SGI™ TP9400 RAID Owner's Guide

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About This Guide

This Owner's Guide gives an overview of the TP9400 and provides information regarding routine operation and replacement procedures. It also provides troubleshooting and reference information for all customer-replaceable components.

Audience

This guide is intended for system operators and service technicians who have extensive knowledge of Fibre Channel network technology, computer system operation, maintenance, and repair.

Use this guide to:

- Become familiar with the TP9400 rack, the components of the controller enclosures and drive enclosures.
- Learn the steps required to operate the TP9400.
- Learn how to replace failed components in the controller enclosures and drive enclosures.

Note: Before using this book, you must install the hardware and software. See the *SGI TP9400 RAID Installation and Upgrade Guide* (108-0292-00X), the *SGI TP9400 RAID IRIX Administration Guide* (007-4306-00X), and the *TPSSM7 RAID Software Concepts Guide for TP9400* (007-4305-00X).

Structure of This Guide

This guide contains the following chapters:

- Chapter 1, “Introduction to the TP9400”— Introduces the TP9400, gives a functional overview, and describes features of the system.
- Chapter 2, “The Controller Enclosure” — Gives a detailed overview of the controller enclosure and its components.
- Chapter 3, “Controller Enclosure Operation”— Describes the functions and basic operation of the controller enclosure, including power up and troubleshooting with the indicator lights.
- Chapter 4, “Controller Enclosure Component Replacement Procedures”— Gives detailed procedures for replacing failed controller enclosure components.
- Chapter 5, “The Drive Enclosure”— Gives a detailed overview of the drive enclosure and its components.
- Chapter 6, “Drive Enclosure Operation”— Describes the functions and basic operation of the drive enclosure, including power up and troubleshooting with the indicator lights.
- Chapter 7, “Drive Enclosure Component Replacement Procedures”— Gives detailed procedures for replacing failed drive enclosure components.
- Chapter 8, “Cabling”— Describes cabling between TP9400 components and between the components and the hosts.
- Appendix A, “Specifications and Requirements”— Describes component specifications and requirements for purposes of installation and maintenance.
- Appendix B, “SGI Field Engineering Compliance Statements”— Describes the regulatory and compliance information for the TP9400.

Related Publications

This Owner's Guide is part of a document set that fully supports the installation, operation, and service of the TP9400. Make sure you also have the following publications:

Note: When a document number ends in "X", use the latest available version of that document.

- *SGI TP9400 RAID Installation and Upgrade Guide* (108-0292-00X)
  This guide gives complete instructions on how to unpack, install, and configure the TP9400 and its components. It also contains upgrade information.
- *SGI TP9400 RAID IRIX Administration Guide* (007-4306-00X)
  This guide gives complete instructions on how to install the TPSSM7 software for host and/or client operation.
- *TPSSM7 RAID Software Concepts Guide for TP9400* (007-4305-00X)
  This guide explains the terminology and features of the TPSSM7 storage management software for the TP9400.
- *SGI Storage Area Network Installation Instructions* (108-0252-00X)
  This guide comes packed with the Fibre Channel switch and provides information on Storage Area Network installation and topologies.
- See also the SGI online technical bulletin TIB #200121 at:
  `http://bits.csd.sgi.com/cgi-bin/site.cgi?msgId=sbs_BltView&docNumber=200121`

  This describes the most recent procedures for updating new or replaced controller canisters to normal operating mode.

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Introduction to the TP9400

This chapter describes the TP9400 and gives an overview of the primary components of the system.

The Total Performance 9400 (TP9400) is a rack-mounted RAID high bandwidth, highly available, Fibre Channel storage subsystem.

System Features

The TP9400 has the following features:

- Outstanding performance, utilizing multi-channel end-to-end Fibre Channel technology.
- Continuous availability, with constant monitoring and optional redundancy of all active components.
- Dynamic scalability making it easy to grow all subsystem resources without disruption.
- Superior connectivity allowing simultaneous connection to multiple servers directly or by way of Storage Area Networks. Supports optical host connections.
- Vast storage capacity, maximizing storage density per square foot.
- Storage management facilities for installation, configuration, expansion, and monitoring.
- Controller enclosure(s) and drive enclosure(s) with redundant power supplies and hot-swappable components.
- Configurable to meet customer performance requirements.
- Supports as many as 110 drives.
- RAID 0, 1, 3, 5 support for LUNs containing n+1 drives ($n \leq 29$).
- Battery backup for cache data — 3 days (72 hours) for 1 GB interface controllers and 7 days (168 hours) for 2 GB controller models.

Note: JBOD is not supported.

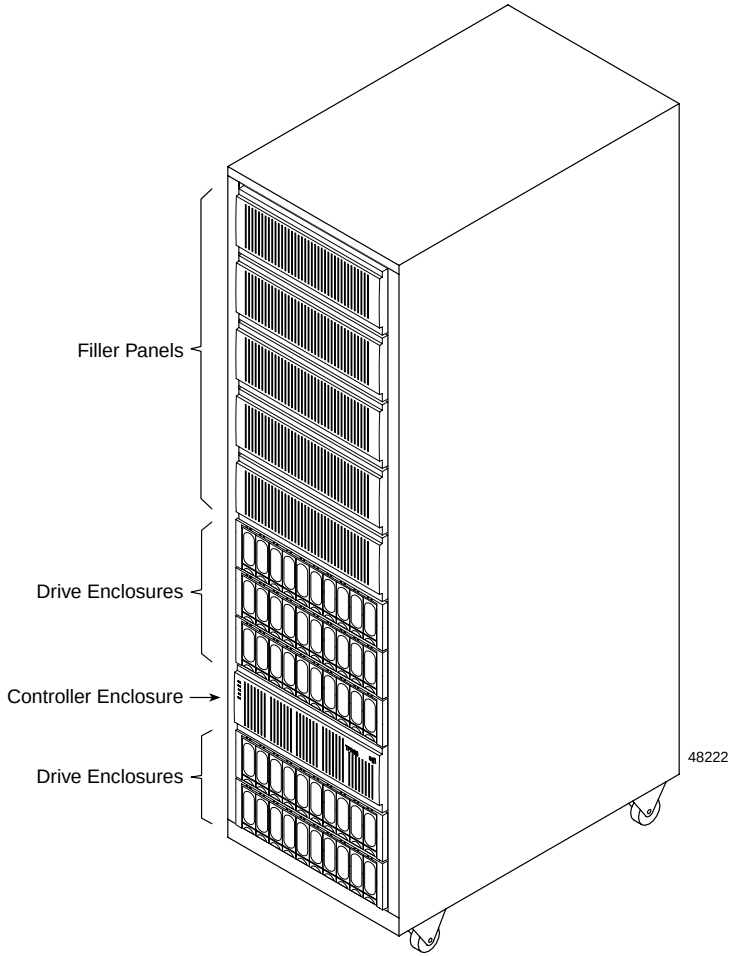

Figure 1-1 TP9400 Controller Enclosure, Drive Enclosures, and Blank Panels

Following are descriptions of the rack, the controller enclosures, and the drive enclosures as shown in Figure 1-1.

Rack

The rack has the following features:

- 72" high x 22" wide x 36" deep
- 38 Rack Units (1 rack unit = 1.75 inches)
- Removable rear panel
- Dual power distribution units (PDUs)
- Convenient access to power and data cables through a opening in the top of the rack

Controller Enclosure

The controller enclosures have the following features:

- Four rack units high (1 rack unit = 1.75 inches)
- Dual Active RAID controller levels
- Supports RAID 0, 1, 3, 5
- Supports two types of host and drive connections:
  a. GBIC host and drive connections for controllers with 1 GB interface
  b. SFP host and drive connections for controllers with 2 GB interface
- 256 MB, 512 MB or 1 GB ECC protected cache memory per controller:
  a. 1 GB interface controller supports 256MB or 512 MB cache memory
  b. 2 GB interface controller supports 1 GB cache memory
- Battery backup for cache data:
  a. 3 days (72 hrs) for controllers with 1 GB interface
  b. 7 days (168 hours) for controllers 2 GB interface
- Redundant, hot-swappable power supplies
- Redundant, hot-swappable, cooling fans
- One to four front-end minihubs per controller enclosure
- Two host connections per front-end minihub (direct attachment only)[1]
- Four host ports per RAID controller (via 2 front end minihubs)

- Supports point-to-point, switch and arbitrated loop topologies
- One to four back-end minihubs per controller enclosure
- Four Fibre Channel drive interfaces with two sets of redundant loops
- Two Ethernet interfaces per controller enclosure for controller management
- Audible alarm (controlled through an enable/disable switch)
- Fault and Status LEDs

Drive Enclosure

The drive enclosures have the following features:

- Three rack units high (1 rack unit = 1.75 inches)
- Up to ten hot-pluggable dual-ported Fibre Channel drives (FC-AL)
- Supports 1.6" and 1" drive form factors
- Fault and Activity indicators
- Redundant hot-pluggable power supplies
- Redundant hot pluggable Environmental Service Modules (ESMs)
- Redundant cooling fans
- GBIC drive enclosure interfaces

[1] If connecting the minihub to a host via a switch, only one minihub connector can be attached to each switch.

The Controller Enclosure

The TP9400 controller enclosure is a high-performance unit that provides dual, redundant controller boards and Fibre Channel interfaces to both the host and drive channels.

Designed to provide maximum host- and drive-side redundancy, the controller enclosure supports direct attachment of up to four hosts containing two single-port host adapters each.

A controller enclosure contains the following replaceable components:

- Redundant controller canisters
- Battery canister
- Redundant fan canisters
- Redundant power supply canisters
- A fan/communications canister
- Fibre Channel interface minihub canisters (GBIC and SFP)
- Ethernet and RS-232 interface connectors

Important: Several references are made in this chapter to the storage management software (TPSSM7). For complete information on the operation and use of this software, please refer to the document titled *Total Performance Storage System Manager 7* (TPSSM7) (860-0283-00X).

Front View

The front of the controller enclosure has the following components (Figure 2-1):

- **Front cover** — A removable cover with holes for viewing the status lights and slots for air circulation.

- **Battery canister** — One removable canister that contains batteries and battery charger circuitry.
- **Controller fan canister** — One removable canister that contains two cooling fans.
- **Controller canisters —** Two removable canisters, each contains one controller.

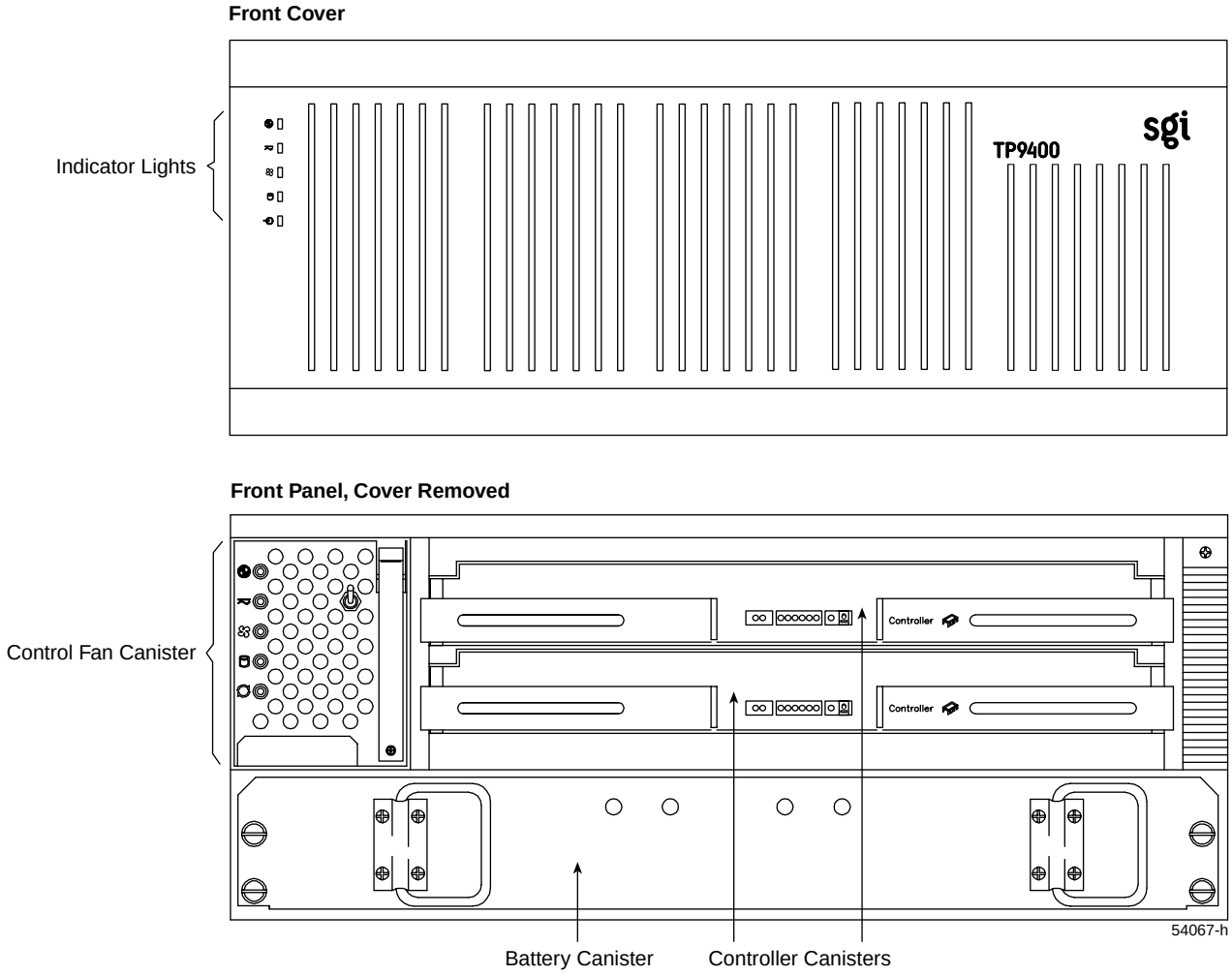

Figure 2-1 Front View of the Controller Enclosure

Rear View

The rear of the controller enclosure has the following components (Figure 2-2):

- **Host and drive interface minihubs —** Up to eight removable GBIC or SFP minihubs for connecting fiber optic host and drive interface cables to the controller enclosure.
- **Fan/communications canister** — One removable canister that contains two cooling fans and ethernet connections.
- **Power supply canisters** — Two removable canisters that contain the power supplies.

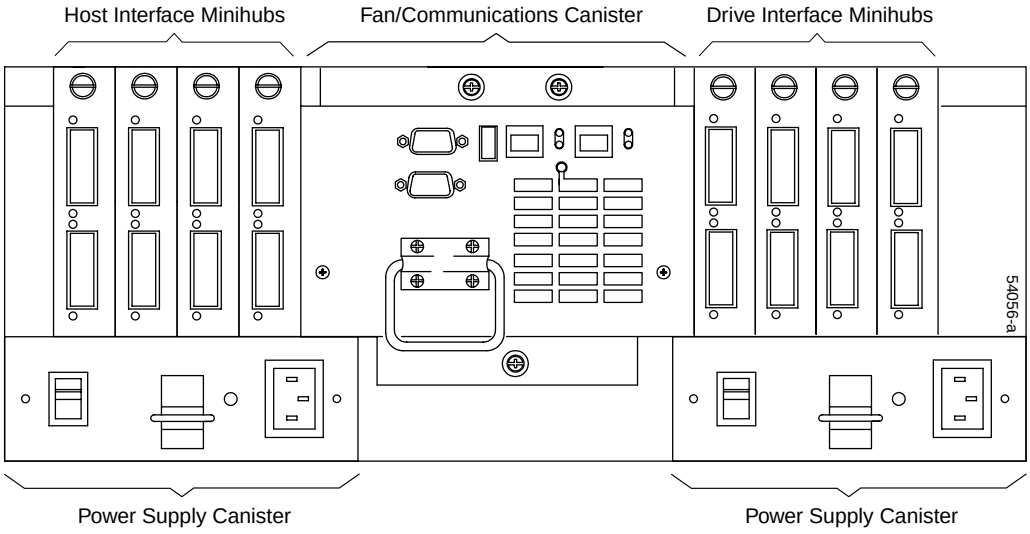

Figure 2-2 Rear View of the Controller Enclosure

Note: The minihubs pictured in Figure 2-2 are GBIC minihubs.

Controller Enclosure Interface Components

The rear of the controller enclosure can accommodate up to eight minihub canisters: Up to four front end (host) and up to four back end (drive) minihubs (Figure 2-3). Each minihub has two Fibre Channel connectors. You connect the host- or drive-interface cables to the respective minihubs. For more information on these connectors, see the sections “Diagnostic Interface Connectors” on page 19, “Host Interface Connectors” on page 24, and “Drive Interface Connectors” on page 25.

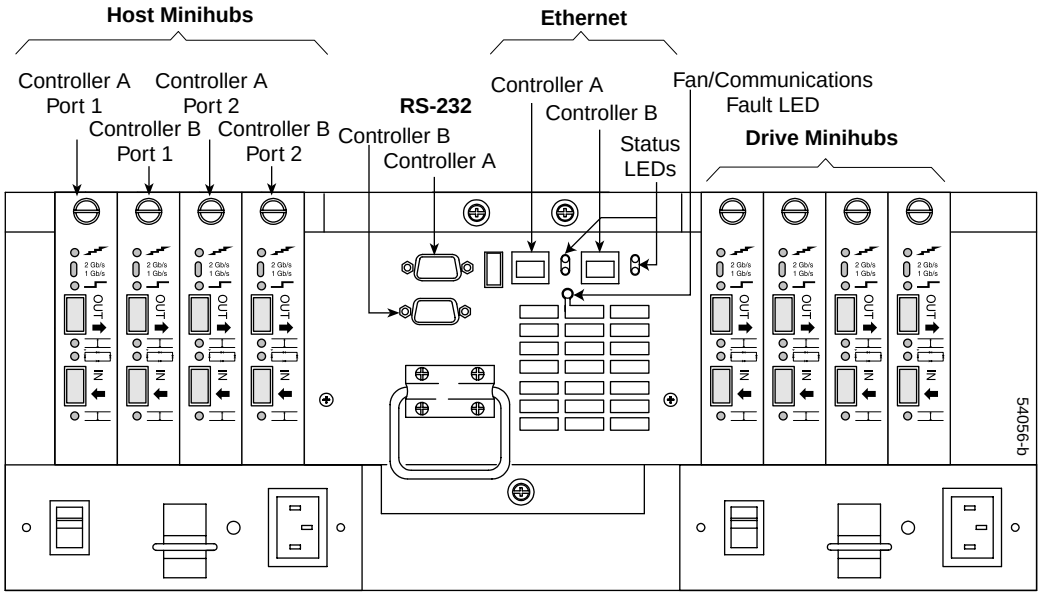

Figure 2-3 TP9400 Interface Components

Note: The minihubs shown in Figure 2-3 are SFP minihubs. The basic interface connections are the same for GBIC and SFP minihubs.

For information about replacing these components, refer to Chapter 4, “Controller Enclosure Component Replacement Procedures”.

Minihub Types

The TP9400 uses two types of minihubs: GBIC and SFP.

GBIC Minihubs

GBIC minihubs are used with 1 GB interface controllers. Each minihub requires 2 GBIC modules, which are installed in the Fibre Channel connectors, as shown in Figure 2-4. GBIC minihubs have a maximum data transfer rate of 1 GB/s.

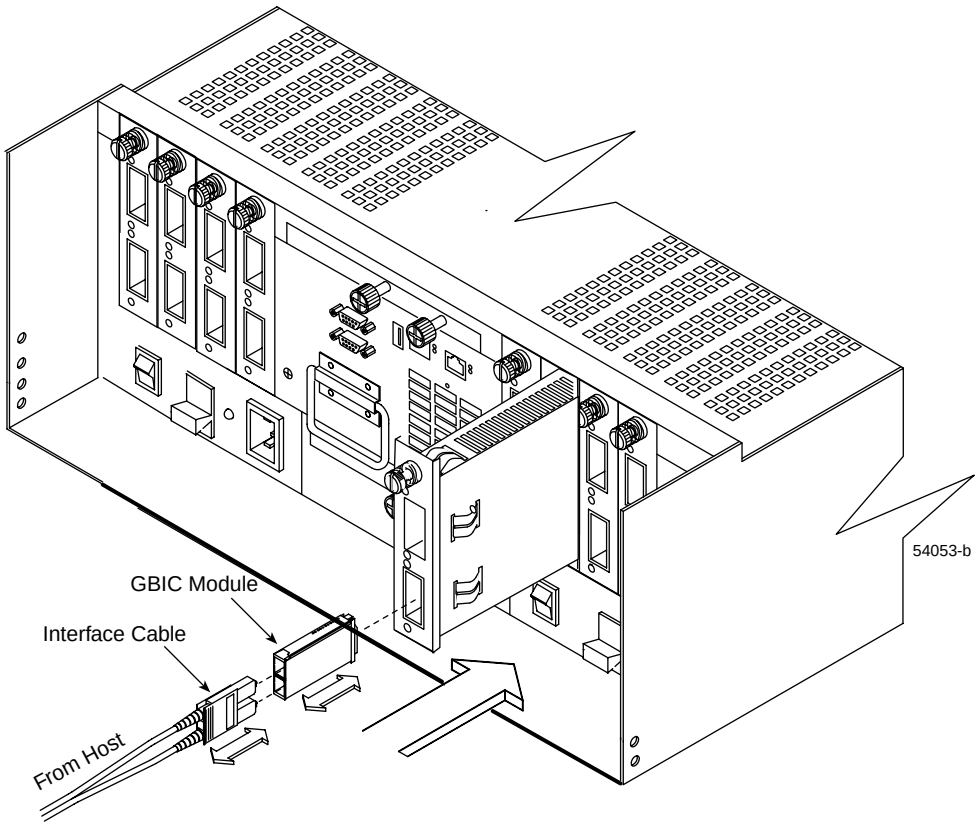

Figure 2-4 GBIC Minihub with GBIC Module

SFP Minihubs

SFP Minihubs are used with 2 GB interface controllers. Each SFP minihub requires 2 SFP transceivers, which are inserted in the Fibre Channel connections. Refer to Figure 2-5.

Note: You may be required to remove the lower SFP from the minihub in some configurations. Refer to for more information.

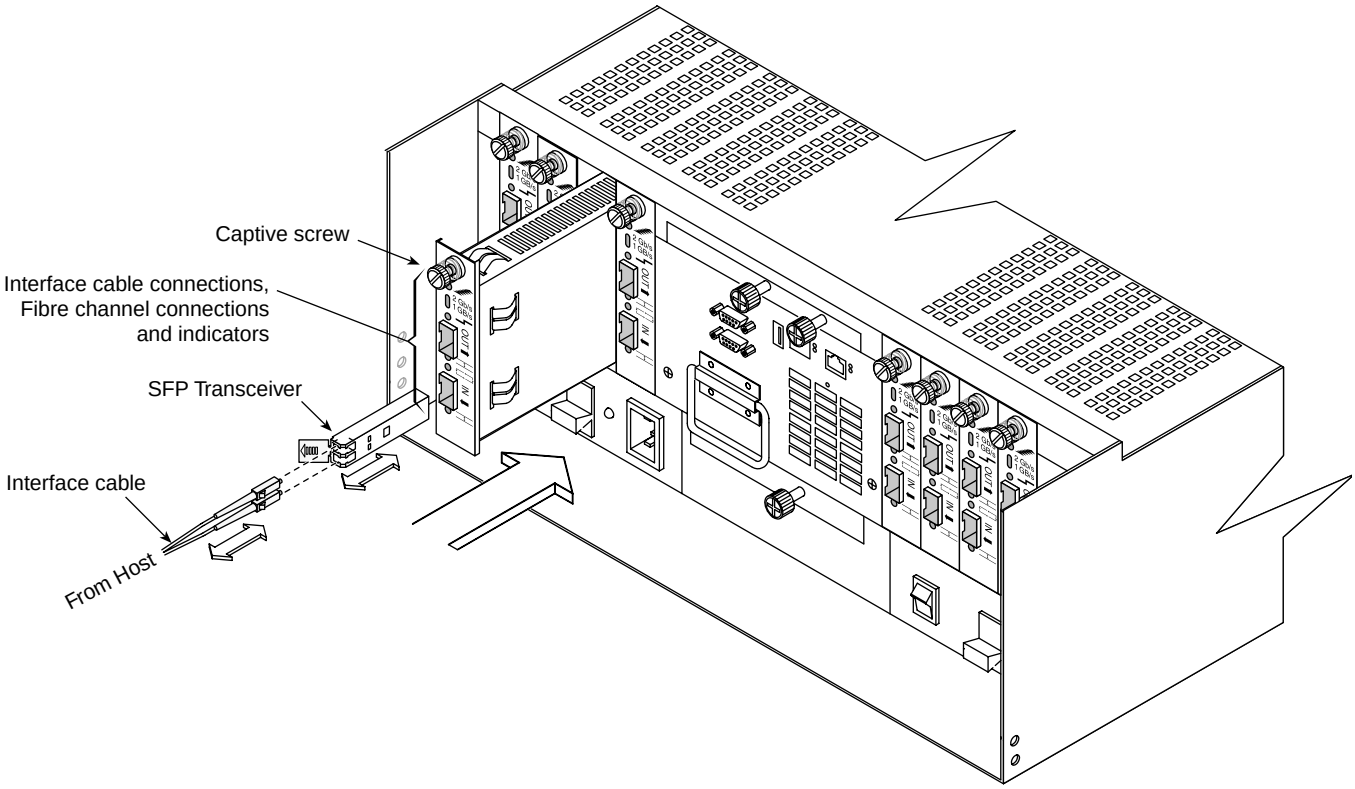

Figure 2-5 SFP Minihub with SFP Transceiver

Controller Enclosure Components

The controller enclosure has owner-removable and replaceable components called "canisters." Following are descriptions of each of these components.

