ServeRAID H1110 SAS/SATA Controller
for IBM System x

Installation and User's Guide

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Note: Before using this information and the product it supports, read the general information in Appendix B, “Notices,” on page 15 and see the *Important Notices and Warranty Information* document that comes with the ServeRAID H1110 SAS/SATA controller.

First Edition (September 2011)

Safety

Before installing this product, read the Safety Information.

قبل تركيب هذا المنتج، يجب قراءة الملاحظات الآمنية

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

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

安裝本產品之前，請先閱讀「安全資訊」。

Prije instalacije ovog produkta obavezno pročitajte Sigurnosne Upute.

Před instalací tohoto produktu si přečtěte příručku bezpečnostních instrukcí.

Læs sikkerhedsforskrifterne, før du installerer dette produkt.

Lees voordat u dit product installeert eerst de veiligheidsvoorschriften.

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

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

Vor der Installation dieses Produkts die Sicherheitshinweise lesen.

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

לפני שתתקינו מוצר זה, קראו את הוראות הבטיחות.

A termék telepítése előtt olvassa el a Biztonsági előírásokat!

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

製品の設置の前に、安全情報をお読みください。

본 제품을 설치하기 전에 안전 정보를 읽으십시오.

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

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

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

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

Перед установкой продукта прочтите инструкции по технике безопасности.

Pred inštaláciou tohto zariadenia si pečítaje Bezpečnostné predpisy.

Pred namestitvijo tega proizvoda preberite Varnostne informacije.

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

Läs säkerhetsinformationen innan du installerar den här produkten.

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

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Chapter 1. Introduction

The IBM® ServeRAID H1110 SAS/SATA controller provides one port for connection to Serial Attached SCSI (SAS) or Serial ATA (SATA) devices. This port is capable of 6.0 Gbps (gigabits per second) SAS link rates and 6.0 Gbps SATA link rates. The PCI Express (PCIe) transmission and reception data rate is 5.0 Gbps in each direction, yielding a total bandwidth of 10.0 Gbps for each full-duplex lane. The ServeRAID H1110 SAS/SATA controller has four full—duplex PCI Express lanes that provide possible host-side maximum transmission and reception rates of up to 5.0 GBps (gigabytes per second).

The ServeRAID H1110 SAS/SATA controller comes with a limited warranty. For more information, see the *Important Notices and Warranty Information* document that comes with the ServeRAID H1110 SAS/SATA controller.

If firmware and documentation updates are available, you can download them from the IBM Web site. The ServeRAID H1110 SAS/SATA controller might have features that are not described in the documentation that comes with the ServeRAID H1110 SAS/SATA controller, 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/systems/support/.

Note: Changes are made periodically to the IBM Web site. Procedures for locating firmware and documentation might vary slightly from what is described in this document.

The IBM Documentation CD

The IBM *Documentation* CD contains documentation for the ServeRAID H1110 SAS/SATA controller 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 computer 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 the ServeRAID H1110 SAS/SATA controller from the **Product** menu. The **Available Topics** list displays all the documents for the PDU. 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 is displayed 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 Crtl+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.

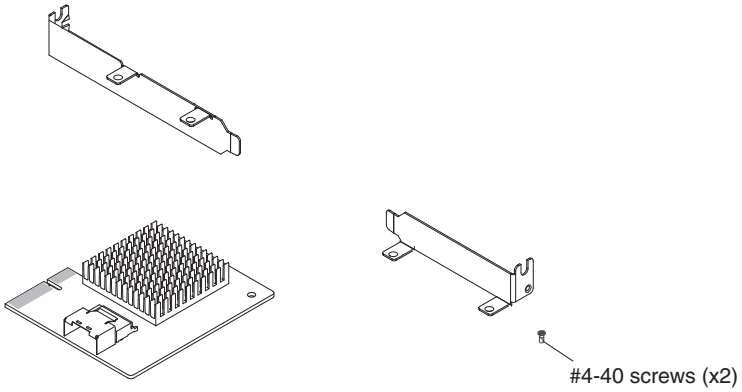
Notices and statements in this document

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.

