



IBM FAStT EXP500

Installation and User's Guide



IBM FAStT EXP500

Installation and User's Guide

Note: Before using this information and the product it supports, be sure to read the general information under Appendix B, "Warranty information" on page 47 and Appendix C, "Notices" on page 59.

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Safety information



Before installing this product, read the Safety Information.

قبل تركيب هذا المنتج، يجب قراءة الملاحظات الأمنية

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

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

安裝本產品之前，請先閱讀「安全資訊」。

Prije instalacije ovog produkta obavezno pročitajte Sigurnosne Upute.

Před instalací tohoto produktu si přečtěte příručku bezpečnostních instrukcí.

Læs sikkerhedsforskrifterne, før du installerer dette produkt.

Lees voordat u dit product installeert eerst de veiligheidsvoorschriften.

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

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

Vor der Installation dieses Produkts die Sicherheitshinweise lesen.

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

לפני שתתקינו מוצר זה, קראו את הוראות הבטיחות.

A termék telepítése előtt olvassa el a Biztonsági előírásokat!

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

製品の設置の前に、安全情報をお読みください。

본 제품을 설치하기 전에 안전 정보를 읽으십시오.

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

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

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

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

Перед установкой продукта прочтите инструкции по технике безопасности.

Pred inštaláciou tohto zariadenia si 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.

Statement 1



DANGER

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

To avoid a shock hazard:

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

To Connect:

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.

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

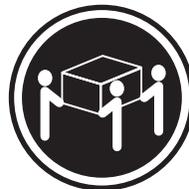
Some laser products contain an embedded Class 3A or Class 3B laser diode. Note the following.

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

Statement 4



≥18 kg (39.7 lb)



≥32 kg (70.5 lb)

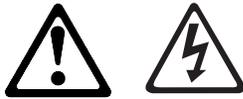


≥55 kg (121.2 lb)

CAUTION:

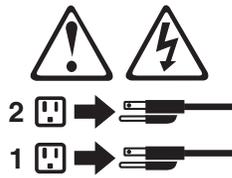
Use safe practices when lifting.

Statement 5

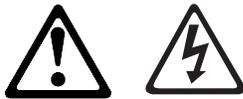


CAUTION:

The power control button on the device and the power switch on the power supply do not turn off the electrical current supplied to the device. The device also might have more than one power cord. To remove all electrical current from the device, ensure that all power cords are disconnected from the power source.

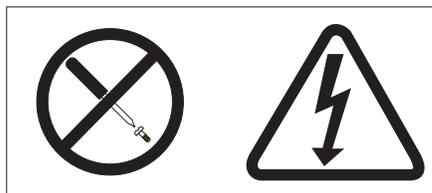


Statement 8



CAUTION:

Never remove the cover on a power supply or any part that has the following label attached.



Hazardous voltage, current, and energy levels are present inside any component that has this label attached. There are no serviceable parts inside these components. If you suspect a problem with one of these parts, contact a service technician.

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 replacing options in your IBM® Fibre Array Storage Technology (FAStT) EXP500 storage expansion unit. It also provides information on troubleshooting your expansion unit. To set up your expansion unit, refer to Chapter 2, “Installing the expansion unit” on page 11 for detailed information.

How this book is organized

Chapter 1, “Introduction” on page 1, describes the expansion unit. This chapter includes an inventory checklist and an overview of the expansion unit features and components.

Chapter 2, “Installing the expansion unit” on page 11, contains the information and instructions needed to install the expansion unit in an EIA standard rack. Operating specifications, tray switch settings, and power-cord routing information are also included.

Chapter 3, “Installing and replacing devices” on page 21, contains step-by-step instructions for installing and removing customer replaceable units (CRUs), such as hard disk drives, power supplies, ESM boards, and fans. In addition, this chapter contains instructions for turning on and turning off the expansion unit during normal and emergency situations.

Chapter 4, “Solving problems” on page 39, contains the problem symptoms and error messages that are specific to your expansion unit. This chapter also provides instructions on how to obtain service and technical assistance for your expansion unit and other IBM products that you might plan to use.

Chapter 5, “Getting help and technical assistance” on page 43, contains information about how to get help, service, or technical assistance.

Appendix A, “Records” on page 45, provides a section to record and update important information about your expansion unit, including serial number and device records. Whenever you add options to your expansion unit, be sure to update the information in this appendix.

Appendix B, “Warranty information” on page 47, contains product warranty information.

Appendix C, “Notices” on page 59, contains product notices and trademark information.

Notices used in this book

The caution and danger statements used in this book also appear in the multilingual Safety Information book provided with the IBM FAStT EXP500. Each caution and danger statement is numbered for easy reference to the corresponding statements in the safety book.

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

- **Note:** 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 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.

Chapter 1. Introduction

The IBM Fibre Array Storage Technology (FAStT) EXP500 storage expansion unit is a compact unit that provides high-capacity, Fibre Channel (FC) disk storage. It delivers fast, high-volume data transfer, retrieval, and storage functions across multiple drives, to multiple hosts. The expansion enclosure is designed for continuous, reliable service; the modular, redundant disk drives, power supplies, ESM boards, and fans use hot-swap technology for easy replacement without shutting down the system.

The FAStT EXP500 FC expansion unit supports redundant, dual-loop configurations. Optional external FC cables and gigabit interface converters (GBICs) connect the controller to the expansion unit.

You can connect FAStT EXP500 FC expansion units together to support a large number of disk drives on a Fibre Channel loop. Refer to your controller documentation for additional information on how many expansions units can be supported on a single loop.

Designed for easy installation and integration into the Microsoft® Windows® NT® environment, the expansion unit supports FC technology for the host and drive interfaces.

After you review the introductory information provided in this chapter, see Chapter 2, "Installing the expansion unit" on page 11 to begin the installation process.

This chapter contains:

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Getting help on the World Wide Web	2
FAStT EXP500 bays	3
Hot-swap drive bays	3
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Features at a glance

The following table summarizes the features of the expansion unit. For a list of the operating specifications, such as weight, height, and heat output, see Table 2 on page 12.

General <ul style="list-style-type: none">• Modular components:<ul style="list-style-type: none">– High-capacity disk drives– Environmental services monitor (ESM) boards– Power supplies– Cooling fans• Technology:<ul style="list-style-type: none">– Supports disk arrays– Supports clustering– Fibre Channel host interface– Redundant data storage, cooling system, power system, and ESM boards– Hot-swap technology for drives, power supplies, fans, and ESM boards	<ul style="list-style-type: none">• User interface:<ul style="list-style-type: none">– Built-in power, activity, and fault indicators– Identification labeling on customer replaceable units (CRUs), rear indicator lights, switches, and connectors– Easy-to-replace drives, power supplies, ESM boards, and fans Disk drive storage <p>Maximum drives per expansion unit: 10</p>	ESM boards <ul style="list-style-type: none">• Technology and interfaces:<ul style="list-style-type: none">– Fibre Channel: 40-pin FC disk drives– Fibre Channel interface: Four, GBICs connectors for incoming and outgoing FC cables (two GBICs on each ESM board)
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Table 1. Features at a glance

Clustering support

Clustering is a means of sharing array groups among controllers to provide redundancy of controllers and servers. This redundancy is important if a hardware component fails. If a hardware component failure occurs after clustering has been set up, another server will take ownership of the array group.

Clustering requires additional hardware and specialized software. For more information about clustering, go to <http://www.ibm.com/pc/ww/eserver/xseries/clustering/>.

Getting help on the World Wide Web

You can obtain up-to-date information about your IBM FAST EXP500, a complete listing of the options that are supported on your model, and information about other IBM server products on the World Wide Web. For more information, see Chapter 5, “Getting help and technical assistance” on page 43.

FASTT EXP500 bays

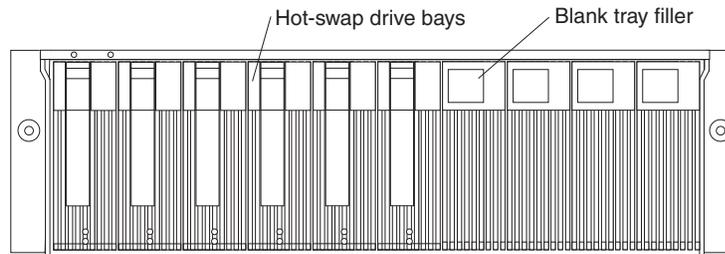
The following sections show the hot-swap CRUs on the FASTT EXP500 expansion unit.

The hot-swap features of the FASTT EXP500 expansion unit enable you to remove and replace hard disk drives, power supplies, ESM boards, and fans without turning off the expansion unit. Therefore, you can maintain the availability of your system while a hot-swap device is removed, installed, or replaced.

Hot-swap drive bays

The following illustration shows the location of the hot-swap drive bays accessible from the front of your expansion unit. The FASTT EXP500 supports up to 10 (half-high or slim-line) 40-pin FC hard disk drives. These drives come preinstalled in drive trays. This drive-and-tray assembly is called a *drive CRU* (customer replaceable unit). You can install the drive CRUs in the 10 drive bays on the front of the expansion unit.

In this example illustration, six of the 10 bays contain drive CRUs and four bays contain blank tray fillers. To maintain proper cooling within your expansion unit, always keep a blank tray filler in each drive bay that does not contain a drive CRU. For information on installing and replacing drive CRUs, refer to Chapter 3, “Installing and replacing devices” on page 21.

