



IBM FAStT Host Adapter

Installation and User's Guide



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Note

Before using this information and the product it supports, be sure to read the general information under Appendix D, "Product warranties and notices" on page 35.

Third Edition (March 2001)

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Safety Information



Before installing this product, read the Safety Information.

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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)。

Prije instalacije ovog produkta obavezno pročitajte Sigurnosne Upute.

Před instalací tohoto produktu si přečtěte příručku bezpečnostních instrukcí.

Læs sikkerhedsforskrifterne, før du installerer dette produkt.

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.

Lees voordat u dit product installeert eerst de veiligheidsvoorschriften.

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

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

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

Перед установкой продукта прочтите инструкции по технике безопасности.

Pred inštaláciou tohto zariadenia si pečítajte Bezpečnostné predpisy.

Pred namestitvijo tega proizvoda preberite Varnostne informacije.

Antes de instalar este producto lea la información de seguridad.

Läs säkerhetsinformationen innan du installerar den här produkten.

安裝本產品之前，請先閱讀「安全資訊」。

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:

1. Turn everything OFF.
2. First, attach all cables to devices.
3. Attach signal cables to connectors.
4. Attach power cords to outlet.
5. Turn device ON.

To Disconnect:

1. Turn everything OFF.
2. First, remove power cords from outlet.
3. Remove signal cables from connectors.
4. Remove all cables from devices.

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 statement

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

IEC 825-1:1993 CENELEC EN 60 825

About this book

This book provides instructions for installing and customizing the configuration of your IBM® FASTT Host Adapter and connected devices, and for installing and updating the device drivers. It also provides information on troubleshooting your IBM FASTT Host Adapter. To set up your IBM FASTT Host Adapter, refer to Chapter 2, “Installing the adapter” on page 5 for detailed information.

How this book is organized

This book is comprised of the following parts:

- Part I. Hardware installation

Chapter 1, “Hardware overview,” describes the IBM FASTT Host Adapter. This chapter includes an overview of the IBM FASTT Host Adapter features.

Chapter 2, “Installing the adapter,” contains the information and instructions needed to prepare and install the IBM FASTT Host Adapter.

Chapter 3, “Troubleshooting,” covers the type of installation problems that can cause the IBM FASTT Host Adapter to function incorrectly.

- Part II. Software installation

Chapter 4, “Software overview,” provides preinstallation information for installing the device drivers.

Chapter 5, “Installing the Windows NT and Windows 2000 device drivers,” provides instructions for installing Windows NT® and Windows® 2000 device drivers.

Chapter 6, “Installing the NetWare device driver,” provides instructions for installing the NetWare device driver in a system that is running Novell NetWare.

- Part III. Appendices

Appendix A, “Fast!UTIL,” provides detailed configuration information for users who want to customize the configuration of the IBM FASTT Host Adapter and connected devices.

Appendix B, “Adapter operating environment and specifications,” contains the IBM FASTT Host Adapter operating environment and specification information.

Appendix C, “Getting help, service, and information,” provides information on getting help, service, technical assistance, or additional product information.

Appendix D, “Product warranties and notices,” contains product notices, warranties, and trademarks.

Notices used in this book

This book contains notices to highlight information or provide safety information:

- **Notes**

These notices provide important tips, guidance, or advice.

- **Attention**

These notices indicate possible damage to programs, devices, or data. An attention notice is placed just before the instructions or situation in which damage could occur.

- **Caution**

These notices indicate situations that can be potentially hazardous to you. A caution notice is placed just *before* descriptions of potentially hazardous procedure steps or situations.

- **Danger**

These notices indicate situations that are potentially lethal or extremely hazardous to you. A danger notice is placed just *before* descriptions of potentially lethal or extremely hazardous procedure steps or situations.

Related publications

Additional publications are available for purchase from IBM. For a list of publications available in your country:

- In the U.S. and Puerto Rico, call 1-800-426-7282.
- In Canada, call 1-800-465-1234.
- In other countries, contact the IBM support organization that services your area, your IBM marketing representative, or your IBM reseller.

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Chapter 1. Hardware overview

The IBM® FAStT Host Adapter is a high-performance, direct memory access (DMA), bus-master, host adapter designed for high-end systems. The function and performance are derived from the ISP2200A chip, making this FAStT Host Adapter a leading-edge host adapter.

The ISP2200A chip combines a powerful RISC processor, a fibre protocol module (FPM) with gigabit transceivers, and a 64-bit peripheral component interconnect (PCI) local bus interface in a single-chip solution. The IBM FAStT Host Adapter supports all Fibre Channel (FC) peripheral devices that support private-loop direct attach (PLDA) and fabric-loop attach (FLA).

What is Fibre Channel?

Fibre Channel technology is outlined in the *Information Systems - Fibre Channel Protocol for SCSI (small computer system interface - FCP)* standard, revision 12, 30 May 1995. Fibre Channel is a high-speed data transport technology used for mass storage and networking. The IBM FAStT Host Adapter connects:

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

Using a Fibre Channel arbitrated loop (FC-AL), 126 devices can be supported, compared to 15 devices with Ultra SCSI.

