IBM @server BladeCenter Fibre Channel
Expansion Card and
IBM @server BladeCenter JS20 Fibre Channel
Expansion Card

IBM

Installation and User's Guide

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Note: Before using this information and the product it supports, read the general information in Appendix B, "IBM Statement of Limited Warranty Z125-4753-08 04/2004," on page 31 and Appendix C, "Notices," on page 55.

Contents

Safety

Before installing this product, read the Safety Information.

قبل تركيب هذا المنتج، يجب قراءة الملاحظات الآمنية

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

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

安裝本產品之前，請先閱讀「安全資訊」。

Prije instalacije ovog produkta obavezno pročitajte Sigurnosne Upute.

Před instalací tohoto produktu si přečtěte příručku bezpečnostních instrukcí.

Læs sikkerhedsforskrifterne, før du installerer dette produkt.

Lees voordat u dit product installeert eerst de veiligheidsvoorschriften.

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

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

Vor der Installation dieses Produkts die Sicherheitshinweise lesen.

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

לפני שתתקינו מוצר זה, קראו את הוראות הבטיחות.

A termék telepítése előtt olvassa el a Biztonsági előírásokat!

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

製品の設置の前に、安全情報をお読みください。

본 제품을 설치하기 전에 안전 정보를 읽으십시오.

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

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

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

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

Перед установкой продукта прочтите инструкции по технике безопасности.

Pred inštaláciou tohto zariadenia si pečítaje Bezpečnostné predpisy.

Pred namestitvijo tega proizvoda preberite Varnostne informacije.

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

Läs säkerhetsinformationen innan du installerar den här produkten.

Important:

> 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 and User's Guide* contains instructions for installing:

- The IBM® @server BladeCenter™ Fibre Channel Expansion Card in an HS20 or HS40 blade server
- The IBM @server BladeCenter JS20 Fibre Channel Expansion Card in an IBM @server BladeCenter JS20 blade server

Except where specifically stated otherwise, the terms *I/O expansion card* and *expansion card* refer to both the IBM @server BladeCenter Fibre Channel Expansion Card and the IBM@serverBladeCenter JS20 Fibre Channel Expansion Card throughout this document. Except where specifically stated otherwise, the IBM @server BladeCenter unit (for example, the BladeCenter Type 8677) and IBM @server BladeCenter T unit are referred to throughout this document as the BladeCenter unit.

This document applies to blade servers that are installed in the IBM @server BladeCenter and IBM @server BladeCenter T units. This document contains information about:

- Features of the expansion card
- Installing the expansion card in your blade server
- Updating the basic input/output system (BIOS) code or firmware code and device drivers of the expansion card
- Performing custom configuration of the expansion card
- Performing basic troubleshooting of the expansion card

Note: The IBM @server BladeCenter Fibre Channel Expansion Card contains BIOS code to provide storage area network (SAN) startup (boot) functions on the IBM BladeCenter HS20 and HS40 blade servers. The IBM @server BladeCenter JS20 Fibre Channel Expansion Card contains firmware code to provide SAN startup (boot) functions on the IBM BladeCenter JS20 blade server.

The expansion card is a 2 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 bay 3 and bay 4 in the BladeCenter or BladeCenter T unit.

Note: The modules in I/O-module bay 3 and bay 4 must support Fibre Channel operation.

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The expansion card comes with a three-year limited warranty. For information about your warranty, see Appendix B, "IBM Statement of Limited Warranty Z125-4753-08 04/2004," on page 31. You can obtain up-to-date information about the expansion card and other IBM @server products at http://www.ibm.com/eserver/xseries/.

This *Installation and User's Guide* and the most recent versions of other documents that contain detailed information about your BladeCenter unit, blade server, and available options are provided in Portable Document Format (PDF) on the IBM support Web site, http://www.ibm.com/pc/support/.

You can register the expansion card at http://www.ibm.com/pc/register/.

For service or assistance, see Appendix A, "Getting help and technical assistance," on page 29.

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 used for mass storage and networking.

By adding BladeCenter Fibre Channel I/O 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 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

In addition to reviewing the documentation in this library, be sure to review the IBM @server *BladeCenter Planning and Installation Guide* or the IBM @server *BladeCenter T Planning and Installation Guide* for information to help you prepare for system installation and configuration.

The most recent version of the following related BladeCenter documentation is available in PDF on the World Wide Web.

To locate the most recent version of the BladeCenter documentation, including the IBM @server *BladeCenter Planning and Installation Guide* or the IBM @server *BladeCenter T Planning and Installation Guide*, complete the following steps:

1. Go to the IBM support Web site, http://www.ibm.com/pc/support/.
2. In the **Learn** section, click **Publications**.
3. On the "Publications" page, in the **Brand** field, select **Servers**.

4. In the **Family** field, select **BladeCenter**.

   Do not change the default values in the **Type**, **Model**, and **Operating system** fields.

5. Click **Continue**.

   A list of the available BladeCenter documentation will be displayed under the heading **Results by date**.

Notes:

- To display different results, you can select **BladeCenter HS20**, **BladeCenter HS40**, or **BladeCenter JS20**.
- Web sites are updated as required. Therefore, Web site contents, navigation, and addresses might vary.

In addition to this *Installation and User's Guide*, the following related documentation is available in PDF on the World Wide Web or on the *Documentation* CD that comes with the expansion card:

- *Safety Information*: This document contains translated 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.
- IBM @server *BladeCenter 2-Port Fibre Channel I/O Module Installation Guide*: This document contains detailed setup and installation instructions for the Fibre Channel I/O module and the IBM BladeCenter SAN Utility.
- IBM @server *BladeCenter Fibre Channel I/O Management User's Guide*: This document 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 @server BladeCenter and BladeCenter T unit *Installation and User's Guide*:

  Each type of BladeCenter unit has a customized *Installation and User's Guide* that provides general information about your BladeCenter unit, including:
  - Information about features
  - How to set up, cable, and start your BladeCenter unit
  - How to install options in your BladeCenter unit
  - How to configure your BladeCenter unit
  - How to perform basic troubleshooting of your BladeCenter unit
  - How to get help
- IBM @server BladeCenter blade server *Installation and User's Guide*:

  Each type of blade server has a customized *Installation and User's Guide* that provides general information about your blade server, including:
  - Information about features

- How to set up and start your blade server
- How to install options in your blade server
- How to configure your blade server
- How to install an operating system on your blade server
- How to perform basic troubleshooting of your blade server
- How to get help

- IBM @server *BladeCenter Remote SAN Boot for JS20*: This document provides a user-oriented discussion about how to set up and use a remote boot configuration for blade servers through a logical drive from a Fibre Channel storage array. This document also provides information about configuring a Fibre Channel expansion adapter and describes various Fibre Channel based storage solutions.