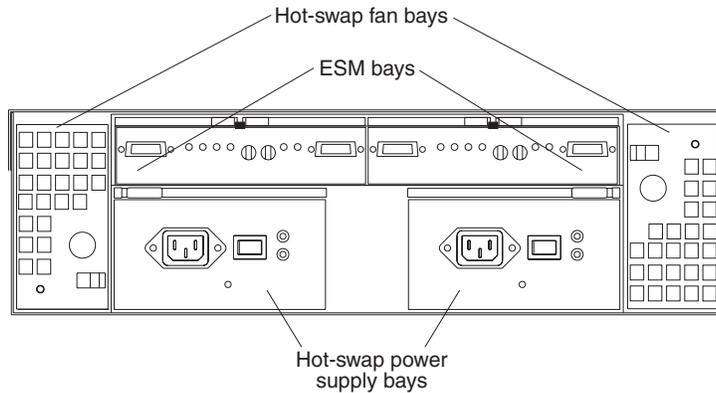


Attention:

Never hot swap a drive CRU when its green Activity LED is flashing. Hot swap a drive CRU only when its amber Fault LED is completely on and not flashing or when the drive is inactive with the green Activity LED completely on and not flashing.

Fan, ESM, and power supply bays

The following illustration shows the location of the hot-swap fan bays, the hot-swap environmental services monitor (ESM) bays, and the hot-swap power supply bays.



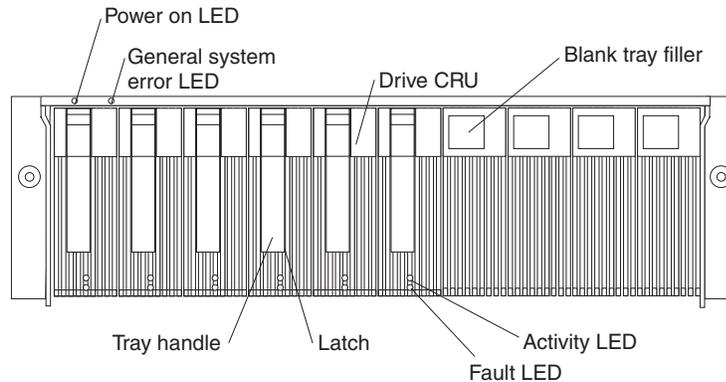
ESM bays: Your expansion unit comes with two hot-swappable ESM boards. The environmental services monitor (ESM) boards provide a 1 gigabit FC interface to the drives and monitors the overall status of the expansion unit. Each ESM board has two GBIC connector ports for connecting your expansion unit to the controller or connecting two or more FAST EXP500 expansion units together. The ESM boards provide redundancy when both boards are configured into redundant FC loops. Refer to your FC controller documentation to determine if the controller supports this redundancy function.

Hot-swap fan bays: Your expansion unit has two interchangeable hot-swap and redundant fan units. Each unit contains two fans. If one fan unit fails, the second fan unit continues to operate. Both fan units must be installed to maintain proper cooling within your expansion unit, even if one fan unit is not operational.

Hot-swap power supply bays: Your expansion unit comes with two hot-swap and redundant power supplies. Both power supplies must be installed to maintain proper cooling within your expansion unit, even if one power supply is not operational.

Front controls and indicators

The primary controls on the front of the expansion unit are shown in the following illustration.



Activity LED: Each drive CRU has an Activity LED. When flashing, this green LED indicates drive activity. When completely on, this green LED indicates the drive is properly installed.

Blank tray filler: Expansion units shipped without a full set of drives (10) contain blank trays in the unused drive bays. Before installing new drives, you must remove the blank trays and save them. Each of the 10 bays must always contain either a blank tray or a drive CRU. Each blank tray contains a filler piece for use with a slim-line drive.

Drive CRU: You can install up to 10 hot-swap drive CRUs (customer replaceable units) in the expansion unit. Each drive CRU consists of a hard disk drive and tray.

Fault LED: Each drive CRU has a Fault LED. When lit, this amber LED indicates a drive failure. When flashing, this amber LED indicates that a drive Identify or Rebuild process is in progress.

General system error LED: When lit, this amber LED indicates that the unit has a fault, such as in a power supply, fan unit, or hard disk drive.

Latch: This multipurpose blue latch releases or locks the drive CRU in place.

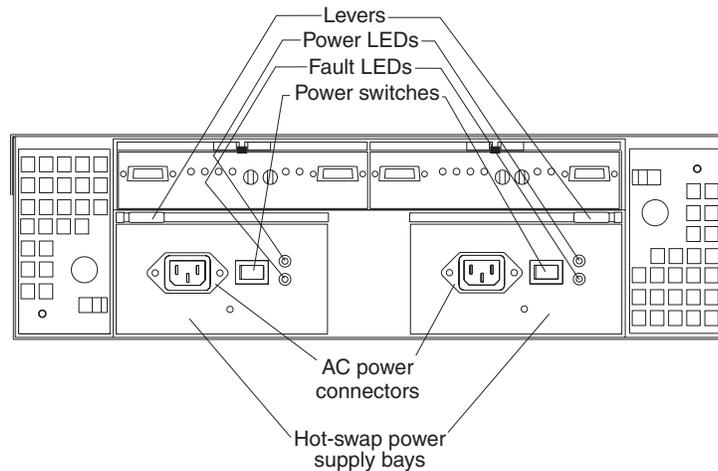
Power-on LED: When lit, this green light indicates that the unit has good dc power.

Tray handle: You can use this multipurpose handle to insert and remove a drive CRU in the bay.

Rear controls, indicators, and connectors

Two hot-swap power supply CRUs, two hot-swap fan CRUs, and two environmental services monitor (ESM) boards are accessible from the back of the expansion unit. These components contain several controls, indicators, and connectors.

Power supply controls, indicators, and connectors



AC power connectors: The power cords for the power supplies connect here.

Fault LEDs: These amber Fault LEDs light if a power supply failure occurs or if the power supply is turned off.

Levers: Use these locking handles to remove or install a power supply.

Power LEDs: These green LEDs light when the expansion unit is turned on and receiving ac power.

Power supply CRUs: The two hot-swap power supplies are located here. Both power supply CRUs must be installed, even if one power supply is not operational.

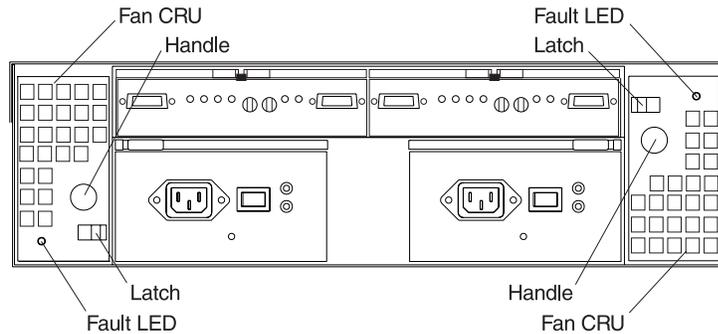
Power switches: Use these switches to turn the power supplies on and off. You must turn both switches on to take advantage of the redundant power supplies.

Fan controls and indicators

The fans in your FAStT EXP500 are hot-swappable and redundant. This means that your FAStT EXP500 will continue to operate if a fan fails. It also means that you can remove and replace the fan while the FAStT EXP500 is on and accessing drives.

Attention:

The fans in your expansion unit draw in fresh air and force out hot air. These fans are hot-swappable and redundant; however, when one fan fails, the fan unit must be replaced within 48 hours in order to maintain redundancy and optimum cooling. When you replace the failed unit, be sure to install the second fan within 10 minutes to prevent any overheating due to the lack of the additional fan unit.

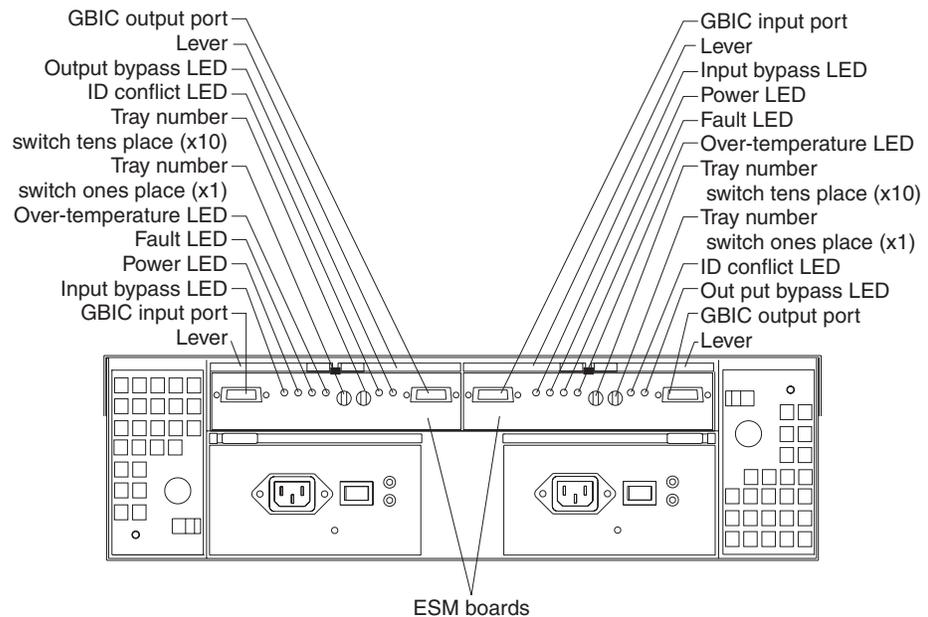


Fan CRUs: The two fan CRUs are located here. These fans are hot-swappable and redundant.

Fault LEDs: These amber LEDs light when a fan failure occurs.

Latches and handles: Use the latches and handles to remove or install the fan CRUs.

ESM boards user controls



ESM boards: The environmental services monitor (ESM) boards contain the expansion unit controls, switches, and LEDs. Each ESM board has two GBIC ports for connecting the expansion unit to the controller.

