

QLogic 4 Gbps FC Single-Port and Dual-Port
PCIe HBAs for IBM System x



Installation and User's Guide

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PCIe HBAs for IBM System x



Installation and User's Guide

Note: Before using this information and the product it supports, read the warranty information in Appendix B, "IBM Statement of Limited Warranty Z125-4753-08 04/2004," on page 43 and the general information in Appendix C, "Notices," on page 61.

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Safety

Before installing this product, read the Safety Information.

قبل تركيب هذا المنتج، يجب قراءة الملاحظات الأمنية

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

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

安裝本產品之前，請先閱讀「安全資訊」。

Prije instalacije ovog produkta obavezno pročitajte Sigurnosne Upute.

Před instalací tohoto produktu si 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 ασφαλείας (safety information).

לפני שתתקינו מוצר זה, קראו את הוראות הבטיחות.

A termék telepítése előtt olvassa el a Biztonsági előírásokat!

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

製品の設置の前に、安全情報をお読みください。

본 제품을 설치하기 전에 안전 정보를 읽으십시오.

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

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

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

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

Перед установкой продукта прочтите инструкции по технике безопасности.

Pred inštaláciou tohto zariadenia si pečítajte Bezpečnostné predpisy.

Pred namestitvijo tega proizvoda preberite Varnostne informacije.

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

Läs säkerhetsinformationen innan du installerar den här produkten.

Important:

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

For example, if a caution statement is labeled “D005a,” translations for that caution statement are in the *IBM Systems Safety Notices* document under “D005a.”

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.



DANGER

When working on or around the system, observe the following precautions:

Electrical voltage and current from power, telephone, and communication cables are hazardous. To avoid a shock hazard:

- Connect power to this unit only with the provided power cord. Do not use the provided power cord for any other product.
- Do not open or service any power supply assembly.
- Do not connect or disconnect any cables or perform installation, maintenance, or reconfiguration of this product during an electrical storm.
- The product might be equipped with multiple power cords. To remove all hazardous voltages, disconnect all power cords.
- Connect all power cords to a properly wired and grounded electrical outlet. Ensure that the outlet supplies proper voltage and phase rotation according to the system rating plate.
- Connect any equipment that will be attached to this product to properly wired outlets.
- 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 procedures when installing, moving, or opening covers on this product or attached devices.

To disconnect:

1. Turn off everything (unless instructed otherwise).
2. Remove the power cords from the outlets.
3. Remove the signal cables from the connectors.
4. Remove all cables from the devices.

To connect:

1. Turn off everything (unless instructed otherwise).
2. Attach all cables to the devices.
3. Attach the signal cables to the connectors.
4. Attach the power cords to the outlets.
5. Turn on the devices.

(D005a)



CAUTION:

This product might contain one or more of the following devices: CD-ROM drive, DVD-ROM drive, DVD-RAM drive, or laser module, which are Class 1 laser products. Note the following information:

- Do not remove the covers. Removing the covers of the laser product could result in exposure to hazardous laser radiation. There are no serviceable parts inside the device.
- Use of the controls or adjustments or performance of procedures other than those specified herein might result in hazardous radiation exposure.

(C026)



CAUTION:

Data processing environments can contain equipment transmitting on system links with laser modules that operate at greater than Class 1 power levels. For this reason, never look into the end of an optical fiber cable or open receptacle. (C027)



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

Chapter 1. Introduction

This *Installation and User's Guide* contains instructions for installing the following host bus adapters in an IBM® System x™ server:

- QLogic 4 Gbps FC Single-Port PCIe HBA for IBM System x
- QLogic 4 Gbps FC Dual-Port PCIe HBA for IBM System x

The QLogic 4 Gbps FC Single-Port or Dual-Port PCIe Host Bus Adapter for IBM System x is referred to throughout this document as *host bus adapter*.

This document contains information about:

- Installing the host bus adapter
- Updating the BIOS code and nonvolatile random access memory (NVRAM), using either the SANSurfer Pro Utility or the flasutil Utility program
- Installing host bus adapter device drivers
- Performing custom configuration of the host bus adapter, using the Fast!Util utility program
- Performing basic troubleshooting of the host bus adapter

The host bus adapter is a 4 Gbps high-performance, direct memory access (DMA), bus master, Fibre Channel host adapter that is designed for high-end servers. The function and performance are derived from the ISP2432 chip.

The ISP2432 chip combines a powerful, reduced instruction set computer (RISC) processor, a Fibre Channel protocol manager (FPM) with one 4 Gb Fibre Channel transceiver, and a PCI Express (PCIe) local bus interface in a single-chip solution. The host bus adapter supports all Fibre Channel peripheral devices that support private-loop direct attach (PLDA) and fabric-loop attach (FLA).

The host bus adapter can connect the following devices:

- Mainframe computers
- Super computers
- Workstations
- Storage devices
- Servers

If firmware and documentation updates are available, you can download them from the IBM Web site. To check for updates, complete the following steps:

1. Go to <http://www.ibm.com/systems/x/>.
2. Under **Resources**, select **Drivers and downloads**.
3. In the **Brand** field, select **Options**.
4. In the **Family** field, select **Storage Expansion**.
5. In the **Type** field, select **Fibre**.
6. In the **Operating System** field, select the applicable operating system.
7. Click **Continue**.

You can select firmware updates, device drivers, and publications.

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

The host bus adapter comes with a one-year limited warranty. For information about your warranty, see Appendix B, “IBM Statement of Limited Warranty Z125-4753-08 04/2004,” on page 43.

For service or assistance, see Appendix A, “Getting help and technical assistance,” on page 41.

Related documentation

This *Installation and User's Guide* contains setup, installation, configuration, and troubleshooting instructions for the host bus adapter. It also provides general information about the host bus adapter, including warranty information, and how to get help.

In addition to this *Installation and User's Guide*, the following related documentation is provided with the host bus adapter:

- *IBM Systems Safety Notices*

This document is in Portable Document Format (PDF) in the Documentation folder on the *QLogic 4 Gbps FC Single-Port and Dual-Port PCIe HBAs for IBM System x Support CD*. It contains translated versions of caution and danger statements. Each caution and danger statement in this document is labeled with a number. This number is used to cross reference the English-language caution or danger statement with translated versions of the caution or danger statement in the *IBM Systems Safety Notices* document.

- *QLogic 4 Gbps FC Single-Port and Dual-Port PCIe HBAs for IBM System x Quick Installation Guide*

This printed document contains basic instructions for installing the host bus adapter.

Notices and statements in this document

The caution and danger statements in this document are also in the multilingual *IBM Systems Safety Notices* document, which is on the *QLogic 4 Gbps FC Single-Port and Dual-Port PCIe HBAs for IBM System x Support CD*. Each statement is followed by a reference number that you can use to locate the corresponding statement in your language in the *IBM Systems Safety Notices* document.

The following notices and statements are used in this document:

- **Note:** These notices provide important tips, guidance, or advice.
- **Important:** These notices provide information or advice that might help you avoid inconvenient or problem situations.
- **Attention:** These notices indicate potential damage to programs, devices, or data. An attention notice is placed just before the instruction or situation in which damage might occur.
- **Caution:** These statements indicate situations that can be potentially hazardous to you. A caution statement is placed just before the description of a potentially hazardous procedure step or situation.
- **Danger:** These statements indicate situations that can be potentially lethal or extremely hazardous to you. A danger statement is placed just before the description of a potentially lethal or extremely hazardous procedure step or situation.

Features and specifications

The host bus adapter has the following features:

- Compatible with x4 PCIe slot
- Conforms to *PCI Express Base Specification rev. 1.0a*, *PCI Express Card Electromechanical Specification rev. 1.0*, and *PCI Bus Power Management Interface Specification revision 1.1*

The host bus adapter operating environment specifications are described in the following table.

Table 1. Host bus adapter operating environment specifications

Environment	Minimum	Maximum
Operating temperature	10°C (50°F)	35°C (95°F)
Storage temperature	-20°C (-4°F)	70°C (158°F)
Relative humidity (noncondensing)	8%	80%
Storage humidity (noncondensing)	5%	95%

The host bus adapter specifications are described in the following table.

Table 2. Host bus adapter specifications

Type	Specification
Host bus	<ul style="list-style-type: none">• Conforms to <i>PCI Express Base Specification rev. 1.0a</i>, <i>PCI Express Card Electromechanical Specification rev. 1.0</i>, and <i>PCI Bus Power Management Interface Specification revision 1.1</i>• Bus interface: PCI Express x4• Memory: 1 MB SRAM, 1 MB flash (SPI), and 2 KB NVRAM (SPI)• Compliance: <i>PCI Express Base Specification rev. 1.0a</i>, <i>PCI Express Card Electromechanical Specification rev. 1.0</i>, <i>PCI Bus Power Management Interface Specification revision 1.1</i>
PCI Express signaling environment	Support for 3.3 V
PCI Express transfer rate	PCI Express x4 bus at 2.5 GHz

Table 2. Host bus adapter specifications (continued)

Type	Specification
Fibre Channel specifications	<ul style="list-style-type: none"> • Data rate: 4/2/1 Gbps auto-negotiation (4.2480/2.1240/1.0625 Gbps) • Performance: 100,000 IOPS • Topology : Point-to-point (N_Port), arbitrated loop (NL_Port), and switched fabric (N_Port)Logins Support for F_Port and FL_Port login. • 2,048 concurrent logins and 2,048 active exchanges • Class of service Class 2 and 3 • Protocols FCP (SCSI-FCP), IP (FC-IP), FC-TAPE (FCP-2) • Compliance: SCSI-3 Fibre Channel Protocol (SCSI-FCP), Fibre Channel Physical and Signaling Interface (FC-PH), Fibre Channel 2nd Generation (FC-PH-2), Third Generation Fibre Channel Physical and Signaling Interface (FC-PH-3), Fibre Channel-Arbitrated Loop (FC-AL-2), Fibre Channel Fabric Loop Attachment Technical Report (FC-FLA), Fibre Channel-Private Loop Direct Attach Technical Report (FC-PLDA), Fibre Channel Tape (FC-TAPE) profile, SCSI Fibre Channel Protocol-2 (FCP-2), Second Generation FC Generic Services (FC-GS-3), Third Generation FC Generic Services (FC-GS-3), Fibre Channel Framing and Signaling (FC-FS)
Processor	Single-chip design that includes a RISC processor, Fibre Channel protocol manager, PCI or PCI-X DMA controller, and integrated serializer/deserializer (SERDES) and electrical transceivers that can auto-negotiate a data rate of 4 GB per second
Host data transfer	64-bit, bus-master DMA data transfers to 2000 MB per second
RAM	1 M of SRAM supporting parity protection
BIOS ROM	1 M of flash ROM, field programmable
NVRAM	2 KB, field programmable
Connectors (external)	<ul style="list-style-type: none"> • Small form factor fixed (SFF) multimode optic with LC-style connector • Cable distances: <ul style="list-style-type: none"> – 1 Gbps: 500 meters 50/125 µm fiber, 300 meters 62.5/125 µm fiber – 2 Gbps: 300 meters 50/125 µm fiber, 150 meters 62.5/125 µm fiber – 4 Gbps: 150 meters 50/125 µm fiber, 70 meters 62.5/125 µm fiber
Form factor	Low-profile PCI Express adapter: 6.89 x 16.765 cm (2.713 x 6.6 in.)
Power dissipation	5.0 watts (maximum)

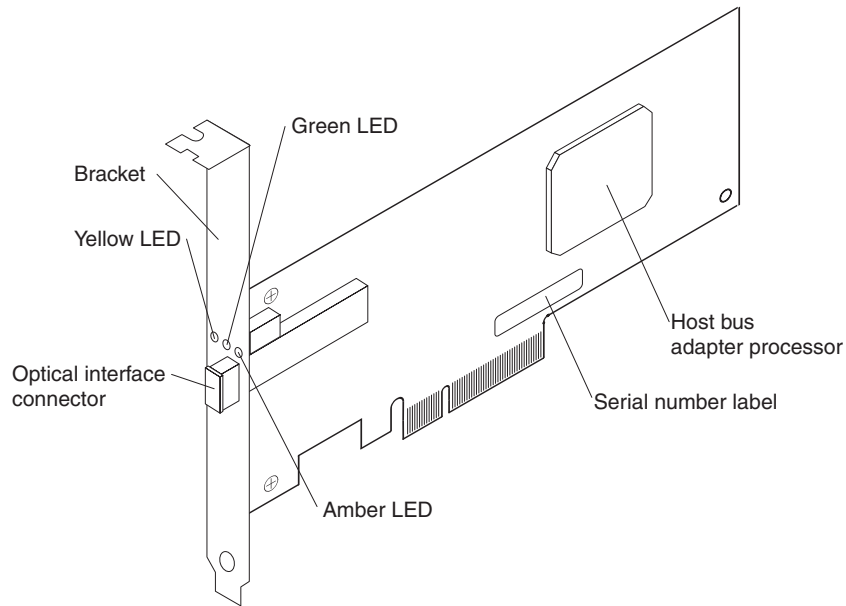
Inventory checklist

The host bus adapter option package contains the following items:

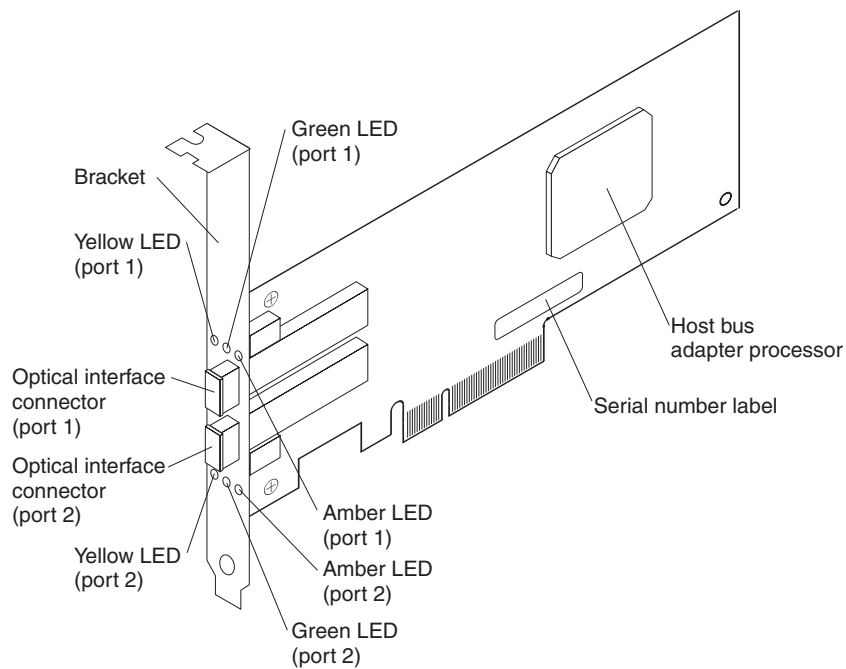
- One of the following host bus adapters:
 - QLogic 4 Gbps FC Single-Port PCIe HBA for IBM System x
 - QLogic 4 Gbps FC Dual-Port PCIe HBA for IBM System x
- Low-profile expansion slot bracket
- *QLogic 4 Gbps FC Single-Port and Dual-Port PCIe HBAs for IBM System x Quick Installation Guide*
- *QLogic 4 Gbps FC Single-Port and Dual-Port PCIe HBAs for IBM System x Support CD*

Host bus adapter components

The major components of the single-port host bus adapter are shown in the following illustration.