- IBM @server *BladeCenter SAN Solutions Guide*: This document provides a user-oriented discussion about 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 @server *BladeCenter Fibre Channel I/O 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.

- *IBM Hardware Maintenance Manual and Troubleshooting Guide*: This document contains information to help you solve problems yourself or to provide helpful information to a service technician.

- *IBM FAStT MSJ User's Guide*: This document is only available on the IBM support Web site, http://www.ibm.com/pc/support/. It provides information about installing the IBM FAStT MSJ diagnostic program. You can use this program to verify the status of the Fibre Channel connections.

Features and specifications

The expansion card has the following features:

- Compliance with Third Generation Fibre Channel Physical and Signaling Interface (PC-PH-3), revision 9.2
- Compliance with U.S. and international safety and emissions standards
- Support for direct memory access (DMA)
- Support for bus mastering
- Fast!UTIL BIOS utility program to customize the configuration parameters on the BladeCenter Expansion Card and attached drives

Note: This feature is not available on the IBM @server BladeCenter JS20 Fibre Channel Expansion Card.

- Support for Fibre Channel protocol small computer system interface (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. Expansion card specifications

Type	Specification
Fibre Channel specifications	• Bus transfer rate: 200 MB per second maximum at half-duplex and 400 MB per second maximum at full-duplex • Support for both FCP-SCSI and IP protocols • Support for point-to-point fabric connection: F-Port Fabric Login • Support for Fibre Channel Arbitrated Loop (FCAL) public loop profile: FL-Port Login • Support for Fibre Channel services class 2 and 3 • Support for FCP-SCSI initiator and target operation • Support for full-duplex operation • Copper interface ac coupled
Processor	Single-chip design with two completely independent 2 Gb serial Fibre Channel ports. Each port provides: • Reduced instruction set computer (RISC) processor • Integrated serializer/deserializer • Receive DMA sequencer • Frame buffer • Five-channel DMA controller
Host data transfer	64-bit, 100 MHz bus-master DMA data transfers to 800 MB per second
Random-access memory (RAM)	512 KB sync burst static random-access memory (SRAM) per channel supporting parity protection
BIOS or firmware code read-only memory (ROM)	ROM 128 KB of flash memory (the flash is field programmable)
Nonvolatile random-access memory (NVRAM)	NVRAM 256 bytes, field programmable
Onboard DMA	Five-channel DMA controller for each port: transmit, receive, command, auto-request, and auto-response
Frame buffer first-in first-out (FIFO)	Integrated 4 KB transmit and 6 KB receive frame buffer FIFO for each data channel

Table 1. Expansion card specifications (continued)

Type	Specification
Connectors (internal only)	• Board-to-board Molex High Speed Mezzanine (HSM) type for serial interfaces • 200 pin board-to-board for peripheral component interconnect-X (PCI-X) interface
Dimensions	Approximately 9.35 cm x 13.14 cm (3.683 in. x 5.275 in.)
Operating power	Less than 12 watts

Inventory checklist

The expansion card option package includes the following items:

- One IBM @server BladeCenter Fibre Channel Expansion Card or IBM @server BladeCenter JS20 Fibre Channel Expansion Card
- I/O expansion option tray
- *IBM @server BladeCenter Fibre Channel Expansion Card and IBM @server BladeCenter JS20 Fibre Channel Expansion Card Installation and User's Guide* (this document)

Notices and statements used in this book

The caution and danger statements used in this book are also in the multilingual *Safety Information* book provided on the IBM support Web site, http://www.ibm.com/pc/support/. Each caution and danger statement is numbered for reference to the corresponding statement in the *Safety Information* book.

The following 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 potential 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 following illustration shows the components on the top of the expansion card.

Note: The illustrations in this document might differ slightly from your hardware.
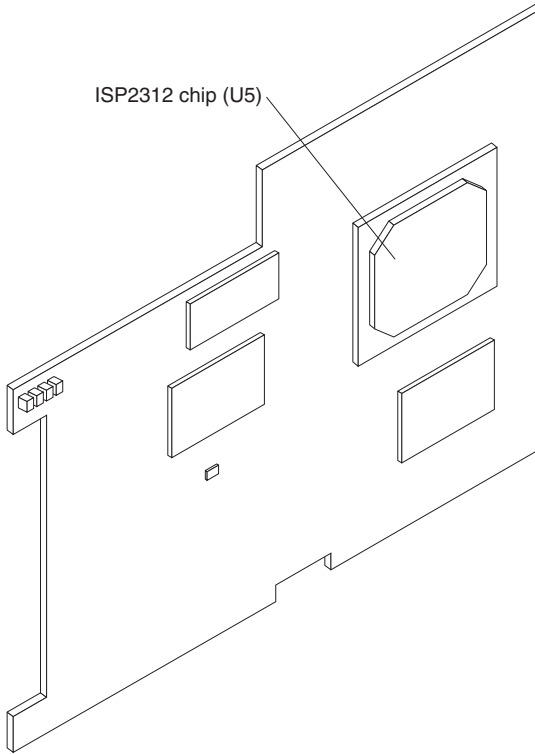
ISP2312 chip (U5)

Figure 1. Expansion card (top)

ISP2312 chip (U5): The ISP2312 chip provides a PCI-X local bus interface and two completely independent 2 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 an external memory interface in a single-chip solution.

The following illustration shows the components on the bottom of the expansion card.

I/O expansion
card connector (J3)

I/O expansion
card connector (J2)
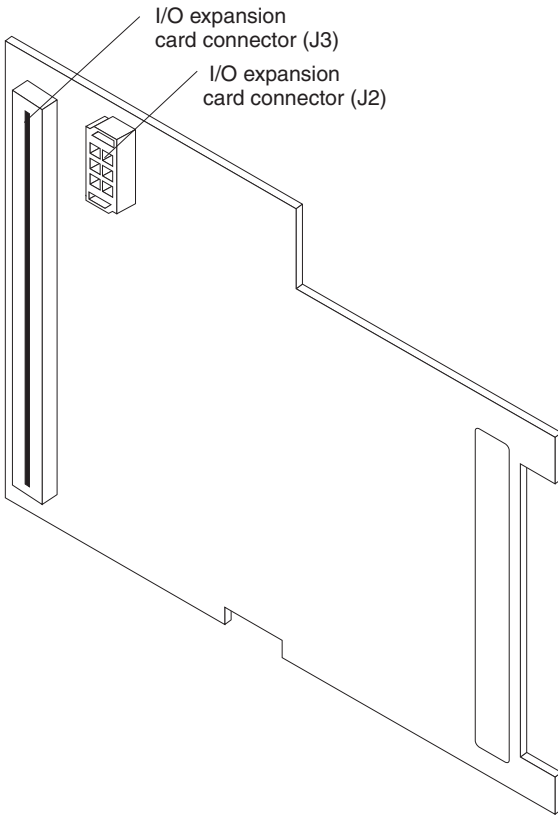
Figure 2. Expansion card (bottom)

Chapter 2. Installing the I/O expansion card

This chapter provides detailed instructions for installing the I/O expansion card in your blade server.

