IBM®

@server

HS20 Fibre Channel
Expansion Card

Installation and User's Guide

IBM @server HS20 Fibre Channel Expansion Card

Installation and User's Guide

Note: Before using this information and the product it supports, read the general information in Appendix B, "Warranty information", on page 35 and Appendix C, "Notices", on page 49.

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.

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, unles 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.

Chapter 1. Introduction

This *Installation and User's Guide* contains instructions for installing your IBM HS20 Fibre Channel Expansion Card in an IBM @server BladeCenter™ HS20 blade server. This publication contains information about:

- Installing and configuring the HS20 Expansion Card
- Updating the BIOS code and device drivers of the HS20 Expansion card

The IBM HS20 Fibre Channel 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 HS20 Expansion Card to switch-module bay 3 and bay 4 in the BladeCenter unit. This provides a high-performance connection between the 64-bit PCI-X bus in the blade server and the two IBM BladeCenter 2-Port Fibre Channel Switch Modules in the BladeCenter unit.

Note: The modules in switch-module bay 3 and bay 4 in the BladeCenter unit must be IBM @server BladeCenter 2-Port Fibre Channel Switch Modules.

Your IBM HS20 Fibre Channel Expansion Card comes with a three-year limited warranty. For information about your warranty, see Appendix B, "Warranty information", on page 35. You can obtain up-to-date information about your IBM HS20 Fibre Channel Expansion Card and other IBM server products at http://www.ibm.com/eserver/xseries/.

Packaged with this *Installation and User's Guide* is a software CD that helps you to configure hardware and install device drivers.

This *Installation and User's Guide* and other publications that provide detailed information about your BladeCenter unit, blade server, and available options are provided in Portable Document Format (PDF) on the IBM *BladeCenter Documentation* CD, which comes with the HS20 blade server.

For service or assistance, see Appendix A, "Getting help and technical assistance", on page 31.

The IBM HS20 Fibre Channel Expansion Card is referred to throughout this book as the HS20 Expansion Card or the expansion card.

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 HS20 Expansion Cards to the blade servers and BladeCenter 2-Port Fibre Channel switch modules to the BladeCenter unit, you can attach the blade server to an external storage area network (SAN) through the external 2 Gbps (gigabits per second) optical ports on the switch modules. The HS20 Expansion Card supports data-transfer rates up to 200 MB per second half-duplex and 400 MB per second full-duplex.

Related publications

This *Installation and User's Guide* contains setup and installation instructions for your HS20 Expansion Card, including information about getting started and how to configure your HS20 Expansion Card.

In addition to this *Installation and User's Guide*, the following related documentation is provided with your BladeCenter HS20 blade server:

- *IBM @server BladeCenter 2-Port Fibre Channel Switch Module Installation Guide*

  This publication is provided in PDF on the IBM *BladeCenter Documentation* CD. This publication contains detailed setup and installation instructions for the Fibre Channel switch module and the IBM BladeCenter SAN Utility.

- IBM @server *BladeCenter Fibre Channel Switch Management User's Guide*

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

- *IBM @server BladeCenter Type 8677 Installation and User's Guide*

  This publication is provided in PDF on the IBM *BladeCenter Documentation* CD. It provides general information about your BladeCenter unit, including:

  - Information about features
  - How to set up, cable, and start 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 HS20 Type 8678 Installation and User's Guide*

  This publication is provided in PDF on the IBM *BladeCenter Documentation* CD. It provides general information about your blade server, including:

  - Information about features

- How to set up and start 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 SAN Solutions Guide*

  This publication is provided in PDF on the IBM *BladeCenter Documentation* CD. It 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 Switch Interoperability Guide*

  This publication is provided in PDF on the IBM *BladeCenter Documentation* CD. It provides detailed Fibre Channel switch 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.

- *Rack Installation Instructions*

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

- *Safety Information*

  This multilingual publication is provided in Portable Document Format (PDF) on the IBM *BladeCenter Documentation* CD. It contains translated versions of the caution and danger statements that appear in the documentation for your server. Each caution and danger statement has an assigned number, which you can use to locate the corresponding statement in your native language.

- *IBM Hardware Maintenance Manual and Troubleshooting Guide*

  This publication is provided in PDF on the IBM *BladeCenter Documentation* CD. It contains information to help you solve problems yourself or to provide helpful information to a service technician.

- *IBM FAStT MSJ User's Guide*

  This publication is provided in PDF on the IBM *BladeCenter HS20 Fibre Channel Expansion Card Support* CD. 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.

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

In addition to reviewing the publications in this library, be sure to review the *IBM BladeCenter Planning and Installation Guide* located at http://www.ibm.com/eserver/bladecenter/ on the World Wide Web for information to help you prepare for system installation and configuration.

Features and specifications

The HS20 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 basic input/output system (BIOS) utility program to customize the configuration parameters on the HS20 Expansion Card and attached drives
- Support for Fibre Channel protocol SCSI (FCP-SCSI) and Fibre Channel Internet protocol (FCP-IP)
- Support for point-to-point fabric connection (F-port fabric login)
- Support for Fibre Channel service (classes 2 and 3)

The following list and table provide a summary of the specifications of your HS20 Fibre Channel Expansion Card.

Temperature and altitude
- Blade server on: 10° to 35°C (50° to 95°F) at an altitude of 0 to 914 m (2998.69 ft)
- Blade server on: 10° to 32°C (50° to 89.6°F) at an altitude of 914 m to 2134 m (2998.69 ft to 7000 ft)
- Blade server off: -40° to 60°C (-40° to 140°F)
- Shipping temperature: -40° to 60°C (-40° to 140°F)
- Storage altitude: 0 to 2133 m (6998 ft)

Humidity

- Blade server on: 8% to 80%
- Blade server off: 5% to 80%

Table 1. HS20 Expansion Card specifications

Type	Specification
Expansion card bus	Supports subset of PCI local bus specification, revision 2.2 and the PCI-X specification 1.0a
PCI/PCI-X signaling environment	Supports 3.3 V only
PCI/PCI-X transfer rate	The burst transfer rate is based on the input clock speed multiplied by the number of bytes (8). • PCI - 66 = 525 MB per second • PCI-X - 100 = 800 MB per second
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 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: • RISC processor • Integrated serializer/deserializer • Receive direct memory access (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
RAM	512 KB sync burst SRAM per channel supporting parity protection
BIOS ROM	BIOS ROM 128 KB of flash memory (the flash is field programmable)
NVRAM	NVRAM 256 bytes, field programmable
Onboard DMA	Five-channel DMA controller for each port: transmit, receive, command, auto-request, and auto-response

Table 1. HS20 Expansion Card specifications (continued)

Type	Specification
Frame buffer FIFO	Integrated 4 KB transmit and 6 KB receive frame buffer FIFO for each data channel
Connectors (internal only)	• Board-to-board Molex HSM type for serial interfaces • 200 pin board-to-board for 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 HS20 Expansion Card option package contains the following items:

- HS20 Expansion Card
- I/O expansion option tray
- IBM *HS20 Fibre Channel Expansion Card Installation and User's Guide*
- IBM HS20 *Fibre Channel Expansion Card Support* CD

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 *BladeCenter Documentation* CD. Each caution and danger statement is numbered for reference to the corresponding statement in the *Safety Information* book.