Controller Canister

Each controller comes in a removable, portable unit, called a controller canister (Figure 2-6). The controller canisters slide into one of two controller slots on the front of the controller enclosure and attach to hosts via 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 canister has ten indicators: one Power, one Fault, and six Status indicators.

There are two types of controllers: 1 GB interface controllers and 2 GB interface controllers. The only difference between these two types of controllers is the speed which they operate at. They are physically identical, so you must use the part number on your controller canister to determine what type of controller you have.

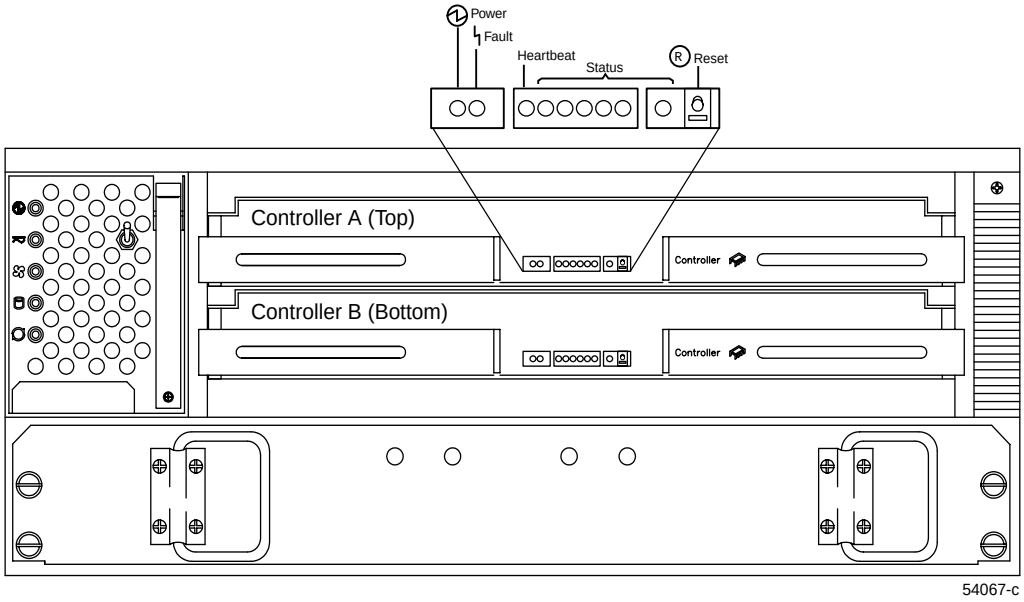

Figure 2-6 Redundant Controllers and Indicator Lights

The controller enclosure supports one or two controller canisters, which attach to hosts via Fibre Channel connections. When using a single-controller array, the controller must be installed in slot A.

You can hot swap a failed controller canister, replacing it while the controller enclosure 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 (TPSSM7).

If cache mirroring is enabled in redundant controllers and one controller fails, the second controller will assume processing functions without data loss. However, some or all data may be lost if cache mirroring is disabled and a failure occurs before data can be written from cache memory to disk.

If you replace the controller canister and continue to experience problems, the controller enclosure may have defective components or connections. Check the storage management software (TPSSM7) for indications of other component failures.

If a controller canister fails, the Controller Fault indicator on the affected controller canister will glow. For more information about indicators, see "Checking the Controller Enclosure Indicator Lights" on page 36.

When you replace a failed controller, and if certain NVSRAM bits are set, the firmware on the new controller is automatically synchronized with the firmware on the second controller (the one currently managing the array) controller. This ensures that the controller firmware level is the same on both controllers after a replacement. You do not have to download new controller firmware after replacing the controller. See the storage management software (TPSSM7) for information on these bit settings on your system.

The Controller Fault indicator blinks while the firmware is being synchronized. The status indicators on the controller blink in a moving pattern to indicate a serial download. Do not remove the controller until the automatic synchronize process completes.

Warning: Avoid damaging the controller. If the controller is removed or if power is interrupted before synchronization is complete, the controller being updated may fail, and you will need to replace it.

Battery Canister

The battery canister houses rechargeable batteries and a battery charger board. The battery canister plugs into the front of the controller enclosure (Figure 2-7). The battery provides backup power only to the controllers' cache memory. All data stored in memory will be preserved as long as the batteries can sustain power to the cache memory. However, the battery will not provide power to the rest of the system during a power outage. Controllers with the 1 GB interface can store data in cache for up to 3 days. Controllers with the 2 GB interface can store data in cache for up to 7 days. The system will not be able to write I/O to the drive enclosures without a backup power source, such as an Uninterruptible Power Supply (UPS).

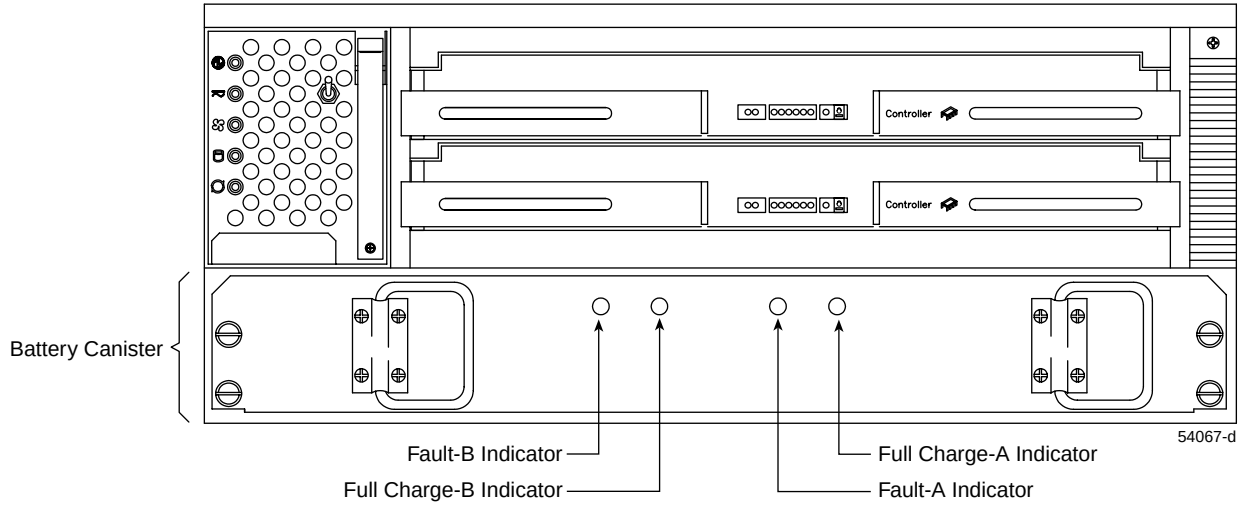

Figure 2-7 Battery Canister

The batteries inside the battery canister have a two-year life expectancy. Replace the battery canister every two years or whenever it fails to hold a charge. Using the controller enclosure in a hot environment (above 35° C or 95° F) lowers the life expectancy of the battery canister. Under these conditions, you may need to replace the battery more often.

The service label on the battery canister provides a blank line for recording the last date on which the battery was serviced (see Figure 3-8 on page 45). Check this label to determine when to replace the canister. See the storage management software (TPSSM7) for information about using the software to track battery age.

You can hot swap the battery canister, replacing it while the controller enclosure is in operation, however, use the TPSSM7 storage management software to make sure that there is no data in cache and that all caching is stopped before you remove a battery canister. Data in cache is unprotected if a power outage occurs while the battery canister is out of operation.

If a battery fails, the fault indicator on the battery canister will glow. For more information about indicators, see "Checking the Controller Enclosure Indicator Lights" on page 36.

If you replace the battery canister and continue to experience battery problems (such as a loss of battery power to the controllers or batteries not charging properly), the controller enclosure may have defective components or connections. Check the storage management software (TPSSM7) for indications of other component failures.

Controller Fan Canister

The controller fan canister is a single, removable unit containing two cooling fans and temperature monitoring logic. The controller fan plugs directly into a slot on the front of the controller enclosure, to the left of the controllers (Figure 2-8). The fan has a lever and a handle for easy removal. Five indicators provide overall system status information (Figure 4-8 on page 60). The dual fans in the fan canister provide a redundant cooling system to both controller canisters. If one fan fails, the other will continue to operate, providing sufficient air circulation to prevent the controllers from overheating until you can replace the entire controller fan canister.

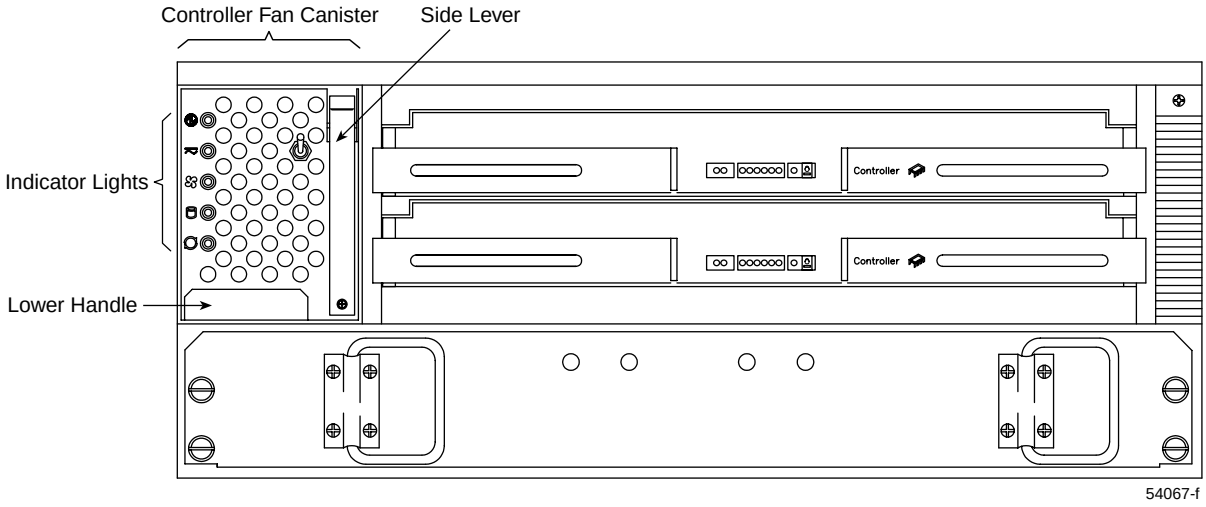

Figure 2-8 Controller Fan Canister

To prevent cooling problems, the controller enclosure 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 enclosure to overheat. Also, make sure that the ambient air temperature around the controller enclosure is within the environmental requirements. To boost air circulation, the controller enclosure has air vents along its top and sides (Figure 2-9). These vents serve as air intake and exhaust passages. Always keep vents clean and free of obstructions.

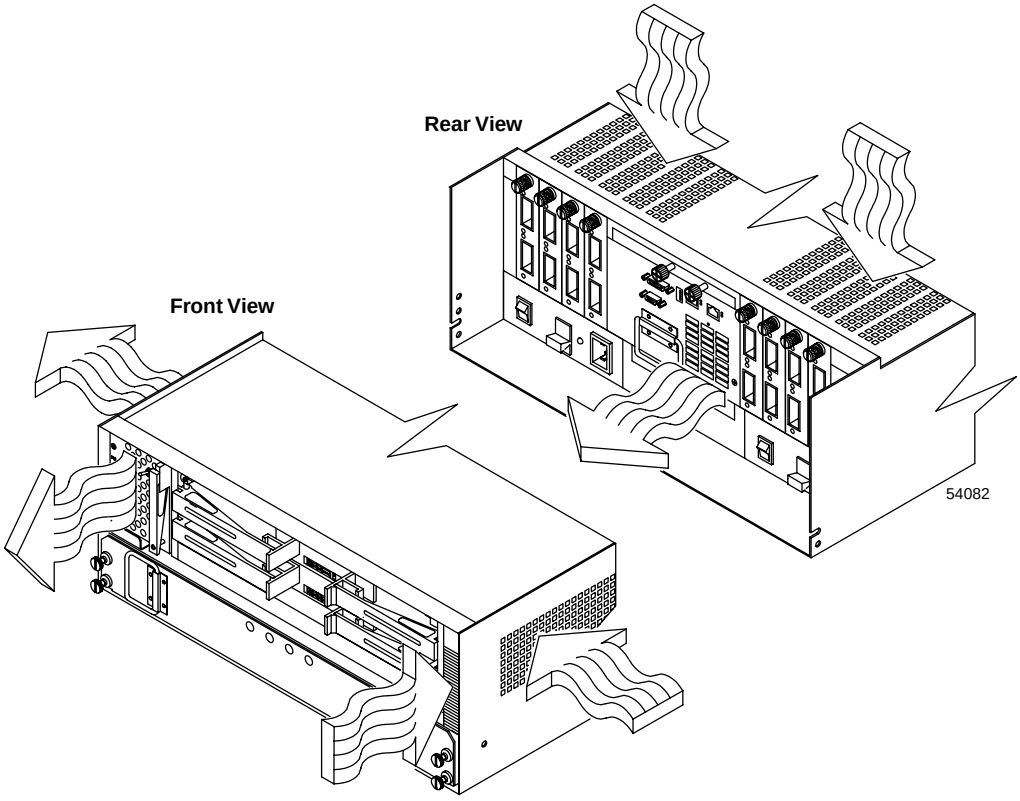

Figure 2-9 Controller Enclosure Air Flow

Both fans failing simultaneously in the controller fan canister is unlikely. Such a failure would cause either one or both controllers to overheat. Under these circumstances, the amber controller indicator on the front may turn on. Shut down the controller enclosure immediately and let the unit cool to room temperature and replace the controller fan.

You can hot swap the controller fan canister, replacing it while the controller enclosure is in operation, as long as you complete the exchange within 15 minutes. The time limit only applies to the total time that the fan canister is out of the chassis. The time begins when you remove the failed canister and ends when you re-seat the new one. This does not include the time it takes you to perform the entire procedure (for example, checking indicators).

If a fan fails, the fault indicator on the fan canister will glow. For more information about indicators, see “Checking the Controller Enclosure Indicator Lights” on page 36.

If you replace the fan canister and continue to experience problems, the controller enclosure may have defective components or connections. Check the storage management software (TPSSM7) for indications of other component failures.

Fan/Communications Canister

The fan/communications canister is a single, removable unit containing two cooling fans. This canister plugs into a slot at the center at the rear of the controller enclosure, just above the power supplies (Figure 2-10). The fan/communications canister has three captive screws and a pull ring for securing and removing the canister. The canister contains dual fans that provide a redundant cooling system to both power supply canisters. If one fan within the canister fails, the other will continue to operate. A single fan will provide sufficient air circulation to prevent the power supplies from overheating until you can replace the entire fan/communications canister.

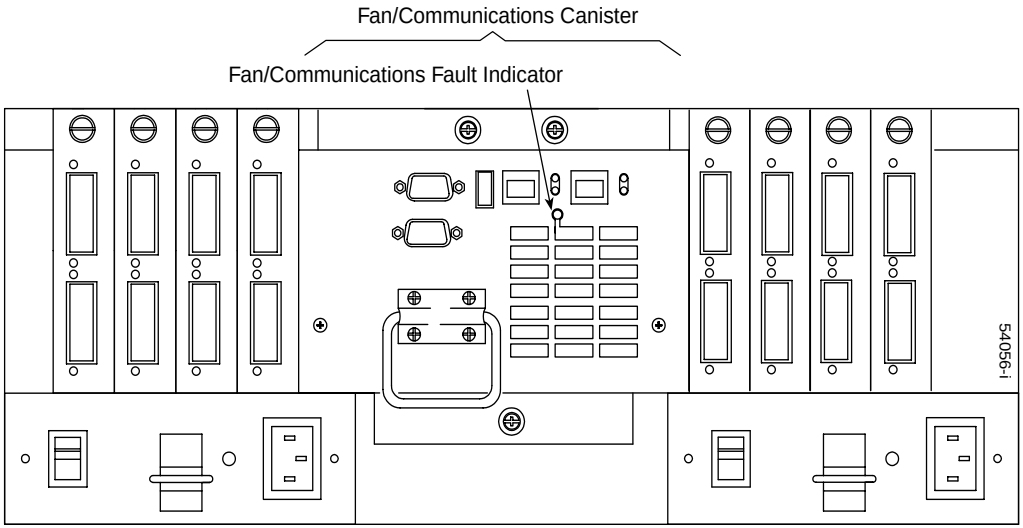

Figure 2-10 Fan/Communications Canister and Fault Indicator

You can hot swap the fan/communications canister, replacing it while the controller enclosure is in operation, as long as you complete the exchange within 15 minutes from the time you remove the failed unit until you seat the new one.

It is unlikely that both fans in the fan/communications canister would fail simultaneously. Such a failure would cause one or both power supplies to overheat. In these circumstances, the amber Power Supply Fault indicator on the front cover turns on and the overheated power supply automatically shuts down (its green Power Supply indicator turns off). Once the ambient air temperature cools below 70º C (158º F), the power supply automatically turns on. Replace the failed fan/communications canister, then check the indicators (Power Supply Fault indicator on the front and Power Supply indicator at the rear). If the Power Supply Fault indicator remains on, replace the power supply. For more information about indicators, see "Checking the Controller Enclosure Indicator Lights" on page 36.

If you replace the fan/communications canister and continue to experience problems, the controller enclosure may have defective components or connections. Check the storage management software (TPSSM7) for indications of other component failures.

Diagnostic Interface Connectors

The fan/communications canister has two Ethernet (RJ-45) connectors, one for Controller A and one for Controller B (Figure 2-11). The Ethernet connectors are used to manage the storage arrays directly from a remote management station. The canister also has two serial (RS-232) connectors, one for Controller A and one for Controller B. These connectors are used to diagnose problems, using storage management software (TPSSM7) or other diagnostic tools. (The RS-232 connector is primarily intended for use by SGI field personnel.)

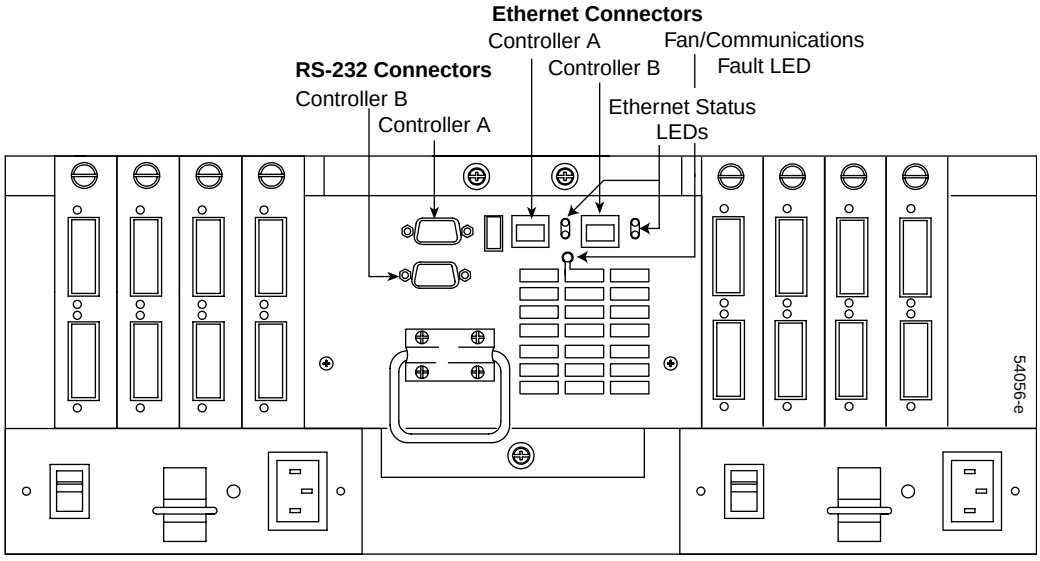

Figure 2-11 Controller Enclosure Diagnostic Interface Connectors (Rear)

Power Supply Canister

The controller enclosure's power system consists of two power supply canisters. The canisters slide into either of the two slots at the rear of the controller enclosure (Figure 2-12). The power supply canisters 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 enclosure if the other power supply is turned off or malfunctions.

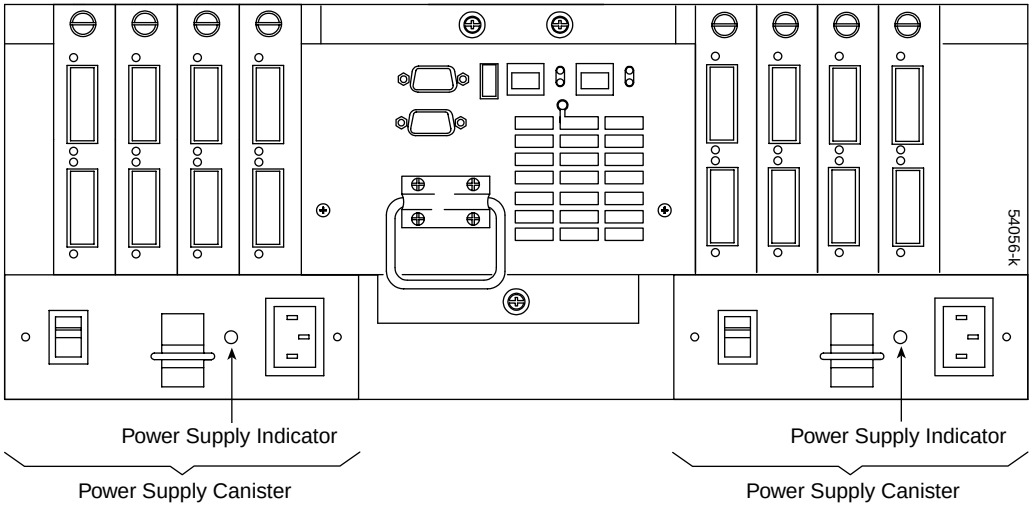

Figure 2-12 Power Supplies and Indicators

Both power supply canisters have 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 will shut down. All power remains off until one of the following occurs:

- You cycle the power switches (turn the power switches off, then turn them back on). See "Overtemp Condition and Power Supply Shutdown" on page 31 for more information on recovering from an overtemp condition.
- The power supplies automatically resume operation when the ambient air temperature cools to below 70º C (158º F). When the power supplies automatically resume operation, the controller also will resume operation.

After one of these occurs, then 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 enclosure to normal operation without operator intervention.

Because the two power supplies provide redundancy, you can hot swap a failed power supply, replacing it while the controller enclosure is in operation.

Note: An abrupt power loss to the controller enclosure can cause data corruption, especially if the power loss occurred when data was being downloaded to cache memory or written to disk. If a sudden power loss causes data corruption, you may need to use the storage management software (TPSSM7) to recover the data.

If a power supply fails, the green Power Supply indicator on the power supply will be off and the amber Power Supply Fault indicator on the controller fan canister on the front of the controller enclosure will glow. If both power supplies fail, the fault indicator cannot come on. For more information about indicators, see "Checking the Controller Enclosure Indicator Lights" on page 36.

If you replace the power supply canister and continue to experience problems, the controller enclosure may have defective components or connections. Check the storage management software (TPSSM7) for indications of other component failures.