Fault LEDs: These amber LEDs light when an ESM board failure occurs.

GBIC input ports: The two GBIC input ports are for attaching the optional GBICs to the expansion unit.

GBIC output ports: The two GBIC output ports are for attaching the optional GBICs to the expansion unit.

The optional GBICs (input and output) are for attaching your optical cables to the expansion unit, then to the controller or additional expansion units. Insert the GBICs in the expansion unit GBIC ports and attach your FC cables to the GBICs, then connect the FC cables to the controller or additional expansion units.

ID conflict LEDs: These amber LEDs light if the expansion unit tray ID settings for the ESM boards do not match. In this case, the expansion unit uses the tray number of the left ESM board.

Input/Output bypass LEDs: These amber LEDs light when no valid input signal is detected and when no data is passed through the port. When no cable is connected to the port, the LEDs also light. Both ports on the ESM board are bypassed and the LEDs are lit in the event of an ESM board fault. In this case, the ESM Fault LED is also lit.

Levers: Use these levers when removing and inserting the ESM boards.

Power LEDs: These green LEDs are lit when there is power to the ESM board.

Over-temperature LEDs: These amber LEDs light if the expansion unit overheats.

Tray number switches: These switches assign the physical addresses of the disk drives and the system management processors that are participating in the loop, and they identify the FAST EXP500 expansion unit. The base switch (x1) sets the IDs of the disk drives on the loop. The settings of both the base ID switch (x1) and the extended ID switch (x10) together is the expansion unit ID. The switches set the expansion unit ID using values of 00–99. The base ID switch (x1) is for the ones position and the extended ID switch (x10) is for the tens position.

System-management software support

The FAST EXP500 expansion unit meets the SES (SCSI-3 Enclosure Service) industry standards for external enclosures. The level of system management support is dependent upon the software and services provided by the FC controller. Refer to your controller documentation for additional information on the level of system management support provided.

Chapter 2. Installing the expansion unit

This chapter contains the information needed to install the expansion unit in an Electronic Industries Association (EIA) standard rack cabinet.

You will need a flat-blade and a Phillips screwdriver to install your expansion unit. The rack cabinet comes with general installation instructions for installing optional devices.

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Removing CRUs	14
Setting the interface options	15
Installing the expansion unit in a rack cabinet	16
Completing the installation	19
Installing identification labels	19
Cabling the expansion unit	19

Operating specifications

The following table summarizes the operating specifications of the expansion unit.

<p>Size (with front panel and without mounting rails)</p> <ul style="list-style-type: none"> • Depth: 56.3 cm (22.2 in) • Height: 12.8 cm (5 in) • Width: 44.7 cm (17.6 in) <p>Weight</p> <ul style="list-style-type: none"> • Standard expansion unit as shipped: 25 kg (54.5 lbs) • Typical expansion unit fully loaded: 35.5 kg (78 lbs) <p>Electrical input</p> <ul style="list-style-type: none"> • Sine-wave input (50 to 60 Hz) is required • Input Voltage: <ul style="list-style-type: none"> – Low range: <ul style="list-style-type: none"> - Minimum: 90 V ac - Maximum: 127 V ac – High range: <ul style="list-style-type: none"> - Minimum: 198 V ac - Maximum: 257 V ac – Input kilovolt-amperes (kVA) approximately: <ul style="list-style-type: none"> - Minimum configuration: 0.06 kVA - Maximum configuration: 0.36 kVA 	<p>Environment</p> <ul style="list-style-type: none"> • Air temperature: <ul style="list-style-type: none"> – expansion unit on: 10° to 35° C (50° to 95° F) Altitude: 0 to 914 m (3000 ft.) – expansion unit on: 10° to 32° C (50° to 90° F) Altitude: 914 m (3000 ft.) to 2133 m (7000 ft.) • Humidity: <ul style="list-style-type: none"> – 8% to 80% 	<p>Acoustical noise emissions values</p> <p>For open bay (0 drives installed) and typical system configurations (8 hard drives installed).</p> <ul style="list-style-type: none"> – Sound Power (idling): <ul style="list-style-type: none"> - 6.3 bels (open bay) - 6.5 bels (typical) – Sound Power (operating): <ul style="list-style-type: none"> - 6.3 bels (open bay) - 6.6 bels (typical) – Sound Pressure (idling): <ul style="list-style-type: none"> - 47 dBA (open bay) - 49 dBA (typical) – Sound Pressure (operating): <ul style="list-style-type: none"> - 47 dBA (open bay) - 50 dBA (typical) <p>These levels are measured in controlled acoustical environments according ISO 7779 and are reported in accordance with ISO 9296. The declared sound power levels indicate an upper limit, below which a large portion of machines operate. Sound pressure levels in your location might exceed the average 1-meter values stated because of room reflections and other nearby noise.</p>
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Table 2. Expansion unit operating specifications

Inventory checklist

After you unpack your expansion unit, verify that you have the following items:

Hardware:

- IBM FAStT EXP500 storage expansion unit
- Two to four power cords
- Two expansion unit ID (0–9) labels
- Rack-mounting hardware kit (1)
 - Two rails (right and left assembly)
 - Ten M6 black hex-head screws
 - Ten M6 cage nuts
 - Ten M6 clip nuts

Publications:

- IBM FAStT EXP500 Installation and User's Guide* (this book)
- IBM Safety Book*
- Template for installing the expansion unit in a rack cabinet

If an item is missing or damaged, contact your IBM reseller or your IBM marketing representative.

If you have not already done so, review the information in Chapter 1, “Introduction” on page 1 and record your expansion-unit serial number in the table in “Identification numbers” on page 46.

Getting started

Before you begin, review the following tasks and assumptions:

- If you are installing the expansion unit in a rack cabinet, you have already installed the other components in the rack cabinet and moved the rack cabinet to its permanent operating location.
- You have already installed the controllers and appropriate host adapters.
- There are optical Fibre Channel (FC) cables attached to the controllers or other previously installed Fibre Array Storage Technology (FAStT) EXP500 expansion units, ready for final connection to the expansion unit.
- The installation site meets all area, environmental, power, and site requirements for the expansion unit. Refer to the expansion unit requirements listed under “Operating specifications” on page 12.

Preparing the expansion unit

This section explains how to prepare the expansion unit for installation by removing the CRUs (customer replaceable units) and by setting the interface options.

Removing CRUs

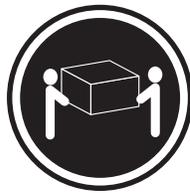
It is easier to lift the expansion unit and install it in a rack cabinet if you remove all CRUs (drives, fans, power supplies, and ESM cards) first. A fully loaded expansion unit with 10 disk drives, two fan units, two ESM boards, and the two power supplies installed weighs 35.5 kg (78 lb). If you remove all the CRUs, you can reduce the overall weight.

Attention:

If you have data stored on the drives, label the drives before you remove them. Then when you replace the drives, install them in the same drive bays from which you removed them. Otherwise, you might lose data.

See Chapter 3, “Installing and replacing devices” on page 21 for the information needed to remove the CRUs.

Statement 4



≥18 kg (39.7 lb)



≥32 kg (70.5 lb)



≥55 kg (121.2 lb)

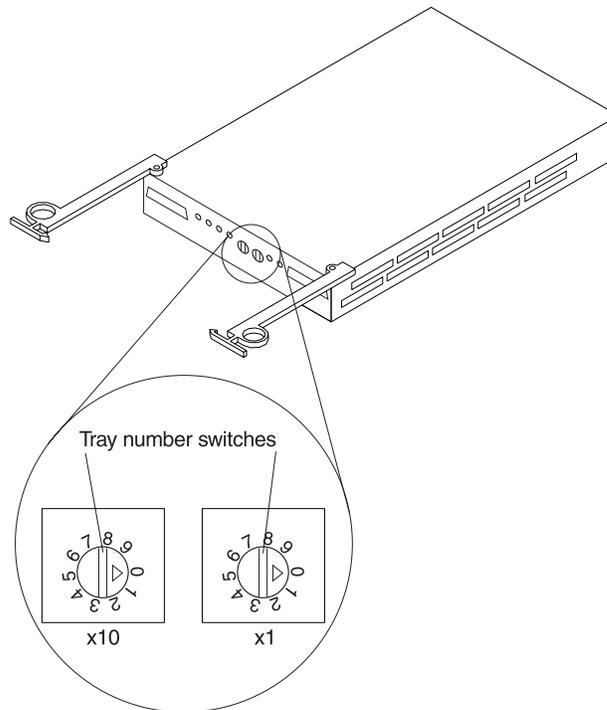
CAUTION:

Use safe practices when lifting.

Setting the interface options

There are two rotary tray number switches on each ESM board located on the back of the expansion unit. It is easier to set these switches before you install the expansion unit in a rack cabinet.

The switch on the left of the ESM board is for the extended ID, which is the tens position (x10). The switch on the right is for the base ID, which is the ones position (x1). The tray number switches have 10 settings. Use these settings (0–9) to identify the ID of the expansion unit.



Fibre Channel (FC) loop and ID settings

When you install a drive CRU in the expansion unit, the drive tray plugs into a printed circuit board called the *midplane*. The midplane sets the Fibre Channel loop ID automatically, based on the setting of the tray number switch and the physical location (bay) of the drive CRU.

Tray number settings

Each ESM board has two tray number switches. These rotary switches (values 0–9) set various addresses and IDs. The base ID switch (x1) is for the ones position and the extended ID switch (x10) is for the tens position. The settings of the two switches, when used together, provide a two-digit ID of the expansion unit. The system management software uses this ID to provide correlation between the system management graphics and the physical expansion unit; the ID identifies which physical unit corresponds to the system management status.

