

IBM Fibre Channel



# Hardware Maintenance Manual





IBM Fibre Channel



# Hardware Maintenance Manual

**Note:** Before using this information and the product it supports, be sure to read the general information under "Notices" on page 470.

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## Chapter 1. IBM Fibre Channel

**Note:** If you are using a PDF version of this book, please be patient in allowing the software to take you from a link to its destination.

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

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

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

Fibre Channel supports data transfer rates of 100 MB per second. A multimode optical interface is used for distances up to 500 meters. With increased connectivity and performance, Fibre Channel is the technology preferred and used by system designers.

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### About this book

This manual is designed to provide problem determination and resolution for the issues most commonly encountered with IBM Fibre Channel devices and configurations. The structure of this manual begins with the problem determination steps and continues with the individual components. Please follow the structure of the guide by always starting with "Chapter 2. PD entry," on page 3 to provide component isolation. Do not jump ahead to the particular device.

---

### Diagnostics and test information

These service procedures are designed to help you isolate problems. They are written with the assumption that you have model-specific training on all computers, or that you are familiar with the computers, functions, terminology, and service-related information provided in this manual and the appropriate IBM Server Hardware Maintenance Manual.

Start with the "General checkout" sections in each chapter of this Fibre Channel Maintenance Manual to assist you in diagnosing the IBM Fibre Channel products described within this manual.

For Error Codes and Error Messages, refer to the "Symptom-to-FRU index" of the server that the Fibre Channel Hub, Adapter, or RAID Controller is connected to.

**Note:** For information about managed hubs and switches that may be in your installation, refer to the individual publications for those devices:

- *IBM 3534 SAN Fibre Channel Managed Hub Installation and Service Guide SY27-7616*

- *IBM SAN Fibre Channel Switch 2109 Model S8 Installation and Service Guide*
- *IBM SAN Fibre Channel Switch 2109 Model S16 Installation and Service Guide SG26-7352*

This installation and service information can be accessed on the World Wide Web:

**<http://www.storage.ibm.com/ibmsan/products.htm>**

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## Chapter 2. PD entry

The lists of indications below provide you with entry points to the Problem Determination (PD) maps that are found in this chapter.

**Attention:** The PD map flowcharts in this chapter are not to be used in order of their appearance. **It is very important that you always start working with the PD maps from the starting points in this chapter** (see “General symptoms” on page 4, “Specific problem areas” on page 4, and “PD maps and diagrams” on page 5). Do not use a flowchart unless you are sent there from a particular symptom or problem in one of the lists of indications, or you are sent there from another PD map.

---

### Considerations before starting PD maps

Because there is a large variety of hardware and software combinations that can be encountered, use the following information to assist you in problem determination. Before you start the PD maps, confirm that you have checked the following.

- Verify any recent hardware changes.
- Verify any recent software changes.
- Verify that the BIOS is at the latest level. See “File updates” on page 4 and specific server Hardware Maintenance Manuals for details about this procedure.
- Verify that the drivers are at the latest levels. See “Installing the Windows NT and Windows 2000 device drivers” on page 71 and “Installing the NetWare device driver” on page 74.
- Verify that the configuration matches the hardware. See the lists of compatible hardware at the beginning of each of the following chapters.
- Verify that FAStT Check is at the latest level. See “Chapter 3. IBM FAStT Check,” on page 23.

As you go through problem determination, consider these questions.

- Do diagnostics fail?
- Is the failure repeatable?
- Has this configuration ever worked?
- If this configuration has been working, what changes were made prior to it failing?
- Is this the original reported failure? If not, try to isolate failures using the lists of indications that follow (see “General symptoms” on page 4, “Specific problem areas” on page 4, and “PD maps and diagrams” on page 5).

**Important**

To eliminate confusion, systems are considered identical only if the following are *exactly* identical for *each* system:

- Machine type and model
- BIOS level
- Adapters and attachments (in same locations)
- Address jumpers, terminators, and cabling
- Software versions and levels

Comparing the configuration and software setup between “working” and “non-working” systems will often resolve problems.

## File updates

Use the IBM support area on the World Wide Web (WWW) to download Diagnostic, BIOS Flash, and Device Driver files:

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

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## General symptoms

- **RAID Controller passive**  
If you determine that a RAID Controller is passive, go to “RAID Controller Passive PD map” on page 6.
- **Failed or moved cluster resource**  
If you determine that a cluster resource has failed or has been moved, go to “Cluster Resource PD map” on page 7.
- **Bootup long delay at blue screen**  
If at bootup you experience a long delay (more than 10 minutes) at blue screen, go to “Bluescreen Delay PD map” on page 8.
- **Systems Management or SM7 performance problems**  
If you discover a problem through the Systems Management or Storage Management tools, go to “Systems Management PD map” on page 9.

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## Specific problem areas

- **NT Event Log**  
“Appendix A. PD hints — RAID controller errors in the NT event log,” on page 331
- **Major Event Log (MEL)**  
“Appendix F. PD hints — MEL data format,” on page 361
- **SM7**  
“Systems Management PD map” on page 9
- **Indicator lights on devices**  
“Drive side hints” on page 426

- **Control panel or SCSI adapters**  
“Installing the Windows NT and Windows 2000 device drivers” on page 71
- **Managed hub or switch logs**
- **Cluster Administrator**

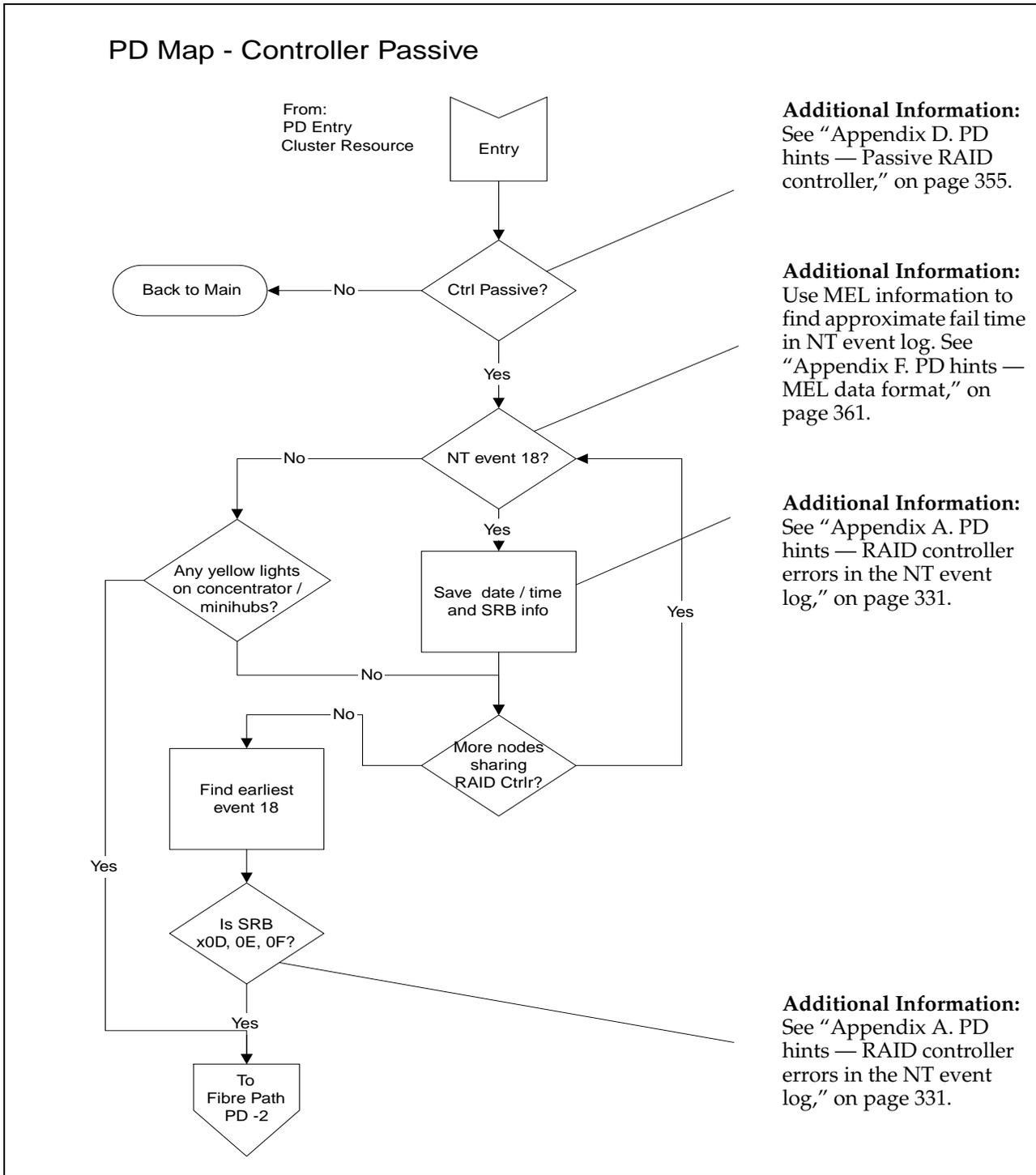
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## PD maps and diagrams

- **Configuration Type Determination**  
In order to break larger configurations into manageable units for debugging, see “Appendix C. PD hints — Configuration types,” on page 349.
- **Hub or Switch PD**  
If you determine that a problem exists within a hub or switch, go to “Hub / Switch PD map 1” on page 11.
- **Fibre Path PD**  
If you determine that a problem exists within the Fibre Path, go to “Fibre Path PD map 1” on page 14.
- **Device PD**  
If you determine that a problem exists within a device, go to “Device PD map 1” on page 20.

# RAID Controller Passive PD map

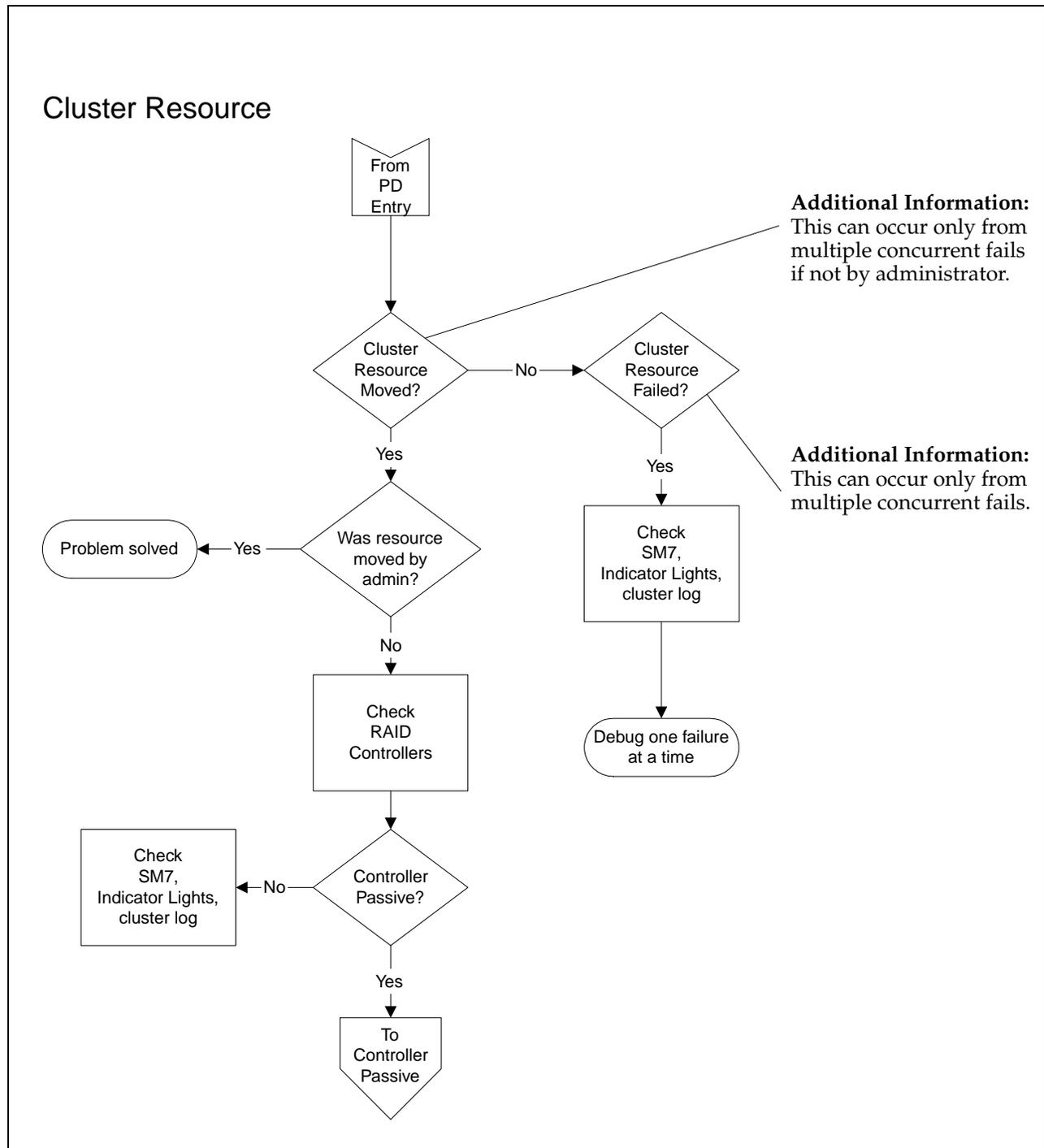
From "General symptoms" on page 4, "Cluster Resource PD map" on page 7.



To see the Fibre Path PD 2, go to "Fibre Path PD map 2" on page 15.

# Cluster Resource PD map

From "General symptoms" on page 4.

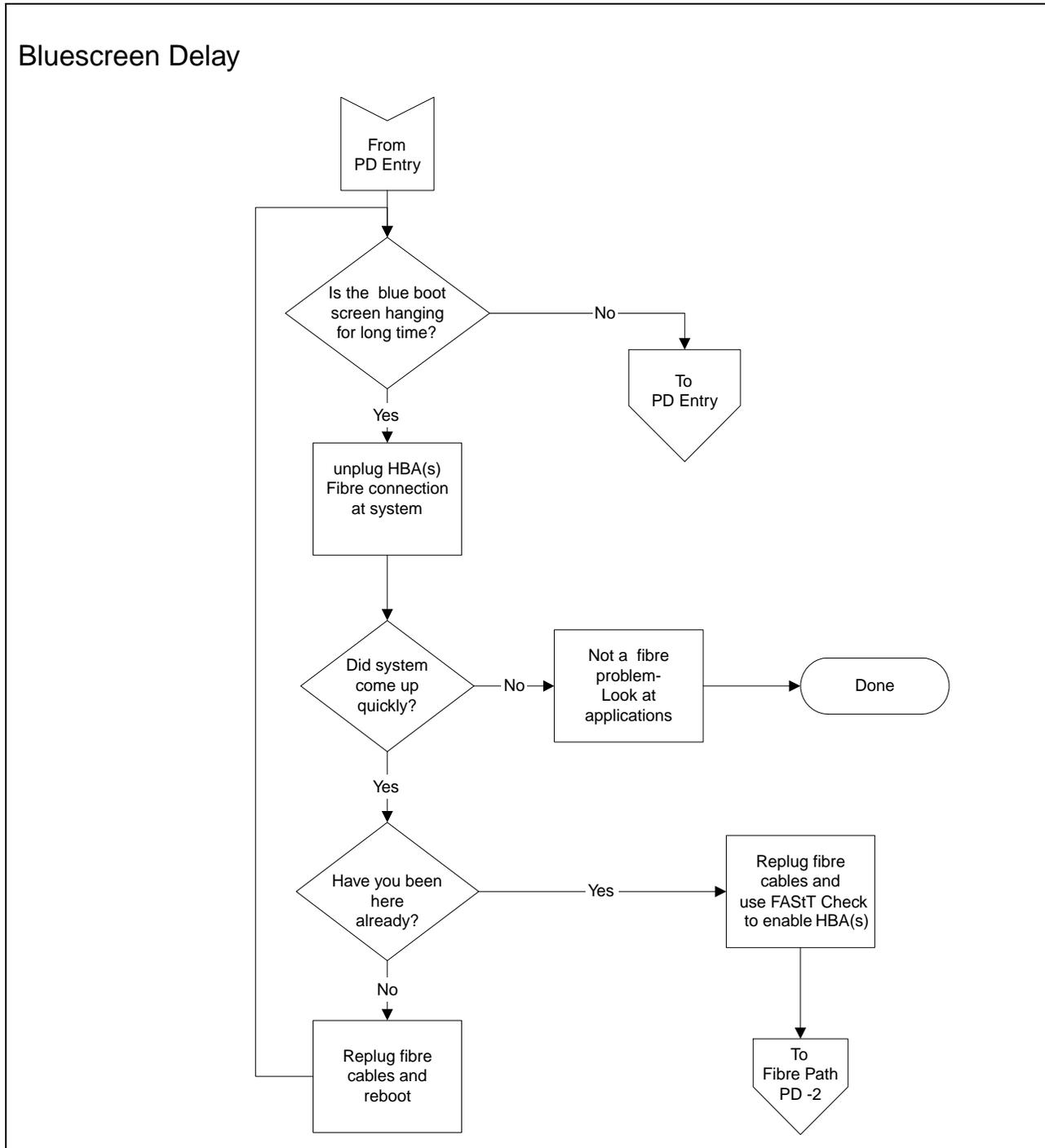


To see the Controller Passive PD Map, go to "RAID Controller Passive PD map" on page 6.

## Bluescreen Delay PD map

From “General symptoms” on page 4.

To see the screens necessary to perform this check, see “Bluescreen delay” on page 423.

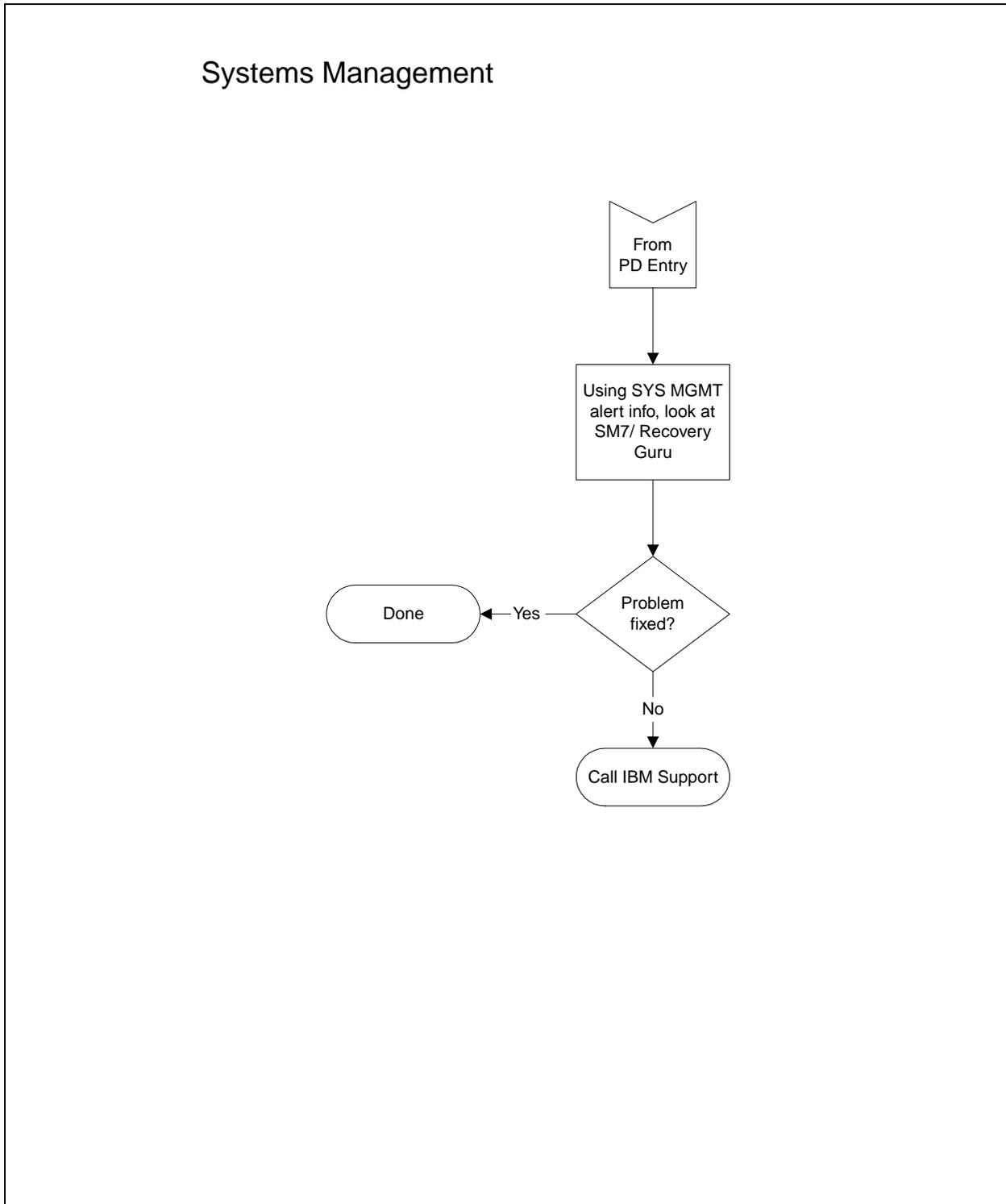


To see the options for PD entry, go back to “Chapter 2. PD entry,” on page 3.

To see the Fibre Path PD, go to “Fibre Path PD map 2” on page 15.

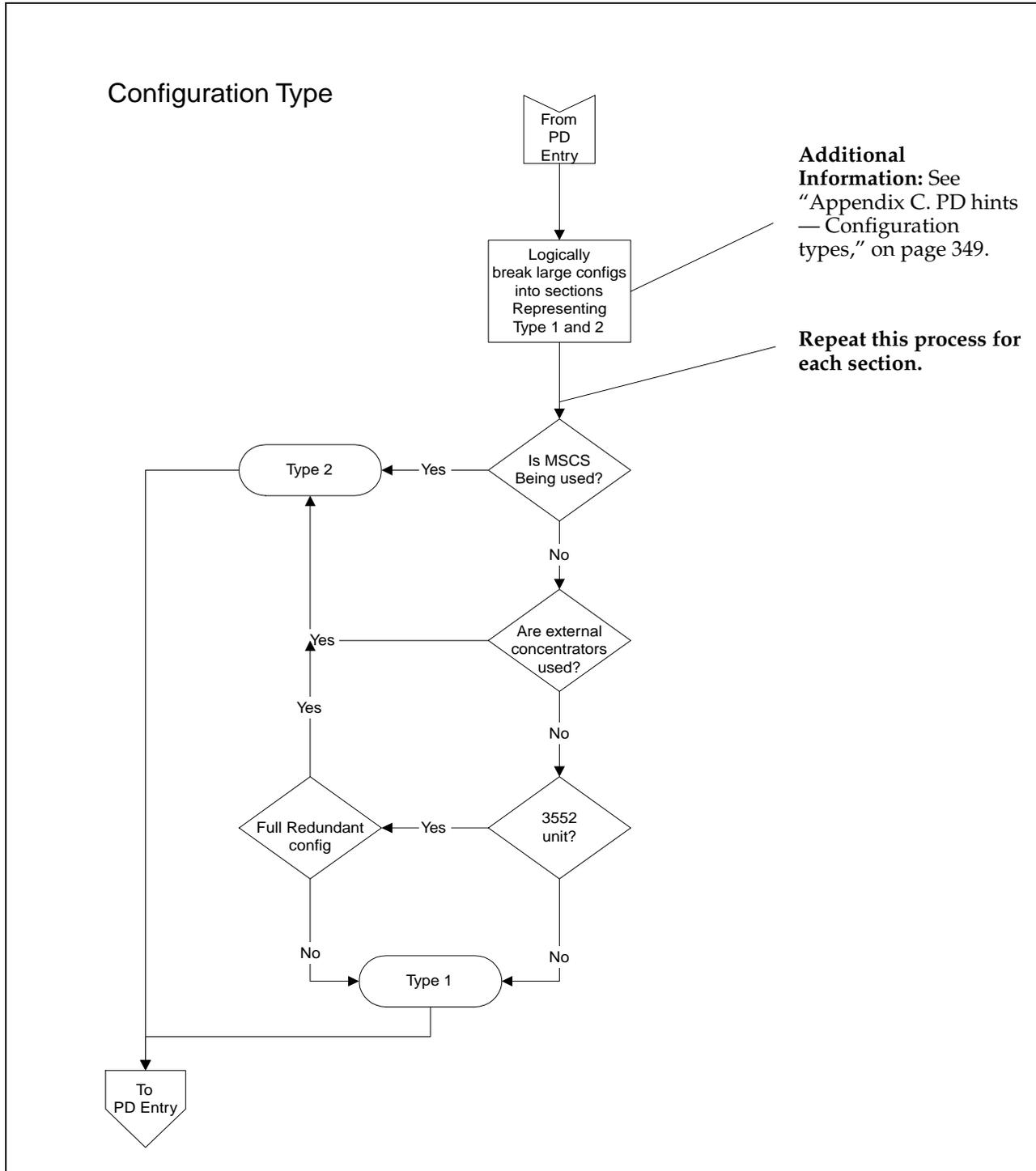
## Systems Management PD map

From "General symptoms" on page 4.



## Configuration Type PD map

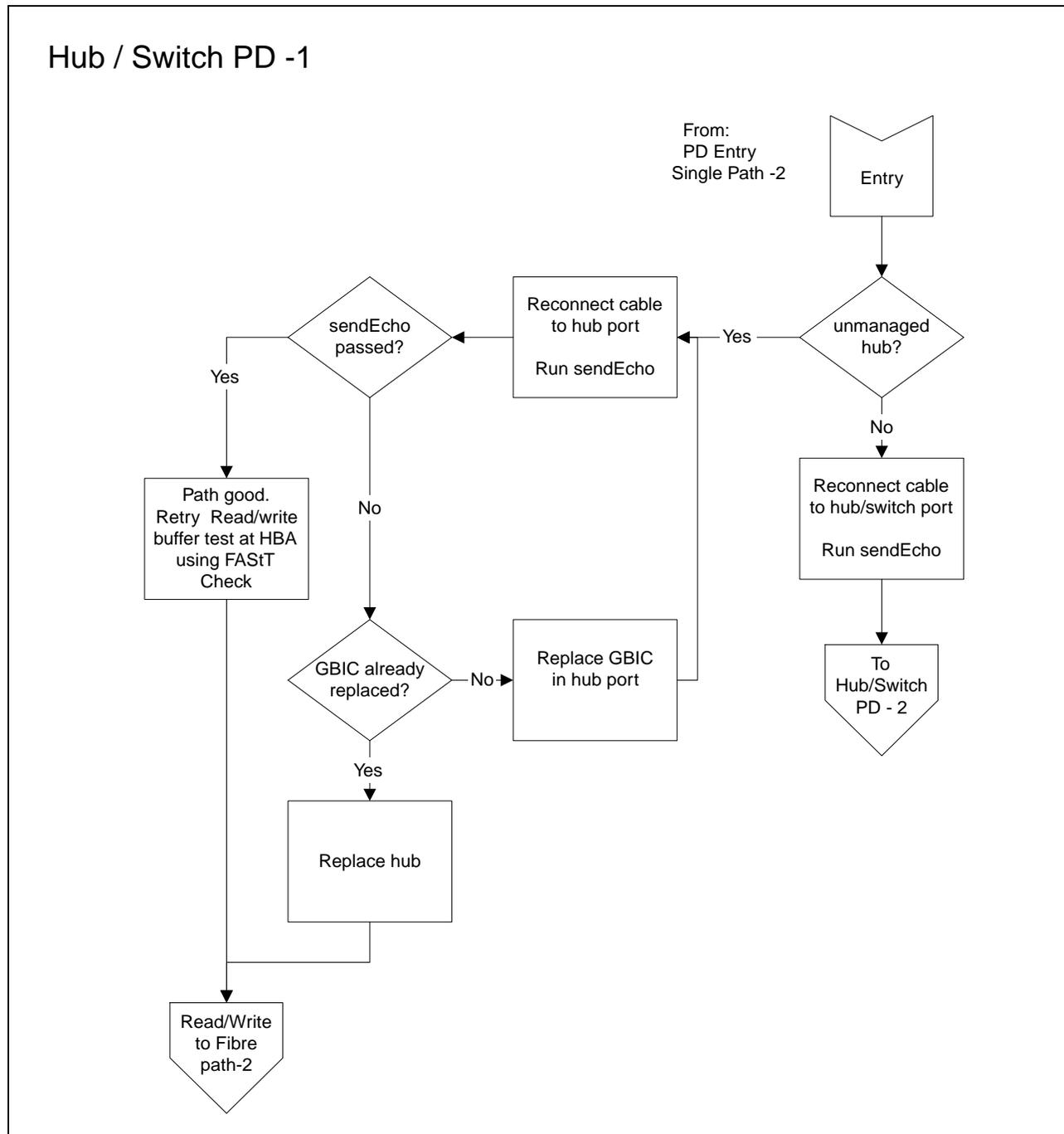
To perform certain Problem Determination procedures, you need to determine whether your fibre configuration is Type 1 or Type 2. You will need this information for later PD procedures.



To see the options for PD entry, go back to "Chapter 2. PD entry," on page 3.

## Hub / Switch PD map 1

From “PD maps and diagrams” on page 5, “Single Path Fail PD map 2” on page 17.



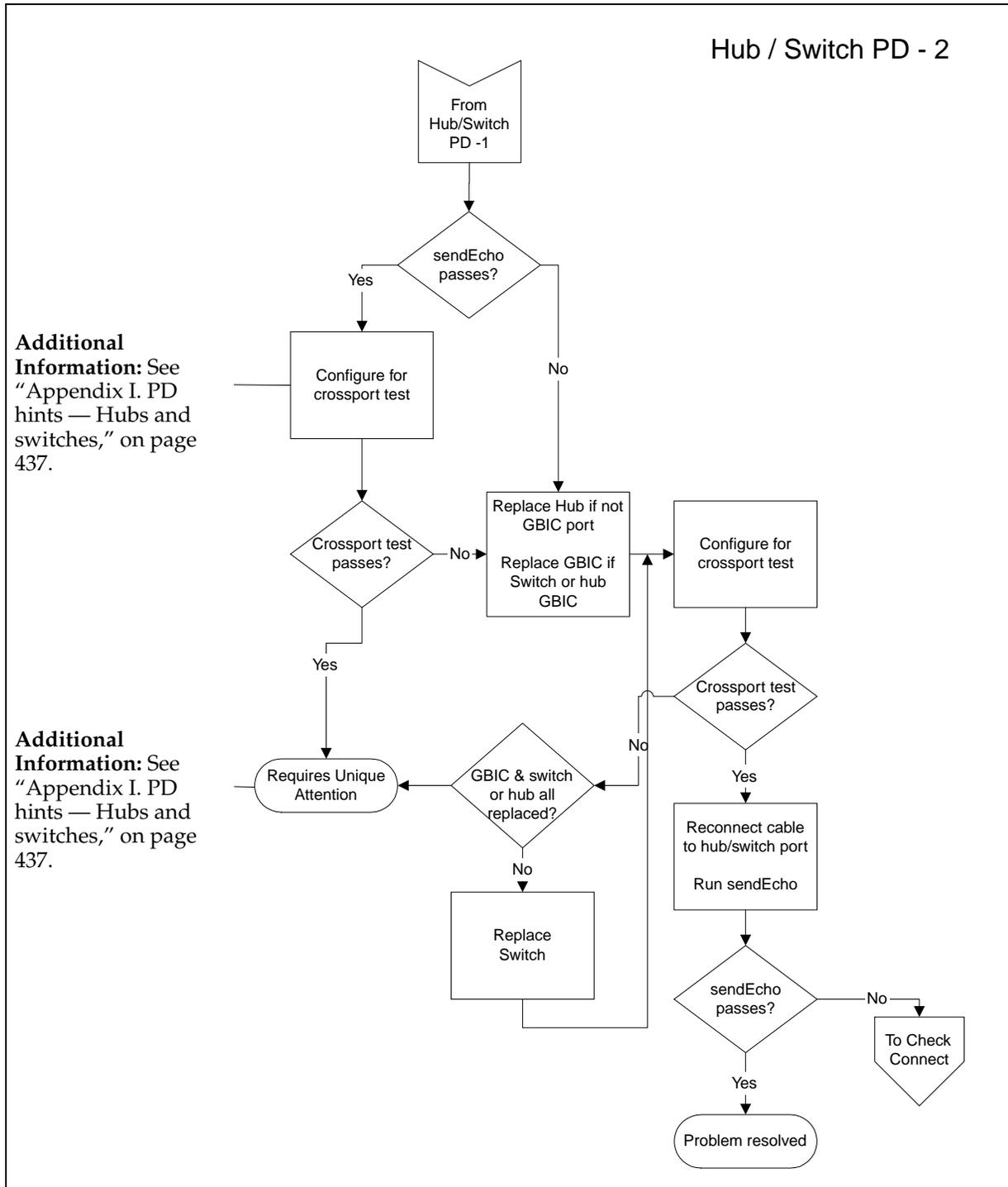
For information about sendEcho tests, see “Appendix E. PD hints — SendEcho tests,” on page 357.

For information about Read/Write Buffer tests, see “Chapter 3. IBM FASTT Check,” on page 23.

To see the Hub / Switch PD 2, go to “Hub / Switch PD map 2” on page 12.

## Hub / Switch PD map 2

From "Hub / Switch PD map 1" on page 11.

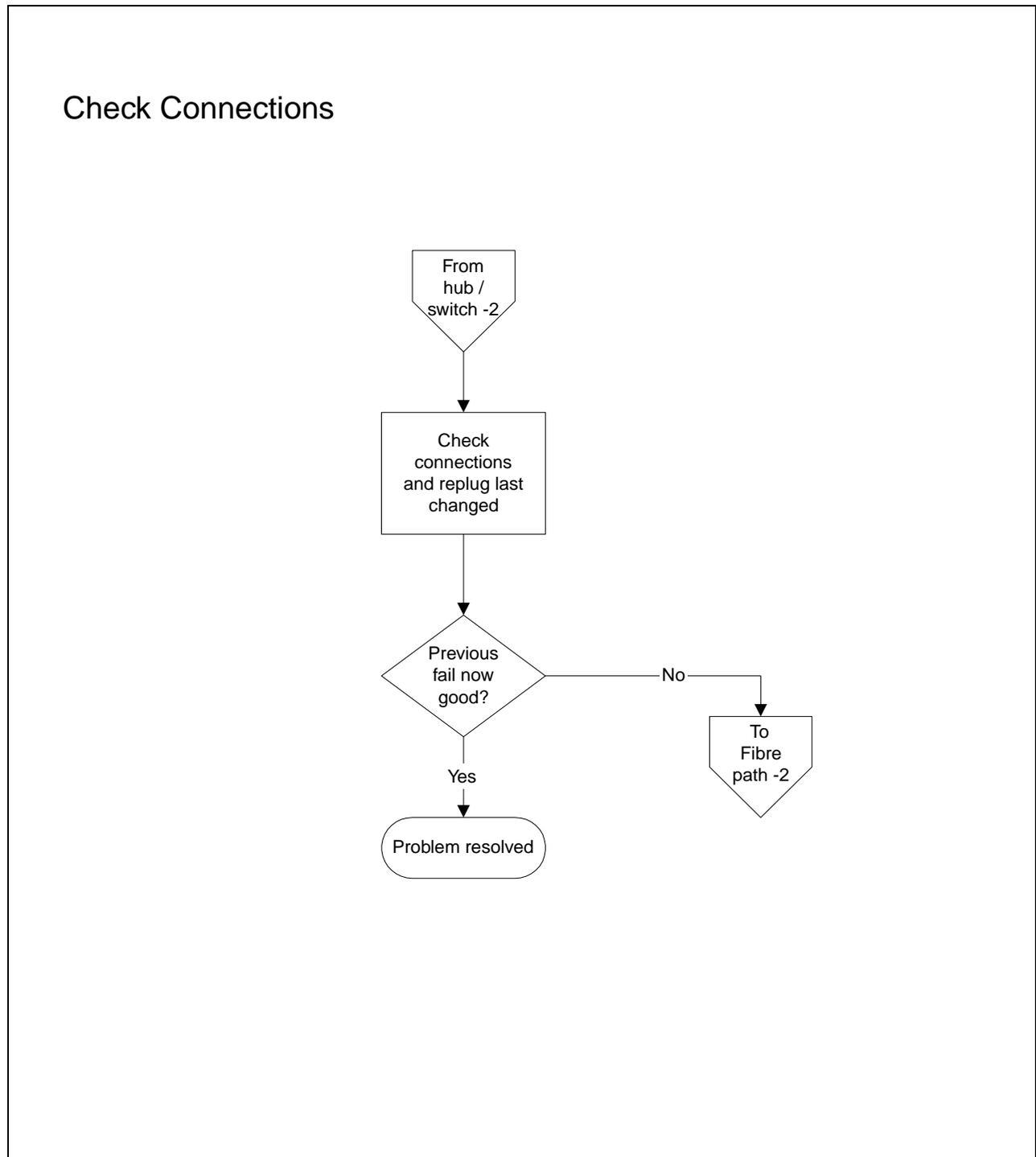


For information about sendEcho tests, see "Appendix E. PD hints — SendEcho tests," on page 357.

To see the "Check Connections PD Map," see "Check Connections PD map" on page 13.

## Check Connections PD map

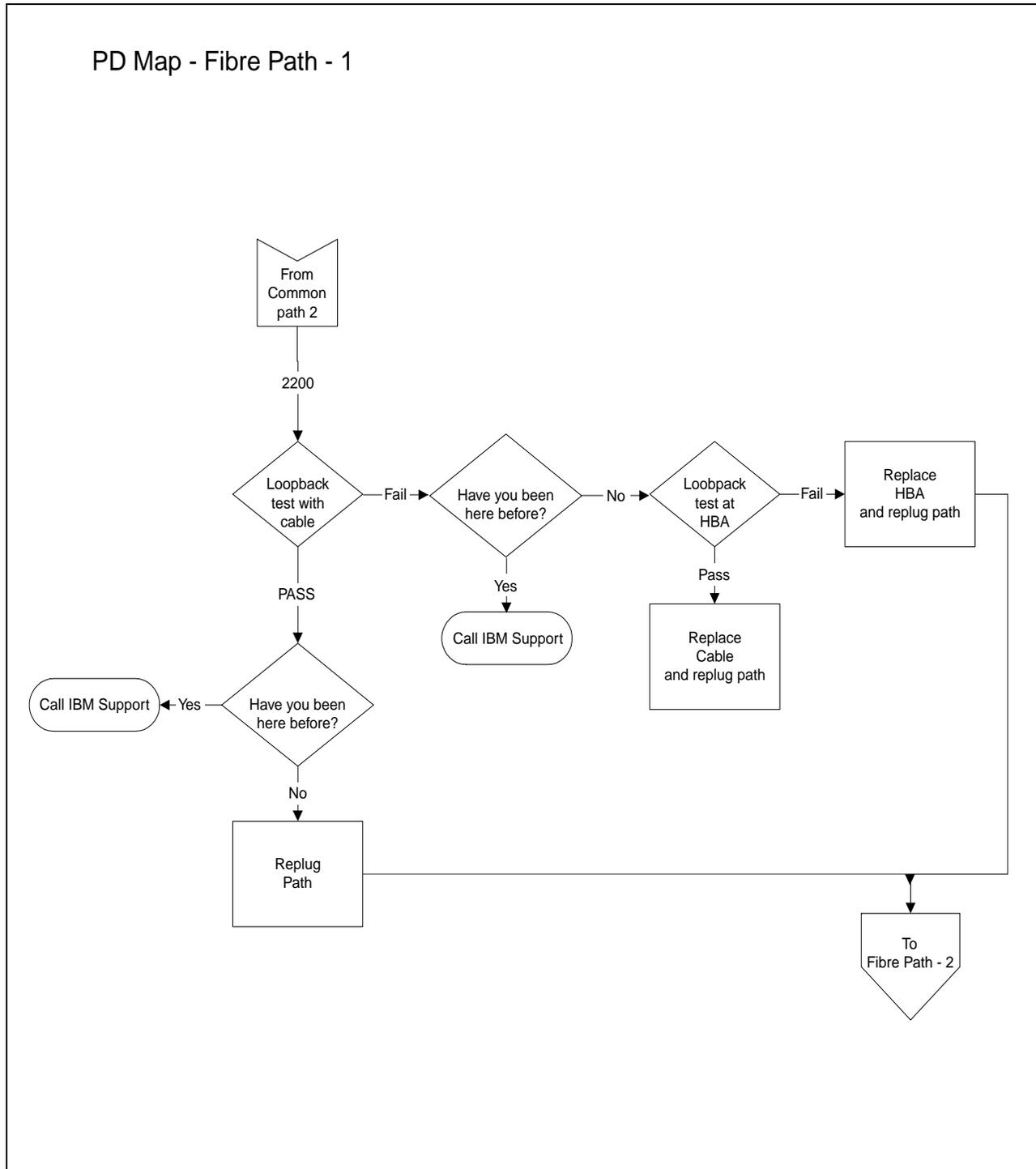
From "Hub / Switch PD map 2" on page 12.



To see the Fibre Path PD, go to "Fibre Path PD map 2" on page 15.

# Fibre Path PD map 1

From "Common Path PD map 2" on page 19.

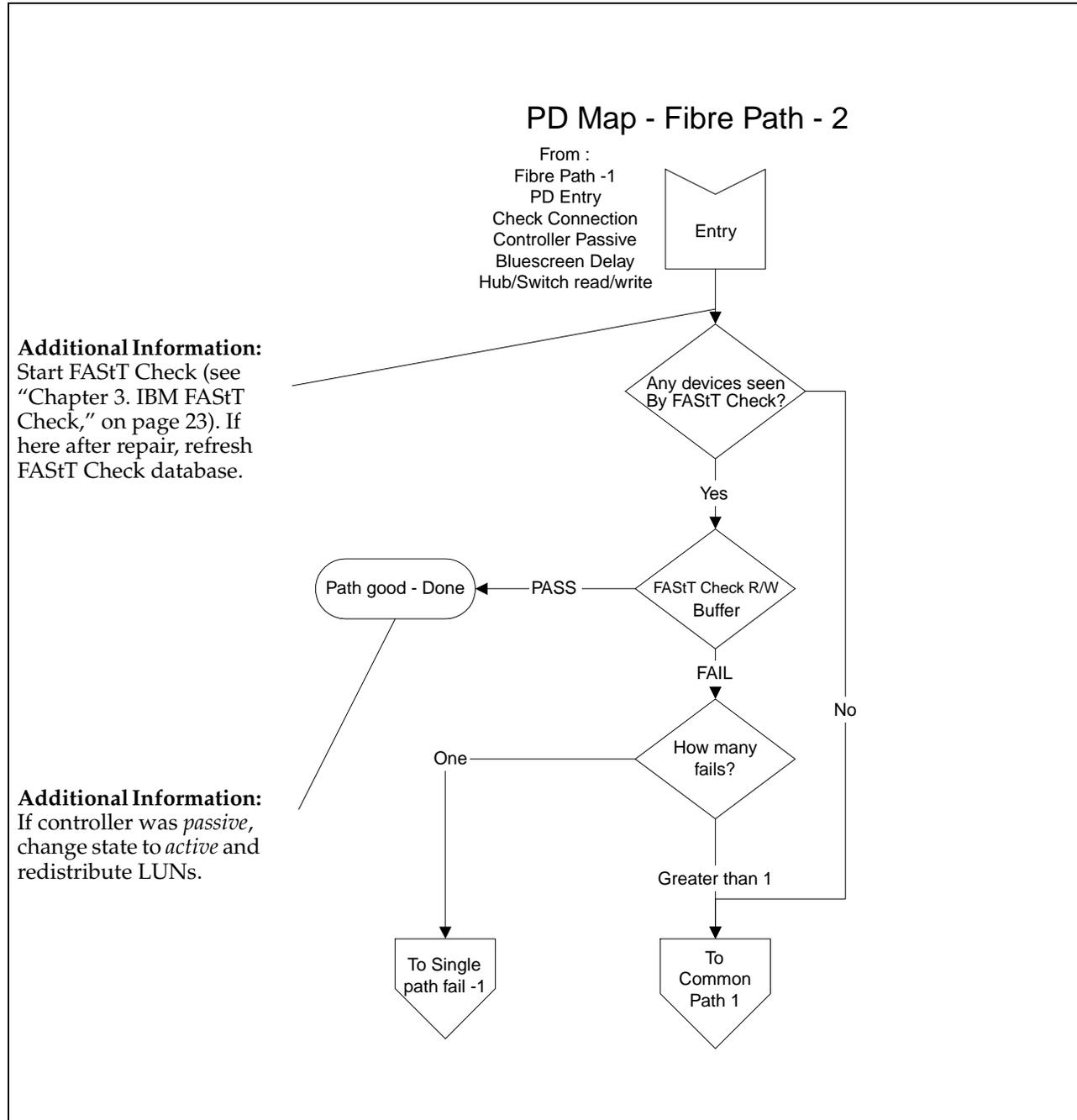


For information about running loopback tests, see "Chapter 3. IBM FAStT Check," on page 23.

To see the Fibre Path PD Map 2, go to "Fibre Path PD map 2" on page 15.

## Fibre Path PD map 2

From "Fibre Path PD map 1" on page 14, "Chapter 2. PD entry," on page 3, "Check Connections PD map" on page 13, "RAID Controller Passive PD map" on page 6, "Bluescreen Delay PD map" on page 8, "Hub / Switch PD map 1" on page 11.

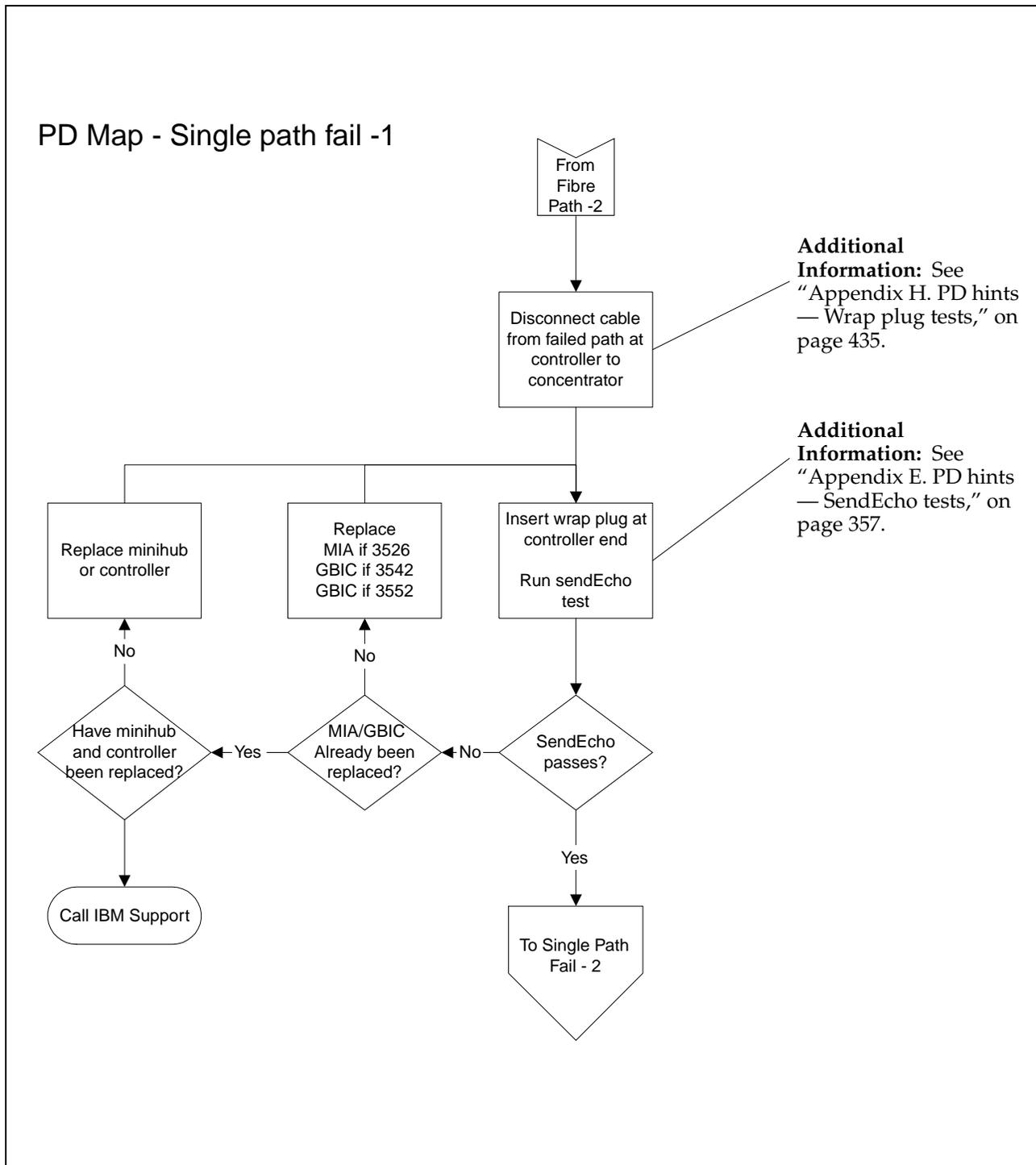


To see the "Single Path fail" PD map, go to "Single Path Fail PD map 1" on page 16.

To see the "Common Path" PD map, go to "Common Path PD map 1" on page 18.

# Single Path Fail PD map 1

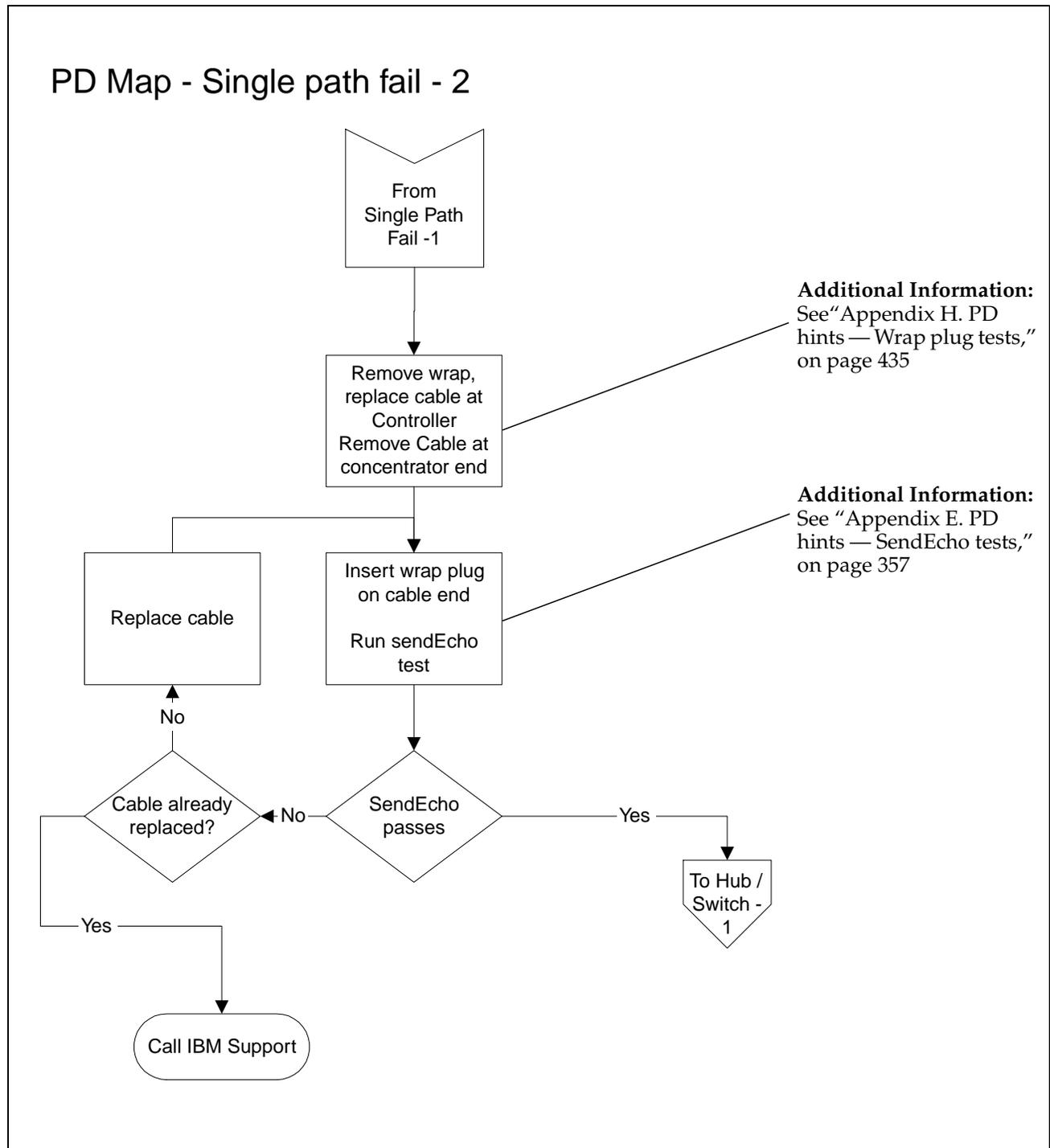
From "Fibre Path PD map 2" on page 15.



To see the "Single Path Fail" PD map 2, go to "Single Path Fail PD map 2" on page 17.

## Single Path Fail PD map 2

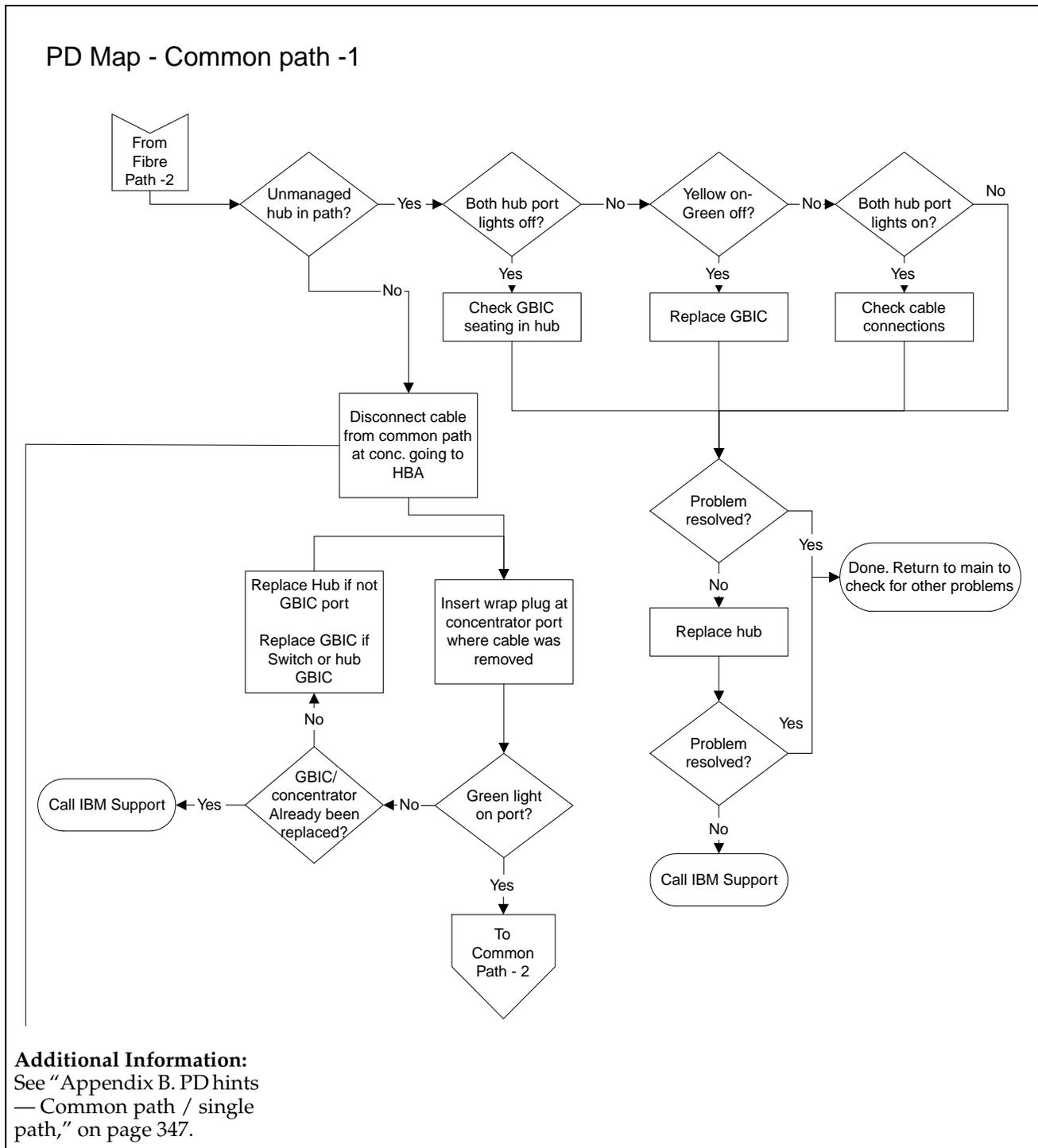
From "Single Path Fail PD map 1" on page 16.



To see the Hub/Switch PD Map 1, go to "Hub / Switch PD map 1" on page 11.

# Common Path PD map 1

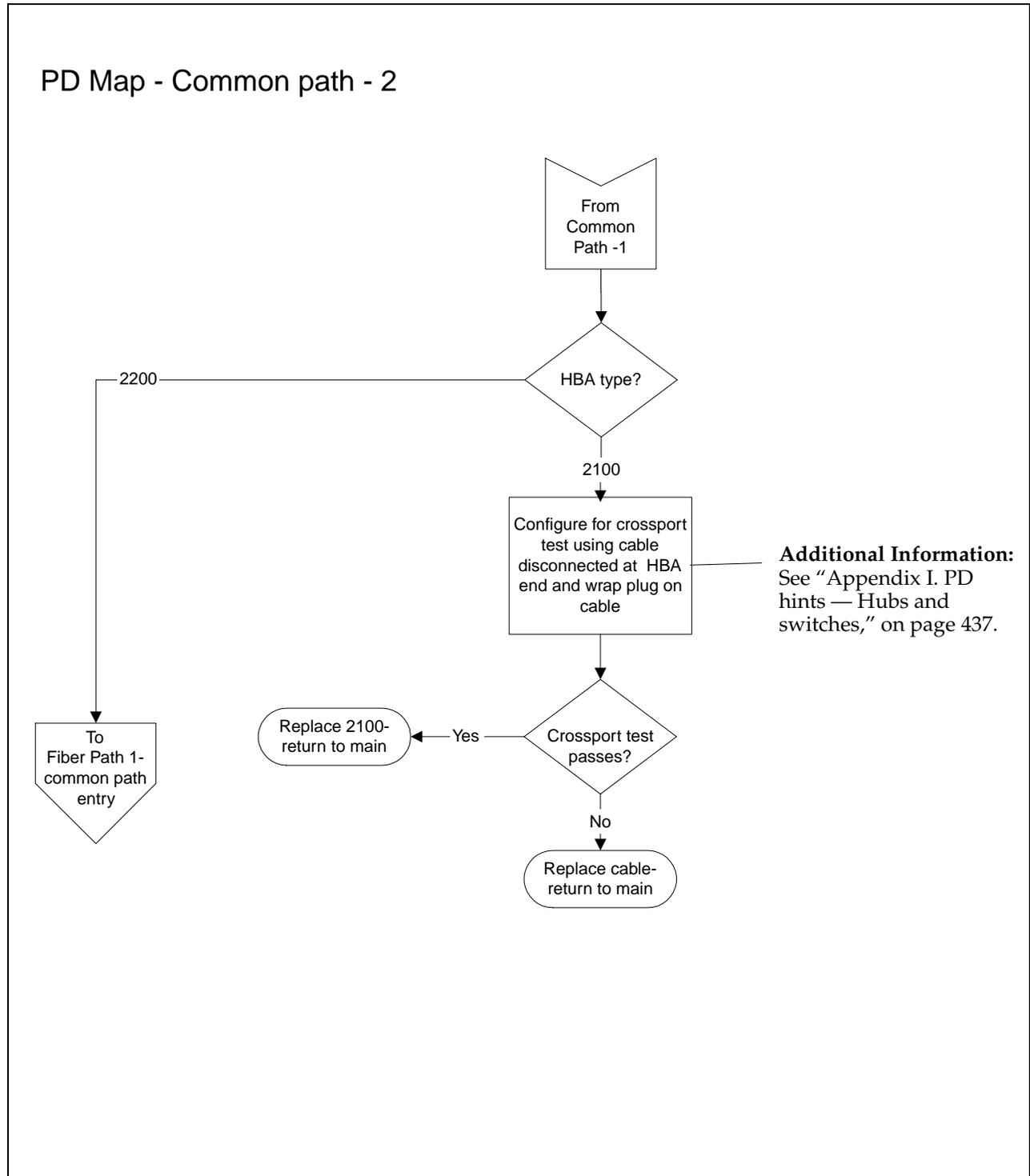
From "Fibre Path PD map 2" on page 15.



To see the Common Path PD map 2, go to "Common Path PD map 2" on page 19.

## Common Path PD map 2

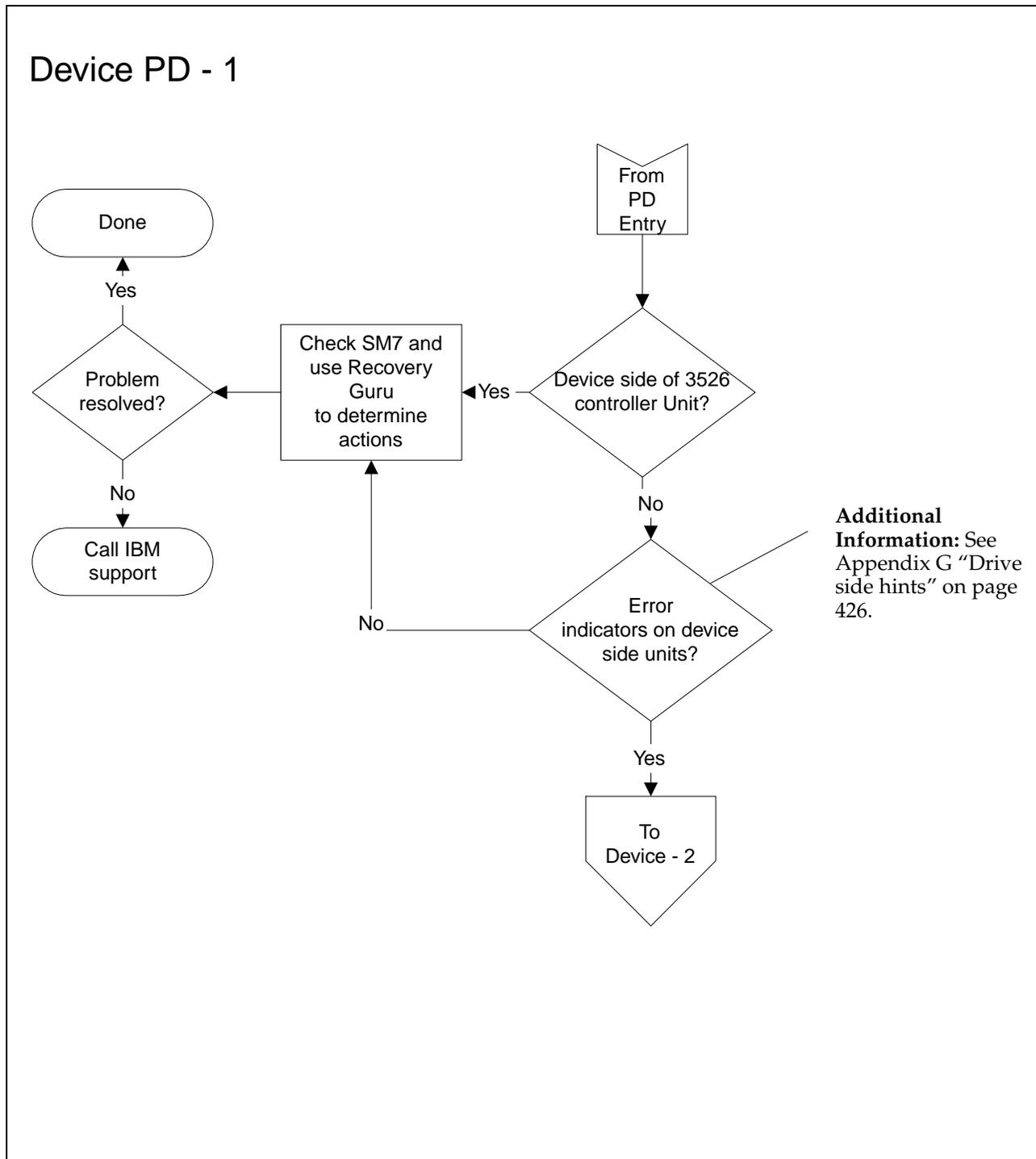
From "Common Path PD map 1" on page 18



To see the Fibre path PD map 1, go to "Fibre Path PD map 1" on page 14.

## Device PD map 1

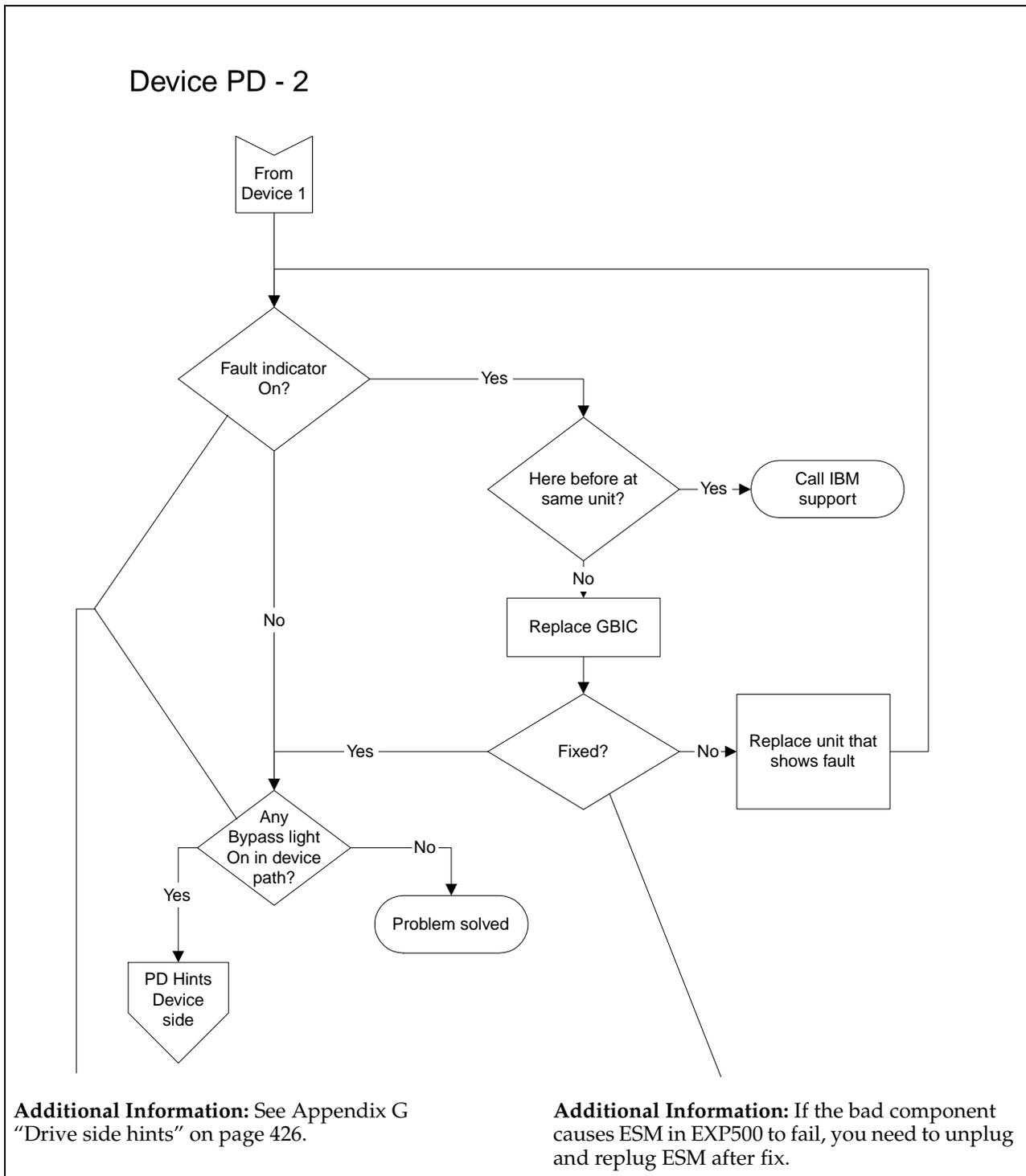
From "PD maps and diagrams" on page 5.



To see the Device PD map 2, go to "Device PD map 2" on page 21.

## Device PD map 2

From "Device PD map 1" on page 20.



To see PD Hints about troubleshooting the device (drive) side, go to "Drive side hints" on page 426.



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## Chapter 3. IBM FAStT Check

IBM FAStT Check is an application that works with the Intel® Desktop Management Information (DMI) 2.0 specification. Together with the IBM FAStT Check Instrumentation, you can use IBM FAStT Check to manage and control one or more Netfinity® Fibre Channel Host Bus Adapters (QLA2100) or Netfinity FAStT Host Bus Adapters (QLA2200) that are installed on local or remote computers.

You use IBM FAStT Check, in conjunction with Problem Determination (PD) procedures, on new or existing installations to assist in diagnosing Fibre Channel (FC) subsystem problems (in adapters, controllers, and devices that are attached to the FC loop).

IBM FAStT Check has the following functions:

- Retrieving and displaying general information about adapters
- Requesting and displaying real-time adapter statistics
- Performing diagnostic operations on adapters and attached devices
- Displaying nonvolatile random access memory (NVRAM) parameters for adapters and accepting and executing changes on these parameters

**Attention:** Do not alter NVRAM parameters unless an IBM technical support representative instructs you to do so.

**Note:** NVRAM parameters determine the mode of operation of the host bus adapters. To modify these parameters, you must enable the NVRAM **Update** option. In addition, you must provide the correct password, and the password must be authenticated. IBM FAStT Check Agent and Security, which is installed along with FAStT Check, is used to enable NVRAM updates. Only when a user is logged on as an administrator can security be used.

### Important information concerning IBM FAStT Check

IBM FAStT Check is a diagnostic program that issues commands that might interfere with normal I/O operations. When you start the loopback or read/write buffer tests, a warning message is displayed that advises you to ensure that no I/O operations are active before the tests are started.

Before you run IBM FAStT Check, it is important that the controller in the loop that requires testing be in a passive state. Run the Netfinity Fibre Channel Storage Manager to check that the controller is in a passive state. If it is not, set it to passive mode. Putting the controller in a passive state ensures that no I/O operations are active on that loop.

**Note:** In the Subsystem Management window of the Netfinity Fibre Channel Storage Manager, right-click the controller to display its properties, and select **Interfaces** to obtain the loop ID and the arbitrated loop physical address (AL\_PA) of the controller that is in the passive state. In the IBM FAStT Check Port Database window, make sure that the loop ID and AL\_PA of the controller of the loop that is to be tested matches the controller that is in the passive state.

For details, refer to the Netfinity Fibre Channel Storage Manager installation and user's handbook or run the online help.

This book contains information about the following topics:

- Installing and starting IBM FAStT Check, including a quick overview of problem diagnosis
- Configuring IBM FAStT Check features
- Viewing and changing machine and adapter information
- Utilities and diagnostics
- Setting up a new DMI connection
- Uninstalling IBM FAStT Check

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## Installing and starting IBM FAStT Check

The IBM FAStT Check application consists of two separate components: the IBM FAStT Check Agent and the IBM FAStT Check application GUI. This chapter explains how to install and start the GUI application. The application provides communication with the agent.

The IBM FAStT Check Agent resides on the same system on which the host bus adapters are installed.

For local management, install and run the IBM FAStT Check GUI application on the same system on which the adapters are installed. For remote management, install and run the application on any system on the same network to which the managed machines are connected.

Because IBM FAStT Check is based on DMI, it cannot operate without the DMI Service Provider. The Service Provider that is used by IBM FAStT Check is manufactured by Intel. You install it along with the application.

### Installing IBM FAStT Check

To install IBM FAStT Check, start the IBM FAStT Check setup.exe and follow the instructions on the panels.

Restart the system before running the application.

#### Notes:

1. Use the default settings except in the two Select Components windows:
  - **FAStT Check:** Select **NT\2000** or **NetWare installation**.  
If you are also configuring a Novell NetWare Server, select the **FAStT Check NetWare Agent**. Click **OK** to continue.
  - **DMI:** Select both check boxes (**DMI 2.0 Services Provider** and **DMI 2.0 DCE Client**).
2. If IBM FAStT Check is already installed in a system running Microsoft® Windows, you must stop the Win32SL service *prior* to reinstalling the application. To stop Win32SL, click **Settings** → **Control Panel** → **Services** → **Stop Win32SL**.
3. If you are installing the FAStT Check NetWare Agent, the installation displays a Choose Destination Location window. Use the **Browse** button to point to the \SYSTEM directory on the NetWare SYS Volume.

**Note:** Remember that the drive letter must be mapped to the root of the NetWare SYS Volume.

**Note:** You must also load the NetWare Agent on the NetWare server. There are two methods for loading the agent and its components. The agents were

added to the AUTOEXEC.NCF file. If the NetWare server is restarted, the agent and its components are automatically loaded. If you want to manually load the agent and its components, type the following at the NetWare prompt:

- RPCSTART.NCF
- LOAD NWSL -r
- LOAD NWDMI2
- LOAD NWCDMI
- LOAD ONCSP
- LOAD QLFVAGNT

4. To manage or control a host bus adapter, IBM FAStT Check must first establish a DMI connection to the machine in which the adapter is installed. This machine can be the local system where IBM FAStT Check is running or any system on the same network to which the local system is connected.

To establish a DMI connection, the system to which you connect must meet the following requirements:

- At least one host bus adapter must be installed and active.
- The DMI Component Instrumentation Service (DMI\_CI.EXE) must be installed and running.

For more detailed information about DMI connections, see “Setting up a new DMI connection” on page 42.

## Starting IBM FAStT Check

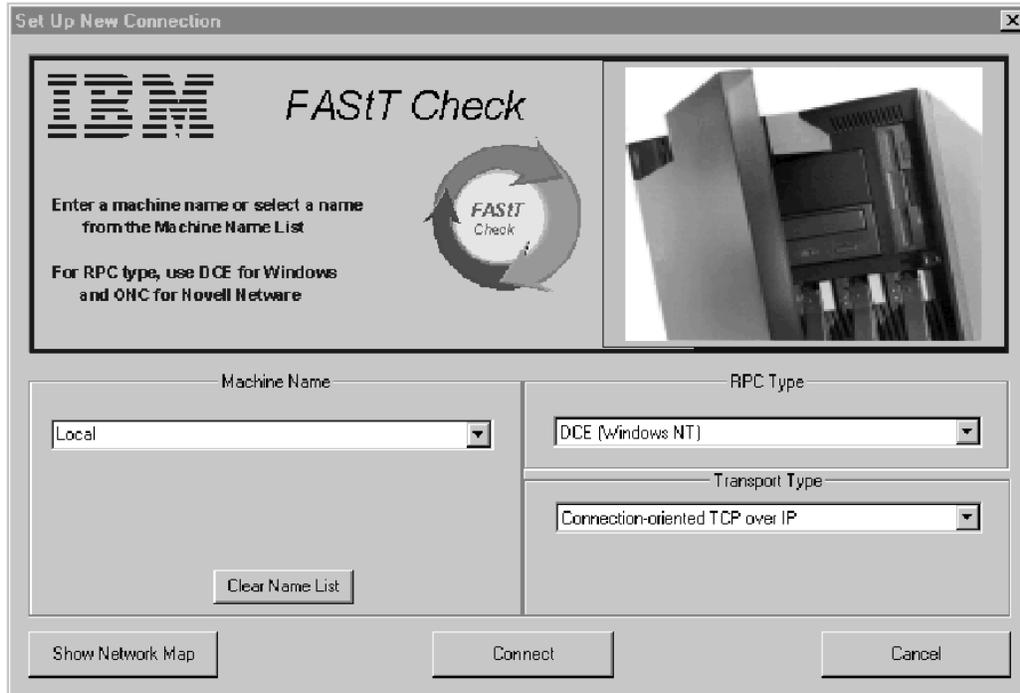
After installing IBM FAStT Check, start it by using one of the following procedures:

- If you have installed a shortcut on your desktop, click the shortcut.
- If you have not installed a shortcut on your desktop, click **Start** —> **Programs**. In the FAStT Management folder, click **FAStT Check**—> **FAStT Check Application**.
- If IBM FAStT Check does not respond after being started, end the task by clicking **Task Manager** —> **Processes** and stopping the dmi\_ma.exe process.

After IBM FAStT Check is started, the IBM FAStT Check icon (see the following figure) is displayed on the bottom-right corner of the screen. (This area is also known as the system tray.) This icon indicates that IBM FAStT Check is running.



When you start IBM FAStT Check and whenever you set up a DMI connection to either local or remote computers, the Set Up New Connection window opens (see the following figure).

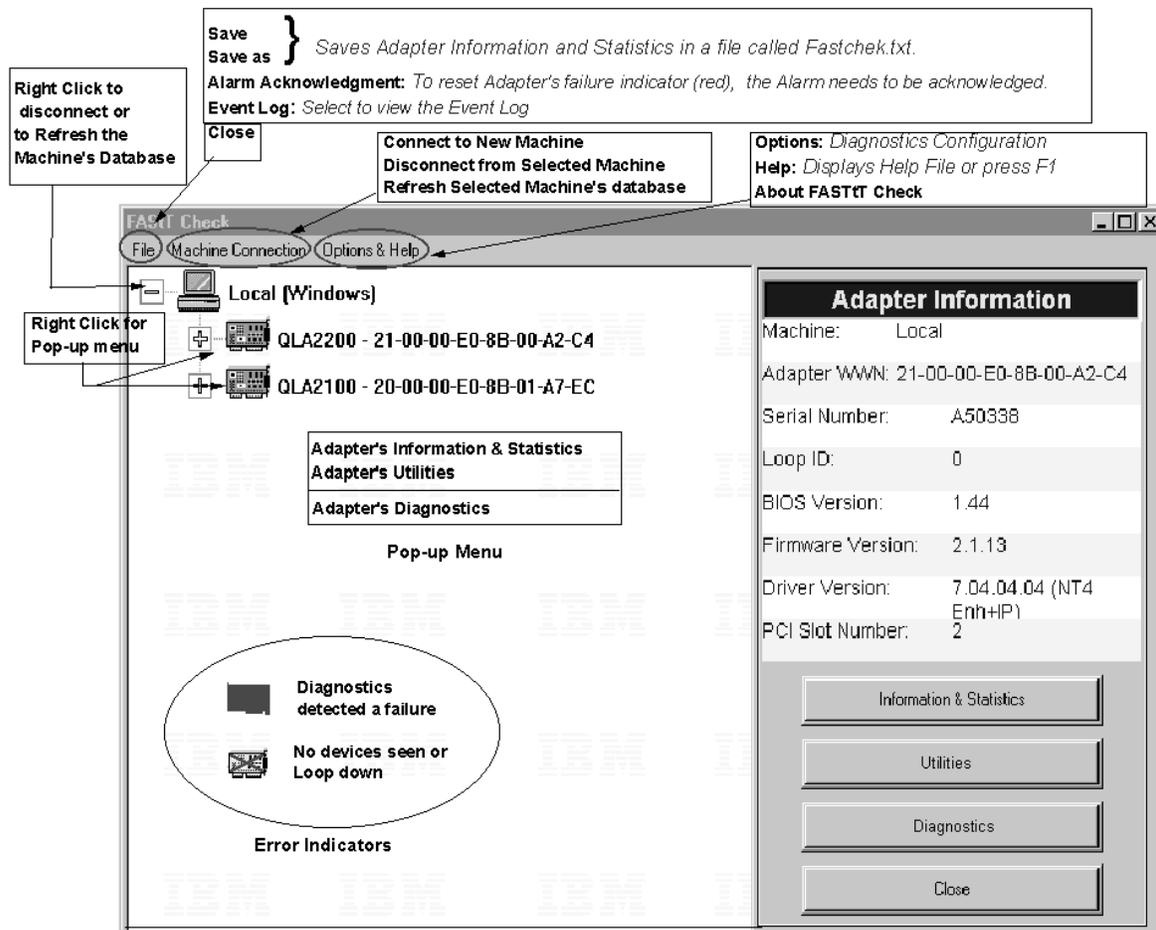


Follow these steps to run the Set Up New Connection window functions:

1. In the **Machine Name** list, click **Local** to test the adapters and associated FC devices for the system in which IBM FAST Check resides.
2. If a remote machine is present on the network, connect to the remote machine by typing its name in the Machine Name field in the Set Up New Connection window. Click the **Show Network Map** button to display the names of all the connectable machines and the network domains to which the machines belong.

**Notes:**

- a. You must install IBM FAST Check in the remote machine. The IBM FAST Check Agent (file QLFVAGNT.EXE) must be running to connect to a remote machine.
  - b. Do not connect a machine more than once. (Choose either local or machine name.)
  - c. On Windows 2000® systems, a DMIAddRowIn\_FillSubScriptioGroupInfo() failed! 503 message may be displayed when connecting a machine locally. This can occur if an error in one of the network connections is present. To correct the error, disable the bad network connection in the Network properties.
3. Select the proper RPC type (DCE for Windows or ONC for NetWare).
  4. Click the **Connect** button. The FAST Check main window opens (see the following figure).



The figure above shows the window that lists the adapters that are connected to a local system. The adapter type and associated worldwide node name are displayed next to each adapter icon. When you select the adapter, the panel on the right displays the adapter information (see "General Information & Statistics main window" on page 34).

**Note:** Press F1 to display online help for any IBM FASTT Check window.

To see which devices are connected to the adapter, expand the tree by double-clicking on the adapter icon in the left panel. Highlighting any device shows the device information on the right-hand panel.

If a loopback malfunction occurred (indicating that a loop is down) after performing a test, the associated adapter icon is highlighted in red. After the problem is corrected, you must acknowledge the alarm to reset the icon to green (operational).

A yellow adapter icon with a red X through it indicates that the adapter cannot communicate with any devices in the loop or that no devices are in the loop. After you resolve the problem, the adapter icon is reset to green, indicating a successful loop initialization. If this does not occur, right-click the machine icon and select menu option **Refresh Selected Machine's Database**.

**Note:** The adapter icon takes a few seconds to turn green, depending on the complexity of the loop (LIP duration) and of the Polling interval set in the Options dialog. See "Configuring IBM FASTT Check" on page 31.

## Overview of the FAST Check main window

Buttons are located on the bottom right of the FAST Check main window. Use these buttons for frequently performed operations.

- If you select a machine in the left panel of the FAST Check main window, the following buttons are displayed:

- **Connect to New Machine**
- **Close**

The **Connect to New Machine** button performs the same function as **Connect to New Machine** in the main menu and the **System Tray** menu (for more information about this option, see “Viewing and changing machine information” on page 32). The **Close** button has the same function as **Close** in the **File** menu.

- If you select an adapter in the left panel of the FAST Check main window, the adapter information is displayed in the right panel and the following three buttons are displayed:

- **Information & Statistics**
- **Diagnostics**
- **Utilities**

These buttons are duplicates of the pop-up menu options with the same names (for more information about these options, see “Viewing and changing adapter information” on page 34).

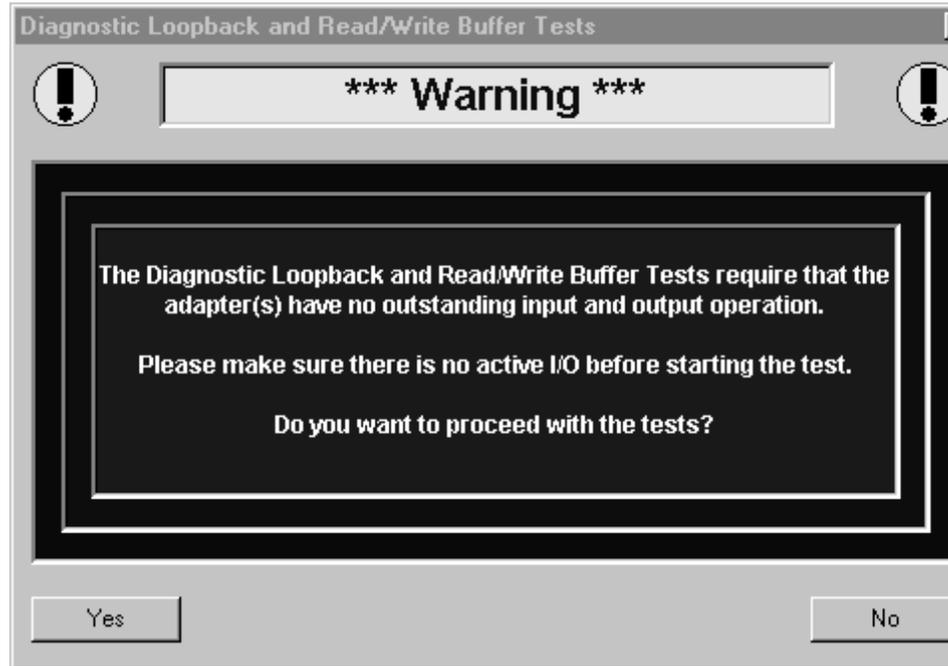
The following sections of this user’s guide provide detailed information about the menu items that are found on the main window:

- **File:**
  - **Save and Save as:** Saves the adapter’s information and statistics in a file called fastchek.txt (**Save**) or a file name of your choosing (**Save as**)
  - **Alarm acknowledgment:** “Acknowledging alarms” on page 40
  - **Event Log:** “Managing event logs” on page 41
  - **Close:** Exits program
- **Machine Connection:**
  - **Connect to New Machine:** “Viewing and changing machine information” on page 32
  - **Disconnect from Selected Machine:** “Viewing and changing adapter information” on page 34
  - **Refresh Selected Machine’s Database:** “Viewing and changing machine information” on page 32
- **Options & Help:**
  - **Options:** “Configuring IBM FAST Check” on page 31
  - **Help:** “Getting help and navigating” on page 31
  - **About FAST Check:** Displays product and version information

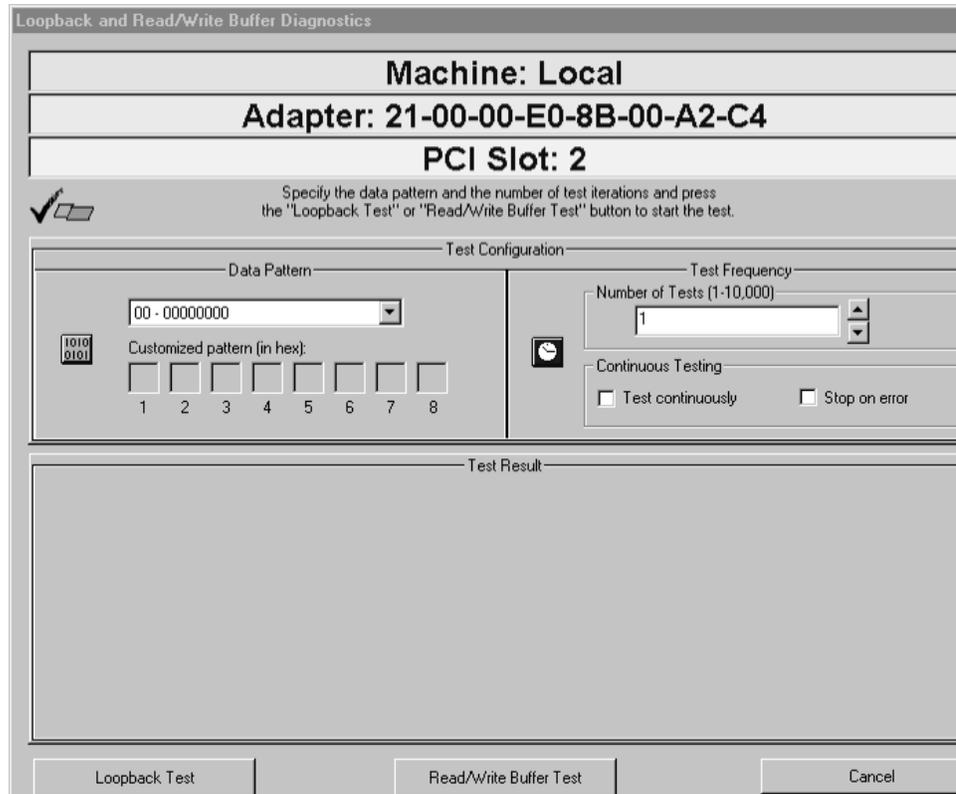
## Performing the diagnostics

To perform diagnostics, right-click the desired adapter icon in the left panel of the FAStT Check main window. The adapter pop-up menu is displayed with the following options: **Adapter's Information & Statistics**, **Adapter's Utilities**, and **Adapter's Diagnostics**. Perform the following steps to run the diagnostics:

1. Click the **Adapter's Diagnostics** button. The Warning message window is displayed (see the following figure).



2. Ensure that other applications are not running I/O operations (see "Important information concerning IBM FAStT Check," on page 23). If no I/O operations are running, click the **Yes** button. The Loopback and Read/Write Buffer Diagnostics window opens (see following figure) before you start the tests.



3. Click the desired data pattern (pre-set or customized).
4. Select **Test Continuously** or up to 10 000 iterations. Read/write buffer tests can take up to 15 minutes to run if the maximum number of iterations is selected.
5. Select **Stop on Error** to halt the program when errors are encountered.
6. Click **Loopback Test** or **Read/Write Buffer Test**.

**Notes:**

- a. The Netfinity Fibre Channel Host Bus Adapter (QLA2100) does not support loopback mode. Use only the read/write test for this type of adapter.
  - b. A wrap connector and coupler (see README file for part number) is available to assist in isolating loop problems. When running the loopback test, you can plug the wrap connector directly into the Netfinity FAStT Host Bus Adapter (QLA2200) to verify whether the adapter is functional. You can then move the wrap connector to other points in the loop (for example, ends of cables, hubs, and so on) to isolate the point of failure.
  - c. If the read/write buffer test returns the message Adapter has no devices attached, go to the FAStT Check main window, click the Machine icon and select **Refresh Selected Machine's Database** from the **Machine Connection** menu on the tool bar. You can also right-click the machine icon and select the "Refresh the machine database" menu option to refresh the machine database.
7. Monitor the IBM FAStT Check icon in the system tray for an indication of a malfunction. (The icon will blink and change to red if failures are encountered.)

For more detailed information about loopback and read/write buffer tests, see "Utilities and diagnostics" on page 37.

## Getting help and navigating

### Getting help

Click the **Help** menu option to display the online help in a Windows® help format. See the following figure.



Click on a main topic, **IBM DMI Management Application** or **IBM DMI Management Application's Main Menu**, to expand the topic list; then click a help section as needed.

### Navigating IBM FAStT Check

To display the IBM FAStT Check main menu or to return to IBM FAStT Check when other applications are active, right-click the icon in the system tray. Select one of the following options from the pop-up menu that is displayed.

- **New Machine Connection**
- FAStT Check main dialog\*
- Help on FAStT Check
- About IBM FAStT Check
- Exit FAStT Check\*\*

\* To return to the FAStT Check main dialog when other application windows are on the screen

\*\* Appears only when no machine connection is present

The first menu item option in the preceding list is **bold** to indicate that it is selected when the FAStT Check icon is double-clicked. For information about the **New Machine Connection** option, see "Setting up a new DMI connection" on page 42.

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## Configuring IBM FAStT Check

If you select **Options** from the **Options & Help** menu of the main window, the FAStT Check Configuration window opens. Use this window to configure the following functions:

- **Polling Interval**

This is the interval that is used by IBM FAStT Check to poll connected machines for alarms and indications. The polling interval always applies to the currently selected machine in the main window.

After the adapter for the system is connected, IBM FAStT Check starts polling the system for alarms and indications. The default polling rate is once every 30 seconds, but you can change the rate by typing the new polling interval into the **Interval** field or by using the arrows on the right side of the field to increase or decrease the polling rate.

The polling interval must be in the range of 1 second to 3600 seconds (one hour). IBM FAStT Check rejects invalid entries. (If an entry is invalid, the polling interval remains unchanged.)

If you use a fast polling rate, IBM FAStT Check receives indications rapidly from the connected system. However, faster polling rates consume more system microprocessor resources and slow down the system.

- **Event Log Size**

IBM FAStT Check maintains a log file to keep track of all alarms, warnings, and informational messages from connected systems. The default log size is 100 events, but you can change this to any value in the range of 20 to 200. Large log files hold more events than small log files, but are less easily managed.

- **Log Informational Event**

To enable logging of an informational event, select this check box. Informational events are defined as loop up and port update.

- **Log Warning Event**

To enable logging events that are classified as warnings, select this check box. Warning events are defined as loop initialization primitive (LIP) reset.

- **Warning Messages**

To disable warning messages for diagnostics, select the **Disable Warning Messages for Diagnostics** check box.

After making the desired changes to these settings, click the **Save** button to make the changes effective. Click the **Done** button to return to the FAStT Check main window.

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## Viewing and changing machine and adapter information

From the FAStT Check main window, you can view and change the machine and adapter information either through the tool bar or by right-clicking on the machines or adapter icons.

### Viewing and changing machine information

The panel on the left side of the FAStT Check main window displays the map of the connected machines and their adapters. To select an adapter, double-click the machine name to expand the adaptor list, or click the plus sign (+) next to the machine name. An adapter name consists of two parts: the type and worldwide node name (for example, 2100 20-00-00-E0-8B-6D-8F-21).

When you select **Machine Connection** from the main menu, the following options are displayed:

- **Connect to New Machine:** Opens the Set Up New Connection window, which you use to set up a new DMI connection to a machine.

- **Disconnect from Selected Machine:** Disconnects an adapter from a machine. (Clicking this option is the same as right-clicking the machine name and displaying the **Disconnect from Machine** menu.)

The **Disconnect Machine** button terminates the DMI connection between IBM FAST Check and the managed machine and removes the machine from the list of active machines. You might want to disconnect a machine to manage another machine or when the current machine is experiencing problems that stop DMI communication.

During the information viewing-and-changing process, if IBM FAST Check receives an error resulting from DMI messages, it opens the IBM DMI Management Application window (see the following figure).



This error can occur for a number of reasons, such as termination of the adapter DMI instrumentation, breaking of the network link between two machines, or when a managed machine becomes disabled.

To terminate the DMI link and delete the machine from the list of active machines, click the **Disconnect Machine** button in the Fibre Channel Adapter Management/Configuration window, and then click **Yes**.

- **Refresh Selected Machine's Database:** Allows IBM FAST Check to obtain an updated view of the system if you remove or add host bus adapters, devices, or LUNs. The database will retain all of the previous devices from the last configuration, providing you with a trace of the changes you made while diagnosing the problem. As a result, be aware that when the Read/Write test is run, those devices that are no longer physically attached but still in the database will return "Unknown" status. See the following figure.

Read/Write Buffer Test Result			
Loop ID / Status	Data Mismatch	Link Failure	Loss
0 / Unknown	R/W Buffer not supported		
0 / Unknown	R/W Buffer not supported		
0 / Unknown	R/W Buffer not supported		
0 / Unknown	R/W Buffer not supported		
0 / Unknown	R/W Buffer not supported		
0 / Unknown	R/W Buffer not supported		
0 / Unknown	R/W Buffer not supported		
4 / Success	0	0	

## Viewing and changing adapter information

If you right-click an adapter in the FASTT Check main window, a pop-up menu with the following options is displayed. (This menu is also displayed in the bottom right panel of the main window when you select the adapter.)

- **Adapter's Information & Statistics**  
Clicking this option opens the General Information & Statistics window, which contains three pages: General Information, Statistics, and Port Database.
- **Adapter's Utilities**  
Clicking this option opens the Adapter's Utilities window, which contains two pages: Link Status and NVRAM Settings.
- **Adapter's Diagnostics**  
Clicking this option will initiate the diagnostics.

### General Information & Statistics main window

When you click the **Adapter's Information & Statistics** option from the pop-up menu for an adapter, the General Information & Statistics window opens. This window is a property window with three pages:

- Adapter General Information
- Adapter Statistics
- Adapter Port Database

These pages display both general, static information about the host bus adapter and dynamically changing statistics.

When the General Information and Statistics window opens, the Adapter General Information page is displayed. To select another page, click the tab for the page. In the top part of each page, the names of the currently selected machine and adapter are displayed. To return to the FASTT Check main window, click **OK** or **Cancel** at the bottom of the window.

- Adapter General Information page  
This page displays the following information about the adapter:
  - Adapter Worldwide Node Name: The node name of the adapter
  - Serial Number: The serial number (in decimal) of the adapter
  - Loop ID: The loop ID of the adapter
    - Note:** Devices (including adapters) on FC arbitrated loops have an AL\_PA that you can set to a preferred ID (for example, the Netfinity 3526 and 3552 FC RAID Controllers) or that can be dynamically allocated. Loop IDs are 7-bit values that represent the 127 valid AL\_PA addresses.
  - BIOS version of the adapter
  - Firmware Version: The version number of the adapter firmware
  - Driver Version: The version number of the adapter device driver
    - Note:** Ensure that the adapter firmware (FW), BIOS, and device driver are at the latest level. (For detailed information, see the IBM support Web site <http://www.pc.ibm.com/pc/support>). If a second similar adapter is installed, verify that the levels are consistent with each other.
  - PCI Slot Number

- Adapter Statistics page

This page displays the following statistical information about the adapter. You can reset these statistics by clicking the **Reset All Statistics** button on the right side.

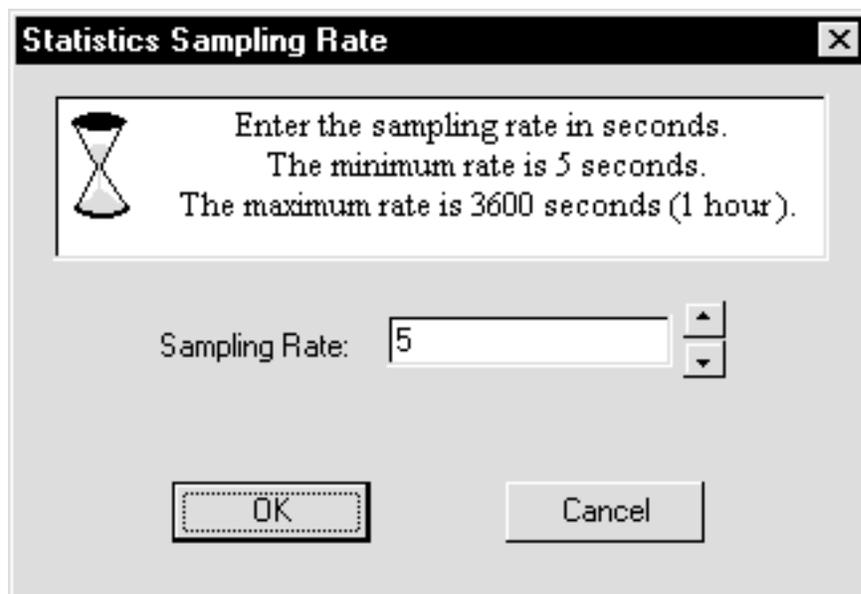
- Adapter Errors: The number of errors that were reported by the adapter controller
- Device Errors: The number of device errors that were reported by the adapter driver
- LIP Reset: The number of LIP resets that were reported by the adapter driver
- I/O Count: The total number of I/O operations that were reported by the adapter device driver
- I/O Per Second: The current number of I/O operations per second
- Bytes Per Second: The current number of bytes that are processed by the adapter per second

This page also has a configuration section on the right side that provides the following functions:

- Selecting the sampling mode (manual or automatic)
- Setting the rate of sampling for automatic mode
- Initiating a sampling in manual mode by clicking the **Update Statistics** button when manual mode is selected

To select a sampling mode if it is not currently active (if the button is *not* selected), select a mode, and then select the check box. The other mode is automatically deselected.

To change the sampling rate (the default is once every five seconds), make sure that the automatic sampling mode is selected (or else make sure the button is disabled) and click the **Set Sampling Rate** button. The Statistics Sampling Rate window opens (see the following figure).



To change the sampling rate, type the new value, or use the arrows on the right side of the list box to increase or decrease the sampling rate. The valid range for this sampling rate is 5 to 3600 seconds. To close the window without making any changes, click the **Cancel** button.

If you type an invalid value, the **DMI\_MA** window opens (see the following figure).



- Product Rev. (Revision)

#### — Loop Map

The loop map consists of two columns: the first column is an ordered device list, and the second column is the device AL\_PA. The right side of the loop map displays the list of all AL\_PAs, ordered in the same way as the electrical (not physical) connections between devices as established by the most recent LIP.

For example, Port 1 is the first (electrical) device on the loop. It has an AL\_PA of EF (the physical address of the adapter). Port 2 is the next device on the loop. It has an AL\_PA of E1 (the IBM Netfinity 3526 controller).

---

## Utilities and diagnostics

This chapter describes the following functions:

- Adapter's utilities
- Adapter's diagnostics
- Performing loopback and read/write buffer tests
- Acknowledging alarms
- Managing event logs

### Adapter's Utilities

The Adapter's Utilities main window opens when you click the **Adapter's Utilities** option from the pop-up menu for an adapter. The Utilities main window is a property window with two pages:

- Link Status
- NVRAM Settings

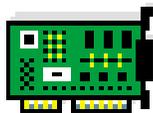
These pages provide information about the link status of an adapter and attached devices, and the NVRAM settings of the adapter. There are also buttons that you can use to update the NVRAM and flash BIOS of the adapter.

To select a page, click the tab of the page. In the top part of each page, the names of the currently selected machine and adapter are displayed. To return to the FASTT Check main window, click **OK** or **Cancel** at the bottom of the page.

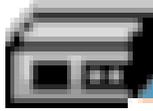
- Link Status page

When this page opens, IBM FASTT Check retrieves the latest adapter link status from the driver and displays the status for the adapter and all attached devices.

The first column of the link status list is the loop ID (AL\_PA assigned values) of the adapter and the attached devices. The adapter is identified by the following icon:



The devices are identified by the following icon:



The next four columns display the following diagnostic information about the adapter or devices:

- Link Failure: A loss of word synchronization for more than 100 msec or loss of signal.
  - Loss of Sync (<100ms): Four invalid transmission words out of eight (FC-PH rules) causes loss of sync. Only transitions from "in sync" to "out of sync" are counted. Three valid ordered sets in a row are required to reestablish word sync.
  - Loss of Signal: The receiver is not sensing a valid input signal.
  - Invalid CRC: The number of Cyclic Redundancy Check (CRC) errors that were detected by the device.
- NVRAM Settings and Flash Update page

This page displays all the adapter parameters that are saved in the nonvolatile RAM of the adapter. It also has three buttons which allow you to update NVRAM parameters and to update the adapter's firmware. The three buttons are:

- Restore Previous NVRAM Settings  
This button restores the value of the settings which were present prior to the last changes that were made.
- Send New NVRAM Settings  
This button sets the host bus adapter NVRAM settings to the new settings. In order for the new settings to take effect, the system needs to be restarted.
- Update Flash From File  
This button allows you to upgrade the adapter's firmware. Do not perform flash updates unless an IBM technical-support representative instructs you to do so.

**Note:** The NVRAM parameters are preset at the factory. Do not alter them unless an IBM technical-support representative instructs you to do so. Adapter operation might be adversely affected if you enter the wrong parameters.

## Adapter's Diagnostics

You can initiate the Diagnostics either by right-clicking on the desired adapter in the main FASTT Check window or on the Diagnostics button in the bottom right corner of that window. When either method is used, the application displays a warning message that asks that all I/O operations be stopped before the tests are performed. If you want to proceed with the test, click **Yes**. There are two tests that can be run:

- Loopback test
- Read/write buffer test

**Note:** To disable the warning message, click **Options & Help**, click **Options**, and then select the **Disable Warning Messages for Diagnostics** check box.

## Performing loopback and read/write buffer tests

The loopback test is internal to the adapter. The test evaluates the Fibre Channel loop stability and error rate. The test transmits and receives (loops back) the specified data and checks for frame CRC, disparity, and length errors, as well as performing a comparison of the transmitted data with the data received. A wrap plug and coupler are available as an assembly (see README file for part number) to provide loopback capability at the adapter, cable or cables, hubs, and so on. This is useful for isolating loop problems.

You can use the read/write buffer test to send data through the SCSI Write Buffer command to a target device, to read the data back through the SCSI Read Buffer command, and to compare the data for errors. The link status of the device before and after the read/write buffer test is also compared. If errors occur, the test indicates a broken or unreliable link between the adapter and the device, or a defective device.

The Loopback and Read/Write Buffer Diagnostics window has three sections:

- **Data Pattern:** Use the Data Pattern section to set the test pattern. You can select a data byte from the list or specify your own 8-byte pattern. To select your own test data, click **Customized** from the list and type the data in hexadecimal format (0-FF) into the boxes.
- **Test Frequency:** Use the Test Frequency section to specify the number of tests that you want to run. You can type a test number in the range of 1 to 10 000 or use continuous testing. If you select continuous testing, a window with a **Cancel** button opens while the test is running. To stop testing, click **Cancel**. To halt the program when errors occur, select **Stop on Error**.
- **Test Result:** The Test Result section displays the results of a testing run. The first column indicates whether the test passed or failed. The remaining information in this section pertains to error counters.

For a loopback test, the Test Result section displays the following information:

Test Status | CRC Error | Disparity Error | Frame Length Error

For a read/write buffer test, the Test Result section displays the following information:

Loop ID/Status | Data Mismatch | Link Failure | Loss of Sync | Loss of Signal | Invalid CRC

Follow these steps to perform a loopback/read-write buffer test:

1. Select the desired data pattern (pre-set or customized).
2. Select **Test Continuously** or up to 10 000 iterations. Read/write buffer tests can take up to 15 minutes to run if the maximum number of iterations is selected.
3. Select **Stop on Error** to stop the program when errors are encountered.
4. Click **Loopback Test** or **Read/Write Buffer Test**.

### Notes:

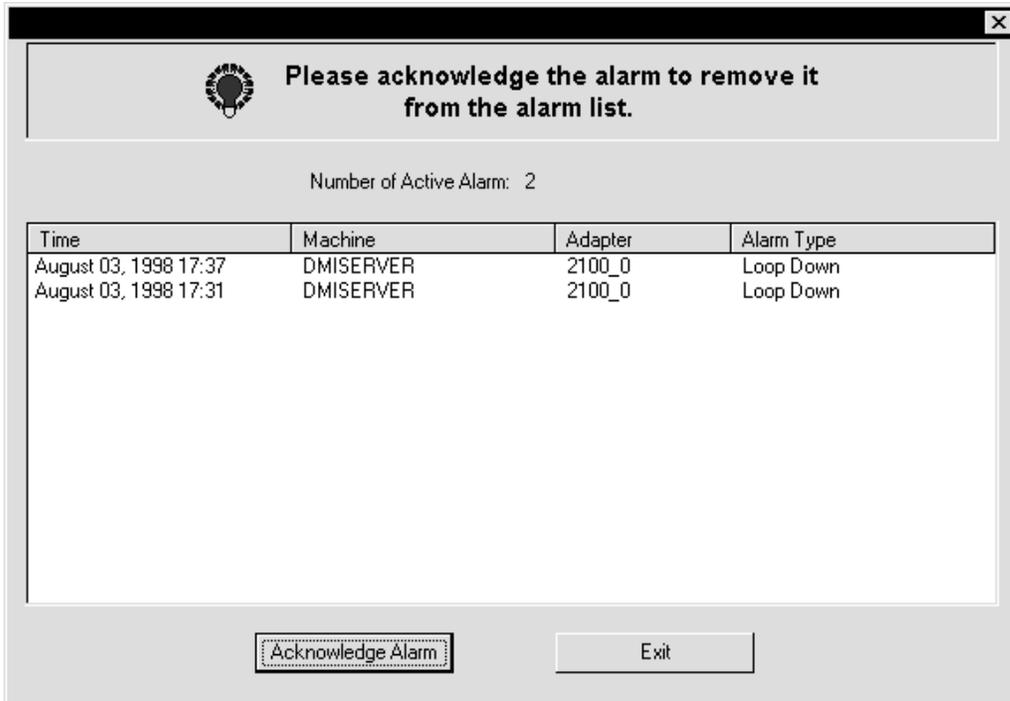
- a. The Nefinity Fibre Channel Host Bus Adapter (QLA2100) does not support the loopback test. Run only the read/write buffer test for this type of adapter.
- b. When running the loopback test, you can plug the wrap connector directly into the Netfinity FAStT Host Bus Adapter (QLA2200) to verify that the adapter is functional. You can then move the wrap connector to other points in the loop (for example, cables, hubs, and so on) to isolate the point of failure.
- c. If the read/write buffer test returns the message **Adapter has no devices attached**, go to the FAStT Check main window, click on the Machine icon and

select **Refresh Selected Machine's Database** from the **Machine Connection** menu on the tool bar.

5. Monitor the IBM FASTT Check icon in the system tray for an indication of a malfunction. If a malfunction occurs, the icon changes to red and blinks.

## Acknowledging alarms

When you click **Alarm Acknowledgment** from the **File** menu in the main window, the Alarm Acknowledgment window opens (see the following figure). Use this window to acknowledge and clear alarms.



When a DMI connection is established, IBM FASTT Check continuously monitors the connected machine for alarms and indications.

When an alarm condition (for example, a loop down) is reported, the IBM FASTT Check icon in the bottom right corner of the screen changes from green (its normal state) to flashing red:



The flashing icon indicates that there is at least one active alarm in the application that you need to acknowledge. The icon stops flashing and returns to its normal state after you acknowledge all active alarms and after the alarm list is empty.

Using the Alarm Acknowledgment window, you can acknowledge alarms that have been reported from connected machines.

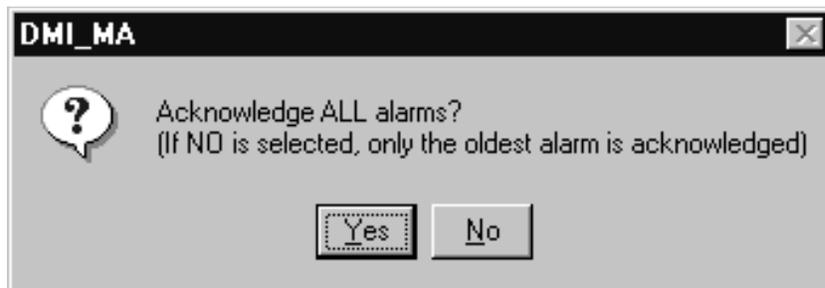
Each alarm in the alarm list includes the following information:

- Time: The date and time when the alarm was reported
- Machine: The name of the machine where the alarm originated
- Adapter: The name of the adapter where the alarm occurred
- Alarm Type: A brief explanation of the alarm

You can scroll this list vertically if the list of alarms does not fit on the screen. Alarms are displayed in the order that they occur, with the most recent alarm at the top of the list.

To acknowledge alarms that are displayed in the alarm list, click the **Acknowledge Alarm** button.

If there is more than one active alarm, the DMI\_MA window opens (see the following figure).



Using this window, you can acknowledge all alarms at once. If you click the **Yes** button, all alarms are cleared and the list empties. If you click the **No** button, only the oldest alarm in the alarm list is acknowledged and removed.

If the alarm list is empty (if there is no active alarm) and you click the **Acknowledge Alarm** button, a message window opens informing you that there is no active alarm.

## Managing event logs

If you click **Event Log** in the **File** menu in the FAStT Check main window, the Event Log window opens. This window lists all the alarms and events from the adapters.

Each event in the list is preceded by a small icon that identifies the event as an alarm, a warning, or an informational message.

- An alarm event type is preceded by this icon:



- A warning event type is preceded by this icon:



- An informational event type is preceded by this icon:



To the right of the icon is the date and time when IBM FASTT Check received the event. The text classifies the type of event (ERROR [Alarm], WARNING, or INFO), followed by a description of the event. This description includes the machine name and adapter number that originated the event.

There are two types of operations that you can perform on event logs: printing the event log and resetting the event log.

- **Printing the event log**  
To print all the events in the list, click the **Print Event List** button. The Print Event Log window closes when the printing completes.
- **Resetting the event log**  
To delete all the events in the list, click the **Reset Event List** button, and then click the **Yes** button in the confirmation window.

**Note:** The event log is saved in a file called event.txt in the directory in which FASTT Check was installed.

---

## Setting up a new DMI connection

To manage or control a host bus adapter, IBM FASTT Check must first establish a DMI connection to the machine on which the adapter is installed. This machine can be the local system where IBM FASTT Check is running or any system on the same network as the local system.

In the FASTT Check main window, the first menu option in the **Machine Connection** menu, **Connect to New Machine**, sets up a DMI connection to either the local or remote computers. When you click this option, the Set Up New Connection window opens.

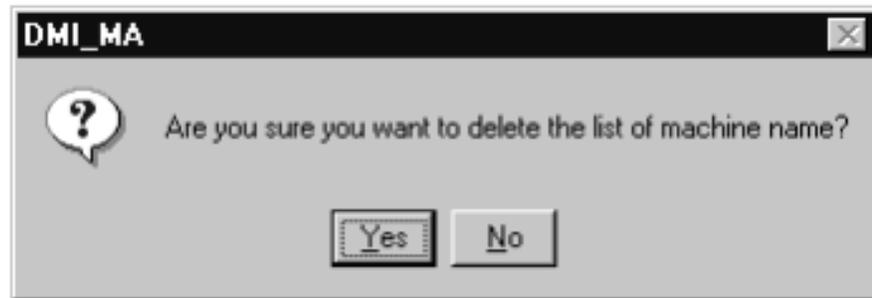
In this window, type the name of the system to which you want to connect and the transport type you want to use for the connection. This window (through the **Show Network Map** option) also lists the names of all computers currently on the network. This window has the following controls:

- **Show Network Map** button  
This button helps you find the machine names. When you click it, the Show Network Map window opens and displays the names of all the connectable machines and the domains to which the machines belong.
- **Machine Name** field  
Type the name of the machine to which you want to connect in the **Machine Name** field. After typing the machine name, click the **Connect** button to initiate the DMI connection process, or click **Cancel** if you decide not to initiate any DMI connection.

After the DMI connection is established to a remote machine, IBM FASTT Check saves the name of the remote machine so that you do not have to type the name again if you want to connect to the same machine the next time the application is started.

To select the name of a machine that was previously connected to IBM FASTT Check, click the arrow button on the right edge of the **Machine Name** field. In the list, click the machine name. The machine name is displayed in the field.

To delete the names of remote machines that were previously connected to IBM FAStT Check, click the **Clear Name List** button below the **Machine Name** field. When the DMI\_MA window opens (see the following figure), click **Yes** to delete all the names.



- **Transport Type** field  
After entering or selecting the machine name, use the **Transport Type** list to select the transport for the DMI connection. The following table lists the available transport types.

Table 1. DMI transport types

Description	Transport Type
Connection-oriented TCP over IP	ncacn_ip_tcp
Connection-oriented TCP over NetBIOS	ncacn_nb_tcp
Connection-oriented IPX over NetBEUI	ncacn_nb_ipx
Connection-oriented NetBIOS over NetBEUI	ncacn_nb_nb
Connection-oriented named pipes	ncacn_np
Connection-oriented SPX	ncacn_spx
Connection-oriented DECnet transport	ncacn_dnet_nsp
Datagram (connectionless) UDP over IP	ncadg_ip_udp
Datagram (connectionless IPX)	ncadg_ipx
Local (cross-process) procedure call	ncalrpc

If you do not select a transport type, the first item, Connection-oriented TCP over IP (ncacn\_ip\_tcp), is used. This transport type is normally used for a Windows environment. If you select ONC (NetWare), ncacn\_spx is used as the default protocol.

For information about the DMI connection, click **About IBM FAStT Check** in the **Options & Help** menu of the main window. Clicking this menu option opens a window that shows the version number and release date of IBM FAStT Check, as well as the following information about the Intel DMI Service Provider when at least one DMI connection is established:

- The version number of the Service Provider
- The version number of the DMI specification

---

## Uninstalling IBM FAStT Check

To uninstall IBM FAStT Check, the FAStT Check Agent (either NT/2000 or Netware) services must be stopped. This section explains how to stop these security agents.

**Note:** If you also want to uninstall DMI 2.0 Service, you must stop the Win32sl service before uninstalling DMI 2.0. The DMI 2.0 Service Provider provides its own uninstall option.

### Stopping the FAStT Check NT/2000 security agent

To manually stop the FAStT Check NT/2000 security agent, perform the following steps.

1. Click **Start --> Settings --> Control Panel --> Services**.
2. Go to the QLFVAGNT service and click the Stop button.

### Stopping the FAStT Check NetWare security agent

To manually stop the FAStT Check NetWare security agent, type the following at the command prompt:

```
:UNLOAD QLFVAGNT  
:UNLOAD ONCSP  
:UNLOAD NWCDMI  
:UNLOAD NWDMI2  
:UNLOAD NWSL  
:UNLOAD TIRPC  
:UNLOAD LOCAL_ND  
:UNLOAD SPX_ND  
:UNLOAD TCP_ND  
:UNLOAD SPXS  
:UNLOAD IPXS  
:UNLOAD RPCBSTUB  
:UNLOAD NETDIR
```

## Uninstalling IBM FAStT Check

The following procedure will guide you in uninstalling the local copy of the FAStT Check Application and the FAStT Check Security Agent. If the Netware Agent was also installed, the uninstall program will attempt to uninstall it. For the uninstall program to properly uninstall the NetWare agent, the drive mapped to the /SYSTEM folder of the NetWare SYS Volume when FAStT Check was installed must be available.

1. Run the FAStT Check Application by clicking **Start --> Programs --> FAStT Check Management --> FAStT Check --> Uninstall**.
2. Follow the onscreen instructions to remove the installed components.



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## Chapter 4. Type 3523 Fibre Channel Hub and GBIC

**Note:** The PD maps provide you with additional diagnostic aids and can be found on the IBM support web site: <http://www.pc.ibm.com/qtechinfo/MIGR-4P3PMR.html>. The PDs can also be found in this book. See “Chapter 2. PD entry,” on page 3.

The type 3523 Fibre Channel Hub and GBIC are compatible with the following IBM products:

- Fibre Channel Adapter (FRU 01K7354) (see Chapter 5 on page 59)
- IBM FAStT Host Adapter (FRU 09N7292) (see Chapter 6 on page 65)
- Type 3526 Fibre Channel RAID controller (see Chapter 7 on page 81)

The IBM Fibre Channel Hub is a 7-port central interconnection for Fibre Channel Arbitrated Loops that follow the ANSI FC-AL standard. Each Fibre Channel Hub port receives serial data from an attached node and retransmits the data out of the next hub port to the next node attached in the loop. Each reception includes data regeneration (both signal timing and amplitude) supporting full-distance optical links.

The Fibre Channel Hub detects any loop node that is missing or is inoperative and automatically routes the data to the next operational port and attached node in the loop. LED indicators provide status information to indicate whether the port is active or bypassed.

Each port requires a Gigabit Interface Converter (GBIC) to connect it to each attached node. The Fibre Channel Hub supports any combination of short-wave or long-wave optical GBICs. The GBICs are *hot-pluggable* into the Fibre Channel Hub, which means you can add host computers, servers, and storage modules to the arbitrated loop dynamically without powering off the Fibre Channel Hub or any connected devices. If you remove a GBIC from a Fibre Channel Hub port, that port is automatically bypassed. The remaining hub ports continue to operate normally with no degradation of system performance. Conversely, if you plug a GBIC into the Fibre Channel Hub, it is automatically inserted and becomes a node on the loop if valid Fibre Channel data is received from the device.

Data transfer within the Fibre Channel Hub is implemented in serial differential Positive Emitter Coupled Logic (PECL) AC coupled logic. Each Fibre Channel Hub port monitors the serial data input stream as well as the GBIC connected to it.

The following conditions cause the Fibre Channel Hub to bypass a port:

- TX\_FAULT: Detects a GBIC transmitter fault.
- RX\_LOS: Detects a loss of received signal amplitude from the device.
- MOD\_DEF: Detects the absence of a GBIC.

The Fibre Channel Hub circuitry detects off-frequency data, excessive jitter, or inadequate edge transition density on a per-port basis. The Fibre Channel Hub uses the standardized AMP SCA2 20-pin connector to implement hot plugging. Surge currents, caused by hot plugging, are minimized by slow-start circuitry and a pin-sequencing procedure on the GBIC. Electrostatic discharge (ESD) transients are minimized by means of sequenced connector contacts.

The Fibre Channel Hub includes a universal power supply that can operate from 95 to 250 V ac and from 50 to 60 Hz.

---

## General checkout

Installation and operational problems in an arbitrated loop environment are typically caused by one of the following:

- Faulty cabling or cable connector
- Incorrect cable plugging
- Faulty GBIC
- Faulty hubs
- Invalid Fibre Channel signaling from the host bus adapter (HBA) or disk array
- Device driver or microcode conflicts between the HBAs and other devices.

The following information will help you to isolate and correct the physical layer problems. For protocol-related problems, such as inoperability between devices, see the documentation that came with the individual devices.

## Port Status LEDs

The hub provides two status LEDs for each port. Use these LEDs to help you quickly diagnose and recover from problems.

The upper, green LED is lit when an operational GBIC is installed. The lower, amber LED is lit when the port is in the bypass mode. In the bypass mode, a port is disabled, which prevents erratic signals or data from disrupting loop activity. The bypass mode could be triggered by the loss of valid signal or by a GBIC fault. The combination of green and amber LEDs indicates one of the four following states.

*Table 2. Port Status LEDs*

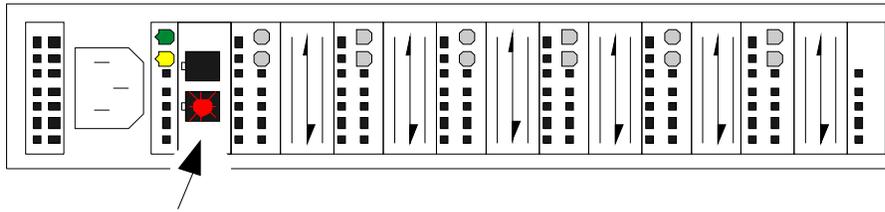
Green LED	Amber LED	Port State
Off	Off	No GBIC Installed
On	Off	Operational GBIC; Valid Signal
Off	On	Faulty GBIC; Port Bypassed
On	On	Operational GBIC; No Valid Signal; Port Bypassed

## Verifying GBIC and cable signal presence

**Note:** Do *not* look directly into any fiber cable or GBIC optical output. Read “Appendix J. Related service information,” on page 441. To view an optical signal, use a mirror to view the reflected light.

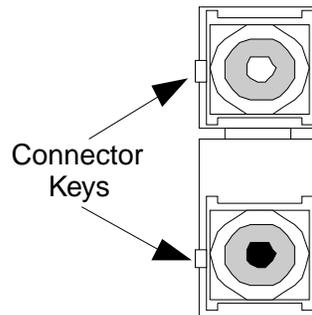
### Verifying signal presence

In addition to verifying port LED status, you can verify signal presence by using a mirror to look for a reflected light at the fiber-optic cable ends and the GBIC transmitter. To verify signal presence at the hub end of a link, insert a GBIC into the hub and place a mirror at the bottom of the SC connector. If a signal is present, you will see a low intensity red light in the mirror reflecting from the GBIC transmitter.



### Verifying node end

To verify the integrity of the fiber-optic cable at the node end of a link, make sure the cable is attached to the GBIC at the hub and the hub is turned on. Dual SC fiber-optic cable connectors are keyed and will insert into a GBIC in one direction only. Place a mirror at the node end of the link. A low intensity red light is visible in the mirror reflection of one of the SC leads, as shown in the following figure.



If a fiber-optic cable has good transmitter output but a broken or degraded receiver lead, the end node might sense a *loop down* state. Because the transmitter is good, the hub responds to the end node valid Fibre Channel signal and adds the device to the loop. But, because the end node is not receiving Fibre Channel signals, it will stream loop-down sequences onto the loop. This prevents all data communications among the devices on the loop and will continue to do so until the condition is corrected.

### Verifying hub end

To verify the integrity of the fiber-optic cable at the hub end, make sure the fiber-optic cable is plugged into the host bus adapter at the host or into a disk-array controller and that the device is enabled on the loop. Using a mirror, examine the cable SC leads to verify that a low-intensity red light is visible on the receiver lead.

**Note:** Some fiber-optic cables are marked with an A on the receiver lead and a B on the transmitter lead and are keyed. Some multimode cables plugged into a GBIC, HBA, or disk array controller are key-oriented with the B lead inserted into the device transmitter. Place a mirror on the opposite end of the cable to see the low-intensity red light on the A receiver lead.

---

## Features

The Fibre Channel Hub is designed with seven modular user-configurable interface ports. These seven ports comply with the GigaBit Interface Converter (GBIC) specification. GBICs are available in two media types:

- Long-wave optical
- Short-wave optical

This section covers both the Fibre Channel Hub and the GBICs.

The following list summarizes the features of the Fibre Channel Hub:

- Seven configurable media-interface optical ports provide high performance.
- Plug and Play provides fault tolerance for online system configuration changes.
- Modular Gigabit Interface Converter (GBIC) transceiver design allows you to use ports when needed.
- Cascadable ports allow up to 127 connections (where one port is reserved for connection to fabric or switch-active ports) or support of multiple loop implementations.
- Simplified cable management can be used for centralized storage management applications.
- Hot-pluggable GBIC provides an optimal solution for entry storage interconnect needs.
- Half-rack width (1U = 1.75 in.) low profile hub packaging offers highest port density in single 1 unit height rack mount.
- Auto-sensing power supply supports 95 to 250 V ac and 50 to 60 Hz.

### Fibre Channel long-wave GBIC

Features of the long-wave optical GBIC include:

- Full-speed: 1.0625 Gbps
- Uses single-mode 9 micron fiber
- Wavelength: 1310 nm
- Non-OFC laser
- Uses dual SC fiber-optic connectors
- Fiber lengths: 1 meter minimum, 10 kilometers maximum

### Fibre Channel short-wave GBIC

Features of the short-wave optical GBIC include:

- Compliant with Fibre Channel FC-PH-2 physical layer option 100-M5-SN-I
- Full-speed: 1.0625 Gbps
- Wavelength: 780 nm
- Non-OFC laser
- Supports multimode 50 micron fiber (1 meter/minimum, 500 meters/maximum)
- Uses dual SC fiber-optic connectors

## Fibre Channel-Arbitrated Loop

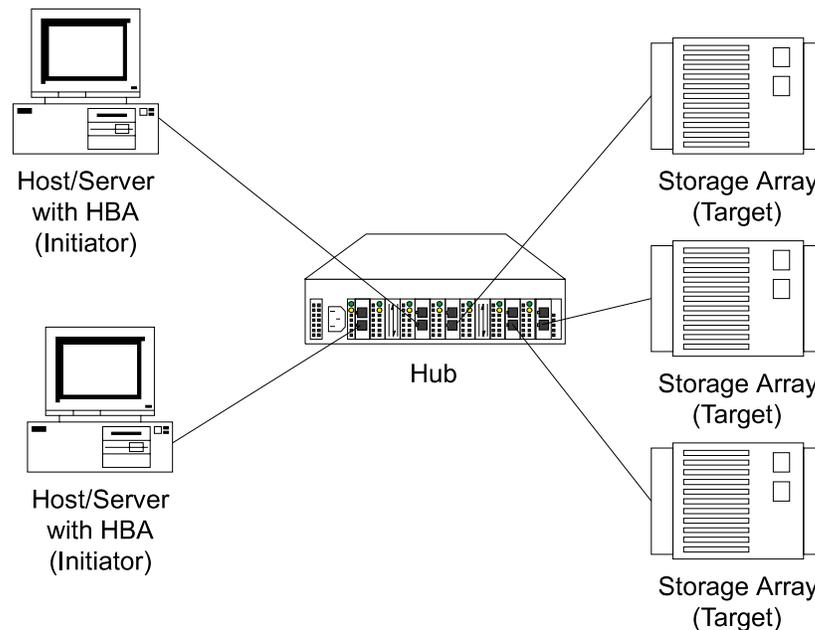
The Fibre Channel-Arbitrated Loop (FC-AL) is an ANSI standard (X3T11) product designed to provide shared bandwidth over low-cost media. Early adapters primarily use the SCSI protocol transported over Fibre Channel for distributed server and storage-cluster applications. The Fibre Channel Hub is a central point of interconnection designed to maintain a fault-tolerant physical loop topology. The Fibre Channel Hub can also be used to implement configurations that extend the size of the FC-AL loop to its maximum size of 127 active loop ports (includes one optional Fabric-Loop port).