Minihub Canister

A minihub canister is an interface card located at the rear of the controller enclosure (Figure 2-13). It is a single, removable unit that provides the Fiber Channel interface between a controller enclosure and hosts and drives. The rear of the controller enclosure can accommodate up to eight interface cards that function as minihubs: up to four host canisters and up to four drive minihub canisters. Each minihub has two Fibre Channel connections. You connect the host-interface or drive-interface cables to the respective minihub.

There are two types of minihubs: GBIC and SFP.

- A GBIC (Gigabit Interface Converter) minihub has two Fibre Channel connectors called GBIC modules. GBIC minihubs are used with 1 GB interface controllers.
- An SFP (Small Form-factor Pluggable) minihub has two Fibre Channel connectors called SFP transceivers. SFP minihubs are used with 2 GB interface controllers.

The minihubs are interchangeable and can be installed on either the host-side or the drive-side. However, you cannot mix different types of minihubs within a controller enclosure.

Note: All minihubs pictured in this section are GBIC minihubs.

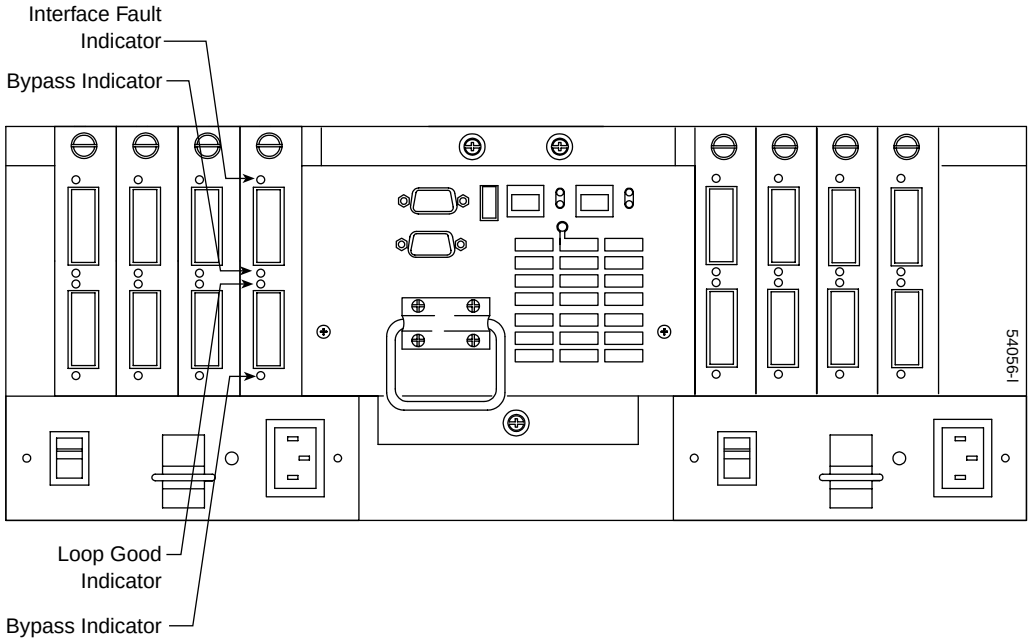

Figure 2-13 Minihub Canister and indicator lights

You can hot swap a failed minihub, replacing it while the controller enclosure is in operation.

Four indicators provide status information. If a minihub fails, the Interface Fault indicator on the minihub canister will glow and the Loop Good indicator will be off. For more information about indicators, see "Checking the Controller Enclosure Indicator Lights" on page 36.

If you replace the minihub canister and continue to experience problems, the controller enclosure may have defective components or connections. Check the storage management software (TPSSM7) for indications of other component failures.

Host Interface Connectors

There are up to four host minihubs, two per controller (Figure 2-14). Minihubs 1 and 3 correspond to the top controller (controller A) and minihubs 2 and 4 correspond to the bottom controller (controller B). Each minihub provides host loop capability and self-diagnostic features. To ensure redundancy, you must connect each host to each controller board.

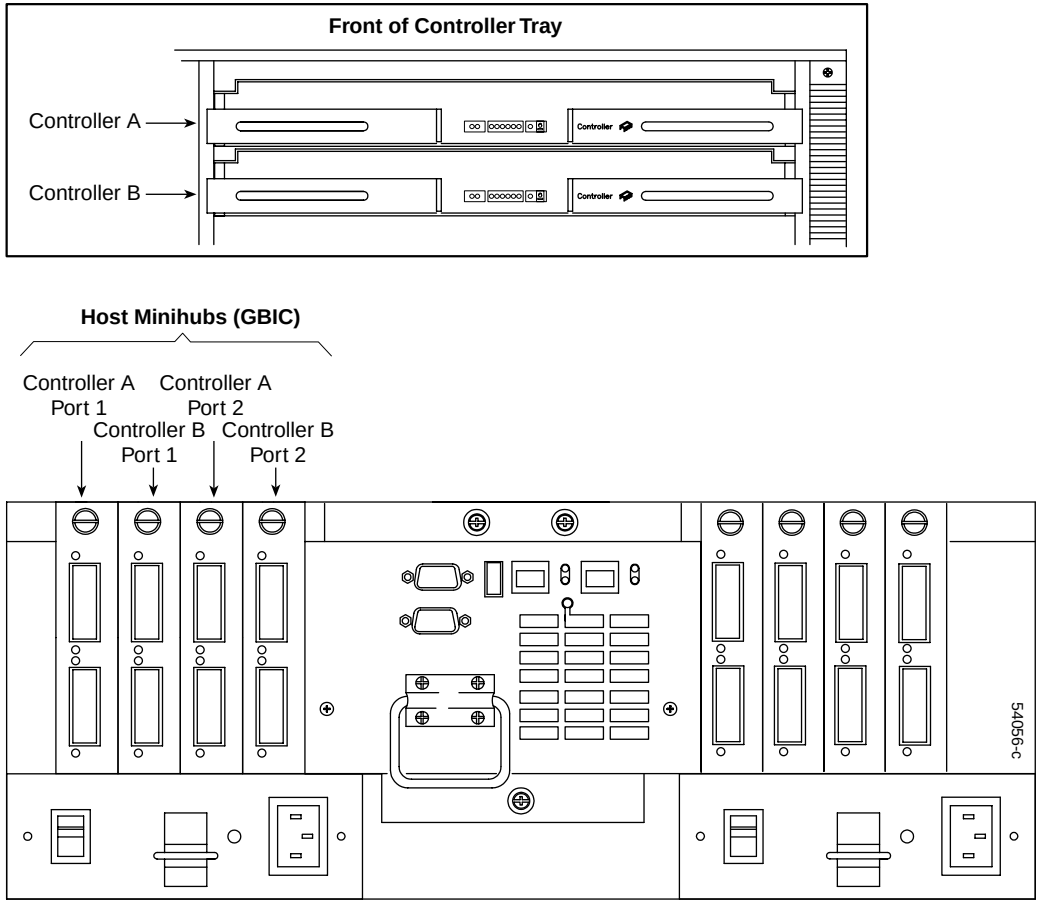

Figure 2-14 Controller Enclosure Host Interface Connectors

Note: Figure 2-14 shows a GBIC host interface. The connectors are in the same locations on an SFP host interface.

Drive Interface Connectors

Each drive minihub canister represents a single drive channel (Figure 2-15). The drive channels are set up in pairs to support two data paths to each drive (redundant drive loop configurations). Each pair supports up to 11 drive enclosures, containing 10 drives each, or up to 110 drives.

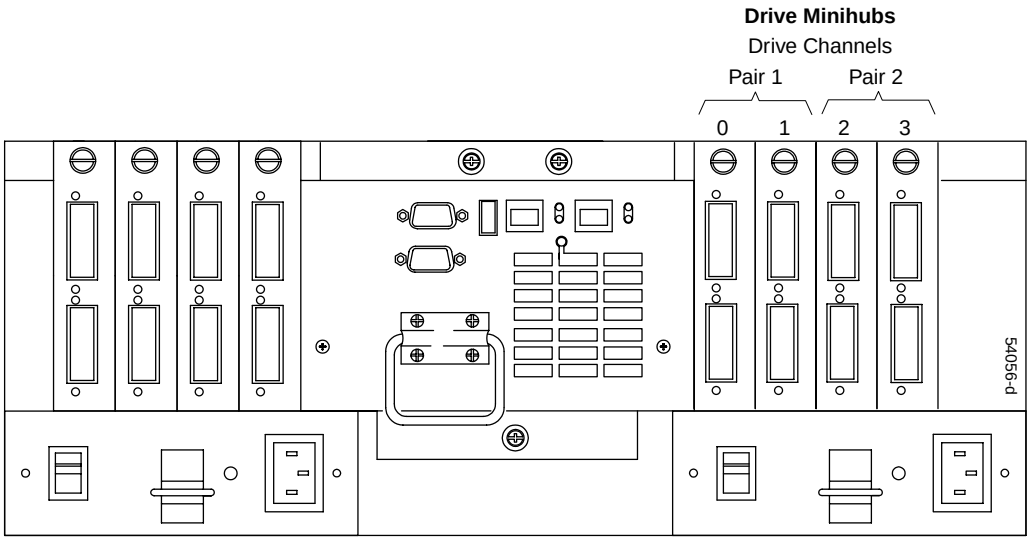

Figure 2-15 Controller Enclosure Drive Minihub Connectors (Rear)

GBIC Module

A GBIC (Gigabit Interface Converter) is a module that fits into the GBIC minihub (interface card) that is located at the rear of the 1 GB interface controller enclosure (Figure 2-16). Each GBIC minihub has two GBIC modules. You connect the host-interface or drive-interface cables to the respective GBIC module, which passes the signal to the minihub.

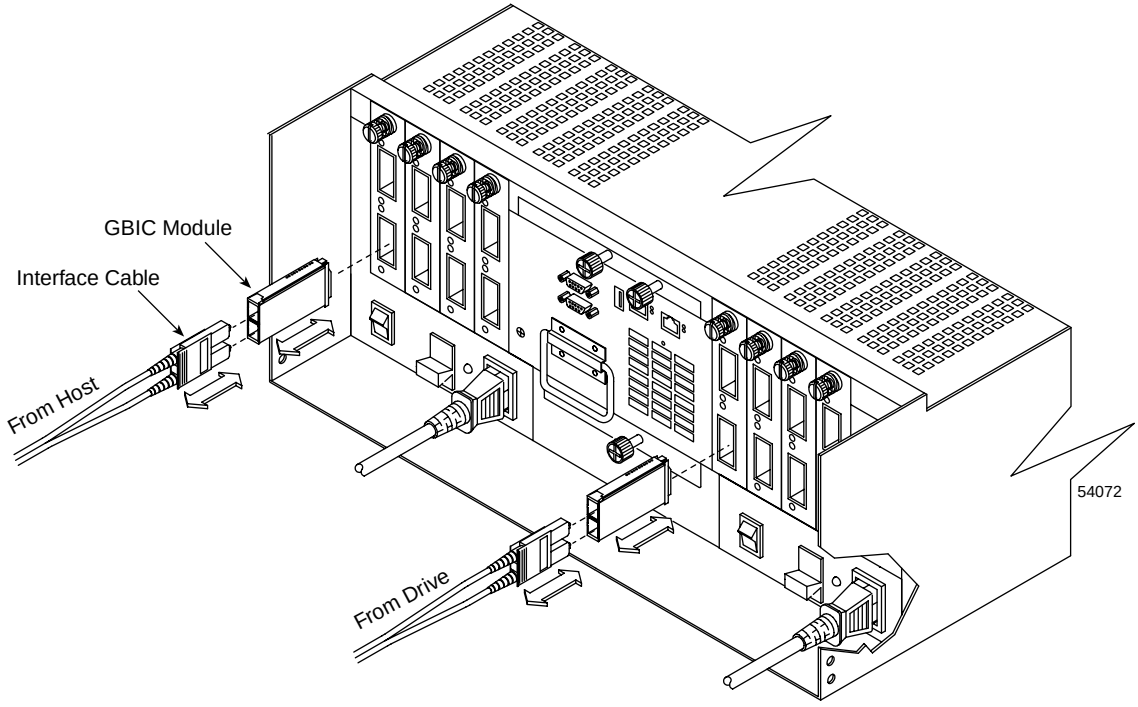

Figure 2-16 Removing and Installing a GBIC Module

You can hot swap a failed GBIC module, replacing it while the controller enclosure is in operation. If you replace the GBIC module and continue to experience problems, the controller enclosure may have defective components or connections. Check the storage management software (TPSSM7) for indications of other component failures.

SFP Transceiver

An SFP (Small Form-factor Pluggable) transceiver is a module that fits into the rear of an SFP minihub located at the rear of the 2 GB controller enclosure (Figure 2-16). Each SFP minihub has two SFP transceivers. You connect the host-interface or drive-interface cables to the respective SFP transceiver, which passes the signal to the minihub.

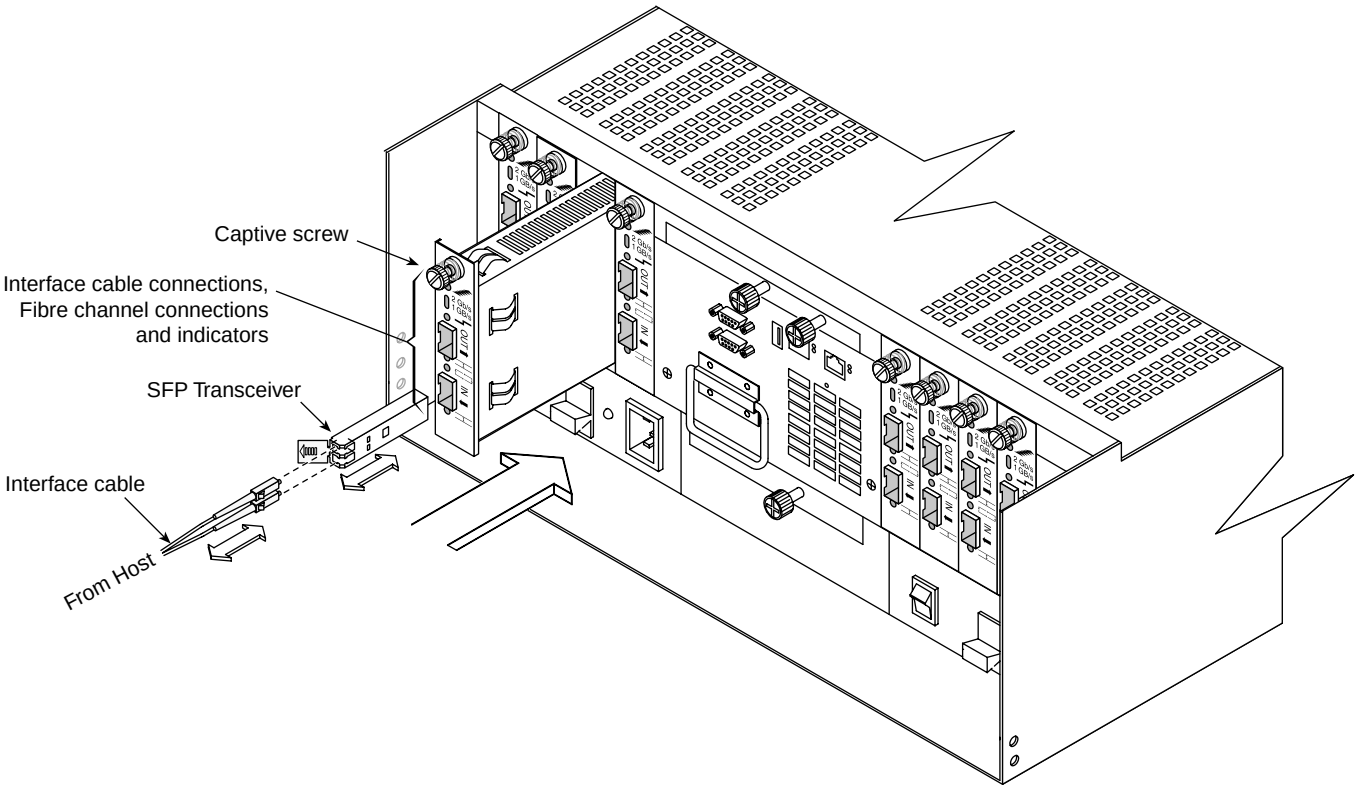

Figure 2-17 Removing and Installing an SFP Transceiver

You can hot swap a failed SFP transceiver, replacing it while the controller enclosure is in operation. If you replace the SFP transceiver and continue to experience problems, the controller enclosure may have defective components or connections. Check the storage management software (TPSSM7) for indications of other component failures.

Controller Enclosure Operation

This chapter describes the operation of the controller enclosure, powering on and off, monitoring the system through software and indicator lights, and moving the controller enclosure to another location.

Accessing the Controller

To access the controller enclosure components, cables, indicator lights, and switches, you must remove the front cover (Figure 3-1).

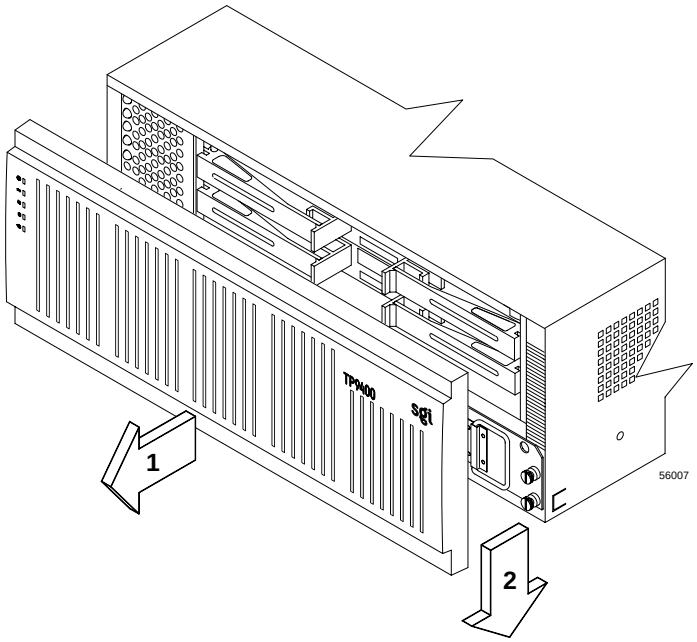

Figure 3-1 Removing the Front Cover of the Controller Enclosure

Turning the Power On

Use this procedure to turn on the controller enclosure power. If you are restoring power to the controller enclosure after an emergency shutdown or power outage, go to "Overtemp Condition and Power Supply Shutdown" on page 31.

Note: To speed drive spin-up, start the drive enclosures before or at the same time as the controller enclosure. If you plan to use the main breaker to turn on all enclosures at the same time, make sure the switches on each drive enclosure and each controller enclosure are on before turning on the main breaker. For instructions on powering-up the drive enclosures, refer to the drive enclosure documentation.

Caution: Bending or damaging Fibre Channel cables can result in degraded performance or data loss. Fibre Channel cables are fragile and can break easily. Handle the cables carefully when removing the rear cover of a deskside unit. Do not pinch them with tie wraps, step on them, or bend them at sharp angles.

1. Remove the rear access panel on the rack.

Warning: Risk of electrical shock! Never turn on the power to any equipment if there is evidence of fire, water, or structural damage. If there is evidence of damage, call the factory or appropriate service organization for assistance. Depending on the current service agreements, you may or may not need to return the unit for repair/replacement.

2. Turn on both power switches on the rear of the controller enclosure (Figure 3-2). You must turn on both switches to take advantage of the redundant power supplies. Then, go to "Checking the Controller Enclosure Indicator Lights" on page 36.

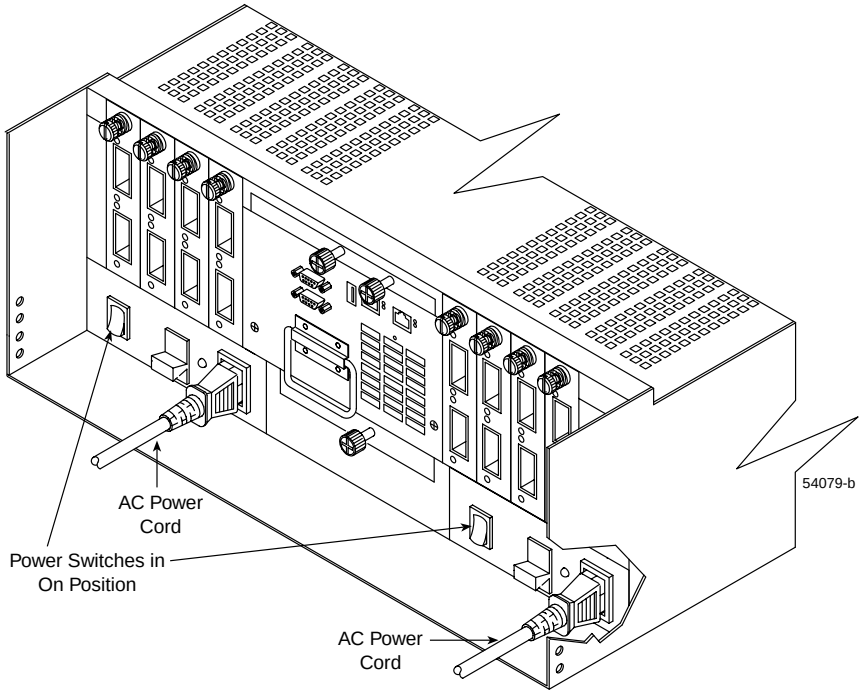

Figure 3-2 Turning the Power On

Wait until the controller enclosure completes its power up before checking for faults. In 1 GB interface controller enclosures, it may take up to 15 minutes for the battery canister to complete its self test and up to six hours to fully charge. In 2 GB interface controller enclosures, it may take up to 30 minutes for the battery canister to complete its self test and up to twelve hours to fully charge.While the battery is charging, both the Full Charge-A and the Full Charge-B indicators will blink. When the battery is fully charged, these two indicators will glow steady green.

Overtemp Condition and Power Supply Shutdown

If the fan/communications canister fails or is unable to maintain an internal temperature below 70° C (158° F), one or both of the power supplies in the controller enclosure may shut down (Figure 3-3). If both power supplies shut down, the controller enclosure is inoperable.

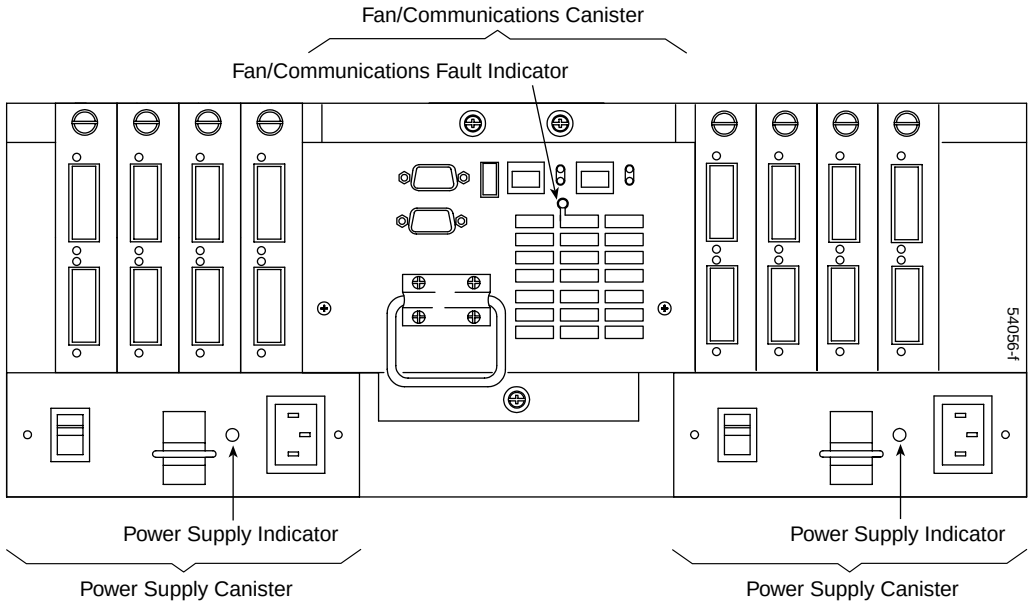

Figure 3-3 Fan/Communications and Power Supply Indicators (Rear)

The storage management software (TPSSM7) will warn you if the temperature of the controller enclosure is rising, before it has risen sufficiently to shut down the power supplies. The warning comes when the enclosure temperature exceeds 45° C (113° F). The enclosure shuts down if the temperature rises to 70° C (158° F).