You can set the expansion unit ID to any value from 00–99. Each expansion unit attached to a Fibre Channel controller must have a unique ID.

The base ID switch (x1) also sets the physical IDs of the drives within the expansion unit. Some controllers might require all drives on the FC loop to have a unique, hard-assigned address. Refer to your controller documentation to determine if unique, hard-assigned addresses are required.

For each expansion unit ID, set the tray number for both ESM boards to the same value. Set the tray number for each pair of ESM boards to a unique value. The value must be different from all other pairs of ESM boards attached to the controller.

Attention:

Each expansion unit tray number on both ESM boards must match exactly. Otherwise, the expansion unit might not function properly in the event of an ESM board failure.

Installing the expansion unit in a rack cabinet

The FAStT EXP500 expansion unit requires 3U of EIA rack mounting space. Before installing the expansion unit in a rack cabinet, it is important that you do the following:

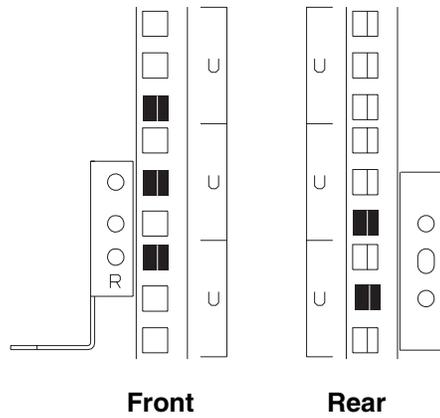
- Review the rack cabinet documentation for safety and cabling considerations. Ensure that your planned installation is within the rack-enclosure guidelines for heat generation, electrical requirements, air flow, and mechanical loading.

Note: Because of the limited space in some rack cabinets, it might be easier to connect and route cables before you install the mounting brackets and hardware devices.

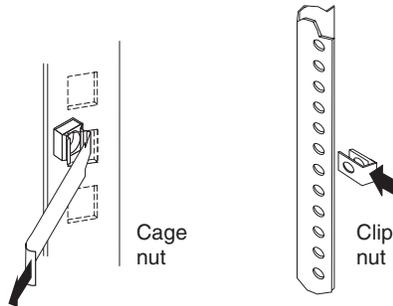
- Install the expansion unit in a maximum 35 degree C environment.
- To ensure proper air flow, position the unit in the rack cabinet so that the air vents are not blocked. Usually 15 cm (6 in.) of air space is sufficient.
- To ensure the rack cabinet stability, load the rack cabinet starting from the bottom.
- If you install multiple components in the rack cabinet, do not overload the power outlets.
- Connect the expansion unit to a properly grounded outlet.

Use the rack-mounting template that comes with the expansion unit to locate the rack mounting holes and install the unit into a rack cabinet. If you misplace the template, you can use the following steps to install your expansion unit:

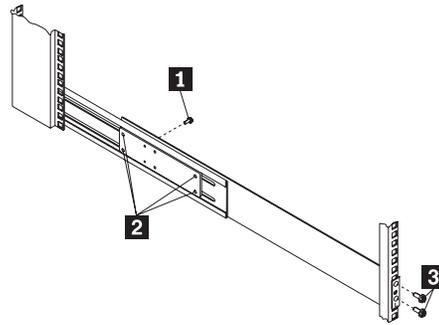
1. Use the following illustration of front and rear rack mounting flanges to determine the appropriate rack mounting holes for installing cage nuts or clip nuts to secure your FAStT EXP500 rails.



Note: Use clip nuts if your rack cabinet has round holes. If your rack has square holes, you can use the rack insertion tool or a flat-blade screwdriver to install cage nuts.

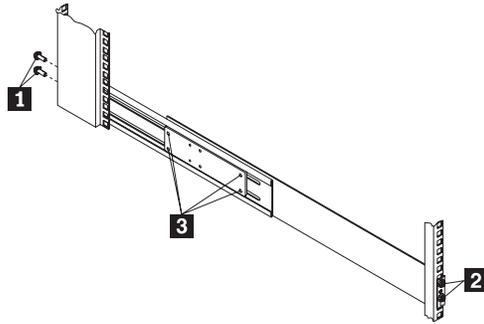


2. On the rail marked L, remove and save the small screw **1**; then, loosen the four large screws **2**.



3. Hold the rail against the outside of the left rack mounting flange and loosely insert the front black hex screws **3**.

4. Extend the rail outside of the rear rack mounting flange; then, install and tighten both rear black hex screws **1**.



5. Tighten the two front screws **2**; then, tighten the four large screws **3**.

Repeat step 2 on page 17 through step 5 to install the rail marked R on the right side of the rack cabinet.

Statement 4



≥18 kg (39.7 lb)



≥32 kg (70.5 lb)

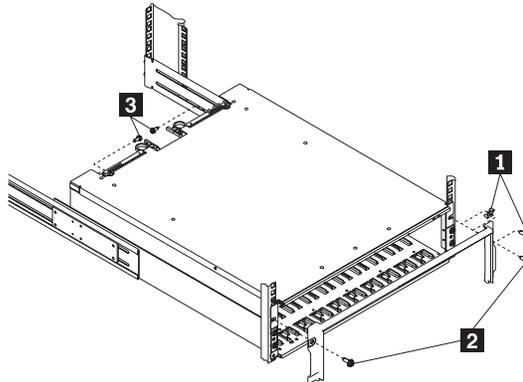


≥55 kg (121.2 lb)

CAUTION:

Use safe practices when lifting.

6. Lift and then slide the expansion unit into the rack cabinet; then, remove and discard both white screws and wing nuts **1** from the bezel.



7. Align the bezel locator pins with the expansion unit; then, secure the bezel and FAST EXP500 with two black hex screws **2**.

8. Use the two small screws **3** (removed in step 2 on page 17) to secure the rear of the expansion unit.

9. Install hard disk drives, fans, ESM boards, and power supplies in the FAStT EXP500 expansion unit according to Chapter 3, “Installing and replacing devices” on page 21; then, return here to complete the installation.
10. Continue with “Completing the installation.”

Completing the installation

This section provides the information needed to complete the installation. Instructions for installing the identification labels and cabling the expansion unit are included.

Installing identification labels

Your expansion unit comes with two expansion unit ID labels.



1. Install the expansion unit ID labels.
 - a. Verify the setting of the tray number switches (0–9).
 - b. Apply the expansion unit ID labels that match the setting for the tray number switches.
2. Continue with “Cabling the expansion unit.”

Cabling the expansion unit

This section provides the FC expansion unit power cabling information. After you attach your expansion unit power cables, use the instruction provided in “Turning the expansion unit on and off” on page 36 for the initial startup of the expansion unit.

The IBM FAStT EXP500 provides redundant loop support. A redundant FAStT EXP500 loop consists of one or more expansion units connected to a host (controller) using two sets of FC cables. If one FC fails, the host will use the other FAStT EXP500 loop to maintain I/O to the FAStT EXP500 array group.

Fibre Channel loop

A Fibre Channel (FC) loop consists of FC disk drives connected to each other and to one or more controllers. A loop can support multiple controllers, a large number of disk drives, and other addressable entities such as system management logic chips. Refer to your controller documentation for information on controller-dependent hardware configuration details. Some controllers might have restrictions on the maximum number of disk drives supported on a loop, cabling restrictions, and other requirements.

GBICs

Your FAStT EXP500 expansion unit supports large, complex and redundant, disk drive loop configurations. Each ESM board has two GBIC ports. These GBIC ports are labeled with an ↑ (input) and a ↓ (output). You build a loop by connecting one or more FAStT EXP500 expansion units to one or more controllers. You then use dual fibre-optical cables to connect one FAStT EXP500 expansion unit to another in a daisy-chain. It takes only one GBIC on the ESM board to connect a single FAStT EXP500 expansion unit to a controller.

Optical Fibre Channel cable restrictions

Controllers that are FC compliant can use any external cable length offered by IBM in any clustered or nonclustered application.

Power cabling

The expansion unit uses two standard power cords. You can connect the power cords to a primary power unit inside the rack cabinet, such as a properly grounded ac distribution unit or uninterruptible power supply (UPS), or to an external source, such as a properly grounded electrical outlet.

If you have not already done so, attach the power supply cord as follows:

1. Wrap the strain relief clamp around the power cord approximately 20 cm (8 in.) from the power supply connection end.
2. Attach the power supply nut and tighten it securely.
3. Connect the power cord to the power supply.
4. Plug the supply power cord into a properly grounded electrical outlet.
5. Go to "Turning the expansion unit on and off" on page 36 for the initial startup of the expansion unit.

Chapter 3. Installing and replacing devices

This chapter provides instructions to help you install or remove customer replaceable units (CRUs), such as hot-swap drives, fans, ESM boards, and power supplies. This chapter also contains instructions for turning the expansion unit on and off.

This chapter contains:

Handling static-sensitive devices	22
Working with hot-swap drives	22
Installing hot-swap drives	23
Replacing hot-swap drives	26
Working with hot-swap power supplies	27
Removing a hot-swap power supply	27
Installing a hot-swap power supply	28
Working with hot-swap ESM boards	30
Working with GBICs	31
Installing GBICs	31
Working with hot-swap cooling fans	35
Turning the expansion unit on and off	36
Turning on the expansion unit	36
Turning off the expansion unit	36
Performing an emergency shutdown	37
Restoring power after an emergency	38

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 in 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 surface.
- Take additional care when handling devices during cold weather because heating reduces indoor humidity and increases static electricity.

Working with hot-swap drives

Before you begin

- Read the safety and handling guidelines provided in “Safety information” on page v and “Handling static-sensitive devices.”
- Ensure that your current system configuration is working properly.
- Back up all important data before you make changes to storage devices, such as hard disk drives.