Overview



The ServeRAID H1110 SAS/SATA controller PCI Express interface is compliant with the PCI Express Specification. The ServeRAID H1110 SAS/SATA controller implements the PCI Express interface physically as a x4 interface. The ServeRAID H1110 SAS/SATA controller SAS interface is compatible with the ANSI Serial Attached SCSI standard, version 1.0, and the Serial ATA Specification, version 1.0a.

The ServeRAID H1110 SAS/SATA controller provides a 4 Mb flash ROM for storing the BIOS code and firmware. The ServeRAID H1110 SAS/SATA controller also provides a 32 Kb x 8-bit NVSRAM for storing the nonvolatile RAID information when a system failure occurs.

Features

The ServeRAID H1110 SAS/SATA controller has the following features:

- Transfers data by using SCSI information units.
- Provides compatibility with SATA target devices.
- Supports internal connection to hard disk drives for IBM System x servers.

PCI performance

The ServeRAID H1110 SAS/SATA controller has the following PCI Express features:

- x4 link width support
- Lane reversal and polarity inversion
- Replay buffer that preserves a copy of the data for retransmission in case a cyclic redundancy check (CRC) error occurs
- Packetized and layered architecture
- PCI Express
  - Leverages existing PCI device drivers
  - Supports the memory, I/O, and configuration address spaces
  - Supports memory read/write transactions, I/O read/write transactions, and configuration read/write transactions

Software

The ServeRAID H1110 SAS/SATA controller supports the following operating systems:

- Microsoft Windows Server 2003 32-bit and 64-bit (x86 and AMD), Windows Server 2008, and Windows Server 2008 R2

- Red Hat Enterprise Linux 4, Red Hat Enterprise Linux 5 and Red Hat Enterprise Linux 6
- SUSE Linux Enterprise Server 9, SUSE Linux Enterprise Server 10, and SUSE Linux Enterprise Server 11
- VMware ESX 4.0 Update 1 and VMware ESXi 4.0 Update 1

Specifications

The following sections describe the ServeRAID H1110 SAS/SATA controller specifications.

Physical dimensions

The SAS ServeRAID H1110 SAS/SATA controller board is 79.27 mm (3.1 in.) x 64.39 mm (2.5 in.). The PCI Express x4 connection is made through the edge connector J1. The component height on the top and bottom of the ServeRAID H1110 SAS/SATA controller board follows the PCI Express specifications.

Electrical specifications

The SAS ServeRAID H1110 SAS/SATA controller is powered from the PCI Express +12 V power rail. The integrated +1.8 V and +3.3 V voltages are regulated from the PCI Express +12 V rail through switching regulators. The LSIAS2004 uses +1.0 V, 1.8 V and +3.3 V; all other components use +3.3 V. The maximum power requirement for the ServeRAID H1110 SAS/SATA controller under normal operation is listed in the following table.

Table 1. Power requirements [1]

Voltage	Current	Power
12.0 V (nominal)	0.67 amps	7.2 watts
[1] Power requirements are based on the assumption that no more than half of the LEDs are lit at any time.		

Thermal and atmospheric specifications

The ServeRAID H1110 SAS/SATA controller has the following atmospheric characteristics:

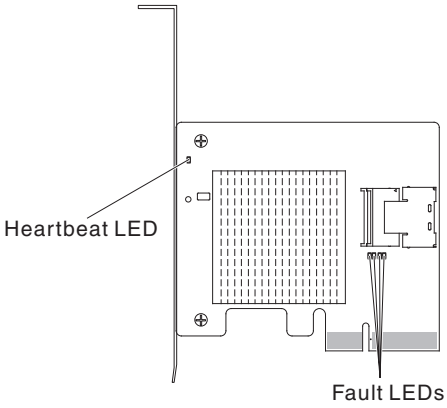
- Temperature range: 0°C to 60°C (32°F to 140°F) dry bulb
- Relative humidity range: 5% to 90% noncondensing
- Maximum dewpoint: 32°C (89°F)

The following parameters define the storage and transit environment for the ServeRAID H1110 SAS/SATA controller:

- Temperature range: -45°C to +105°C (-49°F to +221°F) dry bulb
- Relative humidity range: 5% to 90% noncondensing

LEDs

The following illustration shows the ServeRAID H1110 SAS/SATA controller LEDs.