Note: The blade server shown in the illustrations in this section might be different from your blade server. For additional information, see the documentation that comes with your blade server.

Installation guidelines

Before you begin to install the I/O expansion card in your blade server, read the safety information beginning on page v and the guidelines in "Handling static-sensitive devices" on page 10. This information will help you work safely with your blade server and options.

Make sure that you are using the latest versions of device drivers, firmware, and BIOS or firmware code for your blade server, management module, and I/O modules that are used by the I/O expansion card. Go to the IBM support Web site, http://www.ibm.com/pc/support/ for the latest information about upgrading the device drivers, firmware, and BIOS or firmware code for BladeCenter components. The latest instructions are in the documentation that comes with the updates.

If your blade server has an integrated drive electronics (IDE) hard disk drive installed in the IDE connector location where you are installing the I/O expansion card, you will need to remove it to install the I/O expansion card. The I/O expansion card occupies the same space as this hard disk drive and replaces it. You cannot install a hard disk drive in the IDE connector while an I/O expansion card is installed in that connector location. This means that you must choose to install either an IDE hard disk drive or an I/O expansion card in some types of blade servers.

Important:
- If an IDE hard disk drive must be removed to install the I/O expansion card, and this disk drive contains any information that you want to keep, back it up to another storage device.
- If an IDE hard disk drive must be removed to install the I/O expansion card, and this disk drive is part of a redundant array of independent disks (RAID) array, unconfigure this RAID array before removing the hard disk drive. See your operating-system documentation for instructions.

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 I/O expansion card, you must install at least one I/O module that supports Fibre Channel operation in the BladeCenter unit when you install an 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 of the same type.
- If your blade server type supports installation of two I/O expansion cards, you must install I/O modules that support Fibre Channel operation in the BladeCenter unit when you install two expansion cards in any blade server that is installed in the BladeCenter unit.

See the following BladeCenter documentation for additional information:

- The *Installation and User's Guide* for your blade server provides blade-server specific I/O 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 and your system, 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.
- 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 chassis 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.
- Wear an electrostatic-discharge wrist strap, if one is available.

Installing the I/O expansion card in a blade server

To install the I/O expansion card in a blade server, complete the following steps:

1. Before you begin installing the I/O expansion card in your blade server, read the "Installation guidelines" on page 9. This section contains information about procedures that should be performed before you remove your blade server from the BladeCenter unit to install the I/O expansion card.

2. If the blade server is installed in a BladeCenter unit and operating, shut down the operating system; then, turn off the blade server. (See the *Installation and User's Guide* for your blade server for instructions.)

   Attention: Wait at least 30 seconds, until the drives stop spinning, before proceeding to the next step.

   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.

3. Remove the blade server from the BladeCenter unit, open the blade server cover, and locate the connectors where the I/O expansion card will be installed. See the *Installation and User's Guide* for your blade server for instructions.

   Important:

   - If an IDE hard disk drive must be removed to install the I/O expansion card, and this disk drive contains any information that you want to keep, back it up to another storage device.
   - If an IDE hard disk drive must be removed to install the I/O expansion card, and this disk drive is part of a RAID array, unconfigure this RAID array before removing the hard disk drive. See your operating-system documentation for instructions.

IDE drive

Tray

Riser card

Short screws
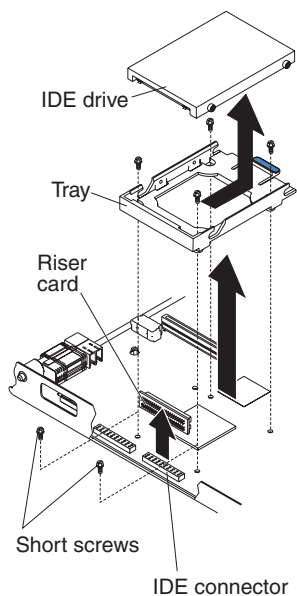
IDE connector

4. If an IDE hard disk drive is installed in the IDE connector location where you are installing the I/O expansion card, remove the drive, riser card, and tray (save the screws that secure the tray to the system board). Otherwise, remove the two screws near the IDE connector, if these items are present.

5. Install the I/O expansion tray that comes with the I/O expansion card. Secure the tray to the blade server with the screws from the option kit.

I/O expansion card connector

I/O expansion card connector

IBM I/O expansion card

Short screws

I/O expansion tray

Raised hook

I/O expansion option connector (server)

Short screws

I/O expansion option connector (server)

6. Remove the I/O expansion card from the static-protective package.

7. Make sure that the protective cover is removed from I/O expansion card connector J2; then, slide the narrow end of the I/O expansion card into the raised hook on the I/O expansion tray.

8. Align the I/O expansion card connectors (J2 and J3) on the I/O expansion card with the I/O expansion option connectors on the blade server; then, gently press the card into the connectors.

   Note: For a more detailed view of connectors J2 and J3, see Figure 2 on page 8.

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.
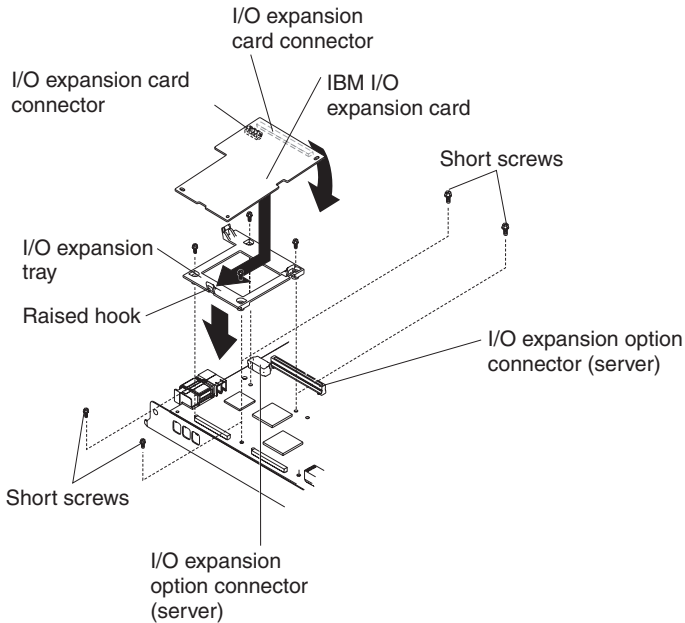
Important: The blade server cannot be inserted into the BladeCenter unit until the cover is installed and closed. Do not attempt to override this protection.