The major components of the dual-port host bus adapter are shown in the following illustration.



Fibre Channel overview

Fibre Channel technology is outlined in the SCSI-3 Fibre Channel Protocol (SCSI-FCP) standard. Fibre Channel is a high-speed data transport technology that is used for mass storage and networking.

Using a Fibre Channel Arbitrated loop (FC-AL), 126 Fibre Channel devices can be supported, compared to 15 small computer system interface (SCSI) devices with Ultra SCSI.

The host bus adapter uses a multimode shortwave optical interface for distances up to 500 meters when it is operating at 1 Gbps, 300 meters at 2 Gbps, and 150 meters at 4 Gbps.

The host bus adapter is a 4 Gbps Fibre Channel device that supports data transfer rates up to 400 MB per second half-duplex and 800 MB per second full-duplex on optical interfaces.

Host bus adapter LEDs

The yellow, green, and amber light emitting diodes (LEDs) are described in the following table.

Table 3. Host bus adapter activity

Yellow LED	Green LED	Amber LED	Activity	Description
Off	Off	Off	Power off	The host bus adapter is not receiving power. The server is powered-off.
On	On	On	Power on (before firmware initialization)	The host bus adapter is receiving power from the PCIe slot, but it is not initialized by the adapter firmware.
Flashing	Flashing	Flashing	Power on (after firmware initialization)	The host bus adapter has been successfully initialized by the adapter firmware and is in a ready state. The adapter firmware is initialized when the adapter BIOS code is loaded, Ctrl+Q is pressed, or the host bus adapter device driver is loaded.
Flashing alternately	Flashing alternately	Flashing alternately	Firmware error	The host bus adapter firmware has detected an unrecoverable error condition.
Off	Off	On/Flashing	Online	1 Gbps link / I/O activity
Off	On/Flashing	Off	Online	2 Gbps link / I/O activity
On/Flashing	Off	Off	Online	4 Gbps link / I/O activity
Flashing	Off	Flashing	Beacon	The host bus adapter is responding to a Beacon command from the host bus adapter management software.

Chapter 2. Installing the host bus adapter

This chapter provides instructions for installing the host bus adapter in a server.

Installation guidelines

Before you install the host bus adapter in the server, read the following information:

- Read the safety information that begins on page v and the guidelines in “Handling static-sensitive devices.” This information will help you work safely.
- When you install the new host bus adapter, take the opportunity to download and apply the most recent firmware updates. This step will help to ensure that any known issues are addressed and that host bus adapter is ready to function at maximum levels of performance. Make sure that you are using the latest versions of device drivers, firmware code, and basic input/output system (BIOS) code for the server and the host bus adapter. To download the most recent device drivers and firmware updates, go to <http://www.ibm.com/systems/x/>. Follow the instructions that are included with the download procedure.
- Observe good housekeeping in the area where you are working. Place removed covers and other parts in a safe place.
- Do not attempt to lift an object that you think is too heavy for you. If you have to lift a heavy object, observe the following precautions:
 - Make sure that you can stand safely without slipping.
 - Distribute the weight of the object equally between your feet.
 - Use a slow lifting force. Never move suddenly or twist when you lift a heavy object.
 - To avoid straining the muscles in your back, lift by standing or by pushing up with your leg muscles.
- Have a small flat-blade screwdriver available.
- When you are finished working on the server, reinstall all safety shields, guards, labels, and ground wires.

Handling static-sensitive devices

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

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

- Limit your movement. Movement can cause static electricity to build up around you.
- The use of a grounding system is recommended. For example, wear an electrostatic-discharge wrist strap, if one is available. Always use an electrostatic-discharge wrist strap or other grounding system when you work inside the server with the power on.
- Handle the device carefully, holding it by its edges or its frame.
- Do not touch solder joints, pins, or exposed circuitry.
- Do not leave the device where others can handle and damage it.

- While the device is still in its static-protective package, touch it to an unpainted metal surface on the outside of the server for at least 2 seconds. This drains static electricity from the package and from your body.
- Remove the device from its package and install it directly into the server without setting down the device. If it is necessary to set down the device, put it back into its static-protective package. Do not place the device on the server cover or on a metal surface.
- Take additional care when you handle devices during cold weather. Heating reduces indoor humidity and increases static electricity.

Handling fiber-optic cables

Attention: To avoid damage to a fiber-optic cable, follow these guidelines:

- Do not route the cable along a folding cable-management arm.
- When you attach the cable to a device on slide rails, leave enough slack in the cable so that it does not bend to a radius of less than 38 mm (1.5 in.) when the device is extended or become pinched when the device is retracted.
- Route the cable away from places where it can be snagged by other devices in the rack.
- Do not use plastic cable ties in place of the provided cable straps.
- Do not overtighten the cable straps or bend the cable to a radius of less than 38 mm (1.5 in.).
- Do not put excess weight on the cable at the connection point. Make sure that the cable is well supported.
- Use the following suggested maximum cable lengths:
 - 1 Gbps: 500 meters 50/125 μm fiber, 300 meters 62.5/125 μm fiber
 - 2 Gbps: 300 meters 50/125 μm fiber, 150 meters 62.5/125 μm fiber
 - 4 Gbps: 150 meters 50/125 μm fiber, 70 meters 62.5/125 μm fiber

What you need for the installation

To install the host bus adapter in the server, you will need a small Phillips screwdriver. Depending on the configuration, you might need the following two items:

- An LC-LC fiber-optic cable (used to connect Fibre Channel nodes to a loop)
- LC-SC fiber-optic cable (used to connect an LC-LC fiber-optic cable to a device that requires an SC connector)

Note: The LC-LC and LC-SC fiber-optic cables do not come with the host bus adapter and must be purchased separately.

Installing the host bus adapter



CAUTION:

This product might contain one or more of the following devices: CD-ROM drive, DVD-ROM drive, DVD-RAM drive, or laser module, which are Class 1 laser products. Note the following information:

- Do not remove the covers. Removing the covers of the laser product could result in exposure to hazardous laser radiation. There are no serviceable parts inside the device.
- Use of the controls or adjustments or performance of procedures other than those specified herein might result in hazardous radiation exposure.

(C026)



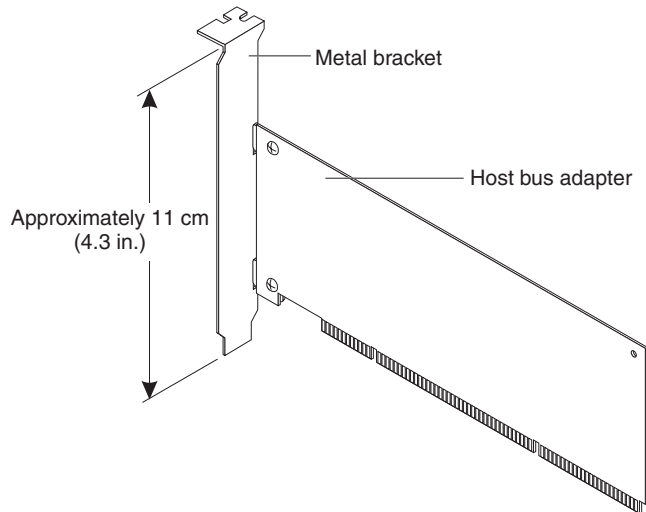
CAUTION:

Data processing environments can contain equipment transmitting on system links with laser modules that operate at greater than Class 1 power levels. For this reason, never look into the end of an optical fiber cable or open receptacle. (C027)

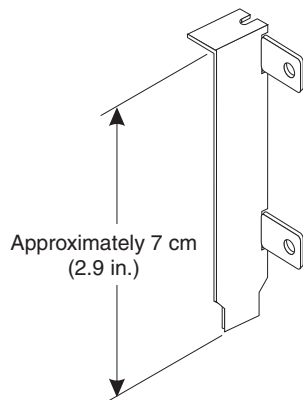
Before you install the host bus adapter, make sure that the preinstalled expansion slot bracket is the correct size for the server in which you are installing the host bus adapter.

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

The host bus adapter comes with a preinstalled expansion-slot bracket that is approximately 11 cm (4.3 in.) long. If the opening for the PCI-X or PCIe expansion-slot is approximately 10 cm (4.0 in.) long, you will use the preinstalled bracket.



The option package also contains a low-profile expansion-slot bracket that is approximately 7 cm (2.9 in.) long. If the opening for the PCI-X or 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 7 on page 13 in the following procedure.



Note: Installing the host bus adapter in a server with an Intel® 64-bit processor (IA-64) is not supported.

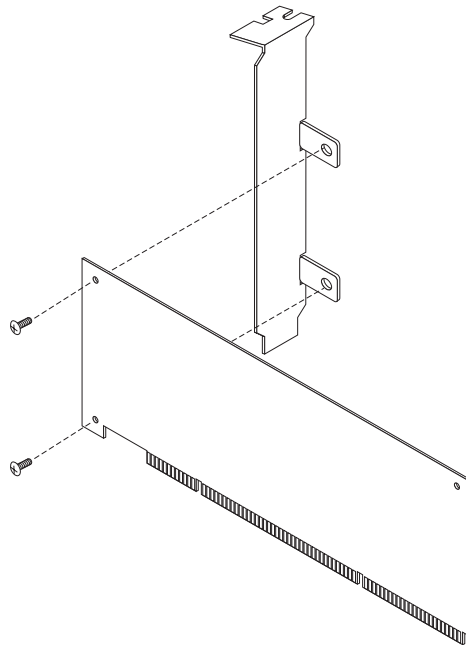
To install the host bus adapter in a server, complete the following steps:

1. Read the safety information that begins on page v and “Handling static-sensitive devices” on page 9.
2. Write down the serial number of the host bus adapter. Each adapter has a unique serial number. If the nonvolatile random access memory (NVRAM) (also referred to as NOVRAM) is damaged, you are prompted for the host bus adapter serial number. See the illustrations in “Host bus adapter components” on page 6 for the serial number location.
3. Check the server system board and make any necessary configuration changes to accommodate the host bus adapter.

Note: The host bus adapter is self-configuring. If your server requires manual configuration to enable the host bus adapter, bus-master slot, and interrupt request (IRQ) level, use the Configuration/Setup Utility program, which is part

of the server basic input/output system (BIOS). For more information about the Configuration/Setup Utility program, see the *User's Guide* that comes with the server.

4. Turn off the server and peripheral devices and disconnect the power cords.
5. Remove the server cover. For more information, see the *Installation Guide* that comes with the server.
6. Touch the static-protective package that contains the host bus adapter to any unpainted surface on the outside of the server; then, grasp the host bus adapter 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 host bus adapter appears to be damaged.
7. 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 8.
 - a. Orient the host bus adapter as shown in the following illustration.



- b. Remove the two screws that hold the bracket onto the host bus adapter.
 - c. Lift the bracket from the host bus adapter 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 host bus adapter and the holes on the tabs align with the holes on the host bus adapter.
 - e. From the front side of the host bus adapter, attach the bracket to the host bus adapter using the two screws that you removed in step 7b.
8. Determine which x4 PCIe slot you will use. Depending on the server model, you might have to remove the expansion-slot cover or release the bracket lever for the selected PCIe 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 host bus adapter in your server, see the *User's Guide* that comes with the server.
9. Position the host bus adapter by aligning the PCIe connector with the PCIe slot on the system board. Insert the host bus adapter firmly into the connector.

Note: Depending on the server model, you might have to install the host bus adapter in a riser card and then install the riser card with the host bus adapter in the PCIe slot on the system board.

10. Secure the host bus adapter to the server chassis. Replace the expansion-slot screw if you removed it in step 8 on page 13, or return the bracket lever to the closed position.
11. Remove the protective caps from the ends of an LC-LC fiber-optic cable and from the optical interface connector on the host bus adapter (see “Handling fiber-optic cables” on page 10).
12. Connect one end of the LC-LC fiber-optic cable to the optical interface connector on the host bus adapter. Connect the other end to a Fibre Channel device.
13. Replace the server cover.
14. Reconnect the power cords.
15. Turn on all external Fibre Channel devices; then, turn on the server. To make sure that the host bus adapter is functioning correctly, check the LEDs on the front bracket of the host bus adapter. For more information about the host bus adapter LEDs, see “Host bus adapter LEDs” on page 7.

The following information is displayed.

For a single-port host bus adapter:

```
QLogic Corporation
QLE2460 PCI Fibre Channel ROM BIOS Version X.XX
Copyright (C) QLogic Corporation 1993-2005 All Rights Reserved.
www.qlogic.com
```

```
Press <Ctrl+Q> for Fast!UTIL
```

```
BIOS for Adapter 0 is disabled
ROM BIOS not installed
```

For a dual-port host bus adapter:

```
QLogic Corporation
QLE2462 PCI Fibre Channel ROM BIOS Version X.XX
Copyright (C) QLogic Corporation 1993-2005 All Rights Reserved.
www.qlogic.com
```

```
Press <Ctrl+Q> for Fast!UTIL
```

```
BIOS for Adapter 0 is disabled
BIOS for Adapter 1 is disabled
```

If the displayed information is not correct and you have verified that the host bus adapter is configured correctly, see Chapter 6, “Troubleshooting,” on page 37.