Heartbeat LED (green)

This LED flashes green to indicate the ServeRAID H1110 SAS/SATA controller heartbeat.

Fault LED (amber)

When a fault condition occurs on the port, the corresponding amber fault LED is lit.

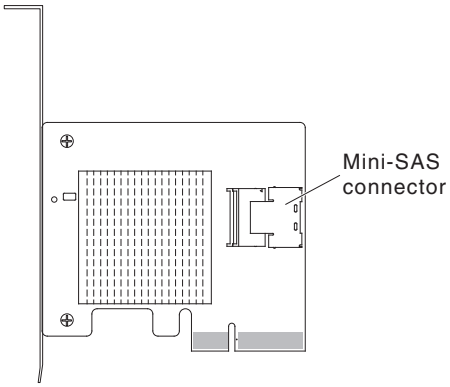
Chapter 2. Installing the ServeRAID H1110 SAS/SATA controller

This chapter describes how to install the ServeRAID H1110 SAS/SATA controller and provides other information that you must consider when you install the ServeRAID H1110 SAS/SATA controller.

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

Connector

The internal latching mini—SAS connector on ServeRAID H1110 SAS/SATA controller is shown in the following illustration.



Handling the ServeRAID H1110 SAS/SATA controller

Attention: Static electricity can damage the server and other electronic devices. To avoid damage, keep the ServeRAID H1110 SAS/SATA controller in its static-protective package until you are ready to install it or change the bracket.

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.
- The use of a grounding system is recommended but is not required. For example, wear an electrostatic-discharge wrist strap, if one is available.
- Handle the ServeRAID H1110 SAS/SATA controller carefully, holding it by its edges or its frame.
- Do not touch solder joints, pins, or exposed circuitry.
- Do not leave the ServeRAID H1110 SAS/SATA controller where others can handle and damage it.
- While the ServeRAID H1110 SAS/SATA controller is still in its static-protective package, touch it to an unpainted metal part of the server for at least 2 seconds. This drains static electricity from the package and from your body.
- If you do not have to change the bracket, remove the ServeRAID H1110 SAS/SATA controller from its package and install it directly into the server without setting down the ServeRAID H1110 SAS/SATA controller. If it is necessary to set down the ServeRAID H1110 SAS/SATA controller, put it back into its

static-protective package. Do not place the ServeRAID H1110 SAS/SATA controller on the server cover or on a metal surface.

- If you have to change or remove the bracket, remove the ServeRAID H1110 SAS/SATA controller from its package and place the ServeRAID H1110 SAS/SATA controller on a flat, static-protective surface. Do not place the ServeRAID H1110 SAS/SATA controller on the server cover or on a metal surface.
- Take additional care when you handle the ServeRAID H1110 SAS/SATA controller during cold weather. Heating reduces indoor humidity and increases static electricity.

Installing the ServeRAID H1110 SAS/SATA controller in the server

Statement 1:

DANGER

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

To avoid a shock hazard:

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

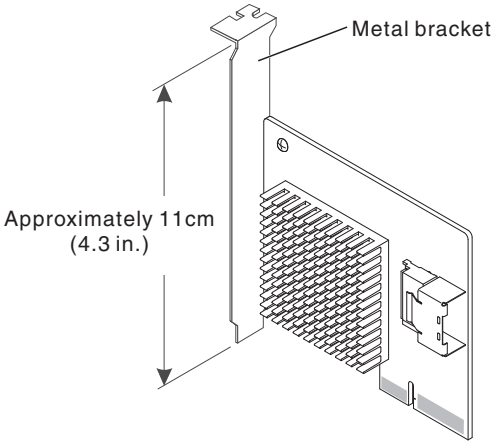
To Connect:	To Disconnect:
1. Turn everything OFF.	1. Turn everything OFF.
2. First, attach all cables to devices.	2. First, remove power cords from outlet.
3. Attach signal cables to connectors.	3. Remove signal cables from connectors.
4. Turn device ON.	4. Remove all cables from devices.

Before you install the controller, determine the server PCI Express slot that you want to use. If an expansion-slot bracket is required, use the following guidelines to select the correct bracket size.