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

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

Major components of the HS20 Expansion Card

The following illustration shows the top of the HS20 Expansion Card.

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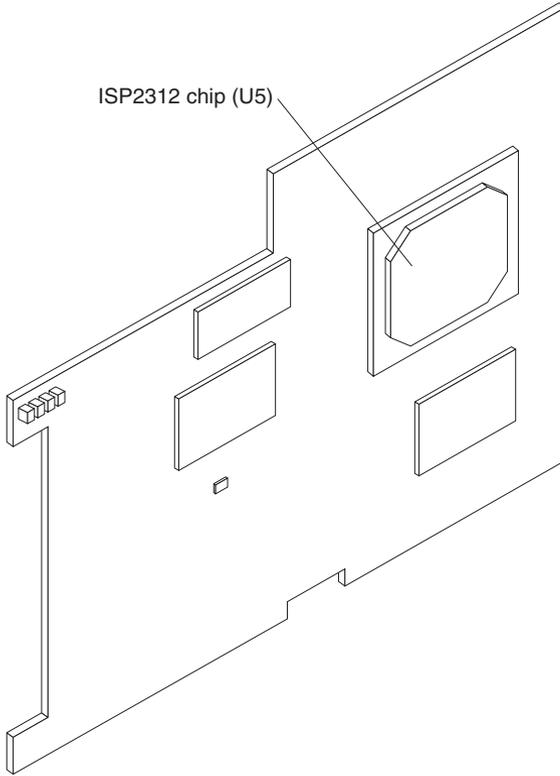
ISP2312 chip (U5)

Figure 1. HS20 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 HS20 Expansion Card.

PCI-X connector (J3)

Fibre Channel
high-speed connector (J2)
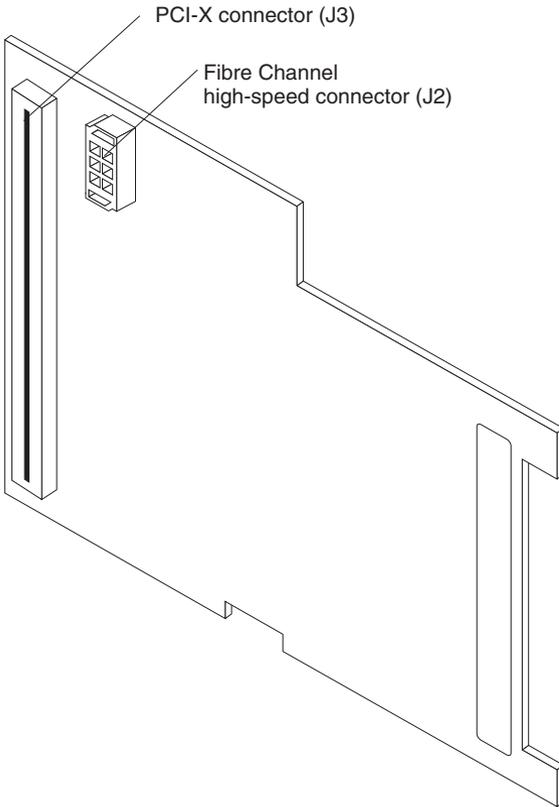
Figure 2. HS20 Expansion Card (bottom)

PCI-X connector (J3): This connector is a 64-bit PCI-X interface with a 200-pin board-to-board connector that is connected to the blade server.

Fibre Channel high-speed connector (J2): Communication signals are routed from the blade server through the Fibre Channel high-speed connector on the HS20 Expansion Card to switch-module bay 3 and bay 4 in the BladeCenter unit.

Chapter 2. Installing the HS20 Expansion Card

This chapter provides detailed instructions for installing the HS20 Expansion Card in your blade server.

Installation guidelines

Before you begin installing the HS20 Expansion Card in your blade server, read the following information:

- Read the safety information beginning on page v and the guidelines in "Handling static-sensitive devices". This information will help you work safely with your blade server and options.
- Have a small flat-blade screwdriver and a Phillips screwdriver available.

Handling static-sensitive devices

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

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

- Limit your movement. Movement can cause static electricity to build up around you.
- Handle the device carefully, holding it by its edges or its frame.
- Do not touch solder joints, pins, or exposed circuitry.
- Do not leave the device where others can handle and damage it.
- While the device is still in its static-protective package, touch it to an unpainted metal part of the BladeCenter unit 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 your blade server cover or on a metal surface.
- Take additional care when handling devices during cold weather. Heating reduces indoor humidity and increases static electricity.

Installing the HS20 Expansion Card

Complete the following steps to install the HS20 Expansion Card in a blade server:

1. Review the safety information beginning on page v and the Safety Information book that is provided in PDF on the IBM *BladeCenter Documentation* CD that comes with your blade server.

2. Read "Handling static-sensitive devices" on page 9.

3. Ensure that one IBM BladeCenter 2-Port Fibre Channel Switch Module is installed in switch-module bay 3 or bay 4 in the BladeCenter unit. See the *IBM BladeCenter 2-Port Fibre Channel Switch Module Installation Guide* for detailed installation instructions.

   Note: You must install at least one Fibre Channel switch module in the BladeCenter unit when you install the IBM HS20 Fibre Channel Expansion Card in a blade server. Installing a second Fibre Channel switch module in the BladeCenter unit provides a backup switch in case one switch module fails.

Fibre Channel switch-module bay 3

BladeCenter unit rear view

Fibre Channel switch-module bay 4
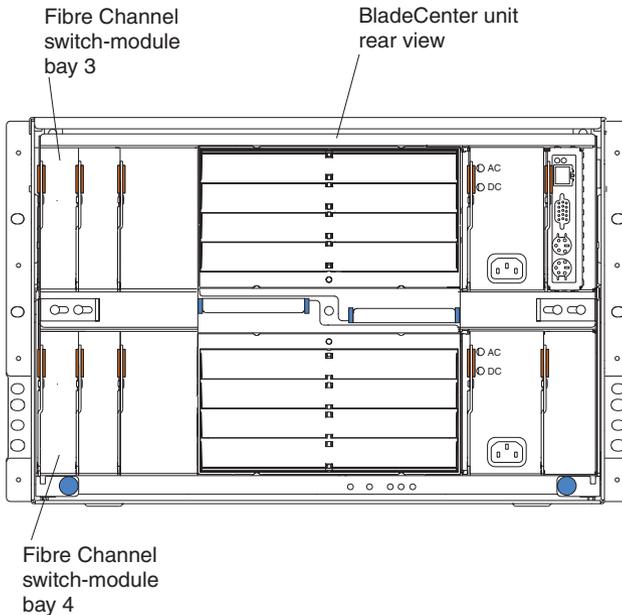
4. If the blade server is operating, press the power-control button (behind the blade server control panel door) to shut down the operating system and turn off the blade server. For the location of the control panel door, see the illustration on page 14. Wait at least 30 seconds, until the drives stop spinning, before proceeding to the next step.