Fibre Channel supports data transfer rates of 100 MB per second, which is more than twice that of Ultra SCSI (40 MB per second). A multimode optical interface is used for distances up to 500 meters. With increased connectivity and performance, Fibre Channel is the technology preferred and used by system designers.

Fibre Channel adapter features

Fibre Channel adapter features include:

- Compliance with Third Generation Fibre Channel Physical and Signaling Interface - 3 (PC-PH-3), revision 9.2
- Compliance with Fibre Channel Arbitrated Loop (FC-AL-2) standard
- Compliance with Intel® PCI version 2.2 specification
- Compliance with U.S. and international safety and emissions standards
- Support for bus-master DMA
- Fast!UTIL basic input/output system (BIOS) utility program to customize the configuration parameters on the IBM FAStT Host Adapter and attached drives
- Supports Fibre Channel SCSI (FCP-SCSI) and internet protocol (IP) protocols
- Supports point-to-point fabric connection (F-PORT FABRIC LOGIN)
- Supports Fibre Channel service (Classes 2 and 3)

- 32 bit or 64 bit, 66 or 33 MHz operation
- Simultaneous mixed-peripheral configurations and startable device support for Fibre Channel devices that meet the following standards:
 - Fibre Channel — Private Loop Direct Attach Technical Report (FC-PLDA) revision 1.10, 17 February 1997
 - Fibre Channel — Fabric Loop Attachment Technical Report (FC-FLA) revision 2.1, 12 July 1997

Chapter 2. Installing the adapter

This chapter contains instructions for preparing and installing the IBM FASTT Host Adapter.

Preinstallation procedures

Before you begin

- Read "Handling static-sensitive devices."
- Read "What you need for the installation."

Handling static-sensitive devices

Attention: Static electricity can damage electronic devices and your system. To avoid damage, keep static-sensitive devices in their static-protective package until you are ready to install them.

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

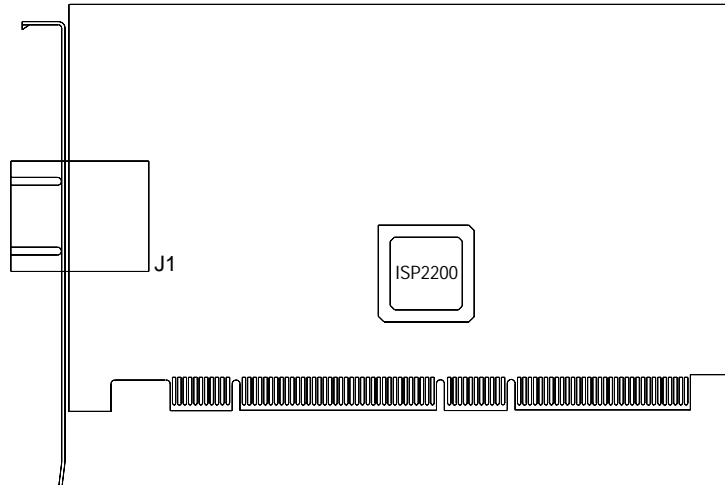
- Limit your movement. Movement can cause static electricity to build up around you.
- Handle the device carefully, holding it by its edges or its frame.
- Do not touch solder joints, pins, or exposed printed circuitry.
- Do not leave the device where others can handle and possibly damage the device.
- While the device is still in its static-protective package, touch it to an unpainted metal part of the system unit for at least two seconds. (This drains static electricity from the package and from your body.)
- Remove the device from its package and install it directly into your system unit without setting it down. If it is necessary to set the device down, place it on its static-protective package. (If your device is an adapter, place it component side up.) Do not place the device on your system unit cover or on a metal table.
- Take additional care when handling devices during cold weather because heating reduces indoor humidity and increases static electricity.

What you need for the installation

To install the IBM FASTT Host Adapter in your server, you need an optical, multimode cable with an SC-style duplex connector.

Adapter layouts

The following figure identifies the adapter components referred to in this chapter.



Installing the IBM FAST Host Adapter

Before you begin the installation, write down the serial number of the IBM FAST Host Adapter. In the event that the nonvolatile random access memory (NVRAM) is damaged, the system will prompt you for the IBM FAST Host Adapter serial number.

Attention: To avoid damage to your fiber-optic cables, follow these guidelines:

- Do not route the cable along a folding cable-management arm.
- When attaching fiber-optic cables to a device on slide rails, leave enough slack in the cables so that they do not bend to a radius smaller than 76 mm (3 in.) when extended or become pinched when retracted.
- Route the cable away from places where it can snag on other devices in the rack.
- Do not over tighten the cable straps or bend the cables to a radius smaller than 76 mm (3 in.).
- Do not put excess weight on the cable at the connection point and be sure that the cable is well supported.

Follow these steps to install the IBM FAST Host Adapter in your server:

1. Check the system board and make any configuration changes needed to accommodate the IBM FAST Host Adapter.
2. Turn off the peripheral devices, then the server.
3. Disconnect the power cords.
4. Remove the server cover.
5. Remove the slot cover.
6. Choose any PCI bus slot that supports 32 or 64-bit adapters. You can install the adapter in a 64-bit PCI slot if one is available. If a 64-bit slot is not available, then you can use a 32-bit PCI slot.
7. Align the adapter with the expansion slot. Carefully press the adapter into the slot until it is fully seated.