Drives are devices that your system uses to store and retrieve data. This section explains how you can increase the expansion unit capacity by adding more drives or replacing existing drives with ones containing a larger capacity.

Before you install or remove drive CRUs, review the following information:

- **Blank trays:**
Expansion units without a full set of drives (10) contain blank trays in the unused drive bays. Before installing new drives, you must remove the empty trays. Save the empty trays for future use. Each of the 10 bays must always contain either a blank tray or a drive CRU. Each blank tray contains a filler piece for use with a half-high or slim-line drive.

- **Drive CRUs:**

Your expansion unit supports IBM Fibre Channel (FC) hard disk drives. These IBM drives come preinstalled in a drive tray, ready for installation. (Do not detach the drive from the tray.) This drive and tray assembly is called a *drive CRU* (customer replaceable unit). You can install the drive CRUs directly into the 10 drive bays on the front of the expansion unit.

- **Drive CRU labels:**

A label is provided on the front of the drive CRU tray. Use this label to record the location information for each drive *before* you remove it. Ensure that you keep track of the drives and their corresponding bays. Also, record the location information in Table 4 on page 46. (If you reinstall a drive in the wrong bay, you might lose data.)

- **Drive LEDs:**

Each drive tray has two LEDs, which indicate the status for that particular drive. The drive LED states and descriptions are as follows.

LED	LED State	Definitions
Activity LED	Green flashing	The green light flashes to indicate FC activity to the drive.
Activity LED	Green on	The green light is on to indicate the drive is properly installed.
Fault LED	Amber flashing	The amber light flashes to indicate a drive rebuild is under way, or that a drive has been identified by software.
Fault LED	Amber on	The amber light is on to indicate a drive failure.

- **Fibre Channel loop IDs:**

When you install a drive CRU in the expansion unit, the drive tray plugs into a printed circuit board called the *midplane*. The midplane sets the Fibre Channel loop ID automatically, based on the setting of the tray number switch and the physical location (bay) of the drive CRU.

- **Hot-swap hardware:**

Your expansion unit contains hardware that enables you to replace a failed hard disk drive without turning off the expansion unit. Therefore, you have the advantage of continuing to operate your system while a hard disk drive is removed or installed. These drives are known as *hot-swap* drives.

- **Slim-line drives:**

You can install slim-line, hot-swap drive CRUs, which are slightly smaller in size than the standard disk drive. These drive CRUs do not fill the entire drive bay. To maintain proper air flow and cooling when you install a slim-line drive, you must also install one of the fillers provided in the blank trays.

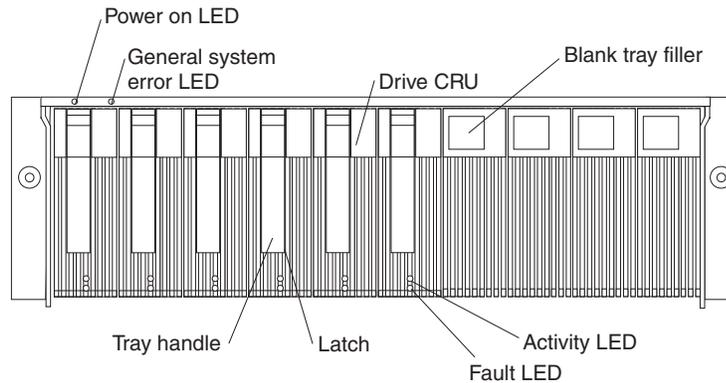
Installing hot-swap drives

Use the following procedure to install drives in the expansion unit. You can install additional drives while the expansion unit is powered up and running.

Note: If you are replacing a drive, see “Replacing hot-swap drives” on page 26.

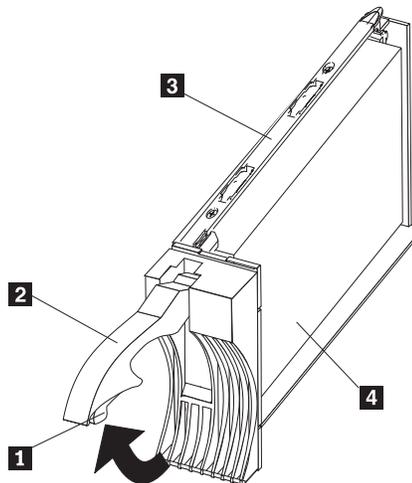
1. Read the instructions that come with the drive CRU.

2. Check for Fault LEDs. If any amber LEDs are lit, refer to “Troubleshooting” on page 40.



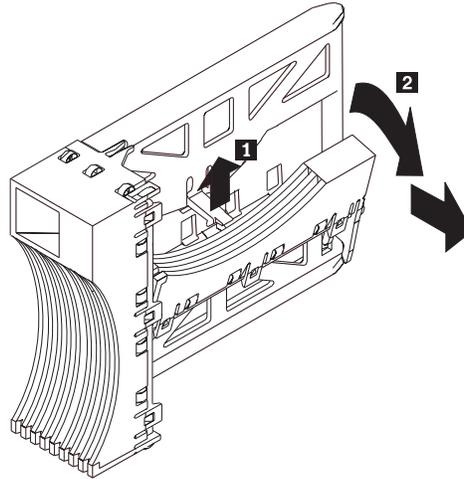
3. Determine the bay into which you want to install the drive.
4. Remove the blank tray.
 - a. Insert a finger into the square hole at the top of the blank tray to grip and pull the tray out of the drive bay.
 - b. Save the blank tray for later use.
5. Install the drive CRU:

Note: The hard disk drive comes with a tray already attached. Do not attempt to detach the drive **4** from the tray **3**.

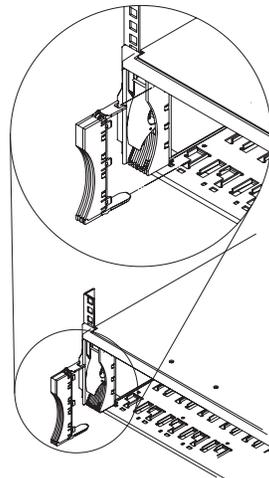


- a. Release the blue latch **1** on the drive CRU by pressing on the inside of the bottom of the tray handle.
- b. Pull the handle **2** on the tray out into the open position.
- c. Slide the drive CRU into the empty bay until the tray handle **2** touches the expansion unit bezel.
- d. Push the tray handle **2** down into the closed (latched) position.

6. If you are installing a slim-line drive, continue with step 6a. Otherwise, go to step 7.
 - a. Locate the filler piece on the inside of the blank tray.
 - b. Pull up on the small latch **1** inside the blank tray to release the filler piece.
 - c. Tilt the filler piece up from the blank tray **2**; then, remove it from the tray as shown in the following illustration.



- d. Insert the filler piece into the empty space left in the drive bay, as shown in the following illustration.



7. Check the drive LEDs.
 - a. When a drive is ready for use, the green Activity LED is on and the amber Fault LED is off.
 - b. If the amber Fault LED is completely on and not flashing, remove the drive from the unit and wait 10 seconds; then, reinstall the drive.
8. Configure the drive using the appropriate software.

Now that you have completed this task, go and update the information in Appendix A, "Records" on page 45.

Replacing hot-swap drives

Drive problems include any malfunctions that delay, interrupt, or prevent successful I/O activity between the hosts and the hard disk drives in the expansion unit. This includes transmission problems between the host controllers, the ESM boards, and the drives. This section explains how to replace a failed drive.

Attention:

Failure to replace the drives in their correct bays might result in loss of data. If you are replacing a drive that is part of a RAID level 1 or RAID level 5 logical drive, ensure that you install the replacement drive in the correct bay.

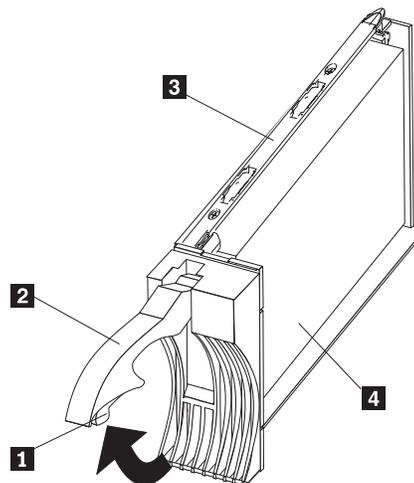
Check the hardware and software documentation provided with your system to see if there are restrictions regarding hard disk drive configurations. Some system Fibre Channel (FC) configurations might not allow mixing different drive capacities or types within an array.

1. Determine the location of the drive that you want to remove.

Attention:

Never hot swap a drive CRU when its green Activity LED is flashing. Hot swap a drive CRU only when its amber Fault LED is completely on and not flashing or when the drive is inactive with the green Activity LED completely on and not flashing.

2. Remove the drive CRU.
 - a. Press on the inside of the bottom of the tray handle to release the blue latch **1**.
 - b. Pull the handle **2** on the tray **3** out into the open position.
 - c. Lift the drive CRU partially out of the bay.
 - d. To avoid possible damage to the drive **4**, wait at least 20 seconds before fully removing the drive CRU from the expansion unit to allow for the drive to spin down.



- e. Verify that there is proper identification (such as a label) on the drive CRU, then slide it completely out of the expansion unit.

- f. If you are replacing a slim-line drive, ensure that the filler piece remains in place for use with the new drive.
3. Install the new drive CRU.
 - a. Gently push the drive CRU into the empty bay until the tray handle **2** touches the expansion unit bezel.
 - b. Push the tray handle **2** down into the closed (latched) position.
4. Check the drive LEDs.
 - a. When a drive is ready for use, the green Activity LED is on and the amber Fault LED is off.
 - b. If the amber Fault LED is completely on and not flashing, remove the drive from the unit and wait 10 seconds; then, reinstall the drive.
5. Return to normal operation.