16. Use one of the following methods to install the applicable device driver and update the host bus adapter BIOS code and NVRAM:
 - **(Preferred method)** Follow the procedures in Chapter 3, “Installing device drivers and using the SANSurfer Pro Utility to update BIOS and NVRAM,” on page 15.
 - Follow the procedures in Chapter 4, “Using the flasutil utility (from a CD or diskette) to update BIOS and NVRAM and device driver instructions,” on page 23.

Chapter 3. Installing device drivers and using the SANsurfer Pro Utility to update BIOS and NVRAM

This chapter contains the instructions for installing the SANsurfer Pro Utility program and using it to update the host bus adapter BIOS code and NVRAM, and installing device drivers. The SANsurfer Pro Utility program and host bus adapter device drivers are provided on the *QLogic 4 Gbps FC Single-Port and Dual-Port PCIe HBAs for IBM System x Support CD* (the support CD).

If you want to use the flasutil utility program to update the host bus adapter BIOS code and nonvolatile random access memory (NVRAM), see Chapter 4, "Using the flasutil utility (from a CD or diskette) to update BIOS and NVRAM and device driver instructions," on page 23.

Note: For the latest information about operating-system support, versions of device drivers, utilities, and documentation, go to <http://www.ibm.com/systems/x/>. (For instructions, see page 1.)

After you install the host bus adapter, perform the following general tasks. The detailed instructions are in the following sections.

1. Install the applicable host bus adapter device driver.
2. Install the QLogic SANsurfer Pro Utility program.
3. Use the SANsurfer Pro Update Option ROM Utility program to update the BIOS code.
4. Use the SANsurfer Pro Update NVRAM Utility program to update the NVRAM.

Installing the host bus adapter device drivers

The host bus adapter device drivers and installation instructions for the following operating systems are provided on the support CD:

- Microsoft® Windows® Server 2003, Advanced Server, or Enterprise Edition
- Red Hat® Enterprise Linux® version 4
- SUSE Linux Enterprise Server version 8 or version 9
- Novell NetWare version 6.5

Important: Make sure that the device drivers for the host bus adapter are installed on the server that contains the adapter. If the correct device drivers are not installed on the server in which the host bus adapter is installed, the SANsurfer program does not list the adapter. If the server in which the SANsurfer program is installed is *not* the host server that contains the host bus adapter, make sure that the SANsurfer agent is installed on the host server and that the Ethernet port on the host server is in the same IP subnet as the server in which the SANsurfer Pro Utility program is installed.

For installation instructions, see the readme files for the applicable operating systems, which are in the corresponding operating system directories on the support CD.

Note: For the latest information about operating-system support, versions of device drivers, utilities, and documentation, go to <http://www.ibm.com/systems/x/>. (For instructions, see page 1.)

QLogic SANsurfer Pro Utility overview

You can use the QLogic SANsurfer Pro Utility program to manage the host bus adapter in a storage area network (SAN). It is a network-capable application that can connect to and configure host bus adapters in remote servers, enabling centralized management and configuration of an entire SAN that contains components and storage devices.

You can use the SANsurfer Pro Utility program to manage and control one or more host bus adapters that are installed in local or remote servers. The SANsurfer Pro Utility program is used, along with problem determination procedures (PDPs), on new or existing installations to help diagnose Fibre Channel (FC) subsystem problems in adapters, controllers, and devices that are attached to the Fibre Channel fabric or loop.

You can also perform the following operations:

Disable (unconfigure) a device on a host bus adapter

When a device is unconfigured, it is not recognized by the host bus adapter and is not accessible to the adapter in that server.

Enable a device

This operation adds a device and makes it accessible to the host bus adapter in that server.

Notes:

1. The diagnostic functions of the SANsurfer Pro Utility program are available for all operating systems that support it.
2. Not all features of the SANsurfer program are supported for all operating systems that support it. For information about possible program limitations, see the operating system-specific readme file.
3. If you are prompted for a password, the default password is `config` (all lowercase).

SANsurfer Pro Utility features

Use the SANsurfer Pro Utility program to perform the following tasks:

- Set the SANsurfer Pro Utility program options
- Connect to hosts for managing host bus adapters installed in the hosts
- Disconnect from a host
- View detailed event and alarm-log information
- Use host-to-host SAN configuration policies
- Configure port devices
- Use logical unit number (LUN) level configuration
- Monitor in real time to determine when failovers occur, using the Failover Watcher
- Control host-side agent operations, including setting of the host agent polling interval
- Review host adapter information, including:
 - General information
 - Statistics
 - Information about attached devices
 - Link status for attached device

- Perform adapter functions, including:
 - Configuring the adapter NVRAM settings
 - Executing fiber diagnostics (read/write buffer loopback tests)
 - Performing flash updates on an adapter
 - Performing NVRAM updates on an adapter
- Manage configurations:
 - Saving configurations for offline policy checks and SAN integrity
 - Loading configurations from a file if the host is offline for policy checks and SAN integrity
- Confirm security

Installing the QLogic SANsurfer Pro Utility

The installation files for the QLogic SANsurfer Pro Utility for Microsoft Windows, Novell NetWare, and Linux platforms are on the support CD or you can download the Web package from <http://www.ibm.com/systems/x/>. (For instructions, see page 1.)

SANsurfer Pro Utility installation and system requirements

The SANsurfer Pro Utility installation and system requirements are in the readme files that come with the utility program.

Installing on Microsoft Windows and Novell NetWare platforms

Note: If the SANsurfer Pro Utility is already installed, uninstall it before you install a new version.

To install the SANsurfer Pro Utility on a server or workstation that is running a Microsoft Windows or Novell NetWare operating system, complete the following steps:

1. Insert the support CD that comes with the host bus adapter into the CD drive.
2. Double-click the executable installation file, for example, `sansurfer2.0.30b81_windows_install.exe`, and follow the instructions in the window.
3. In the Choose Product Features window, select one of the following preconfigured installation sets, or select **Custom** to define an installation set.
 - Select **FC HBA GUI and Agent** to install the SANsurfer FC HBA Manager, including the FC Windows agent.
 - Select **SANsurfer FC HBA Manager** to install only the SANsurfer FC HBA Manager GUI.

Notes:

- a. To install the Novell NetWare agent, in the Choose Product Component window, you must select **Custom** and then select the **SANsurfer FC Windows NT 4/2000/2003 Agent** check box.
- b. Do not select the following installation sets, unless they are applicable to your configuration.
 - SANsurfer Switch Manager GUI, to install only the SANsurfer Switch Manager GUI. This option is for managing QLogic switches only.
 - iSCSI GUI and Agent, to install the SANsurfer iSCSI HBA Manager GUI, including the iSCSI (Windows, Linux, or Solaris) agent.

- SANsurfer iSCSI HBA Manager, to install only the SANsurfer iSCSI HBA Manager (GUI, not the iSCSI [Windows, Linux, or Solaris] agent).
4. Click **Next**.
 5. **For Windows:** In the Choose Install Folder window, select the directory in which you want to install the SANsurfer Pro Utility. (The default is *Windows_system_drive:\Program Files\QLogic Corporation\SANsurfer*.)
For Novell NetWare: If you are installing the SANsurfer NetWare Agent, the Choose Destination Location window opens. Click **Browse** to point to the *\SYSTEM* directory on the NetWare SYS volume. The installer automatically saves the agent in the applicable NetWare volume.
- Note:** The drive letter must be mapped to the root of the NetWare SYS volume.
6. When you are prompted, do *not* enable the QLogic failover configuration. Use the multipath device driver that is recommended by your storage subsystem provider.
 7. Click **Install** and follow the instructions in the window.

Notes:

1. There is no 64-bit version of the QLogic SANsurfer Pro Utility program for Windows Server 2003 IA-64 or x64 editions. You must use the 32-bit version of the QLogic SANsurfer Pro Utility program for the Windows Server 2003 64-bit edition. Uninstall the QLogic SANsurfer Pro Utility program when the diagnostics are complete; otherwise, the program might cause the server to lock up in heavy I/O loads.
2. For information about other program limitations, see the readme file.

Installing on a Linux platform

Note: If the SANsurfer Pro Utility program is already installed, uninstall it before you install a new version.

If you want to perform a command-line installation of the QLogic SANsurfer Pro Utility or a command-line installation of only the qlremote agent, or if you have questions about the installation, see the instructions in the readme file.

To install the SANsurfer Pro Utility on a Linux platform, complete the following steps:

1. Insert the support CD that comes with the host bus adapter into the CD drive.
2. Open a shell (command prompt), and change to the directory that contains the installation file, for example, *sansurfer2.0.30b81_linux_install-i.bin*.
3. At the prompt, type the following command to start the program installation wizard:

```
sh ./program_name
```

where *program_name* is *sansurfer2.0.30b81_linux_install-i.bin*
4. In the Choose Product Features window, select one of the following preconfigured installation sets, or select **Custom** to define an installation set.
 - Select **FC HBA GUI and Agent** to install the SANsurfer FC HBA Manager, including the FC Linux agent.
 - Select **SANsurfer FC HBA Manager** to install only the SANsurfer FC HBA Manager GUI.

Note: Do not select the following installation sets, unless they are applicable to your configuration.

- SANsurfer Switch Manager GUI, to install only the SANsurfer Switch Manager GUI. This option is for managing QLogic switches only.
- iSCSI GUI and Agent, to install the SANsurfer iSCSI HBA Manager GUI, including the iSCSI (Windows, Linux, or Solaris) agent.
- SANsurfer iSCSI HBA Manager, to install only the SANsurfer iSCSI HBA Manager (GUI, not the iSCSI [Windows, Linux, or Solaris] agent).

5. Click **Next**.

The QLogic SANsurfer Pro Utility program is installed in the `/opt/QLogic_Corporation/SANsurfer` directory. The launch script is located in the `/usr` directory. The `qlremote` is installed in the `/usr/local/bin` directory.

6. When you are prompted, do *not* enable the QLogic failover configuration. Use the multipath device driver that is recommended by your storage subsystem provider.
7. Click **Install** and follow the instructions in the window.

Note: For information about other program limitations, see the readme file.

Using the SANsurfer Pro Update Option ROM Utility to update the BIOS code

Use the Update Option ROM Utility in the SANsurfer Pro Utility program to update the host bus adapter BIOS code. The latest version of host bus adapter BIOS code is available from <http://www.ibm.com/systems/x/>. (For instructions, see page 1.) The BIOS code file is a binary (.bin) file, for example, `q24mfxxx.bin`.

Note: For the dual-port host bus adapter, there is only one flash BIOS image for both ports; however, each port has its own NVRAM setting.

Important: Make sure that the device drivers for the host bus adapter are installed on the server that contains the adapter. If the correct device drivers are not installed on the server in which the host bus adapter is installed, the SANsurfer program does not list the adapter. If the server in which the SANsurfer program is installed is *not* the host server that contains the host bus adapter, make sure that the SANsurfer agent is installed on the host server and that the Ethernet port on the host server is in the same IP subnet as the server in which the SANsurfer Pro Utility program is installed.

To update the flash BIOS firmware, complete the following steps:

1. Double-click the SANsurfer Pro Utility program icon to start the SANsurfer Pro Utility application.
2. When the Connect to Host window opens, click **Connect** to connect to the preferred host.
3. When a configuration wizard window opens asking you to start the wizard, click **No**.
4. On the SANsurfer FC HBA window, click the **FC HBA** tab on the left pane and select the port under the newly installed host bus adapter. Click the **Information** tab in the right pane to view all the information about the new adapter.
5. Click the **Utilities** tab.
6. Click **Update Option ROM** to start the BIOS code update.

Important: There is only one BIOS image per host bus adapter; therefore, the **Update Option ROM** button is not available when you select the second port of a dual-port host bus adapter.

7. When you are prompted, select the applicable BIOS file, and then click **OK**.
8. When the BIOS is updated, the Option ROM Save window opens. Click **OK**.
9. Repeat steps 4 on page 19 through 8 to update the BIOS code for other host bus adapters in the host server.
10. After the update is completed, if you want to update the adapter NVRAM, go to “Using the SANsurfer Pro Update NVRAM Utility to update the NVRAM.” Otherwise, restart the server.

Using the SANsurfer Pro Update NVRAM Utility to update the NVRAM

Use the Update NVRAM Utility in the SANsurfer Pro Utility program to update the host bus adapter NVRAM firmware. The latest version of host bus adapter NVRAM firmware is available from <http://www.ibm.com/systems/x/>. (For instructions, see page 1.) The NVRAM firmware file is a data (.dat) file, for example, nvram200.dat.

Important: Make sure that the device drivers for the host bus adapter are installed on the server that contains the adapter. If the correct device drivers are not installed on the server in which the host bus adapter is installed, the SANsurfer program does not list the adapter. If the server in which the SANsurfer program is installed is *not* the host server that contains the host bus adapter, make sure that the SANsurfer agent is installed on the host server and that the Ethernet port on the host server is in the same IP subnet as the server in which the SANsurfer Pro Utility program is installed.

To update the NVRAM firmware, complete the following steps:

1. Double-click the SANsurfer Pro Utility program icon to start the SANsurfer Pro Utility application.
2. When the Connect to Host window opens, click **Connect** to connect to the preferred host.
3. When a configuration wizard window opens asking you to start the wizard, click **No**.
4. On the SANsurfer FC HBA window, click the **FC HBA** tab on the left pane and select the port under the newly installed host bus adapter. Click the **Information** tab in the right pane to view all the information about the new adapter.
5. Click the **Utilities** tab.
6. Click **Update NVRAM**.
7. When you are prompted, enter the file name for the NVRAM firmware update, and then click **OK**.

The SANsurfer Pro Utility program verifies the content of the new file and updates the firmware. If the firmware update has failed, an error message is displayed.

