

IBM System x3850 X5 and x3950 X5  
Types 7145, 7146, 7143, and 7191



# Installation and User's Guide



IBM System x3850 X5 and x3950 X5  
Types 7145, 7146, 7143, and 7191



# Installation and User's Guide

**Note:** Before using this information and the product it supports, read the general information in “Notices” on page 121, the *IBM Safety Information* and *Environmental Notices and User Guide* documents on the *IBM Documentation CD*, and the *Warranty Information*.

**Ninth Edition (July 2011)**

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## Safety

Before installing this product, read the Safety Information.

قبل تركيب هذا المنتج، يجب قراءة الملاحظات الأمنية

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

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

安裝本產品之前，請先閱讀「安全資訊」。

Prije instalacije ovog produkta obavezno pročitajte Sigurnosne Upute.

Před instalací tohoto produktu si přečtete příručku bezpečnostních instrukcí.

Læs sikkerhedsforskrifterne, før du installerer dette produkt.

Lees voordat u dit product installeert eerst de veiligheidsvoorschriften.

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

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

Vor der Installation dieses Produkts die Sicherheitshinweise lesen.

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

לפני שתתקינו מוצר זה, קראו את הוראות הבטיחות.

A termék telepítése előtt olvassa el a Biztonsági előírásokat!

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

製品の設置の前に、安全情報をお読みください。

본 제품을 설치하기 전에 안전 정보를 읽으십시오.

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

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

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

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

Перед установкой продукта прочтите инструкции по технике безопасности.

Pred inštaláciou tohto zariadenia si pečítajte Bezpečnostné predpisy.

Pred namestitvijo tega proizvoda preberite Varnostne informacije.

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

Läs säkerhetsinformationen innan du installerar den här produkten.

**Important:**

Each caution and danger statement in this document is labeled with a number. This number is used to cross reference an English-language caution or danger statement with translated versions of the caution or danger statement in the *Safety Information* document.

For example, if a caution statement is labeled "Statement 1," translations for that caution statement are in the *Safety Information* document under "Statement 1."

Be sure to read all caution and danger statements in this document before you perform the procedures. Read any additional safety information that comes with the server or optional device before you install the device.

**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:

1. Turn everything OFF.
2. First, attach all cables to devices.
3. Attach signal cables to connectors.
4. Attach power cords to outlet.
5. Turn device ON.

### To Disconnect:

1. Turn everything OFF.
2. First, remove power cords from outlet.
3. Remove signal cables from connectors.
4. Remove all cables from devices.

## Statement 2



### CAUTION:

When replacing the lithium battery, use only IBM Part Number 15F8409 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.



Class 1 Laser Product  
Laser Klasse 1  
Laser Klass 1  
Luokan 1 Laserlaite  
Appareil À Laser de Classe 1

### Statement 4



≥ 18 kg (39.7 lb)



≥ 32 kg (70.5 lb)



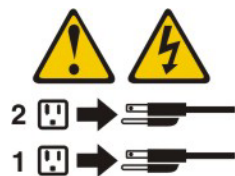
≥ 55 kg (121.2 lb)

**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 11



**CAUTION:**

The following label indicates sharp edges, corners, or joints nearby.



**Statement 12**



**CAUTION:**

The following label indicates a hot surface nearby.



**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.

**Statement 15**



**CAUTION:**

Make sure that the rack is secured properly to avoid tipping when the server unit is extended.

**Statement 17**



**CAUTION:**  
The following label indicates moving parts nearby.



**Statement 26**



**CAUTION:**  
Do not place any object on top of rack-mounted devices.



**Statement 37**



**DANGER**

When you populate a rack cabinet, adhere to the following guidelines:

- Always lower the leveling pads on the rack cabinet.
- Always install the stabilizer brackets on the rack cabinet.
- Always install the heaviest devices in the bottom of the rack cabinet.
- Do not extend multiple devices from the rack cabinet simultaneously, unless the rack-mounting instructions direct you to do so. Multiple devices extended into the service position can cause your rack cabinet to tip.
- If you are not using the IBM 9308 rack cabinet, securely anchor the rack cabinet to ensure its stability.

**Attention:** This product is suitable for use on an IT power distribution system whose maximum phase-to-phase voltage is 240 V under any distribution fault condition.



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## Chapter 1. The System x3850 X5 and x3950 X5 server

This *Installation and User's Guide* contains instructions for setting up your IBM System x3850 X5 or x3950 X5 Type 7145, 7146, 7143, or 7191 server, installing optional devices, and starting and configuring the server. This document also contains information and instructions for installing optional devices in the optional IBM MAX5 for System x memory expansion module (see "IBM MAX5 for System x memory expansion module" on page 21 for more information about the optional memory expansion module). For diagnostic and troubleshooting information and instructions for removing and installing server components, see the *Problem Determination and Service Guide* that is on the IBM Documentation CD.

**Important:** The IBM MAX5 for System x memory expansion module is an Underwriters Laboratories (UL) Listed Accessory for use with the IBM System x3850 X5 and x3950 X5 servers only.

In addition to the instructions in Chapter 2, "Installing optional devices," on page 29 for installing optional hardware devices, updating firmware and device drivers, and completing the installation, IBM Business Partners must also complete the steps in "Instructions for IBM Business Partners" on page 29.

The IBM System x3850 X5 and x3950 X5 server is a 4U<sup>1</sup>-high, high-performance server. It can be upgraded to a symmetric multiprocessing (SMP) server through a microprocessor upgrade. It is ideally suited for networking environments that require superior microprocessor performance, efficient memory management, flexibility, and large amounts of reliable data storage.

Performance, ease of use, reliability, and expansion capabilities were key considerations in the design of the server. These design features make it possible for you to customize the system hardware to meet your needs today and provide flexible expansion capabilities for the future.

For information about features that help increase performance, reliability, and availability, see "What your server offers" on page 8 and "Reliability, availability, and serviceability" on page 11.

The server comes with a limited warranty. For information about the terms of the warranty and getting service and assistance, see the *Warranty Information* document that comes with the server.

The server contains IBM Enterprise X-Architecture technologies, which help increase performance, reliability, and availability. For more information, see "What your server offers" on page 8 and "Reliability, availability, and serviceability" on page 11.

You can obtain up-to-date information about the server and other IBM® server products at <http://www.ibm.com/systems/x/>. At <http://www.ibm.com/support/mysupport/>, you can create a personalized support page by identifying IBM products that are of interest to you. From this personalized page, you can subscribe

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1. Racks are measured in vertical increments of 4.45 cm (1.75 inches) each. Each increment is called a "U." A 1-U-high device is 1.75 inches tall.

to weekly e-mail notifications about new technical documents, search for information and downloads, and access various administrative services.

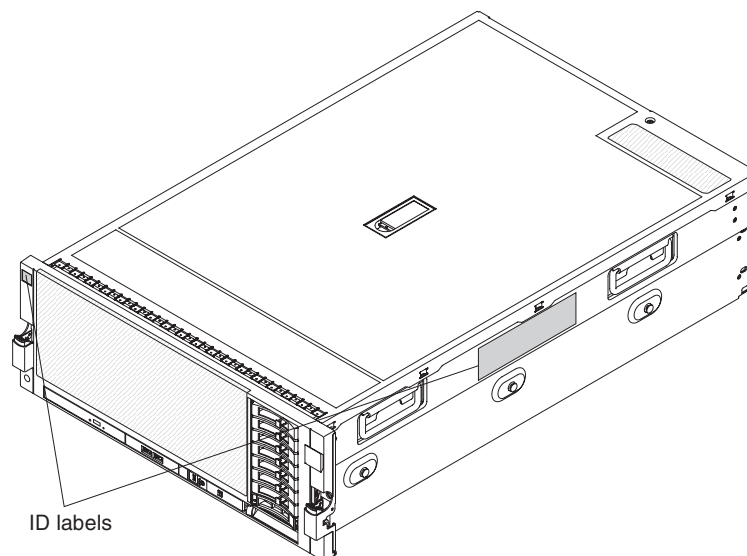
If you participate in the IBM client reference program, you can share information about your use of technology, best practices, and innovative solutions; build a professional network; and gain visibility for your business. For more information about the IBM client reference program, see <http://www.ibm.com/ibm/clientreference/>.

If firmware and documentation updates are available, you can download them from the IBM website. The server might have features that are not described in the documentation that comes with the server, and 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 the server documentation. To check for updates, go to <http://www.ibm.com/supportportal/>.

Record information about the server in the following table.

<b>Product name</b>	IBM System x3850 X5 or x3950 X5
<b>Machine type</b>	7145, 7146, 7143, or 7191
<b>Model number</b>	_____
<b>Serial number</b>	_____

The model number and serial number are on labels on the right side of the server and on the front, visible on the bezel, as shown in the following illustration.



For a list of supported optional devices for the server, see <http://www.ibm.com/systems/info/x86servers/serverproven/compat/us/>.



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## The IBM Documentation CD

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

- Microsoft Windows XP, Windows 2000, or Red Hat Linux
- 100 MHz microprocessor
- 32 MB of RAM
- Adobe Acrobat Reader 3.0 (or later) or xpdf, which comes with Linux operating systems

### Using the Documentation Browser

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

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

- If Autostart is enabled, insert the CD into the CD or DVD drive. The Documentation Browser starts automatically.
- If Autostart is disabled or is not enabled for all users, use one of the following procedures:
  - If you are using a Windows operating system, insert the CD into the CD or DVD drive and click **Start --> Run**. In the **Open** field, type  
`e:\win32.bat`

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

- If you are using Red Hat Linux, insert the CD into the CD or DVD drive; then, run the following command from the `/mnt/cdrom` directory:  
`sh runlinux.sh`

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

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

To search all the documents, type a word or word string in the **Search** field and click **Search**. The documents in which the word or word string appears are listed

in order of the most occurrences. Click a document to view it, and press Ctrl+F to use the Acrobat search function, or press Alt+F to use the xpdf search function within the document.

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

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## Related documentation

This *Installation and User's Guide* contains general information about the server, including how to set up the server, install supported optional devices, and configure the server. The following documentation also comes with the server:

- *IBM Warranty Information*

This printed document contains the warranty terms and a pointer to the IBM Statement of Limited Warranty on the IBM website.

- *Safety Information*

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

- *Problem Determination and Service Guide*

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

- *Rack Installation Instructions*

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

If you are adding an optional memory expansion module or scaling to another server, see the rack installation instructions that comes with the cable option kit.

- *Environmental Notices and User's Guide*

This document is in PDF on the IBM *Documentation* CD. It contains translated environmental notices.

- *IBM License Agreement for Machine Code*

This document is in PDF on the IBM *Documentation* CD. It provides translated versions of the *IBM License Agreement for Machine Code* for your product.

- *Licenses and Attributions Document*

This document is in PDF on the IBM *Documentation* CD. It provides the open-source notices.

Depending on the server model, additional documentation might be included on the IBM *Documentation* CD.

The ToolsCenter for System x and BladeCenter is an online information center that contains information about tools for updating, managing, and deploying firmware, device drivers, and operating systems. The ToolsCenter for System x and BladeCenter is at <http://publib.boulder.ibm.com/infocenter/toolctr/v1r0/index.jsp>.

The server might have features that are not described in the documentation that comes 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 the server documentation. To check for updated documentation and technical updates, go to <http://www.ibm.com/supportportal/>.

---

## Notices and statements in this document

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

The following notices and statements are used in this document:

- **Note:** 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 might 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 of the server. Depending on the server model, some features might not be available, or some specifications might not apply.

### Notes:

1. Racks are marked in vertical increments of 4.45 cm (1.75 inches). Each increment is referred to as a unit, or "U." A 1-U-high device is 4.45 cm (1.75 inches) tall.
2. Power consumption and heat output vary depending on the number and type of optional features that are installed and the power-management optional features that are in use.
3. The sound 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.
4. When you add an optional memory expansion module to your server configuration and you plan to use the optional USB flash device with VMware ESXi embedded hypervisor software, see the documentation that comes with the USB flash device and the operating system installation instructions for installing ESXi (or ESX, depending on your environment) on your server at

<http://www.ibm.com/supportportal/>. The documentation provides additional installation and configuration information that you must follow before you use the memory expansion module.

Table 1. Features and specifications

<p><b>Microprocessor:</b></p> <ul style="list-style-type: none"> <li>• Intel Xeon EX versions of the 6000 and 7000 Series or E7 Series multi-core microprocessor with up to 24 MB or 30 MB last level cache.</li> <li>• 1066 MHz front-side bus (FSB)</li> <li>• Support for up to four microprocessors             <ul style="list-style-type: none"> <li>– Four Quick Path Interconnect (QPI) links per microprocessor at up to 6.4 GT/s (gigatransfers per second)</li> <li>– Four Scalable Memory Interconnect (SMI) links per microprocessor at up to 6.4 GT/s</li> </ul> </li> </ul> <p><b>Note:</b> Use the Setup utility to determine the type and speed of the microprocessors. The server does not support mixing microprocessor types.</p> <p><b>Memory:</b></p> <ul style="list-style-type: none"> <li>• Type: Registered, ECC, PC3-10600 double data rate (DDR) III, SDRAM</li> <li>• Sizes: 1 GB (Types 7145 and 7146 only) and 2 GB (PC3-10600 running at 1066 Mb/sec), 4 GB, 8 GB, 16 GB, and 32 GB (Types 7143 and 7191 only) (PC3L-8500-777 DDR3 ECC running at 1066 Mb/sec) in pairs</li> <li>• Minimum (Types 7145 and 7146): 2 GB (two DIMMs per memory card minimum)</li> <li>• Minimum (Types 7143 and 7191): 4 GB (two DIMMs per memory card minimum)</li> <li>• Maximum: 1 TB (2 TB when using 32 GB DIMMs in Types 7143 and 7191) (eight memory cards, each card containing 8 DIMM connectors for a total of 64 DIMMs)</li> <li>• Connectors: Two-way interleaved, eight dual inline memory module (DIMM) connectors per memory card</li> <li>• Supports 1.35-volt (low-voltage) and 1.5-volt registered DIMMs</li> <li>• Machine Types 7145 and 7146 uses the Intel 7500 Scalable Memory Buffer only</li> <li>• Machine Types 7143 and 7191 uses the Intel 7510 Scalable Memory Buffer only</li> </ul>	<p><b>Expansion slots:</b></p> <ul style="list-style-type: none"> <li>• Six non-hot-swap PCI Express x8 (three full-length and three half-length) slots (slot 2 is electrically x4)</li> <li>• One non-hot-swap PCI Express x16 (full-length) slot</li> <li>• Emulex 10 GbE Custom Adapter for IBM System x in slot 7 (optional in some models)</li> </ul> <p><b>Upgradeable microcode:</b></p> <p>System UEFI, FPGA, diagnostics, service processor, IMM, and SAS microcode</p> <p><b>Power supply:</b></p> <ul style="list-style-type: none"> <li>• Standard: One or two dual-rated power supplies (depending on the model).             <ul style="list-style-type: none"> <li>– 1975 watts at 220 V ac input</li> <li>– 875 watts at 110 V ac input</li> </ul> </li> <li>• Hot-swappable and redundant at 220 V ac, only with two power supplies</li> <li>• If the server is operating at 110 V ac, a second power supply must be installed.</li> </ul> <p><b>Size:</b></p> <ul style="list-style-type: none"> <li>• 4U</li> <li>• Height: 172.8 mm (6.81 in.)</li> <li>• Depth: 712.13 mm (28.04 in.)</li> <li>• Width: (without rack EIA brackets) 440 mm (17.32 in.)</li> <li>• Width: (with rack EIA brackets) 482.6 mm (19 in.)</li> <li>• Weight: approximately 49.90 kg (110 lb) when fully configured</li> </ul> <p><b>Drives:</b></p> <ul style="list-style-type: none"> <li>• Slim CD/DVD-ROM: SATA (optional)</li> <li>• Serial Attached SCSI (SAS) 2.5-inch hard disk drives (optional)</li> <li>• Solid state 1.8-inch drives (optional)</li> </ul> <p><b>Expansion bays:</b></p> <ul style="list-style-type: none"> <li>• Eight SAS, 2.5-inch bays or sixteen solid state 1.8-inch bays</li> <li>• One 12.7 mm removable-media drive bay (CD/DVD drive optional)</li> </ul>	<p><b>Acoustical noise emissions:</b></p> <ul style="list-style-type: none"> <li>• Sound power, idle: 5.8 bel declared</li> <li>• Sound power, operating: 6.3 bel declared</li> </ul> <p><b>Airflow:</b></p> <ul style="list-style-type: none"> <li>• Nominal airflow: 67 cubic feet per minute (CFM)</li> <li>• Typical airflow: 100 CFM</li> <li>• Maximum airflow: 241 CFM</li> </ul> <p><b>Environment:</b></p> <ul style="list-style-type: none"> <li>• Air temperature:             <ul style="list-style-type: none"> <li>– Server on:                 <ul style="list-style-type: none"> <li>- 10°C to 35°C (50°F to 95°F); altitude: 0 to 914 m (3000 ft).</li> <li>- 10°C to 32°C (50°F to 90°F); altitude: 914 to 2133 m (7000 ft).</li> </ul> </li> <li>– Server off: 10°C to 43°C (50.0°F to 109.4°F); maximum altitude: 2133 m (6998.0 ft)</li> </ul> </li> <li>• Humidity:             <ul style="list-style-type: none"> <li>– Server on: 8% to 80%</li> <li>– Server off: 8% to 80%</li> </ul> </li> <li>• Particulate contamination:             <p><b>Attention:</b> Airborne particulates and reactive gases acting alone or in combination with other environmental factors such as humidity or temperature might pose a risk to the server. For information about the limits for particulates and gases, see “Particulate contamination” on page 123.</p> </li> </ul> <p><b>Heat output:</b></p> <p>Approximate heat output:</p> <ul style="list-style-type: none"> <li>• Minimum configuration: 648 Btu per hour (190 watts)</li> <li>• Typical configuration: 3753 Btu per hour (1100 watts)</li> <li>• Design maximum configuration:             <ul style="list-style-type: none"> <li>– 5971 Btu per hour (1930 watts) at 110 V ac</li> <li>– 6739 Btu per hour (2150 watts) at 220 V ac</li> </ul> </li> </ul>
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Table 2. Features and specifications (continued)

<p><b>Scalability and memory expansion:</b></p> <ul style="list-style-type: none"> <li>• Eight-socket scalability option uses 4 QPI external cables</li> <li>• Multi-node configurations require 4 microprocessors in each node</li> <li>• MAX5 memory expansion module option uses four QPI ports</li> </ul> <p><b>Note:</b> When you add an optional memory expansion module to your server configuration and you plan to use the optional USB flash device with VMware EXSi embedded hypervisor software, see the documentation that comes with the USB flash device and the operation system installation instructions for installing VMware ESXi (or ESX, depending on your environment) on your server at the IBM websight at <a href="http://www.ibm.com/systems/support/">http://www.ibm.com/systems/support/</a>. The documentation provides additional installation and configuration information that you need to follow before you use the memory expansion module.</p>	<p><b>Integrated functions:</b></p> <ul style="list-style-type: none"> <li>• Integrated management module (IMM), which provides service processor control and monitoring functions, video controller, and remote keyboard, video, mouse, and remote hard disk drive capabilities</li> <li>• Light path diagnostics</li> <li>• Eight Universal Serial Bus (USB) ports (2.0) <ul style="list-style-type: none"> <li>– Four on rear of server</li> <li>– Two on front of server</li> <li>– Two internal</li> </ul> </li> <li>• Broadcom 5709 dual 10/100/1000 MB Ethernet controller</li> <li>• Matrox video <ul style="list-style-type: none"> <li>– 16 MB video memory</li> <li>– SVGA compatible</li> </ul> </li> <li>• Serial-attached SCSI (SAS) controller with RAID capabilities</li> <li>• Support for ServeRAID-BR10i SAS/SATA controllers (Types 7145 and 7146 only) or ServeRAID-M1015 SAS/SATA controllers (Types 7143 and 7191 only) and ServeRAID-M5015 SAS/SATA/SSD controllers (all Types)</li> <li>• Serial connector</li> <li>• QPI Expansion Ports</li> </ul>	<p><b>Electrical input:</b></p> <ul style="list-style-type: none"> <li>• Sine-wave input (50 - 60 Hz) required</li> <li>• Input voltage low range: <ul style="list-style-type: none"> <li>– Minimum: 100 V ac</li> <li>– Maximum: 127 V ac</li> </ul> </li> <li>• Input voltage high range: <ul style="list-style-type: none"> <li>– Minimum: 200 V ac</li> <li>– Maximum: 240 V ac</li> </ul> </li> <li>• Approximate input kilovolt-amperes (kVA): <ul style="list-style-type: none"> <li>– Minimum: 0.20 kVA</li> <li>– Typical: 1.12 kVA</li> <li>– Maximum: 1.95 kVA (110 V ac)</li> <li>– Maximum: 2.17 kVA (220 V ac)</li> </ul> </li> </ul>
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## What your server offers

The server uses the following features and technologies:

- **UEFI-compliant server firmware**

IBM UEFI firmware offers several features, including Unified Extensible Firmware Interface (UEFI) 2.1 compliance; Active Energy Manager technology; enhanced reliability, availability, and serviceability (RAS) capabilities; and basic input/output system (BIOS) compatibility support. UEFI replaces the BIOS and defines a standard interface between the operating system, platform firmware, and external devices. UEFI-compliant System x<sup>®</sup> servers are capable of booting UEFI-compliant operating systems, BIOS-based operating systems, and BIOS-based adapters as well as UEFI-compliant adapters.

**Note:** The server does not support DOS.

For more information about UEFI, go to <http://www-947.ibm.com/systems/support/supportsite.wss/docdisplay?lnidocid=MIGR-5083207&brandind=5000008>.

- **Integrated management module**

The integrated management module (IMM) combines service processor functions, video controller, and remote presence and blue-screen capture features in a single chip. The IMM provides advanced service processor control, monitoring, and alerting function. If an environmental condition exceeds a

threshold or if a system component fails, the IMM lights LEDs to help you diagnose the problem, records the error in the IMM event log, and alerts you to the problem. Optionally, the IMM also provides a virtual presence capability for remote server management capabilities. The IMM provides remote server management through industry-standard interfaces:

- Intelligent Platform Management Interface (IPMI) version 2.0
- Simple Network Management Protocol (SNMP) version 3
- Common Information Model (CIM)
- Web browser (For more information, see “Using the integrated management module” on page 104.)

- **IBM Systems Director**

IBM Systems Director is a platform-management foundation that streamlines the way you manage physical and virtual systems in a heterogeneous environment. By using industry standards, IBM Systems Director supports multiple operating systems and virtualization technologies for IBM and non-IBM x86 platforms. For more information, see the documentation on the IBM Systems Director DVD and “IBM Systems Director” on page 12.

- **IBM Electronic Service Agent**

IBM Electronic Service Agent is a software tool that monitors the server for hardware error events and automatically submits electronic service requests to IBM service and support. Also, it can collect and transmit system configuration information on a scheduled basis so that the information is available to you and your support representative. It uses minimal system resources, is available free of charge, and can be downloaded from the web. For more information and to download Electronic Service Agent, go to <http://www.ibm.com/support/electronic/>.

- **IBM X-Architecture® technology**

IBM X-Architecture technology combines proven, innovative IBM designs to make your x86-processor-based server powerful, scalable, and reliable. For more information, see <http://www.ibm.com/servers/eserver/xseries/xarchitecture/enterprise/index.html>.

- **Large system-memory capacity**

The server supports up to 1 TB of system memory. The memory controller supports error correcting code (ECC) for up to 64 industry-standard PC3-10600, 240-pin, registered, double-data-rate (DDR) III, synchronous dynamic random access memory (SDRAM) dual inline memory modules (DIMMs). The optional 32-DIMM IBM MAX5 for System x memory expansion module is available for purchase and provides up to 512 GB of additional memory. For more information about the memory expansion module, see “IBM MAX5 for System x memory expansion module” on page 21.

- **Memory ProteXion**

The Memory ProteXion feature provides the equivalent of a hot-spare drive in a RAID array. It is based in the memory controller, and it enables the server to sense when a chip on a DIMM has failed and to route the data around the failed chip.

- **Memory Sparing**

The server supports memory sparing. Memory sparing reserves memory capacity for failover in the event of a DIMM failure, and the reserved capacity is subtracted from the total available memory. Memory sparing provides less redundancy than memory mirroring does. If a predetermined threshold of correctable errors is reached, the contents of the failing DIMM are copied to the spare memory, and the failing DIMM or rank is disabled. To enable memory

sparing through the Setup utility, select **System Settings > Memory**. (Memory sparing and memory mirroring cannot be used together.)

- **IBM ServerGuide Setup and Installation CD**

The *ServerGuide Setup and Installation CD*, which you can download from the web, provides programs to help you set up the server and install a Windows operating system. The ServerGuide program detects installed optional hardware devices and provides the correct configuration programs and device drivers. For more information about the *ServerGuide Setup and Installation CD*, see “Using the ServerGuide Setup and Installation CD” on page 102.

- **Integrated network support**

The server comes with an integrated Broadcom 5709 dual Gigabit Ethernet controller, which supports connection to a 10 Mbps, 100 Mbps, or 1000 Mbps network. For more information, see “Configuring the Broadcom Gigabit Ethernet controller” on page 108.

- **Integrated Trusted Platform Module (TPM)**

This integrated security chip performs cryptographic functions and stores private and public secure keys. It provides the hardware support for the Trusted Computing Group (TCG) specification. You can download the software to support the TCG specification, when the software is available.

- **Large data-storage capacity and hot-swap capability**

The server supports up to eight 1-inch (26 mm) slim-high, 2.5-inch hot-swap hard disk drives that are connected to two SAS backplanes. With the hot-swap feature, you can add, remove, and replace hard disk drives without turning off the server. For more information, see “Installing a hot-swap power supply” on page 52.

- **Light path diagnostics**

Light path diagnostics provides LEDs to help you diagnose problems. For more information, see the section about light path diagnostics in the *Problem Determination and Service Guide*.

- **PCI Express 2.0 adapter capabilities**

The server has six slots for PCI Express 2.0 x8 adapters and one slot for PCI Express x16 adapters. For more information, see “Installing a PCI Express adapter” on page 47.

- **Active Energy Manager**

The Active Energy Manager solution is an IBM Systems Director extension that measures and reports server power consumption as it occurs. This enables you to monitor power consumption in correlation to specific software applications programs and hardware configurations. You can obtain the measurement values through the systems-management interface and view them, using IBM Systems Director. For more information, see the documentation on the IBM Systems Director DVD, or see <http://www.ibm.com/systems/management/director/extensions/actengmgr.html>.

- **Dynamic System Analysis (DSA) Preboot diagnostic programs**

The DSA Preboot diagnostic programs are stored in integrated USB memory and collect and analyze system information to aid in diagnosing server problems. The diagnostic programs collect the following information about the server:

- Event logs for ServeRAID controllers and service processors
- Hard disk drive health
- Installed hardware
- Light path diagnostics status
- Network interfaces and settings
- RAID controller configuration



- Service processor status and configuration
- System configuration
- Vital product data, firmware, and UEFI configuration

For additional information about DSA, see the *Problem Determination and Service Guide* on the IBM Documentation CD.

- **Redundant connection**

The addition of an optional network interface card (NIC) provides a failover capability to a redundant Ethernet connection. If a problem occurs with the primary Ethernet connection, all Ethernet traffic that is associated with the primary connection is automatically switched to the redundant NIC. If the applicable device drivers are installed, this switching occurs without data loss and without user intervention.

- **Redundant cooling and power capabilities**

The redundant cooling of the fans in the server enables continued operation if one of the fans fails. The server supports up to two hot-swap power supplies, which provide redundant power for many server configurations.

- **ServeRAID support**

The server supports ServeRAID controllers to create a redundant array of independent disks (RAID) configurations.

- **Symmetric multiprocessing (SMP)**

The server supports up to four multi-core Intel Xeon microprocessors. One or more multi-core microprocessors provides SMP capability.

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## Reliability, availability, and serviceability

Three important server design features are reliability, availability, and serviceability (RAS). The RAS features help to ensure the integrity of the data that is stored in the server, the availability of the server when you need it, and the ease with which you can diagnose and correct problems.

The server has the following RAS features:

- Advanced memory features:
  - Single-bit memory error detection
  - Single-bit memory error hardware correction
  - Multi single-bit memory error recovery and corrections
  - Uncorrectable error (UE) detection
  - Full array memory mirroring (FAMM) redundancy
  - Automatic failover recovery for UEs when FAMM is configured
  - Automated logical removal of failed DIMMs on reboots prior to replacement
  - Automatic address parity checking during writes and reads
- Automatic BIOS recovery (ABR) for UEFI
- Automatic error retry and recovery
- Automatic restart after a power failure
- Availability of microcode and diagnostic levels
- Integrated management module (service processor)
- Built-in, menu-driven electrically erasable programmable ROM (EEPROM) based setup, system configuration, and diagnostic programs
- Built-in monitoring for fan, power, temperature, voltage, and power-supply redundancy
- Error codes and messages
- Error correcting code (ECC) L2 cache and system memory
- Fault-resistant startup
- Hot-swap hard disk drives

- IBM Systems Director workgroup-hardware-management tool
- Information and light path diagnostics LED panels
- Integrated management module
- Service processor adapter for remote systems management
- Parity checking on the SAS bus and PCI Express buses
- Power managed and Advanced Configuration and Power Interface (ACPI) compliant
- Power-on self-test (POST)
- Predictive Failure Analysis (PFA) alerts
- Redundant Ethernet capabilities (requires optional Ethernet adapter) with failover support
- Redundant hot-swap capability
  - Cooling fans with speed-sensing capability
  - Power supplies
- Remind button to temporarily flash the system-error LED
- Remote system problem-determination support
- ROM-based diagnostic programs
- Standby voltage for systems-management features and monitoring
- Startup (boot) from LAN using Preboot Execution Environment (PXE) protocol
- System auto-configuring from the configuration menu
- System error logging
- Upgradeable microcode for POST, IMM, diagnostics, service processor, and read-only memory (ROM) resident code, locally or over the LAN
- Vital product data (VPD) on microprocessors, system boards, power supplies, and SAS (hot-swap-drive) backplane
- Wake on LAN capability

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## IBM Systems Director

IBM Systems Director is a platform-management foundation that streamlines the way you manage physical and virtual systems in a heterogeneous environment. By using industry standards, IBM Systems Director supports multiple operating systems and virtualization technologies in IBM and non-IBM x86 platforms.

Through a single user interface, IBM Systems Director provides consistent views for viewing managed systems, determining how these systems relate to one another, and identifying their statuses, helping to correlate technical resources with business needs. A set of common tasks that are included with IBM Systems Director provides many of the core capabilities that are required for basic management, which means instant out-of-the-box business value. These common tasks include discovery, inventory, configuration, system health, monitoring, updates, event notification, and automation for managed systems.

The IBM Systems Director Web and command-line interfaces provide a consistent interface that is focused on driving these common tasks and capabilities:

- Discovering, navigating, and visualizing systems on the network with the detailed inventory and relationships to the other network resources
- Notifying users of problems that occur on systems and the ability to isolate the sources of the problems
- Notifying users when systems need updates and distributing and installing updates on a schedule
- Analyzing real-time data for systems and setting critical thresholds that notify the administrator of emerging problems

- Configuring settings of a single system and creating a configuration plan that can apply those settings to multiple systems
- Updating installed plug-ins to add new features and functions to the base capabilities
- Managing the life cycles of virtual resources

For more information about IBM Systems Director, see the documentation on the *IBM Systems Director* DVD that comes with the server, the IBM Systems Director Information Center at [http://publib.boulder.ibm.com/infocenter/director/v6r1x/index.jsp?topic=/director\\_6.1/fqm0\\_main.html](http://publib.boulder.ibm.com/infocenter/director/v6r1x/index.jsp?topic=/director_6.1/fqm0_main.html) and the Systems Management Web page at <http://www.ibm.com/systems/management/>, which presents an overview of IBM Systems Management and IBM Systems Director.

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## The UpdateXpress System Pack Installer (UXSPI)

The UpdateXpress System Pack Installer detects supported and installed device drivers and firmware in the server and installs available updates. For additional information and to download the UpdateXpress System Pack Installer, go to the ToolsCenter for System x and BladeCenter at <http://publib.boulder.ibm.com/infocenter/toolsctr/v1r0/index.jsp> and click **UpdateXpress System Pack Installer**.

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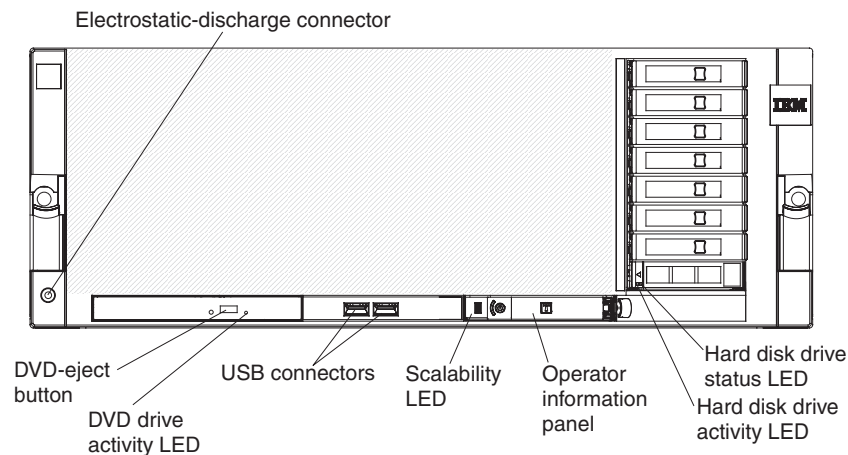
## Server controls, LEDs, and power

This section describes the controls, light-emitting diodes (LEDs), connectors on the front and rear of the server, and how to turn the server on and off.

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

### Front view

The following illustration shows the controls, LEDs, and connectors on the front of the server. (See “Operator information panel” on page 14 for information about the operator information panel.) The DVD drive is optional in some models.



**Electrostatic-discharge connector:** Connect an electrostatic-discharge wrist strap to this connector when you work with static-sensitive devices.

**DVD-eject button:** Press this button to release a CD or DVD from the DVD drive.

**DVD drive activity LED:** When this LED is lit, it indicates that the DVD drive is in use.

**USB 1 and 2 connectors:** Connect USB devices to these connectors.

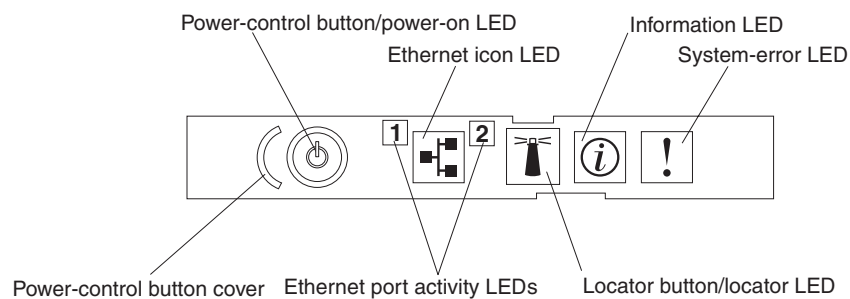
**Scalability LED:** This white LED is lit when the server is connected to another server in a multi-node configuration. This LED is lit and remains on after POST on the primary and secondary server.

**Hard disk drive activity LED:** When this LED is flashing, it indicates that the drive is in use.

**Hard disk drive status LED:** On some server models, each hot-swap hard disk drive has a status LED. When this LED is lit, it indicates that the drive has failed. If an optional IBM ServeRAID controller is installed in the server, when this LED is flashing slowly (one flash per second), it 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.

## Operator information panel

The following illustration shows the controls and LEDs on the operator information panel.