Working with hot-swap power supplies

The power supplies are customer replaceable units (CRUs) and do not require preventive maintenance.

- The power supplies must always be in their proper places to maintain proper expansion-unit cooling.
- Use only the supported power supplies for your specific expansion unit.

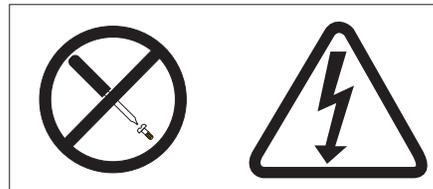
Removing a hot-swap power supply

Statement 8



CAUTION:

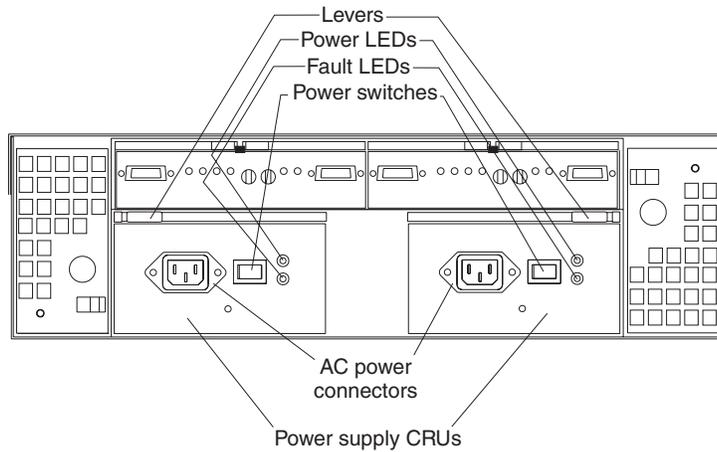
Never remove the cover on a power supply or any part that has the following label attached.



Hazardous voltage, current, and energy levels are present inside any component that has this label attached. There are no serviceable parts inside these components. If you suspect a problem with one of these parts, contact a service technician.

To remove a hot-swap power supply:

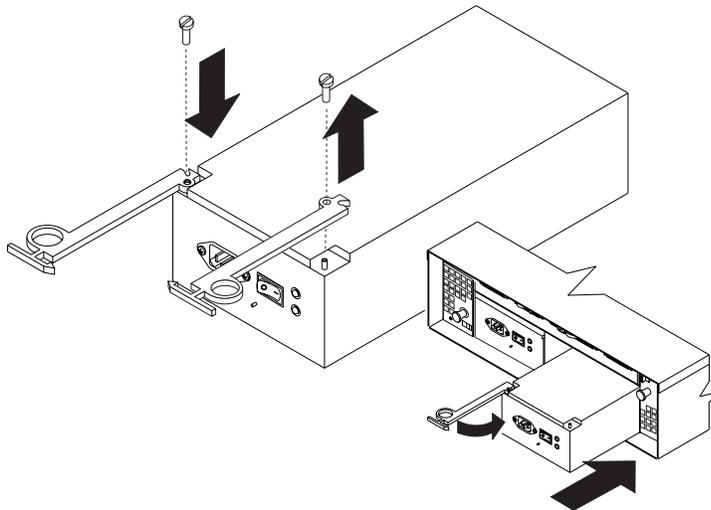
1. Turn the power supply switch to the Off position.



2. Unplug the power supply cord from the electrical outlet.
3. Disconnect the power cord from the power supply.
4. Remove the nut and clamp from the rear of the power supply.
5. Remove the power supply from the expansion unit.
 - a. Grasp the pull-ring on the power supply lever and squeeze the latch to release it.
 - b. Pull the lever open and remove the power supply.

Installing a hot-swap power supply

Note: When replacing a power supply due to a failure, ensure that the power supply latch is mounted on the side of the power supply that faces the middle of the expansion unit. If not, remove the lever screw, flip the lever over and tighten the screw on the opposite side.



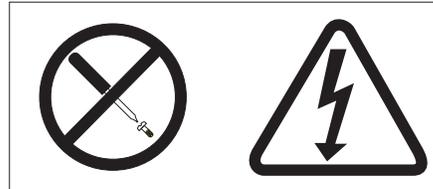
To install a hot-swap power supply:

Statement 8



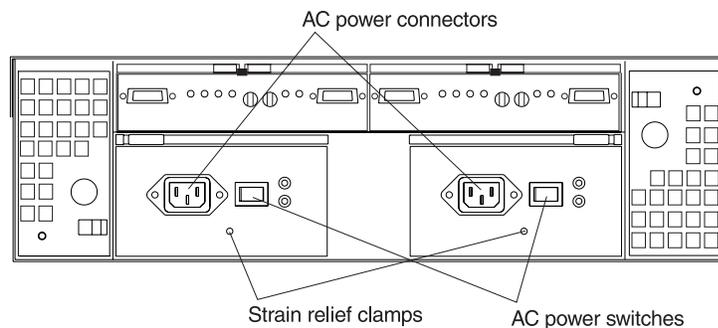
CAUTION:

Never remove the cover on a power supply or any part that has the following label attached.



Hazardous voltage, current, and energy levels are present inside any component that has this label attached. There are no serviceable parts inside these components. If you suspect a problem with one of these parts, contact a service technician.

1. Ensure that the ac power switch on the power supply you are installing is in the Off position.
2. Install the power supply in the expansion unit.
 - a. Slide the power supply into the expansion unit. Be sure the lever is pulled straight out as you slide the power supply into the expansion unit.
 - b. Close the lever until the pull-ring latch locks in place. Make sure the lever locks into place in the expansion-unit chassis.
3. Wrap the clamp around the power cord approximately 20 cm (8 in.) from the power supply connection end.
4. Attach the power supply nut and tighten it securely.
5. Connect the power cord to the power supply.



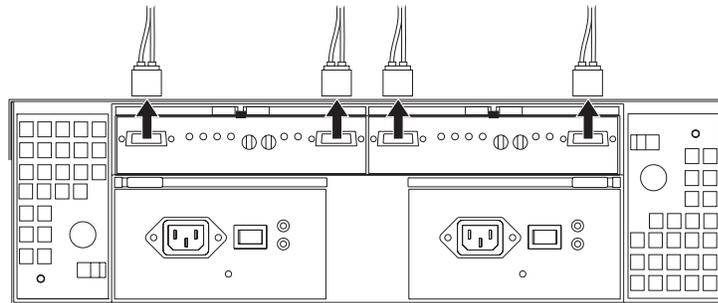
6. Plug the supply power cord into a properly grounded electrical outlet.
7. Turn the power supply switch to the On position.

Working with hot-swap ESM boards

When replacing an ESM board, remember to do the following:

1. Check the software documentation provided with your system for instructions on ESM board failure-recovery procedures. Follow the steps provided in the software documentation before continuing to step 2.
2. Label each cable to ensure that all cables are properly reconnected to the new ESM board.
3. Label the GBICs when you remove them. You must install the GBICs in the same positions on the new ESM board.
4. Remove the GBICs and FC cables from the failed ESM board.

Note: Be careful not to bend the FC cables at a sharp angle or pinch them with objects. This can decrease the performance or cause data loss.



5. To remove the failed ESM board (the Fault indicator light is lit), push down on the latch. The levers will pop out of the locked position.
6. Grasp the pull-rings and pull out on the levers, then remove the ESM board.
7. Set the tray numbers on the new ESM board to match the tray numbers on the failed ESM board.
8. Install the new ESM board by sliding it into the empty slot. Be sure the levers are pulled straight out as you slide the ESM board into the expansion unit.
9. Close the levers until the pull-ring latch locks in place. Make sure the levers lock into place in the expansion-unit chassis.
10. Reattach the GBICs and FC cables to their original locations.
11. Check the Bypass LEDs at both ends of the reattached cables. If the Bypass LEDs are on, reattach the cables and GBICs.
12. Check the Power and Fault indicator lights on the new ESM board:
 - If the Power indicator is off, the ESM board might not be inserted correctly.
 - If the Fault indicator is lit, the Power indicator does not light, or any other Fault indicator is lit, refer to “Troubleshooting” on page 40.
13. Refer to your storage management software for instructions on enabling the ESM board.

Working with GBICs

The expansion unit has four gigabit interface card (GBIC) ports (two on each ESM board). Use the GBIC ports to attach FC cables to the expansion unit.

Installing GBICs

This section provides information on installing GBICs and adding additional Fibre Array Storage Technology (FAST) EXP500 expansion units to a loop. The GBICs are laser products.

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.



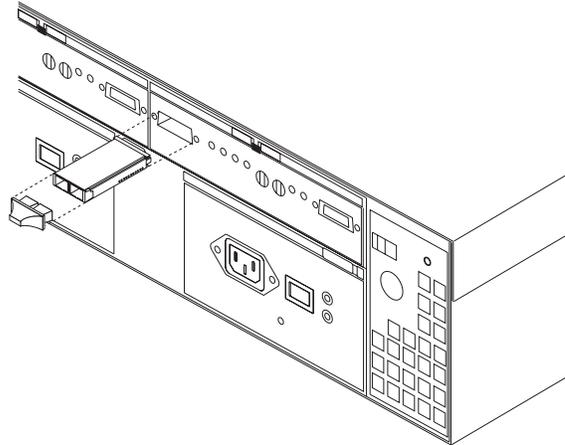
DANGER

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

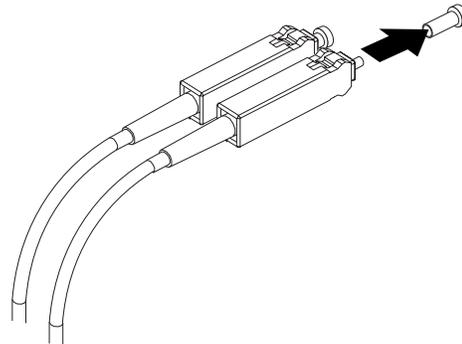
Laser radiation when open. Do not stare into the beam, do not view directly with optical instruments, and avoid direct exposure to the beam.