The Controller Fan Fault indicator (Figure 3-4) comes on if the temperature reaches 45° C (113° F). If both power supplies shut down, the fault indicator cannot come on.

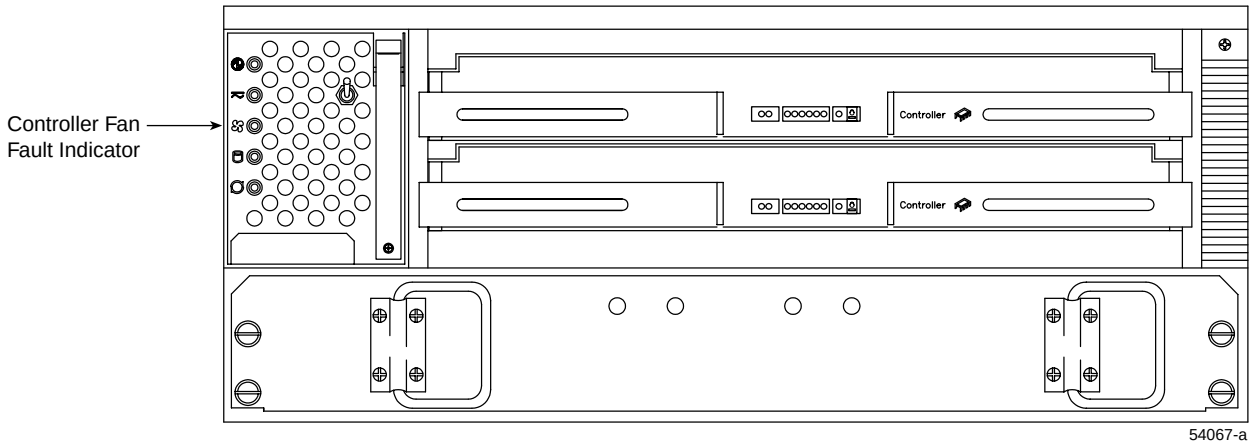

Figure 3-4 Controller Fan Fault Indicator (Front)

Turning the Power On After an Overtemp Shutdown

Use this procedure to regain normal system operation after a power supply shutdown.

1. If your controller enclosure shuts down unexpectedly, use the storage management software (TPSSM7) to determine if the controller enclosure has overheated. If an overtemp shutdown is indicated, continue with the following steps.
2. Remove the rear access panel on the rack.
3. Turn off the power switches and do whatever is necessary to cool the controller enclosure (replace the fans, use external fans to cool the room, and so on).

Warning: Risk of electrical shock! Never turn on the power to any equipment if there is evidence of fire, water, or structural damage. If there is evidence of damage, call the factory or appropriate service organization for assistance. Depending on the current service agreements, you may or may not need to return the unit for repair/replacement.

4. Once the air temperature is below the upper operating temperature of 45° C (113° F), turn on both power switches on the rear of the controller enclosure (Figure 3-2). You must turn on both switches to take advantage of the redundant power supplies. Then, go to "Checking the Controller Enclosure Indicator Lights" on page 36.

Turning the Power On 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, remove the rear access panel on the rack and check all components and cables for damage.

Warning: Risk of electrical shock! Never turn on the power to any equipment if there is evidence of fire, water, or structural damage. If there is evidence of damage, call the factory or appropriate service organization for assistance. Depending on the current service agreements, you may or may not need to return the unit for repair/replacement.

Note: To speed drive spin-up, it is recommended that you start the drive enclosures before or at the same time as the controller enclosure. 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 enclosure are on before turning on the main breaker. For instructions on powering-up the drive enclosures, refer to the drive enclosure documentation.

2. Turn on the power (Figure 3-2 on page 31).
   a. If only the rack power is off, check the circuit breaker in the rack and make certain it is on.
   b. Turn on the power switches on all drive enclosures attached to the controller enclosure.
   c. Turn on both power switches on the rear of the controller enclosure (Figure 3-2). You must turn on both switches to take advantage of the redundant power supplies. Then, go to “Checking the Controller Enclosure Indicator Lights” on page 36.

Turning the Power Off

Use this procedure to turn off the controller enclosure power. The controller enclosure is designed to run continuously, 24 hours a day. Once you turn on the controller enclosure, it should remain on except during certain service procedures.

Caution: Avoid possible data corruption. Except in an emergency, never turn off the power if any controller enclosure fault indicators are on. Always correct the fault first by using the proper troubleshooting or servicing procedure. For guidance, refer to the storage management software (TPSSM7) or see "Checking the Controller Enclosure Indicator Lights" on page 36.

1. Remove the rear access panel on the rack.
2. Prepare the controller enclosure for shutdown.
   a. Stop all I/O activity to the controller enclosure and attached drive enclosures. Logically disconnect the controller and drive enclosures from the hosts. Make sure that the Fast Write Cache indicator on the front cover of each controller enclosure and all applicable Active indicators on the front cover of each drive enclosure are off (not blinking).

      Note: If a parity check is in progress, it may take hours or days for the drive indicators to stop blinking.)

   b. Make sure that all amber fault indicators on the controller enclosure are off. If any fault indicators are on, correct the problem before turning off the power (see "Checking the Controller Enclosure Indicator Lights" on page 36).
3. Turn off the power switches on the rear of the controller enclosure (Figure 3-2).
4. Turn off the rack's main circuit breakers or power switches.

Monitoring Status through Software

Use the storage management software (TPSSM7) to monitor controller enclosure status. You should run the software constantly and check it frequently.

The storage management software (TPSSM7) provides the best way to diagnose and repair controller enclosure 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 enclosure has fault indicators, these lights do not necessarily indicate which component has failed or needs to be replaced, or which type of recovery procedure you must perform. In some cases (such as loss of redundancy in various controller enclosure components), the fault light does not even come on. Only the storage management software (TPSSM7) can detect the failure.

In addition, recovering from a controller enclosure failure may require that you perform procedures other than replacing the component. The storage management software (TPSSM7) will explain these procedures.

Caution: Not following the software recovery procedures could lead to data loss.

Note: For more information on the storage management software (TPSSM7), see the *SGI TP9400 RAID IRIX Administration Guide* (007-4306-001), the *SGI TP9400 RAID Software Concepts Guide* (007-4305-001), and the *SGI Storage Area Network Installation Instructions* (108-0252-003).

Checking the Controller Enclosure Indicator Lights

It is important that you check all the indicator lights on the front and rear of the controller enclosure when you turn on the power. After you turn on the power, the indicators may blink intermittently. Wait until the controller enclosure completes its power up before checking for faults. Normally, it may take up to 15 minutes for the battery canister to complete its self test and up to 6 hours to fully charge, particularly after an unexpected power loss of more than a few minutes. While the battery is charging, both the Full Charge-A and the Full Charge-B indicators will blink. When the battery is fully charged, these two indicators will glow steadily (Figure 3-5).

1. To view all of the indicators, remove the front cover of the controller enclosure (Figure 3-1 on page 29) and remove the rear access panel on the rack.

   Note: The controller enclosure indicators display the status of the controller enclosure and its components. Green indicator lights mean normal operating status; amber indicators mean a possible failure. If you see an amber indicator, use the storage management software (TPSSM7) to diagnose and repair the problem.

2. Check the indicators on the front of the controller enclosure (“Front Indicator Lights” on page 37).
3. Check the indicators on the rear of the controller enclosure (“Rear Indicator Lights” on page 39).
4. If all indicators show a “normal status,” replace the front cover (Figure 3-1 on page 29). If the indicator lights show a fault, run the storage management software (TPSSM7) to diagnose and repair the problem.

Front Indicator Lights

Figure 3-5 and Table 3-1 describe the indicator lights on the front of the controller enclosure.

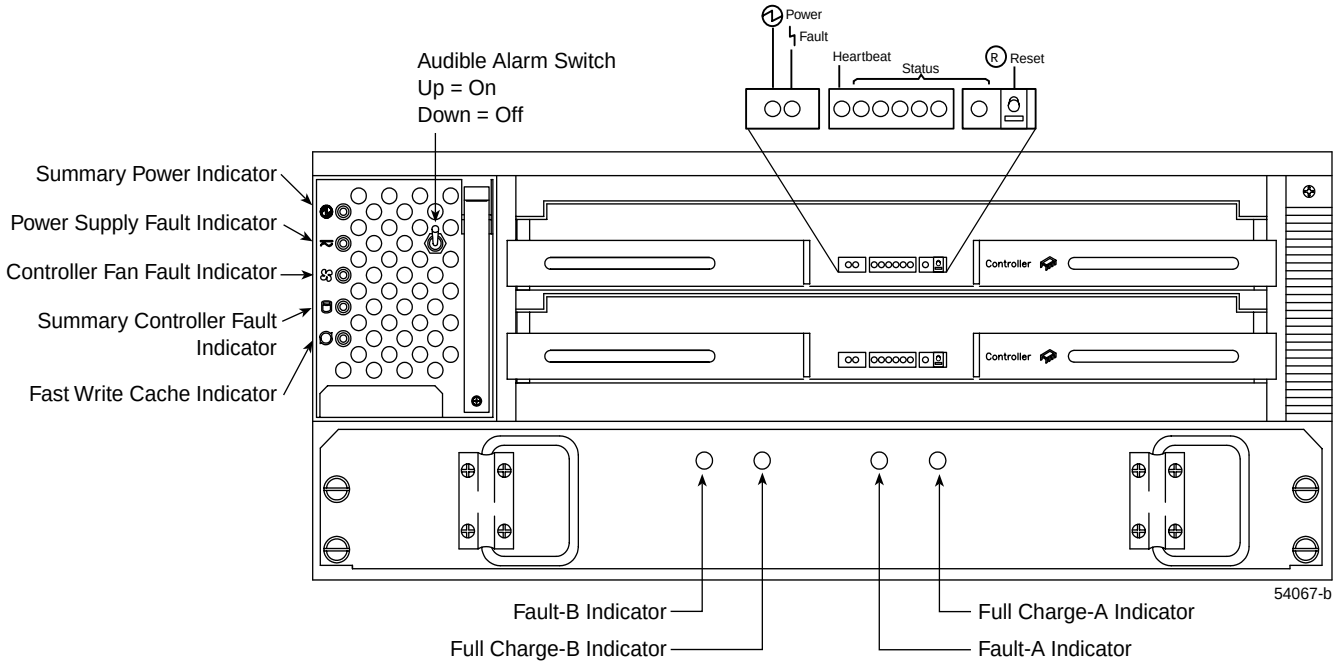

Figure 3-5 Indicator Lights (Front)

Note: You have the option of using the audible alarm to warn you of faults (Figure 3-5). The alarm is turned on (in upward position) when shipped. To disable the alarm, flip the switch to the downward position.

Table 3-1 Indicator Lights (Front)

Component	Indicator Light	Color	Normal Operation	Problem Indicator	Condition Indicated[a]
Controller Canister	Controller Power Indicator	Green	On	Off	Controller enclosure is unplugged or turned off; power supply failure; power supply is installed incorrectly or is missing; overtemp condition.
	Controller Fault Indicator	Amber	Off	On	Controller failure; fault condition on this controller.
	Heartbeat Indicator	Green	Blinking	Not blinking[b]	No controller activity. (This will always blink during normal operation, even when idle.)
Controller Fan Canister	Summary Power Indicator	Green	On	Off	Controller enclosure is unplugged or turned off; power supply failure; power supply is installed incorrectly or is missing; overtemp condition.
	Power Supply Fault Indicator	Amber	Off	On	No power to controller enclosure (all indicator lights are off); power supply is turned off or unplugged; power supply is overheated or failed; power supply is installed incorrectly or is missing.
	Controller Fan Fault Indicator	Amber	Off	On	Fan/communications canister is missing, unplugged, or failed; circuitry failure; controller fan failed; controller fan failure caused one or both controllers to overheat.

Table 3-1 (continued) Indicator Lights (Front)

Component	Indicator Light	Color	Normal Operation	Problem Indicator	Condition Indicated[a]
	Summary Controller Fault Indicator	Amber	Off	On	One controller failed; one or more failed memory modules (SIMMs or DIMMs) on a controller. Note: Check the Controller Fault indicator on each controller to determine which controller failed.
	Fast Write Cache Indicator	Green	Steady or Blinking	Software dependent[c]	Indicator light's normal operation is Off if: - Cache is not enabled - Battery is not ready
Battery Canister	Fault-A or Fault-B Indicator	Amber	Off	On	Left or right battery bank failed; battery is either discharged or defective.
	Full Charge-A or Full Charge-B Indicator	Green	On[d]	Off	Left or right battery bank is not fully charged; power has been off for an extended period and has drained battery power; batteries are weak and battery canister needs to be replaced.

a. Always use the storage management software (TPSSM7) to precisely identify the failure.

b. There are eight status indicators, the Heartbeat and seven others, that flash in various patterns, depending on the controller status.

c. Fast Write Cache indicator blinks only during a fast write operation.

d. If either Full Charge-A or -B indicator blinks, the battery is in the process of charging. This process may take up to 15 minutes.

Rear Indicator Lights

Figure 3-6 and Table 3-2 describe the indicator lights on the rear of a 1 GB interface controller enclosure with GBIC minihubs. Figure 3-7 and Table 3-3 describe the indicator lights on the rear of a 2 GB interface controller enclosure with SFP minihubs.

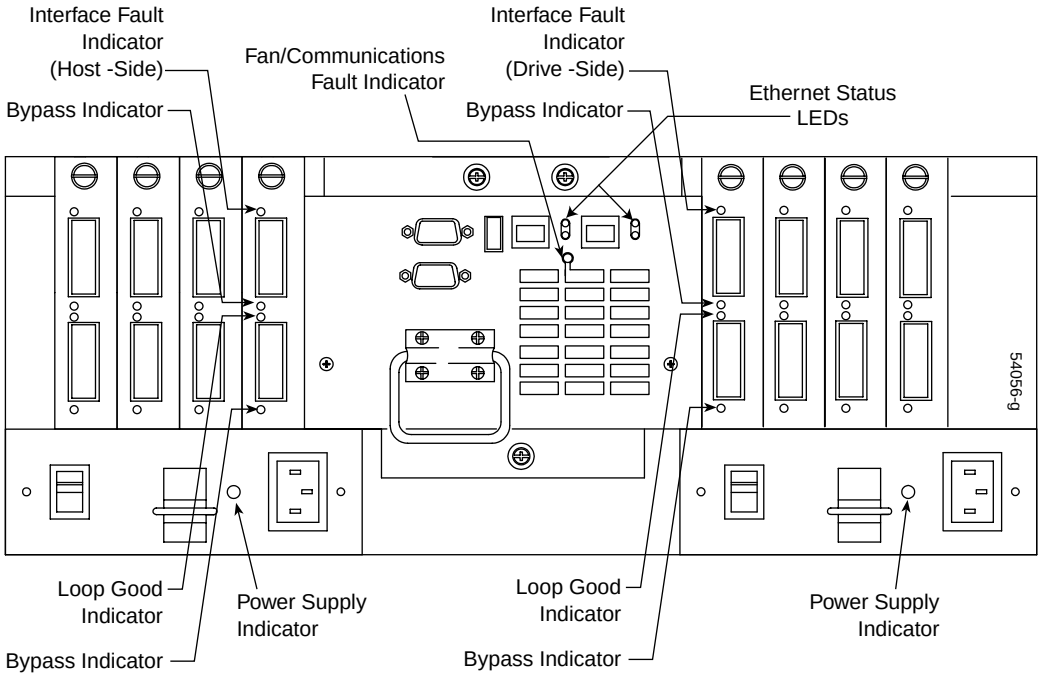

Figure 3-6 1 GB Interface Controller Rear Indicator Lights (GBIC)

Table 3-2 1 GB Interface Controller Rear Indicator Lights (GBIC)

Component	Indicator Light	Color	Normal Operation	Problem Indicator	Condition Indicated[a]
GBIC Interface Minihub Canisters (Host-side)	Interface Fault Indicator	Amber	Off	On	Minihub has failed. If a host-side minihub is not communicating to a controller, this fault light will always be on.
	Bypass Indicator	Amber	Off	On	Minihub has failed; loose, missing, or damaged cables.

Table 3-2 (continued) 1 GB Interface Controller Rear Indicator Lights (GBIC)

Component	Indicator Light	Color	Normal Operation	Problem Indicator	Condition Indicated[a]
	Loop Good Indicator	Green	On	Off	Host loop is not operational; faulty device may be connected to minihub; minihub failure; controller failure; power failure. If a host-side minihub is not connected to a controller, the green light will always be off and the Fault light will always be on.
Fan/Communications Canister	Fan/Comm Fault Indicator	Amber	Off	On	Fan/communications canister has failed or is installed incorrectly.
	100 BT Indicator	Green	N/A	N/A	When lit, controller is operating at 100BT. When off, the controller is running at 10BT. When off, module link light should be on. If both are off, there is a communication fault. **Note:** This light can disabled in the NVSRAM settings.
	Module Link Indicator	Green	N/A	N/A	When lit, controller is operating at 10BT. When not lit and 100 BT indicator is lit, the controller is running at 100BT. If both are off, there is a communication fault. **Note:** This light can disabled in the NVSRAM settings.
GBIC Interface Minihub Canisters (Drive-side)	Interface Fault Indicator	Amber	Off	On	Minihub has failed. If a drive-side minihub is not connected to a controller, this fault light will always be on.
	Bypass Indicator	Amber	Off	On	Minihub has failed; loose, missing, or damaged cables.

Table 3-2 (continued) 1 GB Interface Controller Rear Indicator Lights (GBIC)

Component	Indicator Light	Color	Normal Operation	Problem Indicator	Condition Indicated[a]
	Loop Good Indicator	Green	On	Off	Drive loop is not operational; faulty device may be connected to minihub; minihub failure; drive failure; power failure. If a drive-side minihub is not connected to a controller, the green light will always be off and the Fault light will always be on.
Power Supply Canisters	Power Supply Indicator	Green	On	Off	Power switch is off; power cord unplugged; power supply failure; power supply is overheated.

a. Always use the storage management software (TPSSM7) to precisely identify the failure.

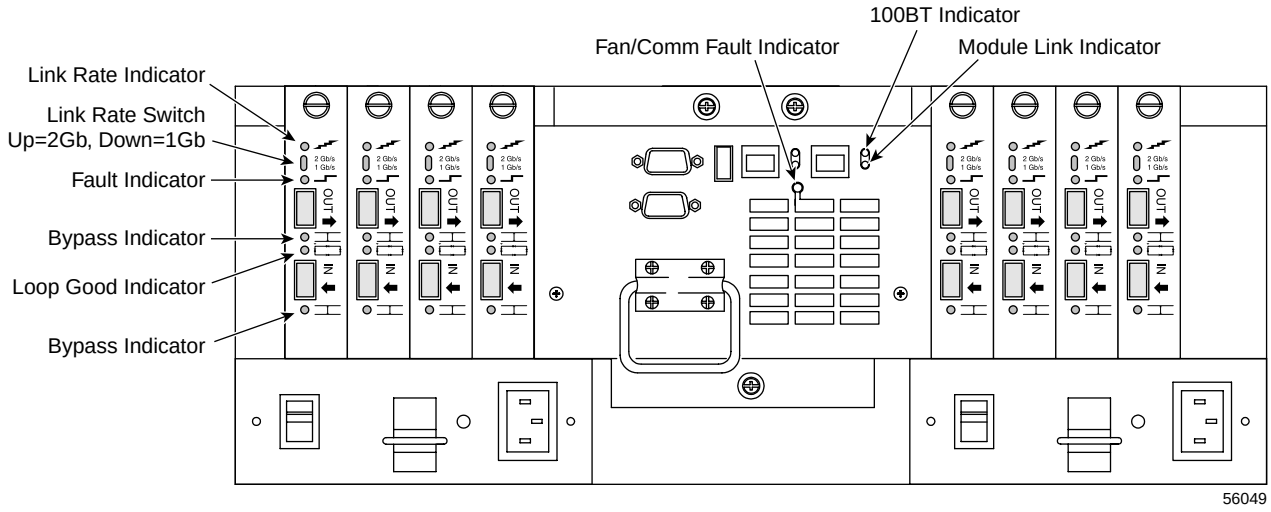

Figure 3-7 2 GB Interface Controller Rear Indicator Lights (SFP)

Table 3-3 2 GB Interface Controller Rear Indicator Lights (SFP)

Component	Indicator Light	Color	Normal Operation	Problem Indicator	Condition Indicated[a]
SFP Interface Minihub Canisters (Host-side)	Link Rate Indicator	Green	N/A	N/A	On: Data transfer rate is 2GB/s Off: Data transfer rate is 1GB/s
	Fault Indicator	Amber	Off	On	Lit from power up through diagnostics, then turned off. If not lit during power up, there is a fault on the board. If lit during normal operation, there is a fault on the board.
	Bypass Indicator	Amber	Off	On	2 lights on: 2 SFP transceivers inserted, but no devices connected 1 light off: active device connected to SFP transceiver 2 lights off: one or no SFP transceivers inserted
	Loop Good Indicator	Green	On	Off	Host loop is not operational; faulty device may be connected to minihub; minihub failure; controller failure; power failure. If a host-side minihub is not connected to a controller, the green light will always be off and the fault light will always be on.
Fan/Communications Canister	Fan/Comm Fault Indicator	Amber	Off	On	Fan/communications canister has failed or is installed incorrectly.
	100 BT Indicator	Green	N/A	N/A	When lit, controller is operating at 100BT. When off, the controller is running at 10BT. When off, module link light should be on. If both are off, there is a communication fault. **Note:** This light can disabled in the NVSRAM settings.

Table 3-3 (continued) 2 GB Interface Controller Rear Indicator Lights (SFP)

Component	Indicator Light	Color	Normal Operation	Problem Indicator	Condition Indicated[a]
	Module Link Indicator	Green	N/A	N/A	When lit, controller is operating at 10BT. When not lit and 100 BT indicator is lit, the controller is running at 100BT. If both are off, there is a communication fault. **Note:** This light can disabled in the NVSRAM settings.
SFP Interface Minihub Canisters (Drive-side)	Link Rate Indicator	Green	N/A	N/A	On: Data transfer rate is 2GB/s Off: Data transfer rate is 1GB/s
	Link Rate Switch	N/A	N/A	N/A	Switch in UP position: data transfer is 2 GB/s Switch in DOWN position: data transfer is 1 GB/s
	Fault Indicator	Amber	Off	On	Lit from power up through diagnostics, then turned off. If not lit during power up, there is a fault on the board. If lit during normal operation, there is a fault on the board.
	Bypass Indicator	Amber	Off	On	2 lights on: 2 SFP transceivers inserted, but no devices connected 1 light off: active device connected to SFP transceiver
	Loop Good Indicator	Green	On	Off	Host loop is not operational; faulty device may be connected to minihub; minihub failure; controller failure; power failure. If a host-side minihub is not connected to a controller, the green light will always be off and the fault light will always be on.
Power Supply Canisters	Power Supply Indicator	Green	On	Off	Power switch is off; power cord unplugged; power supply failure; power supply is overheated.

a. Always use the storage management software (TPSSM7) to precisely identify the failure.

Checking the Battery Service Date

1. Remove the front cover from the controller enclosure (Figure 3-1).
2. Check the "Battery Support Information" label (Figure 3-8).

   The label on the front of the battery canister has three dates:

   - **Date of Manufacture:** — The date the battery canister was built at the factory.
   - **Date of Installation:** — The date the battery canister was installed in the controller enclosure.
   - **Replacement Date:** — The date you should replace the battery canister.

   Look at the Replacement Date. If it is time to replace the battery, install a new battery canister, using the same instructions as shown in "Replacing a Failed Battery Canister" on page 54). Otherwise, go to step 3.

Important: Under normal circumstances, replace the battery canister every two years. Using the controller enclosure in a hot environment (above 35° C or 95° F) lowers the life expectancy of the battery canister. Under these conditions, you may need to replace the battery more often.