---

### Additional service information

#### Applications and configurations

The Fibre Channel Hub modular interface provides flexibility and is upgradable to available short-wave and long-wave optical Fibre Channel product port interfaces. Fibre Channel products that are commonly interconnected to the Fibre Channel Hub are Fibre Channel host bus adapters, FC-AL storage devices, and FC-AL storage arrays. SCSI initiators (workstations and servers) set up and initiate the transfer of data to or from the storage devices. The storage devices that receive the requests made by the SCSI initiators are the SCSI targets. Initiators and targets represent individual nodes that are linked by the shared FC-AL.



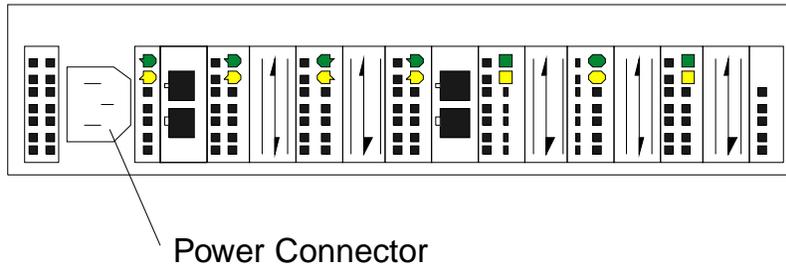
#### Power on systems check — Fibre Channel Hub

Power on the storage modules first, then the controller and the Fibre Channel Hub, then everything else.

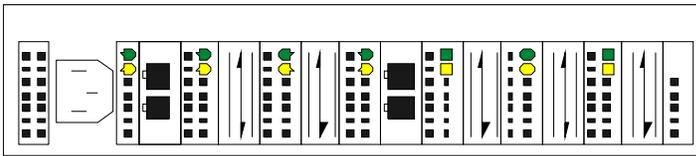
**Note:** Make sure the Fibre Channel Hub is powered on before the host adapter to insure proper loop initialization.

**To insure proper operation:**

1. Connect the power cord to the Fibre Channel Hub, then to the electrical outlet.



2. Power on the attached FC-AL compatible nodes.
3. Check the Device Active (green) LEDs on the Fibre Channel Hub ports.



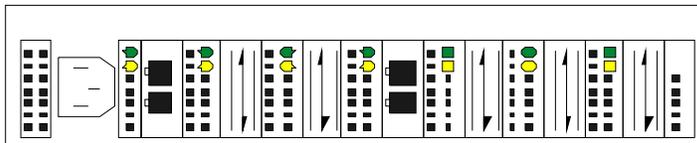
**Active On**  
Green LEDs on Top Row

**LED On** This indicates that a GBIC is present and functioning properly.

**LED Off** This indicates a fault condition. Examples of a fault condition include: a GBIC transmitter fault, an improperly seated GBIC, an absent GBIC, or another failed device. The port will be in the bypass state, which precludes the port from participating in the FC-AL. This is the normal status of operation for Fibre Channel Hub ports in which GBICs are not installed.

**Note:** FC-AL compatible nodes must perform loop initialization procedures at power on to function properly on the loop. FC-AL nodes also perform loop initialization or reinitialization depending on their prior state of operation.

4. Check the Port Bypass (amber) LEDs.



**Bypass**  
Amber LEDs on Bottom Row

**LED On** If the Active (green) LED of the port is off, the port is nonoperational and the Bypass (amber) LED for the port is on. If a properly functioning port (the Active green LED is on) with a GBIC present also has the Bypass LED

on, either the loss of signal or poor signal integrity has caused the port to go into the bypass state. When the port is in this state, it cannot participate in the FC-AL.

The bypass state is also the normal status condition when no GBIC is present in the port, a GBIC is present but not attached to a FC-AL node, or a GBIC is attached to a cable assembly with nothing attached at the opposite end. Replacing such a port (or removing and reinserting the GBIC into the same port twice) is considered to be a loop configuration change which invokes the Loop Initialization Procedure.

**LED Off** This indicates that the Fibre Channel Hub port and device are fully operational and actively participating in the FC-AL.

5. The FC-AL should be fully operational. Check that proper loop discovery has taken place and all required devices are participating in the loop. Some host bus adapters might provide this level of functionality or it might be resident in the application software on the host operating system.

---

## Installation procedures

This section contains the following installation information:

- “Installing the Fibre Channel Hub rack”
- “Installing the GBIC” on page 56
- “Removing the GBIC” on page 57

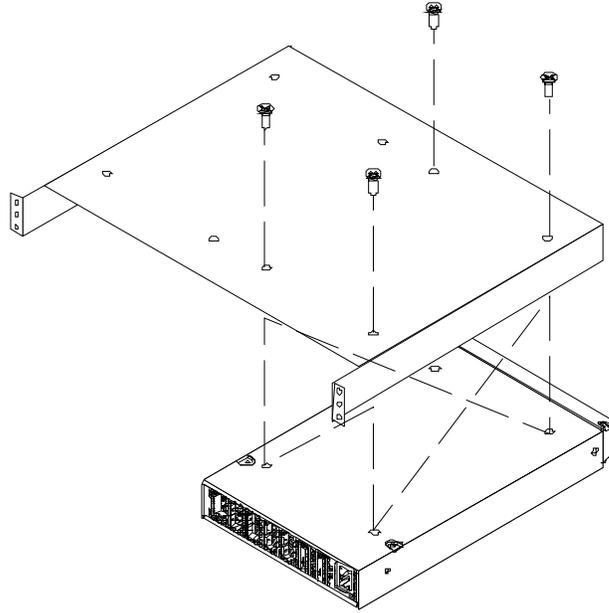
### Installing the Fibre Channel Hub rack

The Fibre Channel Hub comes with a tray and bezel for installation in a rack.

**Note:** Also use this procedure to assist in removing the Fibre Channel Hub from a rack shelf.

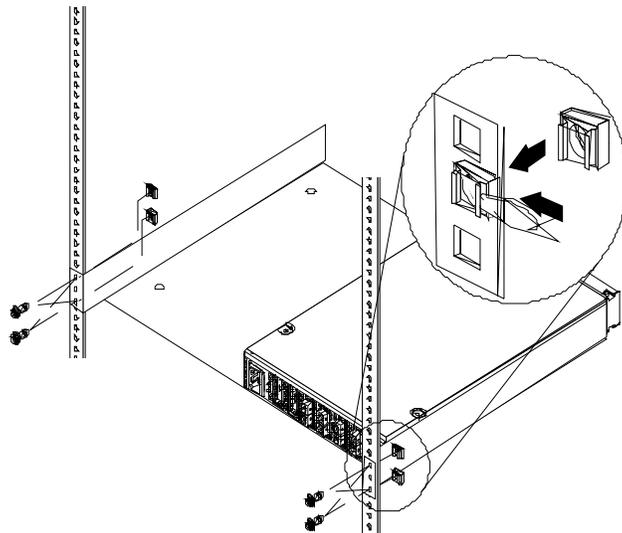
To install the Fibre Channel Hub in the rack:

1. Turn the hub upside down and place it on a flat surface.
2. Turn the tray upside down and place it on the hub.
3. Align the four holes in the tray with the holes in the hub. Line up the back lip of the tray with the back side of the hub.
4. Using a Phillips head screw driver, install the four smaller screws in the aligned holes.

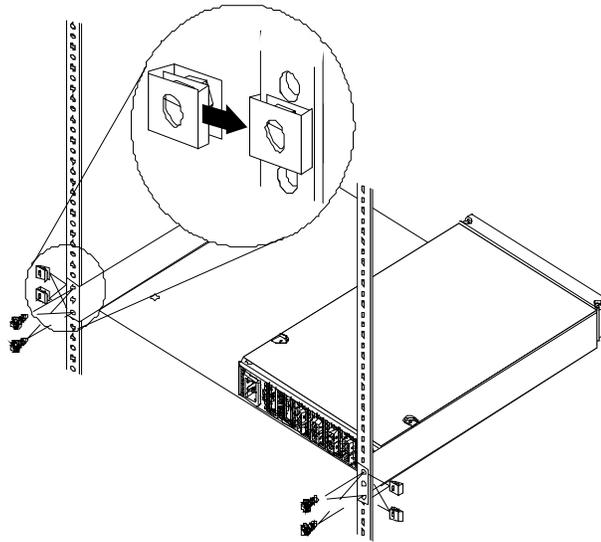


5. Turn the tray over so that the hub is on top of the tray.
6. Find the rack position into which you are installing the Fibre Channel Hub; then, take four clip nuts and install them in the rear of the rack. Make sure you have installed one in each screw hole you will be using for the tray installation.

If the rack has square holes, snap the M6 clip nuts into place on the rear of the rack.



If the rack has round holes, slide the 10-32 clip nuts into place on the rear of the rack.

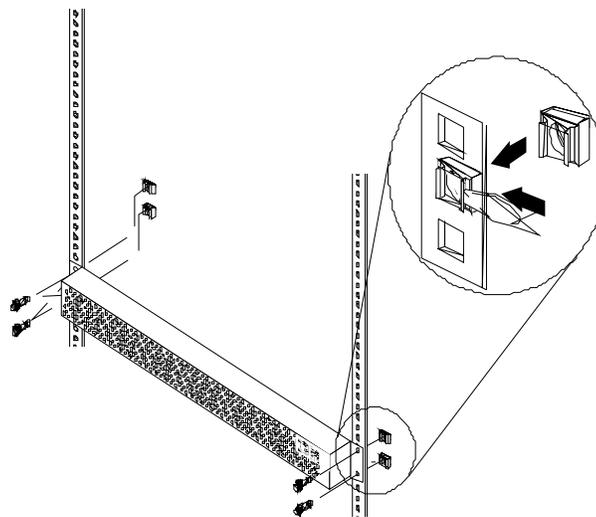


7. Pick up the tray and line up the top and bottom screw holes with the clip nuts on the rack. While holding the tray in place, install four of the larger screws.

If the rack has square holes and you used the M6 clip nuts, use the M6 hex washer headed screws.

If the rack has round holes and you used the 10-32 clip nuts, use the 10-32 hex washer headed screws.

8. Install the remaining four clip nuts in the front of the rack. Be sure to line them up opposite the hub and tray.
9. Line up the top and bottom bezel screw holes with the clip nuts on the rack. While holding the bezel in place, install four of the larger screws.



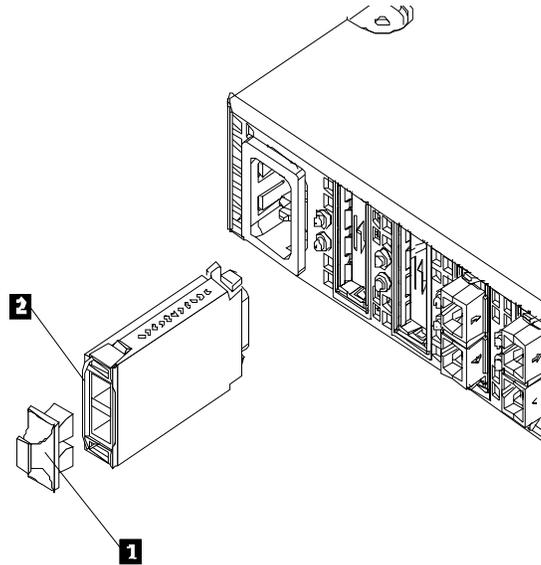
If the rack has square holes, use the M6 clip nuts and hex washer headed screws.

If the rack has round holes, use the 10-32 clip nuts and hex washer headed screws.

## Installing the GBIC

There are several different types of GBICs available. You can insert any type of GBIC into any available hub port.

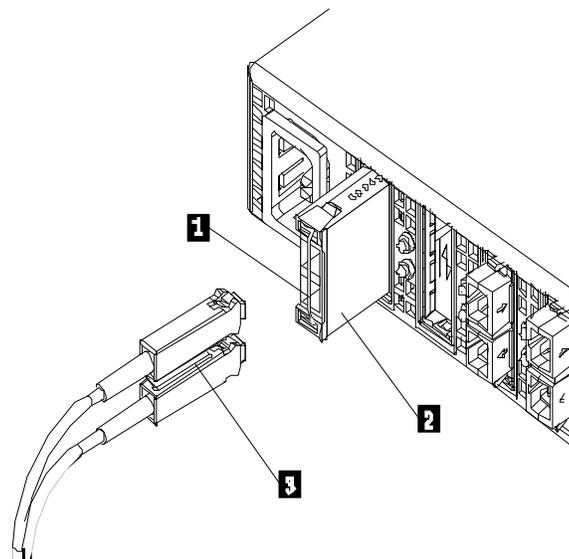
1. Remove the plastic cover (1) from the GBIC (2).



2. Insert the cables into the GBIC.

If the GBIC you are installing has a metal latch, move the latch to the unlocked (center) position (1). Slide the GBIC (2) into the port, then move the GBIC latch back to the locked position (flush with the rear of the GBIC). Connect the fiber-optic cable (3) to the installed GBIC.

If the GBIC you are installing does not have a metal latch, slide the GBIC (2) into the port. Connect the fiber-optic cable (3) to the installed GBIC.



For cable management information, go to <http://www.pc.ibm.com/support/> on the World Wide Web.

## Removing the GBIC

To remove a GBIC that does not have a metal latch from the hub port:

1. Press the opposing tabs on the GBIC toward each other while slowly removing the module from the hub (with the fiber-optic cables still installed).
2. Remove the cable assembly from the GBIC.

To remove a GBIC that has a metal latch from the hub port: (Refer to the figures in "Installing the GBIC" on page 56.)

1. Remove the fiber-optic cable assembly from the GBIC.
2. Move the latch to the unlocked (center) position.
3. Press the opposing tabs on the GBIC toward each other while slowly removing it from the port.

---

## Symptom-to-FRU index

The Symptom-to-FRU lists symptoms, errors, and the possible causes. The most likely cause is listed first.

The PD maps provide you with additional diagnostic aids and can be found on the IBM support web site: <http://www.pc.ibm.com/qtechinfo/MIGR-4P3PMR.html>. The PDs can also be found in this book. See "Chapter 2. PD entry," on page 3.

**Note:**

1. Always start with the "General checkout" on page 48. For IBM devices not supported by this index, refer to the manual for that device.
2. Do *not* look directly into any fiber cable or GBIC optical output. Read "Appendix J. Related service information," on page 441. To view an optical signal, use a mirror to view the reflected light.

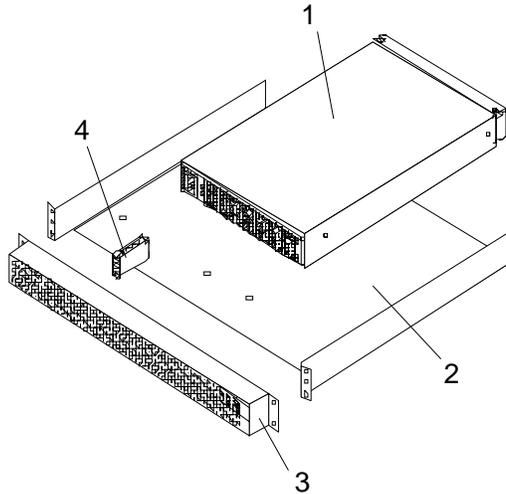
*Table 3. Symptom-to-FRU index for Type 3523 Fibre Channel Hub and GBIC*

Problem	FRU/Action
GBIC installed in one or more ports but no LED is lit.	<ol style="list-style-type: none"> <li>1. <b>Power cord</b></li> <li>2. Power source</li> </ol>
GBIC installed but only the amber LED is lit.	<ol style="list-style-type: none"> <li>1. <b>Reseat GBIC</b></li> <li>2. GBIC</li> </ol>
GBIC installed and both green and amber LEDs are lit.	<p><b>The hub is not receiving a valid Fibre Channel signal from the end node. Do the following:</b></p> <ol style="list-style-type: none"> <li>1. Unplug the fiber cable from the node and, using a mirror, verify that an optical signal is present on the cable. If no red light is visible, replace the cable.</li> <li>2. Using a mirror, examine the SC connectors on the HBA or disk controller. If no red light is visible, check the HBA or disk controller.</li> <li>3. If a light is present on both the cable lead and the end node, check the HBA or the disk controller.</li> </ol>

Table 3. Symptom-to-FRU index for Type 3523 Fibre Channel Hub and GBIC

Problem	FRU/Action
<p>GBIC is installed, only the green LED is lit, but no communication occurs between the devices.</p>	<p><b>The hub is receiving a valid Fibre Channel signal from the end device, but no upper-level protocols are active.</b></p> <ol style="list-style-type: none"> <li>1. Verify that the proper HBA device drivers are loaded for the appropriate operating system and that the host has been configured to recognize the attached disk devices.</li> <li>2. Unplug the fiber cable from the end node and verify that an optical signal is present on the cable lead. If no signal is present, the lead of the cable might be defective. Replace the cable.</li> </ol>

## Parts listing (Type 3523 Fibre Channel Hub & GBIC)



Index	Fibre Channel Hub (Type 3523)	FRU
1	Port Fiber Hub Assembly	01K6738
2	HUB Tray Assembly	10L7042
3	HUB Tray Bezel	10L7041
4	Short-Wave GBIC	03K9206
	Long-Wave GBIC (option)	03K9208
	Misc. Hardware Kit	01K6739

---

## Chapter 5. Fibre Channel Adapter (FRU 01K7354)

**Note:** The PD maps provide you with additional diagnostic aids and can be found on the IBM support web site: <http://www.pc.ibm.com/qtechinfo/MIGR-4P3PMR.html>. The PDs can also be found in this book. See "Chapter 2. PD entry," on page 3.

The Fibre Channel Adapter (FRU 01K7354) is compatible with the following IBM products:

- Type 3523 Fibre Channel Hub and GBIC (see Chapter 4 on page 47)
- Type 3526 Fibre Channel RAID controller (see Chapter 7 on page 81)
- Type 2109 Fibre Channel Switch
- Type 3534 Managed Hub

---

### General checkout

There are three basic types of problems that can cause the adapter to function incorrectly:

- Hardware problems
- System configuration problems
- Fibre Channel problems

#### Hardware problems

The following list will help you determine whether a problem was caused by the hardware:

- Verify that all of the adapters are installed securely.
- Verify that all of the cables are connected securely to the correct connectors. Be sure that the SC connectors that attach from the J1 connector on the adapter to the device are connected correctly.
- Verify that the adapter is installed correctly and seated firmly in the expansion slot.
- Verify that all peripheral devices are properly powered on. See "Scan Fibre Channel Devices" on page 62 for information about displaying attached devices.

#### System configuration problems

To determine whether a problem was caused by the system configuration, check the system board to make sure it is configured properly (see "Installation procedures" on page 63).

#### Fibre Channel problems

To determine whether a problem was caused by the Fibre Channel, verify that all of the FC devices were powered on before you powered on the server.

---

## Features

Fibre Channel adapter features include:

- Compliance with Fibre Channel Physical and Signaling Interface - 3 (PC-PH-3), revision 9.2
- Compliance with Fibre Channel Arbitrated Loop (FC-AL), revision 4.5
- Compliance with Intel® PCI version 2.1 specification
- Compliance with U.S. and international safety and emissions standards
- Support for bus master DMA
- Use of Fast!UTIL basic input/output system (BIOS) utility program for customizing the configuration parameters on the IBM Fibre Channel PCI Adapter and attached drives

Mixed peripheral support includes:

- Simultaneous mixed-peripheral configurations and startable device support for FC devices that meet the following standards:
- Compliance with FC-PLDA, revision 1.10, 17 February 1997
- Compliance with FC-FLA, revision 2.1, 12 July 1997

---

## Additional service information

### Fast!UTIL

The Fibre Channel adapter can be configured using Fast!UTIL. Access Fast!UTIL by pressing Alt + Q during the adapter BIOS initialization (it might take a few seconds for the Fast!UTIL menu to appear). If there are more than one IBM Fibre Channel PCI adapters, Fast!UTIL asks you to select the adapter you want to configure. After changing the settings, Fast!UTIL restarts the system to load the new parameters.

**Note:** If the configuration settings are incorrect, the IBM Fibre Channel PCI Adapter will not function properly.

The following section describes the Fast!UTIL options.

#### Configuration Settings

The first selection on the Fast!UTIL **Options** menu is **Configuration Settings**. These settings configure the FC devices and the PCI adapter to which they are attached.

#### Host Adapter Settings

From the **Configuration Settings** menu in Fast!UTIL, select **Host Adapter Settings**. The current default settings for the host adapter are listed in Table 4 and described in the remainder of this section.

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

Table 4. Fast!UTIL Host Adapter Settings

Setting	Options	Default
Host adapter BIOS	Enabled or Disabled	Disabled
Enable LUNs	Yes or No	Yes

Table 4. Fast!UTIL Host Adapter Settings

Setting	Options	Default
Execution throttle	1, 4, 8, 16, 32, 64, 128, 255	255
Drivers load RISC code	Enabled or Disabled	Enabled
Frame size	512, 1024, 2048	2048
IOCB allocation	1-512 buffers	256 buffers
Loop reset delay	0-15 seconds	5 seconds
Extended error logging	Enabled or Disabled	Disabled
Port down retry count	0-255	0

- **Host adapter BIOS:** When this setting is disabled, the ROM BIOS on the IBM Fibre Channel PCI Adapter is disabled, freeing space in upper memory. The default is Disabled.
- **Enable LUNs:** When this setting is yes, multiple logical unit numbers (LUNs) are supported. When this setting is no, multiple LUNs are not supported. LUN support is typically required for CD-ROM changers or redundant array of independent disks (RAID) boxes that use LUNs to map drives. The default is Yes.
- **Execution throttle:** This setting specifies the maximum number of commands executing on any one port. When a port's execution throttle is reached, no new commands are executed until the current command finishes executing. The valid options for this setting are: 1, 4, 8, 16, 32, 64, 128, and 255. The default is 255.
- **Drivers load RISC code:** When this setting is enabled, the host adapter uses the RISC firmware that is embedded in the device driver. When this setting is disabled, the device driver loads the latest version of RISC firmware found on the system. The default is Enabled.
 

**Note:** In order for the embedded device driver software to be loaded, the driver being loaded must support this setting. If the driver does not support this setting, the result is the same as if the setting were disabled, regardless of the setting. Leaving this option enabled guarantees a certified combination of software driver and RISC firmware.
- **Frame size:** This setting specifies the maximum frame length supported by the IBM Fibre Channel PCI Adapter. The default size is 2048.
- **IOCB allocation:** This setting specifies the maximum number of buffers from the firmware buffer pool that are allocated to any one port. The default is 256 buffers.
- **Loop reset delay:** After resetting the loops, the firmware refrains from initiating any loop activity for the number of seconds specified in this setting. The default is 5 seconds.
- **Extended error logging:** This setting provides additional error and debug information to the operating system. The default is Disabled.
- **Port down retry count:** This setting specifies the number of times the software retries a command to a port returning port down status. The default is 0 retries.

### Selectable Boot Settings

You access the **Selectable Boot Settings** option from the **Configuration Settings** menu. If you enable this option, you can select the node name you want to start up (boot) from. After this option is enabled, the system is forced to start up from the selected FC drive, ignoring any IDE drives attached to the system. If you disable this

option, the system looks for an IDE drive from which to start. If an IDE drive is not found, the system looks for the first startable FC drive. When this setting is disabled, the boot ID and boot LUN parameters have no effect.

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

### Adapter Hard ID Settings

The **Adapter Hard ID Settings** option from the **Configuration Settings** menu forces the IBM Fibre Channel PCI Adapter to use the selected hard ID (0-125).

### Restore Default Settings

The **Restore Defaults** option from the **Configuration Settings** menu restores the PCI adapter default settings.

### Raw NVRAM Data

This option displays the adapter nonvolatile random access memory(NVRAM) contents in hexadecimal format. Data cannot be modified.

### Scan Fibre Channel Devices

This option scans the FC loop and lists all the connected devices by loop ID. Information about each device is listed, for example, vendor name, product name, and revision. This information is useful when configuring the IBM Fibre Channel PCI Adapter and attached devices.

### Fibre Channel Disk Utility

This option scans the FC loop bus and lists all the connected devices by loop ID. You can select a disk device and perform a low-level format or verify the disk media.

**Note:** Performing a low-level format destroys all data on the disk.

## Specifications

The IBM Fibre Channel PCI Adapter operating environment and specification information is as follows:

*Table 5. IBM Fibre Channel PCI Adapter operating environment*

Environment	Minimum	Maximum
Operating temperature	0° C (32° F)	55° C (131° F)
Storage temperature	-20° C (-4° F)	70° C (158° F)
Relative humidity (noncondensing)	10%	90%
Storage humidity (noncondensing)	5%	95%

*Table 6. IBM Fibre Channel PCI Adapter specifications*

Type	Specification
Host bus	Conforms to PCI Local Bus Specification, revision 2.1
PCI signaling environment	3.3 V and 5.0 V buses supported
PCI transfer rate	264 MB per second maximum burst rate for 33 MHz operation (ISP2100 chip)

Table 6. IBM Fibre Channel PCI Adapter specifications

Type	Specification
Fibre Channel specifications	Bus type: fiber-optic media (QLA2100F) Bus transfer rate: 100 MB per second maximum
Central processing unit (CPU)	Single chip design that includes a RISC processor, Fibre Channel protocol manager, PCI DMA controller, and 1-gigabit transceivers
Host data transfer	64-bit, bus master DMA data transfers to 264 MB per second
RAM	128KB of SRAM
BIOS ROM	128KB of flash ROM in two 64KB, software selectable banks. The flash is field-programmable.
NVRAM	256 bytes, field-programmable
Onboard DMA	Three independent DMA channels: two data and one command. Integrated 4KB frame buffer FIFO for each data channel
Connectors (external)	SC-style connector that supports non-OFC, multimode fiber-optic cabling using 1x9 fiber-optic transceiver module. Total cable length cannot exceed 500 meters.
Form factor	17.78 cm x 10.67 cm (7.0 in. x 4.2 in.)
Operating power	Less than 15 watts

## Installation procedures

This section contains information about installing adapter layouts.

### Adapter layouts

The following figure identifies the adapter components referenced throughout this section.



## Installing the adapter

**Note:** To avoid damage to the fiber-optic cables, follow these guidelines:

- Do not route the cable along a folding cable management arm.
- When attaching to a device on slides, leave enough slack in the cable so that it does not bend to a radius smaller than 3 inches when extended or become pinched when retracted.
- Route the cable away from places where it can be snagged by other devices in the rack.
- Do not over tighten the cable ties or bend the cables to a radius smaller than 3 inches.
- Do not put excess weight on the cable at the connection point and be sure it is well supported.

Follow these steps to install the IBM Fibre Channel PCI Adapter. Also refer to these steps for removal and replacement.

**Note:** The adapter can be installed in any PCI bus slot that supports 32 or 64-bit adapters.

1. Check the system board and make any configuration changes necessary to accommodate the IBM Fibre Channel PCI Adapter if the system requires it.
2. Power off the peripheral devices. Then, power off the computer.
3. Disconnect the power cords.
4. Remove the computer cover, saving the screws.
5. Line up the adapter with the expansion slot. Carefully press the adapter into the slot until it seats firmly.
6. Secure the adapter in place.
7. Connect one end of the fiber cable from the devices to the J1 connector on the adapter.
8. Carefully reinstall the computer cover and secure it.
9. Connect the power cables.
10. Power on all external FC devices; then, power-on the PC and observe the monitor. The BIOS lists all FC devices attached to the PCI adapter.

```
QLogic Corporation
QLA2000, QLA 2100 PCI Fibre Channel ROM BIOS Version X.XX
Copyright (C) QLogic Corporation 1998 All rights
reserved.
```

```
Press <Alt-Q> for Fast!UTIL
```

```
BIOS for Adapter X is disabled
```

```
ROM BIOS not installed
```

Refer to *IBM Fibre Channel PCI Adapter Software Installation Guide* for detailed instructions on how to install the device drivers.

If the information displayed is not correct and you have checked the adapter configuration, go to “General checkout” on page 59.

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## Chapter 6. IBM FAStT Host Adapter (FRU 09N7292)

**Note:** The PD maps provide you with additional diagnostic aids and can be found on the IBM support web site: <http://www.pc.ibm.com/qtechinfo/MIGR-4P3PMR.html>. The PDs can also be found in this book. See "Chapter 2. PD entry," on page 3.

The IBM FAStT Host Adapter (FRU 09N7292) is compatible with the following IBM products:

- Type 3526 Fibre Channel RAID controller (see Chapter 7 on page 81)
- Type 3552 FAStT500 RAID controller (see Chapter 8 on page 105)
- FAStT200 type 3542 and FAStT200 HA type 3542 (see Chapter 9 on page 177)
- Type 2109 Fibre Channel Switch
- Type 3534 Managed Hub

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

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

---

### General checkout

There are three basic types of problems that can cause the adapter to malfunction:

- Hardware problems
- Fibre Channel problems

#### Hardware problems

The following list will help you determine whether your installation problem is caused by the hardware:

- Verify that all adapters are installed securely.
- Verify that all cables are attached securely to the correct connectors. Be sure that the FC connectors that attach from the J1 connector on the adapter to the device are connected securely.
- Verify that the adapter is installed correctly and fully seated in the expansion slot. Check for interference due to nonstandard PCI connectors.
- Verify that all peripheral devices are turned on. See "Scan Fibre Channel devices" on page 79 for information about displaying attached devices.

## Fibre Channel problems

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

The PDs provide you with additional diagnostic aids and can be found on the IBM support web site: <http://www.pc.ibm.com/qtechinfo/MIGR-4P3PMR.html>. The PDs are also in this book. See "Chapter 2. PD entry," on page 3.

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## Features

FAStT Host Adapter features include:

- Compliance with Third Generation Fibre Channel Physical and Signaling Interface - 3 (PC-PH-3), revision 9.2
- Compliance with Fibre Channel Arbitrated Loop (FC-AL-2) standard
- Compliance with Intel® PCI version 2.2 specification
- Compliance with U.S. and international safety and emissions standards
- Support for bus-master DMA
- Fast!UTIL basic input/output system (BIOS) utility program to customize the configuration parameters on the FAStT Host Adapter and attached drives
- Support for Fibre Channel SCSI (FCP-SCSI) and internet protocol (IP) protocols
- Support for point-to-point fabric connection (F-PORT FABRIC LOGIN)
- Support for Fibre Channel service (Classes 2 and 3)
- 32 bit or 64 bit, 66 or 33 MHz operation
- Simultaneous mixed-peripheral configurations and startable device support for Fibre Channel devices that meet the following standards:
  - Fibre Channel -- Private Loop Direct Attach Technical Report (FC-PLDA) revision 1.10, 17 February 1997
  - Fibre Channel -- Fabric Loop Attachment Technical Report (FC-FLA) revision 2.1, 12 July 1997

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## Additional service information

The following information supports the IBM FAStT Host Adapter.

## Specifications

This section contains the FAStT Host Adapter operating environment and specification information.

*Table 7. FAStT Host Adapter operating environment*

Environment	Minimum	Maximum
Operating temperature	0° C (32° F)	55° C (131° F)
Storage temperature	-20° C (-4° F)	70° C (158° F)
Relative humidity (noncondensing)	10%	90%
Storage humidity (noncondensing)	5%	95%

Table 8. FAStT Host Adapter Specifications

Type	Specification
Host bus	Conforms to PCI Local Bus Specification, revision 2.2
PCI signaling environment	3.3 V and 5.0 V buses supported
PCI transfer rate	<ul style="list-style-type: none"> <li>• 264 MB per second maximum burst rate for 33 MHz operation (ISP2200A chip)</li> <li>• Supports dual address bus cycles</li> </ul>
Fibre Channel specifications	<ul style="list-style-type: none"> <li>• Bus type: fiber-optic media (shortwave 50 micron)</li> <li>• Bus transfer rate: 100 MB per second maximum (200 full-duplex)</li> <li>• Supports both FCP-SCSI and IP protocols</li> <li>• Supports point-to-point fabric connection: F-Port Fabric Login</li> <li>• Supports FC-AL public loop profile: FL-Port Login</li> <li>• Supports Fibre Channel services class 2 and 3</li> <li>• FCP SCSI initiator and target operation</li> <li>• Full-duplex operation</li> </ul>
Processor	Single chip design that includes a RISC processor, Fibre Channel protocol manager, PCI DMA controller, and 1-gigabit transceivers
Host data transfer	64-bit, bus master DMA data transfers to 528 MB per second
RAM	128 KB of SRAM
BIOS ROM	128 KB of flash ROM in two 64 KB, software selectable banks. The flash is field-programmable.
NVRAM	256 bytes, field-programmable
Onboard DMA	Three independent DMA channels: two data and one command. Integrated 4 KB frame buffer FIFO for each data channel
Connectors (external)	<ul style="list-style-type: none"> <li>• SC-style connector that supports non-OFC, multimode fiber-optic cabling using 1x9 fiber-optic transceiver module</li> <li>• Total cable length cannot exceed 500 meters</li> <li>• Two three-position, point-to-point cable (internal)</li> </ul>
Form factor	17.8 cm x 10.7 cm (7.0 in. x 4.2 in.)
Operating power	Less than 15 watts
Other compliance	<ul style="list-style-type: none"> <li>• PCI 98, including ACPI</li> <li>• Less than 28% processor utilization as measured in a TPCC benchmark</li> <li>• Operation system support for Windows NT version 4, Windows 2000 version 1, NetWare version 4.x and 5.x, SCO UnixWare version 7.x</li> <li>• Worldwide agency compliance as defined for IBM products</li> <li>• 100% Plug and Play compatibility with our existing Fibre Channel RAID Controller</li> </ul>

---

## Installation procedures

This section contains the following installation information:

- “Adapter preinstallation procedures”
- “Adapter layouts” on page 69
- “Installing the adapter” on page 69
- “Installing the software” on page 70
- “Installing the Windows NT and Windows 2000 device drivers” on page 71
- “Installing the NetWare device driver” on page 74
- “Fast!UTIL” on page 75

### Adapter preinstallation procedures

Use the following instructions for preparing to install the FAStT Host Adapter.

#### Handling static-sensitive devices

Static electricity, though harmless to you, can seriously damage adapter components or options.

**Note:** When you are adding an internal option, do not open the static-protective package containing the option until you are instructed to do so.

When you handle options and other adapter components, take these precautions to avoid damage from static electricity:

- Limit your movement. Movement can cause static electricity to build up around you.
- Always handle components carefully. Never touch any exposed circuitry.
- Prevent others from touching components.
- When you are installing a new option, touch the static-protective package containing the option to a metal expansion-slot screw or other unpainted metal surface on the adapter for at least two seconds. (This reduces static electricity from the package and from your body.)
- When possible, remove the option and install it directly into the adapter without setting the option down. When this is not possible, place the static-protective package that the option comes in on a smooth, level surface and place the option on it.
- Do not place the option on the adapter's covers or any metal surface.

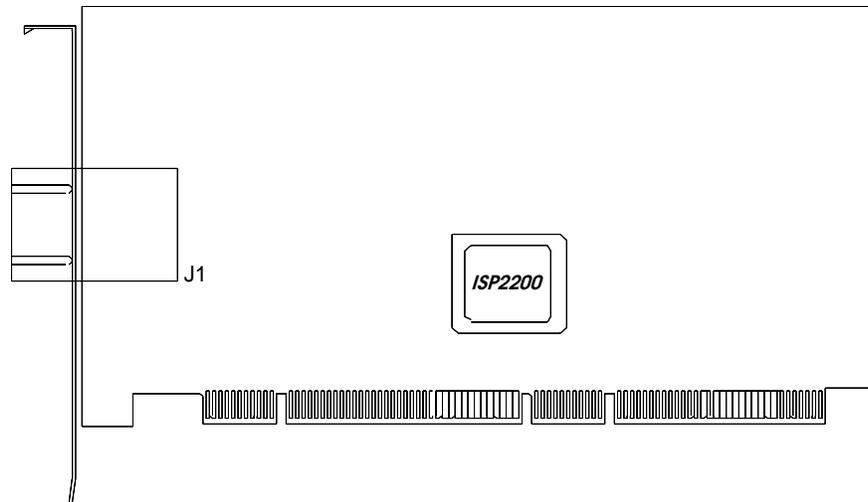
#### What you need for the installation

To install the FAStT Host Adapter in your server, you need:

- An optical, multimode cable with an SC-style duplex connector
- A screwdriver (usually a Phillips #1)
- Two three-position, point-to-point, internal FC cables for the FAStT Host Adapter, if you are using an internal connector

## Adapter layouts

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



## Installing the adapter

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

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

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

1. Turn off the peripheral devices. Then turn off the server.
2. Disconnect the power cords.
3. Remove the server cover.
4. Remove the slot cover.
5. Choose any PCI bus slot that supports 32 or 64-bit adapters. You can install the adapter in a 64-bit PCI slot if one is available. If a 64-bit slot is not available, then you can use a 32-bit PCI slot.
6. Align the adapter with the expansion slot. Carefully press the adapter into the slot until it is fully seated.
7. Connect one end of the fiber cable from the devices to the J1 connector on the adapter.
8. Carefully replace and secure the server cover.

9. Reconnect the power cords.
10. Turn on all external FC devices; then, turn on the server and observe the monitor. You will not see the devices because the adapter BIOS is set to Disabled by default. Instead, you will see the information below. To see the devices, press Alt+Q; then, use the utility program. See “Fast!UTIL” on page 75 for details about the utilities.

The BIOS lists all FC devices attached to the FAStT Host Adapter.

**Note:** You will see this information only if you have the BIOS set to Enabled. Otherwise, you will see a portion of this information on your monitor because BIOS is set to Disabled by default.

```
QLogic Corporation
QLA2200 PCI Fibre Channel ROM BIOS Version X.XX
Copyright (C) QLogic Corporation 1998 All rights reserved.
www.qlogic.com
```

Press <Alt-Q> for Fast!UTIL

BIOS for Adapter X is disabled.

ROM BIOS not installed.

If the information displayed is correct, you have successfully installed the FAStT Host Adapter in your computer.

See “Installing the software” for detailed instructions on how to install the device drivers.

If the information displayed is not correct and you have checked the adapter configuration, see “General checkout” on page 65 for troubleshooting information.

## Installing the software

After installing your IBM FAStT Host Adapter, you are ready to install the device drivers that you need.

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

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

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

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

### Before you begin

Create driver diskettes by copying the image you need from the IBM FAS<sup>t</sup>T Host Adapter Support CD for the following:

- *FAS<sup>t</sup>T Host Adapter for Windows 2000*
- *FAS<sup>t</sup>T Host Adapter for Windows NT 4.0*
- *FAS<sup>t</sup>T Host Adapter for NetWare 5.1*

You will be prompted for the driver diskettes during the operating system installation process. Read through the software installation chapters to determine which device driver you want to install.

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

1. Insert the *IBM FAS<sup>t</sup>T Host Adapter Support CD* into the CD-ROM drive.
2. To create the IBM FAS<sup>t</sup>T Host Adapter device driver diskette for Windows NT 4, at the command prompt, type:

```
d:\tools\dsk4w32 d:\images\nt4\nt4_7040404.img a:
```

Where *d* is the CD-ROM drive and *a* is the diskette drive.

3. To create the IBM FAS<sup>t</sup>T Host Adapter device driver diskette for Windows 2000, at the command prompt, type:

```
d:\tools\dsk4w32 d:\images\w2k\w2k_7040302.img a:
```

Where *d* is the CD-ROM drive and *a* is the diskette drive.

4. To create the IBM FAS<sup>t</sup>T Host Adapter device driver diskette for NetWare 5.1, at the command prompt, type:

```
d:\tools\dsk4w32 d:\images\nw51\nw51_550v.img a:
```

Where *d* is the CD-ROM drive and *a* is the diskette drive.

5. Press Enter.
6. Remove the diskette from the diskette drive and label the diskette appropriately.
7. Remove the *IBM FAS<sup>t</sup>T Host Adapter Support CD* from the CD-ROM drive.

## Installing the Windows NT and Windows 2000 device drivers

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

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

The following files are provided on the IBM FAS<sup>t</sup>T Host Adapter driver diskette that you created for the Windows NT device driver installation:

- TXTSETUP.OEM: Driver installation script for initial Windows NT text setup

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

The following files are provided on the IBM FAStT Host Adapter driver diskette that you created for the Windows 2000 device driver installation:

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

The following files are provided on the IBM FAStT Host Adapter driver diskette that you created for the NetWare Version 5.1 device driver installation.

- README.TXT
- RELEASE.TXT
- \Netware\QL2200.DDI
- \Netware\QL2200.HAM

## Installing Windows NT and Windows 2000

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

1. Insert the Windows NT or Windows 2000 setup diskette or insert the Windows NT or Windows 2000 installation CD into the CD-ROM drive.
2. After the standard devices have been detected and configured, use the **S** option to **Specify Additional Device**.
3. Select **Other**; then, press Enter.
4. Insert the FAStT Host Adapter device driver diskette you made in "Installing the Windows NT and Windows 2000 device drivers" on page 71; then, press Enter.
5. Select **QLogic QLA2200**; then, press Enter.
6. Select the standard installation procedure.

## Adding the Windows NT driver

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

1. On your desktop, click **My Computer** → **Control Panel** → **SCSI Adapters**.
2. Click the **Drivers** tab and click **Add**.
3. Select **QLogic** from the list of manufacturers and click **Have Disk**.
4. Insert the IBM FAStT Host Adapter driver diskette you created for Windows NT. At the prompt type:

a:\nt

where *a* is the diskette drive letter. Click **OK**.

5. If you are installing the drivers from a CD-ROM, at the prompt type:

z:\NT4\2200\NT

where *z* is the CD-ROM drive letter.

6. Select **IBM Netfinity QLA2200 PCI Fibre Channel Adapter** and click **OK**.
7. Click **Yes** to restart your server so the driver settings can take effect now or click **No** to restart your system at a later time.

## Adding the Windows 2000 driver

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

1. After you install the IBM FAStT Host Adapter, restart the system. The system searches for the newly installed device. If the system finds the new device, it indicates that the device has been detected.
2. If prompted to insert the device driver diskette, insert the IBM FAStT Host Adapter device driver for Windows 2000 diskette that you created. When prompted, follow the instructions. If you want to update a previously installed version of the device driver, follow the procedures in "Updating the Windows 2000 device driver" on page 74.

## Updating the Windows NT device driver

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

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

```
CD \WINNT\SYSTEM32\DRIVERS
```

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

```
COPY QL2200.SYS QL2200.SAV
```

4. Insert the IBM FAStT Host Adapter device driver for Windows NT diskette into your diskette drive.
5. Copy the new device driver over the old device driver. For example, type:

```
COPY A:\NT\QL2200.SYS
```

Where *a* is the diskette drive letter.

6. If you are installing drivers from the CD-ROM, type:

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

Where *z* is the CD-ROM drive letter.

7. Remove the IBM FASTT Device Drivers for Windows NT diskette.
8. Restart your system to install the device driver.

## Updating the Windows 2000 device driver

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

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

## Installing the NetWare device driver

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

**NetWare device driver files and parameters:** The following files are provided on the IBM FASTT Host Adapter device drivers for NetWare diskette for the NetWare 5.1 device driver installation:

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

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

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

*Table 9. NetWare device driver parameters*

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

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

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

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

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

```
COPY A:\NETWARE\QL2200.HAM C:\NWSERVER\
```

3. If you are installing the driver from a CD-ROM, type:  
COPY z:\NW51\2200\NETWARE\QL2200.HAM C:\NWSERVER\  
Where *a* is the diskette drive letter and *z* is the CD-ROM drive letter.
4. Install the device driver at the NetWare server prompt (: ) by typing the LOAD command with the SLOT parameter.

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

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

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

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

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

---

## Fast!UTIL

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

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

This section describes the Fast!UTIL options.

### Configuration settings

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

### Host adapter settings

You can access this option from the **Configuration Settings** menu. The current default settings for the host adapter are listed in Table 10 on page 76 and are described immediately following the table.

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

Table 10. Host Adapter Settings

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

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

#### Selectable boot settings

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

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

#### Adapter hard ID settings

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

#### Restore default settings

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

#### Raw NVRAM data

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

#### Advanced adapter settings

You can access this option from the **Configuration Settings** menu. The default settings for the host adapter are listed in Table 11 on page 77 and are described immediately following the table.

Table 11. FAS*t*T Host Adapter Advanced adapter settings

Setting	Options	Default
Execution throttle	1-256	256
Fast command posting	Enabled or Disabled	Enabled
>4GByte addressing	Enabled or Disabled	Disabled
LUNs per target	0, 8, 16, 32, 64, 128, 256	0
Enable LIP reset	Yes or No	No
Enable LIP full login	Yes or No	Yes
Enable target reset	Yes or No	Yes
Login retry count	0-255	30
Port down retry count	0-255	30
Drivers load RISC code	Enabled or Disabled	Enabled
Enable database updates	Yes or No	No
Disable database load	Yes or No	No
IOCB allocation	1-512 buffers	256 buffers
Extended error logging	Enabled or Disabled	Disabled

- **Execution throttle:** Specifies the maximum number of commands executing on any one port. When a port reaches its execution throttle, Fast!UTIL does not execute any new commands until the current command is finish executing. The valid options for this setting are 1-256. The default (optimum) is 256
- **Fast command posting:** Decreases command execution time by minimizing the number of interrupts. The default is Enabled.
- **>4GByte addressing:** Enable this option when the system has more than 4 GB of memory available. The default is Disabled.
- **LUNs per target:** Specifies the number of LUNs per target. Multiple logical unit number (LUN) support is typically for redundant array of independent disks (RAID) enclosures that use LUNs to map drives. The default is 8. If you are using a 3526, 3542, or 3552 with more than 8 LUNs, set the number of LUNs to 0.
- **Enable LIP reset:** Determines the type of loop initialization process (LIP) reset that is used when the operating system initiates a bus reset routine. When this option is set to Yes, the device driver initiates a global LIP reset to clear the target device reservations. When this option is set to No, the device driver initiates a global LIP reset with full login. The default is No.
- **Enable LIP full login:** Instructs the ISP chip to log in to all ports after any LIP. The default is Yes.
- **Enable target reset:** Enables the drivers to issue a Target Reset command to all devices on the loop when an SCSI Bus Reset command is issued. The default is Yes.
- **Login retry count:** Specifies the number of times the software tries to log in to a device. The default is 30 retries.
- **Port down retry count:** Specifies the number of times the software retries a command to a port that is returning port-down status. The default is 30 retries.
- **Drivers load RISC code:** When this option is set to Enabled, the host adapter uses the RISC firmware that is embedded in the software device driver. When

this option is set to Disabled, the software device driver loads the RISC firmware found on the system. The default is Enabled.

**Note:** To load the embedded device driver software, the device driver being loaded must support this setting. If the driver does not support this setting, the result is the same as if this option is set to Disabled, regardless of the setting. Leaving this option enabled ensures a certified combination of software driver and RISC firmware.

- **Enable database updates:** When this option is set to Enabled, it allows the software to save the loop configuration information in flash memory as the system powers down. The default is No.
- **Disable database load:** When this option is set to No, the device database is read from the Registry during driver initialization. When this option is set to Yes, the device database is created dynamically during device driver initialization. The default is No.

**Note:** This option usually applies to the Windows NT and Windows 2000 operating environments.

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

#### Extended firmware settings

You can access this option from the **Configuration Settings** menu. The default settings for the host adapter are listed in Table 12 and are described immediately following the table.

Table 12. FAStT Host Adapter Extended firmware settings

Setting	Options	Default
Extended control block	Enabled or Disabled	Enabled
RIO operation mode	0, 1, 2, 3, 4	0
Connection options	0, 1, 2, 3	3
NonParticipating hard ID	Enabled or Disabled	Disabled
Class 2 service	Enabled or Disabled	Disabled
ACK0	Enabled or Disabled	Disabled
Fibre Channel tape support	Enabled or Disabled	Disabled
Fibre Channel confirm	Enabled or Disabled	Disabled
Commandreferencenumber	Enabled or Disabled	Disabled
Read transfer ready	Enabled or Disabled	Disabled
Response timer	0-255	0
Interrupt delay timer	0-255	0

- **Extended control block:** Enables all other extended firmware settings. The default is Enabled.

- **RIO operation mode:** Specifies the reduced interrupt operation (RIO) modes, if supported by the software device driver. RIO modes enable posting multiple command completions in a single interrupt (see Table 13). The default is 0.

Table 13. FAStT Host Adapter RIO operation modes

Option	Operation Mode
0	No multiple responses
1	Multiple responses, 16-bit handles, interrupt host
2	Multiple responses, 32-bit handles, interrupt host
3	Multiple responses, 16-bit handles, delay host interrupt
4	Multiple responses, 32-bit handles, delay host interrupt

- **Connection options:** Defines the type of connection (loop or point-to-point) or connection preference (see the table below). The default is 3.

Table 14. FAStT Host Adapter Connection options

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

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

### Scan Fibre Channel devices

Use this option to scan the FC loop and list all the connected devices by loop ID. Information about each device is listed, for example, vendor name, product name,

and revision. This information is useful when configuring your FAStT Host Adapter and attached devices.

## **Fibre Channel disk utility**

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

### **CAUTION:**

**Performing a low-level format destroys all data on the disk.**

### **Select Host Adapter**

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

---

## Chapter 7. Type 3526 Fibre Channel RAID controller

**Note:** The PD maps provide you with additional diagnostic aids and can be found on the IBM support web site: <http://www.pc.ibm.com/qtechinfo/MIGR-4P3PMR.html>. The PDs can also be found in this book. See “Chapter 2. PD entry,” on page 3.

The Type 3526 Fibre Channel RAID controller is compatible with the following IBM products:

- Type 3523 Fibre Channel Hub and GBIC (see Chapter 4 on page 47)
- Fibre Channel Adapter (FRU 01K7354) (see Chapter 5 on page 59)
- IBM FAStT Host Adapter (FRU 09N7292) (see Chapter 6 on page 65)
- Type 2109 Fibre Channel Switch
- Type 3534 Managed Hub

---

### General checkout

Use the status LEDs, the “Symptom-to-FRU index” on page 100, and the connected server HMM to diagnose problems.

### Using the Status LEDs

The LEDs of the control unit indicate the hardware status:

- Green LED indicates normal operation
- Amber LED indicates a hardware problem

The LEDs on the controller unit indicate the status of the controller unit and its individual components. The green LEDs indicate a normal operating status; amber LEDs indicate a hardware fault. Check all of the LEDs on the front and back of the controller unit when it is powered on.

**Note:**

1. If power was just applied to the controller unit, the green and amber LEDs might turn on and off intermittently. Wait until the controller unit finishes powering up before you begin checking for faults.
2. To view the controller Customer Replaceable Unit (CRU) LEDs, the front cover must be removed from the controller unit. See “Removing the front cover” on page 93.

Also use LEDs on the front cover, controller CRUs, and drive units (if applicable) to determine whether the controllers and drives are responding to I/O transmissions from the host.

The following list describes LED activities:

- If a Fast Write Cache operation to the controller unit (or attached drive units), or if other I/O activity is in progress, then you might see several green LEDs blinking, including: the Fast Write Cache LED (on the front cover), controller CRU status LEDs, or applicable drive activity LEDs.

- The green Heartbeat LEDs on the controller CRUs blink continuously. The number and pattern of green status LEDs lit on the controllers depend on how the system is configured. An active controller will not have the same status LEDs lit as a passive controller. See “Controller CRU and battery LEDs” on page 95.

---

## Features

The following list summarizes the features of the Type 3526 Fibre Channel RAID controller:

- Redundant fail-over
- Hot-swap components
- 128 MB cache per controller CRU as shipped
- Supports up to six IBM EXP 15 Expansion Units
- Supports Ethernet, Fiber, and Serial communications to each controller CRU
- Supports EXP200 expansion units

---

## Additional service information

### Powering on the controller

**Note:** All drive modules must be powered on before you power on the controller.

The controller might take from three to 10 seconds to power on. During this time, the amber and green LEDs on the controller unit flash.

After power on, check all fault LEDs to make sure they are off. If a fault LED is on, refer to the “Symptom-to-FRU index” on page 100.

### Recovering from a power supply shutdown

Both power supplies have a built-in temperature sensor designed to prevent the power supplies from overheating. If a temperature sensor detects an over-temperature condition (ambient air temperature of 70° C (158° F) or above), the “overheated” power supply automatically shuts down. The other power supply remains on as long as its temperature remains below 70° C (158° F). If not, the second power supply shuts down, which turns off all power to the controller unit.

After the air temperature cools to below 70° C (158° F), the power supplies automatically restart. An automatic restart resets the controllers, attempts to spin up the drives (which has no effect on the drives if they are already running), and returns the controller unit to a normal operating state. Typically, you will not need to perform recovery procedures after an automatic power supply shutdown and restart.

After a power supply shutdown, check all controller LEDs.

If the power supply power LED is off, or the amber power supply LED on the front cover is on, go to the “Symptom-to-FRU index” on page 100.

### Connectors and Host IDs

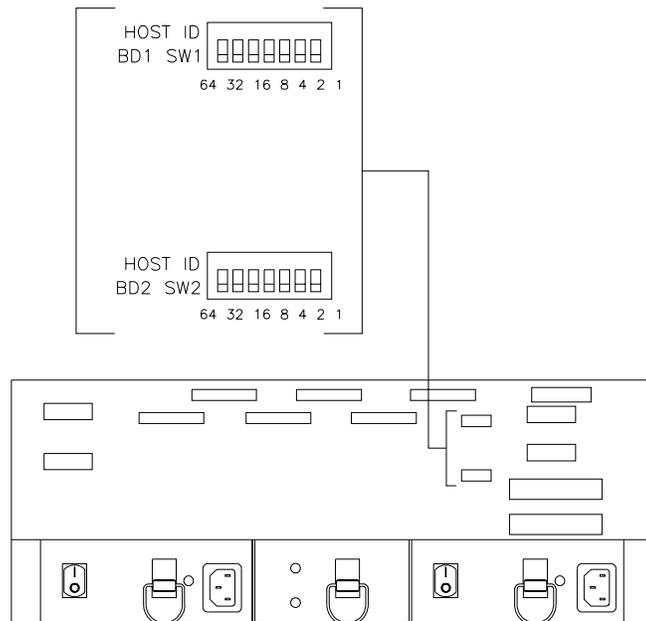
The Host ID switches and connectors for interface cables are on the connector plate located on the back of the controller unit.

## Host and drive ID numbers

Each controller must have a unique Fibre Host ID number. The Host ID numbers assigned to each controller are based on two elements:

- Host ID numbers set through hardware switches on the controller unit. There are five Host ID switches that allow you to set ID numbers 0 through 127 for each controller. The factory default settings are ID #5 for Controller A and ID #4 for controller B.
- Software algorithms that calculate the actual Fibre Channel address, based on the controller unit's hardware settings and position on the loop or hub.

**Note:** The preferred ID is assigned on the Fibre Channel loop unless it is already being used. If the ID is already in use, a soft ID is assigned.



## Fibre Channel host cable requirements

For the Type 3526 Fibre Channel RAID Controller, you must use multi-mode, 50 micrometer fiber-optic cable and a Media Interface Adapter (MIA), shown in the following figure.

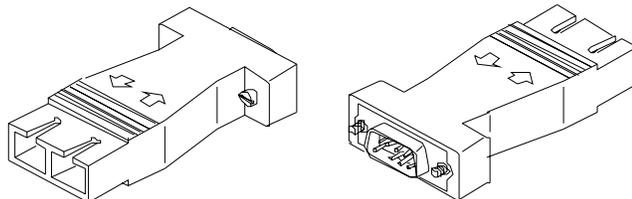


Table 15. Media Interface Adapter (MIA) specifications

Cable	Media type	Data size	Transfer speed	Range
Fiber-optic (multi-mode, 50 micrometer)	Short-wave laser	100 MB/sec	1062.5 Mbaud	up to 500 m

## LVD-SCSI drive cable requirements

To connect the controller unit to a drive module, you must use 68-pin, VHDCI (very high density cable interface) LVD, Ultra 2 SCSI cables. The controller unit has six drive connectors that support 16-bit interface protocols. Each connector represents a single drive channel that supports up to 10 drives per channel for a total of 60 drives.

### Specifications

#### Size

- With front panel:
  - Depth: 610mm (24in.)
  - Height: 174mm (6.8in.)
  - Width: 482mm (19in.)

#### Weight

- Controller unit maximum weight: 34.5 kg (76 lb)
- Controller unit empty: 14.3 kg (31.6 lb)
- Battery: 9.7 kg (21.4 lb)

#### Electrical Input

- Sign-wave input (50 to 60 Hz)
  - Low range: Minimum: 90 V ac Maximum: 127 V ac
  - High range: Minimum: 198 V ac Maximum: 257 V ac
- Input Kilovolt-amperes (kVA) approximately:
  - Minimum configuration: 0.06 kVA
  - Maximum configuration: 0.39 kVA

#### Environment

- Air temperature:
  - hub on: 10° to 35° C (50° to 95° F) Altitude: 0 to 914 m (3000 ft.)
  - hub on: 10° to 32° C (50° to 90° F) Altitude: 914 m (3000 ft.) to 2133 m (7000 ft.)
- Humidity:
  - 8% to 80%

#### Heat Output

- Approximate heat output in British Thermal Units (BTU) per hour:
  - Maximum configuration: 731.8 BTU (214 watts)

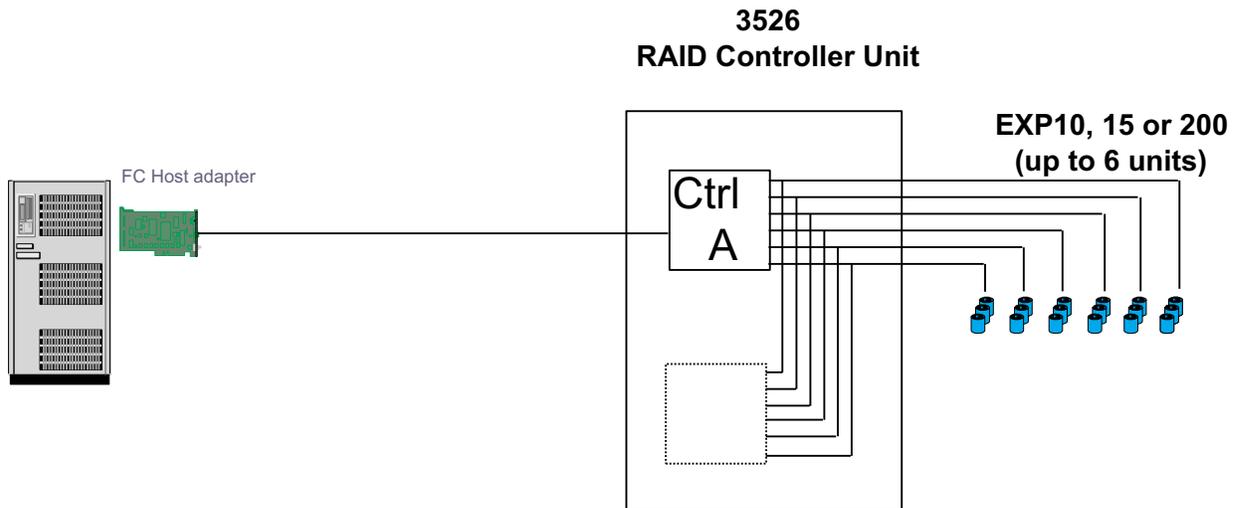
#### Acoustical Noise Emissions Values

- Sound Power (idling and operating):
  - 6.4 bels
- Sound Pressure (idling and operating):
  - 50 dBA

## Tested configurations

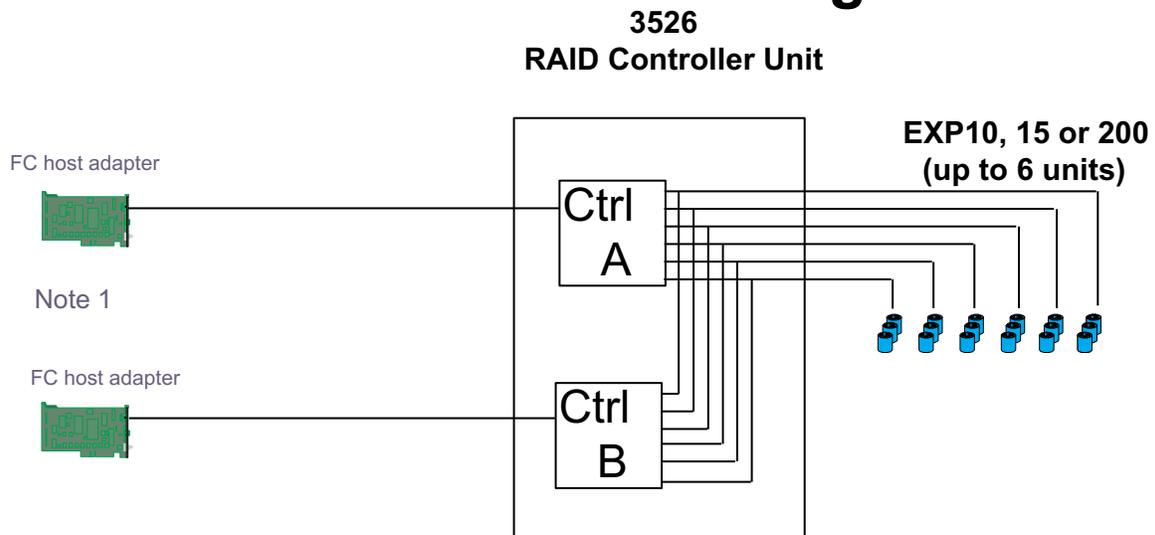
The following configurations are for the Type 3526 Fibre Channel RAID Controller.

# Basic Configuration



Note: Basic as shipped, single controller, no hubs or switches

# Basic Dual Controller Configuration



Note 1: Adapters can be in the same or different systems; choice affects total redundancy

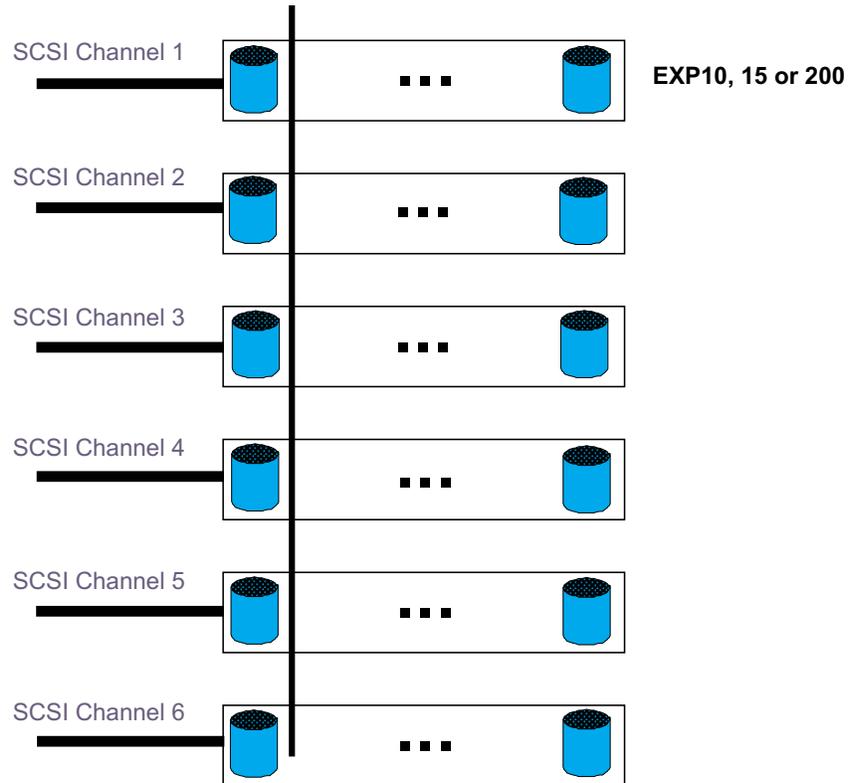
Note 2: No hubs or switches

Note 3: For max redundancy on the drive side use orthogonal striping (see orthogonal striping chart)

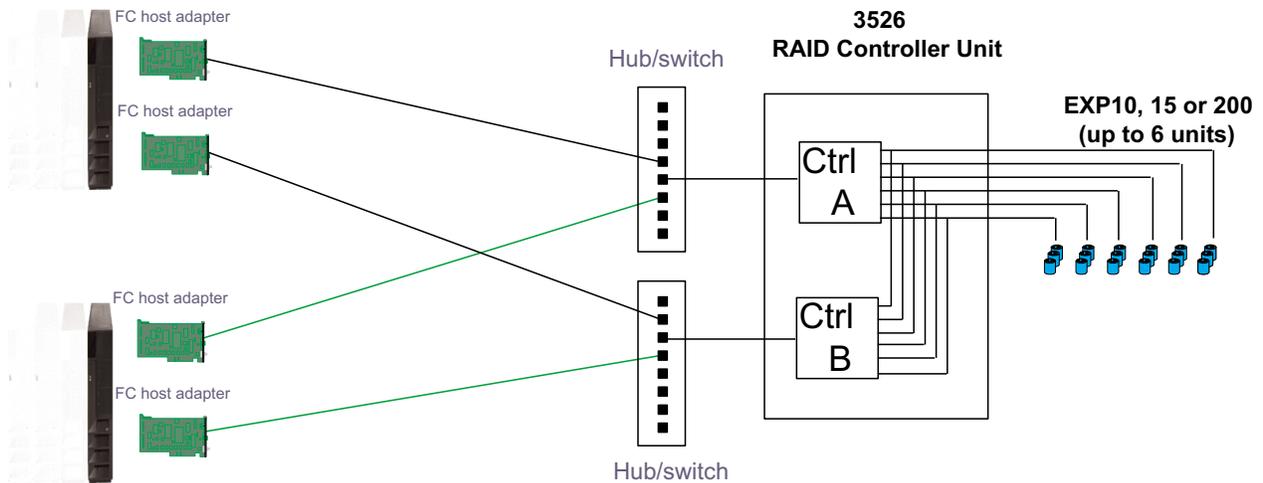
Note 4: This config does not provide for "NO single point of failure"

# Orthogonal Data Striping

Data striped across channels



# Simple Fully Redundant



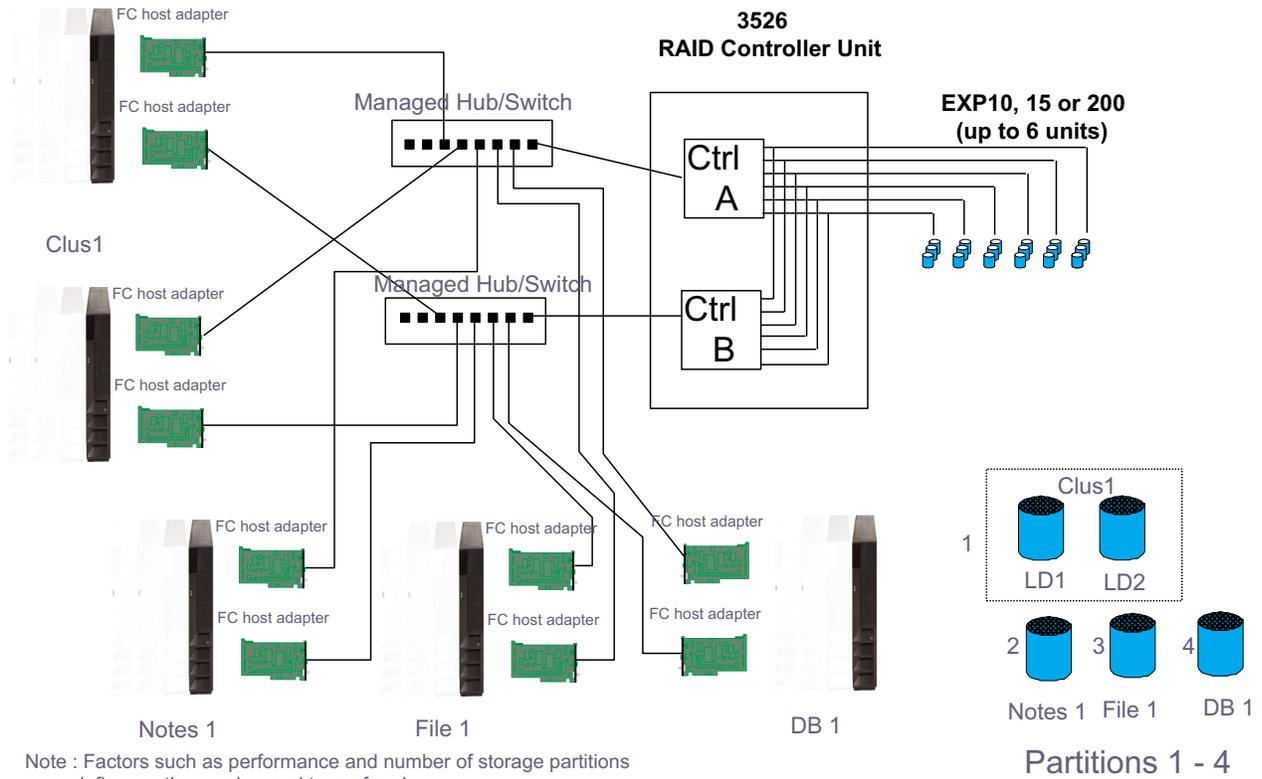
## Redundant Servers

Note 1: Since disks are seen from multiple places some form of protection such as MSCS, storage partitioning, Sanergy, Oracle etc **must** be used.

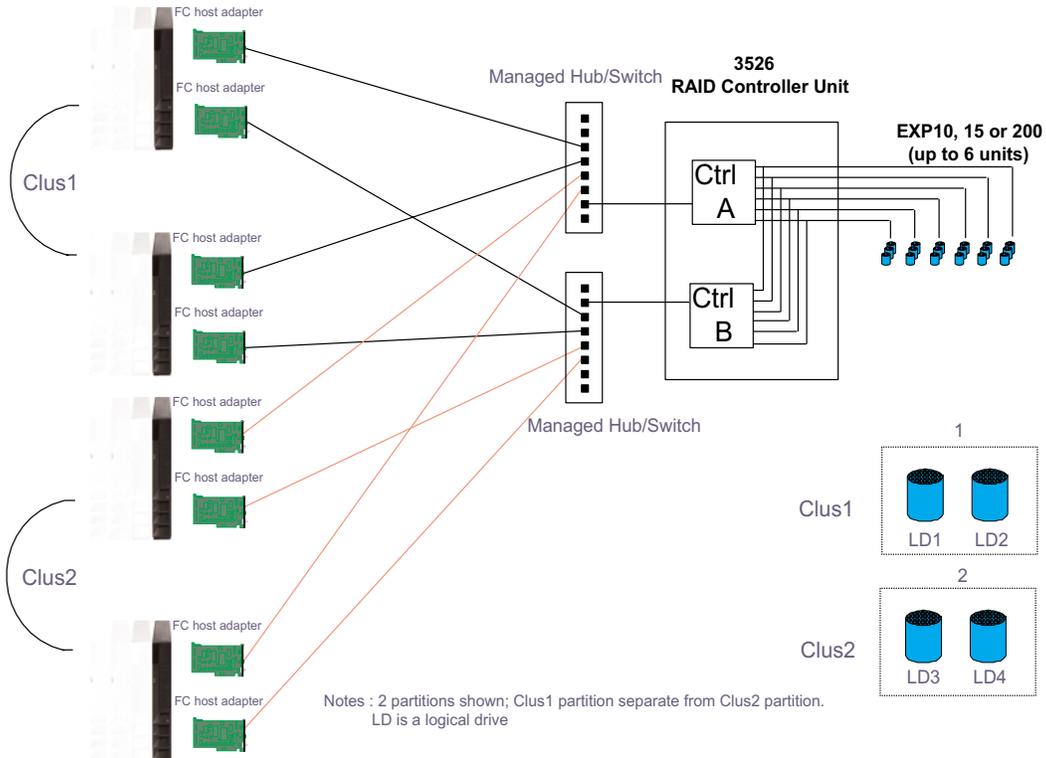
Note 2: For best performance and managability a managed hub or switch is preferred

Note 3: Always try to keep connections to hub on adjacent ports and unplug all unused GBICs

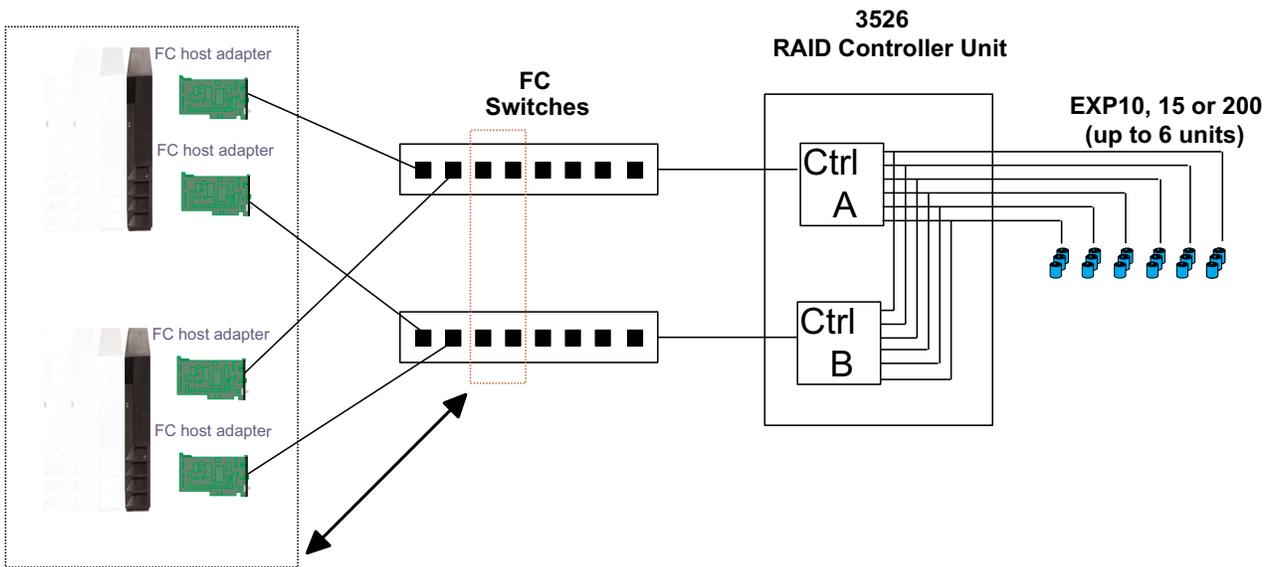
# Cluster/Non-Cluster Share



# Multi-MSCS No External Hubs



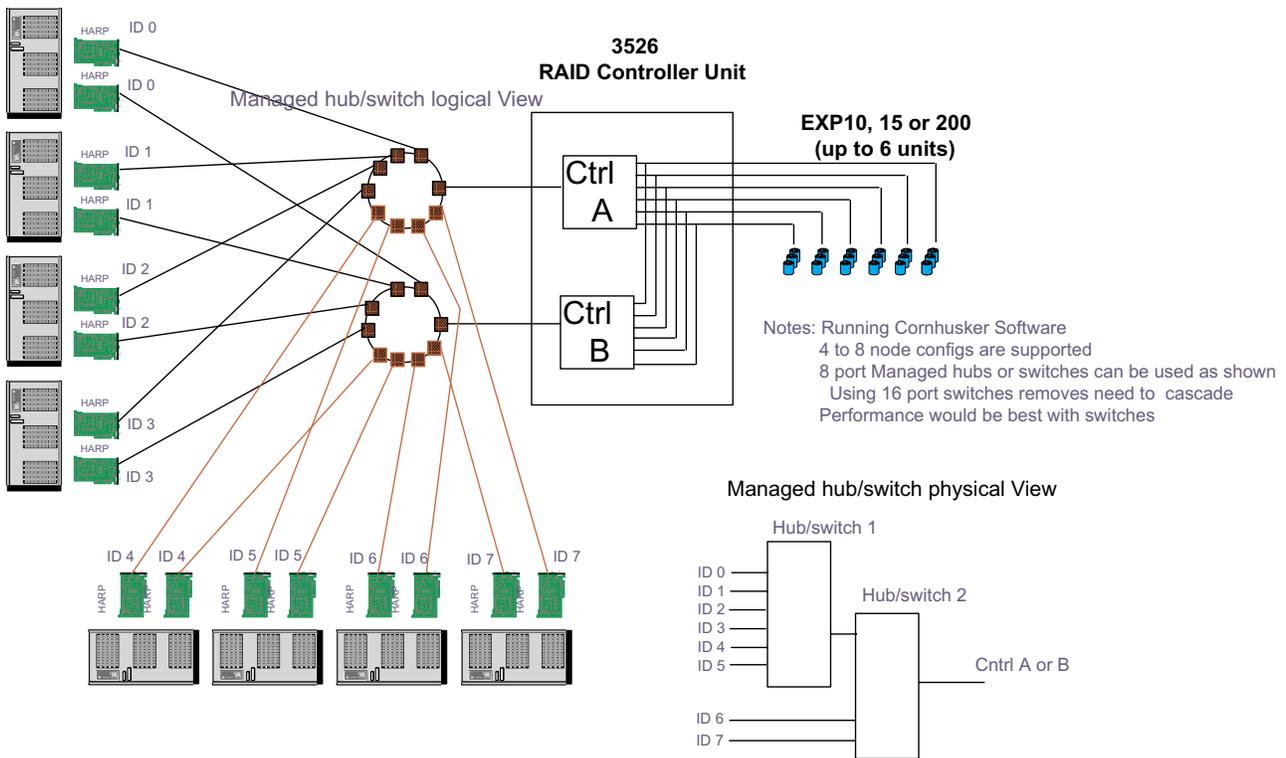
# Multi-MSCS extended



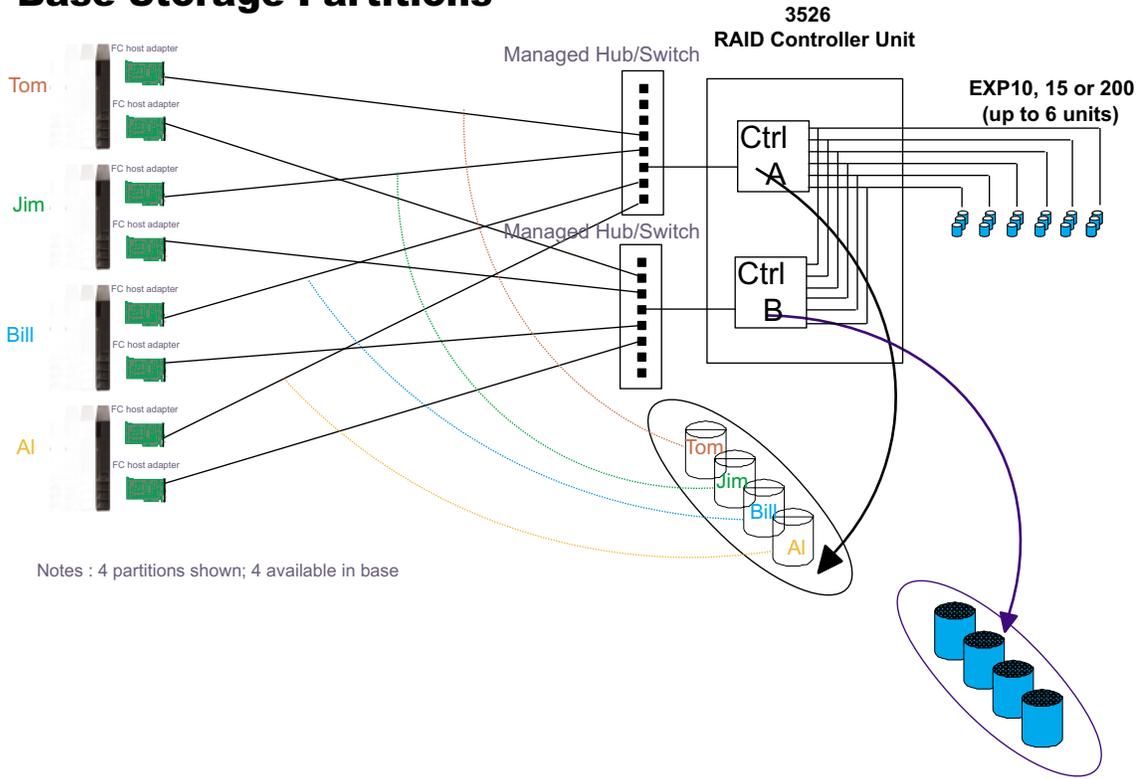
**Notes :**

- Each group of 4 ports on the switches (red dash box) can support one cluster element (black dash box)
- Storage partitioning is used to separate clusters
- Match performance needs of servers to max I/o available from 60 drives
- You may use some the switch ports to add 3526 units rather than hosts. Extending this to 16 port switches allows more of both

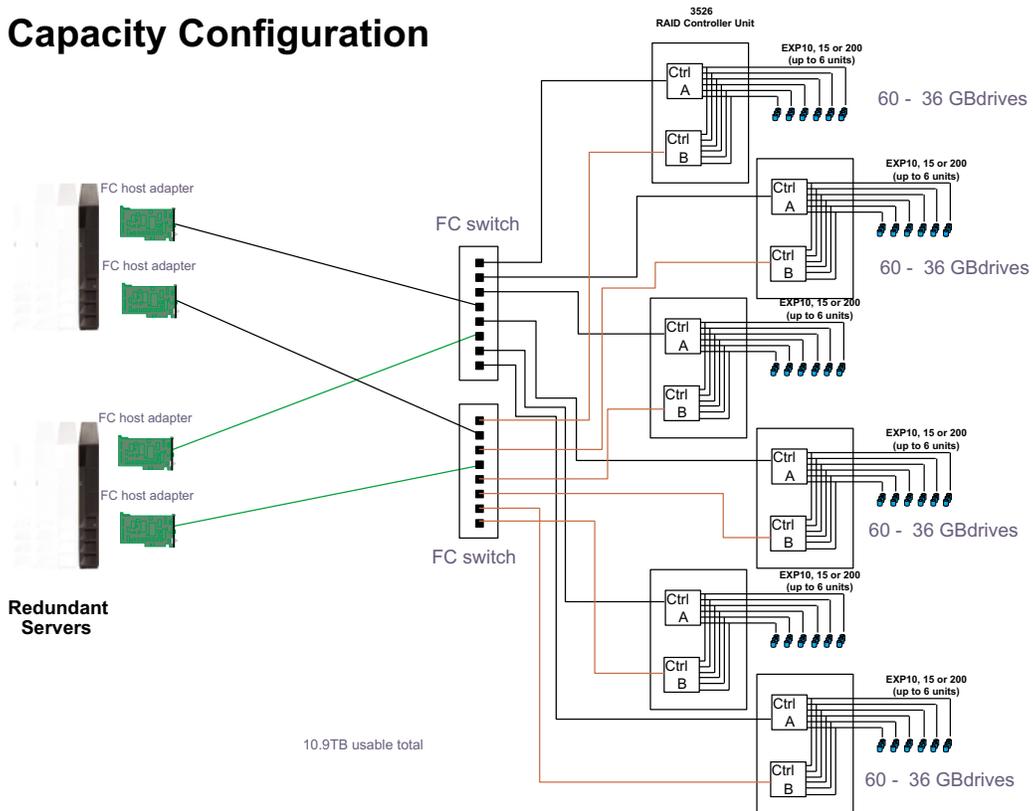
# Cornhusker configuration



# Base Storage Partitions



# Capacity Configuration



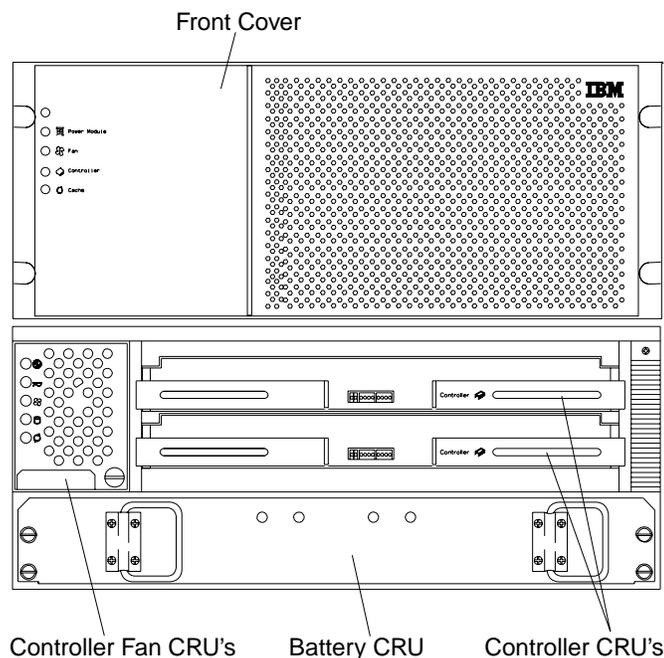


## Locations and installation procedures

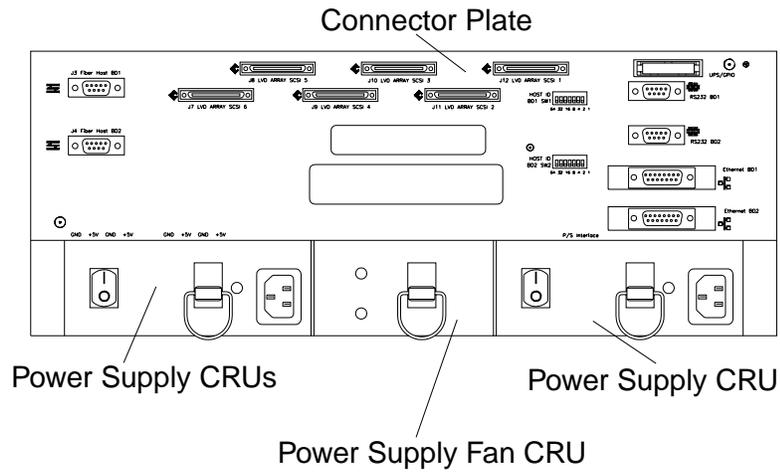
This section contains the following:

- “Controller unit front view”
- “Controller unit back view” on page 92
- “Air flow” on page 92
- “Removing the front cover” on page 93
- “Front LEDs” on page 93
- “Rear LEDs” on page 94
- “Removing and installing the controller CRU” on page 94
- “Controller CRU and battery LEDs” on page 95
- “Removing and installing the controller CRU fan” on page 96
- “Interface connections” on page 96
- “Removing and installing the power supply” on page 97
- “Removing and installing the power supply fan” on page 98
- “Replacing the battery” on page 98
- “Installing the rack” on page 100

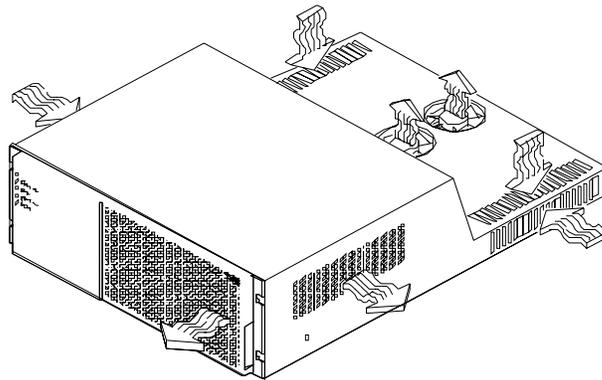
### Controller unit front view



## Controller unit back view

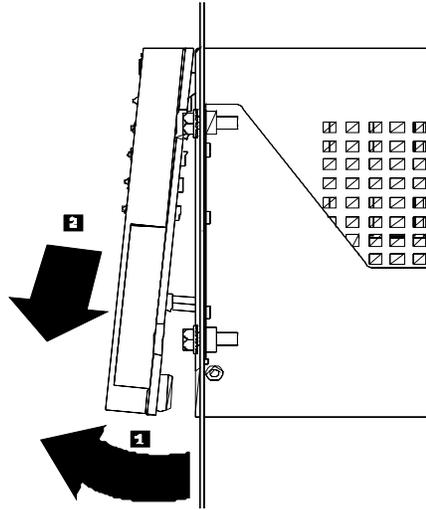


## Air flow



The controller unit must have proper air circulation throughout the chassis. To boost air circulation, the chassis has air vents along its top and sides. These vents serve as air intake and exhaust passages. Assure that vents are clean and free of obstruction.

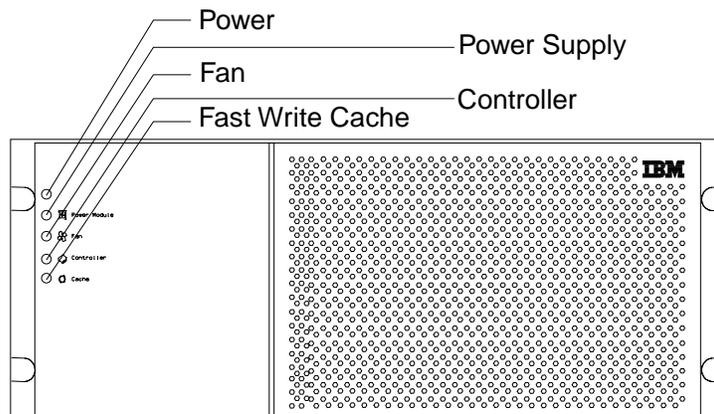
## Removing the front cover



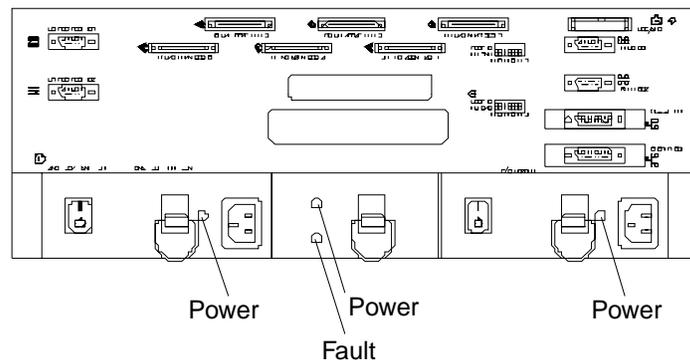
### Removing the front cover:

1. Pull out on the bottom to release pins, then slide cover down.
2. To replace front cover, slide top edge of cover under lip of chassis, then push bottom of cover until pins snap into mounting holes.

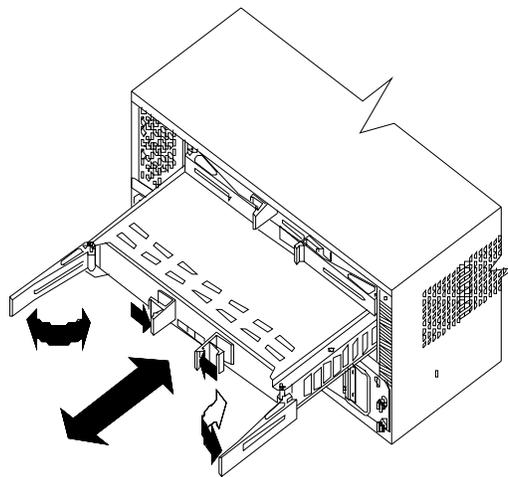
## Front LEDs



## Rear LEDs



## Removing and installing the controller CRU



**Note:** Keep track of which controller CRU belongs in each slot. To prevent data loss, you must replace each controller (A or B) in its original slot.

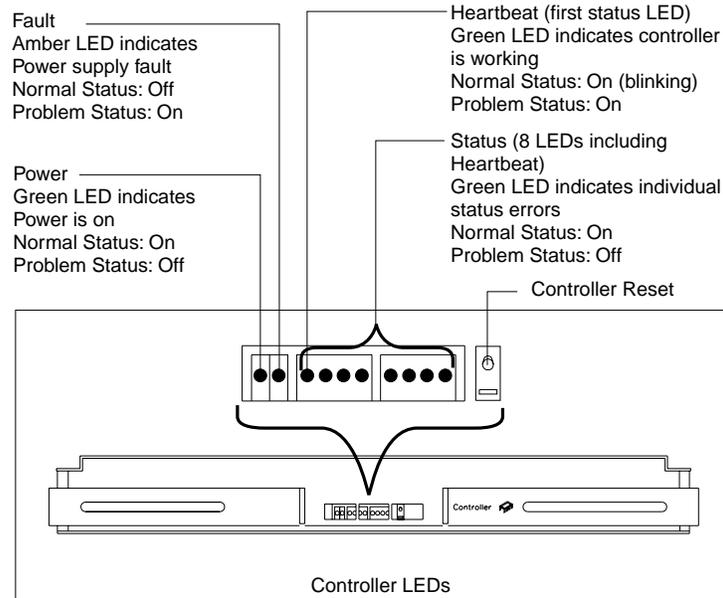
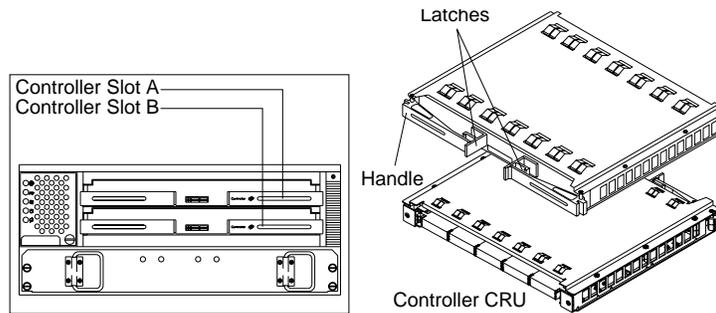
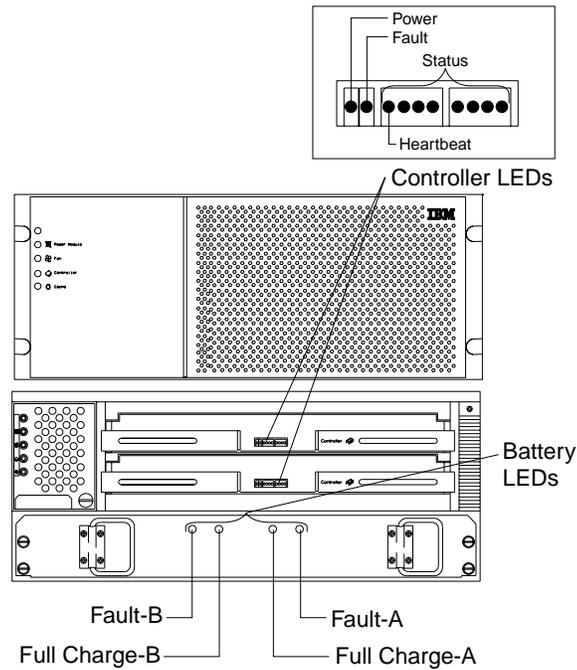
### Removing a Controller CRU:

1. Unlock the levers of the controller you want to remove.
2. Open both levers *at the same time*.
3. Pull out the controller.

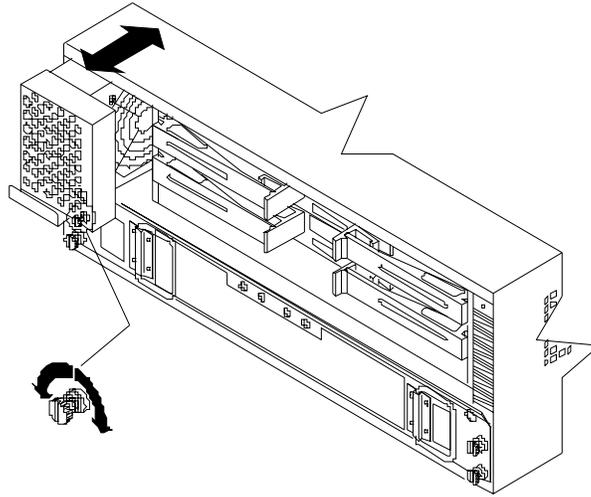
### Installing a Controller CRU:

1. Make sure both levers are straight out as shown in the figure above.
2. Carefully push the Controller CRU into the slot making sure both levers swing inward *at the same time*.
3. Close and lock both levers at the same time.

# Controller CRU and battery LEDs



## Removing and installing the controller CRU fan



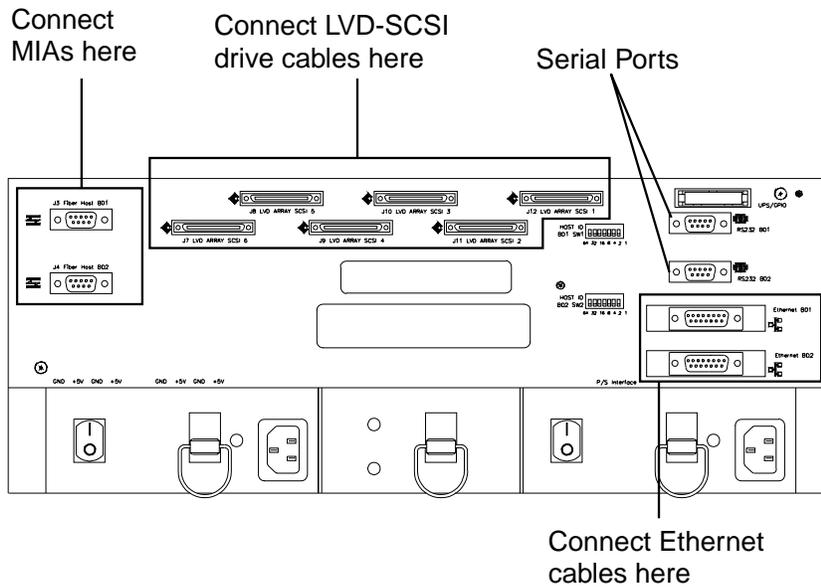
### Removing the Controller CRU fan:

1. Loosen captive screw.
2. Pull firmly on handle to remove CRU.

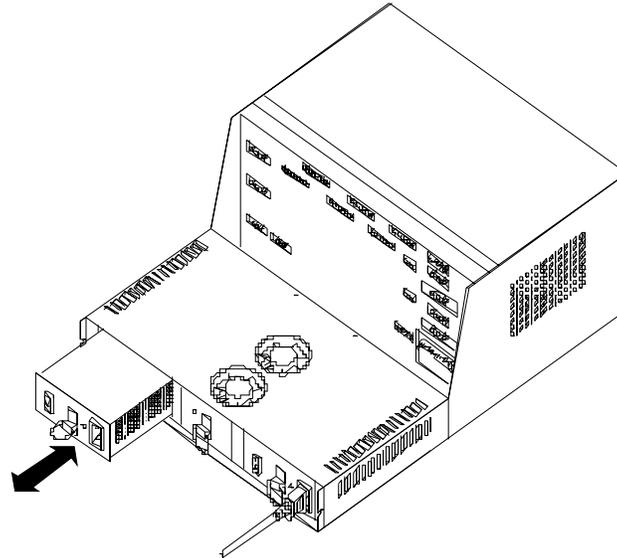
### Installing the Controller CRU fan:

1. Push Controller CRU Fan firmly into slot and tighten the captive screw.

## Interface connections



## Removing and installing the power supply



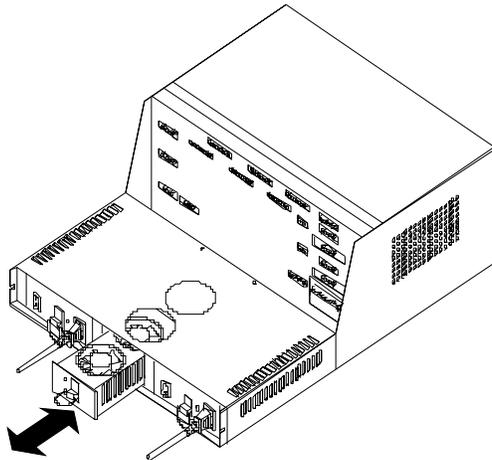
### Removing the power supply CRU:

1. Power off the power supply CRU.
2. Disconnect the power cord from the power supply CRU.
3. Pull the pull ring lever up to unlatch the CRU.
4. Pull the CRU out of the controller unit.

### Installing the power supply CRU:

1. Install the new power supply CRU into the controller unit.
2. The lever snaps down when the CRU is seated properly in the chassis. If the lever remains up, push on the power supply CRU until the lever snaps into place.
3. Connect the power cord, power on the controller unit and check all LEDs.

## Removing and installing the power supply fan



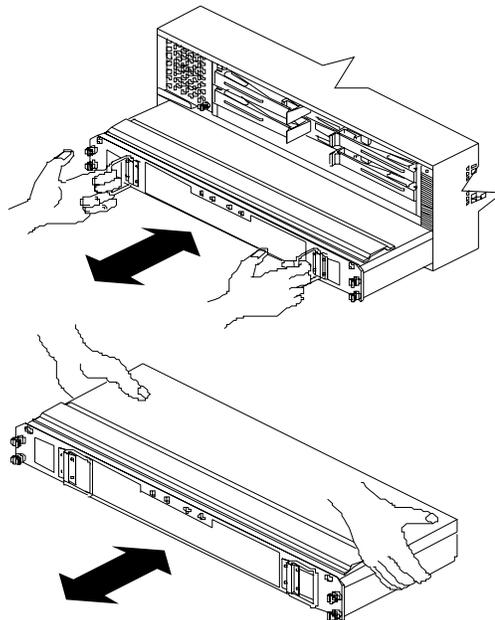
### Removing the power supply fan:

1. Pull the pull ring lever up to unlatch the CRU.
2. Pull the CRU out of the controller unit.

### Installing the power supply fan:

1. Install the new power supply fan CRU into the controller unit.
2. The lever snaps down when the CRU is seated properly in the chassis. If the lever remains up, push on the power supply fan CRU until the lever snaps into place.

## Replacing the battery



### Removing the battery CRU:

Unpack the battery CRU. Save the shipping material for transporting the used battery CRU. Find the "Battery Support Information" label on the front of the new battery CRU.

1. Record today's date on the blank line next to "Date of Installation".
2. Remove the front cover of the controller unit.

#### Important

The battery CRU weighs approximately 24 lbs. Make sure you are prepared to support its weight when you remove it from the chassis.

3. Turn the captive screws on the battery CRU counterclockwise. If they are too tight, use a flat blade screwdriver to loosen the screws.
4. Pull battery CRU out about 2 inches.
5. Grasp the battery sides with *both hands* and slide out.

### Installing the Battery CRU:

1. Slide the battery CRU into the slot and tighten all captive screws.
2. Replace the front cover.
3. Allow the system to run for at least 24 hours in order to properly charge the battery.

When properly charged, both Full Charge LEDs will be lit on the front of the battery CRU.

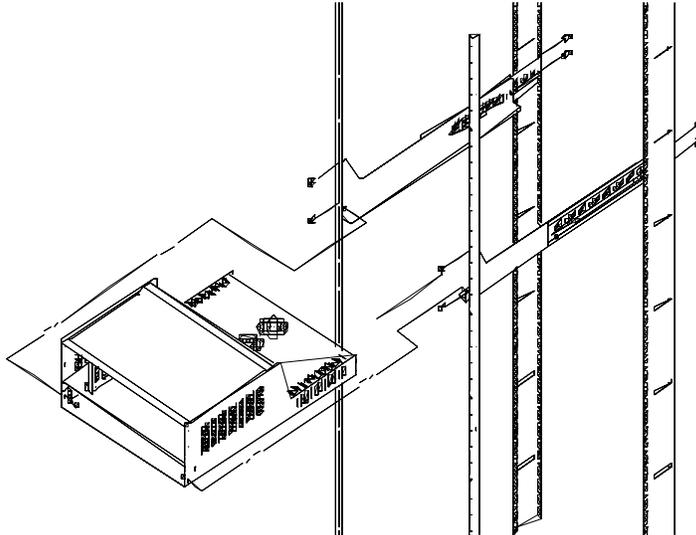
#### Important

Dispose of the used battery CRU according to local and federal regulations, which may include hazardous material handling procedures.

#### Important

If the used battery CRU is leaking electrolyte gel, *do not* ship it to a recycling center. Handle damaged batteries according to your local regulations, which may include procedures for handling batteries as hazardous waste.

## Installing the rack



**Note:** Before removing or placing the controller unit in the rack, carefully remove the battery from the controller unit. See “Replacing the battery” on page 98.

1. Loosen the adjustment screws on both side rails and adjust to fit the rack.
2. Secure the side rails to the rack cabinet using eight M6 screws and eight rack mounting nuts. Make sure both side rails are parallel and level to one another in the rack cabinet.
3. Tighten the rail adjustment screws.
4. After the side rails are secured to the rack, carefully slide the controller unit onto the side rails.
5. Secure the controller unit with two screws on the front sides of the battery compartment.

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## Symptom-to-FRU index

The Symptom-to-FRU index lists symptoms and the possible causes. The most likely cause is listed first.

The PDs also provide you with additional diagnostic aids and can be found on the IBM support Web site: <http://www.pc.ibm.com/qtechinfo/MIGR-4P3PMR.html>. The PDs can also be found in this book. See “Chapter 2. PD entry,” on page 3.

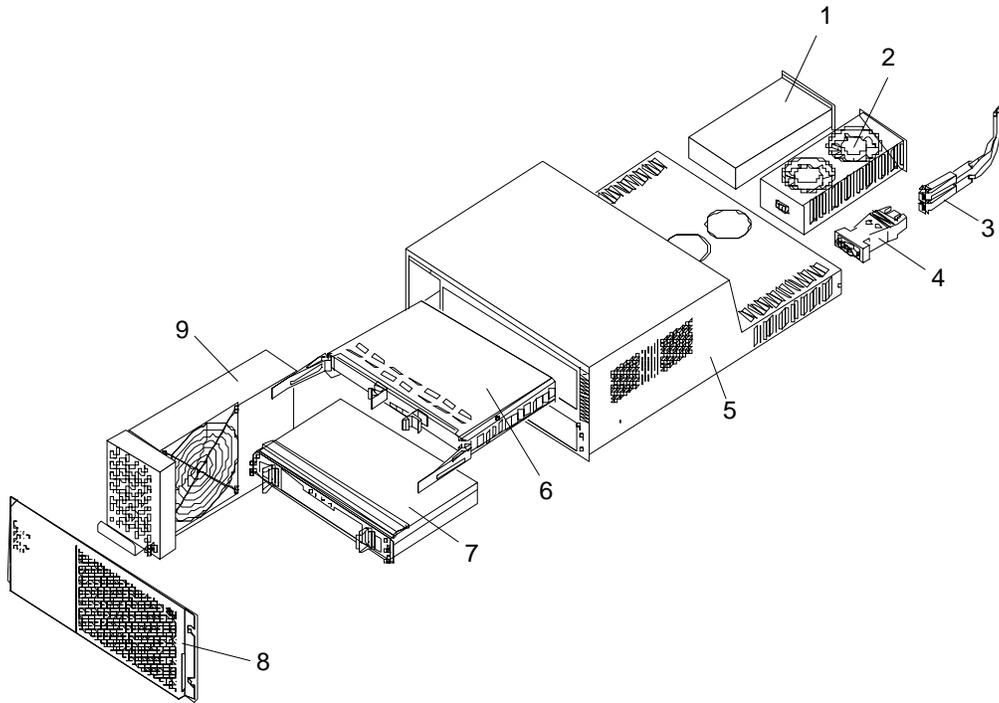
**Note:**

1. Always start with the “General checkout” on page 81. For IBM devices not supported by this index, refer to the manual for that device.
2. Do *not* look directly into any fiber cable or GBIC optical output. Read “Appendix J. Related service information,” on page 441. To view an optical signal, use a mirror to view the reflected light.

Table 16. Symptom-to-FRU index for Type 3526 Fibre Channel RAID controller

Problem	FRU/Action
Controller LED (front cover) is on.	<ol style="list-style-type: none"> <li>1. <b>Reseat Controller CRU</b></li> <li>2. Place Controller online using SM7 GUI</li> <li>3. If in passive mode, check Fibre path/GBIC</li> <li>4. Controller CRU</li> </ol>
Software issued a controller error message.	<ol style="list-style-type: none"> <li>1. <b>Check Controller Fan</b></li> <li>2. Controller CRU</li> </ol>
Software errors occur when attempting to access controllers or drives.	<ol style="list-style-type: none"> <li>1. <b>Check appropriate software and documentation to make sure the system is set up correctly and the proper command was executed.</b></li> <li>2. Power to the Controller</li> <li>3. Interface cables</li> <li>4. ID settings</li> <li>5. Controller</li> <li>6. Drive</li> <li>7. Controller backpanel</li> </ol>
Fan LED (front cover) is on.	<ol style="list-style-type: none"> <li>1. <b>Power supply fan CRU</b></li> <li>2. Controller fan CRU</li> </ol>
Controller and Fan fault LEDs (front cover) are on.	<ol style="list-style-type: none"> <li>1. <b>Check both Fan and Controller CRUs for fault LED and replace faulty CRU.</b></li> </ol>
Fault-A or Fault-B LED (battery CRU) is on. <b>Note:</b> The Fault-A or Fault-B LED <i>will</i> be on during battery charging.	<ol style="list-style-type: none"> <li>1. <b>Battery CRU</b></li> </ol>
Full Charge-A or Full Charge-B LED (battery CRU) is off.	<ol style="list-style-type: none"> <li>1. <b>Power on Controller and allow batteries to charge for 24 hours until the Full Charge LEDs are on.</b></li> <li>2. Battery CRU</li> <li>3. Both power supplies</li> </ol>
No power to controller (all power LEDs off)	<ol style="list-style-type: none"> <li>1. <b>Check power switches and power cords</b></li> <li>2. Power supplies</li> </ol>
Power Supply LED is off.	<ol style="list-style-type: none"> <li>1. <b>Check and reseat power supply</b></li> <li>2. Check for overheating. Wait ten minutes for the power supply CRU to cool down. See "Recovering from a power supply shutdown" on page 82.</li> <li>3. Power supply CRU</li> </ol>
Power Supply CRU LEDs are on, but all other CRU LEDs are off.	<ol style="list-style-type: none"> <li>1. <b>DC power harness</b></li> </ol>

## Parts listing (Type 3526 Fibre Channel RAID Controller)



Index	Fibre Channel RAID Controller (Type 3526)	FRU
1	350-Watt Power Supply	01K6743
2	Rear Fan Assembly (Power Supply Fan)	01K6741
3	Optical Cable - 5 Meters (option)	03K9202
3	Optical Cable - 25 Meters (option)	03K9204
4	Media Interface Adapter (MIA)	03K9280
5	Frame Assembly with Midplane	10L6981
6	Controller Assembly with 32 MB memory /128 MB cache	10L6993
7	Battery Backup Assembly	01K6742
8	Bezel Assembly	10L7043
9	Front Fan Assembly (Controller CRU Fan)	01K6740
	128 MB cache module	10L5862
	Battery Cable	03K9285
	Fan Cable	03K9281
	Power Cable	03K9284
	Miscellaneous Hardware Kit	01K6739

Index	Fibre Channel RAID Controller (Type 3526)	FRU
	Rail Kit	10L6982



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## Chapter 8. Type 3552 FAStT500 RAID controller

**Note:** The PD maps provide you with additional diagnostic aids and can be found on the IBM support Web site: <http://www.pc.ibm.com/qtechinfo/MIGR-4P3PMR.html>. The PDs can also be found in this book. See “Chapter 2. PD entry,” on page 3.

The IBM FAStT500 RAID controller is compatible with the following IBM products:

- IBM FAStT Host Adapter (FRU 09N7292) (see Chapter 6 on page 65)
- IBM FAStT EXP500 enclosure (see Chapter 11 on page 273)
- Type 2109 Fibre Channel Switch
- Type 3534 Managed Hub

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### General checkout

Use the indicator lights, “Symptom-to-FRU index” on page 173, and the connected server HMM to diagnose problems.

The PD maps provide you with additional diagnostic aids and can be found on the IBM support Web site: <http://www.pc.ibm.com/qtechinfo/MIGR-4P3PMR.html>. The PDs can also be found in this book. See “Chapter 2. PD entry,” on page 3.

### Checking the indicator lights

The controller unit indicator lights display the status of the controller unit and its components. Green indicator lights mean normal operating status; amber indicator lights mean a possible failure.

It is important that you check all the indicator lights on the front and back of the controller unit when you turn on the power. After you turn on the power, the indicator lights might blink intermittently. Wait until the controller unit completes its power up before checking for faults. It can take up to 15 minutes for the battery to complete its self-test and up to 24 hours to fully charge, particularly after an unexpected power loss of more than a few minutes.

Use the following procedure to check the controller unit indicator lights and operating status.

1. To view the indicator lights, remove the controller unit bezel.
2. Check the indicator lights on the front of the controller unit.
3. Check the indicator lights on the back of the controller unit.
4. Check the indicator lights on the mini-hubs.
5. If all indicator lights show a normal status, replace the bezel; otherwise, run the storage-management software to diagnose and repair the problem.

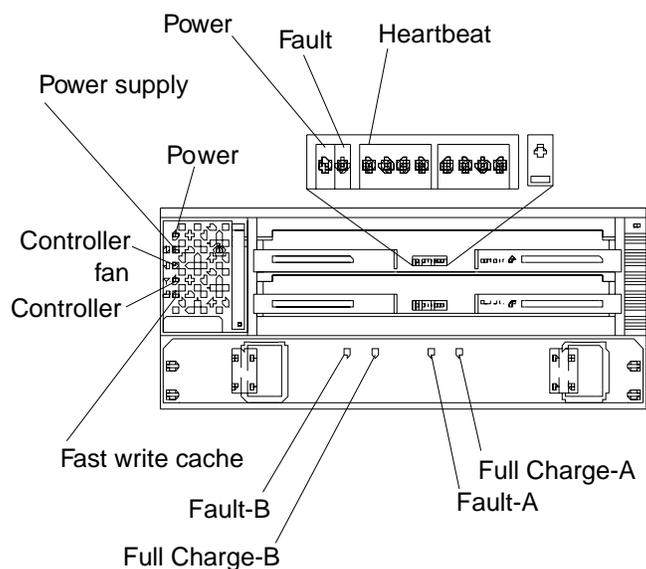


Table 17. Type 3552 FAST500 RAID controller indicator lights

Indicator light	Color	Normal Operation	Problem Indicator	Possible Conditions indicated by the problem indicator (1)
<b>Component: controller CRU</b>				
Power	Green	On	Off	<ul style="list-style-type: none"> <li>No power to controller unit</li> <li>No power to storage subsystem</li> <li>Cables are loose or the switches are off</li> <li>Power supply has failed, is missing, or is not fully seated</li> <li>Overtemperature condition</li> </ul>
Fault	Amber	Off	On	Controller failure; controller fault condition
Heartbeat	Green	Blinking (2)	Not blinking (2)	No controller activity
Status (eight lights including Heartbeat)	Green	Various patterns depending on the condition	Various patterns depending on the condition	If the second, third, sixth, and seventh lights are on or if all eight lights are on, there is a memory fault indicating that the controller CRU has failed.
<b>Component: controller fan</b>				
Power	Green	On	Off	<ul style="list-style-type: none"> <li>No power to controller unit</li> <li>No power to storage subsystem</li> <li>Cables are loose or the switches are off</li> <li>Power supply has failed, is missing, or is not fully seated in controller unit</li> <li>Overtemperature condition</li> </ul>

Table 17. Type 3552 FASt500 RAID controller indicator lights

Indicator light	Color	Normal Operation	Problem Indicator	Possible Conditions indicated by the problem indicator (1)
Power supply fault	Amber	Off	On	<ul style="list-style-type: none"> <li>Power supply has failed</li> <li>Overtemperature</li> <li>Power supply is turned off, disconnected, or not fully seated in controller unit</li> <li>No power to controller unit or storage subsystem (all indicator lights are off)</li> </ul>
Controller fan fault	Amber	Off	On	<ul style="list-style-type: none"> <li>Controller fan has failed</li> <li>Fan and communications module is missing, unplugged, or has failed</li> <li>Circuitry failure</li> <li>Overtemperature condition</li> </ul>
Controller fault	Amber	Off	On	Controller has failed; one or more memory modules failed (SIMMs or DIMMs)
Fast write cache	Green	Steady or blinking (3)	Software dependent (3)	Normal operation is off if: <ul style="list-style-type: none"> <li>Cache is not enabled</li> <li>Battery is not ready</li> </ul>
<b>Component: battery</b>				
Fault-A or Fault-B	Amber	Off	On	<ul style="list-style-type: none"> <li>Left or right battery bank has failed</li> <li>Battery is either discharged or defective</li> </ul>
Full Charge-A or Full Charge-B	Green	On (4)	Off	<ul style="list-style-type: none"> <li>Left or right battery bank is not fully charged</li> <li>Power has been off for an extended period and has drained battery power</li> <li>Batteries are weak</li> </ul>
<ol style="list-style-type: none"> <li>Always use the storage-management software to identify the failure.</li> <li>There are eight status lights (the Heartbeat and seven others) that glow in various patterns, depending on the controller status.</li> <li>The fast write cache indicator light is on when there is data in cache and blinks during a fast write operation.</li> <li>If either Full Charge-A or Full Charge-B indicator light blink, the battery is in the process of charging.</li> </ol>				

The indicator lights are located on the back of the controller unit.

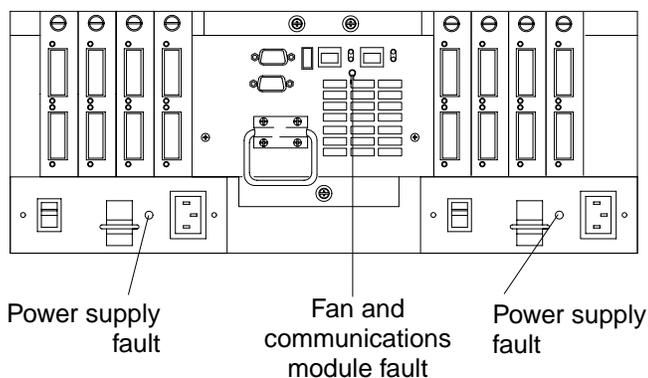
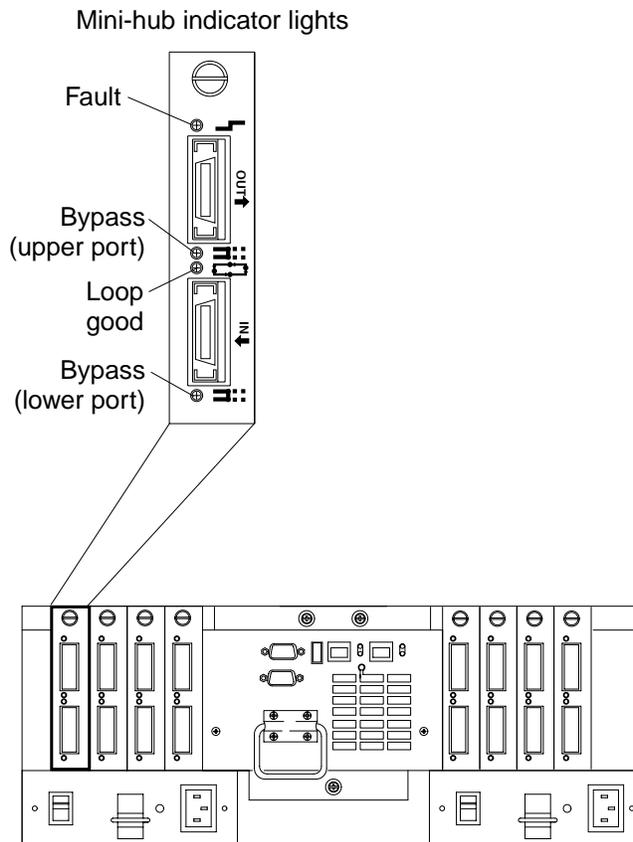


Table 18. Type 3552 FASt500 RAID controller indicator lights

Indicator light	Color	Normal Operation	Problem Indicator	Possible Conditions indicated by the problem indicator (1)
<b>Fan and communications module</b>				
Fan and communication fault	Amber	Off	On	<ul style="list-style-type: none"> <li>Fan and communications module has failed or is installed incorrectly</li> <li>Overtemperature condition</li> </ul>
<b>Power supply</b>				
Power supply	Green	On	Off	<ul style="list-style-type: none"> <li>No power to controller unit</li> <li>No power to storage subsystem</li> <li>Power supply has failed</li> <li>Overtemperature condition</li> </ul>
1. Always use the storage-management software to identify the failure.				

The mini-hub indicator lights on the back of the controller unit are shown in the following figure.



The following table describes the mini-hub indicator lights.

Table 19. Mini-hub indicator lights

Icon	Indicator light	Color	Normal Operation	Problem Indicator	Possible condition indicated by the problem indicator
<b>Component: mini-hub (host-side)</b>					
	Fault	Amber	Off	On	Mini-hub or GBIC has failed  <b>Note:</b>  If a host-side mini- hub is not connected to a controller, this fault light is always on.
	Bypass (upper port)	Amber	Off	On	<ul style="list-style-type: none"> <li>Upper mini-hub port is bypassed</li> <li>Mini-hub or GBIC has failed, is loose, or is missing</li> <li>Fiber-optic cables are damaged</li> </ul> <b>Note:</b>  If the port is unoccupied, the light is on.
	Loop good	Green	On	Off	<ul style="list-style-type: none"> <li>The loop is not operational</li> <li>Mini-hub has failed or a faulty device might be connected to the mini-hub</li> <li>Controller has failed</li> </ul> <b>Note:</b>  If a host-side mini-hub is not connected to a controller, the green light is always off and the fault light is always on.
	Bypass (lower port)	Amber	Off	On	<ul style="list-style-type: none"> <li>Lower mini-hub port is bypassed</li> <li>Mini-hub or GBIC has failed, is loose, or is missing</li> <li>Fiber-optic cables are damaged</li> </ul> <b>Note:</b>  If the port is unoccupied, the light is on.
<b>Component: mini-hub (drive-side)</b>					
	Fault	Amber	Off	On	Mini-hub or GBIC has failed  <b>Note:</b>  If a drive-side mini-hub is not connected to a controller, this fault light is always on.

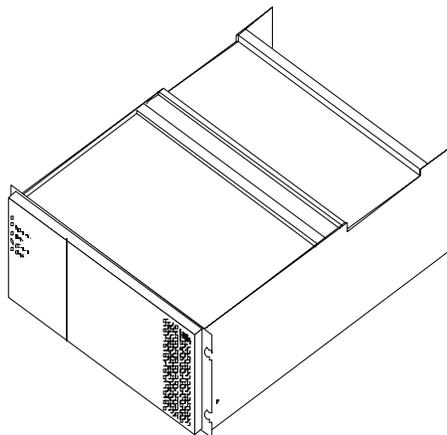
Table 19. Mini-hub indicator lights

Icon	Indicator light	Color	Normal Operation	Problem Indicator	Possible condition indicated by the problem indicator
	Bypass (upper port)	Amber	Off	On	<ul style="list-style-type: none"> <li>Upper mini-hub port is bypassed</li> <li>Mini-hub or GBIC has failed, is loose, or is missing</li> <li>Fiber-optic cables are damaged</li> </ul> <p><b>Note:</b> If the port is unoccupied, the light is on.</p>
	Loop good	Green	On	Off	<ul style="list-style-type: none"> <li>The loop is not operational</li> <li>Mini-hub has failed or a faulty device might be connected to the mini-hub</li> <li>Drive has failed</li> </ul> <p><b>Note:</b> If a drive-side mini-hub is not connected to a controller, the green light is always off and the fault light is always on.</p>
	Bypass (lower port)	Amber	Off	On	<ul style="list-style-type: none"> <li>Lower mini-hub port is bypassed</li> <li>Mini-hub or GBIC has failed, is loose, or is missing</li> <li>Fiber-optic cables are damaged</li> </ul> <p><b>Note:</b> If the port is unoccupied, the light is on.</p>

## Features

The controller unit is used with rack-mounted drive enclosures (also referred to as expansion units) for Fibre Channel.

The following figure shows the IBM FASt500 RAID Controller. The following list summarizes the features of the Type 3552 Fibre Channel RAID Controller.



The controller unit comes with the following items:

- Hardware
  - Two RAID controllers
  - Two power supplies
  - Battery
  - Two host mini-hubs and two drive mini-hubs
  - Two power cords or two high voltage rack jumpers
  - One rack-mounting hardware kit:
  - Two rails (right and left)
  - Eight black M6 hex-head screws
  - Eight clip nuts
  - Eight cage nuts
  - Software and documentation including:
    - IBM FAStT Storage Manager Version 7.01 CD:
    - IBM FAStT Storage Manager 7.01
    - Publications and online help in Adobe Acrobat PDF format
- Rack Mounting Assembly including
  - Rack Mounting Installation Instructions
  - Rack Mounting Template
  - White tape dots
  - Fibre Channel Cabling Instructions
- Controller unit components

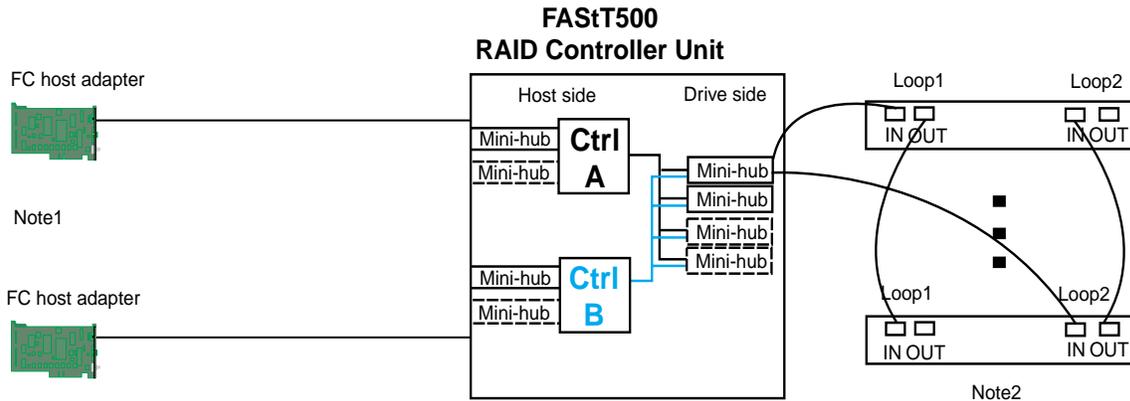
The controller unit has the following removable components, called customer-replaceable units (CRUs). All CRUs are accessible from either the front or back of the controller unit.

  - Bezel (front cover)
  - Controller fan
  - Battery
  - Controller (two each)
  - Power supply (two each)
  - Host mini-hub (comes with two, four maximum)
  - Drive mini-hub (comes with two, four maximum)
  - Fan and communications module

## Tested configurations

The following configurations are for the Type 3552 IBM FASt500 RAID Controller.

