6 Gb SAS HBA

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 C, “Notices,” on page 37 and see the *Important Notices and Warranty Information* document that comes with the host bus adapter.

First Edition (June 2010)

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. Attach power cords to outlet.	4. Remove all cables from devices.
5. Turn device ON.	

Contents

Chapter 1. Introduction

The IBM® 6 Gb SAS HBA provides eight ports for connection to Serial Attached SCSI (SAS) or Serial ATA (SATA) devices. Each 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 2.5 Gbps in each direction, yielding a total bandwidth of 5.0 Gbps for each full-duplex lane. The 6 Gb SAS HBA, referred to throughout this document as the SAS HBA, has eight PCI Express lanes that provide possible host-side maximum transmission and reception rates of up to 4.0 GBps (gigabytes per second).

The SAS host bus adapter (HBA) comes with a limited warranty. For more information, see the *Important Notices and Warranty Information* document that comes with the SAS HBA.

If firmware and documentation updates are available, you can download them from the IBM Web site. The SAS HBA might have features that are not described in the documentation that comes with the SAS HBA, 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, complete the following steps.

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.

1. Go to http://www.ibm.com/systems/support/.
2. Under **Product support**, click **System x**.
3. Under **Popular links**, click **Software and device drivers**.
4. Under **Related downloads**, click **ServeRAID** for the ServeRAID software matrix.

The IBM Documentation CD

The IBM *Documentation* CD contains documentation for the SAS HBA 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 SAS HBA 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 SAS HBA PCI Express interface is compliant with the PCI Express Specification, revision 1.0a. The SAS HBA implements the PCI Express interface physically as a x8 interface, which also functions in a x8 host slot that is wired as a x4 slot. The SAS HBA SAS interface is compatible with the ANSI Serial Attached SCSI Specification, revision 2.0, and the Serial ATA Specification, revision 2.6.

The functionality of the SAS HBA comes from the LSI2008 controller chip. The LSI2008 chip integrates eight high-performance SAS or SATA ports. The design of the SAS HBA makes it easy to add SAS interfaces to a computer, workstation, or server with a PCI Express bus.

The SAS HBA provides a 2 Mb x 8-bit flash ROM for storing the BIOS code and firmware. The SAS HBA also provides a 32 Kb x 8-bit NVSRAM for storing the nonvolatile RAID information when a system failure occurs, and a 128 Kb x 36-bit pipelined burst static random access memory (PBSRAM) device for storing SAS address port information, which enables connection to more than 128 devices.

Features

The SAS HBA has the following features:

- Supports narrow port and wide port as described in Table 1.

Table 1. SAS bandwidth

Half duplex	Full duplex
Narrow port (1 lane) - 600 MBps	Narrow port (1 lane) - 1200 MBps
Wide port (2 lanes) - 1200 MBps	Wide port (2 lanes) - 2400 MBps
Wide port (4 lanes) - 2400 MBps	Wide port (4 lanes) - 800 MBps

- Supports Serial SCSI Protocol (SSP), Serial Tunneling Protocol (STP), and Serial Management Protocol (SMP) as defined in the Serial Attached SCSI (SAS) Specification, version 2.0.
- Supports SATA as defined in the Serial ATA Specification, version 2.6.
- Provides configurable drive spin-up sequencing on a per-port basis.
- Simplifies cabling with a serial point-to-point architecture.
- Provides smaller and thinner cables that do not restrict airflow.
- Provides a serial point-to-point, enterprise-level storage interface.
- Transfers data by using SCSI information units.
- Provides two LEDs on the PCI expansion-slot bracket for the SAS HBA. One LED indicates activity on any SAS/SATA port. The other LED indicates a heartbeat or a fault condition.
- Provides compatibility with SATA target devices.
- Supports internal connection to hard disk drives for IBM System x3455 servers.
- Supports systems with Unified Extensible Firmware Interface (UEFI) 2.0 and 2.1.

PCI performance

The SAS HBA has the following PCI Express features:

- Single-lane link transfer rate up to 2.5 Gbps in each direction
- x8 and x4 link width support
- Scalable interface
  - Single-lane aggregate bandwidth of up to 0.5 GBps (500 MBps)
  - Quad-lane aggregate bandwidth of up to 2.0 GBps (2000 MBps)
  - 8-lane aggregate bandwidth of up to 4.0 GBps (4000 MBps)
- Serial point-to-point interconnections between devices
  - Reduces the electrical load of the connection
  - Enables higher transmission and reception frequencies
- Lane reversal and polarity inversion
- PCI Express hot plug
- Power management support
  - PCI Power Management 1.2
  - Active State Power Management (ASPM), including the L0, L0s, and L1 states, that places links in a power-saving mode during times of no link activity
- Replay buffer that preserves a copy of the data for retransmission in case a cyclic redundancy check (CRC) error occurs
- PCI Express Advanced Error Reporting capabilities

- Packetized and layered architecture
- High bandwidth per pin with low overhead and low latency
- PCI Express
  - Is compatible with PCI and PCI-X software
  - 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
- 4 KB of PCI configuration address space per device
- Posted and non-posted transactions
- Quality of service (QOS) link configuration and arbitration policies
- Traffic Class 0 and one virtual channel
- Message Signaled Interrupts (both MSI and MSI-X) and INTx interrupt signaling for legacy PCI support
- End-to-end cyclic redundancy check (ECRC) and Advanced Error Reporting

Software

The SAS HBA 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 and Red Hat Enterprise Linux 5
- 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 SAS HBA specifications.