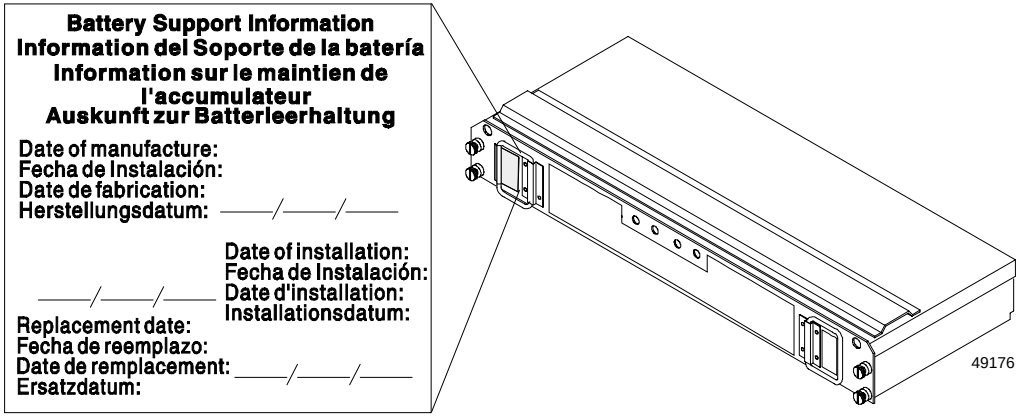

Figure 3-8 Checking the Battery Service Date

3. Replace the front cover on the controller enclosure (Figure 3-1 on page 29).

Moving the Controller Enclosure

Before moving the controller enclosure to a new location or removing the enclosure from its rack, it is highly recommended that you first remove each canister. This decreases the controller enclosure's weight (making it easier to move), helps safeguard the equipment, and ensures a easier transition to the new environment.

If you are moving the controller enclosure 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 may be able to move the controller enclosure without removing each canister. If you do not have sufficient assistance or equipment to safely move the equipment to its new location, refer to Chapter 4, "Controller Enclosure Component Replacement Procedures" for instructions on depopulating the controller enclosure.

Note: If you are moving the controller enclosure a significant distance (to another building, city, etc.), it is recommended that you pack it in its original shipping container.

Removing the Controller Enclosure

Use the following procedure to remove and reinstall the controller enclosure.

1. Remove the front cover (Figure 3-1 on page 29).
2. It is highly recommended that you remove the canisters to make the enclosure lighter and easier to remove. For instructions, see Chapter 4, "Controller Enclosure Component Replacement Procedures".
3. Remove mounting screws on the front and rear of the enclosure (Figure 3-9). Pull the enclosure out of the rear of the rack. Set it on a level, dry surface.

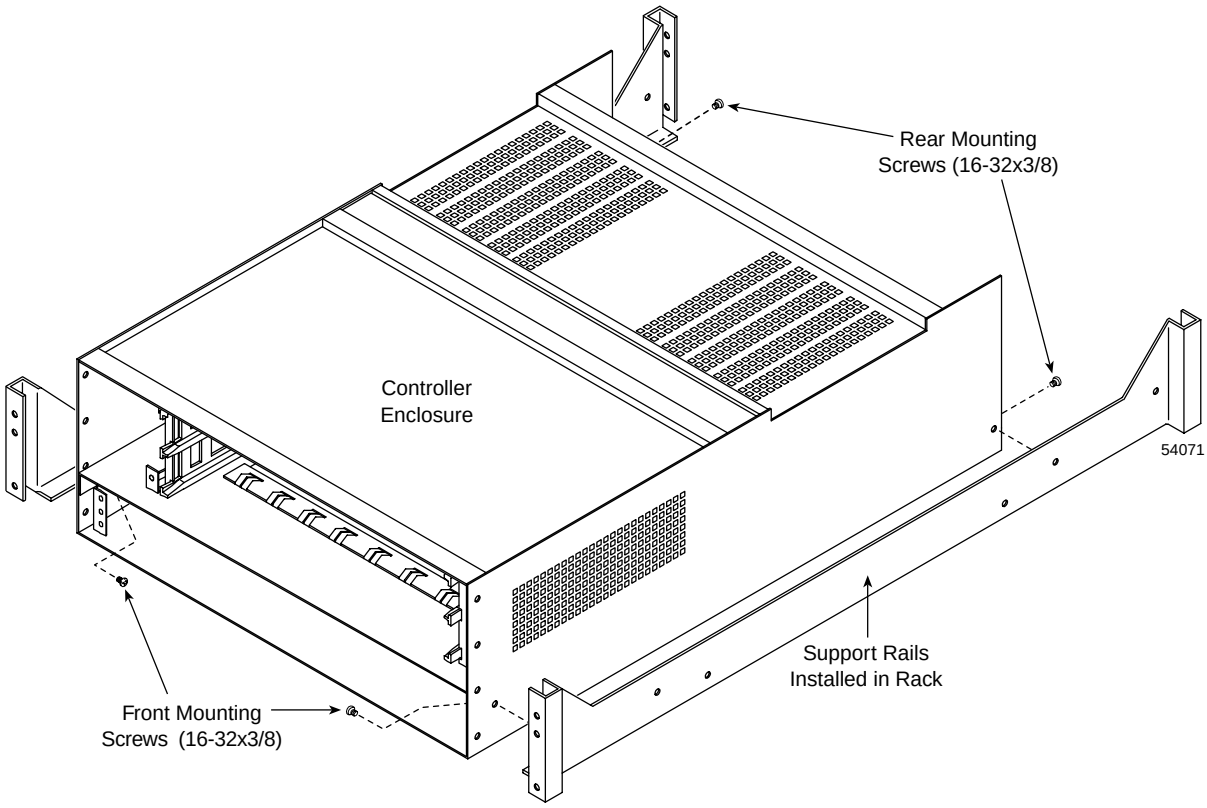

Figure 3-9 Removing the Controller Enclosure from the Rack

4. Repeat steps 1 through 3 for any other controller enclosures to be moved.
5. To move or ship the controller enclosure, choose one of the following methods:
   - If moving the controller enclosure to another rack, remove the support rails, if applicable, and power cords from the old rack and install them in the new rack. Then, install the controller enclosure in the new rack.
   - If shipping the controller enclosure to another location, replace all canisters in the controller enclosure. Carefully pack the unit in its original shipping container. If the rack at the new location is not preconfigured with the support rails, you will also need to remove them and ship them.

Reinstalling the Controller Enclosure

Use the following procedure to reinstall the controller enclosure into a rack.

1. Install the support rails in the rack. Refer to the procedure in the *SGI TP9400 RAID Installation and Upgrade Guide* (108-0292-00X).
2. From the rear of the rack, slide the controller enclosure into the rack along the support rails (Figure 3-9).
3. Fasten the rear and front mounting screws (Figure 3-9).
4. Replace the front cover (Figure 3-1).
5. Wearing antistatic protection, reinstall the components into the controller enclosure. Refer to Chapter 4, “Controller Enclosure Component Replacement Procedures”.

Controller Enclosure Component Replacement Procedures

This chapter describes the replacement of each component in the controller enclosure, in the event of a component failure.

Replacing a Failed Controller Canister

Use the following procedure when instructed by the storage management software (TPSSM7) to replace a controller canister.

Important: After replacing a controller, you must return the system to its normal operating condition. See "Returning a Failed or New Canister to Normal Operating Mode" on page 52.

Before starting this procedure, read "Controller Canister" on page 11.

Caution: Electrostatic discharge can damage sensitive components. Use appropriate antistatic precautions before handling any components.

1. Unpack and check the new controller.

Caution: To avoid potential data loss, make sure that the new controller is the same type (memory size, etc.) as the one you are replacing. If you accidentally install a controller of a different type, the storage management software (TPSSM7) will suspend cache mirroring and issue an error message.

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 is the same type as the one you are going to replace.

2. Determine if you must modify the steps in this procedure.

   a. Read the kit instructions shipped with the new controller canister as well as all controller repair and recovery instructions provided with the operating system and storage management software (TPSSM7).

   b. If necessary, modify the remaining steps to meet the system requirements. Kits often contain the most current servicing information. If the kit instructions conflict with those in this procedure, use the kit instructions.

3. Remove the front cover (Figure 4-1).

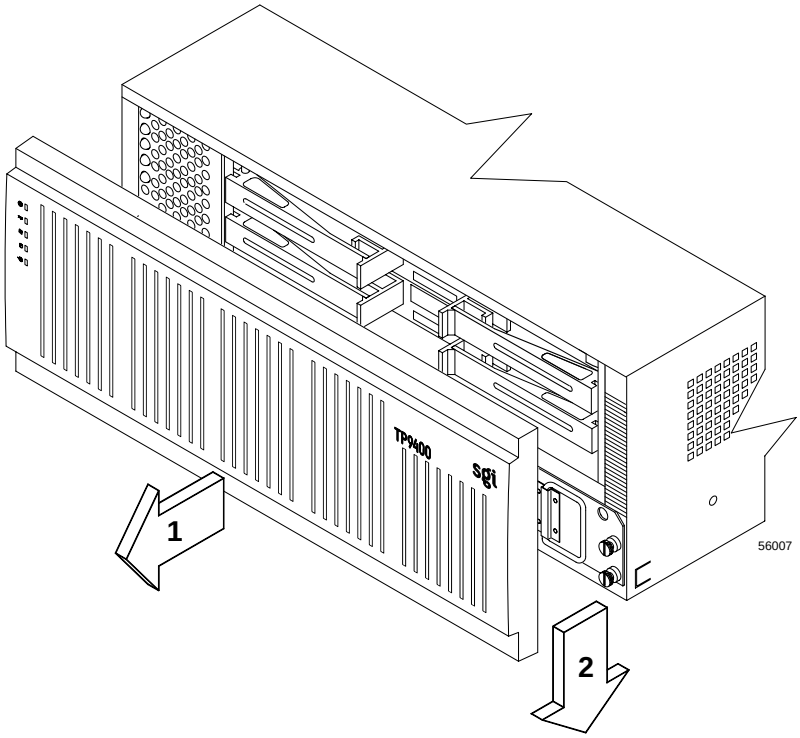

Figure 4-1 Removing the Front Cover of the Controller Enclosure

Caution: Removing a controller that is operating normally (not failed) could result in data loss. Only remove a controller that has a fault indicator that is glowing or that you have marked as "Failed" (offline) through the storage management software (TPSSM7).

4. Remove the failed controller by squeezing the two center tabs, opening the handles, and sliding the canister out of the enclosure. Close the handles (Figure 4-2).

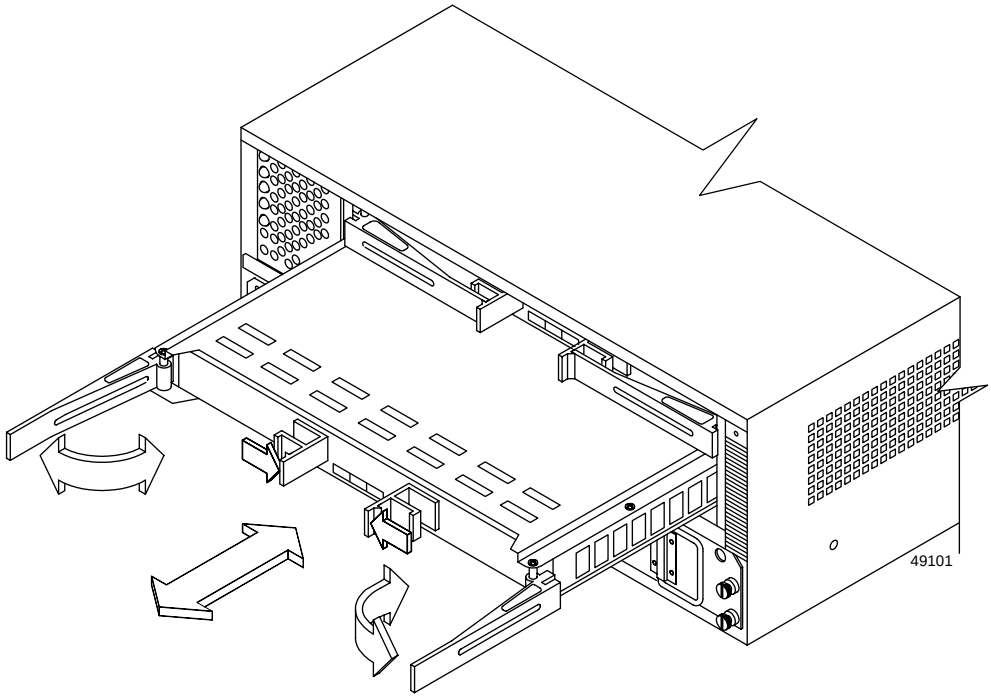

Figure 4-2 Removing and Installing a Controller Canister

Important: If you are using a single-controller array, the controller must be placed in the top slot (Slot A) so the array will identify it as an active controller. This does not apply if you have a dual-controller array.

5. Install the new controller.

When you replace a failed controller, the storage management software (TPSSM7) will automatically synchronize the firmware between the existing controller and the new controller. If not, you must download new firmware to the replaced controller. See the storage management software for more information.

6. Check the controller canister that you just installed by doing the following:
   a. Check the controller canister indicators. The green Controller Power indicator should be on and the amber Controller Fault indicator should be off (Figure 3-5 on page 37). If so, go to step 7. If the Controller Power indicator remains off or the Controller Fault indicator is on after a few seconds, make sure that the controller canister is locked into place. If the Controller Fault indicator remains on, go to step b.
   b. Use the storage management software (TPSSM7) 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 enclosure is operating without error, go to step 7. If not, go to step c.
   c. Try replacing the controller. Check for new error messages or controller faults. Replace the controller canister with a new one if necessary. If this corrects the fault and the controller enclosure is operating without error, go to Go to step 7. If not, go to step d.
   d. If the previous steps do not correct the problem, call the customer support representative (see "Product Support" on page xix).
7. Replace the front cover on the controller enclosure (Figure 4-1 on page 50).

Returning a Failed or New Canister to Normal Operating Mode

Important: After replacing a controller, you must return the system to its normal operating mode according to the steps outlined below. The procedure is to be used after replacing a failed storage controller canister in the dual-active TP9400.

1. Bring up the TPSSM7 Storage Manager window.
2. Left-click the replaced storage controller.
3. Right-click the replaced controller to display the pop-up menu.
4. Select Change Mode on the pop-up menu.

5. Select Active (the current state should be Passive).
6. To confirm the selection, click Yes.

   A dialog box similar to that of Figure 4-3 is displayed.

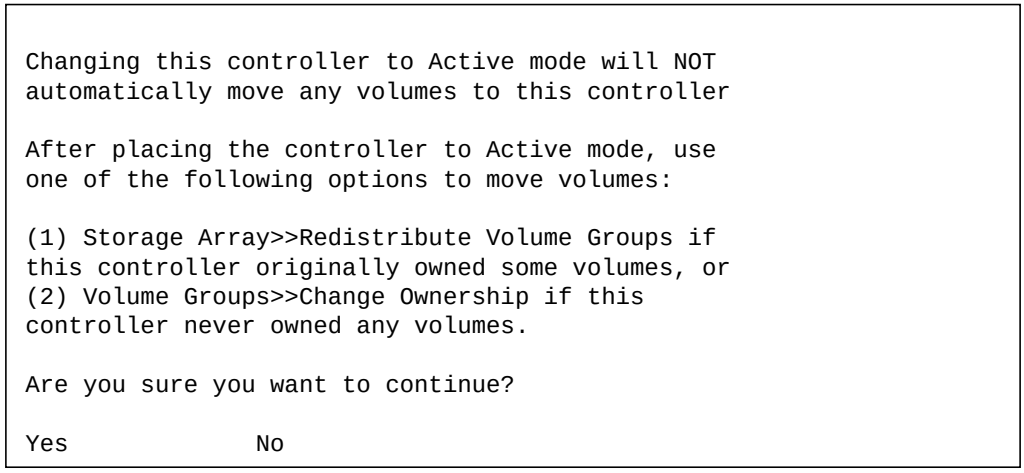

Figure 4-3 Active Mode Dialog Box

7. Read the information in the dialog box, then make the appropriate choices and allow 30 to 60 seconds to elapse.

   If you get an Error 23, click OK and repeat steps 2 through 7.

Important: If you are installing a new controller, or the above procedure fails to fail over the LUNS, perform the steps listed below.

---

1. As “root,” issue the following commands:
   a. scsiha -p <ctrls>; example scsiha -p 2 6 7
   b. ioconfig -f /hw (probe all paths associated with failed storage controller and make sure they are in the hardware graph)
2. Wait until the commands complete (this could take up to several minutes).

Note: You can use the scsifo -d and hinv -c disk commands to check change of path status.

3. Left-click on Storage Array.
4. From the resulting pop-up menu, click Redistribute Volume Groups.
5. To confirm the selection, click Yes.

   A dialog box similar to that of Figure 4-3 is displayed.
6. Read the information in the dialog box, then make the appropriate choices and allow 30 to 60 seconds to elapse.

Note: SGI does have a multipath driver for use with LUNS that have an XLV or XVM volume only.

Everything should have failed back to both storage controllers. However, not all original paths may be in use. To adjust back to original paths use the scsifo -s <current path> command. See the example command below.

```
scsifo -s 209c00a0b8001396/lun4/c7p2
```

Note: You can use the scsifo -d and hinv -c disk commands to check change of path status.

Note: Be patient. Failover can take a long time, depending on several factors.

Replacing a Failed Battery Canister

Use the following procedure when instructed by the storage management software (TPSSM7) to replace a battery canister.

Before starting this procedure, read “Battery Canister” on page 14.

Caution: Electrostatic discharge can damage sensitive components. Use appropriate antistatic precautions before handling any components.

1. Use the storage management software (TPSSM7) to check for data in cache and to disable caching.

   Make sure that there is no data in cache and that all caching is stopped. Data in cache is unprotected if a power outage occurs while the battery canister is out of operation.

Caution: Opening the battery canister will void your warranty. Because the battery canister is a sealed unit, you must replace the entire canister (not just the batteries) in order to keep the battery backup system in working order.

2. Unpack the battery canister. Save the packing material for shipping the used battery canister to a disposal facility. Record the following service date information on the front label of the new battery canister (Figure 4-4):

   - **Date of Installation:** Record today's date.
   - **Replacement Date:** Record the expiration date (two years from today's date).

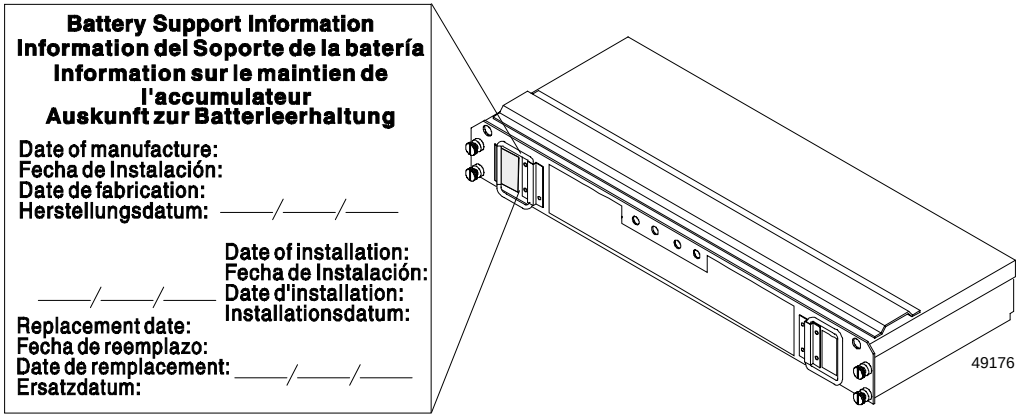

Figure 4-4 Recording the Battery Support Information

3. Remove the front cover (Figure 3-1 on page 29).

Caution: Be careful when removing the battery canister. It weighs approximately 14 lbs.

4. Remove the battery canister (Figure 4-5 on page 56).

   Turn the captive screws counterclockwise, using a flat-blade screwdriver to loosen the screws, if necessary. Use the handles to pull out the battery canister a few inches. Grasp the sides of the battery with both hands and remove the canister.

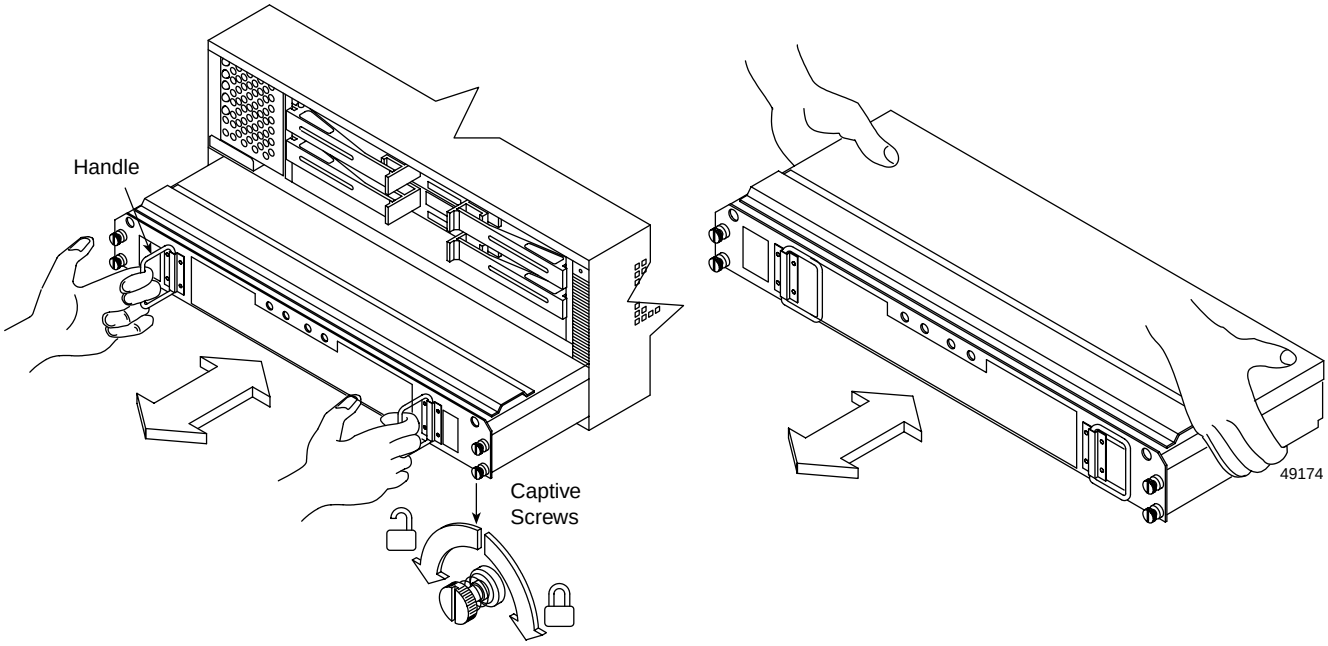

Figure 4-5 Removing and Installing a Battery Canister

5. Install the new battery canister by sliding the it into the slot and tighten all captive screws.
6. Replace the front cover by reversing the sequence in Figure 4-1 on page 50.

7. Let the system run for an appropriate amount of time to properly charge the batteries. In 1 GB interface controller enclosures, it may take up to 15 minutes for the battery canister to complete its self test and up to six hours to fully charge. In 2 GB interface controller enclosures, it may take up to 30 minutes for the battery canister to complete its self test and up to twelve hours to fully charge.
8. Check the battery canister indicators (Figure 4-6). When properly charged, both Full Charge indicators on the front of the battery canister will glow steadily.

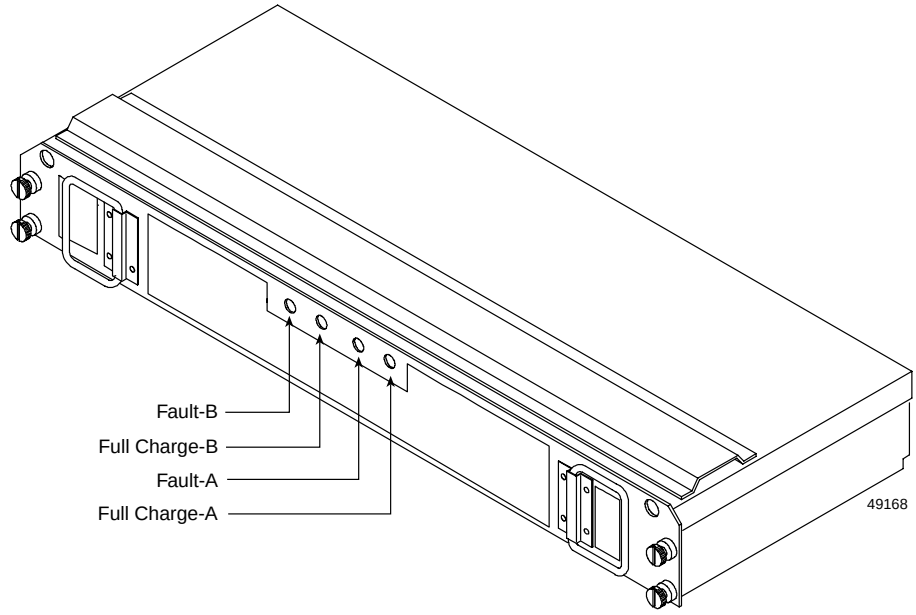

Figure 4-6 Battery Canister Indicators

Note: If either the Full Charge-A or Full Charge-B indicator is blinking, the battery is in the process of charging.