To install a GBIC, do the following:

- Remove the protective cap from the GBIC.



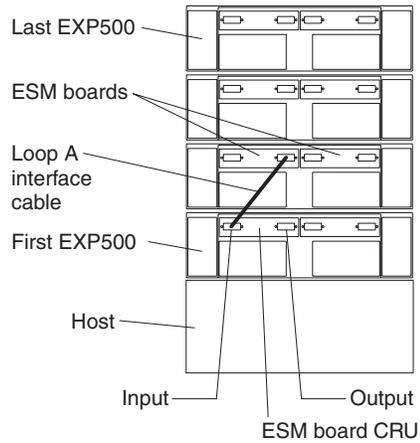
- Move the GBIC latch to the unlocked (center) position.
- Insert the GBIC into the GBIC port on the ESM board.
- Move the GBIC latch back to the locked position (flush with the rear of the GBIC).
- Remove the protective caps from the fiber-optic cable.



- Connect the fiber-optic cable to the installed GBIC.

Adding FAStT EXP500 expansion units to a loop

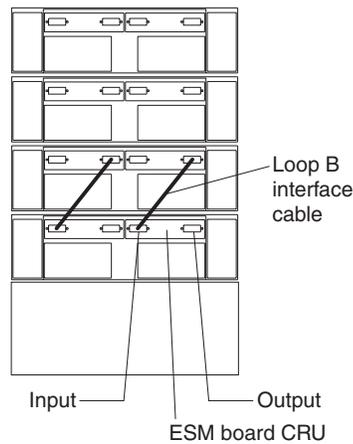
If you want to add an additional FAStT EXP500 expansion unit to a loop, cable the GBIC input port on the existing ESM board (shown as First EXP500 in the figure below) to a GBIC output port on the new FAStT EXP500 expansion unit. You can daisy-chain additional FAStT EXP500 expansion units until the loop reaches the maximum defined by the controller. The controller might also have cabling configuration information or restrictions that you must follow.



FAStT EXP500 loop redundancy

The FAStT EXP500 expansion unit provides redundant loop support. This redundant loop support is available when the second ESM board is configured (as shown in the figure below). If an ESM board, cable, or GBIC fails on a loop, the second loop provides an additional measure of redundancy (that is, an alternative path to your disk drives).

Some FC controllers might not support loop redundancy. IBM Fibre Channel (FC) disk drives are dual-ported, providing individual access from two FC loops to the same disk drive. When configuring the ESM boards, configure the second ESM board the same way you configured the first ESM board. Refer to your controller documentation for more information on dual-loop support and implementation.



The GBIC ports are labeled with an ↑ (input) and a ↓ (output). Some controllers might provide additional reliability features if an ↑ (input) port is connected to a ↓ (output) port. As you daisy-chain FAStT EXP500 expansion units together, connecting ↑ (input) ports to ↓ (output) ports can facilitate reliability. In many cases, a loop will still function properly without attaching the ↑ (input) ports to ↓ (output) ports. Refer to your controller documentation for requirements on connections between input and output ports.

Working with hot-swap cooling fans

Attention:

Do not run the expansion unit without adequate ventilation and cooling, because it might cause damage to the internal components and circuitry.

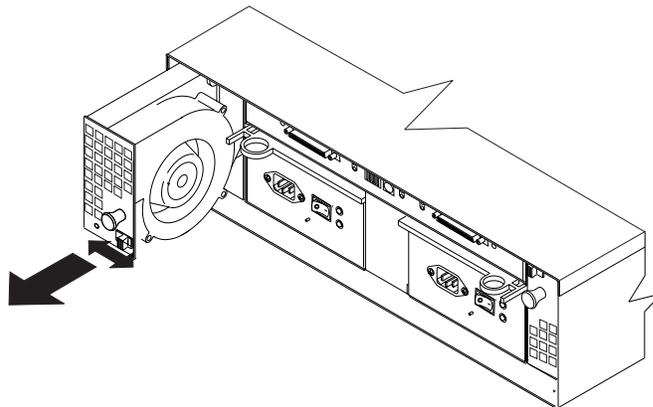
The fans are interchangeable and customer replaceable and do not require preventive maintenance. The fans help maintain proper air circulation across the components inside the expansion unit. Air flows through the expansion unit from the front to the back.

You can hot-swap the fans (replace them while the expansion unit is turned on and running), as long as you complete the exchange within 10 minutes. This time limit applies only to the total time that a fan is out of the expansion unit, beginning when you remove the failed unit and ending when you reseat the new one. This does not include the time it takes you to perform this entire procedure (checking LEDs, unpacking the new fan, and so on).

Both fan units must always be in place, even if one is not functioning properly, to maintain proper cooling.

Use the following procedure to replace a hot-swap fan:

1. Check the LEDs on the back of the expansion unit.
2. If the amber Fault LED is on, remove the failed fan.
 - a. Slide the latch to unlock the fan CRU.
 - b. Use the handle (black knob) to pull the fan from the expansion unit.



3. Install the new fan unit.
 - a. Place the fan CRU in front of the fan slot.
 - b. Hold the latch open and slide the fan all the way into the slot. If the fan does not go into the bay, rotate it 180°. Ensure that the latch is on the side closest to the center of the expansion unit.
 - c. Release the latch. If the lever remains open, pull back on the fan slightly, then push it in again until the latch snaps into place.
4. Check the LEDs.

The Fault LEDs turn off after a few seconds; if they remain on, refer to “Troubleshooting” on page 40.

Turning the expansion unit on and off

This section contains instructions for turning the expansion unit on and off under normal and emergency circumstances.

If you are turning on the expansion unit after an emergency shutdown or power outage, refer to “Restoring power after an emergency” on page 38.

Turning on the expansion unit

Use this procedure to turn on the power for the initial startup of the expansion unit.

1. Verify that:
 - a. All communication and power cables are plugged into the back of the expansion unit and an ac power outlet.
 - b. All hard disk drives are locked securely in place.
 - c. The tray number switches on the expansion unit are set correctly. (See “Setting the interface options” on page 15 for more information.)
2. Check the system documentation for all the hardware devices you intend to turn on and determine the proper startup sequence.

Note: Be sure to turn on the IBM FAStT EXP500 before or at the same time as the server.

3. Turn on the power to each device, based on the startup sequence.

Attention:

If you are restarting the system after a normal shutdown, wait at least 10 seconds before you turn on the power supply switches.

4. Turn on both power supply switches on the back of the unit.

The expansion unit might take a few seconds to power up. During this time, you might see the amber and green LEDs on the expansion unit turn on and off intermittently. When the startup sequence is complete, only the green LEDs on the front and back and the amber Bypass LEDs for unconnected GBIC ports should remain on. If other amber LEDs remain lit, refer to “Troubleshooting” on page 40.

Turning off the expansion unit

Attention:

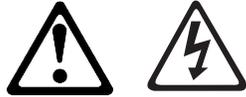
Except in an emergency, never turn off the power if any Fault LEDs are lit on the expansion unit. Correct the fault before you turn off the power, using the proper troubleshooting or servicing procedure. This will ensure that the expansion unit will power up correctly later. For guidance, refer to “Troubleshooting” on page 40.

The expansion unit is designed to run continuously, 24 hours a day. Once you turn on the expansion unit, do not turn it off. Turn off the power only when:

- Instructions in a hardware or software procedure require you to turn off the power.

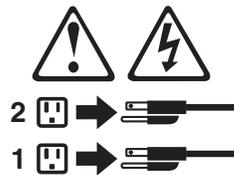
- A service technician tells you to turn off the power.
- A power outage or emergency situation occurs (see “Performing an emergency shutdown”).

Statement 5



CAUTION:

The power control button on the device and the power switch on the power supply do not turn off the electrical current supplied to the device. The device also might have more than one power cord. To remove all electrical current from the device, ensure that all power cords are disconnected from the power source.



Use this procedure to turn off the power.

1. Check the system documentation for all hardware devices you intend to turn off and determine the proper power-down sequence.
2. Make sure that all I/O activity has stopped.
3. Make sure that all amber Fault LEDs are off. If any Fault LEDs are lit (drives, power supplies, or fans), correct the problem before you turn off the power. For guidance, refer to “Troubleshooting” on page 40.
4. Turn off both power supply switches on the back on the expansion unit.

Performing an emergency shutdown

Attention:

Emergency situations might include fire, flood, extreme weather conditions, or other hazardous circumstances. If a power outage or emergency situation occurs, always turn off all power switches on all computing equipment. This will help safeguard your equipment from potential damage due to electrical surges when power is restored. If the expansion unit loses power unexpectedly, it might be due to a hardware failure in the power system or midplane (see “Troubleshooting” on page 40).

Use this procedure to shut down during an emergency.

1. If you have time, stop all activity and check the LEDs (front and back). Make note of any Fault LEDs that are lit so you can correct the problem when you turn on the power again.
2. Turn off all power supply switches; then, unplug the power cords from the expansion unit.

Restoring power after an emergency

Use this procedure to restart the expansion unit if you turned off the power supply switches during an emergency shut down, or if a power failure or a power outage occurred.

1. After the emergency situation is over or power is restored, check the expansion unit for damage. If there is no visible damage, continue with Step 2; otherwise, have your system serviced.
2. After you have checked for damage, ensure that the power switches are in the off position; then, plug in the expansion unit power cords.
3. Check the system documentation for the hardware devices you intend to power up and determine the proper startup sequence.

