6 Gb Performance Optimized 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 B, “Notices,” on page 15 and see the *Important Notices* and *Warranty Information* documents that comes with the host bus adapter.

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.

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.

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 Performance Optimized 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 can also achieve 6.0 Gbps SATA link rates. The PCI Express 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 6 Gb Performance Optimized HBA referred to throughout this document as HBA, is implemented using eight PCI Express lanes, which provide possible host-side maximum transmission and reception rates of up to 4.0 GBps (gigabytes per second).

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

If firmware and documentation updates are available, you can download them from the IBM Web site. The HBA might have features that are not described in the documentation that comes with the 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, go to http://www.ibm.com/supportportal/.

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

Overview

The HBA PCI Express interface is compliant with the PCI Express Specification, revision 2.0. The HBA implements the PCI Express interface physically as an x8 interface, which also functions in a x8 host slot that is wired as a x4 slot. The 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 HBA comes from the LSI2008 controller chip. The LSI2008 chip integrates eight high-performance SAS or SATA ports. The design of the HBA makes it easy to add SAS interfaces to a computer, workstation, or server with a PCI Express bus.

The HBA contains flash ROM for storing the BIOS code and firmware. The LEDs on the HBA report heartbeat, activity, and fault conditions when detected by the firmware.

Features

The 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) - 4800 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.
- Provides two LEDs on the PCI expansion-slot bracket for the 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 systems with Unified Extensible Firmware Interface (UEFI) 2.1 and 2.3.

PCI performance

The HBA has the following PCI Express features:

- Single (1 lane) link transfer rate up to 6.0 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

- 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 nonposted 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 HBA supports the following operating systems:

- Microsoft Windows Server 2003 32-bit and 64-bit (x86 and AMD), Windows Server 2008, Windows Server 2008 R2, Windows 2008 SP2, and Windows 2008 R2 SP1
- 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, VMware ESXi 4.0 Update 1, VMware ESX 4.1, VMware ESXi 4.1, and VMware 5.0

Specifications

The following sections describe the HBA specifications.

Physical dimensions

The HBA board is 167.6 mm (6.6 in.) x 68.6 mm (2.7 in.). The PCI Express x8 connection is made through the edge connector J6. The component height on the top and bottom of the HBA board follows the PCI Express specifications. The HBA supports SAS/SATA connections through two SFF-8087 mini-SAS internal connectors, J4 and J5.

Electrical specifications

The 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 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 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 HBA:

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

Chapter 2. Installing the HBA

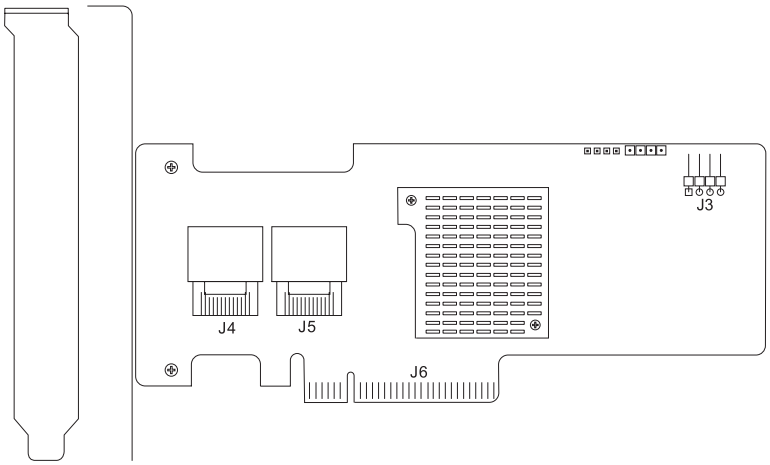
This chapter describes how to install the HBA and provides other information that you must consider when you install the HBA.

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.

LEDs and connectors

The following illustration shows the LEDs and connectors on the HBA.



J3 (External LED drive activity/fault header)

The J3 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.

J4 (x4 mini-SAS [SFF-8087] Port 1 internal connector)

The J4 mini-SAS connector connects the cables from the controller to SAS drives, SATA II drives, or a SAS expander.

J5 (x4 mini-SAS [SFF-8087] Port 0 internal connector)

The J5 mini-SAS connector connects the cables from the controller to SAS drives, SATA II drives, or a SAS expander.

J6 (PCI Express x8 connector)

The PCI Express interface has eight PCI Express ports that provide possible host-side maximum transmission and reception rates of up to 5.0 GBps. The HBA supports a x8 PCI Express link width. The connection is made through the edge connector J6. The signal definitions and pin numbers conform to the PCI Express specifications.