The following controls and LEDs are on the operator information panel:

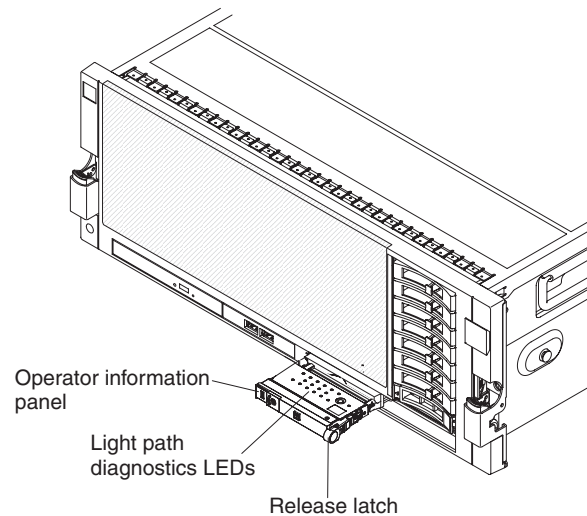
- **Power-control button and power-on LED:** Press this button to turn the server on and off manually or to wake the server from a reduced-power state. The states of the power-on LED are as follows:
  - Off:** AC power is not present, or the power supply or the LED itself has failed.
  - Flashing rapidly (4 times per second):** The server is turned off and is not ready to be turned on. The power-control button is disabled. In a fully configured server, it could take up to 8 minutes after the server is connected to ac power, before the power-control button becomes active.
  - Flashing slowly (once per second):** The server is turned off and is ready to be turned on. You can press the power-control button to turn on the server.
  - Lit:** The server is turned on.
  - Fading on and off:** The server is in a reduced-power state. To wake the server, press the power-control button or use the IMM web interface. For information about logging on to the IMM web interface, see “Logging on to the IMM web interface” on page 106.
- **Ethernet icon LED:** This LED lights the Ethernet icon.

- **Information LED:** When this LED is lit, it indicates that a noncritical event has occurred. An LED on the light path diagnostics panel is also lit to help isolate the error.
- **System-error LED:** When this LED is lit, it indicates that a system error has occurred. An LED on the light path diagnostics panel is also lit to help isolate the error.
- **Locator button and locator LED:** Use this LED to visually locate the server among other servers. It is also used as the physical presence for trusted Platform Module (TPM). Press this button to turn on or turn off this LED locally. You can use IBM Systems Director to light this LED remotely.  
In a two-node configuration, this LED is lit on the primary server and flashes on the secondary server during POST.  
You can press this button or use an IPMI command to turn this LED on or off.
- **Ethernet port activity LEDs:** When either of these LEDs is lit, it indicates that the server is transmitting to or receiving signals from the Ethernet LAN that is connected to the Ethernet port that corresponds to that LED.

## Light path diagnostics panel

The light path diagnostics panel is on the top of the operator information panel.

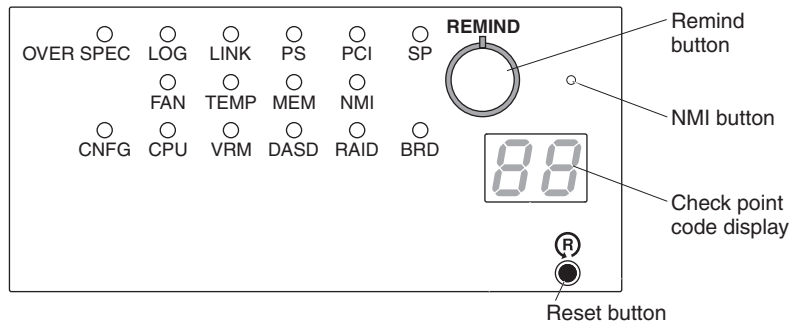
To access the light path diagnostics panel, slide the blue release button on the operator information panel to the left. Pull forward on the operator information panel until the hinge of the panel is free of the server chassis. Then pull down on the operator information panel, so that you can view the light path diagnostics panel information.



The following illustration shows the controls and LEDs on the light path diagnostics panel.

### Note:

1. Do not run the server for an extended period of time while the light path diagnostics panel is pulled out of the server.
2. Light path diagnostics LEDs remain lit only while the server is connected to power.



- **Remind button:** This button places the system-error LED on the front panel into Remind mode. In Remind mode, the system-error LED flashes once every 2 seconds until the problem is corrected, the server is restarted, or a new problem occurs.

By placing the system-error LED indicator in Remind mode, you acknowledge that you are aware of the last failure but will not take immediate action to correct the problem. The remind function is controlled by the IMM.

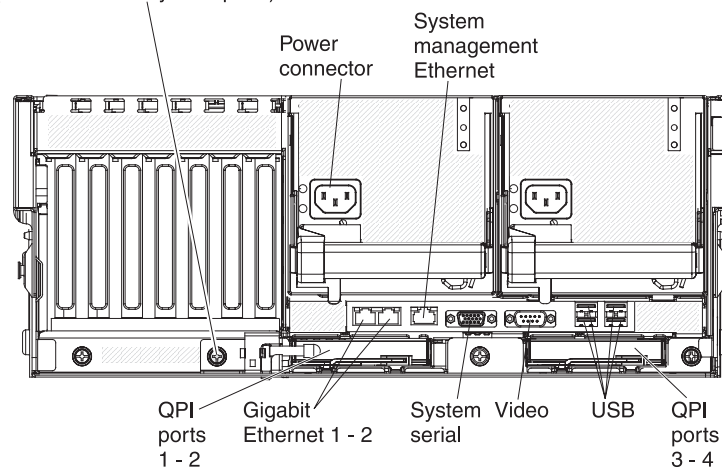
- **NMI button:** Press this button to force a nonmaskable interrupt to the microprocessor, if you are directed to do so by IBM service.
- **Reset button:** Press this button to reset the server and run the power-on self-test (POST). You might have to use a pen or the end of a straightened paper clip to press the button. The reset button is in the lower-right corner of the light path diagnostics panel.

For more information about light path diagnostics, see the *Problem Determination and Service Guide* on the IBM Documentation CD.

## Rear view

The following illustration shows the connectors on the rear of the server.

A thumbscrew is in this position only when a 2-node lock bracket is installed (2-node Scalability Kit Option)



**Power-cord connector:** Connect the power cord to this connector.

**System-management connector:** Use this connector to connect the server to a network for systems-management information control. This connector is used only by the IMM.

**USB connectors:** Connect USB devices, such as a USB mouse or keyboard, to these connectors.

**Video connector:** Connect a monitor to this connector. In a two-node configuration, connect the monitor to the primary server to see standard system output.

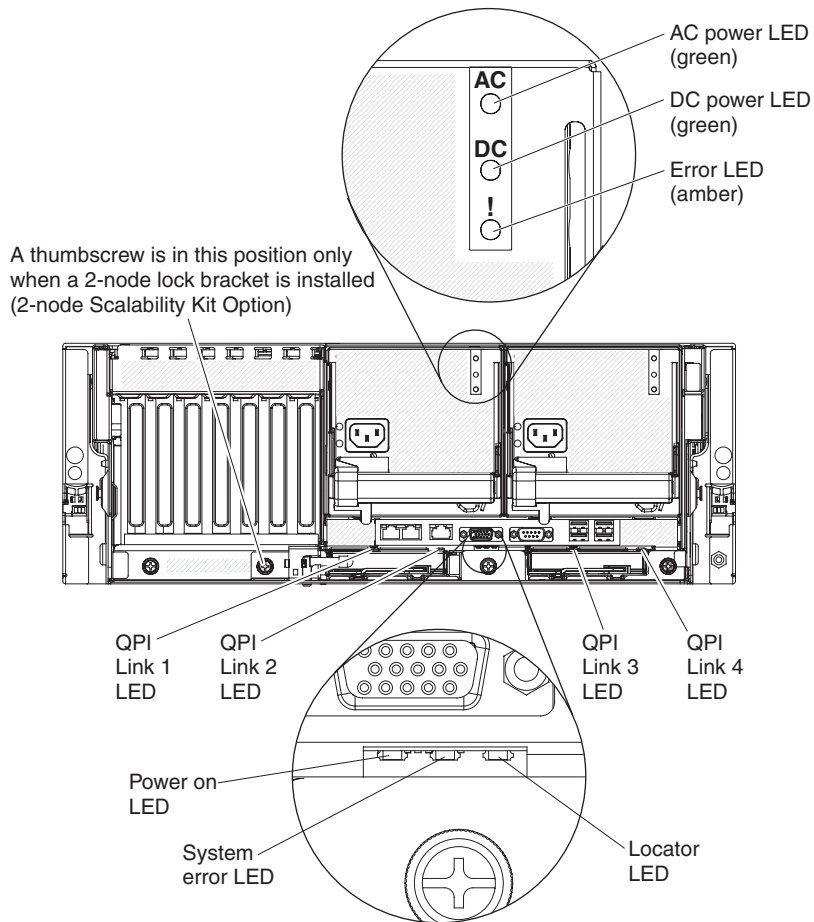
**Serial connector:** Connect a 9-pin serial device to this connector. The serial port is shared with the integrated management module (IMM). The IMM can take control of the shared serial port to perform text console redirection and to redirect serial traffic, using Serial over LAN (SOL).

**QPI ports 1 - 4:** In a single-node configuration, use these connectors to insert either a QPI wrap card or a filler panel. The QPI wrap cards enable increased performance in certain models. In a two-node configuration, insert the QPI cables in these ports to connect another server or a memory expansion module to your server. See the documentation that came with your QPI cable kit for detailed cabling instructions.

**Gigabit Ethernet 1 and 2 connectors:** Use these connectors to connect the server to a network.

## Rear view LEDs

The following illustration shows the LEDs on the rear of the server. For more information about solving power-supply problems, see the *Problem Determination and Service Guide*.



**AC power LED:** Each hot-swap power supply has an ac power LED and a dc power LED. When the ac power LED is lit, it indicates that sufficient power is coming into the power supply through the power cord. During typical operation, both the ac and dc power LEDs are lit. For any other combination of LEDs, see the *Problem Determination and Service Guide*.

**DC power LED:** Each hot-swap power supply has a dc power LED and an ac power LED. When the dc power LED is lit, it indicates that the power supply is supplying sufficient dc power to the system. During typical operation, both the ac and dc power LEDs are lit. For any other combination of LEDs, see the *Problem Determination and Service Guide*.

**Error LED:** When the power-supply error LED is lit, it indicates that the power supply has failed. See the *Problem Determination and Service Guide* for detailed information about power-supply errors.

**QPI link LEDs 1 - 4:** When the QuickPath Interconnect (QPI) link LEDs are lit, they indicate that the QPI links are fully established.

Table 3. QPI link LEDs

Link LEDs	Number of nodes	QPI wrap card or cable status
Off	1	None installed
On	1	Wrap card installed, working



Table 3. QPI link LEDs (continued)

Link LEDs	Number of nodes	QPI wrap card or cable status
Off at failing port	1	Wrap card installed, not working
On	2	Cables installed, working
Off at failing port	2	Cables installed, not working

**Power-on LED:** See “Operator information panel” on page 14 for the various states of the power-on LED.

**System-error LED:** When this LED is lit, it indicates that a system error has occurred. An LED on the light path diagnostics panel is also lit to help isolate the error.

**Locator LED:** Use this LED to visually locate the server among other servers. You can use IBM Systems Director to light this LED remotely.

In a two-node configuration, this LED is lit on the primary server and flashes on the secondary server during POST.

You can press the Locator button on the operator information panel on the front of the server or use an IPMI command to turn this LED on or off.

## 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 integrated management module (IMM) is shut down; however, the server can respond to requests from the IMM, 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.

In a two-node configuration, connect both servers to an ac power source as close to the same time as possible to ensure optimum operation.

### Turning on the server

Approximately 30 seconds, or up to 8 minutes in a 2-node configuration, after the server is connected to ac power, the power-control button becomes active, and one or more fans might start running to provide cooling while the server is connected to power. You can turn on the server and all nodes in the partition and start the operating system by pressing the power-control button.

If you are restarting a two-node server after it has been turned off, you must allow extra time for the hardware to synchronize before you turn on the server again.

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.
- The systems-management software can turn on the server remotely.
- If your operating system supports the Wake on LAN feature, the Wake on LAN feature can turn on the server.

**Note:** Some memory is reserved for various system resources and is unavailable to the operating system. The amount of memory that is reserved for system resources depends on the operating system, the configuration of the server, and the configured PCI options.

## 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 IMM, such as a remote request to turn on the server. While the server remains connected to ac power, one or more fans might continue to run. To remove all power from the server, you must disconnect it from the power source.

**Important:** To view the error LEDs on the system board, leave the server connected to a power source.

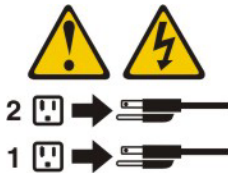
Some operating systems require an orderly shutdown before you turn off the server. See your operating-system documentation for information about shutting down the operating system.

### 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.
- The IMM 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 IMM.

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## IBM MAX5 for System x memory expansion module

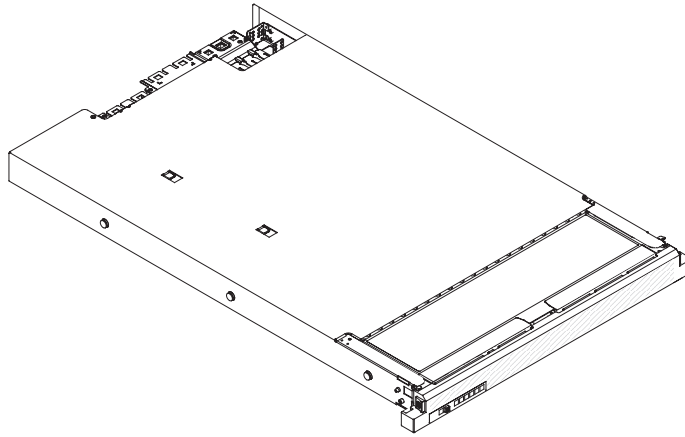
If you purchased an optional IBM MAX5 for System x (MAX5) memory expansion module, it supports up to 32 DDR3 DIMMs, two 675-watt power supplies, and five 40 mm hot-swap speed-controlled fans. It provides added memory and multi-node scaling support for host servers. The MAX5 expansion module is based on eX5, the next generation of Enterprise X-Architecture. The MAX5 expansion module is designed for performance, expandability, and scalability; the fans and power supplies use hot-swap technology for easy replacement without requiring that expansion module be turned off.

### Notes:

1. Before you attach the memory expansion module to the server and try to use it, you must update the server firmware with the latest level of firmware or code. The firmware in the server and the memory expansion module must be at the same level. If you attach and try to use the memory expansion module without updating the server firmware or making sure that the firmware in the server and memory expansion module are at the same level, you might get unexpected system behavior, or the server might not power on. For special instructions to follow before you attach the memory expansion module to the server, see <http://www.ibm.com/support/entry/portal/docdisplay?lnocid=MIGR-5085756>.
2. When you add an optional memory expansion module to your server configuration and you plan to use the optional USB flash device with VMware ESXi embedded hypervisor software, see the documentation that comes with the USB flash device and the operating-system installation instructions for installing VMware ESXi (or ESX, depending on your environment) on your server at <http://www.ibm.com/systems/support/>. The documentation provides additional installation and configuration information that you must to follow before you use the memory expansion module.

If you are adding an optional memory expansion module or scaling to another server, see the rack installation instructions that come with the cable option kit.

The following illustration shows the memory expansion module. The illustrations in this document might differ slightly from your hardware.



See <http://www.ibm.com/systems/info/x86servers/serverproven/compat/us/> for a list of supported optional devices for the memory expansion module.

For information about the terms of the warranty for the expansion module, see the documentation that comes with the expansion module.

Before you start the host server to power on the memory expansion module, make sure that the server has the latest level of code or firmware. To obtain the latest code or firmware and update instructions, go to <http://www.ibm.com/supportportal/>.

## Memory expansion module features and specifications

The following table contains a summary of the features and specifications of the memory expansion module.

Table 4. MAX5 expansion module features and operating specifications

<ul style="list-style-type: none"> <li>• Intel 7500 or 7510 scalable memory buffer (depending on your model) with eight memory ports (four DIMMs on each port)</li> <li>• Xcellerated Memory Technology</li> <li>• EXA chip set</li> <li>• QuickPath Interconnect (QPI) architecture technology:             <ul style="list-style-type: none"> <li>– Four 6.4 gigatransfers (GT) per second QuickPath Interconnect links (for up to 2 microprocessors)</li> <li>– Three 10.0 GT per second EXA scalability links</li> </ul> </li> <li>• Scalability:             <ul style="list-style-type: none"> <li>– Connects to the x3850 X5 and x3950 X5 (4U) rack servers using QPI cables</li> </ul> </li> </ul>	<p><b>DIMMs:</b></p> <ul style="list-style-type: none"> <li>• Minimum: 2 DIMMs (two 2 GB DIMMs (4 GB total)</li> <li>• Maximum: 32 DIMM connectors (up 1 TB of memory, depending on the DIMM size)</li> <li>• Type of DIMMs: PC3-10600R-999, 1333 MHz or PC3-8500R, 1066 MHz, ECC, DDR3 registered SDRAM dual inline memory modules (DIMMs)</li> <li>• Supports 2 GB, 4 GB, 8 GB, 16 GB, and 32 GB DIMMs</li> <li>• Supports 1.35 V (low-voltage) and 1.5 V registered DIMMs (see “Installing DIMMs in the memory expansion module” on page 83 for more information).</li> </ul>	<p><b>Power supply:</b></p> <ul style="list-style-type: none"> <li>• One or two 675-watt (110 - 220 V ac auto-sensing) standard (depending on the model)</li> <li>• Supports up to two 675-watt (110 - 220 V ac auto-sensing) hot-swap power supplies with built-in fans for redundancy support</li> </ul> <p><b>Light path diagnostics LEDs:</b></p> <ul style="list-style-type: none"> <li>• Board LED</li> <li>• Configuration LED</li> <li>• Fan LEDs</li> <li>• Link LED (for QPI and EXA links)</li> <li>• Locate LED</li> <li>• Memory LEDs</li> <li>• Power-on LEDs</li> <li>• Power supply LEDs</li> </ul>
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Table 4. MAX5 expansion module features and operating specifications (continued)

<p><b>Acoustical noise emissions:</b> For maximum system configurations (32 DIMMs installed)</p> <ul style="list-style-type: none"> <li>• Sound power (idling): 6.2 bels</li> <li>• Sound power (operating): 6.2 bels</li> <li>• Sound pressure (idling): 48 dBA</li> <li>• Sound pressure (operating): 48 dBA</li> </ul> <p><b>Size:</b></p> <ul style="list-style-type: none"> <li>• Height: 4.4 cm (1.73 in.)</li> <li>• Depth: 72.4 cm (28.5 in.)</li> <li>• Width: 48.3 cm (19.0 in.)</li> <li>• Weight: approximately 12.8 kg (28.2 lb) for a standard unit; when fully configured, 15.4 kg (33.9 lb)</li> </ul> <p><b>Fans:</b></p> <ul style="list-style-type: none"> <li>• Five hot-swap 40 mm fans</li> </ul>	<p><b>Environment:</b></p> <ul style="list-style-type: none"> <li>• Air temperature: <ul style="list-style-type: none"> <li>– Enclosure on: 10° to 35°C (50° to 95°F); altitude: 0 to 914.4 m (3000 ft). Decreased system temperature by 0.75° for every 1000 ft. increase in altitude.</li> <li>– Enclosure off: 5° to 45°C (41° to 113°F)</li> <li>– Shipment: -40°C to +60°C (-40°F to 140°F)</li> </ul> </li> <li>• Humidity: <ul style="list-style-type: none"> <li>– Enclosure on: 20% to 80%; maximum dew point: 21°C (70°F)</li> <li>– Enclosure off: 8% to 80%; maximum dew point: 27°C (80°F)</li> <li>– Shipment: 5% to 100%</li> </ul> </li> <li>• Particulate contamination: <p><b>Attention:</b> Airborne particulates and reactive gases acting alone or in combination with other environmental factors such as humidity or temperature might pose a risk to the server. For information about the limits for particulates and gases, see “Particulate contamination” on page 123.</p> </li> </ul>	<p><b>Heat output</b></p> <p>Approximate heat:</p> <ul style="list-style-type: none"> <li>• Minimum configuration: 314 Btu per hour (92 watts)</li> <li>• Maximum configuration 2048 Btu per hour (600 watts)</li> </ul> <p><b>Electrical input:</b></p> <ul style="list-style-type: none"> <li>• Sine-wave input (50 - 60 Hz) required</li> <li>• Input voltage low range: <ul style="list-style-type: none"> <li>– Minimum: 90 V ac</li> <li>– Maximum: 136 V ac</li> </ul> </li> <li>• Input voltage high range: <ul style="list-style-type: none"> <li>– Minimum: 198 V ac</li> <li>– Maximum: 264 V ac</li> </ul> </li> <li>• Approximate input kilovolt-amperes (kVA): <ul style="list-style-type: none"> <li>– Minimum: 0.1 kVA</li> <li>– Maximum: 0.6 kVA</li> </ul> </li> </ul> <p><b>Note:</b></p> <ol style="list-style-type: none"> <li>1. Power consumption and heat output vary depending on the number and type of optional features that are installed and the power-management optional features that are in use.</li> <li>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 stated values 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.</li> </ol>
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## What the memory expansion module offers

The memory expansion module provides several features for easy operation, including the following features:

- Replaceable components

The major replaceable components in the memory expansion module are dual inline memory modules (DIMMs), fans, and power supplies. See “Memory expansion module components” on page 81 for the components that the expansion module supports.

- Light path diagnostics LEDs  
The memory expansion module has light path diagnostics LEDs (front and rear) to indicate hardware, scaling, and power problems.
- Redundant cooling and power capabilities  
The memory expansion module supports a maximum of two 675-watt hot-swap power supplies and five single-motor hot-swap fans. The redundant fans provide continued cooling if one fan fails. The memory expansion module comes with one 675-watt hot-swap power supply and five fans. If a problem occurs with one of the power supplies, the other power supply can meet the power requirements.
- Large memory capacity  
The memory bus supports up to 1 TB of memory. The memory controller supports error correcting code (ECC) for up to 32 industry-standard 1066 MHz PC3-10600R-999 or 1333 MHz PC3-8500, DDR3 (third-generation double-data-rate), registered, synchronous dynamic random access memory (SDRAM) DIMMs.

## Reliability, availability, and serviceability features of the memory expansion module

Three of the most important features in product design are reliability, availability, and serviceability (RAS). These factors help to ensure that the integrity of the data processed in your memory expansion module is preserved, that the expansion module is available when you want to use it, and should a failure occur, you can easily diagnose and repair the failure with minimal inconvenience.

The memory expansion module has a 1-year parts and 1-year labor limited warranty, or it assumes the warranty of the x3850 X5 or x3950 X5 host server to which it is attached, whichever is longer.

The following is an abbreviated list of the RAS features that the expansion module supports:

- Chipkill memory protection
- Hot-swap and redundant cooling with fan-speed-sensing capability (front serviceability)
- Hot-swap and redundant power supplies (rear serviceability)
- Information LED panel
- In-rack serviceability
- Memory redundant bit steering (RBS) and error correcting code (ECC)
- Memory mirroring support (mirrored DIMMs are mutually exclusive of each other)
- QuickPath Interconnect (QPI) fail down
- Rear serviceability power supplies

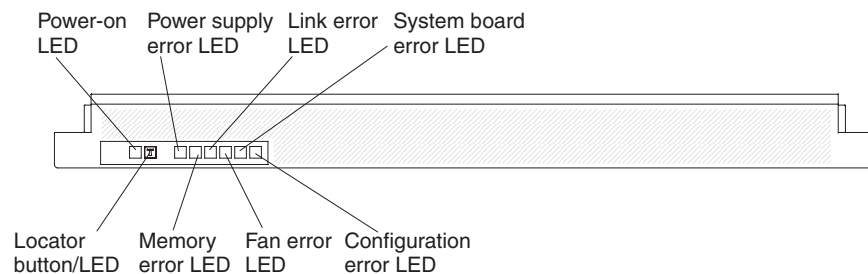
## LEDs and connectors on the memory expansion module

This section describes the light-emitting diodes (LEDs) and connectors on the front and rear of the memory expansion module.

### Front view

The following illustration shows the indicators on the front of the memory expansion module. All of the LEDs are controlled by the integrated management module (IMM) in the host server.

**Note:** The memory expansion module does not have a power-on control. All functions of the memory expansion module are controlled by the host server to which it is connected.



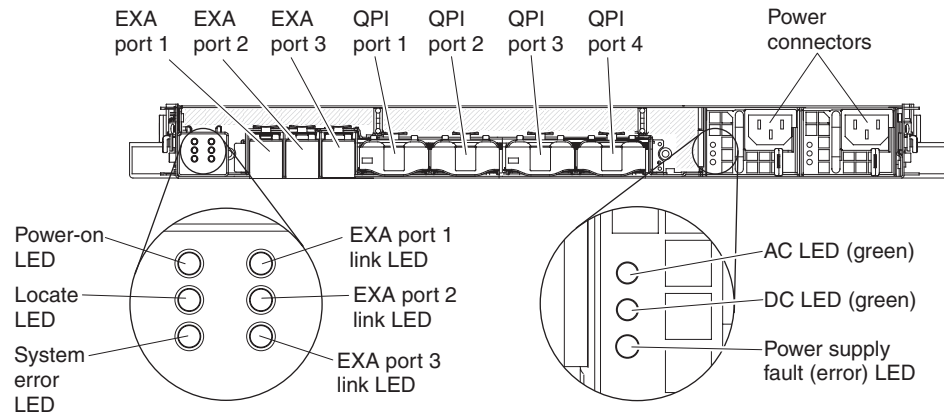
**Information panel:** This panel contains the indicators for the memory expansion module.

- **Power-on LED:** When this green LED is lit, it indicates that the memory expansion module is powered on.
- **Locate LED:** Use this blue LED to locate the memory expansion module. The locate LED also has a button that you can press to light up other servers or other memory expansion modules to which the memory expansion module is connected.
- **Power supply fault (error) LED:** When this amber LED is lit, it indicates a faulty hot-swap power-supply.
- **Memory error LED:** When this amber LED is lit, it indicates a DIMM problem.
- **Link error LED:** When this amber LED is lit, indicates that a QPI link fault or a EXA link fault has occurred. The port LED for the link that has been disconnected will not be lit on the rear of the memory expansion module. EXA link LEDs are on the rear of the memory expansion module, and the QPI link LEDs are on the server to which the memory expansion module is connected.
- **Fan error LED:** When this amber LED is lit, it indicates a fan error.
- **System board error LED:** When this amber LED is lit, it indicates a memory expansion module system-board tray error.
- **Configuration error LED:** When this amber LED is lit, it indicates a configuration error. The memory LED might be lit to indicate a memory configuration error.



## Rear view

The following illustration shows the indicators on the rear of the memory expansion module.



- **Power-on LED:** When this green LED is lit, it indicates that the memory expansion module is powered on. This LED is functionally equivalent to the power-on LED on the front of the memory expansion module.
- **Locate LED:** When this blue LED is lit, it indicates that the command from the server IMM to the memory expansion module is complete. Use this blue LED to locate the memory expansion module. The front locate LED also has a button that you can press to locate other servers or other memory expansion modules to which the memory expansion module is connected. This LED is functionally equivalent to the locate LED on the front of the memory expansion module.
- **System error LED:** When this LED is lit, it indicates that a system error has occurred.
- **QPI ports:** Insert either a QPI cable or a filler panel in each of these connectors.

**Note:** When you handle the QPI cables, take precautions to avoid damaging the high density interface. Dropping or incorrectly connecting the QPI cables can damage the high density interface. Store the protective covers that come on the end of the QPI cables for reuse when you perform maintenance on the server or memory expansion module or when you remove the cables of any reason.

- **Power connector:** Connect a power cord to one of these connectors.
- **AC power LED:** Each hot-swap power supply has an ac power LED and a dc power LED. When the ac power LED is lit, it indicates that sufficient power is being supplied to the power supply through the power cord. During normal operation, both the ac and dc power LEDs are lit.
- **DC power LED:** Each hot-swap power supply has a dc power LED and an ac power LED. When the dc power LED is lit, it indicates that power supply is supplying adequate dc power to the memory expansion module. During normal operation, both the ac and dc power LEDs are lit.
- **Power supply fault (error) LED:** When this amber LED is lit, it indicates a faulty hot-swap power supply.
- **EXA link LED:** When this green LED is lit, it indicates that an EXA link is functioning.

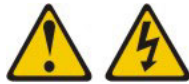
## Turning on the memory expansion module

The memory expansion module is controlled by the server. Turning on the memory expansion module refers to connecting the memory expansion module power cord to the power source and pressing the power-control button on the host server. The host server must be connected to the memory expansion module and configured to identify the memory expansion module. Normally, when the operating system on the server starts, the server issues a power-on request to the memory expansion module.

## Turning off the memory expansion module

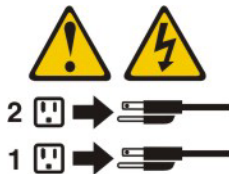
The memory expansion module is turned off only if the connected server issues a power-off request and you disconnect the memory expansion module power cord from the power source. You cannot turn off the memory expansion module manually.

### 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.



You can disconnect the memory expansion module power cords from the power source to shut off all power immediately without damaging the memory expansion module, but it might cause an unrecoverable error and loss of data on the connected server.

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## Chapter 2. Installing optional devices

This chapter provides detailed instructions for installing optional hardware devices in the server.

In addition to the instructions in this chapter for installing optional hardware devices, updating firmware and device drivers, and completing the installation, IBM Business Partners must also complete the steps in “Instructions for IBM Business Partners.”

**Important:** To help ensure that the devices that you install work correctly and do not introduce problems, observe the following precautions:

1. Make sure that the server and the installed firmware levels support the devices that you are installing. If necessary, update the UEFI and IMM firmware and any other firmware that is stored on the system boards. For information about where firmware is stored in the server, see Chapter 6, “Configuration information and instructions,” in the *Problem Determination and Service Guide*. For a list of supported optional devices for the server, see <http://www.ibm.com/systems/info/x86servers/serverproven/compat/us/>.
2. Before you install optional hardware devices, make sure that the server is working correctly. Start the server and make sure that the operating system starts, if an operating system is installed, or that a 19990305 error code is displayed, indicating that an operating system was not found but the server is otherwise working correctly. If the server is not working correctly, see the *Problem Determination and Service Guide* for information about how to run diagnostics.
3. Follow the installation procedures in this chapter and use the correct tools. Incorrectly installed devices can cause system failures because of damaged pins in sockets or connectors, loose cabling, or loose components.
4. Use the best practices to apply current firmware and device-driver updates for the server and optional devices. To download the *IBM System x Firmware Update Best Practices* document, go to <http://www.ibm.com/support/entry/portal/docdisplay?brand=50000020&lnidocid=MIGR-5082923>. Additional hints and tips are available from the following sites:
  - IBM support: <http://www.ibm.com/supportportal/>
  - System x configuration tools: <http://www.ibm.com/systems/x/hardware/configtools.html>

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### Instructions for IBM Business Partners

In addition to the instructions in this chapter for installing optional hardware devices, updating firmware and device drivers, and completing the installation, IBM Business Partners must also complete the following steps:

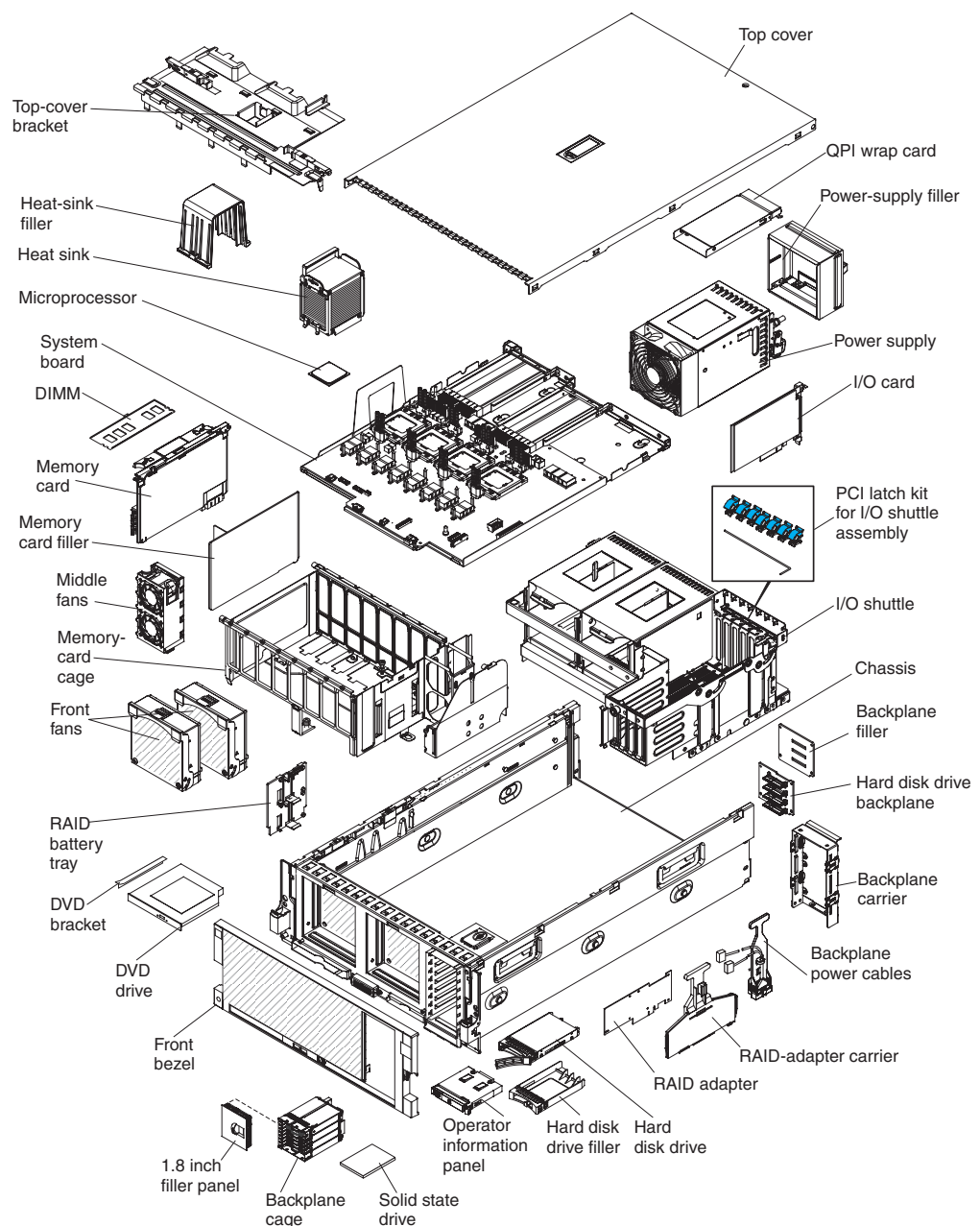
1. Before you configure a server for a customer, complete the Solution Assurance checklist at <http://w3.ibm.com/support/assure/assur30i.nsf/webindex/sa294/>.
2. After you have confirmed that the server starts correctly and recognizes the newly installed devices and that no error LEDs are lit, run the Dynamic System Analysis (DSA) stress tests. For information about using DSA, see the *Problem Determination and Service Guide*.

3. Shut down and restart the server multiple times to ensure that the server is correctly configured and functions correctly with the newly installed devices.
4. Save the DSA log as a file and send it to IBM.
5. To ship the server, repackage it in the original undamaged packing materials and observe IBM procedures for shipping.