8. Secure the adapter in place.
9. Connect one end of the fiber-optic cable from the device to the J1 connector on the adapter.
10. Carefully install and secure the server cover.
11. Connect the power cables.
12. Turn on all external Fibre Channel devices; then, turn on the server. The following information displays:

```
QLogic Corporation  
QLA2xxx PCI Fibre Channel ROM BIOS Version X.XX  
Copyright (C) QLogic Corporation 1998 All rights reserved.  
www.q1c.com
```

Press <Alt+Q> for Fast!UTIL

BIOS for Adapter X is disabled.

ROM BIOS not installed.

To display the Fibre Channel devices, press Alt+Q: then, use the utility program. See Appendix A, "Fast!UTIL" on page 23 for detailed utility information.

See "Part II. Software installation" on page 11 for detailed instructions on how to install the device drivers.

If the information displayed is not correct and you have checked the adapter configuration, see Chapter 3, "Troubleshooting" on page 9 for troubleshooting information.

Chapter 3. Troubleshooting

There are three types of installation problems that might cause your adapter to function incorrectly.

- Hardware problems
- System configuration problems
- Fibre Channel (FC) problems

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

Hardware problems

The following is a list to help you determine if your installation problem is caused by the hardware:

- Verify that all adapters are installed securely.
- Verify that all cables are attached securely to the correct connectors. Be sure that the Fibre Channel connectors that attach from the J1 connector on the adapter to the device are connected securely.
- Verify that the adapter is installed correctly and fully seated in the expansion slot. Check for interference due to nonstandard PCI connectors.
- Verify that all peripheral devices are turned on. See “Scan Fibre Channel devices” on page 28 for information about displaying attached devices.

System configuration problems

To find out if your installation problem was caused by the system configuration, check your system board to ensure that it is configured properly (see “Installing the IBM FAStT Host Adapter” on page 6).

Fibre Channel problems

To determine if your installation problem is caused by the Fibre Channel, verify that all of the Fibre Channel devices were turned on before you turned on the server. Also, ensure that all cables are connected properly.

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Chapter 4. Software overview

After installing your IBM FASTT Host Adapter, you are ready to install the device drivers for the adapter.

The device drivers for the following supported operating systems are provided with your IBM FASTT Host Adapter:

- Windows 2000
- Windows NT Version 4.0
- Novell NetWare Version 5.1

Note: The latest versions of the device drivers, utilities, and documentation are available on the following IBM Web site:

<http://www.ibm.com/pc/support>

Before you begin

- Create driver diskettes by copying the image you need from the *IBM FASTT Host Adapter Support* CD for the following:
 - *FASTT Host Adapter for Windows 2000*
 - *FASTT Host Adapter for Windows NT 4.0*
 - *FASTT Host Adapter for NetWare 5.1*
- **Note:** You will be prompted for the driver diskettes during the operating system installation process.
- Read through the software installation chapters to determine which device driver you want to install.

Use the following steps if you need to create driver diskettes to support the installation of Novell NetWare version 5.1, Microsoft Windows NT 4.0, or Windows 2000:

1. Insert the *IBM FASTT Host Adapter Support* CD into the CD-ROM drive.
2. To create the IBM FASTT Host Adapter device driver diskette:
 - For Windows NT 4, at the command prompt, type:
`d:\tools\dsk4w32 d:\images\nt4\nt4_7040404.img a:`
Where *d* is the CD-ROM drive and *a* is the diskette drive.
 - For Windows 2000, at the command prompt, type:
`d:\tools\dsk4w32 d:\images\w2k\w2k_7040302.img a:`
Where *d* is the CD-ROM drive and *a* is the diskette drive.
 - For NetWare 5.1, at the command prompt, type:
`d:\tools\dsk4w32 d:\images\nw51\nw51_550v.img a:`
Where *d* is the CD-ROM drive and *a* is the diskette drive.
3. Press Enter.
4. Remove the diskette from the diskette drive and label the diskette appropriately.
5. Remove the *IBM FASTT Host Adapter Support* CD from the CD-ROM drive.

Chapter 5. Installing the Windows NT and Windows 2000 device drivers

This section provides instructions for installing the Windows NT and Windows 2000 device drivers under the following operating system conditions:

- Initial installation of the operating system and the device driver
- Installation of the device driver in a previously installed operating system
- Installing an updated device driver in a previously installed operating system that has an older version of the device driver

The following files are provided on the IBM FAS^tT Host Adapter driver diskette that you created in Chapter 4 for the Windows NT device driver installation.

- TXTSETUP.OEM: Driver installation script for initial Windows NT text setup
- QLOGIC: Identification file for Windows NT setup program
- \NT\OEMSETUP.INF: Driver installation script for the Windows NT setup program
- \NT\QL2200.SYS: Windows NT 4.0 device driver
- \NT\README.TXT: Helpful hints about the Windows NT device driver
- \NT\RELEASE.TXT: History of release fixes

The following files are provided on the IBM FAS^tT Host Adapter driver diskette that you created in Chapter 4 for the Windows 2000 device driver installation.

