Emulex 4 Gb Small-Form-Factor Fibre
Channel Expansion Card
for IBM BladeCenter

IBM

Installation Guide

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Note: Before using this information and the product it supports, read the general information in Appendix B, "Warranty information," on page 27 and Appendix C, "Notices," on page 51.

Contents

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 ασφάλειας (safety information).

לפני שתתקינו מוצר זה, קראו את הוראות הבטיחות.

A termék telepítése előtt olvassa el a Biztonsági előírásokat!

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

製品の設置の前に、安全情報をお読みください。

본 제품을 설치하기 전에 안전 정보를 읽으십시오.

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

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

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

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

Перед установкой продукта прочтите инструкции по технике безопасности.

Pred inštaláciou tohto zariadenia si pečítaje Bezpečnostné predpisy.

Pred namestitvijo tega proizvoda preberite Varnostne informacije.

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

Läs säkerhetsinformationen innan du installerar den här produkten.

Important:

All caution and danger statements in this documentation begin with a number. This number is used to cross reference an English caution or danger statement with translated versions of the caution or danger statement in the *IBM Safety Information* book.

For example, if a caution statement begins with a number 1, translations for that caution statement appear in the *IBM Safety Information* book under statement 1.

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

Statement 1:

DANGER

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

To avoid a shock hazard:

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

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

Statement 3:

CAUTION:
When laser products (such as CD-ROMs, DVD drives, fiber optic devices, or transmitters) are installed, note the following:

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

DANGER

Some laser products contain an embedded Class 3A or Class 3B laser diode. Note the following.

Laser radiation when open. Do not stare into the beam, do not view directly with optical instruments, and avoid direct exposure to the beam.

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

Statement 21:

CAUTION:
Hazardous energy is present when the blade is connected to the power source. Always replace the blade cover before installing the blade.

WARNING: Handling the cord on this product or cords associated with accessories sold with this product, will expose you to lead, a chemical known to the State of California to cause cancer, and birth defects or other reproductive harm. *Wash hands after handling.*

ADVERTENCIA: El contacto con el cable de este producto o con cables de accesorios que se venden junto con este producto, pueden exponerle al plomo, un elemento químico que en el estado de California de los Estados Unidos está considerado como un causante de cancer y de defectos congénitos, además de otros riesgos reproductivos. *Lávese las manos después de usar el producto.*

Chapter 1. Introduction

This *Installation Guide* contains instructions for installing the Emulex 4 Gb Small-Form-Factor Fibre Channel Expansion Card for IBM® BladeCenter® in an IBM BladeCenter blade server. It applies to blade servers that are installed in all IBM BladeCenter unit types. This document contains information about:

- Installing and configuring the 4 Gb Fibre Channel expansion card
- Updating the firmware and device drivers of the 4 Gb Fibre Channel expansion card
- Performing custom configuration of the expansion card through the Emulex HBAnyware utility
- Performing basic troubleshooting of the expansion card

The Emulex 4 Gb Fibre Channel expansion card is a 4 Gb Fibre Channel device that has two configurable adapter ports. Communication signals are routed from the blade server through the Fibre Channel high-speed connector on the expansion card to I/O-module bays 3 and 4 in the BladeCenter unit.

If firmware and documentation updates are available, you can download them from http://www.ibm.com/bladecenter/. Click **Support**, and follow the instructions.

Notes:
- The Emulex 4 Gb Small-Form-Factor (SFF) Fibre Channel Expansion Card for IBM BladeCenter is also referred to throughout this document as the *expansion card*, the *Fibre Channel expansion card*, or the *I/O expansion card*.
- Unless otherwise stated, references to the BladeCenter unit apply to all BladeCenter unit types.
- 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 modules in I/O-module bays 3 and 4 must support Fibre Channel operation.
- When the expansion card is used with the Optical Pass Through Module option, the expansion card must operate at 1 Gb or 2 Gb Fibre Channel data-rate speed.
- When the expansion card is used with the HS40 Machine Type 8839 in the second expansion card slot closest to the midplane connector, the expansion card must operate at 1 Gb or 2 Gb Fibre Channel data-rate speed when installed. When the expansion card is installed in the first slot closest to the processors, no speed changes are required.

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- If you are using the 4 Gb expansion card with the BladeCenter T unit, the ports operate at 2 Gb when a Fibre Channel switch is installed in bay 3 or bay 4.

You can register your expansion card with IBM at http://www.ibm.com/support/mysupport/. The product name and serial number are required for registration.