### Basic Configuration



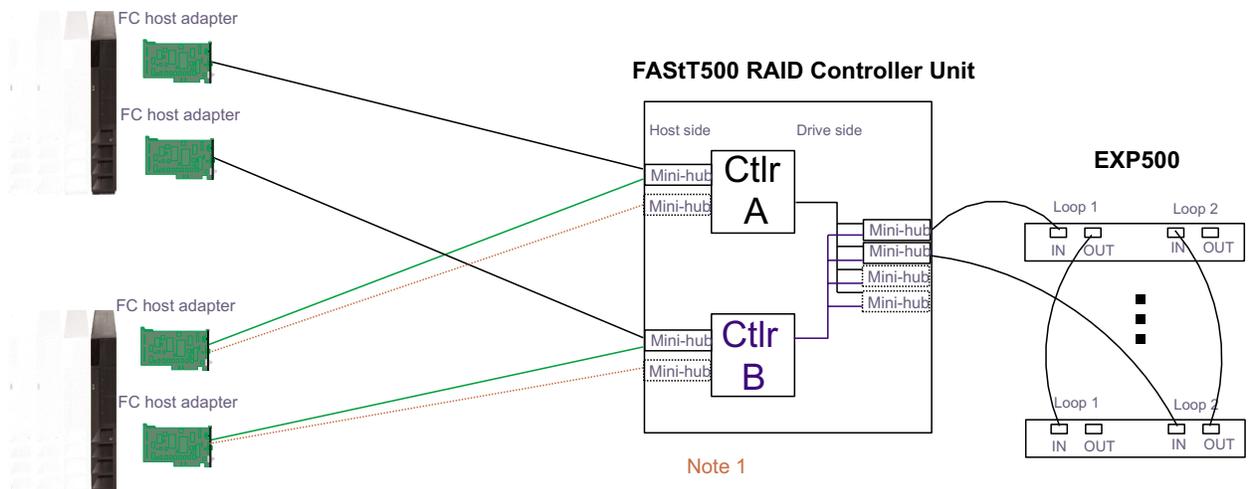
Note 1: Adapters can be in the same or different systems

Note 2: Redundant drive loops are shown and required

Note 3: Mini-hubs in dashes are options

Note 4: For dual redundant loops connect to the optional set of mini-hubs shown as dashed on the drive side

### Simple Fully Redundant

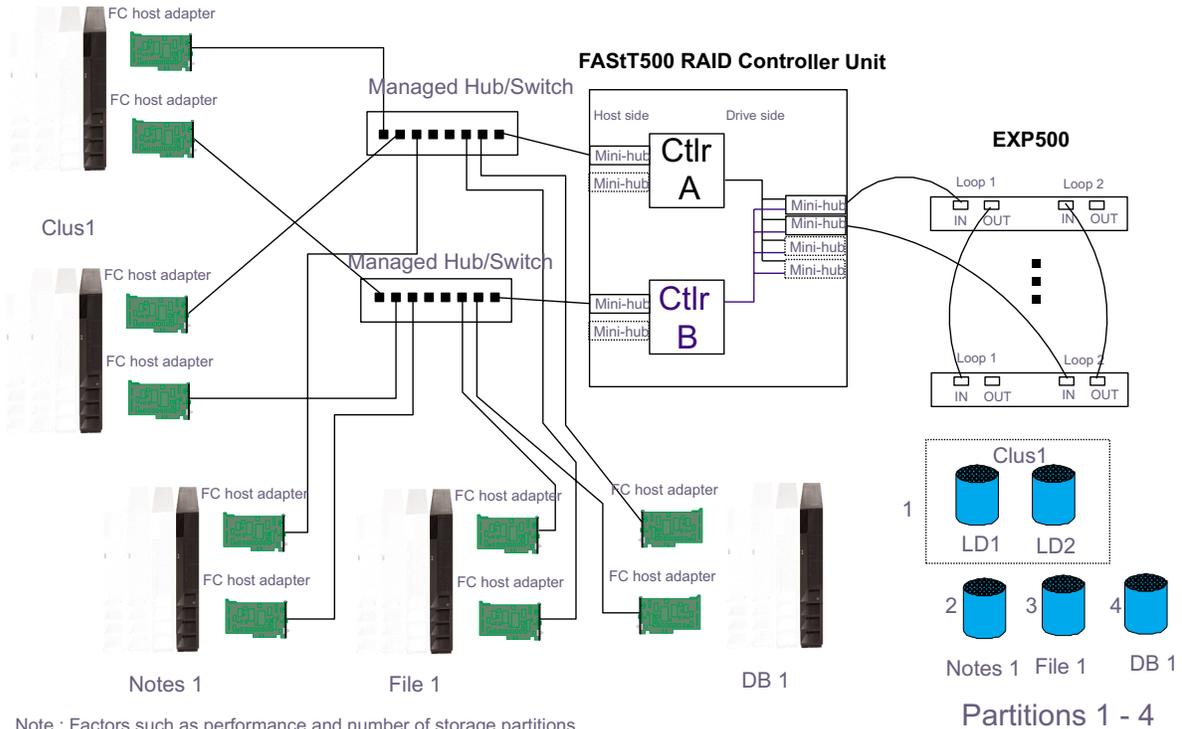


#### Redundant Servers

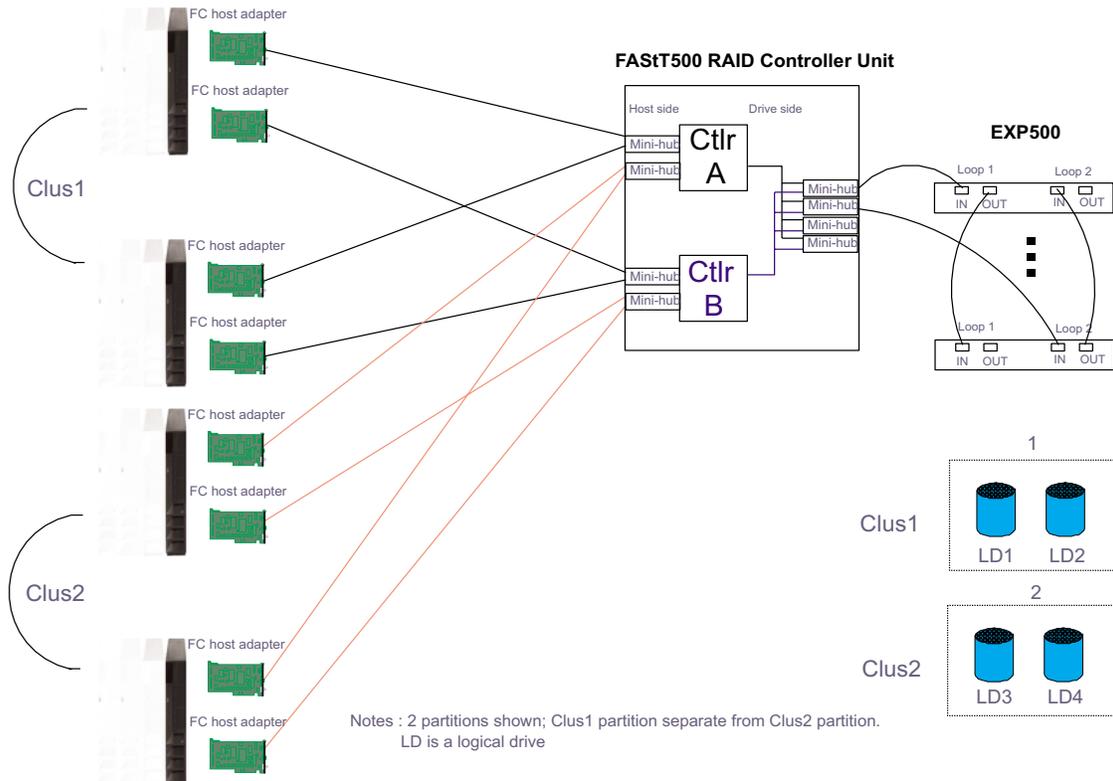
Note 1: Since disks are seen from multiple places some form of protection such as MSCS, storage partitioning, Sanergy, Oracle etc **must** be used.

Note 2: For max bandwidth wire dotted red lines instead of green

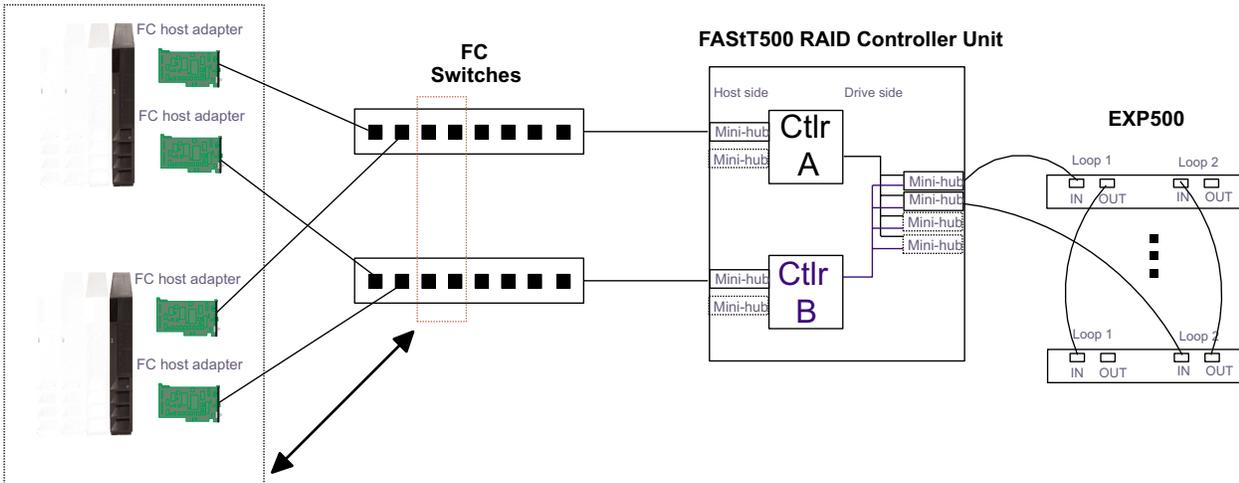
# Cluster/Non-Cluster Share



# Multi-MSCS No External Hubs



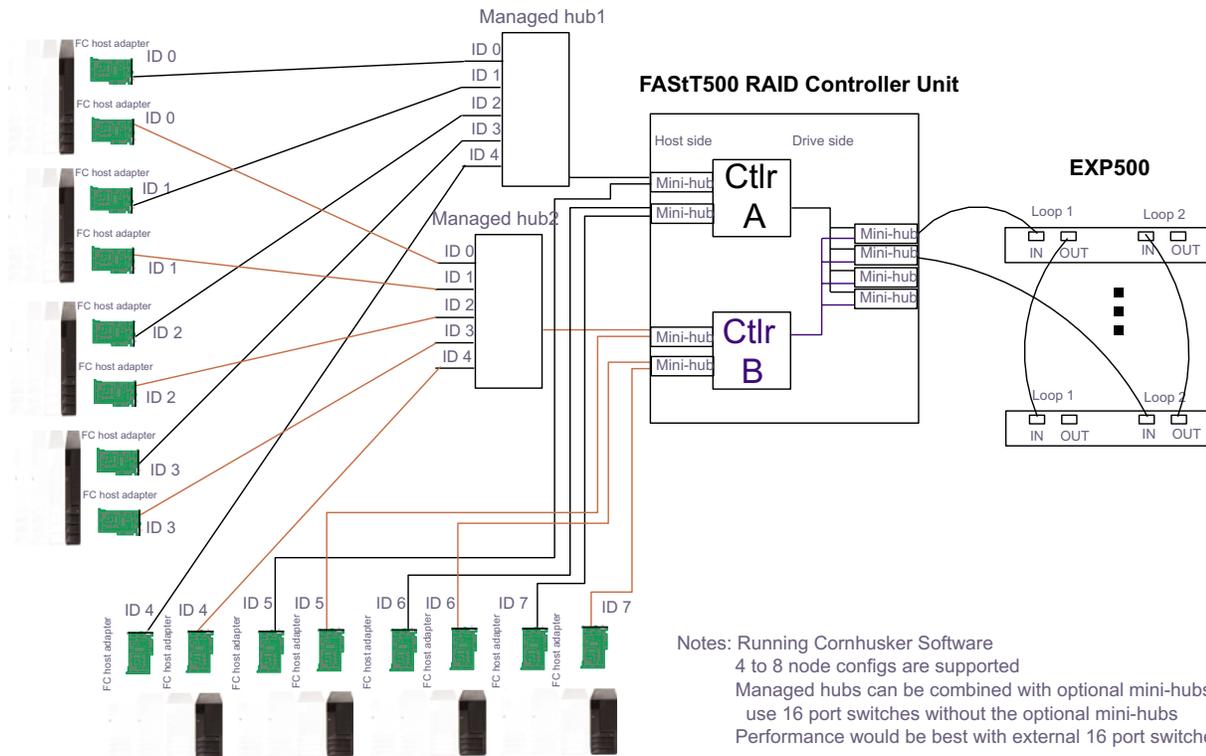
# Multi-MSCS extended



**Notes :**

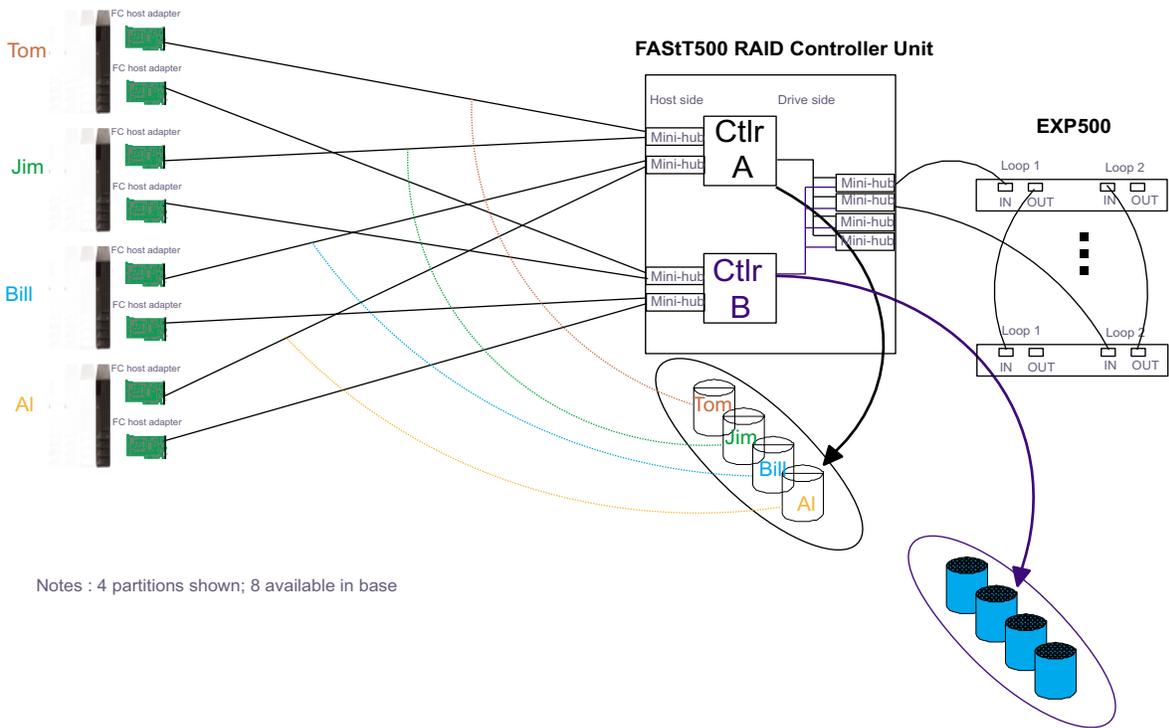
- Each group of 4 ports on the switches (red dash box) can support one cluster element (black dash box)
- Storage partitioning is used to separate clusters
- 16 port switches allow more clusters but this has to be within performance needs and available partitions

# Cornhusker configuration

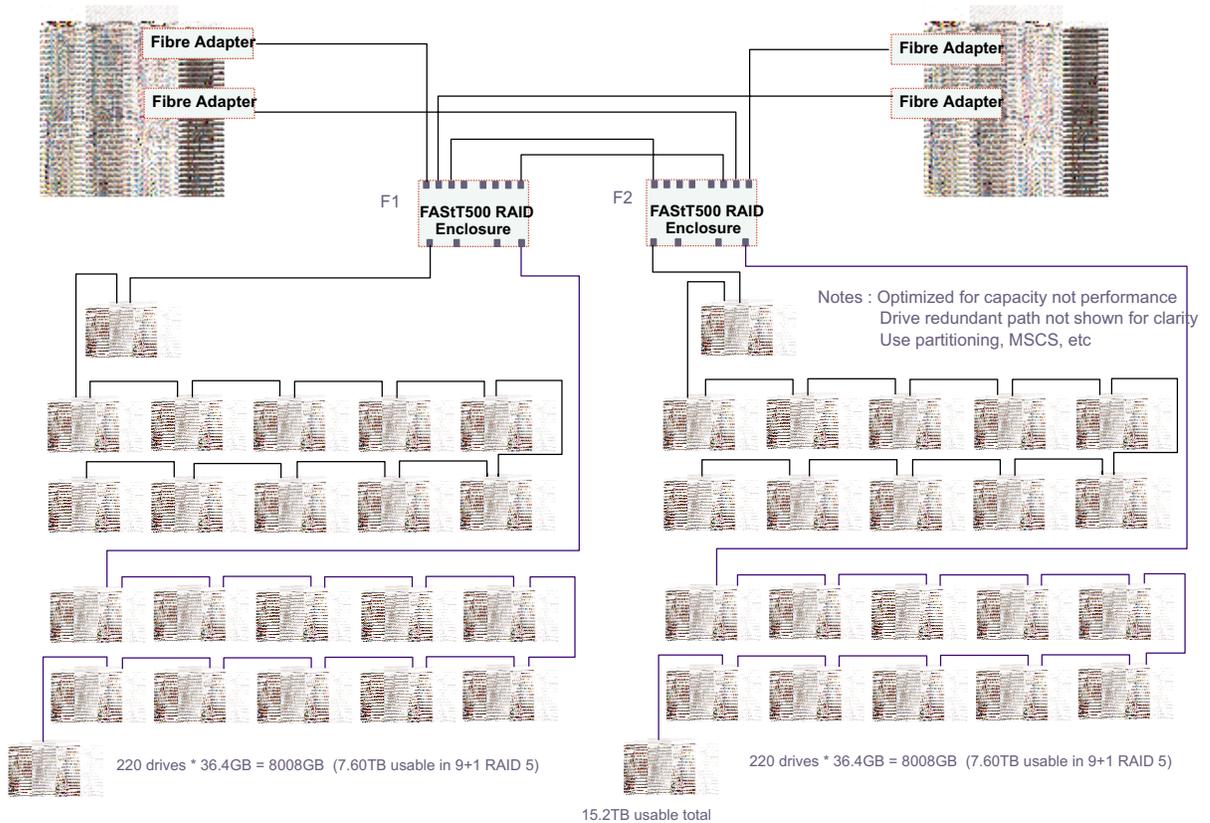


- Notes:** Running Cornhusker Software
- 4 to 8 node configs are supported
  - Managed hubs can be combined with optional mini-hubs or use 16 port switches without the optional mini-hubs
  - Performance would be best with external 16 port switches

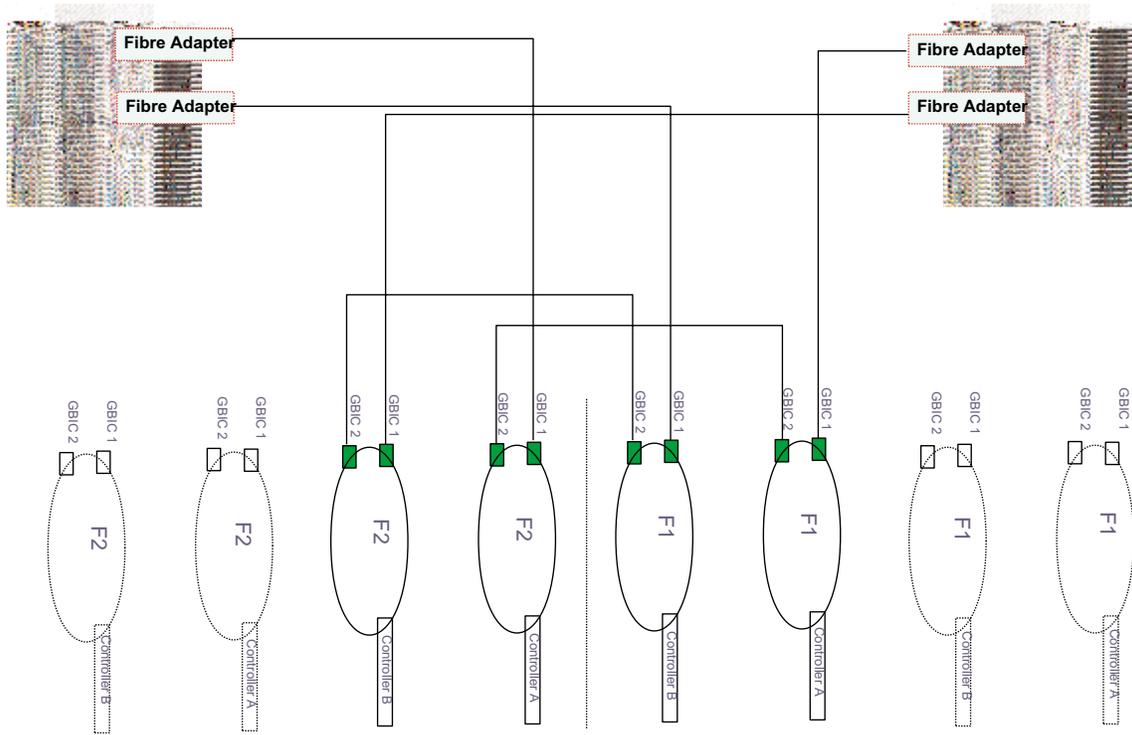
# Base Storage Partitions



# Capacity Configuration

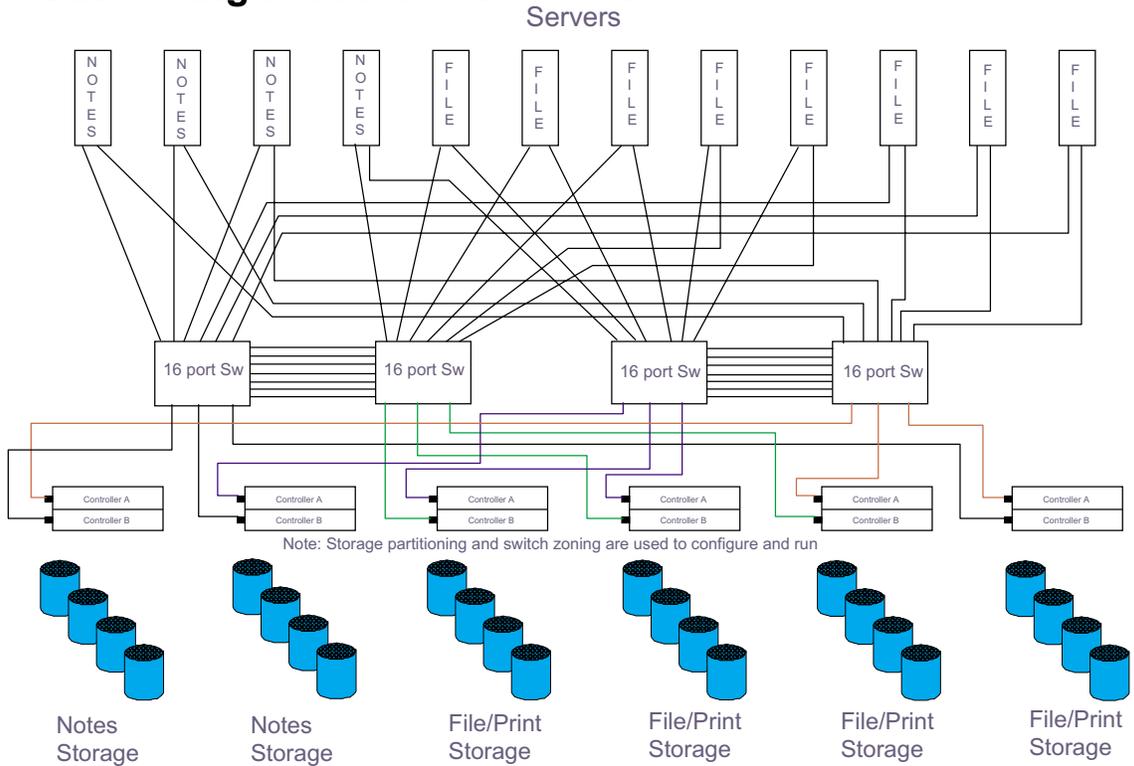


# Capacity Configuration - host detail

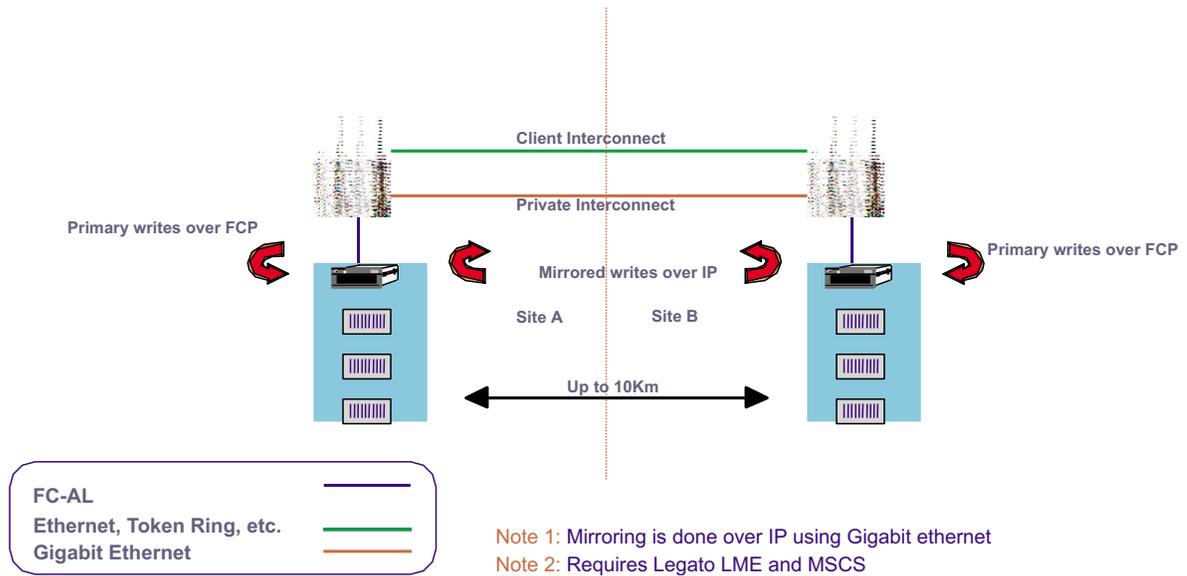


Host-side view

# SAN - Using Partitions of Clusters



# Legato HA/Replication for MSCS



## Preparing for installation

Use the following list to prepare a controller unit for installation.

1. Prepare the site to meet all area, environmental, power, and site requirements.

### Floor space

The floor area at the installation site must provide:

- Enough stability to support the weight of the controller unit and associated equipment.
- Sufficient space to install the controller unit.

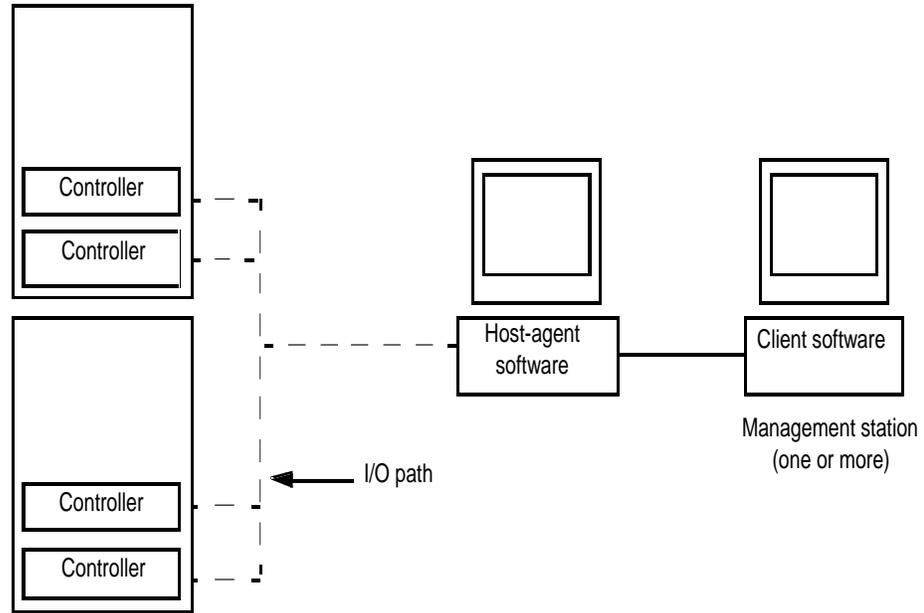
### Weight

The controller unit total weight depends on the number of components installed in the chassis. The maximum weight equals a controller unit containing two RAID controllers, two power supplies, one battery, one controller fan, one fan and communications module, and eight mini-hubs. The empty weight of a controller unit with all the CRUs removed is 15.5 kg (34 lbs). Maximum weight of a controller unit equals 38.6 kg (85 lbs).

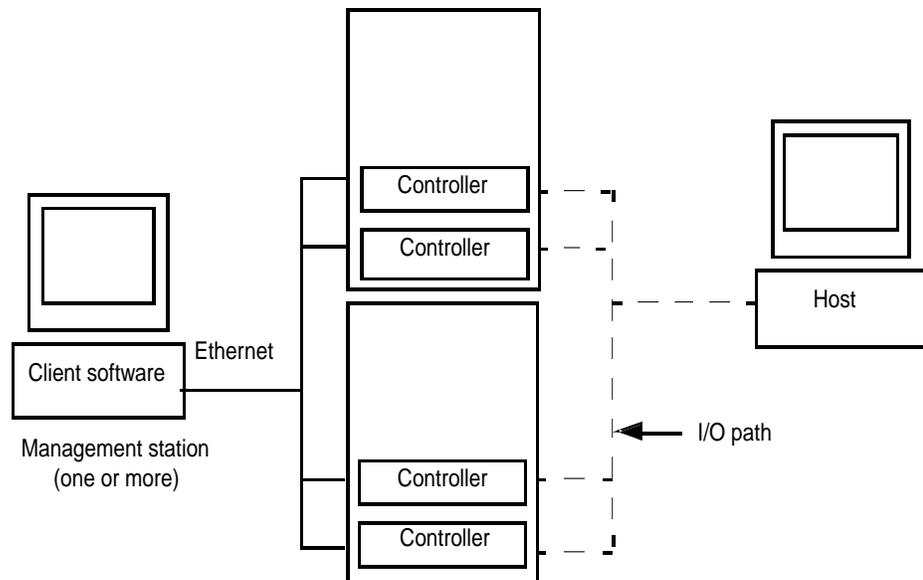
2. Move the controller unit and its rack cabinet to the site.
3. Remove the controller unit from its shipping container and check the contents. If any items are missing, contact your IBM reseller before proceeding.
4. Assemble the tools and equipment you will need for installation. These might include:
  - Power cords (come with the controller)
  - Screwdrivers and wrenches (various sizes)
  - Antistatic protection (such as a grounding wrist strap)
  - Fibre Channel (FC) and Ethernet interface cables and cable straps
  - Rack-mounting hardware (comes with the controller unit)
  - Storage-management software to configure the storage subsystems (comes on an Installation CD with the controller unit)

- Install additional hardware, based on the method of storage subsystem management. You can manage the storage subsystems using the host-agent or direct manage method, as shown in the following figures.

If you are using the **Host-agent method** (uses host-agent software installed on the host machine), install at least one management station and a software-agent host.



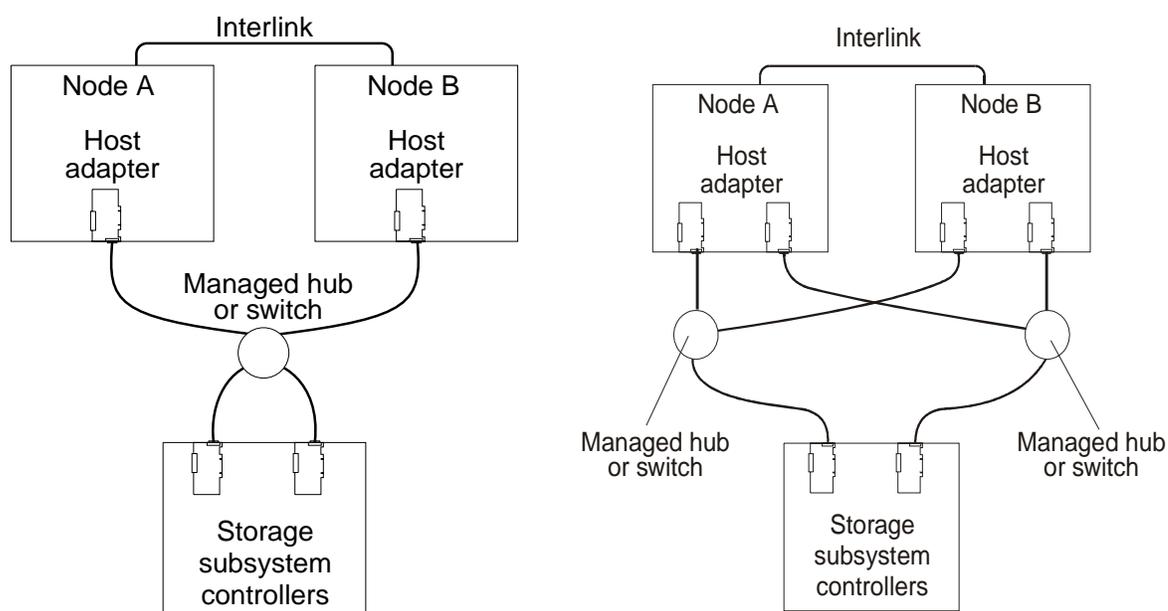
If you are using the **Direct manage method** (uses Ethernet connections from a management station to each controller), then install at least one management station and attach Ethernet cables to each management station (one pair per controller unit). You will connect the cables to each controller later when you install the controller unit. When you finish, continue with step 6.



- Determine the type of Fibre Channel network environment into which you are installing the storage subsystem. Note that a cluster server, acting as a host, has two nodes for failover support.

7. Install the applicable host adapters, based on your path configuration. See the following table and figure for an example of installing a storage subsystem on a Fibre Channel network in a single-path or dual-path configuration.

Path configuration	Action
Single-path - each node connects to only one controller.	Install a single-channel host adapter on each node.
Dual-path - each node connects to both controllers, providing the greatest redundancy protection if a connection problem occurs.	Install two single-channel host adapters in each node.



- Refer to the documentation provided with your host adapters for installation requirements and procedures.
- Use the correct host adapter driver. Refer to the software installation guide and README file on the storage-management software installation CD for information on supported host adapters and drivers.

**Note:** Make sure each host adapter and controller has a unique ID.

When finished, continue with step 8.

8. Attach fiber-optic interface cables to each host adapter. You will connect the other end of the cables to the controller later in the installation process.
9. Continue with "Handling static sensitive devices".

## Handling static sensitive devices

When you handle electrostatic discharge (ESD) sensitive devices, take precautions to avoid damage from static electricity. For details about handling ESD-sensitive devices, refer to the following Web site and use a search term of ESD: <http://www.ibm.com/>

## Preparing the rack

To prepare the rack for installation, review the following list and complete all applicable preparatory procedures.

1. Move, unpack, and level the rack at the installation site.
2. Remove external rack panels.
3. Stop all I/O activity to the devices in the rack.
4. Turn off all drive enclosure and rack power. Disconnect existing power, network, and other external cables.
5. Install additional interface cables and power cables.
6. Install support rails for mounting the controller unit and drive enclosures.
7. Remove, add, or reconfigure drive enclosures or devices in the rack.

### Important

Before installing the controller unit in a rack, it is important that you do the following:

- Review the documentation that comes with your rack enclosure for safety and cabling considerations.
- Install the controller unit in a maximum 35° C environment.
- To ensure proper air flow, do not block the air vents; 15 cm (6 in.) of air space is sufficient.
- To ensure rack stability, load the rack starting at the bottom.
- If you install multiple components in the rack, do not overload the power outlets.
- Always connect the controller unit to a properly grounded outlet.

## Preparing the drive enclosures

Prepare the drive enclosures that you are attaching to the controller unit. This could involve any or all of the following tasks:

- Moving the drive enclosures to the installation site
- Unpacking the drive enclosures from their shipping cartons
- Checking the shipping contents
- Removing all customer replaceable units (CRUs)
- Setting the Bridge Enable switch, as necessary

For detailed instructions on preparing the drive enclosures, refer to the hardware documentation that comes with each device. When you finish preparing the drive enclosures, continue with "Preparing the controller unit".

## Preparing the controller unit

You will need an antistatic wrist strap and a cart or level surface (to hold the CRUs).

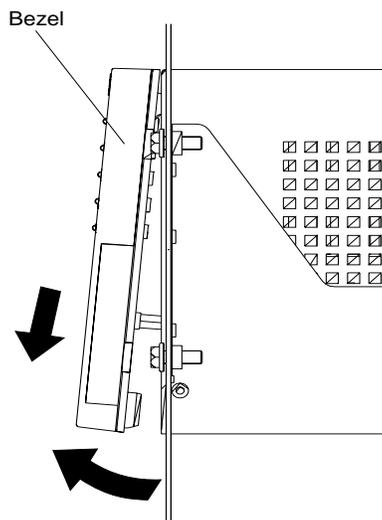
Use this procedure to prepare a controller unit for installation. These instructions assume that you have completed all applicable site, rack cabinet, and drive enclosure preparations previously described.

It is easier to lift the controller unit and install it in a rack if you remove all CRUs first. A fully loaded controller unit with a controller fan, battery, fan and communications module, two controllers, two power supplies, and 8 mini-hubs installed weighs 38.6 kg (85 lbs). If you remove all the CRUs, you can reduce the overall weight.

To gain access to the CRUs, cables, indicator lights, and switches inside the controller unit, you must remove the bezel.

**Attention:** Pulling the bezel out too far can damage the hooks at the top. To avoid damaging the plastic hooks, place the controller unit on a flat surface. Be sure the front of the controller unit extends approximately two inches beyond the edge.

1. Carefully pull out the bottom of the bezel to release the pins; then, slide down the bezel, as shown in the following figure.



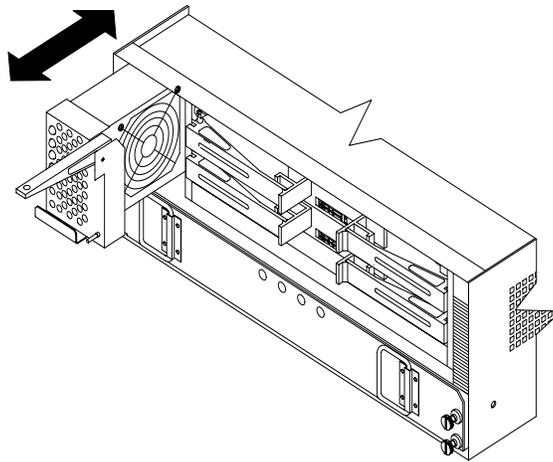
**Note:** To replace the bezel, slide the top edge under the lip on the chassis; then push the bezel bottom until the pins snap into the mounting holes.

2. Check the contents of the shipping container.

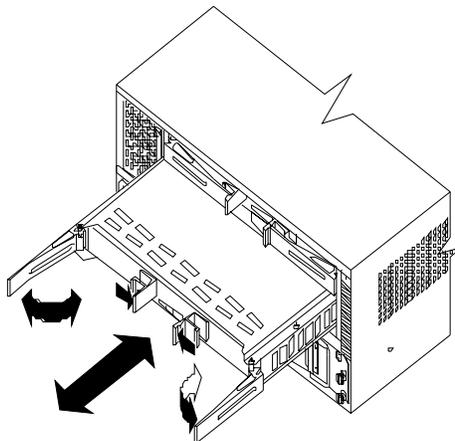
The power cords attach the controller unit to the ac power sources inside the cabinet or to an external power source.

**Attention:** When you handle electrostatic discharge (ESD) sensitive devices, take precautions to avoid damage from static electricity. For details about handling ESD-sensitive devices, refer to the following Web site and use a search term of ESD: <http://www.ibm.com/>

3. Remove the controller fan controllers, battery, power supply, fan and communication module, and mini-hubs.
  - a. Pull up on the fan lever to unlock the fan; then, grasp the lip handle and pull out firmly.



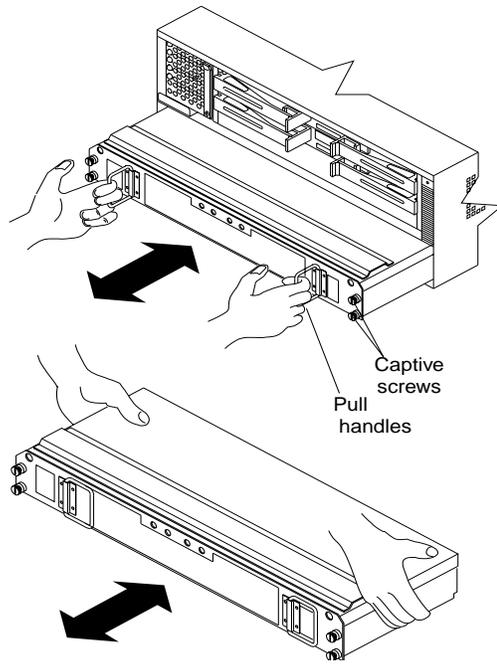
- b. Unlock and open the controller levers; then, using the levers, pull the controller out a couple of inches. Grasp both sides of the controller and remove it.



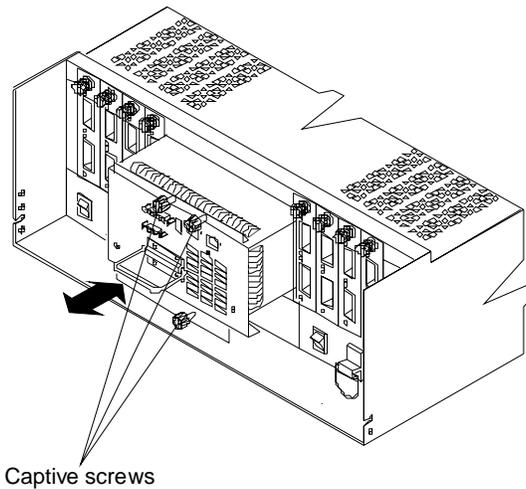
**Important**

To prevent data loss, replace controller A in the upper slot and controller B in the lower slot.

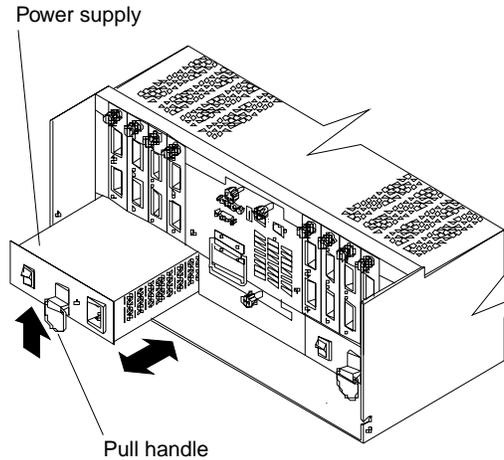
- c. Loosen the screws and pull the battery out a few inches. Grasp both sides of the battery and remove it.



Using the pull tab handle, lift up and pull to release each power supply; then, slide out the power supply.



- d. Loosen the captive screws; then, grasp the screw and pull the mini-hub from the chassis.




---

## Installation procedures

### Installing the support rails

To install the controller unit in a rack, use the rails and mounting hardware supplied with your controller unit.

Where you place the support rails in or on the cabinet depends on where you intend to position the controller unit.

Use the rack mounting installation assembly package that comes with the controller unit to locate the rack mounting holes and install the unit into a rack. If you misplace the template installation assembly package, you can use the following steps to install the controller unit.



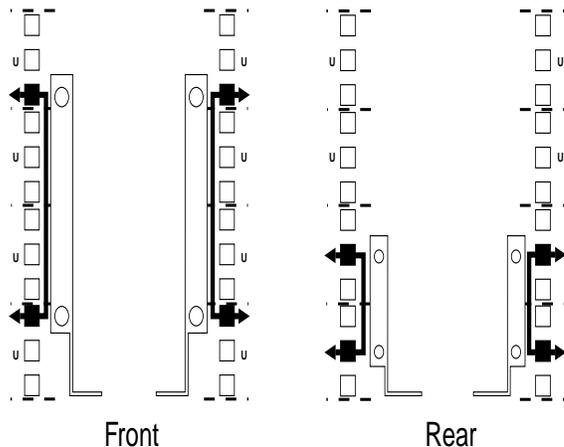
#### CAUTION:

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.

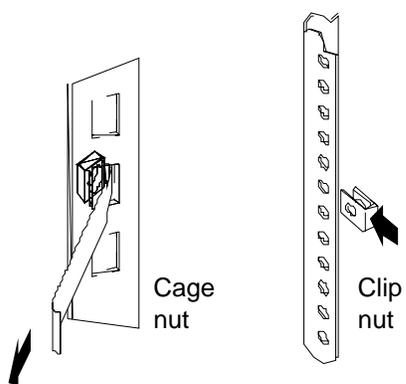


1. Stop all I/O activity to the devices in the rack in which you are installing the controller unit. If your rack has ac distribution boxes, turn off the power switches.

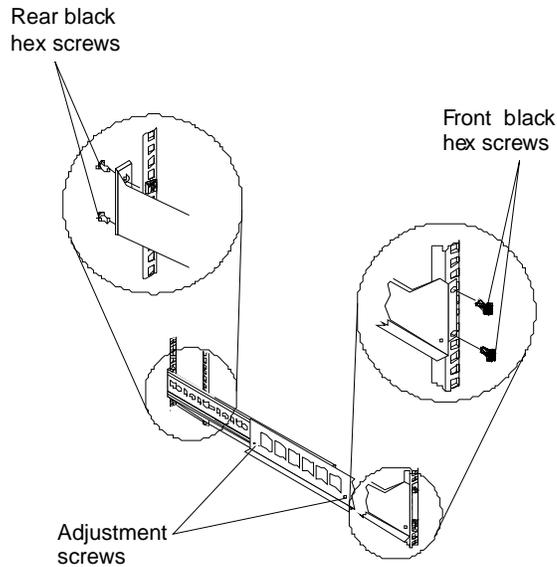
- Use the following figure of front and rear rack-mounting flanges to determine the appropriate rack-mounting holes for installing cage nuts or clip nuts to secure the controller unit rails.



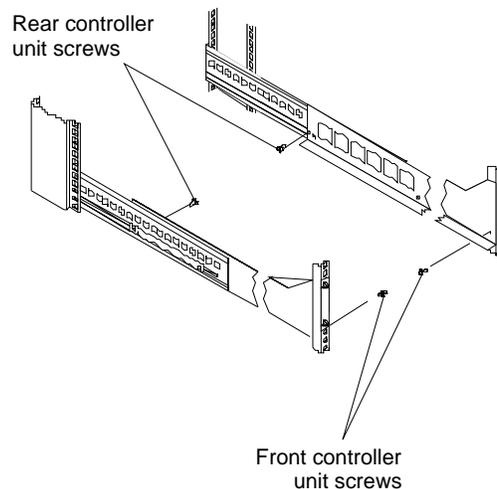
**Note:** Use clip nuts if your rack has round holes. If your rack has square holes, you can use the cage nut insertion tool or a flat-blade screwdriver to install cage nuts.



- On the rail marked R, loosen the two adjustment screws on the inside of the rail and adjust the length of the rail to the depth of your rack.



4. Hold the rail against the outside of the right mounting flange on the rack and loosely insert the two front black hex screws.
5. Extend the rail outside of the rear mounting flange on the rack; then, install and tighten the two rear black hex screws.
6. Tighten the two front black hex screws; then, tighten the adjustment screws on each rail.
7. Repeat step 3 through step 6 to install the rail marked L on the left side of the rack.
8. Using the following figure, remove the front and rear controller unit screws from the rails and save them for securing the controller unit, as described in "Installing the controller unit in the rack" on page 127.

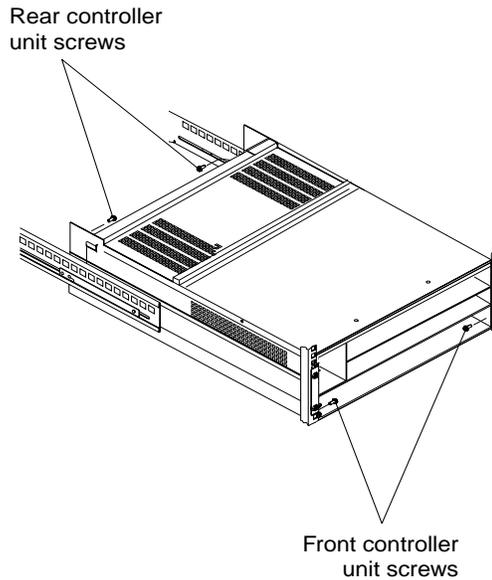


## Installing the controller unit in the rack

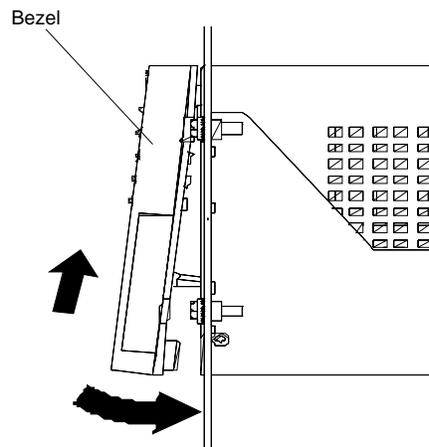
**CAUTION:**  
Use safe practices when lifting.

To install the controller unit in a rack, perform the following steps.

1. Slide the controller unit into the rack and secure the rear of the controller unit with two of the small screws.



2. Secure the front of the controller unit with the other two screws.
3. Install the battery, controllers, and controller fan in the front of the controller unit.  
**Note:** If you are installing additional cache memory in a controller, you can install it now, before you install the controller back in the controller unit. See "Installing additional cache memory in a controller" on page 128.
4. Install the power supplies and fan and communications module in the back of the controller unit.
5. Install the mini-hubs in the back of the controller unit.
6. To replace the bezel, slide the top edge under the lip on the chassis; then, push the bezel bottom until the pins snap into the mounting holes.



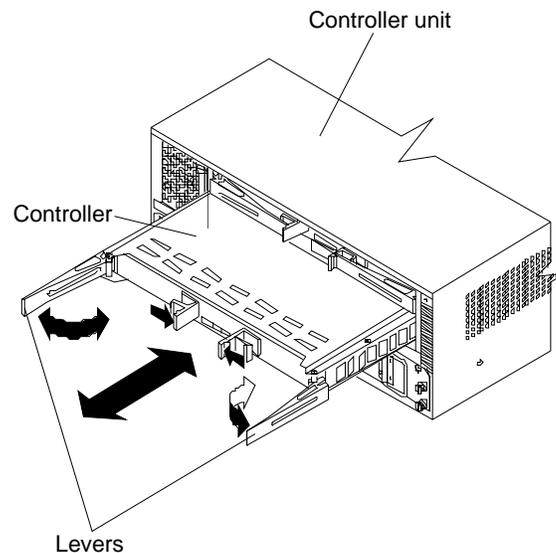
## Installing additional cache memory in a controller

The controller comes with 256 MB of cache memory installed. You can add an additional 256 MB dual inline memory module (DIMM) for a total of 512 MB cache, with the IBM FASTT500 256 MB Cache option.

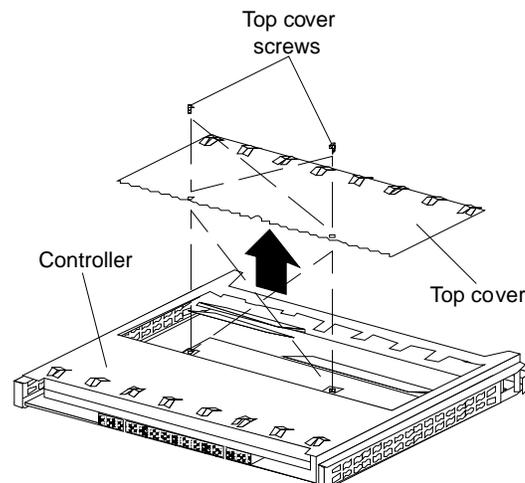
Use the following procedure to upgrade your controller cache memory. If you are installing the controller unit in a rack and have already removed the RAID controller, skip step 1.

**Attention:** When you handle electrostatic discharge (ESD) sensitive devices, take precautions to avoid damage from static electricity. For details about handling ESD-sensitive devices, refer to the following Web site and use a search term of ESD: <http://www.ibm.com/>

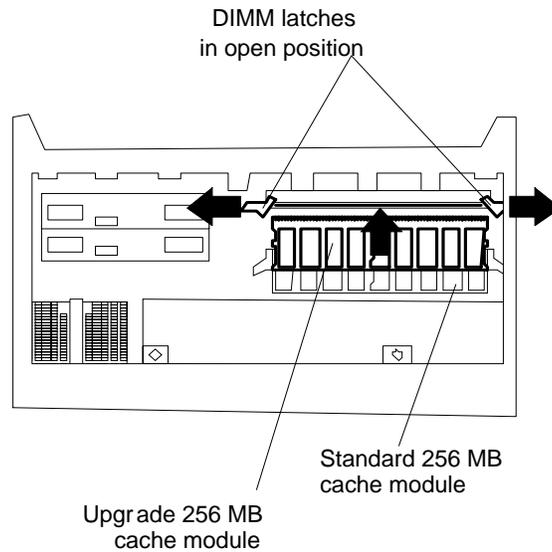
1. Unlock and open the levers on the controller; then, use the levers to pull the controller out of the controller unit a few inches. Grasp both sides of the controller to completely remove it from the controller unit.



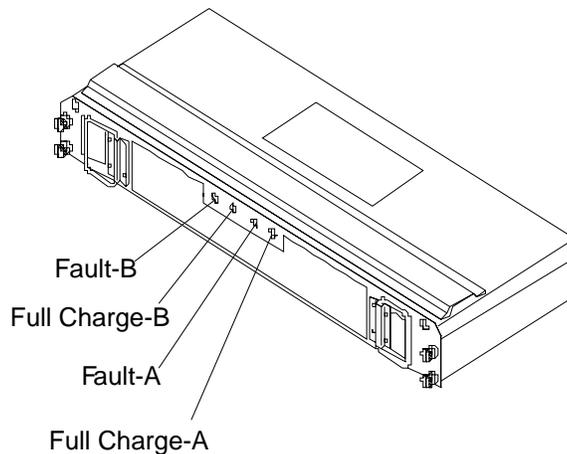
2. Remove both screws from the top cover of the controller; then, lift the cover and set it aside to install after you upgrade your cache.



3. Locate the empty DIMM socket in front of the populated one that contains the standard 256 MB cache memory module. Make sure that both DIMM latches are open to their outermost position before inserting the new memory module.



4. Carefully insert the DIMM into the empty socket, making sure that the left and right edges of the module slide inside the grooves in the DIMM latches. As you push the DIMM into place, the DIMM latches slowly close around the new module.
5. After the DIMM is fully seated in the socket, press firmly inward on the left and right DIMM latches until they lock and secure the DIMM into place.



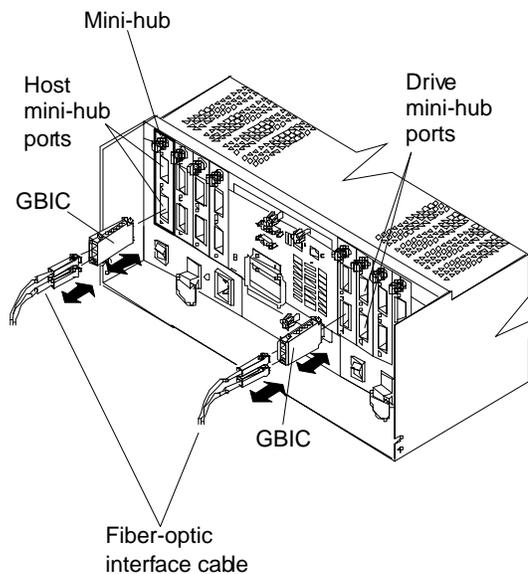
6. Install the top cover.
7. Install the controller back in the controller unit.

## Connecting the controller unit to the loop

The following is a brief description of the components that connect the controller unit to the Fibre Channel Arbitrated Loop (FC-AL) and instructions for installing the interface cables.

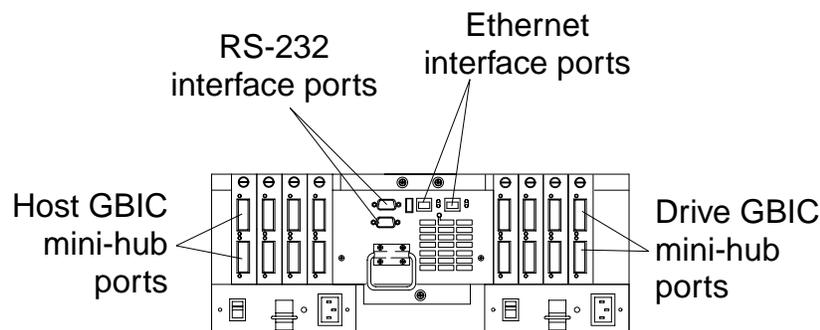
### Mini-hub interface connections

The interfaces that connect the controller and drive enclosures to the storage subsystem are called mini-hubs. When fully configured, the back of the controller unit can accommodate four host mini-hubs and four drive mini-hubs. Each mini-hub is a removable unit. A mini-hub provides the Fibre Channel interface between a controller and hosts and drives. Each mini-hub has two ports. One Gigabit Interface Converter (GBIC) connects into each mini-hub port; then, a host or drive fiber-optic cable connects into the GBIC. The following figure shows the mini-hub interface connections.



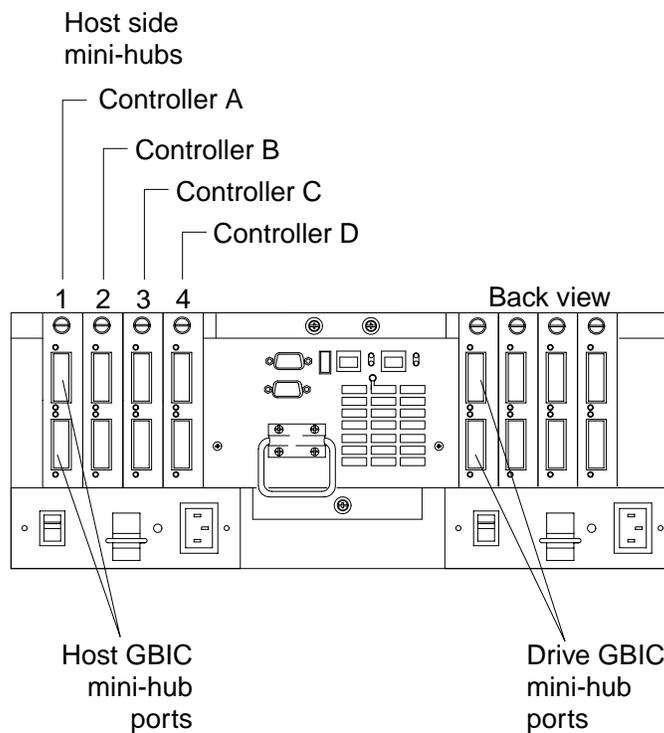
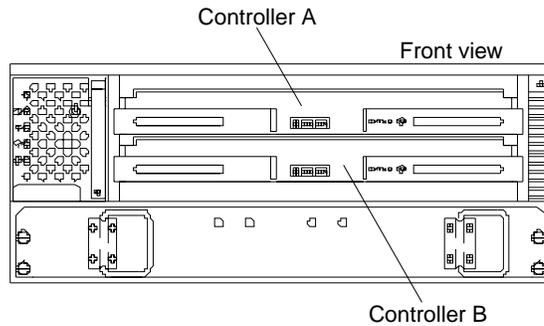
### Controller unit interface ports

The host and drive GBIC mini-hub ports are used to attach cables from the controller and drive enclosures to the storage subsystem. There are also Ethernet ports for storage subsystem-management and RS-232 (serial) ports for diagnostic services. The controller unit interface ports are shown in the following figure.



## Host interface ports

Host mini-hubs connect to the controller in pairs. Mini-hubs 1 and 3 connect to the top controller (Controller A) and mini-hubs 2 and 4 connect to the bottom controller (Controller B). To ensure redundancy, you must connect each host to both controllers through the appropriate mini-hub.



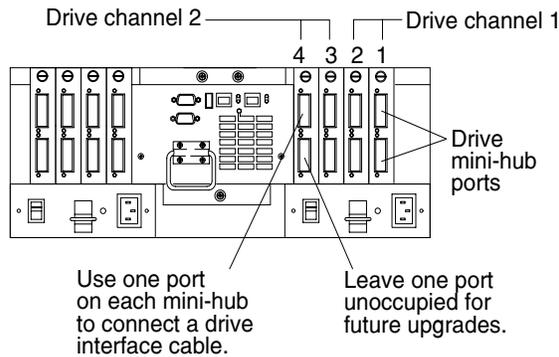
## Drive mini-hubs

Each drive mini-hub connects to Controller A and Controller B and each drive mini-hub represents a single drive channel. The drive channels are set up in pairs to support redundant drive loop configurations (two datapaths per drive enclosure). Each pair supports up to 11 drive enclosures, containing 10 drives each, or a maximum of 110 drives. A fully configured controller unit supports a maximum of 22 drive enclosures (11 drive enclosures per channel pair), or 220 drives.

### Important

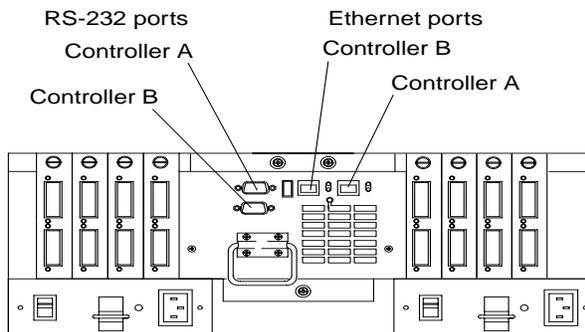
These large configurations are for capacity purposes and might not provide the best performance.

The drive channel cables connect to GBICs, which connect to either the upper or lower port on each mini-hub. Leave the remaining port on each mini-hub unoccupied for future upgrades.



### Ethernet and RS-232 ports

There is one Ethernet port and one RS-232 (serial) port on each controller (Controller A and Controller B). Use the Ethernet ports if you want to directly manage storage subsystems and use the RS-232 ports for diagnostic services. The following figure shows the location of these ports.



### Installing GBICs and fiber-optic cables

A Gigabit Interface Converter (GBIC) is used to connect each mini-hub port to hosts and drives.

#### Installation tips:

- The GBIC module housing has an integral guide key designed to prevent you from inserting the GBIC improperly.
- Use minimal pressure when inserting the GBIC into a port. Forcing the GBIC into a port could cause damage to the GBIC or the port.
- GBICs are hot-pluggable. You can insert or remove the GBIC while the port is powered on.
- The operational loop performance is not affected when you install or remove a GBIC.
- You must connect the fiber-optic interface cable to the GBIC module after you insert the GBIC into the port.

**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.

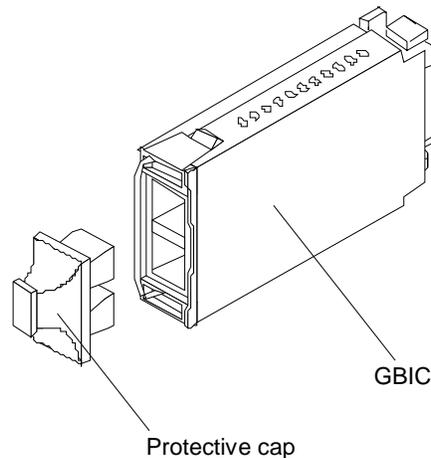
**DANGER**

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:

1. Remove the protective cap from the GBIC, as shown in the following figure.



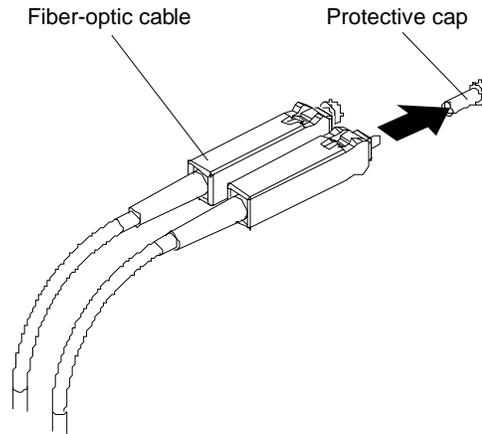
2. If the GBIC you are installing has a metal latch, move the latch to the unlocked (center) position. Slide the GBIC into the port; then, rotate the latch outward to the locked position (flush with the rear of the GBIC).

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

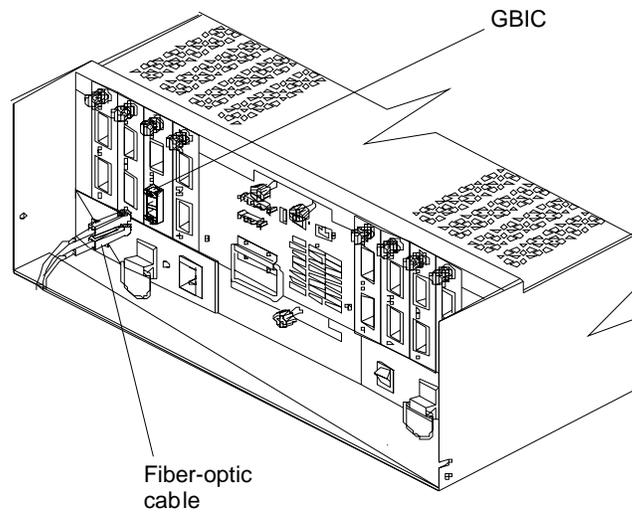
- Do not route the cable along a folding cable-management arm.
- When attaching to a device on slides, leave enough slack in the cable so that it does not bend to a radius smaller than 76 mm (3 inches) when extended or become pinched when retracted.
- Route the cable away from places where it can be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

To connect the fiber-optic cables, do the following.

1. Remove the two protective caps from one end of the fiber-optic cable.



2. Connect the fiber-optic cable to a GBIC that is installed in a mini-hub.



After you install the cables, the Fibre Channel-Arbitrated Loop is operational.

To remove the fiber-optic cables and GBIC, do the following:

1. Remove the fiber-optic cables from the GBIC; then, replace the protective caps.

**Note:** If you are using IBM GBICs, you must remove the fiber-optic cables from the GBIC before you can remove the GBIC from the mini-hub port.

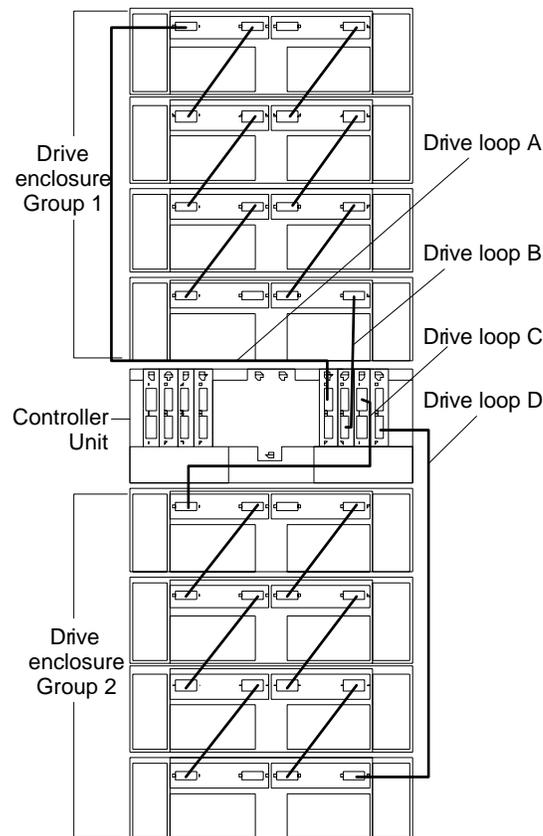
2. Move the metal latch on the GBIC to the unlocked (center) position.
3. Pull the GBIC out of the port.
4. Insert the protective cap on the GBIC.

## Controller unit and drive enclosure cabling overview

The controller unit supports redundant drive loops. A redundant drive loop consists of one or more drive enclosures connected to a controller using two sets of data cables. If one data path fails, the controller uses the other data path to maintain I/O to the drive group.

The following figure shows a storage subsystem containing one controller and two drive groups with four drive enclosures each. Each drive group uses redundant drive loops to connect to the controller unit. Loop A and Loop B make up one redundant pair of drive loops. Loop C and Loop D make up a second redundant pair.

**Attention:** To prevent loss of drive enclosure redundancy, cable the drive enclosures as shown in the following figure.



## Configuring the drive loops

The procedure and figures in this section show an example of cabling a group of drive enclosures into a redundant drive loop. For an example of a drive loop that has only one drive enclosure, skip this procedure and go to “Connecting drive cables to the controller unit” on page 137.

**Attention:** To complete this procedure, you will need two Fibre Channel interface cables. Handle and install fiber-optic cables properly to avoid degraded performance or loss of communications with devices. When working with fiber-optic cables, do not

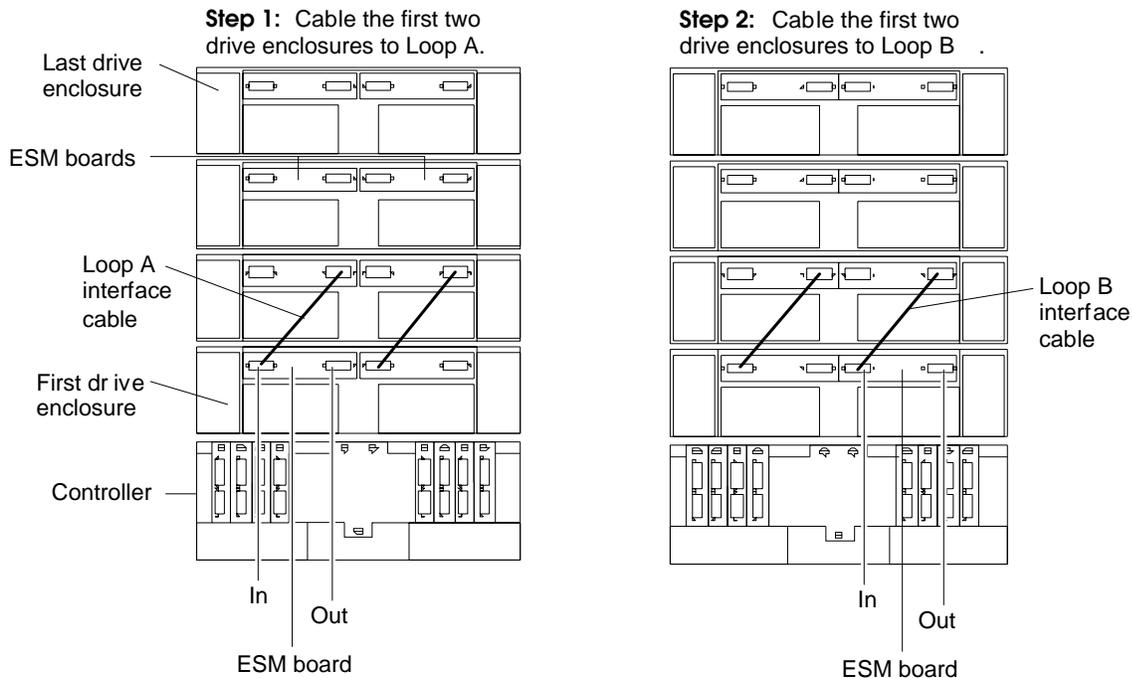
pinch them, step on them, or locate them in aisles or walkways. Do not overtighten the cable straps or bend the cables to a radius smaller than 76 mm (3 in.).

1. Connect the first two drive enclosures to drive Loop A.

Starting with the first drive enclosure, connect an interface cable from the In port on the left environmental services monitor (ESM) board to the Out port on the left ESM board in the second (next) drive enclosure.

2. Connect the same first two drive enclosures to drive Loop B.

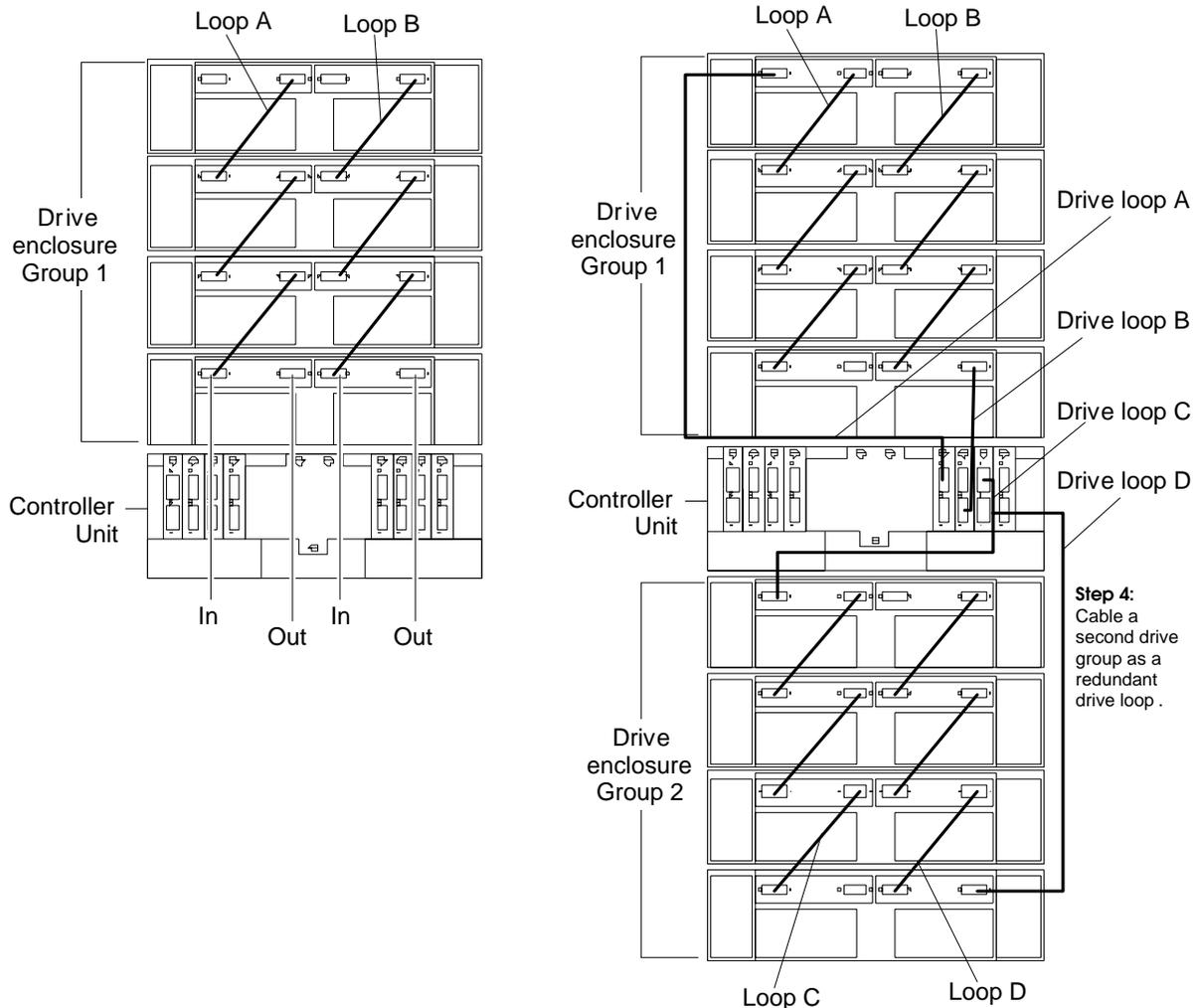
Starting with the first drive enclosure, connect an interface cable from the In port on the right ESM board to the Out port on the right ESM board in the second (next) drive enclosure. If you want to cable more drive enclosures into Loops A and B, continue with the next step; otherwise, go to “Connecting drive cables to the controller unit” on page 137.



3. Connect additional drive enclosures to drive Loops A and B.

Starting with the second drive enclosure, cable each additional drive enclosure into Loops A and B in the same manner. Leave unoccupied the In ports on the last drive enclosure in the loop and the Out ports on the first drive enclosure. If you want to cable a second drive group, repeat this step for the second drive otherwise, go to “Connecting drive cables to the controller unit” on page 137.

4. Repeat step 1 through step 3 to cable a second drive group (Loop C and Loop D on Drive Group 2) in the same manner, as shown in the following figure. When you finish, go to “Connecting drive cables to the controller unit” on page 137.



## Connecting drive cables to the controller unit

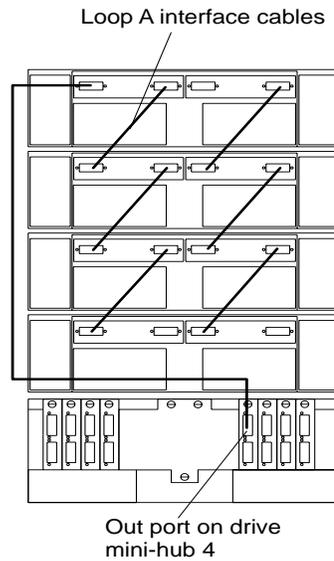
Use the following procedure to connect a redundant drive loop to the controller unit. You will need two Fibre Channel interface cables for each redundant pair of loops (for example, Loop A and Loop B) that you are connecting to the controller unit.

1. Connect drive Loop A to the controller unit.

Starting with the last drive enclosure in Loop A, cable the In port on the left ESM board to the Out (upper) port on drive mini-hub 4 on the controller unit.

Leave the In port on the right ESM board on the last drive enclosure and the In (lower) connector on drive mini-hub 4 unoccupied.

**Step 1:** Connect drive Loop A to the controller unit.



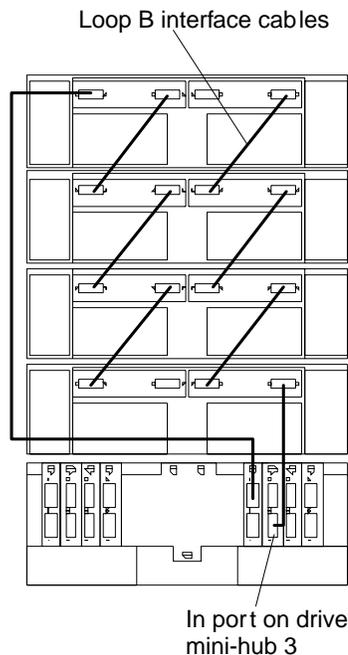
2. Connect drive Loop B to the controller unit.

Starting with the first drive enclosure in the loop, cable the Out port on the right ESM board to the In (lower) port on drive mini-hub 3.

Leave the Out port on the left ESM board and the Out (upper) port on drive mini-hub 3 unoccupied.

To connect a second redundant drive enclosure group to the controller unit, continue with the next step; otherwise, go to "Connecting hosts directly to the controller unit" on page 140.

**Step 2:** Connect drive Loop B to the controller unit.



3. Connect drive Loop C to the controller unit.

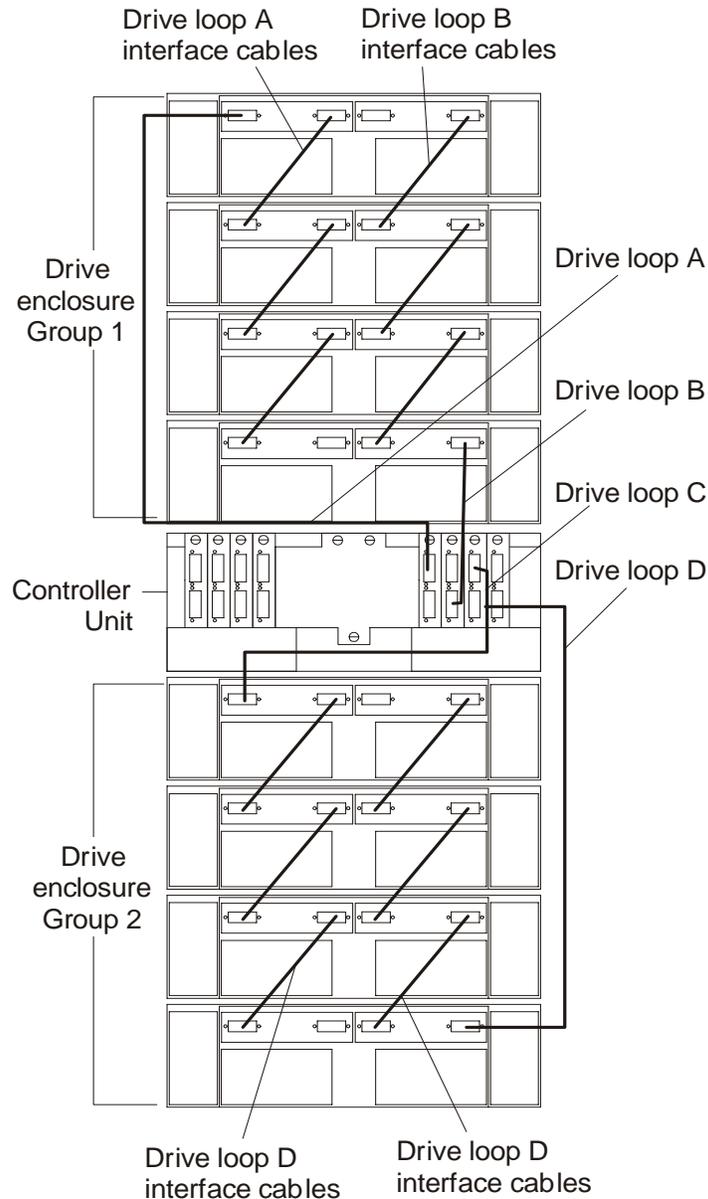
Starting with the first drive enclosure, cable the In port on the left ESM board to the Out (upper) port on drive mini-hub 2.

Leave the In port on the right ESM board and the In (lower) port on the drive mini-hub 2 unoccupied.

4. Connect drive Loop D to the controller unit.

Starting with the last drive enclosure, cable the Out port on the right ESM board to the In (lower) port on mini-hub 1.

Leave the Out port on the left ESM board on the last drive enclosure and the Out (upper) port on drive mini-hub 1 unoccupied.



5. Go to “Connecting hosts directly to the controller unit” on page 140.

## Connecting hosts directly to the controller unit

Use this procedure to connect up to four hosts, with two host adapters each, directly to the controller unit. If you are connecting five or more hosts to the controller unit, go to “Connecting hosts using external devices” on page 141.

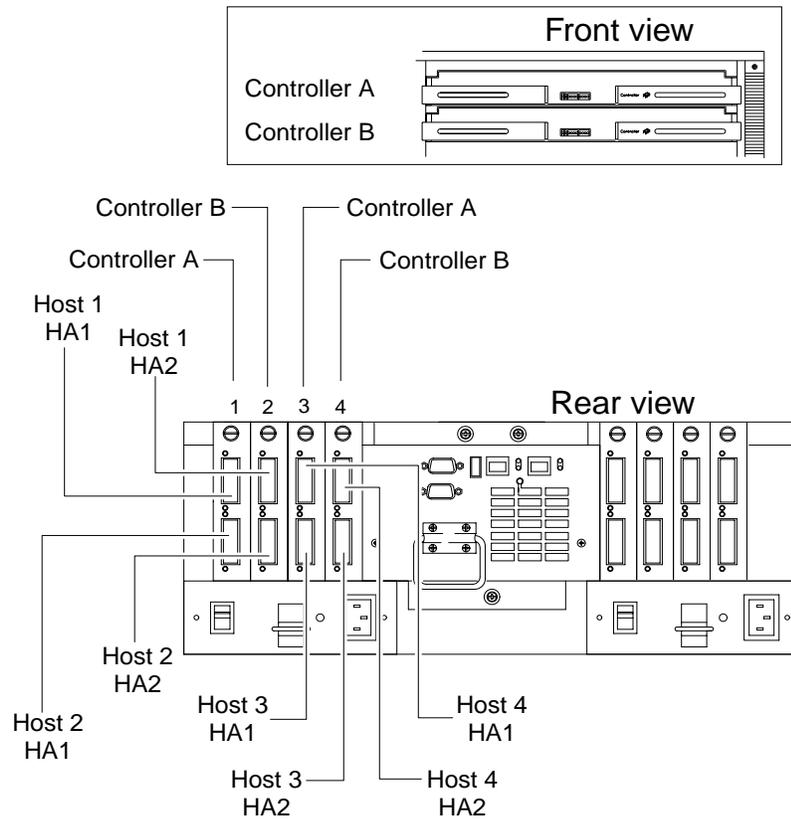
Before proceeding, make sure that you connect Fibre Channel interface cables to all host adapters that you are connecting to the controller unit.

### Important

Host mini-hub 1 and mini-hub 3 correspond to Controller A (top) and mini-hub 2 and mini-hub 4 correspond to Controller B (bottom). To ensure redundancy, connect each host to both controllers. You can use either the upper or lower ports on either mini-hub. The example in the following procedure uses the upper ports for Hosts 1 and 4 and the lower ports for Hosts 2 and 3.

1. Connect the first host (Host 1) to the controller unit.  
Connect Host Adapter 1 (HA1) from Host 1 to a port on host mini-hub.
  - a. Connect HA2 from Host 1 to mini-hub.
  - b. To connect a second host, continue with step 2; otherwise, go to “Connecting secondary interface cables” on page 142.
2. Connect a second host (Host 2) to the controller unit.  
Attach HA1 from Host 2 to the unoccupied port on mini-hub.
  - a. Attach HA2 from Host 2 to the unoccupied port on mini-hub.
  - b. To connect a third host, continue with step 3; otherwise, go to “Connecting secondary interface cables” on page 142.
3. Connect a third host (Host 3) to the controller unit.
  - a. Attach HA1 from Host 3 to mini-hub 3.
  - b. Attach HA2 from Host 3 to mini-hub 4.

To connect a fourth host, continue with step 4; otherwise, go to “Connecting secondary interface cables” on page 142.
4. Connect a fourth host (Host 4) to the controller unit.  
Attach HA1 and HA2 from Host 4 to the two unoccupied ports on mini-hub 3 and mini-hub 4.
5. Go to “Connecting secondary interface cables” on page 142.



## Connecting hosts using external devices

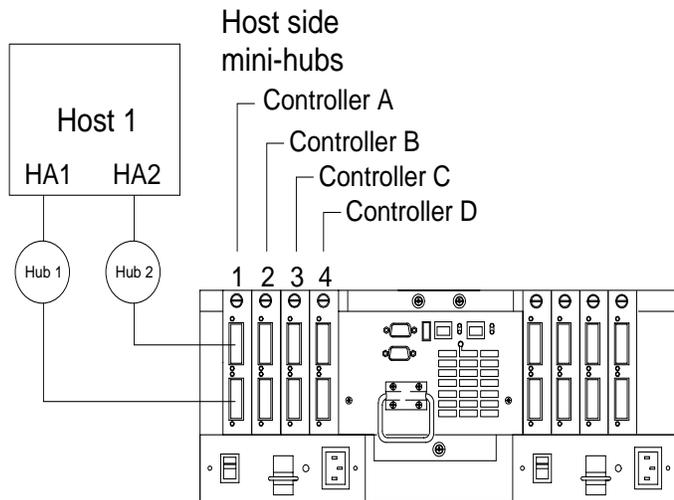
Use this procedure to connect five or more hosts to the controller unit. Using external managed hubs, the controller unit supports up to 32 hosts (64 host adapters) per controller or up to 64 hosts (128 host adapters) for redundant controllers. Before starting, make sure to connect each host to its respective mini-hub.

### Important

Host mini-hub 1 and host mini-hub 3 correspond to Controller A (top). Mini-hub 2 and mini-hub 4 correspond to Controller B (bottom). To ensure redundancy, connect each host to both controllers. You can use either the upper or lower connectors on either mini-hub.

**Note:** Throughout this book, the use of hub or external hub refers to a managed hub.

1. Connect the first host (Host 1) to the controller unit, as shown in the following figure. Connect Host Adapter 1 (HA1) from Host 1 (through Hub 1) to host mini-hub 1. Connect HA2 from Host 1 (through Hub 2) to mini-hub 2.



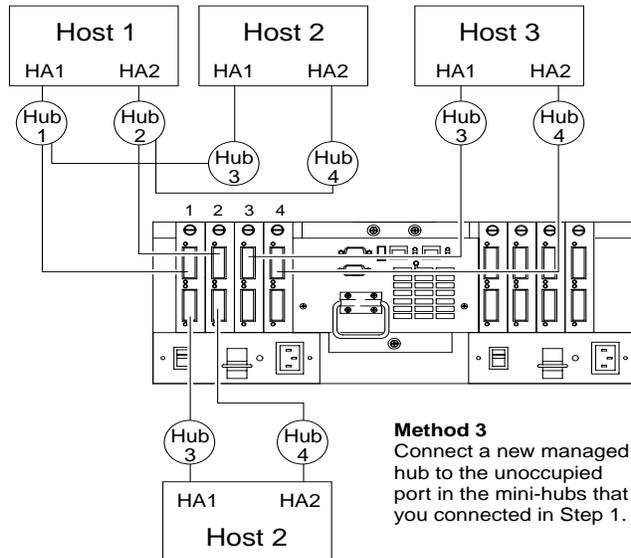
2. Connect additional hosts to the controller unit, using the method shown in the following figure.

**Method 1**

Connect a new managed hub to an available port on each hub that you connected in Step 1.

**Method 2**

Connect a new managed hub to either port on each remaining host mini-hub.



**Method 3**

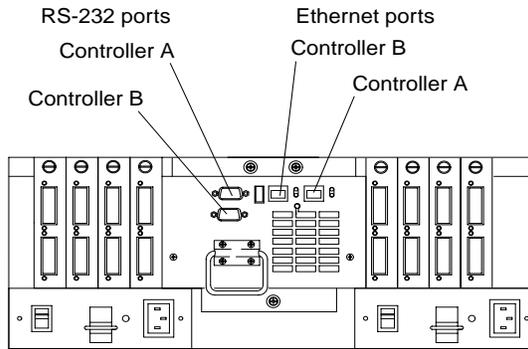
Connect a new managed hub to the unoccupied port in the mini-hubs that you connected in Step 1.

3. Go to "Connecting secondary interface cables".

## Connecting secondary interface cables

Use this procedure to connect Ethernet or RS-232 (serial) interface cables to the controller unit.

1. To directly manage a storage subsystem, connect a pair of Ethernet cables from the management station to the Ethernet ports for Controller A or Controller B on the back of the controller unit.



2. To perform diagnostic procedures, connect an RS-232 interface cable to an RS-232 port (see the preceding figure for the location of these ports).

## Starting the controller unit

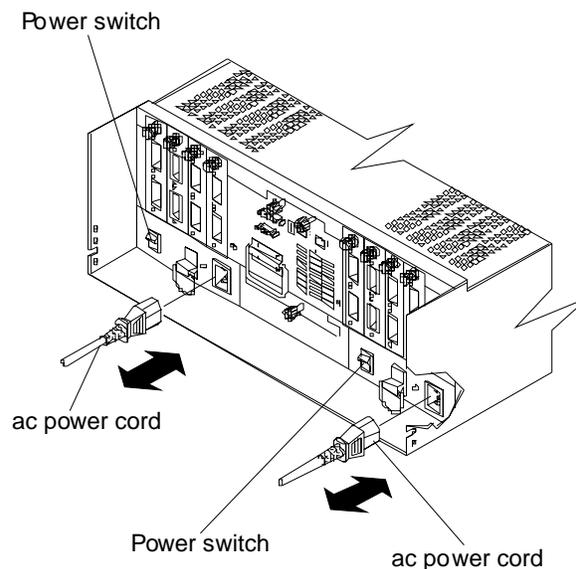
After you install the controller unit in a rack and connect it to the Fibre Channel Arbitrated Loop, you are ready to complete the installation. This section describes how to connect the power cords, turn on and off the power, check the indicator lights, and complete the installation.

### Turning on the power

Use this procedure to connect the power cords to the controller unit and to the ac power source. If you are restoring power to the controller unit after an emergency shutdown or power outage, go to “Overtemperature condition and power supply shutdown” on page 152.

1. Make sure both power switches on the controller unit are off.
2. Plug both controller unit power cords into the controller unit.
3. Plug both controller unit power cords into the ac outlets.

To maintain power redundancy, plug each power cord into an independent power source, such as the ac distribution box inside a cabinet or an external receptacle.



### Important

You must turn on the drive enclosures before or at the same time as turning on the controller unit. The controllers might not recognize the correct configuration if the drives are powered up after the controller unit. If you plan to use the main breaker to turn on all enclosures at the same time, make sure that the switches on each drive enclosure and each controller unit are on before turning on the main breaker. For instructions on powering up the drive enclosures, refer to the drive enclosure documentation.

**Note:** Always wait at least 30 seconds between the time you turn off a power switch and the time you turn on the power again.

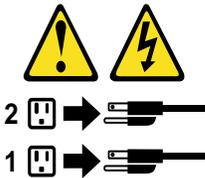
4. Turn on both power switches on the back of the controller unit. You must turn on both switches to take advantage of the redundant power supplies.

## Turning off the power



### 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.



**Attention:** The controller unit is designed to run continuously, 24 hours a day. Except in an emergency, never turn off the power if any controller unit fault indicator lights are lit. Use the proper troubleshooting or servicing procedure to correct the fault before turning off the power. This ensures that the controller unit powers up correctly later.

Use the following procedure to turn off power to the controller unit.

1. Prepare the controller unit for shutdown, as follows:
  - a. Stop all I/O activity to the controller unit and attached drive enclosures. Logically disconnect the controller and drive enclosures from the hosts. Make sure that the fast write cache indicator light on each controller unit front panel and all applicable drive active indicator lights on each drive enclosure front panel are off (not blinking).

**Note:** If a parity check is in progress, it might take a long time for the drive indicator lights to stop blinking.
  - b. Make sure that all amber fault indicator lights on the controller unit are off. If any fault indicator lights are on, correct the problem before turning off the power.

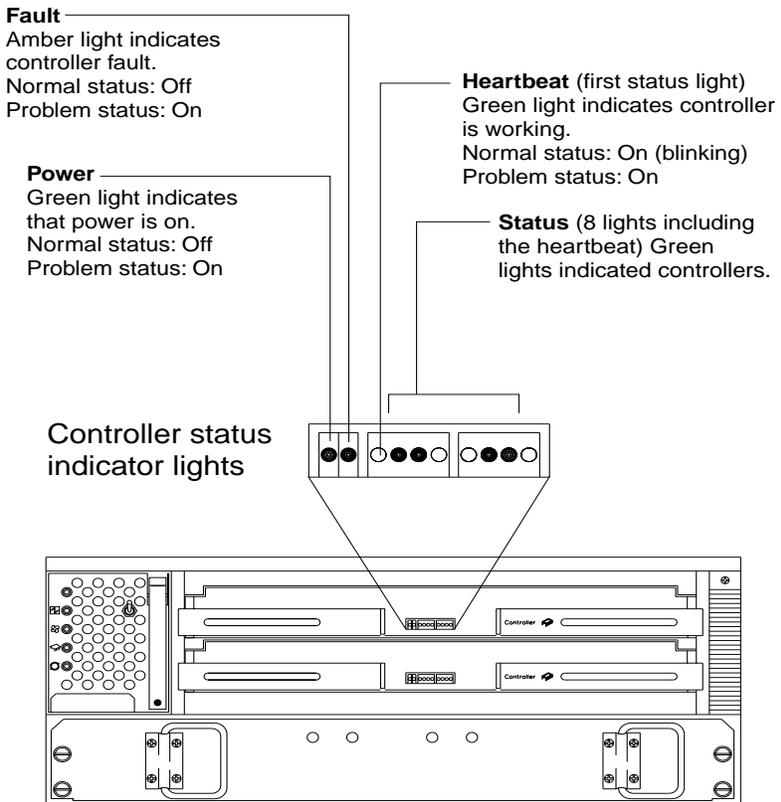
2. Turn off the power switches on the back of the controller unit.
3. Turn off any drive enclosures attached to the controller unit.

## Turning on the controller unit alarm

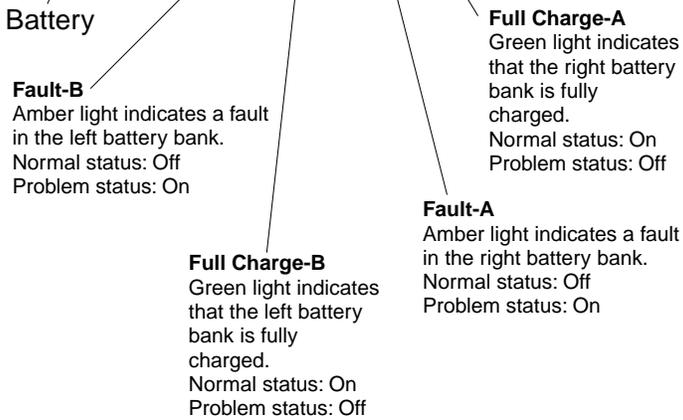
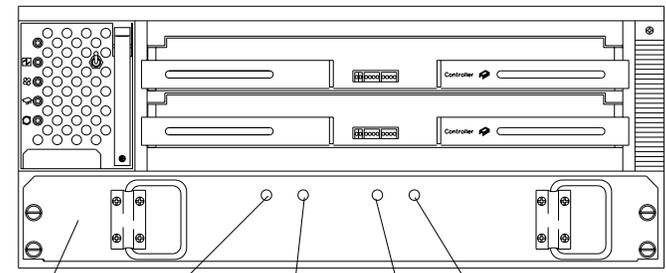
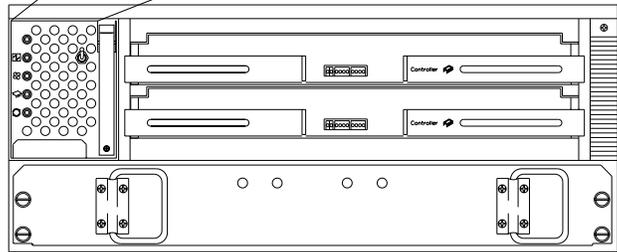
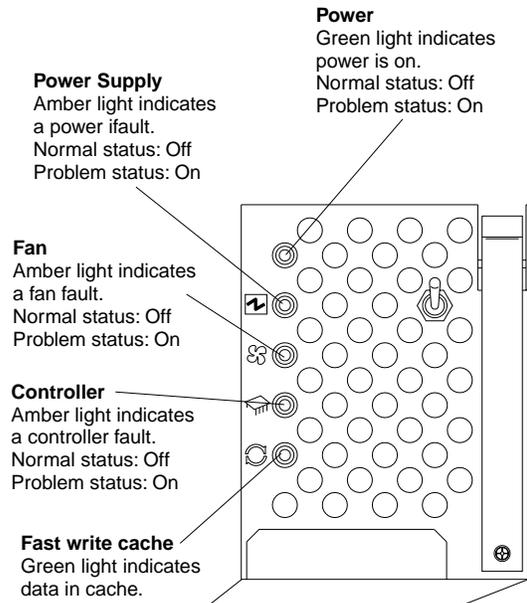
You can arm the alarm that is located on the controller fan by setting the switch in the up position, as shown in the following figure. When the switch is armed, the alarm sounds when a hardware problem occurs.

## Controller unit indicator lights

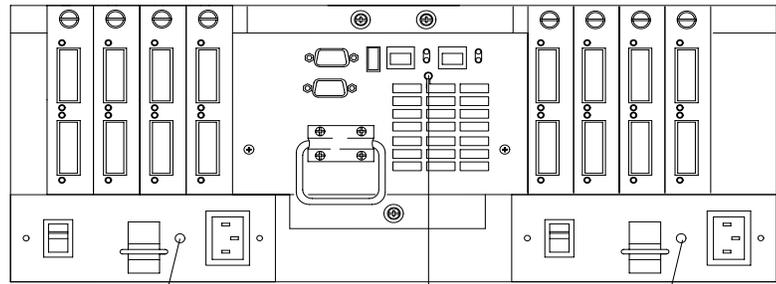
The indicator lights are located on the front the controller unit.



**Note:** Status lights might blink when I/O activity is in progress. If the Heartbeat light blinks continuously, then the other status lights will glow in various patterns to show the status or an error condition. The pattern shown depends on whether the controller is active or passive (offline). For more information, refer to *IBM FASt500 RAID Controller User's Reference* and *IBM FASt Storage Manager for Windows NT Installation and Support Guide*.



The indicator lights on the back of the controller unit are shown in the following two figures.



**Power**

Green light indicates that the power supply is operating properly.  
Normal status: On  
Problem status: Off

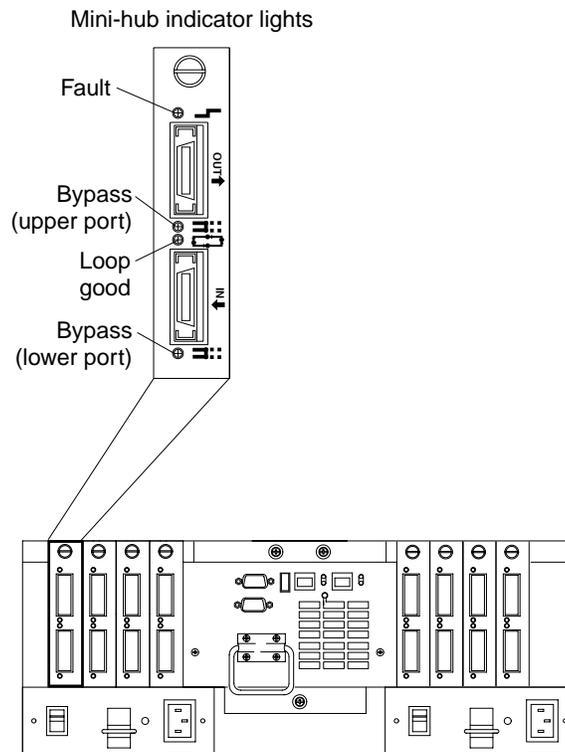
**Fault**

Amber light indicates a fault in the fan and communications module.  
Normal status: Off  
Problem status: On

**Power**

Green light indicates that the power supply is operating properly.  
Normal status: On  
Problem status: Off

The mini-hub indicator lights on the back of the controller unit are shown in the following figure.



The following table describes the mini-hub indicator lights.

Table 20. Mini-hub indicator lights

Icon	Indicator light	Color	Normal Operation	Problem Indicator	Condition Indicated
	Fault	Amber	Off	On	There is a fault in the mini-hub.

Table 20. Mini-hub indicator lights

Icon	Indicator light	Color	Normal Operation	Problem Indicator	Condition Indicated
	Bypass (upper port)	Amber	Off	On	The upper mini-hub port is bypassed. <b>Note:</b> If the port is unoccupied, the light is on.
	Loop good	Green	On	Off	The drive loop is operational.
	Bypass (lower port)	Amber	Off	On	The lower mini-hub port is bypassed. <b>Note:</b> If the port is unoccupied, the light is on.

## Completing the installation

Use the following procedure to check the controller unit for problems.

1. Check the indicator lights on the front of the controller for faults.
2. When all status indicators show "normal status," replace the controller unit front cover.

For operating instructions, refer to the *IBM FASTT500 RAID Controller User's Reference*.

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## Locations and replacement procedures

### Controller unit

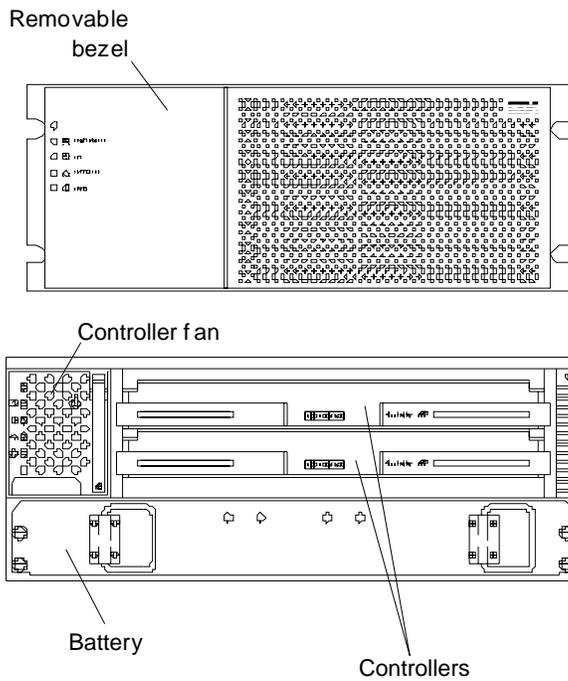
The controller unit supports direct attachment of up to four hosts containing two host adapters each, and is designed to provide maximum host- and drive-side redundancy. Using an external hub, the controller unit can support up to 64 host adapters per controller (up to 128 host adapters per controller unit).

Each controller unit contains several removable components, called customer replaceable units (CRUs), that you can access from either the front or back of the unit. These CRUs include the battery, RAID controllers, controller fan, power supplies, fan and communications module, mini-hubs, and Gigabit Interface Converters (GBICs). The controller unit also has a removable front bezel.

#### Front view

The following figure shows the controller unit front view and the following components:

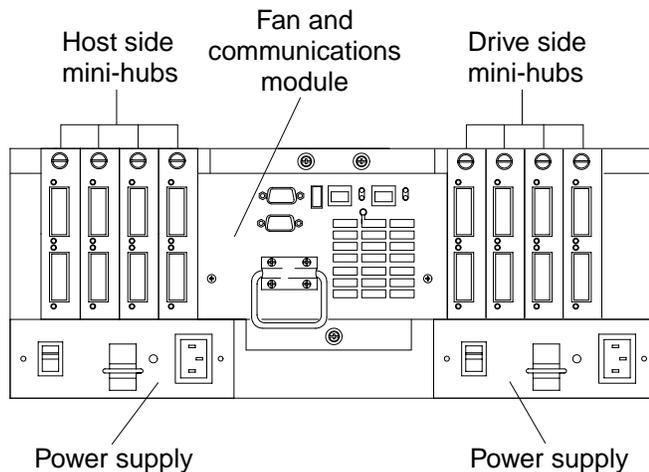
- Bezel - Removable front cover with holes for viewing the status lights and for boosting air circulation.
- Controller fan - One removable unit that contains two cooling fans and status indicator lights.
- Battery - One removable unit that contains a battery and battery charger circuitry.
- Controllers - Two removable units, each contains one RAID controller.



### Back view

The following figure shows the controller unit back view and the following components:

- Host side and drive side mini-hubs - Up to eight removable mini-hubs to which you can connect GBICs and fiber-optic host and drive interface cables for the controller unit.
- Power supplies - Two removable units that contain the power supplies.
- Fan and communications module - One removable unit that contains the power supply cooling fans, Ethernet ports, and RS-232 (serial) ports.

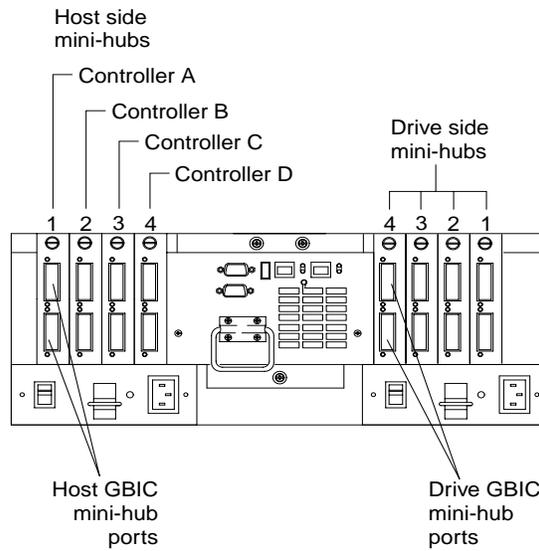


## Interface ports

The controller unit has the following types of interface ports:

- Host
- Drive
- Ethernet
- RS-232 (serial)

The following figure shows the host and drive mini-hub ports.



For more information about connecting the controller unit and drive enclosures (also referred to as expansion units) using the host and drive interface ports, refer to the IBM FAStT500 RAID Controller Installation Guide.

### Host mini-hubs

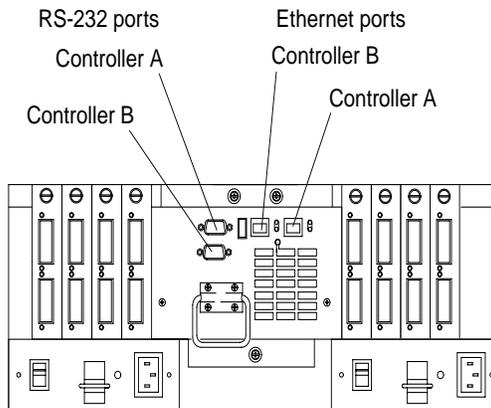
There are up to four host side mini-hubs, two per controller. Mini-hubs 1 and 3 correspond to the top controller (Controller A) and mini-hubs 2 and 4 correspond to the bottom controller (Controller B). Each pair of mini-hubs accommodates one host channel. Each mini-hub provides host loop connectivity and self-diagnostic features. To ensure redundancy, you must connect each host to a Controller A and Controller B mini-hub.

### Drive mini-hubs

The controller unit has four drive channels. Each channel accommodates one drive side mini-hub. All mini-hubs on the drive side attach to both Controller A and Controller B.

### Ethernet and RS-232 interface ports

Each controller has an Ethernet interface port and an RS-232 (serial) interface port. Use the Ethernet ports if you want to directly manage the controllers. Use the RS-232 ports for diagnostic service. The following figure shows the location of these interface ports.

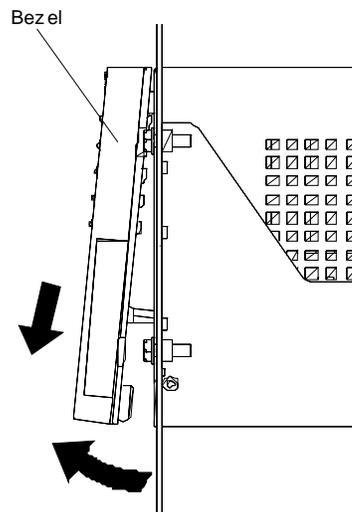


## Accessing the controls

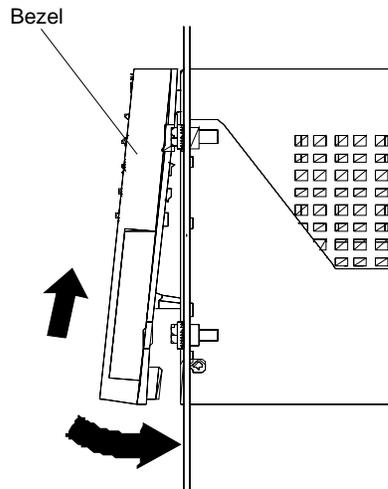
To access the controllers, battery, controller fan, and indicator lights, you must remove the controller unit bezel.

**Attention:** Pulling the cover out too far can damage the plastic hooks at the top. To avoid damaging the hooks, place the controller unit on a flat surface. Be sure the front of the controller unit extends beyond the edge approximately 5 cm (2 in.).

1. Carefully pull the bottom of the bezel out to release the pins; then, slide the bezel down, as shown in the following figure.



2. To replace the bezel, slip the top edge of the bezel under the lip on the chassis; then, push the bottom of the bezel until the pins snap into the mounting holes, as shown in the following figure.



## Monitoring status through software

To monitor controller unit status, always run the storage-management software and check it frequently. Be sure to enable the management alerts that you need. The storage-management software provides the best way to diagnose and repair controller unit failures. This software can help you:

- Determine the nature of the failure
- Locate the failed component
- Provide recovery procedures to repair the failure

Although the controller unit has fault indicators, these lights are summary indicators and might not identify the specific component that has failed or needs replacing, or which type of recovery procedure you must perform. In some cases (such as loss of redundancy in controller unit components), the fault light does not come on. Only the storage-management software can detect the failure.

Recovering from a controller unit failure might require you to perform procedures other than replacing the component. The storage-management software gives these procedures.

**Note:** Always follow the software recovery procedures to prevent data loss.

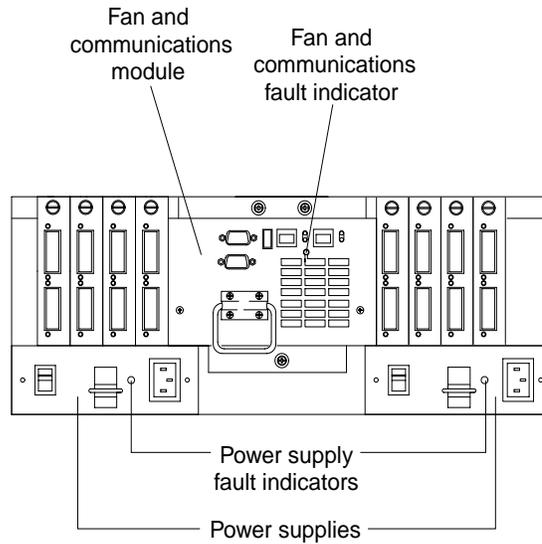
For more information about the storage-management software, refer to the following:

- *IBM FAStT Storage Manager for Windows NT Installation and Support Guide*
- *IBM Fibre Channel Storage Manager Concepts Guide*
- IBM FAStT Storage Manager online help:
  - Enterprise Management Online Help
  - Subsystem Management Online Help

## Overtemperature condition and power supply shutdown

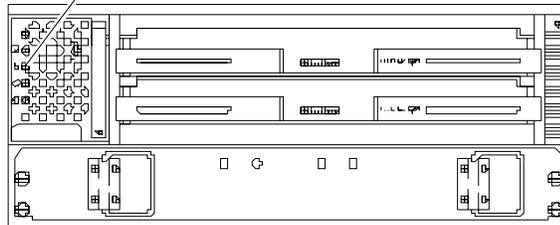
If the fan and communications module fails or is unable to maintain an internal temperature below 70° C (158° F), one or both of the power supplies in the controller

unit might shut down. If both power supplies shut down, the controller unit is not operational.



The storage-management software causes the fault indicator to light before the temperature has risen sufficiently to shut down the power supplies. The light comes on when the controller unit temperature exceeds 45° C (113° F). The controller unit shuts down if the temperature rises to 70° C (158° F). If both power supplies shut down, the fault indicator cannot come on.

Controller fan fault indicator



### Turning on the power after an overtemperature shutdown

If your controller unit shuts down unexpectedly, use the storage-management software to determine whether the controller unit is overheated. If an overtemperature shutdown is indicated, use the following procedure to regain normal system operation.

1. Turn off the power switches and cool the controller unit (for example, replace the fans, use external fans to cool the room, and so on).
2. After the air temperature is below the upper operating temperature of 45° C (113° F), turn on the power switches.
3. Check the controller unit for faults or damage. Use the storage-management software to check the overall status of the controller unit and its components. Repair any faults found.

### Turning on the power after an emergency shutdown

Use this procedure to regain normal system operation after a power failure or emergency shutdown.

1. After the emergency situation is over or power is restored to the building, check all components and cables for damage. If there is no visible damage, continue with step 2; otherwise, have your system serviced.
2. Make sure the power cords are plugged in.
3. Turn on the circuit breakers in the cabinet and turn on the power switches on all drive enclosures attached to the controller unit. If the system is off because of a power outage, the power switches are already on.

#### **Important**

You must turn on the drive enclosures before, or at the same time as, the controller unit. The controllers might not recognize the correct configuration if the attached drives are powered up after the controller unit. If you plan to use the main breaker to turn on all enclosures at the same time, make sure that the switches on each drive enclosure and each controller unit are on before turning on the main breaker. For instructions on powering up the drive enclosures, refer to the drive enclosure documentation.

4. Turn on both power switches on the back of the controller unit.
5. Check the status of the controller unit and other devices. Make sure all fault indicator lights are off on the front and back of the controller unit.  
For more information, see “Checking the indicator lights” on page 105.
6. When all the devices on the system are powered up, check the overall system status using the storage-management software.

## **Preparing to move the controller unit**

Remove each component CRU before moving the controller unit to a new location or before removing the chassis from its cabinet. This helps safeguard the equipment and ensures a smoother transition to the new environment.

If you are moving the controller unit a short distance (within the same building), and you have sufficient assistance (one or more additional helpers) or equipment (such as a fork lift), you might be able to move the controller unit without removing each component CRU. If you do not have sufficient assistance or equipment, use the procedure in “Removing and installing the components”.

If you are moving the controller unit a significant distance (for example, to another building or city), be sure to pack it in its original shipping container.

For more information about assembling or disassembling the controller unit, refer to the IBM FASTT500 RAID Controller Installation Guide.

## **Removing and installing the components**

Use the following procedure to remove all component CRUs before moving or relocating the controller unit. Replace the CRUs after you complete the procedure.

1. Prepare the controller unit for shutdown, as follows:
  - a. Stop all I/O activity to the controller unit and attached drive enclosures.
  - b. Logically disconnect the controller and drive enclosures from the hosts.
  - c. Make sure that the fast write cache indicator light on the front bezel is off (not blinking).

- d. Make sure that all applicable drive active indicator lights on each drive enclosure front panel are off (not blinking).

**Note:** If a parity check is in progress, it can take a long time for the drive indicator lights to stop blinking.

2. Remove the controller unit bezel.
3. Make sure that all amber fault indicator lights on the controller unit are off. If any fault indicator lights are on, correct the problem before turning off the power. For more information, see “Checking the indicator lights” on page 105.

**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.**

4. Turn off both power switches and unplug the power cords from the controller unit.
5. If you are shutting down the system, turn off the main circuit breakers or power switches.
6. Disconnect the interface cables and label the host Fibre Channel cables.

**Attention:** Handle and install fiber-optic cables properly to avoid degraded performance or loss of communications with devices. When working with fiber-optic cables, do not pinch them, step on them, or locate them in aisles or walkways. Do not overtighten the cable straps or bend the cables to a radius smaller than 76 mm (3 in).

7. Disconnect and label all remaining cables from the controller unit, so that you can correctly reconnect them later.

**Attention:** When you handle electrostatic discharge (ESD) sensitive devices, take precautions to avoid damage from static electricity. For details about handling ESD-sensitive devices, refer to the following Web site and use a search term of ESD: <http://www.ibm.com/>

8. Remove all CRUs from the controller unit.
9. Remove the two screws from the inside rear of the controller unit; then, remove the two screws from the inside front of the controller unit. Save the four screws for later.

**Attention:** Do not remove the black hex head screws. These secure the rails that support your controller unit.

**CAUTION:**

**Use safe practices when lifting.**

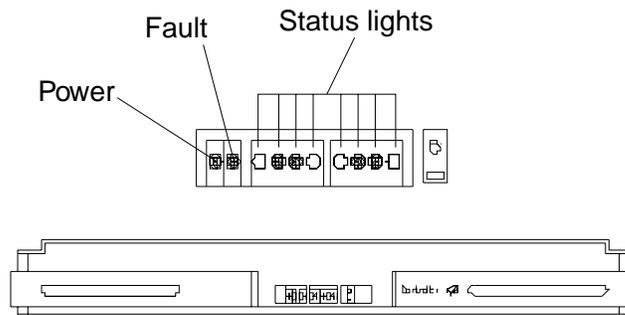
10. Slide the controller unit out of the rack and set it on a level, dry surface.
11. If you are shipping the controller unit to another location, replace all CRUs in the controller unit. Carefully pack the unit in its original shipping container. You are finished with this procedure.
12. If you are moving the controller unit to another cabinet, remove the support rails and power cords from the old cabinet and install them in the new one.
13. To replace the controller unit and components, using the proper cautions, reverse step 1 through step 10, of the controller removal procedure with the following steps.
  - a. Slide the controller unit into the rack.
  - b. Insert and tighten two of the screws that you previously removed on the inside front of the controller unit.

- c. Insert and tighten the remaining two screws on the inside rear of the controller unit.
- d. Replace all CRUs in the controller unit.
- e. Connect the interface cables and host Fibre Channel cables.
- f. Connect the remaining cables to the controller unit.
- g. Turn on the main circuit breakers or power switches.
- h. Plug in the power cords to the controller unit; then, turn on both power switches.
- i. Make sure that all amber fault indicator lights on the controller unit are off. If any fault indicator lights are on, correct the problem.
- j. Replace the controller unit bezel.
- k. Check the indicator lights.

## RAID controller

The controller unit supports redundant array of independent disks (RAID) technology. The controller unit contains two RAID controllers.

Each controller comes in a removable, portable unit, called a controller CRU. The controller CRUs slide into one of two controller slots on the front of the controller unit and attach to hosts through Fibre Channel connections. Two handles lock the controller in place. Each controller slot has a controller slot designation that identifies the physical location of the controller in the chassis: controller slot A (top) or controller slot B (bottom). Each controller CRU has ten indicator lights: one power, one fault, and eight status indicator lights, as shown in the following figure.



### Servicing notes

Consider the following when servicing the controllers in the controller unit:

- The controller unit supports two controller CRUs that attach to hosts through Fibre Channel connections.
- You can hot-swap or replace a failed controller while the controller unit is in operation as long as the failed controller is one of a redundant pair (two controllers attached to the same host) and has a passive or offline status in the storage-management software.
- If cache mirroring is enabled in redundant controllers and one controller fails, the second controller assumes processing functions without data loss. However, some or all data might be lost if cache mirroring is disabled and a failure occurs before data is written from cache memory to disk.

- If you replace the controller CRU and still experience problems, the controller unit might have defective components or connections. Check the storage-management software for indications of other component failures.
- If a controller CRU fails, the fault light on the affected controller glows. For more information about indicator lights, see “Checking the indicator lights” on page 105.
- Firmware between the two controllers is automatically synchronized when you replace a controller.

### Replacing a failed controller

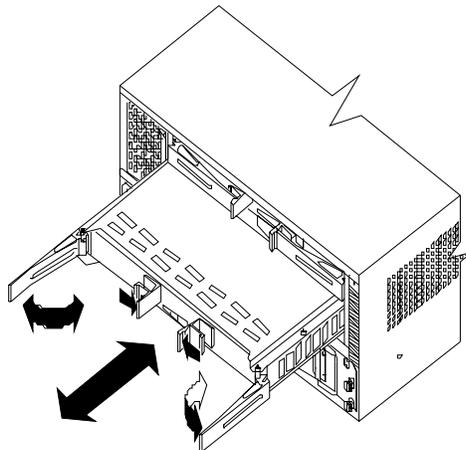
When instructed by the storage-management software, replace a controller CRU using the following procedure.

**Attention:** When you handle electrostatic discharge (ESD) sensitive devices, take precautions to avoid damage from static electricity. For details about handling ESD-sensitive devices, refer to the following Web site and use a search term of ESD: <http://www.ibm.com/>

1. Remove the controller unit bezel, as shown in the following figure.

**Attention:** Removing a controller that is operating normally (not failed) can result in data loss. Only remove a controller that:

- Has a fault indicator light that is glowing.
  - Is marked as Failed (offline) through the storage-management software.
2. Using the following figure as a guide, remove the controller that has failed.
    - a. Squeeze the two center tabs and open the handles.
    - b. Remove the controller.
    - c. Close the handles and snap into place.



**Attention:** To avoid potential data loss, make sure that the new controller has the same memory size as the one you are replacing. If you install a controller with a different memory size, the storage-management software suspends cache mirroring and issues an error message. If the memory size is not the same, you need to upgrade the cache memory. For more information, see “Installing additional cache memory in a controller” on page 128.

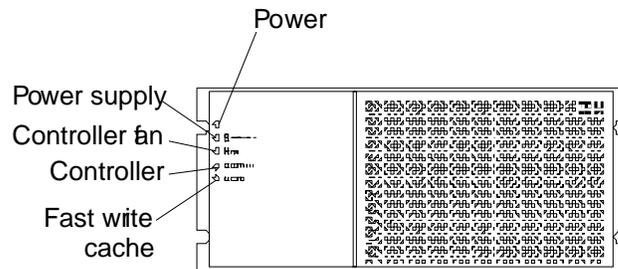
3. Unpack and check the new controller.

Using the proper handling precautions, remove the new controller from the packing material. Check the shipping invoice and the controller to make sure that it has the same memory size as the controller that you just removed.

4. Install the new controller as follows:
  - a. Squeeze the two center tabs and open the handles.
  - b. Using the handles, slide the controller into the slot until the back edge hooks onto the frame.
  - c. Close the handles and snap into place.

**Attention:** When you replace a failed controller, the storage-management software automatically synchronizes the firmware between the existing controller and the new controller. After replacing a controller, always use the storage-management software to verify the firmware levels.

5. Check the controller indicator lights.



- a. If the green power indicator is on and the amber fault indicator is off, go to step 6.
  - b. If the green power indicator remains off or the fault indicator is on after a few seconds, make sure that the controller CRU is locked into place. If the fault indicator remains on, go to step c.
  - c. Use the storage-management software to check the status of both controllers. If applicable, perform the recovery procedures required by the software. If this corrects the fault and the controller unit is operating without error, go to step 6. If not, go to step d.
  - d. Replace the controller CRU. If the problem is not corrected, replace the controller unit bezel faults. Go to step 6.
6. Redistribute arrays.

## Battery

The battery CRU contains rechargeable batteries and a battery-charger board. The battery CRU plugs into the front of the controller unit where it provides backup power to the controllers cache memory. During a power outage, a properly charged battery CRU maintains electrical current to the controllers for up to five days with 256 MB cache memory installed and up to 3 days with 512 MB cache memory installed. Therefore, all data stored in memory is preserved as long as the batteries can sustain power to the cache memory. However, the battery does not provide power to the rest of the system during a power outage. Therefore, the system is not able to write data to drives without a backup power source.

### Servicing notes

Consider the following when servicing the battery in the controller unit:

- The battery has a three-year life expectancy. Replace the battery every three years or whenever it fails to hold a charge. Using the controller unit in a hot environment (above 35° C or 95° F) lowers the life expectancy of the battery. Under these conditions, you might need to replace the battery more often.
- The service label on the battery provides a blank line for recording the last date on which the battery was serviced. Check this label to determine when to replace the battery. For information about using the software to track battery age, refer to the FAStT Storage Manager documentation and online help.
- If a battery fails, the fault light on the battery glows. For more information about indicator lights, see “Checking the indicator lights” on page 105.
- If you replace the battery and still experience battery problems (for example, loss of battery power to the controllers or batteries not charging properly), the controller unit might have defective components or connections. Check the storage-management software for indications of other component failures.

### Replacing a failed battery

When instructed by the storage-management software, replace the battery.

1. Use the storage-management software to check that there is no data in cache and that all caching has stopped. Data in cache is unprotected if a power outage occurs while the battery CRU is out of operation.

**Attention:** When you handle electrostatic discharge (ESD) sensitive devices, take precautions to avoid damage from static electricity. For details about handling ESD-sensitive devices, refer to the following Web site and use a search term of ESD: <http://www.ibm.com/>

2. Prepare the new battery.

Unpack the battery CRU. Save the packing material for shipping the used battery CRU to a disposal facility. Find the "Battery Support Information" label on the front of the new battery CRU, as shown in “Checking the battery service date” on page 161.

3. Fill in the following information:

- Date of Installation - Record today's date on the blank line.
- Replacement Date - Record the expiration date (three years from today's date) on the blank line.

4. Remove the controller unit bezel.

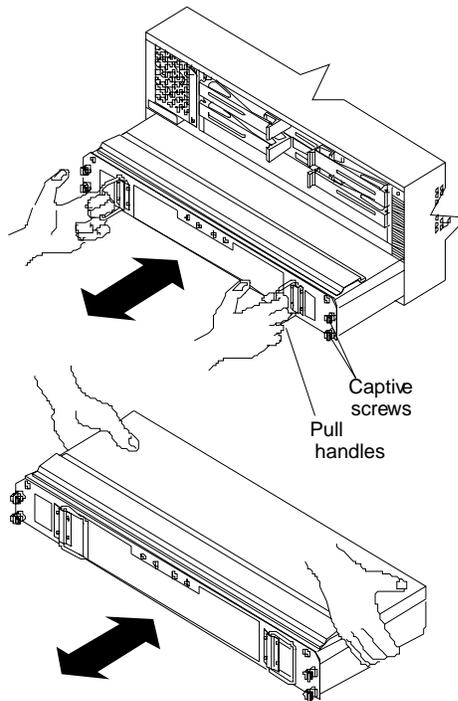
**Attention:** Be careful when removing the battery. The battery weighs approximately 6.4 kg (14 lbs).

**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.**

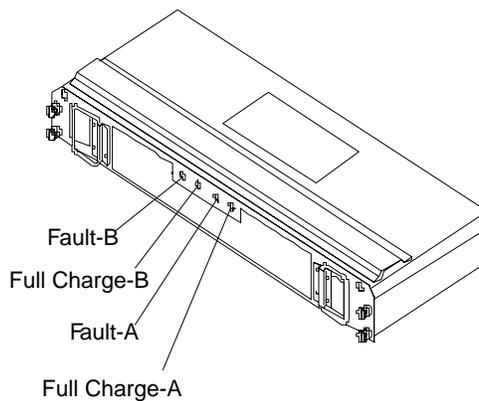
- a. Loosen the four captive screws on the battery. If they are too tight, use a flat blade screwdriver to loosen the screws.
- b. Using the pull handles, slide out the battery about 5 cm (2 in.).
- c. Using both hands, grasp the sides of the battery and pull out.



5. Install the new battery.
  - a. Using both hands, slide the battery about 5 cm (2 in.) into the slot.
  - b. Using the pull handles, push the battery into the slot completely.
  - c. Tighten the four captive screws.
6. Replace the controller unit bezel.
7. Run the system for at least 24 hours to properly charge the battery.

The battery can take up to 15 minutes to complete its self-test and up to 24 hours to fully charge, especially after a power loss of more than a few minutes. When properly charged, both full-charge indicator lights on the front of the battery are on.

8. Check the battery indicator lights.



**Note:** If either the Full Charge-A or the Full Charge-B indicator light is blinking, the battery is in the process of charging.

9. Reset the battery installation date using the storage-management software. The software continues to issue battery-related errors if the installation date is not reset.

**Attention:** Use proper facilities to recycle the used battery CRU. If the battery CRU is physically damaged or leaking electrolyte gel, *do not* ship it to a recycling center. The battery contains sealed lead acid batteries that might be considered hazardous material. You must handle this unit in accordance with all applicable local and federal regulations.