5. Open the two release levers. The blade server moves out of the bay approximately 0.6 cm (0.25 inch).

6. Pull the blade server out of the blade bay. Spring-loaded doors further back in the bay move into place to cover the bay temporarily.

7. Place either a filler blade or another blade server in the bay within 1 minute. The recessed spring-loaded doors will move out of the way as you insert the blade or filler blade.

8. Lay the blade server down on a flat, nonconductive surface, with the cover side up.

9. Press the blade-cover release on each side of the blade server. Open the cover and lay it flat, or lift it from the blade server.

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.
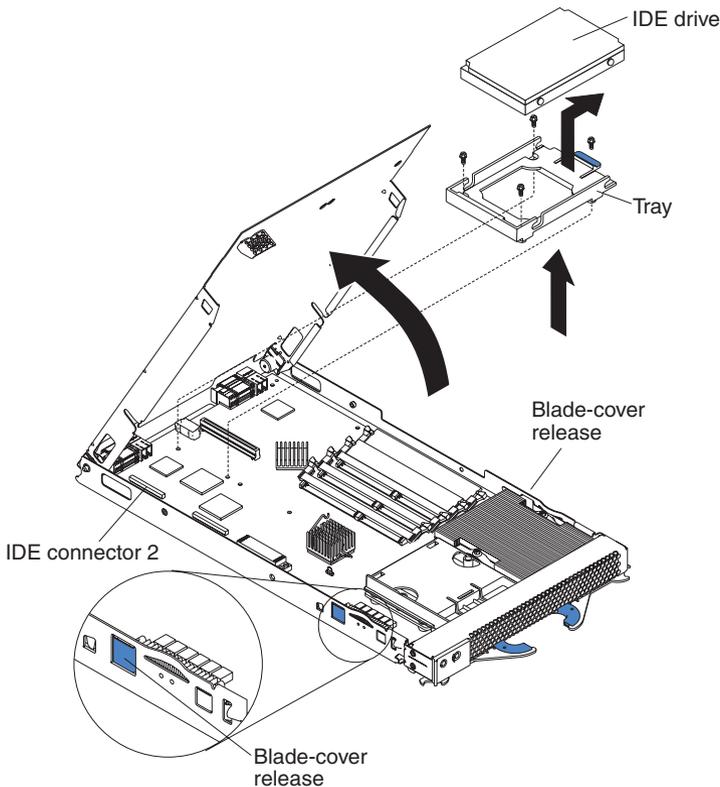
10. If an IDE hard disk drive is in IDE connector 2, remove the drive and tray (save the screws that secure the tray to the system board); otherwise, remove the two screws near IDE connector 2 that secure the system board to the chassis.

11. Install the I/O expansion option tray, which comes with the HS20 Expansion Card. Secure the tray to the system board using a Phillips screwdriver and the screws from the option kit.
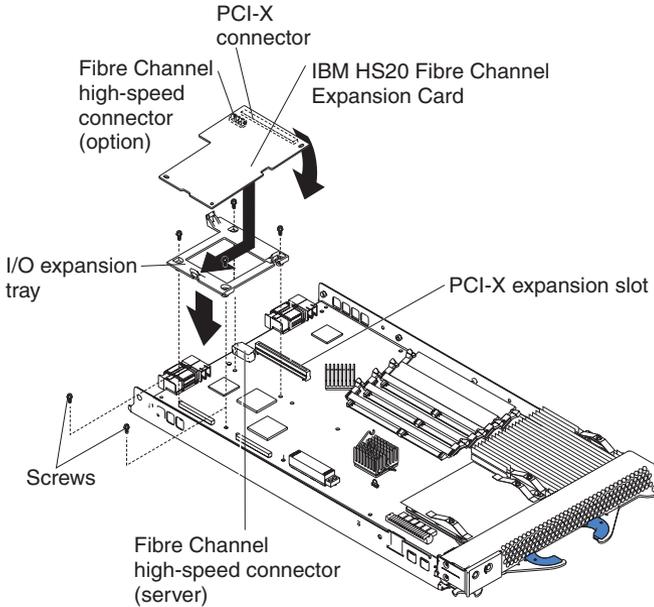
12. Remove the HS20 Expansion Card from the static-protective package.

13. Slide the narrow end of the HS20 Expansion Card into the raised hook on the tray.

14. Align the HS20 Expansion Card connectors with the network-interface option connector and the PCI-X expansion slot.

15. Gently press the card into the connectors.

Cover pins

Blade-cover release

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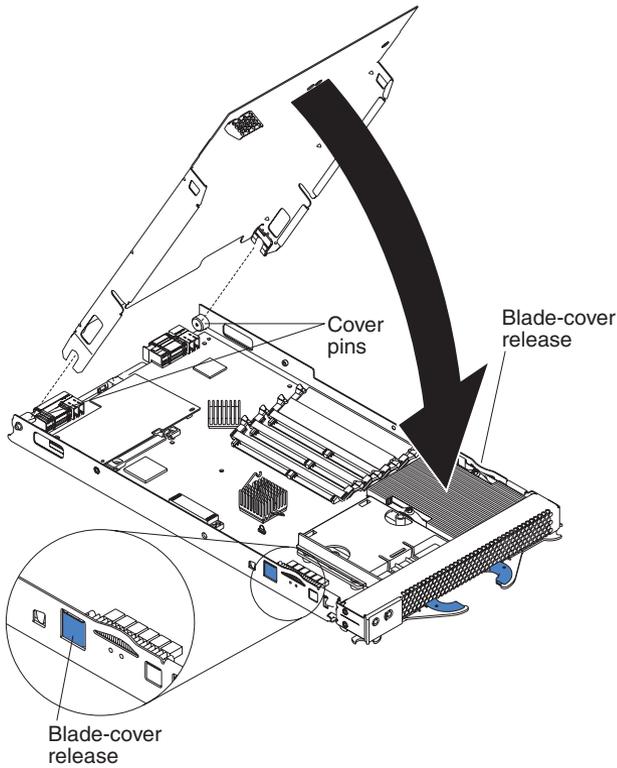
Important: The blade server cannot be inserted into the BladeCenter unit until the cover is installed and closed. Do not attempt to override this protection.

16. Lower the cover so that the slots at the rear slide down onto the pins at the rear of the blade server, as shown in the illustration.

17. Pivot the cover to the closed position as shown in the illustration, until it clicks into place.

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.

18. Ensure that the release levers on the blade server are in the open position (perpendicular to the blade server).

19. Slide the blade server into the bay until it stops. The spring-loaded doors that are further back in the bay and cover the bay opening move out of the way as you insert the blade server into the BladeCenter unit.