Your Emulex Fibre Channel expansion card comes with a one-year limited warranty. For information about your warranty, see Appendix B, "Warranty information," on page 27. You can obtain up-to-date information about your expansion card and other IBM BladeCenter products at http://www.ibm.com/bladecenter/.

For service or assistance, see Appendix A, "Getting help and technical assistance," on page 25.

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.

By adding BladeCenter Fibre Channel expansion cards to the blade servers and Fibre Channel compatible I/O modules to the BladeCenter unit, you can attach the blade server to an external storage area network (SAN) through the external 2 Gbps (gigabits per second) optical ports on the I/O modules. The expansion card supports data-transfer rates up to 200 MB per second half-duplex and 400 MB per second full-duplex per port.

Related documentation

This *Installation Guide* contains setup, installation, configuration, and troubleshooting instructions for the expansion card. This document also provides general information about the expansion card, including warranty information, and how to get help.

In addition to this *Installation Guide*, the following related documentation is provided with your BladeCenter blade server:

- *Safety Information*

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

- Emulex device-driver user manuals for the Microsoft® Windows® and Linux® operating systems

  These Emulex documents are in PDF at http://www.ibm.com/bladecenter/. They come with the Emulex HBAnyware utility and the device drivers for your operating system. These documents describe how to install and use the HBAnyware utility and the device drivers for your operating system.

- *Firmware Update User Manual*

  This Emulex document is in PDF at http://www.ibm.com/bladecenter/. It describes how to update firmware through the HBAnyware utility.

- *Boot Code User Manual*

  This Emulex document is in PDF at http://www.ibm.com/bladecenter/. It describes how to update boot code through the HBAnyware utility, how to configure a host bus adapter (HBA) to boot from a SAN, and how to set up a Fibre Channel boot disk.

- *x86 BootBIOS User Manual*

  This Emulex document is in PDF at http://www.ibm.com/bladecenter/. It describes the Emulex BIOS utility and the x86 BootBIOS feature. This document also contains information about using the Emulex BIOS utility and the x86 BootBIOS feature to configure HBAs.

- IBM *Problem Determination and Service Guide* or *Hardware Maintenance Manual and Troubleshooting Guide*

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

- *Rack Installation Instructions*

  This document contains the instructions for installing the BladeCenter unit in a rack.

- IBM *BladeCenter Fibre Channel I/O Management User's Guide*

  This document is in PDF on the IBM *BladeCenter Documentation* CD. It contains information about using the command line interface (CLI) or the BladeCenter SAN utility to manage the Fibre Channel I/O module and your SAN.

- IBM BladeCenter and BladeCenter T unit *Installation and User's Guide*

  Each type of BladeCenter unit has a customized *Installation and User's Guide* that is provided in PDF on the IBM *BladeCenter Documentation* CD. It provides general information about your BladeCenter unit, including:

  – Information about features

  – How to set up, cable, and start the BladeCenter unit

  – How to install options in the BladeCenter unit

  – How to configure the BladeCenter unit

  – How to perform basic troubleshooting of the BladeCenter unit

- How to get help
- IBM BladeCenter blade server *Installation and User's Guide*

  Each type of blade server has a customized *Installation and User's Guide* that is provided in PDF on the IBM *BladeCenter Documentation* CD. It provides general information about your blade server, including:
  - Information about features
  - How to set up and start the blade server
  - How to install options in the blade server
  - How to configure the blade server
  - How to install an operating system on the blade server
  - How to perform basic troubleshooting of the blade server
  - How to get help
- IBM *BladeCenter SAN Solutions Guide*

  This document provides a user-oriented explanation of how the BladeCenter Fibre Channel options are used to provide different SAN storage solutions for different application requirements. This document also provides an overview and description for backup and restore, business continuance and high availability solutions, and storage consolidation and data-sharing solutions.
- IBM *BladeCenter Fibre Channel Switch Interoperability Guide*

  This document provides detailed Fibre Channel I/O-module configuration data and step-by-step configuration procedures for integrating the BladeCenter unit into other vendor switch fabrics. Each vendor configuration includes an initial integration checklist, configuration limitations, supported switch and firmware versions, specific management application operations, and a successful-integration checklist.

Depending on your blade server model, additional documents might be included on the IBM *BladeCenter Documentation* CD.

The most recent versions of this *Installation Guide* and all other BladeCenter documentation are at http://www.ibm.com/bladecenter/.