Physical dimensions

The SAS HBA board is 167.6 mm (6.6 in.) x 68.5 mm (2.7 in.). The PCI Express x8 connection is made through the edge connector J1. The component height on the top and bottom of the SAS HBA board follows the PCI Express specifications.

Electrical specifications

The SAS HBA is powered from the PCI Express +12 V power rail. The integrated +1.2 V and +3.3 V voltages are regulated from the PCI Express +12 V rail through switching regulators. The LSI2008 uses +3.3 V and +1.2 V; all other components use +3.3 V. The maximum power requirement for the SAS HBA under normal operation is listed in the following table.

Table 2. 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 SAS HBA has the following atmospheric characteristics:

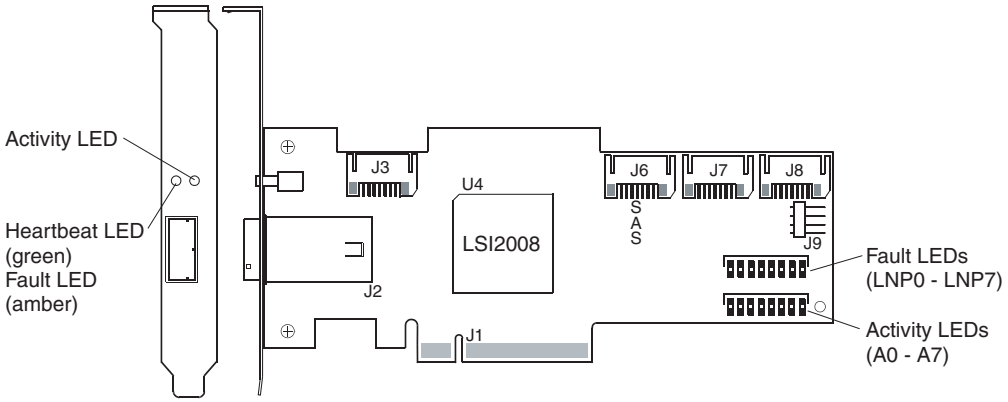
- Temperature range: 0°C to 60°C (32°F to 140°F) dry bulb
- Relative humidity range: 5% to 90% noncondensing
- Maximum dewpoint: 32°C (89°F)

The following parameters define the storage and transit environment for the SAS HBA:

- 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 SAS HBA LEDs.



Heartbeat LED (green) / Fault LED (amber)

This LED is on the PCI bracket. It flashes green to indicate the SAS HBA heartbeat. It turns amber when the SAS HBA firmware detects a fault condition.

Activity LED

This green LED is lit when there is activity on any SAS/SATA port.

Fault LEDs (LNP0 - LNP7)

The eight amber fault LEDs correspond to the eight SAS/SATA ports. When a fault condition occurs on a port, the corresponding LED is lit.

Activity LEDs (A0 - A7)

The eight green activity LEDs correspond to the eight SAS/SATA ports. When there is activity on a port, the corresponding LED is lit.

Chapter 2. Installing the SAS HBA

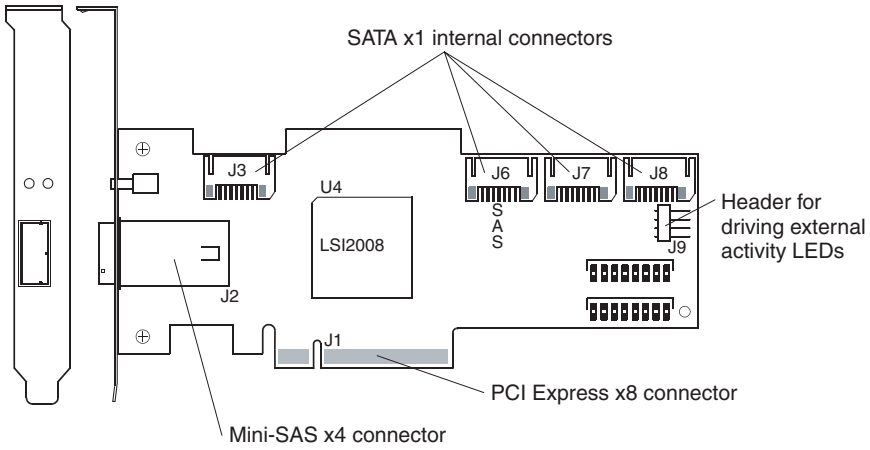
This chapter describes how to install the SAS HBA and provides other information that you must consider when you install the SAS HBA.

Notes:

1. The illustrations in this document might differ slightly from your hardware.
2. A PCI Express connector is smaller than a PCI/PCI-X connector.

Connectors

The SAS HBA connectors are shown in the following illustration.



SATA x1 internal connectors (J3, J6, J7, and J8)
The SATA connectors are SATA x1 internal right-angle latching connectors.