- TXTSETUP.OEM: Driver installation script for initial Windows 2000 text setup
- QLOGIC: Identification file for Windows 2000 setup program
- \WK2\OEMSETUP.INF: Driver installation script for the Windows 2000 setup program
- \WK2\QL2200.SYS: Windows 2000 device driver
- \WK2\README.TXT: Helpful hints about the Windows 2000 device driver
- \WK2\RELEASE.TXT: History of release fixes

Installing Windows NT and Windows 2000

Perform the following steps to install Windows NT 4.0 or Windows 2000 on the drive that is attached to the IBM FAStT Host Adapter.

1. Insert the Windows NT or Windows 2000 setup diskette or insert the Windows NT or Windows 2000 installation CD into the CD-ROM drive.
2. After the standard devices have been detected and configured, use the **S** option to **Specify Additional Device**.
3. Select **Other**; then, press Enter.
4. Insert the FAStT Host Adapter device driver diskette that you created in Chapter 4; then, press Enter.
5. Select **QLogic QLA2200**; then, press Enter.
6. Select the standard installation procedure.

Adding the Windows NT driver

Perform the following steps to add the Windows NT device driver to a previously installed Windows NT 4.0 system.

1. On your desktop, click **My Computer** → **Control Panel** → **SCSI Adapters**.
2. Click the **Drivers** tab and click **Add**.
3. Select **QLogic** from the list of manufacturers and click **Have Disk**.
4. Insert the IBM FAStT Host Adapter driver diskette you created for Windows NT. At the prompt type:
a:\nt
where *a* is the diskette drive letter. Click **OK**.
5. If you are installing the drivers from a CD-ROM, at the prompt type:
z:\NT4\2200\NT
where *z* is the CD-ROM drive letter.
6. Select **IBM Netfinity QLA2200 PCI Fibre Channel Adapter** and click **OK**.
7. Click **Yes** to restart your server so the driver settings can take effect now or click **No** to restart your system at a later time.

Adding the Windows 2000 driver

Perform the following steps to add the Windows 2000 device driver to a previously installed Windows 2000 system.

1. After you install the IBM FAS*t*T Host Adapter, restart the system. The system searches for the newly installed device. If the system finds the new device, it indicates that the device has been detected.
2. If prompted to insert the device driver diskette, insert the IBM FAS*t*T Host Adapter device driver for Windows 2000 diskette that you created in Chapter 4. When prompted, follow the instructions.

If you want to update a previously installed version of the device driver, follow the procedures in “Updating the Windows 2000 device driver” on page 18.

Updating the Windows NT device driver

Perform the following steps if you want to replace an existing Windows NT device driver with an updated version.

1. Open a DOS command prompt.
2. Change the current directory to the Windows NT device driver directory. For example, type:

```
CD \WINNT\SYSTEM32\DRIVERS
```
3. Make a backup copy of the old device driver. You can copy the file into the same directory with a .SAV extension, indicating that it is the saved file. For example, type:

```
copy QL2200.SYS QL2200.SAV
```
4. Insert the IBM FAS*t*T Host Adapter device driver for Windows NT diskette that you created in Chapter 4 into your diskette drive.
5. Copy the new device driver over the old device driver. For example, type:

```
copy a:\NT\QL2200.SYS
```

Where *a* is the diskette drive letter.
6. If you are installing drivers from the CD-ROM, type:

```
copy z:\NT4\2200\NT\QL2200.sys
```

Where *z* is the CD-ROM drive letter.
7. Remove the IBM FAS*t*T device drivers for Windows NT diskette or the *IBM FAS*t*T Host Adapter Support* CD.
8. Restart your system to install the device driver.

Updating the Windows 2000 device driver

Perform the following steps if you want to replace the existing Windows 2000 device driver with an updated version.

1. Click **Start** → **Settings** → **System** → **Hardware** → **Device Manager** → **SCSI and RAID Controllers**
2. Select the QLogic adapter you want to update.
3. Click on the adapter and select **Properties**.
4. Select the **Driver** tab.
5. Click the **Update driver** button and follow the instructions that display in the window.

Chapter 6. Installing the NetWare device driver

This section provides instructions for installing the NetWare device driver in an installed Novell NetWare system.

NetWare device driver files and parameters

The following files are provided on the IBM FAStT Host Adapter device drivers diskette that you created in Chapter 4 for the NetWare 5.1 device driver installation:

- NETWARE\QL2200.HAM: Driver for NetWare 5.1
- NETWARE\QL2200.DDI: Installation information file for QL2200.HAM driver
- README.TXT: Helpful hints about the device driver and setting options for NetWare 5.1
- RELEASE.TXT: History of release fixes

Be sure to review the README.TXT file for both new and changed information.

To customize the interface between the device driver and Novell NetWare, load the QL2200.HAM device driver with the following parameters.

Parameter	Description
SLOT	Provides support for multiple IBM FAStT Host Adapters and installs the device driver for each adapter individually. This parameter is mandatory if you have more than one adapter.
/LUN	Enables support for multiple LUN (logical unit number) devices. This parameter is optional.