Features and specifications

The expansion card has the following features:
- Compliance with U.S. and international safety and emissions standards
- Support for direct memory access (DMA)
- Support for bus mastering
- Support for Fibre Channel protocol SCSI (FCP-SCSI) and Fibre Channel Internet protocol (FCP-IP)
- Support for point-to-point fabric connection (F-port fabric login)

• Support for Fibre Channel service (classes 2 and 3)

The expansion card has the following specifications:

Table 1. Fibre Channel expansion card specifications

Type	Specification
Fibre Channel specifications	• Bandwidth: 4 Gb per second maximum at full-duplex per port • Support for both FCP-SCSI and IP protocols • Support for point-to-point fabric connection: F-Port Fabric Login • Support for FCAL and FCAL-2 FL-Port Login • Support for Fibre Channel services class 2 and 3 • Support for full-duplex operation
Processor	Single-chip design with two completely independent 4 Gb serial Fibre Channel ports. Each port provides: • Reduced instruction set computer (RISC) processor • Integrated serializer/deserializer • Receive direct memory access (DMA) sequencer • Frame buffer • Processor operation at 100/133 MHz
Host data transfer	Burst data transfers up to 1 Gb per second
Application-specific integrated circuit (ASIC) internal static random-access memory (SRAM)	• Error-correcting code (ECC) protected • 1.5 MB internal high-speed SRAM
Non-volatile random-access memory (NVRAM)	NVRAM: 4 MB flash memory, 2 MB per port, field programmable
Onboard DMA	DMA controller for each port: transmit and receive
Frame buffer first in, first out (FIFO)	Integrated 63 KB transmit and 32 KB receive frame buffer for each data channel
Connectors (internal only)	200-pin board-to-board for PCI-X interface
Operating power	• Approximately 4.7 watts or 16.04 British thermal units (Btu) per hour, for 100 MHz devices • Approximately 6.7 watts or 22.9 British thermal units (Btu) per hour, for 133 MHz devices

Inventory checklist

The Fibre Channel expansion card option package includes the following items:

- Emulex 4 Gb SFF Fibre Channel expansion card
- *Emulex 4 Gb Small-Form-Factor Fibre Channel Expansion Card for IBM BladeCenter Installation Guide* (this document)
- *Safety Information* document
- *End User License Agreement*

Notices and statements in this book

The caution and danger statements used in this book are also in the multilingual *Safety Information* book provided on the IBM *BladeCenter Documentation* CD. Each statement is numbered for reference to the corresponding statement in the *Safety Information* book.

The following types of notices and statements are used in this book:

- **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 possible damage to programs, devices, or data. An attention notice is placed just before the instruction or situation in which damage could 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.

Major components of the expansion card

The LP1105 chip provides a PCI-X local bus interface and two completely independent 4 Gb serial Fibre Channel ports. Each port has a RISC processor, an integrated serializer/deserializer (SERDES), a receive DMA sequencer, frame buffer, five-channel DMA controller, and 1.5 MB ECC protected SRAM integrated in a single-chip solution.

Chapter 2. Installing a Fibre Channel expansion card

This chapter provides information about installing a Fibre Channel expansion card in your blade server.

Installation guidelines

Before you install the Fibre Channel expansion card in the blade server, read the following information:

- Read the safety information that begins on page v and the guidelines in "Handling static-sensitive devices" on page 9. This information will help you work safely.
- Make sure that you are using the latest versions of device drivers, firmware code, and basic input/output system (BIOS) code for your blade server, the management module, and the I/O modules that are used by the I/O expansion card.

  When you install your new expansion card, take the opportunity to download and apply the most recent firmware updates for the expansion card and other BladeCenter components. This step will help to ensure that any known issues are addressed and that your expansion card and other BladeCenter components are ready to function at maximum levels of performance. To download the most recent device drivers and firmware and BIOS code updates, go to http://www.ibm.com/bladecenter/ and click **Support**. 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.
- Make sure that you have an adequate number of properly grounded electrical outlets for the BladeCenter unit, monitor, and other devices.
- Back up all important data before you make changes to disk drives.
- Have a small flat-blade screwdriver available.

- Before you remove a hot-swap blade server from the BladeCenter unit, you must shut down the operating system and turn off the blade server. You do not have to shut down the BladeCenter unit.
- Make sure that an I/O module that supports Fibre-Channel operation is installed in I/O-module bay 3, I/O-module bay 4, or both I/O-module bays 3 and 4 in the BladeCenter unit. If your blade server type supports installation of one or more expansion cards, you must install at least one I/O module that supports Fibre Channel operation in the BladeCenter unit when you install a expansion card in the blade server. Installing a second identical I/O module that supports Fibre Channel operation in the BladeCenter unit provides a backup I/O module in case one I/O module fails. If I/O modules are installed in both I/O-module bays 3 and 4, both I/O modules must be the same type.
- When you are finished working on the blade server, reinstall all safety shields, guards, labels, and ground wires.
- For a list of supported options for the blade server, see http://www.ibm.com/servers/eserver/serverproven/compat/us/.