Header for driving external activity LEDs (J9)
The J9 connector is a 4-pin, right-angle header for driving external activity LEDs. Pins 2 and 3 provide the cathode connection for the two external LEDs. Pins 1 and 4 provide 220-ohm pull-ups to +3.3 V.

PCI Express x8 connector (J1)
The PCI Express interface has eight PCI Express ports that provide possible host-side maximum transmission and reception rates of up to 4.0 GBps. The SAS HBA supports a x8 PCI Express link width. The connection is made through the edge connector J1. The signal definitions and pin numbers conform to the PCI Express specifications.

Mini-SAS x4 connector (J2)
The SAS HBA supports a SAS connection through connector J2. The J2 connector is an SFF-8088 mini-SAS external right-angle connector.

Handling the SAS HBA

Attention: Static electricity can damage the server and other electronic devices. To avoid damage, keep the SAS HBA 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 SAS HBA carefully, holding it by its edges or its frame.
- Do not touch solder joints, pins, or exposed circuitry.
- Do not leave the SAS HBA where others can handle and damage it.
- While the SAS HBA 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 SAS HBA from its package and install it directly into the server without setting down the SAS HBA. If it is necessary to set down the SAS HBA, put it back into its static-protective package. Do not place the SAS HBA on the server cover or on a metal surface.
- If you have to change the bracket, remove the SAS HBA from its package and place the SAS HBA on a flat, static-protective surface. Do not place the SAS HBA on the server cover or on a metal surface.
- Take additional care when you handle the SAS HBA during cold weather. Heating reduces indoor humidity and increases static electricity.

Installing the SAS HBA in the server

Statement 1:

DANGER

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

To avoid a shock hazard:

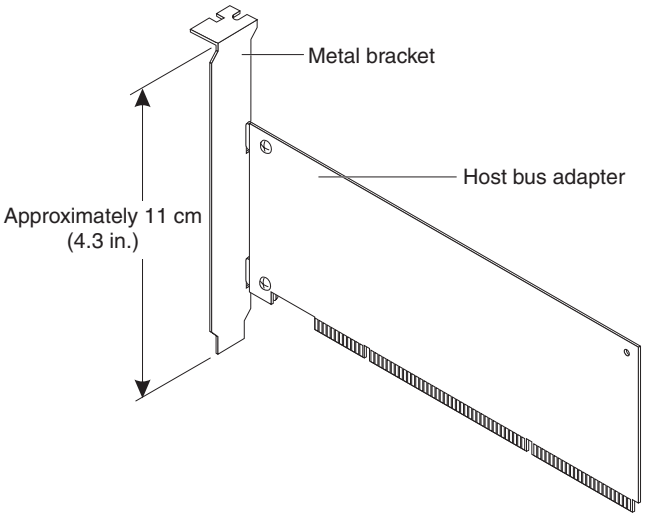
- **Do not connect or disconnect any cables or perform installation, maintenance, or reconfiguration of this product during an electrical storm.**
- **Connect all power cords to a properly wired and grounded electrical outlet.**
- **Connect to properly wired outlets any equipment that will be attached 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. Attach power cords to outlet.	4. Remove all cables from devices.
5. Turn device ON.	

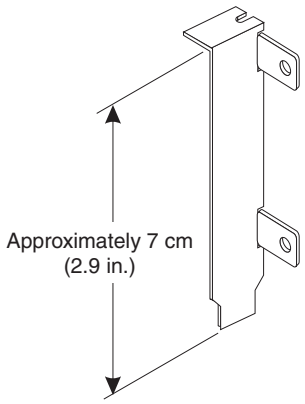
Before you install the SAS HBA, make sure that the preinstalled expansion slot bracket is the correct size for the server in which you are installing the SAS HBA.

Note: The expansion-slot opening is measured along the longest dimension and might be oriented horizontally in some servers.

The SAS HBA comes with a preinstalled expansion-slot bracket that is approximately 11 cm (4.3 in.) long. If the opening for the PCIe expansion slot is approximately 10 cm (4.0 in.) long, you will use the preinstalled bracket.



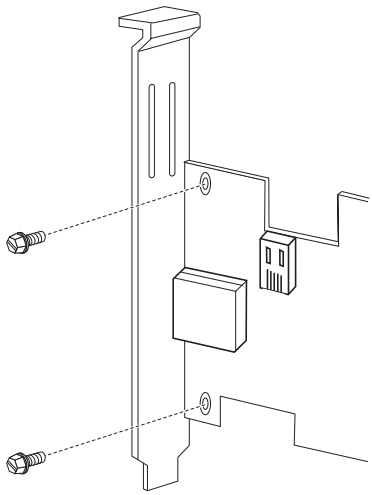
The SAS HBA also comes with a low-profile expansion-slot bracket that is approximately 7 cm (2.9 in.) long. If the opening for the PCIe expansion slot is approximately 6 cm (2.3 in.) long, you must replace the preinstalled bracket with the low-profile bracket. You will do this in step 5 on page 13 in the following procedure.