Installing the NetWare 5.1 device driver

The QL2200.HAM device driver might not be compatible with NetWare versions earlier than 5.1.

Note: You can enter the LOAD command lines in your NetWare STARTUP.NCF file to install the driver automatically when your system starts.

Perform the following steps to install the NetWare 5.1 device driver in a previously installed NetWare system.

1. Insert the IBM FAStT Host Adapter device drivers for NetWare diskette that you created in Chapter 4 in the diskette drive.
2. Copy the QL2200.HAM device driver file from the diskette to the server root directory. For example, type:

```
copy a:\NETWARE\QL2200.HAM c:\NWSERVER\
```

Where *a* is the diskette drive letter and *c* is the root directory.

3. If you are installing the driver from a CD-ROM, type:

```
copy z:\NW51\2200\NETWARE\QL2200.HAM c:\NWSERVER\
```

Where *z* is the CD-ROM drive letter and *c* is the root directory.

4. Install the device driver at the NetWare server prompt (:) by typing the LOAD command with the SLOT parameter.

The following LOAD example works for a default (factory setting) QL2200/2200F adapter.

```
LOAD QL2200.HAM SLOT=X
```

Replace the X in the load line example with the slot identification number of the slot in which the adapter is installed.

5. If you are attaching multiple LUN devices, such as tape changers, add the /LUN switch to the LOAD line. For example, type:

```
LOAD QL2200.HAM SLOT=X /LUN
```

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Appendix A. Fast!UTIL

This appendix provides detailed configuration information for advanced users who want to customize the configuration of the IBM FAStT Host Adapter and the connected devices. You can configure the adapter using the Fast!UTIL utility. Access Fast!UTIL by pressing Alt+Q during the adapter BIOS initialization (it might take a few seconds for the Fast!UTIL menu to appear). If you have more than one IBM FAStT Host Adapter, Fast!UTIL prompts you to select the adapter you want to configure. After changing the settings, Fast!UTIL restarts your system to load the new parameters.

Attention: If the configuration settings are incorrect, your IBM FAStT Host Adapter will not function properly.

Each host adapter has a unique serial number. Take a minute to write down the serial number of the FAStT Host Adapter. In the event that the nonvolatile random access memory (NVRAM) is damaged (see “Scan Fibre Channel devices” on page 28), you will be prompted for the IBM FAStT Host Adapter serial number.

Fast!UTIL options

This section describes the Fast!UTIL options.

Configuration settings

This is the first option on the Fast!UTIL Options menu. These settings configure the Fibre Channel (FC) devices and the IBM FAStT Host Adapter to which they are attached.

Host adapter settings

You can access this option from the Configuration Settings menu. The current default settings for the host adapter are listed in Table 1 and are described immediately following the table.

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

Setting	Options	Default
Host adapter BIOS	Enabled or Disabled	Disabled
Frame size	512, 1024, 2048	2048
Loop reset delay	0–15 seconds	5 seconds
Adapter hard loop ID	Enabled or Disabled	Enabled
Hard loop ID	0–125	125

- **Host adapter BIOS:** When this option is set to Disabled, the ROM BIOS on the IBM FAStT Host Adapter is disabled, freeing space in upper memory. The default is Disabled.

- **Frame size:** Specifies the maximum frame length supported by the IBM FAST Host Adapter. The default size is 2048. If you are using F-Port (point-to-point) connections, the default is best for maximum performance.
- **Loop reset delay:** After resetting the loops, the firmware does not initiate any loop activity for the number of seconds specified in this setting. The default is 5 seconds.
- **Adapter hard loop ID:** Forces the adapter to use the ID specified in the Hard Loop ID setting. The default is Enabled.
- **Hard loop ID:** When the Adapter Hard Loop ID is set to Enabled, the adapter uses the ID specified in this setting. The default ID is 125.

Selectable boot settings

You can access this option from the Configuration Settings menu. When this option is set to Enabled, you can select the node name from which you want to start up (boot). When this option is set to Disabled, the Boot ID and Boot LUN parameters have no effect.

Note: This option applies only to disk devices; it does not apply to CD-ROMs, tape drives, and other nondisk devices.

Adapter hard ID settings

You can access this option from the Configuration Settings menu. It forces the IBM FAST Host Adapter to use the selected hard ID (0–125).

Restore default settings

You can access this option from the Configuration Settings menu. It restores the IBM FAST Host Adapter default settings.

Raw NVRAM data

This option displays the adapter nonvolatile random access memory (NVRAM) contents in hexadecimal format. This is a troubleshooting tool; you cannot modify the data.

Advanced adapter settings

You can access this option from the Configuration Settings menu. The default settings for the host adapter are listed in Table 2 on page 25 and are described immediately following the table.