9. If you have other options to install in this blade server, do so now; otherwise, close the blade server cover and install the blade server in the BladeCenter unit. See the *Installation and User's Guide* for your blade server for instructions.

10. Turn on the blade server; then, set up a command session:

    - If your blade server supports local console connection through the management module switch control of the keyboard/mouse/video to this blade server. See the *Installation and User's Guide* for your blade server for instructions.

    - 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.

11. If your blade server is an IBM BladeCenter JS20, skip this step. This step, including the example text, only applies if your blade server is an IBM BladeCenter HS20 or HS40 and the IBM @server BladeCenter Fibre Channel Expansion Card is installed in your blade server.

    If the information displayed on the monitor screen is similar to the following text, update the BIOS or firmware code if necessary, and install the expansion card device drivers. For more information, see Chapter 3, "Updating the I/O expansion card BIOS or firmware code and NVRAM code and installing device drivers," on page 15. If the information displayed on the monitor screen is not similar to this text and you have checked the expansion card configuration, go to Chapter 6, "Troubleshooting," on page 27 for problem-solving information.

    ```
    QLogic Corporation
    QLA2312 PCI Fibre Channel ROM BIOS Version X.XX
    Copyright (C) QLogic Corporation 1993-2003 All Rights Reserved.
    www.qlogic.com

    Press <Ctrl+Q> for Fast!UTIL

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

Chapter 3. Updating the I/O expansion card BIOS or firmware code and NVRAM code and installing device drivers

After you install the expansion card, be sure that the latest BIOS or firmware code and the nonvolatile random-access memory (NVRAM) code are installed; then, install the device drivers.

Note: For the latest information about supported operating systems, versions of device drivers, BIOS code, firmware code, utilities, and documentation, go to http://www.ibm.com/pc/support/.

Using the Remote Deployment Manager

You can use the Remote Deployment Manager (RDM) version 4.11 Update 2 or later program to install a supported operating systems on blade servers that support the RDM program. Follow the instructions in the documentation that comes with the RDM program. To check if your blade server supports RDM, purchase the RDM software, download the RDM user's guide, and obtain the latest updates, go to:

http://www-1.ibm.com/servers/eserver/xseries/systems_management/
sys_migration/rdm.html

Installing the expansion card device drivers

The latest device drivers, utilities, documentation, and installation instructions for the following supported operating systems are provided at http://www.ibm.com/pc/support/:

- Microsoft® Windows® 2000 and Microsoft Windows 2003
- Red Hat Advanced Server
- SUSE LINUX 8.0 Enterprise

For BladeCenter JS20 Type 8842, SUSE LINUX device drivers are obtained directly from Novell Corporation. Other Linux® device drivers are obtained from Red Hat, Inc. AIX® device drivers are obtained from IBM as part of an AIX license.

Customize the configuration of the BladeCenter I/O expansion card:

- If the I/O expansion card is installed in a BladeCenter HS20 or HS40 blade server, see Chapter 4, "Using IBM Fast!UTIL," on page 17.
- If the I/O expansion card is installed in a BladeCenter JS20 blade server, see Chapter 5, "Using the IBM FAStT MSJ utility," on page 23.

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Chapter 4. Using IBM Fast!UTIL

This chapter provides detailed configuration information for advanced users who want to customize the configuration of the IBM @server BladeCenter Fibre Channel Expansion Card when it is installed in a BladeCenter HS20 or HS40 blade server. You can configure the I/O expansion card using the Fast!UTIL utility.

Note: This chapter does not apply to the IBM @server BladeCenter JS20 Fibre Channel Expansion Card. See Chapter 5, "Using the IBM FAStT MSJ utility," on page 23 for additional information about customizing the configuration of the expansion card when it is installed in a BladeCenter JS20 blade server.

Starting Fast!UTIL

Start or restart the blade server. On the blade server control panel, press the keyboard/video/mouse select button. To access Fast!UTIL, press Ctrl+Q during the expansion card BIOS initialization (it might take a few seconds for the Fast!UTIL menu to be displayed). The expansion card has dual adapter ports that can be configured separately with Fast!UTIL. After changing the settings that are described in the "Configuration Settings menu options" section, Fast!UTIL restarts the blade server to enable the new parameters.

Important: If the configuration settings are incorrect, the expansion card might not function correctly. Do not modify the default configuration settings unless you are instructed to do so by an IBM technical-support representative or in the installation instructions.

Configuration Settings menu options

Note: For information about Remote Boot options, contact your IBM technical-support representative.

Use the options that are described in this section to configure the expansion card. The **Configuration Settings** menu displays several options that you can use to configure your expansion card.

Select host adapter
Use this option to select, configure, or view either of the two I/O port addresses on the expansion card.

Host Adapter Settings

To access this option, select **Host Adapter Settings**. The default settings and the modifiable settings for the expansion card are listed in Table 2 and are described in this section. The expansion card is always point-to-point connected in the blade server with I/O module that supports Fibre Channel operation.

Note: The loop reset delay, adapter hard loop ID, and hard loop ID settings are not applicable.

Table 2. Modifiable expansion card default settings

Setting	Options	Default
Host adapter BIOS	Enabled or disabled	Disabled
Frame size	512, 1024, 2048	2048
Loop reset delay	0-60 seconds	5 seconds
Adapter hard loop ID	Enabled or disabled	Enabled
Hard loop ID	0-125	125
Spin up delay	Enabled or disabled	Disabled
Connection Options	0, 1, 2	2
Fibre Channel tape support	Disabled, Enabled	Enabled
Data rate	0, 1, 2	2

Host adapter BIOS: When this option is disabled, the read-only memory (ROM) BIOS or firmware code on the expansion card is disabled. This makes space available in upper memory. The default setting is **Disabled**.