See the following BladeCenter documentation for additional information:
- The *Installation and User's Guide* for your blade server provides server specific expansion card installation requirements.
- The *Installation Guide* for your BladeCenter unit shows I/O module bay locations.
- The *Installation Guide* for your I/O module has installation and configuration instructions for the I/O module.

Handling static-sensitive devices

Attention: Static electricity can damage electronic devices, including your blade server. 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 working inside the BladeCenter unit 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 any *unpainted* metal surface of the BladeCenter unit or any *unpainted* metal surface on any other grounded rack component in the rack in which you are installing the device 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 blade server without setting down the device. If it is necessary to set down the device, place it back into its static-protective package. Do not place the device on the blade server cover or on a metal surface.
- Take additional care when handling devices during cold weather. Heating reduces indoor humidity and increases static electricity.

Installing the expansion card on a blade server

See the blade server or storage-expansion-unit documentation for detailed instructions about installing the expansion card.

Configuring a command session

After installing the expansion card, turn on the blade server; then, use the following list to determine how to set up a command session:

- If your blade server supports local console connection through the management module, switch control of the keyboard/video/mouse (KVM) component to this blade server. For instructions, see the *Installation and User's Guide* for your blade server.
- If your blade server does *not* support local console connection, see the *Installation and User's Guide* for your blade server for instructions about how to set up a command session with the blade server.

Chapter 3. Updating the boot code and firmware and installing device drivers

After you install the Fibre Channel expansion card, be sure that the latest boot code and the firmware are installed; then, install the device drivers.

If necessary, obtain the latest device drivers, utilities, documentation, and installation instructions for the following supported operating systems from http://www.ibm.com/servers/eserver/serverproven/compat/us/:

- Microsoft Windows 2000 and Microsoft Windows 2003
- Red Hat Advanced Server Version 3
- Red Hat Advanced Server Version 4
- SUSE LINUX Enterprise Server (SLES) Version 8.0
- SLES Version 9

After you install the device drivers, you can customize the configuration of the I/O expansion card. Complete the following steps:

1. Review the documentation that comes with your blade server to determine whether your blade server supports the video function.
2. Use the Emulex HBAnyware utility in one of the following ways, depending on whether or not your blade server supports the video function:
   - If the expansion card is installed in a blade server that supports the video function, you can use the Emulex HBAnyware utility to manage either the local Fibre Channel expansion card or any remote Fibre Channel expansion card on the SAN that is discovered by the Emulex HBAnyware utility. For details about using the Emulex HBAnyware utility to update firmware and boot code and to perform other configuration functions, see Chapter 5, "Using the Emulex HBAnyware utility," on page 17.
   - If the expansion card is installed in a blade server that *does not* support the video function, such as the BladeCenter JS20 or JS21 blade server, you can use the Emulex HBAnyware utility through a network connection to a workstation or by launching the Emulex HBAnyware utility for IBM Director. For additional information, see Chapter 5, "Using the Emulex HBAnyware utility," on page 17.

Chapter 4. Configuring x86 BootBIOS

This chapter provides information about the Emulex BIOS utility and the x86 BootBIOS function that you can use to configure host bus adapters (HBAs) for the expansion card.

Important: If the configuration settings are incorrect, the expansion card might not function correctly.

Before you customize the configuration of the expansion card:

- Make sure that the expansion card is correctly installed in the blade server.
- Make sure that the blade server is correctly installed in the BladeCenter unit.
- Make sure that the blade server, BladeCenter unit, and all other BladeCenter components are correctly configured.
- Make sure that an I/O module that supports Fibre Channel operation is correctly installed in I/O-module bay 3, I/O-module bay 4, or both I/O-module bays 3 and 4 of the BladeCenter unit.
- Make sure that the I/O modules that support Fibre Channel operation are correctly configured.

Notes:

- A host bus adapter is also referred to throughout this document as an *HBA*, a *host adapter*, or an *adapter*.
- For more detailed information about the Emulex BIOS utility and the x86 BootBIOS feature, see the Emulex *x86 BootBIOS User Manual* at http://www.ibm.com/bladecenter/.
- For information about remote boot options, contact your IBM technical-support representative, or review the documentation that comes with your blade server, and is available at http://www.ibm.com/bladecenter/.

