
  - Up to 4 Intel Xeon DP microprocessors
    Note: Use the Information in BIOS to determine the type and speed of the microprocessors installed in your server.
- IBM XA-32™ chip set with integrated memory, I/O, system cache, and remote I/O controllers

Memory:
- Minimum: 2 GB
- Maximum: 64 GB
- Type: 2-way interleaved PC1600, DDR SDRAM, registered DIMMs only
- Supports 512 MB, 1GB and 2 GB dual inline memory modules (DIMMs)
- XceL4™ Server Accelerator Cache (up to 64 MB per SMP Expansion Module)

Drives:
- Diskette: 1.44 MB
- DVD-ROM
- Supports up to two internal Ultra320 SCSI hard disk drives

Active™ PCI-X expansion slots:

Six 64-bit Active PCI-X expansion slots:
- Two 66 MHz PCI-X slots
- Two 100 MHZ PCI-X slots
- Two 133 MHZ PCI-X slots
- Additional PCI-X slots available in an optional remote I/O expansion enclosure

Cooling:

Four hot-swap fans:
- Two 150 mm x 51 mm redundant fans
- Two 150 mm x 38 mm fans

Power supply:

Two hot-swap power supplies (550 watts at 110 V ac or 1050 watts at 220 V ac)

Video:
- ATI Rage XL video on system board
- PCI bus interface
- Compatible with SVGA
- 8 MB SDRAM video memory at 125 MHz

Size (4 U):
- Height: 17.8 cm (7 inches, 4 U)
- Depth: 69.85 cm (27.5 inches)
- Width: 48.3 cm (19 inches)
- Maximum weight: 50 kg (110 lb) depending on your configuration

Integrated functions:
- Broadcom 5704 Dual Gigabit 10/100/1000 Ethernet controller
- Light Path Diagnostics™ feature
- LSI Logic 1030 Dual Ultra320 SCSI controller
- Remote Supervisor Adapter (service processor)
  - ASM interconnect (peer-to-peer) port
  - Ethernet port
  - Management port
- IDE controller
- RXE Management Port
- Three USB ports
- Keyboard port
- SCSI port
- Mouse port
- Symmetrical multiprocessing (SMP) Expansion Ports (up to six ports depending on your configuration)
- Two remote I/O expansion enclosure (RXE) Expansion Ports

Acoustical noise emissions:
- Sound power, idling: 6.5 bel maximum
- Sound power, operating: 6.5 bel maximum

Environment:
- Air temperature:
  - Server on: 10° to 35°C (50.0° to 95.0°F). Altitude: 0 to 914 m (2998.7 ft).
  - Server on: 10° to 32° C (50.0° to 89.6° F). Altitude: 914 m (2998.7 ft) to 2133 m (6998.0 ft).
  - Server off: -40° to 60° C (-104° to 140° F). Maximum altitude: 2133 m (6998.0 ft).
- Humidity:
  - Server on: 8% to 80%
  - Server off: 5% to 100%

Heat output:

Approximate heat output in British thermal units (Btu) per hour:
- Minimum configuration: 855 Btu (250 watts)
- Maximum configuration: 2726 Btu (800 watts)

Electrical input:
- Sine-wave input (50 or 60 Hz) required
- Input voltage low range:
  - Minimum: 100 V ac
  - Maximum: 127 V ac
- Input voltage high range:
  - Minimum: 200 V ac
  - Maximum: 240 V ac
- Input kilovolt-amperes (kVA) approximately:
  - Minimum: 0.250 kVA
  - Maximum: 0.800 kVA

Notes:

1. Power consumption and heat output vary depending on the number and type of optional features installed and the power-management optional features in use.
2. These levels were measured in controlled acoustical environments according to the procedures specified by the American National Standards Institute (ANSI) S12.10 and ISO 7779 and are reported in accordance with ISO 9296. Actual sound-pressure levels in a given location might exceed the average values stated because of room reflections and other nearby noise sources. The declared sound-power levels indicate an upper limit, below which a large number of computers will operate.

Major components of the xSeries 445 server

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

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

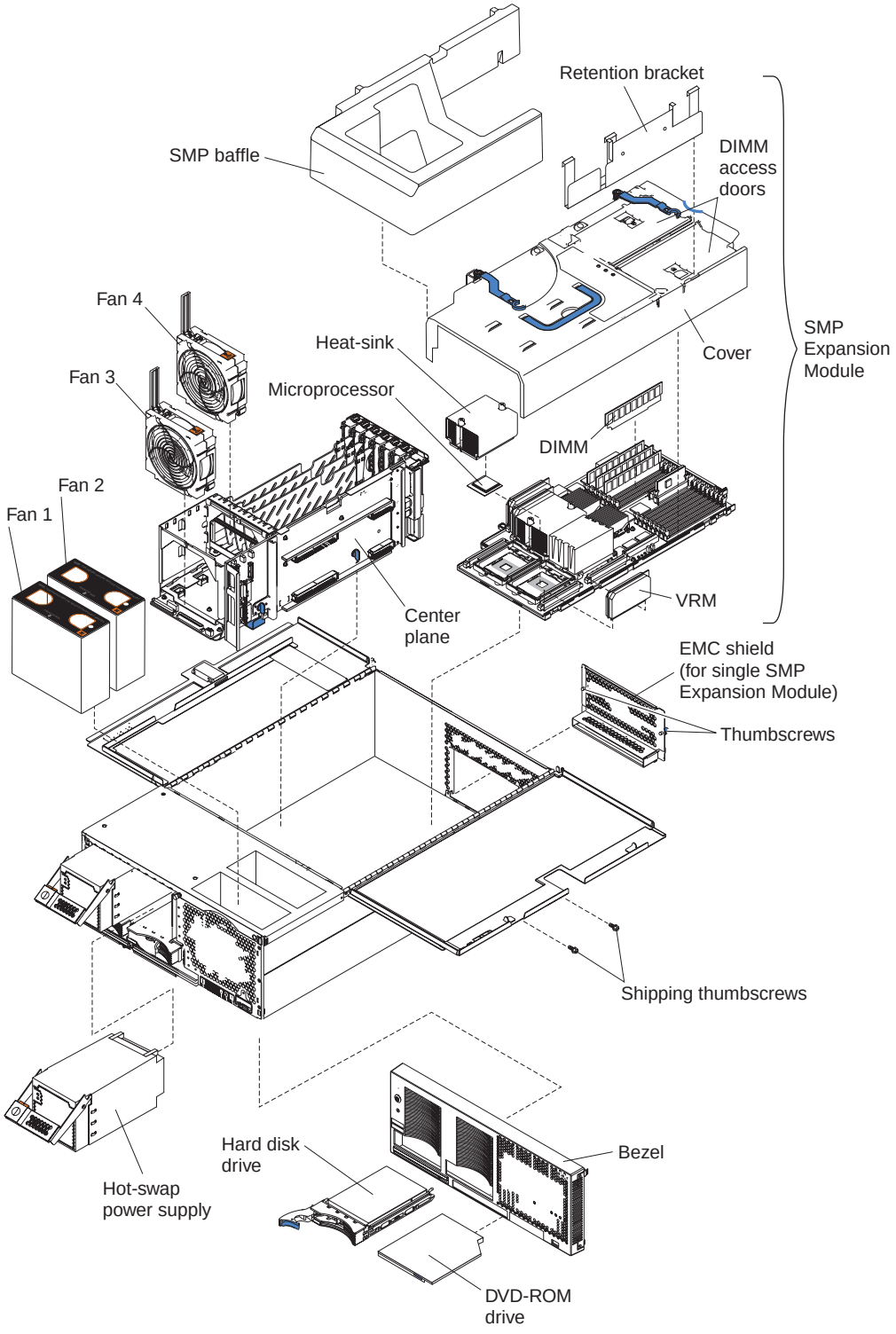


Figure 2. Major components of the xSeries 445 server

Chapter 2. Installing options

This chapter provides basic instructions for installing hardware options in your server. These instructions are intended for users who are experienced with setting up IBM server hardware. If you need more detailed instructions, see the *Option Installation Guide* on the IBM *xSeries Documentation* CD.

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 8. This information will help you work safely with your server and options.
- Make sure that you have an adequate number of properly grounded electrical outlets for your server, monitor, and other devices that you will connect to the server.
- Back up all important data before you make changes to disk drives.
- Have a small flat-blade screwdriver available.
- You do not need to turn off the server to install or replace hot-swap power supplies, hot-swap fans, 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.
- The blue color on components and labels indicates touch points, where a component can be gripped, a latch moved, and so on.
- For a list of supported options for your server, go to http://www.ibm.com/pc/compat/.

System reliability guidelines

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

- Each of the drive bays has a drive or a filler panel and electromagnetic compatibility (EMC) shield installed in it.
- If the server has only one SMP Expansion Module installed ensure that the SMP baffle is installed during normal operation.
- There is adequate space around the server to allow the server cooling system to work properly. Leave approximately 50 mm (2.0 in.) of open space around the front and rear of the server. Do not place objects in front of the fans.
- Do not leave open spaces above or below an installed server in a rack cabinet. To prevent damage to server components, always install a blank filler panel to cover the open space and to ensure proper air circulation.
- You have followed the cabling instructions that come with optional adapters.
- You have replaced a failed fan within 48 hours.
- You have replaced a hot-swap drive within 2 minutes of removal.
- Microprocessor socket 2 always contains either a microprocessor baffle or a microprocessor and heat sink.

Working inside the server with power on

Your server supports hot-swap devices and is designed to operate safely while turned on with the cover open. 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, hairpins, and screws, into the server.

Handling static-sensitive devices

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

To reduce the possibility of damage from 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 static-protective package, touch it to an unpainted metal part of the server 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 server without setting it down. If it is necessary to set down the device, put it back into its static-protective package. Do not place the device on your server cover or on a metal surface.
- Take additional care when handling devices during cold weather. Heating reduces indoor humidity and increases static electricity.

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 7.

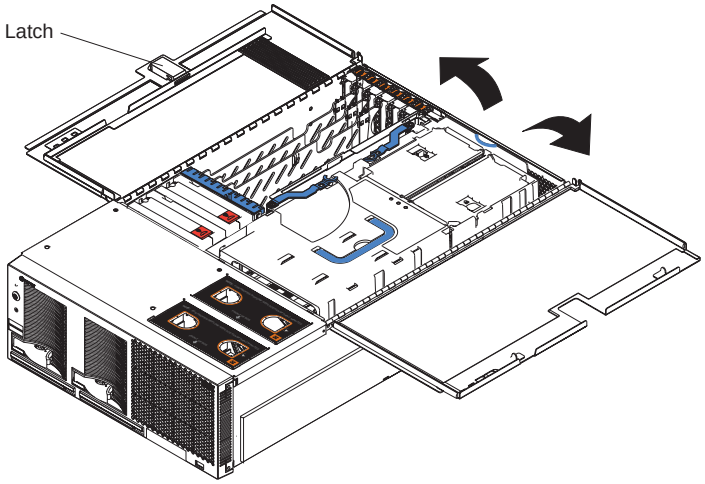


Figure 3. Opening the cover

2. Before opening the top cover, you must remove the rack-support wheels and handles from the server. See the *Rack Installation Instructions* for information.
3. Press the release latch on the left half of the top cover to the left.
4. Using the finger hole in the release latch, open the left half of the cover; then, open the right half 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 (more than 30 minutes) with the cover open might damage server components.

The SMP Expansion Module

The SMP Expansion Module contains the XceL4 system cache, DIMMs, microprocessors, and voltage regulator modules (VRMs). This section provides instructions for removing and installing the SMP Expansion Module, microprocessors, VRMs, and DIMMs.

The following notes describe components in the SMP Expansion Module and other information that you must consider when installing an SMP Expansion Module:

- Use two hands to install or remove an SMP Expansion Module. Do not allow the expansion module to come in contact with the center planar while lifting it out or putting into the server.
- For your server to operate properly, there must be a minimum of one SMP Expansion Module installed.
- An SMP Expansion Module must contain at least one microprocessor and two DIMMs.
- If there is only one SMP Expansion Module installed in the server, an SMP baffle must be installed in place of the upper SMP Expansion Module to ensure proper cooling of the server.
- When the minimum number of microprocessors are installed in the SMP Expansion Module, a microprocessor baffle must be installed in microprocessor socket 4 to ensure proper cooling within the server.
- Before removing or installing SMP Expansion Modules, you must remove the retention bracket or brackets and electromagnetic compatibility (EMC) shield from the rear of the server.
- You must run the Configuration/Setup Utility program whenever you remove or replace an SMP Expansion Module or one of its associated options.

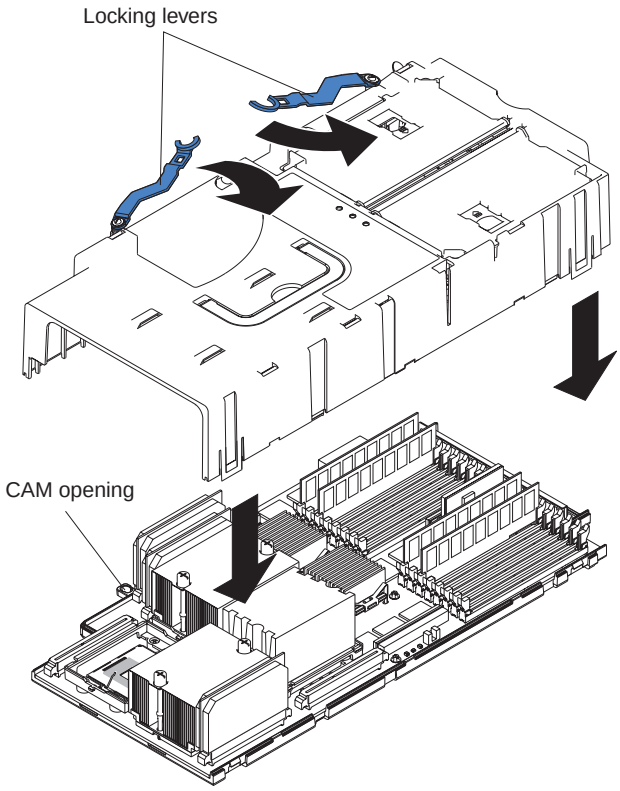


Figure 4. Complete SMP Expansion Module

Removing an SMP Expansion Module and cover

While installing options, you might need to remove one or both of the SMP Expansion Modules. This section describes how to remove an SMP Expansion Module from the server and how to remove the cover from the module.

Complete the following steps to remove an SMP Expansion Module from the server:

1. Read the safety information beginning on page v and “Installation guidelines” on page 7.
2. Turn off the server and peripheral devices, and disconnect the power cords and external cables.
3. Remove the retention bracket or brackets from the server.
   a. Remove the shipping thumbscrews from the right side of the server.

      Note: There are two shipping thumbscrews per retention bracket.

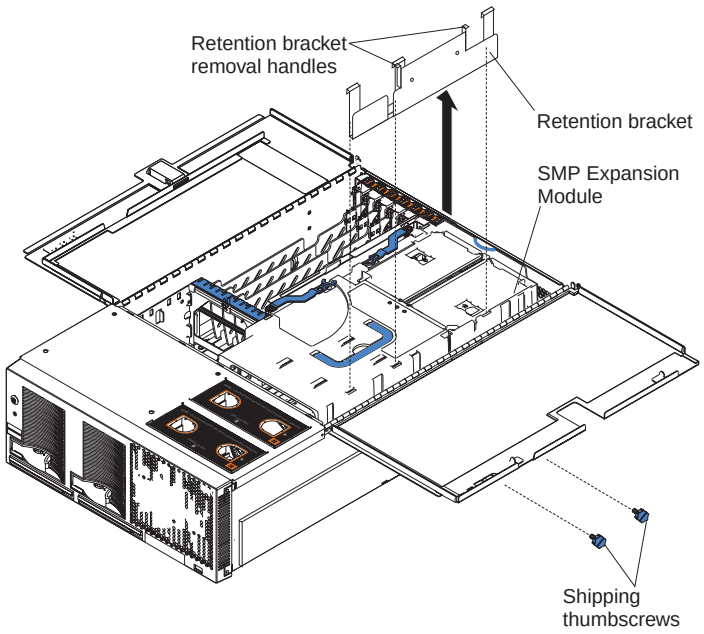


Figure 5. Removing the shipping thumbscrews

   b. Open the cover.
   c. Grasp the retention bracket by the right edge and lift it up and out of the server. Store the retention bracket or brackets in a safe place for later use.

      Note: If there is one SMP Expansion Module installed, you will need to remove the SMP baffle from the server; then, remove the retention bracket from the lower SMP Expansion Module.

4. Remove the EMC shield from the rear of the server:
   a. If necessary, disconnect the SMP Expansion Cables that are connected to the SMP Expansion Modules.
   b. Remove the blue thumbscrews holding the EMC shield to the server.

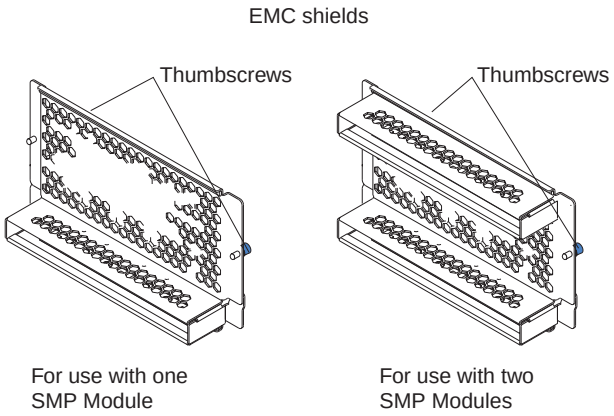


Figure 6. EMC shield thumbscrews

   c. Remove the EMC shield from the rear of the server.

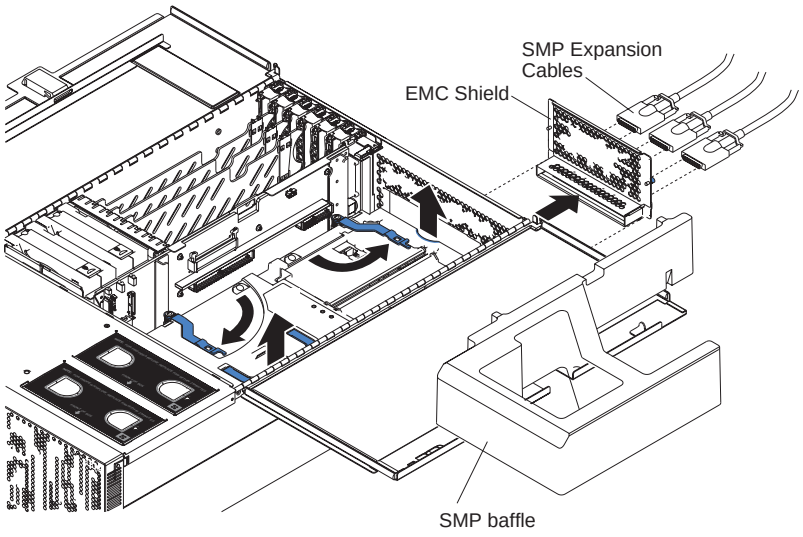


Figure 7. Removing the EMC shield

5. Grasp each of the locking levers on the top of the SMP Expansion Modules, and lift them up slightly.
6. Working from the right side of the server, rotate the two locking levers toward you until they are fully extended, as shown.

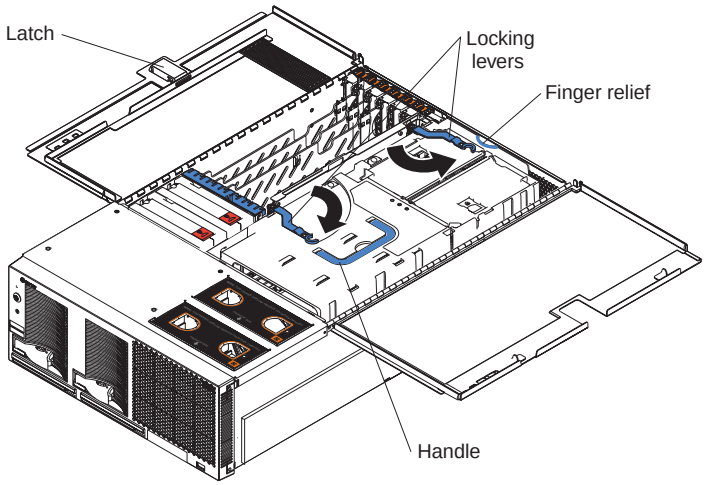


Figure 8. Rotate the locking levers to remove the SMP Expansion Module

7. Being careful not to damage the components on the center plane, use the handle and the finger relief on the SMP Expansion Module cover to lift the SMP Expansion Module out of the server.

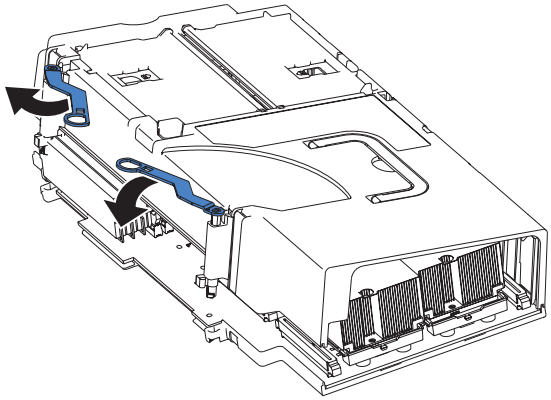


Figure 9. Fully extending the locking levers to remove the SMP Expansion Module cover

8. Remove the SMP Expansion Module cover:
   a. Place the SMP Expansion Module on a flat, level surface.
   b. Rotate the two locking levers until they are fully extended beyond the edge of the SMP Expansion Module cover. Do not force the locking levers past the position shown in the illustration.
   c. Using the locking levers, lift the front edge of the cover off the SMP Expansion Module.