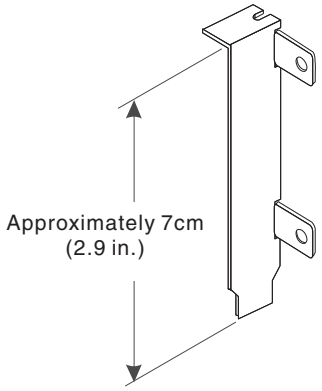
Notes:

1. The expansion-slot opening is measured along the longest dimension and might be oriented horizontally in some servers.
2. Depending on the server model, you may not need to install any expansion slot bracket on the ServeRAID H1110 SAS/SATA controller.

If the opening for the PCIe expansion slot is approximately 10 cm (4.0 in.) long, install the full-height (3U) expansion-slot bracket.

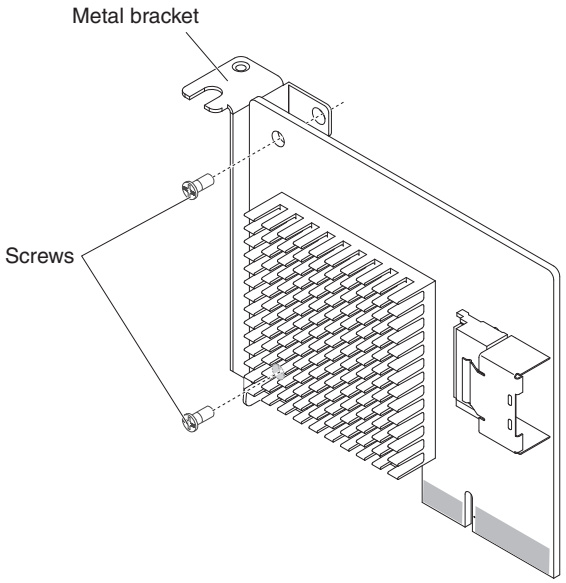


If the opening for the PCIe expansion slot is approximately 6 cm (2.3 in.) long, install the low-profile (2U) expansion-slot bracket on the ServeRAID H1110 SAS/SATA controller.

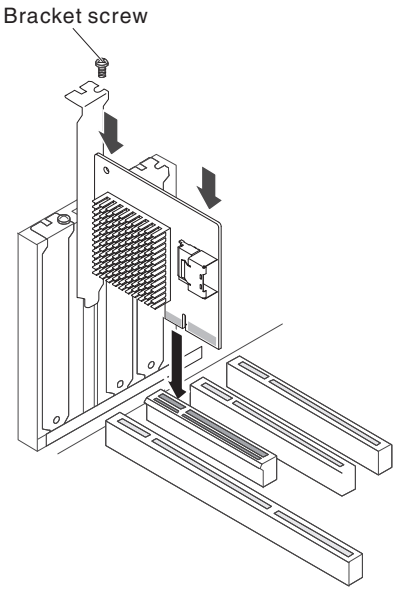


To install the ServeRAID H1110 SAS/SATA controller in the server, complete the following steps.

1. Read the safety information that begins on page iii, and “Handling the ServeRAID H1110 SAS/SATA controller” on page 7.
2. Turn off the server and peripheral devices and disconnect the power cords.
3. Remove the server cover. For more information, see the installation instructions that come with the server.
4. Touch the static-protective package that contains the ServeRAID H1110 SAS/SATA controller to any unpainted surface on the outside of the server; then, grasp the ServeRAID H1110 SAS/SATA controller by the top edge or upper corners and remove it from the package and inspect it for damage. Contact your IBM marketing representative or authorized reseller if the ServeRAID H1110 SAS/SATA controller appears to be damaged.
5. Depending on the server model, install the full-height (3U) or the low-profile (2U) expansion-slot bracket.
   a. Align the expansion-slot bracket so that the tabs are on the back side of the ServeRAID H1110 SAS/SATA controller and the holes on the tabs align with the holes on the ServeRAID H1110 SAS/SATA controller.
   b. From the front side of the ServeRAID H1110 SAS/SATA controller, attach the bracket to the ServeRAID H1110 SAS/SATA controller with the screws.