20. Push the release levers on the front of the blade server to close them.

21. Turn on the blade server. Press the keyboard/mouse/video select button.

CD/diskette/USB select button

CD

Keyboard/ mouse/ video select button
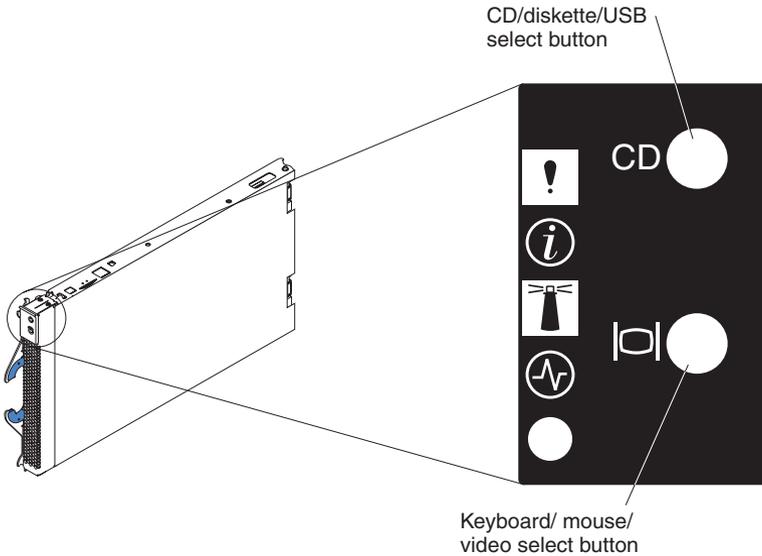
Note: The blade server control panel door is shown in the closed (normal) position in the illustration.

22. If the information displayed on the monitor screen is similar to the following text, update the BIOS code if necessary and install the expansion card device drivers. For more information, see Chapter 3. 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 5, "Troubleshooting", on page 29 for problem-solving information.

```
QLogic Corporation
QLA2312 PCI Fibre Channel ROM BIOS Version X.XX
Copyright (C) QLogic Corporation 1993-2002 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 expansion card BIOS code and NVRAM code and installing device drivers

After you install the HS20 Expansion Card, be sure that the latest BIOS code and the nonvolatile random access memory (NVRAM) code are installed; then, install the device drivers.

Before you can update the BIOS code and NVRAM code, you must create a BIOS Update Utility diskette. You will use the diskette to update the BIOS code and NVRAM code. For more information about creating a diskette, see "Creating a BIOS Update Utility diskette".

To install the device drivers, see "Installing the HS20 Expansion Card device drivers" on page 22.

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

Creating a BIOS Update Utility diskette

To create a BIOS Update Utility diskette, you can copy the image from the *HS20 Fibre Channel Expansion Card Support* CD or download the image from http://www.ibm.com/pc/support/. You can create a BIOS Update Utility diskette for the following operating systems:

- Microsoft® Windows® 2000
- Red Hat Linux®
- SuSE Linux

For Microsoft Windows 2000

Complete the following steps to create a BIOS Update Utility diskette for Microsoft Windows 2000 from the *HS20 Fibre Channel Expansion Card Support* CD:

1. To associate the CD-ROM drive and the diskette drive with the blade server, press the CD/diskette/USB select button on the blade server. For the location of the CD/diskette/USB button, see the illustration on page 14. The LED on the button flashes while the request is being processed, then is steady when the ownership of the CD-ROM or diskette drive is transferred to the blade server.

2. To associate the keyboard port, mouse port, and video port with the blade server, press the keyboard/mouse/video select button. The LED on this

17

button flashes while the request is processed, then is steady when the ownership of the keyboard, mouse, and video is transferred to the blade server.

3. Insert the support CD into the CD-ROM drive.

4. Insert a diskette into the diskette drive.

5. Restart the blade server.

6. At the command prompt, type:

   `e:\tools\dsk4w32 e:\bios\hs20__`*xxx*`.img a:`

   where *e* is the CD-ROM drive letter, *a* is the diskette drive letter, and *xxx* is the latest BIOS code version. For the latest BIOS code version, see the readme file on the *HS20 Fibre Channel Expansion Card Support* CD.

7. Press Enter.

8. Remove the CD from the CD-ROM drive.

9. Remove the diskette from the diskette drive and label the diskette.

10. To update the HS20 Expansion Card BIOS code and NVRAM code, go to "Updating the expansion card BIOS code and NVRAM code" on page 19.

For Red Hat Linux and SuSE Linux

Complete the following steps to create a BIOS Update Utility diskette for Red Hat Linux or SuSE Linux from the *HS20 Fibre Channel Expansion Card Support* CD:

1. To associate the CD-ROM drive and the diskette drive with the blade server, press the CD/diskette/USB select button on the blade server. For the location of the CD/diskette/USB button, see the illustration on page 14. The LED on the button flashes while the request is being processed, then is steady when the ownership of the CD-ROM or diskette drive is transferred to the blade server.

2. To associate the keyboard port, mouse port, and video port with the blade server, press the keyboard/mouse/video select button. The LED on this button flashes while the request is processed, then is steady when the ownership of the keyboard, mouse, and video is transferred to the blade server.

3. Insert the support CD into the CD-ROM drive.

4. Insert a diskette into the diskette drive.

5. Restart the blade server.

6. At the command prompt, type

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

   where *cdromdevicefile* is the specific device file for the CD-ROM block device. Press Enter.

7. Type

```
dd if=/mnt/bios/hs20_xxx.img of=/dev/diskettedevicefile bs=32
```

where *xxx* is the BIOS code version on the CD. For more information, see the readme file on the *HS20 Fibre Channel Expansion Card Support* CD. Press Enter.

8. To unmount the CD file, type the following command and press Enter.

```
unmount /mnt
```

9. Remove the CD from the CD-ROM drive.

10. Remove the diskette from the diskette drive and label the diskette.

11. To update the HS20 Expansion Card BIOS code and NVRAM code, go to "Updating the expansion card BIOS code and NVRAM code".

Updating the expansion card BIOS code and NVRAM code

Attention: Do not turn off or restart the blade server during the BIOS code or NVRAM code update process.

To update the HS20 Expansion Card BIOS code and NVRAM code, use one of the following methods:

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

Using the flasutil command prompt

Complete the following steps to update the HS20 Expansion Card BIOS code and NVRAM code using the flasutil command prompt:

1. To associate the diskette drive with the blade server, press the CD/diskette/USB select button on the blade server. For the location of the CD/diskette/USB button, see the illustration on page 14. The LED on the button flashes while the request is processed, then is steady when the ownership of the CD-ROM or diskette drive is transferred to the blade server.

2. To associate the keyboard port, mouse port, and video port with the blade server, press the keyboard/mouse/video select button. The LED on this button flashes while the request is processed, then is steady when the ownership of the keyboard, mouse, and video is transferred to the blade server.

3. Insert the diskette you created from the support CD into the diskette drive.

4. Restart the blade server. The blade server starts to a DOS prompt.

5. To update the BIOS code and the NVRAM code on the HS20 Expansion Card, at the DOS prompt, type the following command and press Enter:

```
flasutil /l /f /i
```

Notes:

  a. You must add /i to each command for correct vendor recognition.

  b. Commands are not case sensitive.

6. To review additional command-line options that you can use, see "Command-line options"; then, return to step 6.

7. Remove the diskette from the diskette drive and restart the blade server.

8. Go to "Installing the HS20 Expansion Card device drivers" on page 22.

Command-line options

To view a list of supported command-line options, at the DOS prompt, type the following command and press Enter:

```
flasutil /?
```

The following command-line options are displayed:

```
/F xxxx = Write Flash, adapter address = xxxx
    If no address specified then write Flash to all adapters
/W xxxx = Copy Flash to file: QLxxRIM.SAV, adapter type = xxxx
/O <filename.ext> = Use <filename.ext> instead of QLxxROM.BIN
/I = Ignore Subsystem ID
/M = Program all adapters
/Q = Quiet Mode, no messages will be displayed
/V xxxx = Display current version number of BIOS on adapters at address xxxx
    If no address specified then display the BIOS version of all adapters
/C xxxx = Verify Flash of adapter at address xxxx
    If no address specified verify the Flash of all adapters
/Y xxxx = Display port name of adapter at address xxxx
    If no address specified then display port name of all adapters
/i= Vendor recognition
```

Using the flasutil BIOS Update Utility menu

Complete the following steps to update the HS20 Expansion Card BIOS code and NVRAM code using the flasutil BIOS Update Utility menu:

1. To associate the diskette drive with the blade server, press the CD/diskette/USB select button on the blade server. For the location of the CD/diskette/USB button, see the illustration on page 14. The LED on the button flashes while the request is being processed, then is steady when the ownership of the CD-ROM or diskette drive is transferred to the blade server.

2. To associate the keyboard port, mouse port, and video port with the blade server, press the keyboard/mouse/video select button. The LED on this button flashes while the request is processed, then is steady when the ownership of the keyboard, mouse, and video is transferred to the blade server.

3. Insert the diskette you created from the support CD into the diskette drive.

4. Restart the blade server. The blade server starts to a DOS prompt.

5. From the DOS prompt, type the following command and press Enter:

```
flasutil /i
```

The HS20 Expansion Card has two I/O addresses. Both port I/O addresses are displayed.

6. At the **Enter adapter I/O address** prompt, type the I/O address of the port for which you want to update the BIOS code and NVRAM code. Press Enter.

7. The following option menu is displayed:

```
L = Write NVRAM
F = Write Flash
W = Copy Flash to file: QLxxROM.SAV
S = Display serial number
V = Display current BIOS version
C = Verify Flash
X = Verify NVRAM
Y = Display port name
```

8. At the **Enter Option** prompt, type l and press Enter.

9. At the DOS prompt, type the following command and press Enter:

```
flasutil /i
```

10. At the **Enter adapter I/O address** prompt, type the same I/O address that you typed in step 5 on page 21.

The following option menu is displayed:

```
L = Write NVRAM
F = Write Flash
W = Copy Flash to file: QLxxROM.SAV
S = Display serial number
V = Display current BIOS version
C = Verify Flash
X = Verify NVRAM
Y = Display port name
```

11. At the **Enter Option** prompt, type f and press Enter.

12. For each additional option that you want for the same I/O address, repeat step 8 on page 21 through step 11 on page 21, substituting the option letter for f.

13. Repeat step 4 on page 21 through step 12 on page 21 for the second I/O address.

14. Remove the diskette from the diskette drive and restart the blade server.

15. Go to "Installing the HS20 Expansion Card device drivers" on page 22.

Using the Remote Deployment Manager

You can use the Remote Deployment Manager (RDM) program to install a supported Microsoft Windows operating system on a blade server only if the blade server patch has been applied to RDM. Follow the instructions in the documentation that comes with the RDM program. To download the RDM software and user's guide, go to:

http://www.ibm.com/pc/us/eserver/xseries/systems_management/rdm.html

Installing the HS20 Expansion Card device drivers

The device drivers and installation instructions for the following supported operating systems are provided on the *HS20 Fibre Channel Expansion Card Support* CD:

- Microsoft Windows 2000 Server and Advanced Server (requires SP 3)
- Red Hat Linux 7.3
- Red Hat Advanced Server 2.1
- SuSE Linux 8.0 Professional

The installation instructions are in a file in the applicable operating-system directory.

Note: For information about the latest supported device drivers, utilities, and documentation, go to http://www.ibm.com/pc/support/.

To customize the configuration of the HS20 Expansion Card, see Chapter 4, "Using IBM Fast!UTIL", on page 23.

Chapter 4. Using IBM Fast!UTIL

This chapter provides detailed configuration information for advanced users who want to customize the configuration of the HS20 Expansion Card. You can configure the expansion card using the Fast!UTIL utility.

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 HS20 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 HS20 Expansion Card might not function properly. 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 described in this section to configure the HS20 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 HS20 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 on page 24 and are described in this section. The HS20 Expansion Card is always point-to-point connected in the blade server with the 2-port Fibre Channel switch module.

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

Host adapter BIOS: When this option is disabled, the read-only memory (ROM) BIOS code on the HS20 Expansion Card is disabled, freeing space in upper memory. The default is **Disabled**.

Frame size: This setting specifies the maximum frame length supported by the HS20 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 is **Disabled**.

Note: The HS20 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 3 describes these settings and gives examples.

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

Table 3. Nonmodifiable expansion card settings and examples

Setting	Example
BIOS address	CD400
Revision	1.25
Adapter serial number	E59719
Interrupt level	3
Adapter port name	210000E08B07C703

BIOS address: The BIOS address is the HS20 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.

Revision: The BIOS revision is the revision number of the loaded BIOS code on the HS20 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 HS20 Expansion Card.

Interrupt level: The interrupt level is the interrupt that is used by the HS20 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 HS20 Expansion Card default NVRAM settings.

Raw NOVRAM data

This option displays the HS20 Expansion Card NVRAM contents in hexadecimal format. This is a troubleshooting tool; you cannot modify the data.

Advanced Adapter Settings

Use this option to view and set advanced adapter settings. The default settings for the HS20 Expansion Card are listed in Table 4 and are described in this section.

Table 4. Advanced Adapter Settings

Setting	Options	Default
Execution throttle	1-256	256
>4GByte addressing	Enabled or Disabled	Disabled
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

Table 4. Advanced Adapter Settings (continued)

Setting	Options	Default
Extended error logging	Enabled or Disabled	Disabled

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.

>4GByte addressing: Enable this setting when the blade server has more than 4 GB of memory available. The default is **Disabled**.

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

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

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

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

Extended Firmware Settings

Use this option to view and set extended firmware settings. The default settings for the HS20 Expansion Card are listed in Table 5 and are described in this section.

Table 5. Extended firmware settings

Setting	Options	Default
RIO operation mode	0, 5	0
Connection Options	0, 1, 2	2
Fibre Channel tape support	Disabled	Disabled
Interrupt delay timer	0-255	0
Data rate	0, 1, 2	2

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 6). The default is **0**.

Table 6. RIO options and operation modes

Option	Operation mode
0	No multiple responses
5	Multiple responses with minimal interrupts

Connection options: This setting defines the type of connection (loop or point-to-point) or connection preference (see Table 7). The default is **2**.

Table 7. 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 is **Disabled**.

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 is **0**.

Data rate: This setting determines the data rate. The default setting is **2**.

Table 8. Data rate options

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

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 HS20 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. Troubleshooting

The following four types of installation problems might cause your HS20
Expansion Card to function incorrectly:

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

If you are having a problem, use the following information to help you
determine the cause of the problem and the action to take.

Note: Additional troubleshooting and debugging procedures are available in
the *IBM BladeCenter HS20 Hardware Maintenance Manual and
Troubleshooting Guid*e on the IBM *BladeCenter Documentation* CD.

Hardware problems

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

- Verify that the HS20 Expansion Card is installed correctly.
- Verify that the Fast!UTIL data-rate setting is correct. See Chapter 4, "Using
  IBM Fast!UTIL", on page 23.
- Verify that all peripheral devices are turned on and connected through the
  Fibre Channel Switch Module. See "Scan Fibre Channel devices" on page 28
  for information about displaying attached Fibre Channel devices.
- Verify that the IBM 2-Port Fibre Channel Switch Module for the BladeCenter
  unit is installed in a Fibre Channel connection.

Software problems

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

- Verify that the correct device driver is installed.
- Verify that the BIOS code in the expansion card is at the latest level.
- Verify that you have the correct expansion card NVRAM settings for your
  storage area network (SAN) and operating system.

System configuration problems

To determine whether your installation problem is caused by the system configuration, check the blade server to ensure that it is configured properly. For more information, see "Configuration Settings menu options" on page 23.

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

Fibre Channel problems

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

- Verify that an IBM 2-port Fibre Channel Switch Module is installed in switch-module bay 3, module bay 4, or both.
- Verify that the blade server is turned on.
- Verify that the HS20 Expansion Card settings are set to the correct values. See "Configuration Settings menu options" on page 23.

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 xSeries 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.
- 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.
- Use an IBM discussion forum on the IBM Web site to ask questions.

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 xSeries 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 xSeries 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 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, you can order publications 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 xSeries and IntelliStation products, services, and support. The address for
IBM xSeries information is http://www.ibm.com/eserver/xseries/. The
address for IBM IntelliStation information is
http://www.ibm.com/pc/intellistation/.

You can find service information for your IBM products, including supported
options, at http://www.ibm.com/pc/support/. If you click **Profile** from the
support page, you can create a customized support page. The support page
has many sources of information and ways for you to solve problems,
including:

- Diagnosing problems, using the IBM Online Assistant
- Downloading the latest device drivers and updates for your products
- Viewing Frequently Asked Questions (FAQ)
- Viewing hints and tips to help you solve problems
- Participating in IBM discussion forums
- Setting up e-mail notification of technical updates about your products

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, IntelliStation
workstations, and appliances. For information about which products are
supported by Support Line in your country or region, go to
http://www.ibm.com/services/sl/products/.

For more information about Support Line and other IBM services, go to
http://www.ibm.com/services/, or go to http://www.ibm.com/planetwide/
for support telephone numbers.

Hardware service and support

You can receive hardware service through IBM Integrated Technology Services
or through your IBM reseller, if your reseller is authorized by IBM to provide
warranty service. Go to http://www.ibm.com/planetwide/ for support
telephone numbers.

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

Appendix B. Warranty information

This section contains information about your warranty period and the service and support that are provided by your warranty.

Warranty period

The warranty period varies by machine type and country or region.

Contact your place of purchase for warranty service information. Some IBM Machines are eligible for on-site warranty service depending on the country or region where service is performed.

Prior to on-site warranty service, you are required to go through problem determination with an IBM service specialist call center technician.

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