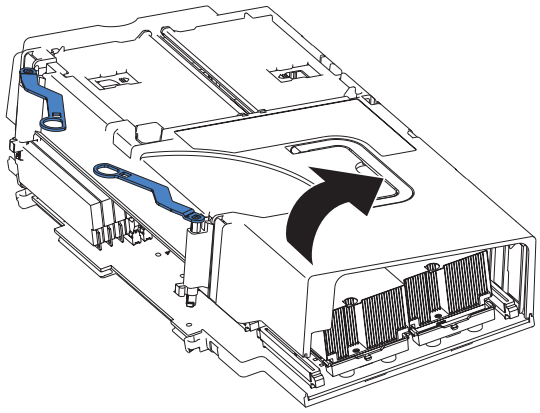


Figure 10. Lifting the front of the cover

d. Lift the cover off the SMP Expansion Module.

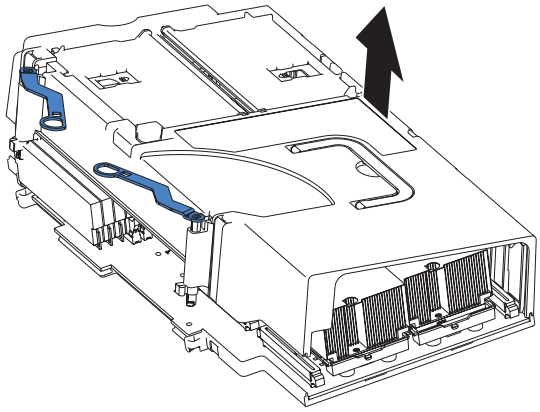


Figure 11. Lifting the cover off the SMP Expansion Module

Installing and replacing a microprocessor

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

- Read the documentation that comes with the microprocessor to determine whether you need to update the basic input/output system (BIOS) code in your server. To download the most current level of BIOS code for the server, go to http://www.ibm.com/pc/support/.
- If your server comes with Intel Xeon MP microprocessors; then, obtain an SMP-capable operating system. For a list of supported operating systems, go to http://www.ibm.com/pc/us/compat/.
- To order additional microprocessor or SMP Expansion Module options, contact your IBM marketing representative or authorized reseller.
- To avoid damage and ensure proper server operation after you install a replacement or an additional microprocessor, use a microprocessor that has the same cache size and type, clock speed, and internal and external clock frequencies as the microprocessors already installed in the individual SMP Expansion Module. For a list of microprocessors supported by your server, see the ServerProven list at http://www.ibm.com/pc/compat/ on the World Wide Web.
- The microprocessor in socket 1 of the bottom SMP Expansion Module is the startup (boot) microprocessor.
- An air baffle or microprocessor must be installed in microprocessor socket 2, depending on your configuration.
- If you are adding Intel Xeon MP microprocessors, populate the empty microprocessor sockets in numeric order, starting with socket 1. If you install the microprocessors in the wrong order, the server will not start.

  Attention: You must ensure that the locking lever on the microprocessor socket is in the fully open position before you insert the microprocessor in the socket. Failure to do so might result in permanent damage to the microprocessor, microprocessor socket, and system board. See Figure 13 on page 18.
- Always install the heat sink that comes with the microprocessor.
- Server models that come with Intel Xeon DP microprocessors support a maximum of two microprocessors per SMP Expansion Module, installed in microprocessor sockets 1 and 4.
- Intel Xeon DP microprocessors are supported in microprocessor sockets 1 and 4 only. Intel Xeon MP microprocessors are supported in microprocessor sockets 1, 2, 3, and 4.The following illustration shows the location of the startup microprocessor and its VRM on the system board. It also shows the microprocessor baffles and the VRM slots for the other microprocessor sockets.

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

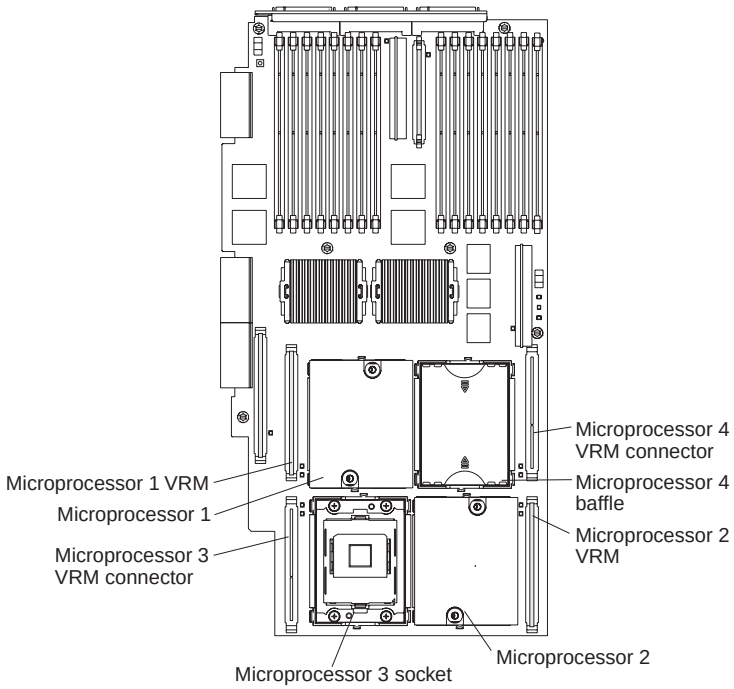


Figure 12. Microprocessor connector and VRM locations

Complete the following steps to install a microprocessor:

1. Read the safety information beginning on page v and “Installation guidelines” on page 7.
2. Turn off the server and peripheral devices, disconnect the power cords, and disconnect all external cables from the SMP Expansion Module; then, open the cover (see “Opening the cover” on page 9 for details).
3. If necessary, remove the SMP baffle or top SMP Expansion Module.

   Note: If your server contains only one SMP Expansion Module, remove the SMP baffle above it to gain access to the module. If your server contains two SMP Expansion Modules, remove the top module to gain access to the bottom or lower SMP Expansion Module.
4. Remove the SMP Expansion Module in which you plan to install the microprocessor; then, remove the module cover and determine the socket where the microprocessor is to be installed. For details, see “Removing an SMP Expansion Module and cover” on page 12.
5. Determine which type of microprocessors are installed in your server. The easiest way to do this is by the locations of the installed microprocessors in the SMP Expansion Module. If the microprocessors are installed only in sockets 1 and 4, your server came with Intel Xeon DP microprocessors. If the microprocessors are installed in any other sockets, such as 1 and 2 or 1, 2, and 3, your server came with Intel Xeon MP microprocessors.

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 8.

6. If necessary, remove the microprocessor baffle from the microprocessor socket. Keep the microprocessor baffle for possible future use.
7. Touch the static-protective package containing the new microprocessor to any *unpainted* metal surface on the server; then, remove the microprocessor from the package.
8. Install the microprocessor:

   Important: When installing Intel Xeon DP microprocessors, you must install them in the following order: socket 1 then socket 4. When installing Intel Xeon MP microprocessors, you must install them in the following order: sockets 1, 2, 3, and then 4.

   a. Remove the protective label from the microprocessor socket.
   b. Rotate the locking lever on the microprocessor socket from its closed and locked position until it stops or clicks in the fully open position (approximately 135° angle), as shown.

      Attention: You must ensure that the locking lever on the microprocessor socket is in the fully open position before you insert the microprocessor in the socket. Failure to do so might result in permanent damage to the microprocessor, microprocessor socket, and system board.

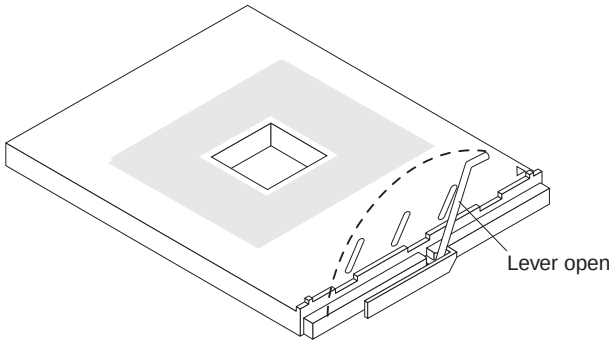


Figure 13. Microprocessor locking lever fully open

   c. Align the triangle icon on the microprocessor with the triangle icon on the socket and press the microprocessor gently into the socket.

      Attention: Make sure that the microprocessor is aligned correctly before you proceed. To avoid bending the pins on the microprocessor, do not use excessive force when pressing it into the socket.
   d. Close the locking lever to secure the microprocessor.
9. Install the VRM in the slot adjacent to the microprocessor socket by holding the new VRM by the upper corners,and plug it *firmly* into the slot.

   Attention: The new microprocessor comes in a kit with a VRM. Some microprocessor options contain a VRM with a clip to secure the VRM in the slot. This clip is not needed for installations in your server and can be discarded. When installing a new microprocessor, you must install the VRM that comes in the kit.

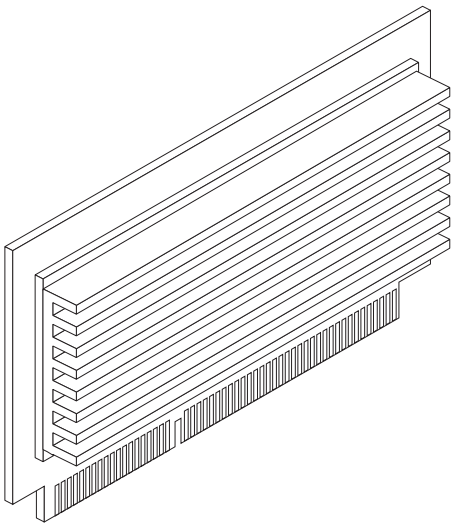


Figure 14. Microprocessor VRM

10. Install the heat sink:
    a. Remove the heat sink from its package and detach the protective cover from the bottom of the heat sink.

       Attention: Do not disturb or contaminate the heat-conducting grease on the bottom of the new heat sink. Doing so damages its heat-conducting capability and exposes the new microprocessor to overheating.

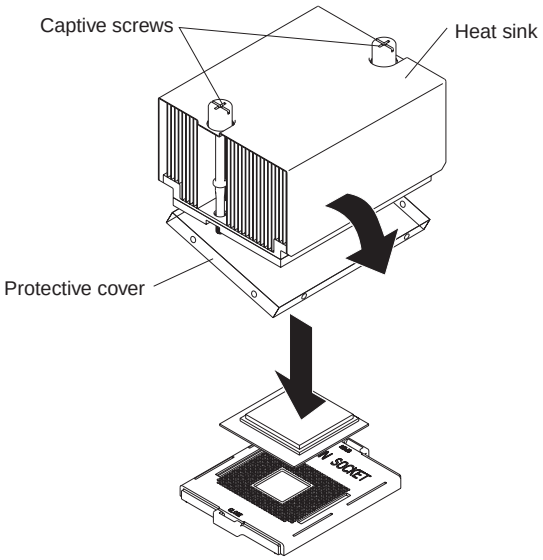


Figure 15. Placing the heat sink on the microprocessor

    b. Align the heat sink over the microprocessor; then, carefully set it down on top of the microprocessor.
    c. Using a screwdriver, secure the heat sink to the microprocessor socket on the SMP board using the two captive mounting screws. Press firmly on the screws and tighten them, alternating between them. Do not overtighten the screws.

11. Close the SMP Expansion Module top cover; then, install the module in the server. For details, see “Reinstalling an SMP Expansion Module and cover” on page 25.
12. If you have other options to install or remove, do so now.
13. Close the cover on the server; then, install the server in the rack cabinet and connect all external cables. For details, see “Install the server in the rack cabinet” on page 35.
14. Turn on the server.
    Important: If your server will not start after replacing or installing a microprocessor, you might have installed a microprocessor in the wrong socket or installed a microprocessor of a different type, or the VRM is not seated properly. Ensure that you have installed the microprocessor in the correct location and that it is of the same type. Also ensure that the VRM is properly seated in the slot.

    Note: When you install or remove microprocessors, the server configuration information changes. Therefore, you must change and save the new configuration information by using the Configuration/Setup Utility program. See the *User’s Guide* on the IBM *xSeries Documentation* CD.

Installing a memory module

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:

- IBM periodically makes updates available to provide enhancements to the standard features of your server. Currently, your server supports the memory mirroring and Memory ProteXion features of the Active Memory technology. Be sure to check the IBM support Web site occasionally to ensure that you have the most current levels of system software installed.
- To use the hot-add and hot-swap memory features, you must reconfigure your server using the Configuration/Setup Utility program. See the *User's Guide* on the IBM *xSeries Documentation* CD for additional information.
- Your server comes with a minimum of two 512 MB DIMMs installed in slots 1 and 3 in the SMP Expansion Module. When installing additional DIMM modules, you must install two DIMMs at a time and in the order described in this section, using the instructions in the ″Installing DIMMs″ procedure on page 23 to maintain performance. See the ServerProven list at http://www.ibm.com/pc/compat for a list of memory modules for use with your server.
- When installing or removing DIMMs, it must be done in pairs and in the order shown in the following table:

  Note: For optimum performance, balance the amount memory between the two ports.

Table 1. Memory

Port	Bank	Slot number
1	1	1, 3
2	1	9, 11
1	2	2, 4
2	2	10, 12
1	3	5, 7
2	3	13, 15
1	4	6, 8
2	4	14, 16

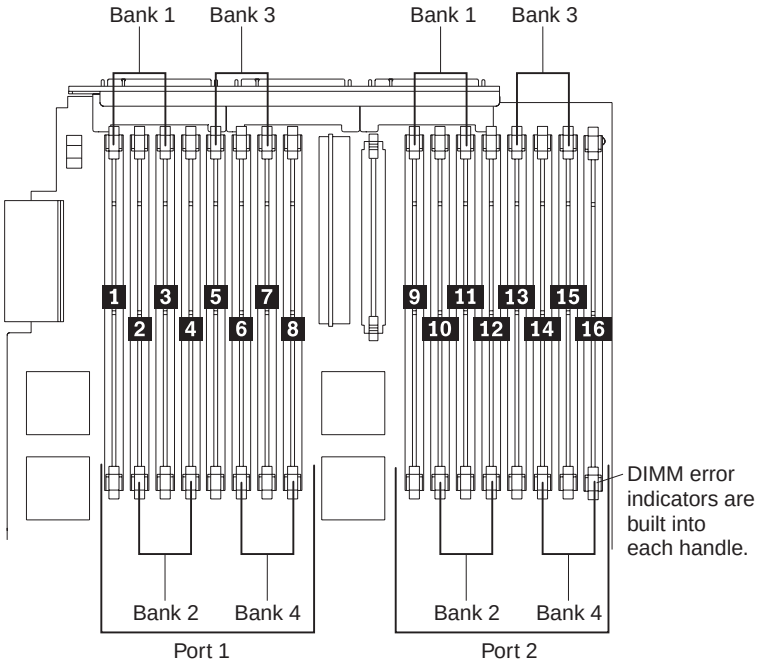


Figure 16. DIMM banks

- Each pair or bank of DIMMs must be of the same size and clock speed to ensure the server will operate properly.
- The installing or removing of DIMMs changes the configuration information in the server. Therefore, you must change and save the new configuration information by using the Configuration/Setup Utility program. When you restart the server, the server displays a message indicating that the memory configuration has changed. Start the Configuration/Setup Utility program and select **Save Settings**. See the *User's Guide* on the IBM *xSeries Documentation* CD for additional information.
- 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.

Installing DIMMs

Complete the following steps to install a DIMM in your server.

1. Read the safety information beginning on page v and “Installation guidelines” on page 7.
2. Turn off the server and peripheral devices, and disconnect all power cords and external cables. Then, open the server cover (see “Opening the cover” on page 9 for details).
3. If necessary, remove the top SMP Expansion Module from the server. See “Removing an SMP Expansion Module and cover” on page 12 for instructions.
4. Open the DIMM access door on the SMP Expansion Module cover that covers the memory port in which you will be installing the new DIMMs.

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

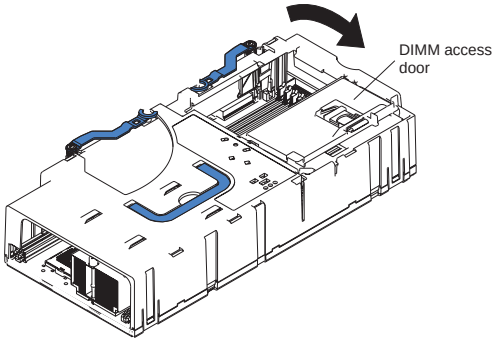


Figure 17. Open the DIMM access door

   Attention: When you handle static-sensitive devices, take precautions to avoid damage from static electricity. For details on handling these devices, see “Handling static-sensitive devices” on page 8.

5. Touch the static-protective package containing the DIMM to any unpainted metal surface on the server. Then, remove the DIMM from the package.
6. Install the DIMM:

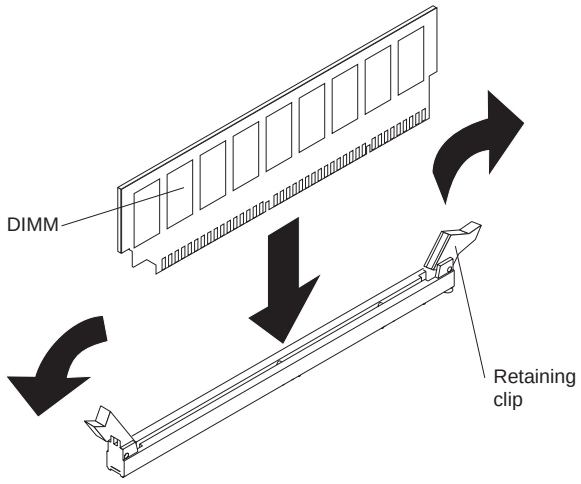


Figure 18. Installing a DIMM

Attention: To avoid breaking the retaining clips or damaging the DIMM connectors, open and close the clips gently.

a. Open the retaining clip on each end of the DIMM connector. Turn the DIMM so that the pins align correctly with the connector.
b. Insert the DIMM into the connector by aligning the DIMM edges with the slots at each end of the DIMM connector. Firmly press the DIMM straight down into the connector by applying pressure on both ends of the DIMM simultaneously. Be sure that the retaining clips snap into the locked position when the DIMM is firmly seated in the connector.
c. If a gap exists between the DIMM and the retaining clips, the DIMM has not been properly installed. In this case, open the retaining clips and remove the DIMM; then, reinsert the DIMM.

7. Close the DIMM access door or reinstall the SMP Expansion Module cover (see “Reinstalling an SMP Expansion Module and cover” on page 25).
8. If you have other options to install or remove, do so now.
9. Close the server cover. See “Install the server in the rack cabinet” on page 35.

Note: Installing or removing DIMMs changes the configuration information in the server. Therefore, you must change and save the new configuration information by using the Configuration/Setup Utility program. See *User's Guide* on the IBM *xSeries Documentation* CD for more information.

Reinstalling an SMP Expansion Module and cover

After installing options in the SMP Expansion Module, you will need to reinstall the SMP Expansion Module cover and reinstall the SMP Expansion Module in the server.

Complete the following steps to reinstall the SMP Expansion Module cover:

1. Install the cover on the SMP Expansion Module:
   a. Set the cover on top of the expansion module.
   b. Extend the locking levers as shown in the illustration; then, let the cam on the front of the cover fall into the cam opening on the SMP Expansion Module circuit board.

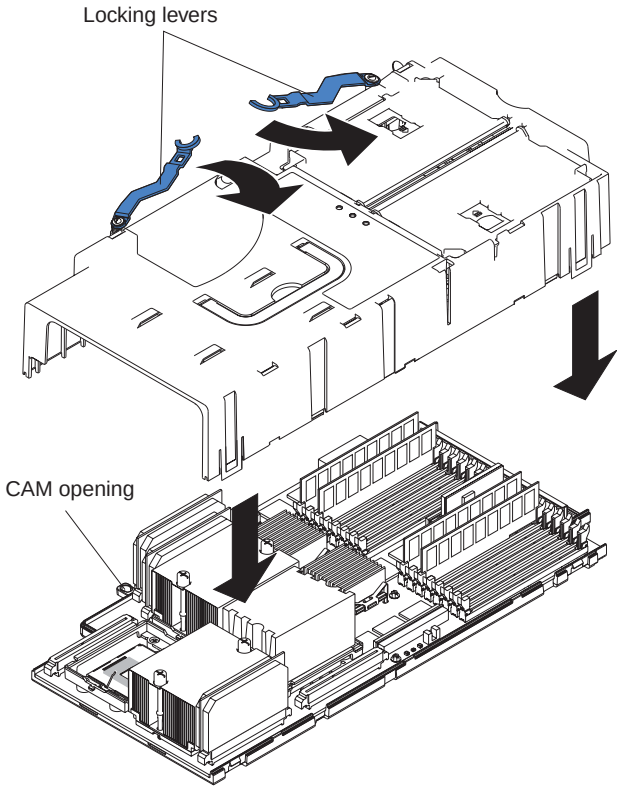


Figure 19. Complete SMP Expansion Module

   c. Release the locking levers and align the rear of the cover with the rear edge of the circuit board.
   d. Press down on the cover until it snaps into place.

e. Lift slightly on the locking levers and rotate them back until they stop.