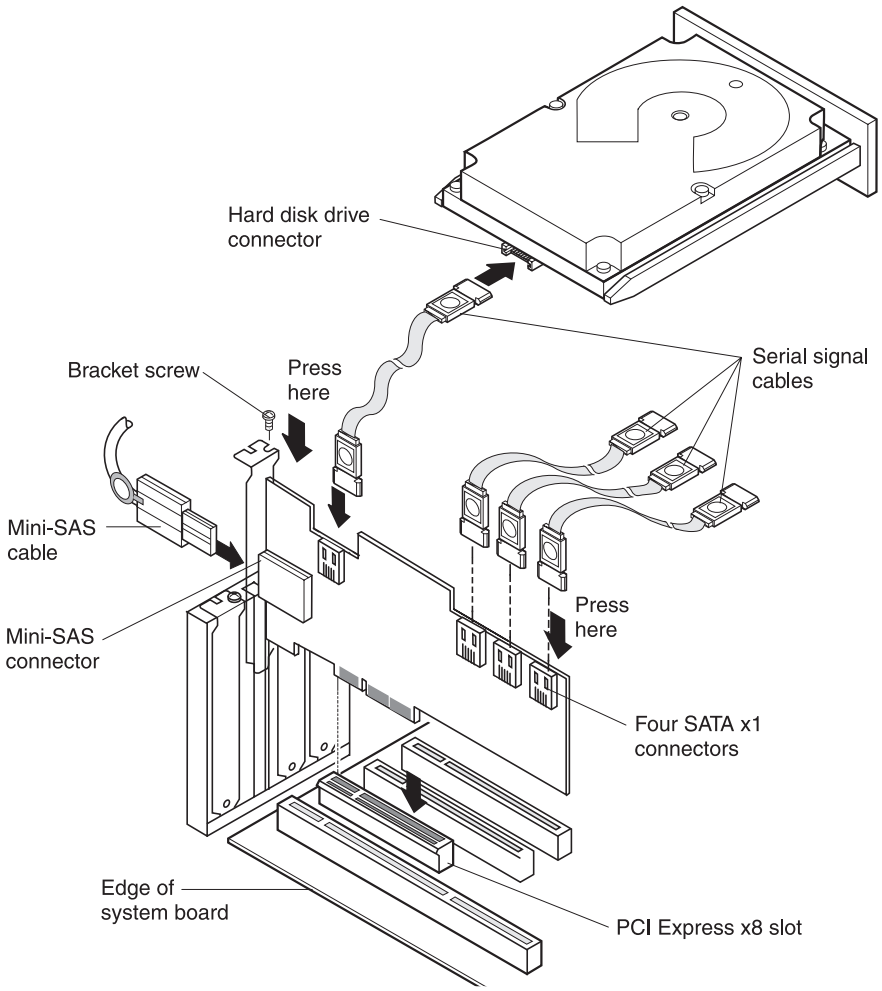
To install the SAS HBA in the server, complete the following steps.

1. Read the safety information that begins on page iii, and “Handling the SAS HBA” on page 10.
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 SAS HBA to any unpainted surface on the outside of the server; then, grasp the SAS HBA 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 SAS HBA appears to be damaged.
5. If you have to remove the preinstalled expansion-slot bracket and replace it with the low-profile bracket, complete the following steps; otherwise, go to step 6.
   a. Orient the SAS HBA as shown in the following illustration.



   b. Remove the two screws that hold the bracket onto the SAS HBA.
   c. Lift the bracket from the SAS HBA and store the bracket in a safe place for possible reuse.
   d. Align the low-profile bracket so that the tabs are on the back side of the SAS HBA and the holes on the tabs align with the holes on the SAS HBA.
   e. From the front side of the SAS HBA, attach the bracket to the SAS HBA, using the two screws that you removed in step 5b.
6. Determine which PCI Express slot you will use. 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. Place the removed parts in a safe place. For detailed instructions for installing the SAS HBA in your server, see the installation instructions that come with the server.



7. Position the SAS HBA by aligning the PCI Express x8 connector with the PCI Express x8 slot on the system board. Insert the SAS HBA firmly into the connector.

   Note: Depending on the server model, you might have to install the SAS HBA in a riser card and then install the riser card with the SAS HBA in the PCIe slot on the system board.
8. Secure the SAS HBA to the server chassis. Replace the expansion-slot cover and the expansion-slot screw if you removed them in step 6 on page 13, or return the bracket lever to the closed position.
9. Connect the serial cables between the SATA x1 internal connectors on the SAS HBA and the serial hard disk drives.
10. Replace the server cover.
11. Reconnect the power cords and turn on the server. Make sure that the green activity LED on the front bracket of the SAS HBA is lit.

Replaceable SAS HBA components

Each replaceable component on the SAS HBA 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 3. SAS HBA CRU part numbers

Description	CRU part number (Tier 1)
IBM 6 Gb SAS HBA and expansion-slot bracket	68Y7354

Appendix A. Using the SAS2 Integrated RAID Configuration Utility

This appendix describes how to use the SAS2 Integrated RAID Configuration Utility to create RAID volumes on LSI SAS2 controllers. The SAS2 Integrated RAID Configuration Utility is referred to throughout this document as the utility.

The utility is a command-line interface that you can use to configure the integrated RAID functions of LSI SAS2 controllers. The utility runs in the DOS, Linux, Extensible Firmware Interface (EFI), and Windows Pre-Installation (WinPE) operating-system environments. It is a minimally interactive program that you can run from a command-line prompt or a shell script. When you use utility commands, the program sends results to the environment through the program status value that it returns when it exits.