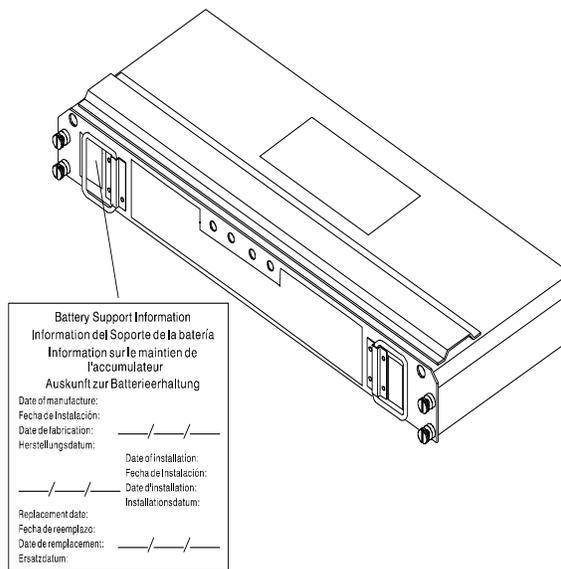
10. Dispose of the used battery CRU according to local and federal regulations, which might include hazardous material handling procedures.

## Checking the battery service date

**Note:** Replace the battery whenever it fails to hold a charge or every three years. Using the controller unit in a hot environment (above 35° C or 95° F) lowers the battery life expectancy. Under these conditions, you might need to replace the battery more often.

To check the battery service date, do the following:

1. Remove the controller unit bezel.
2. Check the Battery Support Information label, as shown in the following figure.



The Battery Support Information label on the front of the battery has three dates:

- Date of Manufacture - Date the battery was built at the factory
- Date of Installation - Date the battery was installed in the controller unit
- Replacement Date - Date to replace the battery (see the note at the beginning of this section)

3. Look at the replacement date and do the following:

- If it is time to replace the battery, install a new battery.
- If it is not time to replace the battery, replace the controller unit bezel.

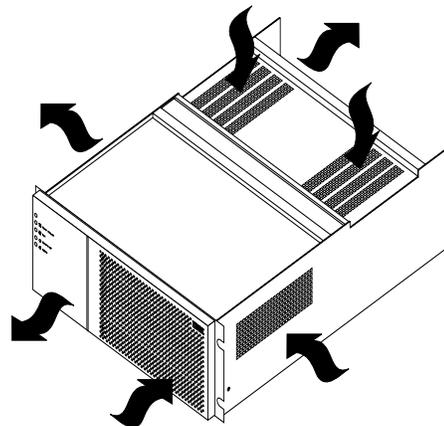
## Controller fan

The controller fan is a single, removable unit containing two cooling fans and temperature monitoring circuitry. The controller fan plugs directly into a slot on the front of the controller unit, to the left of the controllers. Five indicator lights provide overall system status information. The dual fans in the controller fan provide a redundant cooling system to both controller CRUs. If one fan fails, the other continues to operate, providing sufficient air circulation to prevent the controllers from overheating until you can replace the entire controller fan.

To prevent cooling problems, the controller unit must have proper air circulation throughout the chassis. Cooling problems include any malfunctions or obstructions that impede air flow and cause one or more components in the controller unit to overheat. Make sure that the ambient air temperature around the controller unit is within the environmental requirements. To boost air circulation, the controller unit chassis has air vents along its top and sides. These vents serve as air intake and exhaust passages. Always keep vents clean and free of obstructions.

The following figure shows the controller unit air flow. Make sure your installation site allows adequate ventilation to the controller unit during operation.

**Note:** Allow at least 60 cm (2 ft) of clearance in front of and behind the controller unit for proper ventilation.



### Servicing notes

Consider the following when servicing the controller fan:

- Both fans failing simultaneously in the controller fan is unlikely. Such a failure will cause either one or both controllers to overheat. Under these circumstances, the amber controller light on the front panel might turn on. Shut down the controller unit immediately and let the unit cool to room temperature and then replace the controller fan.
- You can hot-swap, or replace, the controller fan, as long as you complete the exchange within 15 minutes. The time limit applies to the total time that the fan is out of the chassis. The time begins when you remove the failed controller fan and ends when you install the new one. This does not include the time it takes to perform the entire procedure (for example, checking the indicator lights).
- If a controller fan fails, the fault light on the controller fan glows. For more information about indicator lights, see “Checking the indicator lights” on page 105.
- If you replace the controller fan and still experience problems, the controller unit might have defective components or connections. Check the storage-management software for indications of other component failures.

## Replacing a failed controller fan

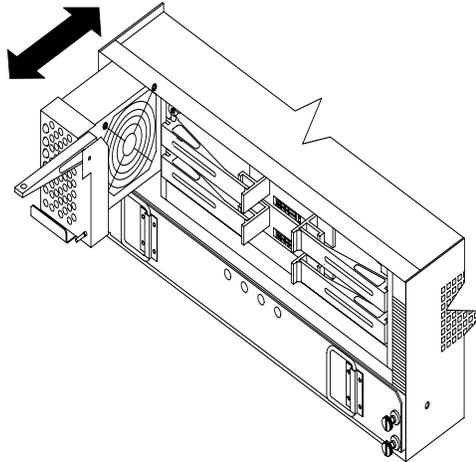
When instructed by the storage-management software, replace a controller fan.

**Attention:** When you handle electrostatic discharge (ESD) sensitive devices, take precautions to avoid damage from static electricity. For details about handling ESD-sensitive devices, refer to the following Web site and use a search term of ESD: <http://www.ibm.com/>

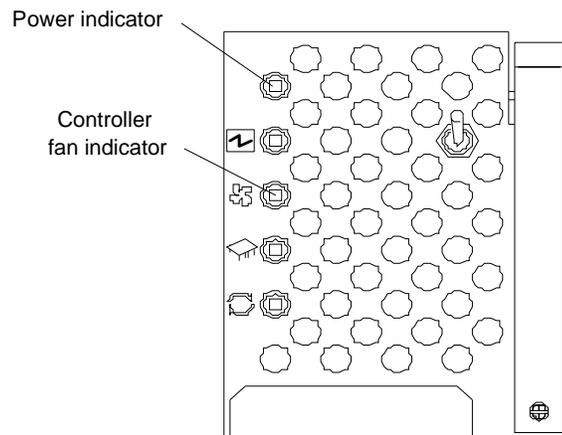
1. Unpack the new controller fan.
2. Remove the controller unit bezel.

**Attention:** To prevent damage to the controller unit components, do not operate the controller unit without adequate ventilation to the controllers. If it will take longer than 15 minutes to replace the controller fan, you must shut down the controller unit to prevent it from overheating. The time limit applies to the total time that the fan is out of the chassis.

3. Remove the failed controller fan.
  - a. Lift up the lever on the controller fan.
  - b. Pull firmly on the bottom lip to remove the fan.



4. Install the new controller fan.
  - a. Slide the new controller fan all the way into the slot.
  - b. Press down on the lever and snap the lever into place.
5. The following figure shows the indicator lights on the controller fan.



When the controller fan is operating properly, the green power indicator is on and the amber indicator is off.

- If the amber fan light is on or the green power indicator remains off, make sure that the controller fan is seated securely in the slot and that the lever is snapped into place.
  - If the controller fan indicator remains on, it might indicate a problem with the new controller fan. Replace the controller fan with a spare, if available. If not, turn off the controller unit to prevent it from overheating until you can replace the fan.
6. Replace the controller unit bezel.

## Fan and communications module

The fan and communications module is a single, removable unit containing two cooling fans, two serial ports, and two Ethernet ports. This module plugs into a slot at the center back of the controller unit, just above the power supplies. It has a locking lever and a pull handle for securing and removing the fan and communications module. The module contains dual fans that provide a redundant cooling system to both power supplies. If one fan within the module fails, the other continues to operate. A single fan provides sufficient air circulation to prevent the power supplies from overheating until you can replace the entire fan and communications module.

### Servicing notes

Consider the following when servicing the fan and communications module:

- The fan and communications module contains two serial RS-232 connections used for diagnostic purposes and two Ethernet RJ-45 connections used for direct network-management.
- You can hot-swap the fan and communications module as long as you complete the exchange within 15 minutes from when you remove the failed unit.
- It is unlikely that both fans in the fan and communications module will fail simultaneously. Such a failure causes one or both power supplies to overheat. In these circumstances, the amber power supply indicator light on the bezel turns on and the overheated power supply automatically shuts down (the green power indicator light turns off). After the ambient air temperature cools below 70° C (158° F), the power supply automatically turns on. Replace the failed fan and communications module then check the power supply indicator lights (fault indicator light on the front and power indicator light on the back). If the power supply fault indicator light remains on, replace the power supply. For more information about indicator lights, see “Checking the indicator lights” on page 105.
- If you replace the fan and communications module and still experience problems, the controller unit might have defective components or connections. Check the storage-management software for indications of other component failures.

### Replacing a failed fan and communications module

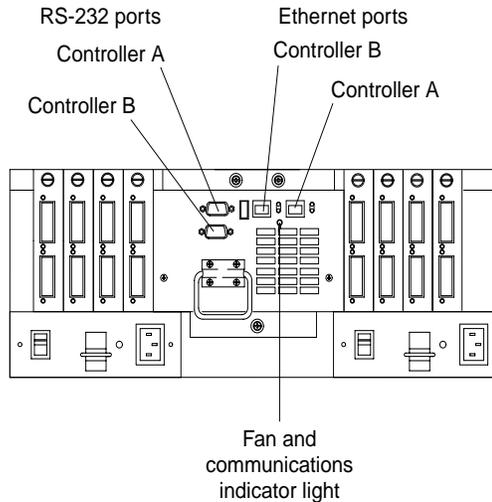
When instructed by the storage-management or diagnostic software, replace the fan and communications unit.

**Attention:** To prevent damage to the controller unit circuitry, do not operate the controller unit without adequate ventilation to the controllers. If it will take longer than 15 minutes to replace the controller fan, you must shut down the controller unit to prevent it from overheating. The time limit applies only to the total time that the fan is out of the chassis. The time begins when you remove the failed module and

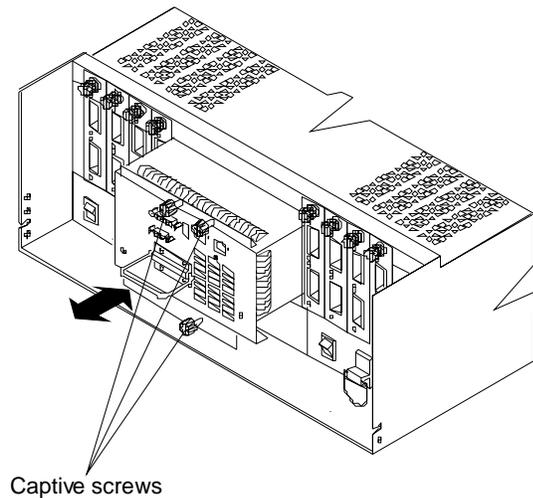
ends when you install the new one. This does not include the time it takes you to perform this entire procedure (for example, checking the lights).

When you handle electrostatic discharge (ESD) sensitive devices, take precautions to avoid damage from static electricity. For details about handling ESD-sensitive devices, refer to the following Web site and use a search term of ESD: <http://www.ibm.com/>

1. Unpack the new fan and communications module.
2. If you are using a diagnostic program, stop the program before disconnecting the cables.
3. Disconnect all RS-232 and Ethernet interface cables from the failed fan and communications module. The locations of the ports are shown in the following figure.



4. Remove the failed fan and communications CRU from the controller unit.



- a. Using a flat-blade screwdriver, loosen the three captive screws on the fan and communications module.
  - b. Use the pull handle to slide the module out of the slot a few inches.
  - c. Grasp the sides of the module with both hands and remove it from the controller unit.
5. Install the new fan and communications module.

Push the new fan and communications module all the way into its chassis slot. Use a flat-blade screwdriver to tighten the three captive screws on the new module, securing it into place.

6. Check the fan and communications indicator light.
  - If the amber fault indicator light is on, make sure that the fan and communications module is inserted all the way into the chassis and secured in place.
  - If the fault indicator light remains on, one or both fans inside the fan and communications module might be malfunctioning. Replace the failed fan and communications module with a spare, if available. If not, shut down the controller unit until you can replace the failed fan and communications module with a new one.
7. Reconnect the interface cables to the new fan and communications module.

## Power supply

The controller unit power system consists of two power supplies. The power supplies slide into either of the two slots on the back of the controller unit. The power supplies provide power to the internal components by converting incoming ac voltage to dc voltage. The power supplies are interchangeable and redundant. Each power supply uses one power cord. You can plug both power cords into a common power source or plug each cord into a separate circuit for power redundancy. One power supply can maintain electrical power to the controller unit if the other power supply is turned off or malfunctions.

### Servicing notes

Consider the following when servicing the power supplies:

- Each power supply has a built-in sensor that detects the following conditions:
  - Overvoltage
  - Overcurrent
  - Overtemperature

If any of these conditions occur, one or both power supplies enter shutdown mode. All power remains off until one of the following occurs:

  - You cycle the power switches (turn off the power switches, wait at least 30 seconds, then turn on the power switches).
  - The power supplies automatically resume operation when the ambient air temperature cools to below 70° C (158° F). When the power supplies automatically resume operation, the controller also resumes operation.

After you manually cycle the power off then on, or when the power supplies automatically resume operation, an automatic restart resets the controllers, attempts to spin up the drives (which has no effect on the drives if they are already running), and returns the controller unit to normal operation without operator intervention.
- You can hot-swap (replace) a power supply because the two power supplies provide redundancy.
- Both power supplies have built-in temperature sensors designed to prevent the power supplies from overheating. If a temperature sensor detects an ambient air temperature greater than 70° C (158° F), the overheated power supply automatically shuts down. The second power supply remains on as long as its temperature remains below 70° C (158° F). If the second power supply overheats, it turns off all power to the controller unit.

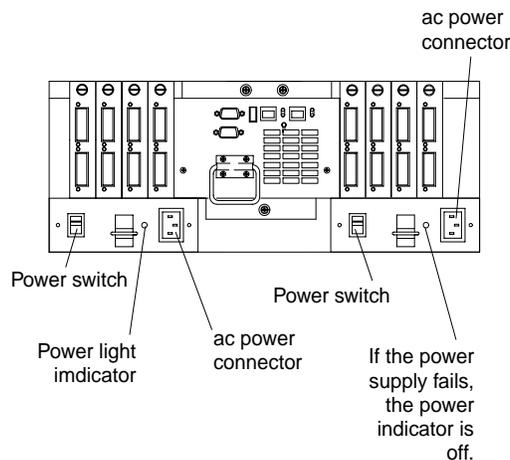
**Note:** There is a serious problem if the air temperature inside the cabinet is hot enough to cause the power supplies to shut down.

- The controller unit is capable of power up recovery without operator intervention. After the air temperature cools to below 70° C (158° F), the power supplies automatically restart. An automatic restart resets the controllers, attempts to spin up the drives (which has no effect on the drives if they are already running), and returns the controller unit to normal operation.
- If a power supply fails, the green power indicator light on the power supply is off and the amber power supply fault light on the controller fan on the front of the controller unit glows. For more information, see “Checking the indicator lights” on page 105.
- If you replace the power supply CRU and still experience problems, the controller unit might have defective components or connections. Check the storage-management software for indications of other component failures.

### Replacing a failed power supply

When instructed by the storage-management software, replace a power supply.

1. Check the power supply indicator light on the back of the controller unit, as shown in the following figure. Be sure that the green power light on the failed power supply is off.



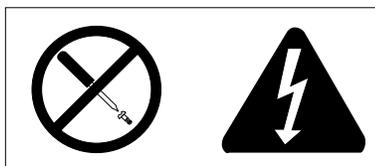
#### CAUTION:

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.

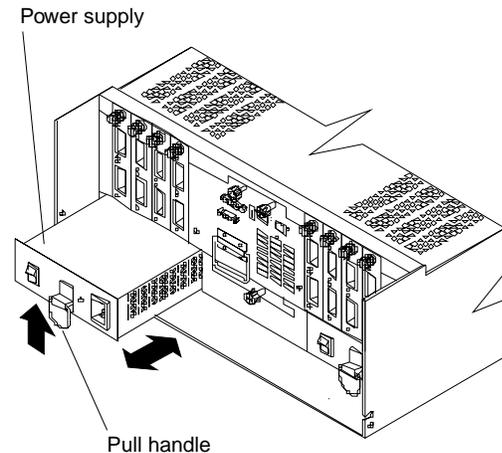
2. Turn off the power switch and unplug the power cord from the failed power supply.

#### 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.



- Using the following figure as a guide, remove the failed power supply.  
Using the pull handle, lift up and pull out to release the power supply; then, slide it out.



**Attention:** When you handle electrostatic discharge (ESD) sensitive devices, take precautions to avoid damage from static electricity. For details about handling ESD-sensitive devices, refer to the following Web site and use a search term of ESD: <http://www.ibm.com/>

- Unpack and install the new power supply. Using the pull handle, push the power supply into the slot until it locks into place.
- Plug in the power cord and turn on the power.
- Check the new power supply and other controller unit indicator lights for faults. For more information, see “Checking the indicator lights” on page 105.

## Mini-hubs

The mini-hubs are located on the back of the controller unit. A mini-hub is a single, removable unit that provides the Fibre Channel interface between a controller unit and hosts or drives. The back of the controller unit can accommodate eight mini-hubs: up to four host side and up to four drive side mini-hubs. Each mini-hub has two ports. A Gigabit Interface Converter (GBIC) is installed in a mini-hub port. Then a fiber-optic interface cable is connected into the GBIC. For more information, see “Chapter 1. IBM Fibre Channel,” on page 1 and “GBICs” on page 170.

### Servicing notes

Consider the following when servicing mini-hubs:

- You can hot-swap (replace) a failed mini-hub while the controller unit is in operation.
- Four indicator lights provide status information. If a mini-hub fails, the interface fault and the bypass indicator lights on the mini-hub glow and the loop good indicator light is off. For more information about indicator lights, see “Checking the indicator lights” on page 105.
- If you replace the mini-hub and the GBICs in them and still experience problems, the controller unit might have defective components or connections. Check the storage-management software for indications of other component failures.

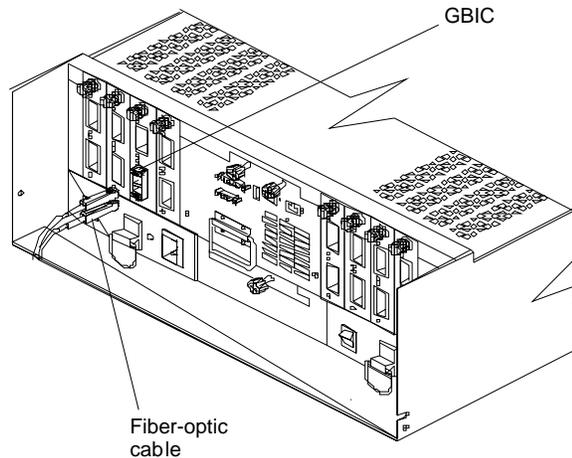
## Replacing a failed mini-hub

When instructed by the storage-management software, replace a mini-hub. Use this procedure to replace either a failed host-side or drive-side mini-hub.

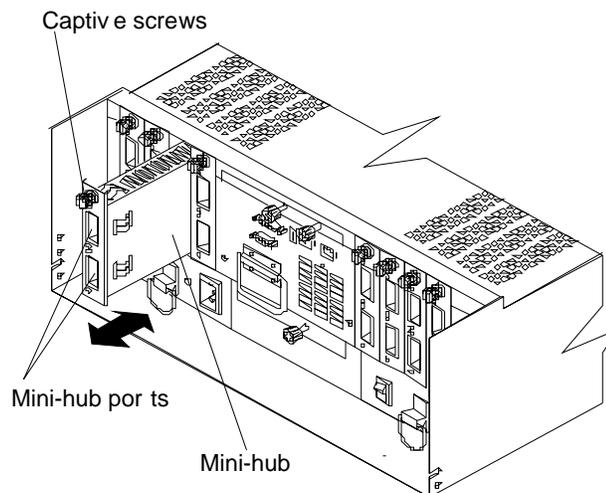
**Attention:** To prevent possible data loss, do not pull cables from a mini-hub that has not failed.

1. On the mini-hub that has failed, remove the fiber-optic cables from the GBICs; then, replace the protective caps on the cables.

**Note:** If you are using IBM GBICs, you must remove the fiber-optic cable from the GBIC before you can remove the GBIC from the mini-hub port.



2. Remove any GBICs in the mini-hub. If a GBIC you are removing has a metal latch, move the latch to the unlocked (center) position. Pull the GBIC from its mini-hub port; then, replace the protective caps on the GBIC.
3. Loosen the captive screw on the mini-hub; then, grasp the screw and pull the mini-hub from the chassis.



**Attention:** When you handle electrostatic discharge (ESD) sensitive devices, take precautions to avoid damage from static electricity. For details about handling ESD-sensitive devices, refer to the following Web site and use a search term of ESD: <http://www.ibm.com/>

4. Unpack the new mini-hub and slide it into the appropriate slot; then, tighten the captive screw.
5. Replace the GBICs.
  - a. Remove the protective cap from the GBIC.
  - b. If the GBIC you are installing has a metal latch, move the metal latch to the unlocked (center) position.
  - c. Slide the GBIC into the mini-hub port.
  - d. Rotate the metal latch outward to the locked position (flush with the rear of the GBIC).
6. Replace the fiber-optic cables.
7. Check the indicator lights on the mini-hub.

When the mini-hub is operating properly, the green loop good light is on and the fault light is off. If the mini-hub is connected to a Fibre Channel loop, the amber port bypass light is off. If a problem is indicated, use the storage-management software to check the controller unit status.

## GBICs

GBICs (Gigabit Interface Converters) are used to connect mini-hub ports to attached nodes. A GBIC slides into a mini-hub port on the back of the controller unit and then a host- or drive-interface cable connects into the GBIC.

### Servicing notes

Consider the following when servicing GBICs:

- You can hot-swap (replace) a failed GBIC while the controller unit is in operation.
- The operational loop performance is not affected when you install or remove a GBIC.
- Four indicator lights on a mini-hub provide status information. If a GBIC fails, the interface fault and the bypass indicator lights on the mini-hub glow and the loop good indicator light is off. For more information about indicator lights, see “Checking the indicator lights” on page 105.
- If you replace the GBIC and still experience problems, the controller unit might have defective components or connections. Check the storage-management software for indications of other component failures.

### Replacing a failed GBIC

#### 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.

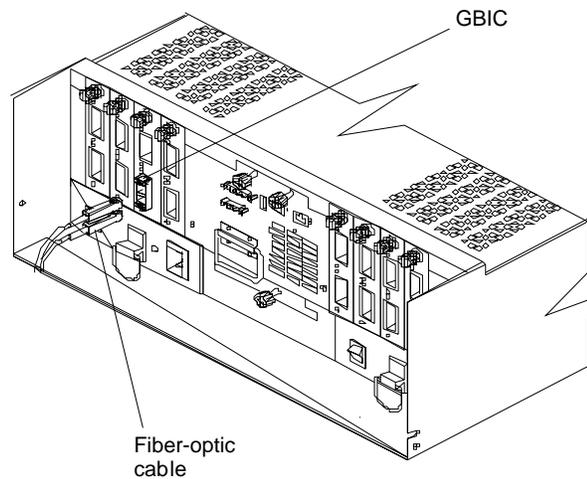
Laser radiation when open. Do not stare into the beam, do not view directly with optical instruments, and avoid direct exposure to the beam.

When instructed by the storage-management software, replace a GBIC in the mini-hub.

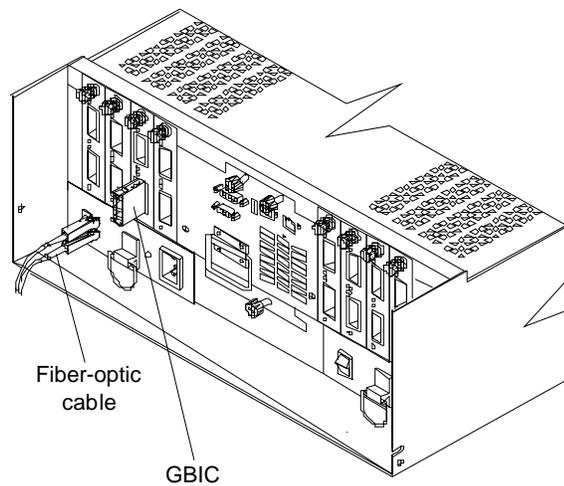
**Attention:** To prevent possible data loss, do not pull cables from a GBIC that has not failed.

1. Remove the fiber-optic cable from the GBIC that has failed; then, replace the protective caps on the cables.

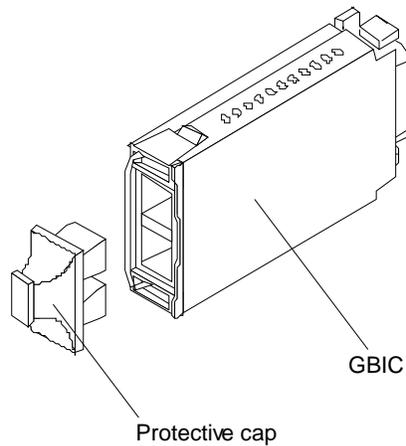
**Note:** If you are using IBM GBICs, you must remove the fiber-optic cable from the GBIC before you can remove the GBIC from the mini-hub port.



2. Remove the GBICs from the mini-hub ports. If the GBIC you are removing has a metal latch, move the latch to the unlocked (center) position. Pull the failed GBIC from its mini-hub port.



3. Insert the protective cap on the GBIC.



**Attention:** When you handle electrostatic discharge (ESD) sensitive devices, take precautions to avoid damage from static electricity. For details about handling ESD-sensitive devices, refer to the following Web site and use a search term of ESD: <http://www.ibm.com/>

4. Unpack the new GBIC; then, do the following:
  - a. Remove the protective cap from the GBIC.
  - b. If the GBIC you are installing has a metal latch, move the metal latch to the unlocked (center) position.
  - c. Slide the GBIC into the mini-hub port.
  - d. Rotate the metal latch outward to the locked position (flush with the rear of the GBIC).
5. Reconnect the interface cables.
6. Check the indicator lights on the mini-hub.

When the mini-hub is operating properly, the green loop good light is on and the fault light is off. If the mini-hub is connected to a Fibre Channel loop, the amber port bypass light is off. If a problem is indicated, use the storage-management software to check the controller unit status.

## Operating specifications

The following information summarizes the operating specifications of the controller unit.

- **Size (with front panel and without mounting rails):**
  - Depth: 63.5 cm (25 in.)
  - Height: 17.45 cm (6.87 in.)
  - Width: 44.45 cm (17.5 in.)
- **Weight:**
  - Typical controller unit fully configured: 38.6 kg (85 lbs)
  - Electrical input
    - Sine-wave input (50 to 60 Hz) is required
    - Input voltage:
      - Low range: Minimum: 90 V ac / Maximum: 132 V ac
      - High range: Minimum: 198 V ac / Maximum: 262 V ac

- Input kilovolt-amperes (kVA) approximately: 0.214 kVA
- **Environment:**
  - Air temperature:
  - Controller unit on: 10° to 35° C (50° to 95° F)
  - Altitude: 0 to 914 m (3000 ft)
  - Controller unit on: 10° to 32° C (50° to 90° F)
  - Altitude: 914 m (3000 ft) to 2133 m (7000 ft)
- **Humidity:** 10% to 80%
- **Acoustical noise emissions values for typical system configurations:**
  - Sound power (idling): 6.5 bels
  - Sound power (operating): 6.5 bels
  - Sound pressure (idling): 49 dBA
  - Sound pressure (operating): 49 dBA

These levels are measured in controlled acoustical environments according to 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.

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## Symptom-to-FRU index

The Symptom-to-FRU index lists symptoms and the possible causes. The most likely cause is listed first.

The PDs also provide you with additional diagnostic aids and can be found on the IBM support web site: <http://www.pc.ibm.com/qtechinfo/MIGR-4P3PMR.html>. The PDs can also be found in this book. See “Chapter 2. PD entry,” on page 3.

**Note:** Always start with the “General checkout” on page 105. For IBM devices not supported by this index, refer to the manual for that device.

**Note:** Do *not* look directly into any fiber cable or GBIC optical output. Read “Appendix J. Related service information,” on page 441. To view an optical signal, use a mirror to view the reflected light.

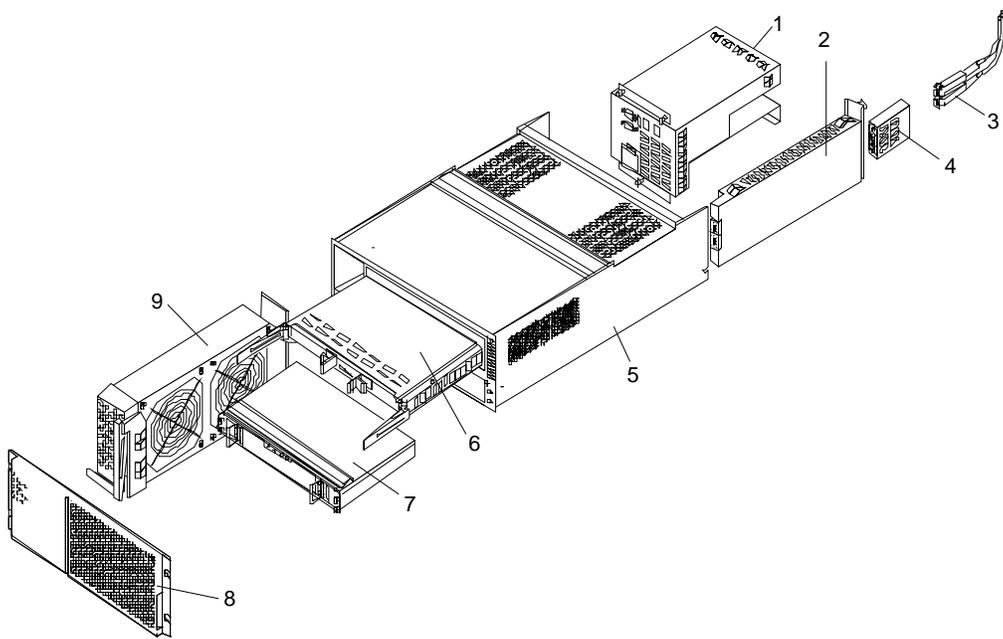
Table 21. Symptom-to-FRU index for Type 3552 FASSt500 RAID controller

Problem	FRU/Action
Controller LED (front cover) is on.	<ol style="list-style-type: none"> <li>1. <b>Reseat Controller CRU.</b></li> <li>2. Place Controller online using SM7 GUI.</li> <li>3. If in passive mode, check Fibre path/GBIC.</li> <li>4. Controller CRU</li> </ol>
Software issued a controller error message.	<ol style="list-style-type: none"> <li>1. <b>Check Controller Fan</b></li> <li>2. Controller CRU</li> </ol>

Table 21. Symptom-to-FRU index for Type 3552 FASt500 RAID controller

Problem	FRU/Action
Software errors occur when attempting to access controllers or drives.	<ol style="list-style-type: none"> <li>1. <b>Check appropriate software and documentation to make sure the system is set up correctly and the proper command was executed.</b></li> <li>2. Power to the Controller</li> <li>3. Interface cables</li> <li>4. ID settings</li> <li>5. Controller</li> <li>6. Drive</li> <li>7. Controller backpanel</li> </ol>
Fan LED (front cover) is on.	<ol style="list-style-type: none"> <li>1. <b>Power supply fan CRU</b></li> <li>2. Controller fan CRU</li> </ol>
Controller and Fan fault LEDs (front cover) are on.	<ol style="list-style-type: none"> <li>1. <b>Check both Fan and Controller CRUs for fault LED and replace faulty CRU.</b></li> </ol>
Fault-A or Fault-B LED (battery CRU) is on.	<ol style="list-style-type: none"> <li>1. <b>Battery CRU</b></li> </ol>
Full Charge-A or Full Charge-B LED (battery CRU) is off.	<ol style="list-style-type: none"> <li>1. <b>Power-on Controller and allow batteries to charge for 24 hours until the Full Charge LEDs are on.</b></li> <li>2. Battery CRU</li> <li>3. Both power supplies</li> </ol>
No power to controller (all power LEDs off).	<ol style="list-style-type: none"> <li>1. <b>Check power switches and power cords.</b></li> <li>2. Power supplies</li> </ol>
Power Supply LED is off.	<ol style="list-style-type: none"> <li>1. <b>Check and reseat power supply.</b></li> <li>2. Check for overheating. Wait ten minutes for the power supply CRU to cool down.</li> <li>3. Power supply CRU</li> </ol>
Power Supply CRUs LED are on, but all other CRU LEDs are off.	<ol style="list-style-type: none"> <li>1. <b>DC power harness</b></li> </ol>

## Parts listing (Type 3552 Fibre Channel RAID controller)



Index	Fibre Channel RAID Controller (Type 3552)	FRU
1	175W-Watt Power Supply	01K6743
2	GBIC Card Assembly	37L0096
	Rear Fan Assembly	37L0102
3	Optical Cable - 1 Meter	37L0083
3	Optical Cable - 5 Meters	03K9202
3	Optical Cable - 25 Meters	03K9204
4	Short Wave GBIC	03K9206
4	Long Wave GBIC	03K9208
5	Frame Assembly with Midplane	37L0093
6	Fibre Channel Host Adapter (optional)	09N7292
7	Battery Backup Assembly	37L0099
8	Bezel Assembly	10L7043
9	Front Fan Assembly (Controller CRU Fan)	37L0094
	256 MB DIMM	37L0095
	Battery Cable	03K9285
	Blank Cannister	37L0098
	Line Cord Jumper, High Voltage	36L8886
	Power Cable	37L0101

<b>Index</b>	<b>Fibre Channel RAID Controller (Type 3552)</b>	<b>FRU</b>
	Miscellaneous Hardware Kit	37L0092
	RAID Card	37L0098
	Rail Kit	37L0085

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## Chapter 9. FAStT200, Type 3542 and FAStT200 HA, Type 3542

**Note:** The PD maps provide you with additional diagnostic aids and can be found on the IBM support web site: <http://www.pc.ibm.com/qtechinfo/MIGR-4P3PMR.html>. The PDs can also be found in this book. See “Chapter 2. PD entry,” on page 3.

The FAStT200 type 3542 and FAStT200 HA type 3542 are compatible with the following IBM products:

- IBM FAStT Host Adapter (FRU 09N7292) (see Chapter 8 on page 65)
- IBM FAStT EXP500 enclosure (see Chapter 11 on page 273)
- Type 3534 Managed Hub
- Type 2109 Fibre Channel Switch

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### General checkout

Use the status LEDs, Symptom-to-FRU list, and the storage management software to diagnose problems. Refer to “Monitoring status through software” on page 183 and “Checking the LEDs” on page 184.

To diagnose a cluster system, use the cluster problem determination procedure. See “Chapter 2. PD entry,” on page 3.

**Note:** If power was just applied to the controller unit, the green and amber LEDs might turn on and off intermittently. Wait until the controller unit finishes powering up before you begin checking for faults.

### General information

The IBM FAStT Storage Server is available in two models. The IBM FAStT200 HA Storage Server (Model 3542-2RU) comes with two RAID controllers, two power supplies, and two cooling units and provides dual, redundant controllers, redundant cooling, redundant power, and battery backup of the RAID controller cache.

The IBM FAStT200 Storage Server (Model 3542-1RU) comes with one RAID controller, two power supplies, and two cooling units and provides battery backup of the RAID controller cache. A FAStT200 Redundant RAID Controller option is available for purchase. Contact your IBM reseller or IBM marketing representative.

The IBM FAStT200 HA Storage Server is designed to provide maximum host- and drive-side redundancy. Each RAID controller supports direct attachment of one host containing one or two host adapters. Using external managed hubs and switches in conjunction with the storage server, you can build even larger configurations. (Throughout this chapter, the use of hub or external hub refers to a managed hub.)

**Note:** Throughout this chapter, the term *storage server* refers to both the IBM FAStT200 Storage Server (Model 3542-1RU) and the IBM FAStT200 HA Storage Server (Model 3542-2RU). Model-specific information is noted where applicable.

## Inventory checklist

After you unpack your storage server, verify that you have the following items:

### Hardware

IBM FAStT200 HA Storage Server (Machine Type 3542, Model 2RU) comes with the following components:

- Two RAID controllers
- Two fan units
- Two power supplies
- Two power cords

IBM FAStT200 Storage Server (Machine Type 3542, Model 1RU) comes with the following removable components:

- One RAID controller
- Two fan units
- Two power supplies
- Two power cords

The following hardware comes with Models 1RU and 2RU:

- One RS-232 cable (for performing diagnostic operations)
- Rack-mounting hardware kit (1)
  - Two rails (right and left assembly)
  - Ten M6 screws
  - Ten M6 cage nuts
  - Ten M6 clip nuts

### Software and documentation (both models):

- IBM FAStT Storage Manager Version 7.02 CD including:
  - FAStT200 Storage Manager Version 7.02
  - Publications and online help in Adobe Acrobat Portable Document Format (PDF)
- Rack Mounting Assembly kit, including:
  - Rack mounting installation instructions
  - Rack mounting template (for aligning the rails properly)
  - White tape dots for marking the holes in the rack
- Fibre Channel cabling instructions

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

## Features

The following table summarizes the features of the storage server. For a list of the operating specifications, such as weight, height, and heat output, see “Operating specifications” on page 180.

Table 22. Features at a glance

<p><b>General</b></p> <ul style="list-style-type: none"> <li>• Modular components:             <ul style="list-style-type: none"> <li>— High-capacity disk drives</li> <li>— RAID controllers</li> <li>— Power supplies</li> <li>— Cooling fans</li> </ul> </li> <li>• Technology:             <ul style="list-style-type: none"> <li>— Support for disk arrays</li> <li>— Support for clustering</li> <li>— Fibre Channel host interface</li> <li>— Redundant data storage, cooling system, power system, and RAID controllers</li> <li>— Hot-swap technology for drives, power supplies, fans, and RAID controllers</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• User interface:             <ul style="list-style-type: none"> <li>— Built-in power, activity, and fault Light Emitting Diodes (LEDs)</li> <li>— Identification labeling on customer replaceable units (CRUs), rear LEDs, switches, and connectors</li> <li>— Easy-to-replace drives, power supplies, RAID controllers, and fans</li> </ul> </li> </ul> <p><b>Disk drive storage</b></p> <p>Maximum drives per storage server: 10</p>	<p><b>RAID controllers</b></p> <ul style="list-style-type: none"> <li>• Technology and interfaces:             <ul style="list-style-type: none"> <li>— Fibre Channel: 40-pin FC disk drives</li> <li>— Fibre Channel interface: Four Gigabit Interface Converter (GBIC) connectors for incoming and outgoing FC cables (two GBICs on each RAID controller)</li> </ul> </li> </ul>
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## 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 in a cluster, another server takes ownership of the array group.

Clustering requires additional hardware and specialized software. For more information about clustering, visit the following IBM Web site:  
<http://www.ibm.com/pc/us/netfinity/clustering>

## Getting help on the World Wide Web

You can obtain up-to-date information about your storage server, a complete listing of the options that are supported on your model, and information about other IBM server products by accessing the IBM Web page at the following address:  
<http://www.ibm.com/pc/us/netfinity>

## Additional service information

### Operating specifications

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

Table 23. Model 3542-2RU storage server operating specifications

Size (with front panel and without mounting rails)	Environment	Acoustical noise emissions values
<ul style="list-style-type: none"> <li>• Depth: 57.5 cm (22.6 in)</li> <li>• Height: 13.2 cm (5.2 in)</li> <li>• Width: 48 cm (18.9 in)</li> </ul> <p><b>Weight</b></p> <ul style="list-style-type: none"> <li>• Standard storage server as shipped: 25.74 kg (56.7 lb)</li> <li>• Typical storage server fully configured: 37.65 kg (83 lb)</li> </ul> <p><b>Electrical input</b></p> <ul style="list-style-type: none"> <li>• Sine-wave input (50 to 60 Hz) is required</li> <li>• Input voltage:               <ul style="list-style-type: none"> <li>— Low range:                   <ul style="list-style-type: none"> <li>– Minimum: 90 V ac</li> <li>– Maximum: 136 V ac</li> </ul> </li> <li>— High range:                   <ul style="list-style-type: none"> <li>– Minimum: 198 V ac</li> <li>– Maximum: 264 V ac</li> </ul> </li> <li>— Input kilovolt-amperes (kVA) approximately:                   <ul style="list-style-type: none"> <li>– Minimum configuration: 0.06 kVA</li> <li>– Maximum configuration: 0.37 kVA</li> </ul> </li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Air temperature:               <ul style="list-style-type: none"> <li>— Storage server on:                   <ul style="list-style-type: none"> <li>10° to 35° C (50° to 95° F)</li> <li>Altitude: 0 to 914 m (3000 ft)</li> </ul> </li> <li>— Storage server on:                   <ul style="list-style-type: none"> <li>10° to 32° C (50° to 90° F)</li> <li>Altitude: 914 m (3000 ft) to 2133 m (7000 ft.)</li> </ul> </li> </ul> </li> <li>• Humidity:               <ul style="list-style-type: none"> <li>— 8% to 80%</li> </ul> </li> </ul>	<p>For open bay (0 drives installed) and typical system configurations (8 hard disk drives installed).</p> <ul style="list-style-type: none"> <li>• Sound power (idling):               <ul style="list-style-type: none"> <li>— 6.3 bels (open bay)</li> <li>— 6.5 bels (typical)</li> </ul> </li> <li>• Sound power (operating):               <ul style="list-style-type: none"> <li>— 6.3 bels (open bay)</li> <li>— 6.8 bels (typical)</li> </ul> </li> <li>• Sound pressure (idling):               <ul style="list-style-type: none"> <li>— 47 dBA (open bay)</li> <li>— 65 dBA (typical)</li> </ul> </li> <li>• Sound pressure (operating):               <ul style="list-style-type: none"> <li>— 47 dBA (open bay)</li> <li>— 68 dBA (typical)</li> </ul> </li> </ul> <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>

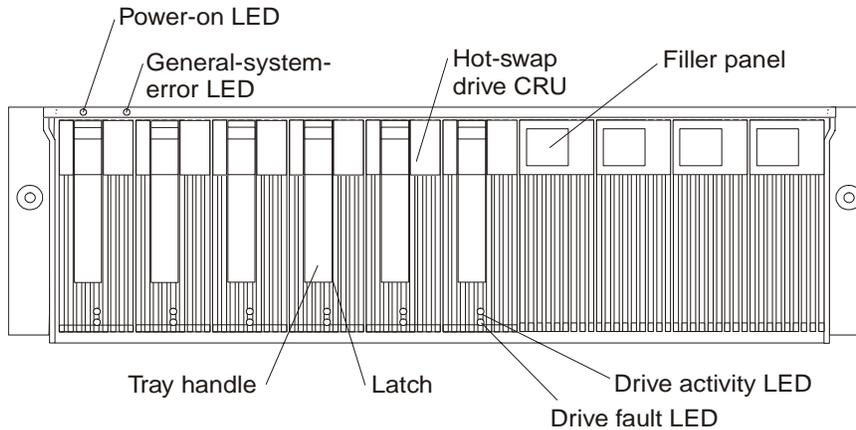
### Storage server components

The following sections show the components of the storage server.

The hot-swap features of the storage server enable you to remove and replace hard disk drives, power supplies, RAID controllers, and fans without turning off the storage server. Therefore, you can maintain the availability of your system while a hot-swap device is removed, installed, or replaced.

#### Front view

The following figure shows the components and controls on the front of the storage server.



### Power-on LED

When on, this green light indicates that the unit has adequate dc power.

### General-system-error LED

When on, this amber LED indicates that the storage server has a fault, such as in a power supply, fan unit, or hard disk drive.

**Note:** If the General-system-error LED is on continuously (not flashing), there is a problem with the storage server. Use the storage-management software to diagnose and repair the problem. For more information, see “Checking the LEDs” on page 184

### Hot-swap drive CRU

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

### Filler panel

The storage server comes without drives installed and contains filler panels in the unused drive bays. Before installing new drives, you must remove the filler panels and save them. Each of the 10 bays must always contain either a filler panel or a drive CRU. Each filler panel contains a filler piece for use with a slim drive.

### Drive activity LED

Each drive CRU has a green Drive activity LED. When flashing, this green LED indicates drive activity. When on continuously, this green LED indicates that the drive is properly installed.

### Drive fault LED

Each drive CRU has an amber Drive fault LED. When on, this amber LED indicates a drive failure. When flashing, this amber LED indicates that a drive identify or rebuild process is in progress.

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

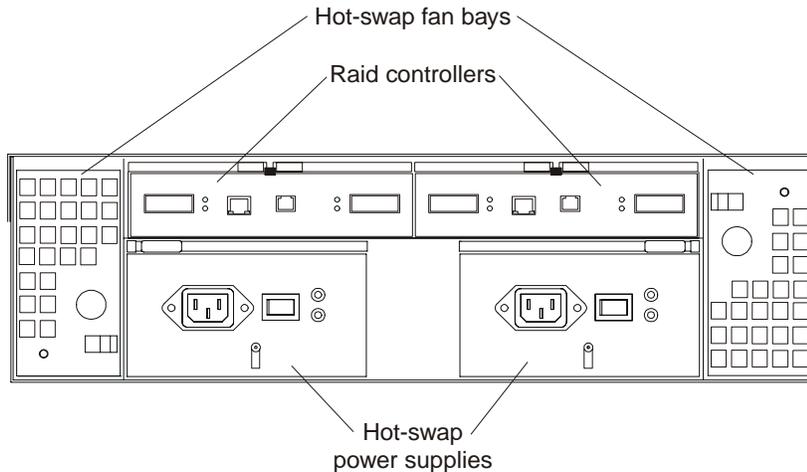
**Tray handle** You can use this multipurpose handle to insert and remove a drive CRU in the bay.

For information on installing and replacing drive CRUs, see “Working with hot-swap drives” on page 202. For more information about the LEDs, see “Checking the LEDs” on page 184.

## Back view

The following figure shows the components at the back of the IBM FAST200 HA Storage Server.

**Note:** If your storage server is a Model 1RU, there is only one RAID controller. There is a blank panel in the second RAID controller opening. The blank panel must remain in place to maintain proper cooling.



### RAID controller

The storage server comes with one or two hot-swap RAID controllers. Each RAID controller contains two ports for Gigabit Interface Converters (GBICs) which connect to the Fibre Channel cables. One GBIC connects to a host system. The other GBIC is used to connect additional expansion units to the storage server.

Each RAID controller also contains a battery to maintain cache data in the event of a power failure. For more information, see “Cache memory and RAID controller battery” on page 200.

### Hot-swap fans

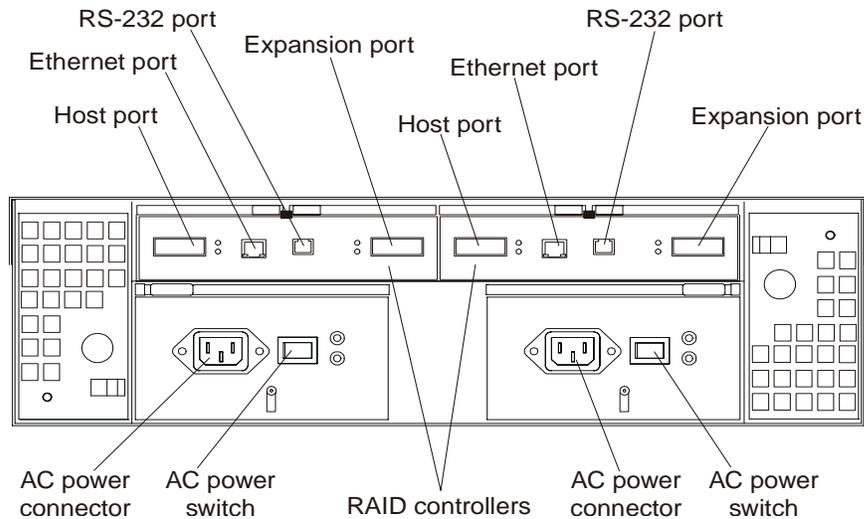
The storage server has two interchangeable hot-swap and redundant fan CRUs. Each fan CRU contains two fans. If one fan CRU fails, the second fan CRU continues to operate. Both fan CRUs must be installed to maintain proper cooling within your storage server, even if one fan CRU is not operational.

### Hot-swap power supplies

The storage server comes with two hot-swap power supplies. Both power supplies must be installed to maintain proper cooling.

## Interface ports and switches

The following figure shows the ports and switches on the back of the storage server.



### RAID controller

Each RAID controller contains several connectors and LEDs. Each controller has one host port and one expansion port for connecting the storage server to hosts or expansion units. You first insert a GBIC into the port and then connect the Fibre Channel cables.

**Host port** The host port is used to connect Fibre Channel cables from the host systems. You first insert a GBIC into the port and then connect the Fibre Channel cables.

### Ethernet port

The Ethernet port is for an RJ-45 10 BASE-T or 100 BASE-T Ethernet connection. Use the Ethernet connection to directly manage storage subsystems.

### Expansion port

The expansion port is used to connect additional expansion units to the RAID controllers. You can connect one expansion unit to each RAID controller. You first insert a GBIC into the port and then connect the Fibre Channel cables.

**RS-232 port** The RS-232 port is a Tj-6 modular jack and is used for an RS-232 serial connection. The RS-232 port is used by service personnel to perform diagnostic operations on the RAID controllers. An RS-232 cable comes with the storage server.

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## Diagnostics

To diagnose Fibre Channel problems, use FAStT Check. See “Chapter 3. IBM FAStT Check,” on page 23.

To diagnose the Type 3542 storage system, use the following diagnostic tools:

- Storage-management software
- Checking LEDs

## Monitoring status through software

Use the storage-management software to monitor the status of the storage server. Run the software constantly, and check it frequently.

The storage-management software provides the best way to diagnose and repair storage-server failures. The software can help you:

- Determine the nature of the failure
- Locate the failed component
- Determine the recovery procedures to repair the failure

Although the storage server has fault LEDs, these lights do not necessarily indicate which component has failed or needs to be replaced, or which type of recovery procedure that you must perform. In some cases (such as loss of redundancy in various components), the fault LED does not turn on. Only the storage-management software can detect the failure.

For example, the recovery procedure for a Predictive Failure Analysis<sup>®</sup> (PFA) flag (impending drive failure) on a drive varies depending on the drive status (hot spare, unassigned, RAID level, current logical drive status, and so on). Depending on the circumstances, a PFA flag on a drive can indicate a high risk of data loss (if the drive is in a RAID 0 volume) or a minimal risk (if the drive is unassigned). Only the storage-management software can identify the risk level and provide the necessary recovery procedures.

**Note:** For PFA flags, the General-system-error LED and Drive fault LEDs do not turn on, so checking the LEDs will not notify you of the failure, even if the risk of data loss is high.

Recovering from a storage-server failure might require you to perform procedures other than replacing the component (such as backing up the logical drive or failing a drive before removing it). The storage-management software gives these procedures.

**Attention:** Not following the software-recovery procedures can result in data loss.

## Checking the LEDs

The LEDs display the status of the storage server and components. Green LEDs indicate a normal operating status; amber LEDs indicate a possible failure.

It is important to check all the LEDs on the front and back of the storage server when you turn on the power. In addition to checking for faults, you can use the LEDs on the front of the storage server to determine whether the drives are responding to I/O transmissions from the host.

### Storage server LEDs (front)

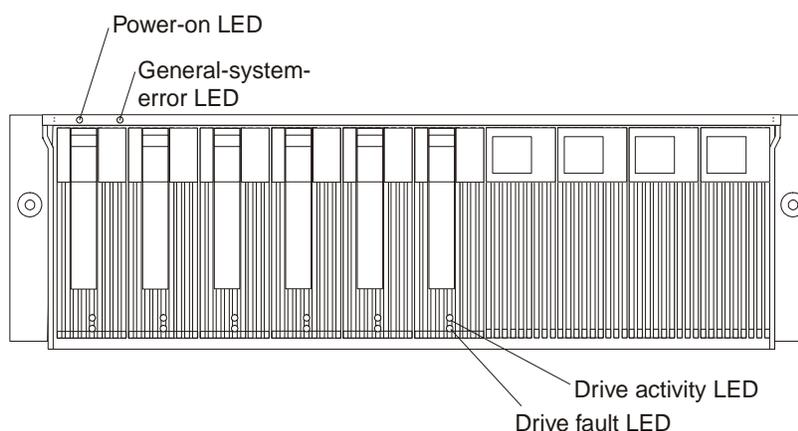


Table 24. Storage server LEDs (front)

LED	Color	Operating states <sup>1</sup>
Drive active	Green	<ul style="list-style-type: none"> <li>• <b>On</b>- Normal operation.</li> <li>• <b>Flashing</b>- The drive is reading or writing data.</li> <li>• <b>Off</b> - One of the following situations has occurred: <ul style="list-style-type: none"> <li>— The storage server has no power.</li> <li>— The storage subsystem has no power.</li> <li>— The drive is not properly seated in the storage server.</li> <li>— The drive has not spun up.</li> </ul> </li> </ul>
Drive fault	Amber	<ul style="list-style-type: none"> <li>• <b>Off</b>- Normal operation.</li> <li>• <b>Flashing</b>- The storage-management software is locating a drive, logical drive, or storage subsystem.</li> <li>• <b>On</b> - The drive has failed, or a user failed the drive.</li> </ul>
Power	Green	<ul style="list-style-type: none"> <li>• <b>On</b>- Normal operation.</li> <li>• <b>Off</b> - One of the following situations has occurred: <ul style="list-style-type: none"> <li>— The storage server has no power.</li> <li>— The storage subsystem has no power.</li> <li>— The power supply has failed.</li> <li>— There is an overtemperature condition.</li> </ul> </li> </ul>
General-system- error	Amber	<ul style="list-style-type: none"> <li>• <b>Off</b>- Normal operation.</li> <li>• <b>On</b> - A storage server component has failed<sup>2</sup>.</li> </ul>
<p><sup>1</sup> Always use the storage-management software to identify the failure.</p> <p><sup>2</sup> Not all component failures turn on this LED. For more information, see “Monitoring status through software” on page 183.</p>		

### Storage server LEDs (rear)

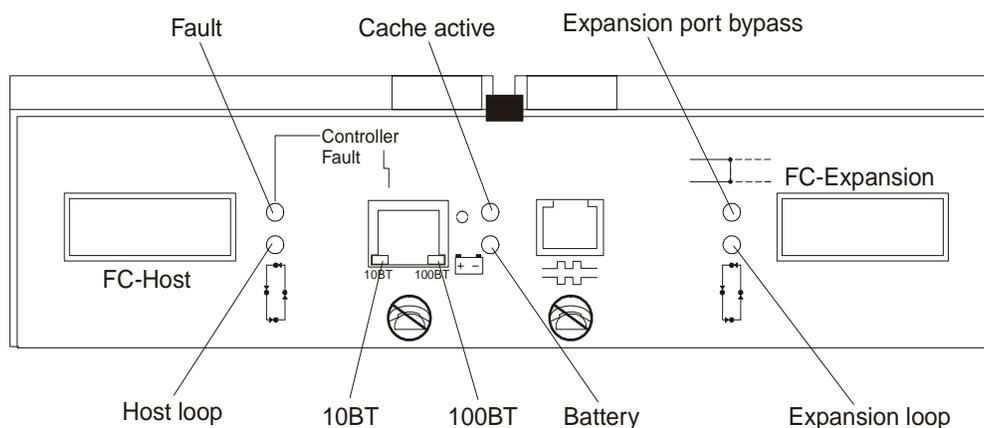


Table 25. RAID Controller LEDs

Icon	LED	Color	Operating states <sup>1</sup>
	Fault	Amber	<ul style="list-style-type: none"> <li>• <b>Off</b>- Normal operation.</li> <li>• <b>On</b> - The RAID controller has failed.</li> </ul>
	Host loop	Green	<ul style="list-style-type: none"> <li>• <b>On</b>- Normal operation</li> <li>• <b>Off</b> - One of the following situations has occurred: <ul style="list-style-type: none"> <li>— The host loop is down, not turned on, or not connected.</li> <li>— A GBIC has failed, or the host port is not occupied.</li> <li>— The RAID controller circuitry has failed, or the RAID controller has no power.</li> </ul> </li> </ul>
	Cache active	Green	<ul style="list-style-type: none"> <li>• <b>On</b>- There is data in the RAID controller cache.</li> <li>• <b>Off</b> - One of the following situations has occurred: <ul style="list-style-type: none"> <li>— There is no data in cache.</li> <li>— There are no cache options selected for this array.</li> <li>— The cache memory has failed, or the battery has failed.</li> </ul> </li> </ul>
	Battery	Green	<ul style="list-style-type: none"> <li>• <b>On</b>- Normal operation.</li> <li>• <b>Flashing</b>- The battery is recharging or performing a self-test.</li> <li>• <b>Off</b> - The battery or battery charger has failed.</li> </ul>
	Expansion port bypass	Amber	<ul style="list-style-type: none"> <li>• <b>Off</b>- Normal operation.</li> <li>• <b>On</b> -One of the following situations has occurred: <ul style="list-style-type: none"> <li>— The expansion port is not occupied.</li> <li>— The Fibre Channel cable is not attached to an expansion unit.</li> <li>— The attached expansion unit is not turned on.</li> <li>— A GBIC has failed, a Fibre Channel cable has failed, or a GBIC has failed on the attached expansion unit.</li> </ul> </li> </ul>
	Expansion loop	Green	<ul style="list-style-type: none"> <li>• <b>On</b>- Normal operation.</li> <li>• <b>Off</b>- The RAID controller circuitry has failed, or the RAID controller has no power.</li> </ul>
No icon	10BT	Green	<ul style="list-style-type: none"> <li>• <b>If the Ethernet connection is 10BASE-T:</b> The 10BT LED is on, 100BT LED flashes faintly.</li> <li>• <b>If the Ethernet connection is 100BASE-T:</b> The 10BT LED is off, 100BT LED is on.</li> <li>• <b>If there is no Ethernet connection:</b> Both LEDs are off.</li> </ul>
No icon	100BT		
<sup>1</sup> Always use the storage-management software to identify the failure.			

## Fan and power supply LEDs

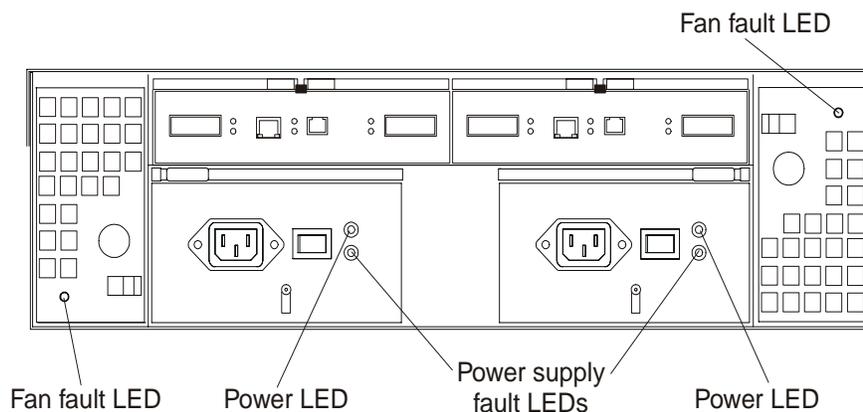


Table 26. Fan LEDs

LED	Color	Operating states <sup>1</sup>
Fault	Amber	<ul style="list-style-type: none"> <li>• <b>Off</b>- Normal operation.</li> <li>• <b>On</b> - The fan CRU has failed.</li> </ul>
<sup>1</sup> Always use the storage-management software to identify the failure.		

Table 27. Power supply LEDs

LED	Color	Operating states <sup>1</sup>
Fault	Amber	<ul style="list-style-type: none"> <li>• <b>Off</b>- Normal operation.</li> <li>• <b>On</b> - One of the following situations has occurred: <ul style="list-style-type: none"> <li>— The power supply has failed.</li> <li>— An overtemperature condition has occurred.</li> <li>— The power supply is turned off.</li> </ul> </li> </ul>
Power	Green	<ul style="list-style-type: none"> <li>• <b>On</b>- Normal operation.</li> <li>• <b>Off</b> - One of the following situations has occurred: <ul style="list-style-type: none"> <li>— The power supply is disconnected.</li> <li>— The power supply is seated incorrectly.</li> <li>— The storage server has no power.</li> </ul> </li> </ul>
<sup>1</sup> Always use the storage-management software to identify the failure.		

## Installation Procedures

This section contains information about installing the storage subsystem configuration and preparing to install the storage server in a rack.

### Storage subsystem configuration

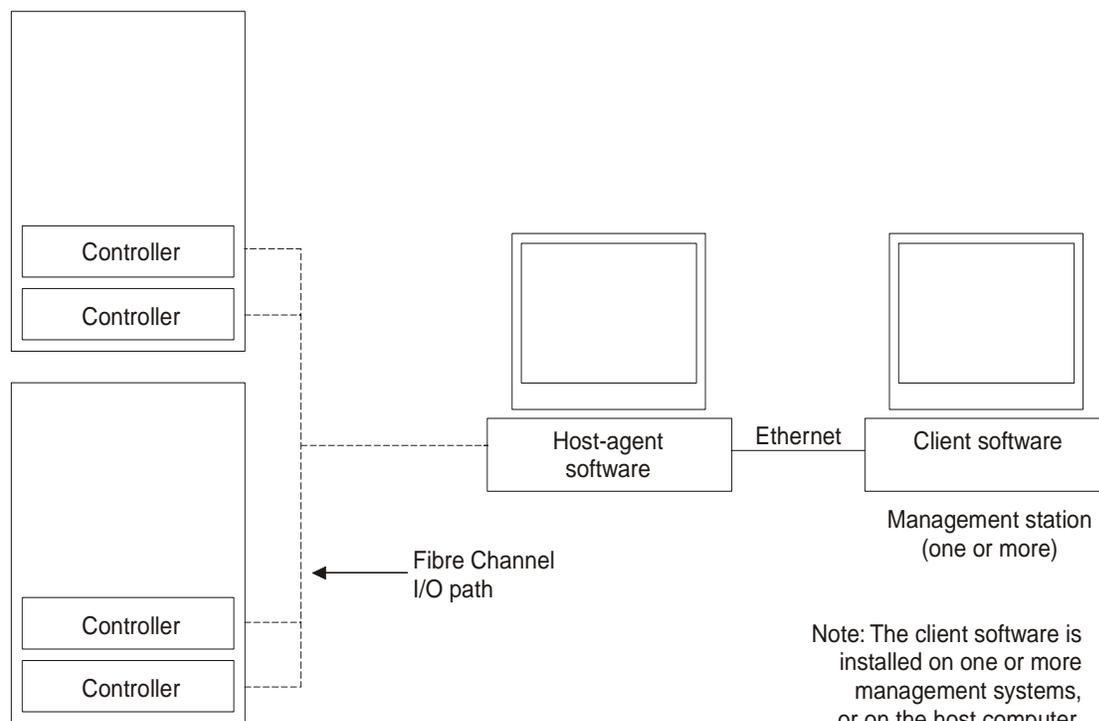
You must set up your storage subsystem configuration before you can install the storage server in a rack. Use the information in the following sections to install the storage subsystem configuration.

#### Storage subsystem management methods

Before you install the storage subsystem configuration, determine which method of storage subsystem management you want to use. You can manage the storage subsystems in either of two ways.

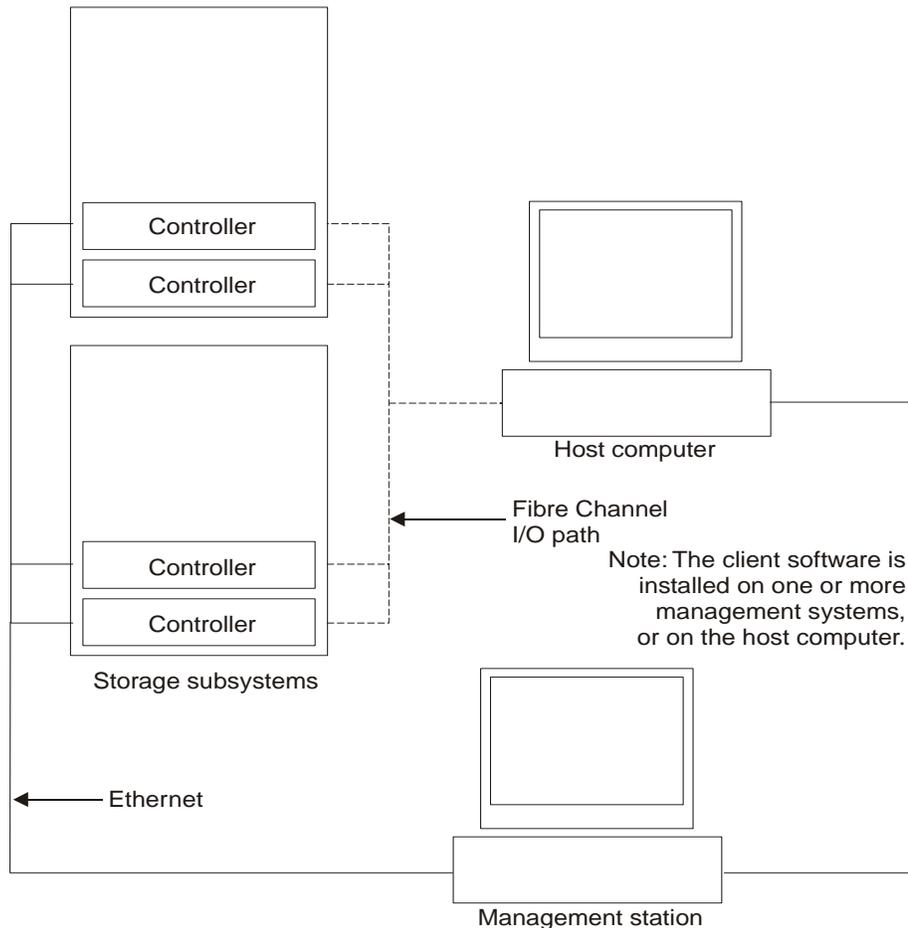
##### Host-agent management method

This method uses host-agent software that is installed on the host server. You must install at least one management station and a software-agent host. The management station can be the host or a workstation on the Ethernet network. A management station will have the client software installed. The following figure shows the host-agent management method.



### Direct management method

This method uses Ethernet connections from a management station to each controller. You must install at least one management station. The management station can be the host or a workstation on the Ethernet network. A management station will have the client software installed. Attach Ethernet cables to each management station (one pair per storage server). You will connect the cables to each controller later when you install the storage server. The following figure shows the direct management method.



### Fibre Channel connections

The storage server Fibre Channel consists of a host Fibre Channel loop and a drive Fibre Channel loop. The host Fibre Channel loop provides the fibre path for host attachment. It can consist of Fibre Channel cables, GBICs, host bus adapters, Fibre Channel switches, Fibre Channel managed hubs, and RAID controllers. The drive Fibre Channel loop provides the fibre path to the hard disk drives (HDDs). The drive Fibre Channel loop consists of Fibre Channel HDDs and optional drive expansion units, Fibre Channel cables, and GBICs.

The Model 3542-2RU storage server supports redundant disk-drive-loop configurations. Each RAID controller has two GBIC ports. These GBIC ports are labeled FC-Host and FC-Expansion Units. You can build a redundant drive loop by connecting one or more expansion units to the redundant RAID controllers. Then, use dual fiber-optic cables to connect one expansion unit to another in a daisy-chain. For more information about adding expansion units, see "Connecting additional expansion units" on page 195.

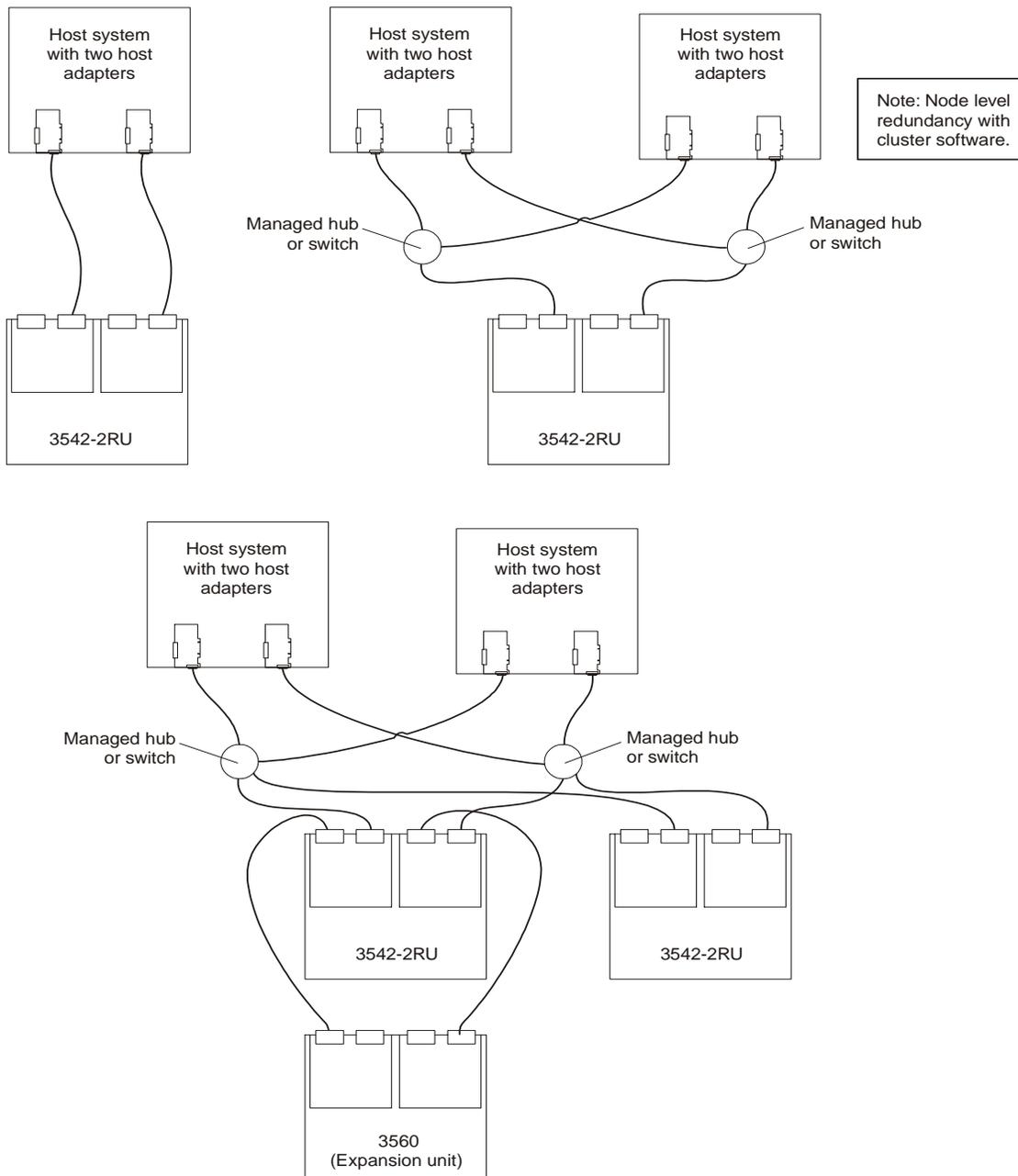
**Note:** The Model 3542-1RU storage server supports a single Fibre Channel host and drive loop.

## Fibre Channel loop configurations

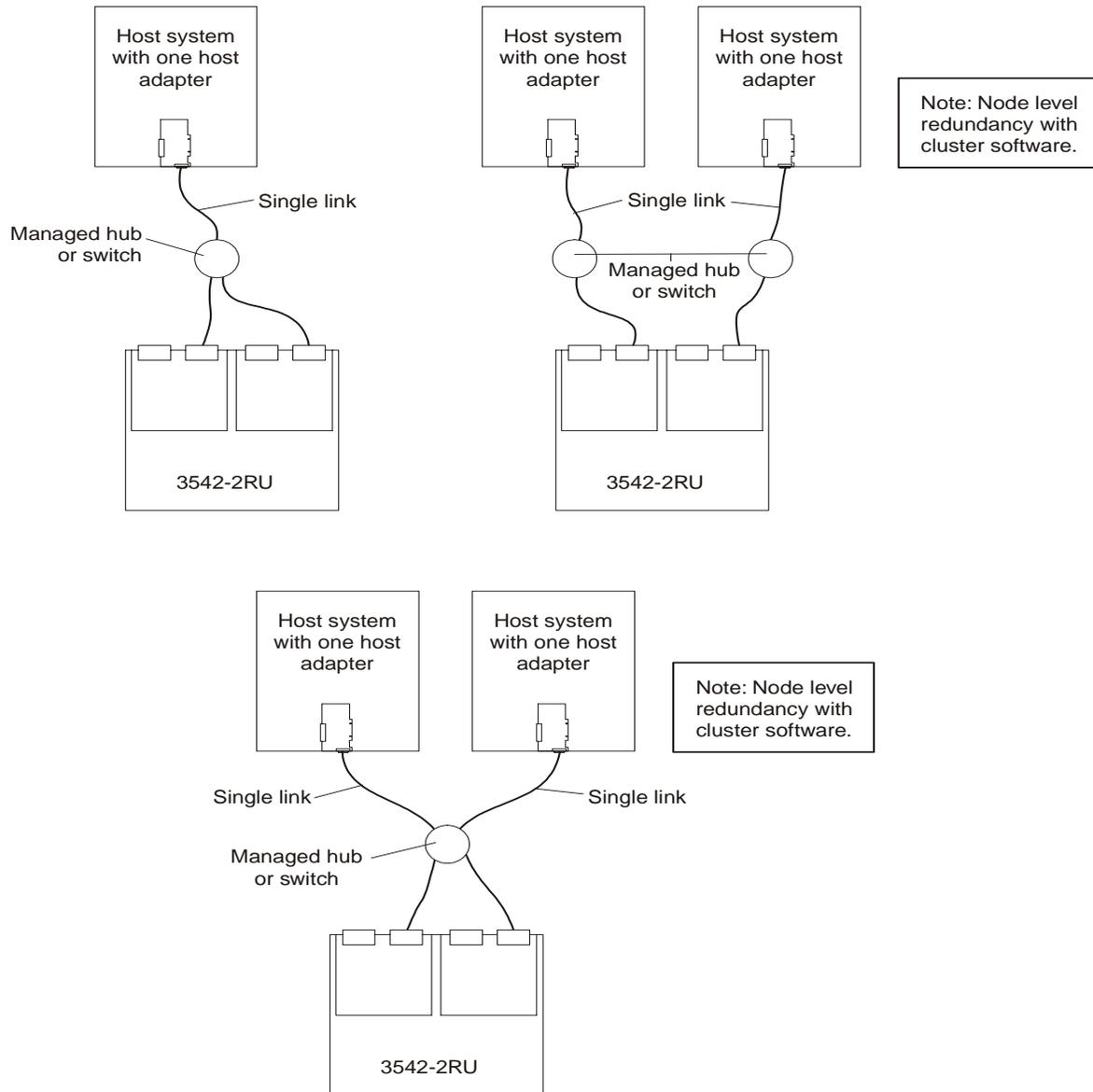
You must determine how the host systems will connect to the storage server. You can connect one host system directly to the storage server or connect multiple hosts to the storage server through managed hubs and switches. The figures in the following sections show common host system configurations.

**Redundant host and drive loops:** The following figure shows examples of redundant host and drive loop Fibre Channel configurations.

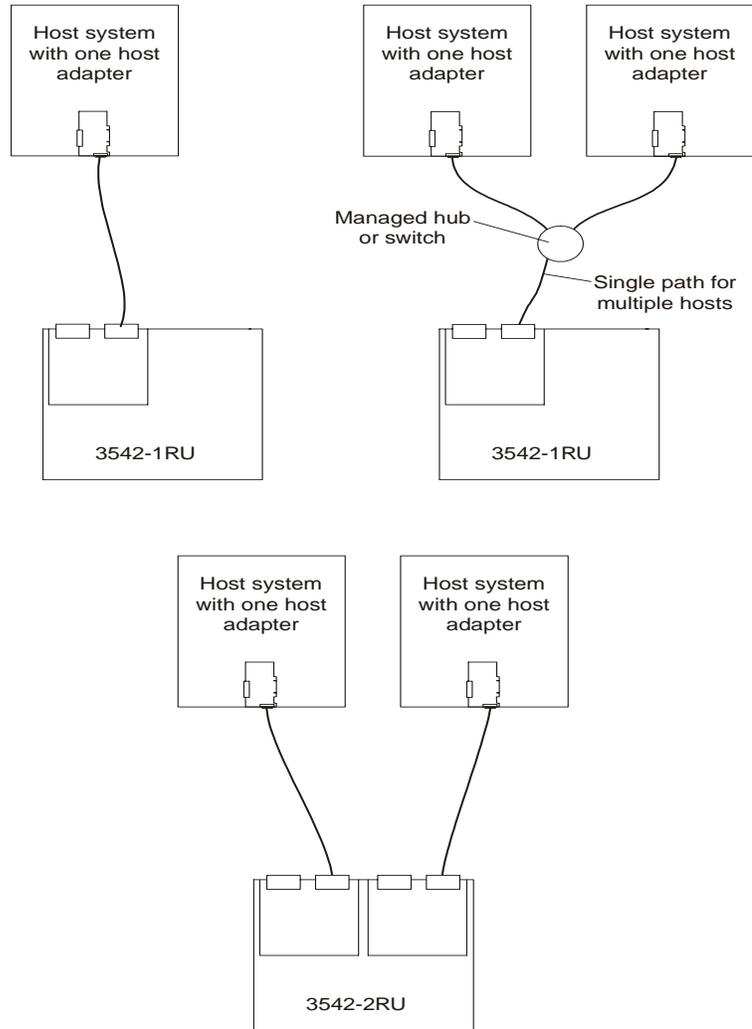
**Note:** These configurations have host and drive path failover protection and are recommended for high availability.



**Partially-redundant host and redundant drive loops:** The following figure shows examples of configurations that have partially-redundant host loops. Partially-redundant host loops have a single link or device in the path between the host and the RAID controller. The single links and devices on the host Fibre Channel loop are single points of failure. If the single link or device fails, the host is not able to access storage until the link is repaired. The host links that have multiple paths to the storage server have path failover protection.



**Non-redundant host and drive loops:** The following figure shows examples of configurations that have non-redundant host and drive Fibre Channel. These configurations have a single path on the host and drive Fibre Channel loop. If either path fails, the host is not able to access storage until the path is repaired. The single controller (Model 3542-1RU) configurations have a single Fibre Channel loop to the hard disk drives. These configurations have no path failover protection.



**Installing the storage subsystem configuration:** Using the information gathered in the previous sections, install the host systems and host adapters.

**Notes:**

1. Refer to the documentation provided with your host adapters for installation requirements and procedures.
2. Use the correct host adapter driver. For the latest supported host adapters and drivers, go to the following Web site: <http://www.ibm.com/pc/support>

Attach fiber-optic interface cables to each host adapter. You will connect the other end of the cables to the controller later in the installation process. For more information about handling fiber-optic cables, see “Installing fiber-optic cables” on page 227.

**Note:** Do not install the storage-management software at this time, if it is not already installed. Install the storage server completely before installing the software, because you cannot test the software installation until the hardware is connected.

## Getting started

Use the following list to prepare a storage server for installation:

1. Prepare the site to meet all area, environmental, power, and site requirements. For more information, see “Operating specifications” on page 180.
2. Move the storage server and its rack cabinet to the site.
3. Remove the storage server from its shipping container and check the contents. If any items are missing, contact your IBM reseller before proceeding.
4. Assemble the tools and equipment that you will need for installation. These might include:
  - Power cords (come with the storage server)
  - Screwdrivers (various sizes)
  - Antistatic protection (such as a grounding wrist strap)
  - Gigabit Interface Converters (GBICs)
  - Fibre Channel and Ethernet interface cables and cable straps
  - Rack-mounting hardware (comes with the storage server)
  - Storage-management software to configure the storage subsystems (comes with the storage server on the *IBM FAStT Storage Manager Version 7.02* installation CD)
5. Install the storage server in the rack. Rack mounting instructions and a template for aligning the holes in the rails and the rack come with the storage server. If you have misplaced these items, see “Rack mounting template and instructions” on page 228.
6. After you install the storage server in the rack, go to “Cabling the storage server”.

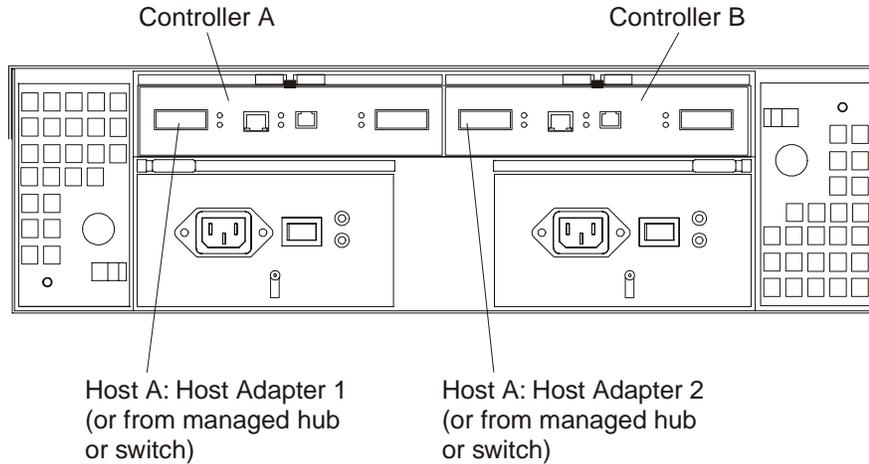
## Cabling the storage server

This section provides the storage server Fibre Channel and power cabling information. After you attach your storage server power cables, use the instructions that are provided in “Turning the storage server on and off” on page 197 for the initial startup of the storage server.

### Connecting hosts to the RAID controllers

To connect a host adapter to the RAID controller, do the following:

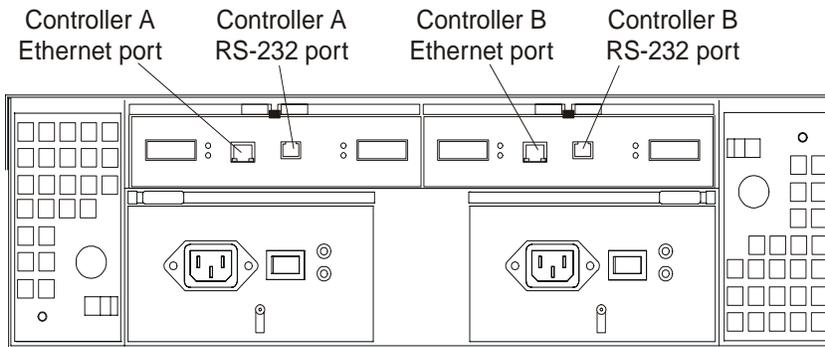
1. Install a GBIC in the host port on the RAID controller.
2. Connect the host-system cables to the RAID controller or to managed hubs and switches. The following figure shows the location on the RAID controllers where the host-system cables connect.



For examples of redundant, partially-redundant, and non-redundant host and drive loop configurations, see “Fibre Channel loop configurations” on page 190.

### Connecting secondary interface cables

Use the Ethernet interface ports on the back of the storage server to connect the controllers for direct management of the storage subsystems. Connect a pair of Ethernet cables from the storage-management station to the Ethernet ports for Controller A (located on the left) and Controller B (located on the right) on the back of the storage server. The following figure shows the location of the ports.



**Note:** The serial (RS-232) interface ports are intended to be used by service technicians to perform diagnostic operations on the storage server.

### Installing the storage-management software

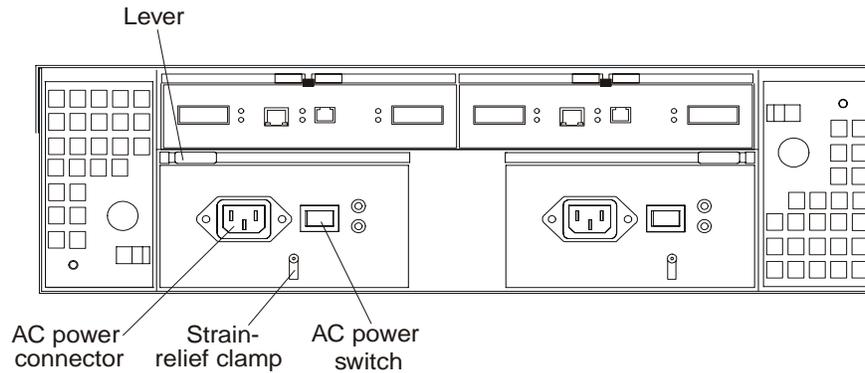
Install the storage-management software using the procedures in the software Installation and Support Guide for your operating system. Use that book and the online help to configure the logical drives, partitions and so on for the RAID controllers. Use your operating system documentation to make the new logical drives accessible to the operating system.

**Note:** Make sure that you start the storage-management software to continuously monitor the status of the storage server. For information about the importance of this information, see “Monitoring status through software” on page 183.

## Power cabling

The storage server uses two standard power cords. You can connect the power cords to a primary power unit inside the rack, such as a properly grounded ac distribution unit, or to an external source, such as a properly grounded electrical outlet.

If you have not already done so, attach the power cords, using the following figure for the location of the component parts.



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 power cord into a properly grounded electrical outlet.
5. Go to “Turning the storage server on and off” on page 197 for the initial startup of the storage server.

## Connecting additional expansion units

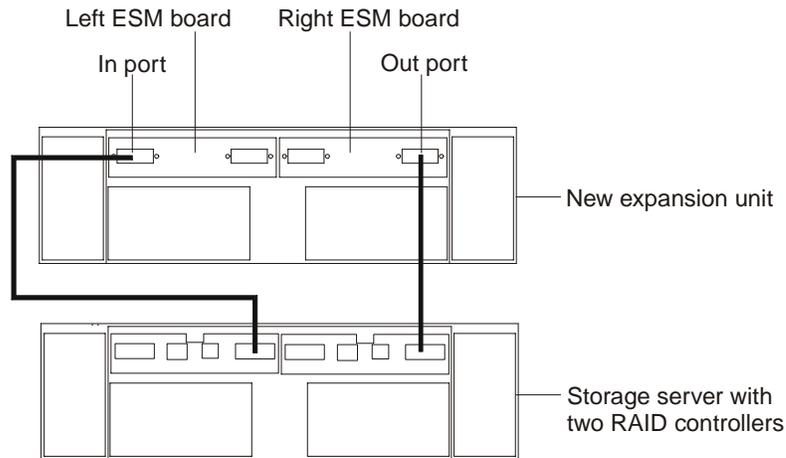
After you install the storage server, you can connect additional expansion units. You can do this at any time after you install the storage server, even while it is turned on and processing data. You can even install one expansion unit now, and an additional expansion unit later.

**Attention:** You can add only *new* expansion units to the storage server. This means that there must be no existing configuration information on the expansion unit you want to install. If the expansion unit that you want to install currently contains logical drives or configured hot spares, you must delete them before connecting the expansion unit to the storage server.

To connect an additional expansion unit, do the following:

1. Follow the instructions in your expansion unit installation manual to set up and mount the new expansion unit.
2. Use the following procedure and figure to connect a single expansion unit to the storage server:
  - a. Use a fiber-optic cable to connect to the FC-Expansion Units port on the left RAID controller in the storage server to the In port on the left ESM board of the expansion unit.
  - b. Use a second fiber-optic cable to connect the FC-Expansion Units port on the right RAID controller in the storage server to the Out port on the right ESM board of the expansion unit.

- c. Ensure that the left and right ESM board IDs (switch settings) are set to an identical value.

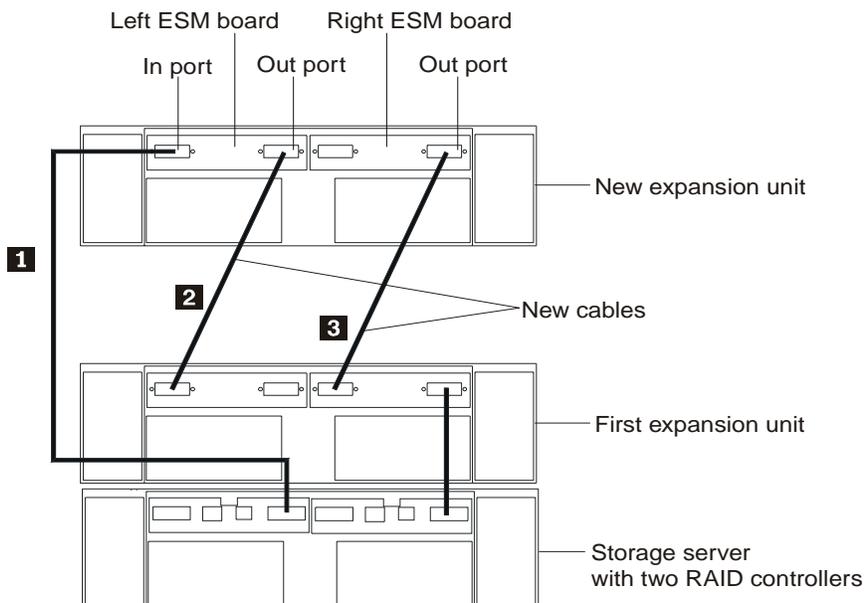


After you complete all connections, the storage server locates the new drives.

3. Use the storage-management software to check the status of the new drives, correct any errors found, and configure the new drives.

Use the following procedure and figure to connect a second expansion unit to the storage server after previously adding the first expansion unit.

1. Disconnect cable **1** from its current connection and connect it to the In port on the left ESM board on the new expansion unit.
2. Connect cable **2** to the In port you disconnected in step 1 and the Out port on the left ESM board on the new expansion unit.
3. Connect a third cable **3** to the In port on the right ESM board on the first expansion unit and the Out port on the right ESM board on the new unit.
4. Make sure that each expansion unit has a unique ID (switch setting) and that the left and right ESM board switch settings on each expansion unit are set to an identical value.



After you complete all connections, the storage server locates the new drives.

5. Use the storage-management software to check the status of the new drives, correct any errors found, and configure the new drives.

For more detailed information about cabling the storage server and expansion units, refer to the IBM FAStT200 Fibre Channel Cabling Instructions that come with the storage server.

## Operating the storage server

This section describes the tasks that are required to operate the storage server.

### Turning the storage server on and off

This section contains instructions for turning the storage server on and off under normal and emergency situations.

If you are turning on the storage server after an emergency shutdown or power outage, refer to “Restoring power after an emergency shutdown” on page 200.

**Turning on the storage server:** Use this procedure to turn on the power for the initial startup of the storage server.

1. Verify that:
  - a. All communication and power cables are plugged into the back of the storage server and a properly grounded ac electrical outlet
  - b. All hard disk drives are locked securely in place. For more information, see “Installing hot-swap drives” on page 203.

**Attention:** If you are restarting the system after a normal shutdown, wait at least 10 seconds before you turn on the power using the power-on sequence in step 2..

2. Check the system documentation for the hardware devices that you intend to power up, and then determine the proper startup sequence. Use the following power-on sequence, where applicable:
  - a. Turn on the power to the supporting devices (for example, Ethernet switches, managed hubs, and management stations) before the storage server.
  - b. You must turn on the expansion units before the storage server. The controllers might not recognize the correct configuration if the drives are powered up after the storage server. For instructions on powering up the expansion units, refer to the expansion-unit documentation.
  - c. Turn on the power to the storage server; then, restart or turn on the power to the host.

3. Turn on the power to each device, based on the power-on sequence in step 2.. To turn on power to the storage server, turn on the power-supply switches on the back of the storage server. You must turn on both power-supply switches to take advantage of the redundant power supplies.
4. Use the storage-management software and the Fault LEDs to check the overall status of the storage server and its components. All LEDs should be green on the front of the storage server. If they are not, use the storage-management software to diagnose the problem (see “Monitoring status through software” on page 183).

**Note:** The green Drive active LED and amber Drive fault LED below the drive CRUs might flash intermittently as the drives spin-up. Wait until the storage server is finished powering up before checking the LEDs on the front of the storage server. For more information, see “Checking the LEDs” on page 184.

## Turning off the storage server:

**Attention:** Except in an emergency, never turn off the power if any storage server Fault LEDs are on. Correct the fault before you turn off the power. This ensures that the storage server will power up correctly later. See “Diagnostics” on page 183.

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

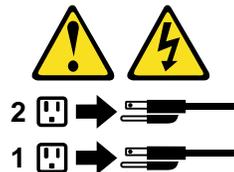
- Instructions in a hardware or software procedure require you to turn off the power.
- A service technician tells you to turn off the power.
- A power outage or emergency situation occurs (see “Performing an emergency shutdown” on page 199).

### Statement 5



#### CAUTION:

The power control button on the device and 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. Before proceeding, use the storage-management software to determine the status of the system components and special instructions. The operating system software might require you to perform other procedures before you turn off the power.
  2. Use the storage-management software to check the status of the storage server. Correct problems that are reported before you turn off the power.
  3. Do the following:
    - a. Stop all I/O activity to the storage server and attached expansion units. Make sure that:
      - All of the green Drive active LEDs on the front of the storage server (and on all attached expansion units) are not flashing.
      - The green Cache active LEDs on the back of the storage server are off.
    - b. If applicable, use the operating-system software to disconnect the storage server logical drives from the host before the storage server is powered off.
- Attention:** To turn off all power to the storage server, you must turn off both power-supply switches and disconnect both power cords. Use the procedure in step 4. for the proper shutdown sequence.
4. Turn off the power to each device based on the following shutdown sequence:

- a. Turn off power to the host before the storage server. If the host must stay powered on to support an existing network, refer to the operating system documentation for information about disconnecting the storage server logical drives from the host before the storage server is powered off.
- b. Turn off power to the storage server before you turn off power to the expansion units. Turn off both power supply switches on the back of the storage server.
- c. Turn off power to other supporting devices (for example, management stations, Fibre Channel switches, Fibre Channel managed hubs, or Ethernet switches).

**Note:** You do not need to perform this step if you are servicing only the storage server.

5. After you perform the necessary maintenance procedures, turn on the power using the procedure in “Turning on the storage server” on page 197.

**Restoring power after an unexpected shutdown:** The storage server might shut down unexpectedly under any of the following conditions.

**Attention:** There might be data loss in each of the following cases.

- The internal temperature of the storage server exceeds the maximum operating temperature (an overtemperature condition).

If both fan CRUs fail or are unable to maintain an internal temperature below 70°C (158°F), one or both of the power supplies in the storage server will shut down. If both power supplies shut down, the unit is inoperable.

The storage-management software warns you if the temperature of the unit is rising, before it has risen sufficiently to shut down the power supplies. The first warning comes when the storage server internal temperature exceeds 45°C (113°F). The storage server shuts down if the temperature rises to 70°C (158°F).

- There is a general power failure or a loss of power to the unit.
- You are forced to shut down the storage server without performing the normal shutdown procedures (listed in “Turning off the storage server” on page 198) because of an emergency situation.

**Attention:** To avoid damage to the hardware, take special care when restarting your system after an unexpected shutdown.

If the storage server shuts down unexpectedly, but there is still power to the site, use the storage-management software to determine if the storage server has overheated.

- If an overtemperature condition is indicated, use the procedure in “Restoring power after an overtemperature shutdown” on page 200 to restart the storage server.
- If the storage server has shut down because of a power failure or an emergency shutdown, use the procedure in “Restoring power after an emergency shutdown” on page 200 to restart the storage server.

*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 storage server loses power unexpectedly, it might be due to a hardware failure in the power system or midplane (see “Diagnostics” on page 183).

Use this procedure to shut down the storage server during an emergency:

1. If you have time, stop all I/O activity to the storage server by shutting down the host or disconnecting the storage server logical drives through the host.
2. Check the LEDs (front and back). Make note of any Fault LEDs that are on so you can correct the problem when you turn on the power again.
3. Turn off all power-supply switches; then, unplug the power cords from the storage server.

*Restoring power after an emergency shutdown:* Use this procedure to restart the storage server if you turned off the power-supply switches during an emergency shutdown, or if a power failure or a power outage occurred:

1. After the emergency situation is over or power is restored, check the storage server 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-supply switches are off; then, plug in the storage-server power cords.
3. Complete step 2 on page 197 to determine the proper power-on sequence for your system.
4. Complete step 3 on page 197 and step 4 on page 197 to turn on power to the devices in your system and to check the status of the storage server.

*Restoring power after an overtemperature shutdown:* Use this procedure to restart the storage server after an unexpected shutdown due to of an overtemperature condition:

1. Make sure that the power-supply switches on the back of the storage server are turned off.
2. Do whatever is necessary to cool the unit (replace the fans, use external fans to cool the room, and so on).
3. Check all components and cables for visible damage. *Do not start the storage server if you find evidence of damage.*
4. Complete step 2 on page 197 to determine the proper power-on sequence for your system.
5. When the internal temperature of the storage server is below 45°C (113°F), complete steps 3 on page 198 and 4 on page 197 to turn on power to the devices in your system and to check the status of the storage server.

## Cache memory and RAID controller battery

Each RAID controller contains 4 KB of cache data. It also contains a rechargeable battery that maintains data in the cache in the event of a power failure. The following sections describe these features and their associated LEDs.

### Cache memory

Cache memory is memory on the RAID controller that is used for intermediate storage of read and write data. Using cache memory can increase system performance. The data for a read operation from the host might be in the cache memory from a previous operation (thus eliminating the need to access the drive itself), and a write operation is completed when it is written to the cache, rather than to the drives.

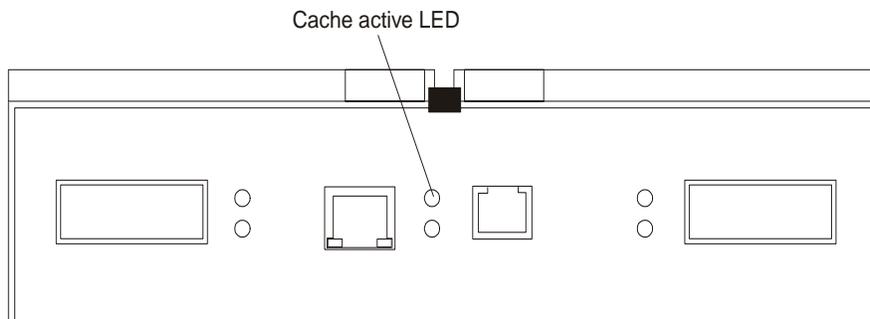
See the storage-management software documentation for information on setting cache memory options.

The RAID controller has a Cache active LED that displays the current status of the cache. The LED is on if there is data in the cache, and it is off if there is no data in the cache.

If caching is enabled and the Cache active LED never comes on during I/O activity, it indicates that the cache memory has failed or the battery has failed (the green Battery LED will be off).

**Note:** Always use the storage-management software to check your cache memory settings before assuming a hardware failure.

The following figure shows the location of the Cache active LED on the front of the RAID controller.



## RAID controller cache battery

Each RAID controller contains a sealed, rechargeable 4-volt lead-acid battery. This battery provides cache backup for up to three days in the event of a power loss.

The service life of the battery is three years, after which time the battery must be replaced. The battery is not customer replaceable. If it fails, you must call a field service representative to replace it. Refer to the storage-management software for information on how to view and set the battery expiration date.

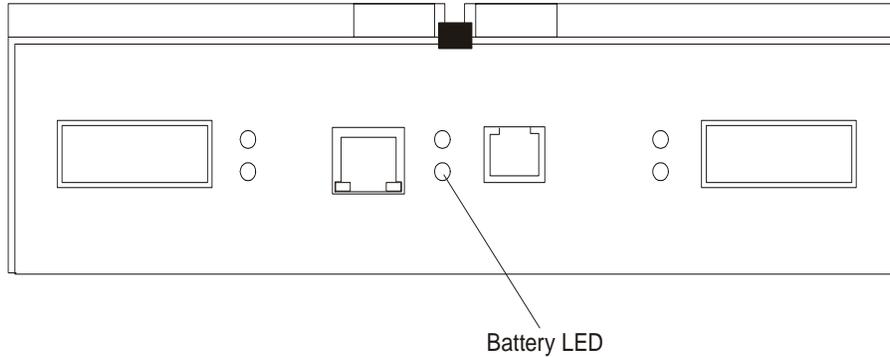
Each RAID controller has a green Battery LED on the back that indicates the battery status, as follows:

- The LED is on and remains steady when the battery is fully charged.
- The LED flashes when the battery is charging or performing a self-test.
- The LED is off if the battery or the battery charger has failed.

The battery performs a self-test at startup and every 25 hours thereafter (during which time the Battery LED flashes). If necessary, the battery begins recharging at that time. If the battery fails the self-test, the Battery LED turns off, indicating a battery fault.

Data caching starts after the battery completes the startup tests.

The following figure shows the location of the Battery LED on the front of the RAID controller.



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## Installing and replacing options

### Handling static-sensitive devices

**Attention:** Static electricity can damage storage server components or options. To avoid damage, keep static sensitive devices in their static protective bag until you are ready to install them.

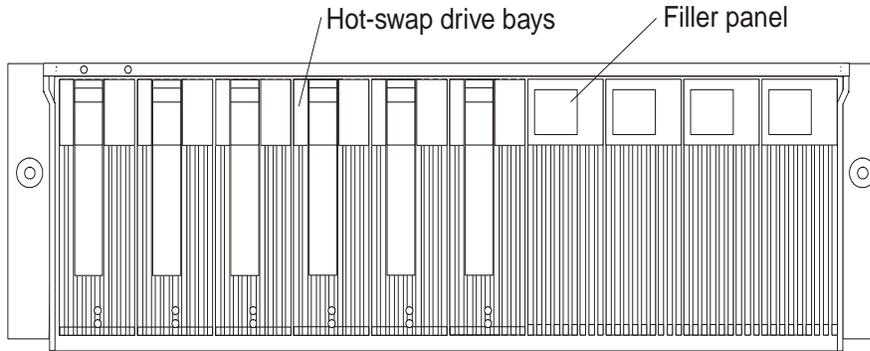
To reduce the possibility of electrostatic discharge (ESD) when you handle options and storage server components, observe the following precautions:

- 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 anti-static package, touch it to an unpainted metal part of the storage server 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 storage server without setting it down. If it is necessary to set the device down, place it on its static-protective package. Do not place the device on your storage server cover or any metal surface.
- Take additional care when handling devices during cold weather as heating reduces indoor humidity and increases static electricity.

### Working with hot-swap drives

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

The following figure shows the location of the hot-swap drive bays that are accessible from the front of the storage server. In this figure, six of the 10 bays contain drive CRUs and four bays contain filler panels. To maintain proper cooling within the storage server, always keep a filler panel in each drive bay that does not contain a drive CRU.



**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 on and not flashing.

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

#### Filler panels

Storage servers without a full set of drives (10) contain filler panels in the unused drive bays. Before installing new drives, you must remove the filler panels. Save the filler panels for future use. Each of the 10 bays must always contain either a filler panel or a drive CRU. Each filler panel contains a filler piece for use with a slim drive.

**Drive CRUs** The RAID controller supports up to 10 (half-high or slim) 40-pin Fibre Channel 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 storage server.

**Drive LEDs** Each drive CRU has two LEDs that indicate the status for that particular drive. For information about the drive LED operating states and descriptions, see “Storage server LEDs (front)” on page 184.

#### Fibre Channel loop IDs

When you install a drive CRU in the storage server, the drive CRU connects into a printed circuit board called the *midplane*. The midplane automatically sets the Fibre Channel loop ID to the default value 00.

#### Hot-swap hardware

The storage server contains hardware that you can use to replace a failed hard disk drive without turning off the storage server. Therefore, you can continue operating the system while a hard disk drive is removed or installed. These drives are known as *hot-swap* drives.

**Slim drives** You can install slim, hot-swap drive CRUs, which are slightly smaller 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 drive, you must also install one of the filler pieces that are provided in the filler panels.

### Installing hot-swap drives

Before you begin, you should perform the following:

- Read the safety and handling guidelines provided in “Electrical safety” on page 463 and “Handling electrostatic discharge-sensitive devices” on page 464.

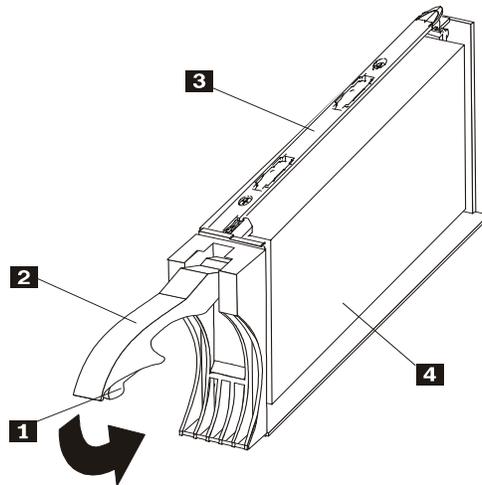
- Ensure that the current system configuration is working properly.
- Back up all important data before you make changes to storage devices, such as hard disk drives.

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

**Note:** If you are replacing a drive, see “Replacing hot-swap drives” on page 205.

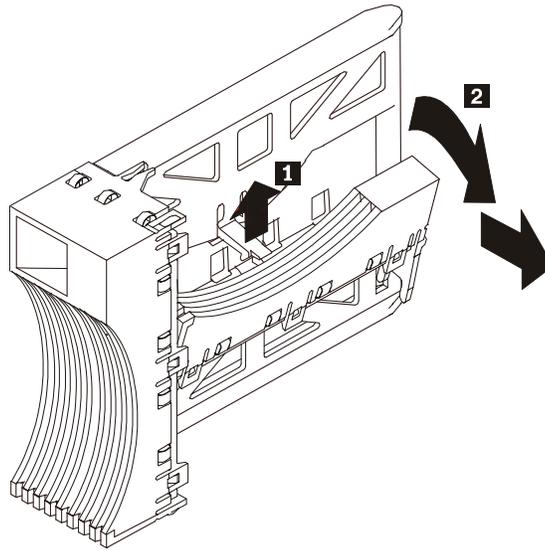
1. Read the instructions that come with the drive CRU.
2. Check for Fault LEDs. If any amber LEDs are lit, see “Checking the LEDs” on page 184 and “Symptom-to-FRU index” on page 232.
3. Determine the bay into which you want to install the drive.
4. Remove the filler panel.
  - a. Insert a finger into the square hole at the top of the filler panel to grip and pull the tray out of the drive bay.
  - b. Save the filler panel 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**.

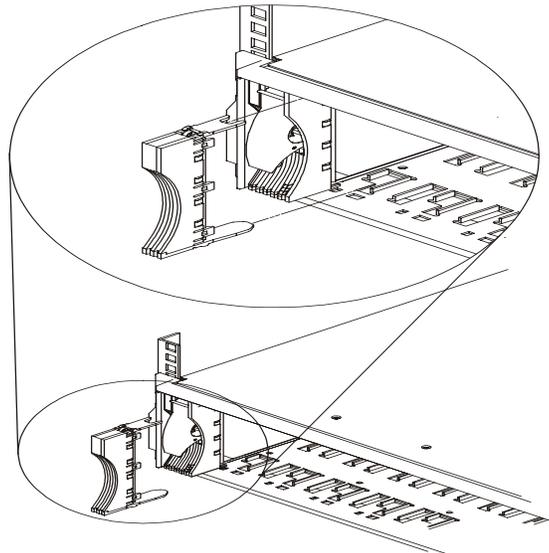


- a. Release the blue latch **1** on the drive CRU by pressing on the inside of the bottom of the tray handle.
  - b. Pull the handle **2** on the tray out into the open position.
  - c. Slide the drive CRU into the empty bay until the tray handle **2** touches the Storage Server bezel.
  - d. Push the 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 on page 205.
    - a. Locate the filler piece on the inside of the filler panel.
    - b. Pull up on the small latch **1** inside the filler panel to release the filler piece.

- c. Tilt the filler piece up from the filler panel **2**; then, remove it from the tray as shown in the following figure.



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



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. Use the storage-management software to configure the drive.

## 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. This includes transmission

problems between the host controllers, the RAID controllers, and the drives. This section explains how to replace a failed drive.

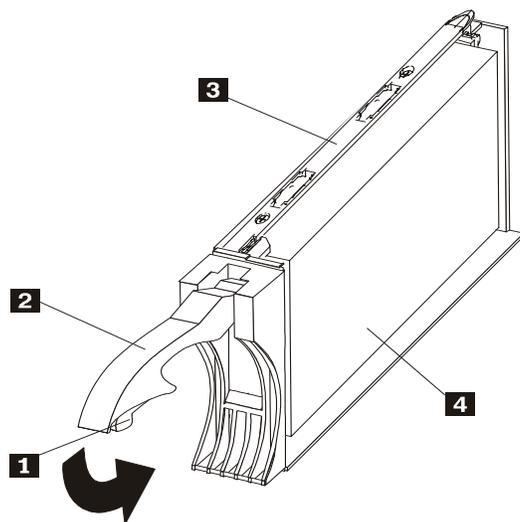
**Attention:** Failure to replace the drives in their correct bays might result in loss of data. If you are replacing a drive that is part of a RAID level 1 or RAID level 5 logical drive, ensure that you install the replacement drive in the correct bay.

Use the following procedure to replace host-swap drives.

1. Check the hardware and software documentation that is provided with the system to see whether there are restrictions regarding hard disk drive configurations. Some system Fibre Channel configurations might not allow mixing different drive capacities or types within an array.
2. Check the storage-management software for recovery procedures for a drive that has failed. Follow the steps in the software procedure before continuing with this procedure.
3. 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 Drive fault LED is on and not flashing or when the drive is inactive with the green Activity LED on and not flashing.

4. 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 storage server to allow for the drive to spin down.



- e. Verify that there is proper identification (such as a label) on the drive CRU, and then slide it completely out of the storage server.
  - f. If you are replacing a slim drive, ensure that the filler piece remains in place for use with the new drive.
5. Install the new drive CRU.

- a. Gently push the drive CRU into the empty bay until the tray handle **2** touches the storage-server bezel.
  - b. Push the tray handle **2** down into the closed (latched) position.
6. Check the drive LEDs.
  - a. When a drive is ready for use, the green Activity LED is on, and the amber Drive fault LED is off.
  - b. If the amber Drive fault LED is on and not flashing, remove the drive from the Storage Server and wait 10 seconds; then, reinstall the drive.
7. Return to normal operation.

## Upgrading drives

You can upgrade drives in two ways:

- Adding drives to empty slots in the storage server (see “Installing hot-swap drives” on page 203).
- Replacing existing drives with larger capacity drives.

### Adding larger capacity drives

This section provides guidelines for upgrading the drives in the storage server. Read the software documentation and this entire section to determine whether you should use this procedure, use a modified version of this procedure, or use a different procedure that is provided by your operating system. *Instructions that are provided with your software should supersede anything stated in this book.*

There are two methods for upgrading drives:

#### Replacing all the drives at the same time

This method requires that you back up the data on the affected drives and then turn off the storage server. After replacing all the drives, you must reconfigure the new drives and restore data from backup. See the procedure in “Replacing all drives at the same time” on page 208.

This is the safest way to exchange drives without losing data. However, this method might take a long time to complete because of the backup, reconfiguration, and restoration processes. In addition, other users are not able to use the storage server (or any expansion units attached to the storage server) until you finish the procedure. You must use this method on RAID 0 logical drives.

#### Replacing the drives one at a time

In this method, you manually fail each drive, replace it, and wait for the system to restore data to the new drive before installing the next drive. After you install the new drives, you can configure them to make the additional drive space available. See the procedure in “Replacing the drives one at a time” on page 210.

Using this method, you can replace the drives while the storage server is running, eliminating the down time that is required if you replace all the drives at once. However, this method is more risky because you can lose data if the drive restoration or storage subsystem reconfiguration process fails. In addition, the reconstruction process might take a long time. This method works only on redundant logical drives (RAID 1, 3, or 5). You cannot use this method with any drives containing RAID 0 logical drives.

Consider backing up your data if you use this method. This safeguards your data if the restoration and reconfiguration process fails or the new drive malfunctions.

The method you use depends on the following considerations:

- Which method most closely matches the recommended drive upgrade procedure that is provided in the operating system or the storage-management software documentation
- Which RAID level is used on the affected drives (RAID 0 requires you to replace all the drives at the same time)
- How much downtime is acceptable as you swap the drives

## Replacing all drives at the same time

Use this procedure to replace all drives at the same time. You must use this method if you are upgrading drives containing RAID 0 logical drives. All the data currently on the drives is lost when you replace the drives; therefore, you must back up all data that is currently on the drives. This procedure also requires you to turn off the storage server, which makes the storage server (and any attached expansion units) inaccessible to other users.

To replace all the drives at the same time, do the following.

1. Read the following:
  - The information in “Adding larger capacity drives” on page 207, particularly the paragraphs that discuss the differences between the two possible upgrade procedures.
  - The information in your software documentation regarding drive upgrades and installation.
  - The documentation that comes with the new drives.

Read all precautionary notes, kit instructions, and other information. Kit instructions often contain the most current information regarding the drives and their installation, plus upgrade or servicing procedures. Compare the kit instructions with this procedure to determine whether you need to modify this procedure.

2. Use the storage-management software to check the status of the storage server. Correct any problems that are reported.
3. Perform a complete backup of the drives that you are replacing.

You need the backup to restore data on the drives later in this procedure.

**Attention:** When you handle electrostatic discharge (ESD) sensitive devices, take precautions to avoid damage from static electricity. For details about handling ESD-sensitive devices, see “Handling static-sensitive devices” on page 202.

4. Unpack the new drives.

Set the drives on a dry, level surface away from magnetic fields. Save the packing material and documentation in case you need to return the drives.

5. Do the following:
  - a. Stop all I/O activity to the storage server and attached expansion units. Make sure that:
    - (1) All of the green Drive activity LEDs on the front of the storage server (and on all attached expansion units) are not flashing.
    - (2) The green Cache active LEDs are off on the front of the RAID controllers.

- b. If applicable, use the operating system software to disconnect the storage server logical drives from the host before the storage server is powered off.

**Attention:** To turn off all power to the storage server, you must turn off both power-supply switches and disconnect both power cords. Use the procedure in step 6. for the proper shutdown sequence.

6. Turn off the power to each device based on the following shutdown sequence:
  - a. Turn off power to the host before the storage server. If the host must stay powered on to support an existing network, refer to the operating system documentation for information about disconnecting the storage server logical drives from the host before the storage server is powered off.
  - b. Turn off power to the storage server before you turn off power to the expansion units. Turn off both power supply switches on the back of the storage server.
  - c. Turn off power to other supporting devices (for example, management stations, Fibre Channel switches, Fibre Channel managed hubs, or Ethernet switches).

**Note:** You do not need to perform this step if you are servicing only the storage server.
7. Use the procedures in “Replacing hot-swap drives” on page 205 to remove the drives that you want to replace. Use the procedures in “Installing hot-swap drives” on page 203 to install the new drives into the storage server.
8. After you install all the new drives, check the system documentation for the hardware devices that you intend to power up, and then determine the proper startup sequence. Use the following power-on sequence, where applicable:
  - a. Turn on the power to the supporting devices (for example, Ethernet switches, managed hubs, and management stations) before the storage server.
  - b. You must turn on the expansion units before the storage server. The controllers might not recognize the correct configuration if the drives are powered up after the storage server. For instructions on powering up the expansion units, refer to the expansion-unit documentation.
  - c. Turn on the power to the storage server; then, restart or turn on the power to the host.
9. Turn on the power to each device, based on the power-on sequence in step 8. To turn on power to the storage server, turn on the power-supply switches on the back of the storage server. You must turn on both power-supply switches to take advantage of the redundant power supplies.
10. Check the green Drive activity LED and the amber Drive fault LED below the new drive CRUs.

Make sure that the Drive activity LEDs are on and the Drive fault LEDs are off.

**Note:** The Drive fault LEDs might flash intermittently while the drives spin up.

  - If the Drive activity LED is off, the drive CRU might not be installed correctly. Remove the drive CRU, wait 30 seconds, and then reinstall it.
  - If the Drive fault LED stays on or the Drive activity LED stays off, the new drive might be faulty. Refer to the storage-management software for problem determination.
11. Use the storage-management software to configure the new drives. See the storage-management software online Help for detailed instructions.
12. Restore the data from backup to all the drives.

## Replacing the drives one at a time

Use this procedure to replace all the drives one at a time. You cannot use this procedure on RAID 0 logical drives (use the procedure in “Replacing all drives at the same time” on page 208).

**Note:** If your storage subsystem has hot spares assigned, you might want to unassign the hot spares while you perform this procedure. If you do not, reconstruction might start on the hot spare before you insert the new drive. The data on the new drive is still rebuilt, but the process takes longer for each drive. Remember to reassign the hot spares when you are finished with this procedure.

To replace the drives one at a time, do the following:

1. Read the following:
  - The information in “Adding larger capacity drives” on page 207, particularly the paragraphs that discuss the differences between the two possible upgrade procedures.
  - The information in your software documentation regarding drive upgrades and installation.
  - The documentation that comes with the new drives.

Read all precautionary notes, kit instructions, and other information. Kit instructions often contain the most current information regarding the drives and their installation, plus upgrade or servicing procedures. Compare the kit instructions with this procedure to determine if you need to modify this procedure.

2. Use the storage-management software to check the status of the unit. Correct any problems that are reported.
3. Back up the data on the drives that you are replacing (optional).

**Attention:** When you handle electrostatic discharge (ESD) sensitive devices, take precautions to avoid damage from static electricity. For details about handling ESD-sensitive devices, see “Handling static-sensitive devices” on page 202.

4. Unpack the new drives.

Set the drives on a dry, level surface away from magnetic fields. Save the packing material and documentation in case you need to return the drives.

5. Using the storage-management software, manually fail the first drive that you want to replace. Make sure that:

- You fail only one drive
- The software status display shows a failed status for the appropriate drive
- The amber Drive fault LED (on the front bezel below the drive) is on

**Attention:** Removing the wrong drive can cause data loss. Make sure that you remove only the failed drive CRU. The Drive fault LED below the failed drive CRU should be on.

If you remove an active drive accidentally, wait at least 30 seconds and then reinstall it. Refer to the storage-management software for further recovery instructions.

6. Use the procedures in “Replacing hot-swap drives” on page 205 to remove the failed drive. Use the procedures in “Installing hot-swap drives” on page 203 to install the new drives into the storage server.

The new drive automatically reconstructs the data after you install it in the drive slot.

During data reconstruction, the amber Drive fault LED might come on for a few minutes, then turn off when the green Drive activity LED begins flashing. A flashing Drive activity LED indicates that data reconstruction is in progress.

**Note:** If your storage subsystem has active hot spares, data might not start copying to the new drive until the data is reconstructed on the hot spare. This increases the time that is required to complete the procedure.

7. Check the green Drive activity LED and the amber Drive fault LED below the new drive CRUs.

Make sure that the Drive activity LEDs are on and the Drive fault LEDs are off.

**Note:** The Drive fault LEDs might flash intermittently while the drives spin up.

- If the Drive activity LED is off, the drive CRU might not be installed correctly. Remove the drive CRU, wait 30 seconds, and then reinstall it.
- If the Drive fault LED stays on or the Drive activity LED stays off, the new drive might be faulty. Refer to the storage-management software for problem determination.

8. Use the storage-management software to monitor the status of the new drive and the progress of the data reconstruction. Wait for data reconstruction to finish (the Drive activity LED stops flashing).

**Note:** The Drive activity LED will continue to flash after reconstruction is finished if there is I/O activity to that drive. In that case, use the host software to determine if the data reconstruction is finished.

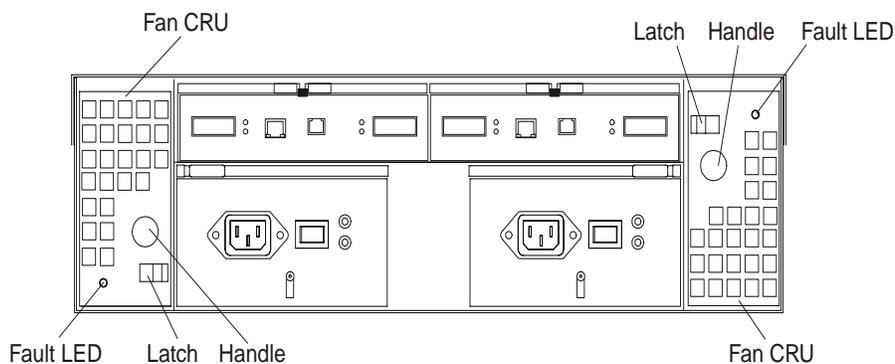
9. When reconstruction is finished on the new drive, repeat step 5 on page 210 through step 8. for each additional drive that you want to install.
10. Use the storage-management software to configure the additional space on the new drives.

## Working with hot-swap cooling fans

The storage server cooling system consists of two fan CRUs, each containing two fans. The fan CRUs circulate air inside the unit by pulling in air through the vents on the front of the drive CRUs and pushing out air through the vents in the back of each fan CRU.

If two fans fail, or the fans cannot maintain an internal temperature below 70°C (158°F), the power supplies in the unit automatically shut down (an overtemperature condition). If this occurs, you must cool the unit and restart it. See “Restoring power after an overtemperature shutdown” on page 200.

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



**Fan CRUs** The two fan CRUs are hot-swappable and redundant.

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

**Latches and handles**

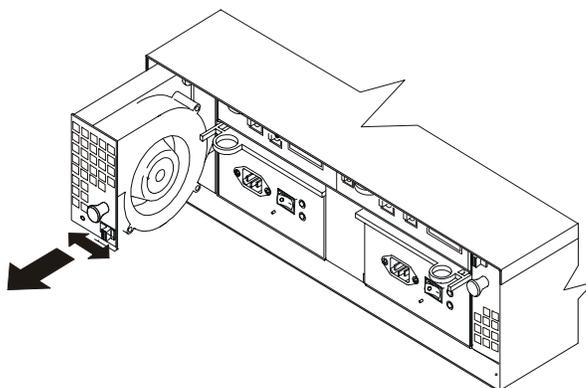
Use the latches and handles to remove or install the fan CRUs.

**Attention:** Do not run the storage server without adequate ventilation and cooling, because it might cause damage to the internal components and circuitry.

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 storage server.
2. If the amber Fault LED is on, remove the fan CRU that has failed.
  - a. Slide the latch to unlock the fan CRU.
  - b. Use the handle (black knob) to pull the fan from the storage server.



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 storage server.
  - c. Release the latch. If the lever remains open, pull back on the fan slightly, and 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 “Diagnostics” on page 183.

## Working with hot-swap power supplies

The storage server power system consists of two power supply CRUs. The power supply CRUs provide power to the internal components by converting incoming ac voltage to dc voltage. One power supply CRU can maintain electrical power to the unit if the other power supply is turned off or malfunctions. The power supply CRUs are interchangeable (by reversing the locking levers).

Each power supply CRU has a built-in sensor that detects the following conditions:

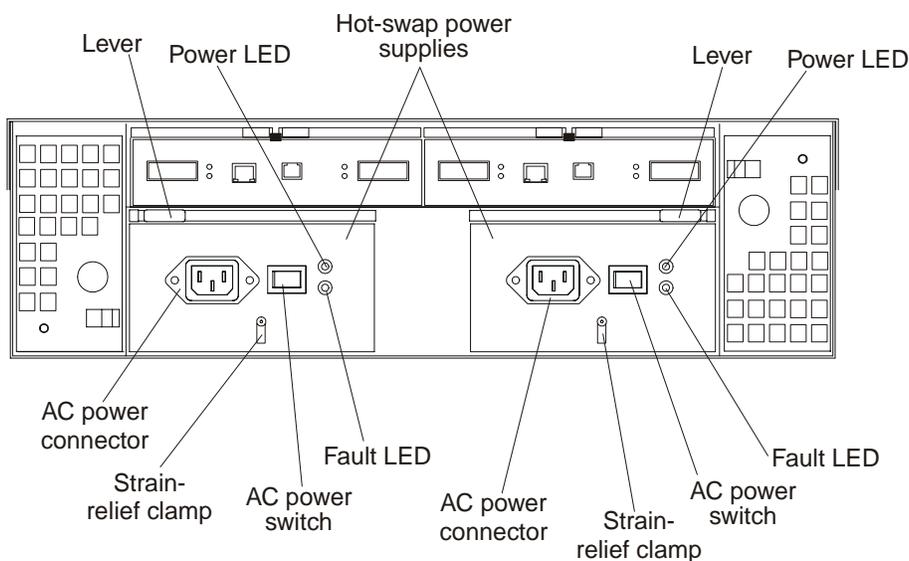
- Over-voltage
- Over-current
- Overheated power supply

If any of these conditions occurs, one or both power supplies shut down. All power remains off until you cycle the power switches (turn the power switches off, wait at least 30 seconds, then turn the power switches on). For more information, see “Restoring power after an emergency shutdown” on page 200 and “Restoring power after an overtemperature shutdown” on page 200.

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

- Always keep the power supplies in their proper places to maintain proper controller-unit cooling.
- Use only the supported power supplies for your specific storage server.

The power-supply controls on the rear of the storage server are shown in the following figure.



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

**Power LED** These green LEDs light when the storage server is turned on and receiving ac power.

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

**AC power switches**

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

**AC power connectors**

This is the connection for the ac power cord.

**Strain-relief clamp**

Use this clamp to provide strain relief on the power cord.

## Removing a hot-swap power supply

**Statement 8**



**CAUTION:**

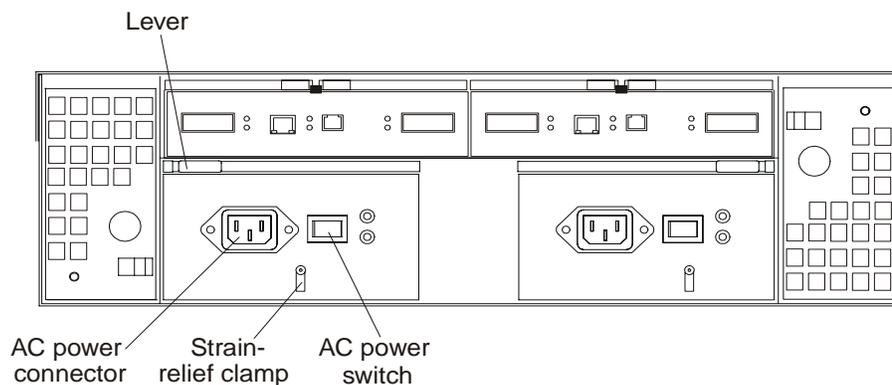
Never remove the cover on a power supply or any part that has the following label attached.



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 off the ac power switch.

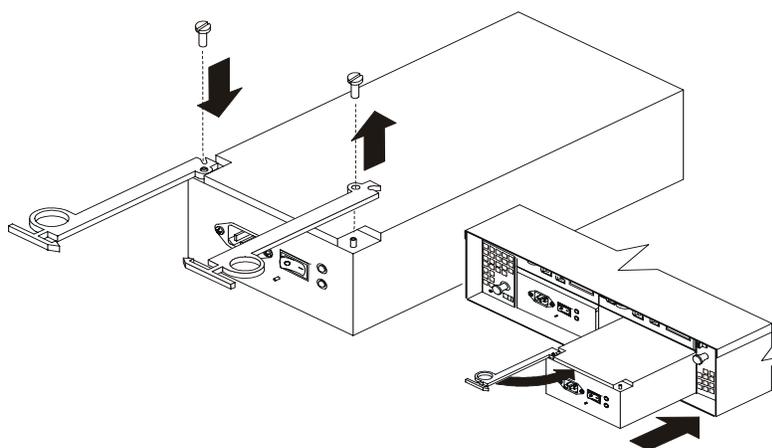


2. Unplug the power cord from the electrical outlet.

3. Disconnect the power cord from the ac power connector on the power supply.
4. Remove the nut and strain-relief clamp from the rear of the power supply.
5. Remove the power supply from the storage server, as follows:
  - 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 that has failed, ensure that the power supply latch is mounted on the side of the power supply that faces the middle of the storage server. If it is 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:**

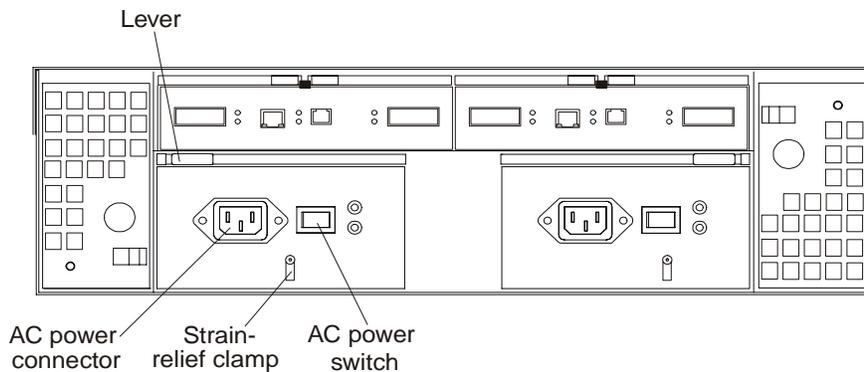
Never remove the cover on a power supply or any part that has the following label attached.



**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 is off on the power supply that you are installing.
2. Install the power supply in the storage server, as follows:

- a. Slide the power supply into the storage server. Make sure that the lever is pulled straight out as you slide the power supply into the storage server.
  - b. Close the lever until the pull-ring latch locks in place. Make sure that the lever locks into place in the storage-server chassis.
3. Wrap the strain-relief 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 AC power connector.