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

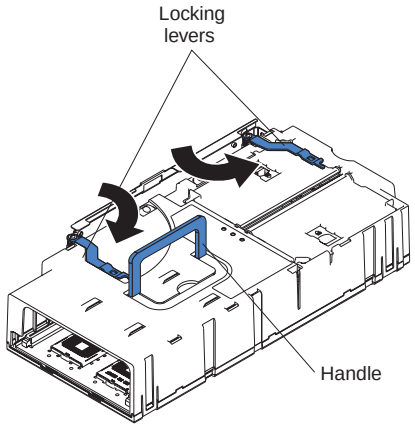


Figure 20. Locking lever position prior to installing the SMP Expansion Module

2. Install the SMP Expansion Module into the server.

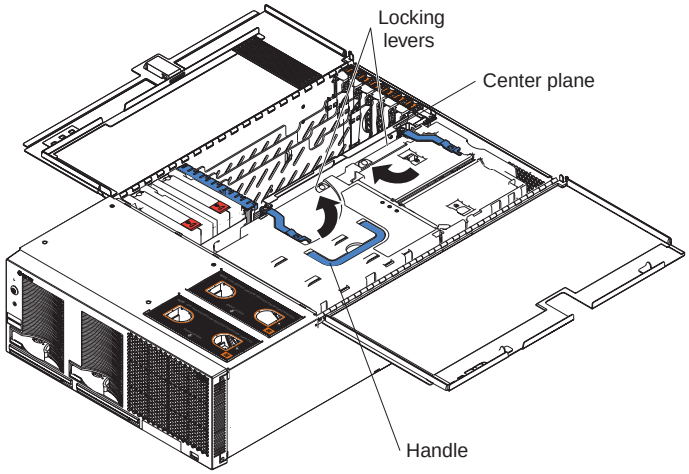


Figure 21. Installing the SMP Expansion Module

a. Lift the SMP Expansion Module by its handle and use the finger relief to hold the SMP Expansion Module steady.
b. Being careful not to damage the components on the center plane, place the SMP Expansion Module into the server.
c. Release the handle and slide the SMP Expansion Module toward the center plane until it stops.

d. Rotate the SMP Expansion Module locking levers forward until the SMP Expansion Module is securely fastened in place. See the following illustration.

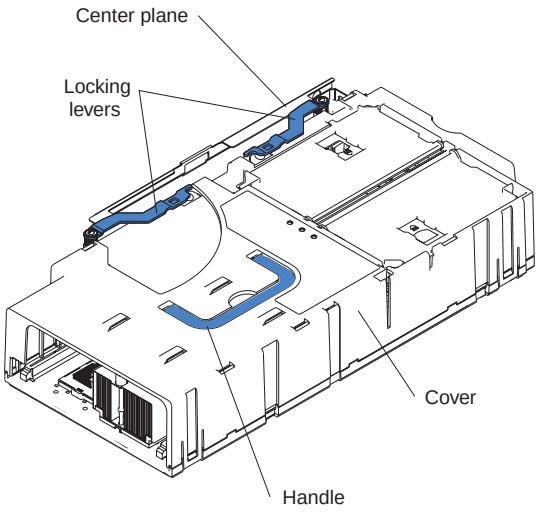


Figure 22. Securing the SMP Expansion Module in place

e. Install the retention bracket.

Notes:

1) If there are two SMP Expansion Modules installed in your server, you must install the retention bracket for each of the SMP Expansion Modules. Be sure to install the bottom retention bracket first, then repeat steps 2a through 2e for the top SMP Expansion Module.
2) If the server is going to shipped or moved over a long distance, you must reinstall the shipping thumbscrews.

Installing an adapter

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 I/O board.

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

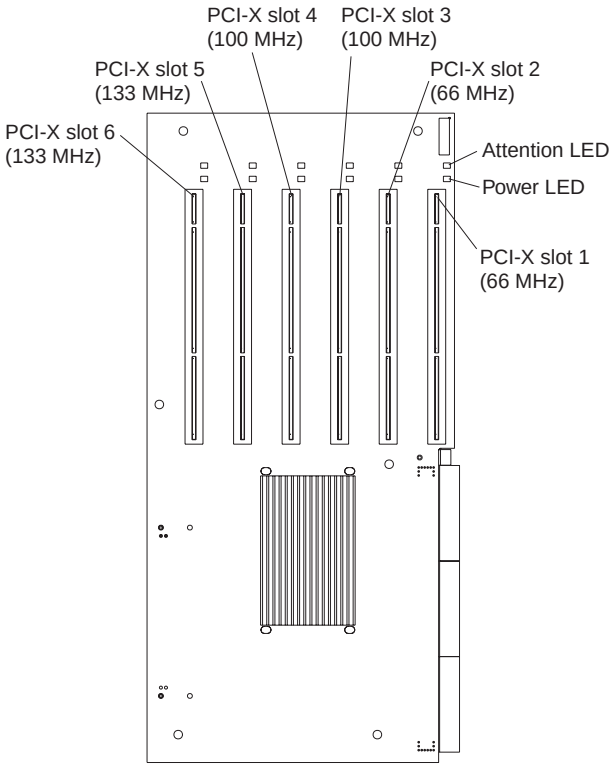


Figure 23. PCI-X slot bus speeds and locations

- Locate the documentation that comes with the adapter and follow those instructions in addition to the instructions in this chapter.
- 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 long adapters have extension handles or brackets installed. Before installing the adapter, you must remove the extension handle or bracket.
- Your server uses a rotational interrupt technique to configure PCI-X adapters. You can use this technique to install PCI-X adapters that currently do not support sharing of PCI-X interrupts.
- Your server scans devices and PCI-X slots to assign system resources in the following order: DVD-ROM drive; disk drives; integrated SCSI devices; PCI-X slots 1, 2, 3, 4, 5, 6; and the integrated Ethernet controller. If an RXE-100 enclosure is attached to the server, the scan continues in sequence with PCI slots 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, and 18.

- You can use the Configuration/Setup Utility program to change the sequence and have the server scan one of the first six PCI slots before it scans the integrated devices. You cannot change the scan sequence of the PCI slots in an RXE-100 enclosure.
- You can install both PCI and PCI-X adapters in the same bus. However, if you install a PCI adapter and a PCI-X adapter in 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 in the same bus, the bus speed will match that of the slowest adapter.
- If a single 133 MHz adapter is installed in PCI-X bus B (slot 3 and 4) and the other slot in PCI-X bus B is empty, the adapter will operate at 133 MHz.
- Your server supports six hot-plug 64-bit adapters in the expansion slots located on the PCI-X board.

  Note: You can add up to 12 PCI-X slots to your server by connecting your server to a remote I/O expansion enclosure. For more information about the expansion enclosure, see the documentation that comes with your expansion enclosure.
- Your server supports 3.3 V adapters; it does not support 5.0 V adapters.
- Do not install a PCI-X adapter in PCI-X slot 1 if you are going to install the serial port that comes with your server. See “Installing the serial port” on page 33 for instruction for installing the serial port.

Note: Before hot-swapping any of the PCI-X adapters, read the information in “Working inside the server with power on” on page 8.

Complete the following steps to install an adapter:

1. Read the safety information beginning on page v and “Installation guidelines” on page 7.
2. Open the top cover.

   Note: There are six PCI-X slots inside your server : two 66 MHz, two 100 MHz, and two 133 MHz. Before attempting to install a new adapter, be sure that there is an available slot for it. If you need additional PCI-X slots, you can purchase a remote I/O expansion enclosure through your IBM marketing representative or authorized reseller.

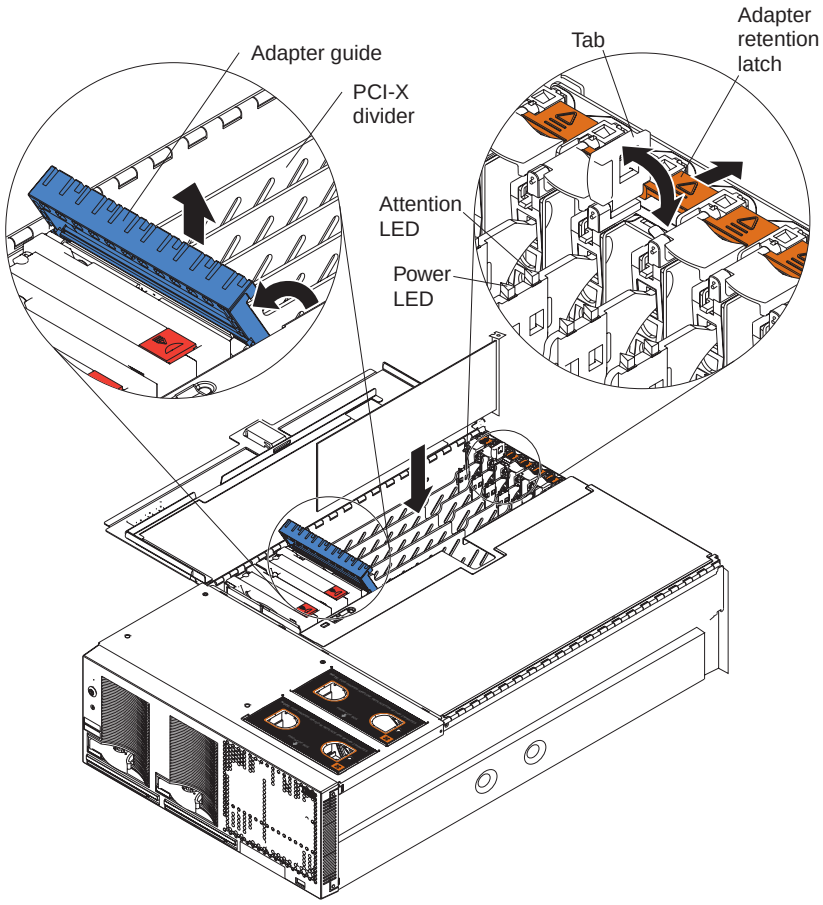


Figure 24. PCI-X slot components

3. See the documentation that comes with your adapter for any cabling instructions.

   Note: Route adapter cables before you install the adapter.

4. Set any jumpers or switches as described by the adapter manufacturer.

   Note: Do not install an adapter in PCI-X slot 1 if you are going to install the serial port that comes with your server. See “Installing the serial port” on page 33 for instructions for installing the serial port.

5. Install the adapter:
   a. 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 and the PCI-X divider.
   d. Carefully grasp the adapter by its top edge or upper corners, and align it with the connector on the PCI-X board.
   e. If necessary remove the extension handles or bracket before installing a long adapter.

      Attention: When you install an adapter, be sure the adapter is correctly seated in the connector. Improperly seated adapters might cause damage to the PCI-X board or to the adapter.

f. Press the adapter *firmly* into the adapter connector.
g. Reinstall the PCI-X dividers between the Active PCI-X adapter slots.
h. Push down on the blue adapter guide to keep the adapter steady.
i. Close the tab; then, push down on the blue adapter retention latch until it clicks into place, securing the adapter.

6. Connect the internal cables to the adapter.
7. If you have other options to install or remove, do so now.
8. Go to “Install the server in the rack cabinet” on page 35.

Cabling a ServeRAID adapter

Some xSeries 445 models come with an optional IBM ServeRAID™ adapter installed to control the internal hot-swap 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 the connector on the SCSI backplane, and the other end is attached to the connector for the integrated SCSI controller 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 will connect this cable to the adapter and to the SCSI backplane.

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

Important: When installing multiple ServeRAID adapters in a server that has the PCI-X slot enabled for high scan (boot) priority, ensure that the ServeRAID adapter controlling the startup (boot) drive is installed in a PCI slot that is scanned before the PCI slots that contain the other ServeRAID adapters. See “Installing an adapter” on page 28.

Complete the following steps to cable the ServeRAID adapter:

1. Read the safety information beginning on page v and “Installation guidelines” on page 7.
2. Turn off the server and disconnect all power cords and external cables; then, open the server cover (see “Opening the cover” on page 9).
3. Remove fans 3 and 4, which are located just behind the PCI-X slots (see the illustration on page 5 for the locations of the fans).
4. Disconnect the short SCSI cable from the SCSI backplane and the integrated SCSI controller 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 28).

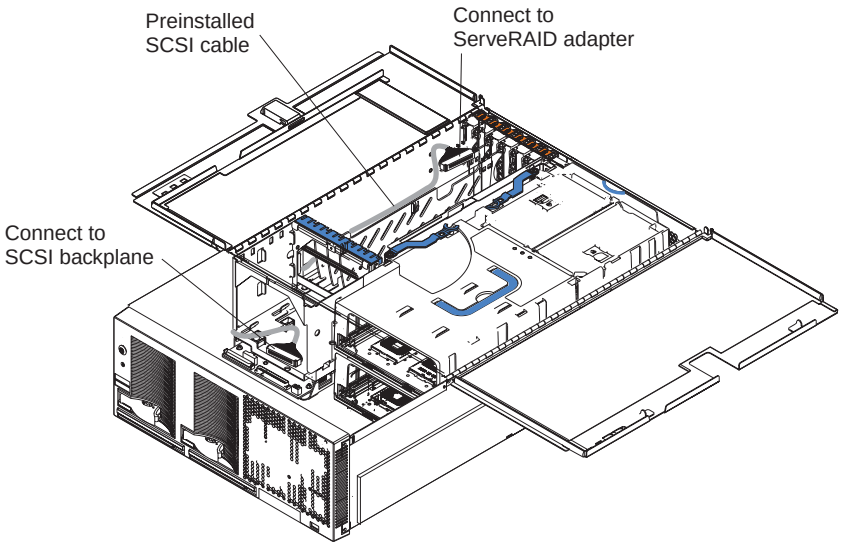


Figure 25. Preinstalled SCSI cable for the ServeRAID adapter

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 connector.

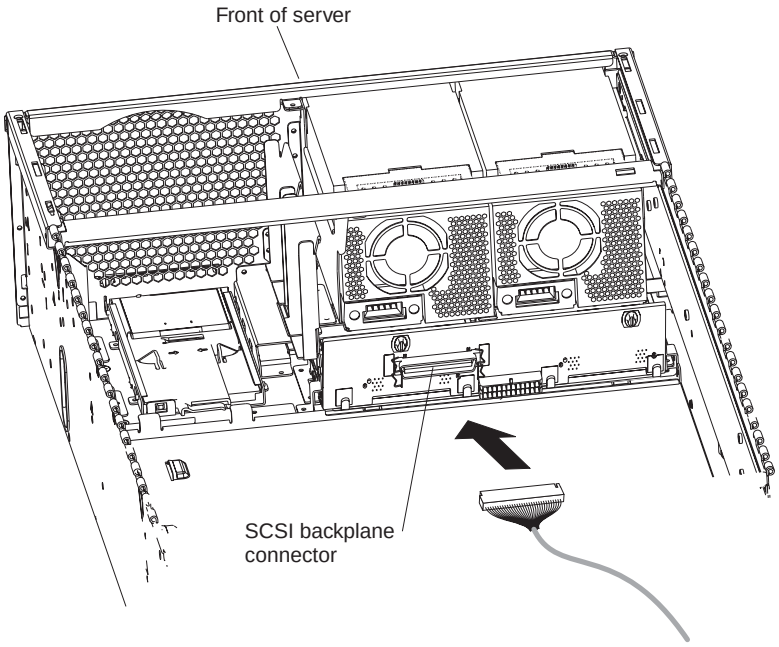


Figure 26. Connecting the preinstalled SCSI cable

8. Reinstall fans 3 and 4.
9. If you have other options to install or remove, do so now.
10. Go to “Completing the installation” on page 33.

Completing the installation

This section provides information about completing the installation of your server, including information about the serial port, rack installation, and how to initially cable your server.

Note: Installation of the serial port is optional. You do not have to install the serial port for your server to operate properly. Also, the cabling information provided in this publication covers some of the possible configurations.

Installing the serial port

Included with your server is a serial port that you can install at any time. This section provides the instructions for installing the serial port.

Note: The serial port will occupy PCI-X slot one.

Complete the following steps to install the serial port.

1. Read the safety information beginning on page v and “Installation guidelines” on page 7.
2. Open the top cover.

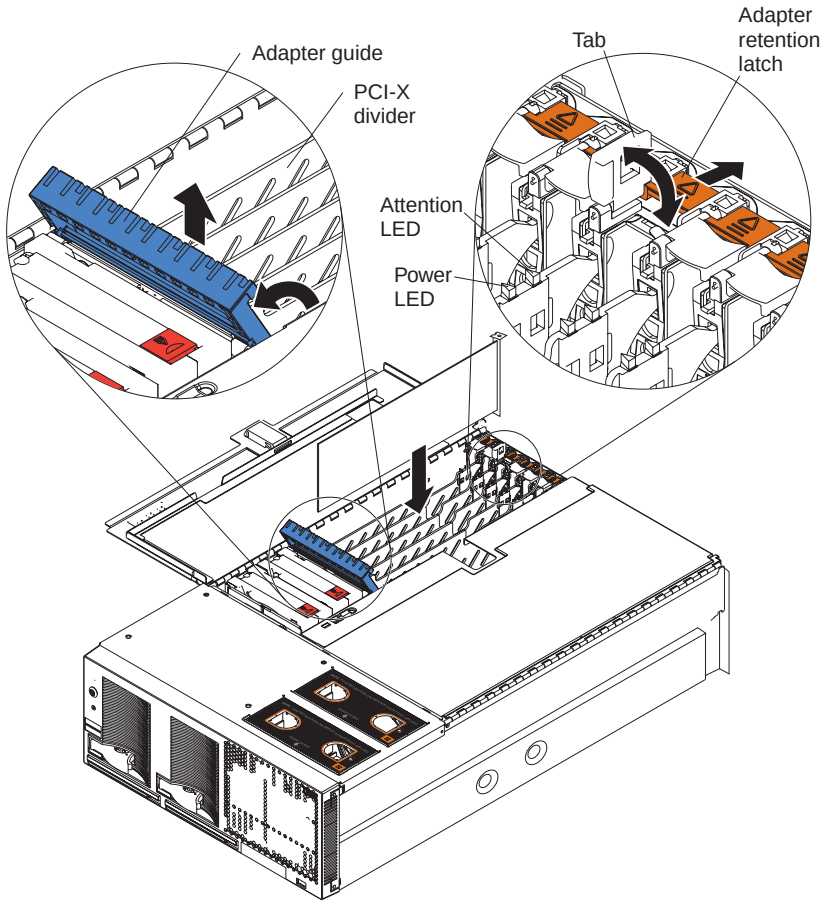


Figure 27. PCI-X slot components

3. Open the blue adapter guide by lifting the front edge, as shown in the illustration.

4. Remove the PCI-X slot cover and the PCI-X divider from slot one.

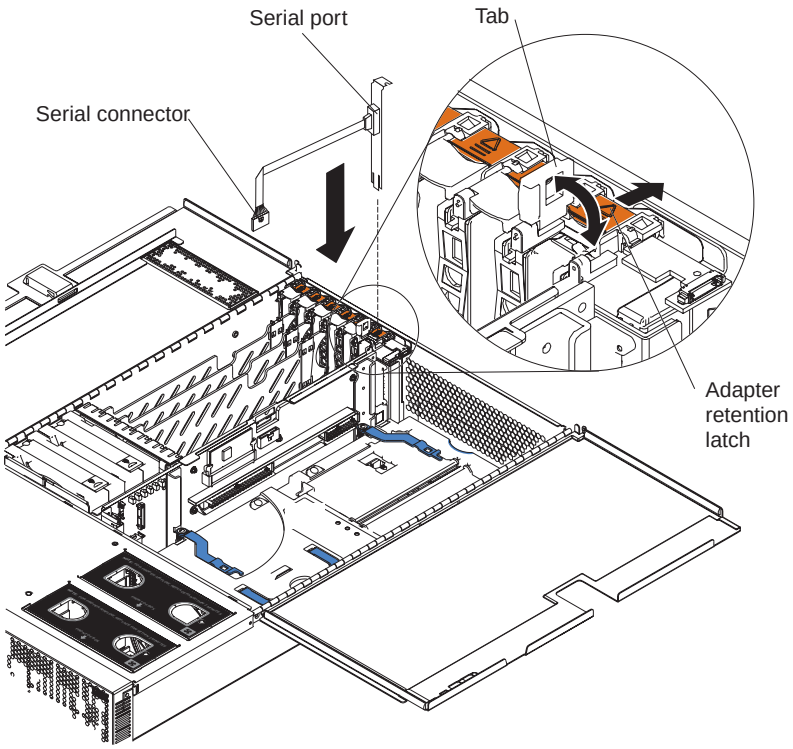


Figure 28. Insert the serial port into PCI-X slot 1

5. Insert the serial port into the opening.
6. Close the tab; then, push down on the blue adapter retention latch until it clicks into place.

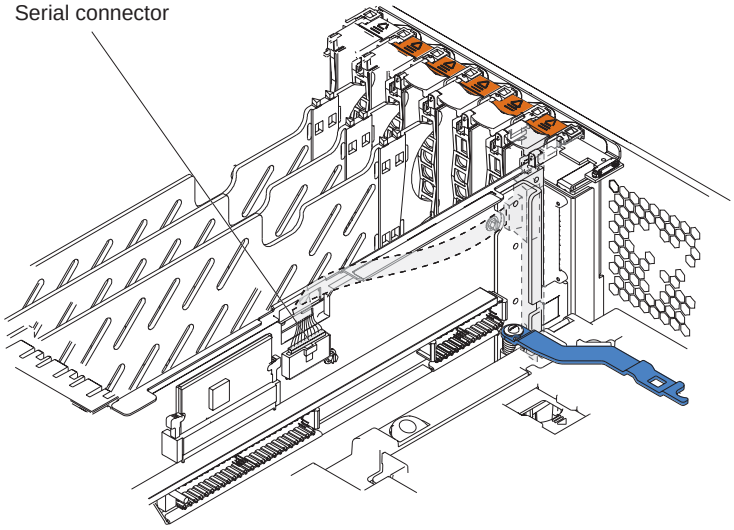


Figure 29. Route the serial port ribbon cable through the slot

7. Route the ribbon cable through the lower slot in the center of the server.
8. Connect the serial port ribbon cable to the connector on the center planar.
9. If you have other options to install or remove, do so now.

10. Go to “Install the server in the rack cabinet”.

    Note: Use the Configuration/Setup Utility program to configure the serial port.