Information passes between the user environment and the utility through the command line, the standard output and standard error interfaces, and the program return value. You can redirect the output streams as permitted by the operating system. When the program exits, it returns a value of 0, if the command is successful. Otherwise, it returns a value of 1.

If a RAID command fails, the utility displays the IOCStatus and IOCLogInfo on the console. You can use this information to analyze the cause of the failure.

You can use the utility for system configuration on the manufacturing floor, post-delivery configuration, and ongoing configuration and monitoring of integrated RAID devices.

Note: The SAS2 Integrated RAID Configuration utility is for the manufacturing environment. To create and manage integrated RAID volumes, use the LSI SAS2 BIOS Configuration Utility (SAS2 BIOS CU).

Command syntax

Read the following guidelines before you use the utility command-line interface:

- Each command has the following format:

  `sas2ircu` *`controller_number command parameters`*
- Each command starts with sas2ircu.
- *controller_number* is the unique controller number that the program assigns to each PCI function on supported controller chips in the system, starting with controller 0. For example, in a system that contains two LSISAS2008 controllers, controller 0 refers to the first controller, and controller 1 refers to the other controller.

  Valid controller number values are 0 to 255 (decimal).
- The *enclosure:bay* parameter specifies the enclosure and slot values of the disk drive for the new RAID volume. You can get these values from the output of the **display** command.
- Use spaces to separate the program name (sas2ircu), controller number, command, and parameters fields.
- The commands are not case sensitive.
- Variables are shown in italics.
- Optional parameters are enclosed in brackets ([ ]).

- Parameters that are enclosed in braces ({ }) can be entered one or more times, as required for the command.
- Do not enter the command-line definition characters [ ] and { } on the command line.

Operating-system support for commands

The following table shows which utility commands are supported on each operating system and controller type. Check your BIOS revision level to be sure that you have an IR or IT controller.

Table 4. Utility commands and operating system support

Command	DOS	Linux	EFI	WinPE	Integrated RAID	Initiator/ target
Create	x	x	x	x	x	-
Delete	x	x	x	x	x	-
Display	x	x	x	x	x	x
Hotspare	x	x	x	x	x	-
List	x	x	x	x	x	x
Status	x	x	x	x	x	x
Mfgpage	x	-	-	-	x	x
Constchk	x	x	x	x	x	-
Activate	x	x	x	x	x	-
Locate	x	x	x	x	x	x
Logir	x	x	x	x	x	x

Activate command

Use the **activate** command to activate an inactive integrated RAID volume.

Syntax

The syntax of the **activate** command is

```
sas2ircu controller_number activate volumeID
```

where:

controller_number
is the index of the controller with the volume that you want to activate.

volumeID is the volume ID of an integrated RAID volume that is currently in the Inactive state.

Return values

0x00 Success: Command completed successfully.

0x01 Failure: Bad command-line arguments or operational failure.

0x02 Adapter_not_found: Cannot find the specified adapter.

Constchk command

Use the **constchk** command to send requests to the integrated RAID firmware to start a consistency check operation on the specified volume.

Syntax

The syntax of the **constchk** command is

```
sas2ircu controller_number constchk volumeID [noprompt]
```

where:

controller_number
: is the index of the controller on which you want to run the consistency check operation.

volumeID
: is the volume ID of an integrated RAID volume, as listed in the **display** command, on which you want to start the consistency check operation.

The optional **noprompt** parameter prevents warnings and prompts from being displayed while the command is running

Return values

0x00 Success: Command completed successfully.

0x01 Failure: Bad command-line arguments or operational failure.

0x02 Adapter_not_found: Cannot find the specified adapter.

Create command

Use the **create** command to create integrated RAID volumes on LSI SAS2 controllers.

When you add a disk to an integrated RAID volume, some of its storage capacity might not be used. For example, if you add a 300 GB disk drive to a volume that uses only 200 GB of capacity on each disk drive, the volume does not use the remaining 100 GB of capacity on the disk drive.

The disk that is identified by the first *enclosure:bay* on the command line becomes the primary disk drive when you create an integrated mirroring (RAID 1) volume. If the controller resynchronizes the disk drives, the data on the primary disk drive becomes available when you access the newly created volume.

When the integrated RAID firmware creates a RAID1 volume, it starts a background initialization of the volume. You can use the **status** command to monitor the status of the initialization.

Observe the following rules when you create integrated RAID volumes and hot spare disks:

- All disks that are part of a volume, including hot spares for that volume, must be on the same SAS2 controller.
- You can create RAID0, RAID1, RAID1E, and RAID10 integrated RAID volumes.
- You can create a maximum of two integrated RAID volumes per controller.
- The configuration of the integrated RAID firmware determines the maximum and minimum number of drives that you can use in integrated RAID volumes. The configuration is specified in the following fields of the I/O controller:

  MaxDrivesRAID0, MaxDrivesRAID1, MaxDrivesRAID10, MaxDrivesRAID1E MinDrivesRAID0, MinDrivesRAID1, MinDrivesRAID10, MinDrivesRAID1E, MaxVolumes, MaxPhysDisks, MaxGlobalHotSpares, MaxPhysDisks (maximum number of physical drives combined in all volumes on the controller)
- You cannot create an integrated RAID volume that combines SAS and SATA hard disk drives.
- You cannot create an integrated RAID volume that combines solid state drives and hard disk drives.
- You cannot use both SATA and SAS solid state drives in a single integrated RAID volume, if the integrated RAID firmware supports it. Support for such a mixing is specified by values in static fields in the MPI2 specification and is specific for solid state drives only.