6. Plug the power cord into a properly grounded electrical outlet.
7. Turn on the power-supply switch.
8. Make sure that the green Power LED on the new power-supply CRU is on and the amber Fault LED is off.
  - If the Power LED is off, the power-supply CRU might not be installed correctly. Remove it and then reinstall it.
  - If the Fault LED is on or the Power LED stays off, refer to the storage-management software for problem determination.

For more information about the LEDs, see “Checking the LEDs” on page 184.

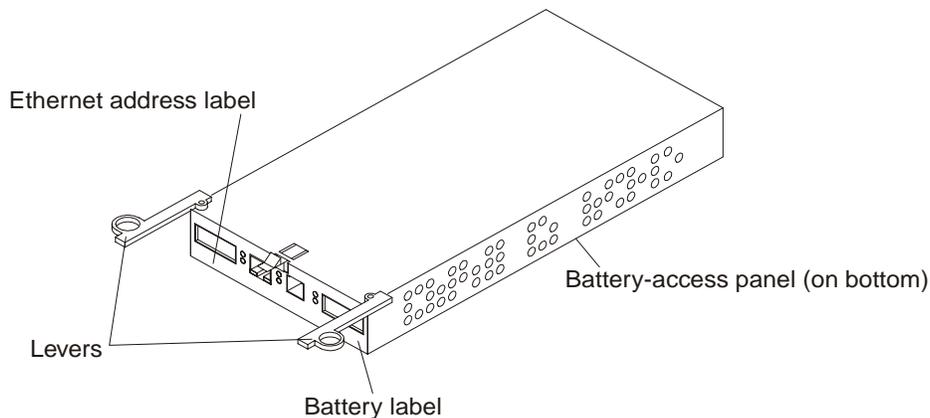
## Working with hot-swap RAID controllers

**Attention:** To prevent overheating, replace the RAID controller or blank filler within 30 minutes of removal. If the RAID controller or filler is removed for more than 30 minutes, you might get a nominal overheating warning indication.

Each RAID controller fits into the back of the storage server and has the following components:

- Battery
- Cache memory
- One host port and one expansion port
- One Ethernet port
- One RS-232 port

Each RAID controller has a unique hardware Ethernet address that is printed on a label on the front. There is also a label giving the installation and expiration date of the battery. The following figure shows the location of these items.



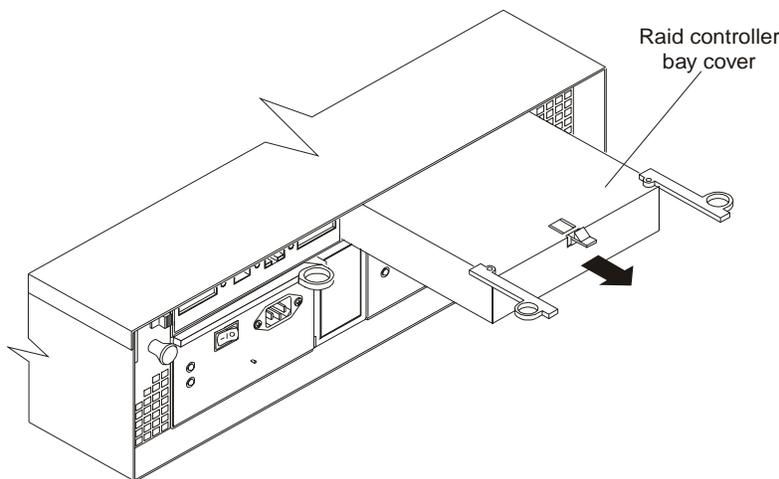
For information about the RAID controller cache memory and rechargeable battery, see "Cache memory and RAID controller battery" on page 200.

### Adding a second RAID controller

Use the following procedure to install a second RAID controller if you have Model 3542-1RU storage server and have purchased the FAStT200 Redundant RAID Controller option.

**Note:** The FAStT200 Redundant RAID Controller option comes with a RAID controller cache battery installed.

1. To remove the RAID controller bay cover, use the following figure and procedure:



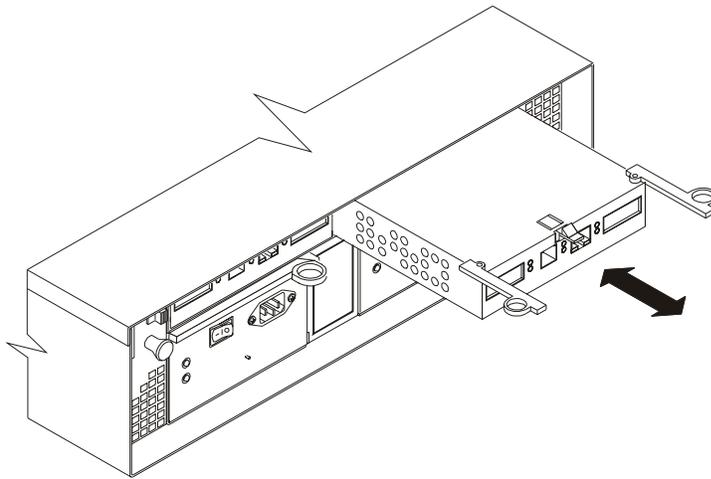
- a. Push down on the latch (centered above the RAID controller bay cover). The levers pop out of the locked position.
- b. Grasp the pull-rings; then, pull on the levers and remove the RAID controller bay cover.

**Attention:** When you handle electrostatic discharge (ESD) sensitive devices, take precautions to avoid damage from static electricity. For details about handling ESD-sensitive devices, see "Handling static-sensitive devices" on page 202.

2. Unpack the new RAID controller.

Set the RAID controller on a dry, level surface away from magnetic fields. Save the packing material and documentation in case you need to return the RAID Controller CRU.

3. Review all documentation that comes with the new RAID controller for updated replacement procedures and other information.
4. Write the battery replacement information on the label on the front of the new RAID controller CRU.
  - Date of Installation – Write today's date
  - Replacement Date – Write the date three years from now
5. Install the new RAID controller, as shown in the following figure.



- a. Slide the RAID controller all the way into the empty slot.
- b. Close both levers until the latch locks into place.

**Attention:** When you add a second RAID controller, the storage-management software automatically synchronizes the firmware between the existing controller and the new controller. After adding a second RAID controller, always use the storage-management software to verify the firmware levels and non-volatile static random access memory (NVS RAM) files.

6. Insert the GBICs according to the instructions in “Installing GBICs” on page 226.
7. Connect the Fibre Channel cables, using the instructions in “Working with GBICs and fiber-optic cables” on page 225. For information about connecting the storage server to other devices, see “Fibre Channel loop configurations” on page 190 and “Cabling the storage server” on page 193.
8. Wait approximately one minute, and then check the green Host Loop LED, the green Expansion Loop LED, and the amber Fault LED on the new RAID controller CRU.
  - If the Host loop LED or the Expansion Loop LED is off, the RAID controller CRU might not be inserted correctly. Remove the CRU and reinsert it.
  - If the Fault LED is on, the Host loop LED and the Expansion loop LED stay off, or any other Fault LED is on, refer to the storage-management software for problem determination.
9. Refer to the storage-management software online help for instructions about downloading the redundant 3542-2RU NVSRAM files and bringing the controller online.

## Replacing a RAID controller

When instructed to do so by the storage-management software, replace a RAID controller that has failed.

**Note:** The replacement RAID controller CRU does not come with a RAID controller cache battery installed. You must remove the cache battery that is inside the existing RAID controller that you are replacing, and install that battery inside the replacement RAID controller CRU. The steps to remove and replace the battery are included in the following procedure.

To replace a RAID controller, do the following:

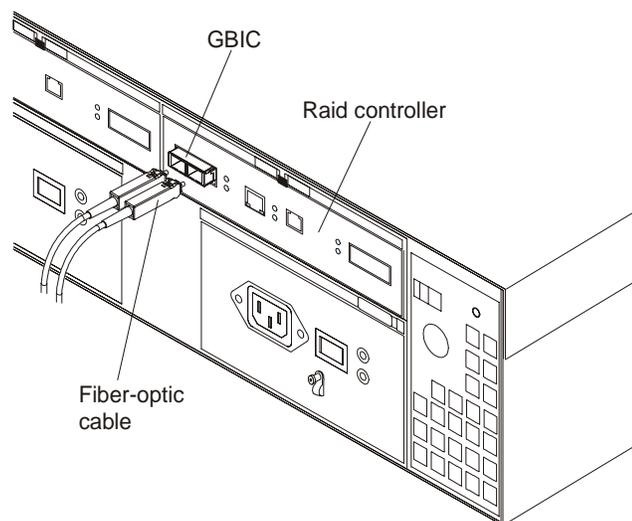
1. Check the storage-management software for instructions on RAID controller failure-recovery procedures. Follow the steps provided in the software documentation before continuing with step 2.
2. If you have redundant RAID controllers (dual-controller configuration), use the storage-management software to take the RAID controller that has failed offline.

**Attention:** To prevent data loss if you have a single controller configuration, you must shutdown your system before you can replace the RAID controller. For the proper shutdown sequence, see “Turning off the storage server” on page 198.

3. Label each cable that connects to the RAID controller that has failed. This ensures that all cables will be properly reconnected to the new RAID controller.

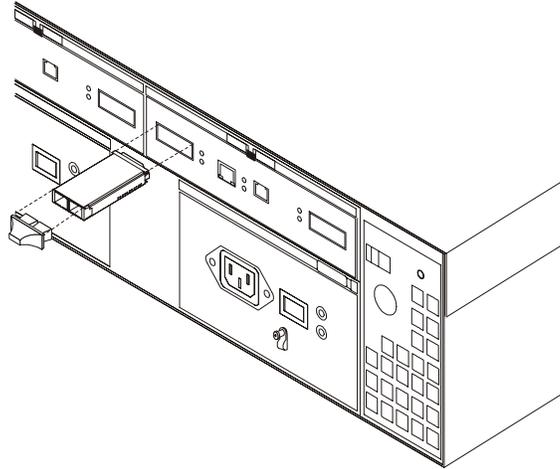
**Attention:** Handle and install fiber-optic cables properly to avoid degraded performance or loss of communications with devices. When working with fiber-optic cables, do not pinch them, step on them, or locate them in aisles or walkways. Do not overtighten the cable straps or bend the cables to a radius smaller than 76 mm (3 in.).

4. From the RAID controller that has failed, remove the Fibre Channel cables from the GBICs. The location of these components is shown in the following figure.

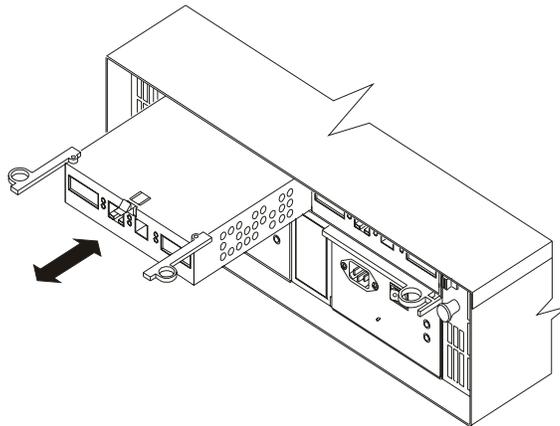


After removing the Fibre Channel cables, insert the protective caps.

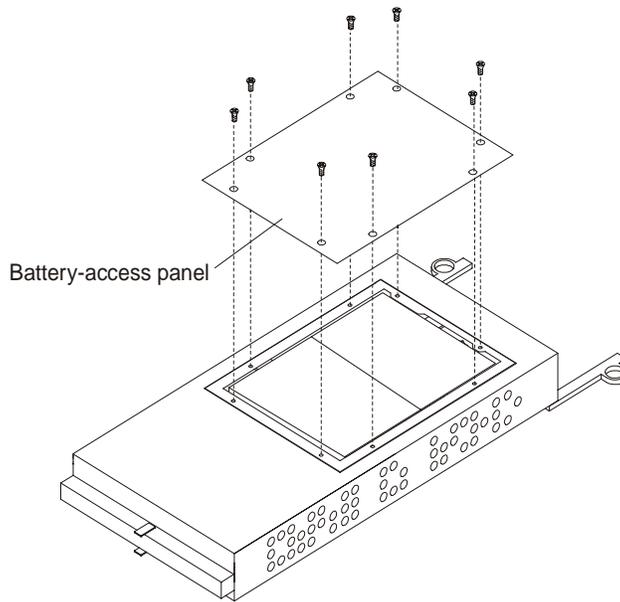
5. Use the following procedure to remove the GBICs from the RAID controller that has failed.
  - a. Move the metal latch on the GBIC to the unlocked (center) position.



- b. Pull the GBIC out of the port.
    - c. Insert the protective cap on the GBIC.
  6. Remove the failed RAID controller (the Fault LED is on), as follows:
    - a. Push down on the latch (centered above the RAID controller). The levers pop out of the locked position.



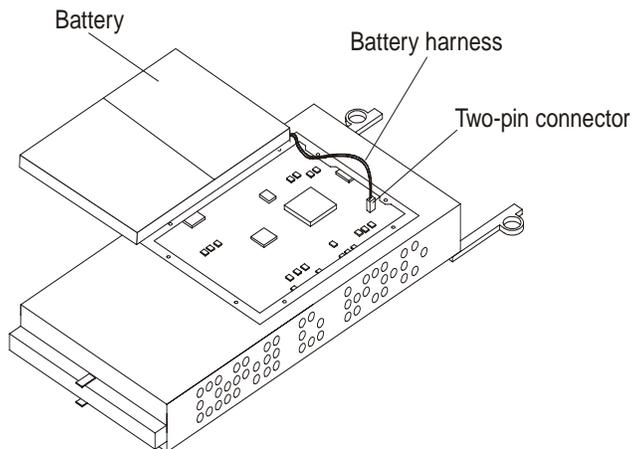
- b. Grasp the pull-rings; then, pull on the levers and remove the RAID controller.
    7. To remove the cache battery, use a Phillips head screwdriver to remove the eight screws from the battery access panel on the bottom of the RAID controller that you just removed, as shown in the following figure.



8. Lift the battery out of the RAID controller.

**Note:** If you cannot lift out the battery, turn over the RAID controller and hold it upside-down so that the battery is close above a flat surface and let it fall out. Do not let the battery pull on the battery harness.

9. Disconnect the battery harness on the battery from the two-pin connector on the controller board, and remove the battery, as shown in the following figure.



Set the battery on a dry, level surface.

**Attention:** When you handle electrostatic discharge (ESD) sensitive devices, take precautions to avoid damage from static electricity. For details about handling ESD-sensitive devices, see "Handling static-sensitive devices" on page 202.

10. Unpack the new RAID controller.

Set the RAID controller on a dry, level surface away from magnetic fields. Save the packing material and documentation in case you need to return the RAID controller.

11. Using a Phillips head screwdriver, remove the eight screws from the battery access panel on the bottom of the replacement RAID controller CRU.
12. Connect the battery harness on the battery to the two-pin connector on the controller board.
13. Position the battery inside the replacement RAID controller, and replace the battery-access panel.
14. Copy the battery replacement information from the label on the front of the failed RAID controller to the label on the front of the replacement RAID controller CRU.
15. Install the new RAID controller, as follows:
  - a. Slide the RAID controller all the way into the empty slot.
  - b. Close both levers until the latch locks into place.

**Attention:** When you replace the failed RAID controller, the storage-management software automatically synchronizes the firmware between the existing controller and the new controller. After replacing a controller, always use the storage-management software to verify the firmware levels and NVSRAM files.

16. Insert the GBICs according to the instructions in “Installing GBICs” on page 226.
17. Connect the Fibre Channel cables to their original locations, according to the instructions in “Installing fiber-optic cables” on page 227.
18. If you have a single-controller configuration, turn on power to the storage server and attached devices. For the proper power-on sequence, see “Turning on the storage server” on page 197.
19. Wait approximately one minute, and then check the green Host Loop LED, green Expansion Loop LED, and amber Fault LED on the new RAID controller.
  - If the Host Loop LED or the Expansion Loop LED is off, the RAID controller might not be inserted correctly. Remove the CRU and reinsert it.
  - If the Fault LED is on, the Host Loop LED and the Expansion Loop LED stay off, or any other Fault LED is on, refer to the storage-management software for problem determination.
20. Refer to the storage-management software online help for instructions on bringing the controller online.

## Replacing the battery in the RAID controller

**Attention:** To prevent overheating, replace the RAID controller or blank filler within 30 minutes of removal. If the RAID controller or filler is removed for more than 30 minutes, you might get a nominal overheating warning indication.

Each RAID controller contains a rechargeable battery that maintains the data in the cache memory.

Use the following procedure if the storage-management software instructs you to replace the battery because the current battery has failed or is nearing its expiration date.

1. Check the storage-management software for instructions on battery replacement procedures. If you are not using write-cache mirroring, this might involve clearing cache memory on the RAID controller that contains the battery that has failed. Follow the steps given in the software procedure before continuing with this procedure.

**Attention:** When you handle electrostatic discharge (ESD) sensitive devices, take precautions to avoid damage from static electricity. For details about handling ESD-sensitive devices, see “Handling static-sensitive devices” on page 202.

2. Unpack the new battery.

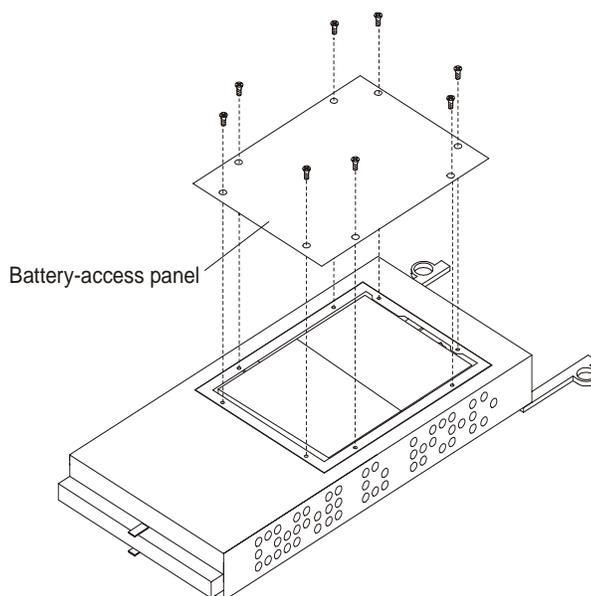
Set the new battery on a dry, level surface. Save all packing materials in case you need to return the battery.

**Note:** The battery comes with a new battery label. You will need this label later in the procedure.

3. Review all documentation that comes with the new battery for updated replacement procedures and other information.
4. Use the storage-management software to locate the RAID controller containing the failed battery (the RAID controller Fault LED might be on).
5. Label each cable that connects to the RAID controller that contains the battery that has failed. This ensures that all cables will be properly reconnected to the RAID controller after you replace the battery.
6. If you have redundant RAID controllers (dual-controller configuration), use the storage-management software to take offline the RAID controller that contains the battery that has failed.

**Attention:** To prevent data loss if you have a single-controller configuration, you must shutdown your system before you can replace the RAID controller battery. For the proper shutdown sequence, see “Turning off the storage server” on page 198.

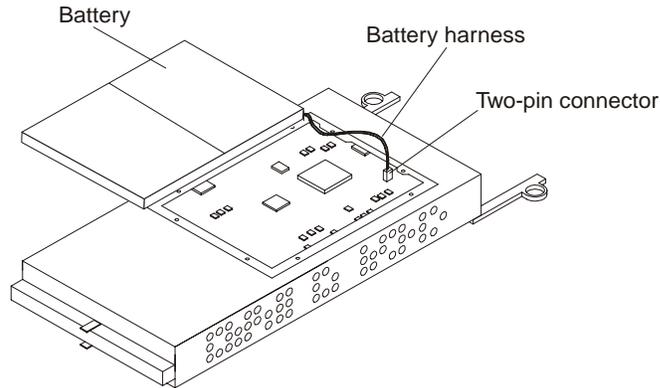
7. From the RAID controller that contains the battery that has failed, remove the Fibre Channel cables and then the GBICs. For more information, see “Working with GBICs and fiber-optic cables” on page 225.
8. Remove the RAID controller as described in “Replacing a RAID controller” on page 219.
9. Using a Phillips head screwdriver, remove the eight screws from the battery access panel on the bottom of the RAID controller CRU, as shown in the following figure.



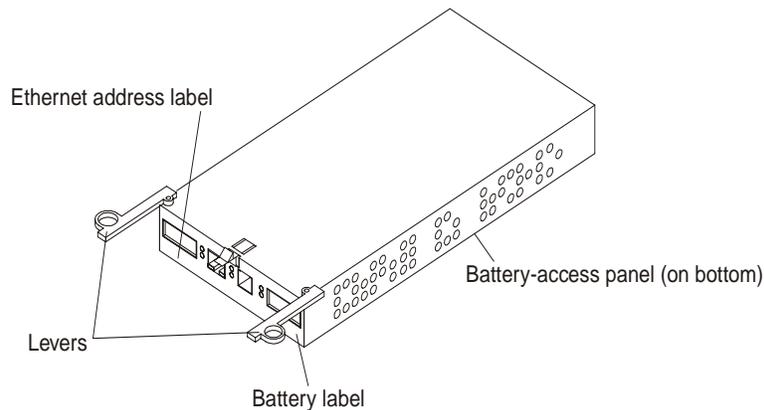
10. Lift the old battery out of the RAID controller CRU.

**Note:** If you cannot lift out the battery, turn over the RAID controller and hold it upside-down so that the battery is close above a flat surface and let it fall out. Do not let the battery pull on the battery harness.

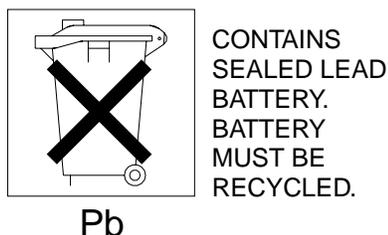
11. Disconnect the battery harness on the old battery from the two-pin connector on the controller board, and remove the battery, as shown in the following figure.



12. Connect the battery harness on the new battery to the two-pin connector on the controller board.
13. Position the battery inside the RAID controller, and replace the battery-access panel.
14. Put the new battery label on the front of the RAID controller, over the old battery label. The location of the battery label is shown in the following figure.



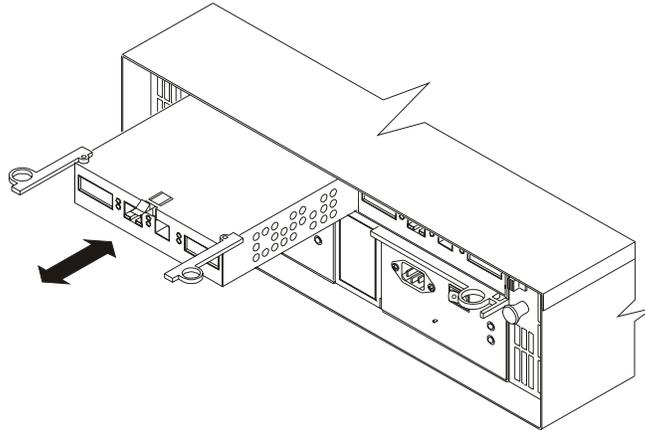
15. Write the battery replacement information on the label on the front of the new RAID controller CRU.
  - Date of Installation – Write today's date
  - Replacement Date – Write the date three years from now
16. Dispose of the used battery CRU according to local and federal regulations, which might include hazardous material handling procedures.



**CAUTION:**

Use proper facilities to recycle the used battery CRU. If the battery CRU is physically damaged or leaking electrolyte gel, *do not* ship it to a recycling center. The battery contains sealed lead-acid batteries that might be considered hazardous material. You must handle this unit in accordance with all applicable local and federal regulations.

17. Install the RAID controller, as shown in the following figure.



- a. Slide the RAID controller all the way into the empty slot.
  - b. Close both levers until the latch locks into place.
18. Install the GBICs and then connect the Fibre Channel cables to their original locations.
  19. If you have a single-controller configuration, turn on power to the storage server and attached devices. For the proper power-on sequence, see “Turning on the storage server” on page 197.
  20. Wait approximately one minute, and then check the green Host Loop LED, the green Expansion Loop LED, and the amber Fault LED on the new RAID controller.
    - If the Host Loop LED or the Expansion Loop LED is off, the RAID controller might not be inserted correctly. Remove the RAID controller and reinsert it.
    - If the Fault LED is on, the Host Loop LED and Expansion Loop LED stay off, or any other Fault LED is on, refer to the storage-management software for problem determination.
  21. Refer to the storage-management software online help for instructions on bringing the controller online and resetting the battery age.

**Note:** There are two cache batteries in the unit (one for each controller). Make sure that you reset the age for the correct battery. Also, you might get a software message indicating that the new battery has failed or is nearing its expiration date. This message will disappear after you reset the battery age through the software and battery charging is completed.

## Working with GBICs and fiber-optic cables

Each RAID controller has one host port and one expansion port. A Gigabit Interface Converter (GBIC) is used to connect each host port and expansion port to hosts and expansion units. The GBIC is inserted into the port, and then a fiber-optic cable is inserted into the GBIC. The other end of the fiber-optic cable connects to an external device. 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.

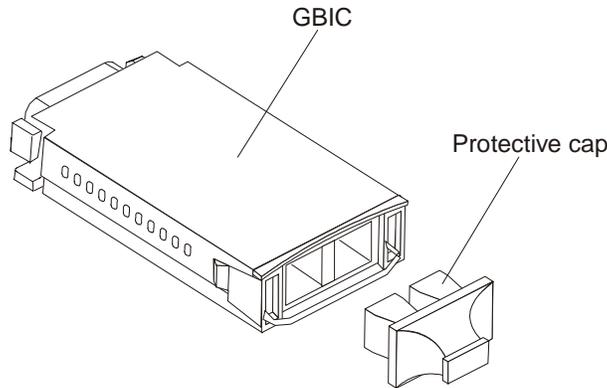
## **Installing GBICs**

Observe the following GBIC installation tips:

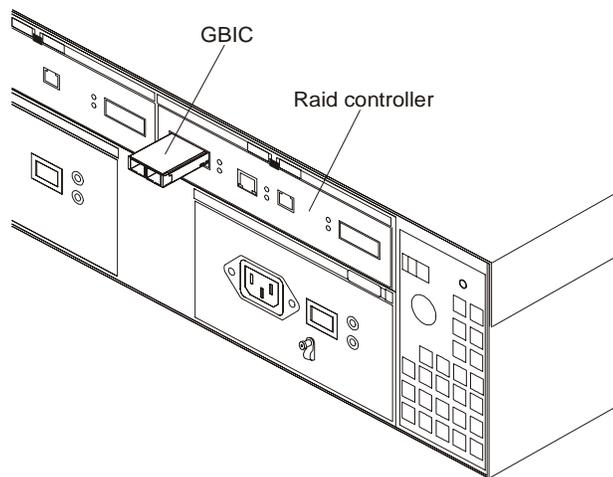
- The GBIC module housing has an integral guide key to prevent you from inserting the GBIC improperly.
- Use minimal pressure when inserting the GBIC into a port. Forcing the GBIC into a port could cause damage to the GBIC or the port.
- GBICs are hot-pluggable. You can insert or remove the GBIC while the storage server is powered on.
- The operational loop performance is not affected when you install or remove a GBIC.
- You must connect the fiber-optic interface cable to the GBIC module after you insert the GBIC into the port.

To install a GBIC, do the following:

1. Remove the protective cap from the GBIC, as shown in the following figure.



2. If the GBIC that you are installing has a metal latch, move the latch to the unlocked (center) position.
3. Insert the GBIC into the host or expansion port on the RAID controller, as shown in the following figure.



4. After the GBIC is inserted into the port completely, rotate the GBIC latch outward to the locked position (flush with the rear of the GBIC).

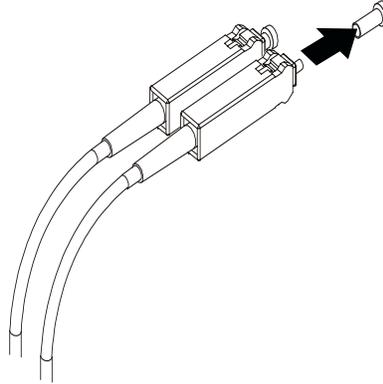
## Installing fiber-optic cables

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

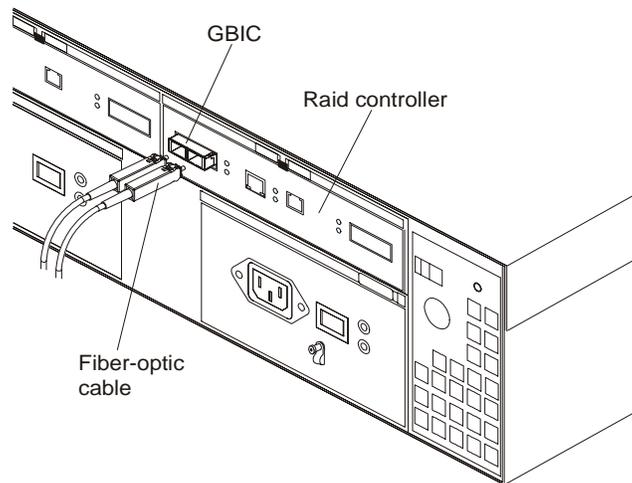
- Do not route the cable along a folding cable-management arm.
- When attaching fiber-optic cables to a device on slide rails, leave enough slack in the cable so that it does not bend to a radius smaller than 76 mm (3 in.) when extended or become pinched when retracted.
- Route the cable away from places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

To connect the fiber-optic cables, do the following.

1. Remove the protective caps from the fiber-optic cable.



2. Connect the fiber-optic cable to the installed GBIC, as shown in the following figure.



**Note:** The fiber-optic cable connection is keyed for proper insertion.

3. Check the LEDs on the RAID controller. When the RAID controller is operating properly, the amber Fault LED is off. For information about the status of the RAID controller LEDs, see Table 25 on page 186.

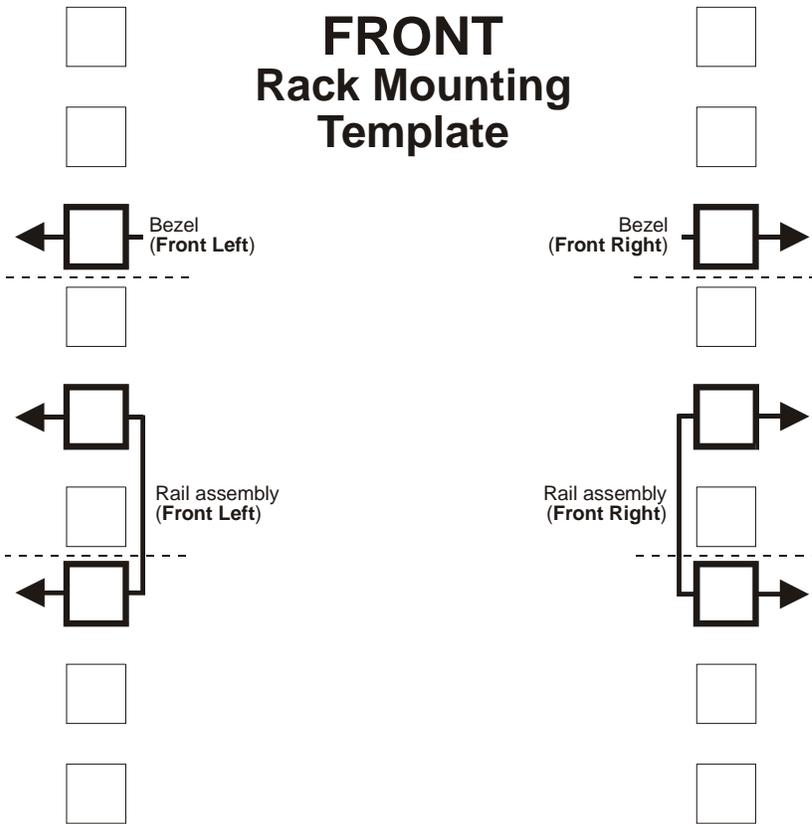
To remove the fiber-optic cables and GBICs, do the following:

1. Gently pull the fiber-optic cable from the GBIC; then, replace the protective caps.
2. Move the metal latch on the GBIC to the unlocked (center) position.
3. Gently pull the GBIC out of the port; then, replace the protective cap.

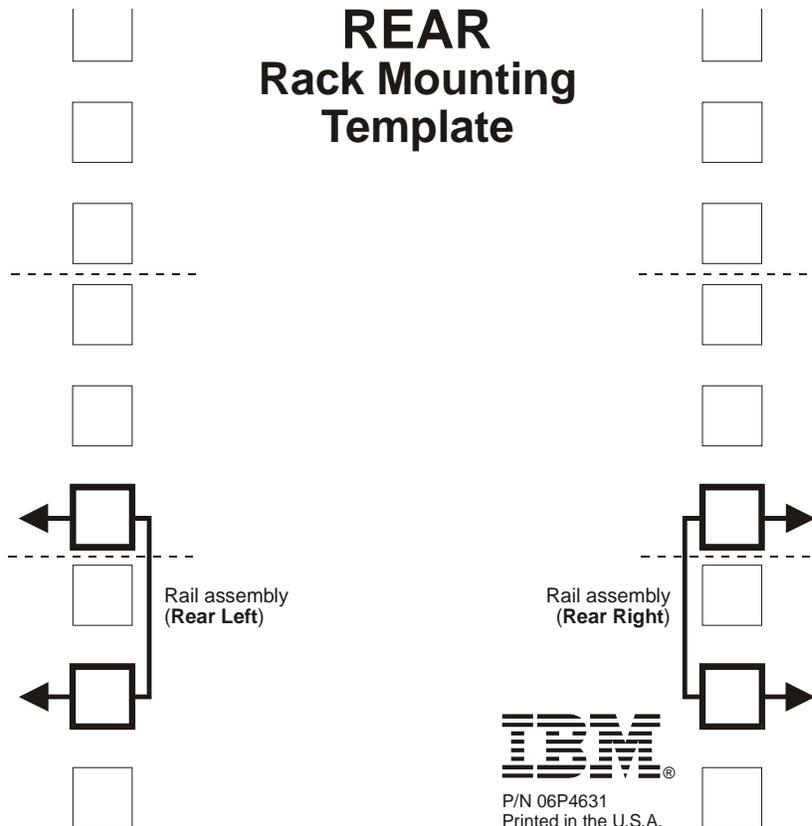
## Rack mounting template and instructions

A rack mounting template and instructions come with the storage server. If you have misplaced these items, use the following template and instructions.

# FRONT Rack Mounting Template



# REAR Rack Mounting Template



P/N 06P4631  
Printed in the U.S.A.

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## Rack Mounting Instructions

Review the documentation that comes with your rack cabinet for safety and cabling information. When installing your storage server in a rack, consider the following:

- Ensure the room air temperature is below 35°C (95°F).
- Do not block any air vents, usually 15 cm (6 in.) of air space provides proper airflow.
- Plan the device installation starting from the bottom of the rack.
- Install the heaviest device in the bottom of the rack.
- Do not extend more than one device out of the rack at the same time.
- Remove the rack doors and side panels to provide easier access during installation.
- Connect all power cords to properly wired and grounded electrical outlets.
- Take precaution to prevent overloading the power outlets when you install multiple devices in a rack.



Use safe practices when lifting.



≥18 kg (37 lbs)



≥32 kg (70.5 lbs)

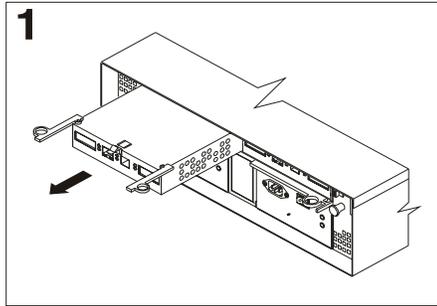


≥55 kg (121.2 lbs)

You will need a flat-blade and a Phillips screwdriver during the installation. The following is a list of items that come with your option. If any items are missing or damaged, contact your place of purchase.

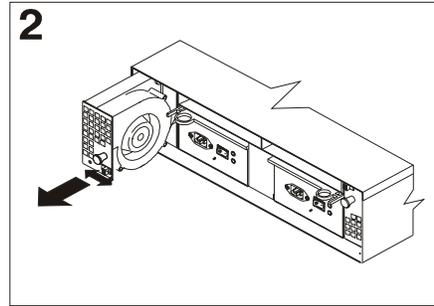
- Cage nuts (10)
- Clip nuts (10)
- M6 screws (10)
- Side rails (2)

**Note:** Refer to your storage server documentation for handling guidelines before removing any ESD-sensitive devices. The first four steps of the installation procedure involve removing some components from the storage server in order to reduce the weight of the storage server for easier installation.



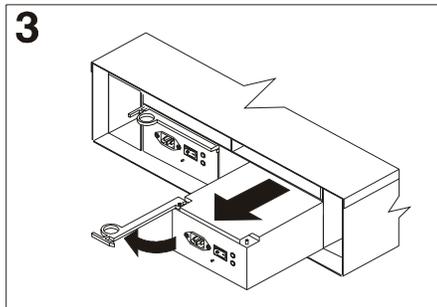
To remove a RAID controller, push down on the latch centered above the controller; then, grasp the pull-rings on the levers and pull them to remove the RAID controller and set it aside for later installation.

If you have a second RAID controller, repeat this step for the second controller.



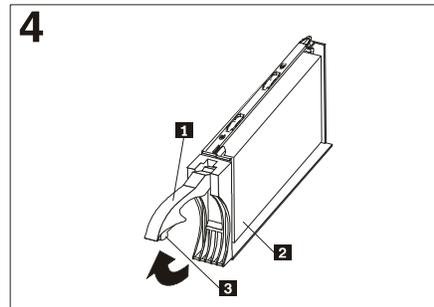
To remove a hot-swap fan, slide the latch on the fan to unlock it; then, pull the handle and remove the fan from the storage server.

Repeat this step for the other fan and set both fans aside for later installation.



To remove a power supply, grasp the pull-ring on the power supply lever and squeeze to release it; then, pull the lever fully open and remove the power supply from the storage server.

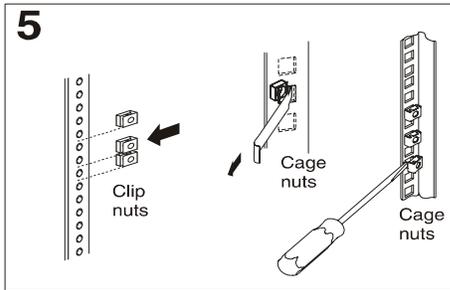
Repeat this step for the other power supply; then, set both power supplies aside for later installation.



To remove a hard disk drive **2**, press the blue latch **3** and pull the handle **1** upwards; then, carefully pull the drive from the storage server.

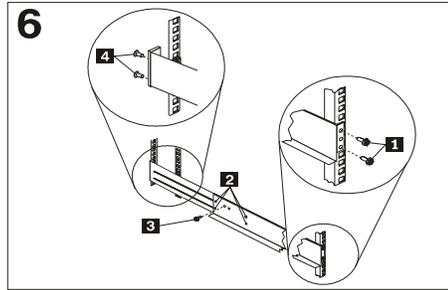
**Note:** Before you remove any hard disk drives, make sure that you mark their location so that you can reinstall them in the same location.

Repeat this step for all hard disk drives.



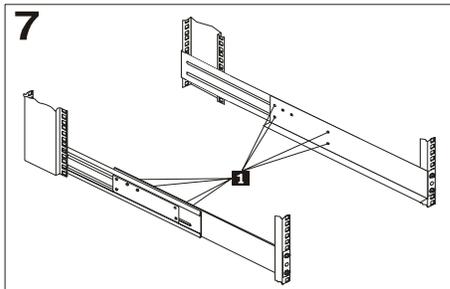
Use the attached template and stickers to mark the appropriate holes on your rack; then, install clip nuts or cage nuts as required for your rack cabinet.

**Note:** Use the cage-nut-insertion tool or a flat-blade screwdriver to install cage nuts.

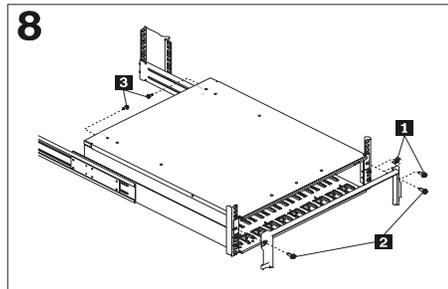


On the rail marked **R**, remove the 6-32 in. screw **3** and loosen the four screws **2**; then, hold the front of the rail against the outside of the right rack-mounting-flange and loosely install two M6 screws **1**.

Extend the rear of the rail outside of the rear rack-mounting-flange; then, install and tighten two M6 screws **4**. Tighten the front screws **1** and repeat this step for the other rail.



Tighten the rail adjustment screws **1** on both rails.



Remove the white screws and nuts **1** from the storage server bezel; then, slide the storage server into the rack. Align the bezel locator pins and attach the bezel with two M6 screws **2**; then, install and tighten the 6-32 in. screws **3**.

**9** Reverse step 1 through step 4 to reinstall the components that you removed; then, refer to your storage server documentation to complete your installation. Store this information with your storage server documentation for future use.

## Symptom-to-FRU index

Use the storage-management software to diagnose and repair controller unit failures. Use this table also to find solutions to problems that have definite symptoms.

Refer to the problem determination maps (PD maps) in "Chapter 2. PD entry," on page 3 for more detailed procedures for problem isolation.

Table 28. Symptom-to-FRU index for FASSt200, Type 3542 and FASSt200 HA, Type 3542 controller

Problem Indicator	Action/FRU
Amber LED on - Drive CRU	1. <b>Replace the drive that has failed.</b>
Amber LED on - Fan CRU	1. <b>Replace the fan that has failed.</b>
Amber LED on - RAID controller Fault LED	1. <b>If the RAID controller Fault LED is lit, replace the RAID controller.</b>

Table 28. Symptom-to-FRU index for FAStT200, Type 3542 and FAStT200 HA, Type 3542 controller

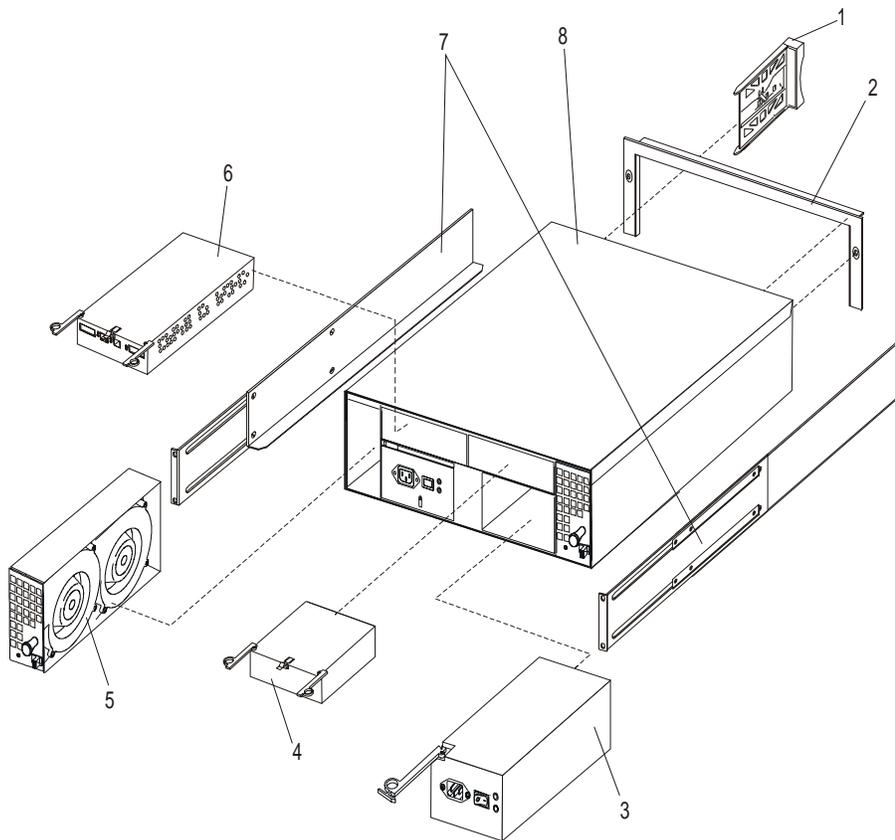
Amber LED on - Expansion port Bypass LED	<ol style="list-style-type: none"> <li>1. <b>No corrective action needed if system is properly configured and no attached expansion units.</b></li> <li>2. Reattach the GBICs and Fibre Channel cables. Replace input and output GBICs or cables as necessary.</li> <li>3. Expansion unit</li> </ol>
Amber LED on - Front panel	<ol style="list-style-type: none"> <li>1. <b>Indicates that a Fault LED somewhere on the storage server has turned on. (Check for amber LEDs on CRUs).</b></li> </ol>
Amber LED on and green LED off - Power supply CRU	<ol style="list-style-type: none"> <li>1. <b>Turn on all power supply power switches</b></li> <li>2. Check ac power</li> </ol>
Amber and green LEDs on - Power-supply CRU	<ol style="list-style-type: none"> <li>1. <b>Replace the failed power-supply CRU</b></li> </ol>
All green LEDs off - All CRUs	<ol style="list-style-type: none"> <li>1. <b>Check that all storage-server power cords are plugged in and the power switches are on</b></li> <li>2. check that the main circuit breakers for the rack are turned on.</li> <li>3. Power supply</li> <li>4. Midplane</li> </ol>
Amber LED flashing - Drive CRUs	<ol style="list-style-type: none"> <li>1. <b>No corrective action is needed. (Drive rebuild or identity is in process)</b></li> </ol>
One or more green LEDs off - Power supply CRUs	<ol style="list-style-type: none"> <li>1. <b>Make sure that the power cord is plugged in and the power-supply switches are turned on.</b></li> </ol>
One or more green LEDs off - All drive CRUs	<ol style="list-style-type: none"> <li>1. <b>Midplane</b></li> </ol>
One or more green LEDs off - Front panel	<ol style="list-style-type: none"> <li>1. <b>Make sure that the cords are plugged in and power supplies are turned on</b></li> <li>2. Midplane</li> </ol>
One or more green LEDs off - Battery	<ol style="list-style-type: none"> <li>1. <b>Battery</b></li> </ol>
One or more green LEDs off - Cache active	<ol style="list-style-type: none"> <li>1. <b>Use the storage-management software to enable the cache.</b></li> <li>2. RAID controller</li> <li>3. Battery</li> </ol>
One or more green LEDs off - Host Loop	<ol style="list-style-type: none"> <li>1. <b>Check if host managed hub or switch is on. Replace attached devices that have failed.</b></li> <li>2. Fibre Channel cables</li> <li>3. GBIC</li> <li>4. RAID controller</li> </ol>
One or more green LEDs off - Expansion Loop	<ol style="list-style-type: none"> <li>1. <b>Ensure drives are properly seated</b></li> <li>2. RAID controller</li> <li>3. Drive</li> <li>4. GBIC or Fibre Channel cable</li> </ol>

Table 28. Symptom-to-FRU index for FAStT200, Type 3542 and FAStT200 HA, Type 3542 controller

Intermittent or sporadic power loss to the storage server - Some or all CRUs	<ol style="list-style-type: none"> <li>1. <b>Check the ac power source</b></li> <li>2. Reseat all installed power cables and power supplies</li> <li>3. Replace defective power cords</li> <li>4. Check for a Fault LED on the power supply, and replace the failed CRU</li> <li>5. Midplane</li> </ol>
Unable to access drives on Drives and Fibre Channel loop	<ol style="list-style-type: none"> <li>1. <b>Ensure that the Fibre Channel cables are undamaged and properly connected.</b></li> <li>2. RAID controller</li> </ol>
Random errors on Subsystem	<ol style="list-style-type: none"> <li>1. <b>Midplane</b></li> </ol>

**Note:** If you cannot find the problem in the troubleshooting table, test the entire system.

## Parts Listing



This parts listing supports the following models: 1RU, 1RX, 2RU, 2RX

Index	Type 3542- IBM FAStT200, FAStT200 HA Storage Server	FRU No.
1	DASD Bezel Filler Asm (all models)	37L0198

Index	Type 3542- IBM FAStT200, FAStT200 HA Storage Server	FRU No.
2	Decorative Bezel (all models)	09N7307
3	Power Supply Asm (350 W) (all models)	19K1164
4	Blank, controller (model 1RU, 1RX)	19K1229
5	Blower Asm (all models)	09N7285
6	FC Controller, (all models)	19K1115
7	Rail Kit Left/Right (all models)	37L0067
8	Midplane/Frame (all models)	19K1220
	Misc. Hardware Kit (all models)	09N7288
	Short Wave GBIC (all models)	03K9206
	Long Wave GBIC (all models)	03K9208
	FAStT Storage Manager Software CD (all models)	19K1230
	Cable, 5M Optical (all models)	03K9202
	Cable, 25M Optical (all models)	03K9204
	Cable, Serial (all models)	19K1179
	Cable, 1M Optical (all models)	37L0083
	9' Line Cord (all models)	6952300
	Battery, Cache (all models)	19K1219
	Line Cord Jumper, High Voltage (model 1RX, 2RX)	36L8886

## Power cords

Table 29. Power cords

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

Table 29. Power cords

IBM power cord part number	Used in these countries and regions
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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## Chapter 10. IBM EXP15 and EXP200 enclosures

**Note:** The PD maps provide you with additional diagnostic aids and can be found on the IBM support web site: <http://www.pc.ibm.com/qtechinfo/MIGR-4P3PMR.html>. The PDs can also be found in this book. See “Chapter 2. PD entry,” on page 3.

The IBM Netfinity EXP15 and EXP200 enclosures are compatible with:

- Type 3526 Fibre Channel RAID controller (see Chapter 7 on page 81)

This chapter contains the information for the EXP15 and EXP200 enclosures. Information that is common to both enclosures is given first. Information that is specific to each enclosure is given second.

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### Features of IBM EXP15 type 3520 and EXP200 type 3530

#### Modularized Components

- High-capacity hard disk drives
- Environmental Services Monitor (ESM) board
- Power supplies
- Cooling fans

#### Technology

- Disk array technology
  - EXP15 type 3520 supports disk array technology
  - EXP200 type 3530 supports disk array technology (Ultra2 disk drives only)
- SCSI host interface
  - EXP15 type 3520 supports LVD or SE host interface
  - EXP200 type 3530 supports Ultra2 or Ultra host interface
- Redundant data storage, cooling system, and power system
- Hot-swap technology for hard disk drives, power supplies, and fans
- Automatic recovery after power failure without user intervention
- EXP200 type 3530 supports clustering

#### User Interface

- Built-in Power, Activity, and Fault indicators
- Identification labeling on Customer Replaceable Units, (CRUs), rear indicator lights, switches and connectors

#### Hard Disk Drives

- Supports up to 10 hard disk drives
- Supports 2 channels per expansion unit
- Supports 5 hard disk drives per channel

## ESM Board

- ID numbers
  - Switch controlled for hard disk drive channel numbers: 1 and 2
  - Switch On - Hard Disk Drive SCSI IDs: 0, 1, 2, 3, and 4 for both Channel 1 and Channel 2
  - Switch Off (default) - Hard Disk Drive SCSI IDs: 0, 1, 2, 3, 4, 8, 9, 10, 11, and 12 for Channel 1 or Channel 2
- Technology and Interfaces
  - Model:
    - EXP15 type 3520: SCSI, LVD, or single-ended
    - EXP200 type 3530: Ultra2 or Ultra
  - SCSI bus interface: Two 68-pin VHDCI connectors for incoming and outgoing SCSI bus cables

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## Diagnostics and test information (for EXP15 and EXP200)

### Important

The service procedures are designed to help you isolate problems. They are written with the assumption that you have model-specific training on all computers, or that you are familiar with the computers, functions, terminology, and service-related information provided in this manual and the appropriate IBM PC/Netfinity Server Hardware Maintenance Manual.

The following is a list of problems and references for diagnosing the IBM EXP15 Storage Expansion Unit - Type 3520 and IBM EXP200 Storage Expansion Unit - Type 3530.

Problem	Reference
Hard Disk Drive Numbering	See "EXP15 drive numbering" on page 247 or "EXP200 drive numbering" on page 257.
Error Codes/Error Messages	Refer to the Symptom-to-FRU Index for the server that the Storage Expansion Unit you are servicing is connected to.
Expansion Unit Options Switches	See "Expansion unit option switches" on page 244.
Fan Controls and Indications	See "EXP15 fan controls and indicators" on page 249 or "EXP200 fan controls and indicators" on page 261.
Performing a Shutdown	See "Performing a shutdown" on page 239.
Power Supply Controls and Indicators	See "EXP15 power supply controls and indicators" on page 250 or "EXP200 power supply controls and indicators" on page 262.
Rear Controls and Indications	See "ESM board controls and indicators" on page 243.
Turning the Power On	See "Turning the power on" on page 239.

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## Additional service information (for EXP15 and EXP200)

This section provides service information that is common to both the EXP15 and EXP200 enclosures.

- “Performing a shutdown”
- “Turning the power on”
- “Specifications” on page 240

### Performing a shutdown

**Note:** If the Expansion Unit loses power unexpectedly, it might be due to a hardware failure in the power system or midplane (see “Symptom-to-FRU index for EXP15 and EXP200” on page 241).

**To perform a shutdown:**

1. Make sure that all I/O activity has stopped. If applicable, logically disconnect from the host controller.
2. 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.
3. Turn off *both* power supply switches on the back of the expansion unit.

### Turning the power on

Use this procedure to power-on the EXP15 and EXP200 Storage Expansion unit.

- **Initial start-up:**

1. Verify that all communication and power cables are plugged into the back of the expansion unit.
  - a. All hard disk drives are locked securely in place.
  - b. **For EXP15:** The option ID switch on the expansion unit is set correctly.  
**For EXP200:** Option switches 1 through 5 and the tray number switch on the expansion unit are set correctly.
  - c. The host controller and other SCSI bus devices are ready for the initial power-up.
  - d. Power-on the expansion unit before powering on the server.
2. Turn on the power to each device, based on this power-up sequence.
3. Turn on *both* power supply switches on the back of the expansion unit.
4. Only the green LEDs on the front and back should be on. If one or more of the amber Fault LEDs are on, refer to “Symptom-to-FRU index for EXP15 and EXP200” on page 241.

- **Re-starting:**

If you are re-starting after a normal shutdown, wait at least ten seconds before you attempt to turn on *either* power supply switch.

## Specifications

Table 30. Specifications for EXP15 type 3520 and EXP200 type 3530

Specification	EXP15 type 3520	EXP200 type 3530
<b>Size (with front panel)</b>	Depth: 57.9 cm (22.8 in.)	Depth: 56.3 cm (22.2 in.)
	Height: 13.2 cm (5.2 in.)	Height: 12.8 cm (5 in.)
	Width: 48.2 mm (18.97 in.)	Width: 44.7 mm (17.6 in.)
<b>Weight</b>	Typical expansion unit as shipped: 39 kg (86 lb)	Typical expansion unit as shipped: 22.5 kg (49.5 lb)
<b>Electrical Input:</b>	Sign-wave input (50 to 60 Hz)	
	<ul style="list-style-type: none"> <li>• Low range: Minimum: 90 V ac / Maximum: 127 V ac</li> <li>• High range: Minimum: 198 V ac / Maximum: 257 V ac</li> </ul>	
	Input Kilovolt-amperes (kVA) approximately	
	<ul style="list-style-type: none"> <li>• Minimum configuration: 0.06 kVA</li> <li>• Maximum configuration: 0.39 kVA</li> </ul>	
<b>Environment</b>	<b>Air Flow:</b> Air flow is from front to back	
	<b>Air temperature:</b>	
	<ul style="list-style-type: none"> <li>• Expansion unit on: 10° to 35° C (50° to 95° F) Altitude: 0 to 914 m (3000 ft.)</li> <li>• Expansion unit on: 10° to 32° C (50° to 90° F) Altitude: 914 m (3000 ft.) to 2133 m (7000 ft.)</li> </ul>	
	<b>Humidity:</b> 10% to 80%	
<b>Heat Output</b>	Approximate heat output in British Thermal Units (BTU) per hour:	
	<ul style="list-style-type: none"> <li>• Minimum configuration: 205.2 BTU (60 watts)</li> <li>• Maximum configuration: 1333.8 BTU (390 watts)</li> </ul>	

Table 30. Specifications for EXP15 type 3520 and EXP200 type 3530

Specification	EXP15 type 3520	EXP200 type 3530
<b>Acoustical Noise Emissions Values</b>	For open bay (0 hard disk drives installed) and typical system configurations (8 hard disk drives installed).	
	<ul style="list-style-type: none"> <li>• Sound Power (idling):                             <ul style="list-style-type: none"> <li>— 6.2 bels (open bay)</li> <li>— 6.4 bels (typical)</li> </ul> </li> <li>• Sound Power (operating):                             <ul style="list-style-type: none"> <li>— 6.2 bels (open bay)</li> <li>— 6.5 bels (typical)</li> </ul> </li> <li>• Sound Pressure (idling):                             <ul style="list-style-type: none"> <li>— 47 dBA (open bay)</li> <li>— 49 dBA (typical)</li> </ul> </li> <li>• Sound Pressure (operating):                             <ul style="list-style-type: none"> <li>— 47 dBA (open bay)</li> <li>— 50 dBA (typical)</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Sound Power (idling):                             <ul style="list-style-type: none"> <li>— 6.3 bels (open bay)</li> <li>— 6.5 bels (typical)</li> </ul> </li> <li>• Sound Power (operating):                             <ul style="list-style-type: none"> <li>— 6.3 bels (open bay)</li> <li>— 6.6 bels (typical)</li> </ul> </li> <li>• Sound Pressure (idling):                             <ul style="list-style-type: none"> <li>— 47 dBA (open bay)</li> <li>— 49 dBA (typical)</li> </ul> </li> <li>• Sound Pressure (operating):                             <ul style="list-style-type: none"> <li>— 47 dBA (open bay)</li> <li>— 50 dBA (typical)</li> </ul> </li> </ul>
	These levels are measured in controlled acoustical environments according to 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.	

## Symptom-to-FRU index for EXP15 and EXP200

**Note:** The PD maps provide you with additional diagnostic aids and can be found on the IBM support web site: <http://www.pc.ibm.com/qtechinfo/MIGR-4P3PMR.html>. The PDs can also be found in this book. See “Chapter 2. PD entry,” on page 3.

Use this chart to find solutions to problems that have definite symptoms.

Table 31. Symptom-to-FRU index for EXP15 and EXP200 Storage Expansion units

Problem Indicator	FRU/Action
<b>EXP200 only:</b> Amber LED On (Front Panel)	1. <b>General Machine Fault</b> Check for amber LED on expansion unit
<b>EXP15 only:</b> Amber and Green LEDs flashing (Drive)	1. <b>Host issued a drive rebuild command</b>
<b>EXP15 only:</b> Amber and Green LEDs Off (Power supply)	1. <b>Reseat hard disk drive</b> 2. Hard disk drive
Amber LED On (Drive)	1. <b>Hard Disk Drive</b>
Amber LED On (Fan)	1. <b>Fan</b>

Table 31. Symptom-to-FRU index for EXP15 and EXP200 Storage Expansion units

Problem Indicator	FRU/Action
Amber LED On (ESM board)	<ol style="list-style-type: none"> <li>1. <b>ESM board</b></li> <li>2. Check for fan fault LED</li> <li>3. Unit is overheating. Check temperature.</li> </ol>
Amber LED On, Green LED Off (Power supply)	<ol style="list-style-type: none"> <li>1. <b>Turn Power Switch On</b></li> <li>2. Power cord</li> <li>3. Reseat Power Supply</li> <li>4. Power Supply</li> </ol>
Amber and Green LEDs On (Power supply)	<ol style="list-style-type: none"> <li>1. <b>Power Supply</b></li> </ol>
All Green LEDs Off (Power supply)	<ol style="list-style-type: none"> <li>1. <b>Check AC voltage cabinet AC voltage line inputs</b></li> <li>2. Power Supplies</li> <li>3. Midplane board</li> </ol>
Intermittent power loss to expansion unit	<ol style="list-style-type: none"> <li>1. <b>Check AC voltage line inputs and cabinet power components</b></li> <li>2. Power Supplies</li> <li>3. Midplane board</li> </ol>
One or more Green LEDs Off (All)	<ol style="list-style-type: none"> <li>1. <b>Turn Power Switch On</b></li> <li>2. Power cord</li> <li>3. Reseat Power Supply</li> <li>4. Power Supply</li> </ol>
One or more Green LEDs Off (Drive)	<ol style="list-style-type: none"> <li>1. <b>No activity to the drive</b></li> <li>2. This can be normal activity</li> </ol>
One or more Green LEDs Off (All Hard Disk Drives or those on one Bus)	<ol style="list-style-type: none"> <li>1. <b>Use SCSI RAID Manager to check drive status</b></li> <li>2. SCSI Cables</li> <li>3. ESM Board</li> <li>4. Midplane board</li> </ol>
<b>EXP15 type 3520:</b> Unable to access drives on one or both SCSI buses	<ol style="list-style-type: none"> <li>1. <b>Check SCSI cables and connections</b></li> <li>2. Option switch 2 must be set to off</li> <li>3. ESM board</li> </ol>
<b>EXP200 type 3530:</b> Unable to access drives on one or both SCSI buses	<ol style="list-style-type: none"> <li>1. <b>Check SCSI cables and connections</b></li> <li>2. Check the drive SCSI ID setting</li> <li>3. ESM board</li> <li>4. Ensure that option switches 1 and 5 are set to the appropriate position (change the switch position only when the expansion unit is powered off).</li> </ol>
Intermittent Power Loss	<ol style="list-style-type: none"> <li>1. <b>AC power or plug</b></li> <li>2. Power supply</li> <li>3. Midplane</li> </ol>
Random errors	<ol style="list-style-type: none"> <li>1. <b>Midplane board</b></li> <li>2. <b>(For EXP15 only)</b> Make sure option switches 1 and 2 are set to Off</li> </ol>

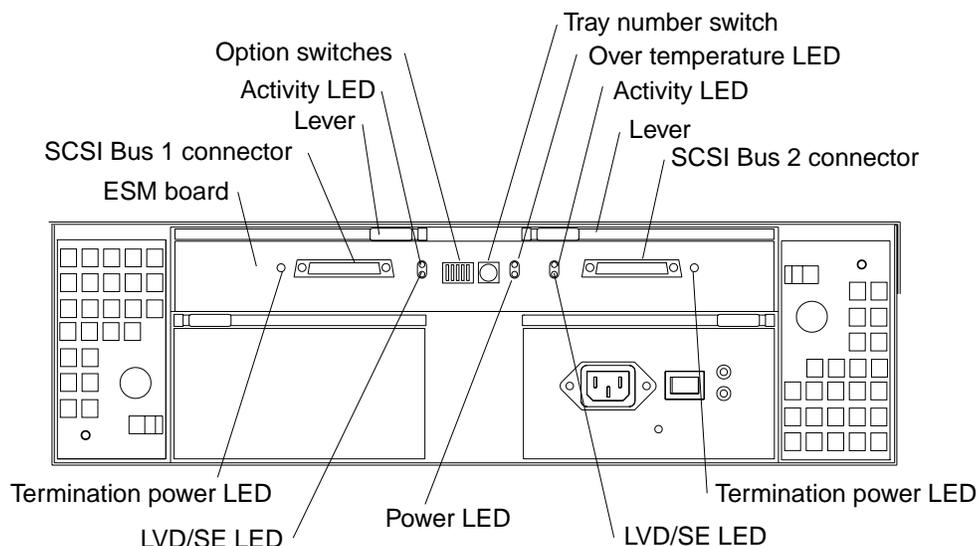
**Note:** If you cannot find the problem using this Symptom-to-FRU Index, test the entire system. See the server documentation for more detailed information on testing and diagnostic tools.

## Locations and installation procedures for EXP15 and EXP200

This section provides locations and installation procedures that are common to both the EXP15 and EXP200 enclosures.

- “ESM board controls and indicators” on page 243
- “Expansion unit option switches” on page 244
- “ESM board replacement” on page 245

### ESM board controls and indicators



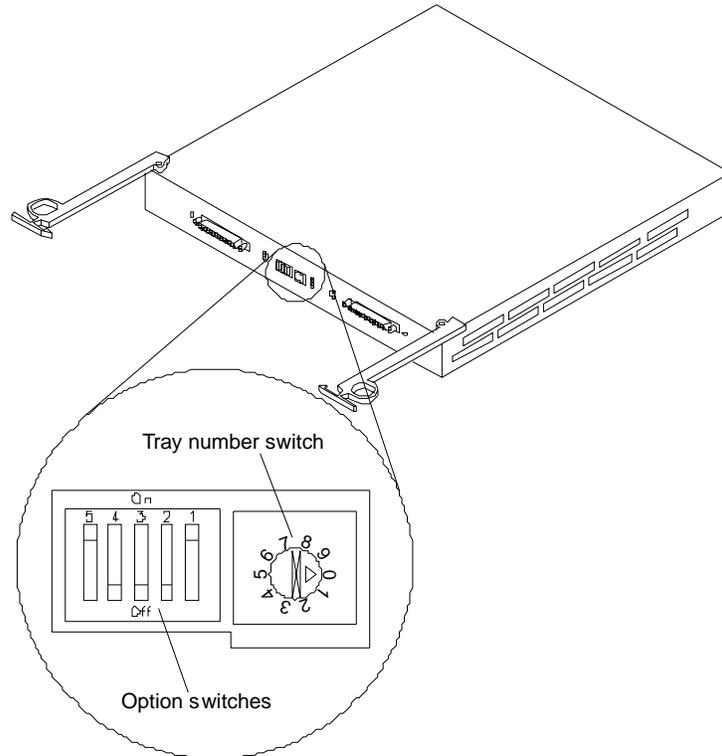
**Note:** SCSI Bus Connectors are 68-pin VHDCI connectors used for attaching SCSI cables.

**Note:** The figure above shows an EXP200 enclosure. (The positions of controls and indicators is identical for both EXP15 and EXP200 enclosures.)

*Table 32. ESM Board LED indications for EXP15 and EXP200 Storage Expansion units*

LED	Description
Termination Power (green)	LED is On if Term Power is present, indicating that the other end of the cable is connected to a power-on controller.
LVD/SE (green)	LED is On if the host bus is in LVD mode (default is SE mode.)
Power (green)	LED is On when there is power to the ESM board.
Over Temp (amber)	This LED is On if the expansion unit overheats.
Active (green)	This LED flashes when there is activity on the external SCSI bus.

## Expansion unit option switches



The EXP15 expansion unit has three types of ID numbers. The EXP200 expansion unit has two types of ID numbers:

### Drive SCSI IDs

Identifies each drive in the expansion unit

**Tray ID** Identifies each expansion unit

### SAF-TE chip SCSI ID (EXP15 only)

System Management SCSI Accessed Fault Tolerant Enclosure processor

Switch settings are as follows:

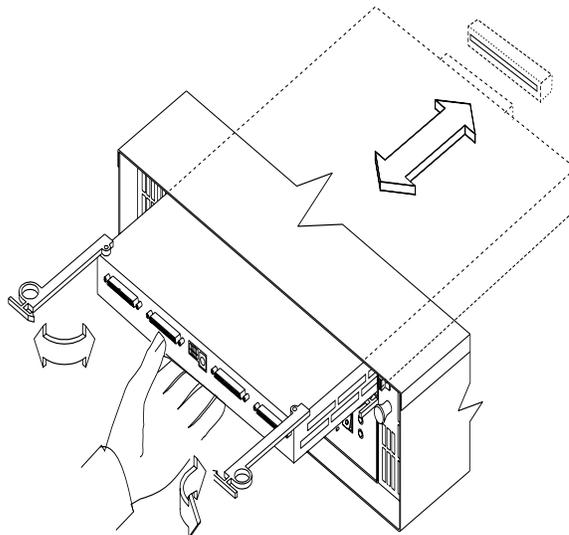
- Option Switches
  - Switch 1 off (default)
    - Bus 1 and 2 as Single Bus 1, accessing all ten drives, (IDs 0-4 and 8-12).
  - Switch 1 on
    - Bus 1 and Bus 2 accessing 5 drives each.
    - Bus 1 accessing IDs 0-4
    - Bus 2 accessing IDs 0-4
- Note:** For EXP15, Option Switches 2-5 must be set to the Off (down) position. Errors might occur if these switches are set to the On position.
- Switch 5 off (default) (**EXP200 only**)

- Rack Mode
- Switch 5 on (**EXP200 only**)
- Tower Mode

When Option Switch 5 is in the On position, two changes occur. First, the SCSI ID ordering is reversed, providing IDs in ascending order from top to bottom. Second, the general system error indicator on the front panel is swapped with the power-on LED, placing the green power-on LED above the general-system error indicator.

- Switches 2 through 4 are reserved and must remain off.
- Tray Number Switch  
Identifies each expansion unit 0-9.
- SAF-TE chip SCSI ID (**EXP15 only**)  
Internal SCSI ID numbers 14 and 15

## ESM board replacement



### To remove the ESM board:

1. Shut down the expansion unit. For shutdown information, see “Performing a shutdown” on page 239.
2. Grasp each pull-ring and squeeze the latches to release.
3. Pull open both levers at the same time and remove ESM board.

### Note: When inserting the ESM board:

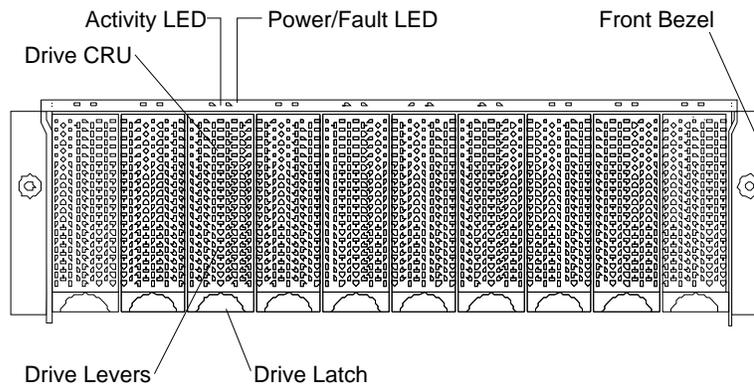
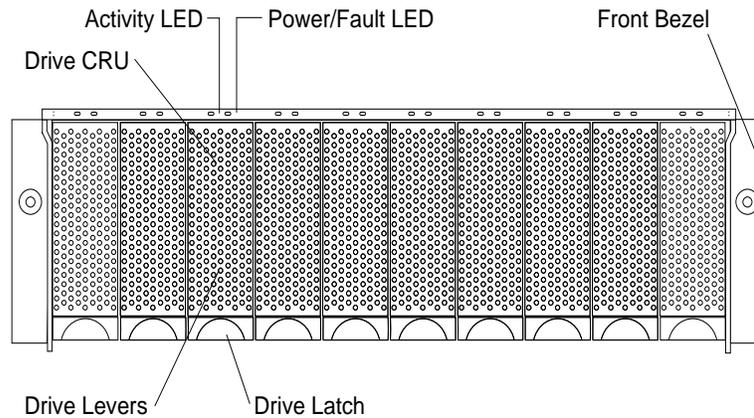
1. Make sure both levers are straight out, as shown above.
2. Using your hand, gently push on the center of the ESM board to insert it into the controller.
3. When inserting the ESM board, make sure both levers swing inward at the same time.
4. Close and lock both levers at the same time.

## Locations and installation procedures for EXP15

This section provides locations and installation procedures that are specifically for the EXP15 enclosure.

- “EXP15 front controls and indicators” on page 246
- “EXP15 drive numbering” on page 247
- “EXP15 replacing drives (hot-swap)” on page 248
- “EXP15 fan controls and indicators” on page 249
- “EXP15 replacing fans (hot-swap)” on page 249
- “EXP15 power supply controls and indicators” on page 250
- “EXP15 replacing power supplies (hot-swap)” on page 251
- “EXP15 removal from rack” on page 251
- “EXP15 replacing rails” on page 253

### EXP15 front controls and indicators

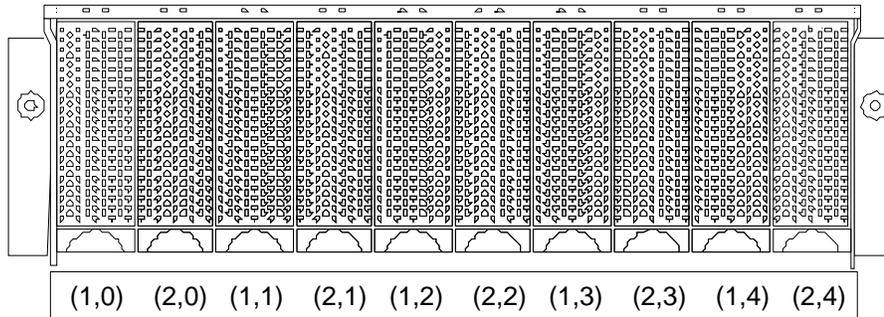


**Note:** Only the IBM ServeRAID, ServeRAID II, ServeRAID-3H, and Fibre RAID controller provide support for the amber Fault LEDs.

## EXP15 drive numbering

There are *two* SCSI channels (1, 2) in the expansion unit. Each channel uses five SCSI ID numbers. Each disk drive within the expansion unit has a unique channel number and SCSI ID number, based on its physical location in the expansion unit.

When a drive is plugged into the midplane, its channel number and SCSI ID are set automatically. The following figure shows bus and SCSI ID values when option switch 1 is set to the on (up) state. Use the option switch on the ESM board to change the ID settings.

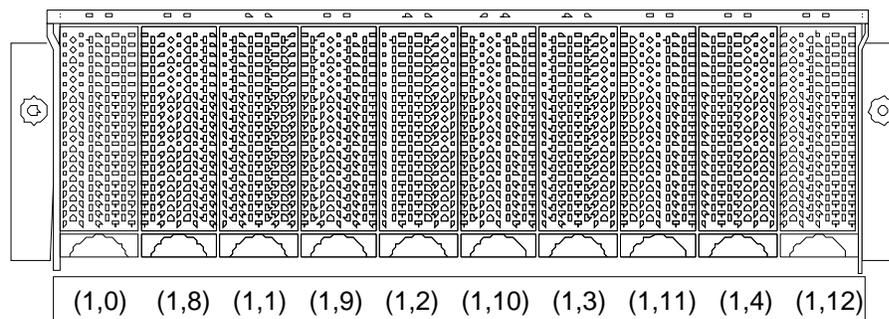


The first number represents the channel number and the second is the SCSI ID.

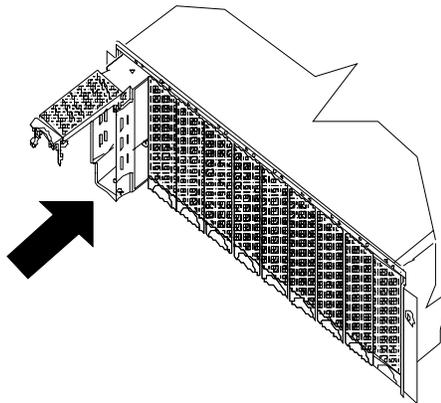
### Notes:

1. For IBM ServeRAID, the view configuration screens show bay numbers, not SCSI IDs. To calculate the bay number, add 1 to the SCSI ID.
2. A blank label is provided in the drive tray behind the drive latch. Use this label to record the address location information for each drive before you remove it. If you install a drive in the wrong bay, data will be lost.
3. 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. Failure to replace the drives in their correct bays can result in loss of data.

If the two channels are daisy chained using option switch 1 in the off position, then the SCSI IDs are as shown and the drives are all on the same channel.



## EXP15 replacing drives (hot-swap)



### To remove the hot-swap drives:

1. Pull on the bottom of the tray lever to release the lever.
  2. Lift the lever and slide the drive partially out of the slot.
- Note:** Wait at least 20 seconds before fully removing the drive from the expansion unit to allow for spin down. Allowing for spin down avoids possible damage to the drive.
- See “EXP15 drive numbering” on page 247 when replacing drives.
3. Install the new drive, making sure at least ten seconds have passed before you install the new drive tray. Unlatch and open the drive lever and insert the drive.
  4. Lock the lever in place.
  5. Check the LEDs.

- a. When drives are ready for use, the green Active LEDs should be off and the Power/Fault LEDs should be glowing green. (A flashing amber LED indicates a drive rebuild).
- b. If the Power/Fault light is solid amber, pull up on the drive latch and lift the drive lever to pull the drive partially out of the bay. Wait at least 20 seconds before fully removing the drive from the expansion unit to allow for spin down. If the SCSI adapter is the IBM ServeRAID; go to the *ServeRAID User's Guide* for additional information and procedures on changing the state of the drive from the current Default state to any other state (for example, HSP, RDY, rebuild drive to ONL, and so on). The amber LED should go off within 10 seconds of the drive state change (to something other than DDD).

In some cases, if the SCSI adapter is the IBM ServeRAID II, the drive automatically resets to either a hotspare (HSP) or be rebuilt (ONL). See the *ServeRAID II User's Guide* for additional information. If the state change in the ServeRAID II configuration does not change automatically (amber LED does not go off), then refer to the *ServeRAID II User's Guide* for directions on how to perform a manual drive state change. The amber LED should go off within 10 seconds of a drive state change (to something other than DDD).

If the state change in the RAID configuration does not change automatically, refer to the *RAID Controller User's Guide* for directions on how to perform a drive state change.

Table 33. LED drives status for EXP15 Storage Expansion Unit

LED	Description
Activity (green)	Indicates read / write or inquiry operation
Power/Fault (green)	Indicates drive present
Power/Fault (amber/green Flashing)	Indicates drive rebuild
Power/Fault (amber)	Indicates a drive failure

## EXP15 fan controls and indicators

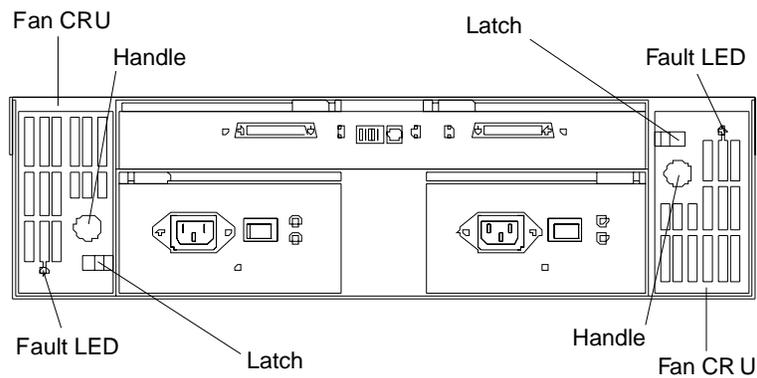
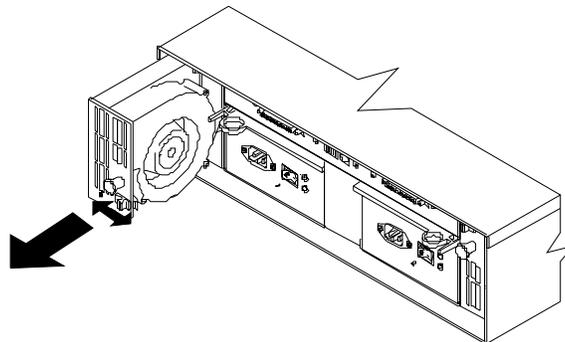


Table 34. Fan LED indications for EXP15 Storage Expansion Unit

LED	Description
Fault LEDs (amber)	LEDs are On when a fan fails.

## EXP15 replacing fans (hot-swap)



### To Remove Cooling Fans:

1. Check the LEDs on the back of the expansion unit.
2. Slide the latch left or right to unlock the fan.

3. Use the handle (black knob) to pull the fan from the expansion unit.
4. Install the new fan by inserting it into the expansion slot and making sure it is seated into the midplane connector. Slide the latch into the middle position.
5. Check the LEDs. If the fault LEDs do not turn off after a few seconds, see “Symptom-to-FRU index for EXP15 and EXP200” on page 241.

**Note:** The fan units are hot-swap redundant; however, when one fan fails, the failing fan unit needs to be replaced within 48 hours in order to maintain redundancy and optimum cooling. When replacing the failed fan unit, insure that this replacement is performed in less than 10 minutes to prevent any overheating. If it takes longer than 10 minutes to replace the fan unit, you must shut down the expansion unit to keep the unit from overheating.

For information on expansion unit shutdown, see “Performing a shutdown” on page 239.

## EXP15 power supply controls and indicators

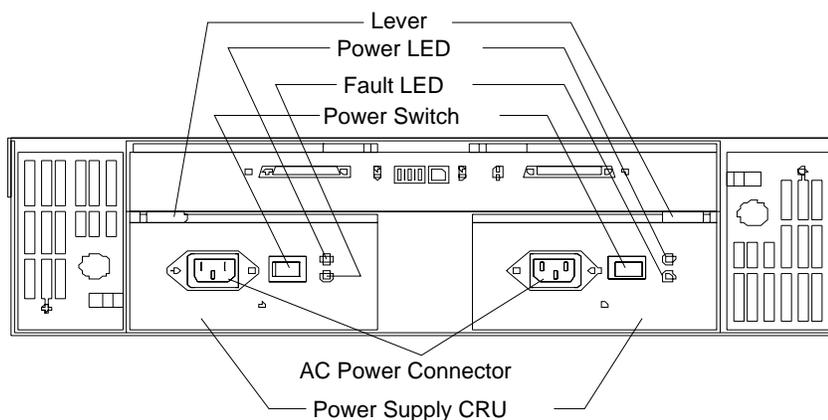
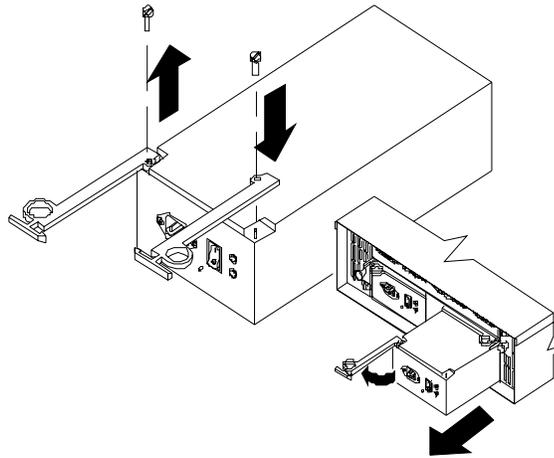


Table 35. Power supply LED indications for EXP15 Storage Expansion Unit

LED	Description
Power (green)	LEDs are On when power switches are turned on.
Fault (amber)	If only the amber LED is on, then power supply is off.
Power (green) and Fault (amber)	Both the green and amber LEDs on indicates a power supply failure.

## EXP15 replacing power supplies (hot-swap)



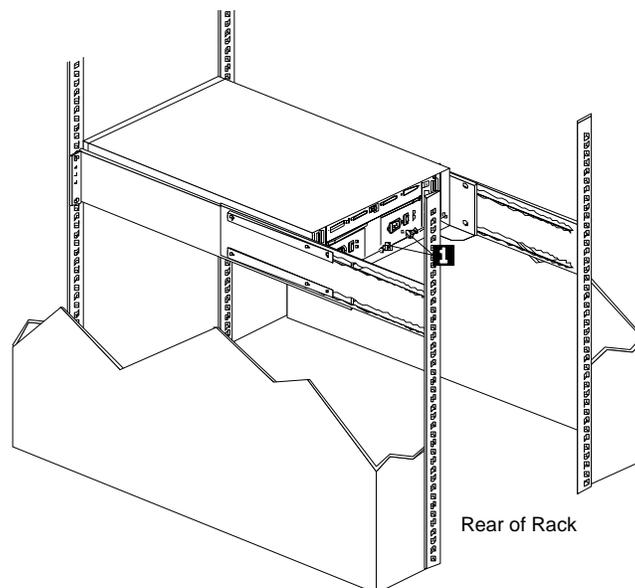
### To remove a power supply:

1. Turn the switch on the power supply to the Off position.
2. Unplug the supply power cord from the electrical outlet.
3. Disconnect the power cord from the power supply.
4. Grasp each pull-ring and squeeze the latches to release.
5. Pull open lever and remove power supply.

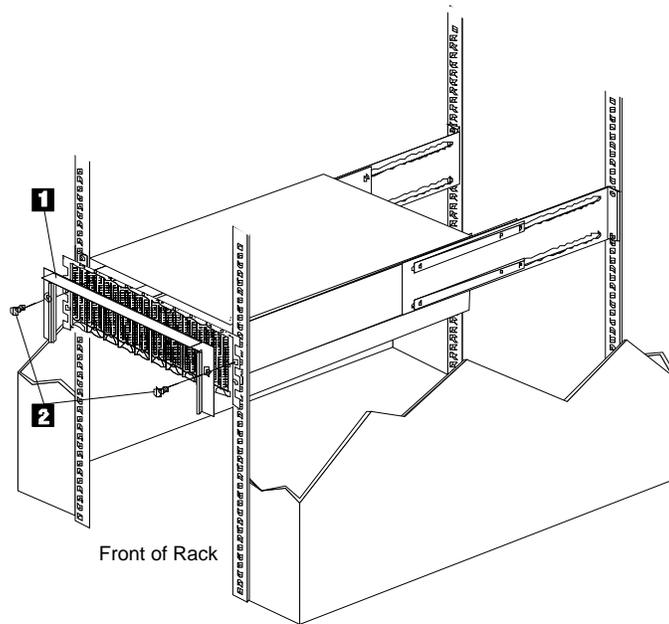
**Note:** When installing a new power supply, make sure that the latch is mounted to the side of the supply that is toward the middle of the machine. If not, remove the lever screw, flip the lever over and replace the screw. See the figure above.

## EXP15 removal from rack

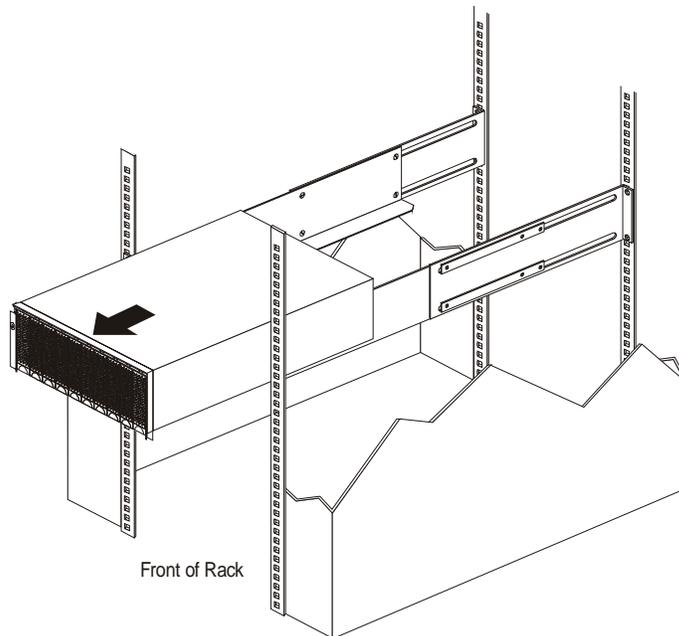
The expansion unit should only need to be removed from the rack for replacement of the midplane board/frame assembly. See "EXP15 parts listing" on page 254 for more information.



1. Remove screws (1) from assembly rails at rear.



2. Remove screws (2) and remove bezel (1).

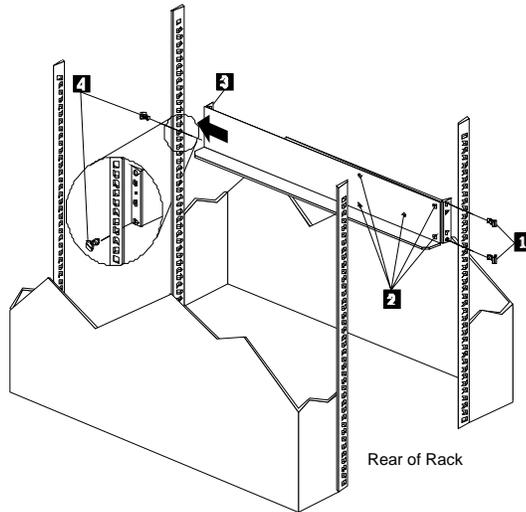


3. Slide expansion unit out of rack.

**Note:** Avoid touching the LED lights when removing the unit to avoid damage to the expansion unit.

## EXP15 replacing rails

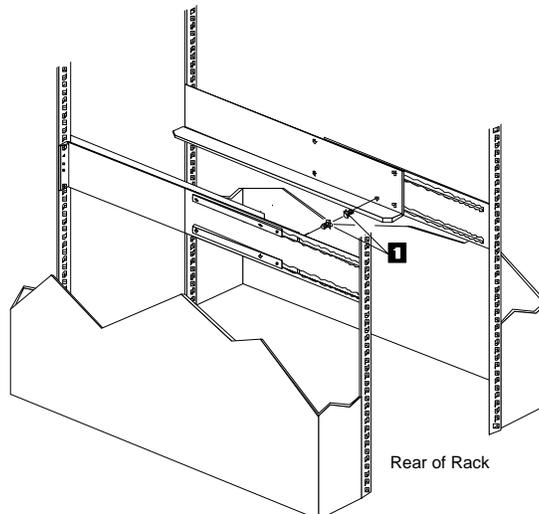
1. Align the rail assembly (provided with the hardware kit) to the rear of the rack.
  - a. Install two black hex head screws (1) in the top and bottom positions, starting with the top.
  - b. Loosely tighten the screws.



2. Loosen the five screws (four large screws and one small screw) (2) located on the interior of the rail assembly; then slide the front rail assembly forward (3) until it makes contact with the front rack rail.

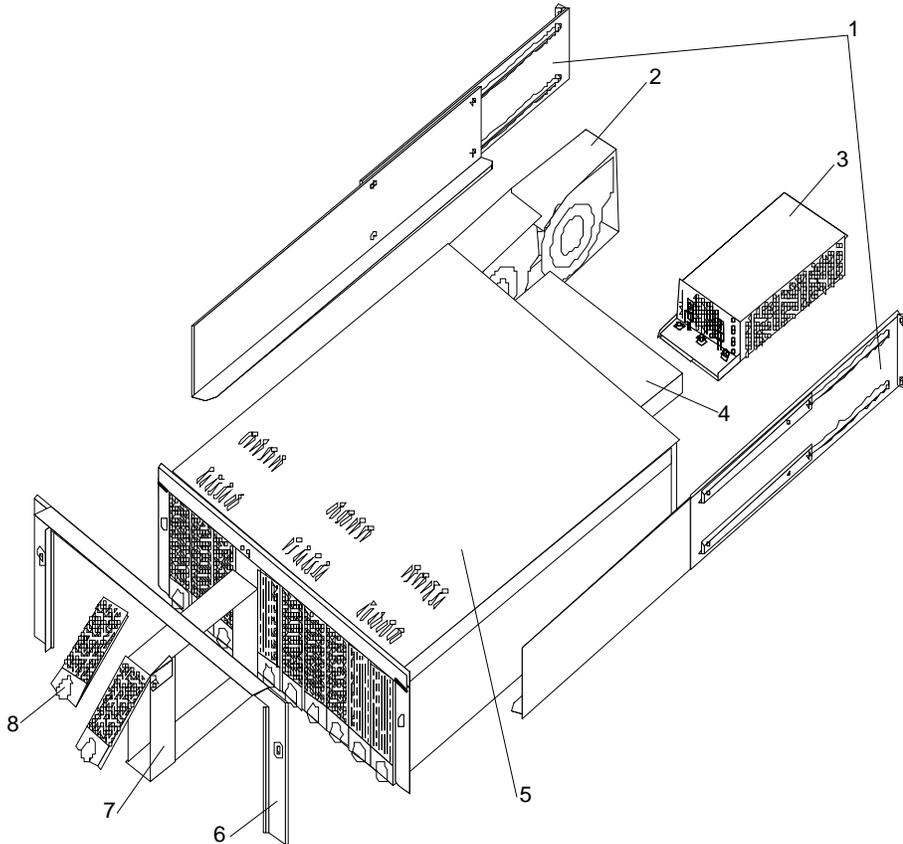
**Note:** Make sure the front rail position matches the rear rail position.
3. From the front of the rack, thread one (black) hex head screw (4) into the bottom position of the rail assembly and tighten firmly.

**Note:** Before tightening, make sure the pins are located correctly in the rail holes.
4. Firmly tighten the screws on the rear of the rack and the four interior screws on the rail assembly.
5. Repeat the rail assembly procedure on the opposite side of the rack.



- Remove the two small 6-32 screws (1) on the interior side of the rails. Save these screws to install the expansion unit.

## EXP15 parts listing



Index	System (IBM EXP15, Type 3520) Model 2RU, 2RX	FRU No.
1	Rail Kit	01K6670
2	Blower Assembly	01K6706
3	350W Power Supply Assembly	01K6709
4	Electronic Module (ESM)	01K6708
5	Midplane/Frame <b>Note:</b> The midplane board and frame are replaced as a unit. If either part is needed, order this FRU.	01K6707
6	Bezel, Front	01K6705
7	Blank Tray, with bezel	01K6667
8	Bezel, HF Tray	01K6666

Index	System (IBM EXP15, Type 3520) Model 2RU, 2RX	FRU No.
	Miscellaneous Hardware Kit <ul style="list-style-type: none"> <li>• ESM Lever Screws (2 each)</li> <li>• Power Supply Lever Screw</li> <li>• Power Cord Retainer</li> <li>• Power Cord Retainer Knurled Nut</li> <li>• EMC Clips (6 each)</li> <li>• Tray Spring</li> <li>• 6-32 Tray Spring Screw and nut</li> <li>• 6-32X1/4-Inch Drive Screws (2 each)</li> <li>• ESM Latch Left</li> <li>• ESM Latch Right</li> <li>• Power Supply Latch</li> <li>• Light Pipes (2 each)</li> <li>• 6-32X1/2-Inch Screw</li> <li>• M6 Rail Screws (2 each)</li> <li>• M5X8L Screw (2 each)</li> <li>• M3X5L Screw (2 each)</li> <li>• Large Spacer (2 each)</li> </ul>	01K6671

Options	FRU No.
LVD SCSI Cable, 2 Meter external	03K9196
LVD SCSI Cable, 4 Meter external	03K9198
LVD SCSI Cable, 12 Meter external	03K9200
4.5 GB Hard Disk Drive with tray and bezel (7200 RPM)	01K6675
4.5 GB Hard Disk Drive with tray and bezel (10,000 RPM)	01K6682
9.1 GB Hard Disk Drive with tray and bezel (7,200 RPM)	01K6679
9.1 GB Hard Disk Drive with tray and bezel (10,000 RPM)	02K0459
18.2 GB Hard Disk Drive with tray and bezel (7,200 RPM)	01K6718
18.2 GB Hard Disk Drive with tray and bezel (10,000 RPM)	02K0462
HF tray with holes (restricted)	01K6677

Table 36. EXP15 power cords

Power Cords	FRU No.
Arabic	14F0033
Belgium	1339520
Bulgaria	1339520
Czech Republic	1339520
Denmark	13F9997

Table 36. EXP15 power cords

Power Cords	FRU No.
Finland	1339520
France	1339520
Germany	1339520
Hungary	1339520
Israel	14F0087
Italy	14F0069
Latvia	1339520
Netherlands	1339520
Norway	1339520
Poland	1339520
Portugal	1339520
Serbia	1339520
Slovakia	1339520
South Africa	14F0015
Spain	1339520
Switzerland	1339520
Switzerland (French/German)	14F0051
U.S. English	62X1045
U.K./Ireland	14F0033
Yugoslavia	1339520

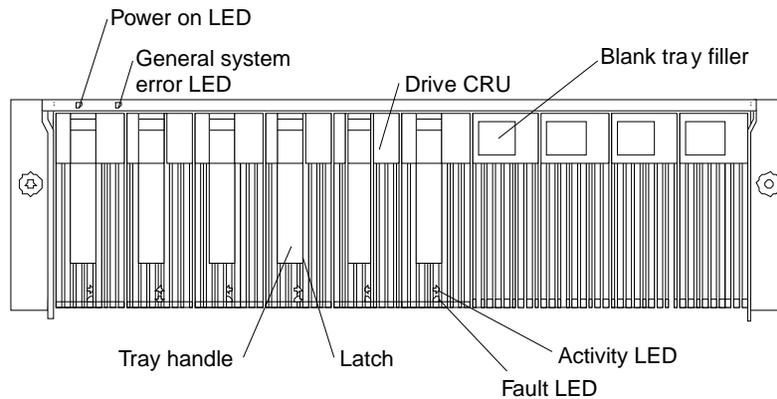
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## Locations and installation procedures for EXP200

This section provides locations and installation procedures specifically for EXP200 enclosures.

- “EXP200 front controls and indicators” on page 257
- “EXP200 drive numbering” on page 257
- “EXP200 replacing drives (hot-swap)” on page 259
- “EXP200 fan controls and indicators” on page 261
- “EXP200 replacing fans (hot-swap)” on page 261
- “EXP200 power supply controls and indicators” on page 262
- “EXP200 replacing power supplies (hot-swap)” on page 262
- “Preparing the EXP200 expansion unit” on page 263
- “Installing the EXP200 expansion unit in a rack” on page 265
- “Installing the EXP200 expansion unit in a tower conversion kit” on page 267
- “Installing the EXP200 expansion unit in a NetBAY enclosure” on page 268

## EXP200 front controls and indicators



**Note:** Only the IBM ServeRAID, ServeRAID II, ServeRAID-3H, and Fibre RAID controller provide support for the amber Fault LEDs.

## EXP200 drive numbering

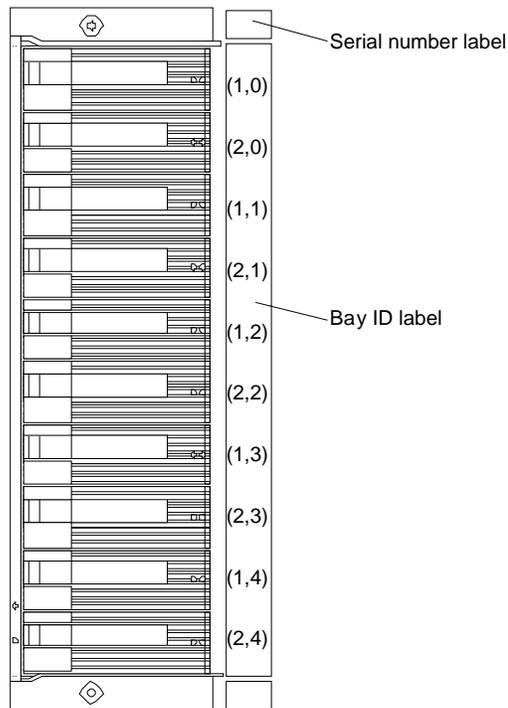
There are *two SCSI channels* (1, 2) in the expansion unit. Each channel uses five SCSI ID numbers. Each disk drive within the expansion unit has a unique channel number and SCSI ID number, based on its physical location in the expansion unit.

When a drive is plugged into the midplane, its channel number and SCSI ID are set automatically. The following figure shows bus and SCSI ID values when option switch 1 is set to On and switch 5 is off. Use the option switch on the ESM board to change the ID settings.



The first number represents the channel number and the second is the SCSI ID.

See the following figure for bus and SCSI ID values when option switch 1 is set to On and switch 5 is on (for tower orientation). Use the option switch on the ESM board to change the ID settings.

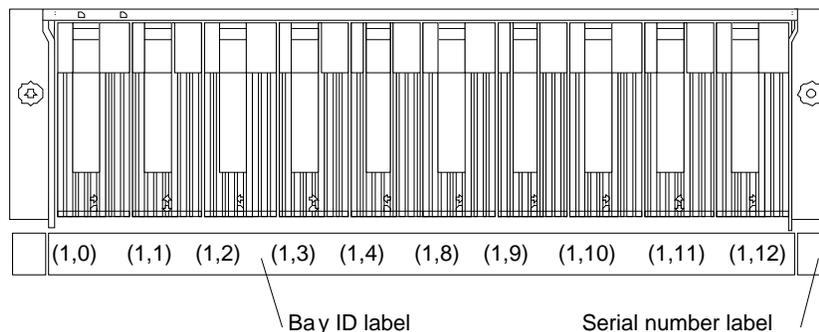


The first number represents the channel number and the second is the SCSI ID.

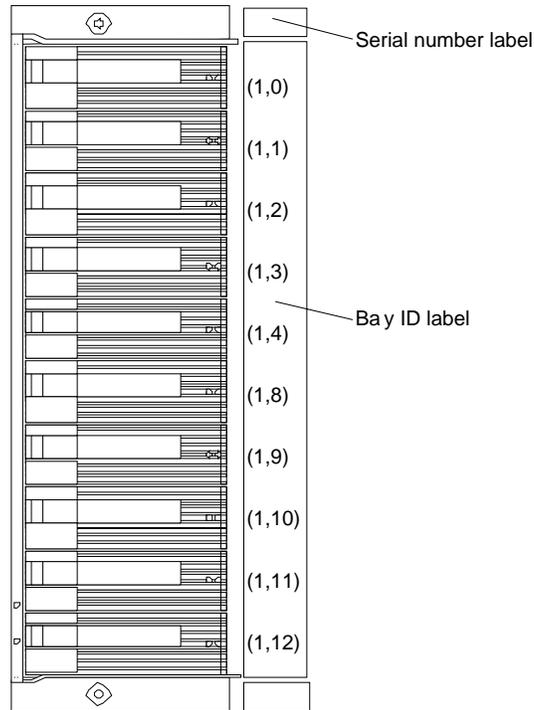
**Notes:**

1. For IBM ServeRAID, the view configuration screens show bay numbers, not SCSI IDs. To calculate the bay number, add 1 to the SCSI ID.
2. A label is provided on the front of the drive tray. Use this label to record the address location information for each drive before you remove it. If you install a drive in the wrong bay, data will be lost.
3. 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. Failure to replace the drives in their correct bays can result in loss of data.

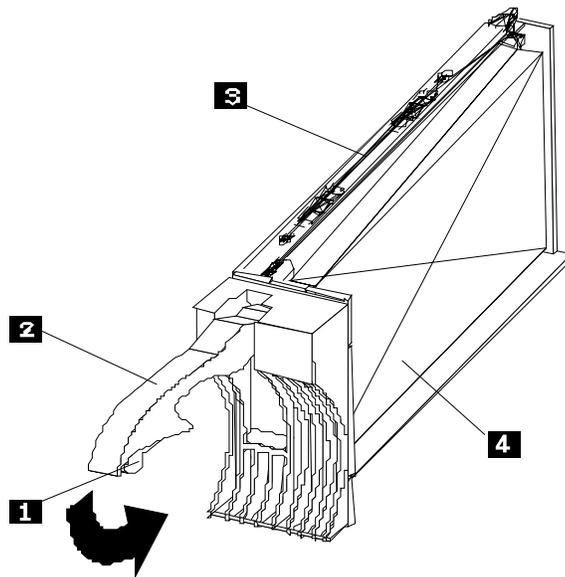
If the two channels are daisy chained using option switch 1 in the off position and switch 5 is off, then the SCSI IDs are as shown and the drives are all on the same channel.



If the two channels are daisy chained using option switch 1 in the off position and switch 5 is on (for tower orientation), then the SCSI IDs are as shown and the drives are all on the same channel.



## EXP200 replacing drives (hot-swap)



**To remove the hot-swap drives:**

1. Press on the inside of the bottom of the tray handle to release the blue latch (1).
2. Pull the handle (2) on the tray (3) out into the open position.
3. Lift the drive CRU partially out of the bay.

**Note:** Wait at least 20 seconds before fully removing the drive from the expansion unit to allow for spin down. Allowing for spin down avoids possible damage to the drive.

See “EXP200 drive numbering” on page 257 when replacing drives.

4. If you are replacing a slim-high drive, ensure that the filler piece remains in place for use with the new drive.
5. Install the new drive, making sure at least ten seconds have passed before you install the new drive tray. Gently push the drive into the empty bay until the tray handle (2) touches the expansion unit bezel.
6. Push the tray handle (2) down into the closed (latched) position.
7. Check the LEDs.

- a. When drives are ready for use, the green Activity LED and the amber Fault LED should be off.
- b. If the Fault light is solid amber, pull up on the drive latch and lift the drive lever to pull the drive partially out of the bay. Wait at least 20 seconds before fully removing the drive from the expansion unit to allow for spin down. If the SCSI adapter is the IBM ServeRAID, go to the *ServeRAID User's Guide* for additional information and procedures on changing the state of the drive from the current Default state to any other state (for example, HSP, RDY, rebuild drive to ONL, and so on). The amber LED should go off within 10 seconds of the drive state change (to something other than DDD).

In some cases, if the SCSI adapter is the IBM ServeRAID II, the drive automatically resets to either a hotspare (HSP) or be rebuilt (ONL). See the *ServeRAID II User's Guide* for additional information. If the state change in the ServeRAID II configuration does not change automatically (amber LED does not go off), then refer to the *ServeRAID II User's Guide* for directions on how to perform a manual drive state change. The amber LED should go off within 10 seconds of a drive state change (to something other than DDD).

If the state change in the RAID configuration does not change automatically, refer to the *RAID Controller User's Guide* for directions on how to perform a drive state change.

*Table 37. LED drive status for EXP200 Storage Expansion unit*

LED	Description
Activity (green/flashing)	Indicates read/write or inquiry operation
Fault (amber/flashing)	Indicates drive rebuild or that drive has been identified by software
Fault (amber)	Indicates a drive failure

## EXP200 fan controls and indicators

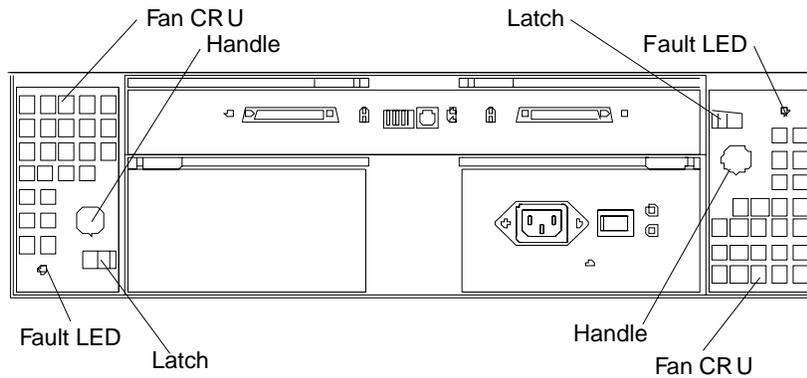
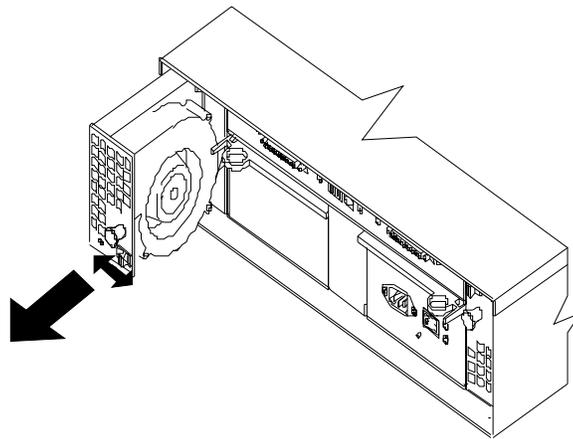


Table 38. Fan LED indications for EXP200 Storage Expansion unit

LED	Description
Fault LEDs (amber)	LEDs are On when a fan fails.

## EXP200 replacing fans (hot-swap)



### To Remove Cooling Fans:

1. Check the LEDs on the back of the expansion unit.
2. Slide the latch left or right to unlock the fan.
3. Use the handle (black knob) to pull the fan from the expansion unit.
4. Install the new fan by inserting it into the expansion slot and making sure it is seated into the midplane connector. Rotate the fan 180° if it does not go into the slot. Slide the latch into the middle position.
5. Check the LEDs. If the fault LEDs do not turn off after a few seconds, see “Symptom-to-FRU index for EXP15 and EXP200” on page 241.

**Note:** The fan units are hot-swap redundant; however, when one fan fails, the failing fan unit needs to be replaced within 48 hours in order to maintain redundancy and optimum cooling. When replacing the failed fan unit, insure that this replacement is performed in less than 10 minutes to prevent any overheating. If it takes longer than 10 minutes to replace the fan unit, you must shut down the expansion unit to keep the unit from overheating.

For information on expansion unit shutdown, see “Performing a shutdown” on page 239.

## EXP200 power supply controls and indicators

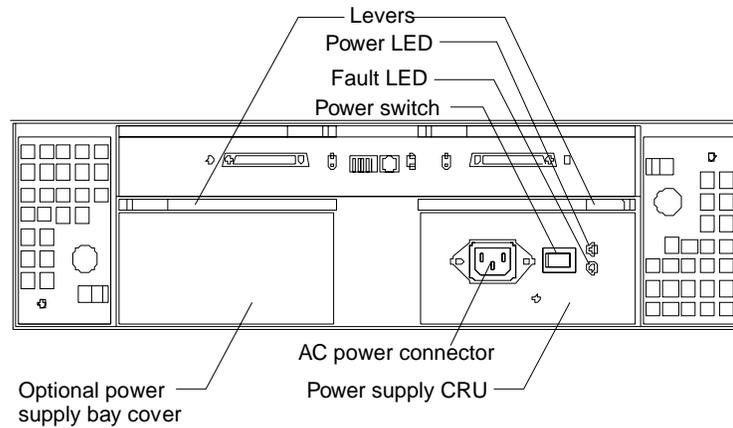
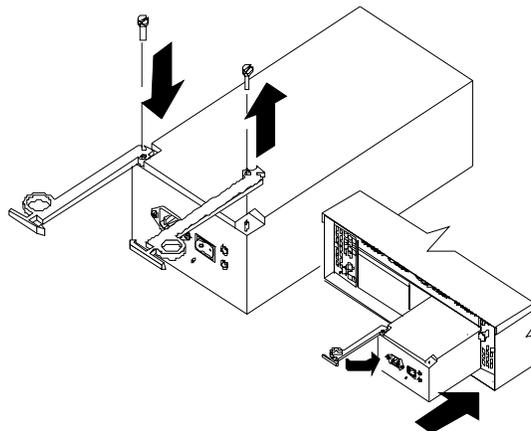


Table 39. Power supply LED indications for EXP200 Storage Expansion unit

LED	Description
Power (green)	LEDs are On when power switches are turned on.
Fault (amber)	If only the amber LED is on, then the power supply is turned off.
Power (green) and Fault (amber)	Both the green and amber LEDs on indicates a power supply failure.

## EXP200 replacing power supplies (hot-swap)



**Attention:** The base unit with one power supply is *not* redundant. You must install the redundant power supply option to make your unit redundant. If you unplug the standard power supply from the basic configuration without having the redundant power option installed, you will lose power to the expansion unit and you might lose data.

**To remove a power supply:**

1. Turn the switch on the power supply to the Off position.
2. Unplug the supply power cord from the electrical outlet.
3. Disconnect the power cord from the power supply.
4. Grasp each pull-ring and squeeze the latches to release.
5. Pull open lever and remove power supply.

**Note:** When installing a new power supply, make sure that the latch is mounted to the side of the supply that is toward the middle of the machine. If not, remove the lever screw, flip the lever over and replace the screw. See the figure above.

## Preparing the EXP200 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 or tower enclosure if you remove all CRUs (drives, fans, and power supplies) first. A fully loaded expansion unit with 10 disk drives, two fan units, and the second power supply installed weighs 36.1 kg (79.5 lbs). The standard unit shipped with one power supply and two fan units weighs 22.5 kg (49.5 lbs). 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 exact drive bays from which you removed them.

**Attention:** The expansion unit is shipped with the decorative bezel attached to the front of the unit with two white screws and nuts. This bezel protects the light pipes located above the drive trays. Leave the decorative bezel in place until you are instructed to remove it during the installation process.

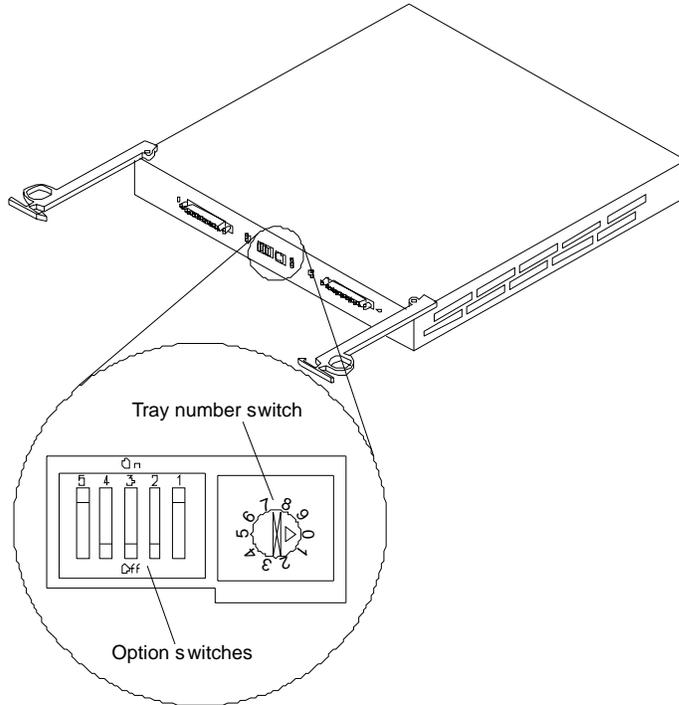
### Setting the interface options

There are five option switches and a tray number switch located on the back of the expansion unit. It is easier to set these switches before you install the expansion unit in a rack or tower enclosure.

**Attention:** Option switch settings must always be set while the expansion unit and host server are powered off. Failure to do so will result in loss of data.

Option Switch 1 controls the SCSI bus and ID settings, and Option Switch 5 controls the rack and tower installation modes. Option Switches 2 through 4 are Reserved; leave these switches in the Off position.

The tray number switch has ten settings (0-9). You can use these settings to identify the tray number for the expansion unit. System-management software, such as IBM Netfinity Manager, uses this tray number when it provides data and alerts for the expansion unit.



**SCSI bus 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 SCSI bus number and ID automatically, based on the setting of Option Switch 1 and the physical location (bay) of the drive CRU.

Your expansion unit supports up to two external SCSI buses and up to two internal SCSI buses. Each internal SCSI bus uses five SCSI IDs. When you install the expansion unit, you can set Option Switch 1 on the ESM board to create two separate five drive SCSI buses, or you can leave it set as one, daisy-chained ten drive SCSI bus.

- **Option Switch 1 set to Off:**

With this default setting, all 10 disk drive bays are on a single SCSI bus. The midplane assigns the SCSI IDs for the drive bays in ascending order from left to right (rack mode) or from top to bottom (tower mode) as follows: 0, 1, 2, 3, 4, 8, 9, 10, 11, 12. The system-management SCSI accessed fault tolerant enclosure (SAF-TE) processor uses SCSI ID 15. When Option Switch 1 is set to the Off position, you can use either external cable connector.

- **Option Switch 1 set to On:**

When Option Switch 1 is set to the On position, two independent internal five-drive SCSI buses are created. External SCSI Bus 1 maps to internal SCSI Bus 1 and external SCSI Bus 2 maps to internal SCSI Bus 2. The midplane assigns the five internal Bus-1 bays SCSI IDs 0, 1, 2, 3, and 4; and the five internal Bus-2 bays SCSI IDs 0, 1, 2, 3, and 4. On each SCSI bus, the system-management processor uses SCSI ID 15.

### Important information

If you are using a ServeRAID software version earlier than Version 3.50, the View Configuration screens might show SCSI IDs or bay numbers. If the data shown on the View Configuration screen begins with 0, it denotes SCSI IDs. If the data shown on the View Configuration screen begins with 1, it denotes bay numbers.

**Rack and tower mode settings:** Option Switch 5 on the ESM board is the rack and tower mode switch. Switch 5 must be in the Off position when the unit is placed in a rack and in the On position if the unit is placed in a tower. When shipped, Option Switch 5 is set to the rack (Off) position.

When Option Switch 5 is in the On position, two changes to your expansion unit occur. First, the SCSI ID ordering is reversed. This SCSI ID reversal provides SCSI IDs in ascending order from top to bottom, when the expansion unit is installed in a tower. Second, the general system error indicator on the front panel is swapped with the power-on LED, placing the green power-on LED above the general-system error indicator.

**Tray number settings:** Use the tray number switch on the ESM board to set a tray identification number for the expansion unit. You can set a number from 0-9. System-management software, such as IBM Netfinity Manager and Symplicity Storage Manager, uses this identification number when it provides data and alerts for the expansion unit.

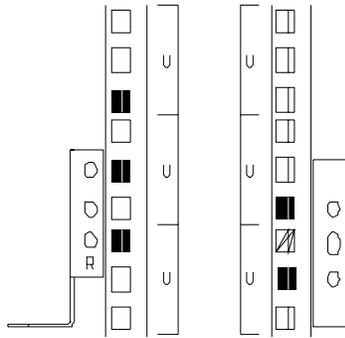
## Installing the EXP200 expansion unit in a rack

The EXP200 expansion unit requires 3U of EIA rack mounting space. Before installing the expansion unit in your rack you must:

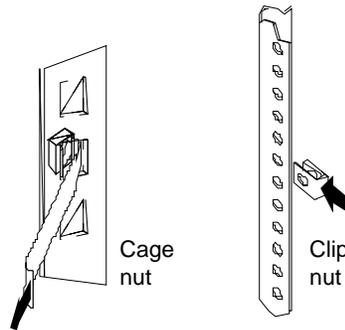
- Plan device installation starting from the bottom of the rack.
- Refer to the rack documentation for safety and cabling considerations. Ensure that your planned installation is within the rack enclosure guidelines for heat generation, electrical requirements, air flow, and mechanical loading.  
**Note:** Because of the limited space in some racks, it might be easier to connect and route cables before you install the mounting brackets and hardware devices.
- Position the unit in the rack to allow for proper air circulation around and through the expansion unit.
- Turn off power to your rack.
- Refer to the rack documentation for instructions on removing its doors and side panels.

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:

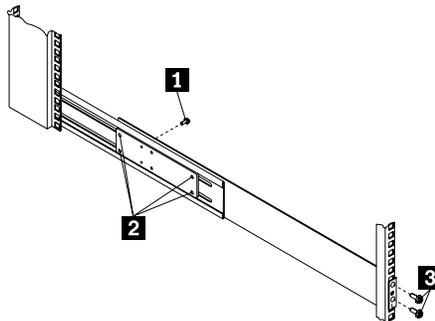
1. Use the following figure of front and rear rack mounting flanges to determine the appropriate rack mounting holes for installing cage nuts or clip nuts to secure your EXP200 rails.



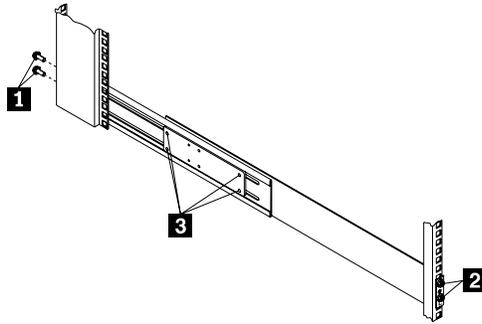
**Note:** Use clip nuts if your rack has round holes. If your rack has square holes, you can use the rack insertion tool or a flat-blade screwdriver to install cage nuts.



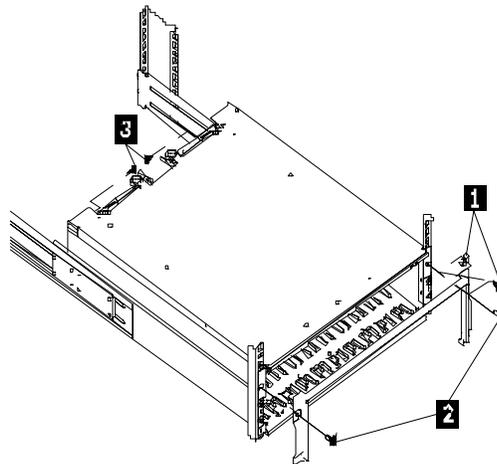
2. On the rail marked L, remove and save the small screw (1); then, loosen the four large screws (2).



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).



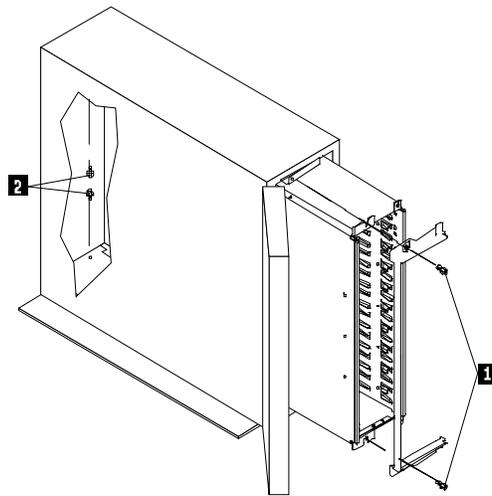
5. Tighten the two front screws (2); then, tighten the four large screws (3).  
Repeat step 2 through step 5 to install the rail marked R on the right side of the rack.
6. Slide the expansion unit into the rack; then, remove and discard both white screws and wingnuts (1) from the bezel.



7. Align the bezel locator pins with the expansion unit; then, secure the bezel and EXP200 with two black hex screws (2).
8. Use the two small screws (3) (removed in step 2) to secure the rear of the expansion unit.
9. Verify that Option Switch 5 is set to Off (see “Setting the interface options” on page 263 for further device settings).
10. Install hard drives, fans, and power supplies in the EXP200 expansion unit

## Installing the EXP200 expansion unit in a tower conversion kit

The EXP200 Rack-to-Tower Conversion Kit provides an enclosure for a single EXP200 expansion unit. Use the mounting hardware that comes with the EXP200 expansion unit to install the unit in the enclosure as follows:



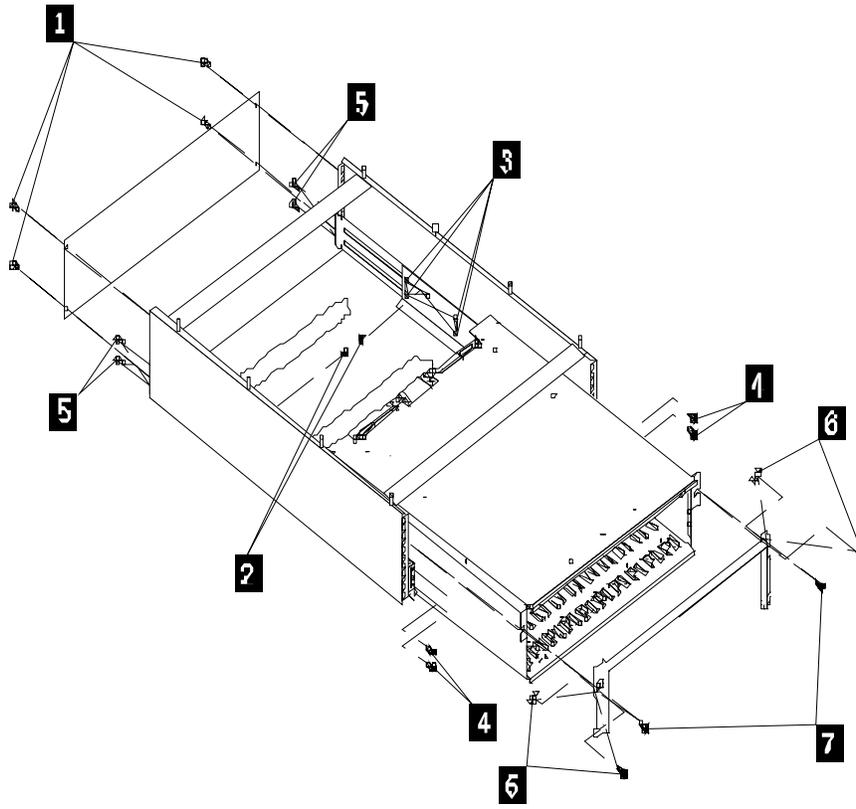
1. Unlock and open the enclosure door.
2. Turn the EXP200 expansion unit counter-clockwise onto its left side and slide it into the enclosure; then, remove the white screws and wingnuts from the EXP200 bezel.
3. Align the bezel locator pins with the expansion unit; then, secure the bezel and EXP200 with black hex screws (1) on the top and bottom.
4. Remove the two small screws from the rails that come with the EXP200 expansion unit; then, secure the rear of the expansion unit with the small screws (2) on the top and bottom.
5. Verify that Option Switch 5 is set to On (see “Setting the interface options” on page 263 for further device settings).
6. Install hard drives, fans, and power supplies in the EXP200 expansion unit.

## Installing the EXP200 expansion unit in a NetBAY enclosure

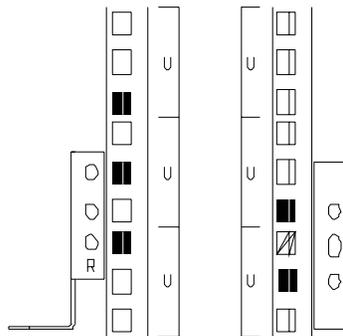
NetBAY enclosures are stackable and each can store a different device, such as the EXP200 expansion unit. You can also attach a server on top of the enclosure. Refer to the NetBAY documentation for details on installing other devices.

**Note:** Due to the depth of the NetBAY3E enclosure, it might be difficult to set the expansion unit option switches after the unit is installed. Verify that Option Switch 5 is set to Off and Option Switch 1 and the tray ID switch are set properly for your environment (see “Setting the interface options” on page 263 for further device settings).

To install the expansion unit in the enclosure, use the following procedure:



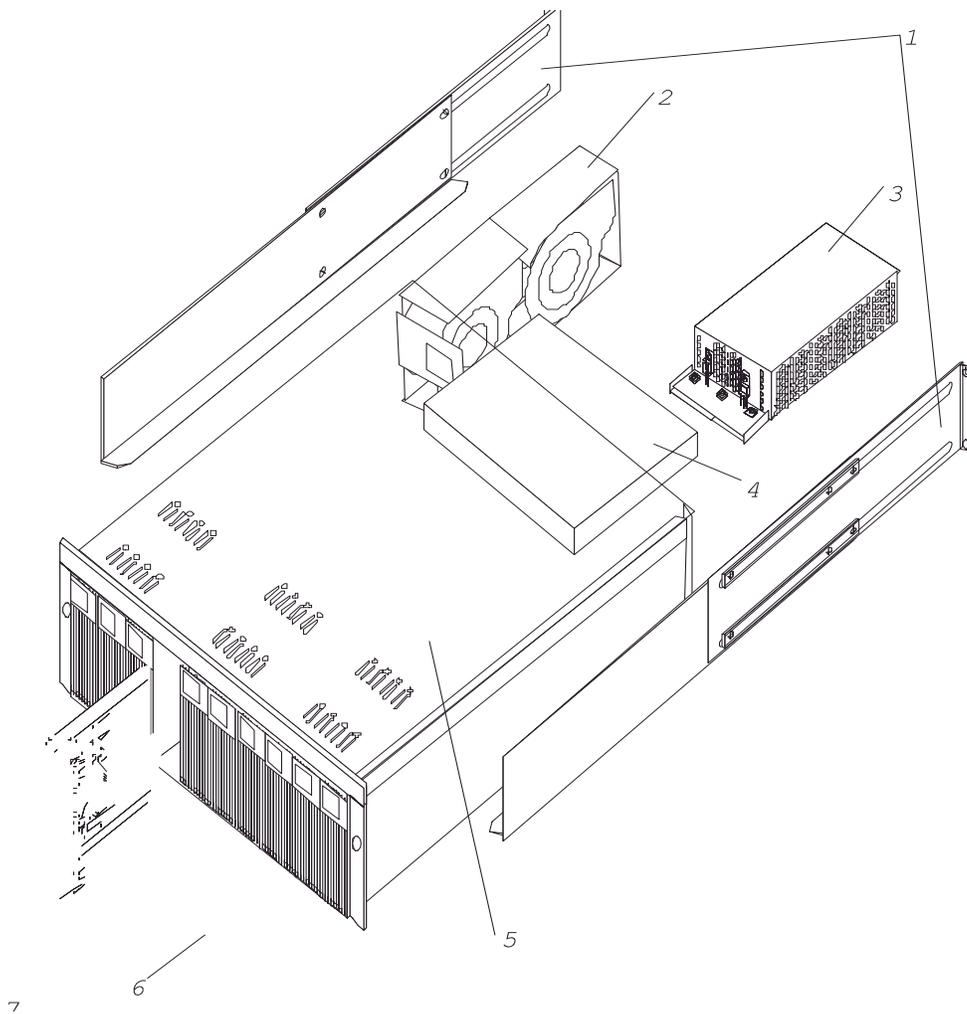
1. Remove the rear of the enclosure (1).
2. Use the following figure to determine the appropriate enclosure mounting holes for installing cage nuts to secure your device and rails.