Support information for IBM Business Partners is available at [http://www.ibm.com/partnerworld/pwhome.nsf/weblook/index\\_us.html](http://www.ibm.com/partnerworld/pwhome.nsf/weblook/index_us.html).

## Server components

The following illustration shows the major components in the server. The illustrations in this document might differ slightly from your hardware.

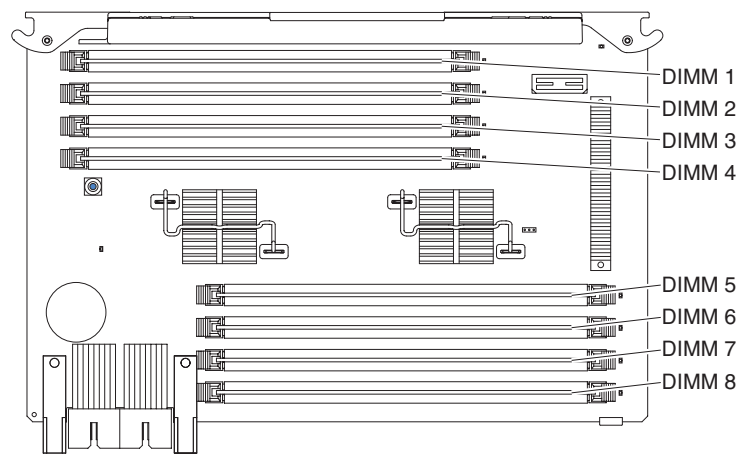


Blue on a component indicates touch points, where you can grip the component to remove it from or install it in the server, open or close a latch, and so on.

Orange on a component or an orange label on or near a component indicates that the component can be hot-swapped, which means that if the server and operating system support hot-swap capability, you can remove or install the component while the server is running. (Orange can also indicate touch points on hot-swap components.) See the instructions for removing or installing a specific hot-swap component for any additional procedures that you might have to perform before you remove or install the component.

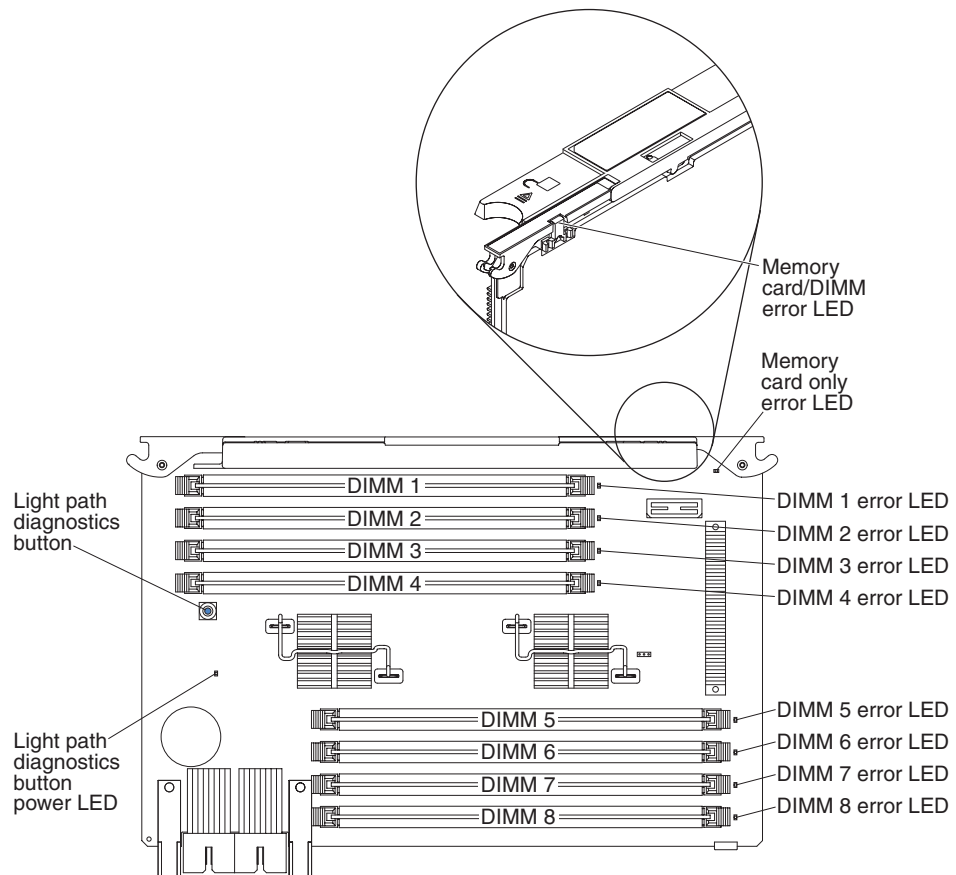
## Memory-card DIMM connectors

The following illustration shows the DIMM connectors on a memory card.



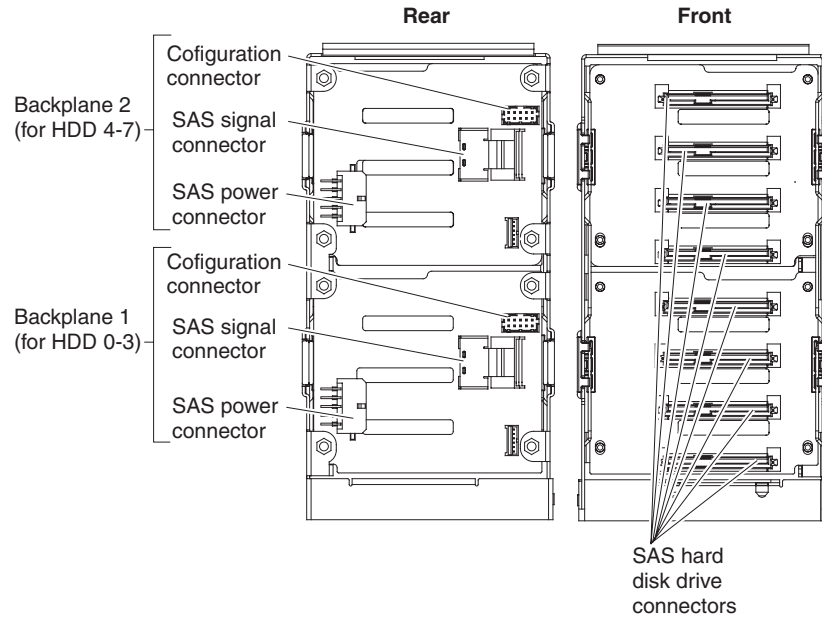
## Memory-card LEDs

The following illustration shows the LEDs on a memory card.



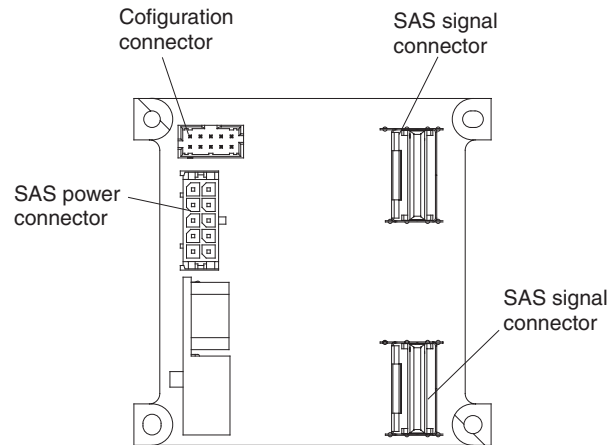
## SAS-backplane connectors

The following illustration shows the hard disk drive connectors on the SAS backplane.



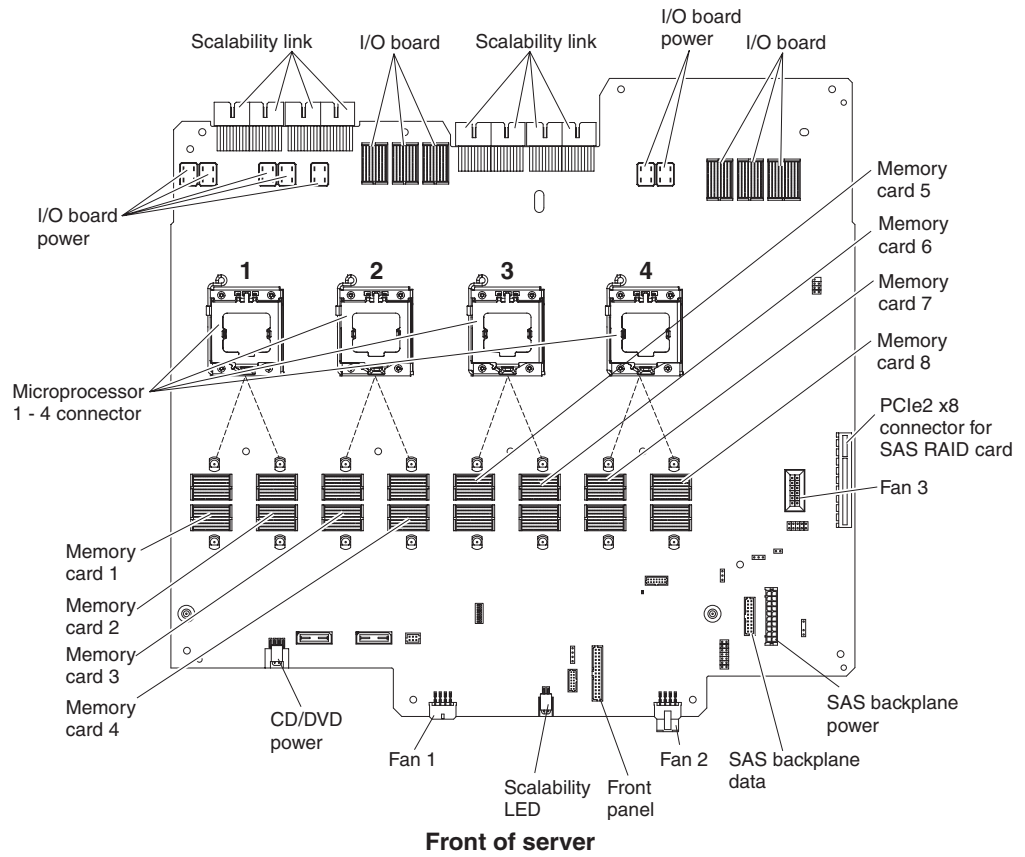
## eXFlash backplane connectors

The following illustration shows the cable connectors on the eXFlash backplane.



# Microprocessor-board connectors

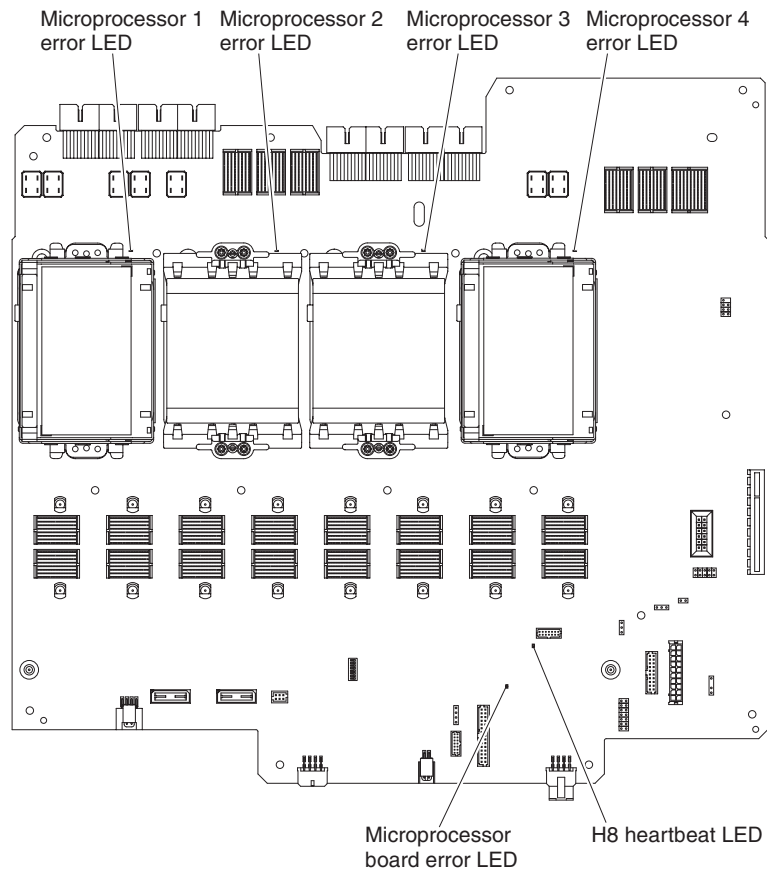
The following illustration shows the connectors on the microprocessor board.





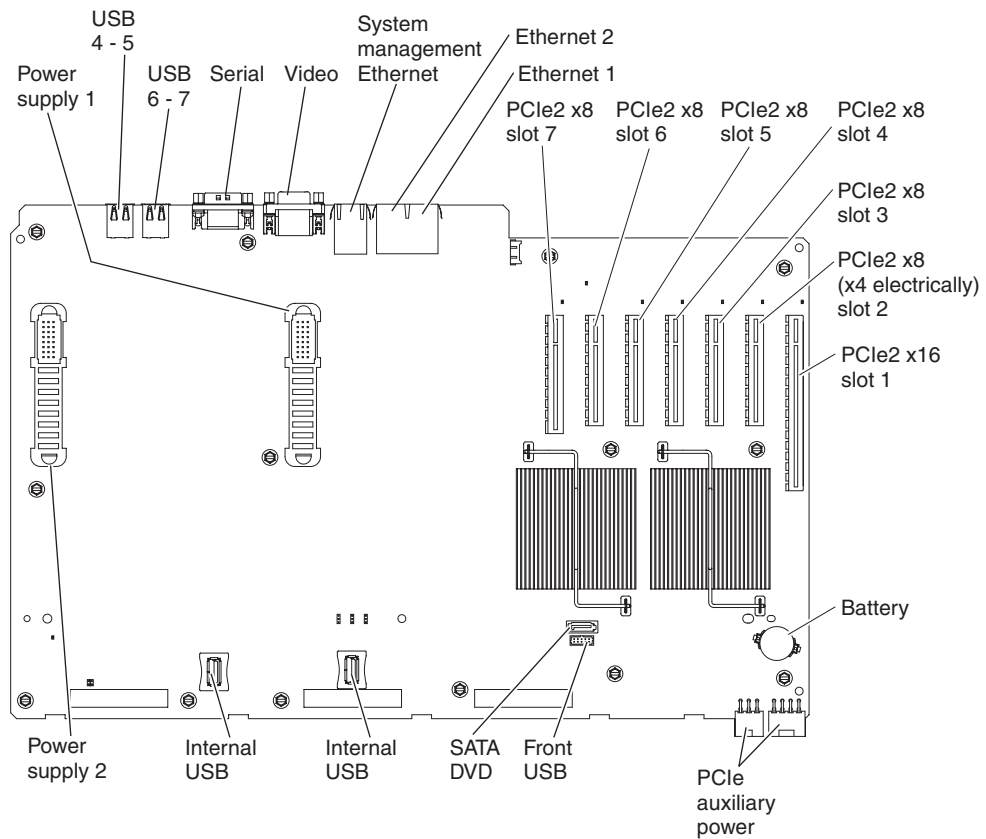
# Microprocessor-board LEDs

The following illustration shows the LEDs on the microprocessor board.



## I/O-board connectors

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



Slot 2 is electrically a x4 connector.

## I/O-board jumpers

The following illustration shows the jumpers on the I/O board.

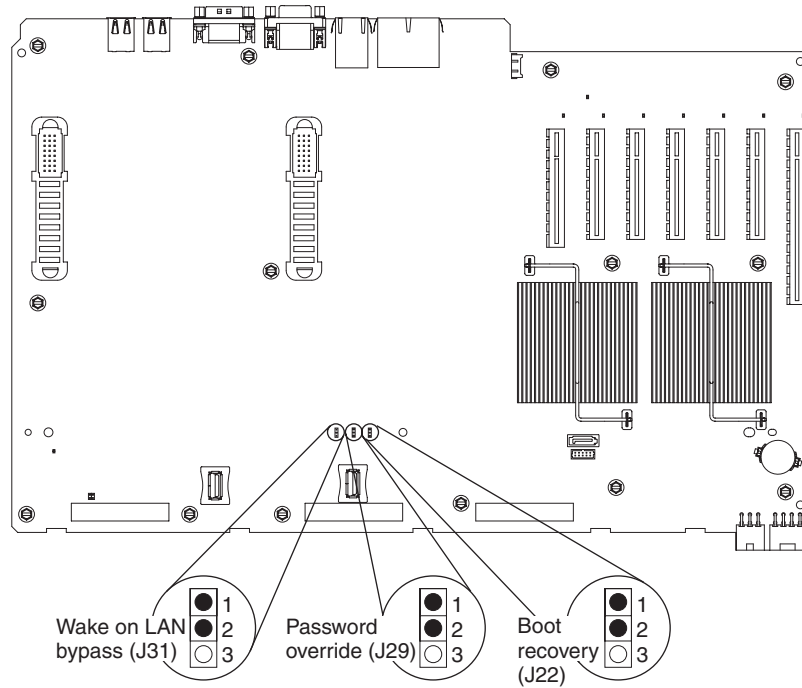


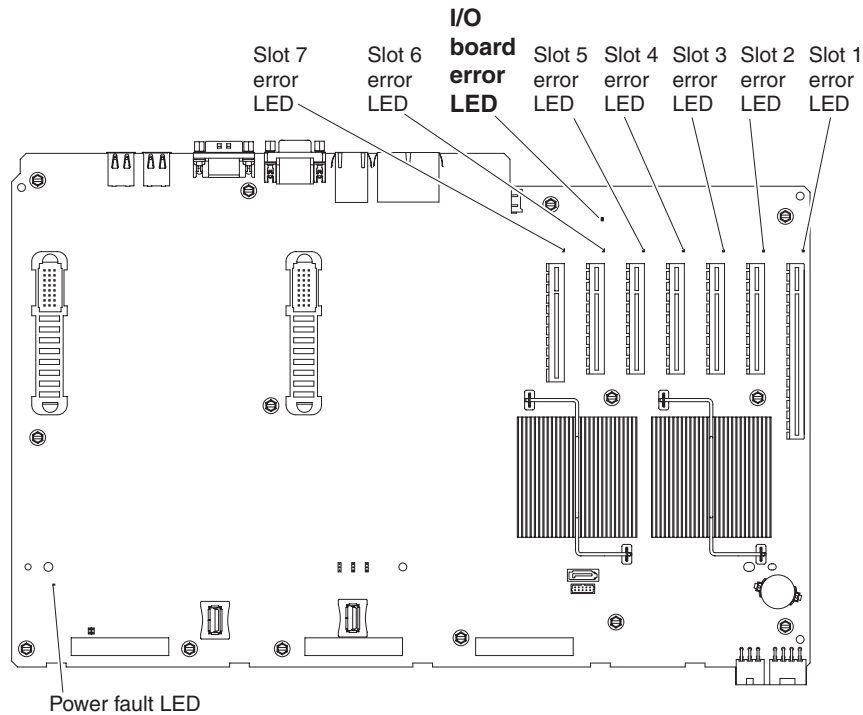
Table 5. I/O-board jumpers

Jumper number	Jumper name	Jumper setting
J31	Wake on LAN bypass	<ul style="list-style-type: none"> <li>• Pins 1 and 2: Normal operation (default).</li> <li>• Pins 2 and 3: Clears Wake on LAN bypass.</li> </ul>
J29	Password override	When you change the position of this jumper, the server bypasses the power-on password check. The next time you turn on the server, the Setup Utility starts and you can change or delete the power-on password. You do not need to move the jumper back to the default position (pins 1 and 2) after the password is overridden.
J22	Boot recovery	<ul style="list-style-type: none"> <li>• Pins 1 and 2: Normal operation (default).</li> <li>• Pins 2 and 3: Enable the UEFI recovery mode.</li> </ul>

**Note:** If no jumper is present, the server responds as if the jumper is on pins 1 and 2.

## I/O-board LEDs

The following illustration shows the LEDs on the I/O board.



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## Installation guidelines

Before you install optional devices, read the following information:

- Read “Safety” on page v, “Working inside the server with the power on” on page 40, and “Handling static-sensitive devices” on page 40. This information will help you work safely.
- Make sure that the devices that you are installing are supported. For a list of supported optional devices for the server, see <http://www.ibm.com/systems/info/x86servers/serverproven/compat/us/>.
- When you install your new server, take the opportunity to download and apply the most recent firmware updates. This step will help to ensure that any known issues are addressed and that your server is ready to function at maximum levels of performance. To download firmware updates for your server, go to <http://www.ibm.com/supportportal/>.

**Note:** Some cluster solutions require specific code levels or coordinated code updates. If the device is part of a cluster solution, verify that the latest level of code is supported for the cluster solution before you update the code.

For additional information about tools for updating, managing, and deploying firmware, see the ToolsCenter for System x and BladeCenter at <http://publib.boulder.ibm.com/infocenter/toolstr/v1r0/index.jsp>.

In a two-node configuration, make sure that the UEFI firmware, FPGA, and IMM code are at the same levels on all nodes.

- Before you install optional hardware devices, make sure that the server is working correctly. Start the server, and make sure that the operating system

starts, if an operating system is installed, or that a 19990305 error code is displayed, indicating that an operating system was not found but the server is otherwise working correctly. If the server is not working correctly, see the *Problem Determination and Service Guide* on the IBM Documentation CD for information about how to run diagnostics.

- Observe good housekeeping in the area where you are working. Place removed covers and other parts in a safe place.
- If you must start the server while the cover is removed, make sure that no one is near the server and that no tools or other objects have been left inside the server.
- Do not attempt to lift an object that you think is too heavy for you. If you have to lift a heavy object, observe the following precautions:
  - Make sure that you can stand safely without slipping.
  - Distribute the weight of the object equally between your feet.
  - Use a slow lifting force. Never move suddenly or twist when you lift a heavy object.
  - To avoid straining the muscles in your back, lift by standing or by pushing up with your leg muscles.
- Make sure that you have an adequate number of properly grounded electrical outlets for the server, monitor, and other devices.
- Back up all important data before you make changes to disk drives.
- Have a small flat-blade screwdriver available.
- To view the error LEDs on the system board and internal components, leave the server connected to power.
- You do not have to turn off the server to install or replace hot-swap power supplies, hot-swap hard disk drives, hot-swap fans, or hot-plug Universal Serial Bus (USB) devices. However, you must turn off the server before you perform any steps that involve removing or installing adapter cables.
- Blue on a component indicates touch points, where you can grip the component to remove it from or install it in the server, open or close a latch, and so on.
- Orange on a component or an orange label on or near a component indicates that the component can be hot-swapped, which means that if the server and operating system support hot-swap capability, you can remove or install the component while the server is running. (Orange can also indicate touch points on hot-swap components.) See the instructions for removing or installing a specific hot-swap component for any additional procedures that you might have to perform before you remove or install the component.
- When you are finished working on the server, reinstall all safety shields, guards, labels, and ground wires.

## A single-power-supply server operating at 208 V ac

One power supply operating at 208 V ac supports a fully populated server, but it does not support power or cooling redundancy.

## System reliability guidelines

To help ensure proper cooling and system reliability, make sure that the following requirements are met:

- Each of the drive bays has a drive or an electromagnetic compatibility (EMC) shield installed in it.

- If the server has redundant power, each of the power-supply bays has a power supply installed in it.
- 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. For proper cooling and airflow, replace the top cover before you turn on the server. Operating the server for extended periods of time (more than 30 minutes) with the top cover removed might damage server components.
- 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.
- For redundant and hot-swappable power supply operation, the power supplies are connected to 200 - 240 V ac.
- Microprocessor sockets 1 - 4 each always contain either a heat-sink blank or a microprocessor and heat sink.

## Working inside the server with the power on

**Attention:** Static electricity that is released to internal server components when the server is powered on might cause the server to halt, which might result in the loss of data. To avoid this potential problem, always use an electrostatic-discharge wrist strap or other grounding system when you work inside the server with the power on.

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

- Avoid wearing loose-fitting clothing on your forearms. Button long-sleeved shirts before you work 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, necklaces, rings, and loose-fitting wrist watches.
- Remove items from your shirt pocket, such as pens and pencils, that might 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 the server and other electronic devices. To avoid damage, keep static-sensitive devices in their static-protective packages until you are ready to install them.

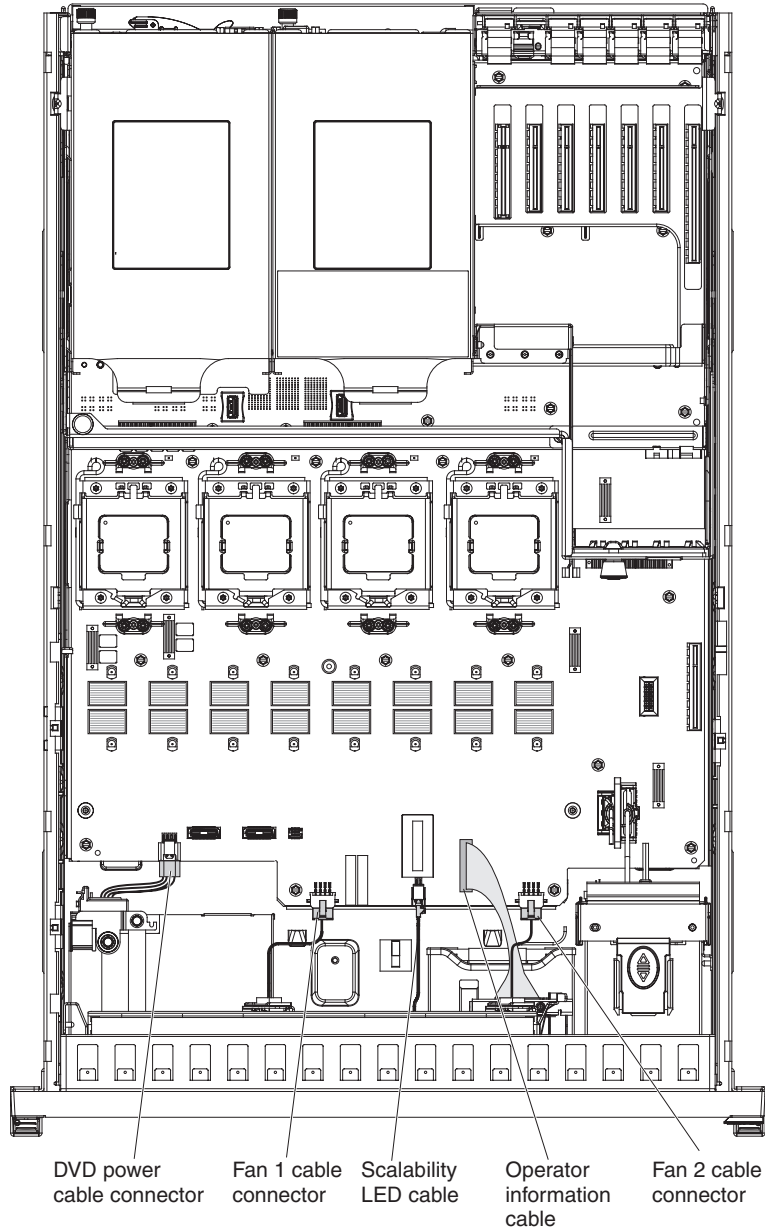
To reduce the possibility of damage from electrostatic discharge, observe the following precautions:

- Limit your movement. Movement can cause static electricity to build up around you.
- Wear an electrostatic-discharge wrist strap, if one is available.
- Handle the device carefully, holding it by its edges or its frame.
- Do not touch solder joints, pins, or exposed 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 surface on the outside 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 down the device. If it is necessary to set down the device, put it back into its static-protective package. Do not place the device on the server cover or on a metal surface.
- Take additional care when you handle devices during cold weather. Heating reduces indoor humidity and increases static electricity.

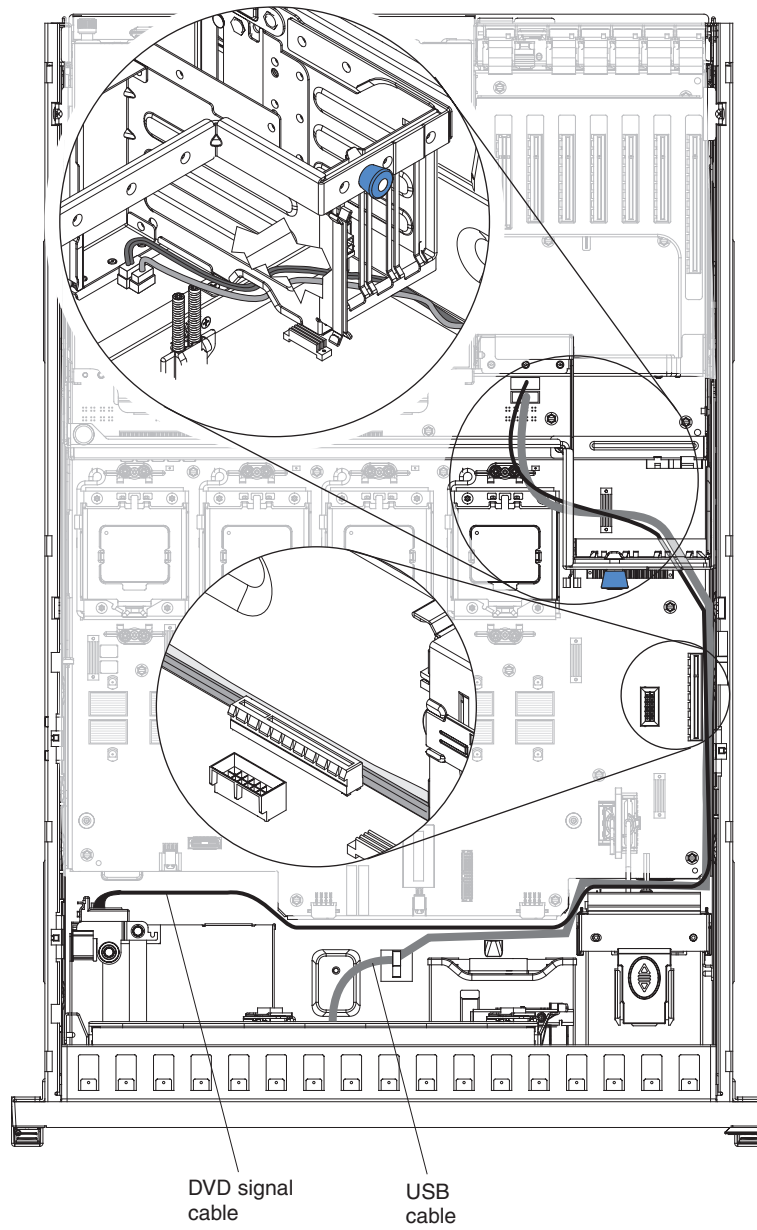
## Internal cable routing and connectors

The following illustration shows the routing of the DVD power, fans 1 and 2, scalability LED, and operator information cables.





The following illustration shows the routing of the USB and DVD signal cables.



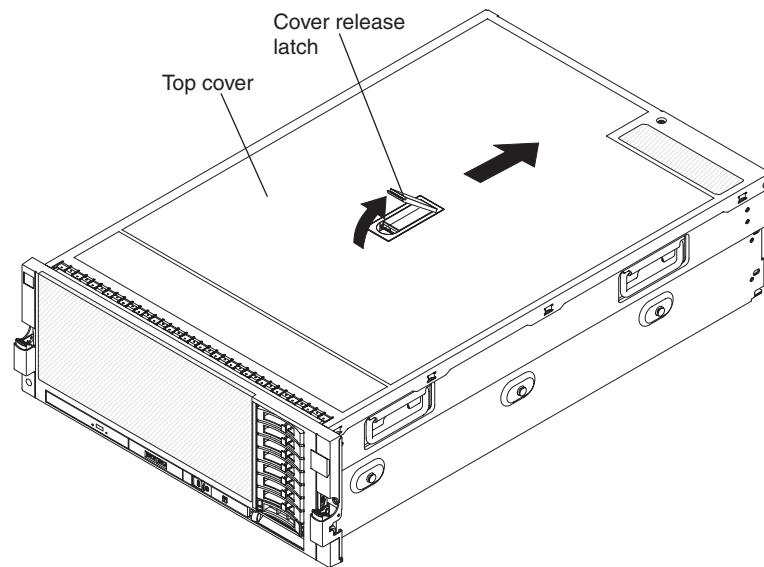
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## Removing the top cover

**Note:** Before you install optional hardware devices, make sure that the server is working correctly. Start the server, and make sure that the operating system starts, if an operating system is installed, or that a 19990305 error code is displayed, indicating that an operating system was not found but the server is otherwise working correctly. If the server is not working correctly, see the *Problem Determination and Service Guide* on the IBM Documentation CD for information about how to run diagnostics.

To remove the top cover, complete the following steps:

1. Read “Safety” on page v and “Working inside the server with the power on” on page 40.
2. If you are installing or replacing a non-hot-swap component, turn off the server and all attached peripheral devices. Disconnect all power cords; then, disconnect all external signal cables from the server.
3. Slide the server out of the rack until the slide rails lock into place.



4. Lift the cover-release latch. The cover slides to the rear approximately 13 mm (0.5 inch). Lift the cover off the server.

**Attention:** For proper cooling and airflow, replace the top cover before you turn on the server. Operating the server for more than 2 minutes with the top cover removed might damage server components.

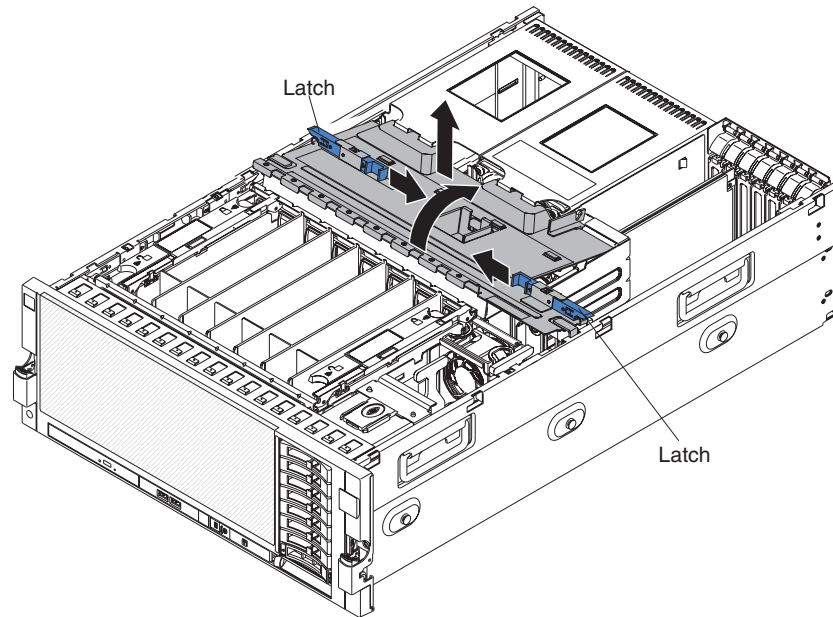
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## Removing the top-cover bracket

To remove the top-cover bracket, complete the following steps:

1. Read “Safety” on page v and “Working inside the server with the power on” on page 40.
2. If you are installing or replacing a non-hot-swap component, turn off the server and all peripheral devices, and disconnect the power cords and all external cables.
3. Slide the server out of the rack until the slide rails lock into place.
4. Remove the top cover (see “Removing the top cover”).