Important:

1. There are two NVRAM setting areas per dual-port host bus adapter (one NVRAM setting area for each port). If you want to update the NVRAM settings on both ports, you must select each port separately and perform the NVRAM update for each port.

2. Updating the NVRAM firmware resets all the NVRAM settings to the default. After you update the NVRAM firmware, you must re-enter all custom configuration settings that are required for your specific operating system.

Chapter 4. Using the flasutil utility (from a CD or diskette) to update BIOS and NVRAM and device driver instructions

Follow the instructions in this chapter to update the host bus adapter BIOS code and nonvolatile random access memory (NVRAM) by using the flasutil utility program (from a CD or diskette); then, install the host bus adapter device drivers.

If you want to use the QLogic SANSurfer Pro Utility program to update the host bus adapter BIOS code and NVRAM, see Chapter 3, “Installing device drivers and using the SANSurfer Pro Utility to update BIOS and NVRAM,” on page 15.

For the latest information about operating-system support, versions of device drivers, utilities, and documentation, go to <http://www.ibm.com/systems/x/>. (For instructions, see page 1.)

You can update the host bus adapter BIOS code by using the *QLogic 4 Gbps FC Single-Port and Dual-Port PCIe HBAs for IBM System x Support CD* (the support CD) that comes with the host bus adapter, or you can create a BIOS Update Utility diskette from the support CD (see the “Creating the host bus adapter BIOS Update Utility diskette” on page 27).

You can use either of the following methods to update the host bus adapter BIOS code and NVRAM:

- flasutil command. Use this method to type command-line options.
- flasutil BIOS Update Utility menu. Use this method to select a command-line option from a menu.

Using the flasutil command to update the BIOS code and NVRAM

Note: For instructions for creating a BIOS Update Utility diskette, see “Creating the host bus adapter BIOS Update Utility diskette” on page 27.

To update the host bus adapter BIOS code and NVRAM by using the flasutil command, complete the following steps:

1. Insert the support CD or the BIOS Update Utility diskette that you created into the CD or diskette drive; then, restart the server. The server starts to a command prompt.
2. To update the BIOS code in the flash utility, at command prompt type:

```
flasutil /i /fb xxxx /o BiosFirmwarefile.bin
```

where *BiosFirmwarefile.bin* is the name of the BIOS firmware file and *xxxx* is the adapter address.

If you omit the BIOS firmware file name, the program looks for a firmware file named ql24rom.bin. If you omit *xxxx*, the program attempts to update all of the host bus adapters in the host with the program firmware file.

Important: If you do not specify the /fb option when you attempt to update the host bus adapter BIOS code, the BIOS image will not be updated correctly.

3. Press Enter.

The existing version of the BIOS code, the newer BIOS code version, and a message that reports whether the update was successful is displayed.

The output from the command `flasutil /i /fb xxxx /o BiosFirmwarefile.bin` is shown in the following example. In this example, 2300 is substituted for `xxxx`.

```
QLogic NOVRAM and FLASH Programming Utility Version 1.55
Copyright (C) QLogic Corporation 1998-2005. All rights reserved.
```

```
Current version of QLE2462 flash BIOS at I/O Address 2300 is 1.04
New version of QLE2462 flash BIOS at I/O Address 2300 is 1.09
Programming QLE2462 flash at I/O Address 2300
Verifying QLE2462 flash at I/O Address 2300
Flash at I/O Address 2300 Verified Successfully
Programming rest of 1 meg flash at I/O Address 2300
...
Flash at I/O Address 2300 Programmed Successfully
```

C:\

Note: For the command `flasutil /i /fb 2400 /o Biosfirmwarefile.bin`, where 2400 is the I/O address of the second port of a dual-port host bus adapter, no update status is displayed because there is only one BIOS area per adapter. This BIOS area is referenced through the I/O address of the first port of a dual-port host bus adapter.

The output from the command `flasutil /i /fb 2400 /o Biosfirmwarefile.bin` is shown in the following example.

```
QLogic NOVRAM and FLASH Programming Utility Version 1.55
Copyright (C) QLogic Corporation 1998-2005. All rights reserved.
```

C:\

4. To update the NVRAM, at the command prompt, type

```
flasutil /i /l xxxx /n nvrinfile.dat
```

where *nvrinfile.dat* is the name of the NVRAM setting file and `xxxx` is the adapter address.

There must also be a companion file with the same NVRAM file name with the `.def` file extension. If you omit the NVRAM setting file name, the program looks for NVRAM files with names `nvr24.dat` and `nvr24.def`. If you omit `xxxx`, the program attempts to update all of the host bus adapters in the host with the NVRAM file.

Note: For a dual-port host bus adapter for which the adapter address is specified, run this command twice (using one port address and then the other) to update the NVRAM on both ports.

5. Press Enter.

The existing version of the NVRAM, the newer NVRAM version, and a message that reports whether the update was successful is displayed.

6. To update the standard NVRAM defaults in the host bus adapter to the new defaults from the NVRAM files, at the command prompt, type

```
flasutil /i /u xxxx
```

where `xxxx` is the host bus adapter address. If you omit `xxxx`, the program attempts to change (on all of the adapters in the host) the standard NVRAM defaults in the adapter to the new defaults from the NVRAM files.

7. Press Enter.

The existing version of the NVRAM, the newer NVRAM version, and a message that reports whether the update was successful is displayed.

The output from running the command `flasutil /i /u xxxx /n nvramfile.dat` is shown in the following example. In this example, 2300 is substituted for `xxxx`.

```
QLogic NOVRAM and FLASH Programming Utility Version 1.55
Copyright (C) QLogic Corporation 1998-2005. All rights reserved.
```

```
Programming QLE2462 NOVRAM at Address 2300
NOVRAM at Address 2300 Loaded Successfully
Updating flash at I/O Address 2300
Verifying flash at I/O Address 2300
Flash at I/O Address 2300 Verified Successfully
```

```
C:\
```

8. To update the host bus adapter BIOS code version number, enter

```
vpd /a /u
```

Note: The `vpd` program supports the `/a` and `/u` options.

The output from the command `vpd /a /u` is shown in the following example. In this example, one QLE2462 host bus adapter with port I/O addresses 2300 and 2400 is installed.

```
Processing all adapters...
2462 at address 2300 [1077.2422.1077.0134.0]
Reading vpd from nvram...
Reading versions from flash...
Updating vpd in nvram...
Verifying...
Verify passed
2462 at address 2400 [1077.2422.1077.0134.1]
Reading vpd from nvram...
Reading versions from flash...
Updating vpd in nvram...
Verifying...
Verify passed
```

```
C:\
```

9. To review additional command-line options that you can use, go to “flasutil command-line options”; then, continue with Step 10.
10. Remove the CD from the CD drive or the diskette from the diskette drive and restart the server.

flasutil command-line options

For a list of the `flasutil` command-line options, enter the following command:

```
flasutil /?
```

The following command-line options are displayed:

```
/L xxxx = Write NOVRAM to adapter address xxxx
           If no address specified then write NOVRAM to all adapters
/F xxxx = Write Flash to adapter, adapter address = xxxx
/FR xxxx = Write ISP2322/6322 Risc Code to Flash , adapter address = xxxx
/FB xxxx = Write MultiFlash image to adapter, adapter address = xxxx
           If no address specified then write Flash to all adapters
/D xxxx = Copy NOVRAM to file: QLxxNVR.SAV, adapter address = xxxx
/W xxxx = Copy Flash to file: QLxxROM.SAV, adapter address = xxxx
/U xxxx = Update Bios NOVRAM defaults, adapter address = xxxx
           If no address specified then Update all adapters
/N <filename.ext> = Use <filename.ext> instead of NVRMxx.DAT
/O <filename.ext> = Use <filename.ext> instead of QLxxROM.BIN
/I         = Ignore Subsystem ID
/M         = Program all adapters
/Q         = Quiet Mode, no messages will be displayed
```

/S xxxx = Display serial number of adapter at address xxxx
 If no address specified then display serial number of all adapters
 /V xxxx = Display current version number of BIOS on adapters at address xxxx
 If no address specified then display BIOS version of all adapters
 /C xxxx = Verify Flash of adapter at address xxxx
 If no address specified then verify Flash of all adapters
 /X xxxx = Verify NOVRAM of adapter at address xxxx
 If no address specified then verify NOVRAM of all adapters
 /Y xxxx = Display Port Name of adapter at address xxxx
 If no address specified then display Port Name of all adapters

Notes:

- Options /l, /d, /u, /n, /t, and /x might not be displayed.
- Important:** Do not use the f or fr option to update the host bus adapter BIOS code. Use the /f option only to update the BIOS code of an IBM FC2 or FC2-133 2 Gb Host Bus Adapter.

flasutil command examples

The following examples illustrate tasks that you can perform by using the flasutil command.

- To write NVRAM to all host bus adapters in the server, without being prompted for an I/O address, enter the following command:

```
flasutil /l
```
- To save the existing code in the host bus adapter at I/O address F600 to file ql24rom.sav, enter the following command:

```
flasutil /w f600
```
- To write NVRAM to the host bus adapter at I/O address F400, enter the following command:

```
flasutil /l f400
```
- To write NVRAM and update the host bus adapter at I/O address F800, enter the following command:

```
flasutil /l f800 /fb f800
```
- To write NVRAM and update all host bus adapters, enter the following command:

```
flasutil /l /fb
```
- To update BIOS NVRAM defaults, enter the following command:

```
flasutil /u
```
- To verify NVRAM in all host bus adapters, enter the following command:

```
flasutil /x
```

Using the flasutil BIOS Update Utility menu to update BIOS code and NVRAM

Note: For instructions for creating a BIOS Update Utility diskette, see “Creating the host bus adapter BIOS Update Utility diskette” on page 27.

To update the host bus adapter BIOS code by using the flasutil BIOS Update Utility menu, complete the following steps:

- Insert the support CD or the BIOS Update Utility diskette that you created into the CD or diskette drive; then, restart the server. The server starts to a command prompt.
- At the command prompt, enter the following command:

```
flasutil
```

3. If only one host bus adapter is installed, go to step 4. If more than one host bus adapter is installed, a list of adapters and I/O addresses is displayed. At the command prompt, enter the applicable I/O address.
4. Type the letter for the option that you want to use. The available options are displayed on the screen.

F = Write Flash
FB = Write MultiFlash image
W = Copy Flash to file: QLxxROM.SAV
S = Display serial number
V = Display current BIOS version
C = Verify Flash
Y = Display port name
L = Write NVRAM
A = Write NVRAM and defaults
D = Copy NVRAM to file: QLxxNVRM.SAV
U = Update BIOS NVRAM defaults
X = Verify NVRAM

Notes:

- a. Options l, a, d, u, and x might not be displayed.
 - b. **Important:** Do not use the f or fr option to update the host bus adapter BIOS code. Use the /f option only to update the BIOS code of an IBM FC2 or FC2-133 2 Gb Host Bus Adapter.
 - c. You can use more than one option to configure each host bus adapter.
 - d. There is only one BIOS (Flash) area in a dual-port host bus adapter. If you use option fb for the second port I/O address of a dual-port adapter, the configuration is successful, but no status message is displayed.
5. If additional adapters are installed or if you want to use additional options to configure the host bus adapter, repeat steps 26 through 4; otherwise, go to step 6.
 6. Remove the CD from the CD drive or the diskette from the diskette drive, and restart the server.
 7. Go to “Installing the host bus adapter device drivers” on page 15.

Creating the host bus adapter BIOS Update Utility diskette

If you cannot use the support CD to update the host bus adapter BIOS code, you can create a diskette, using the support CD. Instructions for creating and using the diskette are described in the following sections.

Note: For a Novell NetWare environment, extract the BIOS Update Utility diskette image, using a server that is running a Microsoft Windows 2000 or Linux operating system.

Create the BIOS Update Utility diskette by copying an image from the support CD or by downloading the image from <http://www.ibm.com/systems/x/>. (For instructions, see page 1.)

For Microsoft Windows

To create a BIOS Update Utility diskette for Microsoft Windows, complete the following steps:

1. Insert the support CD into the CD drive.
2. Insert a diskette into the diskette drive.
3. At the command prompt, type

```
d:\tools\dsk4w32 d:\bios\qlgc_fw_bios_xxx_anyos_i386.img a:
```

Where *d* is the drive letter of the CD drive and *a* is the drive letter of the diskette drive.
4. Press Enter.
5. Remove the CD from the CD drive.
6. Remove the diskette from the diskette drive and label the diskette.
7. You can use either of the following methods to update the host bus adapter BIOS code and NVRAM:
 - flasutil command. Use this method to type command-line options. See “Using the flasutil command to update the BIOS code and NVRAM” on page 23.
 - flasutil BIOS Update Utility menu. Use this method to select a command-line option from the menu. See “Using the flasutil BIOS Update Utility menu to update BIOS code and NVRAM” on page 26.

For Linux

To create a BIOS Update Utility diskette for Linux, complete the following steps:

1. Insert the support CD into the CD drive and restart the server.
2. Insert a diskette into the diskette drive.
3. At the command prompt, type

```
mount -t iso9660/dev/cdromdevicefile /mnt
```

Where *cdromdevicefile* is the specific device file for the CD block device.
4. Press Enter.
5. Enter the following command:

```
dd if=/mnt/bios/qlgc_fw_bios_xxx_anyos_i386.img of=/dev/diskettefile bs=32
```
6. Unmount the CD by typing

```
umount /mnt
```
7. Remove the CD from the CD drive.
8. Remove the diskette from the diskette drive and label the diskette.
9. You can use either of the following methods to update the host bus adapter BIOS code and NVRAM:
 - flasutil command. Use this method to type command-line options. See “Using the flasutil command to update the BIOS code and NVRAM” on page 23.
 - flasutil BIOS Update Utility menu. Use this method to select a command-line option from the menu. See “Using the flasutil BIOS Update Utility menu to update BIOS code and NVRAM” on page 26.