Install the server in the rack cabinet

Close the cover and install the server into a rack cabinet.See the *Rack Installation Instructions* that came with your server for detailed information on how to install the server in a rack cabinet.

Note: After completing the rack installation see “Connecting the cables” on page 36 in this publication for instructions and information.

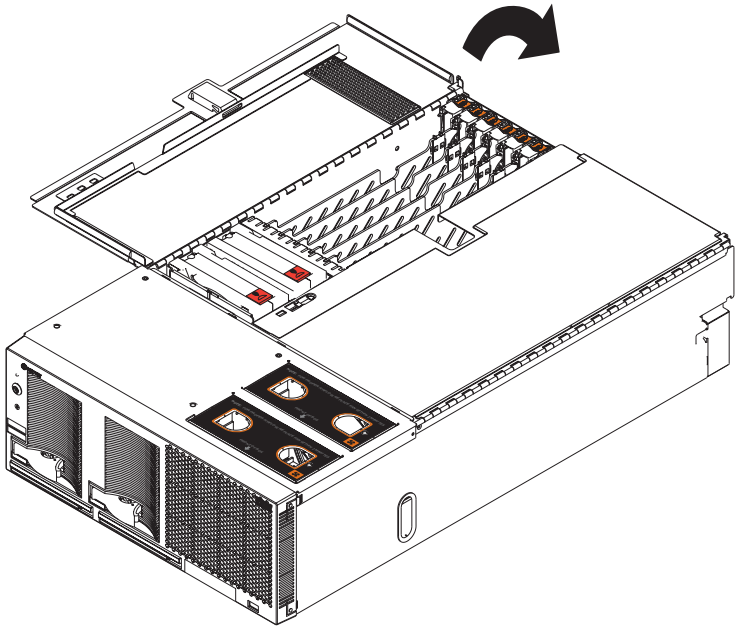


Figure 30. Closing the cover

Connecting the cables

This section describes how to connect cables to the SMP Expansion Port, system power connectors, RXE Expansion Port, SCSI connector, USB connector, video connector, mouse connector, keyboard connector, Ethernet connector, and RXE Management port for up to 16-way operation.

For details about the locations and functions of all of the ports, LEDs, and connectors see Chapter 3, “Server controls, LEDs, and power”, on page 51.

Notes:

1. The information in this publication is for single and dual server configurations using up to 16 microprocessors and four SMP Expansion Modules.
2. There are two different SMP Expansion cables used to connect the SMP Expansion Modules.
   a. 2.5 m (8.2 feet) copper clad (comes in the IBM @server xSeries 445 Two-chassis 16-way Scalability Kit)
   b. 25.4 cm (10 inches) black clad
3. Before connecting RXE or SMP Expansion cables to the server, ensure that the protective cover is removed from the connectors on each end.
4. See the following illustration to locate the connectors on the back of your server. The illustrations in this document might differ slightly from your hardware.

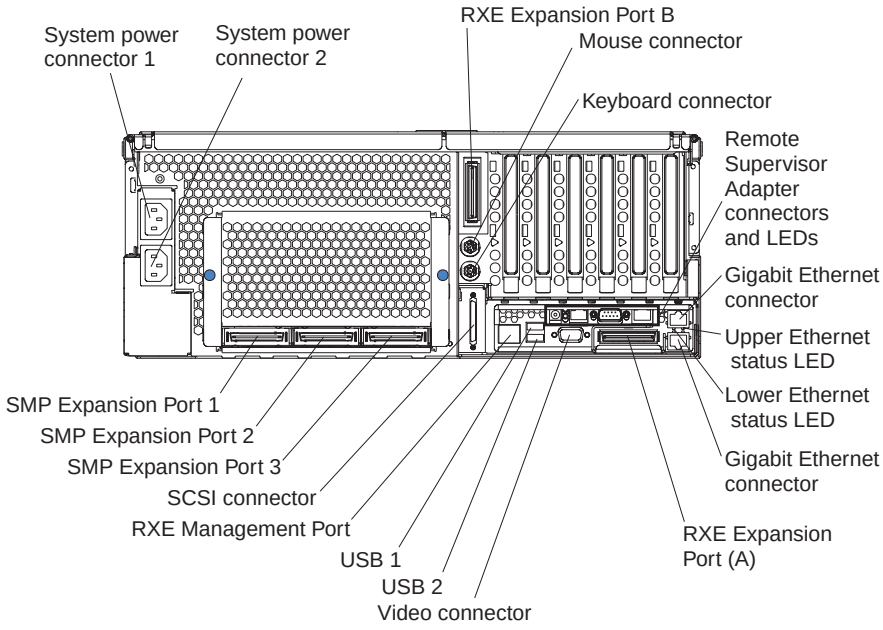


Figure 31. Rear view of server

5. If your server model comes with an operating system, such as Microsoft® Windows® 2000 Datacenter Server or VMware ESX server, see the software documentation provided with your software for additional cabling instructions.

To effectively manage the cables on this 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 Port cabling

Your server has either three or six SMP Expansion Ports located on the back of the server, depending on your configuration. Configurations that use only one SMP Expansion Module do not require any cabling of the SMP Expansion Ports. The cabling information in this section is for configurations using up to four SMP Expansion Modules in two servers.

If you are installing a server with one SMP Expansion Module skip this section. Continue to “One server with one SMP Expansion Module” on page 42 in the RXE Expansion Port section and complete that procedure.

One server with two SMP Expansion Modules: Complete the following steps to cable two SMP Expansion Modules in a single server together, using the two 25.4 cm (10 inches) SMP expansion Cables, for up to 8-way operation. In the illustration, the SMP Expansion Modules are numbered 0 and 1, from bottom to top. The SMP Expansion Ports are numbered 1 through 3, left to right. If your server comes with two SMP Expansion Modules, the SMP Expansion cables are included with the server. If you purchased a second SMP Expansion Module, the cables are included with the option.

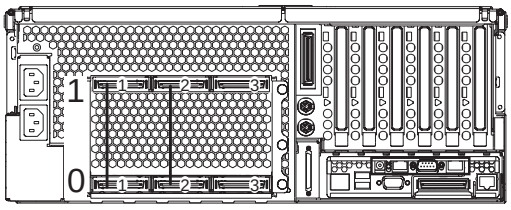


Figure 32. SMP Expansion Module numbering

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

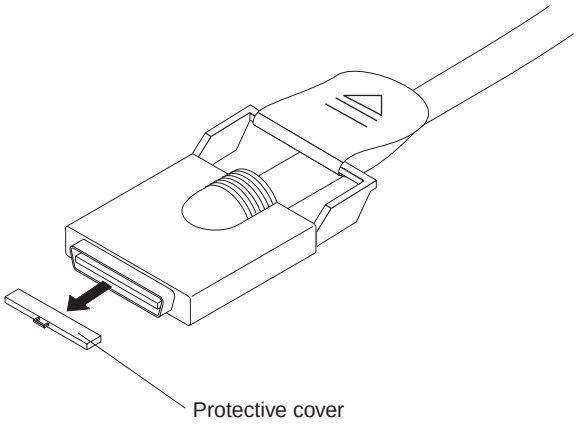


Figure 33. SMP Expansion cable with protective cover

2. Connect one end of a 25.4 cm (10 inches) SMP Expansion cable to port 1 of SMP Expansion Module 0; then, connect the opposite end of the cable to port 1 of SMP Expansion Module 1.

3. Connect one end of the second 25.4 cm (10 inches) SMP Expansion cable to port 2 of SMP Expansion Module 0; then, connect the opposite end of the cable to port 2 of SMP Expansion Module 1.
4. Go to “One server with two SMP Expansion Modules” on page 43 in the ″RXE Expansion Port cabling″ section and complete that procedure.

   Notes:

   a. When multiple cables are connected between the SMP Expansion Module ports, SMP data is interleaved between the cables for better performance.
   b. The server will start and operate with one cable attached between the two SMP Expansion Modules.

Two servers with four SMP Expansion Modules (16-way): Complete the following steps to cable four SMP Expansion Modules and two servers together, using the four 2.5 m (8.2 feet) and two 25.4 cm (10 inches) SMP expansion cables, that came with your servers, for up to 16-way operation. In the illustration, the SMP Expansion Modules are numbered 0 through 3, from primary to secondary server. The SMP Expansion Ports are numbered 1 through 3, left to right.

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

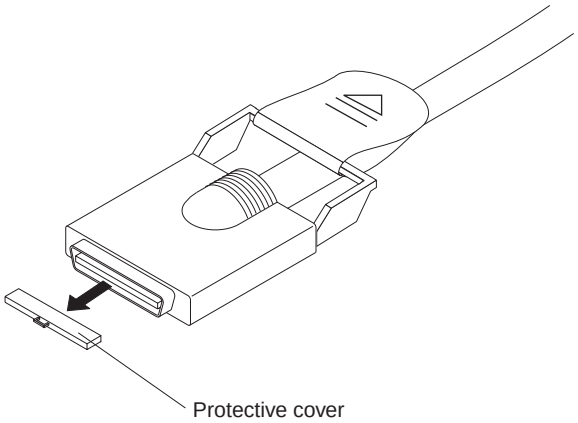


Figure 34. SMP Expansion cable with protective cover

2. Label each end of the 2.5 m (8.2 feet) SMP Expansion cables according to where they will connect to each server. See the following illustration. The SMP Expansion module numbering shown in the following illustration is for reference purposes only. These numbers do not appear on the servers.

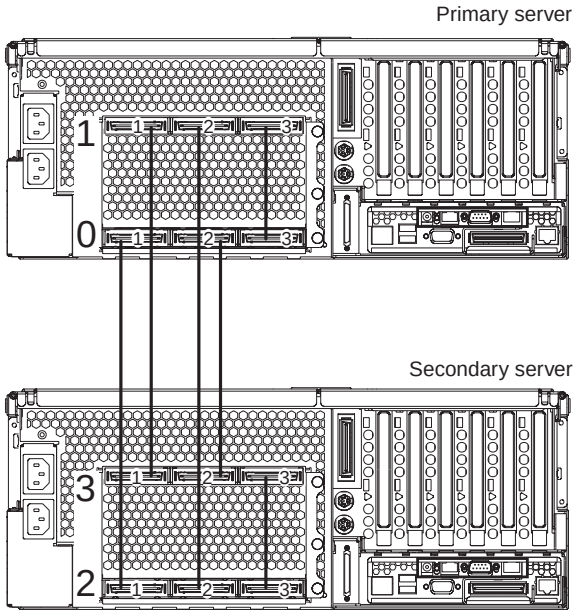


Figure 35. 16-way SMP Expansion port cabling

3. Connect the SMP Expansion cables to the primary server:
   a. Connect one end of a 2.5 m (8.2 feet) SMP Expansion cable to port 1 of SMP Expansion Module 0 on the primary server; then, route the cable through the cable-management arm.

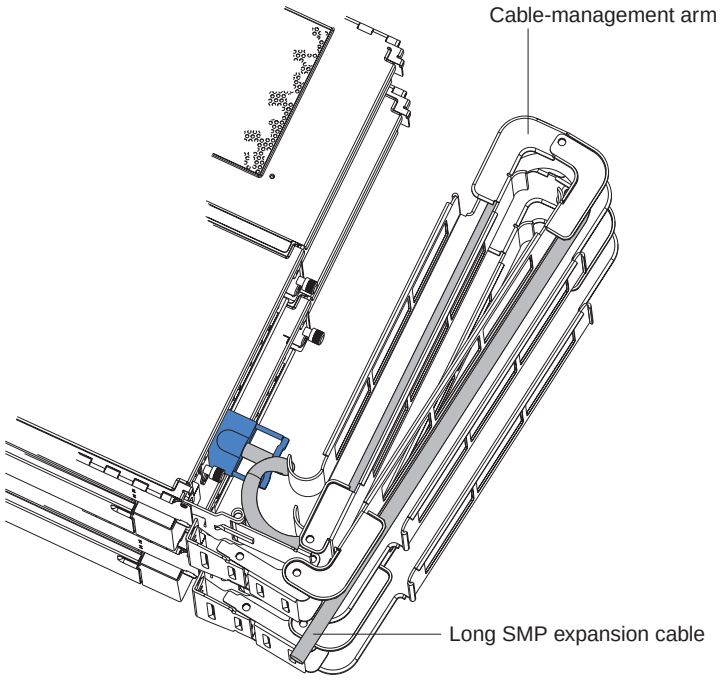


Figure 36. Routing cables through the cable management arm

   b. Connect one end of a 2.5 m (8.2 feet) SMP Expansion cable to port 2 of SMP Expansion Module 0 on the primary server; then, route the cable beside the first cable in the cable-management arm.

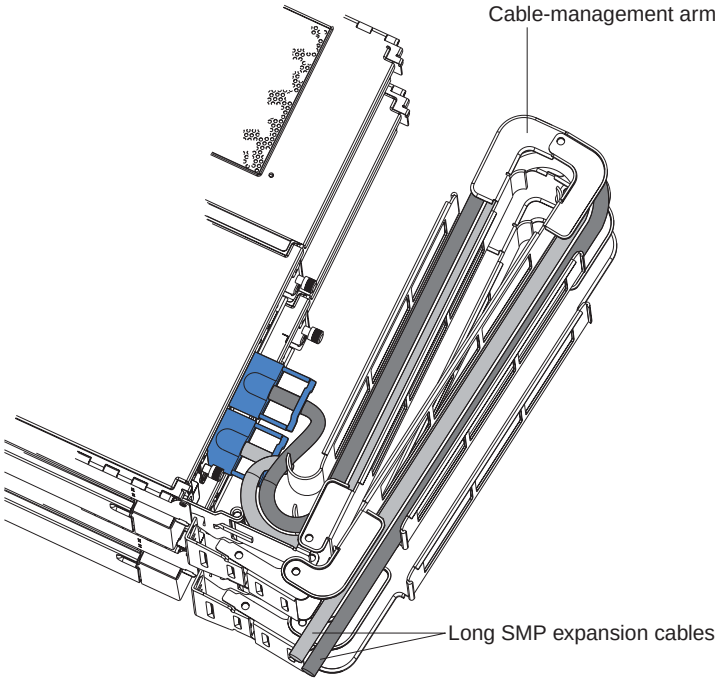


Figure 37. Routing cables through the cable management arm

c. Connect one end of a 2.5 m (8.2 feet) SMP Expansion cable to port 1 of SMP Expansion Module 1 on the primary server; then, route the cable through the cable-management arm as in step 3a on page 39.

d. Connect one end of a 2.5 m (8.2 feet) SMP Expansion cable to port 2 of SMP Expansion Module 1 on the primary server; then, route the cable through the cable-management arm as in step 3b on page 39.

e. Verify that a 25.4 cm (10 inches) SMP Expansion cable is connected between port 3 of SMP Expansion Module 0 and port 3 of SMP Expansion Module 1.

4. Connect the SMP Expansion cables to the secondary server:

   a. Locate the SMP Expansion cable that is connected to port 1 of SMP Expansion Module 0 on the primary server; then, connect the opposite end of the cable to port 1 of SMP Expansion Module 2. Next, route the cable through the secondary cable-management arm.

   b. Locate the SMP Expansion cable that is connected to port 2 of SMP Expansion Module 1 on the primary server; then, connect the opposite end of the cable to port 2 of SMP Expansion Module 2. Next, route the cable through the secondary cable-management arm.

   c. Locate the SMP Expansion cable that is connected to port 1 of SMP Expansion Module 1 on the primary server; then, connect the opposite end of the cable to port 1 of SMP Expansion Module 3. Next, route the cable through the secondary cable-management arm.

   d. Locate the SMP Expansion cable that is connected to port 2 of SMP Expansion Module 0 on the primary server; then, connect the opposite end of the cable to port 2 of SMP Expansion Module 3. Next, route the cable through the secondary cable-management arm.

   e. Verify that a 25.4 cm (10 inches) SMP Expansion cable is connected between port 3 of SMP Expansion Module 2 and port 3 of SMP Expansion Module 3.

5. Connect the Remote Supervisor Adapter Ethernet port 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 perform the necessary functions for the two servers to create or delete 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 “16-way configuration” on page 45 in the ″RXE Expansion Port cabling″ section of this publication and complete that procedure.

RXE Expansion Port cabling

Your server has two RXE Expansion Ports located 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 Ports, see the documentation that comes with the remote I/O enclosure.

One server with one SMP Expansion Module: If your server has one SMP Expansion Module installed, complete the following steps. For information about cabling the RXE Management Ports, see “RXE Management Port cabling” on page 47.

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

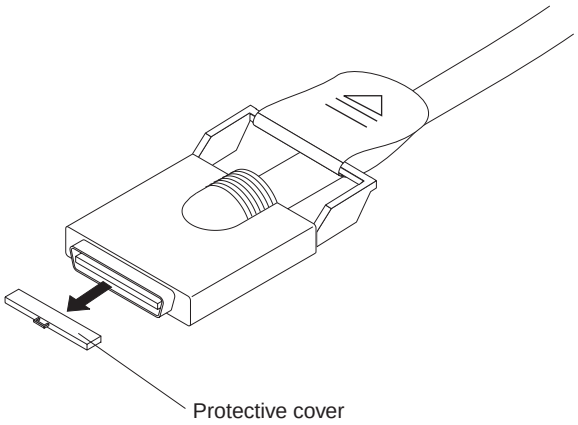


Figure 38. RXE Expansion cable with protective cover

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

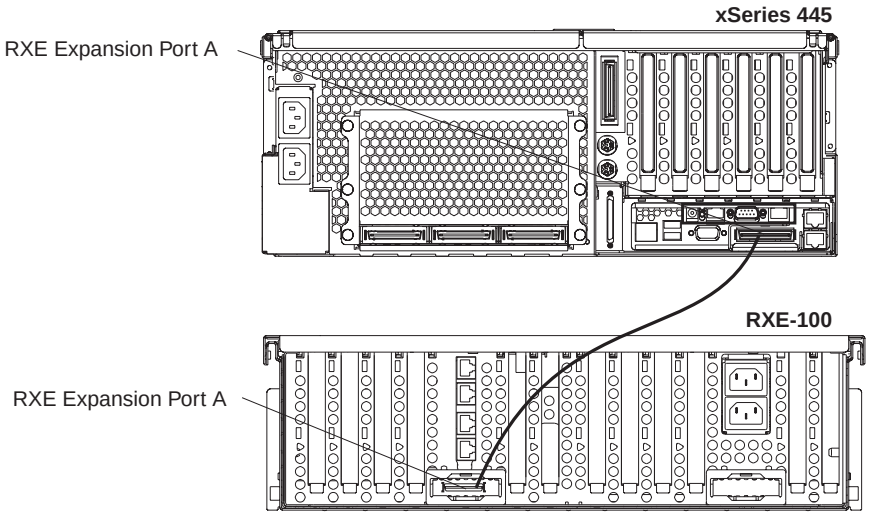


Figure 39. RXE Expansion Port cabling a server with one SMP Expansion Module

3. Connect the opposite end of the cable to an RXE Expansion Port on the remote I/O enclosure.
4. Go to “One server” on page 47 in the ″RXE Management Port cabling″ section and complete that procedure.

One server with two SMP Expansion Modules: If your server has two SMP Expansion Modules installed complete the following steps. For information about cabling the RXE Management Ports, see “RXE Management Port cabling” on page 47.

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

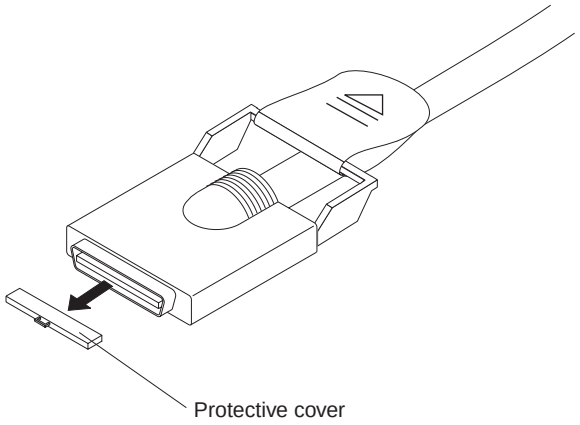


Figure 40. RXE Expansion cable with protective cover

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

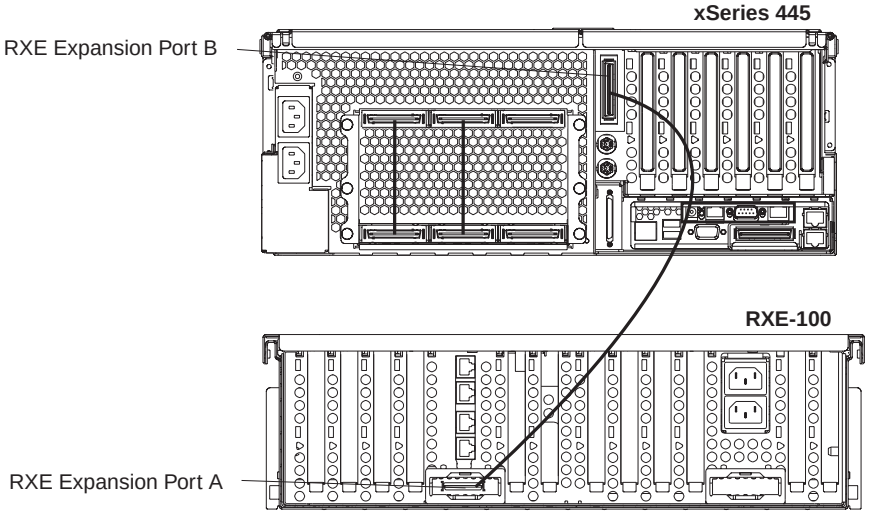


Figure 41. RXE Expansion port cabling a server with two SMP Expansion Modules

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

   Notes:

   a. When two SMP Expansion Modules are installed, both of the RXE Expansion ports are active.

   b. To increase reliability connect a second RXE Expansion cable from the server RXE Expansion Port A to the remote I/O enclosure RXE Expansion Port B. This will create a redundant data path if either of the two cables fail.