Frame size: This setting specifies the maximum frame length supported by the expansion card. The default size is 2048. If you are using F-port (point-to-point) connections, use the default size for maximum performance.

Spin up delay: When this option is enabled, the BIOS code waits up to 5 minutes to find the first drive. The default setting is **Disabled**.

Connection options: This setting defines the type of connection (loop or point-to-point) or connection preference (see Table 3). The default setting is **2**.

Table 3. Expansion card connection options

Option	Type of connection
0	Loop only
1	Point-to-point only
2	Loop preferred; otherwise, point-to-point

Fibre Channel tape support: This setting is reserved for Fibre Channel tape support. The default setting is **Enabled**.

Data rate: This setting determines the data rate for the expansion card. The available options are listed in Table 4. The default setting is **2**.

Table 4. Expansion card data rate options

Option	Data rate
0	1 GB per second
1	2 GB per second
2	Auto select

Note: The expansion card settings and default values will vary, based on the version of BIOS code installed for the expansion card.

There are specific expansion card settings that you cannot modify. Table 5 describes these settings and gives examples.

Note: See the device-driver installation instructions for the required operating-system-specific modifications to the NVRAM.

Table 5. Nonmodifiable expansion card settings and examples

Setting	Example
BIOS address	CD400
BIOS revision	1.38
Adapter serial number	E59719
Interrupt level	3
Adapter port name	210000096B07C703

BIOS address: The BIOS address is the expansion card I/O address where the BIOS code is stored when you press Ctrl+Q. This is the address of the BIOS code in ROM shadow memory.

BIOS revision: The BIOS revision is the revision number of the loaded BIOS code on the expansion card.

Adapter Serial Number: This number is for manufacturing use only. It does not correlate to external labels or to the adapter port name of the expansion card.

Interrupt level: The interrupt level is the interrupt that is used by the expansion card. The interrupt level can change when the operating system is installed.

Adapter port name: This is the worldwide port name of the expansion card.

Selectable Boot Settings

To access this option, select **Selectable Boot Settings**. For more information about boot settings, contact your IBM technical-support representative.

Restore Default Settings

This option is in the **Configuration Settings** menu. It restores the expansion card default NVRAM settings.

Raw NOVRAM data

This option displays the expansion card NVRAM contents in hexadecimal format. This is a troubleshooting tool; you cannot modify the data.

Note: The terms *NOVRAM* and *NVRAM* are used interchangeably in this document. These terms are identical in meaning.

Advanced Adapter Settings

Use this option to view and set advanced adapter settings. The default settings for the expansion card are listed in Table 6 and are described in this section.

Table 6. Expansion card advanced adapter settings

Setting	Options	Default
Execution throttle	1-256	256
LUNs per target	0, 8, 16, 32, 64, 128, 256	0
Enable LIP reset	Yes or No	No
Enable LIP full login	Yes or No	Yes
Enable target reset	Yes or No	Yes
Login retry count	0-255	30
Port down retry count	0-255	30
IOCB allocation	1-512 buffers	256 buffers
Extended error logging	Enabled or Disabled	Disabled
RIO operation mode	0, 5, 6	0
Interrupt delay timer	0-255	0

Execution throttle: This setting specifies the maximum number of commands that can run on any one port. When a port reaches its execution throttle, Fast!UTIL does not run any new commands until the current command is completed. The valid options for this setting are 1 through 256. The default (optimum) is 256.

LUNs per target: This setting specifies the number of logical unit numbers (LUNs) per device. Multiple LUN support is typically for RAID enclosures that use LUNs to map drives. The default setting is **0**.

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

Enable LIP full logon: This setting instructs the application specific integrated circuit (ASIC) chip to log in to all ports after any LIP. The default setting is **Yes**.

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

Login retry count: This setting specifies the number of times the software tries to log in to a device. The default setting is **30** retries.

Port down retry count: This setting specifies the number of times the software retries a command to a port that is returning port-down status. The default setting is **30**.

IOCB allocation: This setting specifies the maximum number of buffers from the firmware buffer pool that are allocated to any one port. The default setting is **256**.

Note: The meaning of *IOCB* is *input/output control block*.

Extended error logging: When set to **Enabled,** this setting provides additional error and debugging information to the Microsoft Windows operating system event error log. The default setting is **Disabled**.

RIO operation mode: This setting specifies the reduced interrupt operation (RIO) mode, if supported by the software device driver. When the expansion card is in the RIO mode you can post multiple command completions in a single interrupt (see Table 7 on page 22). The default setting is **0**.

Table 7. Expansion card RIO options and operation modes

Option	Operation mode
0	No multiple responses
5	Multiple responses with minimal interrupts
6	Interrupt when interruption delay timer expires or there is no action

Interrupt delay timer: This setting contains the value (in 100-microsecond increments) used by a timer to set the wait time between accessing a set of handles and generating an interrupt using direct memory access (DMA). The default setting is **0**.

Scan Fibre Channel devices

Use this option to scan and list all the connected devices. Information about each device is listed, for example, vendor name, product name, and revision. This information is useful when you are configuring the expansion card and attached devices.

Fibre Channel disk utility

The Fibre Channel disk utility is not supported in the IBM BladeCenter Fibre Channel Options.

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

Attention: Performing a low-level format removes all data on the disk.

Loopback data test

This option is not available with your BladeCenter configuration.

ExitFast!UTIL

After you complete the configuration, use this option to exit the menu and restart the blade server.

Chapter 5. Using the IBM FAStT MSJ utility

This chapter provides an overview of the IBM FAStT MSJ (Management Suite Java™) utility that can be used by advanced users to customize the configuration of the IBM @server BladeCenter JS20 Fibre Channel Expansion Card when it is installed in a BladeCenter JS20 blade server. You can perform the custom configuration procedures that are described in this chapter only when the SUSE LINUX operating system or another Linux operating system is running. If you are using the AIX operating system, use the standard "Config Manager and Diagnostics Routine" procedures that are described in the applicable AIX operating-system documentation. For more detailed information, see the *IBM FAStT Management Suite Java User's Guide* version 1.0 or later that is available at http://www.ibm.com/pc/support/.

Overview of the IBM FAStT MSJ utility

The FAStT MSJ utility is used to configure a SAN environment that consists of IBM FAStT 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 an entire SAN containing HBA components, storage devices, and host systems.

You can use IBM FAStT MSJ to manage and control one or more expansion cards that are installed on local or remote systems. The FAStT MSJ 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 by using the FAStT MSJ utility to configure devices in your system:

Disable (unconfigure) a device on a host bus adapter
> When a device is set as unconfigured, it is not recognized by the HBA and is not accessible to the HBA on that system.