<i>Table 2. Advanced adapter settings</i>		
Setting	Options	Default
Execution throttle	1–256	256
Fast command posting	Enabled or Disabled	Enabled
>4GByte addressing	Enabled or Disabled	Disabled
LUNs per target	0, 8, 16, 32, 64, 128, 256	8
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
Drivers load RISC code	Enabled or Disabled	Enabled
Enable database updates	Yes or No	No
Disable database load	Yes or No	No
IOCB allocation	1–512 buffers	256 buffers
Extended error logging	Enabled or Disabled	Disabled

- **Execution throttle:** Specifies the maximum number of commands executing 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 1–256. The default (optimum) is 256.
- **Fast command posting:** Decreases command execution time by minimizing the number of interrupts. The default is Enabled.
- **>4GByte addressing:** Enable this option when the system has more than 4 GB of memory available. The default is Disabled.
- **LUNs per target:** Specifies the number of LUNs per target. Multiple logical unit number (LUN) support is typically for redundant array of independent disks (RAID) enclosures that use LUNs to map drives. The default is 8. If you do not need multiple LUN support, set the number of LUNs to 0.
- **Enable LIP reset:** 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 login:** Instructs the ISP chip to log in to all ports after any LIP. The default is Yes.
- **Enable target reset:** Enables the drivers to issue a Target Reset command to all devices on the loop when a SCSI Bus Reset command is issued. The default is No.
- **Login retry count:** Specifies the number of times the software tries to log in to a device. The default is 30 retries.

- **Port down retry count:** Specifies the number of times the software retries a command to a port that is returning port-down status. The default is 30 retries.
- **Drivers load RISC code:** When this option is set to Enabled, the host adapter uses the RISC firmware that is embedded in the software device driver. When this option is set to Disabled, the software device driver loads the RISC firmware found on the system. The default is Enabled.

Note: To load the embedded device driver software, the device driver being loaded must support this setting. If the driver does not support this setting, the result is the same as if this option is set to Disabled, regardless of the setting. Leaving this option enabled ensures a certified combination of software driver and RISC firmware.
- **Enable database updates:** When this option is set to Enabled, it allows the software to save the loop configuration information in flash memory as the system powers down. The default is No.
- **Disable database load:** When this option is set to Enabled, the device database is read from the Registry during driver initialization. When this option is set to Disabled, the device database is created dynamically during device driver initialization. The default is No.

Note: This option usually applies to the Windows NT and Windows 2000 operating environments.
- **IOCB allocation:** Specifies the maximum number of buffers from the firmware buffer pool that are allocated to any one port. The default setting is 256 buffers.
- **Extended error logging:** Provides additional error and debug information to the operating system. When this option is set to Enabled, events are logged into the Windows NT Event Viewer or Windows 2000 Event Viewer (depending on the environment you are in). The default is Disabled.

Extended firmware settings

You can access this option from the Configuration Settings menu. The default settings for the host adapter are listed in Table 3 on page 27 and are described immediately following the table.

<i>Table 3. Extended firmware settings</i>		
Setting	Options	Default
Extended control block	Enabled or Disabled	Enabled
RIO operation mode	0, 1, 2, 3, 4	0
Connection options	0, 1, 2, 3	3
NonParticipating hard ID	Enabled or Disabled	Disabled
Class 2 service	Enabled or Disabled	Disabled
ACK0	Enabled or Disabled	Disabled
Fibre Channel tape support	Enabled or Disabled	Disabled
Fibre Channel confirm	Enabled or Disabled	Disabled
Command reference number	Enabled or Disabled	Disabled
Read transfer ready	Enabled or Disabled	Disabled
Response timer	0–255	0
Interrupt delay timer	0–255	0

- **Extended control block:** Enables all other extended firmware settings. The default is Enabled.
- **RIO operation mode:** Specifies the reduced interrupt operation (RIO) modes, if supported by the software device driver. RIO modes enable posting multiple command completions in a single interrupt (see Table 4). The default is 0.

<i>Table 4. RIO operation modes</i>	
Option	Operation mode
0	No multiple responses
1	Multiple responses, 16-bit handles, interrupt host
2	Multiple responses, 32-bit handles, interrupt host
3	Multiple responses, 16-bit handles, delay host interrupt
4	Multiple responses, 32-bit handles, delay host interrupt

- **Connection options:** Defines the type of connection (loop or point-to-point) or connection preference (see Table 5 on page 28). The default is 3.

<i>Table 5. Connection options</i>	
Option	Type of connection
0	Loop only
1	Point-to-point only
2	Loop preferred; otherwise, point-to-point
3	Point-to-point; otherwise, loop

- **NonParticipating hard ID:** This setting is reserved. The default is Disabled.
- **Class 2 service:** Enables Class 2 service parameters to be provided during all automatic logins (loop ports). The default is Disabled.
- **ACK0:** Determines the type of acknowledgment (ACK) used. When this option is set to Enabled, sequence ACK is used. When this option is set to Disabled, frame ACK is used. The default is Disabled.
Note: You must enable the Class 2 service setting to use the ACK0 setting.
- **Fibre Channel tape support:** This setting is reserved for Fibre Channel tape support. The default is Disabled.
- **Fibre Channel confirm:** This setting is reserved for Fibre Channel tape support. The default is Disabled.
- **Command reference number:** This setting is reserved for Fibre Channel tape support. The default is Disabled.
- **Read transfer ready:** This setting is reserved. The default is Disabled.
- **Response timer:** Contains the value (in 100-microsecond increments) used by a timer to limit the wait time for accumulating multiple responses. For example, if this field is 8, the time limit is 800 microseconds. The default is 0.
- **Interrupt delay timer:** Contains the value (in 100-microsecond increments) used by a timer to set the wait time between accessing (DMA) a set of handles and generating an interrupt. The default is 0.