4. Go to “One server” on page 47 in the ″RXE Management Port cabling″ section and complete the procedure.

Two stand-alone servers: To cable two stand-alone servers to a single remote I/O enclosure complete the following steps. For information about cabling the RXE Management Ports, see “RXE Management Port cabling” on page 47.

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.

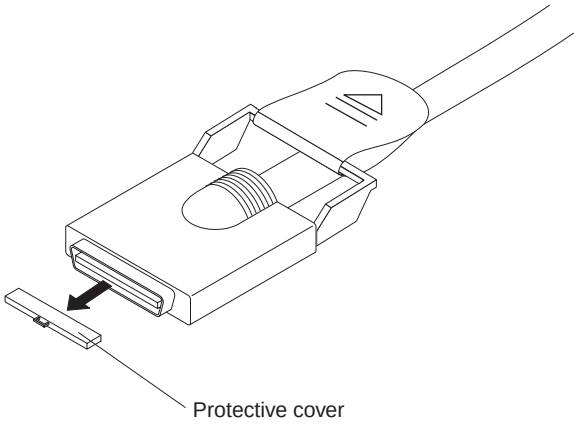


Figure 42. RXE Expansion cable with protective cover

3. Using an RXE Expansion cable, connect one end of the cable to RXE Expansion Port A on the remote I/O enclosure.

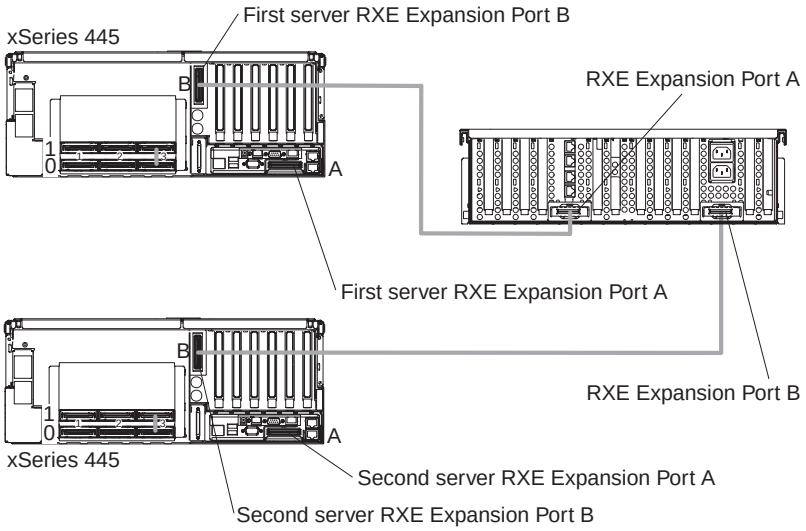


Figure 43. RXE Expansion Port cabling of two stand-alone xSeries 445 servers to a single remote I/O enclosure

4. Connect the opposite end of the cable to RXE Expansion Port A or B on the first server.

   Note: If the server has one SMP Expansion Module installed you must connect the RXE Expansion cable to RXE Expansion Port A on the server. If server has two SMP Expansion Modules installed, connect the cable to RXE Expansion Port B.

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

   Note: When two SMP Expansion Modules are installed, both of the RXE Expansion ports are active.
7. Go to “Two stand-alone servers” on page 48 in the ″RXE Management Port cabling″ section and complete that procedure.

16-way configuration: Complete the following steps to connect an IBM RXE-100 Remote Expansion Enclosure to a 16-way system. For information about cabling the RXE Management Ports, see “RXE Management Port cabling” on page 47.

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

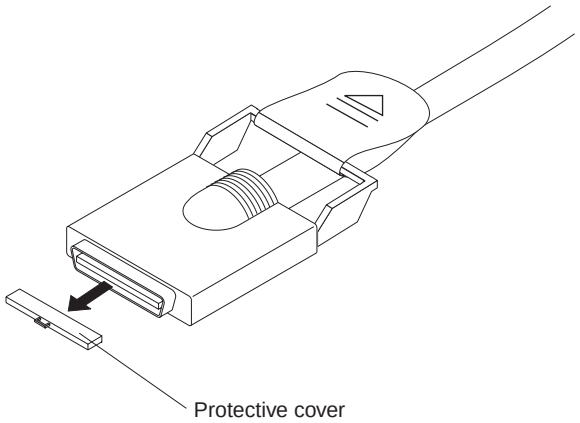


Figure 44. RXE Expansion cable with protective cover

2. Using an RXE Expansion cable, connect RXE Expansion Port A on the primary server to RXE Expansion Port A on the secondary server.

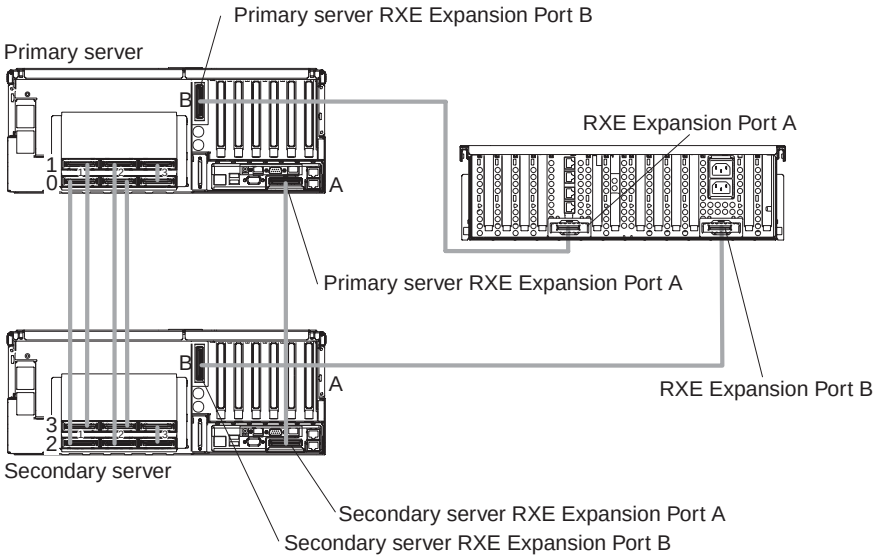


Figure 45. RXE Expansion Port cabling in a 16-way configuration

3. Using an RXE Expansion cable, connect RXE Expansion Port B on the primary server to RXE Expansion Port A on the RXE-100.
4. Using an RXE Expansion cable, connect RXE Expansion Port B on the secondary server to the RXE Expansion Port B on the RXE-100.
5. Go to “16-way configuration” on page 49 in the ″RXE Management Port cabling″ section and complete that procedure.

RXE Management Port cabling

Your server has one RXE Management Port located 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 cable the RXE Management Port on the server to a remote I/O enclosure RXE Management Port.

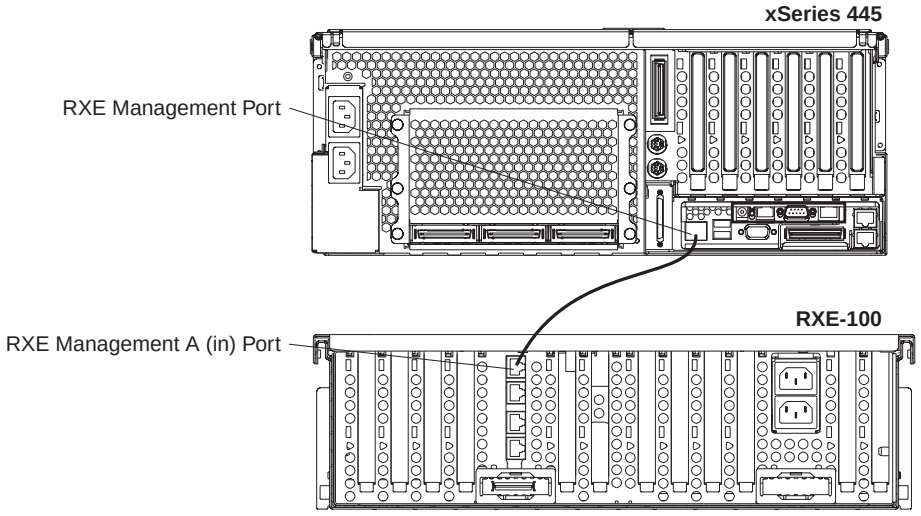


Figure 46. Cabling RXE Management Port - one server

1. Using an RXE Management cable, connect one end of the cable to the RXE Management Port on the server.
2. Connect the opposite end of the cable to the RXE Management A (in) Port on the remote I/O enclosure. The RXE Management Port cabling is the same for a server with two SMP Expansion Modules
3. Connect all remaining external cables to the server; then, go to “Creating a scalable partition” on page 64 and follow the instructions for creating a scalable partition.

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

Note: The configuration shown in the following illustration is two 8-way servers that are independent of each other. Notice that there are no interconnecting cables between the two servers.

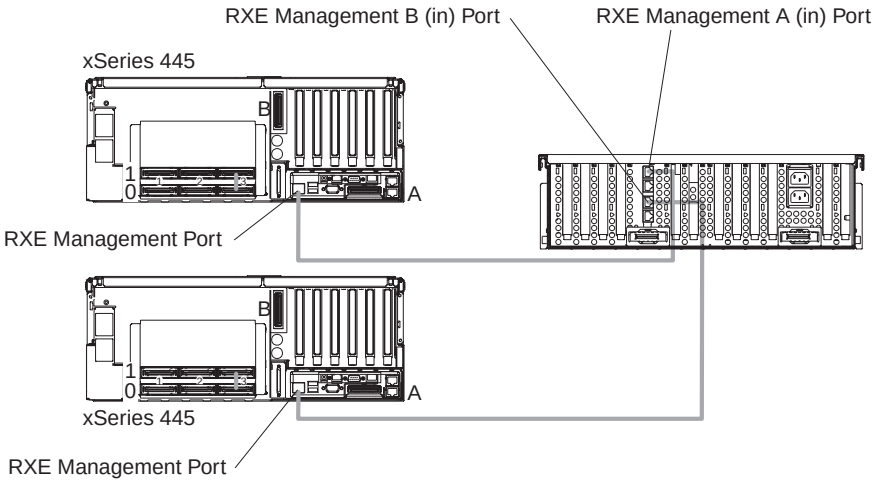


Figure 47. Cabling an RXE Management port - two stand-alone servers

1. Using an RXE Management cable, connect one end of the cable to the RXE Management Port on one of the servers.
2. Connect the opposite end of the cable to the RXE Management A (in) Port on the remote I/O enclosure. The RXE Management Port cabling is the same for a server with two SMP Expansion Modules.
3. Repeat steps 1 and 2 for the second server.
4. Connect all remaining external cables to the servers; then, go to “Creating a scalable partition” on page 64 and follow the instructions for creating a scalable partition.

16-way configuration: Complete the following steps to connect an IBM RXE-100 Remote Expansion Enclosure to a 16-way configuration.

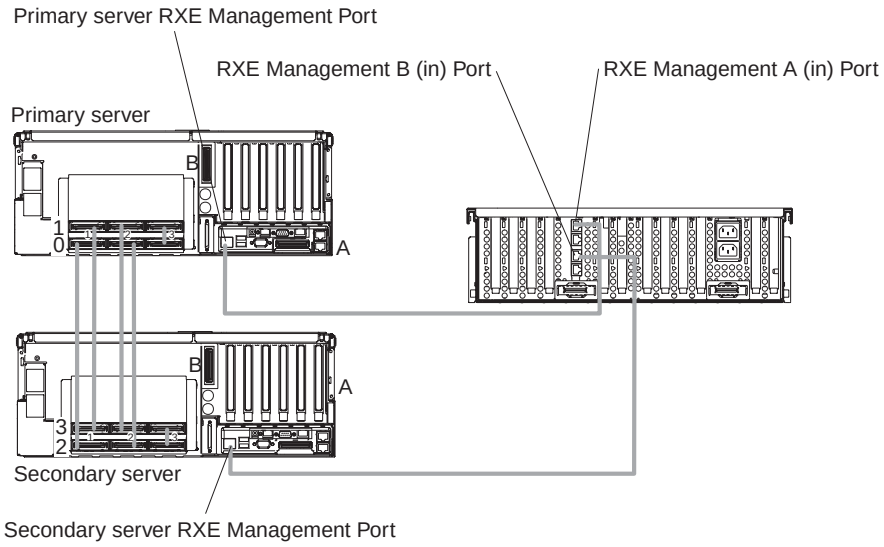


Figure 48. Cabling an RXE Management Port - 16-way configuration

1. Using an RXE Management cable, connect the RXE Management Port on the primary server to RXE Management Port A (in) on the RXE-100.
2. Using an RXE Management cable, connect the RXE Management Port on the secondary server to the RXE Management Port B (in) on the RXE-100.
3. Connect all remaining external cables to the servers; then, go to “Creating a scalable partition” on page 64 and follow the instructions for creating a scalable partition.

Power cabling

Your server uses 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, or to an external source, such as a properly grounded electrical outlet.

Complete the following steps to attach the power-supply cords:

1. Connect a power-supply cord to one of the system power connectors on the rear of the server.
2. Connect the other end of the power-supply cord to a properly grounded electrical outlet or a primary power unit inside the rack cabinet.

   Note: Connecting the power-supply cords to an electrical outlet might cause the server to start automatically. This is an acceptable action. See “Turning on the server” on page 55 for detailed information about turning on the server.
3. Repeat steps 1 and 2 for the second cable.

   Note: The xSeries 445 server requires a 220 V power connection for full power-supply redundancy. Whenever possible, use a 220 V connection for all configurations. However, you can use a 110 V connection, but without power-supply redundancy.

SCSI cabling

Your server has one SCSI connector located on the back of the server. Use this connector to connect the server to an optional SCSI device such as one of the IBM FAStT series of extended enclosures. For detailed information about this option and how to connect it to your server, see the documentation that comes with the option.

USB cabling

Your server has 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 detailed information about this USB option and how to connect it to your server, see the documentation that comes with the option.

Video cabling

Your server has one video connector located on the back of the server. Use this connector to connect the server to a monitor or optional console switch. For detailed information about this option and how to connect it to your server, see the documentation that comes with the option.

Mouse cabling

Your server has one mouse connector located on the back of the server. Use this connector to connect a mouse to the server. For detailed information about this option and how to connect it to your server, see the documentation that comes with the option.

Keyboard cabling

Your server has one keyboard connector on the back of the server. Use this port to connect the server to a keyboard or optional console switch. You can also connect a USB keyboard to the server using one of the USB connectors. After installing a USB keyboard, you might need to use the Configuration/Setup Utility program to enable keyboardless operation and prevent the POST error message 301 from being displayed during startup. For detailed information about this option and how to connect it to your server, see the documentation that comes with the option.

Gigabit Ethernet cabling

Your server has 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 located on the Remote Supervisor Adapter. This connector is used for specific supervisory functions and should not be confused with the Gigabit Ethernet connector located next to the USB 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.

Chapter 3. Server controls, LEDs, and power

This chapter describes the controls and indicators, and provides the information needed to turn on and turn off the server.

Front view

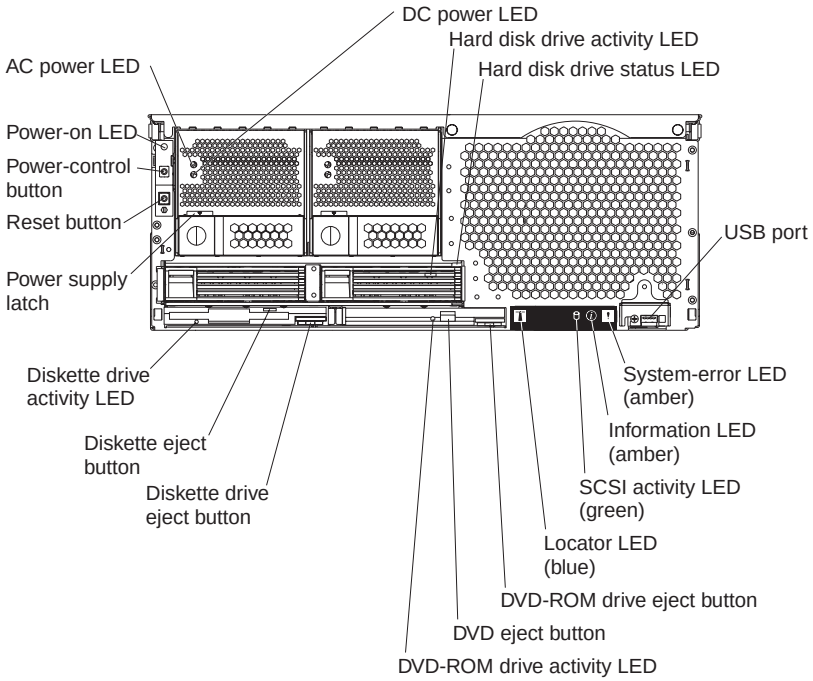


Figure 49. Front view of xSeries 445

AC and DC power LED: Each hot-swap power supply has an ac power LED and a dc power LED. During typical operation, both the ac and dc power LEDs are lit. For any other combination of LEDs, see the *Hardware Maintenance Manual and Troubleshooting Guide* on the IBM *xSeries Documentation* CD.

Hard disk drive activity LED: When this green LED is on, it indicates that the hard disk drive is in use.

Hard disk drive status LED: When the drive is connected to the integrated SCSI controller with RAID capabilities, a flashing status LED indicates that the drive is a secondary drive in a mirrored pair and the drive is being synchronized. When the drive is connected to an optional ServeRAID controller, a slowly flashing (one flash per second) status LED indicates that the drive is being rebuilt. When the LED is flashing rapidly (three flashes per second), it indicates that the controller is identifying the drive.

USB port: This is an automatically configured port that you can use to connect one or more USB devices to the front of the server, using Plug and Play technology.

System-error LED: When this amber LED is on, it indicates a system error has occurred.

Information LED: When this amber LED is on, it indicates information about a system error has been placed in the System Error log.

SCSI activity LED: When this green LED is on, it indicates that there is activity on the SCSI bus.

Locator LED: The locator LED is on the left front of the Light Path Diagnostic drawer. This blue LED indicates the primary and secondary servers. This LED blinks on the primary server. If the LED remains solid, it indicates that server is the secondary server.

DVD-ROM drive eject button: Press this button to release a DVD-ROM drive from the server.

DVD eject button: Press this button to release a DVD from the DVD-ROM drive.

DVD-ROM drive activity LED: When this LED is on, it indicates that the DVD-ROM drive is in use.

Diskette drive eject button: Press this button to release a diskette drive from the server.

Diskette eject button: Press this button to release a diskette from the diskette drive.

Diskette drive activity LED: When this LED is on, it indicates that the diskette drive is in use.

Power-supply latch: This latch is used to secure the power supply in place.

Reset button: Press this button to reset the server and run the power-on self-test (POST). You might have to use a pen or the end of a straightened paper clip to press the button.

Power-control button: Press this button to turn the server on and off manually. A power-control-button shield comes with your server. You can install this disk-shaped shield to prevent the server from being turned off accidentally.

Power-control button: Press this button to turn the server on and off manually. A power-control-button shield comes with your server. You can install this disk-shaped shield to prevent the server from being turned off accidentally.

Rear view

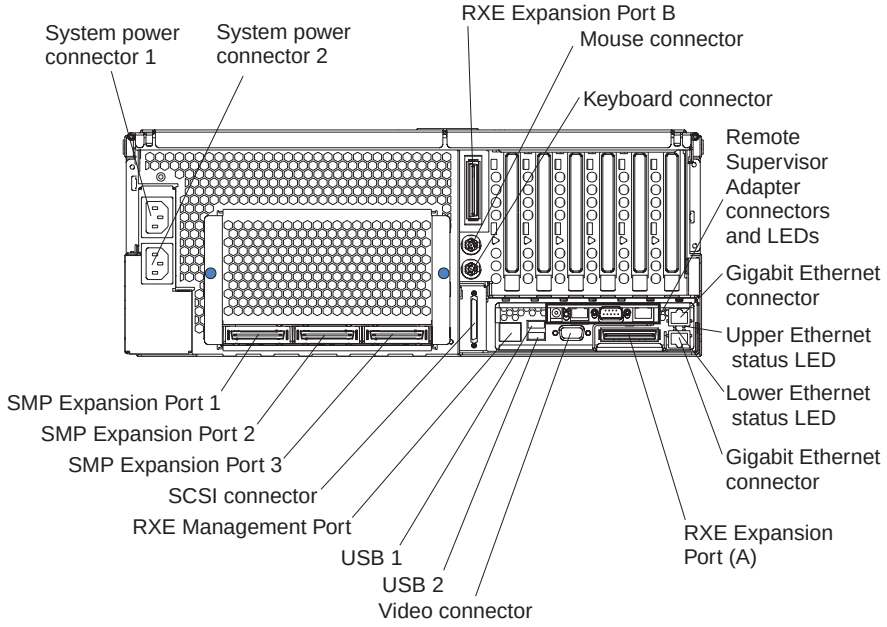


Figure 50. Rear view of xSeries 445

System power connectors (1 and 2): The system power cords are connected to these two connectors to provide power to the system.

RXE Expansion Port B: Use this port to connect the server to a remote I/O enclosure when two SMP Expansion Modules are installed.

Mouse connector: Connect a mouse or other PS/2® device to this connector.

Keyboard port: Signal cables for a keyboard are connected to the keyboard port.

Remote Supervisor Adapter connectors and LEDs: This group of connectors and LEDs located on the back of the server are used for system management information and control.