3. On the rail marked L, remove and save the small screw (2); then, loosen the four large screws (3).
4. Hold the rail against the outside of the left enclosure mounting flange and loosely insert the front black hex screws (4).
5. Extend the rail outside of the rear enclosure mounting flange; then, install and tighten both rear black hex screws (5).

6. Tighten the two front screws (4); then, tighten the four large screws (3).  
Repeat step 3 through step 6 to install the rail marked R on the right side of the enclosure.
7. Slide the expansion unit into the enclosure; then, remove and discard both white screws and wingnuts (6) from the bezel.
8. Align the bezel locator pins with the expansion unit; then, secure the bezel and EXP200 with two black hex screws (7).
9. Use the two small screws (2) (removed in step 3) to secure the rear of the expansion unit.
10. Install hard drives, fans, and power supplies in the EXP200 expansion unit.

## EXP200 parts listing



Index	System (IBM EXP200, Type 3530) Model 1RU, 1RX	FRU No.
1	Rail Kit Left/Right	37L0067
2	Blower Assembly	37L0057
3	350W Power Supply Assembly	37L0059

Index	System (IBM EXP200, Type 3530) Model 1RU, 1RX		FRU No.
	Power Supply Blank		09N7264
4	Electronic Module (ESM, LVD/LVD)		37L0063
5	Midplane/Frame <b>Note:</b> The midplane board and frame are replaced as a unit. If either part is needed, order the above FRU.		37L0061
6	Decorative Bezel, EXP200		37L0065
7	Blank Tray Assembly		37L6708
	Tower Enclosure		37L0120
	Tower Lock/Pawl		37L0121
	Tower Feet		09N7266
	Miscellaneous Hardware Kit		37L0068
	<ul style="list-style-type: none"> <li>• ESM Lever Screws (2 each)</li> <li>• Power Supply Lever Screw</li> <li>• Power Cord Retainer</li> <li>• Power Cord Retainer Knurled Nut</li> <li>• EMC Clips (6 each)</li> <li>• Label - Box ID</li> <li>• Labels - Rack SCSI ID</li> <li>• Labels - Tower SCSI ID</li> <li>• ESM Latch Left</li> </ul>	<ul style="list-style-type: none"> <li>• ESM Latch Right</li> <li>• Power Supply Latch</li> <li>• Light Pipes (2 each)</li> <li>• 6-32X1/2-Inch Flat Head Screw</li> <li>• M6 Rail Screws (2 each)</li> <li>• ESM Cam Channel (2 each)</li> <li>• M6 Nut Clips (2 each)</li> <li>• M6 "C" Clips (2 each)</li> <li>• M5X8L Flat Head Screw (2 each)</li> </ul>	
		LVD SCSI Cable, 2 Meter external	03K9196
		LVD SCSI Cable, 4 Meter external	03K9198
		LVD SCSI Cable, 12 Meter external	03K9200
		LVD SCSI Cable, 20 Meter external	37L0053
		Line Cord, 9 Foot	6952300
		Line Cord Jumper, High Voltage	36L8886

Table 40. EXP200 power cords

Power Cords	FRU No.		Power Cords	FRU No.
Arabic	14F0033		Netherlands	13F9979
Argentina	13F9940		Norway	13F9979
Australia	13F9940		Poland	13F9979
Belgium	13F9979		Portugal	13F9979
Bulgaria	13F9979		Serbia	13F9979
Canada	6952300		Slovakia	13F9979
Czech Republic	13F9979		South Africa	14F0015
Denmark	13F9997		Spain	13F9979
Finland	13F9979		Switzerland	13F9979
France	13F9979		Switzerland (French/German)	14F0051
Germany	13F9979		Thailand	1838574
Hungary	13F9979		U.S. English	6952300
Israel	14F0087		U.K./Ireland	14F0033
Italy	14F0069		Yugoslavia	13F9979
Latvia	13F9979			

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## Chapter 11. IBM FAStT EXP500 enclosure

**Note:** The PD maps provide you with additional diagnostic aids and can be found on the IBM support web site: <http://www.pc.ibm.com/qtechinfo/MIGR-4P3PMR.html>. The PDs can also be found in this book. See “Chapter 2. PD entry,” on page 3.

The IBM Netfinity FAStT EXP500 enclosure is compatible with the following IBM products:

- Type 3552 FAStT500 RAID controller (see Chapter 8 on page 105)
- FAStT200 type 3542 and FAStT200 HA type 3542 (see Chapter 9 on page 177)

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### Features

The following table summarizes the features of the EXP500 type 3560 enclosure. For a list of the operating specifications, such as weight, height, and heat output, see “Specifications” on page 277.

#### General

- Modular components:
  - High-capacity disk drives
  - Environmental services monitor (ESM) boards
  - Power supplies
  - Cooling fans
- Technology:
  - 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
- User interface:
  - 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

- Maximum drives per expansion unit: 10

#### ESM boards

- Technology and interfaces:
  - 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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## Diagnostics and test information

### Important

The service procedures are designed to help you isolate problems. They are written with the assumption that you have model-specific training on all computers, or that you are familiar with the computers, functions, terminology, and service-related information provided in this manual and the appropriate IBM PC/Netfinity Server Hardware Maintenance Manual.

The following is a list of problems and references for diagnosing the IBM FASTT EXP500 type 3530.

Problem	Reference
Hard Disk Drive Numbering	See "Fibre Channel (FC) loop and ID settings" on page 280.
Error Codes/Error Messages	Refer to the Symptom-to-FRU Index for the server that the Storage Expansion Unit you are servicing is connected to.
Expansion Unit Options Switches	See "Installing the expansion unit" on page 278.
Front Controls and Indications	See "Front controls and indicators" on page 297.
Rear Controls and Indications	See "Rear controls, indicators, and connectors" on page 298.

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## Additional service information

- "Turning the expansion unit on and off"
- "Performing an emergency shutdown" on page 275
- "Restoring power after an emergency" on page 276
- "Clustering support" on page 276
- "Getting help on the World Wide Web" on page 276
- "Specifications" on page 277

### 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 276.

#### 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 "Tray number settings" on page 280 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 EXP500 before 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 “Symptom-to-FRU index” on page 301.

## 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, see “Symptom-to-FRU index” on page 301.

The expansion unit is designed to run continuously, 24 hours a day. After 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”).

### 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, see “Symptom-to-FRU index” on page 301.
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 “Symptom-to-FRU index” on page 301).

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 EXP500 before 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 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, see “Symptom-to-FRU index” on page 301 for instructions.
7. Use your installed software application as appropriate to check the status of the expansion unit.

## 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 takes ownership of the array group.

Clustering requires additional hardware and specialized software. For more information about clustering, visit the following IBM Web site:

<http://www.ibm.com/pc/us/netfinity/clustering>

## Getting help on the World Wide Web

You can obtain up-to-date information about your IBM EXP500, a complete listing of the options that are supported on your model, and information about other IBM server products by accessing the IBM Web page at the following address:

<http://www.ibm.com/pc/us/netfinity>

## Specifications

The following summarizes the operating specifications of the EXP500.

### Size (with front panel and without mounting rails)

- Depth: 56.3 cm (22.2 in)
- Height: 12.8 cm (5 in)
- Width: 44.7 cm (17.6 in)

### Weight

- Standard expansion unit as shipped: 25 kg (54.5 lbs)
- Typical expansion unit fully loaded: 35.5 kg (78 lbs)

### Electrical input

- Sine-wave input (50 to 60 Hz) is required
- Input Voltage:
  - Low range:
    - Minimum: 90 V ac
    - Maximum: 127 V ac
  - High range:
    - Minimum: 198 V ac
    - Maximum: 257 V ac
  - Input kilovolt-amperes (kVA) approximately:
    - Minimum configuration: 0.06 kVA
    - Maximum configuration: 0.36 kVA

### Environment

- Air temperature:
  - 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:
  - 8% to 80%

### Acoustical noise emissions values

For open bay (0 drives installed) and typical system configurations (8 hard drives installed).

- Sound Power (idling):
  - 6.3 bels (open bay)
  - 6.5 bels (typical)
- Sound Power (operating):
  - 6.3 bels (open bay)

- 6.6 bels (typical)
- Sound Pressure (idling):
  - 47 dBA (open bay)
  - 49 dBA (typical)
- Sound Pressure (operating):
  - 47 dBA (open bay)
  - 50 dBA (typical)

These levels are measured in controlled acoustical environments according to 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.

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## Locations and installation procedures

The following information supports the EXP500.

- “Installing the expansion unit” on page 278
- “Installing and replacing devices” on page 284
- “IBM FAStT EXP500 bays” on page 295
- “Fan, ESM, and power supply bays” on page 296
- “Front controls and indicators” on page 297
- “Rear controls, indicators, and connectors” on page 298
- “ESM boards user controls” on page 300
- “System-management software support” on page 301

## Installing the expansion unit

Use the following information to install the expansion unit in an EIA standard rack cabinet.

### Getting started

Before you begin, review the following tasks and assumptions:

- If you are installing the expansion unit in a rack, you have already installed the other components in the rack and moved the rack 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 IBM 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 “Specifications” on page 277.

### Preparing the expansion unit

The following information 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 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 lbs). 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 “Installing and replacing devices” on page 284 for the information needed to remove the CRUs.

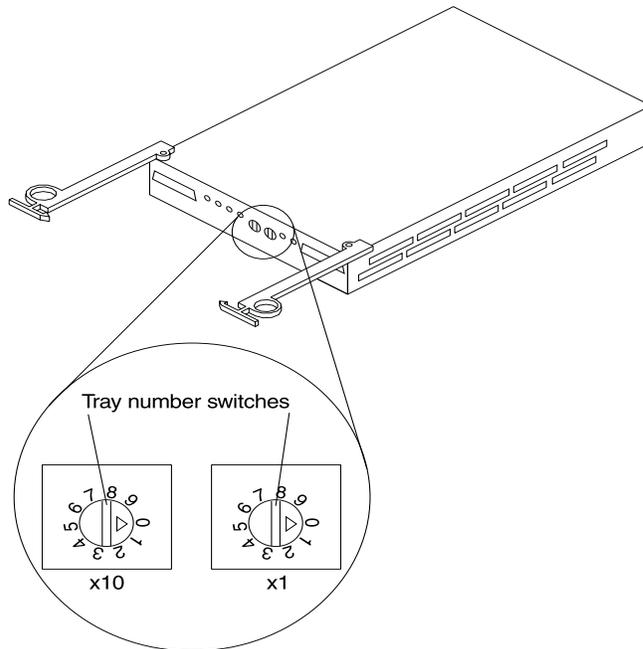


**CAUTION:**  
Use safe practices when lifting.

**Attention:** The expansion unit is shipped with the decorative bezel attached to the front of the unit with two white screws and nuts. This bezel protects the light pipes located above the drive trays. Leave the decorative bezel in place until you are instructed to remove it during the installation process.

**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.

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 (0-9). Use these settings 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 whether 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.

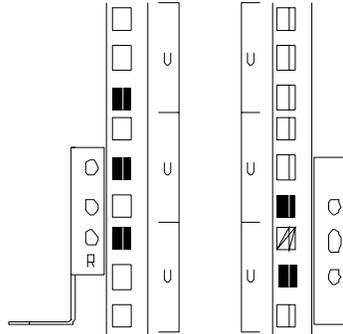
## Installing the expansion unit in a rack

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

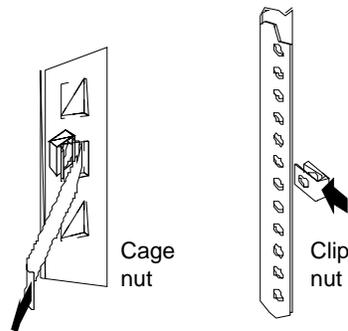
- Review the rack documentation for safety and cabling considerations. Ensure that your planned installation is within the rack-enclosure guidelines for heat generation, electrical requirements, air flow, and mechanical loading.  
**Note:** Because of the limited space in some racks, it might be easier to connect and route cables before you install the mounting brackets and hardware devices.
- Install the expansion unit in a maximum 35° C environment.
- To ensure proper air flow, position the unit in the rack so that the air vents are not blocked. Usually 15 cm (6 inches) of air space is sufficient.
- To ensure the rack stability, load the rack starting from the bottom.
- If you install multiple components in the rack, do not overload the power outlets.
- Plan device installation starting from the bottom of the rack.
- Turn off power to your rack.
- Refer to the rack documentation for instructions on removing its doors and side panels.
- 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:

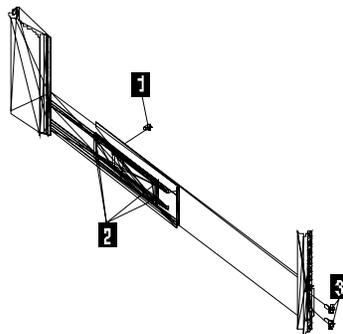
1. Use the following figure of front and rear rack mounting flanges to determine the appropriate rack mounting holes for installing cage nuts or clip nuts to secure your IBM FAStT EXP500 rails.



**Note:** Use clip nuts if your rack 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.

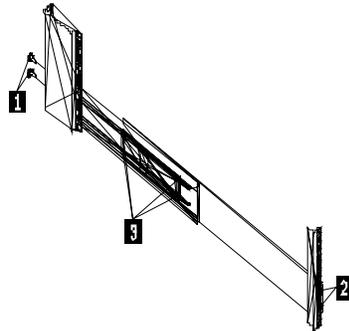


2. On the rail marked L, remove and save the small screw (1); then, loosen the four large screws (2).



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 through step 5 to install the rail marked R on the right side of the rack.



**CAUTION:**  
Use safe practices when lifting.

6. Lift and then slide the expansion unit into the rack; 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 IBM FAST EXP500 with two black hex screws (2).
8. Use the two small screws (3) (removed in step 2) to secure the rear of the expansion unit.
9. Install hard disk drives, fans, ESM boards, and power supplies in the EXP500 expansion unit according to "Installing and replacing devices" on page 284; 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” on page 283.

**Cabling the expansion unit:** This section provides the Fibre Channel 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 274 for the initial startup of the expansion unit.

The IBM FASTT EXP500 provides redundant loop support. A redundant IBM 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 uses the other IBM FASTT EXP500 loop to maintain I/O to the IBM 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 IBM 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 ↑ (input) and ↓ (output). You build a loop by connecting one or more IBM FASTT EXP500 expansion units to one or more controllers. You then use dual fiber-optic cables to connect one IBM FASTT EXP500 expansion unit to another in a daisy-chain. It takes two GBICs on the ESM board to connect a single IBM FASTT EXP500 expansion unit to a controller in a redundant loop.

### 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, 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 on the expansion unit” on page 274 for the initial startup of the expansion unit.

## Installing and replacing devices

Use the following information to help you install or remove customer replaceable units (CRUs), such as hot-swap drives, fans, ESM boards, and power supplies.

### Working with hot-swap drives

#### Before you begin

- Read the safety and handling guidelines provided in this document.
- 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. (If you reinstall a drive in the wrong bay, you might lose data.)

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

Table 41. Drive LEDs for FAStT EXP500 Storage Expansion unit

LED	LED State	Definitions
Activity LED	Green flashing	The green light flashes to indicate FC activity to the drive.

Table 41. Drive LEDs for FAStT EXP500 Storage Expansion unit

LED	LED State	Definitions
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 being removed or installed. These drives are known as *hot-swap* drives.

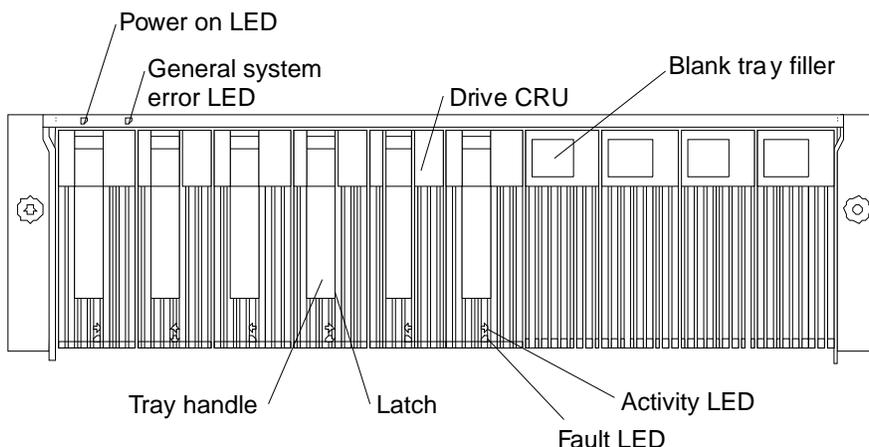
### Slim-line drives

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 287.

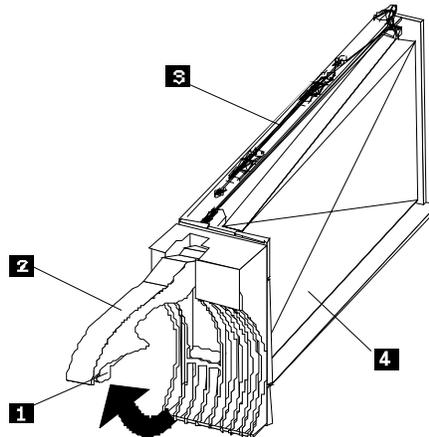
1. Read the instructions that come with the drive CRU.
2. Check for Fault LEDs. If any amber LEDs are lit, refer to “Replacing hot-swap drives” on page 287.



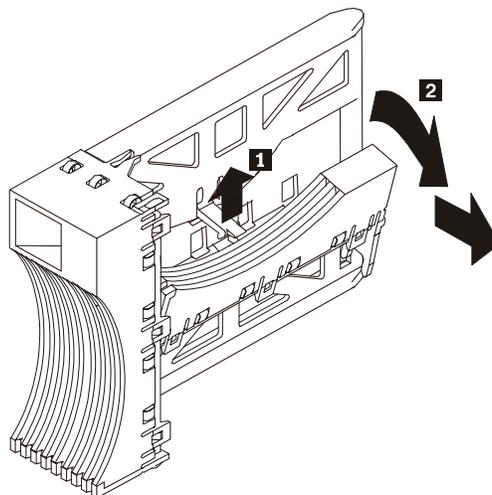
3. Determine the bay into which you want to install the drive.
4. Remove the blank tray.

- 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:

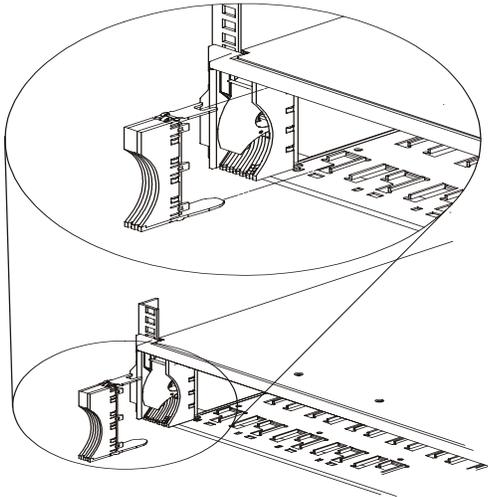
**Note:** The hard disk drive comes with a tray already attached. Do not attempt to detach the drive (4) from the tray (3).



- 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 a below. 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 figure.



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



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.

**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.

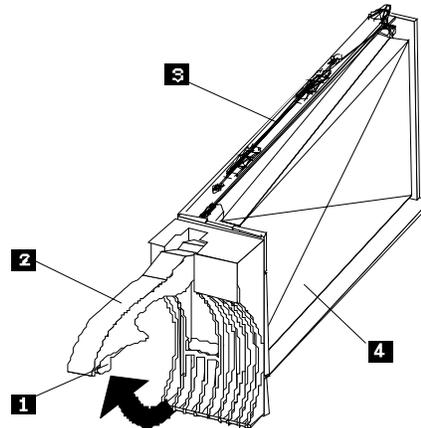
**Attention:** Failure to replace the drives in their correct bays might result in loss of data. If you are replacing a drive that is part of a RAID level 1 or RAID level 5 logical drive, ensure that you install the replacement drive in the correct bay.

Check the hardware and software documentation provided with your system to see whether 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

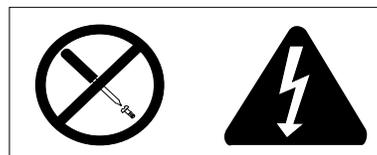
The power supplies are customer replaceable units (CRUs) and do not require preventive maintenance.

- 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:

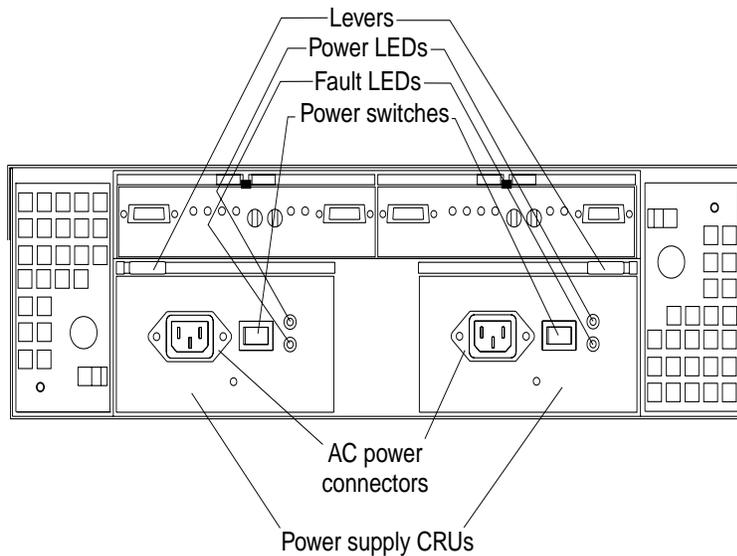
#### CAUTION:

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.



To remove a hot-swap power supply:

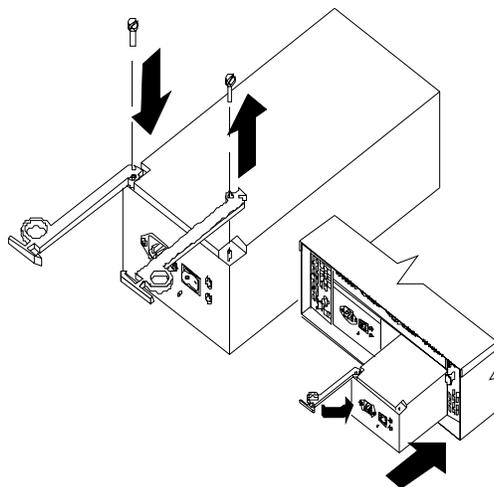
1. Turn the power supply switch to the Off position.



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.

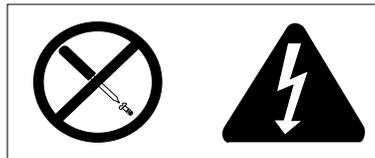


## To install a hot-swap power supply:

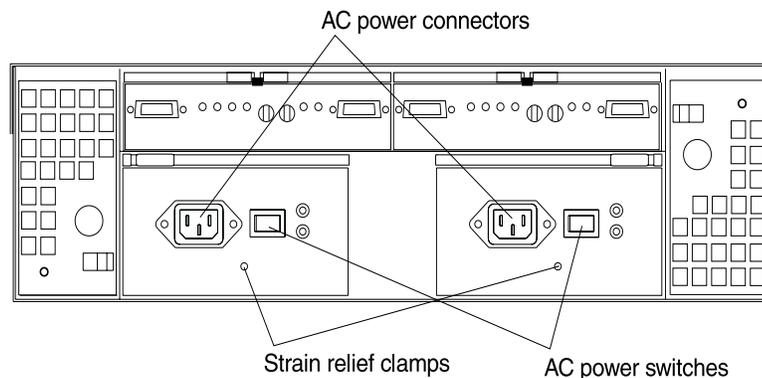


### CAUTION:

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.



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.



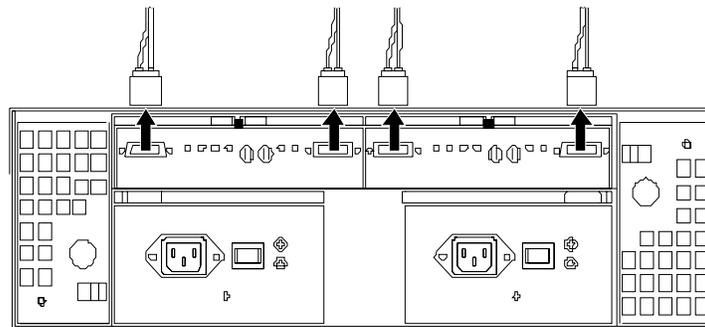
6. Plug the supply power cord into a properly grounded electrical outlet.
7. Turn the power supply switch to the On position.

## 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 “Symptom-to-FRU index” on page 301.
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 IBM Fibre Array Storage Technology (FAS<sup>®</sup>T) EXP500 expansion units to a loop. The GBICs are laser products.



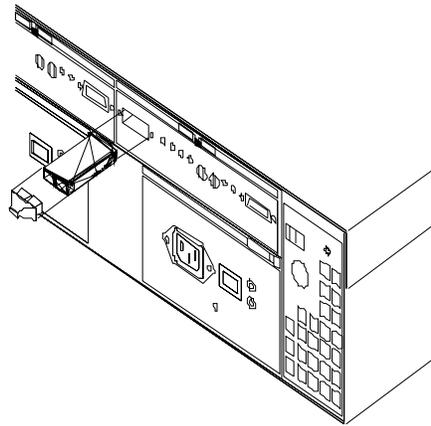
**CAUTION:**

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

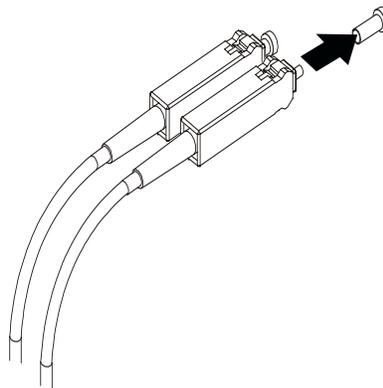
- Do not remove the covers. Removing the covers of the laser product could result in exposure to hazardous laser radiation. There are no serviceable parts inside the device.
- Use of controls or adjustments or performance of procedures other than those specified herein might result in hazardous radiation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

To install a GBIC, do the following:

1. Remove the protective cap from the GBIC.

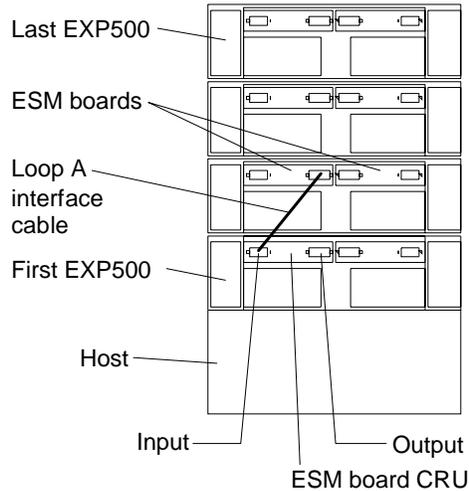


2. Move the GBIC latch to the unlocked (center) position.
3. Insert the GBIC into the GBIC port on the ESM board.
4. Move the GBIC latch back to the locked position (flush with the rear of the GBIC).
5. Remove the protective caps from the fiber-optic cable.



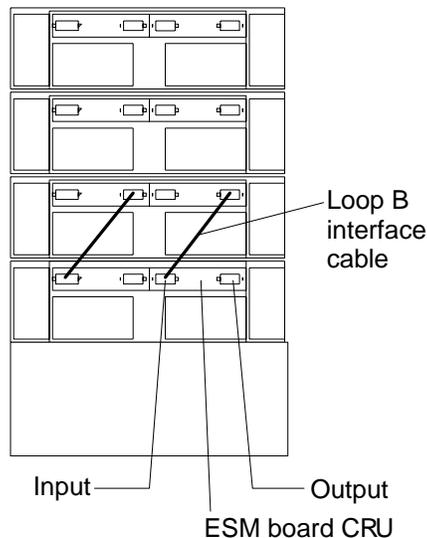
6. Connect the fiber-optic cable to the installed GBIC.

**Adding IBM FAStT EXP500 expansion units to a loop:** If you want to add an additional IBM FAStT EXP500 expansion unit to a loop, cable the GBIC input port on the existing ESM board (shown as First EXP500 in the following figure) to a GBIC output port on the new Netfinity FAStT EXP500 expansion unit. You can daisy-chain additional IBM 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.



**IBM FAStT EXP500 loop redundancy:** The IBM 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 following figure). 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).

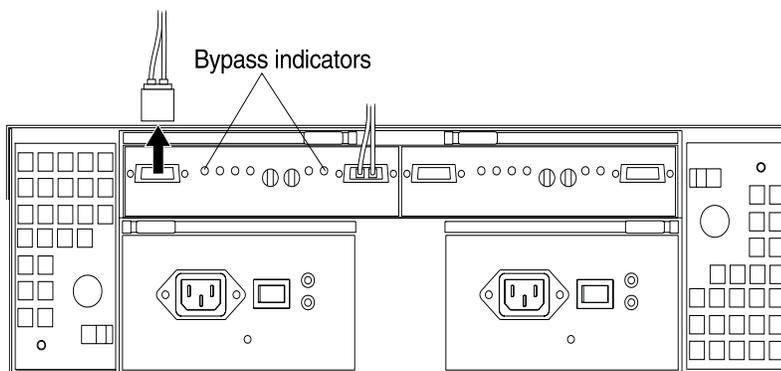
Some FC controllers might not support loop redundancy. IBM Fibre Channel (FC) disk drives are dual-ported, providing individual access from two FC loops to the same disk drive. When configuring the ESM boards, configure the second ESM board the same way you configured the first ESM board. Refer to your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



The GBIC ports are labeled with ↑ (input) and ↓ (output). Some controllers might provide additional reliability features if an ↑ (input) port is connected to an ↓ (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.

A lit Bypass indicator next to a GBIC can be caused by a number of things. It does not necessarily mean that the GBIC has failed. See “Symptom-to-FRU index” on page 301 for other possible causes. If you do determine that a GBIC has failed, follow this procedure to replace the failed GBIC.

1. Check the software documentation provided with your system for instructions on GBIC failure recovery procedures. Follow the steps provided in the software documentation before continuing to step 2.
2. Remove the FC cables from the GBIC.
3. Remove the failed GBIC from the GBIC port on the back of the ESM board.



4. Unpack the new GBIC.  
**Note:** Place the new GBIC on a dry, level surface near the expansion unit and away from magnetic fields. Save all packing materials in case you need to return the GBIC.
5. Read the documentation that came with the new GBIC for replacement procedures and other information.
6. Insert the new GBIC into the GBIC port on the ESM board.
7. Insert the FC cables into the new GBIC.
8. Check the Bypass indicator next to the failed GBIC:
  - If the Bypass indicator is lit, the GBIC might not be inserted correctly.
  - If the Bypass indicator remains lit, or a Fault indicator on the ESM board comes on, refer to “Symptom-to-FRU index” on page 301.
9. Replace or close the back access panel, if necessary.

## 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.

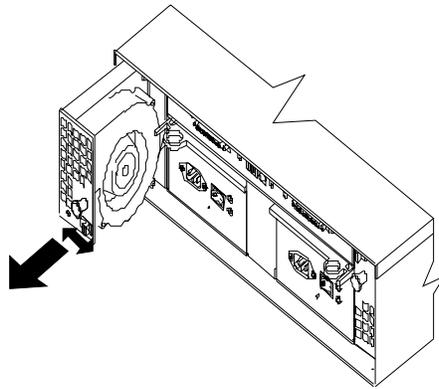
The fans are interchangeable and customer replaceable and do not require preventive maintenance. The fans help maintain proper air circulation across the components inside the expansion unit. Air flows through the expansion unit from the front to the back.

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 reseal 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 “Symptom-to-FRU index” on page 301.

## IBM FAStT EXP500 bays

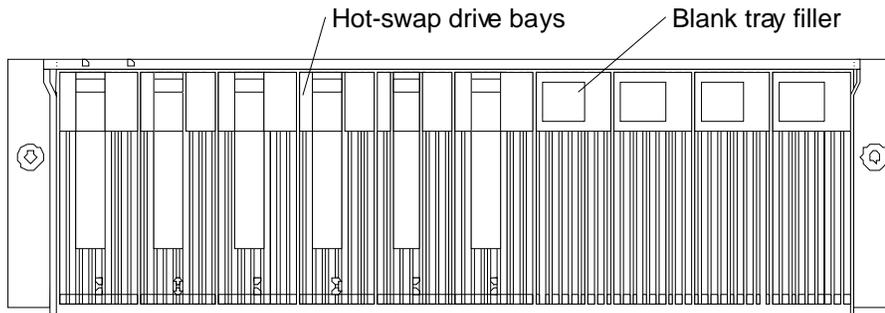
The following sections show the hot-swap CRUs on the IBM FAStT EXP500 expansion unit.

The hot-swap features of the IBM 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 figure shows the location of the hot-swap drive bays accessible from the front of your expansion unit. The IBM 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.

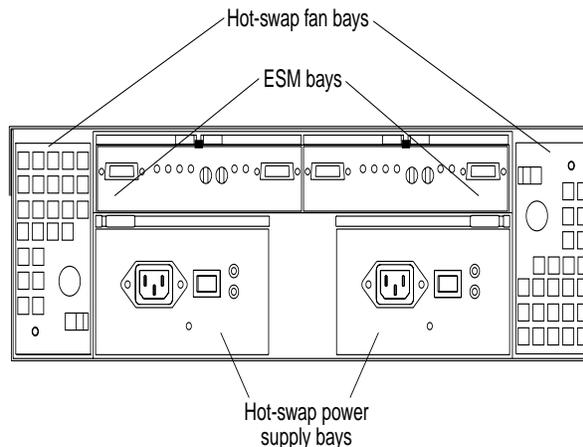
In this example figure, six of the 10 bays contain drive CRUs and four bays contain blank tray fillers. To maintain proper cooling within your expansion unit, always keep a blank tray filler in each drive bay that does not contain a drive CRU. For information on installing and replacing drive CRUs, see “Installing and replacing devices” on page 284.



**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 figure 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 IBM FAStT 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 whether the controller supports this redundancy function.

## Hot-swap fan bays

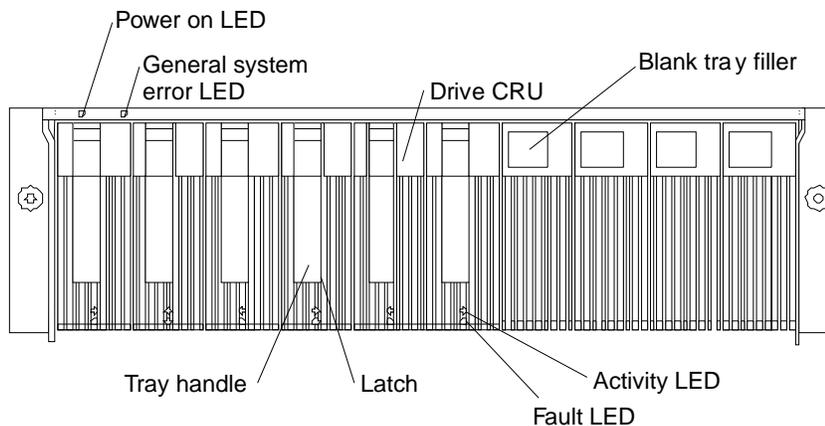
Your expansion unit has two interchangeable hot-swap and redundant fan units. Each unit contains two fans. If one fan unit fails, the second fan unit continues to operate. Both fan units must be installed to maintain proper cooling within your expansion unit, even if one fan unit is not operational.

## 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 figure.



### 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 adequate dc power.

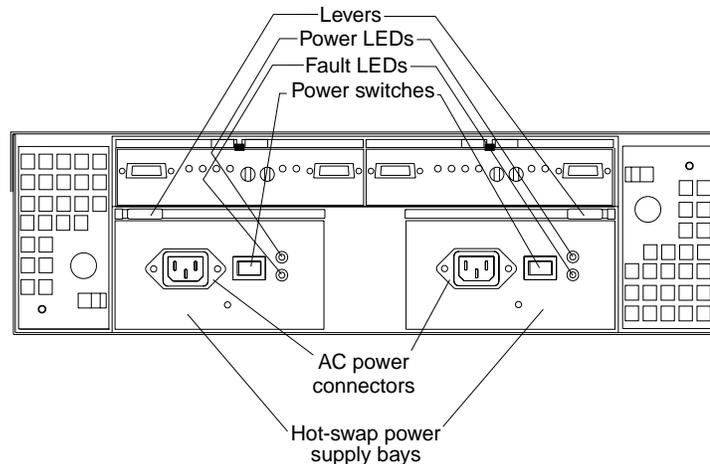
## Tray handle

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



## 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.

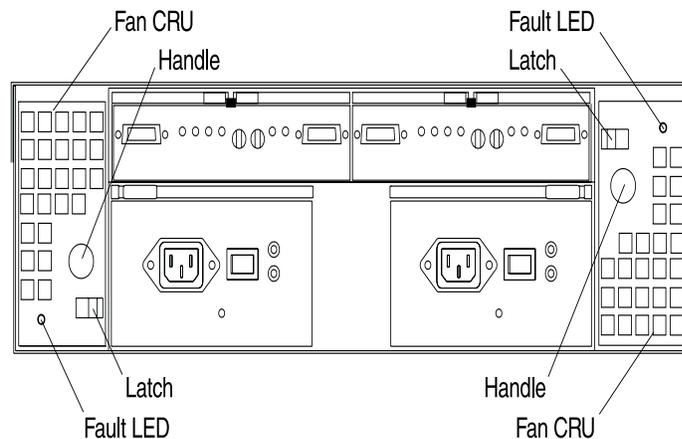
## Power switches

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 IBM FAStT EXP500 are hot-swappable and redundant. This means that your IBM FAStT EXP500 will continue to operate if a fan fails. It also means that you can remove and replace the fan while the IBM 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

There are two fan CRUs. These fans are hot-swappable and redundant.

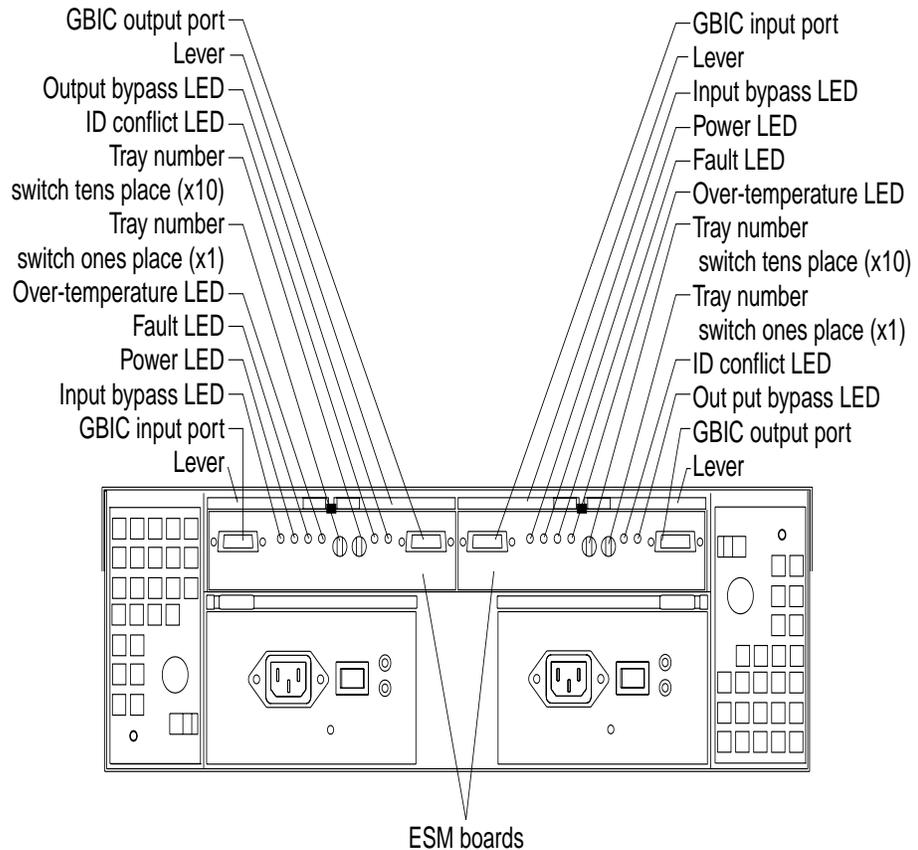
## Fault LEDs

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 IBM FAStT 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 are 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 IBM FAStT 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.

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## Symptom-to-FRU index

**Note:** The PD maps provide you with additional diagnostic aids and can be found on the IBM support web site: <http://www.pc.ibm.com/qtechinfo/MIGR-4P3PMR.html>. The PDs can also be found in this book. See “Chapter 2. PD entry,” on page 3.

Use this chart to find solutions to problems that have definite symptoms.

*Table 42. Symptom-to-FRU index for FAStT EXP500 Storage Expansion unit*

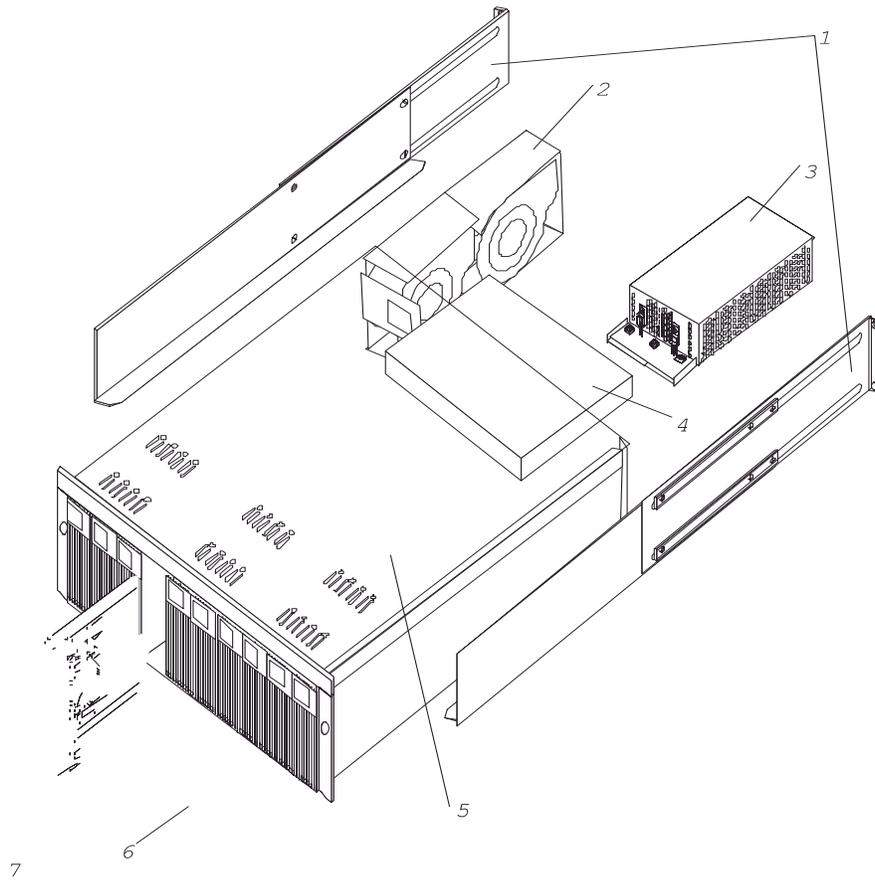
Problem Indicator	FRU/Action
Amber LED On (Front Panel)	1. <b>General Machine Fault</b> Check for amber LED on expansion unit. Use the RAID manager software to check the status.
Amber LED On (Hard Disk Drive)	1. <b>Hard Disk Drive</b>
Amber LED On (Fan)	1. <b>Fan</b>
Amber LED On	1. <b>ESM board</b>
Amber LED On, Green LED Off (Power Supply)	1. <b>Turn Power Switch On</b> 2. Power cord 3. Reseat Power Supply 4. Power Supply
Amber and Green LEDs On (Power Supply)	1. <b>Power Supply</b>

Table 42. Symptom-to-FRU index for FAStT EXP500 Storage Expansion unit

Problem Indicator	FRU/Action
All Green LEDs Off	<ol style="list-style-type: none"> <li>1. <b>Check AC voltage cabinet AC voltage line inputs</b></li> <li>2. Power Supplies</li> <li>3. Midplane board</li> </ol>
Intermittent power loss to expansion unit	<ol style="list-style-type: none"> <li>1. <b>Check AC voltage line inputs, and cabinet power components</b></li> <li>2. Power Supplies</li> <li>3. Midplane board</li> </ol>
One or more Green LEDs Off (Power Supply)	<ol style="list-style-type: none"> <li>1. <b>Turn Power Switch On</b></li> <li>2. Power cord</li> <li>3. Reseat Power Supply</li> <li>4. Power Supply</li> </ol>
One or more Green LEDs On (Drives)	<ol style="list-style-type: none"> <li>1. <b>No activity to the drive</b></li> <li>2. This can be normal activity</li> </ol>
Intermittent Power Loss	<ol style="list-style-type: none"> <li>1. <b>AC power or plug</b></li> <li>2. Power supply</li> <li>3. Midplane</li> </ol>
Random errors	<ol style="list-style-type: none"> <li>1. <b>Midplane board</b></li> </ol>
One or more Green LEDs blinking slowly. (All hard disk drives.)	<ol style="list-style-type: none"> <li>1. <b>Check cabling scheme</b></li> <li>2. FC Cable</li> <li>3. GBIC</li> </ol>
Hard disk drive not visible in RAID management software.	<ol style="list-style-type: none"> <li>1. <b>Hard Disk Drive</b></li> <li>2. Midplane Board</li> </ol>
Amber temperature LED enabled in RAID management software. (ESM Board)	<ol style="list-style-type: none"> <li>1. <b>Check for fan fault LED</b></li> <li>2. Unit is overheating; check temperature.</li> <li>3. ESM Board</li> </ol>
Amber conflict LED on. (ESM Board)	<ol style="list-style-type: none"> <li>1. <b>Tray numbers of ESM boards within a single FAStT EXP500 do not match</b></li> </ol>
GBIC bypass LED.  <b>Note:</b>  It is normal for the LED to be on when no GBIC or cable is installed.	<ol style="list-style-type: none"> <li>1. <b>Check ESM fault LED</b></li> <li>2. GBIC does not detect an incoming signal               <ol style="list-style-type: none"> <li>a. FC Cable</li> <li>b. GBIC or other end on the FC cable</li> <li>c. GBIC adjacent to amber LEDC cable</li> </ol> </li> </ol>

**Note:** If you cannot find the problem using this Symptom-to-FRU Index, test the entire system. See the server documentation for more detailed information on testing and diagnostic tools.

## Parts listing



Index	System (IBM FAStT EXP500 - Type 3560, Model 1RU)	FRU No.
1	Rail Kit Left/Right (Model 1RU)	37L0067
2	Blower Assembly (Model 1RU)	09N7285
3	350W Power Supply Assembly (Model 1RU)	37L0059
4	Electronic Module (ESM, LVD/LVD) (Model 1RU)	37L0103
5	Midplane/Frame (Model 1RU) <b>Note:</b> The midplane board and frame are replaced as a unit. If either part is needed, order the above FRU.	37L0104
6	Decorative Bezel (Model 1RU)	37L0074
7	Blank Tray Assembly (Model 1RU)	37L6708
	Tower Enclosure (Model 1RU)	37L0120
	Tower Lock/Pawl (Model 1RU)	37L0121
	Tower Feet (Model 1RU)	09N7266
	Miscellaneous Hardware Kit (Model 1RU)	09N7288
	LVD SCSI Cable, 20 Meter external (Model 1RU)	37L0083

Index	System (IBM FAStT EXP500 - Type 3560, Model 1RU)	FRU No.
	Line Cord, 9 Foot (Model 1RU)	6952300
	Line Cord Jumper, High Voltage (Model 1RU)	36L8886

Table 43. EXP500 power cords

Power Cords	FRU No.
Arabic	14F0033
Argentina	13F9940
Australia	13F9940
Belgium	13F9979
Bulgaria	13F9979
Canada	6952300
Czech Republic	13F9979
Denmark	13F9997
Finland	13F9979
France	13F9979
Germany	13F9979
Hungary	13F9979
Israel	14F0087
Italy	14F0069
Latvia	13F9979
Netherlands	13F9979
Norway	13F9979
Poland	13F9979
Portugal	13F9979
Serbia	13F9979
Slovakia	13F9979
South Africa	14F0015
Spain	13F9979
Switzerland	13F9979
Switzerland (French/German)	14F0051
Thailand	1838574
U.S. English	6952300
U.K./Ireland	14F0033
Yugoslavia	13F9979

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## Chapter 12. IBM Storage Area Network Data Gateway Router (2108-R03)

---

### Introduction

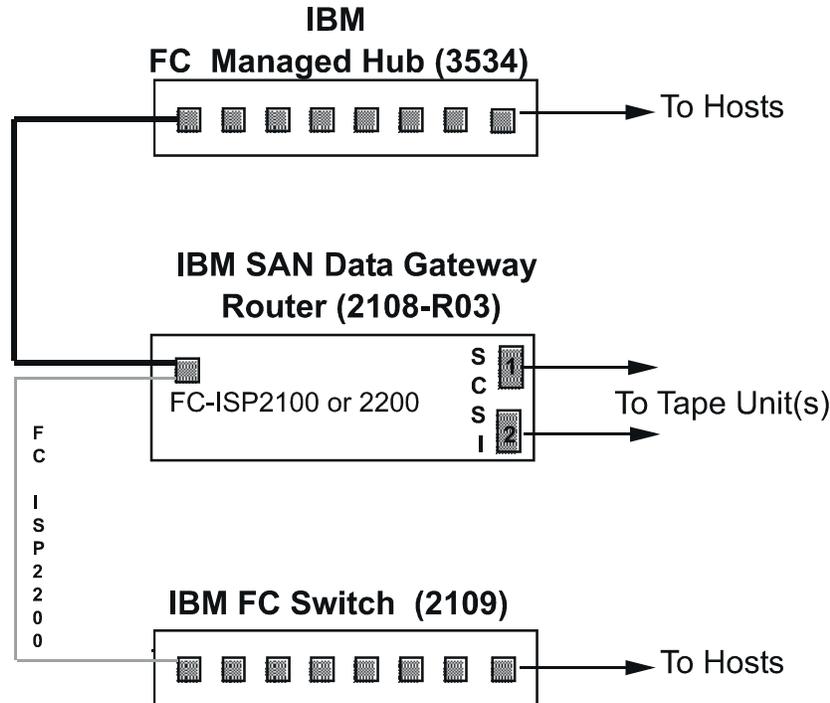
The IBM Storage Area Network Data Gateway Router (2108-R03) provides Fibre Channel to Small Computer Systems Interface (SCSI) connectivity. Typically, tape devices are connected to the SCSI side of the router with Hosts communication through the Fibre Channel interface.

This chapter describes the functionality of the IBM Storage Area Network Data Gateway Router (SDG) as well as the service and diagnostic tools that you may use to diagnose and repair the SDG Router. This chapter is organized as follows:

- Key Features of the SDG Router
- Block Diagram
- Connections
- Fibre Channel port modes and connection options
- Power-up and start sequence guidelines
- SDG Router network setup
- Service aids
  - LED indicators
  - Power-on-self-test (POST)
  - Health check
  - Event log
  - Service Port commands
  - Diagnostics

The Service aids should provide you with sufficient information and guidance to determine whether the unit is functional and how to diagnose problems. For actual FRU isolation please access the full Service Guide and the MAPs by clicking on this link [2108 Model R03 Service Guide](http://www.storage.ibm.com/hardsoft/products/sangateway/2108r03/Document/sf1sgmst.pdf) that will take you to the website: <http://www.storage.ibm.com/hardsoft/products/sangateway/2108r03/Document/sf1sgmst.pdf>, or referring to the manual supplied with your SDG Router.

The following figure shows a typical topology where an SDG Router would be used.



The SDG Router can also be connected to the switch (Fabric), provided the FC card type is an ISP2200.

## Key Features

### Fibre Channel

The SDG Router FC interface for Host attachment is a plug-in Fibre Channel card. The SDG Router can accommodate 1 FC cards providing optical port connectivity. The card contains either a ISP2100 controller or the ISP2200 controller. The ISP2100 supports only Private loop whereas the ISP2200 supports Private loop and Fabric connection. The port supports long wave and short wave laser with SC fiber-optic connectors. The link data rate is 1Gb\s.

### SCSI Channels

The SCSI channels can be up to two Ultra-Wide SE, DE or LVD SCSI channels with internal termination. Each SCSI channel supports up to 15 SCSI target IDs and up to 32 LUNs per ID (subject to an overall total of 128 devices). The SDG Router itself uses one ID, leaving a total of 127 IDs for SCSI devices. The tape devices that are typically connected to the SDG Router are the IBM 3447, 3449, and 3502 although any IBM Tape device with a SCSI interface may be supported.

### Ethernet

The SDG Router has an RJ-45 connector for out-of- band management of the router through the network.

### Service Port

A Service Port is also included to allow Personal Computers to locally manage the SDG Router and initiate diagnostics. The connection is accomplished through the use

of a 9-pin-to-9-pin null-modem cable (supplied). The Service port should be connected and configured as follows:

1. Connect the null modem cable (and the 9- to 25-pin adapter if applicable) between the computer serial (COM) port and the SDG Router service port.
2. Turn on the service terminal.
3. On the service terminal, double-click the hyperTerminal icon.
4. In the New Connection dialog box, enter SDG Router for the name and click OK.
5. In the Connect To dialog box, for the Connect using field, select the COM port number that you have chosen and click OK.
6. In the COM Properties dialog box, select the following:
  - Bits per second: 19 200
  - Data bits: 8
  - Parity: None
  - Stop bits: 1
  - Flow Control: Xon/Xoff
7. Click OK.

### Verifying the connection

If the SDG Router is already on, then characters typed in the terminal should be visible to the operator. The simplest test is to press the Enter key. The SDG Router will respond by displaying a command prompt like:

```
Router >
```

When the SDG Router is restarting, several messages are displayed on the service terminal. A successful start is indicated by the last message:

```
Done executing start-up script.
```

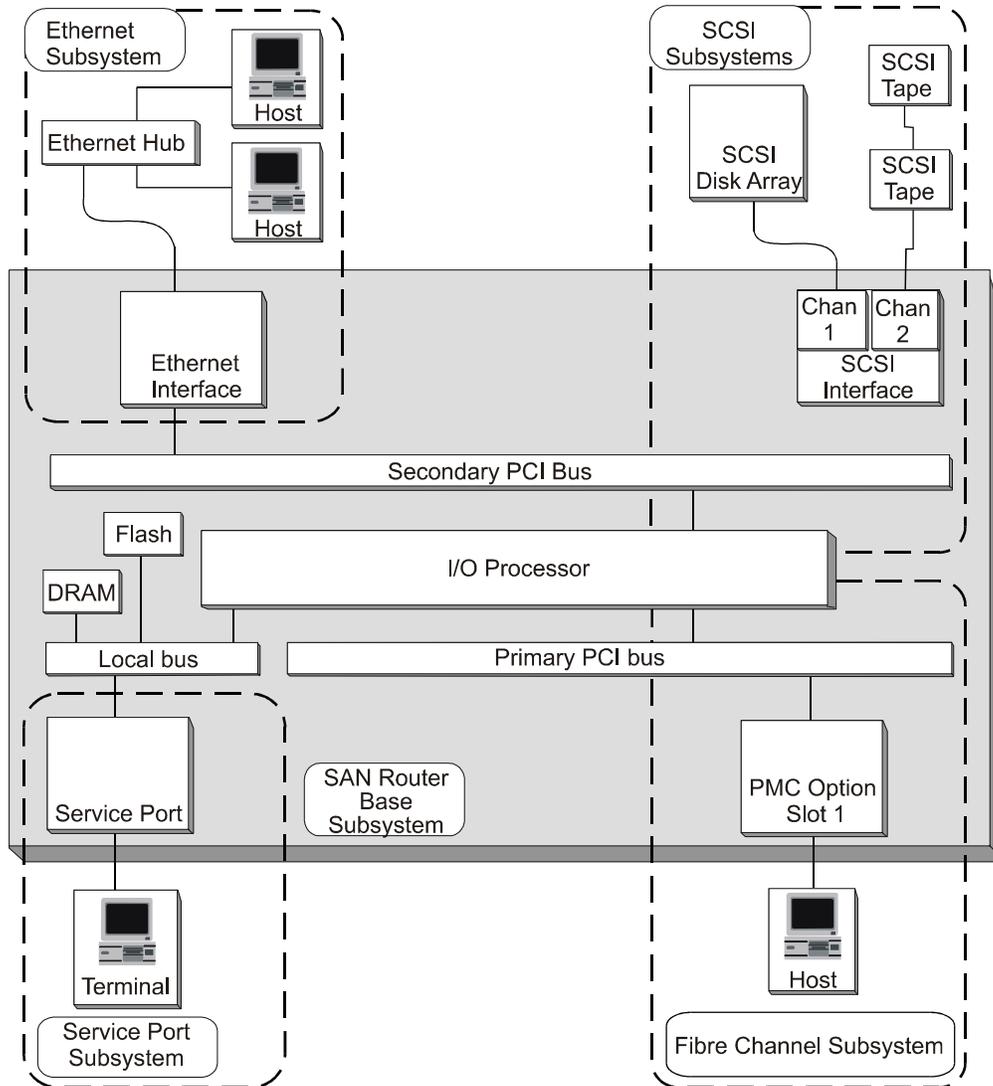
### StorWatch Specialist

The IBM StorWatch SDG Router Specialist (hereafter referred to as StorWatch Specialist) offers full capability for remote management, configuration and event notification. Each SDG Router has internal event logging, event analysis and periodic health check for predictive failure analysis (PFA). These management, configuration and notification capabilities are accessible by way of standard SNMP protocol for use with major network management applications. The StorWatch Specialist offers the Sun Java™ application software for SDG Router remote management and configuration. For a complete description of the StorWatch Specialist and user's guide, please go to the link: [2108 Model RO3 Installation and User's Guide](http://www.storage.ibm.com/hardsoft/products/sangateway/2108r03/Document/sf1iumst.pdf) or the following website:  
<http://www.storage.ibm.com/hardsoft/products/sangateway/2108r03/Document/sf1iumst.pdf>.

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## Block Diagram

The following figure shows the SDG Router Subsystems.



## Connections

### Attaching SCSI devices

SCSI devices are attached to any of the SCSI connectors on the rear of the SDG Router. The device types and speeds, as well as cabling, target IDs, and termination are discussed in this section. High quality cables with the correct latches or screws must be used at all times to ensure reliable connections. Cables are not provided with the SDG Router.

**Note:** Ensure that you read this section before you attach any devices to the Router. See Table 44 on page 309

**Transfer rates – Ultra, fast, and asynchronous:** The SCSI protocol defines two methods of data transfer: synchronous and asynchronous. Asynchronous transfers can run as fast as 5 MHz, while synchronous transfers can run as fast as 20 MHz (Ultra). The rate of transfer is negotiated between a SCSI initiator, such as the SDG Router, and each target. For each target device identified during a bus scan, the SDG Router requests a transfer rate at the Ultra transfer rate. The target replies with the maximum transfer rate it will support, up to the one requested by the SDG Router.

**Note:** In general, devices that are capable of running at Ultra speeds should not be mixed on a bus with slower devices.

**Wide and narrow SCSI buses:** A SCSI bus can be either narrow (8 bit) or wide (16 bit). The SDG Router SCSI buses are all wide, but can be connected to narrow devices with the correct cable adapters. Although it is possible to mix narrow and wide devices on a single SCSI bus, this configuration is not recommended. If any of the devices supports Ultra speeds, then a mix of narrow and wide devices is prohibited. In order for the SDG Router to locate and communicate with the devices, each device on the SCSI bus must be assigned a unique target ID. On a wide (16-bit) SCSI bus, the SCSI standard allows for a total of 16 target IDs. On a narrow (8-bit) SCSI bus, the SCSI standard allows for a total of 8 target IDs. There are no requirements about the ordering or position of the target IDs on the SCSI bus. The only requirement is that there be no duplicate target IDs. The SDG Router uses ID 7. Thus, peripheral devices can use IDs 0 through 6 and 8 through 15, typically selected by a switch or jumpers.

**Attention:** Make sure you do not assign more than one device on a bus to the same target ID. This will prevent that bus from working correctly. The SCSI protocol also defines a priority-based arbitration method, based on the target ID of the device attaching to the bus. The SCSI ID priority order is, from highest to lowest, 7, 6, 5, 4, 3, 2, 1, 0, 15, 14, 13, 12, 11, 10, 9, and 8.

**Limitation of DE, SE, and LVD bus length:** Differential ended (DE) allows longer bus lengths and is reliable even when the lengths of cable between devices are not consistent. A DE SCSI bus can be as long as 25 m. An SE SCSI bus can be as long as 6 m. An LVD (Low Voltage Differential) bus can support up to 12m cables.

**Note:** LVD is not supported by the SDG Router. LVD devices can typically set their interface mode to either SE or LVD depending on the bus to which they are attached.

**Table of SCSI terminology and limitations:** Table 44 defines the number of devices supported, based on the negotiated transfer type. When reviewing the limitations of a bus, the capabilities of the fastest devices must be considered. The bus length indicates total SCSI bus length, including any internal device cables, rather than the length between any two devices.

*Table 44. SCSI Terminology and Limitations*

Transfer type	Maximum bus speed (MBPS)	Bus width (bits)	Bus length, DE (max., m) LVD (max., m) SE (max., m)	Maximum device support
Fast Wide SCSI	20	16	25 12 6	16
Wide Ultra SCSI	40	16	25 12 6	16

### SCSI bus termination

Each end of a SCSI bus must be terminated correctly. The SDG Router provides termination on each of its buses. The terminators can be disabled using a jumper on the SDG Router system board or from the StorWatch Specialist. Each interface has a separate control for the terminators.

**Attention:** Incorrect SCSI bus termination can result in excessive errors on the SCSI bus, data corruption, and the inability to communicate with target devices.

The SDG Router provides termination power on all SCSI buses for external terminators.

Many SCSI target devices have internal terminators. It is imperative that the terminators be disabled for all devices except those at the physical ends of the SCSI bus.

### **DE bus termination**

For DE interfaces, only differential terminators can be used.

**Attention:** A single-ended terminator connected to a DE SCSI channel can cause that bus to be unusable.

### **Problems on the SCSI bus**

When a SCSI bus fails to operate correctly, it is usually caused by incorrect connections to the SCSI bus. Common problems include the following:

- **Missing terminator at the end of a SCSI bus**  
Check that an external terminator is attached or that the end device has termination enabled.
- **Excessive termination**  
Check that all devices, other than the end devices, have termination disabled.
- **Multiple devices at the same ID**  
If two or more devices are configured at the same SCSI ID, only one of those devices can be used by the SDG Router, and data transfers to that device are unreliable. Check that only one device is set to each ID.
- **Target device set to initiator's ID**  
If a target device is set to the same ID as the SDG Router (ID 7), the bus will be unstable and data corruption can result. Check that no target devices are set to ID 7.
- **Bent pins in a SCSI connector**  
The pins in the SCSI connectors are somewhat fragile. Inspect each connector to find pins that were bent when the connector was attached. Replace any cables that have bent pins.
- **Improper device type**  
A DE device on an SE bus or an SE device on a DE bus will cause the bus to be unusable.
- **Incorrect terminator type**  
A DE terminator on an SE bus or an SE terminator on a DE bus will cause the bus to be unusable.
- **Inadequate cables**  
Older cables might not be suitable for running at Ultra speeds. Be sure all cables are rated for Ultra.
- **Mixed cable types**  
If a SCSI bus has both round cables and flat ribbon cables, it might have problems when running at Ultra speeds. Use the same cable type consistently for all segments of the SCSI bus.
- **Unshielded cables**  
An unshielded SCSI cable used externally to a cabinet can cause reliability problems, due to interference from other electrical devices. Use only shielded cables.

---

## Fibre Channel port modes and connection options

The Fibre Channel PMC card contains either the ISP2100 controller or the ISP2200 controllers. The ISP2200 has additional initiator port modes and connection options. Use the `fcShow` command (page 318) to view the status of the Fibre Channel interface.

The ISP2100 supports initiator and target modes on a local loop. The default port mode setting is `istarget` and its connection type is always `loop`. Only loop-capable devices can be attached to it (Fabric is not supported).

The ISP2200 supports both the private and public Fibre Channel, Fabric loop attachment with options for loop and point-to-point connection options. The default port mode setting is `target` and the default connection setting is `loop`.

**Note:** You can change the Port mode options and connection types by using the StorWatch Specialist. For example to set the ISP2200 to Fabric Log in, set the connection type to Point to Point preferred.

### Port mode options

#### Target

In this mode, the port operates as a target and allows a Fibre Channel initiator (or FC switch) to attach to it. The port operates in either private loop or public loop host depending on whether a host or Fabric is attached to it.

- If a host is attached, the port operates as a private target.
- If Fabric is attached, the port operates as a public target.

#### Initiator

In this mode, the port operates as an initiator allowing Fibre Channel targets to be attached to it.

- For the ISP2100, the initiator port mode is always private loop.
- For the ISP2200, you can choose an initiator port mode option.

#### Target and initiator

In this mode, the port can access target devices on the Fibre Channel, and initiators on the Fibre Channel can access the targets attached to the SDG Router.

- For the ISP2100, the port switches between target and initiator modes.
- For the ISP2200, the port operates simultaneously as a target and initiator, and you can choose an initiator port mode option.

### ISP2200 initiator port mode options

**Private** In this option, the SDG Router scans the local loop for devices but does not check for Fabric devices. You can select this option if you are connecting target devices directly to the port.

**Public** In this option, the SDG Router scans the loop for Fabric devices. If it finds a Fabric device, it logs-in and queries the name server for target devices that are available on the Fabric.

- If the SDG Router finds targets attached to the Fabric, it adds all of them to the device map. You can select this option if you are connecting a

Fibre Channel switch to the port and you want the SDG Router to have access to the available target devices attached to the switch.

- If target devices are connected directly to the port, it automatically switches to private mode.

## ISP2200 connection type options

**Loop** With this connection option, the port operates with attached loop-capable devices. If a point-to-point device is attached, the SDG Router cannot communicate with it.

**Point-to-point**

With this connection option, the port supports point-to-point Fabric connection (F-Port Login). It also operates in "old-port mode" for compatibility with N-Port devices that do not support loop. If loop-capable devices are attached, the SDG Router cannot communicate with them.

**Loop preferred**

With this connection option, the port operates in loop mode. However, if the port detects a connection to an N-Port device, it automatically switches to the point-to-point option.

**Point-to-point preferred**

With this connection option, the port operates in point-to-point mode. However, if the port detects a connection to a loop device, it automatically switches to the loop option.

---

## Power-up and start sequence guidelines

### Connecting power

The SDG Router must be connected to ac power with a voltage of 100 - 127 or 200 - 240 volts, at a frequency of 50 to 60 Hz. A power switch is located next to the power connector on the rear panel of the SDG Router.

### Start Sequence

You must start the SDG Router and the attached host and target devices in a specific order. The following procedure describes the order in which you must restart.

**Attention:** Before you restart the SDG Router, you must stop all I/O operations between the host and the SCSI devices.

1. Turn on the SCSI devices. You must turn on all SCSI devices that are attached to the SDG Router before you turn on or restart the SDG Router.
2. Restart the SDG Router. You can invoke a SCSI rescan or restart from the service terminal. The SDG Router scans the SCSI buses as it starts. If you add or remove SCSI devices after the SDG Router has started, it does not detect the changes. After the SDG Router has finished the startup cycle, the Ready light on the front panel blinks at one-second intervals.
3. After the SDG Router has finished the startup cycle, turn on or restart the hosts that are connected by the Fibre Channel to the SDG Router.

---

## SDG Router network setup

The SDG Router must be connected to a 10Base-T Ethernet network for use with the StorWatch Specialist software. An RJ-45 connector is located on the rear panel of the SDG Router for connection to the Ethernet. You will need to first configure the IP address by connecting a terminal or terminal emulator to the service port of the SDG Router.

If you encounter problems configuring the network, the Ethernet port might be defective. See "Ethernet Test" 330.

### 1. Enable the Ethernet port.

By default, the Ethernet port on the SDG Router is disabled. To enable the port, use the **ethEnable** command. The SDG Router must be restarted to activate the Ethernet port.

```
foster > ethEnable
Ethernet will be enabled on the next boot
value = 0 = 0x0
foster >
```

### 2. Restart the SDG Router.

The SDG Router must be restarted to activate the Ethernet port, using the **reboot** command.

```
foster > reboot
```

To set up the network address refer to the examples below. For each of these examples, substitute the values obtained when you initially set up the network parameters of your SDG router (see the *SAN Set Up Guide*).

### 1. Set the host name.

The **hostNameSet** command sets the host name. In this example, the host name of the SDG Router was "Router" and is now being set to "foster."

The shell prompt will change to reflect the new name.

```
Router > hostNameSet "foster"
Target hostname set to foster
value = 0 = 0x0
foster >
```

### 2. Set the host network address.

The **ethAddrSet** command sets the network address. The IP address is specified as four decimal number separated by periods.

```
foster > ethAddrSet "192.168.1.54"
Host Address set to 192.168.1.54 for Ethernet interface
value = 0 = 0x0
```

If you need to set a netmask, specify it after the network address:

```
foster > ethAddrSet "10.0.0.2", "255.0.0.0"
```

### 3. Set the network routes and default SDG Router.

If a network gateway is needed for the SDG Router to communicate with other systems, you must specify one using the **theGateAddrSet** command.

```
foster > gateAddrSet "192.168.1.1"
value = 0 = 0x0
```

When more complicated routing is required to reach the StorWatch Specialist server, use the **route** command to specify the destination address, as a full address (single host) or as an abbreviated subnet address, and specify the address of the gateway that is reachable on the local subnet.

```
foster > route "add", "206.0.0", "192.168.1.1"
value = 0 = 0x0
```

## Service Aids

The SDG Router service capabilities include the following:

- LED indicators
- Power-on-self-test (POST)
- Health Check
- Event Log
- Service Port commands
- Diagnostics

### LED indicators

The LEDs on the front panel provides a visual indication of the status and activity of the SDG and its interfaces. The LEDs are refreshed automatically about 5 times per second.

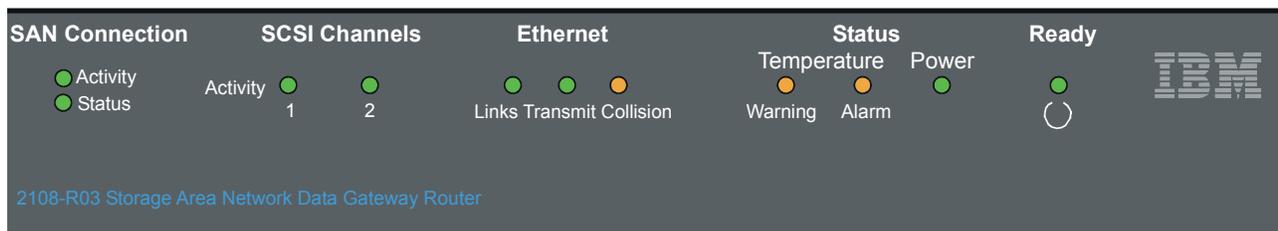


Table 45. LED Indicators

LED's (G=Green) (A=Amber)	Function	On	Off	Flash
<i>SAN Connection</i>				
Activity (G)	Link traffic			SAN interface activity
Status (G)	Link status	Link Active	No transmission (Link down)	

Table 45. LED Indicators

LED's (G=Green) (A=Amber)	Function	On	Off	Flash
<i>SCSI (G)</i>				
Activity (1 and 2)	SCSI Activity	SCSI traffic	No SCSI traffic	SCSI Interface activity
<i>ETHERNET</i>				
Link (G)	Status	Link active	Link down	
Transmit (G)	Status	Transmission in progress		
Collision (A)	Status	Collision occurred		
<i>TEMPERATURE</i>				
WARNING (A)	Preventive failure indicator	Temperature Warning	No temperature problem	N/A
Alarm (A)	Information	Temperature exceeded	No temperature problem	N/A
<i>Power Main (G)</i>	Information	Power applied	No power	N/A
<i>Ready (G)</i>	Information	SDG Failure if on for more than 2 sec.	SDG Failure	Flashes during Startup cycle and once every second thereafter (normal)

## Power-on-self-test (POST)

POST is divided into two functionally distinct parts: the initial-POST (IPOST) and the secondary-POST (SPOST)

IPOST is the first stage of POST and it thoroughly tests the on-board, dynamic random-access memory (DRAM) arrays. IPOST runs from the on-board flash memory. Upon successful completion, IPOST locates SPOST, copies it to DRAM, and then transfers program control to SPOST.

SPOST is the second stage of post. SPOST configures the SDG Router's PCI bus. SPOST then locates, loads, and runs the licensed internal code (LIC).

## Health Check

The health check program queries all subsystems for their operational status. The health check has four levels. A level 1 health check is the most basic, and health check level 4 is the most complete check.

## Event Log

The SDG Router maintains an event log within its on-board flash file system. You can query these logs from the SDG Router service port. Event codes and messages that are generated by the SDG Router subsystems are recorded in this log file.

## Service Port Commands

An extensive command set is available to manage the SDG Router, obtain Status, and run Diagnostics. The commands described below have been extracted from the *SDG Service Guide*. They have been selected to provide you with some basic tools to determine the functional status of the SDG Router. Refer to Appendixes A and B of the *SDG Service Guide* for a description of all the commands.

Table 46. Service Port Commands

Group	Description	Page
diagBoot	Used to transition the SDG Router from normal operation to Diagnostic mode (see normalBoot below)	317
diagHelp	Displays a list of diagnostic commands	317
fcShow	Displays the status of the Fibre Channel interface	318
fcShowDevs	Displays information about the devices that are accessible from the Fibre Channel interface	319
fcShowNames	Displays the node and port names (addresses) of the Fibre Channel	319
hardwareConfig	<b>Diagnostic mode only.</b> Stores FRU VPD information in the SDG non-volatile memory (see sysVpdShow below)	320
help	Displays a list of the commands	320
hlthChkHelp	Displays the list of health check commands	321
hlthChkNow	Initiates the health check for the SDG. Results are displayed.	321
loggerDump	Dumps records from the system event log to the terminal console	322
loggerDumpCurrent	Dumps only the records that were logged since the system was last started are dumped.	322
macShow	Displays the Media Access Control address for the Ethernet interface	323
mapShowDatabase	Device database listing the connected devices	323

Table 46. Service Port Commands

Group	Description	Page
mapShowDevs	Displays the cross-reference map of device addresses.	323
normalBoot	Restores the SDG to normal operating conditions. Used only to transition from diagnostic mode to normal mode.	324
reboot	Preferred method for restarting the SDG Router	324
scsiRescan	Performs a rescan of the SCSI channel(s) to look for new devices	325
scsiShow	Lists all SCSI channels and the attached devices for each channel	325
showBox	Displays a picture of the SDG showing the components present	326
sysConfigShow	Displays current parameter settings.	326
sysVpdShow	Displays Vital Product Data (VPD) information	327
targets	Lists and describes each device currently attached	328
version	Lists the firmware version level	329

The following descriptions are from *Storage Area Network Data Gateway Router Installation and User's Guide* pages 73-97; they also are listed in the *Storage Area Network Data Gateway Router Service Guide* as Appendixes A and B.

#### diagBoot

Use the **diagBoot** command only to transition the SDG Router from normal operation to the special diagnostic mode. The command first ensures that the `ffs0:mt` directory exists, then it verifies that the files `diagnstk.o` and `diagnstk.rc` are in the flash file system. If they are in the root directory, it moves them to the `ffs0:mt` directory.

The **diagBoot** command copies the existing boot parameters to a file in the `ffs0:mt` directory on the SDG Router. It then installs the new boot parameters that direct the SDG Router to start using the special diagnostic startup script, `ffs0:mt/diagnstk.rc`. It renames the persistent map file `config/device.map` as `config/device.bak`. Finally, **diagBoot** issues a `reboot` command to put the changes into effect.

**Note:** Power cycling the SDG Router does not re-instate it to normal mode if previously set to diagnostic mode. Use **normalBoot** command (page 324) to re-initialize the router to normal mode

#### diagHelp

The **diagHelp** command displays a list of the diagnostic commands.

```
Router > diagHelp
```

The following commands are available in diagnostic mode only:

```

ddfTest: Test DDF Memory
elTest: Test Ethernet port w/loop-back cable
fcSlotTest <portnum> : Test specified Fibre Channel port w/loop-back
cable
hardwareConfig: Re-inventory FRUs and update Vital Product Data
normalBoot: Shutdown and restart in normal mode
scsiChannelTest <x,y>: Test specified SCSI Channels w/loop-back cable

```

### fcShow

The **fcShow** command displays the channel status for the Fibre Channel interface.

The following example is for a SDG Router single-port Fibre Channel PMC card (ISP2200 controller). The firmware state for interfaces that have a live connection to a Fibre Channel device are shown as Ready. An interface that has no live connection is shown as "Sync Lost".

```

Router > fcShow
-----
Fibre Channel Controllers
-----
Ctrl : PCI Addr : ISP : Firmware : FW : Ctrl : Nvram : Loop
Id : Bs Dv Fn : Type : State : Version : Addr : Addr : ID}
-----
1 : 00 06 00 : 2200 : Ready : 2.01.2 : c0d98700 : 90001100 : 2 1
-----
value = 80 = 0x50 = ©P©
Router >

```

The following describes the example fields:

#### Ctrl ID

The channel number for this interface

#### PCI Addr

The PCI address of the interface, showing bus, device ID, and function number

#### ISPType

The type of Fibre Channel controller, ISP2100 or ISP2200

#### Firmware State

The current state of the interface as reported by the Fibre Channel PMC adapter firmware. The firmware states are:

- **Configuration Wait:** Firmware is not initialized.
- **Waiting for AL\_PA :** Firmware is performing or waiting to perform loop initialization.
- **Waiting for login:** Firmware is attempting port and process logins with all loop ports.
- **Ready:** Indicates that the interface is connected, operational and ready to process SCSI commands. Any other value indicates intermediate states or interface failure.
- **Sync Lost:** The firmware has detected a loss-of-sync condition and is resynchronizing the serial link receiver. This is the state reported when the Fibre Channel link does not detect a connection to a Fibre Channel device.
- **Error:** The firmware has detected an unrecoverable error condition.

- **Nonparticipating:** The firmware is not participating on the loop because it did not acquire an arbitrated loop physical address (AL\_PA) during initialization.
- **Failed:** The firmware is not responding to commands.

**FW Version**

The version of firmware on the Fibre Channel PMC adapter

**Ctrl Addr**

A pointer to an internal data structure that is used for some diagnostic operations

**Nvram Addr**

The memory address of the parameter RAM for this interface

**Loop ID**

The Fibre Channel loop ID for this interface

**fcShowDevs**

The **fcShowDevs** command displays information about the devices that are accessible from each Fibre Channel interface. The display shows the LUN that the SDG Router has assigned to each device, the SCSI Channel that the device is attached to, the actual SCSI ID and LUN of the device, the vendor, product, revision and serial number of the device.

```
Router > fcShowDevs
FC 1:
LUN Chan Id Lun Vendor Product Rev SN
-----
0 0 0 OPATHLIGHT SAN Router Local 0252 00000060450d00c0
2 3 4 0IBM 03570c11 5324 000000000260
3 3 4 1IBM 03570c11 5324 000000000260
value = 3 = 0x3
Router > Router > fcShowDevs
FC 1:
LUN Chan Id Lun Vendor Product Rev SN
-----
0 0 0 OPATHLGHT SAN Router 0339 00000060451600db
1 1 0 0 ATL L500 6320000 001E JF91101163
2 1 1 0QUANTUM DLT7000 2150 CX921S1423
4 1 2 0QUANTUM DLT7000 2150 CX905S4607
6 2 0 0QUANTUM Powerstor L200 001E JW81477118
8 2 1 0QUANTUM DLT7000 2150 CX919S5223
LUN Chan Id Lun Vendor Product Rev SN
FC 4:
0 0 0 OPATHLGHT SAN Router 0339 00000060451600db
-----
1 1 0 0 ATL L500 6320000 001E JF91101163
2 1 1 0QUANTUM DLT7000 2150 CX921S1423
4 1 2 0QUANTUM DLT7000 2150 CX905S4607
6 2 0 0QUANTUM Powerstor L200 001E JW81477118
8 2 1 0QUANTUM DLT7000 2150 CX919S5223
value =6 =0x6
Router >
```

**fcShowNames** The **fcShowNames** command displays the node and port names (addresses) of the Fibre Channels.

```
Router > fcShowNames
-----
```

```

Ctrl : PCI Addr : ISP : Node : Port
Id : Bs Dv Fn : Type : Name : Name
-----
1 : 00 06 00 : 2200 : 10000060.451603bb : 20010060.451603bb
4 : 00 07 00 : 2200 : 10000060.451603bb : 20020060.451603bb
-----
value = 64 = 0x40 = ©©©
Router >

```

The following describes the example fields:

**Ctrl id**

The channel number for the interface

**PCI Addr**

The PCI address of the interface, showing bus, device ID, and function number

**ISPType**

The type of Fibre Channel controller, ISP2100 or ISP2200

**Node Name**

The Fibre Channel node name for the SDG Router

**Port Name**

The Fibre Channel port name for the interface

**hardwareConfig**

In order to use this command, the SDG Router must be in diagnostic mode. The **hardwareConfig** command records the configurations of installed FRUs by copying them to the nonvolatile vital product data (VPD) stored on the SDG Router base.

The fields that are updated are the SCSI channel types and PMC type. The service representative enters the **hardwareConfig** command after replacing any FRUs. This causes the SDG Router to update the VPD.

```

Router> hardwareConfig
==== Recording Hardware Configuration ====
Scanning PMC option slots...
Scanning SCSI IO Modules...
Checking memory sizes...
MemSize PCI-0 is 64 Mbytes ...Done
value = 0 = 0x0
Router >

```

**help**

The **help** command displays a list of the shell commands.

```

Router > help
help Print this list
cleHelp Print Command Log Entry info
diagHelp Print Diagnostic Help info
hlthChkHelp Print Health Check Help info
mapHelp Print Device Map Help info
netHelp Print Network Help info
snmpHelp Print SNMP Help info
userHelp Print User account info
cd "path" Set current working path
copy ["in"],["out"] Copy in file to out file (0 = std in/out)
h [n] Print (or set) shell history

```

```

ls ["path"[,long]] List contents of directory
ll ["path"] List contents of directory - long format
pwd Print working path
rename "old","new" Change name of file
rm ["name"] Remove (delete) a file
shellLock Lock or unlock shell command interface
version Print Version info
whoami Print user name
clearReservation [devId] Clear reservation on a target (may reset
target)
diagBoot Shutdown and restart in diagnostic mode
initializeBox Delete all device maps, restore factory defaults,
reboot
ridTag ["value"] Display and set serial number of replaced base unit
disableCC [option] Disable Command and Control Interface
option 1 - Report as Invalid (AIX mode)
option 2 - Fully disabled
enableCC Enable Command and Control Interface
scsiRescan [chan] Rescan SCSI Channel (all if chan not specified)
scsiShow Display info for SCSI Channels
fcShow Display info for Fibre Channels
fcShowDevs Display devices available on each Fibre Channel
fcShowNames Display Node and Port names for Fibre Channels
hostTypeShow Display Default Host Type settings
loggerDump [count] Display Logger Dump Records
loggerDumpCurrent [level] Display Logger Dump Records for current
boot
reboot Shut down and restart
reset Restart without shut down
setFcScsiChanMask [chan],[scsi],[allow] Set Channel Access Control
setFcFrameSize [chan],[size] Set FC Frame Size
setFcHardId [chan],[id] Set FC Loop ID
setHost [chan],[OS] Set default host type for FC Channel
OS may be "aix", "nt", "solaris", "hpux"
setSnaCCLun Set LUN for Controller Device (typically zero)
showBox Display graphic of current hardware configuration
sysConfigShow Display System Config Parameters
sysVpdShow Display Vital Product Data
sysVpdShowAll Display Vital Product Data for all subsystems
targets List all known target devices
uptime Display time since last boot

```

### **hlthChkHelp**

The **hlthChkHelp** command displays a list of the health check commands.

```

Router > hlthChkHelp
hlthChkIntervalGet - Show Check Interval
hlthChkIntervalSet <interval> - Set Check Interval
hlthChkLevelGet - Show Check Level
hlthChkLevelSet <level> - Set Check Level
hlthChkNow - Run Health Check Now

```

### **hlthChkNow**

The command causes the SDG Router to execute an immediate, level 4 health check. Results are displayed that will indicate which devices or subsystems failed the check.

```

Router> hlthChkNow

```

### loggerDump [number]

The **loggerDump** command dumps records from the system event log to the console. A numeric parameter can be used to indicate the number of events to display. With no parameter specified, all events in the log file are displayed starting with the most recent events.

```
Router > loggerDump 4
*** Dumping 4 (1018 through 1021) of 1021 records ***
000008 1018 0d:00h:00m:07s:22t -- SCSI 2: Bus RESET
000009 1019 0d:00h:00m:07s:22t -- Target device added: index 0,
handle 0xc0ec2600
000010 1020 0d:00h:00m:08s:18t -- Target device added: index 10,
handle 0xc0ad2590
000011 1021 0d:00h:00m:08s:28t -- SCSI 2: New Device at Id 6, Lun 0
Router >
```

### loggerDumpCurrent [level]

The **loggerDumpCurrent** command dumps records from the system event log to the console. Only the records that were logged since the system was last started are dumped. Level specifies the event log level for the events as shown in the following table.

Table 47. Event Log Levels

Level	Name	Explanation
0	Private	Events that are never shown by the remote event viewer but are recorded in the SDG Router event log
1	Notice	Conditions that should always be reported, such as temperature alarms and device removals
2	Warning	Events that might result in a later problem
3	Information	Events that are not errors or warnings

The following is an example dump after a typical start sequence with four target devices added (one additional device is shown, which is the command and control LUN of the SDG Router itself).

```
Router > loggerDumpCurrent 1
*** Dumping 9 (1010 through 1018) current records with level >= 0 ***
000001 0d:00h:00m:05s:56t -- NOTICE: CS and LOGGING STARTED
000002 0d:00h:00m:07s:19t -- FCAL 1: LIP occurred
000003 0d:00h:00m:07s:19t -- FCAL 1: Loop up
000004 0d:00h:00m:07s:22t -- SCSI 1: Bus RESET
000005 0d:00h:00m:07s:22t -- SCSI 2: Bus RESET
000006 0d:00h:00m:07s:22t -- Target device added:index 0, handle
0xc0ec2600
000007 0d:00h:00m:08s:18t -- Target device added: index 9, handle
0xc1f9e090
000008 0d:00h:00m:08s:18t -- Target device added: index 10, handle
0xc0ad2590
000009 0d:00h:00m:08s:28t -- SCSI 2: New Device at Id 6, Lun 0
value = 0 = 0x0
Router >
```

### macShow

The **macShow** command displays the media access control (MAC) address for the Ethernet interface.

```
Router > macShow
Enet MAC Address: 0.60.45.d.0.80
value = 33 = 0x21 = @!@
Router >
```

### mapShowDatabase

The SDG Router maintains a database of attached devices to ensure that each time a host attaches to the SDG Router, the target devices are seen at a consistent address. The database lists not only the devices presently connected, but also devices that have previously been connected. If a previously attached device is later reattached, it is assigned its previous address. Use the **mapShowDatabase** command to display the persistent device map table.

```
Router > mapShowDatabase
devId Type Chan tId tLun UID
-----
000 SNA 127 127 127 00000060:450d00c0
001 SCSI 001 003 000 00000060:450d00c0
002 SCSI 001 002 000 00000060:450d00c0
003 SCSI 001 001 000 00000060:450d00c0
004 SCSI 002 002 000 00000060:450d00c0
005 SCSI 002 000 000 00000060:450d00c0
006 SCSI 002 006 000 00000060:450d00c0
007 SCSI 002 009 000 00000060:450d00c0
008 SCSI 002 002 001 00000060:450d00c0
009 SCSI 002 005 000 00000060:450d00c0
010 SCSI 002 005 001 00000060:450d00c0
011 SCSI 001 000 000 00000060:450d00c0
012 SCSI 001 006 000 00000060:450d00c0
value = 0 = 0x0
Router >
```

The following describes the example fields:

#### devId

The index of the device in the database.

#### Type

The type of interface where the device is connected. SNA indicates an internal device. SCSI or Fibre Channel indicate I/O interfaces.

#### Chan

The channel number of the interface where the device is attached.

#### TId

Target ID mapping for SCSI initiators.

#### TLun

Target LUN mapping for SCSI initiators.

#### UID

For a Fibre Channel interface, the unique ID of the device. For SCSI interface, the unique ID of the SDG Router.

### mapShowDevs

The SDG Router maintains a cross-reference map of device addresses.

Information about the presently attached and available devices in the map can be displayed using the **mapShowDevs** command.

```
Router > mapShowDevs
devId Type Chan iId iLun UID tId tLun Handle Itl
-----
000 SNA 127 127 127 00000060.450d00c0 001 000 c0ec2600h 00000000h
009 SCSI 002 005 000 09000060.450d00c0 255 255 c1f9e090h 00000000h
010 SCSI 002 005 001 0a000060.450d00c0 255 255 c0ad2590h 00000000h
012 SCSI 001 006 000 0c000060.450d00c0 255 255 c1ffdf10h c1ffdc80h
value = 0 = 0x0
Router >
```

The following describes the example fields:

**devId**

The index of the device in the database.

**Type**

The type of interface where the device is attached to the SDG Router.

**Chan**

The channel number of the interface

**iId**

For a SCSI interface only, device ID of the device

**tLun**

For a SCSI interface only, the logical unit number of the device.

**UID**

For a Fibre Channel interface, unique ID of the device. For SCSI interface, a constructed unique ID based on the unique ID of SDG Router.

**tId**

Target ID mapping for SCSI initiators

**tLun**

Target LUN mapping for SCSI initiators

**Handle**

An internal pointer used for some diagnostic operations

**Itl**

An internal pointer used for some diagnostic operations

**normalBoot**

Certain commands and tests are only available in diagnostic mode. Switching to diagnostic mode saves all configuration parameters so that they are restored before returning to normal operation. Use the **normalBoot** command to restore the SDG Router to normal operating conditions.

This command is used only to transition a SDG Router from the special diagnostic mode to normal operations. It restores the boot parameters that was copied by **diagBoot**. The new persistent device map is erased, and the original map file is renamed config/device.map restoring it for use when the SDG Router restarts. The **normalBoot** command then restarts the SDG Router.

**reboot**

The **reboot** command requests that the SDG Router shut down existing operations and then restart. This is the preferred method of restarting the SDG Router. There are processes running within the SDG Router that might

have writes pending to files within the SDG Router's flash file system. Following a **reboot** command, these processes flush their data to the flash file system, and the flash file system writes all pending data out to the flash memory. The SDG Router starts a reset cycle only after all pending data has been successfully written to the flash file system.

```
Router > reboot
```

### **scsiRescan [channel]**

The **scsiRescan** command requests a SCSIrescan to look for new devices. If channel is specified (1 or 2), then only that channel is scanned. If channel is not specified or if channel is 0, then all channels are scanned.

#### **Notes:**

1. Rescanning a SCSI bus can delay I/O commands pending on that bus for several seconds. Do not rescan SCSI buses when this delay cannot be tolerated. If possible, scan only the bus where a new device has been added.
2. If a channel is specified, that channel is scanned and the prompt is returned on completion. If no channel is specified (or 0 is specified), SCSI channels 1 and 2 are scanned in sequence and the prompt is returned on completion.
3. When a device is discovered, there can be further device specific initialization that continues after the scan has completed. In this case, the device might not show up immediately when you issue the **fcShowDevs** command. (Tape and changer devices that indicate a ready status are available after the scan is completed.)
4. If a SCSI target device requires replacement, remove the old device. Set the new device to the same SCSI bus ID as the old device and attach it to the same channel. Rescan the channel to update the configuration data. The new device should be available to host systems with the same LUN as the old device.

### **scsiShow**

The **scsiShow** command lists all SCSI channels and the attached devices for each channel.

```
Router > scsiShow
SCSI Initiator Channel 1: 0xc195e670
ID LUN Vendor Product Rev | Sync/Off Width
-----|-----
0 0 IBMAS400 DFHSS4W 4545 | 12/15 16 S W Q
SCSI Initiator Channel 2: 0xc0ed3900
ID LUN Vendor Product Rev | Sync/Off Width
-----|-----
 4 0 IBM 0357011 5324 | 25/15 16 S W
 4 1 IBM 0357011 5324 |
value = 0 = 0x0
Router >
```

The following describes the example fields:

#### **ID**

The SCSI ID of the target device

#### **LUN**

The SCSI LUN of the target device

#### **Vendor**

The content of the Vendor ID field from the SCSI inquiry data



```
FC Node WWN: 10000060.45160104
value =0 =0x0 Router >
```

### **sysVpdShow or sysVpdShowAll**

The **sysVpdShow** command displays vital product data (VPD) information. The VPD for the SDG Router includes such items as serial numbers and installed memory sizes.

```
Router > sysVpdShow
===== VPD =====
name SAN Router
uid 00:60:45:16:01:04
s/n 100111
mfg Pathlight Tech
board OntarioII 1.1
" s/n 08357659
flash 2Mbyte
dram 32Mbyte
slot1 10772100 FCOSW
scsi 1: DET 2: DET
EC OTA08000H
RID Tag
value =0 =0x0
Router >
```

The following describes the example fields:

#### **name**

Product name: up to 16 characters

#### **uid**

Unique Ethernet MAC address of the product: 32 characters displayed as hexadecimal bytes separated by colons

#### **s/n**

Product serial number: up to 16 characters

#### **mfg**

Product manufacturer: up to 16 characters

#### **board**

Name of the system board contained in the base unit: up to 16 characters

#### **" s/n**

System board serial number: up to 16 characters

#### **flash**

Size of the flash memory on the system board

#### **dram**

Size of the DRAM on the system board

#### **slot1**

Card type installed in SAN connection slot one

#### **scsi 1**

SCSI type for each of the two channels, DET for "differential, terminated" and SET for "single-ended, terminated"

#### **EC**

Engineering change (EC) level for the system board: up to 16 characters

## RID

RID tag identifier: up to 16 characters

### The **sysVpdShowAll**

command shows more information and includes product data for the Fibre Channel PMC card.

```
Router > sysVpdShowAll
===[ Vital Product Data ]===
--[ Base Assembly ]-----
Name SAN Data Gateway Router
Mfg Pathlight Tech
UID 00:60:45:16:01:04
S/N 100111Assy HCO OTA08000H
Assy HCO OTA08000H
Board OntarioII 1.1
" S/N 08357659
Flash 2 Mbyte
Dram 32 Mbyte
RID Tag 100111
--[ Slot 1 ]-----
Type 10772100 FCOSW
S/N 123456
UID 0060.45160065
HCO SC004120H
value =0 =0x0
Router >
```

## targets

The SDG Router maintains a list of target devices that are attached to the I/O channels. The **targets** command lists each device that is currently attached and provides a description of each device.

```
Router > targets
Idx Tdev Vendor Product Rev | Type Specific
-----|-----
0 0xc194a400 PATHLGHT SAN Router Local 0252 | Cmd/Cntrl Status 0h
2 0xc1ffc390 IBM 03570C11 5324 | Tape: Blk Size 32768 , flags 7h
3 0xc1ffc290 IBM 03570C11 5324 | Changer: flags 7h
value =4 =0x4
Router >
```

### Idx

Device Index in the target list

### Tdev

An internal pointer, used for some diagnostic operations

### Vendor

Content of the Vendor ID field from the SCSI Inquiry Data

### Product

Content of the Product ID field from the SCSI Inquiry Data

### Rev

Content of the Revision ID field from the SCSI Inquiry Data

### Type Specific

For each device type, information pertinent to the device

## version

The SDG Router has software that controls all functions. The **version** command displays the revision of that operating software. The first line displayed is the SDG Router firmware version. The lines that follow pertain to the operating system software version.

```
Router > version
SAN Data Gateway Router Version 0339.11 Built Dec 13 1999, 15:14:14
VxWorks (for Pathlight (i960RD)) version 5.3.1.
Kernel: WIND version 2.5.
value = 26 = 0x1a
Router >|
```

## Diagnostics

The diagnostic suite is a subset of the manufacturing test program. When enabled, the diagnostic suite is capable of performing external loopback testing of all major hardware interfaces (SCSI, Fibre Channel, and Ethernet).

Toolkit P/N 34L2606 (supplied with the Router) contains the necessary loopback plugs to run the Diagnostics. It includes the following:

- Service port cable: One RS-232 null-modem cable with 9-pin connectors
- SCSI loopback cable: One short wide-Ultra cable with 68-pin connectors
- Fibre Channel: One Fibre Channel short-wavelength or long-wavelength fiber-optic loopback plug
- Ethernet: One 10Base-T Ethernet loopback cable
- Fuses: Two 250 V, 4 A time-lag fuses (type F4AL)

### Diagnostic tests

To verify proper operation of the SDG or whenever a FRU has been replaced, a complete diagnostic check of the router may be performed. It is recommended that you perform these tests prior to returning the SDG Router to the customer.

### Diagnostic test preparation

1. Attach the service terminal to the SDG Router.
2. Turn on the SDG Router and wait until it has finished the startup cycle.
3. From the service terminal, type **diagBoot**
4. Wait until the SDG Router has finished the startup cycle. The Shell prompt should be **diagmode>**
5. From the service terminal, type **showBox**.
6. Verify that the SDG Router is configured according to the customer's requirements.
  - a. If all installed FRUs are shown, go to "Fibre Channel tests"
  - b. If all installed FRUs are not shown, go to Chapter 3 of the 2108 Model R03 Service Guide (MAP).

### Fibre Channel tests

1. Attach the Fibre Channel loopback plug to the card in PMC slot 1. (You can also use the plug from FASTT Check).

**Note:** This test works only if the card is an ISP2200. If the card is an ISP 2100, the following error is displayed: "Card in slot 0 is not Fibre Channel." You can also run FASTT Check to verify if the SDG Router

is being detected. However, you cannot run the diagnostics (Loopback and Read/Write Buffer test) on the SDG Router.

2. From the service terminal, type **fcSlotTest 1**
  - a. If the **fcSlotTest** test completes successfully, remove the loopback plug and go to "SCSI test".
  - b. If not, go to Chapter 3 of the 2108 Model R03 Service Guide (MAP).

#### **SCSI test**

1. If there is only one SCSI interface installed, proceed to "Ethernet Test".
2. Attach the SCSI loopback cable to SCSI channels 1 and 2.
3. From the service terminal, type **scsiChannelTest 1, 2**.
  - a. If the test completes successfully, go to step 4.
  - b. If not, go to Chapter 3 of the 2108 Model R03 Service Guide (MAP).
4. Remove the SCSI loopback cable.
5. Proceed to "Ethernet Test".

#### **Ethernet test**

1. Obtain the SDG Router Ethernet network parameters from the customer. Configure the Ethernet port host name, address, routes, and enable the Ethernet. See "SDG Router network setup" on page 313
2. Attach the Ethernet loopback plug to the Ethernet port.
3. From the service terminal, type **elTest**
4. If the test completes successfully, go to step 5. If not, go to Chapter 3 of the 2108 Model R03 Service Guide (MAP).
5. Remove the Ethernet loopback plug.

#### **Verifying SDG Router operation**

1. From the service terminal, type **normalBoot**
2. Wait until the SDG Router has finished the startup cycle. The Ready light should be blinking once every second indicating the SDG Router POST was successful. If the light remains on or is off, go to Chapter 3 of the 2108 Model R03 Service Guide (MAP).

---

## Appendix A. PD hints — RAID controller errors in the NT event log

**Note:** You should arrive at this appendix from a PD map or indication in “Chapter 2. PD entry,” on page 3. If this is not the case, refer to “Chapter 2. PD entry,” on page 3.

After you have read the relevant information in this appendix, return to “RAID Controller Passive PD map” on page 6.

This appendix offers general guidelines explaining what errors can appear in an event log and what actions to perform when these errors occur.

**Note:** If you have Windows NT 4.0 system, the driver is listed as SYMarray. If you have Windows NT/2000, the driver is listed as RDACFLTR.

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### Common error conditions

#### Getting a series of SYMarray event ID 11s in the NT event log

Open up and review the events. A series of event ID 11s generally indicates a number of bus resets and could be caused by a bad host bus adapter. This can also be the result of a bad cable.

#### Getting a series of SYMarray event ID 11s and 18s in the NT event log

Open up and review the events. A series of event ID 11s generally indicates LIPs (Loop resets). This generally indicates a bad fibre path. It could be an indication of a problem with a GBIC, an MIA, or an adapter.

The event ID 18s mean that RDAC failed a controller path. The fault will most likely be a component in the fibre path, rather than the controller.

#### Getting a series of SYMarray event ID 15s in the NT event log

This is undocumented. A series of event ID 15s indicates that the link is down. The problem is generally within the Fibre path.

---

### Event log details

In addition to reviewing the SYMlicity Storage Manager log, you may choose to review the event log on your NT system. You view the event log in a GUI environment (see figure below). To open the event log, click **Start --> Programs --> Administrative Tools --> Event Viewer**.

Date	Time	Source	Category	Event	User
 2/22/99	4:35:25 AM	symarray	None	11	N/A
 2/21/99	11:34:35 PM	symarray	None	11	N/A
 2/18/99	12:47:45 AM	SNMP	None	1001	N/A

Table 48 on page 332 lists the most common, but not necessarily the only, event IDs that might be encountered in a SYMarray (RDAC) event.

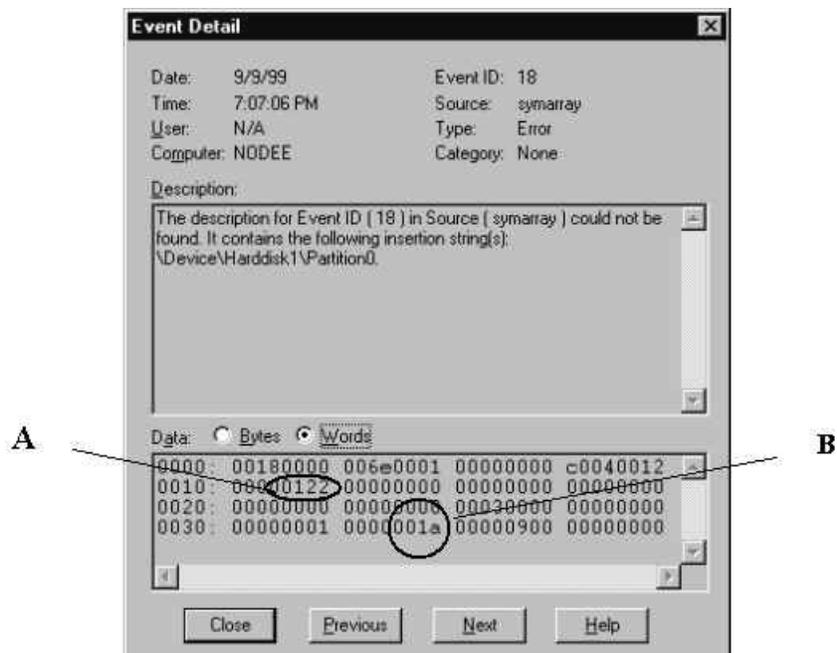
Table 48. Common SYMarray (RDAC) event IDs

Event	Microsoft Label Identifier	Description
9	IO_ERR_TIMEOUT	The device %s did not respond within timeout period.
11	IO_ERR_CONTROLLER_ERROR	Driver detected controller failure.
16	ERR_INVALID_REQUEST	The request is incorrectly formatted for %1.
18	IO_LAYERED_FAILURE	Driver beneath this layer failed.
389	STATUS_IO_DEVICE_ERROR	The I/O device reported an I/O error.

Event ID 18 is a special case. SYMarray uses event ID 18 to designate a failed controller path. (The controller on the physical path is the failed controller.) All LEDs on the controller are usually lit when a failure has occurred. This does not necessarily mean that the controller is defective, but rather that some component along the path to the controller is generating errors. Possible components include host adapter, fibre cable, GBIC, hub, and so on.

In a multi-node cluster with multiple event ID 18s, the log entry with the earliest time most likely initiated the original controller failure. The other event ID 18s on other nodes were most likely responses to the original failure and typically contain an SRB status of (0x0a - SCSI Selection Timeout). You need to check the system's date and time stamp for synchronization to validate which entry has the earliest time. To review an entry in the Event Viewer, perform the following steps:

1. Double-click on the entry you wish to review.
2. Mark the **Words** radio button to convert the bottom text from bytes to words.



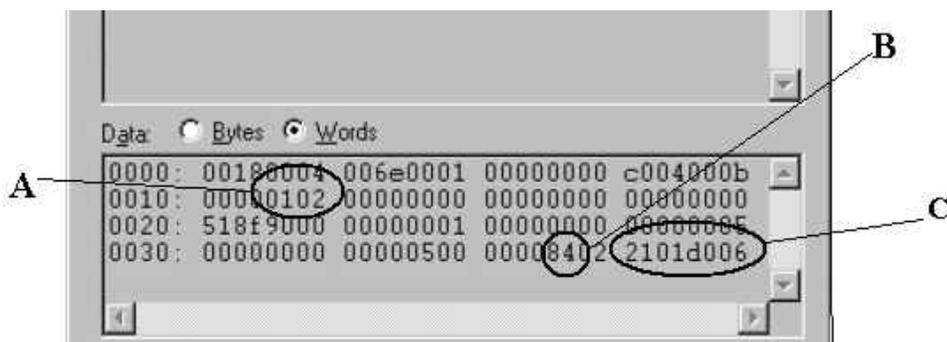
A. The last 4 digits (2 bytes) in this field indicate the unique error value. In this example, the error value shown indicates a Controller Failover Event.

B. For Event ID 18, this offset represents the SCSI operation that was attempted when the failover event took place.

Table 49. Unique Error Value - Offset 0x0010

Unique Error Value - Offset 0x0010			
Value	Meaning	Value	Meaning
100	Media Error (check condition)	110	Device Not Ready (check condition)
101	Hardware Error (check condition)	111	No Sense (check condition)
102	Recovered Error (check condition)	112	Unrecognized Sense Key
103	Default - Controller Error	113	Error being returned to system which would otherwise not be logged
105	Command Aborted or Timed Out	114	SCSI Release Configuration Error, Multiple paths to the same controller
106	Phase Sequence Error	115	SCSI Reserve Configuration Error, Multiple paths to the same controller
107	Request Flushed	116	The driver has discovered more paths to a controller than are supported (four are supported)
108	Parity Error or Unexpected Bus Free	117	The driver has discovered devices with the same WWN but different LUN numbers
109	SCSI Bus Error Status (busy, queue full, and so on)	122	Controller Failover Event (alternate controller/path failed)
10a	Bus Reset	123	A path to a multipath controller has failed
10e	Aborted Command (check condition)	124	A controller failover has failed
10f	Illegal Request (check condition)	125	A Read/Write error has been returned to the system

The following example is a recovered drive timeout error on drive 2, 1.



- A. This error indicates (according to the error codes listed in Table 49) a recovered error.
- B. This bit indicates validity of the following word. A number 8 means field C is a valid sense key. A number other than 8 means that field C is not valid and should be disregarded.
- C. This word represents the FRU code, SCSI sense key, ASC and ASCQ.

ffkkaaqq -			
ff = FRU code	kk = SCSI sense key	aa = ASC	qq = ASCQ

---

## Sense Key table

Table 50. Sense Key table

SENSE KEY	DESCRIPTION
0x00	No Sense
0x01	Recovered Error
0x02	Not Ready
0x03	Medium Error
0x04	Hardware Error
0x05	Illegal Request
0x06	Unit Attention
0x07	Data Protect (Not Used)
0x08	Blank Check (Not used)
0x09	Vendor Specific (Not used)
0x0A	Copy Aborted (Not used)
0x0B	Aborted Command
0x0C	Equal (Not used)
0x0D	Volume Overflow (Not used)
0x0E	Miscompare
0x0F	Reserved (Not used)

---

## ASC/ASCQ Table

This section lists the Additional Sense Codes (ASC) and Additional Sense Code Qualifier (ASCQ) values returned by the array controller in the sense data. SCSI-2 defined codes are used when possible. Array-specific error codes are used when necessary, and are assigned SCSI-2 vendor-unique codes 80-FFH. More detailed sense key information can be obtained from the array controller command descriptions or the SCSI-2 standard.

Codes defined by SCSI-2 and the array vendor-specific codes are shown in Table 51. The sense keys most likely to be returned for each error are also listed in the table.

Table 51. ASC/ASCQ values

ASC	ASCQ	Sense Key	Description
00	00	0	No Additional Sense Information  The controller has no sense data available for the requesting host and addressed logical unit combination.

Table 51. ASC/ASCQ values

ASC	ASCQ	Sense Key	Description
04	01	2	<p>Logical Unit is in the Process of Becoming Ready</p> <p>The controller is executing its initialization functions on the addressed logical unit. This includes drive spinup and validation of the drive and logical unit configuration information.</p>
04	02	2	<p>Logical Unit Not Ready, Initializing Command Required</p> <p>The controller is configured to wait for a Start Stop Unit command before spinning up the drives, but the command has not yet been received.</p>
04	04	2	<p>Logical Unit Not Ready, Format In Progress</p> <p>The controller previously received a Format Unit command from an initiator, and is in the process of executing that command.</p>
04	81	2	Storage Module Firmware Incompatible - Manual Code Synchronization Required
04	A1	2	Quiescence Is In Progress or Has Been Achieved
0C	00	4	<p>Unrecovered Write Error</p> <p>Data could not be written to media due to an unrecoverable RAM, battery, or drive error.</p>
0C	00	6	<p>Caching Disabled</p> <p>Data caching has been disabled due to loss of mirroring capability or low battery capacity.</p>
0C	01	1	<p>Write Error Recovered with Auto Reallocation</p> <p>The controller recovered a write operation to a drive and no further action is required by the host. Auto reallocation may not have been used, but this is the only standard ASC/ASCQ that tells the initiator that no further actions are required by the driver.</p>
0C	80	4, (6)	<p>Unrecovered Write Error Due to Non-Volatile Cache Failure</p> <p>The subsystem Non-Volatile cache memory recovery mechanisms failed after a power cycle or reset. This is possibly due to some combination of battery failure, alternate controller failure, or a foreign controller.</p> <p>User data may have been lost.</p>
0C	81	4, (6)	<p>Deferred Unrecoverable Error Due to Memory Failure</p> <p>Recovery from a Data Cache error was unsuccessful.</p> <p>User data may have been lost.</p>
11	00	3	<p>Unrecovered Read Error</p> <p>An unrecovered read operation to a drive occurred and the controller has no redundancy to recover the error (RAID 0, degraded RAID 1, degraded mode RAID 3, or degraded RAID 5).</p>

Table 51. ASC/ASCQ values

ASC	ASCQ	Sense Key	Description
11	8A	6	Miscorrected Data Error - Due to Failed Drive Read  A media error has occurred on a read operation during a reconfiguration operation.  User data for the LBA indicated has been lost.
18	02	1	Recovered Data - Data Auto Reallocated  The controller recovered a read operation to a drive and no further action is required by the host. Auto reallocation may not have been used, but this is the only standard ASC/ASCQ that tells the initiator that no further actions are required by the driver.
1A	00	5	Parameter List Length Error  A command was received by the controller that contained a parameter list and the list length in the CDB was less than the length necessary to transfer the data for the command.
20	00	5	Invalid Command Operation Code  The controller received a command from the initiator that it does not support.
21	00	5	Logical Block Address Out of Range  The controller received a command that requested an operation at a logical block address beyond the capacity of the logical unit. This error could be in response to a request with an illegal starting address or a request that started at a valid logical block address and the number of blocks requested extended beyond the logical unit capacity.
24	00	5	Invalid Field in CDB  The controller received a command from the initiator with an unsupported value in one of the fields in the command block.
25	00	5	Logical Unit Not Supported  The addressed logical unit is currently unconfigured. An Add LUN operation in the Logical Array Mode Page must be executed to define the logical unit before it is accessible.
26	00	5	Invalid Field in Parameter List  The controller received a command with a parameter list that contained an error. Typical errors that return this code are unsupported mode pages, attempts to change an unchangeable mode parameter, or attempts to set a changeable mode parameter to an unsupported value.
28	00	6	Not Ready to Ready Transition  The controller has completed its initialization operations on the logical unit and it is now ready for access.
29	00	6	Power On, Reset, or Bus Device Reset Occurred  The controller has detected one of the above conditions.
29	04	6	Device Internal Reset  The controller has reset itself due to an internal error condition.

Table 51. ASC/ASCQ values

ASC	ASCQ	Sense Key	Description
29	81	(6)	<p>Default Configuration has been Created</p> <p>The controller has completed the process of creating a default logical unit. There is now an accessible logical unit that did not exist previously. The host should execute its device scan to find the new logical unit.</p>
29	82	6	<p>Controller Firmware Changed Through Auto Code Synchronization</p> <p>The controller firmware has been changed through the Auto Code Synchronization (ACS) process.</p>
2A	01	6	<p>Mode Parameters Changed</p> <p>The controller received a request from another initiator to change the mode parameters for the addressed logical unit. This error notifies the current initiator that the change occurred.</p> <p>This error may also be reported in the event that Mode Select parameters changed as a result of a cache synchronization error during the processing of the most recent Mode Select request.</p>
2A	02	6	<p>Log Parameters Changed</p> <p>The controller received a request from another initiator to change the log parameters for the addressed logical unit. This error notifies the current initiator that the change occurred.</p> <p>This error is returned when a Log Select command is issued to clear the AEN log entries.</p>
2F	00	6	<p>Commands Cleared by Another Initiator</p> <p>The controller received a Clear Queue message from another initiator. This error is to notify the current initiator that the controller cleared the current initiators commands if it had any outstanding.</p>
31	01	1, 4	<p>Format Command Failed</p> <p>A Format Unit command issued to a drive returned an unrecoverable error.</p>
32	00	4	<p>Out of Alternates</p> <p>A Re-assign Blocks command to a drive failed.</p>
3F	01	(6)	<p>Drive micro-code changed</p>
3F	0E	6	<p>Reported LUNs data has changed</p> <p>Previously LUN data reported via a Report LUNs command has changed (due to LUN creation or deletion or controller hot-swap)</p>

Table 51. ASC/ASCQ values

ASC	ASCQ	Sense Key	Description
3F	8N	(6)	<p>Drive No Longer Usable</p> <p>The controller has set a drive to a state that prohibits use of the drive. The value of N in the ASCQ indicates the reason why the drive cannot be used.</p> <p>0 - The controller set the drive state to "Failed - Write failure"</p> <p>1 - Not used</p> <p>2 - The controller set the drive state to "Failed" because it was unable to make the drive usable after replacement. A format or reconstruction error occurred.</p> <p>3 - Not used</p> <p>4 - Not used</p> <p>5 - The controller set the drive state to "Failed - No response"</p> <p>6 - The controller set the drive state to "Failed - Format failure"</p> <p>7 - The controller set the drive state to "User failed via Mode Select"</p> <p>8 - Not used</p> <p>9 - The controller set the drive state to "Wrong drive removed/replaced"</p> <p>A - Not used</p> <p>B - The controller set the drive state to "Drive capacity &lt; minimum"</p> <p>C - The controller set the drive state to "Drive has wrong block size"</p> <p>D - The controller set the drive state to "Failed - Controller storage failure"</p> <p>E - Drive failed due to reconstruction failure at Start of Day (SOD)</p>
3F	98	(6)	<p>Drive Marked Offline Due to Internal Recovery Procedure</p> <p>An error has occurred during interrupted write processing causing the LUN to transition to the Dead state. Drives in the drive group that did not experience the read error will transition to the Offline state (0x0B) and log this error.</p>
3F	BD	(6)	<p>The controller has detected a drive with Mode Select parameters that are not recommended or which could not be changed. Currently this indicates the QErr bit is set incorrectly on the drive specified in the FRU field of the Request Sense data.</p>
3F	C3	(6)	<p>The controller had detected a failed drive side channel specified in the FRU Qualifier field.</p>
3F	C7	(6)	<p>Non-media Component Failure</p> <p>The controller has detected the failure of a subsystem component other than a disk or controller. The FRU codes and qualifiers indicate the faulty component.</p>
3F	C8	(6)	<p>AC Power Fail</p> <p>The Uninterruptible Power Source has indicated that AC power is no longer present and the UPS has switched to standby power.</p>

Table 51. ASC/ASCQ values

ASC	ASCQ	Sense Key	Description
3F	C9	(6)	Standby Power Depletion Imminent The UPS has indicated that its standby power source is nearing depletion. The host should take actions to stop IO activity to the controller.
3F	CA	(6)	Standby Power Source Not at Full Capability The UPS has indicated that its standby power source is not at full capacity.
3F	CB	(6)	AC Power Has Been Restored The UPS has indicated that AC power is now being used to supply power to the controller.
3F	D0	(6)	Write Back Cache Battery Has Been Discharged The controllers battery management has indicated that the cache battery has been discharged.
3F	D1	(6)	Write Back Cache Battery Charge Has Completed The controllers battery management has indicated that the cache battery is operational.
3F	D8	(6)	Cache Battery Life Expiration The cache battery has reached the specified expiration age.
3F	D9	(6)	Cache Battery Life Expiration Warning The cache battery is within the specified number of weeks of failing.
3F	E0	(6)	Logical Unit Failure The controller has placed the logical unit in a Dead state. User data, parity, or both can no longer be maintained to ensure availability. The most likely cause is the failure of a single drive in non-redundant configurations or a second drive in a configuration protected by one drive. The data on the logical unit is no longer accessible.
3F	EB	(6)	LUN marked Dead due to Media Error Failure during SOD An error has occurred during interrupted write processing causing the LUN to transition to the Dead state.

Table 51. ASC/ASCQ values

ASC	ASCQ	Sense Key	Description
40	NN	4, (6)	<p>Diagnostic Failure on Component NN (0x80 - 0xFF)</p> <p>The controller has detected the failure of an internal controller component. This failure may have been detected during operation as well as during an on-board diagnostic routine. The values of NN supported in this release of the software are as follows:</p> <p>80 - Processor RAM</p> <p>81 - RAID Buffer</p> <p>82 - NVSRAM</p> <p>83 - RAID Parity Assist (RPA) chip or cache holdup battery</p> <p>84 - Battery Backed NVSRAM or Clock Failure</p> <p>91 - Diagnostic Self Test failed non-data transfer components test</p> <p>92 - Diagnostic Self Test failed data transfer components test</p> <p>93 - Diagnostic Self Test failed drive Read/Write Buffer data turnaround test</p> <p>94 - Diagnostic Self Test failed drive Inquiry access test</p> <p>95 - Diagnostic Self Test failed drive Read/Write data turnaround test</p> <p>96 - Diagnostic Self Test failed drive Self Test</p>
43	00	4	<p>Message Error</p> <p>The controller attempted to send a message to the host, but the host responded with a Reject message.</p>
44	00	4, B	<p>Internal Target Failure</p> <p>The controller has detected a hardware or software condition that does not allow the requested command to be completed. If the sense key is 0x04 indicating a hardware failure, the controller has detected what it believes is a fatal hardware or software failure and it is unlikely that a retry would be successful. If the sense key is 0x0B indicating an aborted command, the controller has detected what it believes is a temporary software failure that is likely to be recovered if retried.</p>
45	00	1, 4	<p>Selection Time-out on a Destination Bus</p> <p>A drive did not respond to selection within a selection time-out period.</p>
47	00	1, B	<p>SCSI Parity Error</p> <p>The controller detected a parity error on the host SCSI bus or one of the drive SCSI buses.</p>
48	00	1, B	<p>Initiator Detected Error Message Received</p> <p>The controller received an Initiator Detected Error Message from the host during the operation.</p>

Table 51. ASC/ASCQ values

ASC	ASCQ	Sense Key	Description
49	00	B	Invalid Message Error The controller received a message from the host that is not supported or was out of context when received.
49	80	B	Drive Reported Reservation Conflict A drive returned a status of reservation conflict.
4B	00	1, 4	Data Phase Error The controller encountered an error while transferring data to or from the initiator or to or from one of the drives.
4E	00	B	Overlapped Commands Attempted The controller received a tagged command while it had an untagged command pending from the same initiator or it received an untagged command while it had one or more tagged commands pending from the same initiator.
5D	80	6	Drive Reported PFA (Predicted Failure Analysis) Condition
80	02	1, 4	Bad ASC code detected by Error/Event Logger
80	03	4	Error occurred during data transfer from SRM host.
84	00	4, 5	Operation Not Allowed With the Logical Unit in its Current State The requested command or Mode Select operation is not allowed with the logical unit in the state indicated in byte 76 of the sense data. Examples would be an attempt to read or write a dead logical unit or an attempt to verify or repair parity on a degraded logical unit.
84	06	4	LUN Awaiting Format A mode select has been done to create a LUN but the LUN has not been formatted.
85	01	4	Drive IO Request Aborted IO Issued to Failed or Missing drive due to recently failed removed drive. This error can occur as a result of IOs in progress at the time of a failed or removed drive.
87	00	4	Microcode Download Error The controller detected an error while downloading microcode and storing it in non-volatile memory.
87	08	4	Incompatible Board Type For The Code Downloaded
87	0C	6	Download failed due to UTM LUN number conflict
87	0E	6	Controller Configuration Definition Inconsistent with Alternate Controller
88	0A	(6)	Subsystem Monitor NVSRAM values configured incorrectly
8A	00	5	Illegal Command for Drive Access The initiator attempted to pass a command through to a drive that is not allowed. The command could have been sent in pass-thru mode or by attempting to download drive microcode.

Table 51. ASC/ASCQ values

ASC	ASCQ	Sense Key	Description
8A	01	5	<p>Illegal Command for the Current RAID Level</p> <p>The controller received a command that cannot be executed on the logical unit due to its RAID level configuration. Examples are parity verify or repair operations on a RAID 0 logical unit.</p>
8A	10	5	<p>Illegal Request- Controller Unable to Perform Reconfiguration as Requested</p> <p>The user requested a legal reconfiguration but the controller is unable to execute the request due to resource limitations.</p>
8B	02	B, (6)	Quiescence Is In Progress or Has Been Achieved
8B	03	B	Quiescence Could Not Be Achieved Within the Quiescence Timeout Period
8B	04	5	Quiescence Is Not Allowed
8E	01	E, (6)	<p>A Parity/Data Mismatch was Detected</p> <p>The controller detected inconsistent parity/data during a parity verification.</p>
91	00	5	<p>General Mode Select Error</p> <p>An error was encountered while processing a Mode Select command.</p>
91	03	5	<p>Illegal Operation for Current Drive State</p> <p>A drive operation was requested through a Mode Select that cannot be executed due to the state of the drive. An example would be a Delete Drive when the drive is part of a LUN.</p>
91	09	5	<p>Illegal Operation with Multiple SubLUNs Defined</p> <p>An operation was requested that cannot be executed when multiple SubLUNs are defined on the drive.</p>
91	33	5	<p>Illegal Operation for Controller State</p> <p>The requested Mode Select operation could not be completed due to the current state of the controller.</p>
91	36	5	<p>Command Lock Violation</p> <p>The controller received a Write Buffer Download Microcode, Send Diagnostic, or Mode Select command, but only one such command is allowed at a time and there was another such command active.</p>
91	3B	6	<p>Improper LUN Definition for Auto-Volume Transfer mode - AVT is disabled.</p> <p>Controller will operate in normal redundant controller mode without performing Auto-Volume transfers.</p>
91	50	5	<p>Illegal Operation For Drive Group State</p> <p>An operation was requested that cannot be executed due to the current state of the Drive Group.</p>
91	51	5	<p>Illegal Reconfiguration Request - Legacy Constraint</p> <p>Command could not be completed due to Legacy configuration or definition constraints.</p>

Table 51. ASC/ASCQ values

ASC	ASCQ	Sense Key	Description
91	53	5	Illegal Reconfiguration Request - System Resource Constraint Command could not be completed due to resource limitations of the controller.
94	01	5	Invalid Request Due to Current Logical Unit Ownership
95	01	4	Extended Drive Insertion/Removal Signal The controller has detected the drive insertion/removal signal permanently active.
95	02	(6)	Controller Removal/Replacement Detected or Alternate Controller Released from Reset The controller detected the activation of the signal or signals used to indicate that the alternate controller has been removed or replaced.
98	01	(6)	The controller has determined that there are multiple sub-enclosures with the same ID value selected.
98	02	(6)	Sub-enclosure with redundant ESMs specifying different Tray IDs
98	03	(6)	Sub-enclosure ESMs have different firmware levels
A0	00	(6)	Write Back Caching Could Not Be Enabled The controller could not perform write-back caching due to a battery failure or discharge, Two Minute Warning signal from the UPS, or an ICON failure.
A1	00	(6)	Write Back Caching Could Not Be Enabled - RDAC Cache Size Mismatch The controller could not perform write back caching due to the cache sizes of the two controllers in the RDAC pair not matching.
A4	00	(6)	Global Hot Spare Size Insufficient for All Drives in Subsystem. A defined Global Hot Spare is not large enough to cover all of the drives present in the subsystem. Failure of a drive larger than the Global Hot Spare will not be covered by the Global Hot Spare drive.
A6	00	(6)	Recovered processor memory failure The controller has detected and corrected a recoverable error in processor memory.
A7	00	(6)	Recovered data buffer memory error The controller has detected and corrected a recoverable error in the data buffer memory. Sense bytes 34-36 will contain the count of errors encountered and recovered.
C0	00	4, (6)	The Inter-controller Communications Have Failed The controller has detected the failure of the communications link between redundant controllers.
D0	06	4	Drive IO Time-out The controller destination IO timer expired while waiting for a drive command to complete.

Table 51. ASC/ASCQ values

ASC	ASCQ	Sense Key	Description
D1	0A	4	Drive Reported Busy Status A drive returned a busy status in response to a command.
E0	XX	4	Destination Channel Error XX = 00 through 07 indicates the Sense Key returned by the drive after a check condition status XX = 10 indicates that a bus level error occurred
E0	XX	6	Fibre Channel Destination Channel Error XX = 20 indicates redundant path is not available to devices XX = 21 indicates destination drive channels are connected to each other Sense Byte 26 will contain the Tray ID. Sense Byte 27 will contain the Channel ID.

## FRU Code table

A nonzero value in the FRU code byte identifies a field-replaceable unit that has failed or a group of field-replaceable modules that includes one or more failed devices. For some Additional Sense Codes, the FRU code must be used to determine where the error occurred. For example, the Additional Sense Code for SCSI bus parity error is returned for a parity error detected on either the host bus or one of the drive buses. In this case, the FRU field must be evaluated to determine whether the error occurred on the host channel or a drive channel.

Because of the large number of replaceable units possible in an array, a single byte is not sufficient to report a unique identifier for each individual field-replaceable unit. To provide meaningful information that will decrease field troubleshooting and problem resolution time, FRUs have been grouped. The defined FRU groups are listed in the following table.

Table 52. FRU codes

FRU code	Description
0x01	Host Channel Group
0x02	Controller Drive Interface Group
0x03	Controller Buffer Group
0x04	Controller Array ASIC Group
0x05	Controller Other Group
0x06	Subsystem Group
0x07	Subsystem Configuration Group
0x08	Sub-enclosure Group
0x09-0x0F	Reserved

Table 52. FRU codes

FRU code	Description
0x10-0xFF	Drive Groups

**Host Channel Group (0x01)**

A FRU group consisting of the host SCSI bus, its SCSI interface chip, and all initiators and other targets connected to the bus.

**Controller Drive Interface Group (0x02)**

A FRU group consisting of the SCSI interface chips on the controller that connect to the drive buses.

**Controller Buffer Group (0x03)**

A FRU group consisting of the controller logic used to implement the on-board data buffer.

**Controller Array ASIC Group (0x04)**

A FRU group consisting of the ASICs on the controller associated with the array functions.

**Controller Other Group (0x05)**

A FRU group consisting of all controller-related hardware not associated with another group.

**Subsystem Group (0x06)**

A FRU group consisting of subsystem components that are monitored by the array controller, such as power supplies, fans, thermal sensors, and AC power monitors. Additional information about the specific failure within this FRU group can be obtained from the additional FRU bytes field of the array sense.

**Subsystem Configuration Group (0x07)**

A FRU group consisting of subsystem components that are configurable by the user, on which the array controller will display information (such as faults).

**Sub-enclosure Group (0x08)**

A FRU group consisting of the attached enclosure devices. This group includes the power supplies, environmental monitor, and other subsystem components in the sub-enclosure.

**Drive Groups (0x10 - 0xFF)**

A FRU group consisting of a drive (embedded controller, drive electronics, and Head Disk Assembly), its power supply, and the SCSI cable that connects it to the controller; or supporting sub-enclosure environmental electronics.