Enable a device
> This operation adds a device and makes it accessible to the HBA on that system.

Designate a path as an alternate or preferred path
> When a device is accessible from more than one adapter in the same system, you can assign one path as the preferred path and the other path as an alternate path. If the preferred path fails, the system switches to the alternate path to make sure that the transfer of data is not interrupted.

Note: The diagnostic functions of the FAStT MSJ utility are available for all supported operating systems. The configuration functions of the FAStT MSJ utility are available only for Linux operating systems.

Installation and system requirements

Make sure that you are using the latest version of the IBM FAStT MSJ utility for the IBM @server BladeCenter JS20 Fibre Channel Expansion Card. Go to the IBM support Web site at http://www.ibm.com/pc/support/ for the latest information about the IBM FAStT MSJ utility. The latest instructions and system requirements are in the documentation that comes with the utility.

Features

The FAStT MSJ utility enables you to:
- Set the FAStT MSJ utility options
- Connect to hosts
- Disconnect from a host
- View detailed event and alarm-log information
- Use host-to-host SAN configuration policies
- Configure port devices
- Use logical unit number (LUN) level configuration
- Monitor in real-time to see when failovers occur, using the Failover Watcher
- Control host-side agent operations, including setting of the host agent polling interval
- Review host adapter information, including:
  – General information
  – Statistics
  – Information about attached devices
  – Link status for attached device
- Perform adapter functions, including:
  – Configuring the adapter NVRAM settings
  – Executing fibre diagnostics (read/write buffer loopback tests)
  – Performing flash updates on an adapter
  – Performing NVRAM updates on an adapter
- Manage configurations:
  – Save configurations for off-line policy checks and SAN integrity
  – Load configurations from a file if the host is off-line for policy checks and SAN integrity
- Confirm security

Update Flash utility

Through the Utilities section of the FAStT MSJ utility, you can update I/O expansion card firmware and perform adapter-level configurations on a host-connected adapter.

When you click **Update Flash** in the Utilities section of the FAStT MSJ utility, and the adapter accepts the update, the application prompts for the file name of the new flash BIOS or firmware code. The latest version of expansion card flash BIOS or firmware code is available from the IBM support Web site at http://www.ibm.com/pc/support/.

After you enter a valid flash BIOS or firmware code file name, click **OK** to complete the update, or click **Cancel** to stop the update. When you click **OK**, the FAStT MSJ utility verifies the file name and format of the new file. If the file is valid, the application then compares the version of the file with the adapter flash version that is currently installed. If the installed adapter version is the same or newer than the file flash version that you are trying to install, the application asks if you still want to update the flash.

If the firmware update fails, an error message is displayed.

Chapter 6. Troubleshooting

If you encounter 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 *Hardware Maintenance Manual and Troubleshooting Guide* or *Problem Determination Guide* for your blade server.

Make sure that you are using the latest versions of device drivers, firmware, and BIOS or firmware code for your blade server, management module, and I/O modules that are used by the I/O expansion card. If these items are obsolete, the BladeCenter unit might not recognize the I/O expansion card and might not turn it on. Go to the IBM support Web site, http://www.ibm.com/pc/support/, for the latest information about upgrading the device drivers, firmware, and BIOS or firmware code for BladeCenter components. The latest instructions are in the documents that come with the updates.

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

- Make sure that the I/O expansion card is installed correctly.
- Make sure that the Fast!UTIL data-rate setting is correct:
  - If the I/O expansion card is installed in a BladeCenter HS20 or HS40 blade server, see "Host Adapter Settings" on page 18.
  - If the I/O expansion card is installed in a BladeCenter JS20 blade server, see the *IBM FAStT Management Suite Java User's Guide* version 1.0 or later that is available at http://www.ibm.com/pc/support/.
- Make sure that all peripheral devices connected to the I/O modules are turned on, operating correctly, and are connected correctly:
  - If the I/O expansion card is installed in a BladeCenter HS20 or HS40 blade server, see "Scan Fibre Channel devices" on page 22 for information about displaying attached Fibre Channel devices.
  - If the I/O expansion card is installed in a BladeCenter JS20 blade server, see the *IBM FAStT Management Suite Java User's Guide* version 1.0 or later that is available at http://www.ibm.com/pc/support/.
- Make sure that one or two I/O modules that support Fibre Channel operation are installed in the correct I/O-module bays of the BladeCenter unit.

To determine whether your installation 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/pc/support/. Also see the *Installation and User's Guide* for your blade server for additional information.
- Make sure that the BIOS or firmware 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 installation problem is caused by the system configuration, check the blade server to make sure that it is configured correctly:

- If the I/O expansion card is installed in a BladeCenter HS20 or HS40 blade server, see "Configuration Settings menu options" on page 17 for additional information.
- If the I/O expansion card is installed in a BladeCenter JS20 blade server, see the *IBM FAStT Management Suite Java User's Guide* version 1.0 or later that is available at http://www.ibm.com/pc/support/.

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

To determine whether your installation 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 installed in I/O-module bay 3, I/O-module bay 4, or both I/O-module bays 3 and 4.
- Make sure that the blade server is turned on.
- Make sure that the expansion card settings are set to the correct values:
  - If the I/O expansion card is installed in a BladeCenter HS20 or HS40 blade server, see "Configuration Settings menu options" on page 17. for additional information.
  - If the I/O expansion card is installed in a BladeCenter JS20 blade server, see the *IBM FAStT Management Suite Java User's Guide* version 1.0 or later that is available at http://www.ibm.com/pc/support/.

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 @server or IntelliStation® system, and whom to call for service, if it is necessary.

Before you call

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

- Check all cables to make sure that they are connected.
- Check the power switches to make sure that the system is 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 blade server *Hardware Maintenance Manual and Troubleshooting Guide*, BladeCenter unit *Hardware Maintenance Manual and Troubleshooting Guide*, or *Problem Determination Guide* at the IBM support Web site, or in the IntelliStation *Hardware Maintenance Manual* at the IBM support Web site.
- Go to the IBM support Web site at http://www.ibm.com/pc/support/ to check for technical information, hints, tips, and new device drivers or to submit a request for information.

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

Using the documentation

Information about your IBM @server or IntelliStation system and preinstalled software, if any, is available in the documentation that comes with your system. That documentation includes printed books, online books, 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

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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/pc/support/ and follow the instructions. Also, some publications are available through the IBM Publications Ordering System at http://www.elink.ibmlink.ibm.com/public/applications/publications/ cgibin/pbi.cgi.