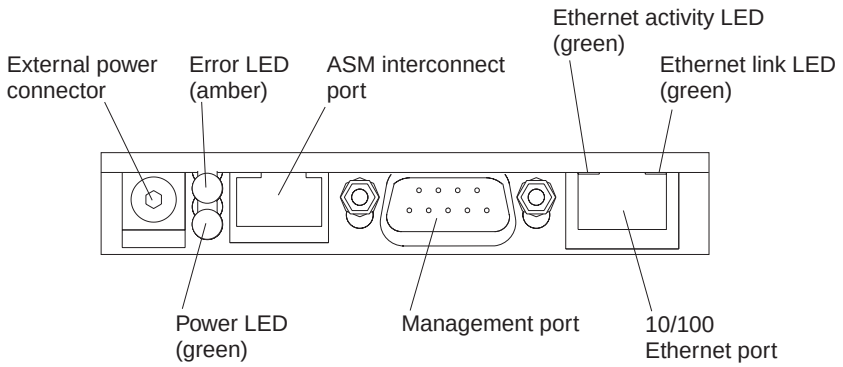


Figure 51. Remote Supervisor Adapter

- **External power connector** - This connector is not supported on this server.

- **Error LED** - This amber LED goes on when a system management error has occurred.
- **ASM interconnect port** - Signal cables for managing expansion module resources are connected to this port.
- **Ethernet activity LED:** When the LED is green there is activity on the Ethernet LAN.
- **Ethernet link LED:** When the LED is green the link is active.
- **10/100 Ethernet port** - Ethernet Signal cables are connected to the Ethernet port.
- **Management port** - Connect a serial cable to this port to enable system management through a modem, or connect a null modem cable to enable system management through a workstation or laptop computer.
- **Power LED** - This green LED goes on and stays on when you plug in your server.

Upper Ethernet status LED: This LED, displays the link and activity status for the upper Gigabit Ethernet port. When the LED is green the link is active. When the LED blinks green and amber there is activity on the Ethernet LAN.

Lower Ethernet status LED: This LED, displays the link and activity status for the lower Gigabit Ethernet port. When the LED is green the link is active. When the LED blinks green and amber there is activity on the Ethernet LAN.

Gigabit Ethernet port: Gigabit Ethernet Signal cables are connected to the Gigabit Ethernet port. This port supports 10/100/1000 speed connections.

RXE Expansion Port A: Use this port to connect the server to a remote I/O enclosure, when only one SMP Expansion Module is installed.

Video port: The signal cable for a monitor connects to the video port.

USB 2: This is an automatically configured port that you can use to connect one or more USB devices to the server, using Plug and Play technology.

USB 1: This is an automatically configured port that you can use to connect one or more USB devices to the server, using Plug and Play technology.

RXE Management Port: Use this port to connect a management cable from the server to a remote I/O enclosure.

SCSI port: This port is used to connect external SCSI devices to the server.

SMP Expansion port 3: This port is used to interconnect two SMP Expansion Modules together in 16-way configurations.

SMP Expansion port 2: This port is used to interconnect two SMP Expansion Modules together.

SMP Expansion port 1: This port is used to interconnect two SMP Expansion Modules together.

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 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 the server is connected to an Advanced System Management interconnect network that contains at least one server with an optional Remote Supervisor Adapter installed, the server can be turned on from the Remote Supervisor Adapter user interface.
  - If your operating system supports the system-management software for an optional Remote Supervisor Adapter, the system-management software can turn on the server.
  - If your operating system supports the Wake on LAN® feature, the Wake on LAN feature can turn on the server.
- If the server is turned on and a power failure occurs, the server will restart automatically when power is restored.
- If the servers is connected to a power source but not turned on, the server can be turned on from the Remote Supervisor Adapter user interface.
- When you connect your server to power for the first time, the Wake on LAN feature can turn on the server.

Note: In a 16-way configuration, when you press the power-control button on either the primary or secondary server, both servers will be turned on. If both servers do not turn on when either power-control button is pressed, see the *Hardware Maintenance Manual* and *Troubleshooting Guide* on the *IBM xSeries Documentation CD*.

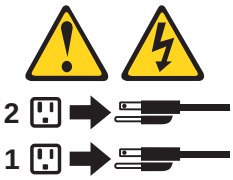
Turning off the server

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 that contains at least one server with an optional Remote Supervisor Adapter installed, the server can be turned off from the Remote Supervisor Adapter user interface.
- If an optional Remote Supervisor Adapter is installed in the server, the server can be turned off from the Remote Supervisor Adapter user interface.
- If the Wake on LAN feature turned on the server, the Wake on LAN feature can turn off the server.
- The service processor can turn off the server as an automatic response to a critical system failure.
- You can turn off the server through a request from the service processor.

Note: In a 16-way configuration, when you press the power-control button on either the primary or secondary server, both servers will be turned off. If both

servers do not turn off when either power-control button is pressed, see the *Hardware Maintenance Manual* and *Troubleshooting Guide* on the *IBM xSeries Documentation CD*.

Chapter 4. Configuring your server

The following configuration programs are provided with your server:

- **IBM *ServerGuide Setup and Installation* CD**

  The *ServerGuide Setup and Installation* CD includes software setup and installation tools that are specifically designed for IBM xSeries 445 servers. If you did not purchase a preconfigured server, you can use this CD during the initial installation of your server to configure the server hardware and to simplify your operating system installation. See the *User's Guide* on the IBM *xSeries Documentation* CD for more detailed information.

  Note: If your server model comes with an operating system, such as Microsoft Windows 2000 Datacenter Server or VMware ESX server, see the software documentation provided with your software for configuration information.

- **Configuration/Setup Utility**

  This program is part of the basic input/output system (BIOS) code that comes with your server. You can use this program to configure the serial connector assignment, change the drive startup sequence, set the date and time, and set passwords. See "Using the Configuration/Setup Utility program" on page 61 for more information.

  Note: In a 16-way configuration some options or settings are defined through the primary server, while others must be defined on the individual server. Ensure that options or settings on the secondary server are correct before creating a scalable partition.

- **LSI Logic Configuration Utility**

  With the built-in LSI Logic Configuration Utility program, you can configure the integrated SCSI controller and the devices that are attached to it. See "Using the LSI Logic Configuration Utility program" on page 62.

- **ServeRAID configuration program**

  This program comes with the optional ServeRAID adapters and with server models that have a ServeRAID adapter preinstalled. If the server has a ServeRAID adapter installed, you must use the ServeRAID configuration program to define and configure the disk-array subsystem *before* you install the operating system. If your server model came with an operating system installed, your disk-array subsystem is already configured. For more information about using the ServeRAID configuration program, see the ServeRAID information on the IBM *xSeries Documentation* CD.

  Note: If your server model comes with an operating system, such as Microsoft Windows 2000 Datacenter Server or VMware ESX server, see the software documentation provided with your software for configuration information.

- **Remote Supervisor Adapter configuration process**

  Configuration activities are also required for the Remote Supervisor Adapter. See "Using the Remote Supervisor Adapter" on page 63 for a description of the Remote Supervisor Adapter features. For information about cabling, configuring, and using the Remote Supervisor Adapter to manage the server remotely, see "Using the Remote Supervisor Adapter" on page 63 and the *Remote Supervisor Adapter User's Guide* on the *IBM xSeries Documentation* CD.

- **Integrated System Management update and configuration**

To update the integrated system management (ISM) firmware, see “Updating the integrated system management firmware” on page 63.

- **Configuring Scalable Partitions**

  The information and instructions needed to create or remove a scalable partition. See “Configuring scalable partitions” on page 63.

Using the ServerGuide Setup and Installation CD

The *ServerGuide Setup and Installation*CD provides state-of-the-art programs to detect the server model and hardware options that are installed, configure the server hardware, provide device drivers, and helps you install your operating system. For information about the supported operating-system versions, see the label on the CD.

Complete the following steps to start the *ServerGuide Setup and Installation* CD:

1. Insert the CD, and restart the server. If the ServerGuide CD does not start, see “ServerGuide startup problems” on page 70.
2. Follow the instructions on the screen to:
   a. Select your language.
   b. View the overview to learn about ServerGuide features and readme file to review installation tips about your operating system and adapter.
   c. Select the operating system you want to install.
   d. Start the setup and hardware configuration programs.
   e. Start the operating-system installation. You will need your operating-system CD.

Note: For information on the supported operating system versions, see the *Setup and Installation* CD label.

Using the Configuration/Setup Utility program

The Configuration/Setup Utility program is part of the BIOS code. You can use it to:

- Configure system devices and ports
- Configure scalable partitions
- Change the drive startup sequence
- Enable USB keyboard and mouse support
- Resolve configuration conflicts
- Set the date and time
- Set passwords and security settings

Complete the following steps to start the Configuration/Setup Utility program:

1. Turn on the server and watch the monitor screen.

   Note: In a 16-way configuration some options or settings are defined through the primary server, while others must be defined on the individual server. Ensure that options or settings on the secondary server are correct before creating a scalable partition.

2. When the message `Press F1 for Configuration/Setup` appears, press F1.

   Note: Depending on your configuration you might experience a delay before the Configuration/Setup menu appears.

3. Follow the instructions on the screen.

Using the LSI Logic Configuration Utility program

LSI Logic Configuration is a built-in, menu-driven configuration utility program that you can use to:

- Perform a low-level format of a SCSI hard disk drive
- Set a SCSI device scan order
- Set a SCSI ID for a controller

Notes:

1. The integrated SCSI controller with RAID capabilities in your server supports only RAID level-1 and RAID level-1 Enhanced (RAID level-1E). Installing an optional ServeRAID-5i controller provides additional RAID levels. See "Using the ServeRAID configuration programs" for information about configuring your server for RAID operation.
2. If you install a different type of RAID adapter in your server, use the configuration method supplied with the RAID adapter to view or change SCSI settings for attached devices.

Complete the following steps to start the LSI Logic Configuration Utility program:

1. Turn on the server.
2. When the `<<< Press <CTRL><C> to start LSI Logic Configuration Utility >>>` prompt appears, press Ctrl+C.

   Note: If an administrator password has been set, you are prompted to type the password to start the LSI Logic Configuration Utility program.
3. Use the arrow keys to select a controller (channel) from the list of adapters; then, press Enter.
4. Follow the instructions on the resulting screen to change the settings of the selected items; then, press Enter. The **Device Properties** and **Mirroring Properties** choices produce additional screens of parameters to review or change.

Using the ServeRAID configuration programs

Note: If your server model came with an operating system, such as Microsoft Windows 2000 Datacenter Server or VMware ESX server, see the software documentation provided with your software for configuration information.

A ServeRAID adapter enables you to use multiple physical SCSI hard-disk drives as logical drives, operating as a disk array. To enable you to configure the ServeRAID controller, the adapter comes with a CD containing the ServeRAID Manager program and the ServeRAID Mini-Configuration program.

Use the IBM *ServeRAID support* CD that comes with your server to configure your integrated SCSI controller with RAID capabilities and perform an initial RAID configuration on your server. For details about using these programs, see the documentation that comes with the ServeRAID adapter and the *User's Guide* on the *IBM Documentation* CD.

Using the Remote Supervisor Adapter

For information about cabling, configuring, and using the Remote Supervisor Adapter to manage the server remotely, see the *User's Guide* and the *Remote Supervisor Adapter User's Guide* on the *IBM Documentation* CD.

Updating the integrated system management firmware

To update the firmware for the integrated system management processor (ISMP), download the Integrated System Management Firmware Update Utility program for your server from the IBM Support Web site at http://www.ibm.com/pc/support. Run the utility program to create a diskette that you can use to update the firmware. The utility program updates the integrated system management firmware only and does not affect any device drivers.

Complete the following steps to update the firmware:

1. Turn off the server.
2. Insert the diskette into the diskette drive.
3. Turn on the server. If the server does not start from the diskette, use the Configuration/Setup Utility program to configure the diskette drive as a startup device. (For more information, see the information about Configuration/Setup Utility start options in the *User's Guide*). Then, start again at step 1 of this procedure.
4. From the main menu, select **Update System Management Firmware** and press Enter.
5. Follow the instructions on the screen to complete the update.

If there is an error in updating the firmware, try installing the firmware again.

Configuring scalable partitions

The Scalable Systems Manager program, when available, is an extension to IBM Director that provides a graphical user interface for creating and managing scalable partitions. See the *Scalable Systems Manager Installation and Users Guide* for information on how to use that program to configure scalable partitions on xSeries 445 servers. You can also use the Configuration/Setup Utility program to configure scalable partitions. This section provides information and instructions for creating and deleting scalable partitions through the Configuration/Setup Utility program.

Before you create scalable partitions, read the following information:

- Before you can create or delete a scalable partition, the Remote Supervisor Adapters must connected 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 perform the necessary functions for the two servers to create or delete scalable partitions.
- When a scalable partition consisting of two servers in a 16-way configuration is created, the DVD-ROM drive, diskette drive, keyboard, USB connectors, mouse, and video are disabled on the secondary server.
- In the Configuration/Setup Utility program Expansion Port A Destination and Expansion Port B Destination refer to the RXE Expansion Port connection from the expansion enclosure to the server.
- In a 16-way configuration, the SMP IDs of the Primary and Secondary Scalable Nodes must be different.

Creating a scalable partition

Complete the following steps to create a scalable partition:

1. If you have not already done so, connect the RXE expansion and RXE management cables between the server and the remote expansion enclosure. See “RXE Expansion Port cabling” on page 42, and “RXE Management Port cabling” on page 47 for information about RXE cabling.
2. Start the Configuration/Setup Utility program.
3. From the main menu, select **Advanced Setup**.
4. Select **Scalable Partition Settings**.
5. Select **Create Scalable Partition Settings**.
6. For 4-way and 8-way, single chassis configurations, complete the following steps:
   a. Select **1 x445 chassis**, as the Scalable System Configuration.
   b. Select the number of PCI-X slots available to the RXE Expansion Port in the remote expansion enclosure. The following choices are available:
      0 - No PCI-X slots are assigned to the RXE Expansion Port.
      6 - Only six of the 12 slots are assigned to the RXE Expansion Port.
      12 - All 12 PCI-X slots are assigned to the RXE Expansion Port.
   c. Complete one of the following procedures, depending on the number of SMP Expansion Modules that are installed:
      - One SMP Expansion Module - If six or 12 PCI-X slots are available, select Primary Scalable Node, Port A for the RXE Port destination.
      - Two SMP Expansion Modules - If six or 12 PCI-X slots are available to port A or port B, select Primary Scalable Node, Port B for the RXE Port destination. If six PCI-X slots are available to port A and six PCI-X slots are available to port B; then, select Primary Scalable Node, Port A for the RXE Port A destination and Primary Scalable Node, Port B for the RXE Port B destination.
   d. Go to step 8 on page 65.
7. For 16-way, two-chassis configuration, complete the following steps:
   a. Select **2 x445 chassis**, as the Scalable System Configuration.
   b. Enter a Scalable Partition ID **0000 through 9999**.
   c. For the primary boot node select **SMP ID 0**.

      Note: The SMP ID can be 0 or 2, but it must be different from the SMP ID of the secondary x445 scalable node.
   d. Enter the Secondary ASM host name or IP address.
   e. From the **Secondary Scalable Node SMP ID** menu, select **Yes, SMP ID 2**.

      Note: This SMP ID must be different from the SMP ID for the primary boot node.
   f. Select the number of PCI-X slots available to the RXE Expansion Port in the remote expansion enclosure. The following choices are available:
      0 - No PCI-X slots are assigned to the RXE Expansion Port.
      6 - Only six of the 12 slots are assigned to the RXE Expansion Port.
      12 - All 12 PCI-X slots are assigned to the RXE Expansion Port.

g. If 12 PCI-X slots are available to port A, select Primary Scalable Node, Port B for the RXE Port A destination. If six PCI-X slots are available to port A and six PCI-X slots are available to port B; then, select Primary Scalable Node, Port A for the RXE Port A destination and Primary Scalable Node, Port B for the RXE Port B destination.

8. Select **Write Scalable Partition Settings** and follow the prompts to exit the menu item.
9. Save and Exit the Configuration/Setup Utility Program.

Note: See the software documentation that comes with your operating system to install your operating system.

Deleting a scalable partition

Complete the following steps to delete the scalable partition:

1. Start the Configuration/Setup Utility on the primary server.
2. From the main menu, select **Advanced Setup**.
3. Select **Scalable Partition Settings**.
4. Select either **Delete ALL Scalable Partition** or **Delete ONLY Local Scalable Partition**.

   Note: Do not select **Write Scalable Partition Settings** when you delete the scalable partition.
5. Exit the Configuration/Setup Utility program.
6. Turn off the servers.
7. If necessary, remove the SMP Expansion cables and reconnect them according to your new configuration. See “Connecting the cables” on page 36 for instructions.
8. Restart the servers.

Chapter 5. Updating IBM Director

If you plan to use IBM Director to manage your server, you must install the applicable IBM Director updates, which could include a Service Pack for your release of IBM Director, individual emergency fixes (interim fix), and a Director System Support Package (DSSP) for this server.

To install the IBM Director updates, complete the following steps, in order:

1. Install the IBM Director application.
2. If the IBM Director CD that comes with your server includes the IBM Director Service Pack, install the Service Pack. If the CD does not contain the Service Pack, check the IBM Web site to see if a Service Pack is available. If it is, download and install the Service Pack according to the instructions in its readme file.
3. Install any applicable interim fix, DSSPs, and additional updates for your server from the IBM Web site.

Complete the following steps to obtain and install interim fix, DSSPs, or other updates:

1. Go to the IBM Web site at http://www.ibm.com.
2. Click **Support & downloads**.
3. In the **Technical support** keyword search field, type `Director 8870` and click **Go**.
4. From the next page, click the interim fix, DSSP, or update that you want to download.
5. From the next page, download the executable file and follow the instructions in the readme file to install the update.

Chapter 6. Solving problems

This section provides basic troubleshooting information to help you solve some common problems that might occur while you are setting up your server.

If you cannot locate and correct the problem using the information in this section, see Appendix A, “Getting help and technical assistance”, on page 79, the *Hardware Maintenance Manual and Troubleshooting Guide* on the IBM *xSeries Documentation* CD, and the “Server Support” flowchart in the front of this book.

Diagnostic tools overview

The following tools are available to help you identify and solve hardware-related problems:

- **POST beep codes**

  The power-on self-test beep codes indicate the detection of a problem.

  – On beep indicates successful completion of POST, with no errors.

  – More than one beep indicates that POST detected a problem. Error messages also appear during startup if POST detects a hardware-configuration problem.

    See “POST beep code descriptions” and the *Hardware Maintenance Manual and Troubleshooting Guide* on the IBM *xSeries Documentation* CD for more information.

- **Troubleshooting charts**

  These charts list problem symptoms and steps to correct the problems. See “Troubleshooting charts” on page 71 for more information.

- **Diagnostic programs and error messages**

  The system diagnostic programs are provided in ROM. These programs test the major components of your server. See the *Hardware Maintenance Manual and Troubleshooting Guide* on the IBM *xSeries Documentation* CD for more information.

- **Light Path Diagnostics feature**

  Use the Light Path Diagnostics feature to identify system errors quickly. See “Light Path Diagnostics feature overview” on page 75 for more information.

POST beep code descriptions

POST emits one beep to signal successful completion. If POST detects a problem during startup, other beep codes might occur. Use the following beep code descriptions to help identify and solve problems that are detected during startup.

Note: See the *Hardware Maintenance Manual and Troubleshooting Guide* on the IBM *xSeries Documentation* CD for more information about the POST beep codes.

One beep
POST was completed successfully.

Repeating long beeps
A memory error has occurred. Make sure that all DIMMs are correctly installed.

One long beep and two short beeps

A video error has occurred, and the BIOS cannot initialize the monitor screen to display additional information.

ServerGuide startup problems

Look for the symptom in the left column of the chart. Probable solutions to the problem are in the right column.

Note: If your server model came with an operating system, such as Microsoft Windows 2000 Datacenter Server or VMware ESX server, see the software documentation provided with your software for configuration information.

Setup	Suggested action
Setup and Installation CD will not start.	• Ensure that the system is a supported server with a startable (bootable) DVD-ROM drive. • If the startup (boot) sequence settings have been altered, be sure the DVD-ROM is first in the boot sequence.
ServeRAID program cannot view all installed drives - or - cannot install NOS.	If you installed an optional ServeRAID adapter: • Ensure that there are no duplicate SCSI IDs or IRQ assignments. • Ensure that the hard disk drive is connected properly.
The *Operating System Installation* program continuously loops.	Free up more space on the hard disk drive.
ServerGuide will not start *your* NOS CD.	Ensure that the NOS CD you have is supported by ServerGuide. See the *Setup and Installation* CD label for a list of NOS versions supported.
Cannot install NOS - option is grayed out.	Either there is no logical drive defined (ServeRAID systems) or the ServerGuide system partition is not present. Run the ServerGuide setup and configuration program and ensure that setup is complete

Troubleshooting charts

The following table lists problem symptoms and suggested solutions.