Installing the host bus adapter device drivers

The host bus adapter device drivers and installation instructions for the following operating systems are provided on the support CD:

- Microsoft Windows Server 2003, Advanced Server, or Enterprise Edition
- Red Hat® Enterprise Linux version 4
- SUSE Linux Enterprise Server version 8 or version 9
- Novell NetWare version 6.5

For installation instructions, see the readme files for the applicable operating systems, which are in the corresponding operating system directories on the support CD.

Note: For the latest information about operating-system support, versions of device drivers, utilities, and documentation, go to <http://www.ibm.com/systems/x/>. (For instructions, see page 1.)

Chapter 5. Configuring the host bus adapter with the Fast!UTIL utility

This chapter provides detailed configuration information for advanced users who want to customize the configuration of the host bus adapter and the connected Fibre Channel devices. You can configure the adapter by using the Fast!UTIL utility.

Starting Fast!UTIL

Important: If the configuration settings are incorrect, the host bus adapter will not function correctly. Do not change the configuration settings from the default settings, unless you are instructed to do so by an IBM technical-support representative or by the installation instructions. The default NVRAM settings, which were loaded in the host bus adapter at the factory, are for a typical Microsoft Windows installation. See the host bus adapter device driver readme file for your operating system to determine the required NVRAM setting modifications for that operating system.

If the host bus adapter is installed in a server with one of the following architectures, you can access Fast!UTIL by pressing Ctrl+Q during the BIOS initialization:

- Intel 32-bit processor (IA-32)
- Intel Extended Memory 64-Bit Technology (EM64T) processor
- Advanced Micro Devices 64-bit (AMD-64) architecture

It might take a few seconds for the Fast!UTIL menu to be displayed. Fast!UTIL prompts you to select the host bus adapter that you want to configure. After you change the settings that are described in “Host bus adapter settings” on page 32, Fast!UTIL restarts the server to enable the new parameters.

Accessing host bus adapter settings through Fast!UTIL

The Fast!UTIL feature provides access to host bus adapter settings. To access this feature, press Alt+Q or Ctrl+Q during BIOS initialization. It might take a few seconds for the Fast!UTIL menu to be displayed. If more than one host bus adapter is installed, Fast!UTIL prompts you to select a host bus adapter to configure. After you change adapter settings, Fast!UTIL restarts the server to load the new parameters. After you start Fast!UTIL, the following selections are available on the Fast!UTIL Options menu:

- Configuration Settings
- Scan Fibre Devices
- Fibre Disk Utility
- Loopback Test
- Select Host Adapter
- Exit FAST!UTIL

You can access the host bus adapter settings through the Configuration Settings menu in Fast!UTIL. See “Host bus adapter settings” on page 32 and “Advanced host bus adapter settings” on page 33 for detailed information about the settings.

Host bus adapter settings

You can modify most of the host bus adapter settings. The current default settings for the host bus adapter are listed and described in “Advanced host bus adapter settings” on page 33. You can modify the following default host bus adapter settings.

BIOS address

The BIOS address is the I/O address where the BIOS code is stored when you press Ctrl+Q, or when you have the BIOS code enabled for starting from the root directory. This is the address of the BIOS code in ROM shadow memory. Multiple host bus adapters can be installed in the server, but only one BIOS instance is loaded for all of the adapters.

Note: The BIOS code is loaded from the first port of the first host bus adapter that the server recognizes. This code is used for all remaining host bus adapters in the same bus or server. The level of BIOS code that is loaded does not affect other adapters with earlier BIOS code levels.

Revision

The BIOS revision is the revision number of the BIOS code that is loaded from the first host bus adapter that the server recognizes. Each adapter in the server has the same BIOS code revision number because only one BIOS code instance is loaded.

Adapter serial number

The adapter serial number is printed on a label on the noncomponent side of the adapter. See “Host bus adapter components” on page 6 for the location of the serial number label.

Interrupt level

This is the interrupt that is used by the host bus adapter. The interrupt level might change when the operating system is installed.

Adapter port name

This is the worldwide port name.

Host adapter BIOS

When the host bus adapter BIOS is disabled, the ROM BIOS on the adapter is disabled, freeing space in upper memory. The host bus adapter BIOS must be enabled if you are starting from a Fibre Channel disk drive that is attached to the PCIe slot. The default is Disabled.

Frame size

This is the maximum frame length that the host bus adapter supports. The default size is 2048, which provides maximum performance for F-Port (point-to-point) connections.

Loop reset delay

After the firmware resets the loop, it refrains from initiating any loop activity for the number of seconds that are specified in this setting. The default is 5 seconds.

Adapter hard loop ID

This setting forces the adapter to attempt to use the ID that is specified in the Hard Loop ID setting. The default is Disabled.

Hard loop ID

If the host bus adapter hard loop ID is enabled, the adapter attempts to use the ID that is specified in this setting. The default ID is 0. Set this ID to a

unique value from 0 through 125, if more than one adapter is connected to a FC-AL loop and the host bus adapter hard loop ID is enabled.

Spin up delay

When this bit is set, the BIOS waits up to 5 minutes to find the first drive. The default setting is Disabled.

Connection Options

This setting defines the type of connection (loop or point-to-point) or connection preference. The default is 2.

Fibre Channel Tape Support

This setting enables FCP-2 recovery. The default is Disabled. Make sure that Fibre Channel Tape Support is disabled if the host bus adapter is connected to a storage subsystem. Most storage subsystems do not support sending I/O from the same host bus adapter to both a storage subsystem and a tape device.

Data Rate

This setting determines the data rate. When this setting is 0, the host bus adapter runs at 1 Gbps. When this setting is 1, the host bus adapter runs at 2 Gbps. When this setting is 2, Fast!UTIL determines the rate that the server can accommodate and sets the rate accordingly. The default is 2 (auto-configure). When the setting is 3, the host bus adapter runs at 4 Gbps.

Table 4. Host bus adapter data rates

Bits 15 - 13 (h)	Data rate
0	1 gigabit per second
1	2 gigabits per second
2	Auto-negotiated
3	4 gigabits per second
4 - 7	Reserved

Advanced host bus adapter settings

From the Configuration Settings menu in Fast!UTIL select **Advanced Adapter Settings**. The following advanced host bus adapter settings are available:

Execution Throttle

This is the maximum number of commands running on any one port. When the execution throttle of a port is reached, no new commands are started until the current command finishes running. The valid options for this setting are 1 through 256. The default is 256.

LUNs per Target

This is the number of LUNs per target. Multiple LUN support is typically for redundant array of independent disks (RAID) servers that use LUNs to map drives. The default is 256.

Enable LIP Reset

This is the type of loop initialization process (LIP) reset that is used when the operating system initiates a bus reset routine. When this setting is Yes, the device driver initiates a global LIP reset to clear the target device reservations. When this setting is No, the device driver initiates a global LIP reset with full login. The default is No.

Enable LIP Full Login

This setting instructs the ISP chip to log in again to all ports after any LIP. The default is Yes.

Enable Target Reset

This setting enables the device drivers to issue a Target Reset command to all devices on the loop when a SCSI Bus Reset command is issued. The default is Yes.

Login Retry Count

This is the number of times that the software tries to log in to a device. The default is 30 retries for a Microsoft Windows operating-system environment. For the correct setting in other operating-system environments, see the device-driver readme file.

Port Down Retry Count

This is the number of seconds that the software waits before it retries a command to a port that is returning port down status. The default is 30 seconds. When the host bus adapter is connected to a storage enclosure with a large number of drives or in MCSC configurations, increase this setting to 70.

Link Down Timeout

This is the number of seconds that the software waits for a link down to come up. The default is 30 seconds.

Extended Error Logging

This is the additional error and debug information for the operating system. When extended error logging is enabled, events are logged into the Windows Event Viewer. The default is Disabled.

Operation Mode

This is the reduced interrupt operation (RIO) mode, if it is supported by the software device driver. RIO modes enable the posting of multiple command completions in a single interrupt. The default is 0.

Interrupt Delay Timer

This is the value (in 100-microsecond increments) that is used by a timer to set the wait time between accessing (DMA) a set of handles and generating an interrupt. The default is 0.

Enable Interrupt

When this setting is Yes, the BIOS uses the IRQ assigned to the adapter. When this setting is No, the BIOS polls for ISP mailbox command-completion status. The default is No.

Selectable boot settings (for Fibre Channel hard disk drives only)

Note: The Selectable Boot Settings option for the host bus adapter applies to only Fibre Channel hard disk drives.

When selectable boot settings is enabled, you can select the worldwide port name of the Fibre Channel hard disk drive from which you want to start (boot). When this option is enabled, the node starts from the selected Fibre Channel hard disk drive, and it ignores any IDE or SCSI hard disk drives that are attached to the server. When this option is disabled, the Boot ID and Boot LUN parameters have no effect.

The BIOS code in some new servers supports selectable start up, which supersedes the Fast!UTIL selectable startup setting. To start from a Fibre Channel

hard disk drive that is attached to the host bus adapter, select the attached Fibre Channel hard disk drive from the server Configuration/Setup Utility menu.

Restore default settings

You can use the Restore Default Settings option to restore the host bus adapter default settings and NVRAM.

The default NVRAM settings are the host bus adapter settings that were saved the last time an NVRAM update operation was run from the BIOS Update Utility program (option u or command line /u switch). If the BIOS Update Utility program was not used to update the default NVRAM settings since the host bus adapter was installed, the factory settings are loaded.

Note: After you select the Restore Default Settings, check the NVRAM settings (for example, the host bus adapter and advanced adapter settings) against the values that are preferred in this document and in the device-driver readme files for your operating system.

Raw NVRAM data

You can use the Raw NVRAM Data option to display the host bus adapter NVRAM contents in hexadecimal format. This is a troubleshooting tool. You cannot modify the data.

Scan Fibre Channel devices

You can use the Scan Fibre Channel Devices option to scan the Fibre Channel loop and list all the connected devices by loop ID. Information about each device is listed, for example, vendor name, product name, and revision. This information is useful when you are configuring the host bus adapter and attached devices.

Fibre Channel disk utility

Attention: When you perform a low-level format, it removes all data on the disk.

You can use the Fibre Channel Disk Utility option to scan the Fiber Channel loop bus and list all the connected devices by loop ID. You can select a disk device and perform a low-level format or verify the disk media or data.

Loopback data test

You can use the Loopback Data Test option to verify the basic transmit and receive functions of the host bus adapter. You must install a Fiber Channel loopback connector option into the optical interface connector on the host bus adapter before you start the test.

Select host adapter

You can use the Select Host Adapter option to select, configure, or view a specific host bus adapter, if multiple adapters are installed in the server.

ExitFast!UTIL

After you complete the host bus adapter configuration, use the ExitFast!UTIL option to exit the menu and restart the server.

Chapter 6. Troubleshooting

The following four types of installation problems might cause the host bus adapter to function incorrectly:

- Hardware problems
- Software problems
- System configuration problems
- Fibre Channel problems

Hardware problems

To determine whether an installation problem is caused by the hardware, perform the following tasks:

- Make sure that all cables are attached securely to the correct connectors. Make sure that one end of the LC-LC fiber-optic cable is attached to the optical interface connector on the host bus adapter and that the other end is connected to the Fibre Channel device.
- Make sure that the host bus adapter is installed correctly and is fully seated in the expansion slot. Check for interference due to nonstandard PCI connectors.
- Make sure that the Fast!UTIL data-rate setting is correct. In some cases, the host bus adapter data rate must be set to the data rate of the device to which the host bus adapter is attempting to send data. Some devices (for example, storage subsystems) might not automatically synchronize the data rate. For more information, see “Host bus adapter settings” on page 32.
- Make sure that all peripheral devices are turned on. See “Fibre Channel problems” on page 38 for information about displaying attached Fibre Channel devices.
- Make sure that the host bus adapter is ServerProven[®] for the server model in which the adapter is installed. Make sure that the latest BIOS code is installed in the server.
- Check the host bus adapter LEDs to be sure that the adapter is working correctly. For more information, see “Host bus adapter LEDs” on page 7.

Software problems

To determine whether an installation problem is caused by the software, perform the following tasks:

- Make sure that the correct device driver is installed.
- Make sure that the host bus adapter is at the correct BIOS version.
- Make sure that the host bus adapter NVRAM settings are correct for the Storage Area Network (SAN) and operating system.

System configuration problems

To determine whether an the installation problem is caused by the system configuration, make sure that the server is configured correctly. For more information, see “Host bus adapter settings” on page 32.

Notes:

1. All PCI-compliant servers automatically detect 32-bit or 64-bit adapters and set the applicable bus speed (for example, 66 MHz or 133 MHz).
2. Some servers do not have enough available memory resources (option ROM) to enable the host bus adapter. To determine how to make more memory resources available, see the *Problem Determination and Service Guide* that comes with the server.

If you still have a server configuration problem, see the documentation that comes with the server, or contact your IBM technical-support representative to determine whether the server system board requires special configuration.

Fibre Channel problems

To determine whether an installation problem is caused by an attached Fibre Channel device, perform the following tasks:

- Make sure that all of the Fibre Channel devices are turned on before you turn on the server.
- Make sure that all cables are connected correctly.
- Make sure that you configured the RAID storage subsystems by using the utilities that are provided by the manufacturer.
- If the Fibre Channel switch supports zoning, make sure that the peripheral device is configured to the same switch zone as the host bus adapter. For more information, see the Fibre Channel switch documentation.
- If the target device is not able to auto-negotiate the Fibre Channel data rate correctly, make sure that the data-rate setting on the host bus adapter matches that on the target device. For example, if the target device is operating at 2 Gbps, set the host bus adapter data rate to 2 Gbps.

Customer replaceable unit parts

Replaceable components are of three types:

- **Tier 1 customer replaceable unit (CRU):** Replacement of Tier 1 CRUs is your responsibility. If IBM installs a Tier 1 CRU at your request, you will be charged for the installation.
- **Tier 2 customer replaceable unit:** You may install a Tier 2 CRU yourself or request IBM to install it, at no additional charge, under the type of warranty service that is designated for your server.
- **Field replaceable unit (FRU):** FRUs must be installed only by trained service technicians.

For information about the terms of the warranty and getting service and assistance, see Appendix B, “IBM Statement of Limited Warranty Z125-4753-08 04/2004,” on page 43.