Syntax

The syntax of the **create** command is

```
sas2ircu controller_number create volume_type size
{enclosure:bay} [volume_name] [noprompt]
```

where:

controller_number
: is the index of the controller for the newly created volume.

volume_type
: is the volume type of the new volume. Valid values are RAID0, RAID1, RAID10, and RAID1E.

size is the size of the RAID volume in MB, or `max` for the maximum available size.

enclosure:bay is the enclosure and slot values of the disk drive for the new RAID volume. You can get these values from the output of the **display** command.

Note: DOS does not support addressing by enclosure:bay.

volume_name is a user-specified string to identify the volume.

The optional **noprompt** parameter prevents warnings and prompts from being displayed while the command is running

Return values

0x00 Success: Command completed successfully.

0x01 Failure: Bad command-line arguments or operational failure.

0x02 Adapter_not_found: Cannot find the specified adapter.

Delete command

Use the **delete** command to delete all integrated RAID volumes and hot spare drives from the specified LSI SAS2 controller. No other controller configuration parameters are changed.

Syntax

The syntax of the **delete** command is

```
sas2ircu controller_number delete [noprompt]
```

where:

controller_number
is the index of the controller with the volumes that you want to delete.

The optional **noprompt** parameter prevents warnings and prompts from being displayed while the command is running

Return values

0x00 Success: Command completed successfully.

0x01 Failure: Bad command-line arguments or operational failure.

0x02 Adapter_not_found: Cannot find the specified adapter.

Display command

Use the **display** command to display information about the LSI SAS2 controller configurations, including controller type, firmware version, BIOS version, volume information, physical drive information, and enclosure (see “Sample output”). The physical device information section displays the duplicate device of a dual-port SAS drive.

Note: One MB is 1048576 bytes. The **display** command rounds down to the nearest MB all amounts stated in MB.

Syntax

The syntax of the **display** command is

```
sas2ircu controller_number display [filename]
```

where:

controller_number
: is the index of the controller for which you want to display information.

filename
: is an optional file name to which you want to store the command output.

Return values

0x00 Success: Command completed successfully.

0x01 Failure: Bad command-line arguments or operational failure.

0x02 Adapter_not_found: Cannot find the specified adapter.

Sample output

The **display** command returns information as shown in the following sample output.

```
Read configuration has been initiated for controller 0
------------------------------------------------------------
Controller information
------------------------------------------------------------
   Controller type                         : SAS2008
   BIOS version                            : 7.00.02.00
   Firmware version                        : 00.250.19.0
   Channel description                     : 1 Serial Attached SCSI
   Initiator ID                            : 112
   Maximum physical devices                : 62
   Concurrent commands supported           : 266
   Slot                                    : 3
   Segment                                 : 0
   Bus                                     : 64
   Device                                  : 1
   Function                                : 0
   RAID Support                            : Yes
------------------------------------------------------------
IR Volume information
------------------------------------------------------------
------------------------------------------------------------
Physical device information
------------------------------------------------------------
Initiator at ID #112
Device at ID #335524
   Device is a Hard disk
   Enclosure #                             : 2
```

```
   Slot #                                  : 2
   Connector ID                            : 4
   State                                   : Ready (RDY)
   Size (in MB)/(in sectors)               : 70007/143374738
   Manufacturer                            : HP
   Model Number                            : DG072A9BB7
   Firmware Revision                       : HPD0
   Serial No                               : B365P720H7330709
   Protocol                                : SAS
   Drive Type                              : SAS
Device at ID #335525
   Device is a Hard disk
   Enclosure #                             : 2
   Slot #                                  : 1
   Connector ID                            : 4
   State                                   : Ready (RDY)
   Size (in MB)/(in sectors)               : 70007/143374738
   Manufacturer                            : HP
   Model Number                            : DG072A9BB7
   Firmware Revision                       : HPD0
   Serial No                               : B365P720H7L70709
   Protocol                                : SAS
   Drive Type                              : SAS
------------------------------------------------------------
Enclosure information
------------------------------------------------------------
Enclosure#                                 : 1
Logical ID                                 : 51234567:89012345
Numslots                                   : 8
StartSlot                                  : 0
```

Logical drive status values are described in the following list:

Okay (OKY)
The volume is in the active state and drives are functioning properly. User data is protected if the current RAID level provides data protection.

Degraded (DGD)
The volume is in the active state. User data is not fully protected because of a configuration change or drive failure.

Failed (FLD)
The volume has failed.

Missing (MIS)
The volume is missing.

Initializing (INIT)
The volume is initializing.

Online (ONL)
The volume is online.

Physical device status values are described in the following list:

Online (ONL)
The drive is operational and is part of a logical drive.

Hot Spare (HSP)
The drive is a hot spare that is available to replace a failed drive in an array.