The IBM Machine Warranties Web site at http://www.ibm.com/servers/support/machine_warranties/ contains a worldwide overview of the IBM Statement of Limited Warranty for IBM Machines, a glossary of terms used in the Statement of Limited Warranty, Frequently Asked Questions (FAQ), and links to Product Support Web pages. The IBM Statement of Limited Warranty is available from this Web site in 29 languages in Portable Document Format (PDF).

Machine - IBM HS20 Fibre Channel Expansion Card

Country or region	Warranty period	Service delivery method
Worldwide	3 years parts - 3 years labor	On-site

Problem determination

Prior to on-site warranty service, you are required to go through problem determination with an IBM service specialist call center technician. The service specialist will run diagnostic tests on the hardware and check the software.

Running diagnostics

The IBM service specialist will help you determine whether your equipment is functioning as specified. It might be necessary to isolate the failing xSeries, Netfinity®, or IntelliStation system; IBM component; or both from any active production environment to run diagnostics and perform defect-isolation programs. You are responsible for making the system, IBM component, or both available for running diagnostics and defect-isolation programs.

Checking software

The IBM service specialist will help you ensure that the correct BIOS code, firmware, device drivers, and other supporting IBM software are installed and correctly configured. It might be necessary to manually gather information about the relevant software levels or run IBM-approved utility programs to gather this information. It might be necessary to isolate the failing system from any active production environment to gather this information. You are responsible, with assistance from the service specialist, for gathering this information. The IBM Statement of Limited Warranty does not include on-site assistance with this activity.

Warranty service and support

With the original purchase of an IBM xSeries or IntelliStation system, you have access to extensive service and support. During the IBM Machine warranty period, you may call IBM or your reseller for problem-determination assistance under the terms of the IBM Statement of Limited Warranty.

The following services are available during the warranty period:

- **Problem determination** - Trained personnel are available to assist you with determining if you have a hardware problem and deciding what action is necessary to fix the problem.
- **IBM hardware repair** - If the problem is determined to be caused by IBM hardware under warranty, trained service personnel are available to provide the applicable level of service, either on-site or at an IBM service center as determined by IBM.
- **Engineering Change management** - Occasionally, there might be changes that are required after a product has been shipped from IBM. In those instances, IBM will make Engineering Changes (ECs) available that apply to your hardware.
- **Customer replaceable units (CRUs)** - Some parts of IBM xSeries and IntelliStation systems are designated as customer replaceable units. IBM ships CRUs to you for replacement by you. CRUs include keyboards, monitors, memory, diskette drives, hard disk drives, and mice (this list is not inclusive of all CRUs).

The following items are not covered under warranty service:

- Replacement or use of non-IBM parts. All IBM parts contain a 7-character identification in the format IBM FRU XXXXXXX.
- Identification of software problem sources.
- Installation of customer replaceable units (CRUs).
- Installation and configuration of BIOS code, firmware, or device drivers that are designated as customer installable.

See the IBM Statement of Limited Warranty for a full explanation of IBM warranty terms. Be sure to retain your proof of purchase to obtain warranty service.

Please have the following information ready when you call:
- The machine type and model of your IBM hardware product (if available)
- Serial numbers of your IBM hardware products
- A description of the problem
- The exact wording of any error messages
- Hardware and software configuration information

International Warranty Service

If you travel with your xSeries or IntelliStation system or relocate it to a country or region where your system is sold and serviced by IBM or IBM resellers authorized to perform warranty service, International Warranty Service (IWS) is available during the warranty period. Eligible IBM systems are identified by their four-digit machine types.

You can obtain IWS through the service delivery method (such as depot, carry-in, or on-site) provided in the servicing country or region. Service methods and procedures vary by country or region, and some service or parts might not be available in all countries and regions. Service centers in certain countries or regions might not be able to service all models of a particular machine type. In addition, some countries or regions might have fees and restrictions that apply at the time of service.

To determine whether your system is eligible for IWS, go to http://www.ibm.com/pc/support/ and click **Warranty lookup**.

Purchasing additional services

During and after the warranty period, you can purchase additional services, such as support for IBM and non-IBM hardware, operating systems, and application programs; network setup and configuration; upgraded or extended hardware repair services; and custom installations. Service availability and service name might vary by country or region.

For more information about these services, contact your IBM marketing representative.

IBM Statement of Limited Warranty Z125-4753-06 8/2000

Part 1 - General Terms

This Statement of Limited Warranty includes Part 1 - General Terms and Part 2 - Country-unique Terms. 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, from IBM or your reseller. 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. Unless IBM specifies otherwise, the following warranties apply only in the country where you acquire the Machine. Nothing in this Statement of Limited Warranty affects any statutory rights of consumers that cannot be waived or limited by contract. If you have any questions, contact IBM or your reseller.

The IBM Warranty for Machines: IBM warrants that each Machine 1) is free from defects in materials and workmanship and 2) conforms to IBM's Official Published Specifications ("Specifications"). The warranty period for a Machine is a specified, fixed period commencing on its Date of Installation. The date on your sales receipt is the Date of Installation unless IBM or your reseller informs you otherwise.

If a Machine does not function as warranted during the warranty period, and IBM or your reseller are unable to either 1) make it do so or 2) replace it with one that is at least functionally equivalent, you may return it to your place of purchase and your money will be refunded.

Extent of Warranty: The warranty does not cover the repair or exchange of a Machine resulting from misuse, accident, modification, unsuitable physical or operating environment, improper maintenance by you, or failure caused by a product for which IBM is not responsible. The warranty is voided by removal or alteration of Machine or parts identification labels.

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. THESE WARRANTIES GIVE YOU SPECIFIC LEGAL RIGHTS AND YOU MAY ALSO HAVE OTHER RIGHTS WHICH VARY FROM JURISDICTION TO JURISDICTION. SOME JURISDICTIONS DO NOT ALLOW THE EXCLUSION OR LIMITATION OF EXPRESS OR IMPLIED WARRANTIES, SO THE ABOVE EXCLUSION OR LIMITATION MAY NOT APPLY TO YOU. IN THAT EVENT, SUCH WARRANTIES ARE LIMITED IN DURATION TO THE WARRANTY PERIOD. NO WARRANTIES APPLY AFTER THAT PERIOD.

Items Not Covered by Warranty: 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 via telephone with "how-to" questions and those regarding Machine set-up and installation, will be provided **WITHOUT WARRANTIES OF ANY KIND.**

Warranty Service: To obtain warranty service for a Machine, contact IBM or your reseller. If you do not register your Machine with IBM, you may be required to present proof of purchase.

During the warranty period, IBM or your reseller, if approved by IBM to provide warranty service, provides without charge certain types of repair and exchange service to keep Machines in, or restore them to, conformance with their Specifications. IBM or your reseller will inform you of the available types of service for a Machine based on its country of installation. At its discretion, IBM or your reseller will 1) either repair or exchange the failing Machine and 2) provide the service either at your location or a service center. IBM or your reseller will also manage and install selected engineering changes that apply to the Machine.

Some parts of IBM Machines are designated as Customer Replaceable Units (called "CRUs"), e.g., keyboards, memory, or hard disk drives. IBM ships CRUs to you for replacement by you. You must return all defective CRUs to IBM within 30 days of your receipt of the replacement CRU. You are responsible for downloading designated Machine Code and Licensed Internal Code updates from an IBM Internet Web site or from other electronic media, and following the instructions that IBM provides.

When 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. 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.

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 problem determination, problem analysis, and service request procedures that IBM or your reseller provides;
   b. secure all programs, data, and funds contained in a Machine;
   c. provide IBM or your reseller with sufficient, free, and safe access to your facilities to permit them to fulfill their obligations; and
   d. inform IBM or your reseller of changes in a Machine's location.

IBM is responsible for loss of, or damage to, your Machine 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 is responsible for any of your confidential, proprietary or personal information contained in a Machine which you return to IBM or your reseller for any reason. You should remove all such information from the Machine prior to its return.

Limitation of Liability: 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.

   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 LIABLE FOR ANY OF THE FOLLOWING: 1) THIRD-PARTY CLAIMS AGAINST YOU FOR DAMAGES (OTHER THAN THOSE UNDER THE FIRST ITEM LISTED ABOVE); 2) LOSS OF, OR DAMAGE TO, YOUR RECORDS OR DATA; OR 3) SPECIAL, INCIDENTAL, OR INDIRECT DAMAGES OR FOR ANY ECONOMIC CONSEQUENTIAL DAMAGES, LOST PROFITS OR LOST SAVINGS, EVEN IF IBM, ITS SUPPLIERS OR YOUR RESELLER IS INFORMED OF THEIR POSSIBILITY. SOME JURISDICTIONS DO NOT ALLOW THE EXCLUSION OR LIMITATION OF INCIDENTAL OR CONSEQUENTIAL DAMAGES, SO THE ABOVE LIMITATION OR EXCLUSION MAY NOT APPLY TO YOU.

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

Part 2 - Country-unique Terms

<u>AMERICAS</u>

BRAZIL

Governing Law: *The following is added after the first sentence:* Any litigation arising from this Agreement will be settled exclusively by the court of Rio de Janeiro.