Using the BIOS utility

The BIOS utility enables you to change HBA parameters (for example, topology, PLOGI retry timer, and auto-scan setting) and configure startup (boot) devices.

The following requirements apply when you are using the BIOS utility:

- The expansion card settings and default values will vary, based on the version of BIOS code installed for the expansion card.
- Default settings are acceptable for most installations.

- In the BIOS utility:
  - Press **d** to reset the selected adapter to its default values.
  - Press **Esc** to return to the previous menu.
  - Press **X** to exit from the menu.
- The default topology is auto topology with loop first. For a Fibre Channel arbitrated loop (FC-AL), each HBA has a default arbitrated loop physical address (AL_PA) of 01 (hexadecimal). If necessary, change this topology setting before you configure boot devices.
- All HBAs or boot drives can be configured to other AL_PAs instead of their default values.
- If the system has more than one HBA with the same PCI bus number, and each has a boot drive attached, the first PCI-scanned HBA will be the boot HBA. The first HBA is usually in the lowest-numbered PCI slot in the system. You can view this information through the BIOS utility.

Starting the BIOS utility

Before you can run the BIOS utility, x86 BootBIOS must be loaded and the boot up message must be enabled on at least one installed HBA in your system.

To start the BIOS utility to configure your HBAs, complete the following steps:

1. Start the blade server. On the blade server control panel, press the keyboard/video/mouse (KVM) select button. (For additional information, see the blade server *Installation and User's Guide*.)
2. Press Alt+E immediately (within 5 seconds) when the BootBIOS prompt appears for starting the BIOS utility. The BIOS utility menu is displayed. This menu contains a list of HBAs.
3. Select the applicable HBA to configure by entering the corresponding number. The main configuration menu is displayed.
4. Press **2** to configure the HBA. The adapter configuration menu is displayed.
5. Select **1** to configure boot devices for remote boot functions or select **2** to configure the HBA parameters.

   If you select to configure the HBA parameters, the adapter configuration menu is displayed. After you change the settings, the BIOS utility restarts the blade server to enable the new parameters.

Important: If the x86 BootBIOS prompt does not appear, you must enable this prompt. For additional information, see the installation section of the Emulex *x86 BootBIOS User Manual* at http://www.ibm.com/bladecenter/.

Enabling x86 BootBIOS on an HBA through the BIOS utility

Before you can use the x86 BootBIOS features, x86 BootBIOS must be enabled on at least one installed HBA in your system.

To enable x86 BootBIOS on an installed HBA, complete the following steps:

1. Start the blade server. On the blade server control panel, press the keyboard/video/mouse (KVM) select button. (For additional information, see the blade server *Installation and User's Guide*.)
2. Press Alt+E immediately (within 5 seconds) when the x86 BootBIOS prompt appears for starting the BIOS utility. The BIOS utility menu is displayed. This menu contains a list of HBAs.
3. Select the applicable HBA by entering the corresponding number. The main configuration menu is displayed.
4. Press **2** to configure the HBA. The adapter configuration menu is displayed.
5. Press **1** to enable or disable x86 BootBIOS. If x86 BootBIOS is not already enabled, you must enable it so that you can use the x86 BootBIOS features.

Important: If the x86 BootBIOS prompt does not appear, you must enable this prompt. For additional information, see the installation section of the Emulex *x86 BootBIOS User Manual* at http://www.ibm.com/bladecenter/.

Descriptions of the options on the adapter configuration menu

This section describes the options on the adapter configuration menu. You can use this menu to view the host adapter parameters for the expansion card. You can change a modifiable value if your system supports the corresponding feature.

- **Enable or Disable BIOS:** This option enables x86 BootBIOS on the selected adapter. Before you can use the x86 BootBIOS features, x86 BootBIOS must be enabled on at least one installed HBA in your system. For additional information, see "Enabling x86 BootBIOS on an HBA through the BIOS utility."
- **Change default ALPA of this adapter:** This option applies only to a Fibre Channel arbitrated loop (FC-AL). The factory default value for each HBA is an arbitrated loop physical address (AL_PA) of **01** (hexadecimal).
- **Change PLOGI Retry Timer (+Advanced Option+):** This option sets the interval for the port log-in (PLOGI) retry timer. The factory default value is **NoPLOGI Retry: 0 msec**.
- **Topology Selection (+Advanced Option+):** If it is necessary to change the topology, do so before you configure the boot devices.
- **Enable or Disable Spinup Delay (+Advanced Option+):** This option enables or disables the spin up delay. The factory default value is **Disabled**.