Table 5. Host bus adapter CRU listing

Description	CRU part number (Tier 1)
4 Gbps FC Single-Port PCIe HBA	39R6526
4 Gbps FC Dual-Port PCIe HBA	39R6528

Appendix A. Getting help and technical assistance

If you need help, service, or technical assistance or just want more information about IBM products, you will find a wide variety of sources available from IBM to assist you. This appendix contains information about where to go for additional information about IBM and IBM products, what to do if you experience a problem with your system or optional device, 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 *Hardware Maintenance Manual and Troubleshooting Guide* or *Problem Determination and Service Guide* on the IBM Documentation CD that comes with your system.

Note: For some IntelliStation® models, the *Hardware Maintenance Manual and Troubleshooting Guide* is available only from the IBM support Web site.

- Go to the IBM support Web site at <http://www.ibm.com/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/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, xSeries®, and BladeCenter® information is <http://www.ibm.com/eserver/xseries/>. The address for IBM IntelliStation information is <http://www.ibm.com/intellistation/>.

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

Software service and support

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

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

Hardware service and support

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

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

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. IBM Statement of Limited Warranty Z125-4753-08 04/2004

Part 1 - General Terms

Part 1 - General Terms

*This Statement of Limited Warranty includes Part 1 - General Terms, Part 2 - Country-unique Terms, and Part 3 - Warranty Information. The terms of Part 2 replace or modify those of Part 1. The warranties provided by IBM in this Statement of Limited Warranty apply only to Machines you purchase for your use, and not for resale. The term "Machine" means an IBM machine, its features, conversions, upgrades, elements, or accessories, or any combination of them. The term "Machine" does not include any software programs, whether pre-loaded with the Machine, installed subsequently or otherwise. **Nothing in this Statement of Limited Warranty affects any statutory rights of consumers that cannot be waived or limited by contract.***

What this Warranty Covers

IBM warrants that each Machine 1) is free from defects in materials and workmanship and 2) conforms to IBM's Official Published Specifications ("Specifications") which are available on request. The warranty period for the Machine starts on the original Date of Installation and is specified in Part 3 - Warranty Information. The date on your invoice or sales receipt is the Date of Installation unless IBM or your reseller informs you otherwise. Many features, conversions, or upgrades involve the removal of parts and their return to IBM. A part that replaces a removed part will assume the warranty service status of the removed part. Unless IBM specifies otherwise, these warranties apply only in the country or region in which you purchased the Machine.

THESE WARRANTIES ARE YOUR EXCLUSIVE WARRANTIES AND REPLACE ALL OTHER WARRANTIES OR CONDITIONS, EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OR CONDITIONS OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. SOME STATES OR JURISDICTIONS DO NOT ALLOW THE EXCLUSION OF EXPRESS OR IMPLIED WARRANTIES, SO THE ABOVE EXCLUSION MAY NOT APPLY TO YOU. IN THAT EVENT, SUCH WARRANTIES ARE LIMITED IN DURATION TO THE WARRANTY PERIOD. NO WARRANTIES APPLY AFTER THAT PERIOD. SOME STATES OR JURISDICTIONS DO NOT ALLOW LIMITATIONS ON HOW LONG AN IMPLIED WARRANTY LASTS, SO THE ABOVE LIMITATION MAY NOT APPLY TO YOU.

What this Warranty Does not Cover

This warranty does not cover the following:

- any software programs, whether pre-loaded or shipped with the Machine, or installed subsequently;
- failure resulting from misuse (including but not limited to use of any Machine capacity or capability, other than that authorized by IBM in writing), accident, modification, unsuitable physical or operating environment, or improper maintenance by you;
- failure caused by a product for which IBM is not responsible; and
- any non-IBM products, including those that IBM may procure and provide with or integrate into an IBM Machine at your request.

The warranty is voided by removal or alteration of identification labels on the Machine or its parts.

IBM does not warrant uninterrupted or error-free operation of a Machine.

Any technical or other support provided for a Machine under warranty, such as assistance with “how-to” questions and those regarding Machine set-up and installation, is provided **WITHOUT WARRANTIES OF ANY KIND**.

How to Obtain Warranty Service

If the Machine does not function as warranted during the warranty period, contact IBM or your reseller to obtain warranty service. If you do not register the Machine with IBM, you may be required to present proof of purchase as evidence of your entitlement to warranty service.

What IBM Will Do to Correct Problems

When you contact IBM for service, you must follow the problem determination and resolution procedures that IBM specifies. An initial diagnosis of your problem can be made either by a technician over the telephone or electronically by access to an IBM website.

The type of warranty service applicable to your Machine is specified in Part 3 - Warranty Information.

You are responsible for downloading and installing designated Machine Code (microcode, basic input/output system code (called “BIOS”), utility programs, device drivers, and diagnostics delivered with an IBM Machine) and other software updates from an IBM Internet Web site or from other electronic media, and following the instructions that IBM provides.

If your problem can be resolved with a Customer Replaceable Unit (“CRU”) (e.g., keyboard, mouse, speaker, memory, hard disk drive), IBM will ship the CRU to you for you to install.

If the Machine does not function as warranted during the warranty period and your problem cannot be resolved over the telephone or electronically, through your application of Machine Code or software updates, or with a CRU, IBM or your reseller, if approved by IBM to provide warranty service, will either, at its discretion, 1) repair it to make it function as warranted, or 2) replace it with one that is at least functionally equivalent. If IBM is unable to do either, you may return the Machine to your place of purchase and your money will be refunded.

IBM or your reseller will also manage and install selected engineering changes that apply to the Machine.

Exchange of a Machine or Part

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

Your Additional Responsibilities

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

You also agree to:

1. ensure that the Machine is free of any legal obligations or restrictions that prevent its exchange;
2. obtain authorization from the owner to have IBM or your reseller service a Machine that you do not own; and
3. where applicable, before service is provided:
 - a. follow the service request procedures that IBM or your reseller provides;
 - b. backup or secure all programs, data, and funds contained in the Machine;
 - c. provide IBM or your reseller with sufficient, free, and safe access to your facilities to permit IBM to fulfill its obligations; and
 - d. inform IBM or your reseller of changes in the Machine's location.
4. (a) ensure all information about identified or identifiable individuals (Personal Data) is deleted from the Machine (to the extent technically possible), (b) allow IBM, your reseller or an IBM supplier to process on your behalf any remaining Personal Data as IBM or your reseller considers necessary to fulfill its obligations under this Statement of Limited Warranty (which may include shipping the Machine for such processing to other IBM service locations around the world), and (c) ensure that such processing complies with any laws applicable to such Personal Data.

Limitation of Liability

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

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

Circumstances may arise where, because of a default on IBM's part or other liability, you are entitled to recover damages from IBM. In each such instance, regardless of the basis on which you are entitled to claim damages from IBM (including fundamental breach, negligence, misrepresentation, or other contract or tort claim), except for any liability that cannot be waived or limited by applicable laws, IBM is liable for no more than

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

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

UNDER NO CIRCUMSTANCES IS IBM, ITS SUPPLIERS OR RESELLERS LIABLE FOR ANY OF THE FOLLOWING EVEN IF INFORMED OF THEIR POSSIBILITY: 1) THIRD PARTY CLAIMS AGAINST YOU FOR DAMAGES (OTHER THAN THOSE UNDER THE FIRST ITEM LISTED ABOVE); 2) LOSS OF,

OR DAMAGE TO, DATA; 3) SPECIAL, INCIDENTAL, OR INDIRECT DAMAGES OR FOR ANY ECONOMIC CONSEQUENTIAL DAMAGES; OR 4) LOST PROFITS, BUSINESS REVENUE, GOODWILL OR ANTICIPATED SAVINGS. SOME STATES OR JURISDICTIONS DO NOT ALLOW THE EXCLUSION OR LIMITATION OF INCIDENTAL OR CONSEQUENTIAL DAMAGES, SO THE ABOVE LIMITATION OR EXCLUSION MAY NOT APPLY TO YOU. SOME STATES OR JURISDICTIONS DO NOT ALLOW LIMITATIONS ON HOW LONG AN IMPLIED WARRANTY LASTS, SO THE ABOVE LIMITATION MAY NOT APPLY TO YOU.

Governing Law

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

THESE WARRANTIES GIVE YOU SPECIFIC LEGAL RIGHTS AND YOU MAY ALSO HAVE OTHER RIGHTS WHICH VARY FROM STATE TO STATE OR JURISDICTION TO JURISDICTION.

Jurisdiction

All of our rights, duties, and obligations are subject to the courts of the country in which you acquired the Machine.

Part 2 - Country-unique Terms

AMERICAS

ARGENTINA

Jurisdiction: *The following is added after the first sentence:*

Any litigation arising from this Statement of Limited Warranty will be settled exclusively by the Ordinary Commercial Court of the city of Buenos Aires.

BOLIVIA

Jurisdiction: *The following is added after the first sentence:*

Any litigation arising from this Statement of Limited Warranty will be settled exclusively by the courts of the city of La Paz.

BRAZIL

Jurisdiction: *The following is added after the first sentence:*

Any litigation arising from this Statement of Limited Warranty will be settled exclusively by the court of Rio de Janeiro, RJ.

CHILE

Jurisdiction: *The following is added after the first sentence:*

Any litigation arising from this Statement of Limited Warranty will be settled exclusively by the Civil Courts of Justice of Santiago.

COLOMBIA

Jurisdiction: *The following is added after the first sentence:*

Any litigation arising from this Statement of Limited Warranty will be settled exclusively by the Judges of the Republic of Colombia.

EQUADOR

Jurisdiction: *The following is added after the first sentence:*

Any litigation arising from this Statement of Limited Warranty will be settled exclusively by the Judges of Quito.

MEXICO

Jurisdiction: *The following is added after the first sentence:*

Any litigation arising from this Statement of Limited Warranty will be settled exclusively by the Federal Courts of Mexico City, Federal District.

PARAGUAY

Jurisdiction: *The following is added after the first sentence:*

Any litigation arising from this Statement of Limited Warranty will be settled exclusively by the courts of the city of Asuncion.

PERU

Limitation of Liability: *The following is added at the end of this section:*

In accordance with Article 1328 of the Peruvian Civil Code the limitations and exclusions specified in this section will not apply to damages caused by IBM's willful misconduct ("dolo") or gross negligence ("culpa inexcusable").

URUGUAY

Jurisdiction: *The following is added after the first sentence:*

Any litigation arising from this Statement of Limited Warranty will be settled exclusively by the City of Montevideo Court's Jurisdiction.

VENEZUELA

Jurisdiction: *The following is added after the first sentence:*

Any litigation arising from this Statement of Limited Warranty will be settled exclusively by the Courts of the Metropolitan Area Of the City of Caracas.

NORTH AMERICA

How to Obtain Warranty Service: *The following is added to this Section:*

To obtain warranty service from IBM in Canada or the United States, call 1-800-IBM-SERV (426-7378).

CANADA

Limitation of Liability: *The following replaces item 1 of this section:*

1. damages for bodily injury (including death) or physical harm to real property and tangible personal property caused by IBM's negligence; and

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

laws in the Province of Ontario.

UNITED STATES

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

laws of the State of New York.

ASIA PACIFIC

AUSTRALIA

What this Warranty Covers: *The following paragraph is added to this section:*

The warranties specified in this Section are in addition to any rights you may have under the Trade Practices Act 1974 or other similar legislation and are only limited to the extent permitted by the applicable legislation.

Limitation of Liability: *The following is added to this section:*

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

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

laws of the State or Territory.

CAMBODIA AND LAOS

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

laws of the State of New York, United States of America.

CAMBODIA, INDONESIA, AND LAOS

Arbitration: *The following is added under this heading:*

Disputes arising out of or in connection with this Statement of Limited Warranty shall be finally settled by arbitration which shall be held in Singapore in accordance with the Arbitration Rules of Singapore International Arbitration Center ("SIAC Rules") then in effect. The arbitration award shall be final and binding for the parties without appeal and shall be in writing and set forth the findings of fact and the conclusions of law.

The number of arbitrators shall be three, with each side to the dispute being entitled to appoint one arbitrator. The two arbitrators appointed by the parties shall appoint a third arbitrator who shall act as chairman of the proceedings. Vacancies in the

post of chairman shall be filled by the president of the SIAC. Other vacancies shall be filled by the respective nominating party. Proceedings shall continue from the stage they were at when the vacancy occurred.

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

All proceedings shall be conducted, including all documents presented in such proceedings, in the English language. The English language version of this Statement of Limited Warranty prevails over any other language version.

HONG KONG S.A.R. OF CHINA AND MACAU S.A.R. OF CHINA

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

INDIA

Limitation of Liability: *The following replaces items 1 and 2 of this section:*

1. liability for bodily injury (including death) or damage to real property and tangible personal property will be limited to that caused by IBM's negligence; and
2. as to any other actual damage arising in any situation involving nonperformance by IBM pursuant to, or in any way related to the subject of this Statement of Limited Warranty, the charge paid by you for the individual Machine that is the subject of the claim. For purposes of this item, the term “Machine” includes Machine Code and Licensed Internal Code (“LIC”).

Arbitration: *The following is added under this heading:*

Disputes arising out of or in connection with this Statement of Limited Warranty shall be finally settled by arbitration which shall be held in Bangalore, India in accordance with the laws of India then in effect. The arbitration award shall be final and binding for the parties without appeal and shall be in writing and set forth the findings of fact and the conclusions of law.

The number of arbitrators shall be three, with each side to the dispute being entitled to appoint one arbitrator. The two arbitrators appointed by the parties shall appoint a third arbitrator who shall act as chairman of the proceedings. Vacancies in the post of chairman shall be filled by the president of the Bar Council of India. Other vacancies shall be filled by the respective nominating party. Proceedings shall continue from the stage they were at when the vacancy occurred.

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

All proceedings shall be conducted, including all documents presented in such proceedings, in the English language. The English language version of this Statement of Limited Warranty prevails over any other language version.

JAPAN

Governing Law: *The following sentence is added to this section:*

Any doubts concerning this Statement of Limited Warranty will be initially resolved between us in good faith and in accordance with the principle of mutual trust.