6. (Optional) Depending on the server model, you might have to remove the expansion-slot cover for the selected PCI Express slot. To remove the expansion-slot cover, you might have to remove the expansion slot screw. For more information about removing the expansion-slot cover, see the *Problem Determination and Service Guide* on the IBM *Documentation* CD that comes with your system. Place the removed parts in a safe place. For detailed instructions for installing the ServeRAID H1110 SAS/SATA controller in your server, see the *User’s Guide*.
7. Position the ServeRAID H1110 SAS/SATA controller by aligning the PCI Express connector with the PCI Express slot on the system board. Insert the ServeRAID H1110 SAS/SATA controller firmly into the connector.



Note: Depending on the server model, you might have to install the ServeRAID H1110 SAS/SATA controller in a riser card and then install the riser card with the ServeRAID H1110 SAS/SATA controller in the PCIe slot on the system board.

8. Secure the ServeRAID H1110 SAS/SATA controller to the server chassis. Replace the expansion-slot screw if you removed it in step 6 on page 10, or return the bracket lever to the closed position.
9. Connect the serial cables between the mini—SAS internal connector on the ServeRAID H1110 SAS/SATA controller and the serial hard disk drives.
10. Replace the server cover.
11. Reconnect the power cords and turn on the server.

Replaceable ServeRAID H1110 SAS/SATA controller components

Each replaceable component on the ServeRAID H1110 SAS/SATA controller is a Tier 1 customer replaceable unit (CRU). Replacement of a Tier 1 CRU is your responsibility. If IBM installs a Tier 1 CRU at your request, you will be charged for the installation.

For information about the terms of the warranty and getting service and assistance, see the *Important Notices and Warranty Information* document.

Table 2. ServeRAID H1110 SAS/SATA controller CRU part numbers

Description	CRU part number (Tier 1)
IBM ServeRAID H1110 SAS/SATA controller	81Y4494

Appendix A. Getting help and technical assistance

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

Before you call

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

- Check all cables to make sure that they are connected.
- Check the power switches to make sure that the system and any optional devices are turned on.
- Use the troubleshooting information in your system documentation, and use the diagnostic tools that come with your system. Information about diagnostic tools is in the *Problem Determination and Service Guide* on the IBM *Documentation* CD that comes with your system.
- Go to the IBM support website at http://www.ibm.com/supportportal/ to check for technical information, hints, tips, and new device drivers or to submit a request for information.

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

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/ and follow the instructions. Also, some documents are available through the IBM Publications Center at http://www.ibm.com/shop/publications/order/.

Getting help and information from the World Wide Web

On the World Wide Web, the IBM website has up-to-date information about IBM systems, optional devices, services, and support. The address for IBM System x® and xSeries® information is http://www.ibm.com/systems/x/. The address for IBM BladeCenter® information is http://www.ibm.com/systems/bladecenter/. The address for IBM IntelliStation® information is http://www.ibm.com/intellistation/.

You can find service information for IBM systems and optional devices at http://www.ibm.com/systems/support/.

Software service and support

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

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 a Business Partner** 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.

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

Appendix B. Notices

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

IBM may not offer the products, services, or features discussed in this document in other countries. Consult your local IBM representative for information on the products and services currently available in your area. Any reference to an IBM product, program, or service is not intended to state or imply that only that IBM product, program, or service may be used. Any functionally equivalent product, program, or service that does not infringe any IBM intellectual property right may be used instead. However, it is the user's responsibility to evaluate and verify the operation of any non-IBM product, program, or service.

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

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.

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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 3. Limits for particulates and gases

Contaminant	Limits
Particulate	• The room air must be continuously filtered with 40% atmospheric dust spot efficiency (MERV 9) according to ASHRAE Standard 52.2[1]. • 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. • The deliquescent relative humidity of the particulate contamination must be more than 60%[2]. • The room must be free of conductive contamination such as zinc whiskers.
Gaseous	• Copper: Class G1 as per ANSI/ISA 71.04-1985[3] • Silver: Corrosion rate of less than 300 Å in 30 days

[1] ASHRAE 52.2-2008 - *Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size*. Atlanta: American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.

[2] 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.

[3] ANSI/ISA-71.04-1985. *Environmental conditions for process measurement and control systems: Airborne contaminants*. Instrument Society of America, Research Triangle Park, North Carolina, U.S.A.

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:

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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.

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

United Kingdom telecommunications safety requirement

Notice to Customers

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

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This 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.

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