- **Auto Scan Setting (+Advanced Option+):** This option enables the first device in the boot entry list to issue a Name Server Inquiry. The factory default value is **Disabled**.
- **Enable, Disable EDD 3.0 (+Advanced Option+):** This option enables or disables the Enhanced Disk Drive (EDD) option that is available on Intel® Itanium® (IA-64) servers only. Enabling EDD 3.0 displays the path to the boot device. The factory default value is **Disabled**.
- **Enable or Disable Start Unit Command (+Advanced Option+):** This command is used to issue the small computer system interface (SCSI) start unit command for various devices, such as tape backup units that are attached to the SAN. You must know the specific LUN of the applicable device to issue the SCSI start unit command. The factory default value is **Disabled**.
- **Enable or Disable Environment Variable (+Advanced Option+):** This option enables or disables the ability to set the boot controller order, if the system supports the environment variable. The factory default value is **Disabled**.
- **Auto Sector Format Select:** This option automatically defines the boot sector (32-sector or 63-sector) of the target disk. The factory default value is **Enabled**.

To reset a parameter for an adapter to its default value, complete the following steps:

1. Select the applicable adapter.
2. Select the applicable option on the configuration menu.
3. Press **d**.

For more detailed information about the Emulex BIOS utility and the x86 BootBIOS, see the Emulex *x86 BootBIOS User Manual* at http://www.ibm.com/bladecenter/.

Chapter 5. Using the Emulex HBAnyware utility

This chapter provides an overview of the Emulex HBAnyware utility for advanced users who want to customize the configuration of a Fibre Channel expansion card that is installed in any type of blade server that supports the video function. For more detailed information, see the HBAnyware utility online help or the documentation that comes with the HBAnyware utility.

Overview of the Emulex HBAnyware utility

The Emulex HBAnyware utility, which comes with the device drivers for your Microsoft Windows or Linux operating system, is used to configure a storage area network (SAN) environment that consists of Fibre Channel host bus adapters (HBAs). It is a network-capable application that can connect to and configure remote systems, enabling centralized management and configuration of HBA components.

You can use the HBAnyware utility to manage and control one or more expansion cards that are installed on local or remote systems. The HBAnyware utility 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 FC fabric or loop.

You can also perform the following operations using the HBAnyware utility to configure devices in your system:

Table 2. HBAnyware utility operations for configuring devices

Operation	Description
Discover local/remote hosts	When a device is set as unconfigured, it is not recognized by the HBA and is not accessible to the HBA on that system.
Set HBA driver parameters to a single adapter or multiple adapters	This operation allows you to set driver parameters to optimize driver performance for a particular operating system or application. You can set parameters on a single adapter or multiple adapters simultaneously through batch mode.
Update firmware on single or multiple adapters	This operation allows you to update adapter firmware and boot code on a single adapter or multiple adapters simultaneously through batch mode.

Table 2. HBAnyware utility operations for configuring devices (continued)

Operation	Description

Run diagnostics including loopback and echo tests	This operation allows you to run diagnostics on an adapter. Options include the following tests:
	• A quick test
	• A full power-on self-test (POST)
	• More advanced diagnostics:
	  – A peripheral component interconnect (PCI) Loopback (testing the PCI bus)
	  – An internal loopback (on the adapter)
	  – An external loopback (requires an external plug)

To reset a parameter for a host bus adapter to its default value, complete the following steps:

1. Select the applicable adapter.
2. Select the **Driver Parameters** tab on the Adapter Properties window.
3. Click the **default** button.

Installation and system requirements

Make sure that you are using the latest version of the HBAnyware utility for the expansion card. See http://www.ibm.com/bladecenter/ or http://www.ibm.com/servers/eserver/serverproven/compat/us/ for the latest information about the HBAnyware utility. The latest instructions and system requirements are in the documentation that comes with the HBAnyware utility.

Features

The HBAnyware utility enables you to perform the following tasks:

• Depending on the device driver, set the HBAnyware utility options
• Connect to hosts
• Discover and manage HBAs on the SAN through Fibre Channel and IP discovery
• Diagnostics features:
    – PCI, internal, and external loopback tests
    – User-initiated POST (adapter health check)
    – End-to-end tests (based on the Echo command)
    – Ping and trace route
    – Beaconing support
    – Firmware/device-driver dump