MALAYSIA

Limitation of Liability: *The word “SPECIAL” in item 3 of the fifth paragraph is deleted.*

NEW ZEALAND

What this Warranty Covers: *The following paragraph is added to this section:*

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

Limitation of Liability: *The following is added to this section:*

Where Machines are not acquired for the purposes of a business as defined in the Consumer Guarantees Act 1993, the limitations in this section are subject to the limitations in that Act.

PEOPLE’S REPUBLIC OF CHINA (PRC)

Governing Law: *The following replaces “laws of the country in which you acquired the Machine” in the first sentence:*

laws of the State of New York, United States of America (except when local law requires otherwise).

PHILIPPINES

Limitation of Liability: *Item 3 in the fifth paragraph is replaced by the following:*

SPECIAL (INCLUDING NOMINAL AND EXEMPLARY DAMAGES), MORAL, INCIDENTAL, OR INDIRECT DAMAGES FOR ANY ECONOMIC CONSEQUENTIAL DAMAGES; OR

Arbitration: *The following is added under this heading:*

Disputes arising out of or in connection with this Statement of Limited Warranty shall be finally settled by arbitration which shall be held in Metro Manila, Philippines in accordance with the laws of the Philippines then in effect. The arbitration award shall be final and binding for the parties without appeal and shall be in writing and set forth the findings of fact and the conclusions of law.

The number of arbitrators shall be three, with each side to the dispute being entitled to appoint one arbitrator. The two arbitrators appointed by the parties shall appoint a third arbitrator who shall act as chairman of the proceedings. Vacancies in the post of chairman shall be filled by the president of the Philippine Dispute Resolution Center, Inc. Other vacancies shall be filled by the respective nominating party. Proceedings shall continue from the stage they were at when the vacancy occurred.

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

All proceedings shall be conducted, including all documents presented in such proceedings, in the English language. The English language version of this Statement of Limited Warranty prevails over any other language version.

SINGAPORE

Limitation of Liability: *The words “SPECIAL” and “ECONOMIC” in item 3 in the fifth paragraph are deleted.*

EUROPE, MIDDLE EAST, AFRICA (EMEA)

THE FOLLOWING TERMS APPLY TO ALL EMEA COUNTRIES:

The terms of this Statement of Limited Warranty apply to Machines purchased from IBM or an IBM reseller.

How to Obtain Warranty Service:

*Add the following paragraph in **Western Europe** (Andorra, Austria, Belgium, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Liechtenstein, Lithuania, Luxembourg, Malta, Monaco, Netherlands, Norway, Poland, Portugal, San Marino, Slovakia, Slovenia, Spain, Sweden, Switzerland, United Kingdom, Vatican State, and any country subsequently added to the European Union, as from the date of accession):*

The warranty for Machines acquired in Western Europe shall be valid and applicable in all Western Europe countries provided the Machines have been announced and made available in such countries.

If you purchase a Machine in one of the Western European countries, as defined above, you may obtain warranty service for that Machine in any of those countries from either (1) an IBM reseller approved to perform warranty service or (2) from IBM, provided the Machine has been announced and made available by IBM in the country in which you wish to obtain service.

If you purchased a Personal Computer Machine in Albania, Armenia, Belarus, Bosnia and Herzegovina, Bulgaria, Croatia, Czech Republic, Georgia, Hungary, Kazakhstan, Kyrgyzstan, Federal Republic of Yugoslavia, Former Yugoslav Republic of Macedonia (FYROM), Moldova, Poland, Romania, Russia, Slovak Republic, Slovenia, or Ukraine, you may obtain warranty service for that Machine in any of those countries from either (1) an IBM reseller approved to perform warranty service or (2) from IBM.

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

Governing Law:

The phrase “the laws of the country in which you acquired the Machine” is replaced by:

1) “the laws of Austria” in **Albania, Armenia, Azerbaijan, Belarus, Bosnia-Herzegovina, Bulgaria, Croatia, Georgia, Hungary, Kazakhstan, Kyrgyzstan, FYR Macedonia, Moldova, Poland, Romania, Russia, Slovakia, Slovenia, Tajikistan, Turkmenistan, Ukraine, Uzbekistan, and FR Yugoslavia**; 2) “the laws of France” in **Algeria, Benin, Burkina Faso, Cameroon, Cape Verde, Central African Republic, Chad, Comoros, Congo Republic, Djibouti, Democratic Republic of Congo, Equatorial Guinea, French Guiana, French Polynesia, Gabon, Gambia, Guinea, Guinea-Bissau, Ivory Coast, Lebanon, Madagascar, Mali, Mauritania, Mauritius, Mayotte, Morocco, New Caledonia, Niger, Reunion, Senegal, Seychelles, Togo, Tunisia, Vanuatu, and Wallis & Futuna**; 3) “the laws of Finland” in **Estonia, Latvia, and Lithuania**; 4) “the laws of England” in **Angola, Bahrain, Botswana, Burundi, Egypt, Eritrea, Ethiopia, Ghana, Jordan, Kenya, Kuwait, Liberia, Malawi, Malta, Mozambique, Nigeria, Oman, Pakistan, Qatar, Rwanda, Sao Tome, Saudi Arabia, Sierra Leone, Somalia, Tanzania, Uganda, United Arab Emirates, the United Kingdom, West Bank/Gaza, Yemen, Zambia, and Zimbabwe**; and 5) “the laws of South Africa” in **South Africa, Namibia, Lesotho and Swaziland**.

Jurisdiction: *The following exceptions are added to this section:*

1) **In Austria** the choice of jurisdiction for all disputes arising out of this Statement of Limited Warranty and relating thereto, including its existence, will be the competent court of law in Vienna, Austria (Inner-City); 2) **in Angola, Bahrain, Botswana, Burundi, Egypt, Eritrea, Ethiopia, Ghana, Jordan, Kenya, Kuwait, Liberia, Malawi, Malta, Mozambique, Nigeria, Oman, Pakistan, Qatar, Rwanda, Sao Tome, Saudi Arabia, Sierra Leone, Somalia, Tanzania, Uganda, United Arab Emirates, West Bank/Gaza, Yemen, Zambia, and Zimbabwe** all disputes arising out of this Statement of Limited Warranty or related to its execution, including summary proceedings, will be submitted to the exclusive jurisdiction of the English courts; 3) **in Belgium and Luxembourg**, all disputes arising out of this Statement of Limited Warranty or related to its interpretation or its execution, the law, and the courts of the capital city, of the country of your registered office and/or commercial site location only are competent; 4) **in France, Algeria, Benin, Burkina Faso, Cameroon, Cape Verde, Central African Republic, Chad, Comoros, Congo Republic, Djibouti, Democratic Republic of Congo, Equatorial Guinea, French Guiana, French Polynesia, Gabon, Gambia, Guinea, Guinea-Bissau, Ivory Coast, Lebanon, Madagascar, Mali, Mauritania, Mauritius, Mayotte, Morocco, New Caledonia, Niger, Reunion, Senegal, Seychelles, Togo, Tunisia, Vanuatu, and Wallis & Futuna** all disputes arising out of this Statement of Limited Warranty or related to its violation or execution, including summary proceedings, will be settled exclusively by the Commercial Court of Paris; 5) **in Russia**, all disputes arising out of or in relation to the interpretation, the violation, the termination, the nullity of the execution of this Statement of Limited Warranty shall be settled by Arbitration Court of Moscow; 6) **in South Africa, Namibia, Lesotho and Swaziland**, both of us agree to submit all disputes relating to this Statement of Limited Warranty to the jurisdiction of the High Court in Johannesburg; 7) **in Turkey** all disputes arising out of or in connection with this Statement of Limited Warranty shall be resolved by the Istanbul Central (Sultanahmet) Courts and Execution Directorates of Istanbul, the Republic of Turkey; 8) in each of the following specified countries, any legal claim arising out of this Statement of Limited Warranty will be brought before, and settled exclusively by, the competent court of a) Athens for **Greece**, b) Tel Aviv-Jaffa for **Israel**, c) Milan for **Italy**, d) Lisbon for **Portugal**, and e)

Madrid for **Spain**; and 9) **in the United Kingdom**, both of us agree to submit all disputes relating to this Statement of Limited Warranty to the jurisdiction of the English courts.

Arbitration: *The following is added under this heading:*

In Albania, Armenia, Azerbaijan, Belarus, Bosnia-Herzegovina, Bulgaria, Croatia, Georgia, Hungary, Kazakhstan, Kyrgyzstan, FYR Macedonia, Moldova, Poland, Romania, Russia, Slovakia, Slovenia, Tajikistan, Turkmenistan, Ukraine, Uzbekistan, and FR Yugoslavia all disputes arising out of this Statement of Limited Warranty or related to its violation, termination or nullity will be finally settled under the Rules of Arbitration and Conciliation of the International Arbitral Center of the Federal Economic Chamber in Vienna (Vienna Rules) by three arbitrators appointed in accordance with these rules. The arbitration will be held in Vienna, Austria, and the official language of the proceedings will be English. The decision of the arbitrators will be final and binding upon both parties. Therefore, pursuant to paragraph 598 (2) of the Austrian Code of Civil Procedure, the parties expressly waive the application of paragraph 595 (1) figure 7 of the Code. IBM may, however, institute proceedings in a competent court in the country of installation.

In Estonia, Latvia and Lithuania all disputes arising in connection with this Statement of Limited Warranty will be finally settled in arbitration that will be held in Helsinki, Finland in accordance with the arbitration laws of Finland then in effect. Each party will appoint one arbitrator. The arbitrators will then jointly appoint the chairman. If arbitrators cannot agree on the chairman, then the Central Chamber of Commerce in Helsinki will appoint the chairman.

EUROPEAN UNION (EU)

THE FOLLOWING TERMS APPLY TO ALL EU COUNTRIES:

The warranty for Machines acquired in EU countries is valid and applicable in all EU countries provided the Machines have been announced and made available in such countries.

How to Obtain Warranty Service: *The following is added to this section:*

To obtain warranty service from IBM in EU countries, see the telephone listing in Part 3 - Warranty Information.

You may contact IBM at the following address:

IBM Warranty & Service Quality Dept.
PO Box 30
Spango Valley
Greenock
Scotland PA16 0AH

CONSUMERS

Consumers have legal rights under applicable national legislation governing the sale of consumer goods. Such rights are not affected by the warranties provided in this Statement of Limited Warranty.

AUSTRIA, DENMARK, FINLAND, GREECE, ITALY, NETHERLANDS, NORWAY, PORTUGAL, SPAIN, SWEDEN AND SWITZERLAND

Limitation of Liability: *The following replaces the terms of this section in its entirety:*

Except as otherwise provided by mandatory law:

1. IBM's liability for any damages and losses that may arise as a consequence of the fulfillment of its obligations under or in connection with this Statement of Limited Warranty or due to any other cause related to this Statement of Limited Warranty is limited to the compensation of only those damages and losses proved and actually arising as an immediate and direct consequence of the non-fulfillment of such obligations (if IBM is at fault) or of such cause, for a maximum amount equal to the charges you paid for the Machine. For purposes of this item, the term "Machine" includes Machine Code and Licensed Internal Code ("LIC").

The above limitation shall not apply to damages for bodily injuries (including death) and damages to real property and tangible personal property for which IBM is legally liable.

2. **UNDER NO CIRCUMSTANCES IS IBM, ITS SUPPLIERS OR RESELLERS LIABLE FOR ANY OF THE FOLLOWING, EVEN IF INFORMED OF THEIR POSSIBILITY: 1) LOSS OF, OR DAMAGE TO, DATA; 2) INCIDENTAL OR INDIRECT DAMAGES, OR FOR ANY ECONOMIC CONSEQUENTIAL DAMAGES; 3) LOST PROFITS, EVEN IF THEY ARISE AS AN IMMEDIATE CONSEQUENCE OF THE EVENT THAT GENERATED THE DAMAGES; OR 4) LOSS OF BUSINESS, REVENUE, GOODWILL, OR ANTICIPATED SAVINGS.**

FRANCE AND BELGIUM

Limitation of Liability: *The following replaces the terms of this section in its entirety:*

Except as otherwise provided by mandatory law:

1. IBM's liability for any damages and losses that may arise as a consequence of the fulfillment of its obligations under or in connection with this Statement of Limited Warranty is limited to the compensation of only those damages and losses proved and actually arising as an immediate and direct consequence of the non-fulfillment of such obligations (if IBM is at fault), for a maximum amount equal to the charges you paid for the Machine that has caused the damages. For purposes of this item, the term "Machine" includes Machine Code and Licensed Internal Code ("LIC").

The above limitation shall not apply to damages for bodily injuries (including death) and damages to real property and tangible personal property for which IBM is legally liable.

2. **UNDER NO CIRCUMSTANCES IS IBM, ITS SUPPLIERS OR RESELLERS LIABLE FOR ANY OF THE FOLLOWING, EVEN IF INFORMED OF THEIR POSSIBILITY: 1) LOSS OF, OR DAMAGE TO, DATA; 2) INCIDENTAL OR INDIRECT DAMAGES, OR FOR ANY ECONOMIC CONSEQUENTIAL DAMAGES; 3) LOST PROFITS, EVEN IF THEY ARISE AS AN IMMEDIATE CONSEQUENCE OF THE EVENT THAT GENERATED THE DAMAGES; OR 4) LOSS OF BUSINESS, REVENUE, GOODWILL, OR ANTICIPATED SAVINGS.**

THE FOLLOWING TERMS APPLY TO THE COUNTRY SPECIFIED:

AUSTRIA

The provisions of this Statement of Limited Warranty replace any applicable statutory warranties.

What this Warranty Covers: *The following replaces the first sentence of the first paragraph of this section:*

The warranty for an IBM Machine covers the functionality of the Machine for its normal use and the Machine's conformity to its Specifications.

The following paragraphs are added to this section:

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

The second paragraph does not apply.

What IBM Will Do to Correct Problems: *The following is added to this section:*

During the warranty period, IBM will reimburse you for the transportation charges for the delivery of the failing Machine to IBM.