Note: Be sure to turn on the IBM FAStT EXP500 prior to or at the same time as the server.

4. Turn on the power to each device, based on the startup sequence.
5. Turn on both power supply switches on the back of the IBM FAStT EXP500.
6. Only the green LEDs on the front and back and the amber Bypass LEDs for unconnected GBIC ports should remain on. If other amber Fault LEDs are on, refer to “Troubleshooting” on page 40 for instructions.
7. Use your installed software application as appropriate to check the status of the expansion unit.

Chapter 4. Solving problems

This chapter contains information to help you solve some of the simpler problems you might have with your expansion unit. It contains the problem symptoms and error messages along with suggested actions to take to resolve the problem.

This chapter also provides instructions on how to obtain service and technical assistance for your expansion unit and other IBM products that you might plan to use.

This chapter contains:

Troubleshooting	40
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Troubleshooting

You can use this table to find solutions to problems that have definite symptoms. Refer to your system management software documentation for additional information.

Table 3 (Page 1 of 2). Expansion unit troubleshooting table

Problem Indicator	Component	Possible Cause	Possible Solutions
Amber LED on	Drive CRU	Drive failure	Replace failed drive.
	Fan CRU	Fan failure	Replace failed fan.
	ESM board Over-temperature LED	Subsystem is overheated	Check fans for faults. Replace failed fan if necessary.
		Environment too hot	Check the ambient temperature around the expansion unit. Cool as necessary.
		Defective LED or hardware failure	If you cannot detect a fan failure or overheating problem, replace the ESM board.
	ESM board Fault LED	ESM board failure	Replace ESM board. Refer to your controller documentation for details.
	ESM board Bypass LED	GBIC port empty	No corrective action needed if system is properly configured.
		ESM board failure	If the ESM board Fault LED is lit, replace the ESM board.
		No incoming signal detected	Reattach the GBICs and Fibre Channel (FC) cables. Replace input and output GBICs or cables as necessary.
	Front panel	General machine fault	Indicates that a Fault LED somewhere on the expansion unit has been turned on. (Check for amber LEDs on CRUs).
GBIC transmit fault		Check that the CRUs are plugged in properly. If no amber LEDs are lit on the CRUs, this indicates a GBIC transmission fault in the expansion unit. Have the failed GBIC replaced (service technician only).	
Amber LED on and green LED off	Power supply CRU	Power switch is turned off or ac power failure	Turn on all power supply power switches.
Amber and green LEDs on	Power supply CRU	Power supply failure	Replace failed power supply CRU.
All green LEDs off	All CRUs	Subsystem power is off	Check that all expansion unit power cords are plugged in and the power switches are on. If applicable, check that the main circuit breakers for the rack are turned on.
		ac power failure	Check the main circuit breaker and ac outlet.
		Power supply failure	Replace the power supply.
		Midplane failure	Have the expansion unit serviced.
Amber LED flashing	Drive CRUs	Drive rebuild or identity is in process	No corrective action needed.

One or more green LEDs off	Power supply CRUs	Power cord unplugged or switches turned off	Make sure the cord is plugged in and the switches are turned on.
	All drive CRUs	Midplane failure	Have the midplane replaced (service technician only).
	Several CRUs	Hardware failure	Replace the affected CRUs. If this does not correct the problem, have the ESM boards replaced, followed by the midplane (service technician only).
	Front panel	Power supply problem	Make sure the cords are plugged in and power supplies are turned on.
Hardware failure		If any other LEDs are on, replace the midplane (service technician only).	
Intermittent or sporadic power loss to the expansion unit	Some or all CRUs	Defective ac power source or partially plugged in power cord	Check the ac power source. Reseat all installed power cables and power supplies. If applicable, check the power components (power units, UPS, and so on). Replace defective power cords.
		Power supply failure	Check for a Fault LED on the power supply and replace the failed CRU.
		Midplane failure	Have the midplane replaced (service technician only).
Unable to access drives	Drives and FC loop	Incorrect ID settings	Ensure that the FC optical cables are undamaged and properly connected. Check the drive ID settings. Note: Change switch position only when your expansion unit is powered off.
		ESM board failure	Have one or both ESM boards replaced.
Random errors	Subsystem	Midplane failure	Have the midplane replaced (service technician only).

Note: If you cannot find the problem in the troubleshooting table, test the entire system. See your server documentation for more detailed information on testing and diagnostic tools.

If you already ran the server test program, or if running the test does not reveal the problem, have the system serviced.

Chapter 5. 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 section 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.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 A. Records

Whenever you add options to your expansion unit, be sure to update the information in this appendix. Accurate, up-to-date records make it easier to add other options and provide needed data whenever you contact technical support.

This appendix contains:

Identification numbers	46
Installed device records	46

Identification numbers

Record and retain the following information.

Product name	IBM FASiT EXP500
Machine type	3560
Model number	_____
Serial number	_____

Table 4. Identification record

The serial number is located on the bottom inside surface on the rear and on the bottom right on the front of the machine.

Installed device records

Use the following table to keep a record of the options installed in or attached to your expansion unit. This information can be helpful when you install additional options or if you ever need to report a hardware problem. Copy these tables before recording information in them, in case you need extra space to write new values later, when you update your system configuration.

Expansion unit disk drive location	Disk drive part number and model number	Disk drive serial number	Tray number (0-9), (0-9)	Minihub identifier (1:4), (1:4)
Bay 1	_____	_____	_____	_____
Bay 2	_____	_____	_____	_____
Bay 3	_____	_____	_____	_____
Bay 4	_____	_____	_____	_____
Bay 5	_____	_____	_____	_____
Bay 6	_____	_____	_____	_____
Bay 7	_____	_____	_____	_____
Bay 8	_____	_____	_____	_____
Bay 9	_____	_____	_____	_____
Bay 10	_____	_____	_____	_____

Table 5. Internal drives and devices

Appendix B. Warranty information

This section contains the warranty period for your product 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 FASiT EXP500

Warranty period - Three Years

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 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 system, 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

AMERICAS

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.

NORTH AMERICA

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.

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 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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xSeries

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Electronic emission notices

Federal Communications Commission (FCC) Statement

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

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

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

Industry Canada Class A emission compliance statement

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

Avis de conformité à la réglementation d'Industrie Canada

Cet appareil numérique de 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：
這是甲類的資訊產品，在
居住的環境中使用時，可
能會造成射頻干擾，在這
種情形下，使用者會被要
求採取某些適當的對策。

Japanese Voluntary Control Council for Interference (VCCI) statement

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

Power cords

For your safety, IBM provides a power cord with a grounded attachment plug to use with this IBM product. To avoid electrical shock, always use the power cord and plug with a properly grounded outlet.

IBM power cords used in the United States and Canada are listed by Underwriter's Laboratories (UL) and certified by the Canadian Standards Association (CSA).

For units intended to be operated at 115 volts: Use a UL-listed and CSA-certified cord set consisting of a minimum 18 AWG, Type SVT or SJT, three-conductor cord, a maximum of 15 feet in length and a parallel blade, grounding-type attachment plug rated 15 amperes, 125 volts.

For units intended to be operated at 230 volts (U.S. use): Use a UL-listed and CSA-certified cord set consisting of a minimum 18 AWG, Type SVT or SJT, three-conductor cord, a maximum of 15 feet in length and a tandem blade, grounding-type attachment plug rated 15 amperes, 250 volts.

For units intended to be operated at 230 volts (outside the U.S.): Use a cord set with a grounding-type attachment plug. The cord set should have the appropriate safety approvals for the country in which the equipment will be installed.

IBM power cords for a specific country or region are usually available only in that country or region.

IBM power cord part number	Used in these countries and regions
13F9940	Argentina, Australia, China (PRC), New Zealand, Papua New Guinea, Paraguay, Uruguay, Western Samoa
13F9979	Afghanistan, Algeria, Andorra, Angola, Austria, Belgium, Benin, Bulgaria, Burkina Faso, Burundi, Cameroon, Central African Rep., Chad, Czech Republic, Egypt, Finland, France, French Guiana, Germany, Greece, Guinea, Hungary, Iceland, Indonesia, Iran, Ivory Coast, Jordan, Lebanon, Luxembourg, Macau, Malagasy, Mali, Martinique, Mauritania, Mauritius, Monaco, Morocco, Mozambique, Netherlands, New Caledonia, Niger, Norway, Poland, Portugal, Romania, Senegal, Slovakia, Spain, Sudan, Sweden, Syria, Togo, Tunisia, Turkey, former USSR, Vietnam, former Yugoslavia, Zaire, Zimbabwe
13F9997	Denmark
14F0015	Bangladesh, Burma, Pakistan, South Africa, Sri Lanka
14F0033	Antigua, Bahrain, Brunei, Channel Islands, Cyprus, Dubai, Fiji, Ghana, Hong Kong, India, Iraq, Ireland, Kenya, Kuwait, Malawi, Malaysia, Malta, Nepal, Nigeria, Polynesia, Qatar, Sierra Leone, Singapore, Tanzania, Uganda, United Kingdom, Yemen, Zambia
14F0051	Liechtenstein, Switzerland
14F0069	Chile, Ethiopia, Italy, Libya, Somalia
14F0087	Israel
1838574	Thailand
6952300	Bahamas, Barbados, Bermuda, Bolivia, Brazil, Canada, Cayman Islands, Colombia, Costa Rica, Dominican Republic, Ecuador, El Salvador, Guatemala, Guyana, Haiti, Honduras, Jamaica, Japan, Korea (South), Liberia, Mexico, Netherlands Antilles, Nicaragua, Panama, Peru, Philippines, Saudi Arabia, Suriname, Taiwan, Trinidad (West Indies), United States of America, Venezuela

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