9. Use the storage management software (TPSSM7) to reset the battery installation date.

   You must reset the battery installation date. Otherwise, the software will continue to issue battery-related errors.

Warning: The battery contains potentially hazardous material! If the battery canister is damaged or is leaking electrolyte gel, DO NOT ship it to a recycling center. The sealed lead acid batteries inside the battery canister may be considered as hazardous material in some regions. Return the battery directly to SGI.

10. Return the used battery canister directly to SGI.

Replacing a Failed Controller Fan Canister

Use the following procedure when instructed by the storage management software (TPSSM7) to replace a controller fan canister.

Before starting this procedure, read "Controller Fan Canister" on page 15.

Caution: Electrostatic discharge can damage sensitive components. Use appropriate antistatic precautions before handling any components.

1. Unpack the new controller fan canister.
2. Remove the front cover (Figure 4-1 on page 50).

Caution: To prevent damage to the controller enclosure circuitry, do not operate the controller enclosure without adequate ventilation to the controllers. If it will take longer than 15 minutes to replace the controller fan canister, you must shut down the controller enclosure to prevent its overheating. The time limit applies only to the total time that the fan canister is out of the chassis. The time begins when you remove the failed canister and ends when you re-seat the new one. This does not include the time it takes you to perform this entire procedure (for example, checking the indicators).

3. Remove the failed controller fan (Figure 4-7).

   Pull up on the side lever, then pull out on the lower handle to remove the fan canister.

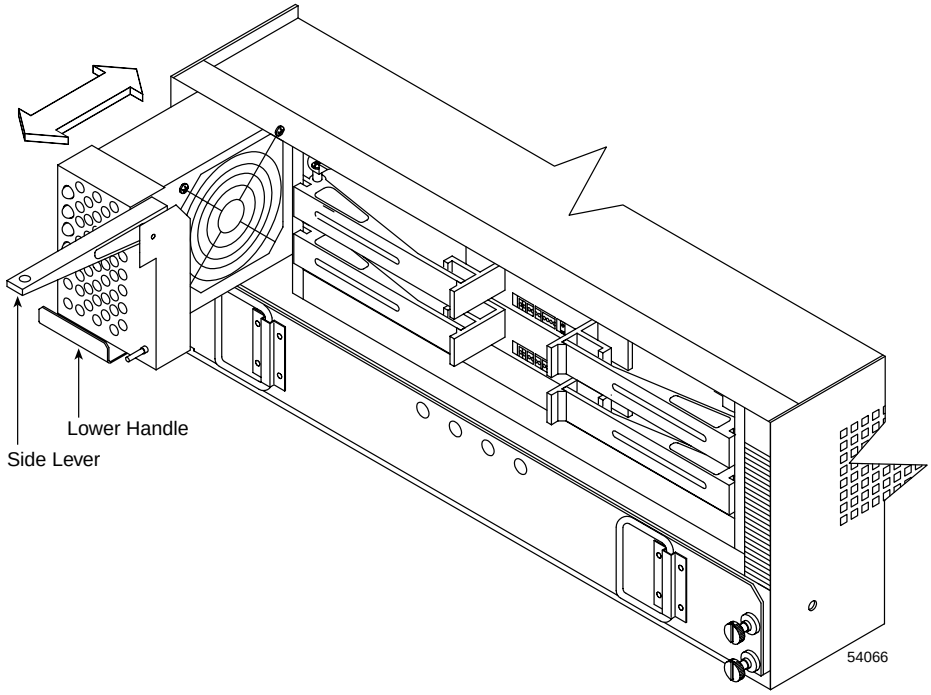

Figure 4-7 Removing and Installing a Controller Fan Canister

4. Install the new controller fan canister (Figure 4-7).

   Slide the new canister all the way into the slot then push the side lever down to secure the canister in place.

   Note: You have the option of using the audible alarm to warn you of faults. The alarm is turned on (in upward position) when shipped. To disable the alarm, flip the switch to the downward position.

5. Check the indicators on the controller fan canister (Figure 4-8).

   The green Summary Power indicator should be on and the amber Controller Fan Fault indicator should be off.

- **If the amber Controller Fan Fault indicator is on, or the green Summary Power indicator is off —** Make sure the canister is seated securely in the slot and the side lever is pushed down.
- **If the amber Controller Fan Fault indicator is on —** There might be a problem with the new controller fan canister. Replace it, if a spare is available. If not, turn off the controller enclosure to prevent it from overheating while you get a replacement canister.
- **If the Power Supply Fault or the Summary Controller Fault is on —** Run the storage management software (TPSSM7) to diagnose and repair the problem.

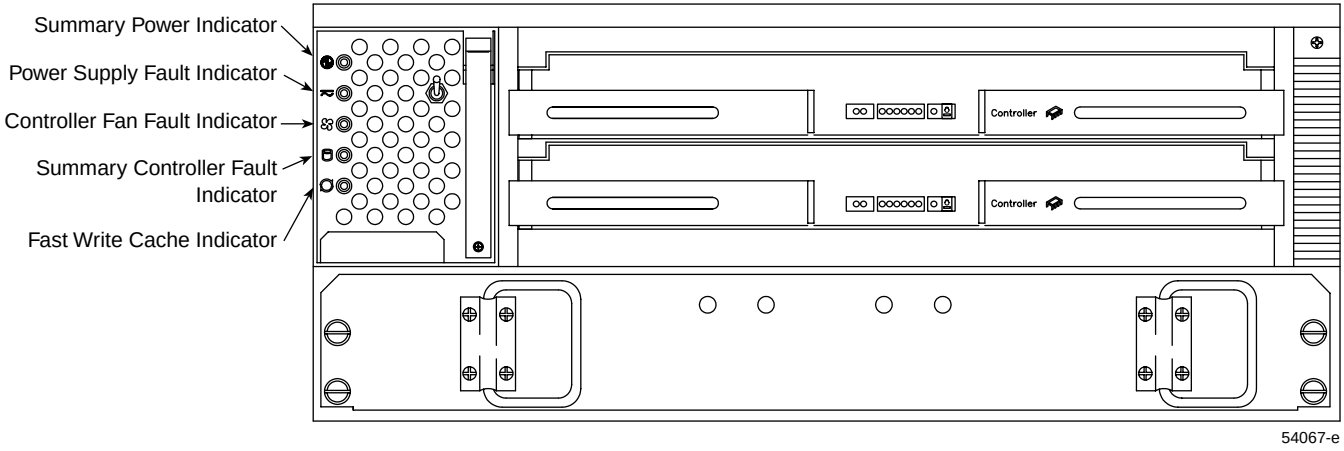

Figure 4-8 Controller Fan Indicators

6. Replace the front cover by reversing the sequence in Figure 4-1.

Replacing a Failed Fan/Communications Canister

Use the following procedure when instructed by the storage management software (TPSSM7) to replace a fan/communications canister.

Before starting this procedure, read “Fan/Communications Canister” on page 18.

Caution: Electrostatic discharge can damage sensitive components. Use appropriate antistatic precautions before handling any components.

1. Unpack the new fan/communications canister.

Caution: Bending or damaging Fibre Channel cables can result in degraded performance or data loss. Fibre Channel cables are fragile and can break easily. Handle the cables carefully. Do not pinch them with tie wraps, step on them, or bend them at sharp angles.

2. Remove or open the rear access panel on the rack.

Important: If you are using a diagnostic program, stop the program before disconnecting the cables. Label the cable that is connected to the failed controller.

3. Disconnect all interface cables (RS-232 and Ethernet) from the failed fan/communications canister (Figure 4-9).

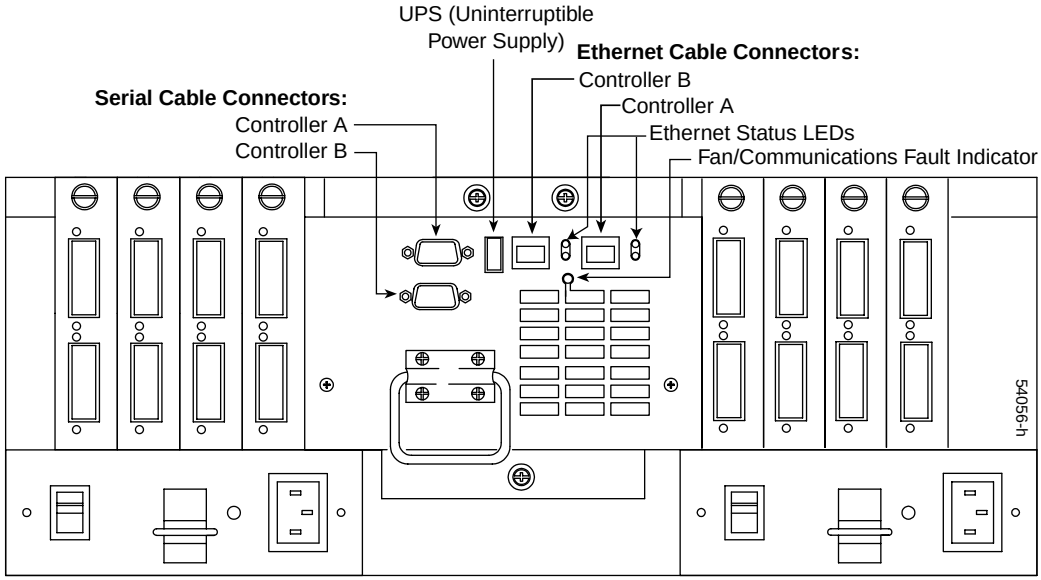

Figure 4-9 Fan/Communications Interface Cables and Fault Indicator

Caution: To prevent damage to the controller enclosure circuitry, read the following: You can replace the fan/communications canister while the controller enclosure is in operation if you complete the exchange within 15 minutes. This time limit applies only to the total time that the fan/communications canister is out of the controller enclosure, beginning when you remove the failed canister and ending when you re-seat the new one. This does not include the time it takes you to do this entire procedure (such as checking indicators).

4. Remove the failed fan/communications canister from the controller enclosure (Figure 4-10).

   Using a flat-blade screwdriver, loosen the three captive screws on the fan/communications canister. Use the handle to pull the canister out of the slot a few inches. Then, grasp the sides of the canister with both hands and remove it from the controller enclosure.

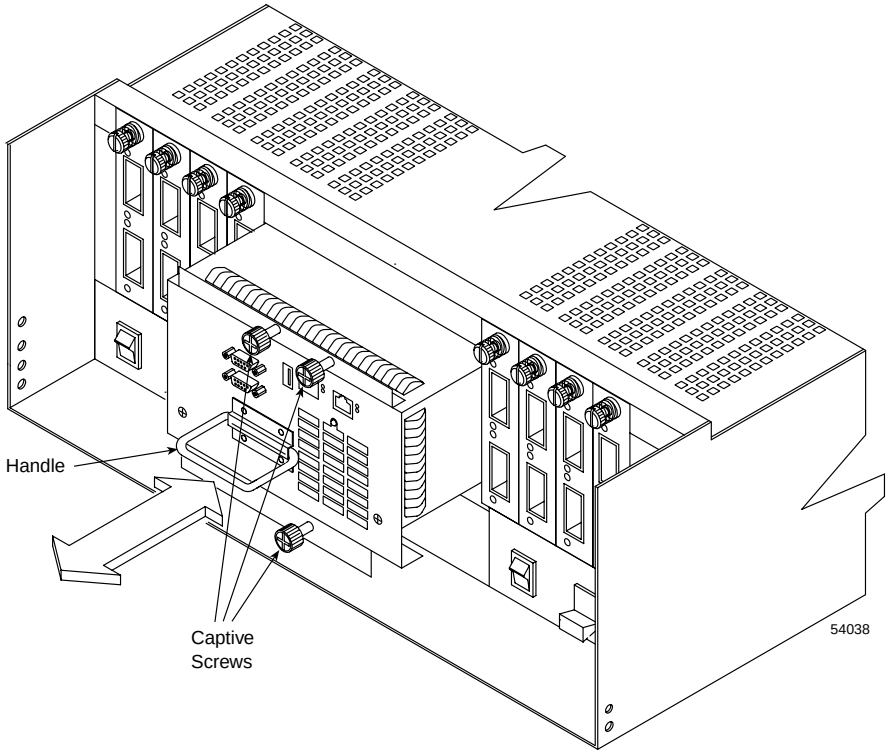

Figure 4-10 Removing and Installing a Fan/Communications Canister

5. Install the new fan/communications canister.

   Push the new fan/communications canister all the way into its chassis slot. Use a flat-blade screwdriver to tighten the three captive screws on the new canister, securing it into place.

6. Check the Fan/Communications Fault indicator (Figure 4-9 on page 61). The amber Fault indicator should be off.

   - **If the Fault indicator turns on —** Make sure that the fan/communications canister is inserted all the way into the chassis and secured in place.
   - **If the Fault indicator remains on —** One or both fans inside the fan/communications canister might be malfunctioning. Replace the failed fan/communications canister with a spare, if available. If not, shut down the

controller enclosure until you can replace the failed fan/communications canister with a new one.

7. Reconnect the interface cables, which you disconnected in step 3, to the new fan/communications canister.

Replacing a Failed Power Supply Canister

Use the following procedure when instructed by the storage management software (TPSSM7) to replace a power supply canister.

Before starting this procedure, read "Power Supply Canister" on page 20.

Caution: Electrostatic discharge can damage sensitive components. Use appropriate antistatic precautions before handling any components.

1. Remove or open the rear access panel from the rack.

Caution: Bending or damaging Fibre Channel cables can result in degraded performance or data loss. Fibre Channel cables are fragile and can break easily. Handle the cables carefully. Do not pinch them with tie wraps, step on them, or bend them at sharp angles.

2. Check the Power indicator on the power supply at the rear of the controller enclosure (Figure 4-11). The green Power indicator on the failed power supply will be off.
3. Turn off the power switch and unplug the power cord from the failed power supply (Figure 4-11).

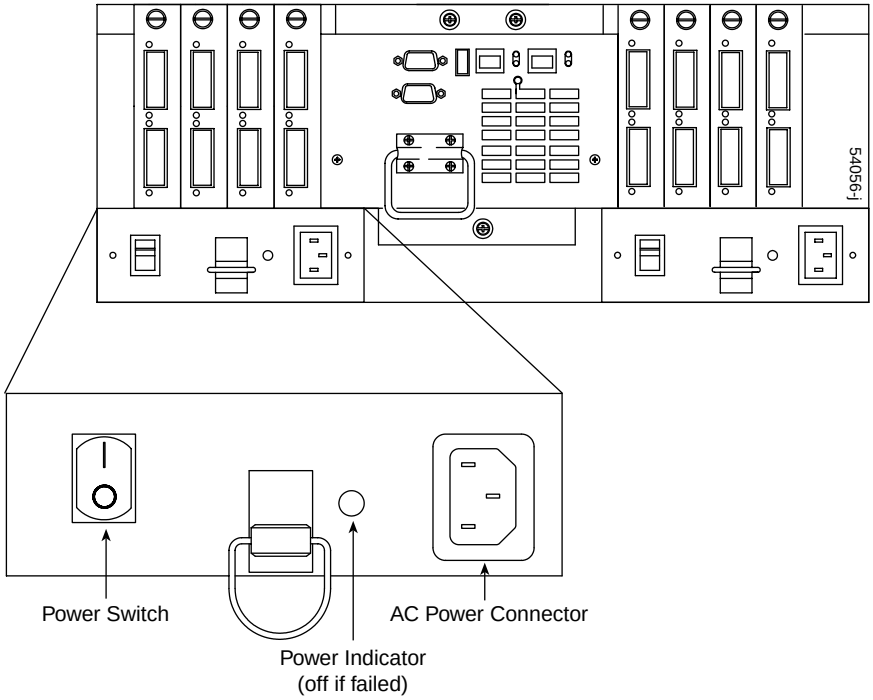

Figure 4-11 Power Supply Switch, Connector, and Indicator

Warning: Risk of electrical shock! Always turn off the power supply power switch and unplug the power supply power cord before you remove or install a power supply canister.

4. Remove the failed power supply (Figure 4-12). Pull the ring to release the canister and slide it out.

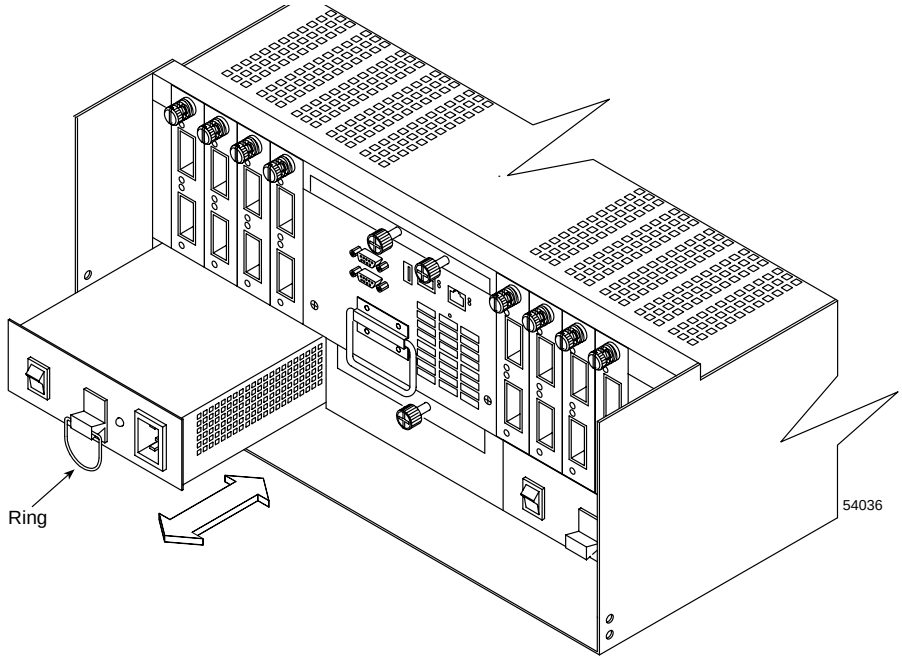

Figure 4-12 Removing and Installing a Power Supply Canister

5. Unpack the new power supply.
6. Make sure that the power switch on the new canister is turned off.
7. Install the new power supply canister (Figure 4-12). Push the canister into the slot until it locks in place.
8. Plug in the power cord and turn on the power (Figure 4-11).
9. Check the new power supply and other controller enclosure indicators for faults.

Replacing a Failed GBIC Module

Use the following procedure when instructed by the storage management software (TPSSM7) to replace a GBIC module.

Before starting this procedure, read "GBIC Module" on page 26.

Caution: Electrostatic discharge can damage sensitive components. Use appropriate antistatic precautions before handling any components.

1. Remove or open the rear access panel on the rack.

Caution: Bending or damaging Fibre Channel cables can result in degraded performance or data loss. Fibre Channel cables are fragile and can break easily. Handle the cables carefully. Do not pinch them with tie wraps, step on them, or bend them at sharp angles.

2. Unpack the new GBIC module and, if available, read the instructions shipped with the new module. If necessary, modify the remaining steps to meet the system requirements. Kits often contain the most current servicing information. If the kit instructions conflict with those in this procedure, use the kit instructions.

Caution: To prevent possible data loss, do not accidentally remove cables from a GBIC module that is not failed.

3. Remove the interface cables from the failed GBIC module (Figure 4-13).

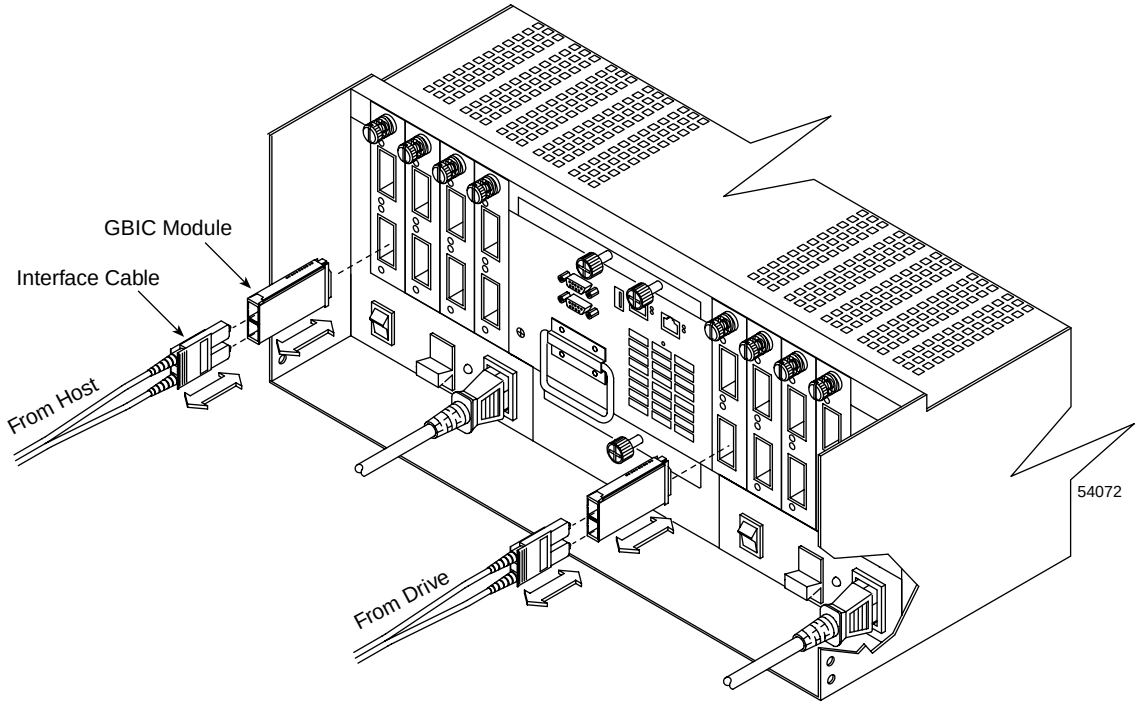

Figure 4-13 Removing and Installing a GBIC Module

4. Remove the failed GBIC module from its minihub slot (Figure 4-13).
5. Insert the new GBIC module into its minihub slot.
6. Reconnect the interface cables.
7. At the system console, reenable the interface.

Replacing an SFP Transceiver

Use the following procedure when instructed by the storage management software (TPSSM7) to replace a SFP transceiver.

Before starting this procedure, read “SFP Transceiver” on page 27.

Caution: Electrostatic discharge can damage sensitive components. Use appropriate antistatic precautions before handling any components.

1. Remove or open the rear access panel on the rack.

Caution: Bending or damaging Fibre Channel cables can result in degraded performance or data loss. Fibre Channel cables are fragile and can break easily. Handle the cables carefully. Do not pinch them with tie wraps, step on them, or bend them at sharp angles.

2. Unpack the new SFP transceiver and, if available, read the instructions shipped with the new part. If necessary, modify the remaining steps to meet the system requirements. Kits often contain the most current servicing information. If the kit instructions conflict with those in this procedure, use the kit instructions.

Caution: To prevent possible data loss, do not accidentally remove cables from an SFP transceiver that is not failed.