- Use host-to-host SAN configuration policies:
  - Configuration profiles (device-driver parameters saved into and reloaded from a file)
  - Auto persistent binding (Microsoft Windows operating system only)
  - HBA/port alias symbolic name
  - Emulex vital product data (eVPD)
  - Flash/firmware update
  - Boot code update
  - Activate loading of expansion ROM boot code for support of remote boot function
- Configure port devices
- Use logical unit number (LUN) level configuration and target binding
- Review host adapter information, including:
  - General information
  - Statistics
  - Information about attached devices
  - Link status for attached device
- Perform adapter functions, including:
  - Configuring the adapter device-driver parameters
  - Running Fibre Channel diagnostics (read/write buffer loopback tests)
  - Performing flash updates on an adapter
- Manage configurations: Configuring a single HBA or multiple adapters
- Confirming security

Chapter 6. Troubleshooting

If you are having a problem, use the following information to help you determine the cause of the problem and the action to take. Additional troubleshooting and debugging procedures are available in the *Problem Determination and Service Guide* or in the *Hardware Maintenance Manual and Troubleshooting Guide* that comes with your blade server.

Make sure that you are using the latest versions of device drivers, firmware code, and BIOS code for your blade server, the management module, and the I/O modules that are used by the I/O expansion card. If these items are obsolete, the BladeCenter unit might not recognize the Fibre Channel expansion card and might not turn it on. To download the most recent device drivers and firmware and BIOS boot code updates, go to http://www.ibm.com/bladecenter/ and click **Support**. Follow the instructions that are included with the download procedure.

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

- Make sure that the expansion card is correctly installed in the blade server.
- Make sure that the blade server is correctly installed in the BladeCenter unit.
- Make sure that the HBAnyware utility device-driver parameters are correct.
  - If the expansion card is installed in a blade server that supports the video function, see Chapter 5, "Using the Emulex HBAnyware utility," on page 17.
  - If the expansion card is installed in a blade server that *does not* support the video function, such as the BladeCenter JS20 or JS21 blade server, you can use the Emulex HBAnyware utility from a remote host through a network connection to a blade server in which the expansion card is installed. You can also configure the expansion card remotely by launching the Emulex HBAnyware utility from an IBM Director console.
- Make sure that an I/O module that supports Fibre Channel operation is correctly installed in I/O-module bay 3, I/O-module bay 4, or both I/O-module bays 3 and 4 of the BladeCenter unit.
- Make sure that all peripheral devices are:
  - Correctly connected to the I/O modules
  - Turned on
  - Operating correctly

  For additional information, see the documentation that comes with the peripheral devices.

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

- Make sure that the correct device driver is installed. To download or get information about the latest supported device drivers, utilities, and documentation, go to http://www.ibm.com/bladecenter/ and click **Support**. Follow the instructions that are included with the download procedure. Also see the *Installation and User's Guide* for your blade server for additional information.
- Make sure that the BIOS functional firmware and boot code in the expansion card is at the latest level.
- Make sure that you have the correct expansion card NVRAM settings for your SAN and operating system.

To determine whether your problem is caused by the system configuration:

- Make sure that the I/O modules that support Fibre Channel operation are correctly configured.
- Make sure that the blade server is correctly configured.
- Make sure that the BladeCenter unit and all other BladeCenter components are correctly configured.

To determine whether your system board requires a special configuration, see the documentation that comes with your BladeCenter unit and blade server, or contact your IBM technical-support representative. For additional information about other configuration requirements, see the documentation that comes with your BladeCenter unit, blade server, and other BladeCenter components.

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

- Make sure that an I/O module that supports Fibre Channel operation is correctly installed in I/O-module bay 3, I/O-module bay 4, or both I/O-module bays 3 and 4 of the BladeCenter unit.
- Make sure that the blade server is turned on.
- Make sure that the BladeCenter expansion-card settings are the correct values:
  - If the expansion card is installed in a blade server that supports the video function, see Chapter 5, "Using the Emulex HBAnyware utility," on page 17 for additional information.
  - If the expansion card is installed in a blade server that *does not* support the video function, such as the BladeCenter JS20 or JS21 blade server, you can use the Emulex HBAnyware utility from a remote host through a network connection to the blade server in which the expansion card is installed. You can also configure the expansion card remotely by launching the Emulex HBAnyware utility from an IBM Director console.

- See the troubleshooting section of the documentation that comes with the applicable Emulex device driver.
- If you determine that the system is correctly configured, see the diagnostics section of the applicable device driver *Installation Guide* or *User's Guide*.

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 BladeCenter 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.
- Go to http://www.ibm.com/bladecenter/ and click **Support** to check for information to help you solve the problem.

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 BladeCenter systems also describes the diagnostic tests that you can perform. Most BladeCenter 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 software.