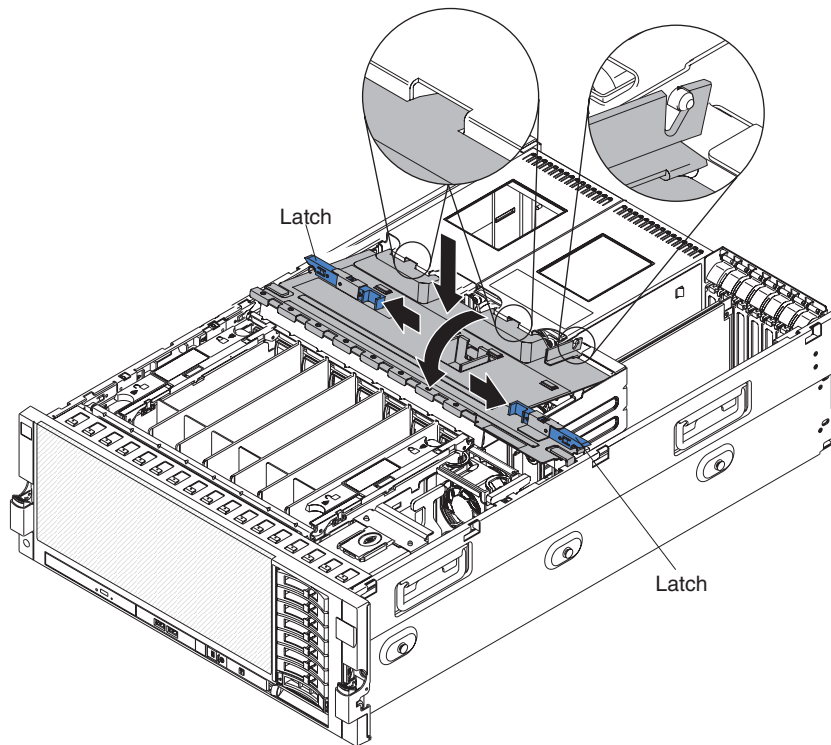
5. Slide the blue latches on the top-cover bracket toward the center of the server.



6. Tilt and lift the top-cover bracket out of the server.
7. If you are instructed to return the top-cover bracket, follow all packaging instructions, and use any packaging materials for shipping that are supplied to you.

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## Installing the top-cover bracket

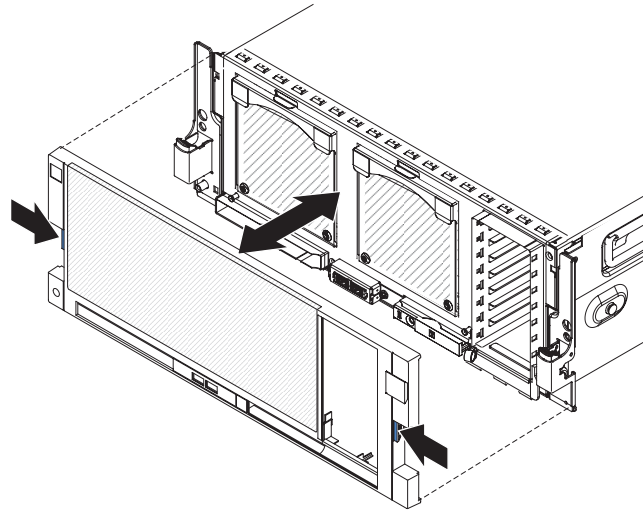


To replace the top-cover bracket, complete the following steps:

1. Make sure that all internal cables are correctly routed.
2. Align the top-cover bracket on top of the server so that the metal tabs line up correctly on the chassis, and then rotate it into place.
3. Slide the blue latches on the top cover bracket toward the outside of the server to lock it in place.

---

## Removing the bezel



**Note:** You do not have to remove the top cover before you remove the bezel.

To remove the bezel, complete the following steps:

1. Read “Safety” on page v and “Working inside the server with the power on” on page 40.
2. Press on the bezel retention tabs on the sides of the bezel and pull the bezel away from the server.

---

## Installing a PCI Express adapter

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

- To confirm that the server supports the adapter that you are installing, see <http://www.ibm.com/systems/info/x86servers/serverproven/compat/us/>.
- An Emulex 10 GbE Custom Adapter for System x comes installed in PCI Express slot 7 in some models.
- Locate the documentation that comes with the adapter and follow those instructions in addition to the instructions in this section. If you must change the switch setting or jumper settings on the adapter, follow the instructions that come with the adapter.
- Avoid touching the components and gold-edge connectors on the adapter.
- If you are installing a ServeRAID adapter with a battery installed on the adapter, you must install the adapter in a full length expansion slot and you must leave an empty expansion slot next to the slot in which you install the ServeRAID adapter.
- The server scans devices and PCI Express slots to assign system resources in the following order: ICH10 RAID, DVD, USB, I/O Hub 1, integrated Ethernet controller, integrated SAS controller, PCI Express slots 5 through 7, I/O Hub 2, and then PCI Express slots 1 through 4. If you have not changed the default startup sequence, the server starts the devices in the following order: DVD drive, USB-attached diskette drive, hard disk drive 0, and network devices.

**Note:** To change the startup sequence, start the Setup utility and select **Start Options** from the main menu. See “Using the Setup utility” on page 96 for details about using the Setup utility.

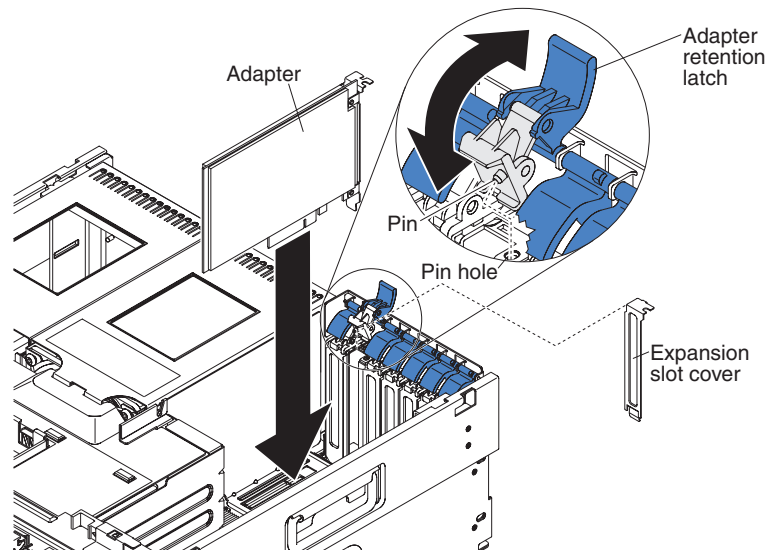
- The PCI Express 2.0 bus configuration is as follows:
  - Expansion slot 1 is x16, slot 2 is x8 (x4 lanes), and slots 3 through 6 are x8.
  - Expansion slot 7 is a non-standard, 106-pin connector but accepts PCI Express x8, x4, and x1 standard adapters.
  - Expansion slots 1 through 4 are non-hot-plug, full-length PCI Express 2.0 and can accept adapters up to 312.00 mm (12.28 inches) long.
  - Expansion slots 5 through 7 are non-hot-plug, half-length PCI Express 2.0 and can accept adapters up to 167.65 mm (6.6 inches) long.

**Attention:** Static electricity that is released to internal server components when the server is powered on might cause the server to halt, which might result in the loss of data. To avoid this potential problem, always use an electrostatic-discharge wrist strap or other grounding system when you work inside the server with the power on.

To install a PCI Express adapter, complete the following steps.

1. Read “Safety” on page v and “Installation guidelines” on page 38.
2. Turn off the server and peripheral devices, and disconnect the power cords and all external cables.
3. Remove the server cover (see “Removing the top cover” on page 44) and determine which PCI Express expansion slot you will use for the adapter.
4. See the documentation that comes with the adapter for instructions for setting jumpers or switches and for cabling.

**Note:** Route adapter cables before you install the adapter.



5. Push the adapter retention latch toward the rear of the server and open the tab.
6. Remove the expansion-slot cover.

**Attention:** When you install an adapter, avoid touching the components and gold-edge connectors on the adapter. Make sure that the adapter is correctly seated in the connector. Incorrectly seated adapters might cause damage to the I/O board or to the adapter.

7. Touch the static-protective package that contains the adapter to any unpainted surface on the outside of the server; then, grasp the adapter by the top edge or upper corners of the adapter and remove it from the package.
8. Carefully grasp the adapter by its top edge or upper corners, and align it with the connector on the I/O board.
9. Press the adapter *firmly* into the adapter connector.
10. Push down on the blue adapter retention latch until it clicks into place, securing the adapter.
11. Connect any required cables to the adapter.

If you have other devices to install or remove, do so now. Otherwise, go to “Completing the installation” on page 79.

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## Installing a ServeRAID adapter for use with eXFlash drives

The following notes describe the ServeRAID adapters that the server supports and other information that you must consider when you install an adapter:

- To confirm that the server supports the ServeRAID adapter that you are installing, see <http://www.ibm.com/systems/info/x86servers/serverproven/compat/us/>.
- Your server supports the ServeRAID M5015 adapter with the ServeRAID M5000 Series Performance Accelerator Key and eXFlash solid state drives.
- Locate the documentation that comes with the adapter and follow those instructions in addition to the instructions in this section. If you must change the switch setting or jumper settings on the adapter, follow the instructions that come with the adapter.
- Avoid touching the components and gold-edge connectors on the adapter.
- The server scans devices and PCI Express slots to assign system resources in the following order: ICH10 RAID, DVD, USB, I/O Hub 1, integrated Ethernet controller, integrated SAS controller, PCI Express slots 5 through 7, I/O Hub 2, and then PCI Express slots 1 through 4. If you have not changed the default startup sequence, the server starts the devices in the following order: DVD drive, USB-attached diskette drive, hard disk drive 0, and network devices.

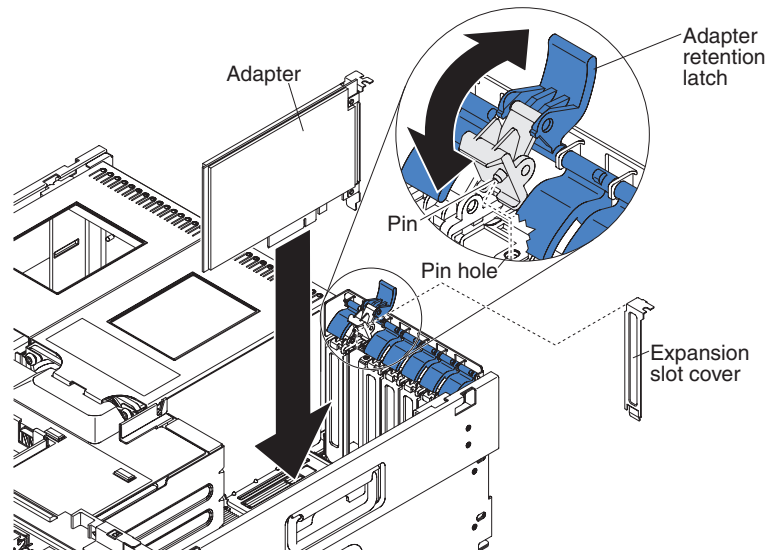
**Note:** To change the startup sequence, start the Setup utility and select **Start Options** from the main menu. See “Using the Setup utility” on page 96 for details about using the Setup utility.

- The PCI Express 2.0 bus configuration is as follows:
  - Expansion slot 1 is x16, slot 2 is x8 (x4 lanes), and slots 3 through 6 are x8.
  - Expansion slot 7 is a non-standard, 106-pin connector but accepts PCI Express x8, x4, and x1 standard adapters.
  - Expansion slots 1 through 4 are non-hot-plug, full-length PCI Express 2.0 and can accept adapters up to 312.00 mm (12.28 inches) long.
  - Expansion slots 5 through 7 are non-hot-plug, half-length PCI Express 2.0 and can accept adapters up to 167.65 mm (6.6 inches) long.

**Attention:** Static electricity that is released to internal server components when the server is powered on might cause the server to halt, which might result in the loss of data. To avoid this potential problem, always use an electrostatic-discharge wrist strap or other grounding system when you work inside the server with the power on.

To install a ServeRAID adapter, for use with eXFlash drives, in a rear PCI connector, complete the following steps.

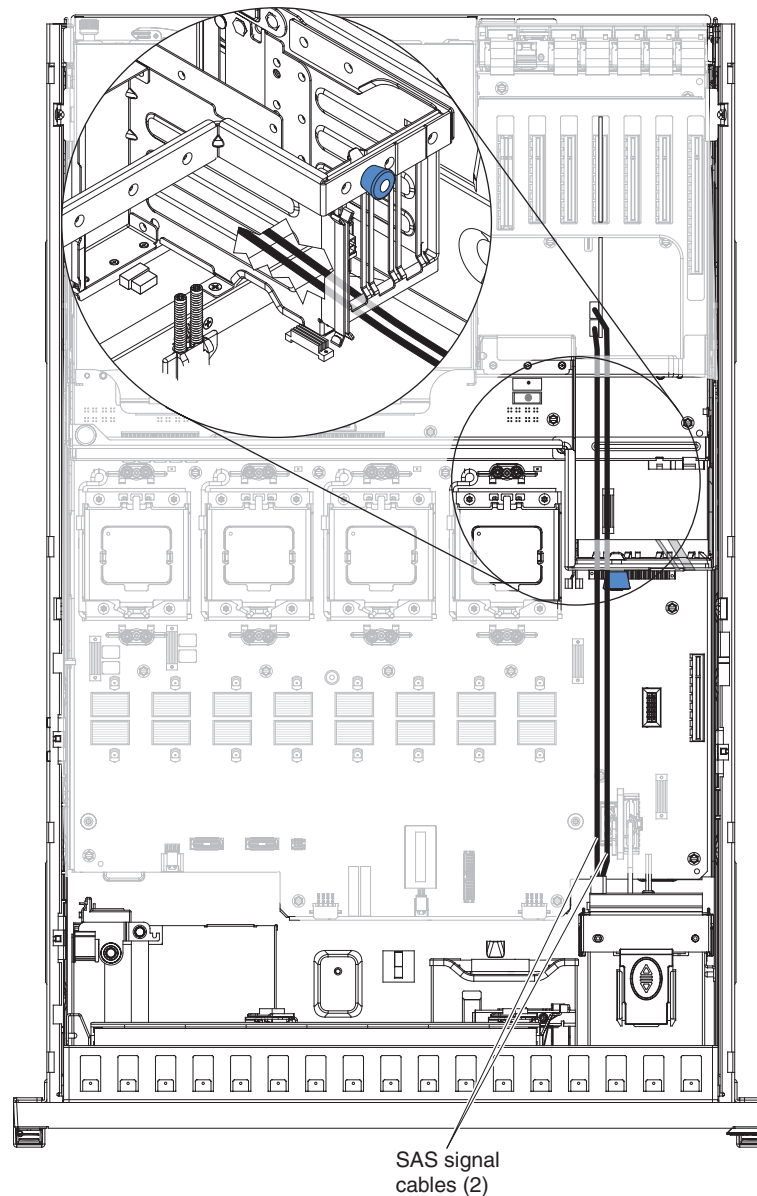
1. Read "Safety" on page v and "Installation guidelines" on page 38.
2. Turn off the server and peripheral devices, and disconnect the power cords and all external cables.
3. Remove the server cover (see "Removing the top cover" on page 44) and determine which PCI Express expansion slot you will use for the adapter.
4. Remove the top cover bracket.
5. Push the adapter retention latch toward the rear of the server and open the tab.



6. Remove the expansion-slot cover.  
**Attention:** When you install an adapter, avoid touching the components and gold-edge connectors on the adapter. Make sure that the adapter is correctly seated in the connector. Incorrectly seated adapters might cause damage to the I/O board or to the adapter.
7. Touch the static-protective package that contains the adapter to any unpainted surface on the outside of the server; then, grasp the adapter by the top edge or upper corners of the adapter and remove it from the package.
8. Carefully grasp the adapter by its top edge or upper corners, and align it with the connector on the I/O board.
9. Press the adapter *firmly* into the adapter connector.
10. Push down on the blue adapter retention latch until it clicks into place, securing the adapter.



11. Route the SAS cables under the bottom of the I/O shuttle.



12. Connect one end of each SAS signal cable that came with the eXFlash drive cage and backplane option to the backplane and the other end to the ServeRAID adapter.
- Connect one end of the first cable to Port 0 on the ServeRAID adapter and the other end to connector J39 on the backplane.
  - Connect one end of the second cable to Port 1 on the ServeRAID adapter and the other end to connector J40 on the backplane.
13. Reinstall the top cover bracket.

If you have other devices to install or remove, do so now. Otherwise, go to “Completing the installation” on page 79.

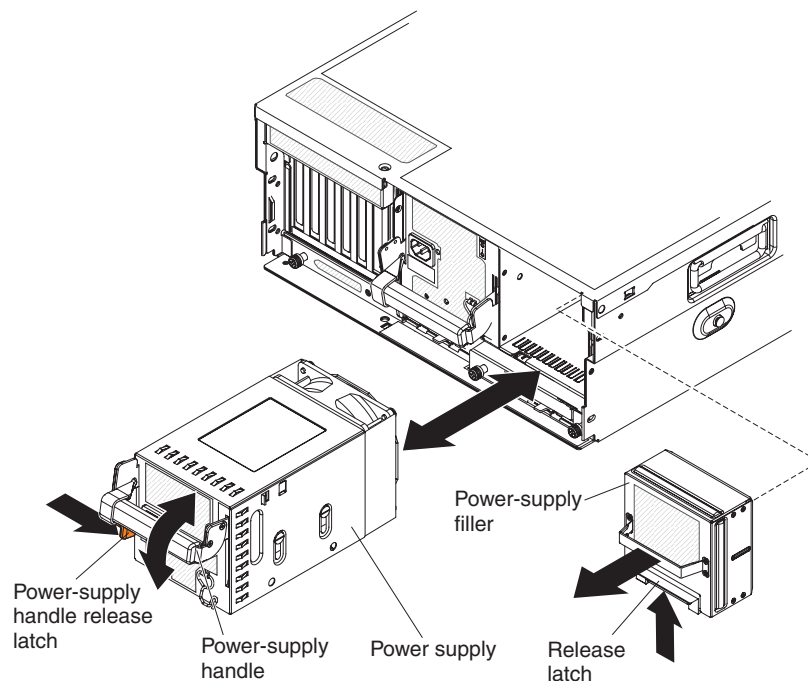
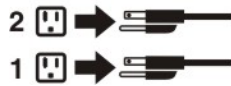
## Installing a hot-swap power supply

### 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.



To confirm that the server supports the power supply that you are installing, see <http://www.ibm.com/systems/info/x86servers/serverproven/compat/us/>.

To install an additional hot-swap power supply, complete the following steps:

1. Read "Safety" on page v and "Installation guidelines" on page 38.
2. Press the blue release latch on the power-supply filler and pull the handle to the open position. Then, remove the filler from power-supply bay 2.
3. If the handle is not already in the open position, press the orange release latch on the power-supply handle to the right and lift the handle up to the open position.

4. Slide the power supply into the bay and fully close the locking handle by sliding it down to the locked position.
5. Connect one end of the power cord for the new power supply into the ac connector on the back of the power supply, and connect the other end of the power cord into a properly grounded electrical outlet.
6. Make sure that the ac power LED on the power supply is lit, indicating that the power supply is operating correctly. If the server is turned on, make sure that the dc power LED on the top of the power supply is lit also.
7. (IBM Business Partners only) Restart the server. Confirm that it starts correctly and recognizes the newly installed devices, and make sure that no error LEDs are lit.
8. (IBM Business Partners only) Complete the additional steps in "Instructions for IBM Business Partners" on page 29.

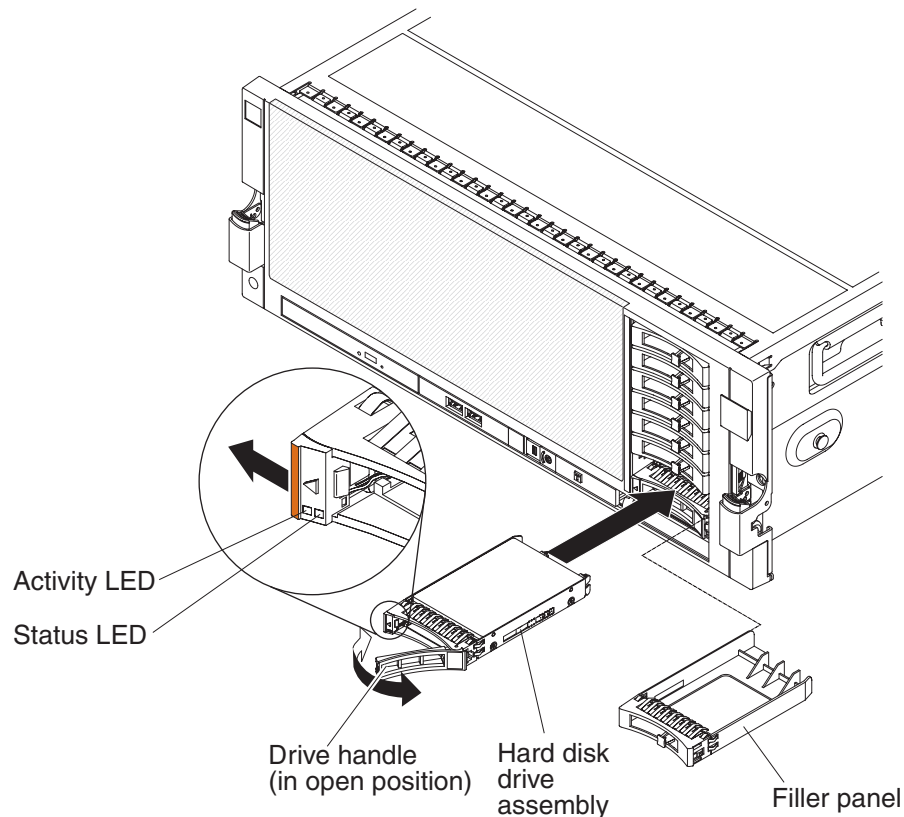
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## Installing a hot-swap hard disk drive

The following notes describe the types of hard disk drives that the server supports and other information that you must consider when you install a hard disk drive:

- To confirm that the server supports the hard disk drive that you are installing, see <http://www.ibm.com/systems/info/x86servers/serverproven/compat/us/>.
- The server supports up to eight 1-inch (26 mm) slim-high, 2.5-inch, hot-swap hard disk drives in the standard hot-swap bays.
- Start installing the hard disk drives from the bottom bay (bay 0).
- If the server will be configured for RAID operation, see the documentation that comes with the controller for instructions for installing a hard disk drive.
- All hot-swap drives in the server should have the same throughput speed rating; using drives with different speed ratings might cause all drives to operate at the lowest throughput speed.
- To minimize the possibility of damage to the hard disk drives when you install the server in a rack configuration, install the server in the rack before you install the hard disk drives.
- You do not have to turn off the server to install hot-swap drives in the hot-swap drive bays. However, you must turn off the server when you perform any steps that involve installing or removing cables.

The following illustration shows how to install a hot-swap hard disk drive.



To install a hot-swap hard disk drive, complete the following steps:

1. Read "Safety" on page v and "Installation guidelines" on page 38.
2. Remove the filler panel from one of the empty hot-swap bays.

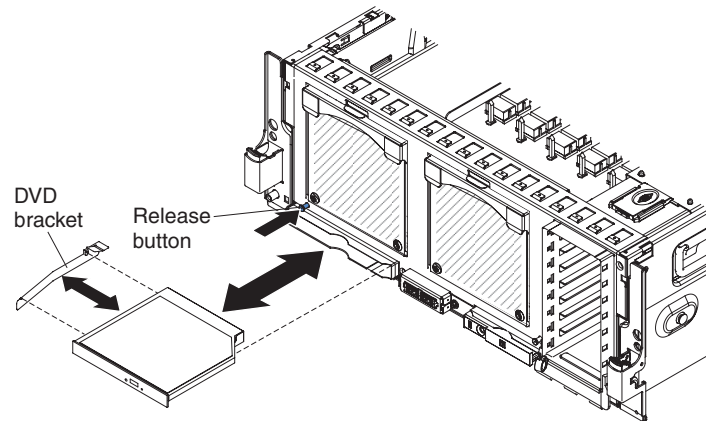
**Note:** When you install a drive in bays 4 through 7, you must first install a hard disk drive backplane.

3. Touch the static-protective package that contains the hard disk drive to any unpainted surface on the outside of the server; then, remove the hard disk drive from the package.
4. Make sure that the drive handle is open; then, install the hard disk drive into the hot-swap bay.
5. (IBM Business Partners only) Restart the server. Confirm that it starts correctly and recognizes the newly installed devices, and make sure that no error LEDs are lit.
6. (IBM Business Partners only) Complete the additional steps in "Instructions for IBM Business Partners" on page 29.

**Note:** Check the hard disk drive status LEDs to make sure that the hard disk drive is operating correctly. If the amber hard disk drive status LED for a drive is lit continuously, that drive is faulty and must be replaced. If the green hard disk drive activity LED is flashing, the drive is being accessed.

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## Installing a DVD (optical) drive



To confirm that the server supports the DVD drive that you are installing, see <http://www.ibm.com/systems/info/x86servers/serverproven/compat/us/>.

To install a DVD drive, complete the following steps:

1. Read "Safety" on page v and "Installation guidelines" on page 38.
2. Turn off the server and peripheral devices, and disconnect the power cord and all external cables.
3. Remove the front bezel.
4. Push the blue release button above the DVD drive bay to remove the filler panel.
5. Pull the bracket off the filler panel.
6. Install the bracket on the side of the DVD drive.
7. Slide the DVD drive into the server until it engages the SATA cable.
8. Reinstall the front bezel.

If you have other devices to install or remove, do so now. Otherwise, go to "Completing the installation" on page 79.

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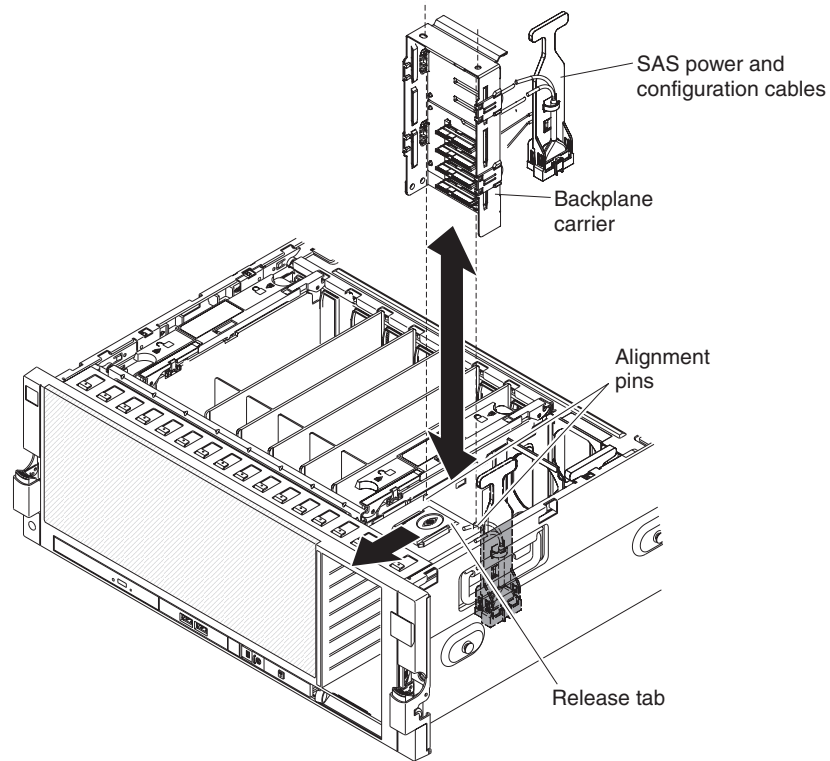
## Installing a 2.5-inch hard disk drive backplane

To confirm that the server supports the hard disk drive backplane that you are installing, see <http://www.ibm.com/systems/info/x86servers/serverproven/compat/us/>.

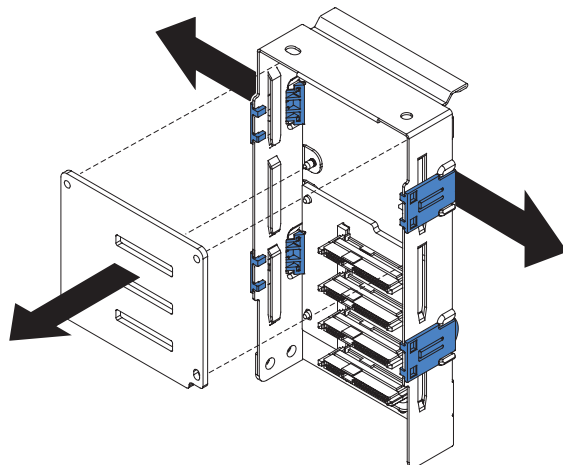
To install a 2.5-inch hard disk drive backplane, complete the following steps:

1. Read "Safety" on page v and "Installation guidelines" on page 38.
2. Turn off the server and peripheral devices, and disconnect the power cord and all external cables.
3. Remove the server cover (see "Removing the top cover" on page 44).
4. Remove the top cover bracket (see "Removing the top-cover bracket" on page 44).
5. Pull out the hard disk drives and hard disk drive fillers just enough to disconnect them from the backplane.
6. Remove the ServeRAID adapter from behind the hard disk drive backplane.

7. Disconnect the SAS signal cables from the ServeRAID adapter.
8. Lift the SAS power and configuration cable handle up to disconnect the cables from the microprocessor board.
9. Slide the backplane carrier release tab forward and slightly lift the carrier.
10. Remove the backplane carrier and SAS power cable handle from the server together.

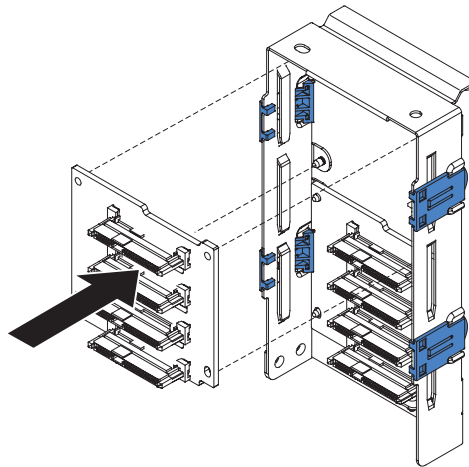


11. Remove the backplane filler from the backplane carrier.



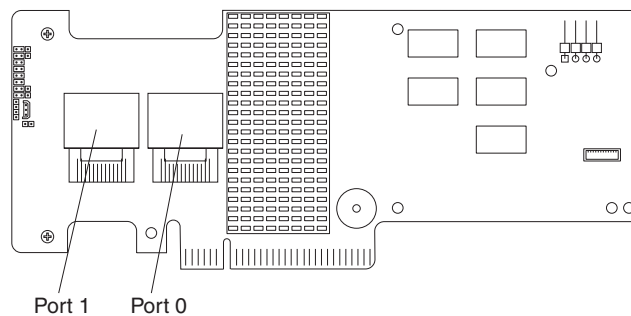
- a. Push the tabs on the backplane outward.
- b. Pull the filler out of the backplane carrier.

12. Orient and install the new backplane into the backplane carrier.

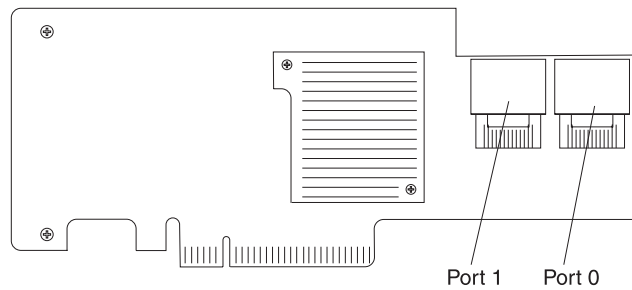


- a. Position the notch in the backplane over the bottom right of the carrier.
  - b. Position the holes in the backplane over the pins in the carrier.
  - c. Push the backplane into the carrier.
13. Connect the new SAS signal cable that came with the backplane to the new backplane.
  14. Connect the two unconnected power cables from the SAS power cable handle to the new backplane. (Look at the cabling of the first backplane to make sure that you cable the new backplane correctly.)
  15. Slide the backplane carrier into place until it latches while you hold the SAS power cable handle out of the way.
  16. Install the SAS power cable handle into place straight down onto the microprocessor board.
  17. Connect the two SAS signal cables to the ServeRAID adapter. Connect the cable from the bottom backplane to port 0 and the cable from the new top backplane to port 1. The following graphics show the port numbers on the ServeRAID adapters.

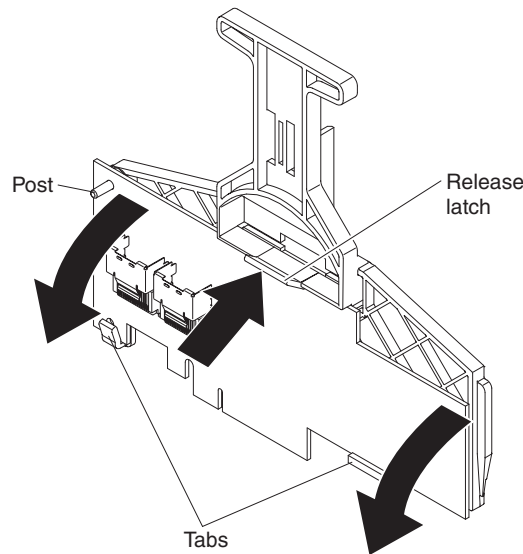
**ServeRAID M5015 controller**



### ServeRAID BR10i controller



18. Install the ServeRAID adapter onto the RAID adapter carrier, and then install the carrier into the server.



19. Install the top cover bracket (see "Installing the top-cover bracket" on page 46).
20. Push the hard disk drives and hard disk drive fillers back into place so that they connect to the backplane.
21. Install the top cover.
22. Connect the cables and power cords (see "Connecting the cables" on page 79).
23. Turn on all attached devices and the server.
24. (IBM Business Partners only) Complete the additional steps in "Instructions for IBM Business Partners" on page 29.

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## Installing an eXFlash 1.8-inch drive cage and backplane

To confirm that the server supports the drive cage and backplane that you are installing, see <http://www.ibm.com/systems/info/x86servers/serverproven/compat/us/>.

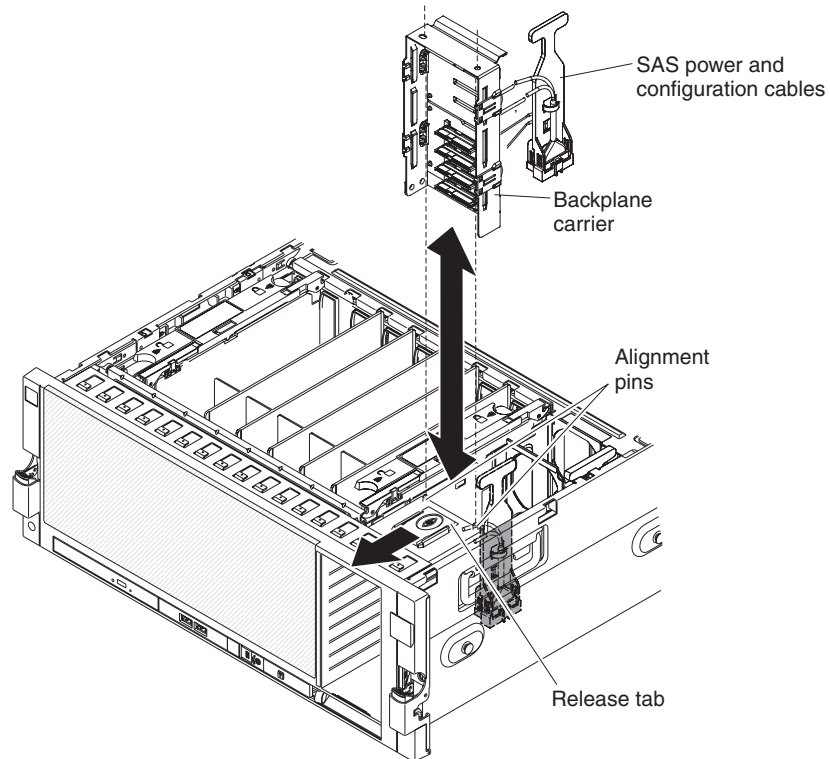
Use the following instructions to install an eXFlash 1.8-inch drive cage when a 2.5-inch SAS hard disk drive backplane is also installed in the server.