Device	Suggested action
DVD-ROM drive The DVD-ROM drive is not recognized.	Verify that: • The primary IDE channel is enabled in the Configuration/Setup Utility program. • All cables and jumpers are installed correctly. • The correct device driver is installed for the DVD-ROM drive **Note:** When two servers are connected in a 16-way configuration the DVD-ROM, diskette drive, keyboard, USB ports, mouse, and video are disabled on the secondary server.
Diskette drive Diskette drive in-use light stays on, or the server bypasses the diskette drive.	If there is a diskette in the drive, verify that: • The diskette drive is enabled in the Configuration/Setup Utility program. • The diskette is good and not damaged. (Try another diskette if you have one.) • The diskette contains the necessary files to start the server. • Your software program is working properly. **Note:** When two servers are connected in a 16-way configuration the DVD-ROM, diskette drive, keyboard, USB ports, mouse, and video are disabled on the secondary server. If the diskette drive in-use light stays on, or the server continues to bypass the diskette drive, call for service.
Other devices Problems such as broken cover locks or indicator lights not working.	Call for service.
Intermittent problems A problem occurs only occasionally and is difficult to detect.	Verify that: • All cables and cords are connected securely to the rear of the server and attached options. • When the server is turned on, air is flowing from the rear of the server at the fan grille. If there is no air flow, the fan is not working. This causes the server to overheat and shut down. • Ensure that the SCSI bus and devices are configured correctly and that the last external device in each SCSI chain is terminated correctly. If the problem remains, call for service.
Keyboard, mouse, or pointing-device All or some keys on the keyboard do not work.	• Make sure that the keyboard cable is properly connected to the server. • Make sure that the server and the monitor are turned on. • Try using another keyboard. **Note:** When two servers are connected in a 16-way configuration the DVD-ROM, diskette drive, keyboard, USB ports, mouse, and video are disabled on the secondary server. If the problem remains, call for service.
The mouse or pointing device does not work.	• Verify that the mouse or pointing-device cable is securely connected and the device drivers are installed correctly. • Try using another mouse or pointing device. **Note:** When two servers are connected in a 16-way configuration the DVD-ROM, diskette drive, keyboard, USB ports, mouse, and video are disabled on the secondary server. If the problem remains, call for service.

Device	Suggested action
USB Keyboard, mouse, or pointing-device All or some keys on the keyboard do not work.	• Make sure that the keyboard USB cable is properly connected to the server. • Make sure that the server and the monitor are turned on. • Ensure that the USB mouse and keyboard support are enabled in BIOS. • Try using another keyboard. **Note:** When two servers are connected in a 16-way configuration the DVD-ROM, diskette drive, keyboard, USB ports, mouse, and video are disabled on the secondary server. If the problem remains, call for service.
The USB mouse or USB pointing device does not work.	• Make sure that the mouse or pointing-device USB cable is properly connected to the server. • Make sure that the server and the monitor are turned on. • Ensure that the USB mouse and keyboard support are enabled in BIOS. • Try using another mouse or pointing device. **Note:** When two servers are connected in a 16-way configuration the DVD-ROM, diskette drive, keyboard, USB ports, mouse, and video are disabled on the secondary server. If the problem remains, call for service.
Memory The amount of memory displayed is less than the amount of memory installed.	Verify that: • The memory modules are seated properly. • You have installed the correct type of memory. • If you changed the memory, the memory configuration has been updated in the Configuration/Setup Utility program. • All DIMM slots are enabled. The server might have automatically disabled a DIMM slot if it detected a problem, or a DIMM slot might have been manually disabled. • Memory mirroring is disabled. If Memory mirroring is enabled, only half of the installed memory will be displayed. If the problem remains, call for service.
Monitor The monitor works when you turn on the server, but goes blank when you start some application programs.	Verify that: • The primary monitor cable is connected to the video port. • You installed the necessary device drivers for the applications. Some IBM monitors have their own self-tests. If you suspect a problem with your monitor, see the information that comes with the monitor for adjusting and testing instructions. **Note:** When two servers are connected in a 16-way configuration the DVD-ROM, diskette drive, keyboard, USB ports, mouse, and video are disabled on the secondary server. If the problem remains, call for service.
The screen is blank.	Verify that: • The server power cord is plugged into the server and a working electrical outlet. • The monitor cables are connected properly. • The monitor is turned on and the brightness and contrast controls are adjusted correctly. **Note:** When two servers are connected in a 16-way configuration the DVD-ROM, diskette drive, keyboard, USB ports, mouse, and video are disabled on the secondary server. If the problem remains, call for service.
Only the cursor appears.	Call for service.

Device	Suggested action
Wavy, unreadable, rolling, distorted screen, or screen jitter.	If the monitor self-tests show the monitor is working properly, consider the location of the monitor. Magnetic fields around other devices (such as transformers, appliances, fluorescent lights, and other monitors) can cause screen jitter or wavy, unreadable, rolling, or distorted screen images. If this happens, turn off the monitor. (Moving a color monitor while it is turned on might cause screen discoloration.) Then move the device and the monitor at least 305 mm (12 in.) apart. Turn on the monitor. **Notes:** 1. To prevent diskette drive read/write errors, be sure the distance between monitors and diskette drives is at least 76 mm (3 in.). 2. Non-IBM monitor cables might cause unpredictable problems. 3. An enhanced monitor cable with additional shielding is available for the 9521 and 9527 monitors. For information about the enhanced monitor cable, see your IBM reseller or IBM marketing representative. If the problem remains, call for service.
Wrong characters appear on the screen.	If the wrong language is displayed, update the BIOS code with the correct language. If the problem remains, call for service.
Option An IBM option that was just installed does not work.	Verify that: • The option is designed for the server. See the “Server Support” flowchart on the inside of the front cover for information about obtaining ServerProven compatibility information from the World Wide Web. • You followed the installation instructions that came with the option. • The option is installed correctly. • You have not loosened any other installed options or cables. • You updated the configuration information in the Configuration/Setup Utility program. Whenever memory or an option is changed, you must update the configuration. If the problem remains, call for service.
An IBM option that used to work does not work now.	Verify that all of the option hardware and cable connections are secure. If the option comes with its own test instructions, use those instructions to test the option. If the failing option is a SCSI option, verify that: • The cables for all external SCSI options are connected correctly. • The last option in each SCSI chain, or the end of the SCSI cable, is terminated correctly. • All external SCSI options are turned on. You must turn on external SCSI options before turning on the server. If the problem remains, call for service.
Power The server does not power on.	Verify that: • The power cables are properly connected to the server. • The electrical outlet functions properly. • The type of memory installed is correct. • If you just installed an option, remove it, and restart the server. If the server now turns on, you might have installed more options than the power supply supports. • The LEDs on the power supply are on. If the problem remains, call for service.

Device	Suggested action
Serial port The number of serial ports identified by the operating server is less than the number of serial ports installed.	Verify that: • Each port is assigned a unique address by the Configuration/Setup Utility program and none of the serial ports are disabled. • The ribbon cable is properly connected to the center planar. • The serial-port adapter, if you installed one, is seated properly. If the problem remains, call for service.
A serial device does not work.	Verify that: • The ribbon cable is properly connected to the center planar. • The serial port is enabled and is assigned a unique address. If the problem remains, call for service.
Software Suspected software problem.	To determine if problems are caused by the software, verify that: • Your server has the minimum memory requirements needed to use the software. For memory requirements, see the information that comes with the software. **Note:** If you have just installed an adapter or memory, you might have a memory-address conflict. • The software is designed to operate on your server. • Other software works on your server. • The software that you are trying to use works on another server. If you received any error messages when using the software program, see the information that comes with the software for a description of the messages and solutions to the problem. If the problem remains, contact your place of purchase.
Universal Serial Bus (USB) ports A USB device does not work.	Verify that: 1. You are not trying to use a USB device during POST, if you have a standard (non-USB) keyboard attached to the keyboard port. **Note:** If a standard (non-USB) keyboard is attached to the keyboard port, then the USB is disabled and the USB device might not work during POST. 2. The correct USB device driver is installed. 3. Your operating server supports USB devices. **Note:** When two servers are connected in a 16-way configuration the DVD-ROM, diskette drive, keyboard, USB ports, mouse, and video are disabled on the secondary server. If the problem remains, call for service.

Light Path Diagnostics feature overview

Use the Light Path Diagnostics feature to quickly identify the system errors that occurred in that server. The Light Path Diagnostics panel is located inside the Light Path Diagnostics drawer, on the front right of the server. To access the Light Path Diagnostic panel, press on the front of the Light Path Diagnostics drawer. The Light Path Diagnostic panel will be exposed.

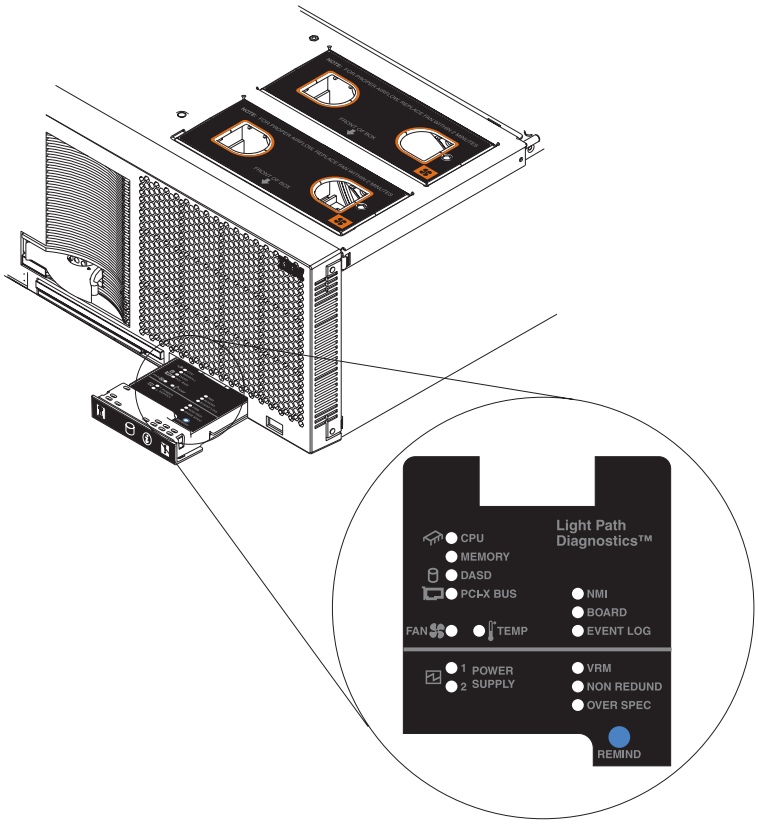


Figure 52. Light Path Diagnostics

Your server is designed so that any Light Path Diagnostic LEDs that are lit, can be lit again without ac power after you open the cover. This feature helps you isolate a problem if an error causes the server to shut down. See “Light Path Diagnostics table” on page 78.

Important: You have up to 12 hours to use the Light Path Diagnostic LEDs after ac power has been removed from the server. After 12 hours, you must turn on the server again to be able to use the Light Path Diagnostic LEDs to identify system errors.

Complete the following steps to view the LEDs when the server cover has been opened:

1. Turn off the server and all peripheral devices; then, disconnect all external cables from the server.
2. Slide the server out of the rack cabinet.
3. Open the top cover.
4. Press and hold the Light Path Diagnostics (blue) button on the diagnostics panel. The LEDs will be lit while the button is pressed.

Note: You can illuminate the LEDs for a maximum of two minutes. After that time, the circuit that powers the LEDs is exhausted.

5. Close the cover on the server; then, slide the server into the rack cabinet and connect all external cables. For more information, see “Install the server in the rack cabinet” on page 35 for instructions.

See “Light Path Diagnostics table” on page 78 for information about identifying problems using these LEDs.

Identifying problems using the Light Path Diagnostics feature

This section provides the information out using the Light Path Diagnostics feature to identify problems that might occur during installation using the Light Path Diagnostic feature.

The diagnostic panel

First look at the diagnostic panel for help in identifying problems. If a system error occurs, the system-error LED on the front of this panel is lit. Press the front of the panel to open it and look for any lit LEDs. Make a note of any LEDs that are lit, then close the panel.

LEDs on the top of the server

After viewing the diagnostic panel, pull out the server from the rack and view the top cover. In the center of the top cover is a set of six LEDs and the system service labels. The numbers beside the LEDs correspond to the numbers located on the system service label. Note the lit LED, and see the numbered block on the system service label that corresponds to the lit LED. Then, follow the instructions, if any, in the numbered block.

LEDs on the SMP Expansion Modules and system boards

To locate the actual component that caused the error, locate the lit LED next to that component.

For example:

A system error has occurred and you note that the CPU LED on the diagnostic panel is lit. Referring to the LEDs on the top cover, you see that LED 2 is lit. You then locate the panel on the system service label with the number 2 on it. In this case, the instructions in the panel tell you to remove the lower SMP Expansion Module. This tells you that the problem occurred with one of the microprocessors in the lower SMP Expansion Module. Follow the procedure in “Removing an SMP Expansion Module and cover” on page 12 to remove the lower SMP Expansion Module; then, remove the cover from the SMP Expansion Module. Located near the edge connectors on the circuit board is the light-path capacitor switch. Press and hold the switch until you locate the lit LED beside the defective microprocessor. Follow the instructions in the *Option Installation Guide* on the IBM *xSeries Documentation* CD to remove and replace the microprocessor.

Light Path Diagnostics table

Use the following table to help determine the cause of the error and the action you should take.

Lit LED on diagnostics panel	Cause	Action
None	An error has occurred and cannot be isolated, or the ASM processor has failed.	An error has occurred that is not represented by a Light Path Diagnostics LED. Check the system error log for more information about the error.
PS	Power supply has failed.	Call for service.
TEMP	The system temperature has exceeded a threshold level.	• Check to see if a fan has failed. If it has, replace the fan. • Make sure the room temperature is not too hot. (See “Features and specifications” on page 5 for temperature information.) If the problem remains, have the system serviced.
FAN	A fan has failed or is operating too slowly. **Note:** A failing fan can also cause the TEMP LED to be on.	Check the LEDs on the fans and replace the indicated fan.
SP	The service processor has failed.	Remove ac power from the server and then restart the server. If the problem remains, call for service.
MEM	A memory error occurred.	• Check the DIMM failure LEDs on the system board. • Replace the DIMM indicated by the lit DIMM failure LED.
CPU	One of the microprocessors has failed.	• Check the microprocessor failure LEDs on the system board. • If a microprocessor failure LED is on, make sure the microprocessor is installed correctly. (See the *Option Installation Guide* on the *IBM xSeries Documentation CD* for installation instructions.) If the problem remains, call for service.
VRM	One of the VRMs on one of the SMP Expansion Module boards has failed.	Remove ac power from the server and then restart the server. If the problem remains, call for service.
PCI	An error occurred on a PCI bus.	• 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. If the problem remains, call for service.

Appendix A. Getting help and technical assistance

If you need help, service, or technical assistance or just want more information about IBM products, you will find a wide variety of sources available from IBM to assist you. This appendix contains information about where to go for additional information about IBM and IBM products, what to do if you experience a problem with your xSeries or IntelliStation® system, and whom to call for service, if it is necessary.

Before you call

Before you call, make sure that you have taken these steps to try to solve the problem yourself:

- Check all cables to make sure that they are connected.
- Check the power switches to make sure that the system is turned on.
- Use the troubleshooting information in your system documentation, and use the diagnostic tools that come with your system.
- Go to the IBM Support Web site at http://www.ibm.com/pc/support/ to check for technical information, hints, tips, and new device drivers.
- Use an IBM discussion forum on the IBM Web site to ask questions.

You can solve many problems without outside assistance by following the troubleshooting procedures that IBM provides in the online help or in the publications that are provided with your system and software. The information that comes with your system also describes the diagnostic tests that you can perform. Most xSeries and IntelliStation systems, operating systems, and programs come with information that contains troubleshooting procedures and explanations of error messages and error codes. If you suspect a software problem, see the information for the operating system or program.

Using the documentation

Information about your IBM xSeries or IntelliStation system and preinstalled software, if any, is available in the documentation that comes with your system. That documentation includes printed books, online books, readme files, and help files. See the troubleshooting information in your system documentation for instructions for using the diagnostic programs. The troubleshooting information or the diagnostic programs might tell you that you need additional or updated device drivers or other software. IBM maintains pages on the World Wide Web where you can get the latest technical information and download device drivers and updates. To access these pages, go to http://www.ibm.com/pc/support/ and follow the instructions. Also, you can order publications through the IBM Publications Ordering System at http://www.elink.ibmlink.ibm.com/public/applications/publications/cgibin/pbi.cgi.

Getting help and information from the World Wide Web

On the World Wide Web, the IBM Web site has up-to-date information about IBM xSeries and IntelliStation products, services, and support. The address for IBM xSeries information is http://www.ibm.com/eserver/xseries/. The address for IBM IntelliStation information is http://www.ibm.com/pc/intellistation/.

You can find service information for your IBM products, including supported options, at http://www.ibm.com/pc/support/.

Software service and support

Through IBM Support Line, you can get telephone assistance, for a fee, with usage, configuration, and software problems with xSeries servers, IntelliStation workstations, and appliances. For information about which products are supported by Support Line in your country or region, go to http://www.ibm.com/services/sl/products/.

For more information about Support Line and other IBM services, go to http://www.ibm.com/services/, or go to http://www.ibm.com/planetwide/ for support telephone numbers. In the U.S. and Canada, call 1-800-IBM-SERV (1-800-426-7378).

Hardware service and support

You can receive hardware service through IBM Integrated Technology Services or through your IBM reseller, if your reseller is authorized by IBM to provide warranty service. Go to http://www.ibm.com/planetwide/ for support telephone numbers, or in the U.S. and Canada, call 1-800-IBM-SERV (1-800-426-7378).

In the U.S. and Canada, hardware service and support is available 24 hours a day, 7 days a week. In the U.K., these services are available Monday through Friday, from 9 a.m. to 6 p.m.

Appendix B. Warranty information

This section contains information about your warranty period and the service and support that are provided by your warranty.

Warranty period

The warranty period varies by machine type and country or region.

Contact your place of purchase for warranty service information. Some IBM Machines are eligible for on-site warranty service depending on the country or region where service is performed.

Prior to on-site warranty service, you are required to go through problem determination with an IBM service specialist call center technician.

This paragraph applies only to products with a warranty period of 3 years on parts and 1 year on labor. A warranty period of 3 years on parts and 1 year on labor means that IBM will provide warranty service without charge for:

1. parts and labor during the first year of the warranty period
2. parts only, on an exchange basis, in the second and third years of the warranty period. IBM will charge you for any labor it provides in performance of the repair or replacement.

The IBM Machine Warranties Web site at http://www.ibm.com/servers/support/machine_warranties/ contains a worldwide overview of the IBM Statement of Limited Warranty for IBM Machines, a glossary of terms used in the Statement of Limited Warranty, Frequently Asked Questions (FAQ), and links to Product Support Web pages. The IBM Statement of Limited Warranty is available from this Web site in 29 languages in Portable Document Format (PDF).

Machine - IBM @server xSeries 445

Country or region	Warranty period	Service delivery method
Worldwide	Parts - 3 years, labor - 3 years	On-site

Problem determination

Prior to on-site warranty service, you are required to go through problem determination with an IBM service specialist call center technician. The service specialist will run diagnostic tests on the hardware and check the software.

Running diagnostics

The IBM service specialist will help you determine whether your equipment is functioning as specified. It might be necessary to isolate the failing xSeries, Netfinity®, or IntelliStation system; IBM component; or both from any active production environment to run diagnostics and perform defect-isolation programs. You are responsible for making the system, IBM component, or both available for running diagnostics and defect-isolation programs.

Checking software

The IBM service specialist will help you ensure that the correct BIOS code, firmware, device drivers, and other supporting IBM software are installed and correctly configured. It might be necessary to manually gather information about the

relevant software levels or run IBM-approved utility programs to gather this information. It might be necessary to isolate the failing system from any active production environment to gather this information. You are responsible, with assistance from the service specialist, for gathering this information. The IBM Statement of Limited Warranty does not include on-site assistance with this activity.

Warranty service and support

With the original purchase of an IBM xSeries or IntelliStation system, you have access to extensive service and support. During the IBM Machine warranty period, you may call IBM or your reseller for problem-determination assistance under the terms of the IBM Statement of Limited Warranty.

The following services are available during the warranty period:

- **Problem determination** - Trained personnel are available to assist you with determining if you have a hardware problem and deciding what action is necessary to fix the problem.
- **IBM hardware repair** - If the problem is determined to be caused by IBM hardware under warranty, trained service personnel are available to provide the applicable level of service, either on-site or at an IBM service center as determined by IBM.
- **Engineering Change management** - Occasionally, there might be changes that are required after a product has been shipped from IBM. In those instances, IBM will make Engineering Changes (ECs) available that apply to your hardware.
- **Customer replaceable units (CRUs)** - Some parts of IBM xSeries and IntelliStation systems are designated as customer replaceable units. IBM ships CRUs to you for replacement by you. CRUs include keyboards, monitors, memory, diskette drives, hard disk drives, and mice (this list is not inclusive of all CRUs).

The following items are not covered under warranty service:

- Replacement or use of non-IBM parts. All IBM parts contain a 7-character identification in the format IBM FRU XXXXXXX.
- Identification of software problem sources.
- Installation of customer replaceable units (CRUs).
- Installation and configuration of BIOS code, firmware, or device drivers that are designated as customer installable.

See the IBM Statement of Limited Warranty for a full explanation of IBM warranty terms. Be sure to retain your proof of purchase to obtain warranty service.

Please have the following information ready when you call:

- The machine type and model of your IBM hardware product (if available)
- Serial numbers of your IBM hardware products
- A description of the problem
- The exact wording of any error messages
- Hardware and software configuration information

International Warranty Service

If you travel with your xSeries or IntelliStation system or relocate it to a country or region where your system is sold and serviced by IBM or IBM resellers authorized

to perform warranty service, International Warranty Service (IWS) is available during the warranty period. Eligible IBM systems are identified by their four-digit machine types.

You can obtain IWS through the service delivery method (such as depot, carry-in, or on-site) provided in the servicing country or region. Service methods and procedures vary by country or region, and some service or parts might not be available in all countries and regions. Service centers in certain countries or regions might not be able to service all models of a particular machine type. In addition, some countries or regions might have fees and restrictions that apply at the time of service.

To determine whether your system is eligible for IWS, go to http://www.ibm.com/pc/support/ and click **Warranty lookup**.