Handling the HBA

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

Installing the HBA in the server

Statement 1:

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

To avoid a shock hazard:

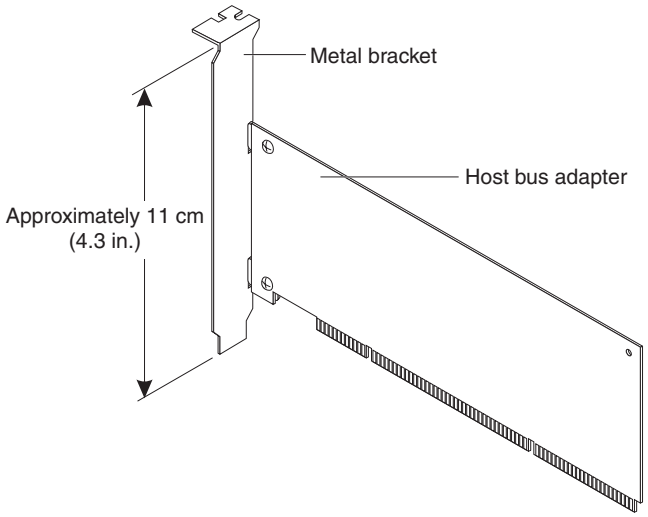
- **Do not connect or disconnect any cables or perform installation, maintenance, or reconfiguration of this product during an electrical storm.**
- **Connect all power cords to a properly wired and grounded electrical outlet.**
- **Connect to properly wired outlets any equipment that will be attached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

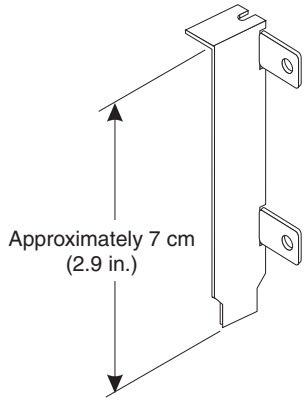
Before you install the HBA, make sure that the preinstalled expansion slot bracket is the correct size for the server PCI Express slot in which you are installing the HBA.

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

The 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.



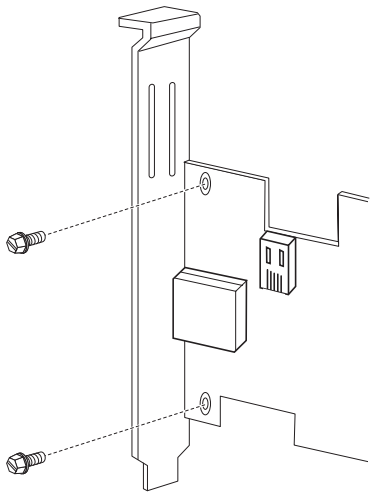
The HBA also comes with a low-profile expansion-slot bracket that is approximately 7 cm (2.9 in.) long. If the opening for the PCIe expansion slot is approximately 6 cm (2.3 in.) long, you must replace the preinstalled bracket with the low-profile bracket. You will do this in step 5 on page 9 in the following procedure.



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

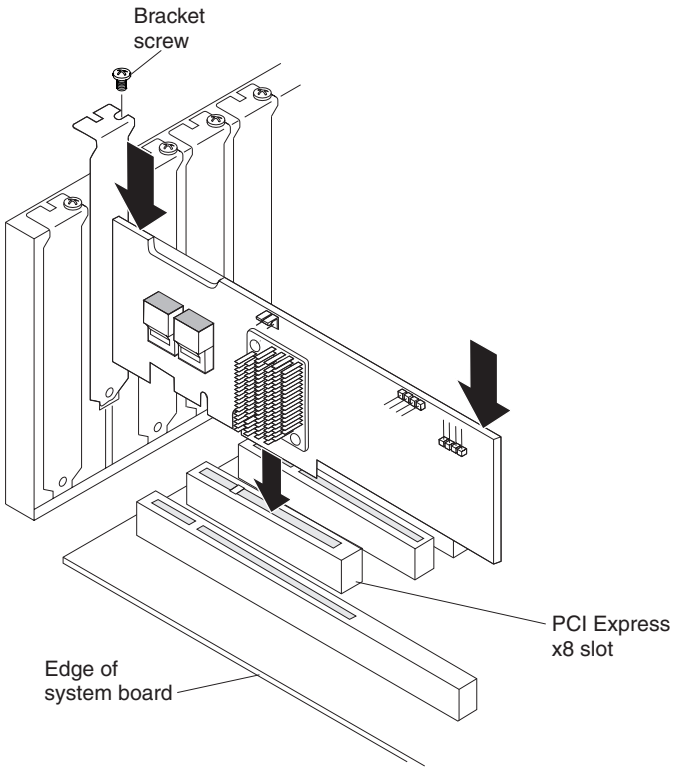
1. Read the safety information that begins on page iii, and “Handling the HBA” on page 6.
2. Turn off the server and peripheral devices and disconnect the power cords.
3. Remove the server cover. For more information, see the installation instructions that come with the server.