To install an eXFlash 1.8-inch drive cage and backplane, complete the following steps:

1. Read "Safety" on page v and "Installation guidelines" on page 38.

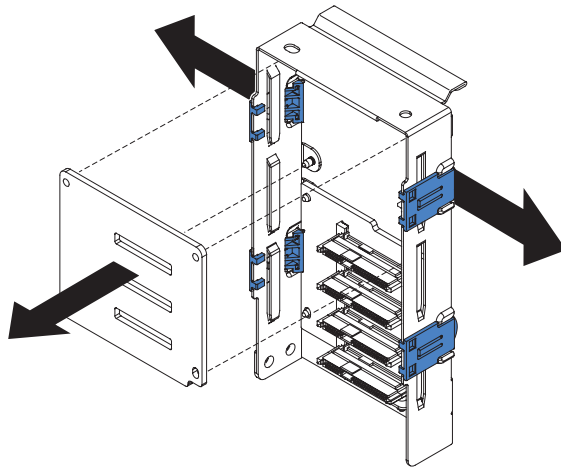


2. Turn off the server and peripheral devices, and disconnect the power cord and all external cables.
3. Remove the server cover (see “Removing the top cover” on page 44).
4. If any hard disk drives or fillers are installed in the server, pull out the bottom four just enough to disconnect them from the backplane, and completely remove any fillers from the top four bays.
5. Remove the backplane carrier and the SAS power cable handle:
  - a. Lift the SAS power and configuration cable handle up to disconnect the cables from the microprocessor board.
  - b. Slide the backplane carrier release tab forward and slightly lift the carrier.
  - c. Remove the backplane carrier and SAS power cable handle from the server together.

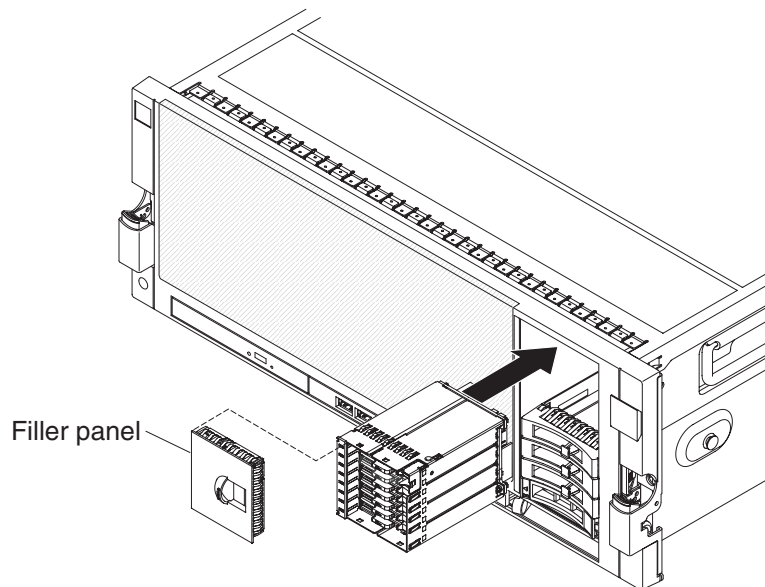


6. Disconnect the power and configuration cables from the backplane. Do not disconnect the SAS signal cable from the backplane.

7. Remove the backplane filler from the backplane carrier.



- a. Push the tabs on the backplane outward.
  - b. Pull the filler out of the backplane carrier.
8. Check the label on the cable handle to make sure you use the correct power and configuration cable handle from the option kit. Connect the new power and configuration cables from the power cable handle to the backplane in the carrier. Use the shorter cables when connecting to the backplane in the bottom position of the carrier.
  9. Slide the backplane carrier into the server while lowering the power and configuration cable handle into place.
  10. Seat the power and configuration handle into the connector on microprocessor board. Do not latch the backplane carrier fully into place yet.
  11. Slide the eXFlash backplane assembly into the hard disk drive cage. Make sure that the LEDs are on the left side.



12. Connect the power and configuration cables into the back of the eXFlash backplane assembly.
13. Seat the backplane carrier into the fully latched position. If there are hard disk drives in the bottom four bays, slide them back into place.

14. Connect the two SAS signal cables to the ServeRAID adapter (such as a ServeRAID B5015 SSD Controller or a 6Gb SSD HBA). Connect the cable from the bottom backplane to port 0 and the cable from the new top backplane to port 1.
15. To install a ServeRAID adapter in one of the PCI connectors, see “Installing a ServeRAID adapter for use with eXFlash drives” on page 49 for installation and cabling information.
16. Install the top cover.
17. To install the solid state drives, see “Installing a 1.8-inch solid state drive.”
18. Connect the cables and power cords (see “Connecting the cables” on page 79).
19. Turn on all attached devices and the server.
20. (IBM Business Partners only) Complete the additional steps in “Instructions for IBM Business Partners” on page 29.

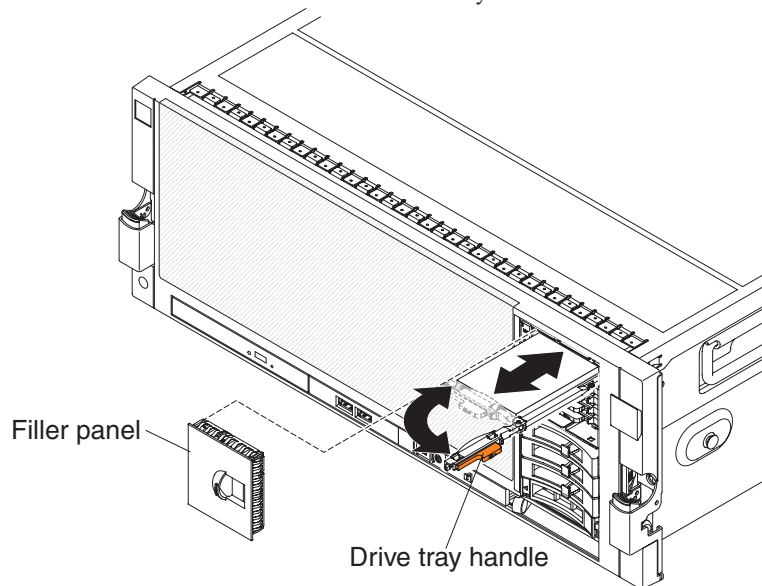
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## Installing a 1.8-inch solid state drive

To confirm that the server supports the solid state drive that you are installing, see <http://www.ibm.com/systems/info/x86servers/serverproven/compat/us/>.

To install a 1.8-inch solid state drive, complete the following steps:

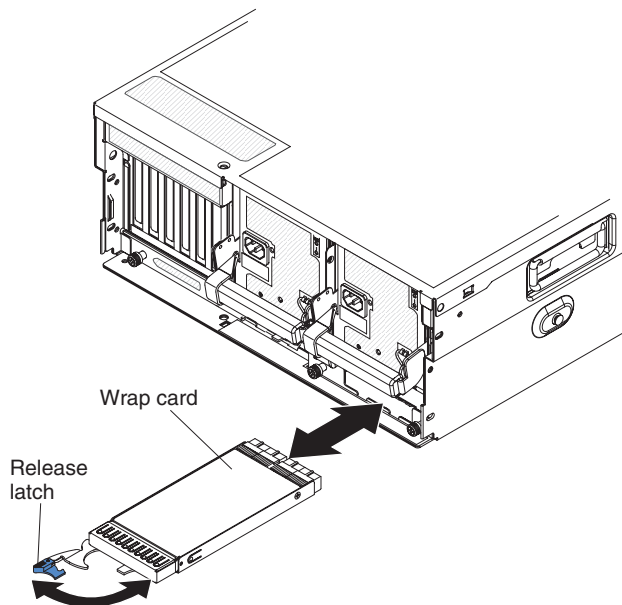
1. Read “Safety” on page v and “Installation guidelines” on page 38.
2. Remove the drive cage filler panel.
3. Slide the drive release latch to the right and rotate the handle to the open position.
4. Push the solid state drive in all the way until it clicks in the backplane.



5. Rotate the handle until the latch clicks closed.
6. Reinstall the drive cage filler panel.
7. (IBM Business Partners only) Restart the server. Confirm that it starts correctly and recognizes the newly installed devices, and make sure that no error LEDs are lit.
8. (IBM Business Partners only) Complete the additional steps in “Instructions for IBM Business Partners” on page 29.

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## Installing a QPI wrap card



In a one node server only, if your server has more than two microprocessors installed, you must install two QPI wrap cards in the server.

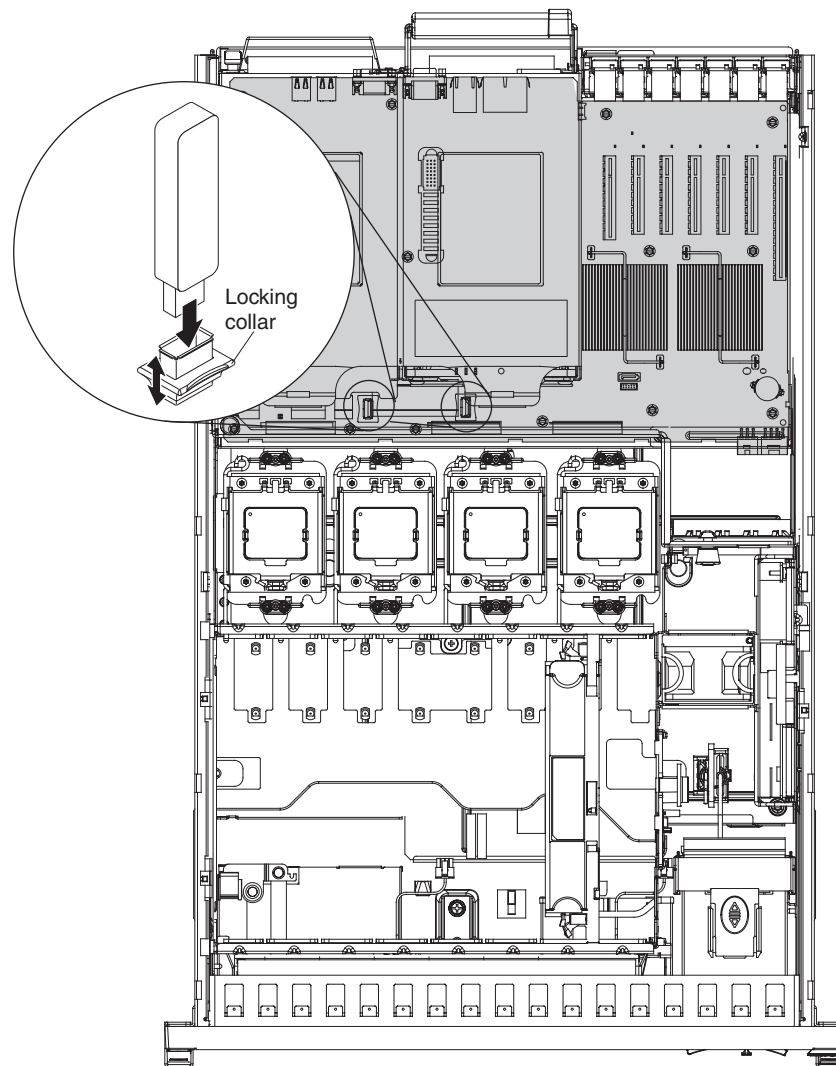
To confirm that the server supports the QPI wrap card that you are installing, see <http://www.ibm.com/systems/info/x86servers/serverproven/compat/us/>.

To install a QPI wrap card, complete the following steps:

1. Read "Safety" on page v and "Installation guidelines" on page 38.
2. Turn off the server and peripheral devices, and disconnect the power cord and all external cables.
3. Rotate the blue release latch on the QPI blank handle, pull the handle to the open position, and pull the blank out of the server.
4. Rotate the blue release latch on the QPI wrap card handle and pull the handle to the open position.
5. Push the wrap card into the bay, and rotate the handle to the locked position.
6. Reconnect the cables and power cords (see "Connecting the cables" on page 79).
7. Turn on all attached devices and the server.
8. If you have other devices to install or remove, do so now. Otherwise, go to "Completing the installation" on page 79.

## Installing an internal removable flash drive

The server supports two internal removable flash drives that are installed in the USB connectors on the I/O board. You do not have to turn off the server to install an internal removable flash drive.



To confirm that the server supports the flash drive that you are installing, see <http://www.ibm.com/systems/info/x86servers/serverproven/compat/us/>.

To install an internal removable flash drive, complete the following steps:

1. Read "Safety" on page v and "Installation guidelines" on page 38.
2. Disconnect the power cable and remove the power supply that is closest to the USB connector that you plan to use.
3. Reach through the empty power-supply bay and make sure that the locking collar on the connector is pushed down to the unlocked position.
4. Insert the internal flash memory drive into the connector.
5. Pull up on the locking collar to lock the internal flash memory drive in place.

**Note:** To remove an internal removable flash memory drive, push down on the locking collar to unlock the drive before you remove the drive.

6. Reinstall the power supply (see Installing a hot-swap power supply) and reconnect the power cable.
7. (IBM Business Partners only) Restart the server. Confirm that it starts correctly and recognizes the newly installed devices, and make sure that no error LEDs are lit.
8. (IBM Business Partners only) Complete the additional steps in “Instructions for IBM Business Partners” on page 29.

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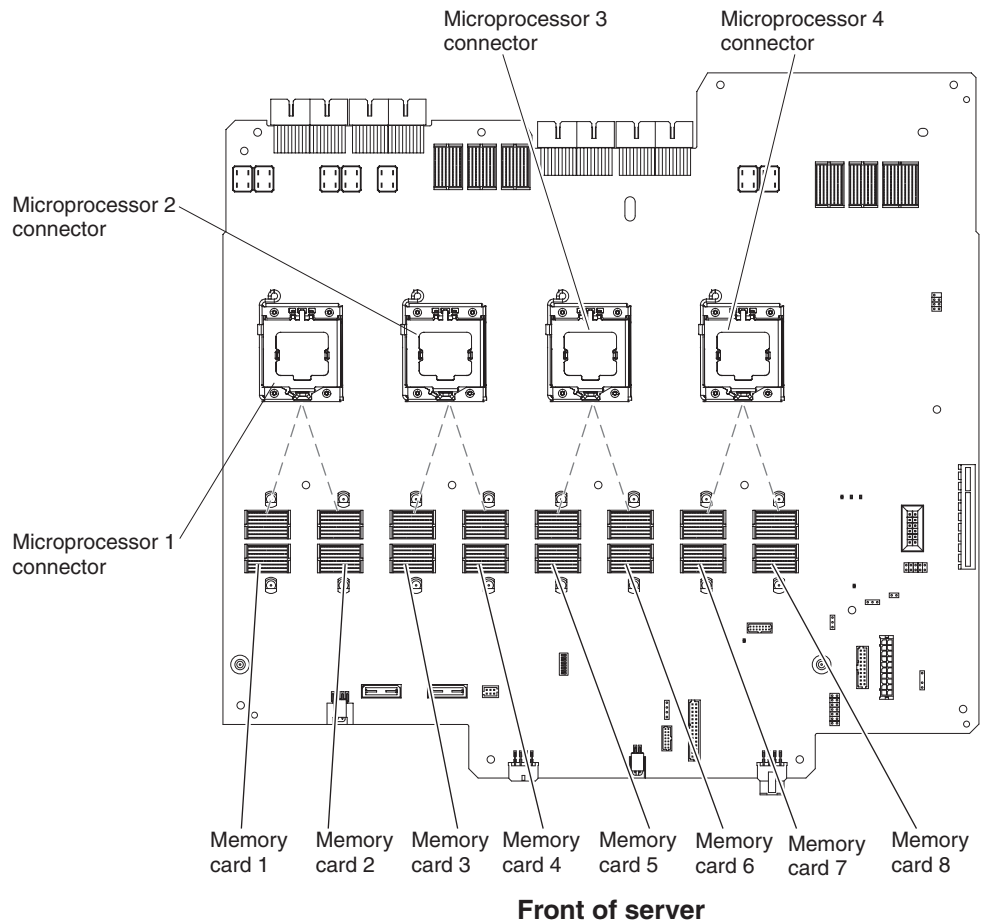
## Memory modules

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

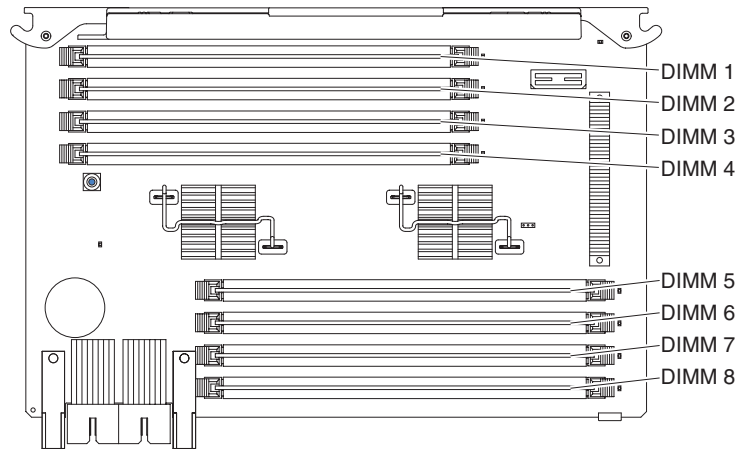
- To confirm that the server supports the memory modules that you are installing, see <http://www.ibm.com/systems/info/x86servers/serverproven/compat/us/>.
- All server model types support 1.5 V, and model types 7143 and 7191 also support 1.35 V, 240-pin, 2 GB PC3-10600 or 4 GB, 8 GB, and 16 GB PC3-8500 double data-rate (DDR) III, registered synchronous dynamic random-access memory (SDRAM) with error correcting code (ECC) DIMMs. Model types 7145 and 7146 also support 1 GB DIMMs and model Types 7143 and 7191 also support 32 GB DIMMs. These DIMMs must be compatible with the latest PC3-10600 or PC3-8500 SDRAM Registered DIMM specifications.
- The server supports up to eight memory cards. Each memory card holds up to eight DIMMs.
- At least one memory card with one pair of DIMMs must be installed for the server to operate.
- The Intel 7500 Scalable Memory Buffer and the Intel 7510 Scalable Memory Buffer are not interchangeable and cannot be used in the same server. Check the label on the top of the memory card and then see <http://www-03.ibm.com/systems/info/x86servers/serverproven/compat/us/> to verify that the memory card you are installing is supported in the server.
- The server supports an additional 512 GB of memory when the 32-DIMM optional IBM MAX5 for System x memory expansion module is attached to the server. An additional 1 TB of memory is supported when 32 GB DIMMs are installed in model types 7143 and 7191.
- When you install additional DIMMs on a memory card, be sure to install them in pairs. The DIMMs in each pair must match each other.
- The server supports memory sparing. Memory sparing reserves memory capacity for failover in the event of a DIMM failure, and the reserved capacity is subtracted from the total available memory. Memory sparing provides less redundancy than memory mirroring does. If a predetermined threshold of correctable errors is reached, the contents of the failing DIMM are copied to the spare memory, and the failing DIMM or rank is disabled. To enable memory sparing through the Setup utility, select System Settings > Memory. (Memory sparing and memory mirroring cannot be used at the same time.)
- You do not have to save new configuration information to the IMM when you install or remove DIMMs. The only exception is if you replace a DIMM that was designated as disabled in the Setup utility **Memory Settings** menu. In this case, you must re-enable the row in the Setup utility or reload the default memory settings.

- When you restart the server after you add or remove a DIMM, the server displays a message that the memory configuration has changed.
- Memory cards in connectors 1 and 2 support microprocessor 1, memory cards in connectors 3 and 4 support microprocessor 2, memory cards in connectors 5 and 6 support microprocessor 3, and memory cards in connectors 7 and 8 support microprocessor 4.
- There are four memory power buses, which are split among the eight memory cards.
- Populate the memory-card connectors to match the microprocessor installation, in the following order: 1, 7, 3, 5, 2, 8, 4, 6. (Microprocessors must be installed in the following order: 1, 4, 2, and 3. See “Installing a microprocessor” on page 73 for more information.)

The following illustration shows the locations of the memory-card connectors.



- The following illustration shows the DIMM connectors on a memory card.



- In a low-cost and low-power DIMM installation, install the DIMMs on each memory card in the order shown in the following tables. The goal in a low-cost and low-power configuration is to completely fill each memory card before you install the next memory card.

*Table 6. Low-cost and low-power DIMM installation sequence*

DIMM pair installation order	Memory-card connector number	DIMM-connector numbers	Installed microprocessors
First	1	1 and 8	1 and 4
Second	7	1 and 8	
Third	1	3 and 6	
Fourth	7	3 and 6	
Fifth	1	2 and 7	
Sixth	7	2 and 7	
Seventh	1	4 and 5	
Eighth	7	4 and 5	

If you plan to install additional memory cards in the low-cost and low-power installation sequence, follow the DIMM installation sequence in Table 6 for each memory card. Install the memory cards in the installation sequence shown in Table 7.

*Table 7. Low-cost and low-power memory-card installation sequence*

Memory card pairs	Memory-card connector number	Installed microprocessors
First	1 and 7	1 and 4
Second	2 and 8	
Third	3 and 5	2 and 3
Fourth	4 and 6	

In a high-performance DIMM installation, install the DIMMs on each memory card in the order shown in the following table. You must install at least one pair of DIMMs on each memory card.



Table 8. High-performance memory-card installation sequence

DIMM pair installation order	Memory-card connector number	DIMM connector numbers
First	1	1 and 8
Second	7	1 and 8
Third	3	1 and 8
Fourth	5	1 and 8
Fifth	2	1 and 8
Sixth	8	1 and 8
Seventh	4	1 and 8
Eighth	6	1 and 8
Ninth	1	3 and 6
Tenth	7	3 and 6
Eleventh	3	3 and 6
Twelfth	5	3 and 6
Thirteenth	2	3 and 6
Fourteenth	8	3 and 6
Fifteenth	4	3 and 6
Sixteenth	6	3 and 6
Seventeenth	1	2 and 7
Eighteenth	7	2 and 7
Nineteenth	3	2 and 7
Twentieth	5	2 and 7
Twenty-first	2	2 and 7
Twenty-second	8	2 and 7
Twenty-third	4	2 and 7
Twenty-fourth	6	2 and 7
Twenty-fifth	1	4 and 5
Twenty-sixth	7	4 and 5
Twenty-seventh	3	4 and 5
Twenty-eighth	5	4 and 5
Twenty-ninth	2	4 and 5
Thirtieth	8	4 and 5
Thirty-first	4	4 and 5
Thirty-second	6	4 and 5

Memory mirroring replicates and stores data on two pairs of DIMMs simultaneously. If a memory failure occurs, the memory controller switches from the primary set of DIMMs to the backup set of DIMMs.

When you use memory mirroring, consider the following information:

- To enable memory mirroring through the Setup utility, select **System Settings > Memory**. For more information, see “Using the Setup utility” on page 96.
- Memory mirroring reduces the available memory by half. For example, if the server has 64 GB of installed memory, only 32 GB of addressable memory is

available when memory mirroring is enabled. Note that some Windows operating systems do not recognize memory mirroring when they report the amount of available memory and instead report the total DIMM capacity.

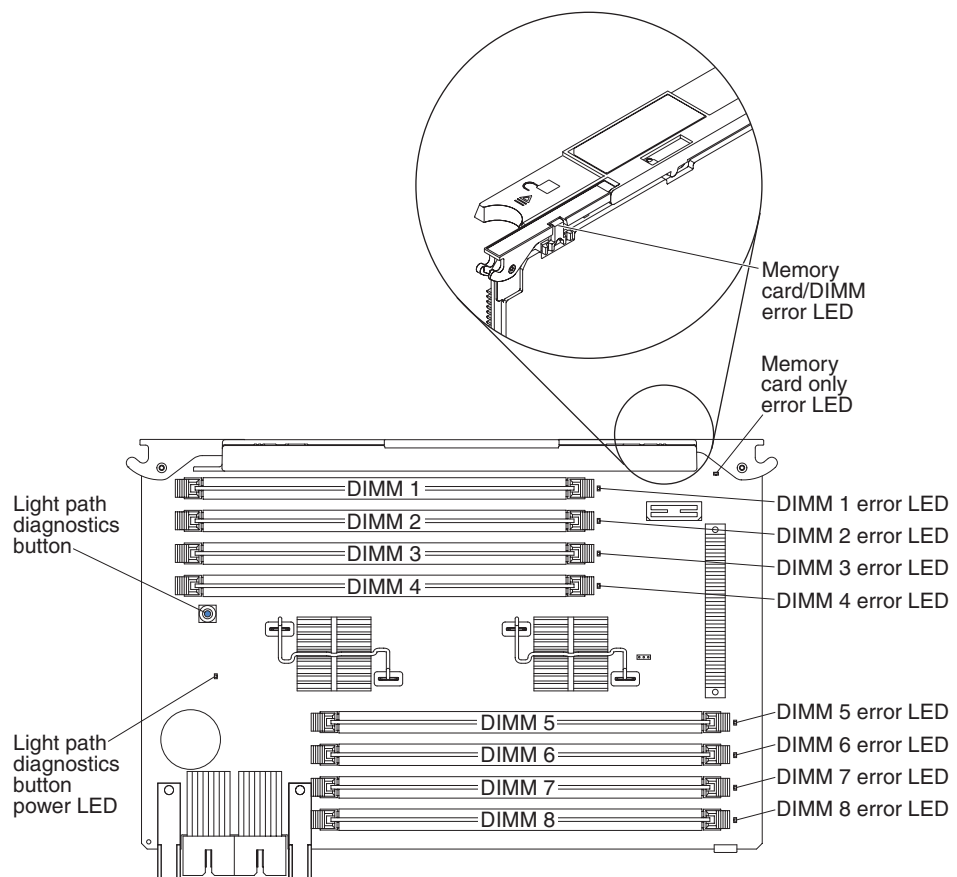
To enable memory mirroring, you must install DIMMs in sets of four, one pair in each memory card. All DIMMs in each set must be the same size and type. Memory cards 1 and 2 mirror each other, cards 3 and 4 mirror each other, memory cards 5 and 6 mirror each other, and cards 7 and 8 mirror each other. Install DIMMs in the sequence shown in the following table.

*Table 9. Memory-card installation sequence for memory-mirroring configuration*

<b>DIMM quad installation order</b>	<b>Memory card</b>	<b>Connector numbers</b>
First	1	1 and 8
	2	1 and 8
Second	7	1 and 8
	8	1 and 8
Third	3	1 and 8
	4	1 and 8
Fourth	5	1 and 8
	6	1 and 8
Fifth	1	3 and 6
	2	3 and 6
Sixth	7	3 and 6
	8	3 and 6
Seventh	3	3 and 6
	4	3 and 6
Eighth	5	3 and 6
	6	3 and 6
Ninth	1	2 and 7
	2	2 and 7
Tenth	7	2 and 7
	8	2 and 7
Eleventh	3	2 and 7
	4	2 and 7
Twelfth	5	2 and 7
	6	2 and 7
Thirteenth	1	4 and 5
	2	4 and 5
Fourteenth	7	4 and 5
	8	4 and 5
Fifteenth	3	4 and 5
	4	4 and 5
Sixteenth	5	4 and 5
	6	4 and 5

- Memory sparing reserves memory capacity for failover in the event of a DIMM failure, and the reserved capacity is subtracted from the total available memory. Memory sparing provides less redundancy than memory mirroring does. If a predetermined threshold of correctable errors is reached, the contents of the failing DIMM are copied to the spare memory, and the failing DIMM or rank is disabled. To enable memory sparing through the Setup utility, select **System Settings > Memory**.
- If a problem with a DIMM is detected, light path diagnostics lights the system-error LED on the front of the server, indicating that there is a problem and guiding you to the defective DIMM. When this occurs, first identify the defective DIMM; then, remove and replace the DIMM.

The following illustration shows the LEDs on the memory card.



**Memory card/DIMM error LED:** When this LED is lit, it indicates that the memory card or a DIMM has failed.

**Memory card only error LED:** When this LED is lit, it indicates that the memory card has failed.

**DIMM 1 - 8 error LED:** When one of these LEDs is lit, it indicates that a DIMM has failed.

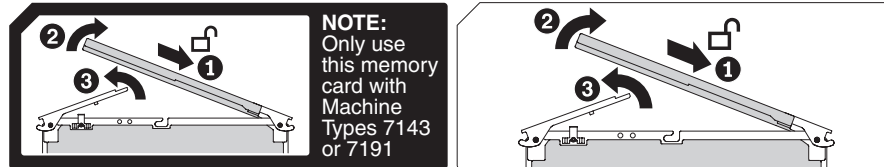
**Light path diagnostics button power LED:** When this LED is lit, it indicates that the capacitor has power and error LEDs can be lit as necessary.

**Light path diagnostics button:** Press this button to relight the error LED that had previously been lit.

## Installing a memory card

At least one memory card with one pair of DIMMs must be installed for the server to operate correctly.

The Intel 7500 Scalable Memory Buffer memory card and the Intel 7510 Scalable Memory Buffer memory card are not interchangeable and cannot be used in the same server. To verify that your server supports the memory card that you are installing, look at the label on the top of the memory card. If the label does not state that the memory card can be used only in machine types 7143 and 7191, the memory card can be used only in machine types 7145 and 7146.



To install a memory card, complete the following steps:

1. Read “Safety” on page v and “Installation guidelines” on page 38.
2. Turn off the server and peripheral devices, and disconnect the power cords and all external cables as necessary to replace the device.
3. Remove the server cover (see “Removing the top cover” on page 44).
4. Remove the memory card filler.
5. Prepare the memory card:
  - a. Touch the static-protective package that contains the memory card to any unpainted surface on the outside of the server; then, remove the memory card from the package.
  - b. Open the levers on the top of the memory card.
  - c. Place the memory card on a flat, static-protective surface, with the DIMM connectors facing up.
  - d. Install DIMMs in the memory card (see “Installing DIMMs”).
6. Add the memory card.

**Attention:** When you move the memory card, do not allow it to touch any components or structures inside the server.

- a. Grasp the memory card by the retention levers and turn the memory card so that the connector aligns with the connector on the microprocessor board and the guides on the chassis.
- b. Insert the memory card into the memory-card connector.
- c. Press the memory card into the connector and close the retention levers.
- d. Slide the blue release latch to the locked position.

If you have other devices to install or remove, do so now. Otherwise, go to “Completing the installation” on page 79.

## Installing DIMMs

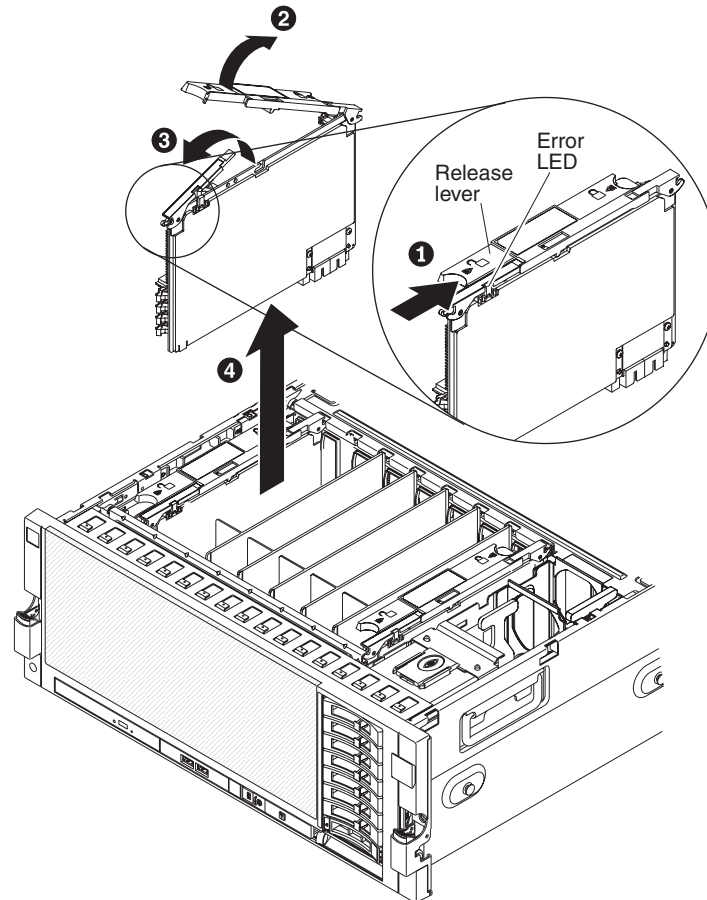
DIMMs must be installed in pairs of the same type and speed. For you to use the memory mirroring feature, all the DIMMs that are installed in the server must be the same type and speed, and the operating system must support memory

mirroring. The following instructions are for installing one pair of DIMMs. To install DIMM pairs on more than one memory card, repeat steps 3 through 7 for each memory card.

To confirm that the server supports the DIMMs that you are installing, see <http://www.ibm.com/systems/info/x86servers/serverproven/compat/us/>.

To install a DIMM, complete the following steps:

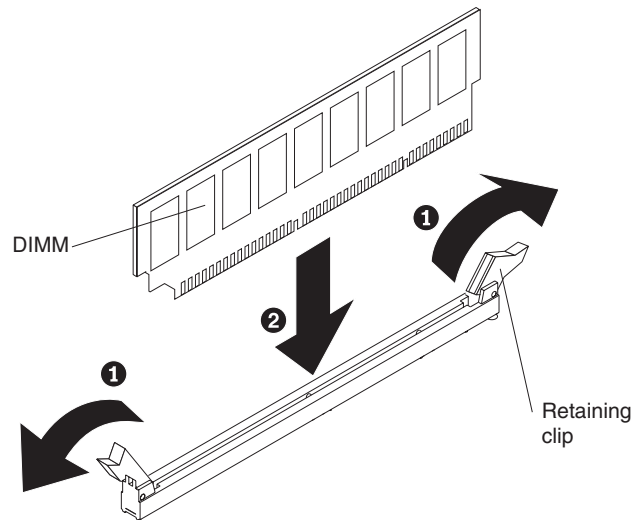
1. Read "Safety" on page v and "Installation guidelines" on page 38.
2. Turn off the server and peripheral devices, and disconnect the power cords and all external cables as necessary.
3. Remove the server top cover (see "Removing the top cover" on page 44).



4. If you are installing DIMMs in a memory card that is already installed in the server, remove the memory card:
  - a. Slide the blue release latch to the unlocked position.
  - b. Open the release levers on the top of the memory card.
  - c. While you hold the release levers open, lift the memory card out of the server.
5. Place a memory card on a flat, static-protective surface, with the DIMM connectors facing up.

**Attention:** To avoid breaking the DIMM retaining clips or damaging the DIMM connectors, open and close the clips gently.
6. Open the retaining clips **1** on each end of the DIMM connector.