Scan Fibre Channel devices

Use this option to scan the Fibre Channel loop and list all the connected devices by loop ID. Information about each device is listed, for example, vendor name, product name, and revision. This information is useful when configuring your IBM FASTt Host Adapter and attached devices.

Fibre Channel disk utility

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.

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

Select host adapter

Use this option to select a specific adapter if you have multiple adapters in your system.

Appendix B. Adapter operating environment and specifications

This appendix contains the IBM FASTT Host Adapter operating environment and specification information.

<i>Table 6. Adapter operating environment</i>		
Environment	Minimum	Maximum
Operating temperature	0°C (32°F)	55°C (131°F)
Storage temperature	-20°C (-4°F)	70°C (158°F)
Relative humidity (noncondensing)	10%	90%
Storage humidity (noncondensing)	5%	95%

<i>Table 7 (Page 1 of 2). Adapter specifications</i>	
Type	Specification
Host bus	Conforms to PCI Local Bus Specification, revision 2.2
PCI signaling environment	3.3 V and 5.0 V buses supported
PCI transfer rate	<ul style="list-style-type: none"> • 264 MB per second maximum burst rate for 33 MHz operation (ISP2200A chip) • Supports dual address bus cycles
Fibre Channel specifications	<ul style="list-style-type: none"> • Bus type: fibre optic media (shortwave 50 micron) • Bus transfer rate: 100 MB per second maximum (200 full-duplex) • Supports both FCP-SCSI and IP protocols • Supports point-to-point fabric connection: F-Port Fabric Login • Supports FCAL public loop profile: FL-Port Login • Supports Fibre Channel services class 2 and 3 • FCP SCSI initiator and target operation • Full-duplex operation
Processor	Single chip design that includes a RISC processor, Fibre Channel protocol manager, PCI DMA controller, and 1-gigabit transceivers
Host data transfer	64-bit, bus master DMA data transfers to 528 MB per second
RAM	128 KB of SRAM
BIOS ROM	128 KB of flash ROM in two 64 KB, software selectable banks. The flash is field programmable.
NVRAM	256 bytes, field programmable
Onboard DMA	Three independent DMA channels: two data and one command. Integrated 4 KB frame buffer FIFO for each data channel
Connectors (external)	<ul style="list-style-type: none"> • SC-style connector that supports non-OFC, multimode fibre optic cabling using 1 x 9 fibre optic transceiver module • Total cable length cannot exceed 500 meters • Two three-position, point-to-point cable (internal)
Form factor	17.8 cm x 10.7 cm (7.0 in. x 4.2 in.)
Operating power	Less than 15 watts

Table 7 (Page 2 of 2). Adapter specifications

Type	Specification
Other compliance	<ul style="list-style-type: none">• PCI 98, including ACPI• Less than 28% processor utilization as measured in a TPCC benchmark• Operation system support for Windows NT version 4, Windows 2000 version 1, and NetWare version 5.1• Worldwide agency compliance as defined for IBM @server xSeries products• 100% Plug and Play compatibility with our existing FAST Fibre Channel RAID Controller

Appendix C. Getting help, service, and information

If you need help, service, technical assistance, or just want more information about IBM products, you will find a wide variety of sources available from IBM to assist you.

With the original purchase of an IBM hardware product, you have access to extensive support coverage. During the IBM hardware product warranty period, you may call the IBM Personal Computer HelpCenter (1-800-772-2227 in the U.S.) for hardware product assistance covered 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.
- Engineering Change Management - Occasionally, there might be changes that are required after a product has been sold. IBM or your reseller, if authorized by IBM, will make Engineering Changes (ECs) available that apply to your hardware.

Be sure to retain your proof of purchase to obtain warranty service. Refer to the IBM hardware warranty for a full explanation of IBM's warranty terms.

Please have the following information ready when you call:

- Machine Type and Model
- Serial numbers of your IBM hardware products
- Description of the problem
- Exact wording of any error messages
- Hardware and software configuration information

On the World Wide Web, the IBM Personal Computing Web site has up-to-date information about IBM Personal Computer products and support.

Some helpful addresses are:

http://www.ibm.com	Main IBM home page
http://www.ibm.com/pc	IBM Personal Computing
http://www.ibm.com/pc/support	IBM Personal Computing Support
http://www.ibm.com/pc/us/accessories	Options by IBM (U.S.)
http://www.ibm.com/pc/us/eserver/xseries	IBM xSeries Servers (U.S.)
http://www.ibm.com/pc/techconnect	IBM TechConnect

You can select a country-specific Web site from these pages.

If you select Profile from the support page, you can create a customized support page that is specific to your hardware, complete with Frequently Asked Questions, Parts Information, Technical Hints and Tips, and Downloadable Files. You will have the information you need, all in one place. In addition, you can choose to receive e-mail notifications whenever new information becomes available about your registered products. You also can access online support forums, which are community sites monitored by IBM support staff.