Using the documentation

Information about your IBM BladeCenter 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/bladecenter/, click **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 BladeCenter systems, optional devices, services, and support at http://www.ibm.com/bladecenter/. For service information, click **Support**.

Software service and support

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

Appendix B. Warranty information

Thank you for your purchase. IBM provides hardware warranty service for this product equivalent to that described in the IBM Statement of Limited Warranty ("SOLW"), a copy of which is included, notwithstanding the section entitled, "What this Warranty Does not Cover" of the SOLW. All references to "Machine" in the SOLW apply to this product (except for its firmware or accompanying software) for purposes of the warranty. References to "IBM's Official Published Specifications" mean the specifications for the product designated by IBM. Any firmware or software included in or which accompanies this product is subject to the terms and conditions of the manufacturer's end user license agreement.

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.

<u>What this Warranty Does not Cover</u>

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**.

<u>How to Obtain Warranty Service</u>

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

<u>AMERICAS</u>

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.*

<u>**EUROPE, MIDDLE EAST, AFRICA (EMEA)**</u>

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.

Emulex 4 Gb Small-Form-Factor Fibre Channel Expansion Card for IBM BladeCenter

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.

EU Country Telephone List

Phone numbers are subject to change without notice. For the warranty service contact telephone number in a country subsequently added to the EU and not yet reflected in the list below, contact IBM in that country or visit the website above for a current telephone listing.

Austria -- +43-1-24592-5901	Latvia -- +386-61-1796-699
Belgium -- +32-70-23-3392	Lithuania -- +386-61-1796-699
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
Estonia -- +386-61-1796-699	Poland -- +48-22-878-6999
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	

Appendix C. Notices

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

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

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> IBM Corporation
> North Castle Drive
> Armonk, NY 10504-1785
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Alert on LAN	Netfinity	Wake on LAN
BladeCenter	Predictive Failure Analysis	XA-32
Chipkill	ServeRAID	XA-64
e-business logo	ServerGuide	X-Architecture
@server	ServerProven	XpandOnDemand
FlashCopy	System x	xSeries
i5/OS		

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

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Important notes

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

CD drive speeds list the variable read rate. Actual speeds vary and are often less than the maximum possible.

When referring to processor storage, real and virtual storage, or channel volume, KB stands for approximately 1000 bytes, MB stands for approximately 1 000 000 bytes, and GB stands for approximately 1 000 000 000 bytes.

When referring to hard disk drive capacity or communications volume, MB stands for 1 000 000 bytes, and GB stands for 1 000 000 000 bytes. Total user-accessible capacity may vary depending on operating environments.

Maximum internal hard disk drive capacities assume the replacement of any standard hard disk drives and population of all hard disk drive bays with the largest currently supported drives available from IBM.

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

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IBM makes no representations or warranties with respect to non-IBM products. Support (if any) for the non-IBM products is provided by the third party, not IBM.

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

Product recycling and disposal

This unit must be recycled or discarded according to applicable local and national regulations. IBM encourages owners of information technology (IT) equipment to responsibly recycle their equipment when it is no longer needed. IBM offers a variety of product return programs and services in several countries to assist equipment owners in recycling their IT products. Information on IBM product recycling offerings can be found on IBM's Internet site at http://www.ibm.com/ibm/environment/products/prp.shtml
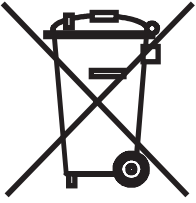
Notice: This mark applies only to countries within the European Union (EU) and Norway.

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。

Remarque : Cette marque s'applique uniquement aux pays de l'Union Européenne et à la Norvège.

L'etiquette 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.

In accordance with the European WEEE Directive, electrical and electronic equipment (EEE) is to be collected separately and to be reused, recycled, or recovered at end of life. Users of EEE with the WEEE marking per Annex IV of the WEEE Directive, as shown above, must not dispose of end of life EEE as unsorted municipal waste, but use the collection framework available to customers for the return, recycling, and recovery of WEEE. Customer participation is important to minimize any potential effects of EEE on the environment and human health due to the potential presence of hazardous substances in EEE. For proper collection and treatment, contact your local IBM representative.

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.

In the Netherlands, the following applies.

For Taiwan: Please recycle batteries.

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

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

Japanese Voluntary Control Council for Interference (VCCI) statement

この装置は、情報処理装置等電波障害自主規制協議会（ＶＣＣＩ）の基準に
基づくクラスＡ情報技術装置です。この装置を家庭環境で使用すると電波妨害を
引き起こすことがあります。この場合には使用者が適切な対策を講ずるよう要求
されることがあります。

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