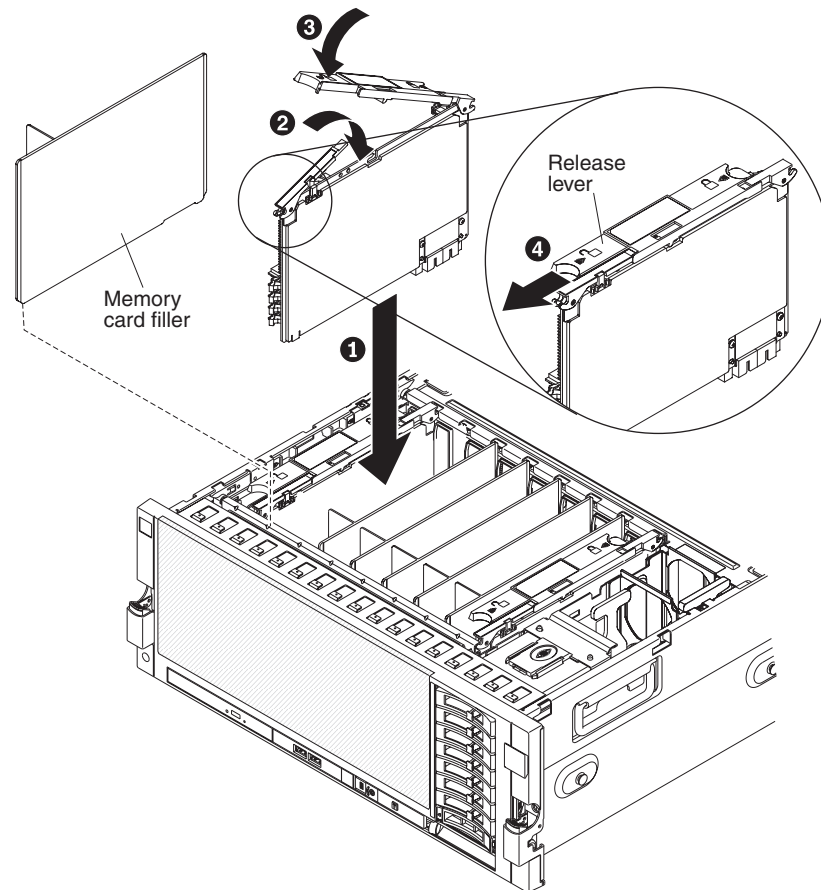
7. Touch the static-protective package that contains the DIMM to any unpainted metal surface on the outside of the server; then, remove the DIMM from the package.
8. Turn the DIMM so that the DIMM keys align correctly with the slot.



9. Insert the DIMM into the connector by aligning the edges of the DIMM with the slots at the ends of the DIMM connector. Firmly press the DIMM straight down into the connector **2** by applying pressure on both ends of the DIMM simultaneously. The retaining clips snap into the locked position when the DIMM is seated in the connector.

**Note:** If there is a gap between the DIMM and the retaining clips, the DIMM has not been correctly inserted; open the retaining clips, remove the DIMM, and then reinsert it.

10. Install the memory card.



- a. If this is a new memory card, remove the memory card filler from the server.
- b. Insert the memory card into the memory-card connector.
- c. Press the memory card into the connector and close the release levers.
- d. Slide the blue release latch to the locked position.

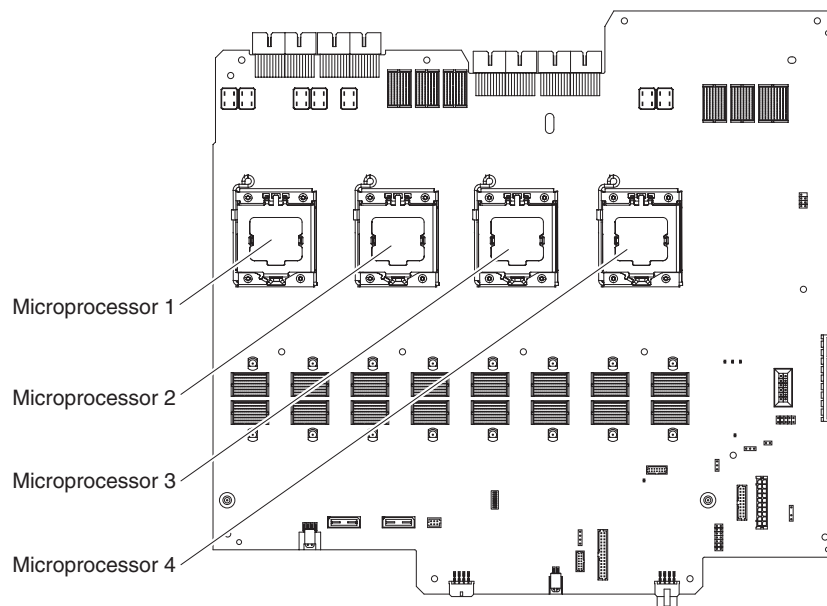
If you have other devices to install or remove, do so now. Otherwise, go to “Completing the installation” on page 79.

## Installing a microprocessor

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

- To confirm that the server supports the microprocessor that you are installing, see <http://www.ibm.com/systems/info/x86servers/serverproven/compat/us/>.
- The optional microprocessors that IBM supports are limited by the capacity and capability of the server. Any microprocessors that you install must have the same specifications as the microprocessors that came with the server.
- The server supports up to four Intel Xeon microprocessors. If you are installing two or more microprocessors, they must be the same cache size and type, and the same clock speed.
- Do not mix Intel Xeon versions of the 6000 and 7000 Series and the E7 Series microprocessors in the same server, it is not supported. In addition:

- Intel Xeon EX versions of the 6000 and 7000 Series microprocessors are supported only on machine types 7145 and 7146.
- Intel Xeon EX E7 Series microprocessors are supported only on machine types 7143 and 7191.
- The server can operate as a symmetric multiprocessing (SMP) server. With SMP, certain operating systems and application programs can distribute the processing load among the microprocessors. This enhances performance for database and point-of-sale applications, integrated manufacturing solutions, and other applications.
- Because of space limitations, you must use the microprocessor tool that comes with the microprocessor, when you install the microprocessor.
- Read the documentation that comes with the microprocessor to determine whether you have to update the UEFI firmware (server firmware). To download the most current level of UEFI firmware, go to <http://www.ibm.com/systems/support/>.
- Obtain an SMP-capable operating system. For a list of supported operating systems, see <http://www.ibm.com/servers/eserver/serverproven/compat/us/>.
- You can use the Setup utility to determine the specific type of microprocessor in the server.
- Microprocessor sockets must always contain either a heat-sink blank or a microprocessor and heat sink.
- Populate the microprocessor sockets in the following order: 1, 4, 2, and 3. The following illustration shows the locations of the microprocessor sockets on the microprocessor board.



**Note:** In a one node server only, if your server has more than two microprocessors installed, you must install two QPI wrap cards in the server.

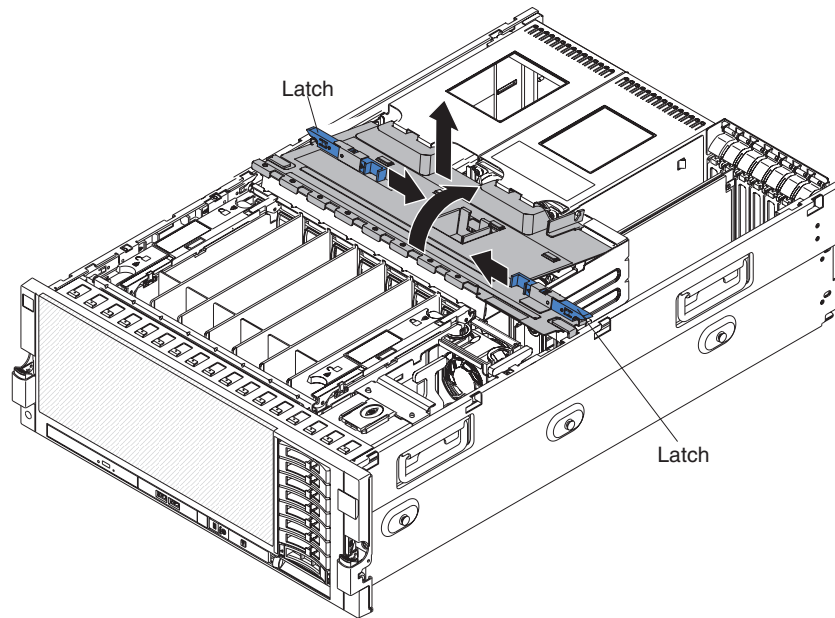
To install a microprocessor, complete the following steps:

1. Read "Safety" on page v and "Installation guidelines" on page 38.
2. Turn off the server and peripheral devices, and disconnect the power cords and all external cables as necessary to replace the device.
3. Remove the server top cover (see "Removing the top cover" on page 44).

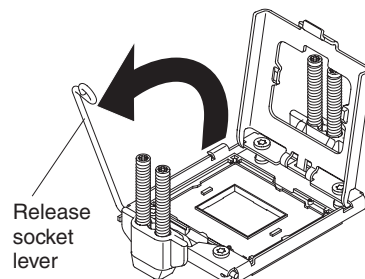


**Attention:** When you handle static-sensitive devices, take precautions to avoid damage from static electricity. For details about handling these devices, see "Handling static-sensitive devices" on page 40.

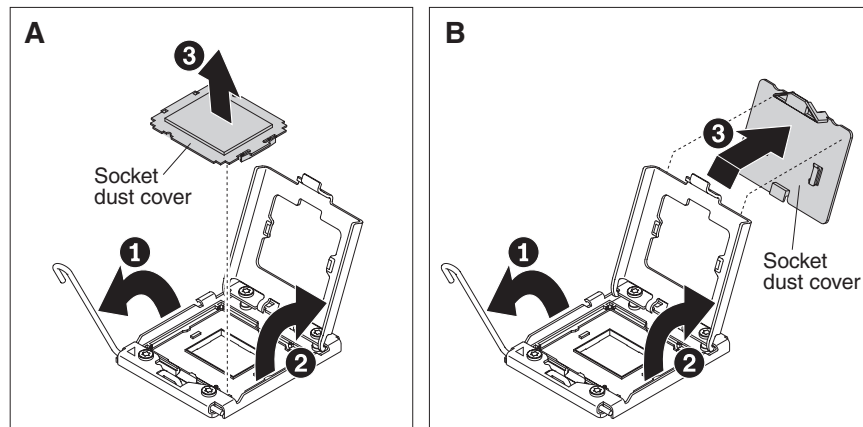
- Slide the blue latches on the top cover bracket toward the center of the server.



- Lift the top cover bracket out of the server.
- Remove the heat-sink blank and store it for future use.
- Open the release socket lever and rotate the load plate.

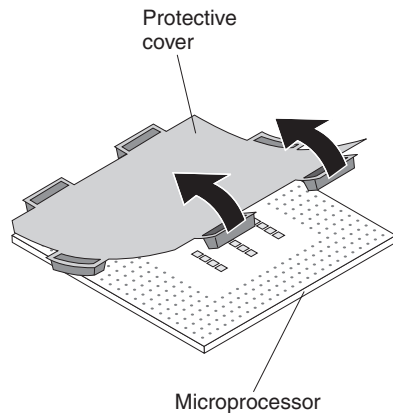


- Remove the socket cover from the microprocessor socket. The microprocessor socket might have the socket cover style shown in illustration A or the style shown in illustration B.



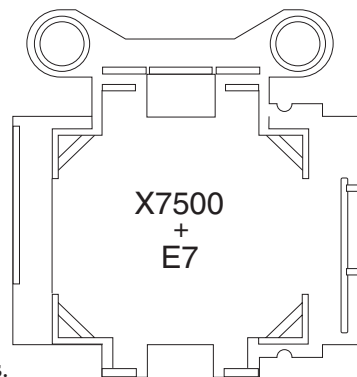
- Install the microprocessor in the microprocessor installation tool:

- a. Remove the static-protective bag, and the foam surrounding the bag, from the box.
- b. Touch the static-protective bag that contains the new microprocessor to any unpainted metal surface on the outside of the server.
- c. Carefully remove the microprocessor from the static-protective bag, touching only the edges of the microprocessor.
- d. If there is a plastic protective cover on the bottom of the microprocessor, carefully remove it.



- e. Put the microprocessor back in the box, component side down on the solid piece of foam.
- f. Locate the microprocessor installation tool that comes with the new microprocessor.

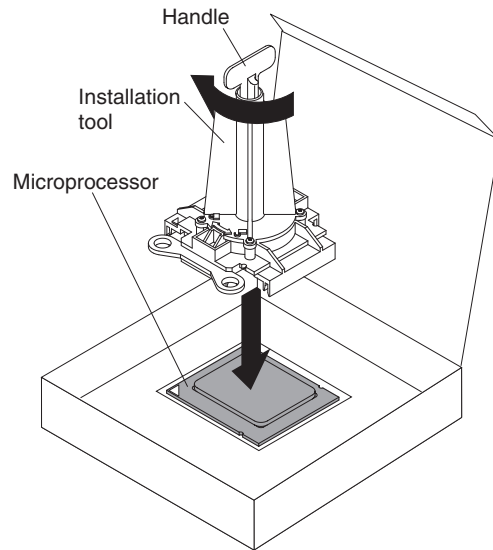
**Note:** If you are installing E7 series microprocessors in your server, you must use the microprocessor installation tool with the text "X7500 + E7" on the bottom of the tool (see the following illustration). Tools that do not have this text on the bottom will not work correctly with the E7 series



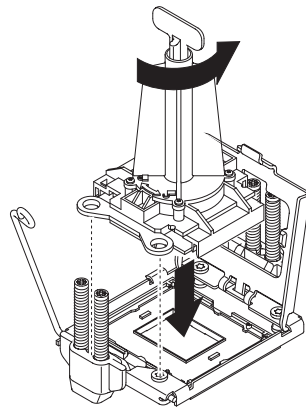
microprocessors.

- g. Twist the handle of the installation tool counterclockwise so that it is in the open position.
- h. Using the triangle on the microprocessor to align it with the installation tool, place the microprocessor on the underside of the tool.
- i. Twist the handle of the installation tool clockwise to secure the microprocessor in the tool.

**Note:** You can pick up or release the microprocessor by twisting the microprocessor installation tool handle.



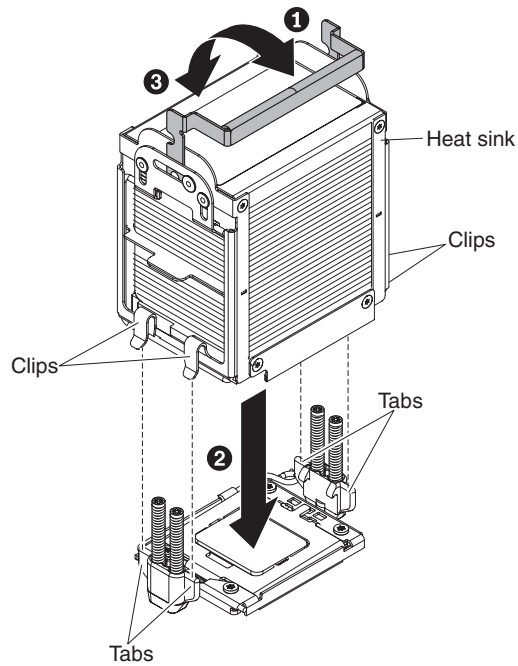
10. Carefully position the microprocessor with the microprocessor tool over the microprocessor socket. Twist the microprocessor tool counterclockwise to insert the microprocessor into the socket.



11. Close the load plate and then rotate the microprocessor-release lever to secure the microprocessor.

**Note:** If you have more microprocessors to install, repeat steps 5-11 for each microprocessor, and then continue with step 12 after you have installed all the microprocessors that you plan to install.

12. Remove the heat sink from its package and rotate the heat-sink handle to the fully open position.
13. Remove the cover from the bottom of the heat sink.
14. Position the heat sink above the microprocessor and align the clips of the heat sink with the tabs next to the microprocessor socket.



15. Press on the top of the heat sink and rotate the lever to the closed position.

If you have other devices to install or remove, do so now. Otherwise, go to "Completing the installation" on page 79.

## Completing the installation

To complete the installation, complete the following steps:

1. If you removed the front bezel, slide the bezel onto the front of the server chassis.
2. If you removed the top-cover bracket, reinstall it. Slide the blue latches into the locked position.
3. Place the top cover over the top of the server.
4. Slide the top cover forward; then, press down on the cover handle until it clicks into place.
5. Connect the cables and power cords to the rear of the server. For more information, see “Connecting the cables.”
6. Start the server. Confirm that it starts correctly and recognizes the newly installed devices, and make sure that no error LEDs are lit.
7. (IBM Business Partners only) Complete the additional steps in “Instructions for IBM Business Partners” on page 29.

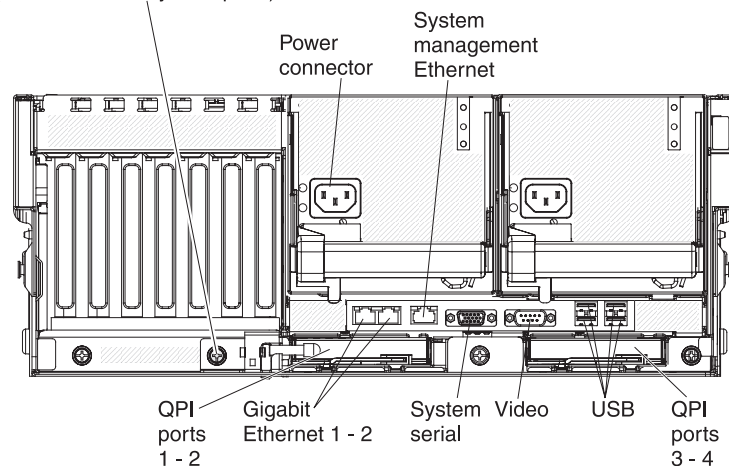
## Connecting the cables

### Notes:

1. Be sure to turn off the server before you connect any cables to or disconnect any cables from the server.
2. Detailed cabling information is available in the *Rack Installation Instructions* that came with your server or the *Installation Instructions* that came with any cable kits.
3. For additional cabling instructions, see the documentation that comes with the optional devices. It might be easier for you to route any cables before you install certain optional devices.

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

A thumbscrew is in this position only when a 2-node lock bracket is installed (2-node Scalability Kit Option)



## Updating the server configuration

When you start the server for the first time after you add or remove a device, you might receive a message that the configuration has changed. The Setup utility starts automatically so that you can save the new configuration settings. For more information, see Chapter 3, "Configuring the server," on page 95.

Some optional devices have device drivers that you must install. For information about installing device drivers, see the documentation that comes with each device.

Before you attach a memory expansion module to the server and try to use it, you must update the server firmware with the latest level of firmware or code. If you attach and try to use the memory expansion module without updating the server firmware, you might get unexpected system behaviour or the server might not power on. For special instructions to follow before you attach the memory expansion module to the server, go to <http://www.ibm.com/support/entry/portal/docdisplay?Indocid=MIGR-5085756>.

The server comes with at least one microprocessor. If more than one microprocessor is installed, the server can operate as a symmetric multiprocessing (SMP) server. You might have to upgrade the operating system to support SMP. For more information, see "Typical operating-system installation" on page 104 and the operating-system documentation.

If the server has an optional RAID adapter and you have installed or removed a hard disk drive, see the documentation that comes with the RAID adapter for information about reconfiguring the disk arrays.

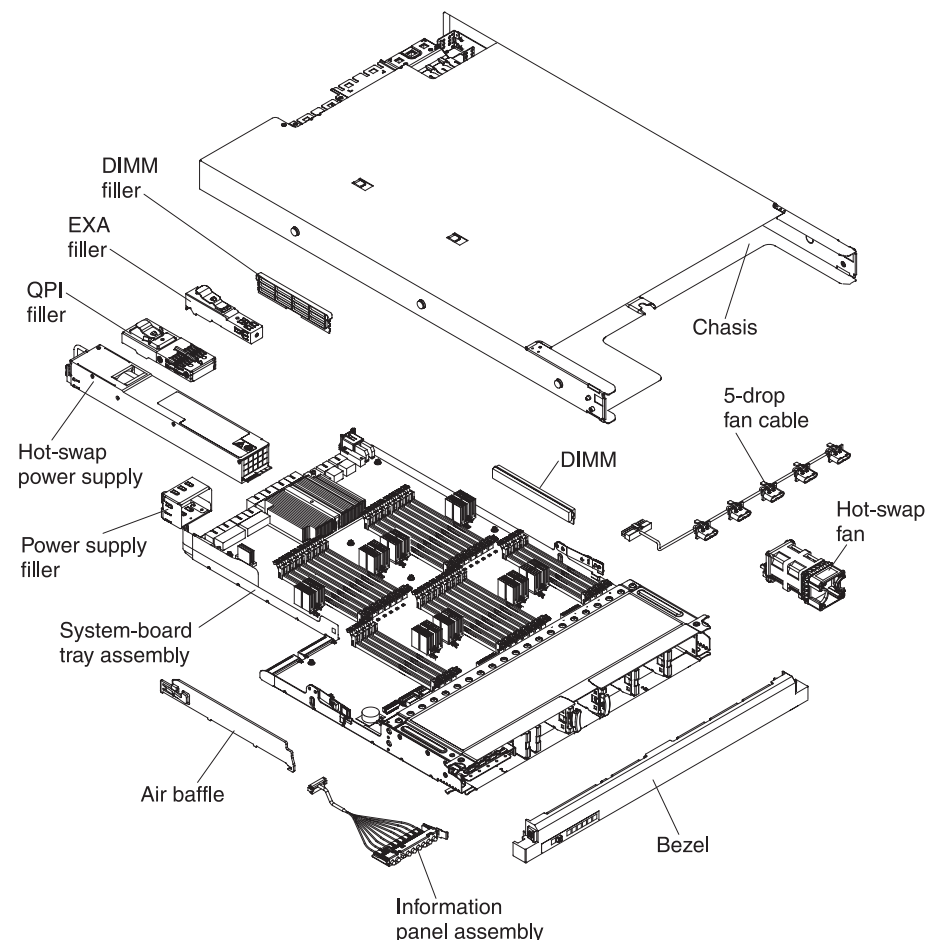
For information about configuring the integrated Gigabit Ethernet controller, see "Configuring the Broadcom Gigabit Ethernet controller" on page 108.

## Installing hardware devices in the memory expansion module

The following sections provide detailed instructions for installing optional hardware devices in the optional IBM MAX5 for System x memory expansion module.

### Memory expansion module components

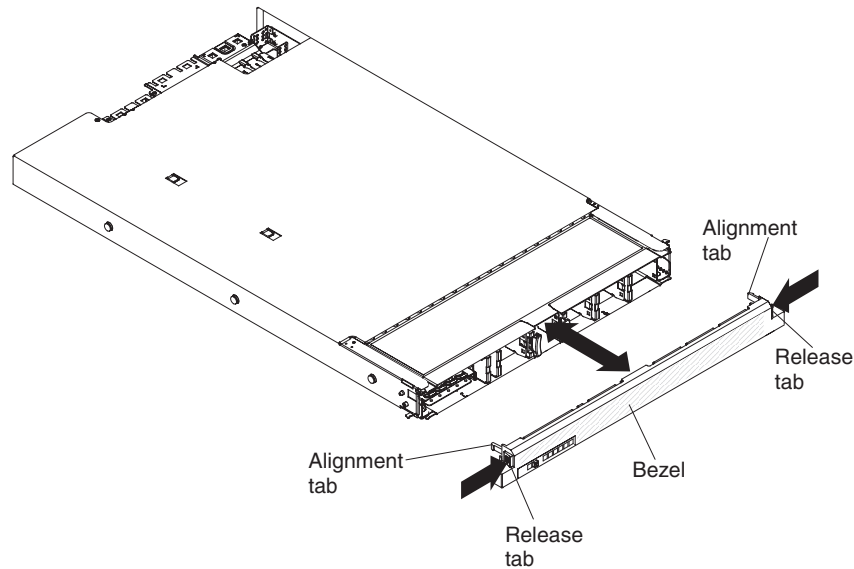
The following illustration shows the major components in the memory expansion module. The illustrations in this document might differ slightly from your hardware.



### Removing the memory expansion module bezel

To remove the memory expansion module bezel, complete the following steps:

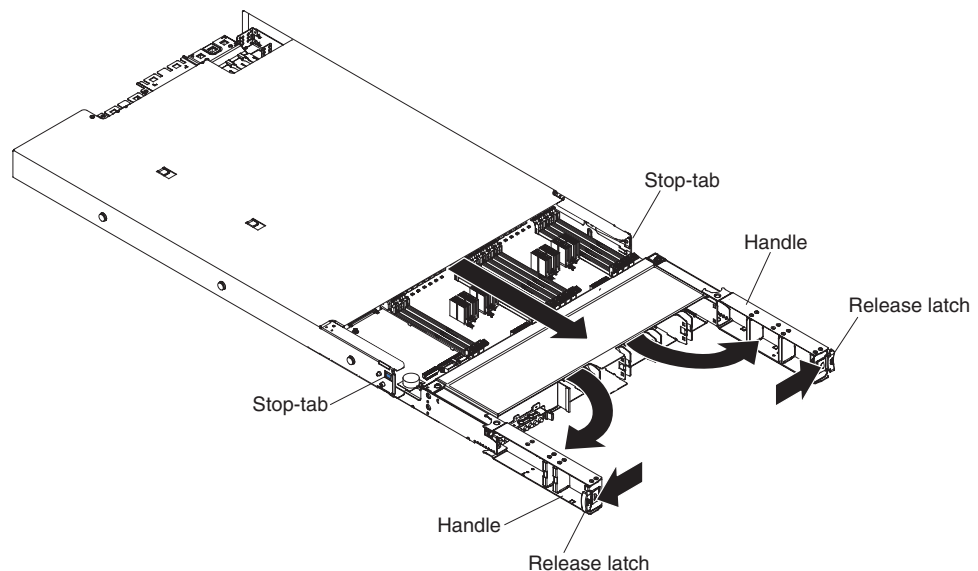
1. Read "Safety" on page v and "Installation guidelines" on page 38.
2. Press in on the release tabs on both ends of the bezel and pull it off the chassis.



## Removing the memory expansion module system-board tray

To remove the memory expansion module system-board tray, complete the following steps:

1. Read "Safety" on page v and "Installation guidelines" on page 38.
2. Turn off the host server (see "Turning off the server" on page 20) and all attached peripheral devices. Disconnect all power cords; then, disconnect all external cables from the server. Disconnect all power cords; then, disconnect all external cables from the memory expansion module. (Do not bend or nick the scalability cables while working with the cables.)
3. Remove the bezel (see "Removing the bezel" on page 47).
4. Grasp the blue release latches on the system-board tray handles and press the release latches in opposite directions and rotate the handles to the fully open position.





5. Grasp the handles and pull the system-board tray out until it stops; then, press in the blue stop-tabs on both sides of the system-board tray and pull the tray out of the chassis.

If you have other devices to install or remove, do so now. Otherwise, go to “Completing the memory expansion module installation” on page 90.

## Installing DIMMs in the memory expansion module

The following notes describe the types of DIMMs that the memory expansion module supports and other information that you must consider when you install DIMMs.

- To confirm that the memory expansion module supports the DIMMs that you are installing, see <http://www.ibm.com/systems/info/x86servers/serverproven/compat/us/>.
- The memory expansion module supports a maximum of 32 DIMMs (single-rank, dual-rank, or quad-rank).

**Note:** To determine the type of a DIMM, see the label on the DIMM. The information on the label is in the format xxxxx nRxxx PC3-xxxxx-xx-xx-xxx. The numeral in the sixth numerical position indicates whether the DIMM is single-rank (n=1) or dual-rank (n=2).

- The DIMM options that are available for the memory expansion module are 2 GB, 4 GB, 8 GB, 16 GB, and 32 GB.
- If you install 32 GB DIMMs in the memory expansion module, all of the DIMMs must be 32 GB capacity DIMMs. You cannot mix 32 GB DIMMs with other capacity DIMMs in the memory expansion module.
- The memory expansion module supports a minimum of 4 GB and a maximum of 1 TB of system memory.
- The memory expansion module supports 1.35 V (low-voltage) and 1.5 V DIMMs. In addition, support is dependent on the host server machine type that the memory expansion module is connected to, as follows:
  - When connecting the memory expansion module to Machine Types 7145 and 7146, install only 1.5 V DIMMs in the memory expansion module
  - When connecting the memory expansion module to Machine Types 7143 and 7191:
    - The memory expansion module supports low-voltage (1.35 V) DIMMs at capacities of 4 GB, 8 GB, 16 GB, and 32 GB only.
    - If you install 32 GB DIMMs in the memory expansion module, all of the DIMMs must be 32 GB capacity DIMMs. You cannot mix the 32 GB DIMMs with other capacity DIMMs in the memory expansion module.
    - When you mix 1.35 V and 1.5 V DIMMs in the memory expansion module, the memory expansion module operates at the 1.5 V rate.
    - You can enable all DIMMs (1.35 V and 1.5 V) to operate at 1.5 V in the host server Setup utility.
- Some memory expansion modules come with the Intel 7500 scalable memory buffer memory card or the Intel 7510 scalable memory buffer memory card. See the parts listing table for the memory expansion module in the *Problem Determination and Service Guide* for information about the Intel memory buffer memory card that is supported on the memory expansion module system-board tray.

- Double-device data correction support is only available when 16 GB x4 DRAM technology DIMMs are installed in the memory expansion module and the memory expansion module is connected to a host server.
- The memory expansion module supports memory sparing through the host server. Memory sparing reserves memory capacity for failover in the event of a DIMM failure, and the reserved capacity is subtracted from the total available memory. Memory sparing provides less redundancy than memory mirroring does. If a predetermined threshold of correctable errors is reached, the contents of the failing DIMM are copied to the spare memory, and the failing DIMM or rank is disabled. To enable memory sparing through the Setup utility, select System Settings > Memory.
- When you populate DIMMs in the memory expansion module, populate the larger capacity DIMMs first; then the smaller capacity DIMMs. See Table 12 on page 85 for non-mirroring mode DIMM population sequence and Table 13 on page 86 for memory-mirroring mode DIMM population sequence.
- The memory expansion module provides eight memory ports (memory channels) and each memory port supports up to four DIMMs. Do not mix DIMMs with x4 technology (DIMMs with DRAMs that are organized with 4 data lanes) and x8 technology (DIMMs with DRAMs that are organized with 8 data lanes) in the same memory port.

*Table 10. Memory ports and DIMM connectors*

Memory ports	DIMM connectors
1	1, 2, 7, and 8
2	3, 4, 5, and 6
3	9, 10, 15, and 16
4	11, 12, 13, and 14
5	17, 18, 23, and 24
6	19, 20, 21, and 22
7	25, 26, 31, and 32
8	27, 28, 29, and 30

Note: 2 GB, 4 GB, and 8 GB DIMMs are x4 technology DIMMs. 16 GB and 32 GB DIMMs are x8 technology DIMMs.

- Do not mix DIMMs with 1 Gb (gigabit) technology, 2 Gb DRAM technology, or other gigabit DRAM technologies in banks of eight DIMMs on memory ports that are on the same memory controller. This is not supported in the memory expansion module. The following table lists the DIMM connectors for each bank of eight DIMMs that are on the memory ports within the same memory controller.

*Table 11. DIMM banks and connectors*

Bank of DIMMs	DIMM connectors
1st bank of DIMMs	1, 2, 3, 4, 5, 6, 7, and 8
2nd bank of DIMMs	9, 10, 11, 12, 13, 14, 15, and 16
3rd bank of DIMMs	17, 18, 19, 20, 21, 22, 23, and 24
4th bank of DIMMs	25, 26, 27, 28, 29, 30, 31, and 32

- DIMMs must be installed in pairs for non-mirroring mode and in sets of four for memory-mirroring mode.

- A minimum of two DIMMs must be installed in the memory expansion module for each microprocessor in the host server.
- The maximum operating speed of the memory expansion module is determined by the slowest DIMM installed in the memory expansion module.
- The memory expansion module does not come with any DIMMs when you purchase it as an optional device. When you install DIMMs, install them in the order shown in the following tables to optimize system performance.
- The memory expansion module supports non-mirroring mode and memory-mirroring mode through the host server.
  - **Non-mirroring mode.** When you use the non-mirroring mode, install DIMMs as indicated in the following table.

*Table 12. Non-mirroring mode DIMM population sequence for the memory expansion module*

Pairs of DIMMs	DIMM connector population sequence
Pair 1	28, 29
Pair 2	9, 16
Pair 3	1, 8
Pair 4	20, 21
Pair 5	26, 31
Pair 6	11, 14
Pair 7	3, 6
Pair 8	18, 23
Pair 9	27, 30
Pair 10	10, 15
Pair 11	2, 7
Pair 12	19, 22
Pair 13	25, 32
Pair 14	12, 13
Pair 15	4, 5
Pair 16	17, 24

**Note:** When you populate DIMMs in the memory expansion module, populate the larger capacity DIMMs first, then the smaller capacity DIMMs.

- **Memory-mirroring mode.** When you use the mirroring mode feature, consider the following information:
  - Memory-mirroring mode replicates and stores data on sets of DIMMs simultaneously. If a failure occurs, the memory controller switches from the primary set of DIMMs to the backup set of DIMMs. To enable memory mirroring through the Setup utility, select **System Settings** → **Memory**. For more information, see “Using the Setup utility” on page 96.
  - DIMMs must be installed in sets of four. The DIMMs in each set must be the same size and type. This is applicable also when the memory expansion module is attached to a host server and the host server has an optional memory tray installed in the server. You must install DIMMs in sets of four DIMMs for memory-mirroring mode in each (server, memory tray, and the memory expansion module).

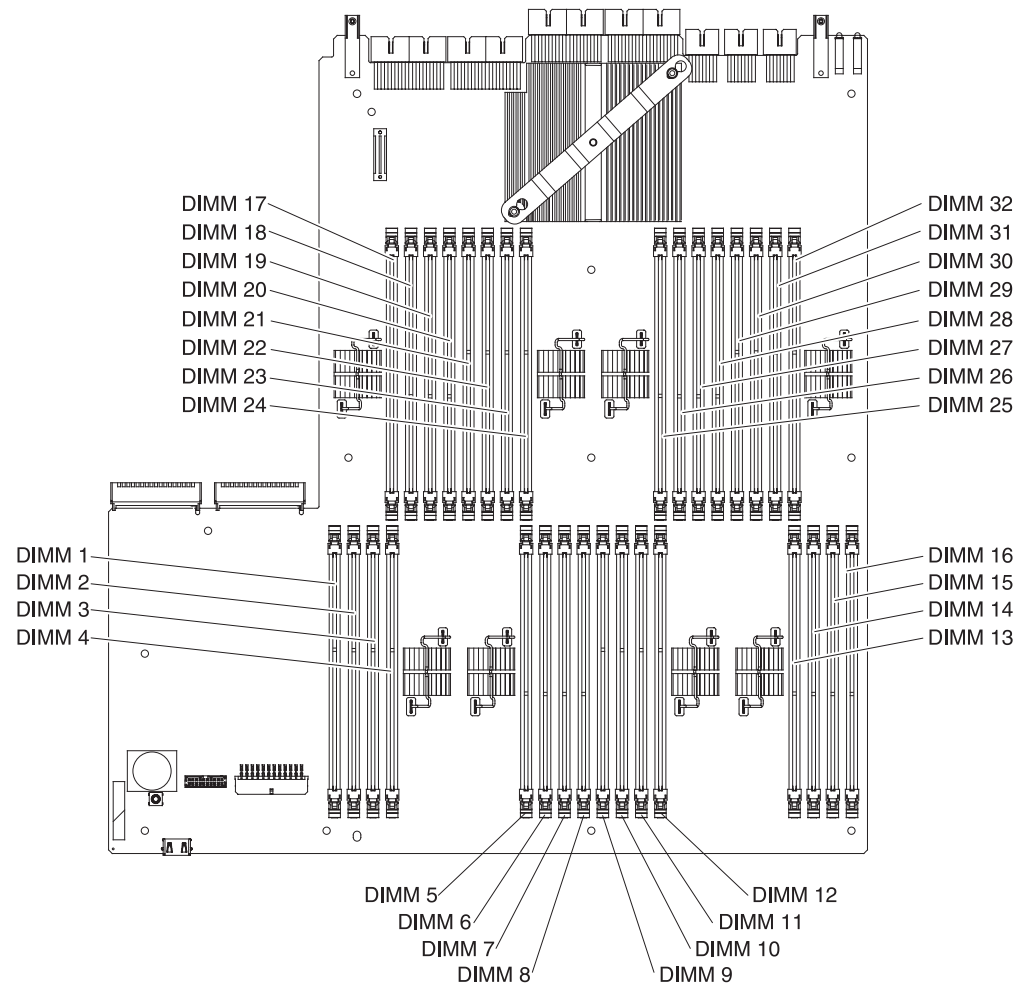
- The maximum available memory is reduced to half of the installed memory when memory mirroring is enabled. For example, if the memory expansion module has 64 GB of memory installed, only 32 GB of addressable memory is available when you use memory mirroring.
- The following table lists the DIMM installation sequence for memory-mirroring mode.