Ready (RDY)
The drive is ready for use as a normal disk drive, or it is ready to be assigned to a disk array or a hot spare pool.

Available (AVL)
The drive might or might not be ready, and it is not suitable for use in an array or a hot spare pool.

Failed (FLD)
The drive was part of a logical drive or was a hot spare drive, and it failed. The drive is now offline.

Missing (MIS)
The drive was part of a logical drive or was a hot spare drive, and it is missing. It has been removed or is not responding.

Standby (SBY)
The device is not a hard disk drive device.

Out of Sync (OSY)
The drive, which is part of a logical drive, is not synchronized with other drives that are part of the logical drive.

Degraded (DGD)
The drive is part of a logical drive and is in a Degraded state.

Rebuilding (RBLD)
The drive is part of a logical drive and is currently rebuilding.

Optimal (OPT)
The drive is optimal and is part of a logical drive.

Physical device drive type values are described in the following list:

SAS_HDD
The drive is a SAS hard disk drive (HDD).

SATA_HDD
The drive is a SATA hard disk drive (HDD).

SAS_SSD
The drive is a SAS solid state drive (SSD).

SATA_SSD
The drive is a SATA solid state drive (SSD).

Physical device protocol values are described in the following list:

SAS The drive supports the SAS protocol.

SATA The drive supports the SATA protocol.

Hotspare command

Use the **hotspare** command to add a hot spare drive to spare pool 0 or delete a hot spare drive. The capacity of the hot spare drive must be greater than or equal to the capacity of the smallest drive in the RAID volume. To check the hot spare drive capacity, issue the **display** command on the drive.

Observe the following rules when you create hot spare drives:

- You cannot create a hot spare drive unless at least one RAID1, RAID10, or RAID1E volume already exists.
- You cannot create a hot spare and add it to an inactive integrated RAID volume.
- You cannot add a SAS hot spare hard disk drive if the existing volumes on the controller use SATA drives. You cannot add a SATA hot spare hard disk drive if the existing volumes on the controller use SAS drives.
- You can add a SAS hot spare solid state drive to a volume that has SATA solid state drives, and you can add a SATA hot spare solid state drive to a volume that has SAS solid state drives, if the integrated RAID firmware allows it. This depends on the values in the static fields.
- The maximum allowable number of hot spare drives depends on the value of the **MaxGlobalHotSpares** field. (Normally, the maximum is two global hot spares per controller.)
- You cannot add a hot spare solid state drive to a volume that has hard disk drives, and you cannot add hard disk drives to a volume that has solid state drives.

Syntax

The syntax of the **hotspare** command is

```
sas2ircu controller_number hotspare [delete] enclosure:bay
```

where:

controller_number
: is the index of the controller on which you want to create the hot spare disk.

enclosure:bay
: is the enclosure and slot values of the hot spare disk drive. You can get these values from the output of the **display** command.

  Note: DOS does not support addressing by enclosure:bay.

The optional **delete** parameter deletes the hot spare disk at *enclosure:bay*.

Return values

0x00 Success: Command completed successfully.

0x01 Failure: Bad command-line arguments or operational failure.

0x02 Adapter_not_found: Cannot find the specified adapter.

List command

Use the **list** command to display a listing of all controllers that are present in the system, along with each corresponding controller index. Use the controller index as an input parameter for other SAS2IRCU commands.

Syntax

The syntax of the **list** command is

```
sas2ircu list
```

Return values

0x00 Success: Command completed successfully.

0x01 Failure: Bad command-line arguments or operational failure.

0x02 Adapter_not_found: Cannot find the specified adapter.

Sample output

The following example shows the output of the **list** command. The format and fields in the output might vary depending on the types of installed controllers.

```
      Adapter    Vendor Device                 SubSys SubSys
Index  Type        ID    ID     Pci Address     Ven ID Dev ID
----- --------- ------ ------ ---------------- ------- ------
0      SAS2008    1000h 72h    00h:01h:00h:00h  1000h   00dah
1      SAS2008    1000h 72h    00h:05h:00h:00h  1000h   00dah
```

Locate command

Use the **locate** command to locate specific drives in a volume by turning on their location indicators.

Syntax

The syntax of the **locate** command is

```
sas2ircu controller_number locate enclosure:bay action
```

where:

controller_number
is the index of the controller that is associated with the drives that you want to locate.

enclosure:bay is the enclosure and slot number of the drive.

action is the following possible actions:

On: Turns on the location indicator of the drive.

Off: Turns off the location indicator of the drive.

Return values

0x00 Success: Command completed successfully.

0x01 Failure: Bad command-line arguments or operational failure.

0x02 Adapter_not_found: Cannot find the specified adapter.

Logir command

Use the **logir** command to upload or clear the integrated RAID log information.

Syntax

The syntax of the **logir** command is

```
sas2ircu controller_number logir action [filename] [noprompt]
```

where:

controller_number
: is the index of the controller that is associated with the logs that you want to upload or clear.

action
: is the following possible actions:

  Upload: Upload the controller logs to a file.

  Clear: – Clear the controller logs.

filename
: is an optional file name to which you want to upload the logs. The default file name is `logir.log`.