4. Touch the static-protective package that contains the HBA to any unpainted surface on the outside of the server; then, grasp the 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 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 on page 10.
   a. Orient the HBA as shown in the following illustration.



   b. Remove the two screws that hold the bracket onto the HBA.
   c. Lift the bracket from the 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 HBA and the holes on the tabs align with the holes on the HBA.
   e. From the front side of the HBA, attach the bracket to the HBA, using the two screws that you removed in step 5b.

6. 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 detailed instructions for installing the HBA in your server, see the installation instructions that come with the server.



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

   Note: Depending on the server model, you might have to install the HBA in a riser card and then install the riser card with the HBA in the PCIe slot on the system board.
8. Replace the expansion-slot screw if you removed it in step 6, or return the bracket lever to the closed position.
9. Connect the SAS cables between the connectors on the HBA and the target devices.
10. Replace the server cover.
11. Reconnect the power cords and turn on the server.

For information about configuring the HBA, see the *IBM SAS2 Integrated RAID Configuration Utility User's Guide* and the *IBM SAS2 BIOS Configuration Utility User's Guide* on the *IBM Documentation* CD that comes with the HBA.

Replaceable HBA components

Each replaceable component on the 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. HBA CRU part numbers

Description	**CRU part number (Tier 1)**
IBM 6 Gb Performance Optimized HBA and expansion-slot bracket	68Y7363

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/systems/intellistation/.

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

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/supline/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 Business Partners** on the right side of the page. For IBM support telephone numbers, see http://www.ibm.com/planetwide/. In the U.S. and Canada, call 1-800-IBM-SERV (1-800-426-7378).

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

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

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UNIX is a registered trademark of The Open Group in the United States and other countries.

Important notes

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

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

Table 4. 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:

Information Development
IBM Corporation
205/A015
3039 E. Cornwallis Road
P.O. Box 12195

Research Triangle Park, North Carolina 27709-2195
U.S.A.

In the request, be sure to include the publication part number and title.

When you send information to IBM, you grant IBM a nonexclusive right to use or distribute the information in any way it believes appropriate without incurring any obligation to you.

Electronic emission notices

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

Federal Communications Commission (FCC) statement

Note: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference, in which case the user will be required to correct the interference at his own expense.

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

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

European Union EMC Directive conformance statement

This product is in conformity with the protection requirements of EU Council Directive 2004/108/EC on the approximation of the laws of the Member States relating to electromagnetic compatibility. IBM cannot accept responsibility for any

failure to satisfy the protection requirements resulting from a nonrecommended modification of the product, including the fitting of non-IBM option cards.

Attention: This is an EN 55022 Class A product. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

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

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

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.

EN 55022 Klasse A Geräte müssen mit folgendem Warnhinweis versehen werden: “Warnung: Dieses ist eine Einrichtung der Klasse A. Diese Einrichtung kann im Wohnbereich Funk-Störungen verursachen; in diesem Fall kann vom Betreiber verlangt werden, angemessene Maßnahmen zu ergreifen und dafür aufzukommen.”

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:
International Business Machines Corp.
New Orchard Road

Armonk, New York 10504
914-499-1900

Der verantwortliche Ansprechpartner des Herstellers in der EU ist:
IBM Deutschland
Technical Regulations, Department M456
IBM-Allee 1, 71137 Ehningen, Germany
Telephone: +49 7032 15-2937
Email: tjahn@de.ibm.com

Generelle Informationen:

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

VCCI Class A statement

この装置は、クラス A 情報技術装置です。この装置を家庭環境で使用すると電波妨害を引き起こすことがあります。この場合には使用者が適切な対策を講ずるよう要求されることがあります。 VCCI-A

This is a Class A product based on the standard of the Voluntary Control Council for Interference (VCCI). If this equipment is used in a domestic environment, radio interference may occur, in which case the user may be required to take corrective actions.

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)

Korea Communications Commission (KCC) statement

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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.

Russia Electromagnetic Interference (EMI) Class A statement

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

People's Republic of China Class A electronic emission statement

中华人民共和国“A类”警告声明

声 明

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

Taiwan Class A compliance statement

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這是甲類的資訊產品，在居住的環境中使用時，可能會造成射頻干擾，在這種情況下，使用者會被要求採取某些適當的對策。

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Part Number: 60Y1455

Printed in USA

(1P) P/N: 60Y1455