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 @server and IntelliStation products, services, and support. The address for IBM @server, xSeries®, and BladeCenter information is http://www.ibm.com/eserver/xseries/. The address for IBM IntelliStation information is http://www.ibm.com/pc/us/intellistation/.

You can find service information for your IBM products, including supported options, at http://www.ibm.com/pc/support/.

Software service and support

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

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

Hardware service and support

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

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

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

Part 1 - General Terms

Part 1 - General Terms

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

What this Warranty Covers

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

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

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What this Warranty Does not Cover

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

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

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

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

How to Obtain Warranty Service

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

What IBM Will Do to Correct Problems

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

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

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

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

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

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

Exchange of a Machine or Part

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

Your Additional Responsibilities

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

You also agree to:
1. ensure that the Machine is free of any legal obligations or restrictions that prevent its exchange;
2. obtain authorization from the owner to have IBM or your reseller service a Machine that you do not own; and
3. where applicable, before service is provided:
   a. follow the service request procedures that IBM or your reseller provides;
   b. backup or secure all programs, data, and funds contained in the Machine;
   c. provide IBM or your reseller with sufficient, free, and safe access to your facilities to permit IBM to fulfill its obligations; and
   d. inform IBM or your reseller of changes in the Machine's location.
4. (a) ensure all information about identified or identifiable individuals (Personal Data) is deleted from the Machine (to the extent technically

possible), (b) allow IBM, your reseller or an IBM supplier to process on your behalf any remaining Personal Data as IBM or your reseller considers necessary to fulfill its obligations under this Statement of Limited Warranty (which may include shipping the Machine for such processing to other IBM service locations around the world), and (c) ensure that such processing complies with any laws applicable to such Personal Data.

Limitation of Liability

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

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

Circumstances may arise where, because of a default on IBM's part or other liability, you are entitled to recover damages from IBM. In each such instance, regardless of the basis on which you are entitled to claim damages from IBM (including fundamental breach, negligence, misrepresentation, or other contract or tort claim), except for any liability that cannot be waived or limited by applicable laws, IBM is liable for no more than
1. damages for bodily injury (including death) and damage to real property and tangible personal property; and
2. the amount of any other actual direct damages, up to the charges (if recurring, 12 months' charges apply) for the Machine that is subject of the claim. For purposes of this item, the term "Machine" includes Machine Code and Licensed Internal Code ("LIC").

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

UNDER NO CIRCUMSTANCES IS IBM, ITS SUPPLIERS OR RESELLERS LIABLE FOR ANY OF THE FOLLOWING EVEN IF INFORMED OF THEIR POSSIBILITY: 1) THIRD PARTY CLAIMS AGAINST YOU FOR DAMAGES (OTHER THAN THOSE UNDER THE FIRST ITEM LISTED ABOVE); 2) LOSS OF, OR DAMAGE TO, DATA; 3) SPECIAL, INCIDENTAL, OR INDIRECT DAMAGES OR FOR ANY ECONOMIC CONSEQUENTIAL DAMAGES; OR 4) LOST PROFITS, BUSINESS REVENUE, GOODWILL OR ANTICIPATED SAVINGS. SOME STATES OR JURISDICTIONS DO NOT ALLOW THE EXCLUSION OR LIMITATION OF INCIDENTAL OR CONSEQUENTIAL DAMAGES, SO THE ABOVE LIMITATION OR EXCLUSION MAY NOT APPLY TO YOU. SOME STATES OR

JURISDICTIONS DO NOT ALLOW LIMITATIONS ON HOW LONG AN IMPLIED WARRANTY LASTS, SO THE ABOVE LIMITATION MAY NOT APPLY TO YOU.

<u>Governing Law</u>

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.

<u>Jurisdiction</u>

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.*

EUROPE, MIDDLE EAST, AFRICA (EMEA)

THE FOLLOWING TERMS APPLY TO ALL EMEA COUNTRIES:
The terms of this Statement of Limited Warranty apply to Machines purchased from IBM or an IBM reseller.

How to Obtain Warranty Service:

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

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

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

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

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

Governing Law:

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

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

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

1) **In Austria** the choice of jurisdiction for all disputes arising out of this Statement of Limited Warranty and relating thereto, including its existence, will be the competent court of law in Vienna, Austria (Inner-City); 2) **in Angola, Bahrain, Botswana, Burundi, Egypt, Eritrea, Ethiopia, Ghana, Jordan, Kenya, Kuwait, Liberia, Malawi, Malta, Mozambique, Nigeria, Oman, Pakistan, Qatar, Rwanda, Sao Tome, Saudi Arabia, Sierra Leone, Somalia, Tanzania, Uganda, United Arab Emirates, West Bank/Gaza, Yemen, Zambia, and Zimbabwe** all disputes arising out of this Statement of Limited Warranty or related to its execution, including summary proceedings, will be submitted to the exclusive jurisdiction of the English courts; 3) in **Belgium** and **Luxembourg**, all disputes arising out of this Statement of Limited Warranty or related to its interpretation or its execution, the law, and the courts of the capital city, of the country of your registered office and/or commercial site location only are competent; 4) **in France, Algeria, Benin, Burkina Faso, Cameroon, Cape Verde, Central African Republic, Chad, Comoros, Congo Republic, Djibouti, Democratic Republic of Congo, Equatorial Guinea, French Guiana, French Polynesia, Gabon, Gambia, Guinea, Guinea-Bissau, Ivory Coast, Lebanon, Madagascar, Mali, Mauritania, Mauritius, Mayotte, Morocco, New Caledonia, Niger, Reunion, Senegal, Seychelles, Togo, Tunisia, Vanuatu, and Wallis & Futuna** all disputes arising out of this Statement of Limited Warranty or related to its violation or execution, including summary proceedings, will be settled exclusively by the Commercial Court of Paris; 5) **in Russia**, all disputes arising out of or in relation to the interpretation, the violation, the termination, the nullity of the execution of this Statement of Limited Warranty shall be settled by Arbitration Court of Moscow; 6) **in South Africa, Namibia, Lesotho and Swaziland**, both of us agree to submit all disputes relating to this Statement of Limited Warranty to the jurisdiction of the High Court in Johannesburg; 7) **in Turkey** all disputes arising out of or in connection with this Statement of Limited Warranty shall be resolved by the Istanbul Central (Sultanahmet) Courts and Execution Directorates of Istanbul, the Republic of Turkey; 8) in each of the following specified countries, any legal claim arising out of this Statement of Limited Warranty will be brought before, and settled exclusively by, the competent court of a) Athens for **Greece**, b) Tel Aviv-Jaffa for **Israel**, c) Milan for **Italy**, d) Lisbon for **Portugal**, and e) Madrid for **Spain**; and 9) **in the United Kingdom**, both of us agree to submit all disputes relating to this Statement of Limited Warranty to the jurisdiction of the English courts.