<u>NORTH AMERICA</u>

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

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.

<u>ASIA PACIFIC</u>

AUSTRALIA

The IBM Warranty for Machines: *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, LAOS, AND VIETNAM

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.

The following is added to this Section: Disputes and differences arising out of or in connection with this Agreement shall be finally settled by arbitration which shall be held in Singapore in accordance with the rules of the International Chamber of Commerce (ICC). The arbitrator or arbitrators designated in conformity with those rules shall have the power to rule on their own competence and on the validity of the Agreement to submit to arbitration. The arbitration award shall be final and binding for the parties without appeal and the arbitral award shall be in writing and set forth the findings of fact and the conclusions of law.

All proceedings shall be conducted, including all documents presented in such proceedings, in the English language. 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 before proceeding upon the reference. The third arbitrator shall act as chairman of the proceedings. Vacancies in the post of chairman shall be filled by the president of the ICC. 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.

The English language version of this Agreement prevails over any other language version.

HONG KONG AND MACAU

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.

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;
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, IBM's liability will be limited to the charge paid by you for the individual Machine that is the subject of the claim.

JAPAN

Governing Law: *The following sentence is added to this Section:*Any doubts concerning this Agreement will be initially resolved between us in good faith and in accordance with the principle of mutual trust.

NEW ZEALAND

The IBM Warranty for Machines: *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 this Section:* Both you and IBM consent to the application of the laws of the State of New York (except when local law requires otherwise) to govern, interpret, and enforce all your and IBM's rights, duties, and obligations arising from, or relating in any manner to, the subject matter of this Agreement, without regard to conflict of law principles.

Any disputes arising from or in connection with this Agreement will first be resolved by friendly negotiations, failing which either of us has the right to submit the dispute to the China International Economic and Trade Arbitration Commission in Beijing, the PRC, for arbitration in accordance with its arbitration rules in force at the time. The arbitration tribunal will consist of three arbitrators. The language to be used therein will be English and Chinese.

An arbitral award will be final and binding on all the parties, and will be enforceable under the Convention on the Recognition and Enforcement of Foreign Arbitral Awards (1958).

The arbitration fee will be borne by the losing party unless otherwise determined by the arbitral award.

During the course of arbitration, this Agreement will continue to be performed except for the part which the parties are disputing and which is undergoing arbitration.

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.

Warranty Service: If you purchase an IBM Machine in Austria, Belgium, Denmark, Estonia, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland or United Kingdom, 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 an IBM Personal Computer Machine in Albania, Armenia, Belarus, Bosnia and Herzegovina, Bulgaria, Croatia, Czech Republic, Georgia, Hungary, Kazakhstan, Kirghizia, 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 an IBM 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 authorized service provider. You are responsible for transportation costs for Machines located outside 50 kilometers of an IBM authorized service provider.

Governing Law: The applicable laws that govern, interpret and enforce rights, duties, and obligations of each of us arising from, or relating in any manner to, the subject matter of this Statement, without regard to conflict of laws principles, as well as Country-unique terms and competent court for this Statement are those of the country in which the warranty service is being provided, except that in 1) Albania, Bosnia-Herzegovina, Bulgaria, Croatia,

Hungary, Former Yugoslav Republic of Macedonia, Romania, Slovakia, Slovenia, Armenia, Azerbaijan, Belarus, Georgia, Kazakhstan, Kyrgyzstan, Moldova, Russia, Tajikistan, Turkmenistan, Ukraine, and Uzbekistan, the laws of Austria apply; 2) Estonia, Latvia, and Lithuania, the laws of Finland apply; 3) Algeria, Benin, Burkina Faso, Cameroon, Cape Verde, Central African Republic, Chad, Congo, Djibouti, Democratic Republic of Congo, Equatorial Guinea, France, Gabon, Gambia, Guinea, Guinea-Bissau, Ivory Coast, Lebanon, Mali, Mauritania, Morocco, Niger, Senegal, Togo, and Tunisia, this Agreement will be construed and the legal relations between the parties will be determined in accordance with the French laws and all disputes arising out of this Agreement or related to its violation or execution, including summary proceedings, will be settled exclusively by the Commercial Court of Paris; 4) 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, United Kingdom, West Bank/Gaza, Yemen, Zambia, and Zimbabwe, this Agreement will be governed by English Law and disputes relating to it will be submitted to the exclusive jurisdiction of the English courts; and 5) in Greece, Israel, Italy, Portugal, and Spain any legal claim arising out of this Statement will be brought before, and finally settled by, the competent court of Athens, Tel Aviv, Milan, Lisbon, and Madrid, respectively.

THE FOLLOWING TERMS APPLY TO THE COUNTRY SPECIFIED:

AUSTRIA AND GERMANY

The IBM Warranty for Machines: *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 six 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.

Extent of Warranty: *The second paragraph does not apply.*

Warranty Service: *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.

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.

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).*

IRELAND

Extent of Warranty: *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 items one and two of the first paragraph of this Section:* 1. death or personal injury or physical damage to your real property solely caused by IBM's negligence; and 2. the amount of any other actual direct damages, up to 125 percent of the charges (if recurring, the 12 months' charges apply) for the Machine that is the subject of the claim or which otherwise gives rise to the claim.

Applicability of suppliers and resellers (unchanged).

The following paragraph is added at the end of this Section: IBM's entire liability and your sole remedy, whether in contract or in tort, in respect of any default shall be limited to damages.

ITALY

Limitation of Liability: *The following replaces the second sentence in the first paragraph:*In each such instance unless otherwise provided by mandatory law, IBM is liable for no more than: 1. *(unchanged)* 2. as to any other actual damage arising in all situations involving nonperformance by IBM pursuant to, or in any way related to the subject matter of this Statement of Warranty, IBM's liability, will be limited to the total amount you paid for the Machine that is the subject of the claim. *Applicability of suppliers and resellers (unchanged).*

The following replaces the third paragraph of this Section: Unless otherwise provided by mandatory law, IBM and your reseller are not liable for any of the following: *(items 1 and 2 unchanged)* 3) indirect damages, even if IBM or your reseller is informed of their possibility.

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 items 1 and 2 of the first paragraph of this Section:*
1. death or personal injury or physical damage to your real property solely caused by IBM's negligence;
2. the amount of any other actual direct damages or loss, up to 125 percent of the charges (if recurring, the 12 months' charges apply) for the Machine that is the subject of the claim or which otherwise gives rise to the claim;

The following item is added to this paragraph: 3. breach of IBM's obligations implied by Section 12 of the Sale of Goods Act 1979 or Section 2 of the Supply of Goods and Services Act 1982.

Applicability of suppliers and resellers (unchanged).

The following is added to the end of this Section: IBM's entire liability and your sole remedy, whether in contract or in tort, in respect of any default shall be limited to damages.

Appendix C. Notices

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Important notes

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

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

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

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

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

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

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

Electronic emission notices

Federal Communications Commission (FCC) statement

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

Properly shielded and grounded cables and connectors must be used in order to meet FCC emission limits. 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 using other than recommended cables and connectors or by unauthorized changes or modifications to this equipment. Unauthorized changes or modifications could void the user's authority to operate the equipment.

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

Industry Canada Class A emission compliance statement

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

Avis de conformité à la réglementation d'Industrie Canada

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

Australia and New Zealand Class A statement

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

United Kingdom telecommunications safety requirement

Notice to Customers

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

European Union EMC Directive conformance statement

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

This product has been tested and found to comply with the limits for Class A Information Technology Equipment according to CISPR 22/European Standard EN 55022. The limits for Class A equipment were derived for commercial and industrial environments to provide reasonable protection against interference with licensed communication equipment.

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

Taiwan electrical emission statement

警告使用者:
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能會造成射頻干擾，在這
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求採取某些適當的對策。

Japanese Voluntary Control Council for Interference (VCCI) statement

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