*Table 13. Memory-mirroring mode DIMM population sequence for the memory expansion module*

Sets of 4 DIMMs	DIMM connector population sequence
Set 1	9, 16, 28, 29
Set 2	1, 8, 20, 21
Set 3	11, 14, 26, 31
Set 4	3, 6, 18, 23
Set 5	10, 15, 27, 30
Set 6	2, 7, 19, 22
Set 7	12, 13, 25, 32
Set 8	4, 5, 17, 24

**Note:** When you populate DIMMs in the memory expansion module, populate the larger capacity DIMMs first, then the smaller capacity DIMMs.

The following illustration shows the locations of the DIMM connectors on the system-board tray.

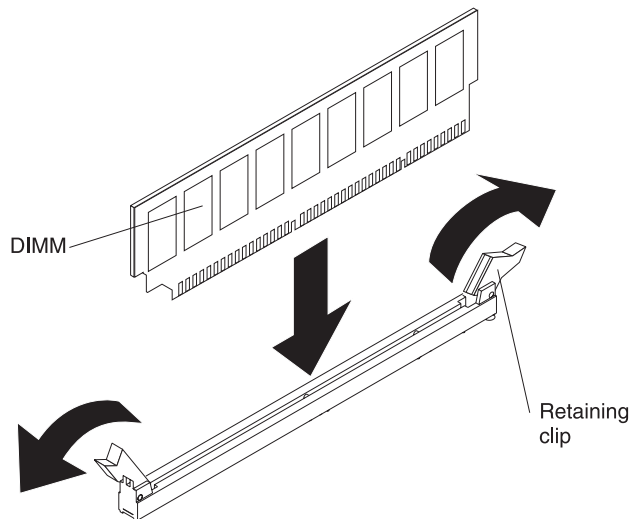


To install a DIMM (memory module) in the memory expansion module, complete the following steps.

**Note:** The memory expansion module might come with DIMM fillers on DIMM connectors that are not populated. Remove them before you install DIMMs in those connectors.

1. Read "Safety" on page v and "Installation guidelines" on page 38.
2. Turn off the host server (see "Turning off the server" on page 20) and all attached peripheral devices. Disconnect all power cords; then, disconnect all external cables from the server. Disconnect all power cords; then, disconnect all external cables from the memory expansion module. (Do not bend or nick the scalability cables when working with the cables.)
3. Remove the bezel (see "Removing the bezel" on page 47).
4. Remove the system-board tray (see "Removing the memory expansion module system-board tray" on page 82).
5. Remove any DIMM fillers from the DIMM connectors that you want to populate.

6. Touch the static-protective package that contains the new DIMM to any unpainted metal surface on the outside of the memory expansion module; then, remove the DIMM from the package.
7. Carefully open both retaining clips on each end of the DIMM connector.  
**Attention:** To avoid breaking the retaining clips or damaging the DIMM connectors, open and close the clips gently.
8. Turn the DIMM so that the DIMM keys align correctly with the connector.
9. Insert the DIMM into the connector by aligning the edges of the DIMM with the slots at the ends of the DIMM connector.



10. Firmly press the DIMM straight down into the connector by applying pressure on both ends of the DIMM simultaneously. The retaining clips snap into the locked position when the DIMM is firmly seated in the connector.

**Note:** If there is a gap between the DIMM and the retaining clips, the DIMM has not been correctly inserted; open the retaining clips, remove the DIMM, and then reinsert it.

11. Replace the system-board tray (see “Replacing the memory expansion module system-board tray” on page 91). Grasp the system-board tray on both sides (near the stop-tabs) and align the system-board tray with the chassis.
12. Slide the system-board tray forward until the tabs on the bottom of the handles touch the chassis; then, close the handles and press firmly on the release latches to snap them into the locked position.

If you have other devices to install or remove, do so now. Otherwise, go to “Completing the memory expansion module installation” on page 90.

## Installing a memory expansion module hot-swap power supply

The following notes describe the type of power supply that the memory expansion module supports and other information that you must consider when you install a power supply:

- To confirm that the memory expansion module supports the power supply you are installing, see <http://www.ibm.com/systems/info/x86servers/serverproven/compat/us/>.

- The IBM MAX5 for System x memory expansion module comes with one or two 675-watt hot-swap 12-volt output power supplies (depending on the model). The input voltage is 110 V ac or 220 V ac auto-sensing. Two power supplies must be installed for redundancy support.

**Note:** You cannot mix 110 V ac and 220 V ac power supplies in the memory expansion module; it is not supported.

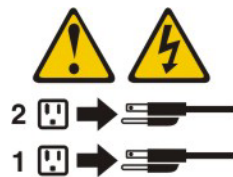
- These power supplies are designed for parallel operation. In the event of a power-supply failure, the redundant power supply continues to power the server. The memory expansion module supports a maximum of two power supplies.

**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.

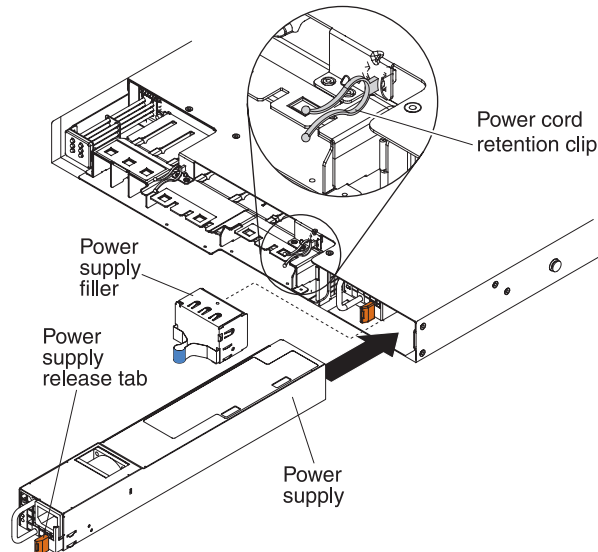


Hazardous voltage, current, and energy levels are present inside any component that has this label attached. There are no serviceable parts inside these components. If you suspect a with one of these parts, contact a service technician.

To install a hot-swap power supply in the memory expansion module, complete the following steps:

1. Read “Safety” on page v and “Installation guidelines” on page 38.

2. If the server is in a rack, at the back of the server, pull back the cable-management arm to gain access to the rear of the server and the power supply.
3. If you are installing a hot-swap power supply into an empty bay, remove the power-supply filler panel from the power-supply bay.
4. Touch the static-protective package that contains the hot-swap power supply to any unpainted metal surface on the server; then, remove the power supply from the package and place it on a static-protective surface.
5. Grasp the handle on the rear of the power supply and slide the power supply forward into the power-supply bay until it clicks. Make sure that the power supply connects firmly into the power-supply connector.



6. Route the power cord through the power cord retention clip so that it does not accidentally become disconnected.
7. Connect the power cord for the new power supply to the power-cord connector on the power supply.
8. Connect the other end of the power cord to a properly grounded electrical outlet.
9. Make sure that the ac power LED and the dc power LED on the power supply are lit, indicating that the power supply is operating correctly. The two green LEDs are to the right of the power-cord connector.
10. (IBM Business Partners only) Restart the server. Confirm that it starts correctly and recognizes the newly installed devices, and make sure that no error LEDs are lit.
11. (IBM Business Partners only) Complete the additional steps in "Instructions for IBM Business Partners" on page 29.

## Completing the memory expansion module installation

To complete the memory expansion module option installation, complete the following steps:

1. Reinstall the system-board tray (see "Replacing the memory expansion module system-board tray" on page 91).
2. Reinstall the memory expansion module bezel (see "Replacing the memory expansion module bezel" on page 92).



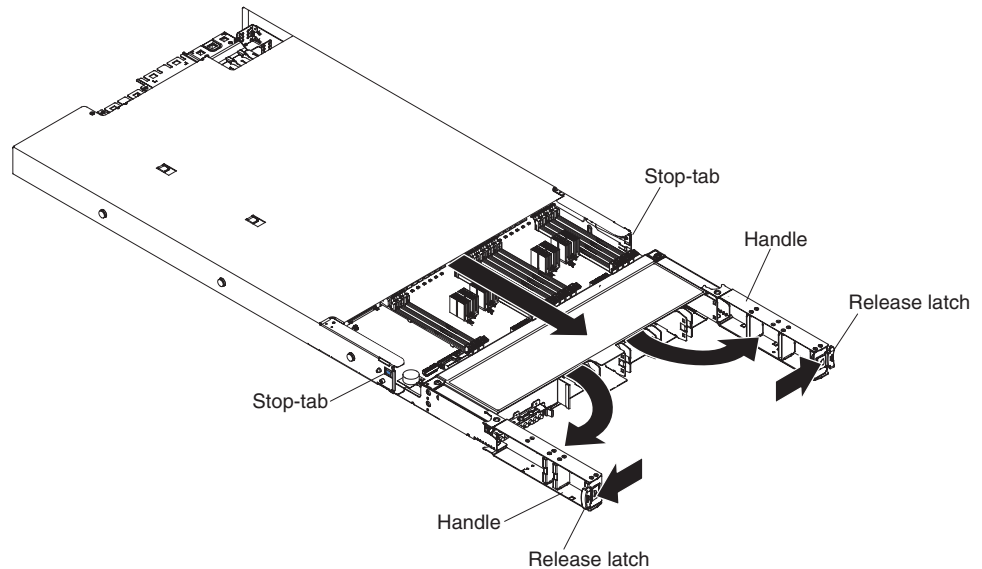
3. Reconnect the cables and power cords (see “Connecting the memory expansion module cables” on page 92).
4. Slide the memory expansion module and the server back into the rack, if necessary.
5. Turn on the peripheral devices and the host server

## Replacing the memory expansion module system-board tray

To confirm that the memory expansion module supports the system-board tray that you are installing, see <http://www.ibm.com/systems/info/x86servers/serverproven/compat/us/>.

To replace the system-board tray, complete the following steps:

1. Read “Safety” on page v and “Installation guidelines” on page 38.
2. Grasp the system-board tray on both sides (near the stop-tabs) and align the system-board tray with the chassis.



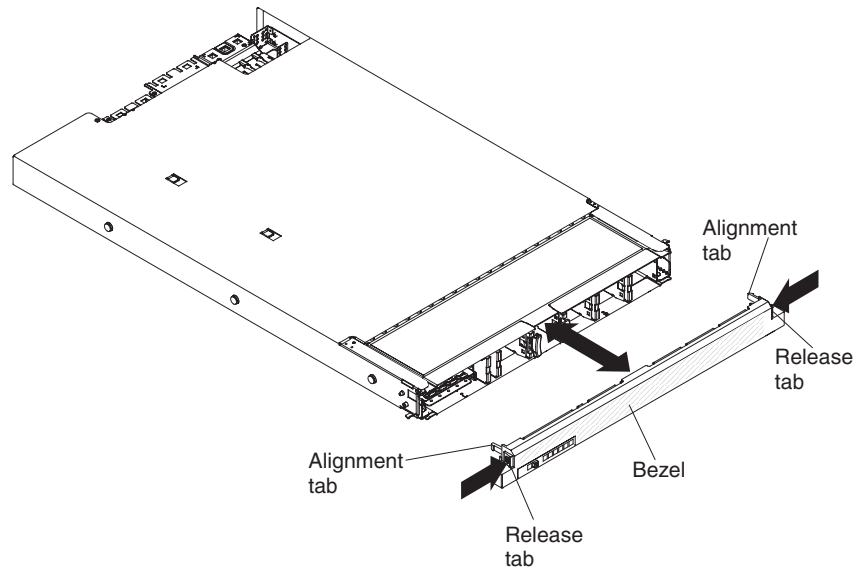
3. Slide the system-board tray forward until the tabs at the bottom of the handles touch the chassis; then, close the handles and press firmly on the release latches to snap them into the locked position.
4. Replace the bezel (see “Replacing the memory expansion module bezel” on page 92).

## Replacing the memory expansion module bezel

To confirm that the memory expansion module supports the bezel that you are installing, see <http://www.ibm.com/systems/info/x86servers/serverproven/compat/us/>.

To replace the memory expansion module bezel, complete the following steps:

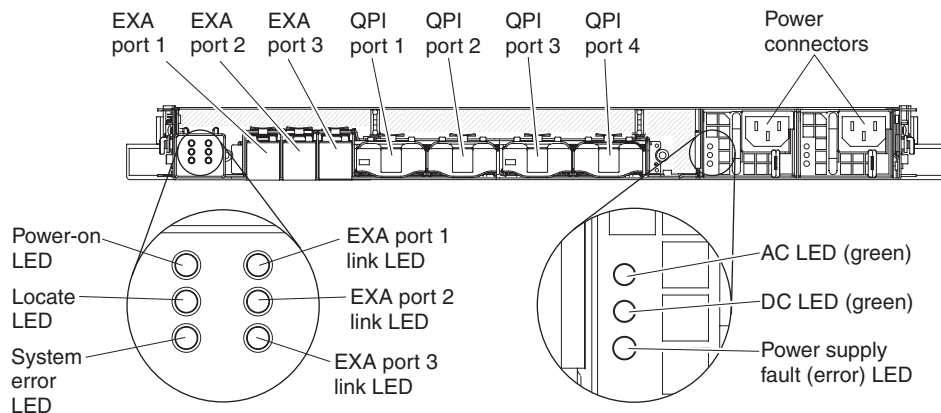
1. Read "Safety" on page v and "Installation guidelines" on page 38.
2. Align the bezel alignment tabs with the chassis and press the bezel onto the chassis until it snaps into place.



## Connecting the memory expansion module cables

To cable the memory expansion module to the host server, see the QPI cable option documentation and the EXA cable option documentation. Be sure to turn off the host server before you connect any cables to or disconnect any cables from the memory expansion module.

The following illustration shows the locations of the connectors on the rear of the memory expansion module.



## **Updating the memory expansion module configuration**

No configuration updates are required to be made directly to the memory expansion module. When the host server configuration is updated, the updates are automatically applied to the memory expansion module through the host server IMM.



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## Chapter 3. Configuring the server

The following configuration programs come with the server:

- **Setup utility**

The Setup utility (formerly called the Configuration/Setup Utility program) is part of the IBM UEFI firmware. Use it to perform configuration tasks such as changing the startup-device sequence, setting the date and time, and setting passwords. For information about using this program, see “Using the Setup utility” on page 96.

- **Configuring the memory expansion module**

The memory expansion module is automatically included in the server Setup utility when it is connected to it with the QPI cables.

- **Boot Selection Menu program**

The Boot Selection Menu program is part of the UEFI firmware. Use it to override the startup sequence that is set in the Setup utility and temporarily assign a device to be first in the startup sequence. For more information about using this program, see “Using the Boot Selection Menu program” on page 102.

- **IBM ServerGuide Setup and Installation CD**

The ServerGuide program provides software-setup tools and installation tools that are designed for the server. Use this CD during the installation of the server to configure basic hardware features, such as an integrated SAS controller with RAID capabilities, and to simplify the installation of your operating system. For information about obtaining and using this CD, see “Using the ServerGuide Setup and Installation CD” on page 102.

- **Integrated management module**

Use the integrated management module (IMM) for configuration, to update the firmware and sensor data record/field replaceable unit (SDR/FRU) data, and to remotely manage a network. For information about using the IMM, see “Using the integrated management module” on page 104 and the *Integrated Management Module User's Guide* on the IBM website.

- **VMware ESXi embedded hypervisor**

An USB flash device with VMware ESXi embedded hypervisor software might be included with some server models and available for purchase for other models. Hypervisor is virtualization software that enables multiple operating systems to run on a host system at the same time. The USB embedded hypervisor flash device installs in either of the I/O board internal USB ports. For more information about using the embedded hypervisor, see “Using the embedded hypervisor” on page 107.

- **Remote presence and blue-screen capture features**

The remote presence feature provides the following functions:

- Remotely viewing video with graphics resolutions up to 1280 x 1024 at 75 Hz, regardless of the system state
- Remotely accessing the server, using the keyboard and mouse from a remote client
- Mapping the CD or DVD drive, diskette drive, and USB flash drive on a remote client, and mapping ISO and diskette image files as virtual drives that are available for use by the server
- Uploading a diskette image to the IMM memory and mapping it to the server as a virtual drive

The blue-screen capture feature captures the video display contents before the IMM restarts the server when the IMM detects an operating-system hang condition. A system administrator can use the blue-screen capture feature to assist in determining the cause of the hang condition.

For more information, see “Using the remote presence and blue-screen capture features” on page 106

- **Ethernet controller configuration**

For information about configuring the Ethernet controller, see “Configuring the Broadcom Gigabit Ethernet controller” on page 108.

- **IBM Advanced Settings Utility (ASU) program**

Use this program as an alternative to the Setup utility for modifying UEFI settings and IMM settings. Use the ASU program online or out of band to modify UEFI settings from the command line without the need to restart the server to run the Setup utility. For information about using this program, see “IBM Advanced Settings Utility program” on page 109.

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## Using the Setup utility

Use the Setup utility to perform the following tasks:

- View configuration information
- View and change assignments for devices and I/O ports
- Set the date and time
- Set and change passwords
- Set the startup characteristics of the server and the order of startup devices
- Set and change settings for advanced hardware features
- View, set, and change settings for power-management features
- View and clear error logs
- Resolve configuration conflicts

## Starting the Setup utility

To start the Setup utility, complete the following steps:

1. Turn on the server.

**Note:** Approximately 3 minutes after the server is connected to ac power, the power-control button becomes active.

2. When the prompt <F1> Setup is displayed, press F1. If you have set an administrator password, you must type the administrator password to access the full Setup utility menu. If you do not type the administrator password, a limited Setup utility menu is available.
3. Select the settings to view or change.

## Setup utility menu choices

The following choices are on the Setup utility main menu. Depending on the version of the IBM UEFI firmware, some menu choices might differ slightly from these descriptions.

- **System Information**

Select this choice to view information about the server. When you make changes through other choices in the Setup utility, some of those changes are reflected in the system information; you cannot change settings directly in the system information.

This choice is on the full Setup utility menu only.

- **System Summary**

Select this choice to view configuration information, including the ID, speed, and cache size of the microprocessors; machine type and model of the server; the serial number; the system UUID; and the amount of installed memory. When you make configuration changes through other choices in the Setup utility, the changes are reflected in the system summary; you cannot change settings directly in the system summary.

- **Product Data**

Select this choice to view the system-board identifier and the revision level or issue date of the server firmware, integrated management module, and diagnostics code.

- **System Settings**

Select this choice to view or change the server component settings. This choice is on the full Setup utility menu only.

- **Adapters and UEFI Drivers**

Select this choice to view information about the adapters and device drivers in the server that are compliant with EFI 1.10 and UEFI 2.0.

- **Processors**

Select this choice to view or change the processor settings.

- **Memory**

Select this choice to view or change the memory settings. To configure memory mirroring, select **System Settings** → **Memory** → **Memory Mirroring Mode** → **Mirrored**.

- **Devices and I/O Ports**

Select this choice to view or change assignments for devices and input/output (I/O) ports. You can configure the serial ports; configure remote console redirection; enable or disable integrated Ethernet controllers, the SAS/SATA controller, SATA optical drive channels, and PCI slots; and view the system Ethernet MAC addresses. If you disable a device, it cannot be configured, and the operating system will not be able to detect it (this is equivalent to disconnecting the device).

- **Power**

Select this choice to view or change power settings.

- **Active Energy Manager**

Select this choice to enable or disable power capping. If you enable power capping, the Active Energy Manager program will limit the maximum power that is consumed by the server.

- **Power Restore Policy**

Select this choice to determine the mode of operation to which the server will be restored after a power outage occurs. You can select **Always on**, **Always off**, or **Restore** to restore the server the state it was in at the time of the power outage.

- **Operating Modes**

Select this choice to select the memory speed or to specify a preset operating mode to configure the server for maximum power savings, maximum efficiency, or maximum performance.

- **Efficiency mode**

Select this choice to maintain the optimal balance between performance and power consumption. The server generally produces the best performance per watt while it is in this mode.

- **Acoustic mode**

Select this choice to configure the server to draw the minimum amount of power and generate the least noise. Server performance might be degraded depending on the application that you are running.

- **Performance mode**

Select this choice to achieve the highest absolute performance for most server applications. The power consumption in this mode is often higher than in the Efficiency or Acoustics mode.

- **Custom mode**

Select this choice only if you understand the functions of the low-level IMM settings. This is the only choice that enables you to change the low-level IMM settings that affect the performance and power consumption of the server.

- **Integrated Management Module**

Select this choice to view or change the settings for the integrated management module.

- **POST Watchdog Timer**

Select this choice to view or enable the POST watchdog timer.

- **POST Watchdog Timer Value**

Select this choice to view or set the POST loader watchdog timer value.

- **Reboot System on NMI**

Enable or disable restarting the server whenever a nonmaskable interrupt (NMI) occurs. **Disabled** is the default.

- **Commands on USB Interface Preference**

Enable or disable the Ethernet over USB interface on IMM.

- **Network Configuration**

Select this choice to view and select the system management network interface port, the IMM MAC address, the current IMM IP address, and host name; define the static IMM IP address, subnet mask, and gateway address; specify whether to use the static IP address or have DHCP assign the IMM IP address; save the network changes; and reset the IMM.

- **Reset IMM to Defaults**

Select this choice to view or reset the IMM to the default settings.

- **Reset IMM**

Select this choice to reset the IMM settings.

- **Legacy Support**

Select this choice to view or set legacy support.

- **Force Legacy Video on Boot**

Select this choice to force INT video support, if the operating system does not support UEFI video output standards.

- **Rehook INT**



Select this choice to enable or disable devices from taking control of the boot process. The default is **Disable**.

- **Legacy Thunk Support**

Select this choice to enable or disable UEFI to interact with PCI mass storage devices that are not UEFI compliant.

- **Network**

Select this choice to view or configure optional network devices, such as iSCSI, PXE, and network devices. There might be additional configuration choices for optional network devices that are compliant with UEFI 2.1 and later.

- **Date and Time**

Select this choice to set the date and time in the server, in 24-hour format (*hour:minute:second*).

This choice is on the full Setup utility menu only.

- **Start Options**

Select this choice to view or change the start options, including the startup sequence, keyboard NumLock state, PXE boot option, and PCI device boot priority. Changes in the startup options take effect when you restart the server.

The startup sequence specifies the order in which the server checks devices to find a boot record. The server starts from the first boot record that it finds. If the server has Wake on LAN hardware and software and the operating system supports Wake on LAN functions, you can specify a startup sequence for the Wake on LAN functions. For example, you can define a startup sequence that checks for a disc in the CD-RW/DVD drive, then checks the hard disk drive, and then checks a network adapter.

This choice is on the full Setup utility menu only.

- **Boot Manager**

Select this choice to view, add, or change the device boot priority, boot from a file, select a one-time boot, or reset the boot order to the default setting.

- **System Event Logs**

Select this choice to access the System Event Manager, where you can view the POST event log and the system-event log.

The POST event log contains the three most recent error codes and messages that were generated during POST.

The system-event log contains POST and system management interrupt (SMI) events and all events that are generated by the baseboard management controller that is embedded in the integrated management module.

**Important:** If the system-error LED on the front of the server is lit but there are no other error indications, clear the system-event log. Also, after you complete a repair or correct an error, clear the system-event log to turn off the system-error LED on the front of the server.

- **POST Event Viewer**

Select this choice to access the POST event viewer to view the POST event log.

- **System Event Log**

Select this choice to view the system-event log.

- **Clear System Event Log**

Select this choice to clear the system-event log.

- **User Security**

Select this choice to set, change, or clear passwords. For information about passwords, see "Passwords."

This choice is on the full and limited Setup utility menu.

- **Set Power-on Password**

Select this choice to set or change a power-on password. For more information, see "Power-on password" on page 101.

- **Clear Power-on Password**

Select this choice to clear a power-on password.

- **Set Administrator Password**

Select this choice to set or change an administrator password. An administrator password is intended to be used by a system administrator; it limits access to the full Setup utility menu. If an administrator password is set, the full Setup utility menu is available only if you type the administrator password at the password prompt. For more information, see "Administrator password" on page 101.

- **Clear Administrator Password**

Select this choice to clear an administrator password.

- **Save Settings**

Select this choice to save the changes that you have made in the settings.

- **Restore Settings**

Select this choice to cancel the changes that you have made in the settings and restore the previous settings.

- **Load Default Settings**

Select this choice to cancel the changes that you have made in the settings and restore the factory settings.

- **Exit Setup**

Select this choice to exit from the Setup utility. If you have not saved the changes that you have made in the settings, you are asked whether you want to save the changes or exit without saving them.

## Passwords

From the **User Security** menu choice, you can set, change, and delete a power-on password and an administrator password. The **User Security** choice is on the full Setup utility menu only.

If you set only a power-on password, you must type the power-on password to complete the system startup and to have access to the full Setup utility menu.

An administrator password is intended to be used by a system administrator; it limits access to the full Setup utility menu. If you set only an administrator password, you do not have to type a password to complete the system startup, but you must type the administrator password to access the Setup utility menu.

If you set a power-on password for a user and an administrator password for a system administrator, you can type either password to complete the system startup. A system administrator who types the administrator password has access to the full Setup utility menu; the system administrator can give the user authority to set, change, and delete the power-on password. A user who types the power-on

password has access to only the limited Setup utility menu; the user can set, change, and delete the power-on password, if the system administrator has given the user that authority.

## Power-on password

If a power-on password is set, when you turn on the server, you must type the power-on password to complete the system startup. You can use any combination of 6 - 20 printable ASCII characters for the password.

If a power-on password is set, you can enable the Unattended Start mode, in which the keyboard and mouse remain locked but the operating system can start. You can unlock the keyboard and mouse by typing the power-on password.

If you forget the power-on password, you can regain access to the server in any of the following ways:

- If an administrator password is set, type the administrator password at the password prompt. Start the Setup utility and reset the power-on password.
- Remove the battery from the server and then reinstall it. For instructions for removing the battery, see the *Problem Determination and Service Guide* on the IBM Documentation CD.

**Attention:** Before you change any switch settings or move any jumpers, turn off the server; then, disconnect all power cords and external cables. See "Safety" on page v. Do not change settings or move jumpers on any system-board switch or jumper blocks that are not shown in this document.

- Change the position of the power-on password override jumper to bypass the power-on password check (see "I/O-board jumpers" on page 37 for more information). The default for the Password override jumper (J29) is pins 1 and 2. While the server is turned off, move the jumper to another position (for example pins 2 and 3) to enable the power-on password override. The power-on password prompt bypasses only once after you move the jumper. Start the Setup utility and reset or clear the power-on password.

You do not have to return the jumper to the previous position.

The power-on password override jumper does not affect the administrator password.

**Attention:** Before you move any jumpers, turn off the server; then, disconnect all power cords and external cables. See "Safety" on page v. Do not change settings or move jumpers on any system-board switch or jumper blocks that are not shown in this document.

## Administrator password

If an administrator password is set, you must type the administrator password for access to the full Setup utility menu. You can use any combination of 6 - 20 printable ASCII characters for the password.

**Attention:** If you set an administrator password and then forget it, there is no way to change, override, or remove it. You must replace the I/O board.

---

## Using the Boot Selection Menu program

The Boot Selection Menu is used to temporarily redefine the first startup device without changing boot options or settings in the Setup utility.

To use the Boot Selection Menu program, complete the following steps:

1. Turn off the server.
2. Restart the server.
3. When the prompt <F12> Select Boot Device is displayed, press F12. If a bootable USB mass storage device is installed, a submenu item (**USB Key/Disk**) is displayed.
4. Use the Up Arrow and Down Arrow keys to select an item from the menu and press Enter.

The next time the server starts, it returns to the startup sequence that is set in the Setup utility.

---

## Starting the backup UEFI firmware

The system board contains a backup copy area for the UEFI firmware. This is a secondary copy of the UEFI firmware that you update only during the process of updating the UEFI firmware. If the primary copy of the UEFI firmware becomes damaged, use this backup copy.

To force the server to start from the backup copy of the UEFI firmware, turn off the server; then, move the UEFI boot recovery J22 jumper to the backup position (pins 2 and 3).

Use the backup copy of the UEFI firmware until the primary copy is restored. After the primary copy is restored, turn off the server; then, move the UEFI boot recovery J22 jumper back to the primary position (pins 1 and 2).

---

## Using the ServerGuide Setup and Installation CD

The *ServerGuide Setup and Installation* CD provides software setup tools and installation tools that are designed for your server. The ServerGuide program detects the server model and optional hardware devices that are installed and uses that information during setup to configure the hardware. The ServerGuide program simplifies operating-system installations by providing updated device drivers and, in some cases, installing them automatically.

You can download a free image of the *ServerGuide Setup and Installation* CD or purchase the CD from the ServerGuide fulfillment website at <http://www.ibm.com/systems/management/serverguide/sub.html>. To download the free image, click **IBM Service and Support Site**.

**Note:** Changes are made periodically to the IBM website. The actual procedure might vary slightly from what is described in this document.

The ServerGuide program requires a supported IBM server with an enabled startable (bootable) CD drive. In addition to the *ServerGuide Setup and Installation* CD, you must have your operating-system CD to install the operating system.

To start the *ServerGuide Setup and Installation* CD, complete the following steps:

1. Insert the CD, and restart the server. If the CD does not start, see "ServerGuide problems" in the *Problem Determination and Service Guide* on the IBM *Documentation* CD.
2. Follow the instructions on the screen to complete the following tasks:
  - a. Select your language.
  - b. Select your keyboard layout and country.
  - c. View the overview to learn about ServerGuide features.
  - d. View the readme file to review installation tips for your operating system and adapter.
  - e. Start the operating-system installation. you will need your operating-system CD.

## ServerGuide features

Features and functions can vary slightly with different versions of the ServerGuide program. To learn more about the version that you have, start the *ServerGuide Setup and Installation* CD and view the online overview. Not all features are supported on all server models.

The ServerGuide program has the following features:

- An easy-to-use interface
- Diskette-free setup, and configuration programs that are based on detected hardware
- Device drivers that are provided for the server model and detected hardware
- Operating-system partition size and file-system type that are selectable during setup

The ServerGuide program performs the following tasks:

- Sets system date and time
- Detects the RAID adapter or controller and runs the SAS RAID configuration program (with LSI chip sets for ServeRAID adapters only)
- Checks the microcode (firmware) levels of a ServeRAID adapter and determines whether a later level is available from the CD
- Detects installed optional hardware devices and provides updated device drivers for most adapters and devices
- Provides diskette-free installation for supported Windows operating systems
- Includes an online readme file with links to tips for hardware and operating-system installation

## Setup and configuration overview

When you use the *ServerGuide Setup and Installation* CD, you do not need setup diskettes. You can use the CD to configure any supported IBM server model. The setup program provides a list of tasks that are required to set up your server model. On a server with a ServeRAID adapter or integrated SCSI controller with RAID capabilities, you can run the SCSI RAID configuration program to create logical drives.

**Note:** Features and functions can vary slightly with different versions of the ServerGuide program.

## Typical operating-system installation

The ServerGuide program can reduce the time it takes to install an operating system. It provides the device drivers that are required for your hardware and for the operating system that you are installing. This section describes a typical ServerGuide operating-system installation.

**Note:** Features and functions can vary slightly with different versions of the ServerGuide program.

1. After you have completed the setup process, the operating-system installation program starts. (You will need your operating-system CD to complete the installation.)
2. The ServerGuide program stores information about the server model, service processor, hard disk drive controllers, and network adapters. Then, the program checks the CD for newer device drivers. This information is stored and then passed to the operating-system installation program.
3. The ServerGuide program presents operating-system partition options that are based on your operating-system selection and the installed hard disk drives.
4. The ServerGuide program prompts you to insert your operating-system CD and restart the server. At this point, the installation program for the operating system takes control to complete the installation.

## Installing your operating system without using ServerGuide

If you have already configured the server hardware and you are not using the ServerGuide program to install your operating system, you can download operating-system installation instructions for the server from <http://www.ibm.com/supportportal/>.

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## Using the integrated management module

The integrated management module (IMM) is a second generation of the functions that were formerly provided by the baseboard management controller hardware. It combines service processor functions, video controller, and remote presence function in a single chip.

The IMM supports the following basic systems-management features:

- Active Energy Manager.
- Alerts (in-band and out-of-band alerting, PET traps - IPMI style, SNMP, e-mail).
- Auto Boot Failure Recovery.
- Automatic Server Restart (ASR) when POST is not complete or the operating system hangs and the operating-system watchdog timer times out. The IMM might be configured to watch for the operating-system watchdog timer and restart the server after a timeout, if the ASR feature is enabled. Otherwise, the IMM allows the administrator to generate an NMI by pressing a nonmaskable interrupt button on the information panel for an operating-system memory dump. ASR is supported by Intelligent Peripheral Management Interface (IPMI).
- Boot sequence manipulation.
- Command-line interface.
- Configuration save and restore.

- DIMM error assistance. The Unified Extensible Firmware Interface (UEFI) disables a failing DIMM that is detected during POST, and the IMM lights the associated system-error LED and the failing DIMM error LED.
- Environmental monitor with fan speed control for temperature, voltages, fan failure, and power supply failure.
- Intelligent Platform Management Interface (IPMI) Specification V2.0 and Intelligent Platform Management Bus (IPMB) support.
- Invalid system configuration (CNFG) LED support.
- Light path diagnostics LEDs to report errors that occur with fans, power supplies, microprocessor, hard disk drives, and system errors.
- Nonmaskable interrupt (NMI) detection and reporting.
- Operating-system failure blue screen capture.
- PCI configuration data.
- PECI 2 support.
- Power/reset control (power-on, hard and soft shutdown, hard and soft reset, schedule power control).
- Query power-supply input power.
- ROM-based IMM firmware flash updates.
- Serial over LAN (SOL).
- Serial port redirection over Telnet or SSH.
- System-event log.

When one of the two microprocessors reports an internal error, the IMM disables the defective microprocessor and restarts the server with the one good microprocessor.

The IMM also provides the following remote server management capabilities through the OSA SMBridge management utility program:

- **Command-line interface (IPMI Shell)**

The command-line interface provides direct access to server management functions through the IPMI 2.0 protocol. Use the command-line interface to issue commands to control the server power, view system information, and identify the server. You can also save one or more commands as a text file and run the file as a script.

- **Serial over LAN**

Establish a Serial over LAN (SOL) connection to manage servers from a remote location. You can remotely view and change the UEFI settings, restart the server, identify the server, and perform other management functions. Any standard Telnet client application can access the SOL connection.

## Obtaining the IP address for the IMM web interface access

To access the IMM web interface, you need the IP address of the IMM, which you can obtain through the Setup utility. To obtain the IP address, complete the following steps:

1. Turn on the server.
2. When the prompt <F1> Setup is displayed, press F1. If you have set both a power-on password and an administrator password, you must type the administrator password to access the full Setup utility menu.

3. Select **System Settings** → **Integrated Management Module** → **Network Configuration**.
4. Locate the IP address.
5. Exit from the Setup utility.