The FRU code designates the channel ID in the most significant nibble and the SCSI ID of the drive in the least significant nibble.

**Note:** Channel ID 0 is not used because a failure of drive ID 0 on this channel would cause an FRU code of 0x00, which the SCSI-2 standard defines as no specific unit has been identified to have failed or that the data is not available.

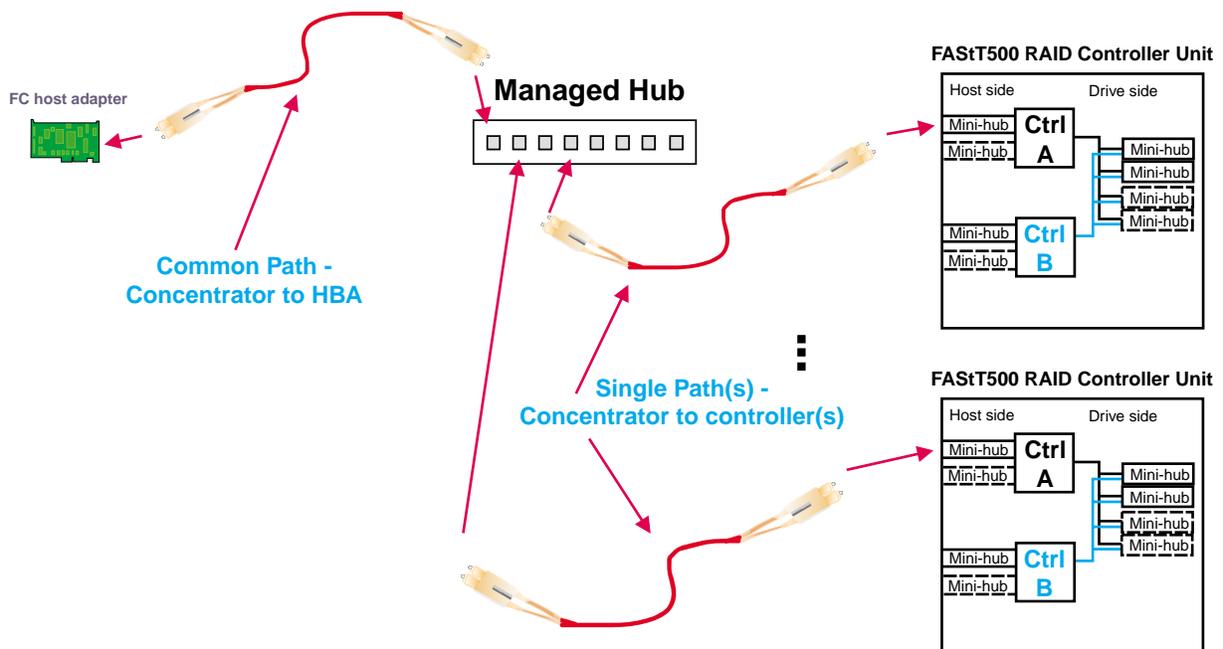


## Appendix B. PD hints — Common path / single path

**Note:** You should arrive at this appendix from a PD map or indication in “Chapter 2. PD entry,” on page 3. If this is not the case, refer to “Chapter 2. PD entry,” on page 3.

After you have read the relevant information in this appendix, return to “Common Path PD map 1” on page 18.

In the following figure, the HBA, HBA-to-concentrator cable, and the port used by this cable are on the common path to all storage. The other cables and ports to the controllers are on their own paths so that a failure on them does not affect the others. This configuration is referred to as single path.





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## Appendix C. PD hints — Configuration types

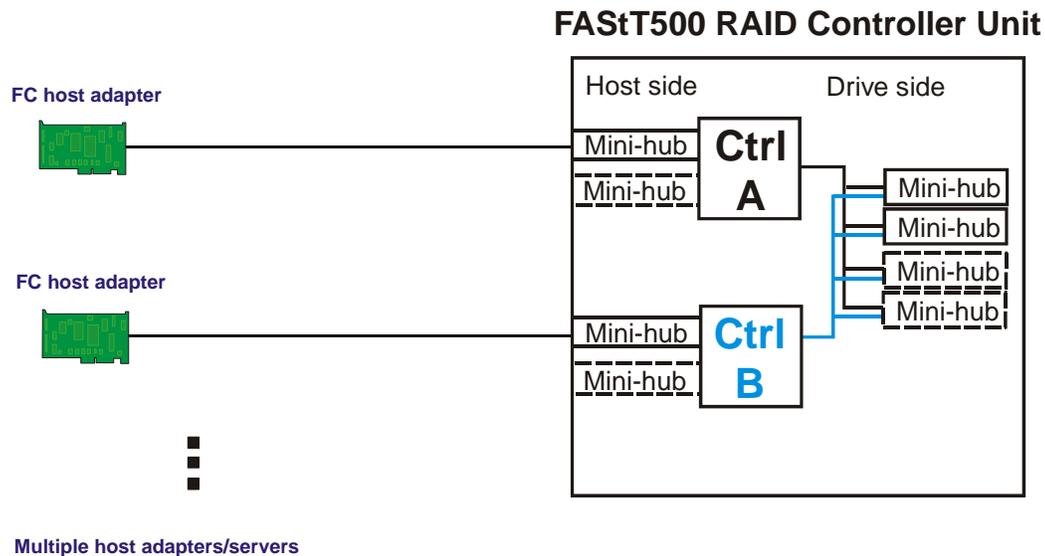
**Note:** You should arrive at this appendix from a PD map or indication in “Chapter 2. PD entry,” on page 3. If this is not the case, refer to “Chapter 2. PD entry,” on page 3.

After you have read the relevant information in this appendix, return to the “Configuration Type PD map” on page 10.

To simplify a complicated configuration so that it can be debugged readily, reduce the configuration to subsets that can be used to build the larger configuration. This process yields two basic configurations. (The type of RAID controller is not material; FAST500 is shown in the examples below.)

---

### Type 1 configuration

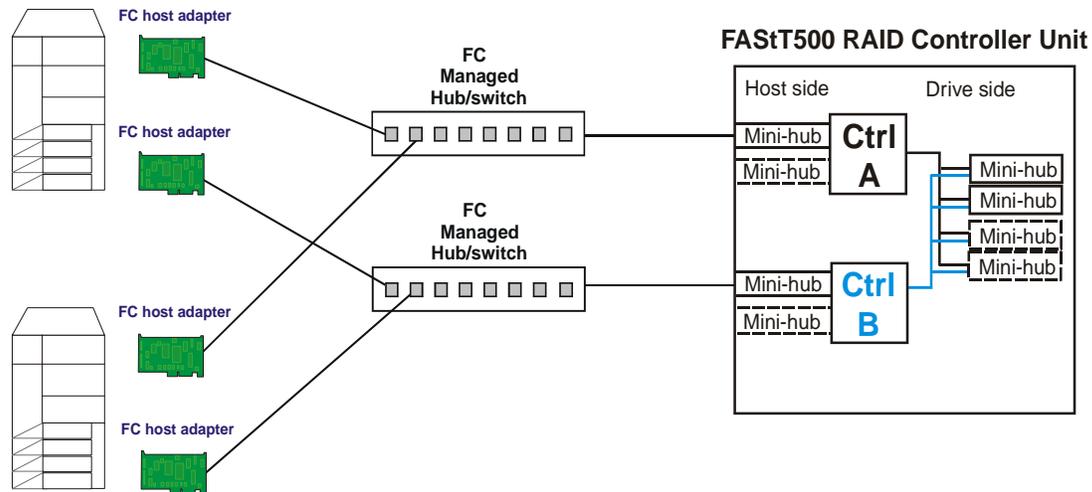


The identifying features of a type 1 configuration are:

- Connected directly to mini-hubs of Controller A and B with one or more host adapters per system
- Multiple servers can be connected, but without system-to-system failover (no MSCS)
- Uses some type of isolation mechanism (such as partitions) between server resources

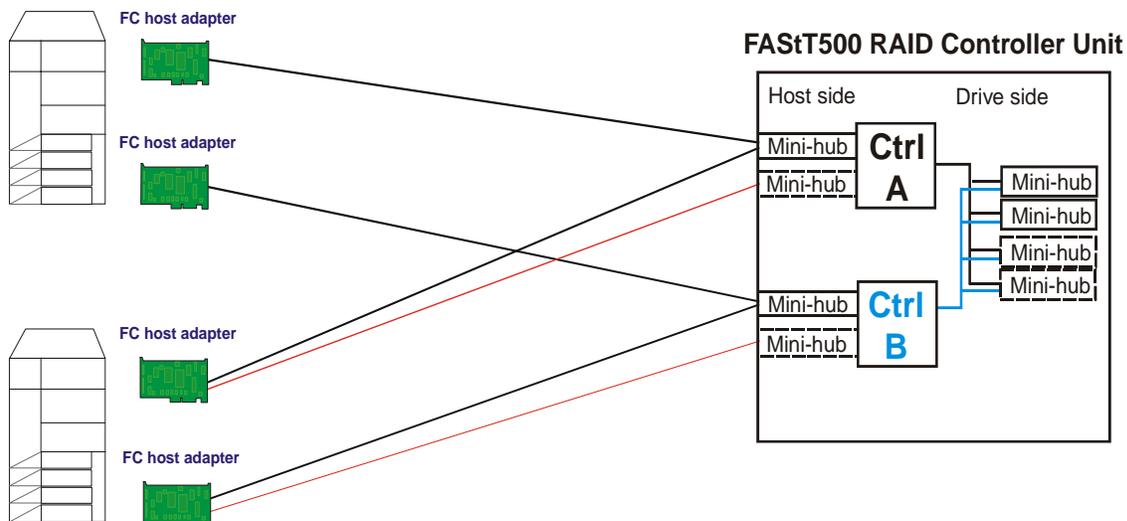
## Type 2 configuration

The type 2 configuration can occur with or without hubs and switches, as shown in the following two figures.



The identifying features of a type 2 configurations are:

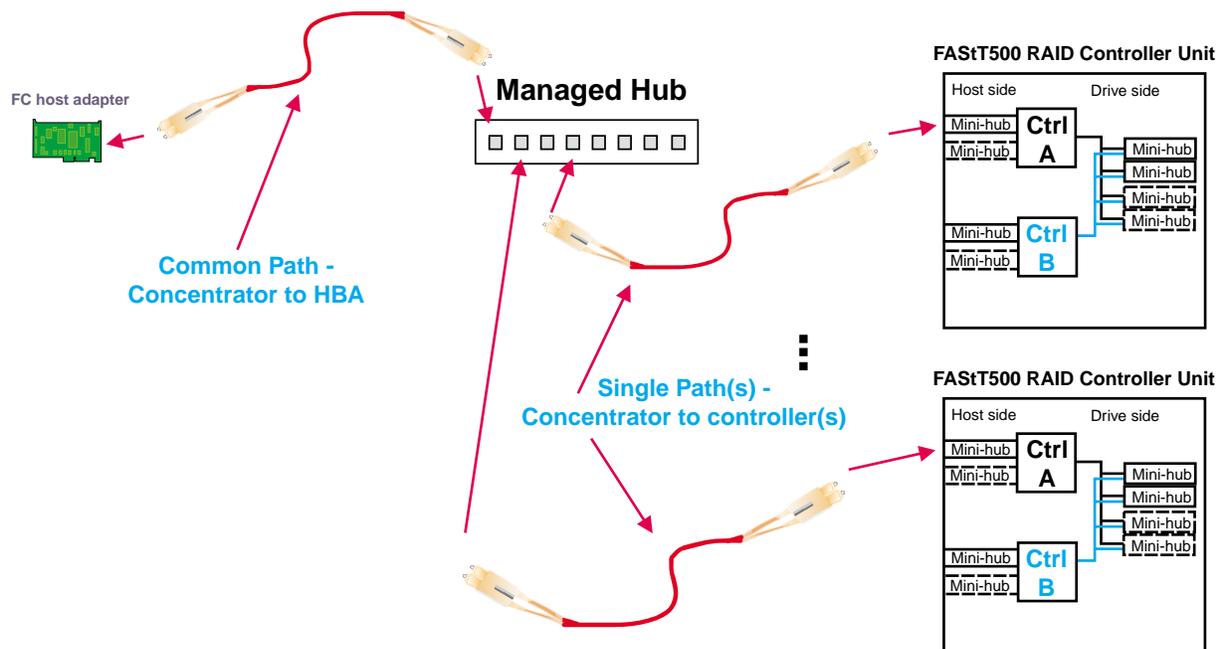
- Multiple host adapters are connected for full redundancy across systems having failover support such as MSCS
- Connected either directly to mini-hubs or through managed hubs or switches (2 GBIC ports per mini-hub are possible)
- Redundant path to mini-hubs can be separated using optional mini-hubs, as shown in the following figure in red (vs. the green path)



## Diagnostics and examples

In a Type 1 configuration there are no externally managed hubs or switches to aid in debugging, so the only diagnostic tools available are FASTT Check (from the host adapter end) and the sendEcho command (from the RAID controller end). If you are going to diagnose a failed path while the alternate path is live for production, be sure that you are familiar with the tools and the connections to the loops so that the correct portion is being exercised and you do not unplug anything in the active path.

For a Type 2 configuration, use the features of the switches and managed hubs and the capability of MSCS to isolate resources from the bad or marginal path before beginning debug activities. The added features of the switches and managed hubs allow a view of log information that shows what problems have been occurring, as well as diagnostics that can be initiated from these managed elements. An additional consideration in a Type 2 configuration is the capability to have more than one RAID controller unit behind a switch or managed hub. In the diagnostic maps, the switches and managed hubs are referred to generically as *concentrators*. The following figure is a Type 2 configuration with multiple controller units.

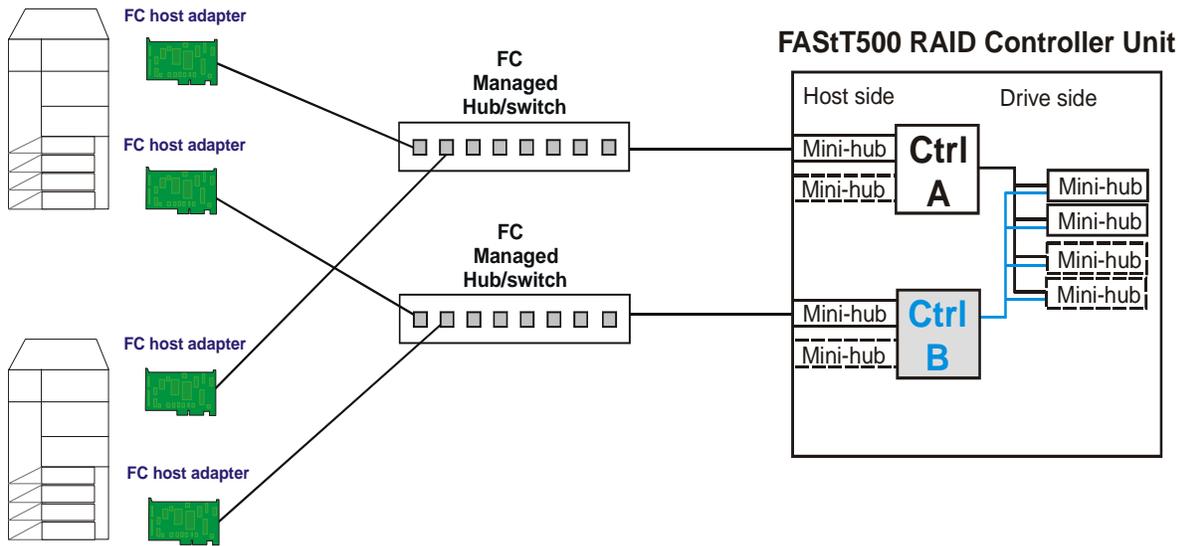


## Debugging example sequence

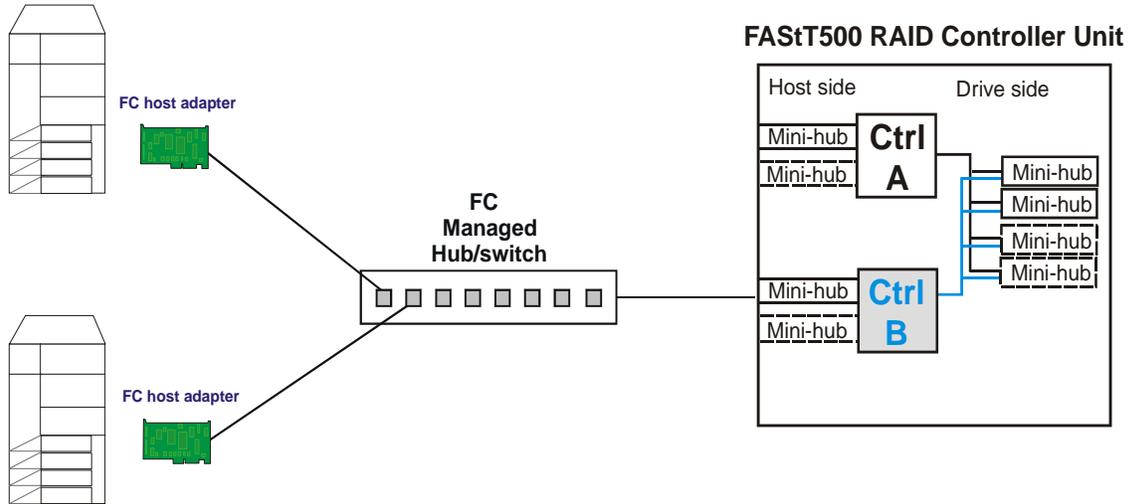
An example sequence for debugging a Type 2 MSCS configuration is shown in the following sequence of figures.

There can be multiple server pairs attached to the switches (using zoning or partitioning for pair isolation) or combinations of Type 1 and Type 2 configurations. Break the larger configuration into its smaller subelements and work with each piece separately. In this way you can remove the good path and leave only the bad path, as shown in the following sequence.

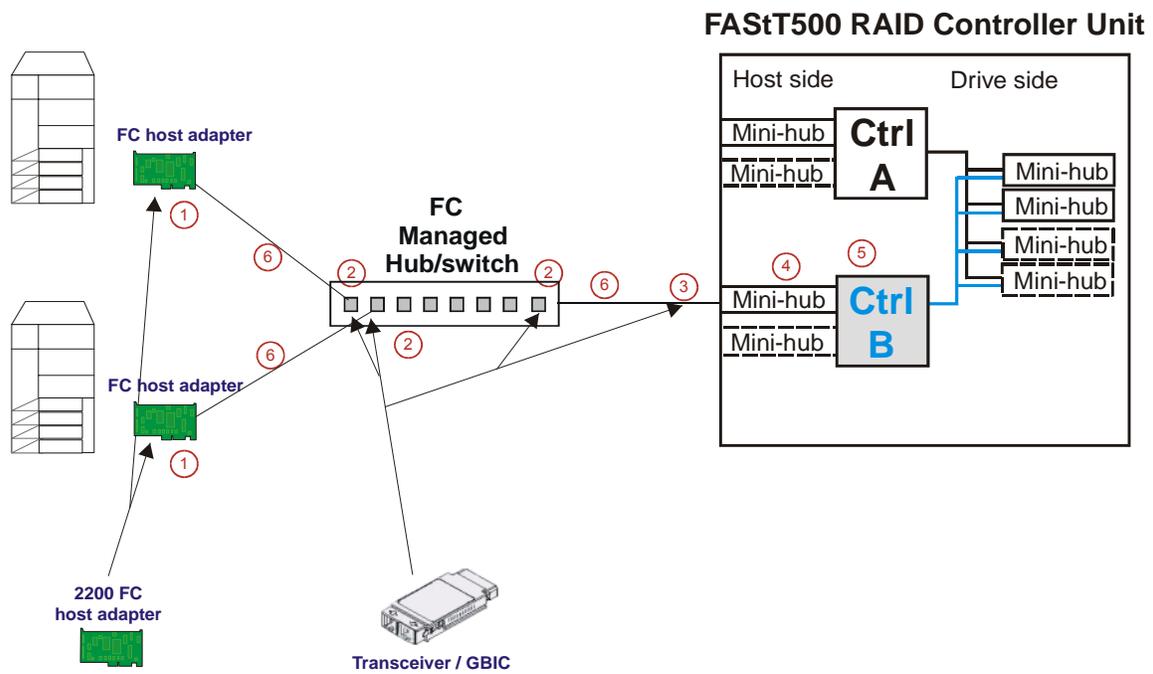
1. One controller is passive. In this example, the passive controller is B.



2. All I/O is flowing through controller A. This yields the following diagram for debugging.



3. To see more clearly what is involved, redraw the configuration showing the path elements in the loop.



#### Elements of the paths:

- Host adapter with optical transceiver (1)
- Optical transceiver in managed hub or GBIC in switch (2)
- GBIC in controller mini-hub (3)
- Mini-hub (4)
- RAID controller (5)
- Optical cables (6)



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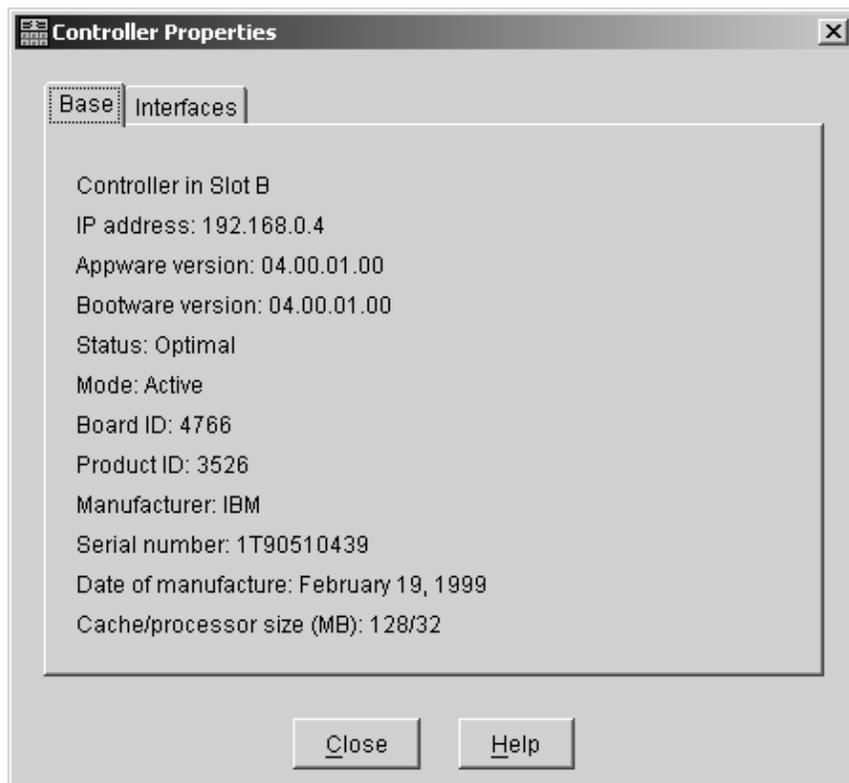
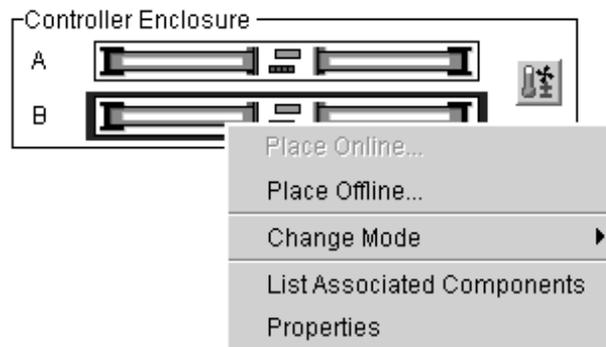
## Appendix D. PD hints — Passive RAID controller

**Note:** You should arrive at this appendix from a PD map or indication in “Chapter 2. PD entry,” on page 3. If this is not the case, refer to “Chapter 2. PD entry,” on page 3.

After you have read the relevant information in this appendix, return to “RAID Controller Passive PD map” on page 6.

Use the SM7 client to view the controller properties of the passive controller, which appears as a dimmed icon.

Right-click on the dimmed controller icon and select **Properties**.



If the Controller Properties view of the dimmed controller icon does not include a message about it being cached, then the controller is passive. Return to the PD map at the page that referred you here (“RAID Controller Passive PD map” on page 6) and continue.

If the Controller Properties information cannot be retrieved, then call IBM Support.

Perform the following steps when you encounter a passive controller and want to understand the cause:

1. Check the controller LEDs to verify that a controller is passive and to see which controller is passive.
2. Look on the system event viewer of the server to find the SYMarray event ID 18. When you find it, write down the date, time, and SRB status. (The SRB status is found in offset x3A in the NT event log. For an example of offset x3A, see the fourth row, third column of the figure on page 332.)
3. If multiple servers are involved, repeat step 2 for each server.
4. Look for the first event ID 18 found in step 2. The SRB status provides information as to why the failure occurred but is valid only if the high order bit is on (8x, 9x, Ax).
5. Check the history of the event log looking for QL2200/QL2100 events. These entries will give further clues as to whether the fibre loop was stable or not.
  - SRB statuses of 0x0d, 0x0e, and 0x0f point to an unstable loop. (To find the value, discard the high order "valid" bit. For example, 8d yields an SRB status of 0d.)
  - QL2200/2100 events of 80110000, 80120000 indicate an unstable loop.
6. If an unstable loop is suspected, diagnose the loop using the fibre path PD aids (see “Fibre Path PD map 1” on page 14).
7. If the diagnosis in step 6 does not reveal the problem, then the adapter and the controller might be the cause. If you determine that the adapter and controller caused the problem, then reset all fibre components on the path and retest.
8. If fibre cabling can be rearranged, swap the adapter cabling so that the adapter communicating to controller A is now connected to controller B (and vice-versa).  
**Note:** *Do not* do this in a system that is still being used for business. It is useful for bring-up debug.
9. When the problem is resolved, set the controller back to active and rebalance logical drives.
10. If the problem occurred as the result of an I/O condition, then rerun and determine whether the failure reoccurs.

**Note:** If the failure still occurs, then you need to perform further analysis, including the use of the serial port to look at loop statuses. The above steps do not include consideration of switches or managed hubs. If these are included, then see “Hub / Switch PD map 1” on page 11 for helpful tools.

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## Appendix E. PD hints — SendEcho tests

**Note:** You should arrive at this appendix from a PD map or indication in “Chapter 2. PD entry,” on page 3. If this is not the case, refer to “Chapter 2. PD entry,” on page 3.

After you have read the relevant information in this appendix, return to “Single Path Fail PD map 1” on page 16.

The 3526 controllers use MIA copper-to-optical converters, while the 3552 controllers use mini-hubs. There are times when these devices, and their corresponding cable mediums, need to be tested to insure that they are functioning properly.

**Note:** Running the loopback test for a short period of time may not catch intermittent problems. It may be necessary to run the test in a continuous loop for at least several minutes to track down intermittent problems.

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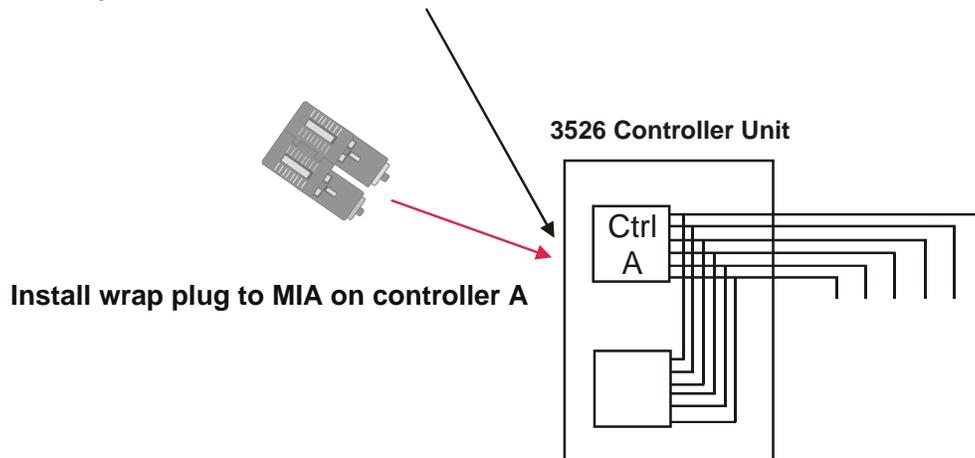
### Setting up for a loopback test

This section describes how to set up for a loopback test.

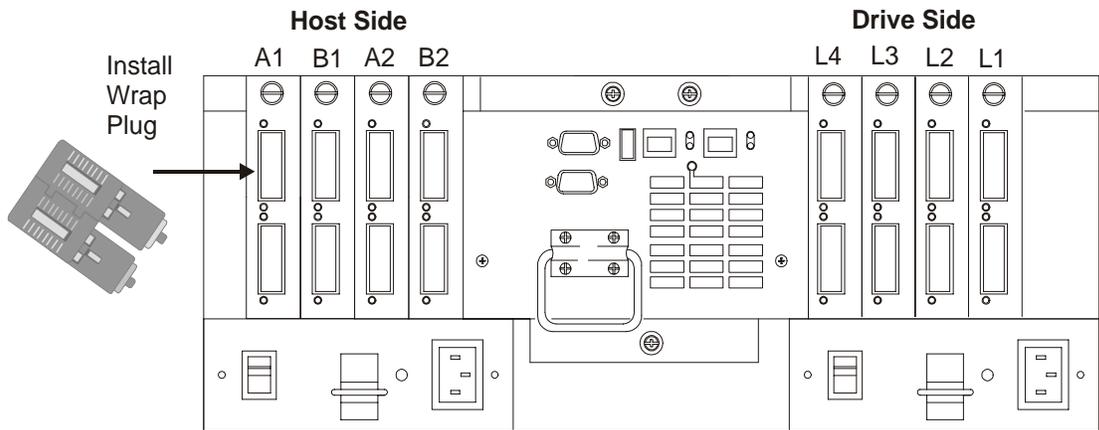
#### Loopback test for MIA or mini-hub testing

1. Remove the fiber-optic cable from the controller’s MIA or mini-hub.
2. Depending on whether you are working with a 3526 or 3552 RAID controller, do one of the following:
  - a. For a Type 3526 RAID controller, install a wrap plug to the MIA on controller A.

#### Failed path of read/write buffer test



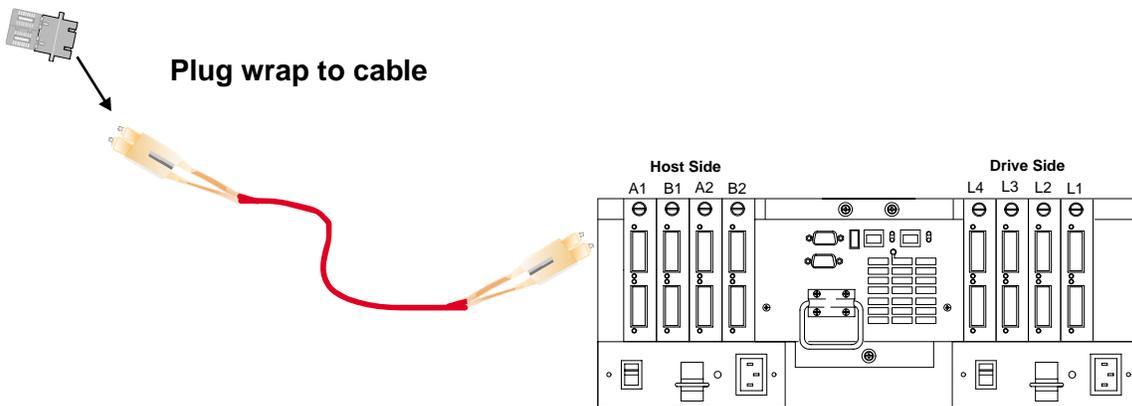
- b. For a Type 3552 RAID controller, install a wrap plug to the GBIC in the mini-hub on controller A.



3. Go to the appropriate Loopback Test section (either "Running the loopback test on a 3526 RAID controller" on page 359 or "Running the loopback test on a FAStT200 or FAStT500 RAID controller" on page 359).

## Loopback test for optical cable testing

1. Detach the remote end of the optical cable from its destination.
2. Plug the female-to-female converter connector from your kit onto the remote end of the optical cable.
3. Insert the wrap plug from your kit into the female-to-female converter.



4. Go to the appropriate "How to run the loopback test" section (either "Running the loopback test on a 3526 RAID controller" on page 359 or "Running the loopback test on a FAStT200 or FAStT500 RAID controller" on page 359).

---

## Running the loopback test on a 3526 RAID controller

1. In the controller shell, type the following: `fc 5`
2. From the output, write down the `AL_PA` (Port\_ID) for this controller.
3. Type the command `isp sendEcho,<AL_PA>,<# of iterations>`  
It is recommended that you use **50 000** for # of iterations. A value of **-1** will run for an infinite number of iterations. Message output to the controller shell is generated for every 10 000 frames sent.
4. Type the command `stopEcho` when tests are complete.

---

## Running the loopback test on a FAStT200 or FAStT500 RAID controller

1. In the controller shell, type the following command: `fcAll`
2. From the output, write down the `AL_PA` (Port\_ID) for the channel to be tested.
3. Type the command `fcChip=X` where X=the chip number for the loop to be tested.
4. Type the command `isp sendEcho,<AL_PA>,<# of iterations>`  
It is recommended that you use **50 000** for # of iterations. A value of **-1** will run for an infinite number of iterations. Message output to the controller shell is generated for every 10 000 frames sent.
5. Type the command `stopEcho` when tests are complete.

If the test is successful, then you will receive the following message:

```
Echo accept (count n)
```

If you receive the following message:

```
Echo timeout interrupt: interrupt ... end echo test
```

or if you receive nonzero values after entering the command `isp sendEcho`, then there is still a problem. Continue with the “Single Path Fail PD map 1” on page 16.



## Appendix F. PD hints — MEL data format

After you have read the relevant information in this appendix, return to “RAID Controller Passive PD map” on page 6.

The SM7 event viewer formats and displays the most meaningful fields of major event log entries from the controller. The data displayed for individual events varies with the event type and is described in “Event Descriptions” on page 366. The raw data contains the entire major event data structure retrieved from the controller subsystem. The event viewer displays the raw data as a character string. Fields that occupy multiple bytes may appear to be byte swapped depending on the host system.

Fields that may appear as byte swapped are noted in the following figure.

	7	6	5	4	3	2	1	0	
	<b>Constant Data Fields</b>								
0 - 7	(MSB)	Sequence Number - <i>(byte swapped)</i>						(LSB)	
8 - 11	(MSB)	Event Number - <i>(byte swapped)</i>						(LSB)	
12 - 15	(MSB)	Timestamp - <i>(byte swapped)</i>						(LSB)	
16 - 19	(MSB)	Location Information - <i>(byte swapped)</i> Channel & Device or Tray & Slot Number						(LSB)	
20 - 23	(MSB)	Iop ID - <i>(byte swapped)</i>						(LSB)	
24 - 25	I / O Origin - <i>(byte swapped)</i>								
26-27	Reserved				(MSB)				
	LUN / Volume Number - <i>(byte swapped)</i>						(LSB)		
28	Controller Number								
29	Number of Optional Fields Present (M)								
30	Total Length of Optional Fields (N)								
31	Pad (unused)								
	Optional Field Data								
32	Data Length								
33 - 34	Data								
32 + L	...								
	Last Optional Data Entry								

---

## Constant data fields

The constant data fields are described in the following section.

### Sequence Number

The Sequence Number field is a 64-bit incrementing value starting from the time the system log was created or last initialized. Resetting the log does not affect this value.

### Event Number

The Event Number field is a 4-byte encoded value that includes bits for drive and controller inclusion, event priority and the event value. The Event Number field is encoded as follows:

Table 53. Event number field

	7	6	5	4	3	2	1	0
0	Internal Flags		Log Group		Priority			
1	Category				Component			
2	(MSB)				Event Value			
3					(LSB)			

### Internal Flags

The Internal Flags field is used internally within the controller firmware for events that require unique handling; the host application ignores these values.

Table 54. Internal Flags field

Flag	Value
Mod Controller Number	0x2
Flush Immediate	0x1

### Log Group

The Log Group field indicates what kind of event is being logged. All events are logged in the system log. The values for the Log Group Field are as follows:

Table 55. Log Group field

Log Group	Value
System Event	0x0
Controller Event	0x1
Drive Event	0x2

## Priority

The Priority field is defined as follows:

*Table 56. Priority field*

Priority	Value
Informational	0x0
Critical	0x1
Reserved	0x2 - 0xF

## Category

The Category field specifies the general category of the event. General types of events that are logged for a given event group are listed after the event group. Event groups are defined as follows:

*Table 57. Category field*

Category	Value
Unknown	0x0
Error	0x1
Failure	0x2
Command	0x3
Notify	0x4
State	0x5
Host	0x6
General	0x7
Reserved	0x8 - 0xF

## Component

The component field is defined as follows:

*Table 58. Component field*

Component	Value
Unknown/Unspecified	0x0
Device	0x1
Power Supply	0x2
Cooling Element	0x3
Mini-hub	0x4
Reserved	0x5
Reserved	0x6

Table 58. Component field

Component	Value
Environmental Services Electronics	0x7
Controller Electronics	0x8
Nonvolatile Cache (RPA Cache Battery)	0x9
Enclosure	0xA
Uninterruptible Power Supply	0xB
Chip - I/O or Memory	0xC
Volume	0xD
Volume Group	0xE
I/O Port CRU	0xF

## Timestamp

The Timestamp field is a 4-byte value that corresponds to the real time clock on the controller. The real time clock is set (via the boot menu) at the time of manufacture. It is incremented every second and started relative to January 1, 1970.

## Location Information

The Location Information field indicates the Channel/Drive or Tray/Slot information for the event. Logging of data for this field is optional and is zero when not specified.

## IOP ID

The IOP ID used by MEL to associate multiple log entries with a single event or I/O. The IOP ID is guaranteed to be unique for each I/O. A valid IOP ID may not be available for certain MEL entries and some events use this field to log other information. The event descriptions indicate whether the IOP ID is being used for unique log information.

Logging of data for this field is optional and is zero when not specified.

## I/O Origin

The I/O Origin field specifies where the I/O or action originated that caused the event. It uses one of the Error Event Logger defined origin codes:

Table 59. I/O Origin field

Value	Definition
0	Active Host
1	Write Cache
2	Hot Spare
3	Other Internal

A valid I/O Origin may not be available for certain MEL entries and some events use this field to log other information. The event descriptions indicate whether the I/O Origin is being used for unique log information.

Logging of data for this field is optional and is zero when not specified.

## LUN/Volume Number

The LUN/Volume Number field specifies the LUN or volume associated with the event being logged.

Logging of data for this field is optional and is zero when not specified.

## Controller Number

The Controller Number field specifies the controller associated with the event being logged.

*Table 60. Controller Number field*

Value	Definition
0x00	Controller with Drive side SCSI ID 7 (normally the top controller in the subsystem)
0x01	Controller with Drive side SCSI ID 6 (normally the bottom controller in the subsystem)

Logging of data for this field is optional and is zero when not specified.

## Number of Optional Fields Present

The Number of Optional Fields Present specifies the number (if any) of additional data fields that follow. If this field is zero then there is no additional data for this log entry.

## Optional Data

The format for the individual Optional Data fields follows:

*Table 61. Optional data fields*

0 - 1	Data Length (L)
2 - 3	Data Field Type
3	Data
L	...

### Data Length

The length in bytes of the optional field data (including the Data Field Type).

### Data Field Type

See “Data field types” on page 404 for the definitions for the various Optional Data fields.

## Data

Optional field data associated with the Data Field Type. This data may appear as byte swapped when using the event viewer.

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## Event Descriptions

This section describes the following events and code information:

- “Destination Driver events”
- “SCSI Source Driver events” on page 369
- “Fibre Channel Source Driver events” on page 369
- “Fibre Channel Destination Driver events” on page 370
- “VDD events” on page 371
- “Cache Manager events” on page 375
- “Configuration Manager events” on page 378
- “Hot-swap events” on page 386
- “Start of Day events” on page 387
- “Subsystem Monitor events” on page 388
- “Command Handler events” on page 391
- “EEL events” on page 395
- “RDAC, Quiescence and ICON Manager events” on page 396
- “SYMBOL server events” on page 398
- “Storage Partitions Manager events” on page 402
- “SAFE events” on page 404
- “Data field types” on page 404
- “SYMBOL return codes” on page 410
- “Event decoding examples” on page 414

## Destination Driver events

Table 62. Destination Driver events

Event: Event Description					
Log Group	Priority	Event Group	Component	Event Number	Optional Data
<b>Channel Failure:</b> Logged when the parallel SCSI destination driver detects a channel failure					
Controller (0x1)	Informational (0x0)	Failure (0x2)	Chip (0xC)	0x1001	Device: FRU information Origin: FRU information
<b>Channel Revival:</b> Currently Not Logged					
Controller (0x1)	Informational (0x0)	Notification (0x4)	Chip (0xC)	0x1002	
<b>Tally Exceeded:</b> Currently Not Logged					
Drive (0x2)	Informational (0x0)	Notification (0x4)	Drive (0x1)	0x1003	

Table 62. Destination Driver events

Event: Event Description					
Log Group	Priority	Event Group	Component	Event Number	Optional Data
<b>Open Error:</b> Currently Not Logged					
System (0x0)	Informational (0x0)	Error (0x1)	Drive (0x1)	0x1004	
<b>Read Failure:</b> Currently Not Logged					
Drive (0x2)	Informational (0x0)	Error (0x1)	Drive (0x1)	0x1005	
<b>Write Failure:</b> Currently Not Logged					
Drive (0x2)	Informational (0x0)	Error (0x1)	Drive (0x1)	0x1006	
<b>No Memory:</b> Logged when memory allocation failed					
System (0x0)	Informational (0x0)	Error (0x1)	Controller (0x8)	0x1007	ID: 0: SCSI Device Structure 1: SCSI_Op NCE Structure 2: SCSI_Op NCE Structure (non-cache) 3: SCSI Ops Data Type Field: 0x0206
<b>Unsupported Chip:</b> Currently Not Logged					
Controller (0x1)	Informational (0x0)	Error (0x1)	Chip (0xC)	0x1008	
<b>Memory Parity Error:</b> Logged when a memory parity error is detected by the destination driver					
Controller (0x1)	Informational (0x0)	Error (0x1)	Controller (0x8)	0x1009	
<b>Drive Check Condition:</b> The driver was unable to recover the specified device returned a check condition to the driver and driver retries have been exhausted					
Drive (0x2)	Informational (0x0)	Error (0x1)	Controller (0x8)	0x100A	Data Field Type: 0x010D
<b>Destination SOD Error:</b> Logged when the destination driver cannot complete SOD initialization successfully					
Controller (0x1)	Informational (0x0)	Error (0x1)	Controller (0x8)	0x100B	Origin: Indicates the structure that could not be allocated. 1: Call to VKI_REBOOT_HOOK failed. 2: Status byte structure allocation failed 3: Data_phase_tag_ptrs structure allocation failed 4: Invalid_Reselect_data structure allocation failed Data Field Type: 0x0206

Table 62. Destination Driver events

Event: Event Description					
Log Group	Priority	Event Group	Component	Event Number	Optional Data
<b>Destination Hardware Error:</b> Currently Not Logged					
Controller (0x1)	Informational (0x0)	Error (0x1)	Controller (0x8)	0x100C	
<b>Destination Timeout:</b> Currently Not Logged					
Controller (0x1)	Informational (0x0)	Error (0x1)	Controller (0x8)	0x100D	
<b>Unexpected Interrupt:</b> Logged due to an unexpected interrupt with no active device on chip					
Controller (0x1)	Informational (0x0)	Error (0x1)	Controller (0x8)	0x100E	Data Field Type: 0x0201
<b>Bus Parity Error:</b> Logged when a Bus Parity error is detected by the destination driver					
Controller (0x1)	Informational (0x0)	Error (0x1)	Controller (0x8)	0x1010	
<b>Drive PFA:</b> The logged device generated a PFA condition					
Controller (0x1)	Informational (0x0)	Error (0x1)	Drive (0x1)	0x1010	None
<b>Chip Error:</b> Currently Not Logged					
Controller (0x1)	Informational (0x0)	Error (0x1)	Drive (0xC)	0x1011	
<b>Destination Driver:</b> Logged when the destination driver has an unrecovered error from the drive					
Controller (0x1)	Informational (0x0)	Error (0x1)	Controller (0x8)	0x1012	Origin: Contains the low level destination driver internal error.  ID: Contains the raw error logger error number.
<b>Destination Diagnostic Failure:</b> Logged when destination driver level 0 diagnostics failed for the specified channel					
Controller (0x1)	Informational (0x0)	Error (0x1)	Controller (0x8)	0x1013	ID: Contains diagnostic test that failed.  1: Read/Write registers 2: 64 byte FIFO 3: DMA FIFO  Data Field Type: 0x010B
<b>Destination Reassign Block:</b> Logged when the destination driver issues a reassign block to the drive due to a write failure					
Controller (0x1)	Informational (0x0)	Error (0x1)	Controller (0x8)	0x1014	Origin: Block List
<b>Bad Mode Parameters:</b> Logged when the controller has detected a drive with Mode Select parameters that are not recommended or which could not be changed					
Controller (0x1)	Informational (0x0)	Error (0x1)	Controller (0x8)	0x1015	Origin: FRU information

## SCSI Source Driver events

Table 63. SCSI Source Driver events

Event: Event Description					
Log Group	Priority	Event Group	Component	Event Number	Optional Data
<b>SCSI Chip:</b> Logged when the SRC driver detects an exception condition from the SCSI chip					
Controller (0x1)	Informational (0x0)	Error (0x1)	Controller (0x8)	0x1101	Device: Base address of the SCSI chip  ID: Register offset where exception was detected possible values are:  0xC     dstat register 0x42    SIST0_REG 0x43    SIST1_REG  Origin: Value of the register
<b>Host Bus Reset:</b> Logged when the source SCSI driver asserts the RESET signal on the host SCSI bus. This is usually done as a response to have a host bus reset propagated to it by the alternate controller in a Wolfpack environment.					
System (0x0)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x1102	None
<b>Host Bus Reset Received:</b> Logged when a host bus reset was received and the controller is going to propagate it to the alternate controller in a wolf pack environment. Log entries for Host Bus Reset Received and Host Bus Reset should always appear in pairs in the system log.					
System (0x0)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x1103	None
<b>Unknown Interrupt:</b> Logged when the source SCSI driver detects an unknown interrupt					
Controller (0x1)	Informational (0x0)	Error (0x1)	Controller (0x8)	0x1104	Device: Base address of the SCSI chip  Origin: Value in the interrupt register.

## Fibre Channel Source Driver events

Table 64. Fibre Channel Source Driver events

Event: Event Description					
Log Group	Priority	Event Group	Component	Event Number	Optional Data
<b>LIP Reset Received:</b> Logged when a selective LIP reset (LipPdPs) is received					
Controller (0x1)	Informational (0x0)	Error (0x1)	Controller (0x8)	0x1201	ID: Internal Checkpoint Code  Origin: 0 = Source Side FC

Table 64. Fibre Channel Source Driver events

Event: Event Description					
Log Group	Priority	Event Group	Component	Event Number	Optional Data
<b>Target Reset Received:</b> Logged when a Target Reset is received					
Controller (0x1)	Informational (0x0)	Error (0x1)	Controller (0x8)	0x1202	ID: Internal Checkpoint Code Origin: 0 = Source Side FC
<b>Third Party Logout Reset Received:</b> Logged when a Third Party Logout with the Global Logout bit set. This is treated as a Target Reset by the controller.					
Controller (0x1)	Informational (0x0)	Error (0x1)	Controller (0x8)	0x1203	ID: Internal Checkpoint Code Origin: 0 = Source Side FC
<b>Initialization Error:</b> Logged when a controller is unable to initialize an internal structure					
Controller (0x1)	Informational (0x0)	Error (0x1)	Controller (0x8)	0x1204	ID: Internal Checkpoint Code Origin: 0 = Source Side FC
<b>General Error:</b> Logged when an internal error (e.g. unable to obtain memory, unable to send frame) occurs					
Controller (0x1)	Informational (0x0)	Error (0x1)	Controller (0x8)	0x1205	ID: Internal Checkpoint Code Origin: 0 = Source Side FC
<b>Link Error Threshold:</b> Logged when Link Error count exceeds the threshold value after the initial notification					
Controller (0x1)	Informational (0x0)	Error (0x1)	Controller (0x8)	0x1206	Dev: Link Error Information ID: Internal Checkpoint Code
<b>Link Error Threshold Critical:</b> Logged when Link Error count exceeds the threshold the first time					
Controller (0x1)	Critical (0x1)	Error (0x1)	Controller (0x8)	0x1207	Dev: Link Error Information ID: Internal Checkpoint Code

## Fibre Channel Destination Driver events

Table 65. Fibre Channel Destination Driver events

Event: Event Description					
Log Group	Priority	Event Group	Component	Event Number	Optional Data
<b>Init Error:</b> Logged when a controller is unable to initialize hardware or an internal structure					
Controller (0x1)	Informational (0x0)	Error (0x1)	Controller (0x8)	0x1500	ID: 1 = TachLite 2 = SGB Allocation 3 = Spy SGB Allocation
<b>Device Reset:</b> Logged when a device reset primitive is sent					
Controller (0x1)	Informational (0x0)	Error (0x1)	Controller (0x8)	0x1501	Device: Port ID: 6 = Device Reset

Table 65. Fibre Channel Destination Driver events

Event: Event Description					
Log Group	Priority	Event Group	Component	Event Number	Optional Data
<b>Device Enable:</b> Logged when a device is enabled					
Controller (0x1)	Informational (0x0)	Error (0x1)	Controller (0x8)	0x1502	Device: Port ID ID: 8 = Device Enable
<b>Device Bypass:</b> Logged when a device is bypassed					
Controller (0x1)	Informational (0x0)	Error (0x1)	Controller (0x8)	0x1503	Device: Port ID ID: 7 = Device Bypass
<b>Channel Reset:</b> Logged when a Fibre Channel port is reset					
Controller (0x1)	Informational (0x0)	Error (0x1)	Controller (0x8)	0x1504	ID: 5 = Channel Reset
<b>Device Missing:</b> Logged when a Bad ALPA error is detected					
Controller (0x1)	Informational (0x0)	Error (0x1)	Controller (0x8)	0x1505	Device: Port ID ID: 11 = Bad ALPA Reply

## VDD events

Table 66. VDD events

Event: Event Description					
Log Group	Priority	Event Group	Component	Event Number	Optional Data
<b>Repair Begin:</b> Logged when a repair operation is started for the specified unit					
System (0x0)	Informational (0x0)	Notification (0x4)	Volume (0xD)	0x2001	None
<b>Repair End:</b> Currently Not Logged					
System (0x0)	Informational (0x0)	Notification (0x4)	Volume (0xD)	0x2002	Data Type Field: 0x0613
<b>Interrupted Write Begin:</b> Currently Not Logged					
System (0x0)	Informational (0x0)	Notification (0x4)	Volume (0xD)	0x2003	
<b>Interrupted Write End:</b> Currently Not Logged					
System (0x0)	Informational (0x0)	Notification (0x4)	Volume (0xD)	0x2004	
<b>Fail Vdisk:</b> Logged when the specified LUN is internally failed					
System (0x0)	Informational (0x0)	Failure (0x2)	Volume (0xD)	0x2005	Origin: LBA of the detected failure

Table 66. VDD events

Event: Event Description					
Log Group	Priority	Event Group	Component	Event Number	Optional Data
<b>Fail Piece:</b> Currently Not Logged					
System (0x0)	Informational (0x0)	Failure (0x2)	Drive (0x1)	0x2006	
<b>Fail Piece Delay:</b> Currently Not Logged					
System (0x0)	Informational (0x0)	Failure (0x2)	Drive (0x1)	0x2007	
<b>Dead LUN Reconstruction:</b> Currently Not Logged					
System (0x0)	Informational (0x0)	Notification (0x4)	Drive (0x1)	0x2008	
<b>RAID 0 Write Fail:</b> Currently Not Logged					
System (0x0)	Informational (0x0)	Error (0x1)	Drive (0x1)	0x2009	
<b>Data Parity Mismatch:</b> Logged when a data/parity mismatch is detected during data scrubbing					
System (0x0)	Informational (0x0)	Error (0x1)	Volume (0xD)	0x200A	Data Type Field: 0x0706
<b>Unrecovered Deferred Error:</b> Currently Not Logged					
System (0x0)	Informational (0x0)	Error (0x1)	Volume (0xD)	0x200B	
<b>Recovered Error:</b> Currently Not Logged					
System (0x0)	Informational (0x0)	Notification (0x4)	Volume (0xD)	0x200C	
<b>I/O Aborted:</b> Currently Not Logged					
System (0x0)	Informational (0x0)	Error (0x1)	Volume (0xD)	0x200D	
<b>VDD Reconfigure:</b> Currently Not Logged					
System (0x0)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x200E	
<b>VDD Synchronize Begin:</b> Logged when cache synchronization is begun from an external (to VDD) source					
System (0x0)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x200F	Data Field Type: 0x0706 0's in Number of blocks filed indicate entire LUN will be synchronized.
<b>VDD Synchronize End:</b> Logged when cache synchronization for the specified unit completes					
System (0x0)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x2010	Device: Contains ending error status  Origin: Contains buf flags value
<b>VDD Purge Begin:</b> Logged when an operation to flush cache for the specified unit is begun					
System (0x0)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x2011	None

Table 66. VDD events

Event: Event Description					
Log Group	Priority	Event Group	Component	Event Number	Optional Data
<b>VDD Purge End:</b> Logged when an operation to flush cache for the specified unit has completed					
System (0x0)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x2012	None
<b>VDD Cache Recover:</b> Logged when unwritten data and parity is recovered from cache at start-of-day or during a forced change in LUN ownership between the controllers					
System (0x0)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x2013	Origin: Contains the number of cache blocks recovered.
<b>VDD Error:</b> Logged when VDD logs an error.					
System (0x0)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x2014	Data Type Field: 0x0707
<b>Uncompleted Write Count:</b> Logged at start-of-day when uncompleted writes are detected in NVSRAM					
System (0x0)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x2015	Origin: Contains the number of uncompleted writes found
<b>Write Count:</b> Logged when vdd processes interrupted writes for the specified unit					
System (0x0)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x2016	Origin: Number of interrupted writes processed.
<b>Log Write Count:</b> Logged when VDD creates a list of interrupted writes from the data/parity checkpoint logs					
System (0x0)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x2017	Origin: Number of interrupted writes processed.
<b>VDD Wait:</b> Logged when an I/O is suspended because of no preallocated resources. This event is logged once per resource					
System (0x0)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x2018	Data Type Field: 0x0700 Data: First 4 characters of the resource name.
<b>VDD Long I/O:</b> Logged if performance monitoring is enabled and an I/O's elapsed time equal to or exceeds the threshold limit					
System (0x0)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x2019	Origin: Contains the elapsed time for the I/O Device: Contains the threshold value.
<b>VDD Restore Begin:</b> Logged at the beginning of a RAID 1 or RAID 5 VDD restore operation					
System (0x0)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x201A	Data Field Type: 0x0612
<b>VDD Restore End:</b> Logged at the end of a restore operation					
System (0x0)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x201B	Data Field Type: 0x0613

Table 66. VDD events

Event: Event Description					
Log Group	Priority	Event Group	Component	Event Number	Optional Data
<b>VDD Recover Begin:</b> Logged at the beginning of a RAID 1 or RAID 5 VDD recover operation					
System (0x0)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x201C	Data Field Type: 0x0617
<b>VDD Recover End:</b> Logged at the end of a recover operation					
System (0x0)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x201D	Data Field Type: 0x0613
<b>VDD Repair Begin:</b> Logged at the beginning of a repair operation					
System (0x0)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x201E	None
<b>VDD Repair End:</b> Logged at the end of a repair operation					
System (0x0)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x201F	Data Field Type: 0x0613
<b>Interrupted Write Fail Piece:</b> Logged when a piece is failed during an interrupted write operation					
System (0x0)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x2020	Data Field Type: 0x0612
<b>Interrupted Write Fail Piece:</b> Logged when a piece is failed during an interrupted write operation					
System (0x0)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x2020	Data Field Type: 0x0612
<b>Interrupted Write Fail Vdisk:</b> Logged when a virtual disk is failed as part of a interrupted write operation					
System (0x0)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x2021	Origin: LBA of the LUN that caused the failure.
<b>Scrub Start:</b> Logged when scrubbing is started for the specified unit					
System (0x0)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x2022	None
<b>Scrub End:</b> Logged when scrubbing operations for the specified unit have completed					
System (0x0)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x2023	Data Field Type: 0x0618
<b>Scrub Resume:</b> Logged when scrubbing operations are resumed for the specified unit					
System (0x0)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x2024	None
<b>Reconstruction Begin:</b> Logged when reconstruction operations are started for the specified unit					
System (0x0)	Informational (0x0)	Notification (0x4)	Drive (0x1)	0x2025	None
<b>Reconstruction End:</b> Logged when reconstruction operations for the specified unit have completed					
System (0x0)	Informational (0x0)	Notification (0x4)	Drive (0x1)	0x2026	Data Field Type: 0x0613
<b>Reconstruction Resume:</b> Logged when reconstruction operations are resumed for the specified unit					
System (0x0)	Informational (0x0)	Notification (0x4)	Drive (0x1)	0x2027	None

Table 66. VDD events

Event: Event Description					
Log Group	Priority	Event Group	Component	Event Number	Optional Data
<b>Reconfiguration Begin:</b> Logged when reconfiguration operations are started for the specified unit					
System (0x0)	Informational (0x0)	Notification (0x4)	Volume (0xD)	0x2028	None
<b>Reconfiguration End:</b> Logged when reconfiguration operations for the specified unit have completed					
System (0x0)	Informational (0x0)	Notification (0x4)	Volume (0xD)	0x2029	Data Field Type: 0x0613
<b>Reconfiguration Resume:</b> Logged when reconfiguration operations are resumed for the specified unit					
System (0x0)	Informational (0x0)	Notification (0x4)	Drive (0x1)	0x202A	None
<b>Parity Scan Begin:</b> Logged when parity scan operations are started for the specified unit					
System (0x0)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x202B	None
<b>Parity Scan End:</b> Logged when parity scan operations for the specified unit have completed					
System (0x0)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x202C	None
<b>Parity Scan Resume:</b> Logged when parity scan operations are resumed for the specified unit					
System (0x0)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x202D	None
<b>Miscorrected Data:</b> Logged when an Unrecoverable Read Error is detected					
System (0x0)	Critical (0x1)	Notification (0x4)	Controller (0x8)	0x202E	Origin: LBA of the LUN that caused the failure.
<b>Auto LUN Transfer End:</b> Logged when an auto lun transfer operation has completed					
System (0x0)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x202F	None

## Cache Manager events

Table 67. Cache Manager events

Event: Event Description					
Log Group	Priority	Event Group	Component	Event Number	Optional Data
<b>Late Check In:</b> Logged when the alternate controller check in late					
System (0x0)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x2101	None
<b>Mirror Out Of Sync:</b> The mirror is out of sync with the alternate controllers mirror					
System (0x0)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x2102	None

Table 67. Cache Manager events

Event: Event Description					
Log Group	Priority	Event Group	Component	Event Number	Optional Data
<b>UPS: Currently Not Logged</b>					
System (0x0)	Informational (0x0)	Notification (0x4)	UPS	0x2103	
<b>Synchronize and Purge: Currently Not Logged</b>					
System (0x0)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x2104	
<b>Reconfigure Cache: Currently Not Logged</b>					
System (0x0)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x2105	
<b>Set Configuration: A request to update the cache managers DACSTORE area was received</b>					
System (0x0)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x2106	None
<b>Clear Configuration: A request to clear the cache managers DACSTORE area was received</b>					
System (0x0)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x2107	None
<b>Cache Manager Errors: Currently Not Logged</b>					
System (0x0)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x2108	
<b>CCM Hardware Mismatch: Write back cache could not be enabled to due different cache sizes of the controllers in the subsystem. ASC/ASCQ value of 0xA1/0x00 is also logged with this event.</b>					
System (0x0)	Informational (0x0)	Error (0x1)	Controller (0x8)	0x2109	None
<b>Cache Disabled Internal: Write back cache could not be enabled or was internally disabled. The ASC/ASCQ value of 0xA0/0x00 is also logged with this event.</b>					
System (0x0)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x210A	None
<b>Cache Synchronize Failed: Cache synchronization between the controllers failed. The ASC/ASCQ value of 0x2A/0x01 is also logged with this event.</b>					
System (0x0)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x210B	None
<b>Cache Battery Failure: Cache battery has failed. ASC/ASCQ of 0x0C/0x00 is also logged with this event.</b>					
System (0x0)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x210C	None
<b>Deferred Error: Currently Not Logged</b>					
System (0x0)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x210D	

Table 67. Cache Manager events

Event: Event Description					
Log Group	Priority	Event Group	Component	Event Number	Optional Data
<b>Cache Data Loss:</b> Logged by cache manager when cache blocks can not be successfully recovered. Companion to an ASC/ASCQ status of 0x0C/0x81.					
Controller (0x1)	Informational (0x0)	Error (0x1)	Controller (0x8)	0x210E	The LUN and LBA (in ID field) are logged in the event data if they are available. An unavailable LUN is logged as 0xFF. An unavailable LBA is logged as 0. No additional data is logged.
<b>Memory Parity Error Detected:</b> Logged when a memory parity error is detected					
Controller (0x1)	Informational (0x0)	Error (0x1)	Controller (0x8)	0x210F	Device: 0 = Processor Memory 1 = RPA Memory 2 = Spectra Double Bit Error 3 = Spectra Multi-Bit Error 4 = Spectra PCI Error 5 = RPA PCI Error
<b>Cache Memory Diagnostic Fail:</b> Logged when a persistent RPA Memory Parity error is detected					
System (0x0)	Informational (0x0)	Failure (0x2)	Controller (0x8)	0x2110	
<b>Cache Task Fail:</b> Currently Not Logged					
System (0x0)	Informational (0x0)	Failure (0x2)	Controller (0x8)	0x2111	
<b>Cache Battery Good:</b> Cache battery has transitioned to the good state					
System (0x0)	Informational (0x0)	Notification (0x4)	Battery (0x9)	0x2112	None
<b>Cache Battery Warning:</b> Logged when the cache battery is within the specified number of weeks of failing. The ASC/ASCQ value of 0x3F/0xD9 is also logged with this event.					
System (0x0)	Informational (0x0)	Error (0x1)	Battery (0x9)	0x2113	
<b>Alternate Cache Battery Good:</b> The alternate controllers cache battery has transitioned to the good state.					
System (0x0)	Informational (0x0)	Notification (0x4)	Battery (0x9)	0x2114	None
<b>Alternate Cache Battery Warning:</b> Currently Not Logged					
System (0x0)	Informational (0x0)	Error (0x1)	Battery (0x9)	0x2115	
<b>Alternate Cache Battery Fail:</b> The alternate controllers cache battery has transitioned to the failed state.					
System (0x0)	Informational (0x0)	Failure (0x2)	Battery (0x9)	0x2116	None

Table 67. Cache Manager events

Event: Event Description					
Log Group	Priority	Event Group	Component	Event Number	Optional Data
<b>CCM Error Cleared:</b> On occasion CCM may log an error prematurely and then clear it later. For example errors may be logged when the alternate controller is removed from the subsystem. If the controller is replaced before a write is done CCM will cancel the errors logged since the controller is replaced and functioning normally.					
System (0x0)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x2117	ID: Contains the event that is being cleared
<b>Memory Parity ECC Error:</b> Logged a memory parity error occurs and information on the error is available					
Controller (0x1)	Informational (0x0)	Error (0x1)	Controller (0x8)	0x2118	Data Field Type: 0x0111
<b>Recovered Data Buffer Memory Error:</b> Logged when the controller has detected and corrected a recoverable error in the data buffer memory					
Controller (0x1)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x2119	
<b>Cache Error Was Corrected:</b> Logged when the cache manager has corrected using the alternate controllers cache memory					
Controller (0x1)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x211a	None

## Configuration Manager events

Table 68. Configuration Manager events

Event: Event Description					
Log Group	Priority	Event Group	Component	Event Number	Optional Data
<b>Mark LUN Optimal:</b> Currently Not Logged					
System (0x0)	Informational (0x0)	Notification (0x4)	Volume (0xD)	0x2201	
<b>Add Vdisk:</b> Logged when a LUN is added to the subsystem					
System (0x0)	Informational (0x0)	Notification (0x4)	Volume (0xD)	0x2202	Data Field Type: 0x0612
<b>Delete Vdisk:</b> Logged when the specified virtual disk is deleted					
System (0x0)	Informational (0x0)	Notification (0x4)	Volume (0xD)	0x2203	None
<b>Resume I/O:</b> Logged when vdResumeIo is called for specified device					
System (0x0)	Informational (0x0)	Notification (0x4)	Volume (0xD)	0x2204	None
<b>Fail Copy Source:</b> Logged when the source drive of a copy type operation fails					
System (0x0)	Informational (0x0)	Notification (0x4)	Volume (0xD)	0x2205	None

Table 68. Configuration Manager events

Event: Event Description					
Log Group	Priority	Event Group	Component	Event Number	Optional Data
<b>CFG Reconstruction Device Complete:</b> Logged when CFG manager has completed reconfiguring the specified device successfully					
System (0x0)	Informational (0x0)	Notification (0x4)	Volume (0xD)	0x2206	None
<b>CFG Copy Device Complete:</b> Logged when the configuration manager has completed the copy process to the specified device					
System (0x0)	Informational (0x0)	Notification (0x4)	Volume (0xD)	0x2207	None
<b>CFG Reconfiguration Setup:</b> Logged by the configuration manager when it has set up the specified unit and device number for reconfiguration and is going to call VDD to start the reconfiguration					
System (0x0)	Informational (0x0)	Notification (0x4)	Volume (0xD)	0x2208	Data Field Type: 0x0612
<b>CFG Reconfiguration:</b> Logged when the LUN has finished reconfigure process the new LUN state is in origin					
System (0x0)	Informational (0x0)	Notification (0x4)	Volume (0xD)	0x2209	None
<b>CFG Copyback Start:</b> Logged when copy task is started					
Log Group	Priority	Event Group	Component	Event Number	Optional Data
<b>CFG Copyback Restart:</b> Logged when copy task is restarted					
System (0x0)	Informational (0x0)	Notification (0x4)	Volume (0xD)	0x220B	None
<b>CFG Fail Delayed:</b> Logged when the specified device or LUN is failed during interrupted write processing. SK/ASC/ASCQ = 0x06/0x3F/0x8E will be reported for the device that is failed. SK/ASC/ASCQ = 0x06/0x3F/0xE0 will be reported for each LUN that is goes dead.					
System (0x0)	Informational (0x0)	Notification (0x4)	Unknown (0x0)	0x220C	None
<b>CFG Scrub Enabled:</b> Logged when the configuration manager enables scrubbing for the specified device Currently Not Logged					
System (0x0)	Informational (0x0)	Notification (0x4)	Unknown (0x0)	0x220D	Origin: 0 - Scrub & parity check are turned off 1 - Scrub is enabled 2 - Parity check is enabled 3 - Scrub & parity check enabled
<b>CFG Scrub Start:</b> Logged when a scrub operation is started for the specified unit					
System (0x0)	Informational (0x0)	Notification (0x4)	Unknown (0x0)	0x220E	Origin: Actual buf address
<b>CFG Scrub Complete:</b> Logged when a scrub operation is completed for the specified unit					
System (0x0)	Informational (0x0)	Notification (0x4)	Unknown (0x0)	0x220F	None

Table 68. Configuration Manager events

Event: Event Description					
Log Group	Priority	Event Group	Component	Event Number	Optional Data
<b>CFG Restore Begin:</b> Logged when cfg manager begins a restore operation on specified unit and device number					
System (0x0)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x2210	None
<b>CFG Restore End:</b> Logged when cfg manager successfully completes a restore operation. If an error occurred during the restore this entry may not appear.					
System (0x0)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x2211	None
<b>CFG Parity Scan Restore:</b> Logged when the configuration manager repairs the parity of specified unit and device					
System (0x0)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x2212	Origin: Starting LBAs for the LUN
<b>Zero LUN:</b> Logged when zeros are written to the specified LUN					
System (0x0)	Informational (0x0)	Notification (0x4)	Drive (0x1)	0x2213	Data Field Type: 0x0706
<b>CFG Copy Sundry:</b> Logged when configuration manager creates 1 or more sundry drives					
System (0x0)	Informational (0x0)	Notification (0x4)	Unknown (0x0)	0x2214	Origin: The number of sundry drives created
<b>CFG Post Fail:</b> Logged when configuration manager posts a UA/AEN for a failed drive					
System (0x0)	Informational (0x0)	Notification (0x4)	Unknown (0x0)	0x2215	
<b>Piece Out of Service (OOS):</b> Logged when the configuration manager take a piece of the specified LUN out of service					
System (0x0)	Informational (0x0)	Notification (0x4)	Drive (0x1)	0x2216	Origin: New LUN state
<b>Piece Fail:</b> Logged when a piece of specified LUN is failed					
System (0x0)	Informational (0x0)	Notification (0x4)	Drive (0x1)	0x2217	Origin: Piece number
<b>Piece Fail Delay:</b> Logged when a piece of specified LUN is failed during uncompleted write processing					
System (0x0)	Informational (0x0)	Notification (0x4)	Drive (0x1)	0x2218	Origin: Piece number
<b>Piece Removed:</b> Logged when a piece of specified LUN has been removed					
System (0x0)	Informational (0x0)	Notification (0x4)	Drive (0x1)	0x2219	Origin: Piece number
<b>Piece Replace:</b> Logged when a piece of specified LUN has been replaced					
System (0x0)	Informational (0x0)	Notification (0x4)	Drive (0x1)	0x221A	Origin: Piece number
<b>Piece In Service:</b> Logged when the configuration manager places a LUN piece in service					
System (0x0)	Informational (0x0)	Notification (0x4)	Drive (0x1)	0x221B	None

Table 68. Configuration Manager events

Event: Event Description					
Log Group	Priority	Event Group	Component	Event Number	Optional Data
<b>Drive Group Offline:</b> Logged when an entire drive group is placed online the first 16 devices of the drive group are recorded in the data buffer					
System (0x0)	Informational (0x0)	Notification (0x4)	Volume Group (0xE)	0x221C	Data Field Type: 0x0603
<b>Drive Group Online:</b> Logged when an entire drive group is placed online					
System (0x0)	Informational (0x0)	Notification (0x4)	Volume Group (0xE)	0x221D	Data Field Type: 0x0603
<b>LUN Initialized:</b> Logged when a LUN has been created					
System (0x0)	Informational (0x0)	Notification (0x4)	Volume (0xD)	0x221E	Device: Contains the LUN number initialized
<b>IAF LUN Initialized:</b> Logged when an immediate availability LUN has been initialized					
System (0x0)	Informational (0x0)	Notification (0x4)	Volume (0xD)	0x221F	Device: Contains the LUN number initialized
<b>GHS Added:</b> Logged when a drive is to the global hot spare list					
System (0x0)	Informational (0x0)	Notification (0x4)	Drive (0x1)	0x2220	None
<b>GHS Removed:</b> Logged when a drive is removed from the hot spare list					
System (0x0)	Informational (0x0)	Notification (0x4)	Drive (0x1)	0x2221	None
<b>Change Unit Number:</b> Logged when a new rank has a duplicate unit number as an existing LUN					
System (0x0)	Informational (0x0)	Notification (0x4)	Drive (0x1)	0x2222	Origin: New unit number LUN: Old unit number
<b>Duplicate Physical Device:</b> Logged when cfg mgr discovers a duplicate data structure exists for two devices					
System (0x0)	Informational (0x0)	Notification (0x4)	Drive (0x1)	0x2223	ID: Device ID of first device Device: Device ID of second device
<b>CFG Reconstruction Start:</b> Logged when reconstruction is started for the specified device					
System (0x0)	Informational (0x0)	Notification (0x4)	Volume (0xD)	0x2224	None
<b>CFG Reconstruction Restart:</b> Logged when reconstruction is restarted for the specified device					
System (0x0)	Informational (0x0)	Notification (0x4)	Volume (0xD)	0x2225	None
<b>CFG Spin Down:</b> Logged when the specified drive is spun down					
System (0x0)	Informational (0x0)	Notification (0x4)	Unknown (0x0)	0x2226	None
<b>Set Device Operational:</b> Logged when the routine cfgSetDevOper (external interface) is called from the shell, by the format command handler, or by the mode select command handler					
Drive (0x2)	Informational (0x0)	Notification (0x4)	Drive (0x1)	0x2227	None

Table 68. Configuration Manager events

Event: Event Description					
Log Group	Priority	Event Group	Component	Event Number	Optional Data
<b>Delete Device:</b> Logged when <code>cfgDelDrive</code> (external interface) or <code>cfgDriveDeleted</code> is called. This interface can be called from the shell or mode select command handler.					
Drive (0x2)	Informational (0x0)	Notification (0x4)	Drive (0x1)	0x2228	None
<b>Ctl Fail Drive:</b> Logged when the configuration manager internally fails the device					
System (0x0)	Informational (0x0)	Notification (0x4)	Drive (0x1)	0x2229	Origin: Reason for failure 0x91: Locked Out 0xA3: User Failed via Mode Select
<b>Mark Drive GHS:</b> Logged when an unassigned drive is specified as a global hot spare					
System (0x0)	Informational (0x0)	Notification (0x4)	Drive (0x1)	0x222A	None
<b>CFG Cold Replaced:</b> Logged when the configuration manager finds a drive that has been cold-replaced (that is, replaced when the controller and subsystem were powered off)					
System (0x0)	Informational (0x0)	Notification (0x4)	Unknown (0x0)	0x222B	None
<b>Device Unassigned:</b> Logged when a drive is to be marked unassigned, also Logged if an unknown drive that was part of a LUN is to be brought online					
Drive (0x2)	Informational (0x0)	Notification (0x4)	Drive (0x1)	0x222C	None
<b>Device Fail:</b> Logged when <code>cfgFailDrive</code> (external interface) or <code>cfgDriveFailed</code> is called.					
Drive (0x2)	Informational (0x0)	Notification (0x4)	Drive (0x1)	0x222D	Origin: Reason for the device failure (contents unspecified)
<b>Device Removed:</b> Logged when a drive has is to be marked removed					
Drive (0x2)	Informational (0x0)	Notification (0x4)	Drive (0x1)	0x222E	None
<b>Device Replace:</b> Logged when a notification is received that a failed drive is to be replaced and that data reconstruction on this device should begin					
Drive (0x2)	Informational (0x0)	Notification (0x4)	Drive (0x1)	0x222F	None
<b>Device Manager Fail:</b> Logged when the configuration manager state machine has been called to fail the device. This is an additional event that indicates the configuration manager has determined that processing has to be done in order to fail the device. Appearance of this entry depends on the drives state previous state prior to being failed.					
Drive (0x2)	Informational (0x0)	Notification (0x4)	Drive (0x1)	0x2230	Origin: Reason for Failure
<b>Device Manager Removed:</b> Logged when the configuration manager state machine is going to mark a drive removed					
Drive (0x2)	Informational (0x0)	Notification (0x4)	Drive (0x1)	0x2231	None

Table 68. Configuration Manager events

Event: Event Description					
Log Group	Priority	Event Group	Component	Event Number	Optional Data
<b>Device Manager Removed 1:</b> Logged when the configuration manager is called to remove a drive that has already been removed					
Drive (0x2)	Informational (0x0)	Notification (0x4)	Drive (0x1)	0x2232	None
<b>Device Manager Removed 2:</b> Logged when an unassigned drive has been marked as removed by the configuration manager					
Drive (0x2)	Informational (0x0)	Notification (0x4)	Drive (0x1)	0x2233	None
<b>Device Manager Removed 3:</b> Logged when a drive has been removed that has not finished reconstruction, usually happens when a drive that is waiting for reconstruction to begin is removed					
Drive (0x2)	Informational (0x0)	Notification (0x4)	Drive (0x1)	0x2234	None
<b>Device Manager Removed 4:</b> Logged when an optimal or replaced drive has been removed					
Drive (0x2)	Informational (0x0)	Notification (0x4)	Drive (0x1)	0x2235	None
<b>Device Manager Copy Done:</b> Logged by the configuration manager state machine when a copy operation has completed on a global hot spare drive					
Drive (0x2)	Informational (0x0)	Notification (0x4)	Drive (0x1)	0x2236	Origin: Internal device flags managed by the configuration manager, definition is unspecified.
<b>Device Manager Copy Done 1:</b> Copy Done: Logged when a replaced drive has finished reconstruction					
Drive (0x2)	Informational (0x0)	Notification (0x4)	Drive (0x1)	0x2237	None
<b>Device Manager New:</b> Logged when a drive has been inserted in a previously unused slot in the subsystem					
Drive (0x2)	Informational (0x0)	Notification (0x4)	Drive (0x1)	0x2238	None
<b>Device Manager GHS Unassigned:</b> Logged when an unassigned drive is marked as a global hot spare internally					
System (0x0)	Informational (0x0)	Notification (0x4)	Drive (0x1)	0x2239	None
<b>Device Manager Delete:</b> Logged when a drive is to be marked as deleted. Previously the drive was unassigned or failed.					
Drive (0x2)	Informational (0x0)	Notification (0x4)	Drive (0x1)	0x223A	None
<b>Device Manager Replace:</b> Logged when a failed or replaced drive is marked as replaced					
Drive (0x2)	Informational (0x0)	Notification (0x4)	Drive (0x1)	0x223B	None

Table 68. Configuration Manager events

Event: Event Description					
Log Group	Priority	Event Group	Component	Event Number	Optional Data
<b>Device Manager Replace 1:</b> Logged when a removed optimal drive or replaced drive has been reinserted of when a failed drive is reinserted					
Drive (0x2)	Informational (0x0)	Notification (0x4)	Drive (0x1)	0x223C	Origin: Location where event is logged, value unspecified
<b>Device Manager Replace 2:</b> Logged when an unassigned drive has been replaced					
Drive (0x2)	Informational (0x0)	Notification (0x4)	Drive (0x1)	0x223D	Origin: Location where event is logged, value is unspecified
<b>Device Manager Operational:</b> Logged when a drive has been marked operational					
Drive (0x2)	Informational (0x0)	Notification (0x4)	Drive (0x1)	0x223E	None
<b>Device Manager Operational:</b> Logged when a optimal drive that has not completed reconstruction is marked operational					
Drive (0x2)	Informational (0x0)	Notification (0x4)	Drive (0x1)	0x223F	None
<b>Device Manager No DACSTORE Unassigned:</b> Logged when an unassigned drive or unassigned global hot spare has no DACSTORE and a DACSTORE has been created					
System (0x0)	Informational (0x0)	Notification (0x4)	Drive (0x1)	0x2240	None
<b>Device Manager No DACSTORE Fail:</b> Logged when an unassigned drive without a DACSTORE has been failed					
System (0x0)	Informational (0x0)	Notification (0x4)	Drive (0x1)	0x2241	None
<b>Device Manager No DACSTORE Delete:</b> Logged when an unassigned drive without a DACSTORE has been deleted					
System (0x0)	Informational (0x0)	Notification (0x4)	Drive (0x1)	0x2242	None
<b>Device Manager No DACSTORE Remove:</b> Logged when an unassigned drive without a DACSTORE has been removed					
System (0x0)	Informational (0x0)	Notification (0x4)	Drive (0x1)	0x2243	None
<b>Device Manager Unassigned:</b> Logged when an unknown drive is marked unassigned					
System (0x0)	Informational (0x0)	Notification (0x4)	Drive (0x1)	0x2244	None
<b>CFG Scrub Stop:</b> Logged when a scrub operation is stopped for the specified unit					
System (0x0)	Informational (0x0)	Notification (0x4)	Unknown (0x0)	0x2245	None
<b>CFG Scrub Resume:</b> Logged when a scrub operation is resumed for the specified unit or drive group					
System (0x0)	Informational (0x0)	Notification (0x4)	Unknown (0x0)	0x2246	None

Table 68. Configuration Manager events

Event: Event Description					
Log Group	Priority	Event Group	Component	Event Number	Optional Data
<b>CFG Unrecovered Interrupted Write:</b> Logged when a LUN is marked Dead due to a media error failure during SOD. An error occurred during Interrupted Write processing causing the LUN to transition to the Dead State. SK/ASC/ASCQ = 0x06/0x3F/0xEB will be offloaded for this error.					
System (0x0)	Critical (0x1)	Notification (0x4)	Volume (0xD)	0x2247	None
<b>CFG Unrecovered Write Failure:</b> Logged when the configuration manager posts and UA/AEN of ASC/ASCQ = 0x3F/0x80 indicating the controller set the drive state to Failed – Write Failure					
System (0x0)	Critical (0x1)	Failure (0x2)	Drive (0x1)	0x2248	Origin: FRU info
<b>CFG Drive Too Small:</b> Logged when the configuration manager posts and UA/AEN of ASC/ASCQ = 0x3F/0x8B indicating the controller set the drive state to Drive Capacity < Minimum					
System (0x0)	Critical (0x1)	Notification (0x4)	Drive (0x1)	0x2249	Origin: FRU info
<b>Wrong Sector Size:</b> Logged when the configuration manager posts and UA/AEN of ASC/ASCQ = 0x3F/0x8C indicating the controller set the drive state to Drive has wrong blocksize					
System (0x0)	Critical (0x1)	Notification (0x4)	Drive (0x1)	0x224A	Origin: FRU info
<b>Drive Format Failed:</b> Logged when the configuration manager posts and UA/AEN of ASC/ASCQ = 0x3F/0x86 indicating the controller set the drive state to Failed – Format failure					
System (0x0)	Critical (0x1)	Notification (0x4)	Drive (0x1)	0x224B	Origin: FRU info
<b>Wrong Drive:</b> Logged when the configuration manager posts and UA/AEN of ASC/ASCQ = 0x3F/0x89 indicating the controller set the drive state to Wrong drive removed/replaced					
System (0x0)	Informational (0x0)	Notification (0x4)	Drive (0x1)	0x224C	Origin: FRU info
<b>Drive No Response:</b> Logged when the configuration manager posts and UA/AEN of ASC/ASCQ = 0x3F/0x85 indicating the controller set the drive state to Failed – No Response					
System (0x0)	Critical (0x1)	Notification (0x4)	Drive (0x1)	0x224D	Origin: FRU info
<b>Reconstruction Drive Failed:</b> Logged when the configuration manager posts and UA/AEN of ASC/ASCQ = 0x3F/0x82 indicating the controller set the drive state to Failed, but it was unable to make the drive usable after replacement					
System (0x0)	Critical (0x1)	Failure (0x2)	Drive (0x1)	0x224E	Origin: FRU info
<b>Partial Global Hot Spare:</b> Logged when a defined Global Hot Spare device is not large enough to cover all of the drives in the subsystem					
System (0x0)	Informational (0x0)	Notification (0x4)	Drive (0x1)	0x224F	None
<b>LUN Down:</b> Logged when the configuration manager posts and UA/AEN of ASC/ASCQ = 0x3F/0xE0 indicating Logical Unit Failure					
System (0x0)	Critical (0x1)	Failure (0x2)	Volume (0xD)	0x2250	None

Table 68. Configuration Manager events

Event: Event Description					
Log Group	Priority	Event Group	Component	Event Number	Optional Data
<b>CFG Read Failure:</b> Logged when the configuration manager posts and UA/AEN of ASC/ASCQ = 0x3F/0x8E indicating that the drive failed due to a reconstruction failure at SOD					
System (0x0)	Critical (0x1)	State (0x5)	Drive (0x1)	0x2251	Origin: FRU info
<b>Fail Vdisk Delayed:</b> Logged when the specified device is failed during interrupted write processing. SK/ASC/ASCQ = 0x06/0x3F/0x98 will be offloaded for each failing device					
System (0x0)	Critical (0x1)	Notification (0x4)	Drive (0x1)	0x2252	None
<b>LUN Modified:</b> Logged when the configuration manager posts and UA/AEN of ASC/ASCQ = 0x3F/0x0E indicating that previous LUN data reported via a Report LUNs command has changed (due to LUN creation/deletion or controller hot-swap)					
System (0x0)	Informational (0x0)	Notification (0x4)	Volume (0xD)	0x2253	None
<b>Drive Parity Scan Error:</b> Logged when there is a parity data mismatch encountered during a drive parity scan operation					
System (0x0)	Critical (0x1)	Notification (0x4)	Volume (0xD)	0x2254	Origin: Number of mismatches
<b>Bad LUN Definition:</b> Logged when there is an improper LUN definition for Auto-LUN transfer. The controller will operate in normal redundant controller mode without performing Auto-LUN transfers					
System (0x0)	Critical (0x1)	Notification (0x4)	Volume (0xD)	0x2255	None

## Hot-swap events

Table 69. Hot-swap events

Event: Event Description					
Log Group	Priority	Event Group	Component	Event Number	Optional Data
<b>HSM Drive Removed:</b> Logged in the system log when the hot-swap monitor detects that a drive has been removed from the system					
System (0x0)	Informational (0x0)	Notification (0x4)	Drive (0x1)	0x2400	Device: Number of the removed drive
<b>HSM Drive Inserted:</b> Logged in the system log when the hot-swap monitor detects that a drive has been inserted in the system					
System (0x0)	Informational (0x0)	Notification (0x4)	Drive (0x1)	0x2401	Device: Number of the inserted drive
<b>Controller:</b> Currently Not Logged					
System (0x0)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x2500	

Table 69. Hot-swap events

Event: Event Description					
Log Group	Priority	Event Group	Component	Event Number	Optional Data
<b>Mode Switch Active:</b> Currently Not Logged					
System (0x0)	Informational (0x0)	State (0x5)	Controller (0x8)	0x2501	
<b>Icon Error:</b> Currently Not Logged					
System (0x0)	Informational (0x0)	Error (0x1)	Controller (0x8)	0x2502	
<b>Mode Switch Active/Passive:</b> Logged on successful completion of an Active/Passive mode switch					
System (0x0)	Informational (0x0)	State (0x5)	Controller (0x8)	0x2503	Origin: Local and alternate mode information
<b>Mode Switch Dual Active:</b> Logged on successful completion of a Dual Active mode switch					
System (0x0)	Informational (0x0)	State (0x5)	Controller (0x8)	0x2504	Origin: Local and alternate mode information
<b>Mode Switch:</b> Currently Not Logged					
System (0x0)	Informational (0x0)	State (0x5)	Controller (0x8)	0x2505	

## Start of Day events

Table 70. Start of Day events

Event: Event Description					
Log Group	Priority	Event Group	Component	Event Number	Optional Data
<b>ACS Download Start:</b> Logged when an ACS Download is started					
Controller (0x1)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x2600	
ACS Download Completed: Logged after the controller has been rebooted after auto code synchronization has been preformed. An ASC/ASCQ value of 0x29/0x82 is also logged with this event					
Controller (0x1)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x2601	Origin: Nonzero indicated download failure
<b>ACS Error:</b> Logged when auto code synchronization failed					
System (0x0)	Informational (0x0)	Error (0x1)	Controller (0x8)	0x2602	Data Field Type: 0x0701
<b>Default LUN Created:</b> Logged when the default LUN was created at SOD					
System (0x0)	Informational (0x0)	State (0x5)	Volume (0xD)	0x2603	None
<b>Persistent Memory Parity Error:</b> Logged when SOD detects that the persistent memory parity error state has been set					
Controller (0x1)	Informational (0x0)	Error (0x1)	Controller (0x8)	0x2604	None

Table 70. Start of Day events

Event: Event Description					
Log Group	Priority	Event Group	Component	Event Number	Optional Data
<b>Start of Day Completed:</b> Logged when the controller has completed initialization					
Controller (0x1)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x2605	None
<b>RPA Parity Error:</b> Logged during ccmInit during start of day if a parity error is found in RPA memory					
Controller (0x1)	Informational (0x0)	Error (0x1)	Controller (0x8)	0x2700	ID: Error block Device: 1 = RPA Memory
<b>PCI Parity Error:</b> Currently Not Logged					
Controller (0x1)	Informational (0x0)	Error (0x1)	Controller (0x8)	0x2701	
<b>RPA Unexpected Interrupt:</b> Logged when an unexpected RPA Interrupt is detected					
Controller (0x1)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x2702	Data Field Type: 0x0110
<b>Recovered Processor DRAM Error:</b> Logged when the controller has encountered recoverable processor DRAM ECC errors (below the maximum threshold)					
Controller (0x1)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x2703	

## Subsystem Monitor events

Table 71. Subsystem Monitor events

Event: Event Description					
Log Group	Priority	Event Group	Component	Event Number	Optional Data
<b>Power Supply:</b> Logged when a power supply changes state					
System (0x0)	Informational (0x0)	Notification (0x4)	Power Supply (0x2)	0x2800	ID: Power Supply Status: 0 = Failed 1 = Good
<b>On Battery:</b> The UPS battery is now supplying power to the subsystem					
System (0x0)	Informational (0x0)	Notification (0x4)	Battery (0x9)	0x2801	None
<b>UPS Battery Good:</b> The UPS battery has charged and transitioned to the good state					
System (0x0)	Informational (0x0)	Notification (0x4)	Battery (0x9)	0x2802	None
<b>UPS Battery 2 Minute Warning:</b> The UPS battery has transitioned given the 2 minute warning.  The UPS has signaled that it has 2 minutes of power left before failing. The controllers will flush any dirty data in their caches and turn off data caching.					

Table 71. Subsystem Monitor events

Event: Event Description					
Log Group	Priority	Event Group	Component	Event Number	Optional Data
System (0x0)	Informational (0x0)	Notification (0x4)	Battery (0x9)	0x2803	None
<b>UPS Battery Fail:</b> Currently Not Logged					
System (0x0)	Informational (0x0)	Failure (0x2)	Battery (0x9)	0x2804	
<b>Line State Change:</b> Logged when a discreet line state change is detected and an AEN is posted. This can either be a good to bad transition or bad to good. This does not include the cache battery line. Cache battery events are logged by the cache manager.					
System (0x0)	Informational (0x0)	Notification (0x4)	Unknown (0x0)	0x2805	Data Field Type: 0x0704
<b>Drive Enclosure:</b> Logged when SSM has detected a change in an enclosure device, other than a drive status					
System (0x0)	Informational (0x0)	Notification (0x4)	ESM (0x7)	0x2806	Data Field Type: 0x0705
<b>Enclosure Fail:</b> Currently Not Logged					
System (0x0)	Informational (0x0)	Failure (0x2)	ESM (0x7)	0x2807	
<b>Enclosure ID Not Unique:</b> Logged when the controller determines that there are multiple sub-enclosures with the same ID value selected					
System (0x0)	Informational (0x0)	Notification (0x4)	ESM (0x7)	0x2808	Device: Sub-enclosure ID in conflict
<b>Line Good:</b> Logged when a subsystem line has transitioned to the Good state					
System (0x0)	Informational (0x0)	Notification (0x4)	Unknown (0x0)	0x2809	Device: Line number that has changed state
<b>Line Missing:</b> Logged when an expected subsystem line is missing					
System (0x0)	Critical (0x1)	Notification (0x4)	Unknown (0x0)	0x280A	Device: Line number that is missing
<b>Line Failed:</b> Logged when a subsystem line has transitioned to the Failed state					
System (0x0)	Critical (0x1)	Notification (0x4)	Unknown (0x0)	0x280B	Device: Line number that has changed state
<b>Enclosure Good:</b> Logged when an enclosure has transitioned to the Good state					
System (0x0)	Informational (0x0)	Notification (0x4)	ESM (0x7)	0x280C	Device: Enclosure ID Origin: FRU Info
<b>Enclosure Fail:</b> Logged when an enclosure has transitioned to the Failed state					
System (0x0)	Critical (0x1)	Notification (0x4)	ESM (0x7)	0x280D	Device: Enclosure ID Origin: FRU Info
<b>Battery Low:</b> Logged when the battery is charge is low					
System (0x0)	Critical (0x1)	Notification (0x4)	Battery (0x9)	0x280E	

Table 71. Subsystem Monitor events

Event: Event Description					
Log Group	Priority	Event Group	Component	Event Number	Optional Data
<b>Redundancy Loss:</b> Logged when a redundant path is not available to devices					
System (0x0)	Informational (0x0)	Notification (0x4)	ESM (0x7)	0x280F	Device: Enclosure ID Origin: FRU Group Qualifier for Sub-enclosure group (Byte 27) or drive slot
<b>Redundancy Restored:</b> Logged when a redundant path to devices is restored					
System (0x0)	Informational (0x0)	Notification (0x4)	ESM (0x7)	0x2810	Device: Enclosure ID Origin: FRU Group Qualifier for Sub-enclosure group (Byte 27) or drive slot
<b>Not Used</b>					
				0x2811	
<b>Mini-hub Normal:</b>					
System (0x0)	Informational (0x0)	Notification (0x4)	Mini-hub (0x4)	0x2812	ID = Type/Channel Type = 1: Host Side Type = 2: Drive Side
<b>Mini-hub Failed:</b>					
System (0x0)	Critical (0x1)	Notification (0x4)	Mini-hub (0x4)	0x2813	ID = Type/Channel Type = 1: Host Side Type = 2: Drive Side
<b>GBIC Optimal:</b>					
System (0x0)	Informational (0x0)	Notification (0x4)	Mini-hub (0x4)	0x2814	ID = Type/Channel Type = 1: Host Side Type = 2: Drive Side
<b>GBIC Failed:</b>					
System (0x0)	Critical (0x1)	Notification (0x4)	Mini-hub (0x4)	0x2815	ID = Type/Channel Type = 1: Host Side Type = 2: Drive Side
<b>Enclosure ID Conflict:</b> Logged when the controller detects duplicate drive tray IDs in the subsystem					
System (0x0)	Critical (0x1)	Notification (0x4)	ESM (0xa)	0x2816	None
<b>Enclosure ID Conflict Cleared:</b> Logged when the controller detects that an enclosure ID conflict no longer exists					
System (0x0)	Informational (0x0)	Notification (0x4)	ESM (0xa)	0x2817	None
<b>Enclosure ID Mismatch:</b> Logged when the controller detects that the two ESM boards in the same drive tray have different IDs					
System (0x0)	Critical (0x1)	Notification (0x4)	ESM (0xa)	0x2818	None

Table 71. Subsystem Monitor events

Event: Event Description					
Log Group	Priority	Event Group	Component	Event Number	Optional Data
<b>Enclosure ID Mismatch Cleared:</b> Logged when the controller detects that the drive tray ESM board ID mismatch has been cleared					
System (0x0)	Informational (0x0)	Notification (0x4)	ESM (0xa)	0x2819	None

## Command Handler events

Table 72. Command Handler events

Event: Event Description					
Log Group	Priority	Event Group	Component	Event Number	Optional Data
<b>Format Unit:</b> Logged when the controller processes a format command. The LUN value indicates the LUN that the controller is formatting					
System (0x0)	Informational (0x0)	Command (0x3)	Volume (0xD)	0x3000	ID field: Indicates the status of the format command: 0 - Write zeros is being done to the unit 1 - The configuration manager is initializing the LUN and controller data structures used. 2 - The entire format operation has successfully completed, status has been returned to the host.
<b>Quiesce:</b> Logged for the <b>quiescence</b> command					
System (0x0)	Informational (0x0)	Command (0x3)	Controller (0x8)	0x3001	ID field: Indicates the state of the quiesce command: 0 - Quiescence is stopped. 1 - Quiescence was started.
<b>Reassign Blocks:</b> Logged for a <b>reassign blocks</b> command that has been issued from the host					
System (0x0)	Informational (0x0)	Command (0x3)	Volume (0xD)	0x3002	ID: Total number of blocks to be reassigned.  Data Field Type: 0x0208
<b>Reserve:</b> Logged for the <b>reserve</b> command					
System (0x0)	Informational (0x0)	Command (0x3)	Volume (0xD)	0x3003	LUN: LUN being reserved. ID: Indicates the reserving host Device: If nonzero, Third party reservation information. The high order byte indicates that a 3rd party reservation was done the low order byte is the third party ID.

Table 72. Command Handler events

Event: Event Description					
Log Group	Priority	Event Group	Component	Event Number	Optional Data
<b>Release:</b> Logged for the <b>release</b> command					
System (0x0)	Informational (0x0)	Command (0x3)	Volume (0xD)	0x3004	LUN: LUN being reserved. ID: Indicates the reserving host Device: If nonzero, Third party reservation information. The high order byte indicates that a 3rd party reservation was done the low order byte is the third party ID.
<b>Synchronize Cache:</b> Logged when controllers begins execution of Synchronize Cache					
System (0x0)	Informational (0x0)	Command (0x3)	Controller (0x8)	0x3005	None
<b>Safe Pass Through:</b> These log entries are made by the set pass through and save pass through command handlers respectively before the pass through command is sent to the drive. The following passed through commands are not logged: Test Unit Ready, Read Capacity, Inquiry, Mode Sense. All other commands are logged regardless of their success or failure.					
System (0x0)	Informational (0x0)	Command (0x3)	Drive (0x1)	0x3006	Data Field Type: 0x0611
<b>Mode Select 1:</b> Logged when Mode Select for Page 0x01 is received and the Post Error bit value has changed from the value stored in NVSRAM					
System (0x0)	Informational (0x0)	Command (0x3)	Volume (0xD)	0x3007	ID: Contains new post error (PER) bit value
<b>Mode Select 2:</b> Logged when mode select for Page 0x02 is received					
System (0x0)	Informational (0x0)	Command (0x3)	Volume (0xD)	0x3008	Data Field Type: 0x0608  Data buffer length = 16 Data: Page 0x02 Mode Select data sent to the controller in SCSI format.
<b>Mode Select 8:</b> Logged when Mode Select Page 0x08 (Caching page) is received					
System (0x0)	Informational (0x0)	Command (0x3)	Volume (0xD)	0x3009	Data Field Type: 0x0608  Data buffer length = 12 Data: Page 0x08 Mode Select data sent to the controller in SCSI format.
<b>Mode Select A:</b> Logged when Mode Select Page 0x0A (Control mode page) is received					
System (0x0)	Informational (0x0)	Command (0x3)	Controller (0x8)	0x300A	Data Field Type: 0x0608  Data buffer length = 8 Data: Page 0x0A Mode Select data sent to the controller in SCSI format

Table 72. Command Handler events

Event: Event Description					
Log Group	Priority	Event Group	Component	Event Number	Optional Data
<b>Mode Select 2A:</b> Logged when Mode Select Page 0x2A (Array physical page) is received					
System (0x0)	Informational (0x0)	Command (0x3)	Controller (0x8)	0x300B	Data Field Type: 0x060C
<b>Mode Select 2B:</b> Logged when Mode Select Page 0x2B (Logical Array page) is received					
System (0x0)	Informational (0x0)	Command (0x3)	Volume (0xD)	0x300C	Data Field Type: 0x0608 Data buffer length = 132 Data: Page 0x2B Mode Select data sent to the controller in SCSI format.
<b>Mode Select 2C:</b> Logged when Mode Select Page 0x2C (Redundant controller page) is received					
System (0x0)	Informational (0x0)	Command (0x3)	Controller (0x8)	0x300D	Data Field Type: 0x0608 Data buffer length: = 106 Data: Page 0x2C Mode Select data sent to the controller in SCSI format.
<b>Mode Select 2E:</b> Logged when Mode Select Page 0x2E - (Vendor unique cache page) is received					
System (0x0)	Informational (0x0)	Command (0x3)	Controller (0x8)	0x300E	Data Field Type: 0x0608 Data buffer length = 30 Data: Page 0x2E Mode Select data sent to the controller in SCSI format.
<b>Mode Select 2F:</b> Logged when Mode Select Page 0x2F (Time page) is received					
System (0x0)	Informational (0x0)	Command (0x3)	Controller (0x8)	0x300F	Device: Contains the time passed to the controller
<b>Mode Select 3A:</b> Logged when Mode Select Page 0x3A (The global hot spare page) is received					
System (0x0)	Informational (0x0)	Command (0x3)	Controller (0x8)	0x3010	ID: Action code specified in the page data Device: Hot spare device specified in the page data
<b>Defect List:</b> Currently Not Logged					
System (0x0)	Informational (0x0)	Command (0x3)	Controller (0x8)	0x3011	

Table 72. Command Handler events

Event: Event Description					
Log Group	Priority	Event Group	Component	Event Number	Optional Data
<b>Write Buffer:</b> Logged when Write Buffer is received to the following buffer IDs:					
0xE8 - SubSystem Identifier					
0xE9 - Subsystem Fault					
0xEA - drive Fault					
0xED - Host Interface Parameters					
0xEE - user configuration options					
0xF0 - BootP Storage					
System (0x0)	Informational (0x0)	Command (0x3)	Controller (0x8)	0x3012	Origin: contains the buffer ID. Data Field Type: 0x0612
<b>Controller Firmware Download:</b> Logged when controller firmware download is started					
Controller (0x1)	Informational (0x0)	Command (0x3)	Controller (0x8)	0x3013	Device: 0 = Download to drive started 1 = Download had completed  Origin: Error value on completion of download 0 = Download Success Other = Error occurred, value of internal controller status
<b>Drive Firmware Download Start:</b> Logged when drive firmware download has started					
Drive (0x2)	Informational (0x0)	Command (0x3)	Drive (0x1)	0x3014	
<b>Pass Through:</b> Currently Not Logged					
Drive (0x2)	Informational (0x0)	Command (0x3)	Drive (0x1)	0x3015	
<b>Alternate Controller:</b> Currently Not Logged					
System (0x0)	Informational (0x0)	Command (0x3)	Controller (0x8)	0x3016	
<b>Set Pass Through:</b> Currently Not Logged					
These log entries are made by the set pass through and save pass through command handlers respectively before the pass through command is sent to the drive. The following passed through commands are not logged: Test Unit Ready, Read Capacity, Inquiry, Mode Sense. All other commands are logged regardless of their success or failure					
System (0x0)	Informational (0x0)	Command (0x3)	Drive (0x1)	0x3017	
<b>Set Pass Command:</b> Currently Not Logged					
System (0x0)	Informational (0x0)	Command (0x3)	Drive (0x1)	0x3018	

Table 72. Command Handler events

Event: Event Description					
Log Group	Priority	Event Group	Component	Event Number	Optional Data
<b>Mode Select Active/Passive Mode:</b> Logged when a Mode Select command to make the controller Active is received					
System (0x0)	Critical (0x1)	Command (0x3)	Controller (0x8)	0x3019	
<b>Drive Firmware Download Fail:</b> Logged when drive firmware download has failed					
Drive (0x2)	Informational (0x0)	Command (0x3)	Drive (0x1)	0x301A	
<b>Drive Firmware Download Complete:</b> Logged when drive firmware download has completed successfully					
Drive (0x2)	Informational (0x0)	Command (0x3)	Drive (0x1)	0x301B	
<b>ESM Firmware Download Start:</b> Logged when ESM firmware download has started					
Drive (0x2)	Informational (0x0)	Command (0x3)	ESM (0x7)	0x301C	Lun: Tray ID of tray containing ESM
<b>ESM Firmware Download Fail:</b> Logged when ESM firmware download has failed					
Drive (0x2)	Informational (0x0)	Command (0x3)	ESM (0x7)	0x301D	Lun: Tray ID of tray containing ESM
<b>ESM Firmware Download Complete:</b> Logged when ESM firmware download has successfully completed					
Drive (0x2)	Informational (0x0)	Command (0x3)	ESM (0x7)	0x301E	Lun: Tray ID of tray containing ESM

## EEL events

Table 73. EEL events

Event: Event Description					
Log Group	Priority	Event Group	Component	Event Number	Optional Data
<b>AEN Posted:</b> Logged when the controller posts an AEN. This is a critical event which causes SymSm 7 to send an SNMP trap to the host					
System (0x0)	Failure (0x2)	Notification (0x4)	Controller (0x8)	0x3101	Data Field Type: 0x0100 Data: Sense data of the AEN as defined in the Software Interface Specification.
<b>EEL Deferred Error:</b> Currently Not Logged					
System (0x0)	Informational (0x0)	Error (0x1)	Controller (0x8)	0x3102	

Table 73. EEL events

Event: Event Description					
Log Group	Priority	Event Group	Component	Event Number	Optional Data
<b>VKI Common Error:</b> Logged when VKI_CMN_ERROR is called with the error level set to ERROR. Calls made with a level of CONTINUE or NOTE will not be logged					
System (0x0)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x3200	Data Field Type: 0x0700
<b>VKI Panic:</b> Logged when VKI_CMN_ERROR is called with the error level set to PANIC. Calls made with a level of CONTINUE or NOTE will not be logged					
System (0x0)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x3201	Data Field Type: 0x0700

## RDAC, Quiescence and ICON Manager events

Table 74. RDAC, Quiescence and ICON Manager events

Event: Event Description					
Log Group	Priority	Event Group	Component	Event Number	Optional Data
<b>SysWipe:</b> Logged when a sys wipe request is sent to the controller. This routine is not called by the controller SW or FW currently. If logged it means the command was entered through the shell interface. If this entry is seen, a corresponding entry of MEL_EV_ICON_SYS_WIPE_ALT should also be logged by the alternate controller.					
System (0x0)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x4000	None
<b>NVSRAM Clear:</b> Logged when an NVSRAM clear message is sent to the alternate controller. This is normally logged as part of a mode select command to the RDAC mode page 0x2C. The companion entry of MEL_EV_ICON_NV_CLR_ALT should also be seen in the event log along with this entry.					
System (0x0)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x4001	None
<b>SysWipe Alternate:</b> Logged when a sys wipe request is received by the alternate controller. This is an unexpected log entry that is logged when the routine i conMgrSendSysWipe is executed from the shell of the alternate controller. This routine is not called by the controller SW. The companion entry of MEL_EV_ICON_SYS_WIPE should also be logged if this entry is seen.					
System (0x0)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x4002	None
<b>NVSRAM Clear Alternate:</b> Logged when an NVSRAM clear message is received from the alternate controller. No additional data is logged. The companion entry of MEL_EV_ICON_NV_CLR should also be seen in the event log along with this entry.					
System (0x0)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x4003	None
<b>Quiesce Message Received:</b> A quiescence manager message was received from the alternate controller.					

Table 74. RDAC, Quiescence and ICON Manager events

Event: Event Description					
Log Group	Priority	Event Group	Component	Event Number	Optional Data
System (0x0)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x4004	ID: Message that was received: 0 = Start controller level quiescence and return Done when completed. 1 = Stop controller level quiescence. 2 = The alternate controller has quiesced. 3 = Release the controller from quiescence.
<b>Controller Quiesce Begin:</b> Controller level quiescence was begun on the controller.					
System (0x0)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x4005	ID: Value of the forceOption parameter that was passed to the routine.
<b>Alternate Controller Quiesce Begin:</b> Controller level quiescence was begun on the alternate controller.					
System (0x0)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x4006	ID: Value of the forceOption parameter that was passed to the routine.
<b>Subsystem Quiesce Begin:</b> Subsystem level quiescence was begun					
System (0x0)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x4007	ID: Value of the forceOption parameter that was passed to the routine.
<b>Controller Quiesce Abort:</b> Controller level quiescence is aborted.					
System (0x0)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x4008	ID: Quiescence state of controller at beginning of the abort.
<b>Controller Quiesce Release:</b> Controller level quiescence is released.					
System (0x0)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x4009	ID: Quiescence state of controller at beginning of release.
<b>Alternate Controller Quiesce Release:</b> Controller level quiescence on alternate is released					
System (0x0)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x400A	ID: Quiescence state of alternate controller at beginning of release.
<b>Reset All Channels:</b> Logged when the controller detects that the alternate controller has been removed or replaced					
System (0x0)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x400B	
<b>Alternate Controller Reset Hold:</b> Logged when the controller successfully puts the alternate controller in the reset/hold state					
System (0x0)	Critical (0x1)	Notification (0x4)	Controller (0x8)	0x400C	

Table 74. RDAC, Quiescence and ICON Manager events

Event: Event Description					
Log Group	Priority	Event Group	Component	Event Number	Optional Data
<b>Alternate Controller Reset Release:</b> Logged when the controller successfully releases the alternate controller from the reset/failed state					
System (0x0)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x400D	
<b>Auto Volume Transfer:</b> Logged when an Auto Volume Transfer is initiated					
System (0x0)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x400e	Lun: Number of Volumes being transferred Origin: 0 = Normal AVT 1 = Forced AVT (LUN will be zero)
<b>Alternate controller has been reset:</b> Logged when the alternate controller was reset. The controller number in the event reflects the controller that was held in reset.					
System (0x0)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x400f	None
<b>Controller Reset:</b> Logged when the controller is going to reset itself through the controller firmware. This event is not logged when the controller is reset because of hardware errors (such as watchdog timeout conditions). The controller number reflects the controller number of the board that was reset.					
System (0x0)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x4010	None

## SYMBOL server events

Table 75. SYMBOL server events

Event: Event Description					
Log Group	Priority	Event Group	Component	Event Number	Optional Data
<b>Assign Volume Group Ownership:</b> Logged on entry to assignVolumeGroupOwnership_1					
System (0x0)	Informational (0x0)	Command (0x3)	Volume Group (0xE)	0x5000	Data Field Type: 0x0603 & 0x0803
<b>Create Hotspare:</b> Logged on entry to assignDriveAsHotSpares_1					
System (0x0)	Informational (0x0)	Command (0x3)	Unknown (0x0)	0x5001	Data Field Type: 0x0804 or 0x0805
<b>Create Volume:</b> Currently Not Logged					
System (0x0)	Informational (0x0)	Command (0x3)	Unknown (0x0)	0x5002	
<b>Delete Hotspare:</b> Logged on entry to deassignDriveAsHotSpares_1					
System (0x0)	Informational (0x0)	Command (0x3)	Unknown (0x0)	0x5003	Data Field Type: 0x0805

Table 75. SYMBol server events

Event: Event Description					
Log Group	Priority	Event Group	Component	Event Number	Optional Data
<b>Delete Volume:</b> Logged on entry to deleteVolume_1					
System (0x0)	Informational (0x0)	Command (0x3)	Volume (0xD)	0x5004	LUN: Volume be deleted
<b>Set Controller Failed:</b> Logged on entry to setControllerToFailed_1					
System (0x0)	Informational (0x0)	Command (0x3)	Controller (0x8)	0x5005	Data Field Type: 0x0813
<b>Set Drive Failed:</b> Logged on entry to setDriveToFailed_1					
System (0x0)	Informational (0x0)	Command (0x3)	Drive (0x1)	0x5006	None
<b>Start Volume Format:</b> Logged on entry to startVolumeFormat_1					
System (0x0)	Informational (0x0)	Command (0x3)	Volume (0xD)	0x5007	None
<b>Initialize Drive:</b> Logged on entry to initializeDrive_1					
System (0x0)	Informational (0x0)	Command (0x3)	Drive (0x1)	0x5008	None
<b>Controller Firmware Start:</b> Logged when a controller firmware download starts					
System (0x0)	Informational (0x0)	Command (0x3)	Controller (0x8)	0x5009	
<b>Load Drive Firmware:</b> Currently Not Logged					
System (0x0)	Informational (0x0)	Command (0x3)	Drive (0x1)	0x500A	
<b>Controller NVSRAM Start:</b> Logged when a controller NVSRAM download starts					
System (0x0)	Informational (0x0)	Command (0x3)	Controller (0x8)	0x500B	
<b>Set Volume Group Offline:</b> Logged on entry to setVolumeGroupToOffline_1					
System (0x0)	Informational (0x0)	Command (0x3)	Volume Group (0xE)	0x500C	Data Field Type: 0x0603
<b>Set Volume Group Online:</b> Logged on entry to setVolumeGroupToOnline_1					
System (0x0)	Informational (0x0)	Command (0x3)	Volume Group (0xE)	0x500D	Data Field Type: 0x0603
<b>Start Drive Reconstruction:</b> Logged on entry to startDriveReconstruction_1					
System (0x0)	Informational (0x0)	Command (0x3)	Drive (0x1)	0x500E	None
<b>Start Volume Group Defragment:</b> Logged on entry to startVolumeGroupDefrag_1					
System (0x0)	Informational (0x0)	Command (0x3)	Volume Group (0xE)	0x500F	Data Field Type: 0x0603

Table 75. SYMBol server events

Event: Event Description					
Log Group	Priority	Event Group	Component	Event Number	Optional Data
<b>Start Volume Group Expansion:</b> Logged on entry to startVolumeGroupExpansion_1					
System (0x0)	Informational (0x0)	Command (0x3)	Volume Group (0xE)	0x5010	Data Field Type: 0x0603 & 0x0809
<b>Start Volume RAID Migration:</b> Logged on entry to startVolumeRAIDMigration_1					
System (0x0)	Informational (0x0)	Command (0x3)	Volume Group (0xE)	0x5011	Data Field Type: 0x0603 & 0x080A
<b>Start Volume Segment Sizing:</b> Logged on entry to startVolumeSegmentSizing_1					
System (0x0)	Informational (0x0)	Command (0x3)	Volume (0xD)	0x5012	Data Field Type: 0x0802
<b>Set Controller To Passive:</b> Logged on entry to setControllerToPassive_1					
System (0x0)	Informational (0x0)	Command (0x3)	Controller (0x8)	0x5013	Data Field Type: 0x0813
<b>Set Controller To Active:</b> Logged on entry to setControllerToActive_1					
System (0x0)	Informational (0x0)	Command (0x3)	Controller (0x8)	0x5014	Data Field Type: 0x0813
<b>Set Storage Array Cache Parameters:</b> Logged on entry to setSACacheParams_1. Instructs the SYMBol Servers controller to propagate a controller cache change to all controllers in the storage array.					
System (0x0)	Informational (0x0)	Command (0x3)	Unknown (0x0)	0x5015	Data Field Type: 0x080B
<b>Set Storage Array User Label:</b> Logged on entry to setSAUserLabel_1. Instructs the controller to change the shared storage array name.					
System (0x0)	Informational (0x0)	Command (0x3)	Unknown (0x0)	0x5016	Data Field Type: 0x080C
<b>Set Controller Time:</b> Logged on entry to setControllerTime_1					
System (0x0)	Informational (0x0)	Command (0x3)	Controller (0x8)	0x5017	Data Field Type: 0x080D
<b>Set Volume Cache Parameters:</b> Logged on entry to setVolumeCacheParams_1					
System (0x0)	Informational (0x0)	Command (0x3)	Volume (0xD)	0x5018	Data Field Type: 0x080E
<b>Set Volume Parameters:</b> Logged on entry to setVolumeParams_1					
System (0x0)	Informational (0x0)	Command (0x3)	Volume (0xD)	0x5019	Data Field Type: 0x080F
<b>Set Volume User Label:</b> Logged on entry to setVolumeUserLabel_1					
System (0x0)	Informational (0x0)	Command (0x3)	Volume (0xD)	0x501A	Data Field Type: 0x0801

Table 75. SYMBOL server events

Event: Event Description					
Log Group	Priority	Event Group	Component	Event Number	Optional Data
<b>Set Controller To Optimal:</b> Logged on entry to setControllerToOptimal_1					
System (0x0)	Informational (0x0)	Command (0x3)	Controller (0x8)	0x501B	Data Field Type: 0x0813
<b>Set Drive To Optimal:</b> Logged on entry to setDriveToOptimal_1					
System (0x0)	Informational (0x0)	Command (0x3)	Drive (0x1)	0x501C	None
<b>Force Volume To Optimal:</b> Logged on entry to forceVolumeToOptimal_1					
System (0x0)	Informational (0x0)	Command (0x3)	Volume (0xD)	0x501D	None
<b>Set Storage Array Tray Positions:</b> Logged on entry to setSATrayPositions_1					
System (0x0)	Informational (0x0)	Command (0x3)	Unknown (0x0)	0x501E	Data Field Type: 0x0810
<b>Set Volume Media Scan Parameters:</b> Logged on entry to setVolumeMediaScanParameters_1					
System (0x0)	Informational (0x0)	Command (0x3)	Volume (0xD)	0x501F	Data Field Type: 0x0811
<b>Set Storage Array Media Scan Rate:</b> Logged on entry to setSAMediaScanRate_1					
System (0x0)	Informational (0x0)	Command (0x3)	Unknown (0x0)	0x5020	Data Field Type: 0x0812
<b>Clear Storage Array Configuration:</b> Logged on entry to clearSAConfiguration_1. Clears the entire array configuration, deleting all volumes and returning to a clean initial state.					
System (0x0)	Informational (0x0)	Command (0x3)	Unknown (0x0)	0x5021	None
<b>Auto Storage Array Configuration:</b> Logged on exit from to autoSAConfiguration_1					
System (0x0)	Informational (0x0)	Command (0x3)	Unknown (0x0)	0x5022	None
<b>RPC Function Return Code:</b> Logged on the return from RPC function returning ReturnCode					
System (0x0)	Informational (0x0)	Command (0x3)	Unknown (0x0)	0x5023	Data Field Type: 0x0814
<b>Write Download Checkpoint:</b> Logged whenever the download checkpoint is updated					
System (0x0)	Informational (0x0)	Command (0x3)	Controller (0x8)	0x5024	Data Field Type: 0x0815
<b>Controller Firmware Download Fail:</b> Logged when a controller firmware download fails					
System (0x0)	Informational (0x0)	Command (0x3)	Controller (0x8)	0x5025	
<b>Controller Firmware Download Complete:</b> Logged when a controller firmware download successfully completes					
System (0x0)	Informational (0x0)	Command (0x3)	Controller (0x8)	0x5026	

Table 75. SYMBol server events

Event: Event Description					
Log Group	Priority	Event Group	Component	Event Number	Optional Data
<b>Controller NVSRAM Download Fail:</b> Logged when a controller NVSRAM download fails					
System (0x0)	Informational (0x0)	Command (0x3)	Controller (0x8)	0x5027	
<b>Controller NVSRAM Download Complete:</b> Logged when a controller NVSRAM download successfully completes					
System (0x0)	Informational (0x0)	Command (0x3)	Controller (0x8)	0x5028	
<b>Battery Update:</b> Logged when the battery parameters are updated					
System (0x0)	Informational (0x0)	Command (0x3)	Controller (0x8)	0x5028	Data Type Field 0x816

## Storage Partitions Manager events

Table 76. Storage Partitions Manager events

Event: Event Description					
Log Group	Priority	Event Group	Component	Event Number	Optional Data
<b>Create Cluster:</b> Logged on entry to spmCreateCluster					
System (0x0)	Informational (0x0)	Command (0x3)	Unknown (0x0)	0x5200	Data Field Type: 0x0900
<b>Delete Cluster:</b> Logged on entry to spmDeleteCluster					
System (0x0)	Informational (0x0)	Command (0x3)	Unknown (0x0)	0x5201	Data Field Type: 0x0901
<b>Rename Cluster:</b> Logged on entry to spmRenameCluster					
System (0x0)	Informational (0x0)	Command (0x3)	Unknown (0x0)	0x5202	Data Field Type: 0x0903
<b>Create Host:</b> Logged on entry to spmCreateHost					
System (0x0)	Informational (0x0)	Command (0x3)	Unknown (0x0)	0x5203	Data Field Type: 0x0907
<b>Delete Host:</b> Logged on entry to spmDeleteHost					
System (0x0)	Informational (0x0)	Command (0x3)	Unknown (0x0)	0x5204	Data Field Type: 0x0901
<b>Rename Host:</b> Logged on entry to spmRenameHost					
System (0x0)	Informational (0x0)	Command (0x3)	Unknown (0x0)	0x5205	Data Field Type: 0x0903
<b>Move Host:</b> Logged on entry to spmMoveHost					
System (0x0)	Informational (0x0)	Command (0x3)	Unknown (0x0)	0x5206	Data Field Type: 0x0902

Table 76. Storage Partitions Manager events

Event: Event Description					
Log Group	Priority	Event Group	Component	Event Number	Optional Data
<b>Create Host Port:</b> Logged on entry to spmCreateHostPort					
System (0x0)	Informational (0x0)	Command (0x3)	Unknown (0x0)	0x5207	Data Field Type: 0x0904
<b>Delete Host Port:</b> Logged on entry to spmDeleteHostPort					
System (0x0)	Informational (0x0)	Command (0x3)	Unknown (0x0)	0x5208	Data Field Type: 0x0901
<b>Rename Host Port:</b> Logged on entry to spmRenameHostPort					
System (0x0)	Informational (0x0)	Command (0x3)	Unknown (0x0)	0x5209	Data Field Type: 0x0905
<b>Move Host Port:</b> Logged on entry to spmMoveHostPort					
System (0x0)	Informational (0x0)	Command (0x3)	Unknown (0x0)	0x520A	Data Field Type: 0x0902
<b>Set Host Port Type:</b> Logged on entry to spmSetHostPortType					
System (0x0)	Informational (0x0)	Command (0x3)	Unknown (0x0)	0x520B	Data Field Type: 0x0906
<b>Create SAPort Group:</b> Logged on entry to spmCreateSAPortGroup					
System (0x0)	Informational (0x0)	Command (0x3)	Unknown (0x0)	0x520C	Data Field Type: 0x0900
<b>Delete SAPort Group:</b> Logged on entry to spmDeleteSAPortGroup					
System (0x0)	Informational (0x0)	Command (0x3)	Unknown (0x0)	0x520D	Data Field Type: 0x0900
<b>Move SA Port:</b> Logged on entry to spmMoveSAPort					
System (0x0)	Informational (0x0)	Command (0x3)	Unknown (0x0)	0x520E	Data Field Type: 0x0902
<b>Create LUN Mapping:</b> Logged on entry to spmCreateLUNMapping					
System (0x0)	Informational (0x0)	Command (0x3)	Volume (0xD)	0x520F	Data Field Type: 0x0908
<b>Delete LUN Mapping:</b> Logged on entry to spmDeleteLUNMapping					
System (0x0)	Informational (0x0)	Command (0x3)	Volume (0xD)	0x5210	Data Field Type: 0x0901
<b>Move LUN Mapping:</b> Logged on entry to spmMoveLUNMapping					
System (0x0)	Informational (0x0)	Command (0x3)	Volume (0xD)	0x5211	Data Field Type: 0x0909
<b>Write DACSTORE Error:</b> Logged when an error occurs when attempting to update the SPM DASCSTORE region					
System (0x0)	Informational (0x0)	Error (0x1)	Unknown (0x0)	0x5212	Data Field Type: 0x090A

## SAFE events

Table 77. SAFE events

Event: Event Description					
Log Group	Priority	Event Group	Component	Event Number	Optional Data
<b>Feature Enabled:</b> Logged when a feature is successfully enabled					
System (0x0)	Informational (0x0)	Notification (0x4)	Unknown (0x0)	0x5400	ID: Feature Code
<b>Feature Disabled:</b> Logged when a feature is successfully disabled					
System (0x0)	Informational (0x0)	Notification (0x4)	Unknown (0x0)	0x5401	ID: Feature Code
<b>Non-Compliance:</b> Logged when there are features enabled that have not been purchased					
System (0x0)	Informational (0x0)	Notification (0x4)	Unknown (0x0)	0x5402	ID: Features not in compliance
<b>Tier Non-Compliance:</b> Logged when there are features that are not in tier compliance (for example, 6 storage partitions when 4 have been purchased)					
System (0x0)	Informational (0x0)	Notification (0x4)	Unknown (0x0)	0x5403	ID: Features not in tier compliance
<b>ID Changed:</b> Logged when a new SAFE ID is successfully generated and stored					
System (0x0)	Informational (0x0)	Notification (0x4)	Unknown (0x0)	0x5404	

## Data field types

Table 78. Data field types

Name	Data Field Type	Data Description
Controller Sense Data	0x0100	Controller sense data follows
Transition (Currently not used)	0x0101	2 byte values follow: old value/state in byte 1
Channel ID (Currently not used)	0x0102	4 byte ID follows channel & ID or tray & slot
Controller Number (Currently not used)	0x0103	4 byte value follows 0 even ID 1 odd ID controller /
Block Number (Currently not used)	0x0104	4 byte LBA follows
Host Number (Currently not used)	0x0105	4 byte host number follows
Software Revision Number (Currently not used)	0x0106	4 byte SW revision number follows
Error Number (Currently not used)	0x0107	4 byte error number follows - event/component specific
Parity Error (Currently not used)	0x0108	
Device Name (Currently not used)	0x0109	8 bytes - device name string

Table 78. Data field types

Name	Data Field Type	Data Description
Number of Blocks (Currently not used)	0x010A	4 byte number of blocks
Unit Number	0x010B	4 byte unit or device number
Component Unique (Currently not used)	0x010C	4 bytes of component specific unique data
Drive Sense	0x010D	1st 32 bytes of drive sense data
Drive Inserted (Currently not used)	0x010E	Channel/Device number of inserted device
Drive Removed (Currently not used)	0x010F	Channel/Device number of removed device
Chip Status	0x0110	Value from chip being logged
ECC Parity Error	0x0111	14 Bytes of parity info <b>Type</b> (1 byte): 0x01: Spectra Double Bit ECC 0x02: Spectra Single Bit ECC 0x03: Processor Double Bit ECC 0x04: Processor Single Bit ECC <b>Syndrome</b> (1 byte): <b>Address</b> (4 bytes): Address of Error <b>Upper Word</b> (4 bytes): <b>Lower Word</b> (4 bytes):
Chip Address	0x0201	4 bytes chip address
Register Value (Currently not used)	0x0202	4 byte register value
Tally Type (Currently not used)	0x0203	4 bytes tally type that exceeded threshold
Destination Device (Currently not used)	0x0204	
Chip Period (Currently not used)	0x0205	4 bytes - SCSI chip sync clock factor
No Memory	0x0206	4 bytes: 0 = Processor Memory 1 = RPA Memory
Bus Number (Currently not used)	0x0207	
Reassign Blocks Data	0x0208	Data: First eight device numbers and block addresses that were successfully reassigned by the controller. Data is pairs of device and block numbers each 4 bytes.
Piece Number (Currently not used)	0x0301	
Repair (Currently not used)	0x0302	
VDD Operation (Currently not used)	0x0303	1 byte VDD operation  0: Restore 1: Recovery 2: Repair 3: Interrupted Write 4: Extra Copy 5: Log Data 6: Stripe Write 7: New Data Write 8: New Parity Write 9: Write Cache

Table 78. Data field types

Name	Data Field Type	Data Description
VDD Data, Parity or Repair Operation (Currently not used)	0x0304	1 byte 0: Data operation 1: Parity operation 2: Repair operation
VDD Algorithm (Currently not used)	0x0305	1 byte VDD algorithm in use
Configuration States (Currently not used)	0x0401	
LUN States (Currently not used)	0x0402	4 bytes - LUN state transition below
Controller State (Currently not used)	0x0403	4 bytes - Controller states
Controller Active-Active Mode	0x0404	<b>Primary controller state</b> (2 bytes) <b>Alternate controller state</b> (2 bytes) 0 = Passive Mode 1 = Active Mode
Controller Active-Passive Mode	0x0405	<b>Primary controller state</b> (2 bytes) <b>Alternate controller state</b> (2 bytes) 0 = Passive Mode 1 = Active Mode
User Data Length (Currently not used)	0x0501	A maximum of 64 bytes can be sent
User Data (Currently not used)	0x0502	
Configuration Data (Currently not used)	0x0601	
Drive Fault Data (Currently not used)	0x0602	
Drive Group Data	0x0603	Drive List
Fault Data (Currently not used)	0x0604	
Post Error (Currently not used)	0x0605	
3rd Party ID (Currently not used)	0x0606	
Reconfiguration Data (Currently not used)	0x0607	
Mode Select Page Data	0x0608	Mode Select Page data in SCSI format. Length varies according to Mode Select Page
Reconstruction (Currently not used)	0x0609	
Mode Select Page 0x08 Data (Currently not used)	0x060A	
Mode Select Page 0x0A Data (Currently not used)	0x060B	
Mode Select Page 0x2A Data	0x060C	Data: Contains pairs of device and status numbers of device whose statuses were changed by the mode select command. A maximum of 40 pairs are logged using the following structure:  <b>Device</b> (4 bytes) <b>Action</b> (1 byte)
Mode Select Page 0x2B Data (Currently not used)	0x060D	
Mode Select Page 0x2C Data (Currently not used)	0x060E	

Table 78. Data field types

Name	Data Field Type	Data Description
Mode Select Page 0x2E Data (Currently not used)	0x060F	
Mode Select Time Data (Currently not used)	0x0610	4 bytes - new time value
Mode Select Page 0x3A Data (Currently not used)	0x0611	
VDD Information	0x0612	<p><b>Flags</b> (4 bytes): Beginning flags contents unspecified.</p> <p><b>VpState</b> (4 bytes): State of the virtual piece</p> <p><b>blockNum</b> (4 bytes): Beginning block number for the restore operation.</p> <p><b>Cluster</b> (4 bytes): Beginning cluster number</p> <p><b>Stripe</b> (4 bytes): Beginning stripe number</p> <p><b>Offset</b> (4 bytes): Beginning offset within the stripe</p> <p><b>Blocks</b> (4 bytes): Number of blocks to restore</p> <p><b>remBlocks</b> (4 bytes): Number of remaining blocks to restore</p> <p><b>dataDev</b> (4 bytes): Device number of the data drive not used for recover operations</p> <p><b>parityDev</b> (4 bytes): Device number of the parity drive.</p>
VDD Status	0x0613	<p><b>Flags</b> (4 bytes): buf flags</p> <p><b>Error</b> (4 bytes): buf error</p>
Pass Through Data	0x0614	<p><b>Direction of data transfer</b> (1 byte)</p> <p><b>Pass through CDB</b> (16 bytes)</p>
Write Buffer Data	0x0615	The data buffer contains a maximum of 64 bytes of data sent to the ID
Download Destination (Currently not used)	0x0616	1 byte download device types
VDD Recovery Data	0x0617	<p>Array of 6 byte entries (Maximum of 36 per MEL entry) indicating the LBA and Number of blocks being recovered.</p> <p><b>LBA</b> (4 bytes)</p> <p><b>Number of Blocks</b> (2 bytes)</p>
Data Scrubbing End Tallies	0x0618	<p><b>Flags</b> (4 bytes): buf flags</p> <p><b>Error</b> (4 bytes): buf error</p> <p><b>Unrecovered</b> (1 byte): Number of Unrecovered errors found during scrub</p> <p><b>Recovered</b> (1 byte): Number of recovered errors found during scrub</p> <p><b>Mismatch</b> (1 byte): Number of data/parity mismatches found during scrub</p> <p><b>Unfixable</b> (1 byte): Number of unfixable errors found during scrub</p>
VDD Information Extended (Currently not used)	0x0650	
ASCII Text Data	0x0700	Data is variable length ASCII String

Table 78. Data field types

Name	Data Field Type	Data Description
ACS Error	0x0701	4 bytes of ACS error data 1: Mirroring Error 2: Buffer Error 3: Image Error 4: CRC Error 5: Flash Error 6: ICON Error 7: Internal Error 8: Other Error
Enclosure ID (Currently not used)	0x0702	4 bytes sub enclosure ID
AC Status (Currently not used)	0x0703	
Line State Change Data	0x0704	<b>Byte 0:</b> Unused <b>Byte 1:</b> Transition Data 0 = Good to bad transition 1 = Bad to good transition <b>Byte 2:</b> Line Number <b>Byte 3:</b> User Component Code
Enclosure Data	0x0705	<b>Byte 0:</b> Transition Data 0 = Good to bad transition 1 = Bad to good transition <b>Byte 1:</b> FRU of device defined by sense data <b>Byte 2:</b> 1st Additional FRU byte <b>Byte 3:</b> 2nd Additional FRU byte
LBA Information	0x0706	<b>Starting LBA</b> (4 bytes) <b>Number of Block</b> (4 bytes)
EEL Information	0x0707	<b>Recovered:</b> (4 bytes) 0 = Unrecovered 1 = Recovered <b>Detection</b> (4 bytes): Detection point in code where logged <b>LBA</b> (4 bytes): LBA of error <b>Number of Blocks</b> (4 bytes): Number of blocks involved in the request <b>ASC</b> (4 bytes): Internal controller error code <b>Recovery</b> (4 bytes): EEL defined recovery actions <b>Flags</b> (4 bytes): EEL flags
SYMBOL Tray Number	0x0800	Tray location
Volume Label Update	0x0801	Volume Label Update Descriptor
SYMBOL Volume Segment Update	0x0802	Volume Segment Sizing Descriptor
SYMBOL Group Ownership Update Descriptor	0x0803	Volume Group Ownership information
SYMBOL Hotspare Count	0x0804	Number of Hot Spares (4 bytes)
SYMBOL Drive Reference List	0x0805	Drive Reference List
SYMBOL Volume Creation Descriptor (Currently not used)	0x0806	
SYMBOL Controller Firmware Descriptor	0x0807	Firmware Update Descriptor

Table 78. Data field types

Name	Data Field Type	Data Description
SYMBOL Drive Firmware Descriptor (Currently not used)	0x0808	
SYMBOL Group Expansion Descriptor	0x0809	Volume Group Expansion Descriptor
SYMBOL Group Migration Descriptor	0x080A	Volume RAID Migration Descriptor
SYMBOL Storage Array Cache Update Descriptor	0x080B	Storage Array Parameter Update Descriptor
SYMBOL Storage Array User Label Update	0x080C	Storage Array User Assigned Label
SYMBOL Time	0x080D	Controller Time (8 bytes)
SYMBOL Volume Cache Descriptor	0x080E	Volume Cache Parameters Update Descriptor
SYMBOL Volume Parameters Descriptor	0x080F	Volume Parameters Update Descriptor
SYMBOL Tray Position List	0x0810	Tray Position List
SYMBOL Volume Media Scan Descriptor	0x0811	Volume Media Scan Parameters Update Descriptor
SYMBOL Storage Array Media Scan Rate	0x0812	Storage Array Media Scan Rate (4 bytes)
SYMBOL Controller Number	0x0813	<b>Controller Number</b> (4 bytes) 0 = This controller 1 = Alternate controller
SYMBOL Return Code	0x0814	<b>RPC Function</b> (4 bytes) See RPC Function Number table  <b>Return Code</b> (4 bytes) See SYMBOL Return code table
Download checkpoint data	0x0815	Checkpoint data
Battery Component Data	0x816	<b>Battery Reset</b> (4 bytes) 0 – battery reset not requested 1 – battery reset requested  <b>Component Location</b> (12 bytes) – A unique ID that identifies the component to the controller firmware. Contents are not specified.
User Assigned Label	0x0900	
SYMBOL Reference Data	0x0901	
SYMBOL Reference Pair Data	0x0902	
SYMBOL Reference Data with User Assigned Label	0x0903	
Host Port Creation Descriptor	0x0904	
Host Port Rename Descriptor	0x0905	
Host Port Type Update Descriptor	0x0906	
Host Creation Descriptor	0x0907	
LUN Mapping Creation Descriptor	0x0908	
LUN Mapping Update Descriptor	0x0909	

Table 78. Data field types

Name	Data Field Type	Data Description
Error Return Code	0x090A	

## SYMBOL return codes

Table 79. SYMBOL return codes

Return Code	Definition	Description
1	0x01 RETCODE_OK	Operation completed successfully
2	0x02 RETCODE_ERROR	Operation failed
3	0x03 RETCODE_BUSY	Operation failed due to resource contention
4	0x04 RETCODE_ILLEGAL_PARAM	Operation failed due to invalid parameterization
5	0x05 RETCODE_NO_HEAP	Controller memory is in short supply
6	0x06 RETCODE_DRIVE_NOT_EXIST	Drive does not exist
7	0x07 RETCODE_DRIVE_NOT_UNASSIGNED	Drive is not unassigned
8	0x08 RETCODE_NO_SPARES_ASSIGNED	No hot spares were assigned
9	0x09 RETCODE_SOME_SPARES_ASSIGNED	Not all of the requested spares were assigned
10	0x0A RETCODE_VOLUME_NOT_EXIST	Volume does not exist
11	0x0B RETCODE_VOLUME_RECONFIGURING	Volume is reconfiguring
12	0x0C RETCODE_NOT_DUAL_ACTIVE	Must be dual active to perform operation
13	0x0D RETCODE_TRY_ALTERNATE	Operation must be performed by alt controller
14	0x0E RETCODE_BACKGROUND	Operation running in background
15	0x0F RETCODE_NOT_IMPLEMENTED	Procedure is not implemented
16	0x10 RETCODE_RESERVATION_CONFLICT	Volume is reserved
17	0x11 RETCODE_VOLUME_DEAD	Volume is dead
18	0x12 RETCODE_INTERNAL_ERROR	Internal target error
19	0x13 RETCODE_INVALID_REQUEST	General configuration request error
20	0x14 RETCODE_ICON_FAILURE	Inter-controller communications failure
21	0x15 RETCODE_VOLUME_FORMATTING	Volume not ready, format in progress
22	0x16 RETCODE_ALT_REMOVED	Request failed because alternate is removed
23	0x17 RETCODE_CACHE_SYNC_FAILURE	Cache synchronization has failed
24	0x18 RETCODE_INVALID_FILE	The download file was invalid
25	0x19 RETCODE_RECONFIG_SMALL_DACSTORE	Illegal request - legacy constraint
26	0x1A RETCODE_RECONFIG_FAILURE	Illegal request - resource constraint
27	0x1B RETCODE_NVRAM_ERROR	Unable to read
28	0x1C RETCODE_FLASH_ERROR	Failure in flashing the firmware

Table 79. SYMbol return codes

Return Code		Definition	Description
29	0x1D	RETCODE_AUTH_FAIL_PARAM	Authentication failed - bad auth parameter
30	0x1E	RETCODE_AUTH_FAIL_PASSWORD	Authentication failed - incorrect password
31	0x1F	RETCODE_MEM_PARITY_ERROR	Memory parity error on controller
32	0x20	RETCODE_INVALID_CONTROLLERREF	Invalid ControllerRef
33	0x21	RETCODE_INVALID_VOLUMEGROUPREF	Invalid VolumeGroupRef
34	0x22	RETCODE_INVALID_VOLUMEREF	Invalid VolumeRef
35	0x23	RETCODE_INVALID_DRIVEREF	Invalid DriveRef
36	0x24	RETCODE_INVALID_FREEEXTENTREF	Invalid FreeExtentRef
37	0x25	RETCODE_VOLUME_OFFLINE	Volume is offline
38	0x26	RETCODE_VOLUME_NOT_OPTIMAL	Volume is not optimal
39	0x27	RETCODE_MODESENSE_ERROR	Internal mode sense failed
40	0x28	RETCODE_INVALID_SEGMENTSIZE	Segment size was invalid
41	0x29	RETCODE_INVALID_CACHEBLKSIZE	Cache block size was invalid
42	0x2A	RETCODE_INVALID_FLUSH_THRESHOLD	Demand flush threshold was invalid
43	0x2B	RETCODE_INVALID_FLUSH_AMOUNT	Demand flush amount was invalid
44	0x2C	RETCODE_INVALID_LABEL	Label was invalid
45	0x2D	RETCODE_INVALID_CACHE_MODIFIER	Cache flush modifier was invalid
46	0x2E	RETCODE_INVALID_READAHEAD	Read ahead multiplier was invalid
47	0x2F	RETCODE_INVALID_RECONPRIORITY	Invalid reconstruction priority
48	0x30	RETCODE_INVALID_SCANPERIOD	Invalid media scan period
49	0x31	RETCODE_INVALID_TRAYPOS_LENGTH	Invalid tray position length
50	0x32	RETCODE_INVALID_REGIONID	Invalid region ID
51	0x33	RETCODE_INVALID_FIBREID	Invalid preferred fibre ID
52	0x34	RETCODE_INVALID_ENCRYPTION	Invalid encryption routine
53	0x35	RETCODE_INVALID_RAIDLEVEL	Invalid RAID level
54	0x36	RETCODE_INVALID_EXPANSION_LIST	DriveRefList was too large or too small
55	0x37	RETCODE_NO_SPARES_DEASSIGNED	No hot spares were assigned
56	0x38	RETCODE_SOME_SPARES_DEASSIGNED	Not all of the requested spares were assigned
57	0x39	RETCODE_PART_DUP_ID	Cluster or host label, or host port ID already exists
58	0x3A	RETCODE_PART_LABEL_INVALID	Illegal (empty) label
59	0x3B	RETCODE_PART_NODE_NONEXISTENT	Cluster, host, or host port ref invalid
60	0x3C	RETCODE_PART_PORT_ID_INVALID	Illegal (empty) host port name
61	0x3D	RETCODE_PART_VOLUME_NONEXISTENT	Nonexistent volume sent to create mapping
62	0x3E	RETCODE_PART_LUN_COLLISION	Attempt to create mapping on taken LUN
63	0x3F	RETCODE_PART_VOL_MAPPING_EXISTS	Mapping on volume already exists

Table 79. SYMBOL return codes

Return Code		Definition	Description
64	0x40	RETCODE_PART_MAPPING_NONEXISTENT	Mapping ref invalid
65	0x41	RETCODE_PART_NO_HOSTPORTS	Mapping create failed due to no host ports
66	0x42	RETCODE_IMAGE_TRANSFERRED	Image was successfully transferred
67	0x43	RETCODE_FILE_TOO_LARGE	totalSize field was too large
68	0x44	RETCODE_INVALID_OFFSET	offset field was invalid
69	0x45	RETCODE_OVERRUN	Attempt to overrun buffer
70	0x46	RETCODE_INVALID_CHUNKSIZE	chunkSize field was invalid
71	0x47	RETCODE_INVALID_TOTALSIZE	totalSize field was invalid
72	0x48	RETCODE_DOWNLOAD_NOT_PERMITTED	NVRAM says download is not permitted
73	0x49	RETCODE_SPAWN_ERROR	Unable to spawn a task
74	0x4A	RETCODE_VOLTRANSFER_ERROR	Unable to transfer volumes during firmware download
75	0x4B	RETCODE_INVALID_DLSTATE	Invalid controller state (i.e. PASSIVE) for download
76	0x4C	RETCODE_CACHECONFIG_ERROR	Can not reconfigure cache during firmware download
77	0x4D	RETCODE_DOWNLOAD_IN_PROGRESS	Firmware download is already in progress
78	0x4E	RETCODE_DRIVE_NOT_OPTIMAL	Drive is not optimal
79	0x4F	RETCODE_DRIVE_REMOVED	Drive is removed
80	0x50	RETCODE_DUPLICATE_DRIVES	List of drives contains duplicate entries
81	0x51	RETCODE_NUMDRIVES_ADDITIONAL	DCE request exceeds limit of additional drives
82	0x52	RETCODE_NUMDRIVES_GROUP	Number of drives specified is not valid for request
83	0x53	RETCODE_DRIVE_TOO_SMALL	The drive specified in the DCE request is too small
84	0x54	RETCODE_CAPACITY_CONSTRAINED	DRM request requires larger volume capacity
85	0x55	RETCODE_MAX_VOLUMES_EXCEEDED	Requesting more volumes than the max allowed
86	0x56	RETCODE_PART_IS_UTM_LUN	new Storage Partition mapping request is the UTM lun
87	0x57	RETCODE_SOME_SPARES_TOO_SMALL	One or more spares assigned was too small to spare all drives
88	0x58	RETCODE_SPARES_SMALL_UNASSIGNED	Not all of the requested spares were assigned, but some that were are too small
89	0x59	RETCODE_TOO_MANY_PARTITIONS	Cannot create a new partition, since storage Partitions are disabled, or there are too many
90	0x60	RETCODE_PARITY_SCAN_IN_PROGRESS	Parity scan is already in progress
91	0x61	RETCODE_INVALID_SAFE_ID	Invalid SAFE ID
92	0x62	RETCODE_INVALID_SAFE_KEY	Invalid SAFE Key (digest)

Table 79. SYMbol return codes

Return Code		Definition	Description
93	0x63	RETCODE_INVALID_SAFE_CAPABILITY	Unsupported capability code
94	0x64	RETCODE_INVALID_SAFE_VERSION	Invalid SAFE version
95	0x65	RETCODE_PARTITIONS_DISABLED	Cannot create an unmapped volume, since storage partitions are disabled
96	0x66	RETCODE_DRIVE_DOWNLOAD_FAILED	A firmware download to a drive failed
97	0x67	RETCODE_ESM_DOWNLOAD_FAILED	A firmware download to an ESM card failed
98	0x68	RETCODE_ESM_PARTIAL_UPDATE	Firmware download to tray (ESMs) failed for one ESM, so versions mismatch
99	0x69	RETCODE_UTM_CONFLICT	Existing volume conflicts with attempt to set UTM volume
100	0x6A	RETCODE_NO_VOLUMES	A volume must exist to perform the operation
101	0x6B	RETCODE_PART_CRTE_FAIL_TBL_FULL	Unable to create host, port or cluster because a table is full

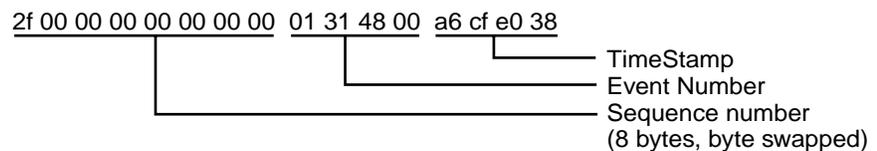
## Event decoding examples

### Example 1: AEN event

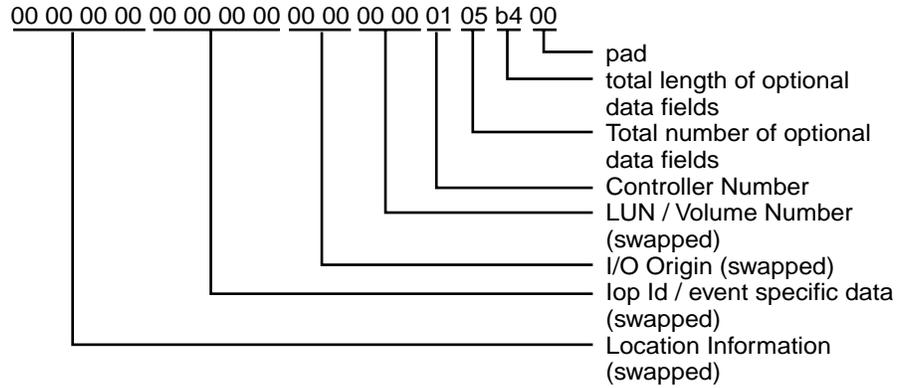
The following is an event as saved from the event viewer.