Appendix D. Product warranties and notices

This appendix contains warranty statements, emission notices, trademarks, and general-information notices.

Warranty Statements

The warranty statements consist of two parts: Part 1 and Part 2. Part 1 varies by country. Part 2 is the same for both statements. Be sure to read both the Part 1 that applies to your country and Part 2.

- **United States, Puerto Rico, and Canada (Z125-4753-05 11/97)**
(Part 1 - General Terms on page 35)
- **Worldwide except Canada, Puerto Rico, Turkey, and United States (Z125-5697-01 11/97)**
(Part 1 - General Terms on page 37)
- **Worldwide Country-Unique Terms**
(Part 2 - Country-Unique Terms on page 39)

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Machine - IBM FASiT Host Adapter

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IBM warrants that each Machine 1) is free from defects in materials and workmanship and 2) conforms to IBM's Official Published 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.

During the warranty period IBM or your reseller, if approved by IBM to provide warranty service, will provide repair and exchange service for the Machine, without charge, under the type of service designated for the Machine and will manage and install engineering changes that apply to the Machine.

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. The replacement may not be new, but will be in good working order.

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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

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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.

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2. the amount of any other actual direct damages, up to the greater of U.S. \$100,000 (or equivalent in local currency) or the charges (if recurring, 12 months' charges apply) for the Machine that is the subject of the claim.

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Machine - IBM FAST Host Adapter

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During the warranty period IBM or your reseller, if approved by IBM to provide warranty service, will provide repair and exchange service for the Machine, without charge, under the type of service designated for the Machine and will manage and install engineering changes that apply to the Machine.

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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.

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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 fulfil their obligations, and

d. inform IBM or your reseller of changes in a Machine's location.

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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.

Production Status

Each IBM Machine is manufactured from new parts, or new and used parts. In some cases, the Machine may not be new and may have been previously installed. Regardless of the Machine's production status, IBM's appropriate warranty terms apply.

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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), IBM is liable for no more than

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Part 2 - Worldwide Country-Unique Terms

ASIA PACIFIC

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 legislation and are only limited to the extent permitted by the applicable legislation.

Extent of Warranty: The following replaces the first and second sentences of this Section: The warranty does not cover the repair or exchange of a Machine resulting from misuse, accident, modification, unsuitable physical or operating environment, operation in other than the Specified Operating Environment, improper maintenance by you, or failure caused by a product for which IBM is not responsible.

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, 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.

PEOPLE'S REPUBLIC OF CHINA: Governing Law: The following is added to this Statement: The laws of the State of New York govern this Statement.

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

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.

EUROPE, MIDDLE EAST, AFRICA (EMEA)

The following terms apply to all EMEA countries.

The terms of this Statement of Warranty apply to Machines purchased from an IBM reseller. If you purchased this Machine from IBM, the terms and conditions of the applicable IBM agreement prevail over this warranty statement.

Warranty Service

If you purchased 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 purchased 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.

The applicable laws, Country-unique terms and competent court for this Statement are those of the country in which the warranty service is being provided. However, the laws of Austria govern this Statement if the warranty service is provided in Albania, Armenia, Belarus, Bosnia and Herzegovina, Bulgaria, Croatia, Czech Republic, Federal Republic of Yugoslavia, Georgia, Hungary, Kazakhstan, Kirghizia, Former Yugoslav Republic of Macedonia (FYROM), Moldova, Poland, Romania, Russia, Slovak Republic, Slovenia, and Ukraine.

The following terms apply to the country specified:

EGYPT: Limitation of Liability: The following replaces item 2 in this Section:

2. 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.

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: 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 are 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.

Production Status: The following paragraph replaces this Section:

Each Machine is newly manufactured. It may incorporate in addition to new parts, re-used parts as well.

Limitation of Liability: The following is added to this Section:

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

In item 2, replace "U.S. \$100,000" with "1.000.000 DEM."

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

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

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 the greater of Irish Pounds 75,000 or 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: (item 1 unchanged) 2) as to any other actual damage arising in all situations involving non-performance 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 second 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.

TURKIYE: Production Status: The following replaces this Section:

IBM fulfils customer orders for IBM Machines as newly manufactured in accordance with IBM's production standards.

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 the greater of Pounds Sterling 150,000 or 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 will be limited to damages.

NORTH AMERICA

CANADA: Warranty Service: The following is added to this Section:
To obtain warranty service from IBM, call **1-800-565-3344**. In Toronto, call **416-383-3344**.

UNITED STATES OF AMERICA: Warranty Service: The following is added to this Section:
To obtain warranty service from IBM, call **1-800-772-2227**.

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

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Federal Communications Commission (FCC) Statement

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

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

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

Industry Canada Class A emission compliance statement

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

Avis de conformité à la réglementation d'Industrie Canada

Cet appareil numérique de 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 community directive conformance statement

This product is in conformity with the protection requirements of EC Council Directive 89/336/EEC on the approximation of the laws of the Member States relating to electro-magnetic compatibility.

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.

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Part Number: 25P1663

Printed in U.S.A.

March 2001

25P1663