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

In Albania, Armenia, Azerbaijan, Belarus, Bosnia-Herzegovina, Bulgaria, Croatia, Georgia, Hungary, Kazakhstan, Kyrgyzstan, FYR Macedonia, Moldova, Poland, Romania, Russia, Slovakia, Slovenia, Tajikistan, Turkmenistan, Ukraine, Uzbekistan, and FR Yugoslavia all disputes arising out of this Statement of Limited Warranty or related to its violation,

termination or nullity will be finally settled under the Rules of Arbitration and Conciliation of the International Arbitral Center of the Federal Economic Chamber in Vienna (Vienna Rules) by three arbitrators appointed in accordance with these rules. The arbitration will be held in Vienna, Austria, and the official language of the proceedings will be English. The decision of the arbitrators will be final and binding upon both parties. Therefore, pursuant to paragraph 598 (2) of the Austrian Code of Civil Procedure, the parties expressly waive the application of paragraph 595 (1) figure 7 of the Code. IBM may, however, institute proceedings in a competent court in the country of installation.

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

EUROPEAN UNION (EU)

THE FOLLOWING TERMS APPLY TO ALL EU COUNTRIES:

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

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

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

You may contact IBM at the following address:
    IBM Warranty & Service Quality Dept.
    PO Box 30
    Spango Valley
    Greenock
    Scotland PA16 0AH

CONSUMERS

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

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

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

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

    The above limitation shall not apply to damages for bodily injuries (including death) and damages to real property and tangible personal property for which IBM is legally liable.
2. **UNDER NO CIRCUMSTANCES IS IBM, ITS SUPPLIERS OR RESELLERS LIABLE FOR ANY OF THE FOLLOWING, EVEN IF INFORMED OF THEIR POSSIBILITY: 1) LOSS OF, OR DAMAGE TO, DATA; 2) INCIDENTAL OR INDIRECT DAMAGES, OR FOR ANY ECONOMIC CONSEQUENTIAL DAMAGES; 3) LOST PROFITS, EVEN IF THEY ARISE AS AN IMMEDIATE CONSEQUENCE OF THE EVENT THAT GENERATED THE DAMAGES; OR 4) LOSS OF BUSINESS, REVENUE, GOODWILL, OR ANTICIPATED SAVINGS.**

FRANCE AND BELGIUM

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

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

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

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

THE FOLLOWING TERMS APPLY TO THE COUNTRY SPECIFIED:

AUSTRIA

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

What this Warranty Covers: *The following replaces the first sentence of the first paragraph of this section:*
The warranty for an IBM Machine covers the functionality of the Machine for its normal use and the Machine's conformity to its Specifications.

The following paragraphs are added to this section:

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

The second paragraph does not apply.

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

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

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

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

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

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

EGYPT

Limitation of Liability: *The following replaces item 2 in this section:*
as to any other actual direct damages, IBM's liability will be limited to the total amount you paid for the Machine that is the subject of the claim. For purposes of this item, the term "Machine" includes Machine Code and Licensed Internal Code ("LIC").

Applicability of suppliers and resellers (unchanged).

FRANCE

Limitation of Liability: *The following replaces the second sentence of the first paragraph of this section:*
In such instances, regardless of the basis on which you are entitled to claim damages from IBM, IBM is liable for no more than: (items 1 and 2 unchanged).

GERMANY

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

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

The following paragraphs are added to this section:

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

The second paragraph does not apply.

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

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

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

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

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

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

HUNGARY

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

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

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

IRELAND

What this Warranty Covers: *The following is added to this section:*
Except as expressly provided in these terms and conditions, all statutory conditions, including all warranties implied, but without prejudice to the generality of the foregoing all warranties implied by the Sale of Goods Act 1893 or the Sale of Goods and Supply of Services Act 1980 are hereby excluded.

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

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

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

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

Items for Which IBM is Not Liable

Save with respect to any liability referred to in item 1 above, under no circumstances is IBM, its suppliers or resellers liable for any of the following, even if IBM or they were informed of the possibility of such losses:
1. loss of, or damage to, data;
2. special, indirect, or consequential loss; or
3. loss of profits, business, revenue, goodwill, or anticipated savings.

SLOVAKIA

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

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

SOUTH AFRICA, NAMIBIA, BOTSWANA, LESOTHO AND SWAZILAND

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

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

UNITED KINGDOM

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

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

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

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

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

Items for Which IBM is Not Liable

Save with respect to any liability referred to in item 1 above, under no circumstances is IBM or any of its suppliers or resellers liable for any of the following, even if IBM or they were informed of the possibility of such losses:
1. loss of, or damage to, data;
2. special, indirect, or consequential loss; or
3. loss of profits, business, revenue, goodwill, or anticipated savings.

Part 3 - Warranty Information

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

Warranty Period

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

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

A warranty period of 3 years on parts and 1 year on labor means that IBM provides warranty service without charge for:
1. parts and labor during the first year of the warranty period; and
2. parts only, on an exchange basis, in the second and third years of the warranty period. IBM will charge you for any labor provided in performance of the repair or replacement(s) in the second and third year of the warranty period.

Machine - IBM BladeCenter Fibre Channel Expansion Card or IBM BladeCenter JS20 Fibre Channel Expansion Card

Country or Region of Purchase	Warranty Period	Type of Warranty Service*
Worldwide	3 years	2
* See "Types of Warranty Service" for the legend and explanations of warranty-service types.		

Types of Warranty Service

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

1. **Customer Replaceable Unit ("CRU") Service**

   IBM provides replacement CRUs to you for you to install. CRU information and replacement instructions are shipped with your Machine and are

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

2. **On-site Service**

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

3. **Courier or Depot Service***

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

4. **Customer Carry-In or Mail-In Service**

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

5. **CRU and On-site Service**

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

6. **CRU and Courier or Depot Service**

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

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

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

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

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

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

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

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

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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.

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

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

Industry Canada Class A emission compliance statement

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

Avis de conformité à la réglementation d'Industrie Canada

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

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

United Kingdom telecommunications safety requirement

Notice to Customers

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

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This 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.

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