Limitation of Liability: *The following paragraph is added to this section:*

The limitations and exclusions specified in the Statement of Limited Warranty will not apply to damages caused by IBM with fraud or gross negligence and for express warranty.

The following sentence is added to the end of item 2:

IBM's liability under this item is limited to the violation of essential contractual terms in cases of ordinary negligence.

EGYPT

Limitation of Liability: *The following replaces item 2 in this section:*

as to any other actual direct damages, IBM's liability will be limited to the total amount you paid for the Machine that is the subject of the claim. For purposes of this item, the term "Machine" includes Machine Code and Licensed Internal Code ("LIC").

Applicability of suppliers and resellers (unchanged).

FRANCE

Limitation of Liability: *The following replaces the second sentence of the first paragraph of this section:*

In such instances, regardless of the basis on which you are entitled to claim damages from IBM, IBM is liable for no more than: (items 1 and 2 unchanged).

GERMANY

What this Warranty Covers: *The following replaces the first sentence of the first paragraph of this section:*

The warranty for an IBM Machine covers the functionality of the Machine for its normal use and the Machine's conformity to its Specifications.

The following paragraphs are added to this section:

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

The second paragraph does not apply.

What IBM Will Do to Correct Problems: *The following is added to this section:*

During the warranty period, transportation for delivery of the failing Machine to IBM will be at IBM's expense.

Limitation of Liability: *The following paragraph is added to this section:*

The limitations and exclusions specified in the Statement of Limited Warranty will not apply to damages caused by IBM with fraud or gross negligence and for express warranty.

The following sentence is added to the end of item 2:

IBM's liability under this item is limited to the violation of essential contractual terms in cases of ordinary negligence.

HUNGARY

Limitation of Liability: *The following is added at the end of this section:*

The limitation and exclusion specified herein shall not apply to liability for a breach of contract damaging life, physical well-being, or health that has been caused intentionally, by gross negligence, or by a criminal act.

The parties accept the limitations of liability as valid provisions and state that the Section 314.(2) of the Hungarian Civil Code applies as the acquisition price as well as other advantages arising out of the present Statement of Limited Warranty balance this limitation of liability.

IRELAND

What this Warranty Covers: *The following is added to this section:*

Except as expressly provided in these terms and conditions, all statutory conditions, including all warranties implied, but without prejudice to the generality of the foregoing all warranties implied by the Sale of Goods Act 1893 or the Sale of Goods and Supply of Services Act 1980 are hereby excluded.

Limitation of Liability: *The following replaces the terms of this section in its entirety:*

For the purposes of this section, a "Default" means any act, statement, omission, or negligence on the part of IBM in connection with, or in relation to, the subject matter of this Statement of Limited Warranty in respect of which IBM is legally liable to

you, whether in contract or tort. A number of Defaults which together result in, or contribute to, substantially the same loss or damage will be treated as one Default occurring on the date of occurrence of the last such Default.

Circumstances may arise where, because of a Default, you are entitled to recover damages from IBM.

This section sets out the extent of IBM's liability and your sole remedy.

1. IBM will accept unlimited liability for death or personal injury caused by the negligence of IBM.
2. Subject always to the **Items for Which IBM is Not Liable** below, IBM will accept unlimited liability for physical damage to your tangible property resulting from the negligence of IBM.
3. Except as provided in items 1 and 2 above, IBM's entire liability for actual damages for any one Default will not in any event exceed the greater of 1) EUR 125,000, or 2) 125% of the amount you paid for the Machine directly relating to the Default.

Items for Which IBM is Not Liable

Save with respect to any liability referred to in item 1 above, under no circumstances is IBM, its suppliers or resellers liable for any of the following, even if IBM or they were informed of the possibility of such losses:

1. loss of, or damage to, data;
2. special, indirect, or consequential loss; or
3. loss of profits, business, revenue, goodwill, or anticipated savings.

SLOVAKIA

Limitation of Liability: *The following is added to the end of the last paragraph:*

The limitations apply to the extent they are not prohibited under §§ 373-386 of the Slovak Commercial Code.

SOUTH AFRICA, NAMIBIA, BOTSWANA, LESOTHO AND SWAZILAND

Limitation of Liability: *The following is added to this section:*

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

UNITED KINGDOM

Limitation of Liability: *The following replaces the terms of this section in its entirety:*

For the purposes of this section, a "Default" means any act, statement, omission, or negligence on the part of IBM in connection with, or in relation to, the subject matter of this Statement of Limited Warranty in respect of which IBM is legally liable to you, whether in contract or tort. A number of Defaults which together result in, or contribute to, substantially the same loss or damage will be treated as one Default.

Circumstances may arise where, because of a Default, you are entitled to recover damages from IBM.

This section sets out the extent of IBM's liability and your sole remedy.

1. IBM will accept unlimited liability for:
 - a. death or personal injury caused by the negligence of IBM; and
 - b. any breach of its obligations implied by Section 12 of the Sale of Goods Act 1979 or Section 2 of the Supply of Goods and Services Act 1982, or any statutory modification or re-enactment of either such Section.
2. IBM will accept unlimited liability, subject always to the **Items for Which IBM is Not Liable** below, for physical damage to your tangible property resulting from the negligence of IBM.
3. IBM's entire liability for actual damages for any one Default will not in any event, except as provided in items 1 and 2 above, exceed the greater of 1) Pounds Sterling 75,000, or 2) 125% of the total purchase price payable or the charges for the Machine directly relating to the Default.

These limits also apply to IBM's suppliers and resellers. They state the maximum for which IBM and such suppliers and resellers are collectively responsible.

Items for Which IBM is Not Liable

Save with respect to any liability referred to in item 1 above, under no circumstances is IBM or any of its suppliers or resellers liable for any of the following, even if IBM or they were informed of the possibility of such losses:

1. loss of, or damage to, data;
2. special, indirect, or consequential loss; or
3. loss of profits, business, revenue, goodwill, or anticipated savings.

Part 3 - Warranty Information

This Part 3 provides information regarding the warranty applicable to your Machine, including the warranty period and type of warranty service IBM provides.

Warranty Period

The warranty period may vary by country or region and is specified in the table below.

Note: "Region" means either Hong Kong or Macau Special Administrative Region of China.

A warranty period of 3 years on parts and 1 year on labor means that IBM provides warranty service without charge for:

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

Qlogic 4 Gbps FC Single-Port PCIe HBA for IBM System x
Qlogic 4 Gbps FC Dual-Port PCIe HBA for IBM System x

Country or Region of Purchase	Warranty Period	Type of Warranty Service*
Worldwide	1 year	1
* See “Types of Warranty Service” for the legend and explanations of warranty-service types.		

Types of Warranty Service

If required, IBM provides repair or exchange service depending on the type of warranty service specified for your Machine in the above table and as described below. Warranty service may be provided by your reseller if approved by IBM to perform warranty service. Scheduling of service will depend upon the time of your call and is subject to parts availability. Service levels are response time objectives and are not guaranteed. The specified level of warranty service may not be available in all worldwide locations, additional charges may apply outside IBM’s normal service area, contact your local IBM representative or your reseller for country and location specific information.

1. Customer Replaceable Unit (“CRU”) Service

IBM provides replacement CRUs to you for you to install. CRU information and replacement instructions are shipped with your Machine and are available from IBM at any time on your request. Installation of Tier 1 CRUs is your responsibility. If IBM installs a Tier 1 CRU at your request, you will be charged for the installation. You may install a Tier 2 CRU yourself or request IBM to install it, at no additional charge, under the type of warranty service designated for your Machine. IBM specifies in the materials shipped with a replacement CRU whether a defective CRU must be returned to IBM. When return is required, 1) return instructions and a container are shipped with the replacement CRU, and 2) you may be charged for the replacement CRU if IBM does not receive the defective CRU within 30 days of your receipt of the replacement.

2. On-site Service

IBM or your reseller will either repair or exchange the failing Machine at your location and verify its operation. You must provide suitable working area to allow disassembly and reassembly of the IBM Machine. The area must be clean, well lit and suitable for the purpose. For some Machines, certain repairs may require sending the Machine to an IBM service center.

3. Courier or Depot Service*

You will disconnect the failing Machine for collection arranged by IBM. IBM will provide you with a shipping container for you to return your Machine to a designated service center. A courier will pick up your Machine and deliver it to the designated service center. Following its repair or exchange, IBM will arrange the return delivery of the Machine to your location. You are responsible for its installation and verification.

4. Customer Carry-In or Mail-In Service

You will deliver or mail as IBM specifies (prepaid unless IBM specifies otherwise) the failing Machine suitably packaged to a location IBM designates. After IBM has repaired or exchanged the Machine, IBM will make it available for your collection or, for Mail-in Service, IBM will return it to you at IBM’s expense, unless IBM specifies otherwise. You are responsible for the subsequent installation and verification of the Machine.

5. CRU and On-site Service

This type of Warranty Service is a combination of Type 1 and Type 2 (see above).

6. CRU and Courier or Depot Service

This type of Warranty Service is a combination of Type 1 and Type 3 (see above).

7. CRU and Customer Carry-In or Mail-In Service

This type of Warranty Service is a combination of Type 1 and Type 4 (see above).

When a 5, 6 or 7 type of warranty service is listed, IBM will determine which type of warranty service is appropriate for the repair.

* This type of service is called ThinkPad EasyServ or EasyServ in some countries.

The IBM Machine Warranty World Wide Web site at http://www.ibm.com/servers/support/machine_warranties/ provides a worldwide overview of IBM's Limited Warranty for Machines, a Glossary of IBM definitions, Frequently Asked Questions (FAQs) and Support by Product (Machine) with links to Product Support pages. **The IBM Statement of Limited Warranty is also available on this site in 29 languages.**

To obtain warranty service contact IBM or your IBM reseller. In Canada or the United States, call 1-800-IBM-SERV (426-7378). In the EU countries, see the telephone numbers below.

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Cyprus -- +357-22-841100	Luxembourg -- +352-298-977-5063
Czech Republic -- +420-2-7213-1316	Malta -- +356-23-4175
Denmark -- +45-4520-8200	Netherlands -- +31-20-514-5770
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Finland -- +358-8001-4260	Portugal -- +351-21-892-7147
France -- +33-238-557-450	Slovakia -- +421-2-4954-1217
Germany -- +49-1805-253553	Slovenia -- +386-1-4796-699
Greece -- +30-210-680-1700	Spain -- +34-91-714-7983
Hungary -- +36-1-382-5720	Sweden -- +46-8-477-4420
Ireland -- +353-1-815-4000	United Kingdom -- +44-0870-550-0900
Italy -- +39-800-820-094	

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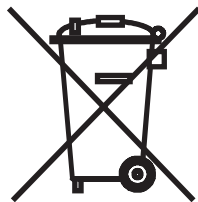
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This appliance is labeled in accordance with European Directive 2002/96/EC concerning waste electrical and electronic equipment (WEEE). The Directive determines the framework for the return and recycling of used appliances as applicable throughout the European Union. This label is applied to various products to indicate that the product is not to be thrown away, but rather reclaimed upon end of life per this Directive.

注意: このマークは EU 諸国およびノルウェーにおいてのみ適用されます。

この機器には、EU 諸国に対する廃電気電子機器指令 2002/96/EC(WEEE) のラベルが貼られています。この指令は、EU 諸国に適用する使用済み機器の回収とリサイクルの骨子を定めています。このラベルは、使用済みになった時に指令に従って適正な処理をする必要があることを知らせるために種々の製品に貼られています。

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L'étiquette du système respecte la Directive européenne 2002/96/EC en matière de Déchets des Equipements Electriques et Electroniques (DEEE), qui détermine les dispositions de retour et de recyclage applicables aux systèmes utilisés à travers l'Union européenne. Conformément à la directive, ladite étiquette précise que le produit sur lequel elle est apposée ne doit pas être jeté mais être récupéré en fin de vie.

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Battery return program

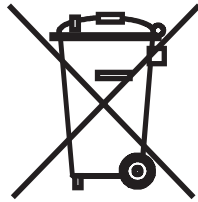
This product may contain a sealed lead acid, nickel cadmium, nickel metal hydride, lithium, or lithium ion battery. Consult your user manual or service manual for specific battery information. The battery must be recycled or disposed of properly. Recycling facilities may not be available in your area. For information on disposal of batteries outside the United States, go to <http://www.ibm.com/ibm/environment/products/batteryrecycle.shtml> or contact your local waste disposal facility.

In the United States, IBM has established a return process for reuse, recycling, or proper disposal of used IBM sealed lead acid, nickel cadmium, nickel metal hydride, and battery packs from IBM equipment. For information on proper disposal of these batteries, contact IBM at 1-800-426-4333. Have the IBM part number listed on the battery available prior to your call.

For Taiwan: Please recycle batteries.



For the European Union:



For California: Perchlorate material – special handling may apply. See <http://www.dtsc.ca.gov/hazardouswaste/perchlorate/>.

The foregoing notice is provided in accordance with California Code of Regulations Title 22, Division 4.5 Chapter 33. Best Management Practices for Perchlorate Materials. This product/part may include a lithium manganese dioxide battery which contains a perchlorate substance.

Electronic emission notices

Federal Communications Commission (FCC) statement

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

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

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

Industry Canada Class A emission compliance statement

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

Avis de conformité à la réglementation d'Industrie Canada

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

Australia and New Zealand Class A statement

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

United Kingdom telecommunications safety requirement

Notice to Customers

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

European Union EMC Directive conformance statement

This product is in conformity with the protection requirements of EU Council Directive 89/336/EEC on the approximation of the laws of the Member States relating to electromagnetic compatibility. IBM cannot accept responsibility for any failure to satisfy the protection requirements resulting from a nonrecommended modification of the product, including the fitting of non-IBM option cards.

This product has been tested and found to comply with the limits for Class A Information Technology Equipment according to CISPR 22/European Standard EN

55022. The limits for Class A equipment were derived for commercial and industrial environments to provide reasonable protection against interference with licensed communication equipment.

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

Taiwanese Class A warning statement

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

Chinese Class A warning statement

聲 明
此為 A 級產品。在生活環境中，該產品可能會造成無線電干擾。在這種情況下，可能需要用戶對其干擾採取切实可行的措施。

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