3. Remove the interface cables from the failed SFP transceiver (Figure 4-14).

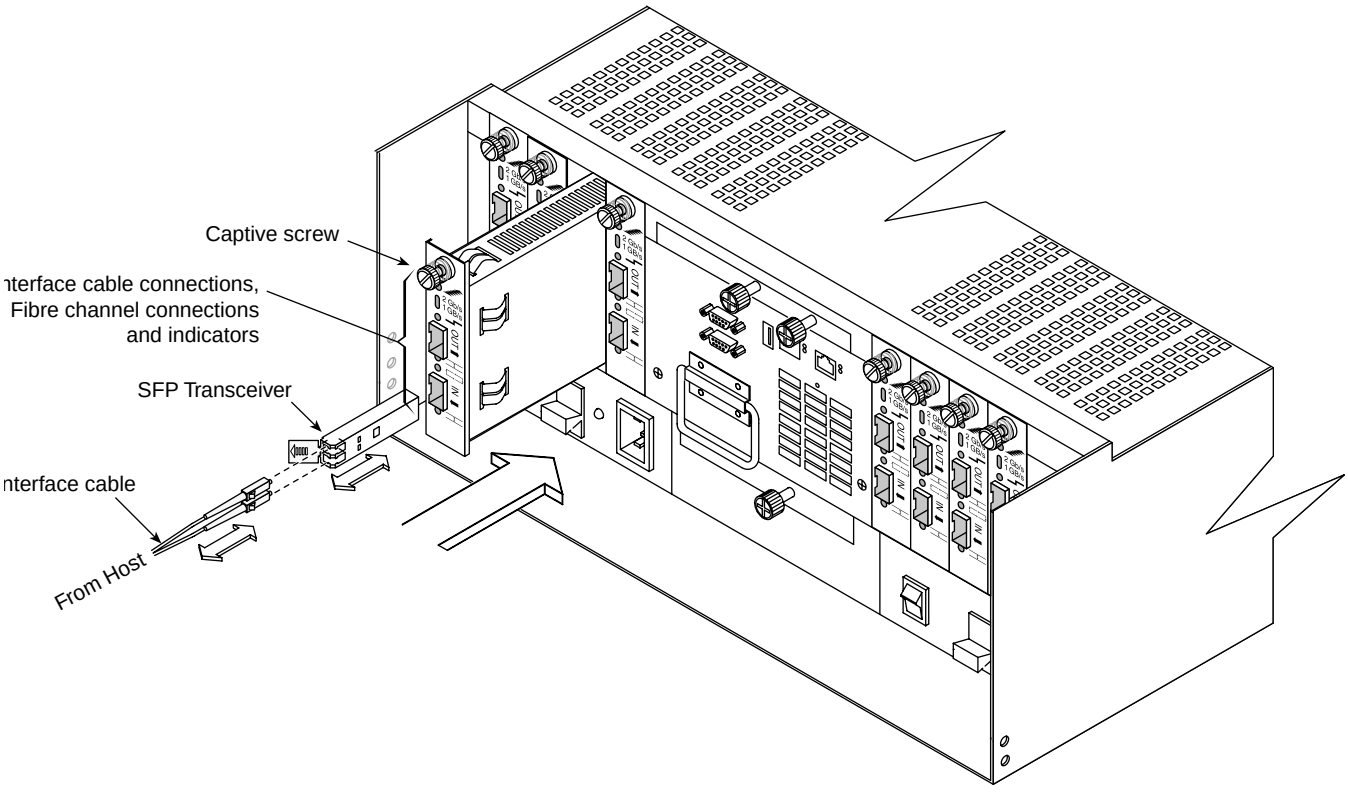

Figure 4-14 Removing and Installing an SFP transceiver

4. Remove the failed SFP transceiver from its minihub slot (Figure 4-14).
5. Insert the new SFP transceiver into its minihub slot.
6. Reconnect the interface cables.

At the system console, reenable the interface.

Replacing a Failed Minihub Canister

Use the following procedure when instructed by the storage management software (TPSSM7) to replace a GBIC or SFP minihub canister.

Note: The minihubs pictured in this procedure are all GBIC minihubs. However, the same procedures apply to SFP minihubs.

Use this procedure to replace either a failed host-side or drive-side minihub canister. Before starting this procedure, read "Minihub Canister" on page 22.

Caution: Electrostatic discharge can damage sensitive components. Use appropriate antistatic precautions before handling any components.

1. Remove or open the rear access panel on the rack.

Caution: Bending or damaging Fibre Channel cables can result in degraded performance or data loss. Fibre Channel cables are fragile and can break easily. Handle the cables carefully. Do not pinch them with tie wraps, step on them, or bend them at sharp angles.

2. Check the minihub indicators at the rear of the controller enclosure. On a failed minihub, the Interface Fault indicator will be on and the Loop Good indicator will be off.
3. Unpack the new minihub canister and, if available, read the instructions shipped with the new minihub. If necessary, modify the remaining steps to meet the system requirements. Kits often contain the most current servicing information. If the kit instructions conflict with those in this procedure, use the kit instructions.

Caution: To prevent possible data loss, do not accidentally remove cables from a GBIC module that is not failed.

4. Remove the interface cables from the Fibre Channel connections on the failed minihub (Figure 4-13 on page 68).
5. Remove each GBIC module or SFP transceiver from the minihub slot (Figure 4-13 on page 68).
6. Unfasten the captive screw on the minihub and remove it from the chassis (Figure 4-15).

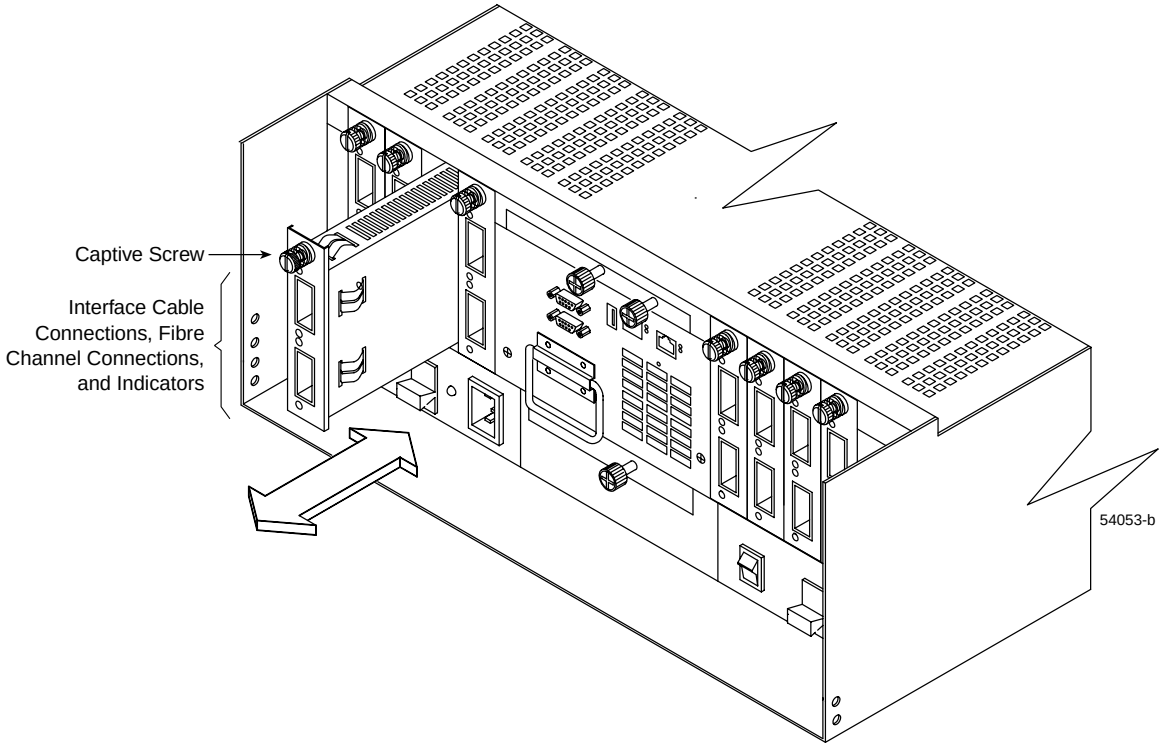

Figure 4-15 Removing and Installing a Minihub

7. Install the new minhub into the slot and tighten the captive screw.
8. Replace each GBIC module or SFP transceiver into the minihub.
9. Replace the interface cables.
10. Check the indicators on the minihub.

    For more information on interpreting the indicators on the rear of the minihub, refer to “Rear Indicator Lights” in Chapter 3. If a problem is indicated, use the storage management software (TPSSM7) to check the controller enclosure status.

The Drive Enclosure

The TP9400 drive enclosure is a compact unit that provides high-capacity disk storage for Fibre Channel environments. All drive enclosures contain:

- Up to ten Fibre Channel disk drives (1.6" or 1")
- Redundant power supplies
- Redundant fans
- Redundant environmental status modules
- Easy-to-use controls
- Replaceable canisters
- Fibre Channel interface

Front View

The front of the drive enclosure contains the following components (Figure 5-1):

- **Drive sleds —** Ten removable sleds containing disk drives. For more information on the drive sleds, see "Drive Sled" on page 77.
- **Drive indicators —** Each drive has an Activity and a Fault indicator above it on the front bezel.
- **Power indicator —** This indicator glows green when the drive enclosure is on.
- **Global Fault indicator —** This indicator glows amber if any component in the drive enclosure has failed.

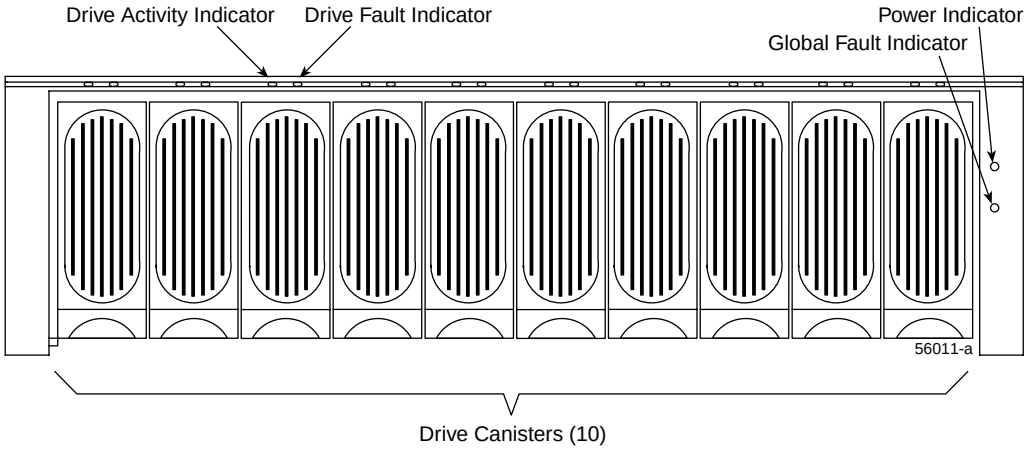

Figure 5-1 Front View of the Drive Enclosure

Important: If the Global Fault or drive Fault indicators are steady amber (not blinking), there is a problem with the drive enclosure. Run the storage management software (TPSSM7) to diagnose and repair the problem. For more information on the indicators, see "Checking the Drive Enclosure Indicator Lights" on page 92.

Rear View

The rear of the drive enclosure contains the following components (Figure 5-2):

- **Fan canisters —** Two removable canisters containing the cooling fans. For more information on the fan canisters, see "Fan Canister" on page 78.
- **Power supply canisters —** Two removable canisters containing the power supplies. For more information on the power supply canisters, see "Power Supply Canister" on page 80.
- **Environmental status modules —** Two removable canisters containing the interface board, called an ESM (Environmental Services Monitor) board. Each canister has two slots for GBICs (Gigabit Interface Converters). For more information on environmental status modules, see "Environmental Status Module" on page 81.

- **Indicators —** Each canister has indicators showing component status. See "Checking the Drive Enclosure Indicator Lights" on page 92 for details.

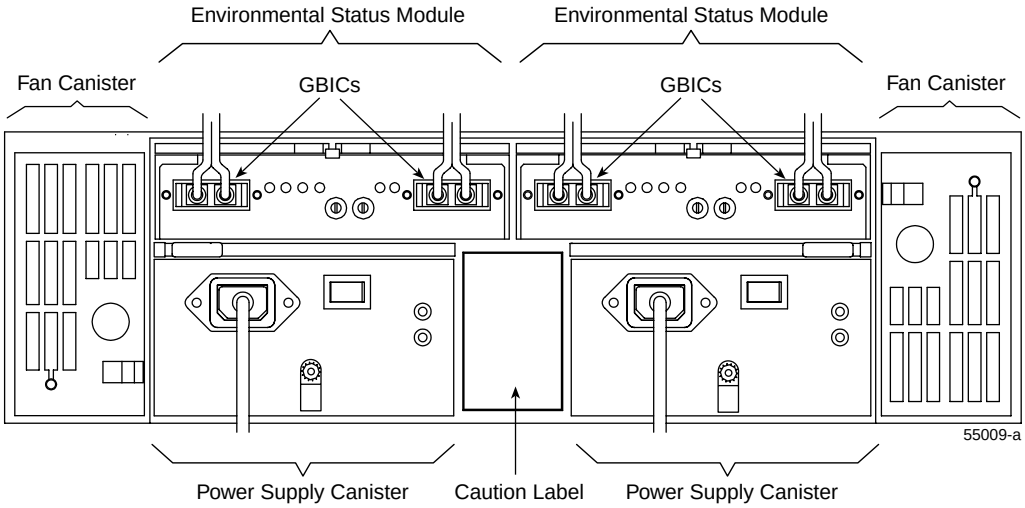

Figure 5-2 Rear View of the Drive Enclosure

Important: An indicator that is glowing amber may indicate a drive enclosure component failure that needs immediate attention. Run the storage management software (TPSSM7) to diagnose and repair the problem. For more information on the indicators, see "Checking the Drive Enclosure Indicator Lights" on page 92.

Interface Connectors and Switches

Figure 5-3 shows the connectors and switches on the rear of the drive enclosure. Table 5-1 describes these items in detail.

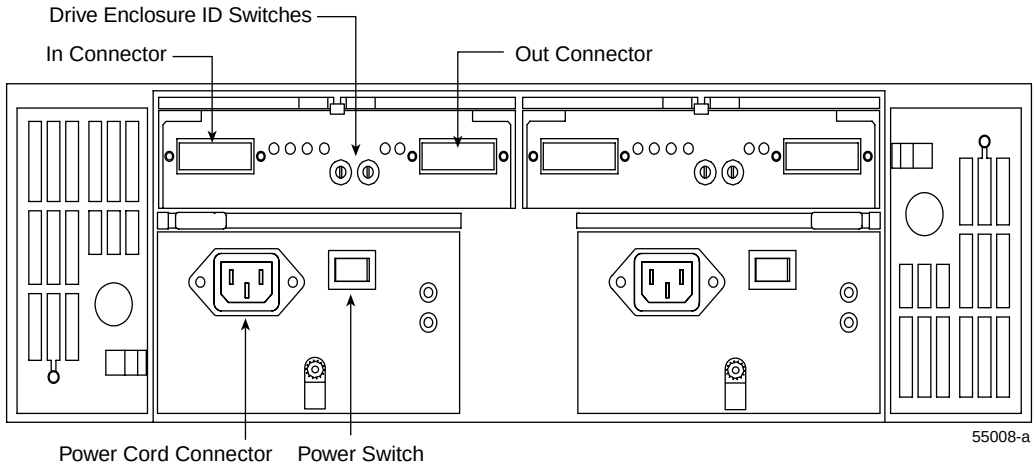

Figure 5-3 Connectors and Switches (Rear)

Table 5-1 Connectors and Switches (Rear)

Component	Item	Description
Environmental Status Module	In, Out Connectors	The connectors are slots that contain an optical (NTT-SC) GBIC. Each canister has two slots, one In and one Out. The GBICs convert the Fibre Channel signals to electrical signals. All drives are accessible from either environmental status module.
	Drive Enclosure ID Switches	These two switches are used to set the enclosure ID number during installation. One switch is the ten's place and the other is the one's place. Each drive enclosure cabled to a controller pair has a unique ID.
Power Supply Canister	Power Cord Connector	This is the connector for the power cord.
	Power Switch	This switch turns the power supply on and off. When both switches are off, the drive enclosure is off.

Drive Enclosure Components

The drive enclosure has owner-removable and owner-replaceable components called "canisters." Following are descriptions of each of these components.

Drive Sled

All disk drives are housed in portable drive sleds (Figure 5-4) that plug directly into one of ten drive slots in the front of the drive enclosure. Each canister has a lever containing an air vent for circulating air to the drives. Each drive has two status indicator lights, located on the front bezel above the drive.

The drives are numbered 1-10, from left to right, as shown in Figure 5-4.

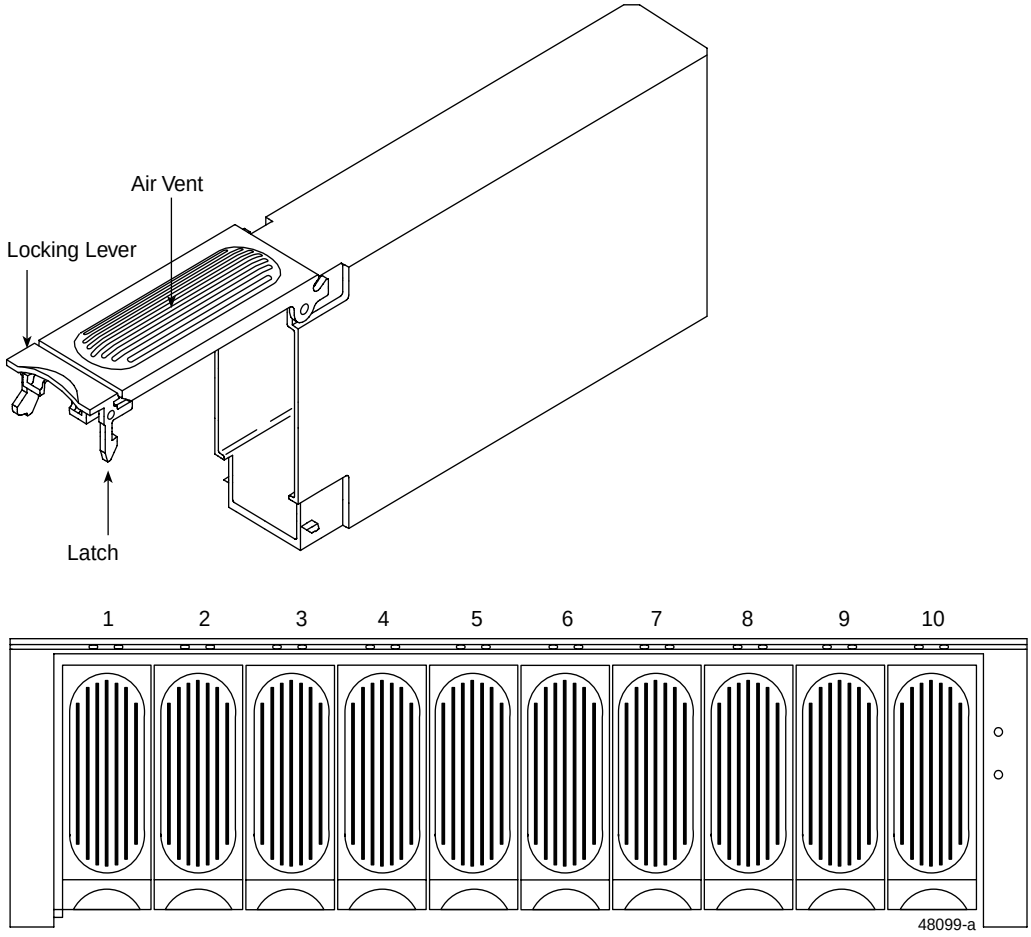

Figure 5-4 Drive Sleds and Drive Numbering

Fan Canister

The drive enclosure's cooling system consists of two fan canisters, each containing two fans. The fan canisters circulate air inside the drive enclosure by pulling air in through the vents on the front of the drive sleds and pushing the air out the vents in the rear of each fan canister (Figure 5-5). The two fan canisters provide redundant cooling. If one fan

canister fails, the second fan canister continues to provide sufficient cooling to operate the drive enclosure.

To prevent cooling problems, the drive enclosure must have proper air circulation throughout the enclosure. Cooling problems include any malfunctions or obstructions that impede air flow and cause one or more components in the drive enclosure to overheat. Also, make sure that the ambient air temperature around the controller enclosure is within the environmental requirements. To boost air circulation, the drive enclosure has air vents at the front and rear (Figure 5-5) that serve as air intake and exhaust passages. Always keep vents clean and free of obstructions.

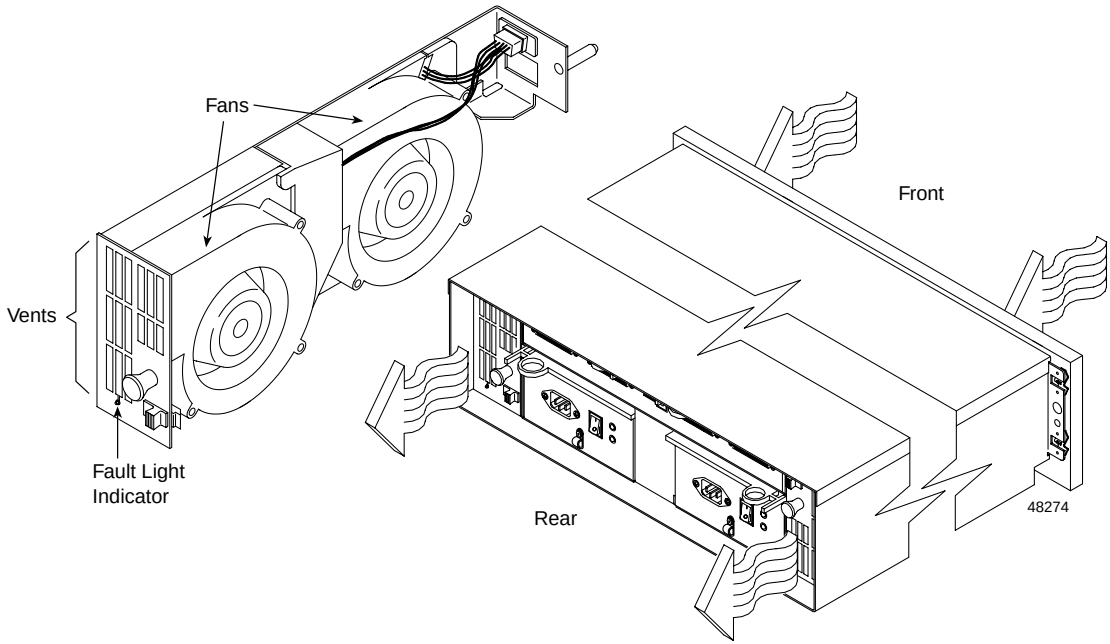

Figure 5-5 Fan Canister and Drive Enclosure Air Flow

Caution: To avoid damage to the internal components and circuitry, do not run the drive enclosure without adequate ventilation and cooling. In the unlikely event that more than one fan fails at the same time, shut down the drive enclosure immediately.

If both fan canisters fail or cannot maintain the internal temperature below 70° C (158° F), the drive enclosure will automatically shut down. If this occurs, you must cool the drive enclosure and restart it. See "Overtemp Condition" on page 87 for more information.

Power Supply Canister

The drive enclosure's power system consists of two power supply canisters (Figure 5-6). The power supply canisters provide power to the internal components by converting incoming AC voltage to DC voltage. One power supply canister can maintain electrical power to the drive enclosure if the other power supply is turned off or malfunctions. The power supply canisters are interchangeable by reversing the locking levers (Figure 5-7).

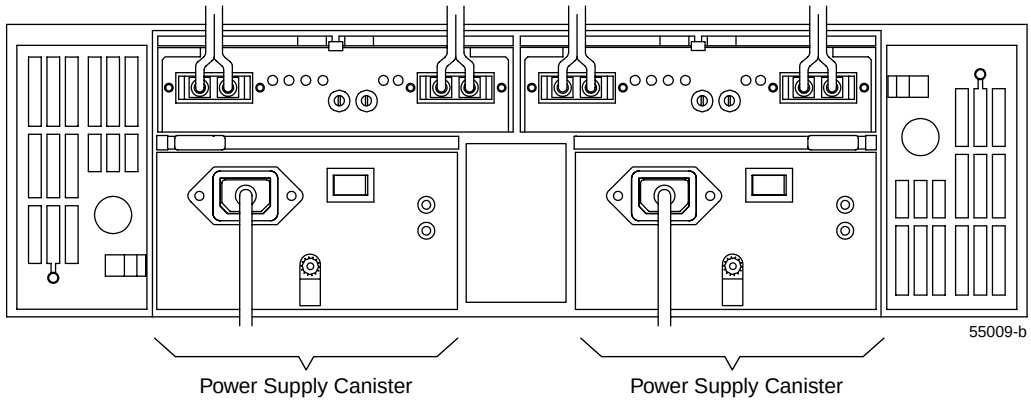

Figure 5-6 Power Supply Canisters in a Drive Enclosure

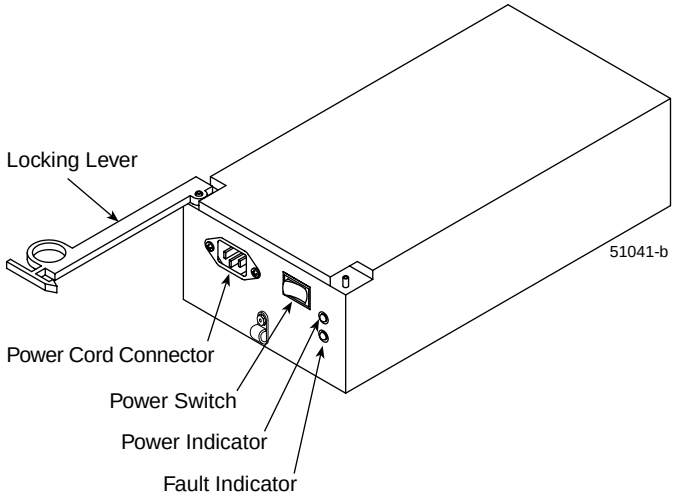

Figure 5-7 Power Supply Canister

Both power supply canisters have 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 will 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). See “Overtemp Condition” on page 87 for more information on recovering from an overtemp condition.