## Logging on to the IMM web interface

For detailed information about the integrated management module (IMM) and how to use it, see the *Integrated Management Module User's Guide* at <http://www.ibm.com/systems/support/>.

To log on to the IMM web interface, complete the following steps:

1. Open a Web browser and in the **Address** or **URL** field, type the IP address or host name of the IMM to which you want to connect.

**Note:** If you are logging on to the IMM for the first time after installation, the IMM defaults to DHCP. If a DHCP host is not available, the IMM assigns a static IP address of 192.168.70.125. The MAC address tag provides the default host name of the IMM and does not require you to start the server.

2. On the Login page, type the user name and password. If you are using the IMM for the first time, you can obtain the user name and password from your system administrator. All login attempts are documented in the system-event log.

**Note:** The IMM is set initially with a user name of USERID and password of PASSWORD (with a zero, not the letter O). You have read/write access. You must change this default password the first time you log on.

3. On the Welcome page, type a timeout value (in minutes) in the field that is provided. The IMM will log you off the web interface if your browser is inactive for the number of minutes that you entered for the timeout value.
4. Click **Continue** to start the session. The System Status page provides a quick view of the server status.

---

## Using the remote presence and blue-screen capture features

The remote presence and blue-screen capture features are integrated functions of the integrated management module (IMM).

The remote presence feature provides the following functions:

- Remotely viewing video with graphics resolutions up to 1600 x 1200 at 85 Hz, regardless of the system state
- Remotely accessing the server, using the keyboard and mouse from a remote client
- Mapping the CD or DVD drive, diskette drive, and USB flash drive on a remote client, and mapping ISO and diskette image files as virtual drives that are available for use by the server
- Uploading a diskette image to the IMM memory and mapping it to the server as a virtual drive

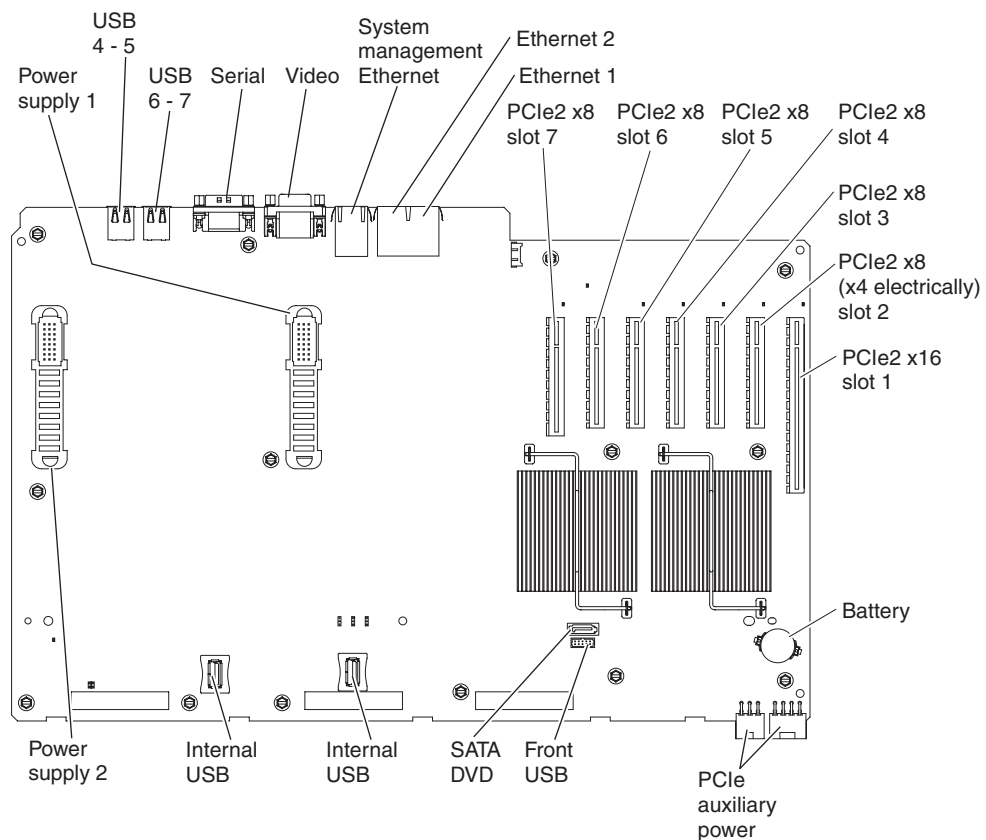


The blue-screen capture feature captures the video display contents before the IMM restarts the server when the IMM detects an operating-system hang condition. A system administrator can use the blue-screen capture to assist in determining the cause of the hang condition.

## Using the embedded hypervisor

The VMware ESXi embedded hypervisor software might be available on the IBM USB flash device with embedded hypervisor. The USB flash device can be installed in either of the I/O board internal USB ports (see the following illustration). Hypervisor is virtualization software that enables multiple operating systems to run on a host system at the same time. The USB flash device is required to activate the hypervisor functions.

**Note:** When you add an optional memory expansion module to your server configuration and you plan to use the optional USB flash device with VMware ESXi embedded hypervisor software, see the documentation that comes with the USB flash device and the operating system installation instructions for installing VMware ESXi (or ESX, depending on your environment) on your server at <http://www.ibm.com/systems/support/>. The documentation provides additional installation and configuration information that you must follow before you use the memory expansion module.



To start using the embedded hypervisor functions, you must add the USB flash device to the startup sequence in the Setup utility.

To add the USB flash device to the startup sequence, complete the following steps:

1. Turn on the server.

**Note:** Approximately 1 to 3 minutes after the server is connected to ac power, the power-control button becomes active.

2. When the prompt <F1> Setup is displayed, press F1.
3. From the Setup utility main menu, select **Boot Manager**.
4. Select **Add Boot Option**; then, select **USB Storage**. Press Enter, and then press Esc.
5. Select **Change Boot Order** and then select **Commit Changes**; then, press Enter.
6. Select **Save Settings** and then select **Exit Setup**.

If the embedded hypervisor flash device image becomes corrupted, you can use the *VMware Recovery* CD that comes with the server to recover the flash device image. To recover the flash device image, complete the following steps:

1. Turn on the server.

**Note:** Approximately 1 to 3 minutes after the server is connected to ac power, the power-control button becomes active.

2. Insert the VMware Recovery CD into the CD or DVD drive.
3. Follow the instructions on the screen.

For additional information and instructions, see the *VMware ESXi Server 31 Embedded Setup Guide* at [http://www.vmware.com/pdf/vi3\\_35/esx\\_3i\\_e/r35/vi3\\_35\\_25\\_3i\\_setup.pdf](http://www.vmware.com/pdf/vi3_35/esx_3i_e/r35/vi3_35_25_3i_setup.pdf)

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## Enabling the Broadcom Gigabit Ethernet Utility program

The Broadcom Gigabit Ethernet Utility program is part of the server firmware. You can use it to configure the network as a startable device, and you can customize where the network startup option appears in the startup sequence. Enable and disable the Broadcom Gigabit Ethernet Utility program from the Setup utility.

---

## Configuring the Broadcom Gigabit Ethernet controller

The Ethernet controllers are integrated on the system board. They provide an interface for connecting to a 10 Mbps, 100 Mbps, or 1 Gbps network and provide full-duplex (FDX) capability, which enables simultaneous transmission and reception of data on the network. If the Ethernet ports in the server support auto-negotiation, the controllers detect the data-transfer rate (10BASE-T, 100BASE-TX, or 1000BASE-T) and duplex mode (full-duplex or half-duplex) of the network and automatically operate at that rate and mode.

You do not have to set any jumpers or configure the controllers. However, you must install a device driver to enable the operating system to address the controllers. For device drivers and information about configuring the Ethernet controllers, see the *Broadcom NetXtreme II Gigabit Ethernet Software* CD. To find updated information about configuring the controllers, go to <http://www.ibm.com/supportportal/>.

---

## Configuring RAID arrays

Through the Setup utility, you can access utilities to configure RAID arrays. The specific procedure for configuring arrays depends on the RAID controller that you are using. For details, see the documentation for your RAID controller. To access the utility for your RAID controller, complete the following steps:

1. Turn on the server.
2. When the prompt <F1> Setup is displayed, press F1. If you have set an administrator password, you must type the administrator password to access the full Setup utility menu. If you do not type the administrator password, a limited Setup utility menu is available.
3. Select **System Settings** → **Adapters and UEFI drivers**.
4. Press Enter to refresh the list of device drivers.
5. Select the device driver for your RAID controller and press Enter.
6. Follow the instructions in the documentation for your RAID controllers.

---

## IBM Advanced Settings Utility program

The IBM Advanced Settings Utility (ASU) program is an alternative to the Setup utility for modifying UEFI settings. Use the ASU program online or out of band to modify UEFI settings from the command line without the need to restart the server to access the Setup utility.

You can also use the ASU program to configure the optional remote presence feature or other IMM settings. The remote presence feature provides enhanced systems-management capabilities.

In addition, the ASU program provides limited settings for configuring the IPMI function in the IMM through the command-line interface.

Use the command-line interface to issue setup commands. You can save any of the settings as a file and run the file as a script. The ASU program supports scripting environments through a batch-processing mode.

For more information and to download the ASU program and the *Advanced Settings Utility User's Guide*, go to <http://www.ibm.com/systems/support/supportsite.wss/docdisplay?lnocid=TOOL-ASU&brandind=5000008>.

---

## Updating IBM Systems Director

If you plan to use IBM Systems Director to manage the server, you must check for the latest applicable IBM Systems Director updates and interim fixes.

**Note:** Changes are made periodically to the IBM Web site. The actual procedure might vary slightly from what is described in this document.

To locate and install a newer version of IBM Systems Director, complete the following steps:

1. Check for the latest version of IBM Systems Director:
  - a. Go to <http://www.ibm.com/systems/management/director/downloads.html>.

- b. If a newer version of IBM Systems Director than what comes with the server is shown in the drop-down list, follow the instructions on the Web page to download the latest version.
2. Install the IBM Systems Director program.

If your management server is connected to the Internet, to locate and install updates and interim fixes, complete the following steps:

1. Make sure that you have run the Discovery and Inventory collection tasks.
2. On the Welcome page of the IBM Systems Director Web interface, click **View updates**.
3. Click **Check for updates**. The available updates are displayed in a table.
4. Select the updates that you want to install, and click **Install** to start the installation wizard.

If your management server is not connected to the Internet, to locate and install updates and interim fixes, complete the following steps:

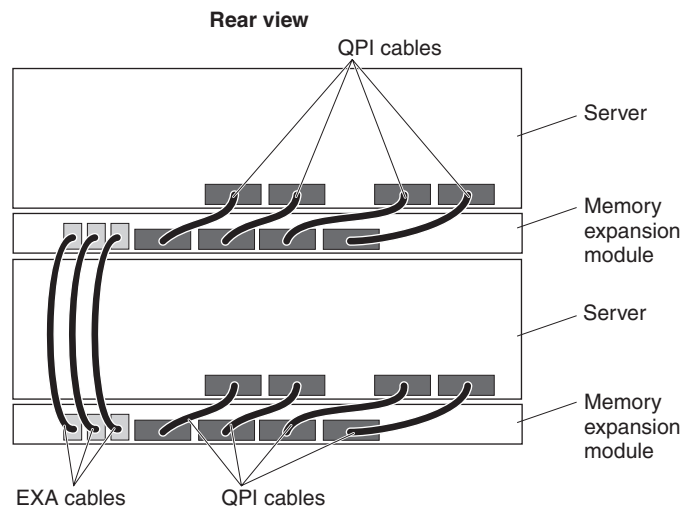
1. Make sure that you have run the Discovery and Inventory collection tasks.
2. On a system that is connected to the Internet, go to <http://www.ibm.com/eserver/support/fixes/fixcentral/>.
3. From the **Product family** list, select **IBM Systems Director**.
4. From the **Product** list, select **IBM Systems Director**.
5. From the **Installed version** list, select the latest version, and click **Continue**.
6. Download the available updates.
7. Copy the downloaded files to the management server.
8. On the management server, on the Welcome page of the IBM Systems Director Web interface, click the **Manage** tab, and click **Update Manager**.
9. Click **Import updates** and specify the location of the downloaded files that you copied to the management server.
10. Return to the Welcome page of the Web interface, and click **View updates**.
11. Select the updates that you want to install, and click **Install** to start the installation wizard.

---

## Configuring an EXA multi-node system

**Note:** The EXA scalability feature is supported only in memory expansion modules that contain the Intel 7510 Scalable Memory Buffer.

This feature requires scalability cables and firmware that supports X-Architecture scalability from one memory expansion module to another memory expansion module. In a 2-node EXA scaled configuration, each memory expansion module is connected to an x3850 X5 or x3950 X5 server, and the memory expansion modules are connected to each other through the EXA scalability cables. (For detailed installation instructions, see the documentation that came with the EXA cables.)



The Scalable Partition web interface is an extension of the IMM web interface and is used to create, delete, control, and view scalable partitions. The Scalable Partition web interface firmware is in the IMM.

A multi-node configuration interconnects multiple servers or scalable partitions. When two servers with memory expansion module configurations are connected through EXA cables, you can merge this multi-node configuration to form a single logical server or partition it into multiple stand-alone servers without removing any cables. This capability to partition a multi-node server into several individual servers without removing any cables is referred to as IBM FlexNode Technology.

As a single logical server, the server is able to use resources from all scalable partitions. The server uses a single, contiguous memory space and provides access to all associated adapters, hard disk drives, and USB devices (including the mouse and keyboard). PCI slot numbering starts with the primary node and continues with the secondary nodes, in numeric order of the logical node IDs. The internal optical drive and VGA connection on the secondary node are disabled, and the server cannot use them.

**Note:** When the server is configured as a single logical server, if there is an ac system power failure to one of the nodes (partitions), the remaining good node powers itself down and remains off until the failing node recovers from the ac power loss. Remote users will not receive any warning or error messages that the partition has failed, but local users will see a 00.bb blinking sequence on the front panel checkpoint display. After the power is restored, both nodes will automatically turn on and boot as a two-node partition. If you replace the I/O card in the server, follow the instructions for creating an EXA multi-node system.

In a stand-alone server, each scalable partition supports an independent operating-system installation. In addition, each scalable partition uses its own individual resources (one server and the associated memory expansion module) as an independent system. One stand-alone server cannot boot an operating system on another stand-alone server.

## Creating an EXA multi-node system

The following information provides instructions for creating an EXA multi-node system from multiple servers and configuring it as a single logical 8-socket server.

**Note:** To check for the latest firmware levels and to download firmware updates, go to <http://www.ibm.com/supportportal/>.

Before you create an EXA multi-node system, make sure that all the nodes in the multi-node configuration contain the following software and hardware:

- The current level of UEFI firmware, SAS UEFI code, IMM firmware, and FPGA firmware (all nodes must be at the same level)
- Microprocessors that are the same cache size, type, and clock speed

**Note:** All the nodes must have all the microprocessor sockets and memory connectors populated.

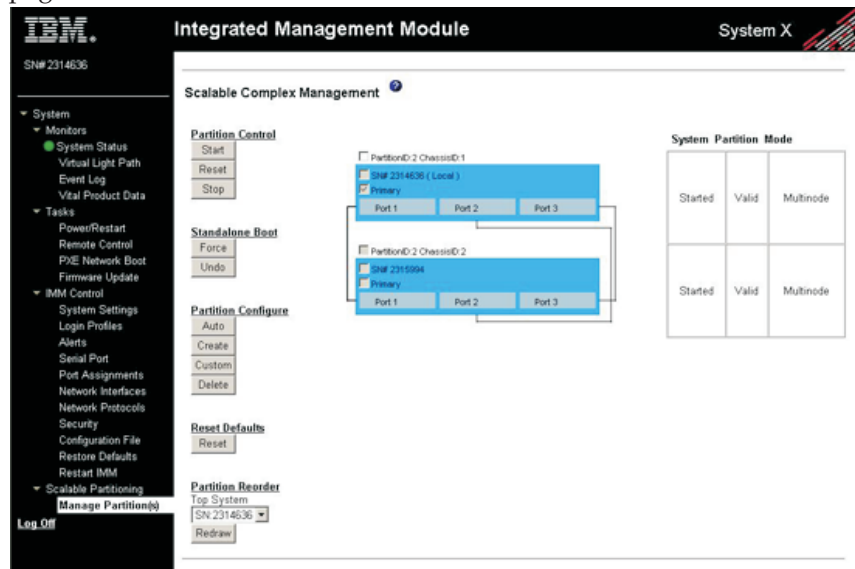
To create a scalable partition, complete the following steps:

1. Connect the EXA cables. For detailed instructions, see the documentation that comes with your cables.
2. Connect all nodes to an ac power source and make sure that they are not running an operating system.

**Note:** All nodes that are part of an existing partition and are connected through EXA cables must be in Standalone mode (part of the partition but operating independently). To enable Standalone mode, on the Scalable Complex Management page, click **Standalone Boot**, and then click **Force**.

3. Connect and log in to the IMM web interface.

**Note:** For instructions for creating, modifying, and controlling partitions through the IMM Telnet interface, see “Using the IMM Telnet interface” on page 114.



4. In the navigation pane, click **Scalable Partitioning**, and then click **Manage Partition(s)**. Use the Scalable Complex Management page to create, delete, control, and view scalable partitions. Select the primary node; then, automatically or manually create a scalable partition:
  - To automatically create a single partition that uses all nodes in the multi-node configuration, click **Partition Configure**, and then click **Auto**.
  - To manually assign nodes to the partition, click **Partition Configure**, select the nodes you want to include as members of the partition, and then click **Create**.

**Note:** To reorder the sequence in which the nodes appear in the diagram on the page, click **Redraw**. For example, you can reorder the diagram to reflect the order in which the nodes are physically installed in a rack. The nodes are reordered according to the QPI or EXA cabling, with the node that you select in the top position.

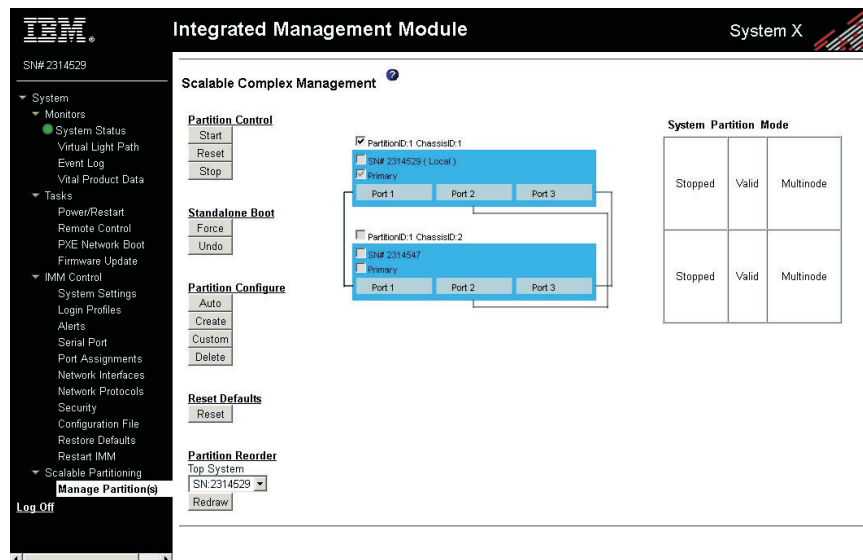
## Partitioning an EXA multi-node system

There are two ways to partition an EXA multi-node system into stand-alone servers: deleting the partition configuration and forcing a stand-alone boot. Both methods are performed through the IMM web interface from the Manage Partition(s) page, through the IMM in either server. The benefit of forcing a stand-alone boot is that you can restore the original partition information by clicking **Undo**.

**Note:** For instructions for creating, modifying, and controlling partitions through the IMM Telnet interface, see “Using the IMM Telnet interface” on page 114.

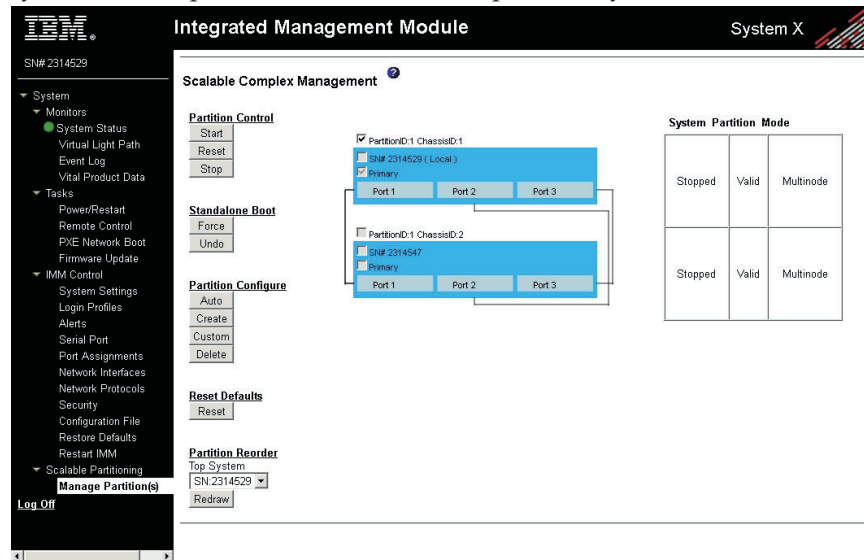
To partition an EXA multi-node system, complete the following steps:

1. Connect and log in to the IMM web interface.
2. Make sure that the scaled system is powered off. In the navigation pane, expand **Scalable Partitioning**, and click **Manage Partition(s)**. Both nodes should be indicated as stopped.
3. Select the chassis that you are connected to through the IMM. The interface control for the other chassis should be disabled.



4. Determine which method you plan to use to partition the multi-node server:
  - To delete the partition, click **Partition Configuration**, and then click **Delete**.
  - To force a stand-alone boot, click **Standalone Boot**, and then click **Force**.

- Make sure that each chassis is in Standalone mode, which indicates that the system is now partitioned into two independent systems.



## Using the IMM Telnet interface

You can create, modify, and control partitions through the IMM Telnet interface. To use the IMM Telnet interface, log in to the IMM Telnet interface on either node and use the scale command for multi-node control and configuration.

To display scale information, in the IMM Telnet interface, type `scale` at the system prompt. Information similar to the following example is displayed.

```
Node UUID: 92CF1100F19111DF8000E41F13E455FC
Node ID: 3c0d
Node SN:
Node Power State: off
Node Partition ID: na
Node Logical ID: na
Node Primary: na
Node Mode: na
```

```
Node UUID: C7C92400EE7011DF8000E41F13E454E4
Node ID: 8bb9
Node SN:
Node Power State: off
Node Partition ID: na
Node Logical ID: na
Node Primary: na
Node Mode: na
```

## Creating a partition by using the IMM Telnet interface

**Note:** Before you create a partition, make sure that the nodes that you intend to include in the partition are powered off and are not in any active partition.



You can create partitions through the IMM Telnet interface by using the auto command (`scale -auto primarynodeid`) or the create command (`scale -create primarynodeid, nodeid`) command.

You can use the auto command to create a partition that includes all the nodes in the complex and specify the node that is to be the primary node. For example, if the EXA system contains only two nodes, 3c0d and 8bb9, to create a 2-node partition with node 3c0d as the primary node, type `scale -auto 3c0d`.

You can use the create command to specify the nodes in the complex that are to be included in the partition. The first node ID in the argument is the primary node. For example, if the EXA system includes nodes 3c0d and 8bb9, to create a 2-node partition with node 3c0d as the primary node, type `scale -create 3c0d, 8bb9`.

After you use either method to create the partition, the scale information is updated with the node partition ID assigned to the partition for future partition operation. When you type `scale` at the system prompt, information similar to the following example is displayed.

```
Node UUID: 92CF1100F19111DF8000E41F13E455FC
Node ID: 3c0d
Node SN:
Node Power State: off
Node Partition ID: 1
Node Logical ID: 0
Node Primary: yes
Node Mode: partition
```

```
Node UUID: C7C92400EE7011DF8000E41F13E454E4
Node ID: 8bb9
Node SN:
Node Power State: off
Node Partition ID: 1
Node Logical ID: 1
Node Primary: no
Node Mode: partition
```

## Deleting a partition by using the IMM Telnet interface

**Note:** Before you delete a partition, make sure that all the nodes in the partition are powered off.

You can delete partitions through the IMM Telnet interface by using the delete command (`scale -delete`) command or the delete -partid command (`scale -delete -partid id`) command.

You can use the delete command to delete all partitions in the complex.

You can use the delete -partid command to delete a specific partition. For example, to delete partition 1, type `scale -delete -partid 1`.

## toggling partitions by using the IMM Telnet interface

**Note:** Before you toggle a partition to Standalone mode, make sure that all the nodes in the partition are powered off.

A partition can be in either of two modes: Standalone and Partition. When the partition is in Standalone mode, each node operates independently. When the partition is in Partition mode, all the nodes in the partition boot as a single system.

The command to toggle the partition is `scale -mode standalone|partition -partid id`.

For example, to set partition 1 in Standalone mode, type `scale -mode standalone -partid 1`.

## Starting, stopping, and resetting by using the IMM Telnet interface

There are three additional partition commands that you can use with the IMM Telnet interface: start, stop, and reset.

You can use the start command (`scale -start {-partid id | -node nodeid}`) to start a partition or node. When you use this command, if the node is in a partition and the partition is not in Standalone mode, all the nodes in the partition will power on. For example, to start partition 1, type `scale -start -partid 1`.

Use the reset command (`scale -reset {-partid id | -node nodeid}`) to reset a partition or node. When you use this command, if the node is in a partition and the partition is not in Standalone mode, all the nodes in the partition will be reset.

Use the stop command (`scale -stop {-partid id | -node nodeid}`) to shut down a partition or node. When you use this command, if the node is in a partition and the partition is in Standalone mode, all the nodes in the partition will power off. For example, to stop node 8bb9, type `scale -stop -node 8bb9`.

---

## Configuring a QPI multi-node system

A multi-node configuration interconnects multiple servers or multiple partitions. This configuration requires 8 microprocessors and 16 memory cards (4 microprocessors and 8 memory cards per node). See the documentation that came with your QPI cables to set up your QPI multi-node configuration.

Before you create scalable partitions, make sure that all the nodes in the multi-node configuration contain the following software and hardware:

- The current level of UEFI code, SAS UEFI code, IMM firmware, and FPGA firmware

**Note:** To check for the latest firmware levels and to download firmware updates, go to <http://www.ibm.com/supportportal/>.

- Microprocessor that are the same cache size and type, and the same clock speed

**Note:** The nodes can vary in the number of microprocessors and the amount of memory each contains, above the minimum.

---

## Appendix. 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.

Use this information to obtain additional information about IBM and IBM products, determine what to do if you experience a problem with your IBM system or optional device, and determine whom to call for service, if it is necessary.

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### Before you call

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

If you believe that you require IBM to perform warranty service on your IBM product, the IBM service technicians will be able to assist you more efficiently if you prepare before you call.

- Check for updated firmware and operating-system device drivers for your IBM product. The IBM Warranty terms and conditions state that you, the owner of the IBM product, are responsible for maintaining and updating all software and firmware for the product (unless it is covered by an additional maintenance contract). Your IBM service technician will request that you upgrade your software and firmware if the problem has a documented solution within a software upgrade.

You can obtain the latest downloads for your IBM product from <http://www.ibm.com/support/fixcentral/systemx/groupView?query.productGroup=ibm%2FSystemx> .

- If you have installed new hardware or software in your environment, check <http://www.ibm.com/systems/info/x86servers/serverproven/compat/us/> to make sure that the hardware and software is supported by your IBM product.
- Use the troubleshooting information in your system documentation, and use the diagnostic tools that come with your IBM product. Information about diagnostic tools is in the *Problem Determination and Service Guide* on the IBM Documentation CD that comes with your product.
- Go to <http://www.ibm.com/supportportal/> to check for information to help you solve the problem.
- Gather the following information to provide to IBM service. This data will help IBM service quickly provide a solution to your problem and ensure that you receive the level of service for which you might have contracted.
  - Hardware and Software Maintenance agreement contract numbers, if applicable
  - Machine type number (IBM 4-digit machine identifier)
  - Model number
  - Serial number
  - Current system UEFI (or BIOS) and firmware levels
  - Other pertinent information such as error messages and logs
- Go to <http://www.ibm.com/support/electronic/portal/> to submit an Electronic Service Request. Submitting an Electronic Service Request will start the process

of determining a solution to your problem by making the pertinent information available to IBM service quickly and efficiently. IBM service technicians can start working on your solution as soon as you have completed and submitted an Electronic Service Request.

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## Using the documentation

Information about your IBM system and preinstalled software, if any, or optional device is available in the documentation that comes with the product. That documentation can include printed documents, online documents, 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/supportportal/> .

You can find the most up-to-date information for System x products at <http://www.ibm.com/systems/x/> .

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## Getting help and information from the World Wide Web

On the World Wide Web, up-to-date information about IBM systems, optional devices, services, and support is available at <http://www.ibm.com/supportportal/> .

You can find the most up-to-date product information for System x products at <http://www.ibm.com/systems/x/> .

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## Software service and support

Through IBM Support Line, you can get telephone assistance, for a fee, with usage, configuration, and software problems with your IBM products.

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

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## Hardware service and support

You can receive hardware service through your IBM reseller or IBM Services.

To locate a reseller authorized by IBM to provide warranty service, go to <http://www.ibm.com/partnerworld/> and click **Find Business Partners** on the right side of the page. For IBM support telephone numbers, see <http://www.ibm.com/planetwide/> . 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.

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## IBM Taiwan product service

Use this information to contact IBM Taiwan product service.

台灣 IBM 產品服務聯絡方式：  
台灣國際商業機器股份有限公司  
台北市松仁路7號3樓  
電話：0800-016-888

IBM Taiwan product service contact information:

IBM Taiwan Corporation  
3F, No 7, Song Ren Rd.  
Taipei, Taiwan  
Telephone: 0800-016-888



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## Important notes

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

This product is not intended to be connected directly or indirectly by any means whatsoever to interfaces of public telecommunications networks, nor is it intended to be used in a public services network.

CD or DVD drive speed is the variable read rate. Actual speeds vary and are often less than the possible maximum.

When referring to processor storage, real and virtual storage, or channel volume, KB stands for 1024 bytes, MB stands for 1,048,576 bytes, and GB stands for 1,073,741,824 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 can 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 that are available from IBM.

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

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

## Particulate contamination

**Attention:** Airborne particulates (including metal flakes or particles) and reactive gases acting alone or in combination with other environmental factors such as humidity or temperature might pose a risk to the server that is described in this document. Risks that are posed by the presence of excessive particulate levels or concentrations of harmful gases include damage that might cause the server to malfunction or cease functioning altogether. This specification sets forth limits for particulates and gases that are intended to avoid such damage. The limits must not be viewed or used as definitive limits, because numerous other factors, such as temperature or moisture content of the air, can influence the impact of particulates or environmental corrosives and gaseous contaminant transfer. In the absence of specific limits that are set forth in this document, you must implement practices that maintain particulate and gas levels that are consistent with the protection of human health and safety. If IBM determines that the levels of particulates or gases in your environment have caused damage to the server, IBM may condition provision of repair or replacement of servers or parts on implementation of appropriate remedial measures to mitigate such environmental contamination. Implementation of such remedial measures is a customer responsibility.

Table 14. Limits for particulates and gases

Contaminant	Limits
Particulate	<ul style="list-style-type: none"> <li>The room air must be continuously filtered with 40% atmospheric dust spot efficiency (MERV 9) according to ASHRAE Standard 52.2<sup>1</sup>.</li> <li>Air that enters a data center must be filtered to 99.97% efficiency or greater, using high-efficiency particulate air (HEPA) filters that meet MIL-STD-282.</li> <li>The deliquescent relative humidity of the particulate contamination must be more than 60%<sup>2</sup>.</li> <li>The room must be free of conductive contamination such as zinc whiskers.</li> </ul>
Gaseous	<ul style="list-style-type: none"> <li>Copper: Class G1 as per ANSI/ISA 71.04-1985<sup>3</sup></li> <li>Silver: Corrosion rate of less than 300 Å in 30 days</li> </ul>
<p><sup>1</sup> ASHRAE 52.2-2008 - <i>Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size</i>. Atlanta: American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.</p> <p><sup>2</sup> The deliquescent relative humidity of particulate contamination is the relative humidity at which the dust absorbs enough water to become wet and promote ionic conduction.</p> <p><sup>3</sup> ANSI/ISA-71.04-1985. <i>Environmental conditions for process measurement and control systems: Airborne contaminants</i>. Instrument Society of America, Research Triangle Park, North Carolina, U.S.A.</p>	

## German Ordinance for Work gloss statement

The product is not suitable for use with visual display work place devices according to clause 2 of the German Ordinance for Work with Visual Display Units.

Das Produkt ist nicht für den Einsatz an Bildschirmarbeitsplätzen im Sinne § 2 der Bildschirmarbeitsverordnung geeignet.

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## Documentation format

The publications for this product are in Adobe Portable Document Format (PDF) and should be compliant with accessibility standards. If you experience difficulties when you use the PDF files and want to request a web-based format or accessible PDF document for a publication, direct your mail to the following address:

*Information Development  
IBM Corporation  
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3039 E. Cornwallis Road  
P.O. Box 12195  
Research Triangle Park, North Carolina 27709-2195  
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## Electronic emission notices

When you attach a monitor to the equipment, you must use the designated monitor cable and any interference suppression devices that are supplied with the monitor.

### 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 might 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.

## European Union EMC Directive conformance statement

This product is in conformity with the protection requirements of EU Council Directive 2004/108/EC 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.

**Attention:** This is an EN 55022 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.

Responsible manufacturer:

International Business Machines Corp.  
New Orchard Road  
Armonk, New York 10504  
914-499-1900

European Community contact:

IBM Technical Regulations, Department M456  
IBM-Allee 1, 71137 Ehningen, Germany  
Telephone: +49 7032 15-2937  
Email: tjahn@de.ibm.com

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Dieses Produkt entspricht den Schutzanforderungen der EU-Richtlinie 2004/108/EG zur Angleichung der Rechtsvorschriften über die elektromagnetische Verträglichkeit in den EU-Mitgliedsstaaten und hält die Grenzwerte der EN 55022 Klasse A ein.

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## **Deutschland: Einhaltung des Gesetzes über die elektromagnetische Verträglichkeit von Geräten**

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### **Zulassungsbescheinigung laut dem Deutschen Gesetz über die elektromagnetische Verträglichkeit von Geräten (EMVG) (bzw. der EMC EG Richtlinie 2004/108/EG) für Geräte der Klasse A**

Dieses Gerät ist berechtigt, in Übereinstimmung mit dem Deutschen EMVG das EG-Konformitätszeichen - CE - zu führen.

Verantwortlich für die Einhaltung der EMV Vorschriften ist der Hersteller:

International Business Machines Corp.  
New Orchard Road  
Armonk, New York 10504  
914-499-1900

Der verantwortliche Ansprechpartner des Herstellers in der EU ist:

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IBM-Allee 1, 71137 Ehningen, Germany  
Telephone: +49 7032 15-2937  
Email: tjahn@de.ibm.com

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바라며, 가정외의 지역에서 사용하는 것을 목  
적으로 합니다.

This is electromagnetic wave compatibility equipment for business (Type A). Sellers and users need to pay attention to it. This is for any areas other than home.

## Russia Electromagnetic Interference (EMI) Class A statement

ВНИМАНИЕ! Настоящее изделие относится к классу А.  
В жилых помещениях оно может создавать радиопомехи, для  
снижения которых необходимы дополнительные меры

## People's Republic of China Class A electronic emission statement

中华人民共和国“A类”警告声明

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。

## Taiwan Class A compliance 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。



---

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Part Number: 81Y1249

Printed in USA

(1P) P/N: 81Y1249



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