The optional **noprompt** parameter prevents warnings and prompts from being displayed while the command is running

Return values

0x00 Success: Command completed successfully.

0x01 Failure: Bad command-line arguments or operational failure.

0x02 Adapter_not_found: Cannot find the specified adapter.

Mfgpage command

Use the **mfgpage** command to update information on manufacturing pages. Only DOS and EFI support this command.

Syntax

The syntax of the **mfgpage** command is

```
sas2ircu controller_number mfgpage passcode mfgpage_number
offset value
```

where:

controller_number
: is the index of the controller that is associated with the manufacturing pages that you want to update.

passcode
: is the passcode that is required for DOS access, which is restricted.

mfgpage_number
: is the manufacturing page (4 or 10) that you want to update.

offset
: is the dword offset (offset of a value) in the specified manufacturing page that you want to update, in hexadecimal format.

value
: is the value of the offset that is being modified, in hexadecimal format.

Return values

0x00 Success: Command completed successfully.

0x01 Failure: Bad command-line arguments or operational failure.

0x02 Adapter_not_found: Cannot find the specified adapter.

Status command

Use the **status** command to display the current status of any existing integrated RAID volumes and the status of any operation that is currently in progress on the selected controller. If no operation is in progress, the utility displays a message indicating this before it exits.

Syntax

The syntax of the **status** command is

```
sas2ircu controller_number status
```

where:

controller_number
is the index of the controller that is associated with the volumes whose status you want to display.

Return values

0x00 Success: Command completed successfully.

0x01 Failure: Bad command-line arguments or operational failure.

0x02 Adapter_not_found: Cannot find the specified adapter.

Sample output

The following example shows the information that the **status** command returns when a volume resynchronization is in progress.

```
Background command progress status for controller 0...
IR Volume 1
   Volume ID                               : 6
   Current operation                       : Synchronize
   Volume status                           : Enabled
   Volume state                            : Degraded
   Physical disk I/Os                      : Not quiesced
   Volume size (in sectors)                : 70311936
   Number of remaining sectors             : 68250624
   Percentage complete                     : 2.93%
```

The following example shows the information that the **status** command returns if a background volume operation is not in progress.

```
IR Volume 1
   Current operation                       : None
   Volume ID                               : 6
   Volume status                           : Enabled
   Volume state                            : Optimal
   Physical disk I/Os                      : Not quiesced
```

The status data fields can have the following values:

Current operation
Synchronize, Consistency Check, OCE, Background Init, or None

Volume status
Enabled or Disabled

Volume state:
[Inactive] Optimal, Degraded, Missing, or Failed

Physical disk I/Os:
Quiesced or Not quiesced

Appendix B. 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 Web site at http://www.ibm.com/systems/support/ 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/systems/support/ 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 Web site 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/.

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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 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).

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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

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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 C. Notices

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Important notes

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.

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 device 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 device 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 device, IBM may condition provision of repair or replacement of device or parts on implementation of appropriate remedial measures to mitigate such environmental contamination. Implementation of such remedial measures is a customer responsibility.

Table 5. 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.

Electronic emission notices

Federal Communications Commission (FCC) statement

Note: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in

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

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

Industry Canada Class A emission compliance statement

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

Avis de conformité à la réglementation d'Industrie Canada

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

Australia and New Zealand Class A statement

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

United Kingdom telecommunications safety requirement

Notice to Customers

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

European Union EMC Directive conformance statement

This product is in conformity with the protection requirements of EU Council Directive 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.

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International Business Machines Corp.
New Orchard Road
Armonk, New York 10504
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European Community contact:
IBM Technical Regulations, Department M456

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Germany Class A statement

Deutschsprachiger EU Hinweis:

Hinweis für Geräte der Klasse A EU-Richtlinie zur Elektromagnetischen Verträglichkeit

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.

Um dieses sicherzustellen, sind die Geräte wie in den Handbüchern beschrieben zu installieren und zu betreiben. Des Weiteren dürfen auch nur von der IBM empfohlene Kabel angeschlossen werden. IBM übernimmt keine Verantwortung für die Einhaltung der Schutzanforderungen, wenn das Produkt ohne Zustimmung der IBM verändert bzw. wenn Erweiterungskomponenten von Fremdherstellern ohne Empfehlung der IBM gesteckt/eingebaut werden.

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Deutschland: Einhaltung des Gesetzes über die elektromagnetische Verträglichkeit von Geräten

Dieses Produkt entspricht dem “Gesetz über die elektromagnetische Verträglichkeit von Geräten (EMVG)”. Dies ist die Umsetzung der EU-Richtlinie 2004/108/EG in der Bundesrepublik Deutschland.

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:
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914-499-1900

Der verantwortliche Ansprechpartner des Herstellers in der EU ist:
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Generelle Informationen:

Das Gerät erfüllt die Schutzanforderungen nach EN 55024 und EN 55022 Klasse A.

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Japan Electronics and Information Technology Industries Association (JEITA) statement

高調波ガイドライン適合品

Japanese Electronics and Information Technology Industries Association (JEITA) Confirmed Harmonics Guideline (products less than or equal to 20 A per phase)

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В жилых помещениях оно может создавать радиопомехи, для снижения которых необходимы дополнительные меры

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声 明

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