Sequence number: 47  
Event type: 3101  
Category: Internal  
Priority: Informational  
Description: AEN posted for recently logged event  
Event specific codes: 6/95/2  
Component type: Controller  
Component location: Controller in slot B  
Raw data:  
2f 00 00 00 00 00 00 00 01 31 48 00 a6 cf e0 38  
00 00 00 00 00 00 00 00 00 00 00 00 01 05 b4 00  
20 00 00 01 70 00 06 00 00 00 00 98 00 00 00 00  
95 02 00 00 00 00 00 00 01 00 00 00 00 00 00 00  
00 00 00 00 20 00 00 81 00 00 00 00 00 08 18 00  
00 00 00 00 00 00 00 00 00 00 00 00 00 00 7a 7a  
7a 20 20 20 20 20 20 20 20 00 00 81 20 20 20 20  
20 20 44 99 10 00 00 00 00 00 00 00 00 00 00 00  
00 00 00 00 00 00 00 00 00 00 00 00 20 00 00 81  
00 00 00 00 00 05 00 00 00 00 00 00 00 00 00 00  
00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  
20 00 00 81 00 00 00 00 00 00 00 00 00 00 00 00  
30 33 32 38 30 30 2f 31 30 32 38 35 31 00 00 00  
00 00 00 00

The raw data contains both constant length and optional event data for each event. It can be interpreted as follows:

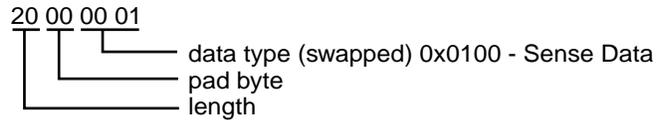


Constant Length Event Data is present for every event log entry. Its length is 32 (0x20) bytes.



This example has 5 optional data fields with a total length of 180 (0xb4) bytes. Each optional data field has a header and data. Headers consists of the length and the data type of the optional data field. Each optional data record contains a maximum of 32 data bytes. The data type is defined in the MEL spec. To find the next data field add the optional data field length + the length of the header (4) to the current position in the buffer. You have reached the end when the number of optional data fields decoded equals the total number of optional fields.

### 1st optional data field



Data:

```

70 00 06 00 00 00 00 98 00 00 00 00
95 02 00 00 00 00 00 01 00 00 00 00 00 00
00 00 00 00

```

To get to the second data field add 34 (length of 32 + 4 header) to your position.

### 2nd optional data field

20 00 00 81

Length is 0x20 - Data type is (continued) sense data

```

00 00 00 00 00 00 08 18 00
00 00 00 00 00 00 00 00 00 00 00 00 7a 7a
7a 20 20 20 20 20 20 20

```

The remainder of the optional data fields can be found by the same method.

**3rd optional data field**

20 00 00 81

Length is 0x20 - Data type is (continued) sense data

20 20 20 20

20 20 44 99 10 00 00 00 00 00 00 00 00 00 00 00

00 00 00 00 00 00 00 00 00 00 00 00 00 00

**4th optional data field**

20 00 00 81

Length is 0x20 - Data type is (continued) sense data

00 00 00 00 00 05 00 00 00 00 00 00 00 00 00 00

00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00

**5nd optional data field**

20 00 00 81

Length is 0x20 - Data type is (continued) sense data

00 00 00 00 00 00 00 00 00 00 00 00 00

30 33 32 38 30 30 2f 31 30 32 38 35 31 00 00 00

00 00 00 00

## Example 2: Mini-hub event

The following is an event as saved from the event viewer.

Date/Time: 8/17/00 6:51 AM

Sequence number: 2

Event type: 2815

Category: Internal

Priority: Critical

Description: GBIC failed

Event specific codes: 0/0/0

Component type: Mini-Hub

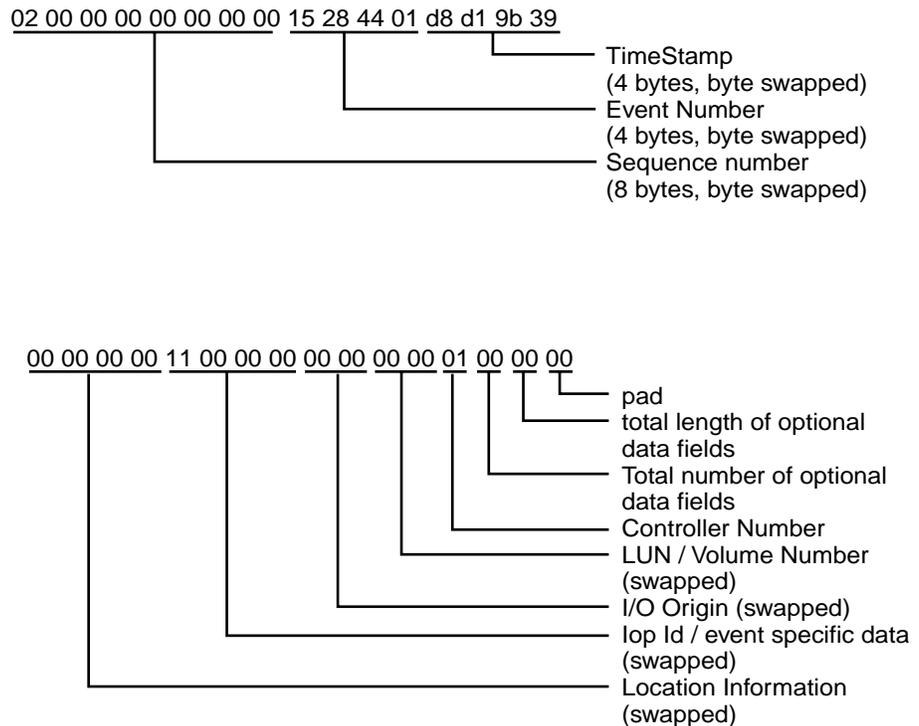
Component location: None

Raw data:

02 00 00 00 00 00 00 00 15 28 44 01 d8 d1 9b 39

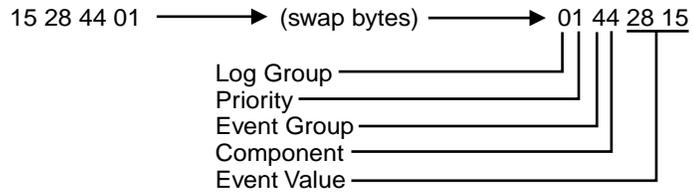
00 00 00 00 11 00 00 00 00 00 00 01 00 00 00

The raw data is composed of only Constant Length Event Data for this event. From the raw data, the mini-hub that is reporting the error can be determined. The raw data can be interpreted as follows:



### Step 1: Decode Event Number field

The first step in decoding any event with this manual is to decipher the Event Number. This requires swapping the order of the bytes in the Event Number field of the raw data as shown below:

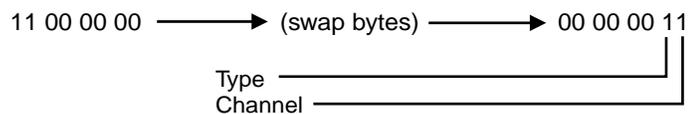


Under the Event Number title in the table given in “Event Descriptions” on page 366, find the value that matches the Event Value in the raw data. For example, the Event Value of 0x2815 above can be found under the Event Number title on page 390. The corresponding text entry preceding this Event Number in the table states: GBIC Failed, which is also the description given next to the Description title in the formatted region of the MEL entry.

The text descriptions corresponding to the Log Group, Priority, Event Group, and Component can also be found on the same line in this table. This information can also be determined by referring to the Table on page 361 and the Table on page 362. However, note that the Category table on these pages should be used to decode the value found in the Component field of the raw data. A text description for the Log Group, Priority, and Component field values are also given next to the Log Group, Priority, and Component Type titles, respectively, in the formatted region of the MEL entry.

### Step 2: Decode Optional Data For Event

Referring again to the table on 390, the information under the Optional Data title for this Event Number states that the ID field of the raw data contains Type/Channel information for this type of event. This data is found in the Iop ID / event specific data field of the raw data. The first step is to swap bytes in this field:



The information in the same table shows that Type 1 refers to a host-side mini-hub. Because a 4774-based controller module can have up to two host-side mini-hubs per controller, it is possible that you will use the value in the Channel field to determine which mini-hub is reporting the error. The mini-hubs for controller A (top controller) are in the first and third slots from the left when looking at the back of the controller module. The mini-hubs for controller B (bottom controller) are in the second and fourth slots from the left when looking at the back of the controller module. For each controller, the mini-hubs on the host side are assigned the values of 0 and 1, with the leftmost mini-hub for each controller being assigned the value of 0. Since the value in the Channel field is 1 in this example, the second mini-hub from the left for the controller that is reporting the error has a failed GBIC.

Finally, the controller that is reporting the error can be found by decoding the Controller Number field in the raw data. A value of 0 in the Controller Number field corresponds to Controller A, while a value of 1 in this field corresponds to Controller B. In this example, controller 1 is reporting the error, which corresponds to controller B.

### Step 3: Summary of the Problem

For this MEL entry, controller B is reporting a GBIC failure in one of its mini-hubs. When looking at the back of the controller module, the failed GBIC is in the second host-side mini-hub from the left for this controller. Since controller B's mini-hubs are in slots 2 and 4, the second host-side mini-hub for controller B is in slot 4. Thus, the mini-hub that contains the failed GBIC is the one in slot 4. It is not currently possible to tell which GBIC in the mini-hub is bad, although the fault LEDs in the mini-hub may be used to determine this.

### Example 3: Mini-hub event

Event as saved from the event viewer.

Date/Time: 8/17/00 7:02 AM

Sequence number: 10

Event type: 2815

Category: Internal

Priority: Critical

Description: GBIC failed

Event specific codes: 0/0/0

Component type: Mini-Hub

Component location: None

Raw data:

```
0a 00 00 00 00 00 00 00 15 28 44 01 52 d4 9b 39
00 00 00 00 23 00 00 00 00 00 00 00 00 00 00 00
```

This example is very similar to the previous example; the significant differences are in the Optional Data field and the Controller Number field. The value in the Controller Number field is 0, which corresponds to controller A. The value in the Optional Data field after byte swapping is: 00 00 00 23. Referring to step 2 in the previous example, this corresponds to a value of 2 in the Type field, and a value of 3 in the Channel field. Referring to the table on page 390, we see that a value of 2 in the Type field denotes a drive-side mini-hub. The drive-side mini-hubs are assigned the values of 0 thru 3 from right to left when looking at the back of the controller module. These values are the same independent of the controller that is reporting the error. The value in the Channel field contains a value that corresponds to one of these mini-hub values. In this example, the value in the Channel field is 3, which corresponds to the fourth drive-side mini-hub from the right when viewing the controller module from the rear.

In summary, controller A is reporting a GBIC failure in the leftmost drive-side mini-hub. The exact GBIC that is bad cannot be determined from the MEL entry, but the LEDs in the mini-hub can be used to determine which GBIC has failed.



## Appendix G. PD hints — Tool hints

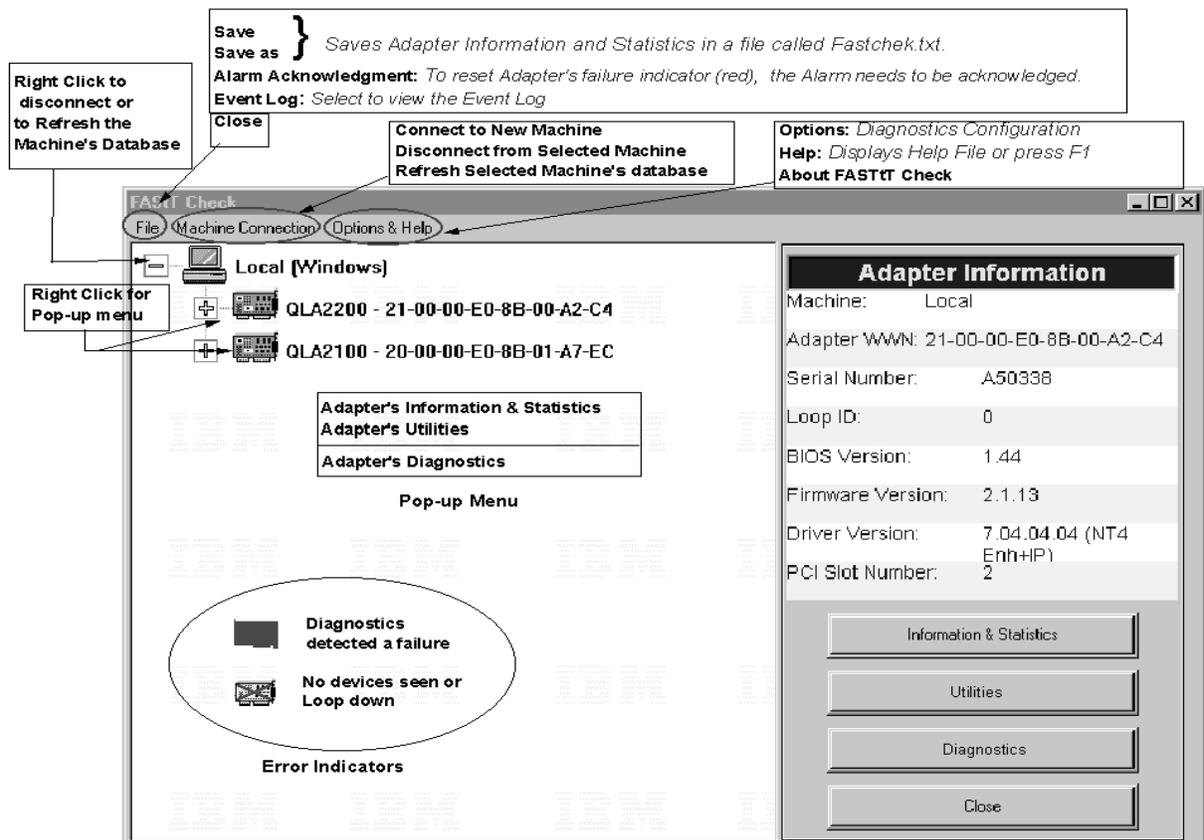
**Note:** You should arrive at this appendix from a PD map or indication in “Chapter 2. PD entry,” on page 3. If this is not the case, refer back to “Chapter 2. PD entry,” on page 3.

This section contains hints in the following PD areas:

- “Bluescreen delay” on page 423
- “Controller units and drive enclosures” on page 425
- “Drive side hints” on page 426
- “Troubleshooting the drive side” on page 429

### Determining the configuration

Use FAStT Check to determine what host adapters are present and where they are in the systems, as well as what RAID controllers are attached and whether they are on Fabric (switches) or loops. Alternately, you can open **Control Panel->SCSI adapters** in Windows NT or **Control Panel->System->Hardware->Device Manager->SCSI and RAID Controllers** for Windows 2000. The following figure is the FAStT Check window for a configuration with both a 2100 and 2200 host adapter. One adapter is attached to a controller in a 3526 unit; one is attached to a controller in a 3552 unit.



A different configuration is shown in the following screen. This figure shows a 2200 adapter in PCI slot 2 in the system. Its World Wide Name is 21-00-00-E0-8B-00-8E-C4 and it has two devices attached to it. The configuration is Fabric (switch) since the Loop ID is greater than 127 or N/A (Fabric).

The screenshot displays the configuration utility interface. On the left, a tree view shows the system configuration under 'Local (Windows)'. It lists two QLA adapters: QLA2100 (20-00-00-E0-8B-00-A3-FC) and QLA2200 (21-00-00-E0-8B-00-8E-C4). The QLA2200 adapter is selected and highlighted. Below it, two IBM devices are listed with Path=0-Target=0 and Path=0-Target=1. On the right, the 'Adapter Information' panel is open, showing the following details:

Adapter Information	
Machine:	Local
Adapter WWN:	21-00-00-E0-8B-00-8E-C4
Serial Number:	A50318
Loop ID:	65535
BIOS Version:	1.44
Firmware Version:	2.1.13
Driver Version:	7.04.04.04 (NT4 Enh+IP)
PCI Slot Number:	4

Below the information panel are three buttons: 'Information & Statistics', 'Diagnostics & Utilities', and 'Close'.

As shown in the following screen, if you select one of the devices beneath a host adapter, you find that it is a controller in a 3526 controller unit.

The screenshot displays the configuration utility interface. On the left, the same tree view is shown, but now one of the IBM devices under the QLA2200 adapter is selected and highlighted. On the right, the 'Device Information' panel is open, showing the following details:

Device Information	
Machine:	Local
Adapter WWN:	21-00-00-E0-8B-00-8E-C4
Node Name:	20-01-00-A0-B8-06-16-36
Port Name:	20-01-00-A0-B8-06-16-37
Port ID:	01-00-00
Path ID:	0
Target ID:	0
Loop ID:	3
Company:	IBM
Product ID:	3526
Product Revision:	0400

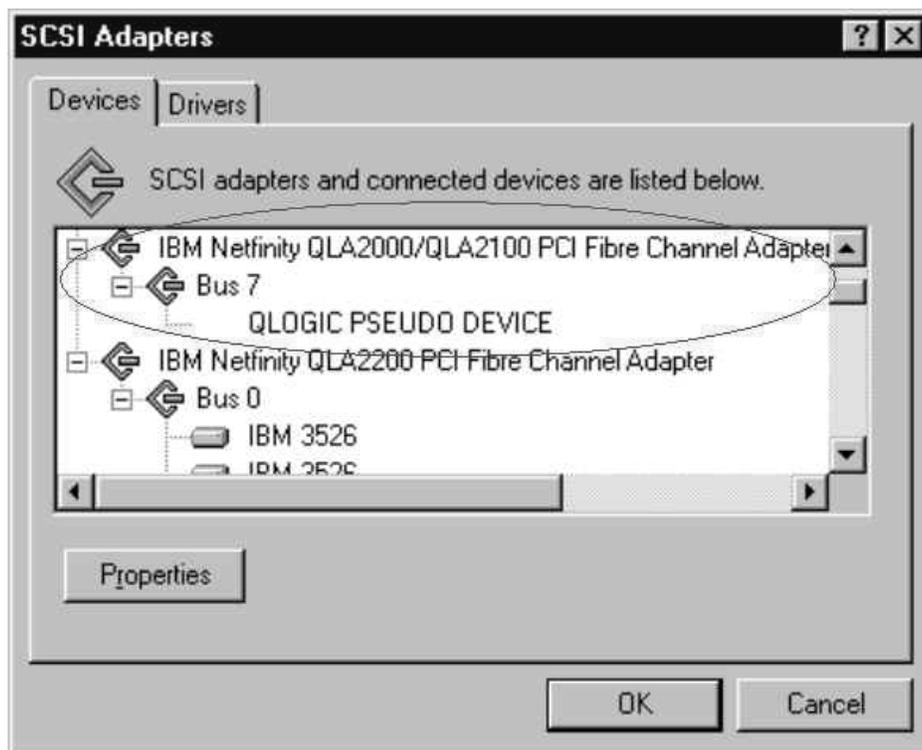
Below the information panel is a 'Close' button.

## Bluescreen delay

When a bluescreen delay (sometimes long enough to appear as a hang condition) occurs, it means that NT is not finding the expected configuration that is in its registry. This can be caused by several things, but the following typical example shows what happens when a Fibre Channel cable connecting a host adapter to the storage has failed (a failed cable is broken so that no light makes it through the cable).

### Bluescreen example:

1. NT comes up to the blue screen and reports the first two lines (version, # of processors and amount of memory). NT takes a very long time to boot. The SCSI Adapters applet in the Control Panel shows the following window for the 2100:



There are no other devices; there should have been a Bus 0 with 21 of the IBM 3526s and one IBM Universal Xport. Note the 2100 DD shows up as started in the Drivers tab here and in the Control Panel Devices applet.

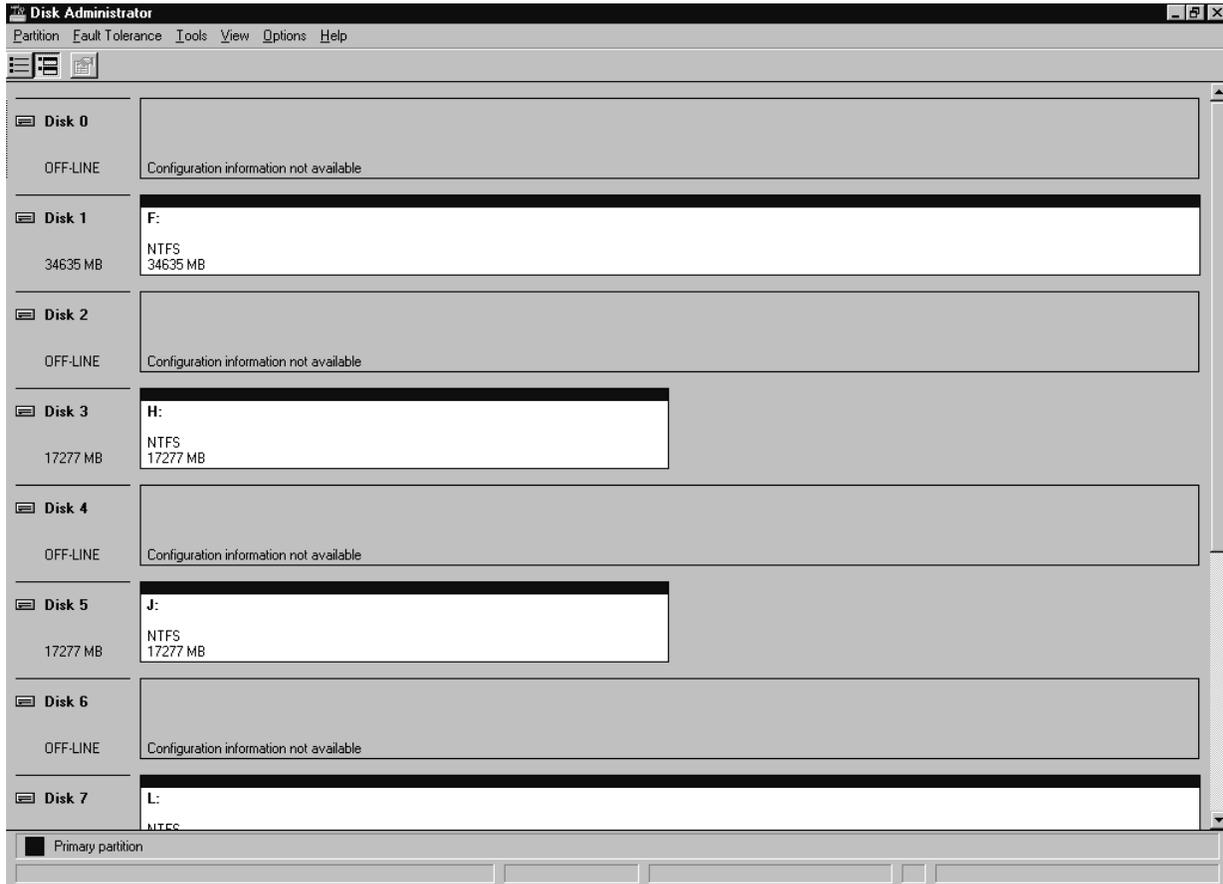
2. WINDISK is started. It takes longer than normal to start (and there is a particularly long pause at the 100% mark) and then reports the following:



3. Because disks were balanced across the two RAID controllers before the error occurred, every other disk shows in the Disk Administrator as "OFF-LINE", and the partition information section is grayed out, showing the following:

Configuration information not available

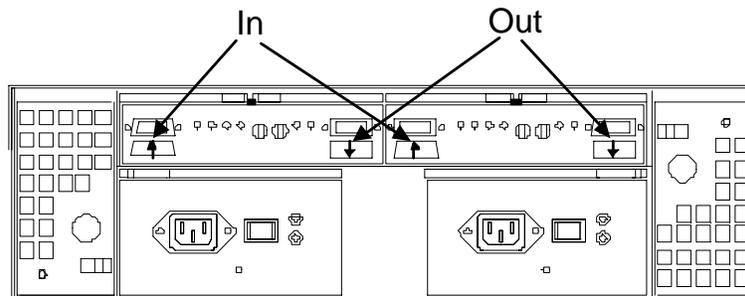
The drive letters do not change for the drives (they are sticky, even though they are set only for boot drive). Because the cable to RAID controller A is the failed cable, it was Disk 0, Disk 2, and so on, that are missing.



4. **If Done:** Return to "Bluescreen Delay PD map" on page 8.

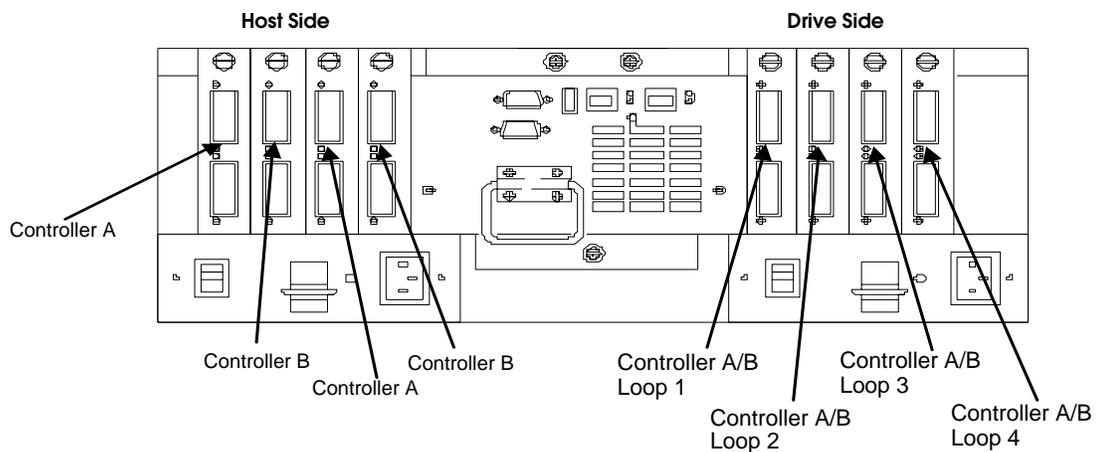
## Controller units and drive enclosures

In the following figure (an EXP500 Fibre Channel drive enclosure), there are two loops in the box. The ESM on the left controls one loop path and the ESM on the right controls another loop path to the drives. This box can be used both with the 3552 and 3542 Controller Units.

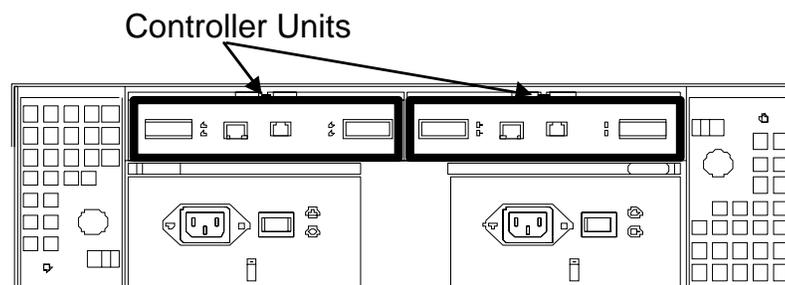


**Note:** In the figure above, the connections for the GBICs are labeled as "In" and "Out." This designation of the connections is for cabling routing purposes only, as all Fibre cables have both a transmit fiber and receive fiber in them. Any connection can function as either output or input (transmitter or receiver).

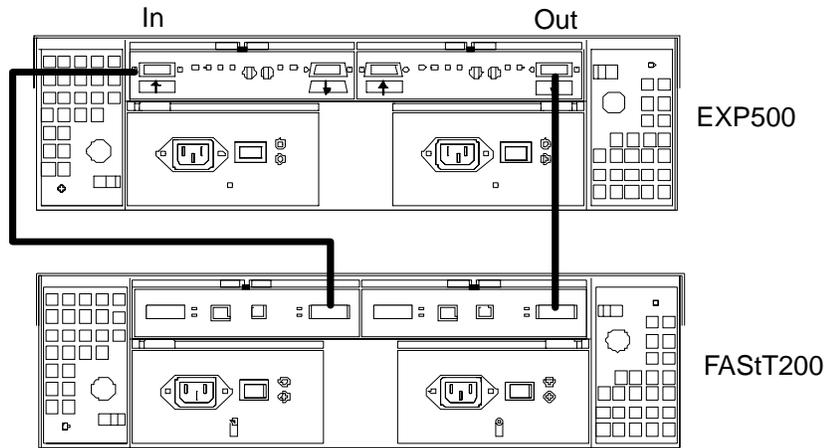
The following figure shows the locations of the controller connections in a FAST500 Fibre Channel controller unit.



The following figure shows the locations of the controller units in a FAST200 Fibre Channel controller and drive enclosure unit.

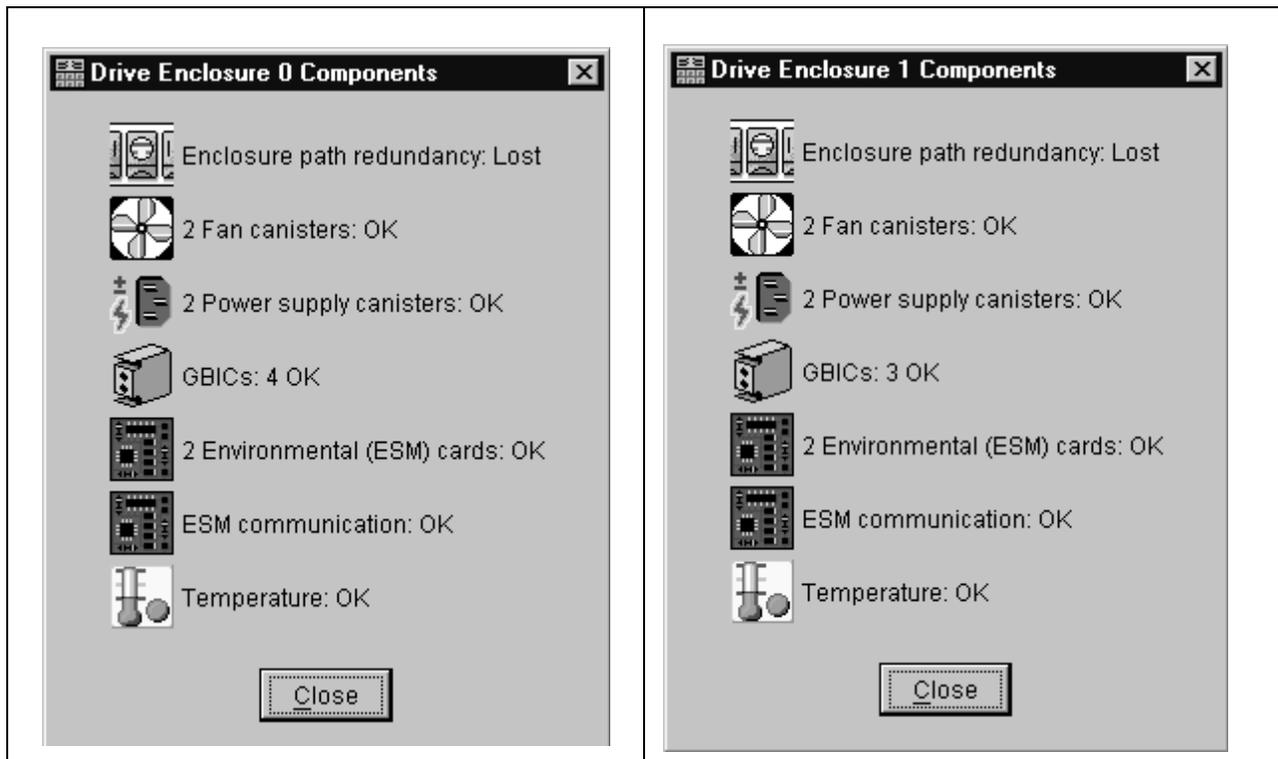


The following figure shows a configuration containing both controllers. It uses GBICs for the connection but does not have the mini-hub feature of the 3552. There is a place for a single host to attach to each controller without using an external concentrator. The other connection on each is used to attach more drives via EXP500 enclosures.

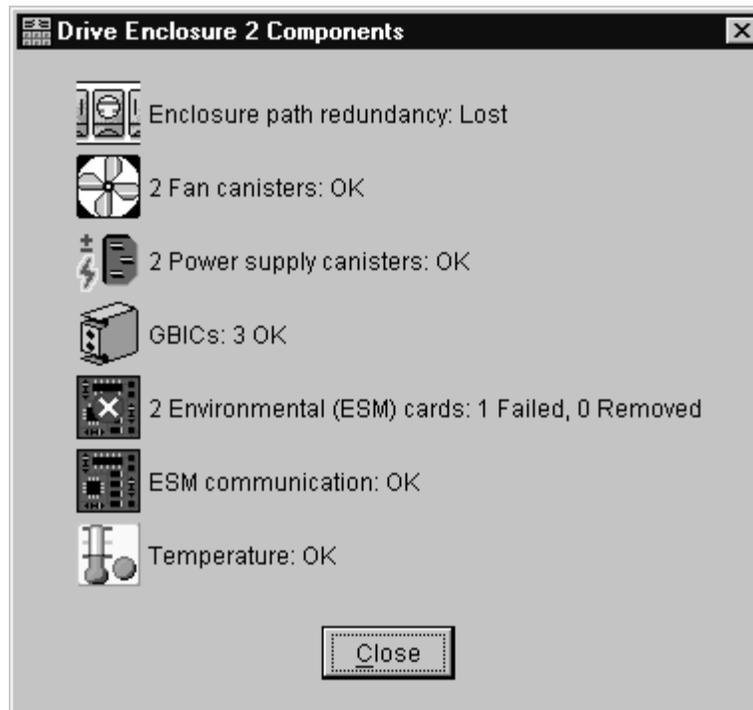


## Drive side hints

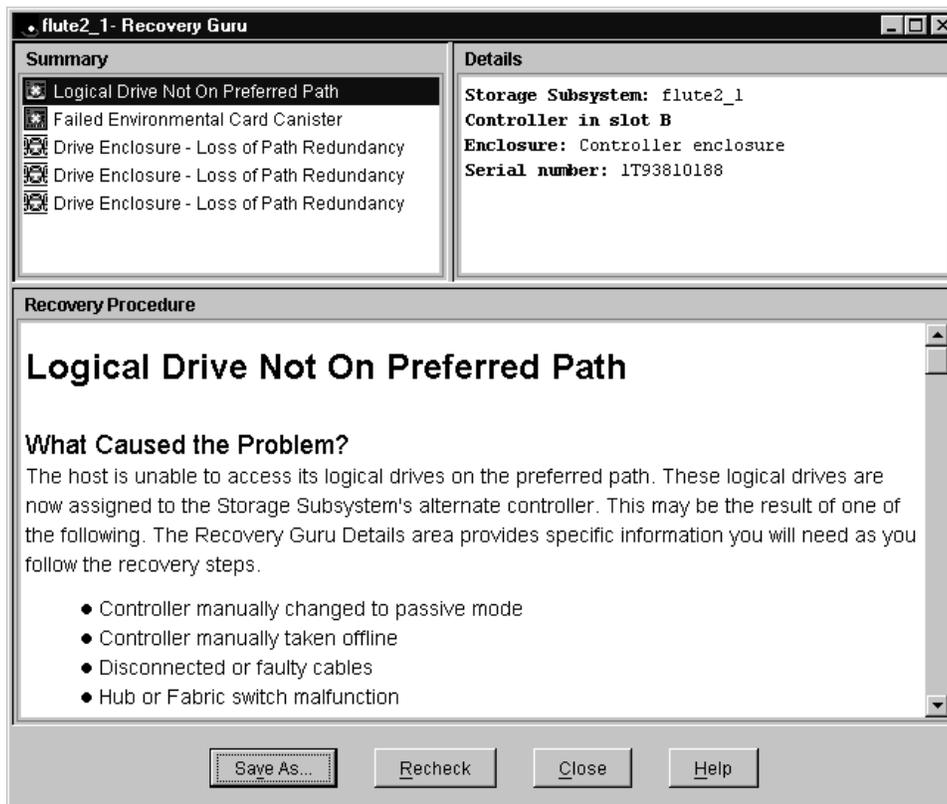
When there is a drive side (device side) issue, looking at SM7 often helps to isolate the problem. The following screens from SM7 show the status of drive enclosures attached to the RAID controller unit. Notice that the screens show that enclosure path redundancy is lost. This is an indication that a path problem exists between the controllers and one or more drive enclosures.



The following screen shows that an ESM has failed.

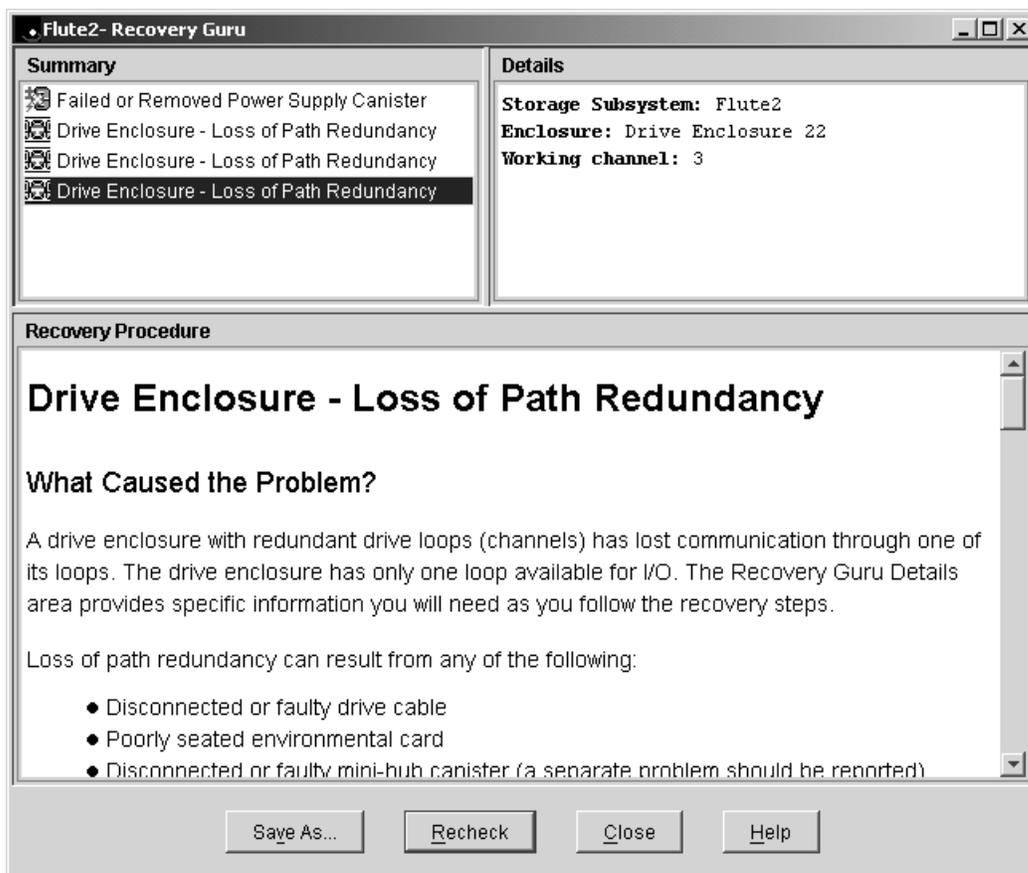


When an ESM has failed, go to the Recovery Guru for suggestions on resolving the problem:



In the Recovery Guru screen, the message Logical drive not on preferred path does not necessarily pertain to the current problem. The drive could have been moved to the other controller and not moved back. The loss of redundancy and the failed ESM are what is important.

**Note:** The following screen also shows that message. However, the power supply message is not significant here because it was missing.



Use the following indicators for drive side problems.

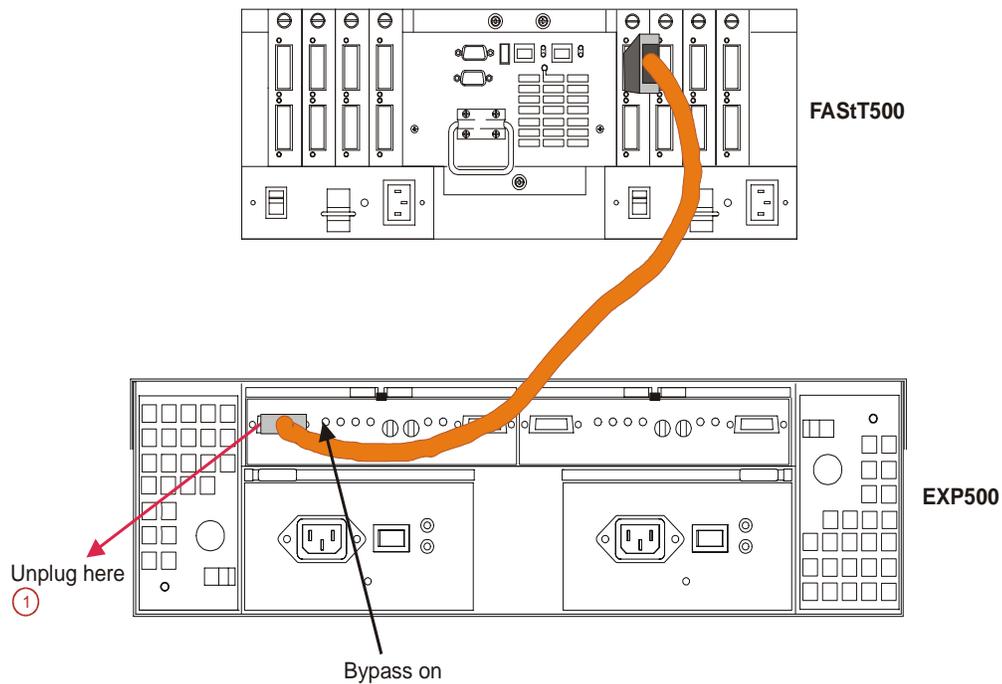
- **FAST200:**
  - Fault light per controller (1 on single controller model and 2 on redundant)
  - Loop bypass per controller (1 or 2)
  - Link status per GBIC port (2) per controller (2 or 4)
- **FAST500: (mini-hubs)**
  - Fault
  - Loop bypass
  - Link status
- **EXP500:**
  - Fault per ESM (2)
  - Loop bypass per GBIC port per ESM (4)
  - Link status per ESM (2)

## Troubleshooting the drive side

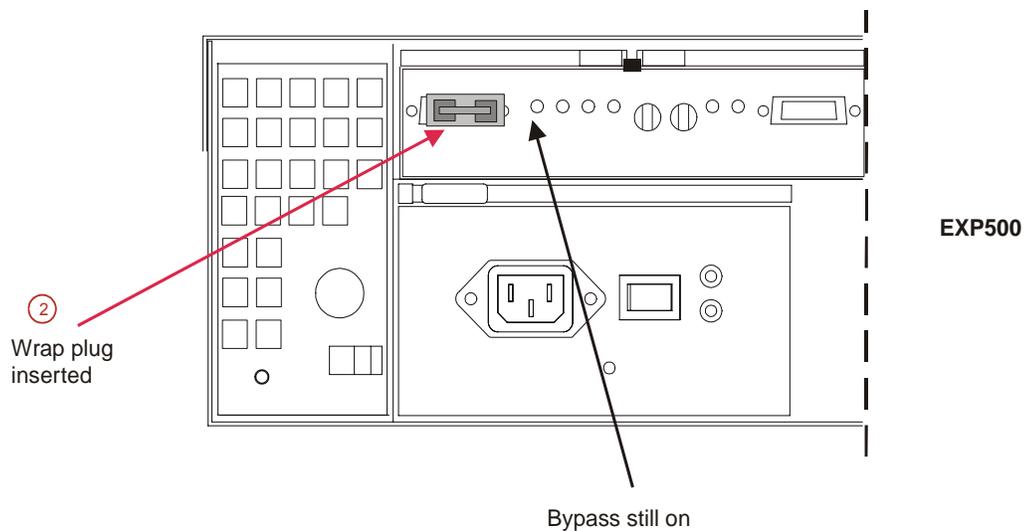
**Note:** Always ensure that you are working on the loop side that is no longer active. Unplugging devices in a loop that is still being used by the host can cause loss of access to data.

To troubleshoot a problem in the drive side, use the following procedure:

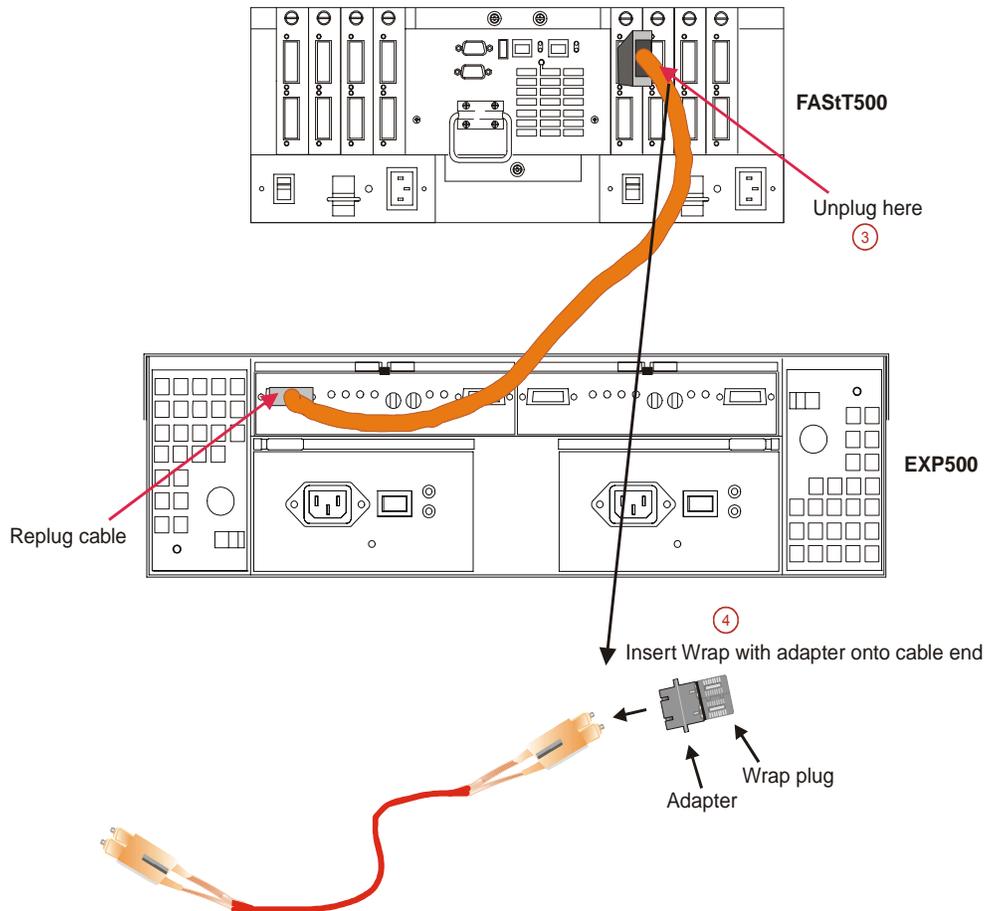
1. Disconnect the cable from the loop element that has the bypass indicator on.



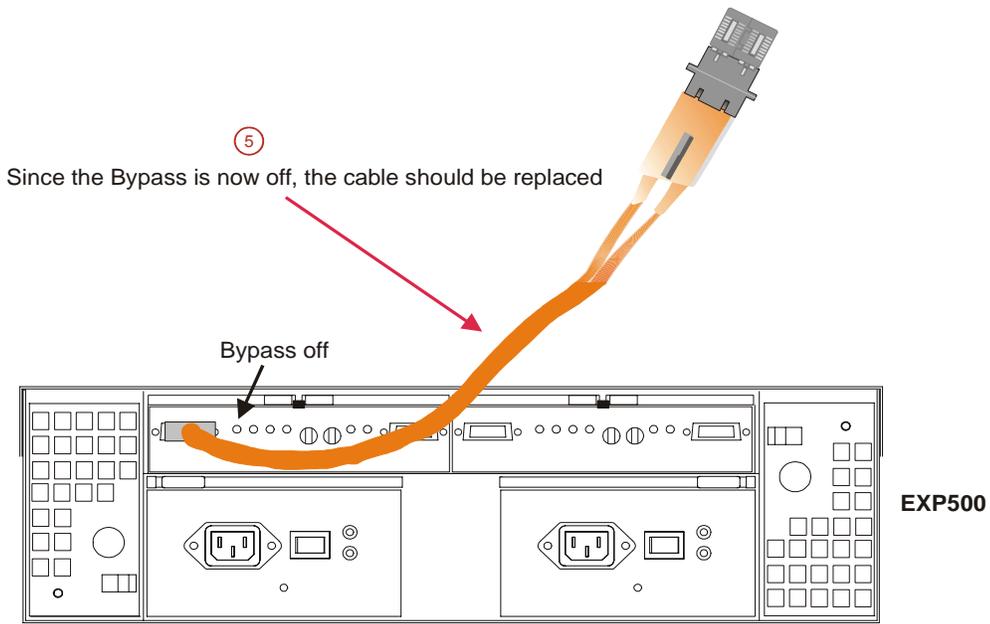
2. Insert a wrap plug in the element from which you disconnected the cable.
  - a. Is the bypass still on? Replace the element (for example, a GBIC). **The procedure is complete.**



- b. If the bypass is now out, then this element is not the problem. Continue with step 3.
3. Reinsert the cable. Then unplug the cable at the other end.
4. Insert a wrap plug with an adapter onto the cable end.
  - a. Is the bypass still on? Replace the cable. **The procedure is complete.**
  - b. If the bypass is now out, then this element is not the problem. Continue with step 5.



- b. If the bypass is now out, then this element is not the problem. In this fashion, keep moving through the loop until everything is replugged or until there are no more bypass or link down conditions.
5. As was shown in step 4, insert the wrap plug into the element from which the cable was removed in step 3.
  - a. Is the bypass still on? Replace the element (for example, a GBIC). **The procedure is complete.**
  - b. If the bypass is now out, then this element is not the problem. In this fashion, keep moving through the loop until everything is replugged or until there are no more bypass or link down conditions.



## Indicator lights and problem indications

The following figures show the indicator lights for each unit on the device side (for the mini-hub, the host side is also shown). The table following each figure shows the normal and problem indications.

The following figure shows the mini-hub indicator lights for the FAST500 RAID controller.

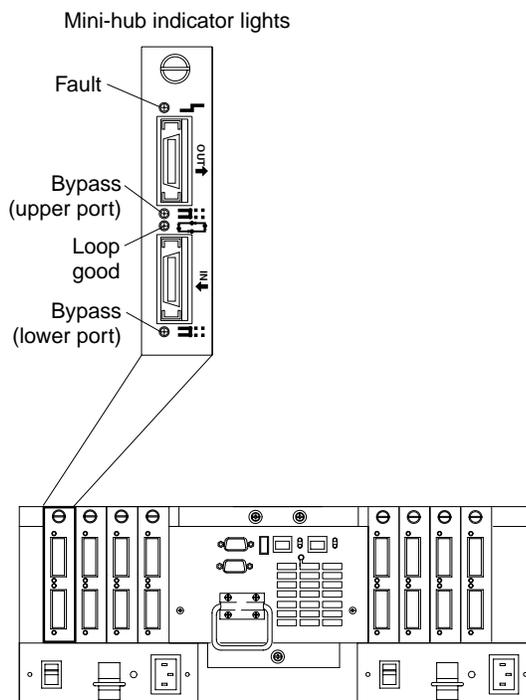


Table 80. FASSt500 mini-hub indicator lights

Icon	Indicator Light	Color	Normal Operation	Problem Indicator	Possible condition indicated by the problem indicator
	Fault	Amber	Off	On	Mini-hub or GBIC has failed. <b>Note:</b> If a host-side mini-hub is not connected to a controller, this fault light is always on.
	Bypass (upper port)	Amber	Off	On	<ul style="list-style-type: none"> <li>Upper mini-hub port is bypassed</li> <li>Mini-hub or GBIC has failed, is loose, or is missing</li> <li>Fiber-optic cables are damaged</li> </ul> <b>Note:</b> If the port is unoccupied, the light is on.
	Loop good	Green	On	Off	<ul style="list-style-type: none"> <li>The loop is not operational</li> <li>Mini-hub has failed or a faulty device might be connected to the mini-hub</li> <li>Controller has failed</li> </ul> <b>Note:</b> If a host-side mini-hub is not connected to a controller, the green light is always off and the fault light is always on.
	Bypass (lower port)	Amber	Off	On	<ul style="list-style-type: none"> <li>Lower mini-hub port is bypassed</li> <li>Mini-hub or GBIC has failed, is loose, or is missing</li> <li>Fiber-optic cables are damaged</li> </ul> <b>Note:</b> If the port is unoccupied, the light is on.

The following figure shows the indicator lights for the FAStT EXP500 ESM.

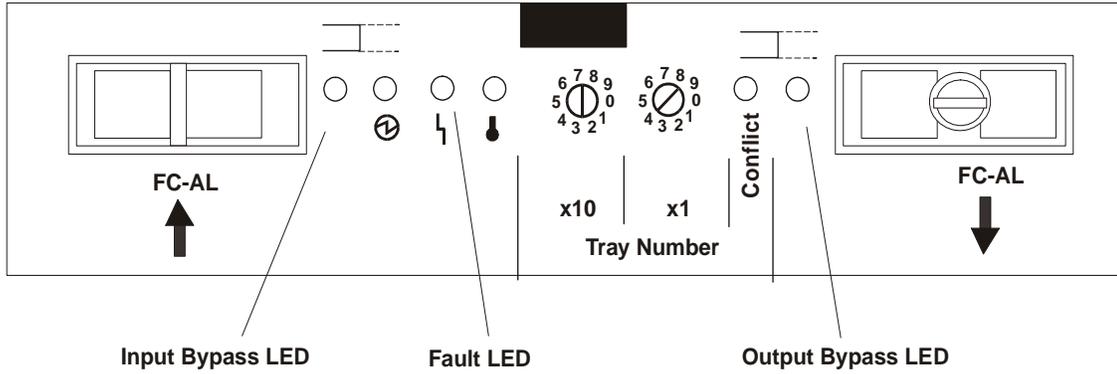


Table 81. EXP500 ESM indicator lights

Icon	Indicator Light	Color	Normal Operation	Problem Indicator	Possible condition indicated by the problem indicator
	Fault	Amber	Off	On	ESM failure <b>Note:</b> If fault is on, both In and Out should be in bypass.
	Input Bypass	Amber	Off	On	Port empty <ul style="list-style-type: none"> <li>Mini-hub or GBIC has failed, is loose, or is missing</li> <li>Fiber-optic cables are damaged</li> <li>No incoming signal detected</li> </ul>
	Output Bypass	Amber	Off	On	<ul style="list-style-type: none"> <li>Port empty</li> <li>Mini-hub or GBIC has failed, is loose, or is missing</li> <li>Fiber-optic cables are damaged</li> <li>No incoming signal detected, is loose, or is missing</li> </ul>

The following figure shows the controller indicator lights for a FAStT200 controller.

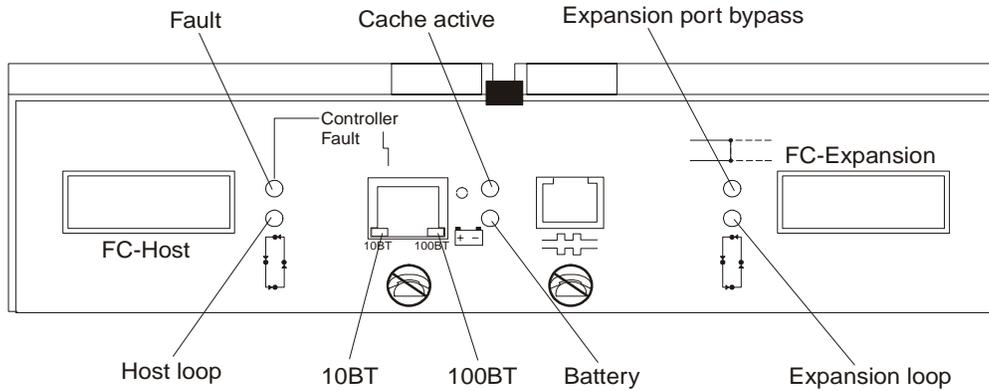


Table 82. FAStT200 controller indicator lights

Icon	Indicator Light	Color	Normal Operation	Problem Indicator	Possible condition indicated by the problem indicator
	Fault	Amber	Off	On	The RAID controller has failed
	Host Loop	Green	On	Off	<ul style="list-style-type: none"> <li>The host loop is down, not turned on, or not connected</li> <li>GBIC has failed, is loose, or not occupied</li> <li>The RAID controller circuitry has failed or the RAID controller has no power.</li> </ul>
	Expansion Loop	Green	On	Off	The RAID controller circuitry has failed or the RAID controller has no power.
	Expansion Port Bypass	Amber	Off	On	<ul style="list-style-type: none"> <li>Expansion port not occupied</li> <li>FC cable not attached to an expansion unit</li> <li>Attached expansion unit not turned on</li> <li>GBIC has failed, FC cable or GBIC has failed in attached expansion unit</li> </ul>

---

## Appendix H. PD hints — Wrap plug tests

**Note:** You should arrive at this appendix from a PD map or indication in “Chapter 2. PD entry,” on page 3. If this is not the case, refer back to “Chapter 2. PD entry,” on page 3.

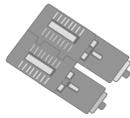
After you have read the relevant information in this appendix, return to “Single Path Fail PD map 1” on page 16.

The following sections illustrate the use of wrap plugs.

---

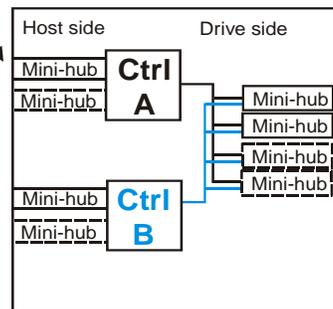
### SendEcho and crossPortTest Path to and from Controller

Failed path of read/write buffer test

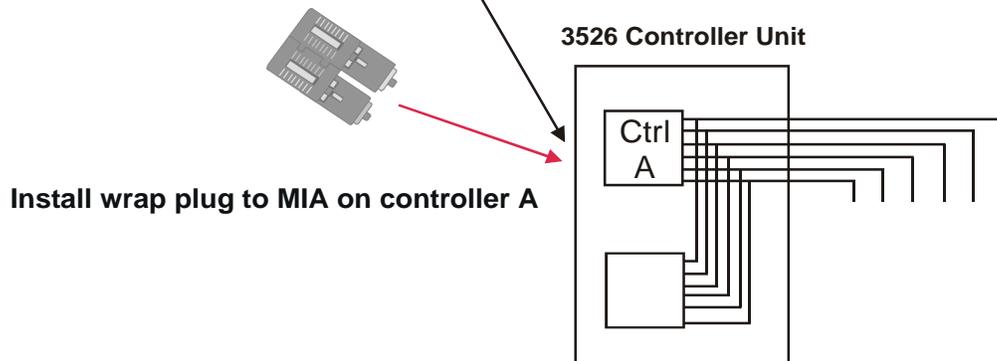


Install wrap plug to GBIC on mini-hub of controller A

**FAStT500 RAID Controller Unit**

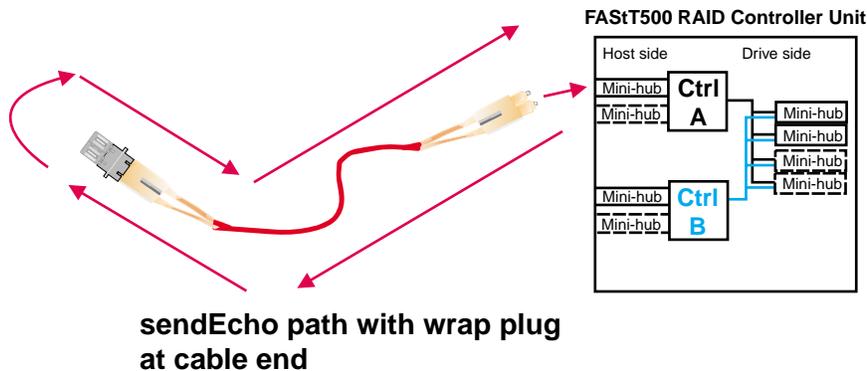


### Failed path of read/write buffer test

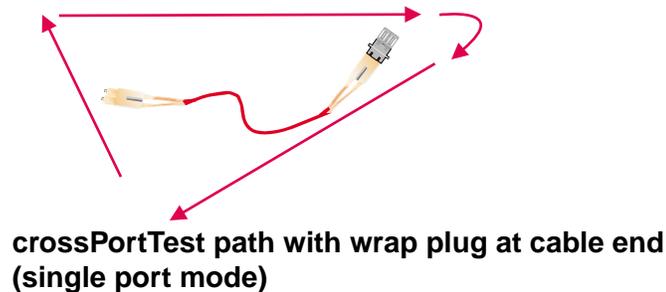
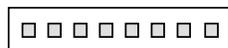


## Alternative wrap tests using wrap plugs

There is dual sourcing capability with wrap tests using wrap plugs. Use sendEcho from the controller or crossPortTest from the managed hub or switch. See "Hub / Switch PD map 1" on page 11 for the information on how to run the crossPortTest. The following figures show these alternative paths.



### Managed Hub



---

## Appendix I. PD hints — Hubs and switches

**Note:** You should arrive at this appendix from a PD map or indication in “Chapter 2. PD entry,” on page 3. If this is not the case, refer back to “Chapter 2. PD entry,” on page 3.

After you have read the relevant information in this appendix, return to the PD map that directed you here, either “Hub / Switch PD map 2” on page 12 or “Common Path PD map 2” on page 19.

---

### Unmanaged hub

The unmanaged hub is used only with the type 3526 controller (see “Chapter 7. Type 3526 Fibre Channel RAID controller,” on page 81). This hub does not contain any management or debug aids other than the LEDs that give an indicator of port up or down.

---

### Switch and managed hub

The switch and managed hub are used with the type 3552 and 3542 controller. The following sections describe tests that can be used with the switch and managed hub.

#### crossPortTest

The `crossPortTest` verifies the intended functional operation of the switch and managed hub by sending frames from each port's transmitter by way of the GBIC or fixed port and external cable to another port's receiver. By sending these frames, the `crossPortTest` exercises the entire path of the switch and managed hub.

A port can be connected to any other port in the same switch or managed hub, provided that the connection is of the same technology. This means that ShortWave ports can only be connected to ShortWave ports; LongWave ports can be connected only to LongWave ports.

**Note:** An error condition will be shown for any ports that are on the switch or managed hub but that are not connected. If you want more information on the `crossPortTest` and its options, see the Installation and Service Guide for the switch or managed hub you are using.

To repeat the results in the following examples, run the tests in online mode and with the `singlePortAlso` mode enabled. The test will run continuously until the **return** key is pressed on the console being used to do Ethernet connected management of the switch or managed hub.

To run, the test must find at least one port with a wrap plug or two ports connected to each other. If one of these criteria is not met, the test results in the following message in the telnet shell:

Need at least 1 port(s) connected to run this test.

The command syntax is `crossPortTest <nFrames>, <0 or 1>` where `<nFrames>` indicates the number of frames to run.

With <nFrames> set to 0, the test runs until you press **Return**.

With the second field set to 0, no single port wrap is allowed and two ports must be cross connected. The first figure below shows the preferred option, which works with either wrap or cross connect. The second figure below shows the default parms, which only work with cross connect.

```
myhub:admin> crossPortTest 0,1

Running Cross Port Test .....
Diags: (Q)uit, (C)ontinue, (S)tats, (L)og: s
Diagnostics Status: Thu Aug 17 14:04:17 2000

port#:  0  1  2  3  4  5  6  7
diags:  OK OK OK OK OK OK OK OK
state:  UP UP UP UP UP DN UP DN

  lm0:  45035906 frTx      794716 frRx      280 LLI_errs.
  lm1:  40920918 frTx      404591 frRx      481 LLI_errs.
  lm2:  54308300 frTx      2317366 frRx      26 LLI_errs.
  lm3:  23820416 frTx      79106 frRx       15 LLI_errs.
  lm4:           0 frTx           0 frRx         0 LLI_errs.
  lm6:           599 frTx          599 frRx         0 LLI_errs. <looped-6>

Central Memory OK
Total Diag Frames Tx: 1804
Total Diag Frames Rx: 2404

Return pressed
```

Wrapped port

```
myhub:admin> crossPortTest

Running Cross Port Test .....
Diags: (Q)uit, (C)ontinue, (S)tats, (L)og: s
Diagnostics Status: Thu Aug 17 14:45:35 2000

port#:  0  1  2  3  4  5  6  7
diags:  OK OK OK OK OK OK OK OK
state:  UP UP UP UP UP UP DN

  lm0:  45042814 frTx      801524 frRx      280 LLI_errs.
  lm1:  40922700 frTx      406295 frRx      481 LLI_errs.
  lm2:  54316812 frTx      2326056 frRx      26 LLI_errs.
  lm3:  23820416 frTx      79106 frRx       15 LLI_errs.
  lm4:           0 frTx           0 frRx         0 LLI_errs.
  lm5:          48 frTx          48 frRx         0 LLI_errs. <looped-6>
  lm6:          48 frTx          48 frRx         0 LLI_errs. <looped-5>

Central Memory OK
Total Diag Frames Tx: 2265
Total Diag Frames Rx: 2865

Diags: (Q)uit, (C)ontinue, (S)tats, (L)og:
```

Return pressed

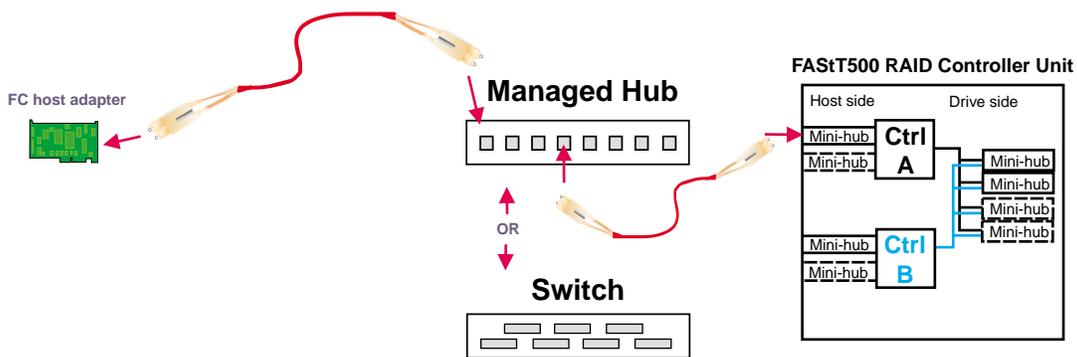
Port 6 connected by cable to port 5

## Alternative checks

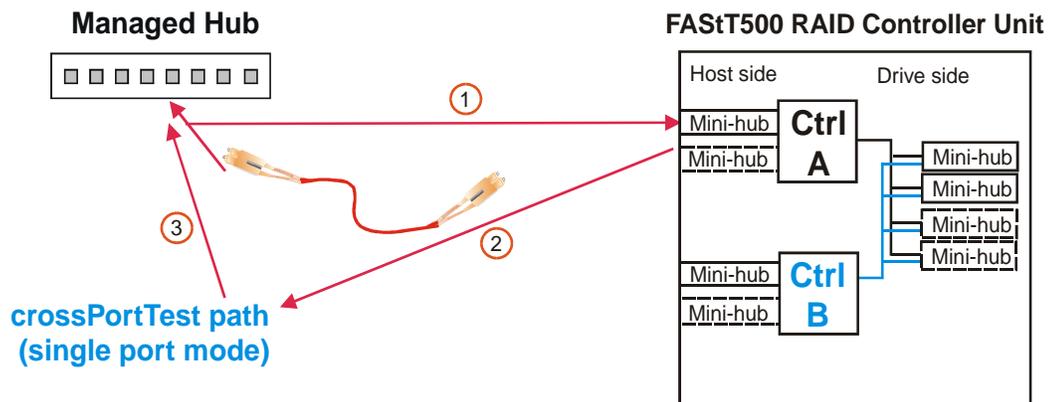
In some rare cases, you may experience difficulty in locating the failed component after you have checked a path. This section gives alternative checking procedures to help resolve the problem.

Some of these checks require plugging and unplugging components. Be aware that this could lead to other difficulties if, for instance, a cable is not plugged back completely. Therefore, when the problem is resolved, you should perform a path check to make sure that no other problems have been introduced into the path. Conversely, if you started with a problem and, after the unplugging and replugging, you end up at a non-failing point in the PD maps without any repairs or replacement, then the problem was probably a bad connection. You should go back to the original check, such as FAStT Check, and rerun the check. If it now runs correctly, then you can assume that you have corrected the problem. It would be a good idea to keep checking the event logs for further indications of problems in this area.

The following figure shows a typical connection path.



In the crossPortTest data is sourced from the managed hub or switch and travels the path outlined by the numbers 1, 2, and 3 in the following figure. For the same path, the sendEcho function is sourced from the RAID controller and travels the path 3, 2, 1. Using both tests when problems are hard to find (for example, if the problems are intermittent) offers a better analysis of the path. In this case, the duration of the run is also important because enough data must be transferred to enable you to see the problem.





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## Appendix J. Related service information

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### Safety notices (multi-lingual translations)

The caution and danger safety notices in this section are provided in the following languages.

- English
- Portuguese (Brazil)
- Chinese
- French
- German
- Italian
- Korean
- Spanish



#### **DANGER**

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.

To avoid shock hazard:

- The power cord must be connected to a properly wired and earthed receptacle.
- Any equipment to which this product will be attached must also be connected to properly wired receptacles.

When possible, use one hand to connect or disconnect signal cables to prevent a possible shock from touching two surfaces with different electrical potentials.

Electrical current from power, telephone, and communications cables is hazardous. To avoid shock hazard, connect and disconnect cables as described following when installing, moving, or opening covers of this product or attached devices.

To Connect	To Disconnect
<ol style="list-style-type: none"><li>1. Turn Everything OFF.</li><li>2. First, attach all cables to devices.</li><li>3. Attach signal cables to receptacles</li><li>4. Attach power cord(s) to outlet.</li><li>5. Turn device ON.</li></ol>	<ol style="list-style-type: none"><li>1. Turn Everything OFF.</li><li>2. First, remove power cord(s) from outlet.</li><li>3. Remove signal cables from receptacles.</li><li>4. Remove all cables from devices.</li></ol>

To Connect	To Disconnect
<b>Note:</b> In the UK, by law, the telephone cable must be connected after the power cord.	<b>Note:</b> In the UK, the power cord must be disconnected after the telephone cable.



**CAUTION:**

When replacing the battery, use only IBM Part Number 33F8354 or an equivalent type battery recommended by the manufacturer. If your system has a module containing a lithium battery, replace it only with the same module type made by the same manufacturer.

The battery contains lithium and can explode if not properly used, handled, or disposed of.

Do not:

- Throw or immerse into water
- Heat to more than 100°C (212°F)
- Repair or disassemble

Dispose of the battery as required by local ordinances or regulations.



**CAUTION:**

When a CD-ROM drive is installed, note the following.

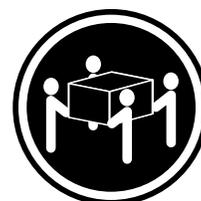
Use of controls or adjustments or performance of procedures other than those specified herein might result in hazardous radiation exposure.

Removing the covers of the CD-ROM drive could result in exposure to hazardous laser radiation. There are no serviceable parts inside the CD-ROM drive. Do not remove the CD-ROM drive covers.

**DANGER**

Some CD-ROM drives 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.



≥ 32 kg (70.5 lbs)

≥ 55 kg (121.2 lbs)

**CAUTION:**

Use safe lifting practices when lifting your machine.



**CAUTION:**

Electrical current from power, telephone, and communication cables can be hazardous. To avoid personal injury or equipment damage, disconnect the attached power cords, telecommunications systems, networks, and modems before you open the server covers, unless instructed otherwise in the installation and configuration procedures.



**PERIGO**

Para evitar choques elétricos, não conecte ou desconecte nenhum cabo, nem efetue instalação, manutenção ou reconfiguração deste produto durante uma tempestade com raios.

Para evitar choques elétricos:

- O cabo de alimentação deve ser conectado a um receptáculo corretamente instalado e aterrado.
- Todos os equipamentos aos quais este produto será conectado devem também ser conectados a receptáculos corretamente instalados.

Quando possível, utilize uma das mãos para conectar ou desconectar cabos de sinal, para evitar um possível choque ao tocar duas superfícies com potenciais elétricos diferentes.

A corrente elétrica proveniente de cabos de alimentação, de telefone e de comunicação é perigosa. Para evitar choques elétricos, conecte e desconecte os cabos conforme descrito a seguir, ao instalar, movimentar ou abrir tampas deste produto ou de dispositivos conectados.

<b>Para Conectar</b>	<b>Para Desconectar</b>
<ol style="list-style-type: none"><li>1. DESLIGUE tudo.</li><li>2. Conecte primeiro todos os cabos nos dispositivos.</li><li>3. Conecte os cabos de sinal nos receptáculos.</li><li>4. Conecte o(s) cabo(s) de alimentação nas tomadas.</li><li>5. LIGUE o dispositivo.</li></ol>	<ol style="list-style-type: none"><li>1. DESLIGUE tudo.</li><li>2. Remova primeiro o(s) cabo(s) de alimentação das tomadas.</li><li>3. Remova os cabos de sinal dos receptáculos.</li><li>4. Remova todos os cabos dos dispositivos.</li></ol>



**Cuidado:**

Ao substituir a bateria, utilize apenas o Número de Peça IBM 33F8354 ou um tipo de bateria equivalente recomendado pelo fabricante. Se seu sistema possuir um módulo com uma bateria de lítio, substitua-o apenas pelo mesmo tipo de módulo, produzido pelo mesmo fabricante. A bateria contém lítio e pode explodir se não for utilizada, manuseada e descartada de forma adequada.

*Não:*

- Jogue ou coloque na água
- Aqueça a mais de 100°C (212°F)
- Conserte nem desmonte.

Descarte a bateria conforme requerido pelas disposições e regulamentações locais.

**Cuidado:**

Quando uma unidade de CD-ROM estiver instalada, observe o seguinte.

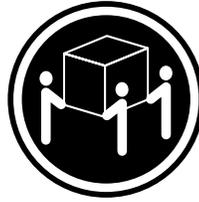
A utilização de controles ou ajustes ou a execução de procedimentos diferentes daqueles especificados nesta publicação pode resultar em exposição perigosa à radiação.

A remoção das tampas da unidade de CD-ROM pode resultar em exposição a radiação perigosa de laser. Não existem peças que possam ser consertadas no interior da unidade de CD-ROM. Não remova as tampas da unidade de CD-ROM.

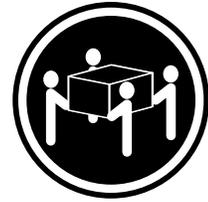
**PERIGO**

Algumas unidades de CD-ROM contém um diodo de laser da Classe 3A ou da Classe 3B. Observe o seguinte.

Radiação de laser quando aberto. Não olhe diretamente para o feixe de laser, não olhe diretamente com instrumentos óticos, e evite exposição direta ao raio.



≥ 32 kg (70.5 lbs)



≥ 55 kg (121.2 lbs)

**Cuidado:**

Utilize práticas seguras para levantamento de peso ao levantar sua máquina.



**Cuidado:**

A corrente elétrica proveniente de cabos de alimentação, de telefone e de comunicação é perigosa. Para evitar ferimentos pessoais ou danos aos equipamentos, desconecte os cabos de alimentação, sistemas de telecomunicação, redes e modems antes de abrir as tampas do servidor, a menos que receba outras instruções nos procedimentos de instalação e configuração.

戶明 1



危險！

为避免雷击危险，请不要在暴风雨期间连接或断开任何电缆，或是进行此产品的安装、维护或重新配置操作。

为避免电气危险：

- 电源线必须连接到适当的电线及接地插座。
- 此产品将要连接的所有设备也必须连接到正确接线的插座上。

如果可能，请使用一只手连接或断开连接信号电缆，以避免在接触两个具有不同电势的表面时遭到电击。

电源线、电话线以及通信电缆中的电流非常危险。为避免电击，请在安装、移动或打开本产品或连接设备的外盖时，按照下述步骤连接或断开电缆。

#### 要连接电缆

1. 关闭所有设备。
2. 首先将所有电缆与设备连接。
3. 将信号线连接到插座。
4. 将电源线连接到电源插座。
5. 打开设备。

#### 要断开电缆

1. 关闭所有设备。
2. 首先从电源插座拔下电源线。
3. 从插座拔下信号电缆。
4. 从设备上拔下所有电缆。

#### 声明 2



##### 注意！

当更换电池时，仅可使用 IBM 部件号为 39J8354 的部件或由制造商推荐的同等电池。如果系统中有包含锂电池的模块，则只能使用由同一制造商制造的同类型模块更换。该电池含有锂，如果使用、操作或处理不当会发生爆炸。

##### 不要：

- 将其投入或浸于水中
- 加热超过 100°C (212°F)
- 修理或拆卸

应按照当地法规和条例对此电池进行处理。

#### 声明 3



##### 注意！

在已安装 CD-ROM 驱动器的情况下，请注意下面的内容。

不遵循此处指定的控制、调整、或操作过程的操作将可能导致危险的辐射泄漏。

取下 CD-ROM 驱动器的外壳会导致危险的激光辐射泄漏。CD-ROM 驱动器内没有可以使用的部件。请不要取下 CD-ROM 驱动器的外壳。

## 声明 4

危险：

某些 CD-ROM 驱动器中包含内置的 2A 类或 2B 类激光二极管。  
请注意下述内容。

打开驱动器会产生激光辐射，请不要凝视激光束，请不要使用光学仪器直接观看激光束，同时也要避免人体直接暴露在激光束下。

## 声明 5



32 kg (70.5 磅)



55 kg (121.2 磅)

注意！

搬动服务器，必须进行安全搬运操作。

## 声明 10



注意！

中深线、中压线以及通信线路中的电流非常危险。为避免人身伤害或设备损坏，除非在安装和配置过程中特别指示，请在打开服务器外盖前断开已连接的全部电源线、通信系统、网络及远程控制器。

• 警告 1



危險

為了避免雷擊，在閃電期間，請勿連接或拔掉本裝置上的任何電纜線，或請勿安裝、維修或重新架設本產品。

為了避免雷擊：

- 電源線必須連接到接線及接地正確的插座。
- 本產品所連接的設備也必須連接到接線正確的插座。

儘可能使用單手來連接或拔掉信號電纜，以避免因接觸兩個不同電位的平面，而受到電擊。

電源、電話及通信電纜上均有電流流通。為了避免電擊，在安裝、移動本產品，或開啓本產品的蓋子或與本產品連接之裝置的蓋子時，請依照下列「連接」及「拔掉」電纜線的步驟操作。

連接

1. 閃避閃電區域。
2. 首先，將所有電纜線連接到正確插座。
3. 將信號電話線連接到信號插座。
4. 將電話線連接到電話插座。
5. 閃避閃電區域。

拔掉

1. 閃避閃電區域。
2. 首先，自可惡劣區域撤掉電纜。
3. 拔掉信號插座上所有信號電纜。
4. 拔掉裝置上的所有電纜線。

• 警告 2



注意：

更換電池時，只能使用 IBM 零件編號 33F8354 的電池，或廠商建議的相同類型的電池。如果您的系統中的緩衝含有鋰電池，更換時，請使用相同廠商製造的相同緩衝類型。如未正常使用、處理或冷棄含有鋰的電池時，可能會造成爆炸。

嚴禁：

- 丟入或浸入水中
- 加熱超過攝氏 100 度 (華氏 212 度)
- 修替或拆解

處理廢棄電池時，請遵照當地法令規章處理。

• 聲明 3



注意：

安裝光碟機時，請注意下列事項：

不依此處所指示的安裝、調整或處理步驟，恐有導致輻射之虞。

移開光碟機蓋子，恐有導致雷射輻射之虞。光碟機中沒有需要維修的部分，請勿移開光碟機的蓋子。

• 聲明 4



危險

光碟機含有內嵌式 Class 3A 或 Class 3B 雷射二極管時，請注意下列事項：

開啓時會產生雷射輻射，請勿凝視光束，不要使用光學儀器直接觀察，且應避免直接暴露在光束下。

• 聲明 5



≥ 32 公斤 (70.5 磅)



≥ 55 公斤 (121.2 磅)

注意：

提昇機器時，請使用安全提昇措施。

• 聲明 10



注意：

電源、電話及通信電纜上均有電流通過。在安裝及架機之時，若非專家指導，為了避免人員受傷，設備受損，在開啓伺服器蓋子之前，請切斷電源線、電信系統、網路及數據機。



## DANGER

Pour éviter tout risque de choc électrique, ne manipulez aucun câble et n'effectuez aucune opération d'installation, d'entretien ou de reconfiguration de ce produit au cours d'un orage.

Pour éviter tout risque de choc électrique:

- Les cordons d'alimentation du présent produit et de tous les appareils qui lui sont connectés doivent être branchés sur des socles de prise de courant correctement câblés et mis à la terre.

Afin d'éviter tout risque de choc électrique provenant d'une différence de potentiel de terre, n'utilisez qu'une main, lorsque cela est possible, pour connecter ou déconnecter les cordons d'interface.

Le courant électrique passant dans les câbles de communication, ou les cordons téléphoniques et d'alimentation peut être dangereux. Pour éviter tout risque de choc électrique, lorsque vous installez ou que vous déplacez le présent produit ou des périphériques qui lui sont raccordés, reportez-vous aux instructions ci-dessous pour connecter et déconnecter les différents cordons.

Connexion	Déconnexion
<ol style="list-style-type: none"><li>1. Mettez les unités hors tension.</li><li>2. Commencez par brancher tous les cordons sur les unités.</li><li>3. Branchez les câbles d'interface sur les prises.</li><li>4. Branchez les cordons d'alimentation sur un socle de prise de courant.</li><li>5. Mettez les unités sous tension.</li></ol>	<ol style="list-style-type: none"><li>1. Mettez les unités hors tension</li><li>2. Commencez pas débrancher les cordons alimentation des socles de prise de courant.</li><li>3. Débranchez les câbles d'interface des prises.</li><li>4. Débranchez tous les câbles des unités.</li></ol>



### Attention:

Remplacez la pile usagée par une pile de référence identique exclusivement - voir la référence IBM - ou par une pile équivalente recommandée par le fabricant. Si votre système est doté d'un module contenant une pile au lithium, vous devez le remplacer uniquement par un module identique, produit par le même fabricant. La pile contient du lithium et présente donc un risque d'explosion en cas de mauvaise manipulation ou utilisation.

- Ne la jetez pas à l'eau.
- Ne l'exposez pas à une température supérieure à 100° C.
- Ne cherchez pas à la réparer ou à la démonter.

Pour la mise au rebut, reportez-vous à la réglementation en vigueur.



### Attention:

Si une unité de CD-ROM est installée, prenez connaissance des informations suivantes:

Pour éviter tout risque d'exposition au rayon laser, respectez les consignes de réglage et d'utilisation des commandes, ainsi que les procédures décrites dans le présent document.

Pour éviter une exposition directe au rayon laser, n'ouvrez pas l'unité de CD-ROM. Vous ne pouvez effectuer aucune opération de maintenance à l'intérieur.

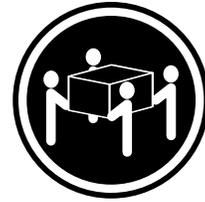
**DANGER**

Certaines unités de CD-ROM contiennent une diode laser de classe 3A ou 3B. Prenez connaissance des informations suivantes:

Rayonnement laser lorsque le carter est ouvert. évitez de regarder fixement le faisceau ou de l'observer à l'aide d'instruments optiques. évitez une exposition directe au rayon.



≥ 32 kg (70.5 lbs)



≥ 55 kg (121.2 lbs)

**Attention:**

Ce produit pèse un poids considérable. Faites-vous aider pour le soulever.



**Attention:**

Le courant électrique circulant dans les câbles de communication et les cordons téléphoniques et d'alimentation peut être dangereux. Pour votre sécurité et celle de l'équipement, avant de retirer les carters du serveur, mettez celui-ci hors tension et déconnectez ses cordons d'alimentation, ainsi que les câbles qui le relient aux réseaux, aux systèmes de télécommunication et aux modems (sauf instruction contraire mentionnée dans les procédures d'installation et de configuration).



**VORSICHT**

Aus Sicherheitsgründen bei Gewitter an diesem Gerät keine Kabel anschließen oder lösen. Ferner keine Installations-, Wartungs- oder Rekonfigurationsarbeiten durchführen.

Aus Sicherheitsgründen:

- Gerät nur an eine Schutzkontaktsteckdose mit ordnungsgemäß geerdetem Schutzkontakt anschließen.
- Alle angeschlossenen Geräte ebenfalls an Schutzkontaktsteckdosen mit ordnungsgemäß geerdetem Schutzkontakt anschließen.

Signalkabel möglichst einhändig anschließen oder lösen, um einen Stromschlag durch Berühren von Oberflächen mit unterschiedlichem elektrischem Potential zu vermeiden.

Elektrische Spannungen von Netz-, Telefon- und Datenübertragungsleitungen sind gefährlich. Um einen Stromschlag zu vermeiden, nur nach den Anweisungen arbeiten, die für Installation, Transport oder Öffnen von Gehäusen dieses Produkts oder angeschlossenen Einheiten gelten.

Kabel anschließen	Kabel lösen
<ol style="list-style-type: none"> <li>1. Alle Geräte ausschalten und Netzstecker ziehen.</li> <li>2. uerst alle Kabel an Einheiten anschließen.</li> <li>3. ZSignalkabel an Anschlußbuchsen anschließen.</li> <li>4. Netzstecker an Steckdose anschließen.</li> <li>5. Gerät einschalten.</li> </ol>	<ol style="list-style-type: none"> <li>1. Alle Geräte ausschalten.</li> <li>2. Zuerst Netzstecker von Steckdose lösen.</li> <li>3. Signalkabel von Anschlußbuchsen lösen.</li> <li>4. Alle Kabel von Einheiten lösen.</li> </ol>



**Achtung:**

Eine verbrauchte Batterie nur durch eine Batterie mit der IBM Teilenummer 33F8354 oder durch eine vom Hersteller empfohlene Batterie ersetzen. Wenn Ihr System ein Modul mit einer Lithium-Batterie enthält, ersetzen Sie es immer mit dem selben Modultyp vom selben Hersteller. Die Batterie enthält Lithium und kann bei unsachgemäßer Verwendung, Handhabung oder Entsorgung explodieren.

Die Batterie nicht

- mit Wasser in Berührung bringen.
- über 100 C erhitzen.
- reparieren oder zerlegen.

Die örtlichen Bestimmungen für die Entsorgung von Sondermüll beachten.



**Achtung:**

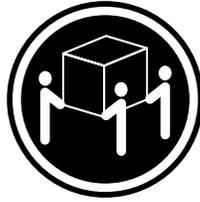
Wenn ein CD-ROM-Laufwerk installiert ist, beachten Sie folgendes. Steuer- und Einstellelemente sowie Verfahren nur entsprechend den Anweisungen im vorliegenden Handbuch einsetzen. Andernfalls kann gefährliche Laserstrahlung auftreten.

Das Entfernen der Abdeckungen des CD-ROM-Laufwerks kann zu gefährlicher Laserstrahlung führen. Es befinden sich keine Teile innerhalb des CD-ROM-Laufwerks, die vom Benutzer gewartet werden müssen. Die Verkleidung des CD-ROM-Laufwerks nicht öffnen.

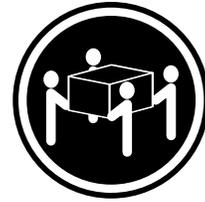
**VORSICHT**

Manche CD-ROM-Laufwerke enthalten eine eingebaute Laserdiode der Klasse 3A oder 3B. Die nachfolgend aufgeführten Punkte beachten.

Laserstrahlung bei geöffneter Tür. Niemals direkt in den Laserstrahl sehen, nicht direkt mit optischen Instrumenten betrachten und den Strahlungsbereich meiden.



≥ 32 kg (70.5 lbs)



≥ 55 kg (121.2 lbs)

**Achtung:**

Beim Anheben der Maschine die vorgeschriebenen Sicherheitsbestimmungen beachten.



**Achtung:**

An Netz-, Telefon- und Datenleitungen können gefährliche elektrische Spannungen anliegen. Um eine Gefährdung des Benutzers oder Beschädigung des Geräts zu vermeiden, ist der Server auszuschalten. Die Verbindung zu den angeschlossenen Netzkabeln, Telekommunikationssystemen, Netzwerken und Modems ist vor dem Öffnen des Servergehäuses zu unterbrechen (sofern in Installations- und Konfigurationsanweisungen nicht anders angegeben).



## PERICOLO

Per evitare il pericolo di scosse elettriche durante i temporali, non collegare o scollegare cavi, non effettuare l'installazione, la manutenzione o la riconfigurazione di questo prodotto.

Per evitare il pericolo di scosse elettriche:

- collegare il cavo di alimentazione ad una presa elettrica correttamente cablata e munita di terra di sicurezza;
- collegare qualsiasi apparecchiatura collegata a questo prodotto ad una presa elettrica correttamente cablata e munita di terra di sicurezza.

Quando possibile, collegare o scollegare i cavi di segnale con una sola mano per evitare il rischio di scosse derivanti dal contatto con due superfici a diverso potenziale elettrico.

La corrente elettrica circolante nei cavi di alimentazione, del telefono e di segnale è pericolosa. Per evitare scosse elettriche, collegare e scollegare i cavi come descritto quando si effettuano l'installazione, la rimozione o l'apertura dei coperchi di questo prodotto o durante il collegamento delle unità.

Per collegare	Per scollegare
<ol style="list-style-type: none"> <li>1. SPEGNERE tutti i dispositivi.</li> <li>2. Collegare prima tutti i cavi alle unità.</li> <li>3. Collegare i cavi di segnale alle prese.</li> <li>4. Collegare il(i) cavo(i) di alimentazione alla presa elettrica.</li> <li>5. ACCENDERE le unità.</li> </ol>	<ol style="list-style-type: none"> <li>1. SPEGNERE tutti i dispositivi.</li> <li>2. Rimuovere prima il(i) cavo(i) di alimentazione dalla presa elettrica.</li> <li>3. Rimuovere i cavi di segnale dalle prese.</li> <li>4. Rimuovere tutti i cavi dalle unità.</li> </ol>



**Attenzione:**

Quando si sostituisce la batteria, utilizzare solo una batteria IBM o batterie dello stesso tipo o di tipo equivalente consigliate dal produttore. Se il sistema di cui si dispone è provvisto di un modulo contenente una batteria al litio, sostituire tale batteria solo con un tipo di modulo uguale a quello fornito dal produttore. La batteria contiene litio e può esplodere se utilizzata, maneggiata o smaltita impropriamente.

Evitare di:

- Gettarla o immergerla in acqua
- Riscaldarla ad una temperatura superiore ai 100° C
- Cercare di ripararla o smaltirla

Smaltire secondo la normativa in vigore (D.Lgs 22 del 5/2/97) e successive disposizioni nazionali e locali.



**Attenzione:**

Quando è installata un'unità CD-ROM, notare quanto segue:

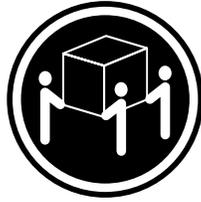
L'utilizzo di controlli, regolazioni o l'esecuzione di procedure non descritti nel presente manuale possono provocare l'esposizione a radiazioni pericolose.

L'apertura di un'unità CD-ROM può determinare l'esposizione a radiazioni laser pericolose. All'interno dell'unità CD-ROM non vi sono parti su cui effettuare l'assistenza tecnica. Non rimuovere i coperchi dell'unità CD-ROM.

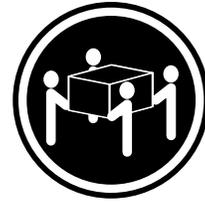
**PERICOLO**

Alcune unità CD-ROM contengono all'interno un diodo laser di Classe 3A o Classe 3B. Prestare attenzione a quanto segue:

Aperto l'unità vengono emesse radiazioni laser. Non fissare il fascio, non guardarlo direttamente con strumenti ottici ed evitare l'esposizione diretta al fascio.



≥ 32 kg (70.5 lbs)



≥ 55 kg (121.2 lbs)

**Attenzione:**

Durante il sollevamento della macchina seguire delle norme di sicurezza.



**Attenzione:**

La corrente circolante nei cavi di alimentazione, del telefono e di segnale è pericolosa. Per evitare situazioni pericolose per le persone o danneggiamenti all'apparecchiatura, scollegare i cavi di alimentazione, i sistemi di telecomunicazioni, le reti e ed i modem prima di aprire i coperchi del server se non diversamente indicato nelle procedure di installazione e configurazione.



**위험**

전기 충격을 피하려면 날씨가 나쁠 때(예: 눈 또는 비가 오거나 천둥 번개가 칠 때)는 케이블을 연결하거나 끊지 않도록 하고 이 제품의 설치, 유지보수 또는 재구성 등의 작업을 수행하지 않도록 하십시오.

전기 충격을 피하려면 다음과 같아야 합니다.

- 고압선은 적절한 배선 및 접지 상태의 콘센트로 연결되어야 합니다.
- 이 제품이 접속될 모든 장비도 적절한 배선 상태의 콘센트로 연결되어야 합니다.

다른 전위를 가진 두 표면을 만졌을 때 발생할 수 있는 전기 충격을 피하려면 한 손으로 신호선을 연결하거나 끊으십시오.

전원, 전화 및 통신 케이블로부터 흘러 나오는 전류는 위험합니다. 전기 충격을 피하려면 이 제품이나 접속 장치를 설치, 이동 및 덮개를 열 때 다음 설명에 따라 케이블을 연결하고 끊도록 하십시오.

연결하려면	연결해제하려면
1. 모든 스위치를 켜고.	1. 모든 스위치를 끄고.
2. 먼저 모든 케이블을 장치에 연결한다.	2. 먼저 모든 케이블을 장치에 제거한다.
3. 신호선을 콘센트에 연결한다.	3. 신호선을 콘센트에서 제거한다.
4. 전원을 콘센트에 연결한다.	4. 장치에서 모든 케이블을 제거한다.
5. 장치 스위치를 켜고.	

경고문 2



**주의:**

배터리를 교체할 때는 IBM 부품 번호 &PN, 또는 제조업체에서 추천하는 동등한 유형의 배터리를 사용하십시오. 시스템에 리튬 배터리를 포함하는 모듈이 있으면 이것은 동일한 제조업체에서 생산된 동일한 모듈 유형으로만 교체하십시오. 배터리에 리튬이 포함되어 있으므로 제대로 사용, 처리 또는 처분하지 않으면 폭발할 수 있습니다.

다음과 주의하십시오.

- 던지거나 물에 담그지 않도록 하십시오.
- 100°C(212°F) 이상으로 가열하지 않도록 하십시오.
- 수리하거나 분해하지 않도록 하십시오.

지역 법령이나 규정의 요구에 따라 배터리를 처분하십시오.

경고문 3



**주의:**

CD-ROM 드라이브가 설치되어 있으면 다음 사항을 명심하십시오.

여기에서 지정하지 않은 방식으로 CD-ROM 드라이브를 제어 또는 조절하거나 다른 절차로 사용하면 위험한 방사능 노출이 발생할 수 있습니다.

CD-ROM 드라이브의 덮개를 제거하면 위험한 레이저 방사능이 노출될 수 있습니다.

CD-ROM 드라이브 내에는 정비할 수 있는 부품이 없습니다. CD-ROM 드라이브 덮개를 제거하지 않도록 하십시오.

경고문 4

**위험**

일부 CD-ROM 드라이브에는 클래스 3A 또는 3B 레이저 2급 진공관(다이오드)이 들어 있습니다. 다음 사항을 명심하십시오.

열면 레이저 방사능이 노출됩니다. 광선을 주시하거나 광학 기계를 직접 쳐다보지 않도록 하고 광선에 노출되지 않도록 하십시오.

경고문 5



32kg(70.5 파운드)



55kg(121.2 파운드)

주의:

기계를 들 때는 안전하게 들어 올리십시오.



**PELIGRO**

Para evitar una posible descarga eléctrica, no conecte ni desconecte los cables ni lleve a cabo ninguna operación de instalación, de mantenimiento o de reconfiguración de este producto durante una tormenta eléctrica.

Para evitar una posible descarga:

- El cable de alimentación debe conectarse a un receptáculo con una instalación eléctrica correcta y con toma de tierra.
- Los aparatos a los que se conecte este producto también deben estar conectados a receptáculos con la debida instalación eléctrica.

Cuando sea posible, utilice una sola mano para conectar o desconectar los cables de señal a fin de evitar una posible descarga al tocar dos superficies con distinto potencial eléctrico.

La corriente eléctrica de los cables de comunicaciones, teléfono y alimentación puede resultar peligrosa. Para evitar una posible descarga, siga las indicaciones de conexión y desconexión de los cables siempre que tenga que instalar, mover o abrir las cubiertas de este producto o de los dispositivos acoplados.

Instrucciones de conexión	Instrucciones de desconexión
<ol style="list-style-type: none"> <li>1. Apague todos los componentes (OFF).</li> <li>2. En primer lugar, conecte todos los cables a los dispositivos.</li> <li>3. Conecte los cables de señal a los receptáculos.</li> <li>4. Conecte los cables de alimentación a las tomas.</li> <li>5. Encienda el dispositivo (ON).</li> </ol>	<ol style="list-style-type: none"> <li>1. Encienda todos los componentes (ON).</li> <li>2. En primer lugar, retire los cables de alimentación de las tomas.</li> <li>3. Retire los cables de señal de los receptáculos.</li> <li>4. Retire todos los cables de los dispositivos.</li> </ol>



**Precaución:**

Al cambiar la batería, utilice únicamente la batería IBM Número de pieza 33F8354 o un tipo de batería equivalente recomendado por el fabricante. Si el sistema tiene un módulo que contiene una batería de litio, sustitúyalo únicamente por el mismo tipo de módulo del mismo fabricante. La batería contiene litio y puede explotar si no se utiliza, manipula o desecha correctamente.

Lo que no debe hacer

- Tirar o sumergir el producto en agua.
- Exponer el producto a una temperatura superior a 100°C.
- Reparar o desmontar el producto.

Cuando quiera desechar la batería, siga las disposiciones y reglamentaciones locales.

**Precaución:**

Cuando instale una unidad de CD-ROM, tenga en cuenta la siguiente información.

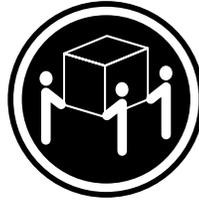
Si se llevan a cabo controles o ajustes o se utilizan métodos que no se atengan a lo aquí especificado, se puede producir una exposición peligrosa a las radiaciones.

Si se retiran las cubiertas de la unidad de CD-ROM, se puede producir una peligrosa exposición a radiaciones de láser. Dentro de la unidad de CD-ROM no existen piezas reparables. No retire las cubiertas de la unidad de CD-ROM.

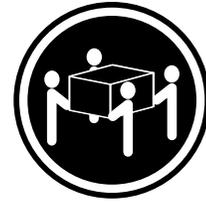
**PELIGRO**

Algunas unidades de CD-ROM tienen incorporado un diodo de láser de Clase 3A o de Clase 3B. Tenga en cuenta la siguiente información.

Cuando la unidad está abierta se generan emisiones de rayos láser. No dirija la mirada al haz, no lo observe directamente con instrumentos ópticos y evite la exposición directa.



≥ 32 kg (70.5 lbs)



≥ 55 kg (121.2 lbs)

**Precaución:**

Alce la máquina con cuidado; el sobrepeso podría causar alguna lesión.



**Precaución:**

La corriente eléctrica de los cables de comunicaciones, de teléfono y de alimentación puede resultar peligrosa. Para evitar posibles lesiones o daños del aparato, desconecte los cables de alimentación, los sistemas de telecomunicaciones, las redes y los módems antes de abrir las cubiertas del servidor, salvo que se indique lo contrario en las instrucciones de las operaciones de instalación y configuración.

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## Safety information

This section contains the safety information with which you need to be familiar, before you service an IBM mobile computer.

### General safety

Follow these rules to ensure general safety:

- Observe good housekeeping in the area of the machines during and after maintenance.
- When lifting any heavy object:
  1. Ensure you can stand safely without slipping.
  2. Distribute the weight of the object equally between your feet.
  3. Use a slow lifting force. Never move suddenly or twist when you attempt to lift.
  4. Lift by standing or by pushing up with your leg muscles; this action removes the strain from the muscles in your back. *Do not attempt to lift any objects that weigh more than 16 kg (35 lb) or objects that you think are too heavy for you.*
- Do not perform any action that causes hazards to the customer, or that makes the equipment unsafe.
- Before you start the machine, ensure that other service representatives and the customer's personnel are not in a hazardous position.
- Place removed covers and other parts in a safe place, away from all personnel, while you are servicing the machine.
- Keep your tool case away from walk areas so that other people will not trip over it.
- Do not wear loose clothing that can be trapped in the moving parts of a machine. Ensure that your sleeves are fastened or rolled up above your elbows. If your hair is long, fasten it.
- Insert the ends of your necktie or scarf inside clothing or fasten it with a nonconductive clip, approximately 8 centimeters (3 inches) from the end.
- Do not wear jewelry, chains, metal-frame eyeglasses, or metal fasteners for your clothing. **Remember:** Metal objects are good electrical conductors.
- Wear safety glasses when you are doing any of the following: hammering, drilling soldering, cutting wire, attaching springs, using solvents, or working in any other conditions that might be hazardous to your eyes.
- After service, reinstall all safety shields, guards, labels, and ground wires. Replace any safety device that is worn or defective.
- Reinstall all covers correctly before returning the machine to the customer.

### Grounding requirements

Electrical grounding of the computer is required for operator safety and correct system function. Proper grounding of the electrical outlet can be verified by a certified electrician.

## Electrical safety

### Important

Use only approved tools and test equipment. Some hand tools have handles covered with a soft material that does not insulate you when working with live electrical currents.

Many customers have, near their equipment, rubber floor mats that contain small conductive fibers to decrease electrostatic discharges. Do not use this type of mat to protect yourself from electrical shock.

Observe the following rules when working on electrical equipment.

- Find the room emergency power-off (EPO) switch, disconnecting switch, or electrical outlet. If an electrical accident occurs, you can then operate the switch or unplug the power cord quickly.
- Do not work alone under hazardous conditions or near equipment that has hazardous voltages.
- Disconnect all power before:
  - Performing a mechanical inspection
  - Working near power supplies
  - Removing or installing main units
- Before you start to work on the machine, unplug the power cord. If you cannot unplug it, ask the customer to power-off the wall box that supplies power to the machine and to lock the wall box in the off position.
- If you need to work on a machine that has *exposed* electrical circuits, observe the following precautions:
  - Ensure that another person, familiar with the power-off controls, is near you.  
**Remember:** Another person must be there to switch off the power, if necessary.
  - Use only one hand when working with powered-on electrical equipment; keep the other hand in your pocket or behind your back.  
**Remember:** There must be a complete circuit to cause electrical shock. By observing the above rule, you may prevent a current from passing through your body.
  - When using testers, set the controls correctly and use the approved probe leads and accessories for that tester.
  - Stand on suitable rubber mats (obtained locally, if necessary) to insulate you from grounds such as metal floor strips and machine frames.

Observe the special safety precautions when you work with very high voltages; these instructions are in the safety sections of maintenance information. Use extreme care when measuring high voltages.

- Regularly inspect and maintain your electrical hand tools for safe operational condition.
- Do not use worn or broken tools and testers.
- *Never assume* that power has been disconnected from a circuit. First, *check* that it has been powered-off.
- Always look carefully for possible hazards in your work area. Examples of these hazards are moist floors, nongrounded power extension cables, power surges, and missing safety grounds.

- Do not touch live electrical circuits with the reflective surface of a plastic dental mirror. The surface is conductive; such touching can cause personal injury and machine damage.
- Do not service the following parts (or similar units) *with the power on* when they are removed from their normal operating places in a machine. (This practice ensures correct grounding of the units.)
  - Power supply units
  - Pumps
  - Blowers and fans
  - Motor generators
- If an electrical accident occurs:
  - **Use caution; do not become a victim yourself.**
  - **Switch off power.**
  - **Send another person to get medical aid.**

## Handling electrostatic discharge-sensitive devices

Any computer part containing transistors or integrated circuits (ICs) should be considered sensitive to electrostatic discharge (ESD). ESD damage can occur when there is a difference in charge between objects. Protect against ESD damage by equalizing the charge so that the machine, the part, the work mat, and the person handling the part are all at the same charge.

### Notes:

1. Use product-specific ESD procedures when they exceed the requirements noted here.
2. Make sure that the ESD protective devices you use have been certified (ISO 9000) as fully effective.

Use the following precautions when handling ESD-sensitive parts.

- Keep the parts in protective packages until they are inserted into the product.
- Avoid contact with other people.
- Wear a grounded wrist strap against your skin to eliminate static on your body.
- Prevent the part from touching your clothing. Most clothing is insulative and retains a charge even when you are wearing a wrist strap.
- Select a grounding system, such as those listed below, to provide protection that meets the specific service requirement.

**Note:** The use of a grounding system is desirable but not required to protect against ESD damage.

- Attach the ESD ground clip to any frame ground, ground braid, or green-wire ground.
- Use an ESD common ground or reference point when working on a double-insulated or battery-operated system. You can use coax or connector-outside shells on these systems.
- Use the round ground-prong of the ac plug on ac-operated computers.
- Use the black side of a grounded work mat to provide a static-free work surface. The mat is especially useful when handling ESD-sensitive devices.

## Safety inspection guide

The intent of this inspection guide is to assist you in identifying potentially unsafe conditions on these products. Each machine, as it was designed and built, had required safety items installed to protect users and service personnel from injury. This guide addresses only those items. However, good judgment should be used to identify potential safety hazards due to attachment of non-IBM features or options not covered by this inspection guide.

If any unsafe conditions are present, you must determine how serious the apparent hazard could be and whether you can continue without first correcting the problem.

Consider these conditions and the safety hazards they present:

- Electrical hazards, especially primary power (primary voltage on the frame can cause serious or fatal electrical shock).
- Explosive hazards, such as a damaged CRT face or bulging capacitor
- Mechanical hazards, such as loose or missing hardware

The guide consists of a series of steps presented in a checklist. Begin the following checks with the power off, and the power cord disconnected.

1. Check exterior covers for damage (loose, broken, or sharp edges).
2. Power-off the computer. Disconnect the power cord.
3. Check the power cord for the following:
  - a. A third-wire ground connector in good condition. Use a meter to measure third-wire ground continuity for 0.1 ohm or less between the external ground pin and frame ground.
  - b. The power cord should be the appropriate type as specified in the parts listings.
  - c. Insulation must not be frayed or worn.
4. Remove the cover.
5. Check for any obvious non-IBM alterations. Use good judgment as to the safety of any non-IBM alterations.
6. Check inside the unit for any obvious unsafe conditions, such as metal filings, contamination, water or other liquids, or signs of fire or smoke damage.
7. Check for worn, frayed, or pinched cables.
8. Check that the power-supply cover fasteners (screws or rivets) have not been removed or tampered with.

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## Miscellaneous information

### Acronyms, Abbreviations, and Terms

<b>Term</b>	<b>Information</b>
ACPA/A	Audio Capture and Playback Adapter
ADP	Automatic Data Processing
AGP	Advanced Graphics Port
Alt	Alternate
ANSI	American National Standards Institute
ARTIC	A Real Time Interface Coprocessor
ASCII	American National Standard Code for Interface Interchange
AT	Advanced Technology (refer to AT Bus)
AVC	Audio Video Connection
BIOS	Basic Input/Output System
bps	Bits Per Second
BPS	Bytes Per Second
CCITT	The International Telephone and Telegraph Consultative Committee
CCS	Common Command Set
CCSB	Common Complete Status Block
CCSB	Configuration Control Sub Board
CD	Compact Disc
CDPD	Cellular Digital Packet Data
CD-ROM	CD Read-Only Memory
CGA	Color Graphics Adapter (See EGA)
CRC	Cyclic Redundancy Check
CRT	Cathode Ray Tube
CRU	Customer Replaceable Unit
CSA	Canadian Standards Association
CSD	Corrective Service Diskette
DASD	Direct Access Storage Device (hard disk)
DMA	Direct Memory Access
DRAM	Dynamic Random Access Memory
ECA	Engineering Change Announcement
ECC	Error Correction Code
EGA	Enhanced Graphics Adapter
ESD	Electrostatic Discharge

<b>Term</b>	<b>Information</b>
ESDI	Enhanced Small Device Interface
EEPROM	Electrically Erasable Programmable Read-Only Memory
EWS	Energy Work Station
FC	Fibre Channel
FRU	Field Replaceable Unit (replaceable part)
GBIC	Gigabit Interface Converter
GPIO	General Purpose Interface Bus (IEEE 348)
GSA	General Services Administration
Ht	Height
IDE	Integrated Drive Electronics
I/O	Input/Output
IC	Integrated Circuit
IEEE	Institute of Electrical and Electronics Engineers
IEC	International Electrotechnical Commission
IML	Initial Machine Load
IPL	Initial Program Load
IRQ	Interrupt Request
ISA	Industry Standard Architecture
ISO	International Organization for Standardization
ISDN	Integrated-Services Digital Network
LAN	Local Area Network
LBA	Local Block Address
LED	Light Emitting Diode
LTB	Local Transfer Bus
LUN	Logical Unit Number (refer to SCSI)
MAP	Maintenance Analysis Procedure
MCGA	Modified Color Graphics Adapter
MCA	Micro Channel Architecture (bus structure)
MHz	Mega Hertz (million cycles per second)
MIDI	Musical Instrument Digital Interface
MM	Multimedia
N/A	Not Available or Not Applicable
NDD	National Distribution Division
NDIS	Network Driver Interface Specification
NMI	Non-Maskable Interrupt
NSC	National Support Center

<b>Term</b>	<b>Information</b>
NVSRAM	Non-Volatile Static Random Access Memory
OEM	Original Equipment Manufacturer
PCI	Peripheral Component Interconnect
PCMCIA	Personal Computer Memory Card International Association
POS	Programmable Option Select
PUN	Physical Unit Number (refer to SCSI)
RAID	Redundant Array of Inexpensive Disks
RAM	Random Access Memory (read/write)
RGB	Red Green Blue (refer to monitors)
RIPL	Remote Initial Program Load
ROM	Read-Only Memory
SASD	Sequential Access Storage Device (Tape)
SCB	Subsystem Control Block
SCSI	Small Computer Systems Interface
SCSI ID	SCSI Identification Number
SPD	Software Product Description
SR	Service Representative
SRAM	Static Random Access Memory
SSA	Serial Storage Architecture
SVGA	Super Video Graphics Array (800x600x16)
STN	Super Twisted Nematic
T/A	NDD Technical Advisor (see your Marketing Representative)
TDD	Telecommunications Device for the Deaf
TFT	Thin-Film Transistor
TPF	ThinkPad File
TSR	Terminate and Stay Resident
UL	Underwriters Laboratory
VCA	Video Capture Adapter
VESA	Video Electronics Standards Association
VGA	Video Graphics Array (640x480x16)
VPD	Vital Product Data
VRAM	Video Random Access Memory
WORM	Write Once Read Many (storage medium)
XGA	Extended Graphics Array
Y/C	Luminance/Chrominance Signal (Video)

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