Purchasing additional services

During and after the warranty period, you can purchase additional services, such as support for IBM and non-IBM hardware, operating systems, and application programs; network setup and configuration; upgraded or extended hardware repair services; and custom installations. Service availability and service name might vary by country or region.

For more information about these services, contact your IBM marketing representative.

IBM Statement of Limited Warranty Z125-4753-06 8/2000

Part 1 - General Terms

This Statement of Limited Warranty includes Part 1 - General Terms and Part 2 - Country-unique Terms. The terms of Part 2 replace or modify those of Part 1. The warranties provided by IBM in this Statement of Limited Warranty apply only to Machines you purchase for your use, and not for resale, from IBM or your reseller. The term “Machine” means an IBM machine, its features, conversions, upgrades, elements, or accessories, or any combination of them. The term “Machine” does not include any software programs, whether pre-loaded with the Machine, installed subsequently or otherwise. Unless IBM specifies otherwise, the following warranties apply only in the country where you acquire the Machine. Nothing in this Statement of Limited Warranty affects any statutory rights of consumers that cannot be waived or limited by contract. If you have any questions, contact IBM or your reseller.

The IBM Warranty for Machines: IBM warrants that each Machine 1) is free from defects in materials and workmanship and 2) conforms to IBM’s Official Published Specifications (“Specifications”). The warranty period for a Machine is a specified, fixed period commencing on its Date of Installation. The date on your sales receipt is the Date of Installation unless IBM or your reseller informs you otherwise.

If a Machine does not function as warranted during the warranty period, and IBM or your reseller are unable to either 1) make it do so or 2) replace it with one that is at least functionally equivalent, you may return it to your place of purchase and your money will be refunded.

Extent of Warranty: The warranty does not cover the repair or exchange of a Machine resulting from misuse, accident, modification, unsuitable physical or operating environment, improper maintenance by you, or failure caused by a product for which IBM is not responsible. The warranty is voided by removal or alteration of Machine or parts identification labels.

THESE WARRANTIES ARE YOUR EXCLUSIVE WARRANTIES AND REPLACE ALL OTHER WARRANTIES OR CONDITIONS, EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OR CONDITIONS OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. THESE WARRANTIES GIVE YOU SPECIFIC LEGAL RIGHTS AND YOU MAY ALSO HAVE OTHER RIGHTS WHICH VARY FROM JURISDICTION TO JURISDICTION. SOME JURISDICTIONS DO NOT ALLOW THE EXCLUSION OR LIMITATION OF EXPRESS OR IMPLIED WARRANTIES, SO THE ABOVE EXCLUSION OR LIMITATION MAY NOT APPLY TO YOU. IN THAT EVENT, SUCH WARRANTIES ARE LIMITED IN DURATION TO THE WARRANTY PERIOD. NO WARRANTIES APPLY AFTER THAT PERIOD.

Items Not Covered by Warranty: IBM does not warrant uninterrupted or error-free operation of a Machine. Any technical or other support provided for a Machine under warranty, such as assistance via telephone with “how-to” questions and those regarding Machine set-up and installation, will be provided **WITHOUT WARRANTIES OF ANY KIND.**

Warranty Service: To obtain warranty service for a Machine, contact IBM or your reseller. If you do not register your Machine with IBM, you may be required to present proof of purchase.

During the warranty period, IBM or your reseller, if approved by IBM to provide warranty service, provides without charge certain types of repair and exchange service to keep Machines in, or restore them to, conformance with their Specifications. IBM or your reseller will inform you of the available types of service for a Machine based on its country of installation. At its discretion, IBM or your reseller will 1) either repair or exchange the failing Machine and 2) provide the service either at your location or a service center. IBM or your reseller will also manage and install selected engineering changes that apply to the Machine.

Some parts of IBM Machines are designated as Customer Replaceable Units (called “CRUs”), e.g., keyboards, memory, or hard disk drives. IBM ships CRUs to you for replacement by you. You must return all defective CRUs to IBM within 30 days of your receipt of the replacement CRU. You are responsible for downloading designated Machine Code and Licensed Internal Code updates from an IBM Internet Web site or from other electronic media, and following the instructions that IBM provides.

When warranty service involves the exchange of a Machine or part, the item IBM or your reseller replaces becomes its property and the replacement becomes yours. You represent that all removed items are genuine and unaltered. The replacement may not be new, but will be in good working order and at least functionally equivalent to the item replaced. The replacement assumes the warranty service status of the replaced item. Many features, conversions, or upgrades involve the removal of parts and their return to IBM. A part that replaces a removed part will assume the warranty service status of the removed part.

Before IBM or your reseller exchanges a Machine or part, you agree to remove all features, parts, options, alterations, and attachments not under warranty service.

You also agree to
1. ensure that the Machine is free of any legal obligations or restrictions that prevent its exchange;
2. obtain authorization from the owner to have IBM or your reseller service a Machine that you do not own; and
3. where applicable, before service is provided:
    a. follow the problem determination, problem analysis, and service request procedures that IBM or your reseller provides;
    b. secure all programs, data, and funds contained in a Machine;
    c. provide IBM or your reseller with sufficient, free, and safe access to your facilities to permit them to fulfill their obligations; and
    d. inform IBM or your reseller of changes in a Machine’s location.

IBM is responsible for loss of, or damage to, your Machine while it is 1) in IBM’s possession or 2) in transit in those cases where IBM is responsible for the transportation charges.

Neither IBM nor your reseller is responsible for any of your confidential, proprietary or personal information contained in a Machine which you return to IBM or your reseller for any reason. You should remove all such information from the Machine prior to its return.

Limitation of Liability: Circumstances may arise where, because of a default on IBM’s part or other liability, you are entitled to recover damages from IBM. In each such instance, regardless of the basis on which you are entitled to claim damages from IBM (including fundamental breach, negligence, misrepresentation, or other

contract or tort claim), except for any liability that cannot be waived or limited by applicable laws, IBM is liable for no more than

1. damages for bodily injury (including death) and damage to real property and tangible personal property; and
2. the amount of any other actual direct damages, up to the charges (if recurring, 12 months' charges apply) for the Machine that is subject of the claim. For purposes of this item, the term "Machine" includes Machine Code and Licensed Internal Code.

   This limit also applies to IBM's suppliers and your reseller. It is the maximum for which IBM, its suppliers, and your reseller are collectively responsible.

UNDER NO CIRCUMSTANCES IS IBM LIABLE FOR ANY OF THE FOLLOWING: 1) THIRD-PARTY CLAIMS AGAINST YOU FOR DAMAGES (OTHER THAN THOSE UNDER THE FIRST ITEM LISTED ABOVE); 2) LOSS OF, OR DAMAGE TO, YOUR RECORDS OR DATA; OR 3) SPECIAL, INCIDENTAL, OR INDIRECT DAMAGES OR FOR ANY ECONOMIC CONSEQUENTIAL DAMAGES, LOST PROFITS OR LOST SAVINGS, EVEN IF IBM, ITS SUPPLIERS OR YOUR RESELLER IS INFORMED OF THEIR POSSIBILITY. SOME JURISDICTIONS DO NOT ALLOW THE EXCLUSION OR LIMITATION OF INCIDENTAL OR CONSEQUENTIAL DAMAGES, SO THE ABOVE LIMITATION OR EXCLUSION MAY NOT APPLY TO YOU.

Governing Law: Both you and IBM consent to the application of the laws of the country in which you acquired the Machine to govern, interpret, and enforce all of your and IBM's rights, duties, and obligations arising from, or relating in any manner to, the subject matter of this Agreement, without regard to conflict of law principles.

Part 2 - Country-unique Terms

AMERICAS

BRAZIL

Governing Law: *The following is added after the first sentence:*
Any litigation arising from this Agreement will be settled exclusively by the court of Rio de Janeiro.

NORTH AMERICA

Warranty Service: *The following is added to this Section:*
To obtain warranty service from IBM in Canada or the United States, call 1-800-IBM-SERV (426-7378).

CANADA

Governing Law: *The following replaces "laws of the country in which you acquired the Machine" in the first sentence:*
laws in the Province of Ontario.

UNITED STATES

Governing Law: *The following replaces "laws of the country in which you acquired the Machine" in the first sentence:*
laws of the State of New York.

ASIA PACIFIC

AUSTRALIA

The IBM Warranty for Machines: *The following paragraph is added to this Section:*
The warranties specified in this Section are in addition to any rights you may have under the Trade Practices Act 1974 or other similar legislation and are only limited to the extent permitted by the applicable legislation.

Limitation of Liability: *The following is added to this Section:*
Where IBM is in breach of a condition or warranty implied by the Trade Practices Act 1974 or other similar legislation, IBM's liability is limited to the repair or replacement of the goods or the supply of equivalent goods. Where that condition or warranty relates to right to sell, quiet possession or clear title, or the goods are of a kind ordinarily acquired for personal, domestic or household use or consumption, then none of the limitations in this paragraph apply.

Governing Law: *The following replaces "laws of the country in which you acquired the Machine" in the first sentence:*
laws of the State or Territory.

CAMBODIA, LAOS, AND VIETNAM

Governing Law: *The following replaces "laws of the country in which you acquired the Machine" in the first sentence:*
laws of the State of New York.

The following is added to this Section:
Disputes and differences arising out of or in connection with this Agreement shall be finally settled by arbitration which shall be held in Singapore in accordance with the rules of the International Chamber of Commerce (ICC). The arbitrator or arbitrators designated in conformity with those rules shall have the power to rule on their own competence and on the validity of the Agreement to submit to arbitration. The arbitration award shall be final and binding for the parties without appeal and the arbitral award shall be in writing and set forth the findings of fact and the conclusions of law.

All proceedings shall be conducted, including all documents presented in such proceedings, in the English language. The number of arbitrators shall be three, with each side to the dispute being entitled to appoint one arbitrator.

The two arbitrators appointed by the parties shall appoint a third arbitrator before proceeding upon the reference. The third arbitrator shall act as chairman of the proceedings. Vacancies in the post of chairman shall be filled by the president of the ICC. Other vacancies shall be filled by the respective nominating party. Proceedings shall continue from the stage they were at when the vacancy occurred.

If one of the parties refuses or otherwise fails to appoint an arbitrator within 30 days of the date the other party appoints its, the first appointed arbitrator shall be the sole arbitrator, provided that the arbitrator was validly and properly appointed.

The English language version of this Agreement prevails over any other language version.

HONG KONG AND MACAU

Governing Law: *The following replaces "laws of the country in which you acquired the Machine" in the first sentence:*
laws of Hong Kong Special Administrative Region.

INDIA

Limitation of Liability: *The following replaces items 1 and 2 of this Section:*
1. liability for bodily injury (including death) or damage to real property and tangible personal property will be limited to that caused by IBM's negligence;
2. as to any other actual damage arising in any situation involving nonperformance by IBM pursuant to, or in any way related to the subject of this Statement of Limited Warranty, IBM's liability will be limited to the charge paid by you for the individual Machine that is the subject of the claim.

JAPAN

Governing Law: *The following sentence is added to this Section:*
Any doubts concerning this Agreement will be initially resolved between us in good faith and in accordance with the principle of mutual trust.

NEW ZEALAND

The IBM Warranty for Machines: *The following paragraph is added to this Section:*
The warranties specified in this Section are in addition to any rights you may have under the Consumer Guarantees Act 1993 or other legislation which cannot be excluded or limited. The Consumer Guarantees Act 1993 will not apply in respect of any goods which IBM provides, if you require the goods for the purposes of a business as defined in that Act.

Limitation of Liability: *The following is added to this Section:*
Where Machines are not acquired for the purposes of a business as defined in the Consumer Guarantees Act 1993, the limitations in this Section are subject to the limitations in that Act.

PEOPLE'S REPUBLIC OF CHINA (PRC)

Governing Law: *The following replaces this Section:*
Both you and IBM consent to the application of the laws of the State of New York (except when local law requires otherwise) to govern, interpret, and enforce all your and IBM's rights, duties, and obligations arising from, or relating in any manner to, the subject matter of this Agreement, without regard to conflict of law principles.

Any disputes arising from or in connection with this Agreement will first be resolved by friendly negotiations, failing which either of us has the right to submit the dispute to the China International Economic and Trade Arbitration Commission in Beijing, the PRC, for arbitration in accordance with its arbitration rules in force at the time. The arbitration tribunal will consist of three arbitrators. The language to be used therein will be English and Chinese. An arbitral award will be final and binding on all the parties, and will be enforceable under the Convention on the Recognition and Enforcement of Foreign Arbitral Awards (1958).

The arbitration fee will be borne by the losing party unless otherwise determined by the arbitral award.

During the course of arbitration, this Agreement will continue to be performed except for the part which the parties are disputing and which is undergoing arbitration.

EUROPE, MIDDLE EAST, AFRICA (EMEA)

THE FOLLOWING TERMS APPLY TO ALL EMEA COUNTRIES:
The terms of this Statement of Limited Warranty apply to Machines purchased from IBM or an IBM reseller.

Warranty Service: If you purchase an IBM Machine in Austria, Belgium, Denmark, Estonia, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland or United Kingdom, you may obtain warranty service for that Machine in any of those countries from either (1) an IBM reseller approved to perform warranty service or (2) from IBM. If you purchase an IBM Personal Computer Machine in Albania, Armenia, Belarus, Bosnia and Herzegovina, Bulgaria, Croatia, Czech Republic, Georgia, Hungary, Kazakhstan, Kirghizia, Federal Republic of Yugoslavia, Former Yugoslav Republic of Macedonia (FYROM), Moldova, Poland, Romania, Russia, Slovak Republic, Slovenia, or Ukraine, you may obtain warranty service for that Machine in any of those countries from either (1) an IBM reseller approved to perform warranty service or (2) from IBM.

If you purchase an IBM Machine in a Middle Eastern or African country, you may obtain warranty service for that Machine from the IBM entity within the country of purchase, if that IBM entity provides warranty service in that country, or from an IBM reseller, approved by IBM to perform warranty service on that Machine in that country. Warranty service in Africa is available within 50 kilometers of an IBM authorized service provider. You are responsible for transportation costs for Machines located outside 50 kilometers of an IBM authorized service provider.

Governing Law: The applicable laws that govern, interpret and enforce rights, duties, and obligations of each of us arising from, or relating in any manner to, the subject matter of this Statement, without regard to conflict of laws principles, as well as Country-unique terms and competent court for this Statement are those of the country in which the warranty service is being provided, except that in 1) Albania, Bosnia-Herzegovina, Bulgaria, Croatia, Hungary, Former Yugoslav Republic of Macedonia, Romania, Slovakia, Slovenia, Armenia, Azerbaijan, Belarus, Georgia, Kazakhstan, Kyrgyzstan, Moldova, Russia, Tajikistan, Turkmenistan, Ukraine, and Uzbekistan, the laws of Austria apply; 2) Estonia, Latvia, and Lithuania, the laws of Finland apply; 3) Algeria, Benin, Burkina Faso, Cameroon, Cape Verde, Central African Republic, Chad, Congo, Djibouti, Democratic Republic of Congo, Equatorial Guinea, France, Gabon, Gambia, Guinea, Guinea-Bissau, Ivory Coast, Lebanon, Mali, Mauritania, Morocco, Niger, Senegal, Togo, and Tunisia, this Agreement will be construed and the legal relations between the parties will be determined in accordance with the French laws and all disputes arising out of this Agreement or related to its violation or execution, including summary proceedings, will be settled exclusively by the Commercial Court of Paris; 4) Angola, Bahrain, Botswana, Burundi, Egypt, Eritrea, Ethiopia, Ghana, Jordan, Kenya, Kuwait, Liberia, Malawi, Malta, Mozambique, Nigeria, Oman, Pakistan, Qatar, Rwanda, Sao Tome, Saudi Arabia, Sierra Leone, Somalia, Tanzania, Uganda, United Arab Emirates, United Kingdom, West Bank/Gaza, Yemen, Zambia, and Zimbabwe, this Agreement will be governed by English Law and disputes relating to it will be submitted to the exclusive jurisdiction of the English courts; and 5) in Greece, Israel, Italy, Portugal,

and Spain any legal claim arising out of this Statement will be brought before, and finally settled by, the competent court of Athens, Tel Aviv, Milan, Lisbon, and Madrid, respectively.

THE FOLLOWING TERMS APPLY TO THE COUNTRY SPECIFIED:

AUSTRIA AND GERMANY

The IBM Warranty for Machines: *The following replaces the first sentence of the first paragraph of this Section:*
The warranty for an IBM Machine covers the functionality of the Machine for its normal use and the Machine's conformity to its Specifications.

The following paragraphs are added to this Section:

The minimum warranty period for Machines is six months. In case IBM or your reseller is unable to repair an IBM Machine, you can alternatively ask for a partial refund as far as justified by the reduced value of the unrepaired Machine or ask for a cancellation of the respective agreement for such Machine and get your money refunded.

Extent of Warranty: *The second paragraph does not apply.*

Warranty Service: *The following is added to this Section:*
During the warranty period, transportation for delivery of the failing Machine to IBM will be at IBM's expense.

Limitation of Liability: *The following paragraph is added to this Section:*
The limitations and exclusions specified in the Statement of Limited Warranty will not apply to damages caused by IBM with fraud or gross negligence and for express warranty.

The following sentence is added to the end of item 2:
IBM's liability under this item is limited to the violation of essential contractual terms in cases of ordinary negligence.

EGYPT

Limitation of Liability: *The following replaces item 2 in this Section:*
as to any other actual direct damages, IBM's liability will be limited to the total amount you paid for the Machine that is the subject of the claim. For purposes of this item, the term "Machine" includes Machine Code and Licensed Internal Code.

Applicability of suppliers and resellers (unchanged).

FRANCE

Limitation of Liability: *The following replaces the second sentence of the first paragraph of this Section:*
In such instances, regardless of the basis on which you are entitled to claim damages from IBM, IBM is liable for no more than: *(items 1 and 2 unchanged)*.

IRELAND

Extent of Warranty: *The following is added to this Section:*
Except as expressly provided in these terms and conditions, all statutory conditions,

including all warranties implied, but without prejudice to the generality of the foregoing all warranties implied by the Sale of Goods Act 1893 or the Sale of Goods and Supply of Services Act 1980 are hereby excluded.

Limitation of Liability: *The following replaces items one and two of the first paragraph of this Section:*
1. death or personal injury or physical damage to your real property solely caused by IBM's negligence; and
2. the amount of any other actual direct damages, up to 125 percent of the charges (if recurring, the 12 months' charges apply) for the Machine that is the subject of the claim or which otherwise gives rise to the claim.

Applicability of suppliers and resellers (unchanged).

The following paragraph is added at the end of this Section:
IBM's entire liability and your sole remedy, whether in contract or in tort, in respect of any default shall be limited to damages.

ITALY

Limitation of Liability: *The following replaces the second sentence in the first paragraph:*
In each such instance unless otherwise provided by mandatory law, IBM is liable for no more than:
1. *(unchanged)*
2. as to any other actual damage arising in all situations involving nonperformance by IBM pursuant to, or in any way related to the subject matter of this Statement of Warranty, IBM's liability, will be limited to the total amount you paid for the Machine that is the subject of the claim.
Applicability of suppliers and resellers (unchanged).

The following replaces the third paragraph of this Section:
Unless otherwise provided by mandatory law, IBM and your reseller are not liable for any of the following: *(items 1 and 2 unchanged)* 3) indirect damages, even if IBM or your reseller is informed of their possibility.

SOUTH AFRICA, NAMIBIA, BOTSWANA, LESOTHO AND SWAZILAND

Limitation of Liability: *The following is added to this Section:*
IBM's entire liability to you for actual damages arising in all situations involving nonperformance by IBM in respect of the subject matter of this Statement of Warranty will be limited to the charge paid by you for the individual Machine that is the subject of your claim from IBM.

UNITED KINGDOM

Limitation of Liability: *The following replaces items 1 and 2 of the first paragraph of this Section:*
1. death or personal injury or physical damage to your real property solely caused by IBM's negligence;
2. the amount of any other actual direct damages or loss, up to 125 percent of the charges (if recurring, the 12 months' charges apply) for the Machine that is the subject of the claim or which otherwise gives rise to the claim;

The following item is added to this paragraph:
3. breach of IBM's obligations implied by Section 12 of the Sale of Goods Act 1979 or Section 2 of the Supply of Goods and Services Act 1982.

Applicability of suppliers and resellers (unchanged).

The following is added to the end of this Section:
IBM's entire liability and your sole remedy, whether in contract or in tort, in respect of any default shall be limited to damages.

Appendix C. Notices

This information was developed for products and services offered in the U.S.A.

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Important notes

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

DVD-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.

Maximum memory may require replacement of the standard memory with an optional memory module.

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Some software may differ from its retail version (if available), and may not include user manuals or all program functionality.

Product recycling and disposal

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. For country-specific instructions, refer to the following Web site: http://www.ibm.com/ibm/environment/products/prp.shtml.

This product may contain a sealed lead acid, nickel cadmium, nickel metal hydride, lithium, or lithium ion battery. Consult your user manual or service manual for specific battery information. The battery must be recycled or disposed of properly. Recycling facilities may not be available in your area. For information on disposal of batteries, contact your local waste disposal facility.

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.

Electronic emission notices

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. IBM is not responsible for any radio or television interference caused 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.

European Union EMC Directive conformance statement

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

声　　明
此为 A 级产品。在生活环境中，
该产品可能会造成无线电干扰。
在这种情况下，可能需要用户对其
干扰采取切实可行的措施。

Japanese Voluntary Control Council for Interference (VCCI) statement

この装置は、情報処理装置等電波障害自主規制協議会（ＶＣＣＩ）の基準に
基づくクラスＡ情報技術装置です。この装置を家庭環境で使用すると電波妨害を
引き起こすことがあります。この場合には使用者が適切な対策を講ずるよう要求
されることがあります。

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
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

IBM power cord part number	Used in these countries and regions
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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Printed in U.S.A.

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