Because the two power supplies provide redundancy, you can hot swap a failed power supply, replacing it while the drive enclosure is in operation.

Environmental Status Module

Each environmental status module contains an ESM (Environmental Services Monitor) board and two slots for GBICs. The ESM board is the interface between the controller enclosure and the drive enclosure, and it monitors drive enclosure status. The canisters fit into the rear of the drive enclosure (Figure 5-8).

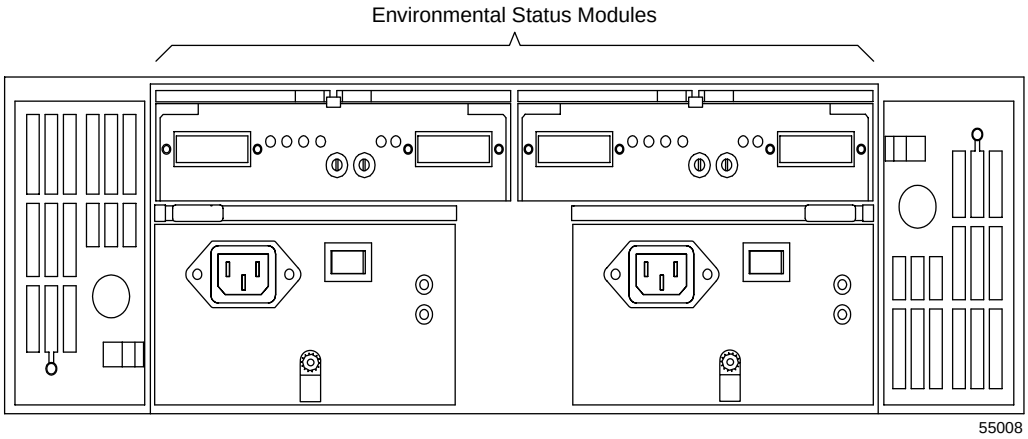

Figure 5-8 Environmental Status Modules in the Drive Enclosure

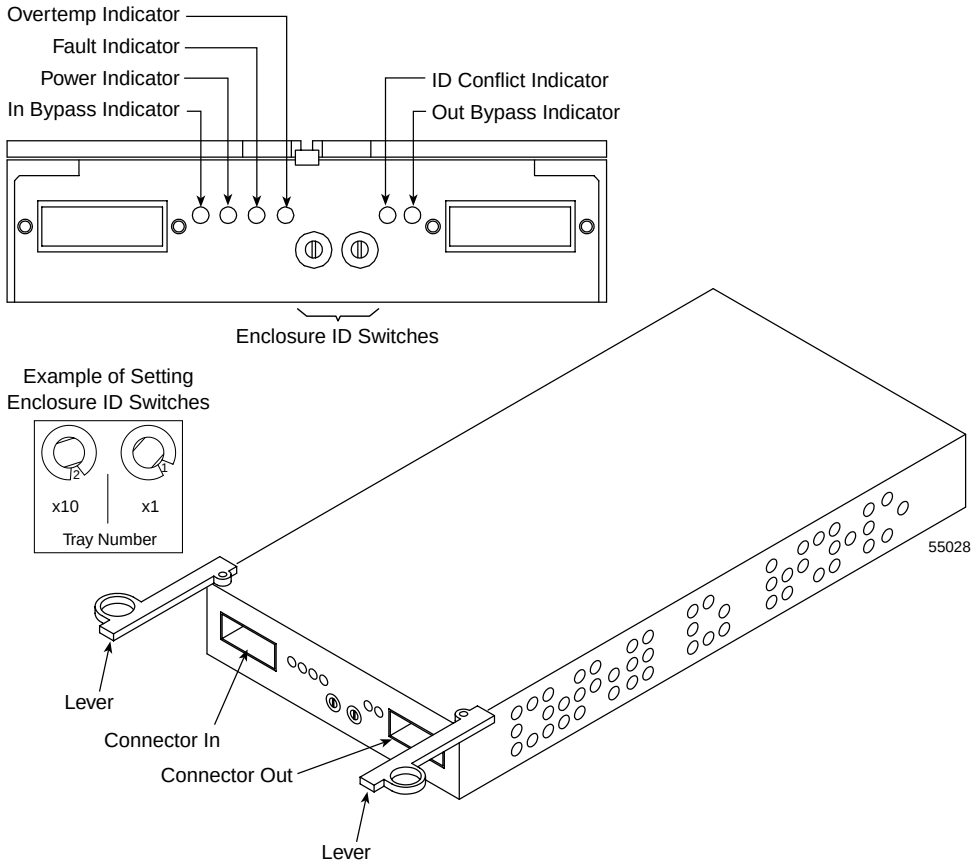

Figure 5-9 Environmental Status Module Indicators and Connectors

See “Checking the Drive Enclosure Indicator Lights” on page 92 for a description of the environmental status module indicators.

GBIC Module

A GBIC (Gigabit Interface Converter) is a module that fits into the environmental status module located at the rear of the drive enclosure (Figure 5-10). Each environmental status module has up to two optical GBIC modules which are replaceable. You can hot swap a failed GBIC module, replacing it while the drive enclosure is in operation.

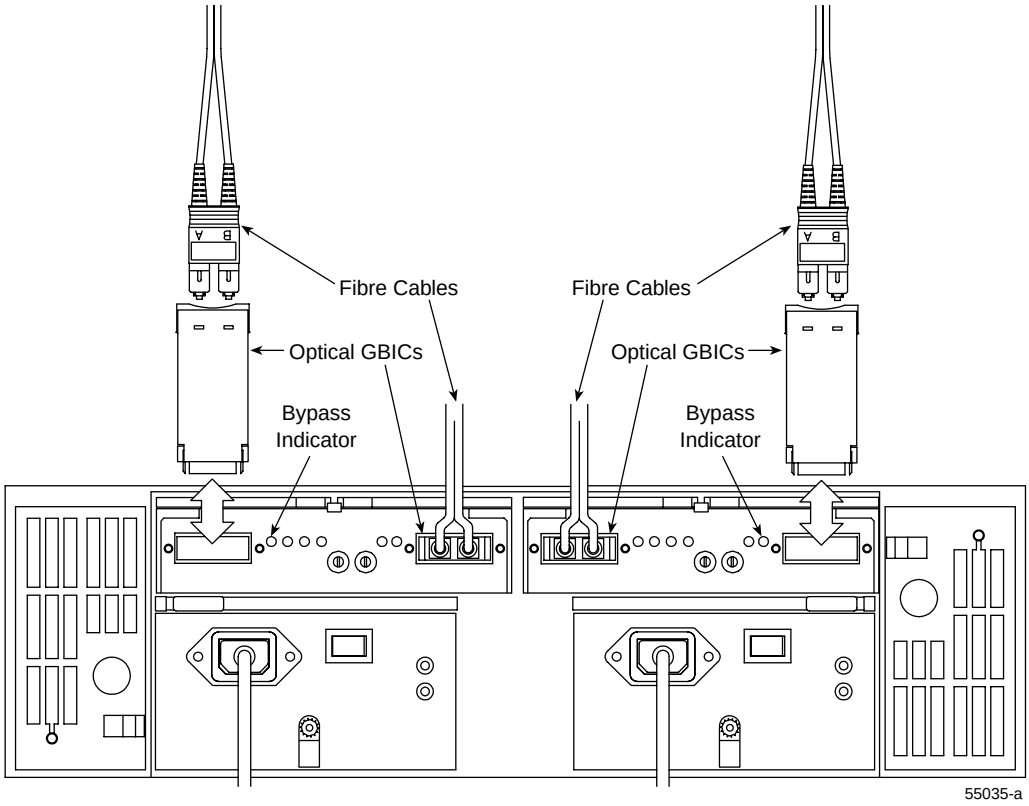

Figure 5-10 Fibre Channel Cables and GBICs

If you replace the GBIC module and still experience problems, the drive enclosure may have defective components or connections. Check the storage management software (TPSSM7) for indications of other component failures.

Drive Enclosure Operation

This chapter describes the operation of the drive enclosure, powering on and off, monitoring the system through software and indicator lights, and moving the drive enclosure to another location.

Turning the Power On

Use the following procedure to turn the drive enclosure on after a normal shutdown (as described in "Turning the Power Off" on page 89). If the drive enclosure was turned off due to an unexpected shutdown or a power failure, use the procedures given in "Turning the Power On After an Unexpected Shutdown" on page 86 to restart the drive enclosure.

Warning: Risk of severe electrical shock. Never turn on the power to any equipment when there is evidence of fire, water, or structural damage. If there is evidence of damage, call the factory or appropriate service organization for assistance. Depending on the current service agreements, you may need to send the unit back to the factory for repair/replacement.

- Turn on both power switches on the rear of the drive enclosure (Figure 6-1) or the main circuit breaker, whichever is applicable. You must turn on both power supply canister switches to take advantage of the redundant power supplies.

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

To speed drive spin-up, it is recommended that you start the drive enclosures before or at the same time as the controller enclosure.

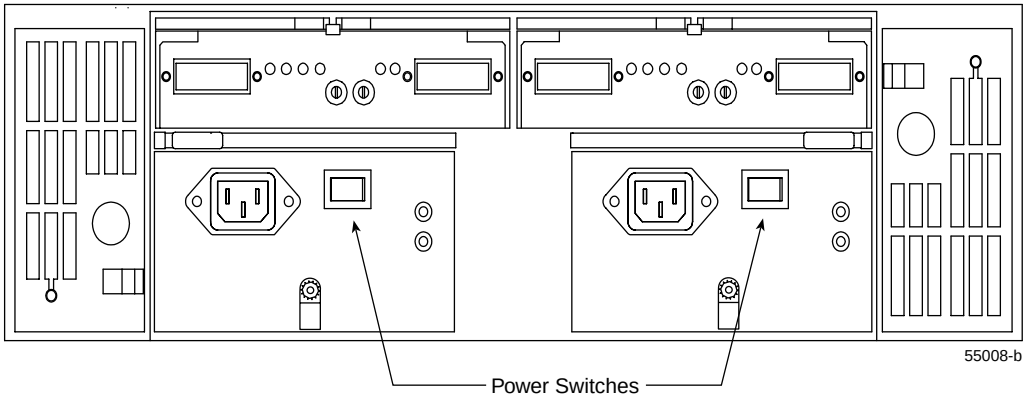

Figure 6-1 Turning the Power On and Off

Note: The Activity and Fault indicators above the drive sleds may flash intermittently as the drives spin-up. Wait until the drive enclosure has finished powering up before checking the indicator lights on the front of the drive enclosure. All indicators should be green. If they are not, use the storage management software (TPSSM7) to diagnose the problem.

Turning the Power On After an Unexpected Shutdown

The drive enclosure (and the entire storage array) may shut down unexpectedly under the following conditions:

- The internal temperature of the drive enclosure exceeds the maximum operating temperature (an overtemp condition). See the following "Overtemp Condition" section for more information on overtemp conditions.
- There is a general power failure or a loss of power to the storage array.
- You are forced to shut down the storage array without performing the normal shutdown procedures (given in "Turning the Power Off" on page 89) due to an emergency situation.

Note that in each of these cases, some data may be lost.

Caution: To avoid damage to the hardware, take special care when restarting the drive enclosure after an unexpected shutdown.

If the drive enclosure shuts down unexpectedly, but there is still power to the site, use the storage management software (TPSSM7) to determine if the drive enclosure has overheated.

- If an overtemp condition is indicated, use the procedure given in "Turning the Power On After an Overtemp Shutdown" on page 88 to restart the drive enclosure.
- If the drive enclosure has shut down because of a power failure or an emergency shutdown, use the procedure given in "Turning the Power On After an Emergency Shutdown" on page 89 to restart the drive enclosure.

Overtemp Condition

If both fan canisters fail or are unable to maintain an internal temperature below 70° C (158° F), one or both of the power supplies in the drive enclosure will shut down. If both power supplies shut down, the drive enclosure is inoperable.

The storage management software (TPSSM7) will warn you if the temperature of the drive enclosure is rising (before it has risen sufficiently to shut down the power supplies). The first warning comes when the enclosure temperature exceeds 40° C (104° F). The enclosure shuts down if the temperature rises above 70° C (158° F).

The Overtemp indicator on the environmental status module (Figure 6-2) comes on if the temperature reaches 40° C (104° F). If both power supplies shut down, the overtemp indicator cannot come on.

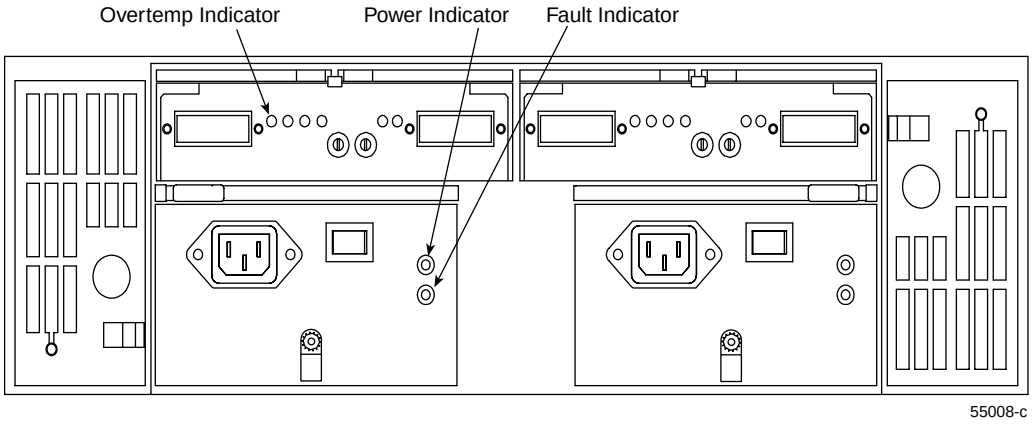

Figure 6-2 Overtemp, Power, and Fault Indicators

Turning the Power On After an Overtemp Shutdown

Use this procedure to restart the drive enclosure after a unexpected shutdown due to an overtemp condition.

1. Turn off both power switches (Figure 6-1).
2. Do whatever is necessary to cool the drive enclosure (replace the fans, use external fans to cool the room, and so on).

Warning: Risk of severe electrical shock. Never turn on the power to any equipment when there is evidence of fire, water, or structural damage. If there is evidence of damage, call the factory or appropriate service organization for assistance. Depending on the current service agreements, you may need to send the unit back to the factory for repair/replacement.

3. Check all components and cables for visible damage. Do not start the drive enclosure if you find evidence of damage.

Note: To speed drive spin-up, it is recommended that you start the drive enclosures before or at the same time as the controller enclosure.

4. Once the internal temperature is below 40° C (104° F), turn on the power switches and wait for the drive enclosure to power up.
5. Use the storage management software (TPSSM7) and the drive Fault indicators (see "Checking the Drive Enclosure Indicator Lights" on page 92) to check the overall status of the drive enclosure and its components. Repair any faults found.

Turning the Power On After an Emergency Shutdown

Use this procedure to restart the drive enclosure after a power failure or emergency shutdown.

1. After the emergency situation is over or power is restored to the site, turn off all power switches (Figure 6-1).

Warning: Risk of severe electrical shock. Never turn on the power to any equipment when there is evidence of fire, water, or structural damage. If there is evidence of damage, call the factory or appropriate service organization for assistance. Depending on the current service agreements, you may need to send the unit back to the factory for repair/replacement.

2. Check all components and cables for visible damage. Do not start the drive enclosure if you find evidence of damage.

Note: To speed drive spin-up, it is recommended that you start the drive enclosures before or at the same time as the controller enclosure.

3. Turn on the power to the drive enclosure and the controller enclosure (Figure 6-1).
4. Use the storage management software (TPSSM7) and the drive Fault indicators (see "Checking the Drive Enclosure Indicator Lights" on page 92) to check the overall status of the drive enclosure and its components. Repair any faults found.

Turning the Power Off

The drive enclosure is designed to run continuously, 24 hours a day. However, you may need to turn the power off for maintenance, such as upgrading the drives or replacing canisters.

1. Use the storage management software (TPSSM7) to determine the status of your system components and any special instructions before proceeding. The operating system software may require you to perform other procedures before turning off the power.
2. Stop all I/O activity to the drive enclosure.

   If applicable, use the storage management software (TPSSM7) to logically disconnect the drive enclosure from the host. Make sure that all the drive Activity indicators on the front of the drive enclosure are not blinking (indicating I/O activity) and that the Fast Write Cache indicator light on the applicable controller enclosure is off (not blinking).
3. Make sure that all the drive enclosure Fault indicators are off.

   If a Fault indicator is on, correct the problem before turning off the power. Use the storage management software (TPSSM7) to diagnose and fix the problem.

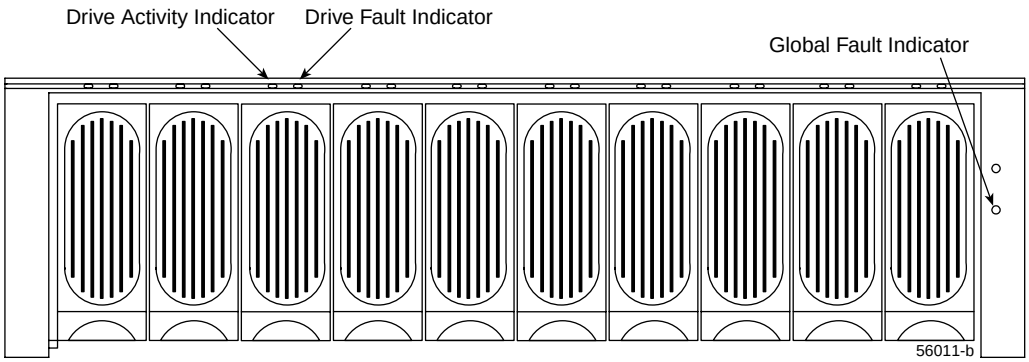

Figure 6-3 Activity and Fault Indicators on Front of Drive Enclosure

Warning: To shut off all power to the drive enclosure, you must turn off both power switches and disconnect both power cords. The drive enclosure has two power switches and two power cords.

4. Turn off both power switches on the rear of the drive enclosure or the main circuit breaker, whichever is applicable (Figure 6-1).

Important: Once the power is off, you must wait at least 30 seconds before you turn it back on again.

5. After you have performed the necessary maintenance procedure, turn on the power again using the procedure given in "Turning the Power On" on page 85.

Monitoring Status Through Software

Use the storage management software (TPSSM7) to monitor drive enclosure status. You should run the software constantly and check it frequently.

The storage management software (TPSSM7) provides the best method to diagnose and repair drive enclosure failures. This software helps you to:

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

Although the drive enclosure has fault indicators, these lights do not necessarily indicate which component has failed or needs to be replaced, or which type of recovery procedure you must perform. In some cases (such as loss of redundancy in various drive enclosure components), the fault light does not even come on. Only the storage management software (TPSSM7) can detect the failure.

For example, the recovery procedure for an impending drive failure (a predictive failure analysis, or PFA, flag on a drive) varies depending on the drive status (hot spare, unassigned, RAID level, current volume 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 (TPSSM7) can identify the risk level and provide the necessary recovery procedures. Note also that in the case of PFA flags, the Global Fault and drive Fault indicators do *not* come on, so just checking the indicators will not notify you of the failure, even if the risk of data loss is high.

In addition, recovering from a drive enclosure failure may require you to perform procedures other than replacing the component (such as backing up the volume or

failing a drive before removing it). The storage management software (TPSSM7) will give these procedures.

Caution: Not following the software recovery procedures could lead to data loss.

Note: For more information on the storage management software (TPSSM7), see the *SGI TP9400 RAID IRIX Administration Guide* (007-4306-001), the *TPSSM7 RAID Software Concepts Guide for TP9400* (007-4305-001), and the *SGI Storage Area Network Installation Instructions* (108-0252-003).

Checking the Drive Enclosure Indicator Lights

The drive enclosure's indicator lights display the status of the drive enclosure and its components. Green indicators mean a normal operating status; amber indicators mean a possible failure.

It is important that you check all the indicators on the front and rear of the drive enclosure when you turn on the power. Besides checking for faults, you can use the indicators on the front of the drive enclosure to determine if the drives are responding to I/O transmissions from the host.

Important: Except as described in the notes following Figure 6-4 and Figure 6-5, an amber light indicates a drive enclosure component failure. If you see an amber indicator, run the storage management software (TPSSM7) to diagnose and repair the problem.

Use this procedure to check the drive enclosure indicators and operating status.

1. Check the indicators on the front of the drive enclosure (Figure 6-4 and Table 6-1).
2. Check the indicators on the rear of the drive enclosure (Figure 6-5 and Table 6-2).
3. If any indicators show other than a "normal status," run the storage management software (TPSSM7) to diagnose and repair the problem.

Front Indicator Lights

Figure 6-4 and Table 6-1 describe the front indicators.

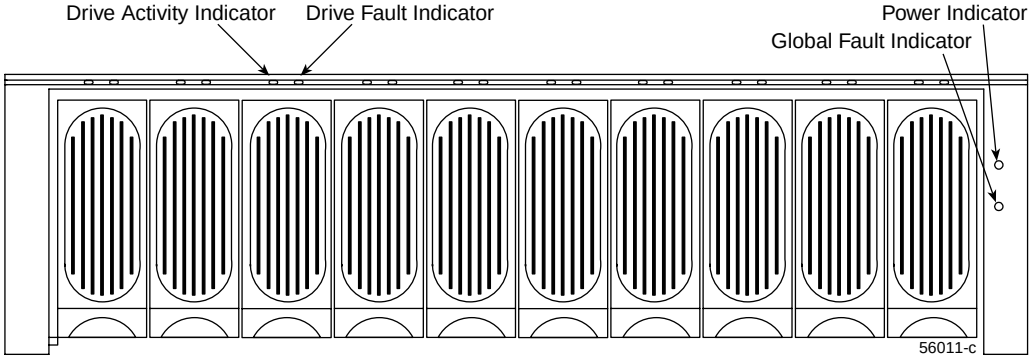

Figure 6-4 Indicator Lights (Front)

Note: The normal operating state of all indicators on the front panel is green (blinking if the drives are processing data). If an amber indicator is on, or a green indicator is off, use the storage management software (TPSSM7) to determine the nature of the fault and the recovery procedure.

Exception: If the drive Fault indicators are blinking, it means that the storage management software (TPSSM7) is locating a drive enclosure component. It does not indicate a failure.

Table 6-1 Indicator Lights (Front)

Indicator Light	Color	Normal Operation	Problem Indicator	Condition Indicated[a]
Drive Activity Indicator	Green	On, steady On, blinking[b]	Off	No power to drive enclosure; no power to storage array; drive not properly seated in drive enclosure; drive not spun up
Drive Fault Indicator	Amber	Off On, blinking[c]	On, steady	Drive failure; drive failed by user

Table 6-1 (continued) Indicator Lights (Front)

Indicator Light	Color	Normal Operation	Problem Indicator	Condition Indicated[a]
Power Indicator	Green	On	Off	No power to drive enclosure; no power to storage array; power supply failure; overtemp condition
Global Fault Indicator[d]	Amber	Off	On	Drive enclosure component failure

a. Always use the storage management software (TPSSM7) to precisely identify a failure.

b. The drive Activity indicator blinks if data is being processed on the drives; otherwise, the indicator is on, steady.

c. The drive Fault indicator blinks when the storage management software (TPSSM7) is locating a drive, volume, or storage array. Otherwise, it is off.

d. Not all drive enclosure component failures will turn this light on. See Chapter 6, "Monitoring Status Through Software," for more information.

Rear Indicator Lights

Figure 6-5 and Table 6-2 describe the rear indicators.

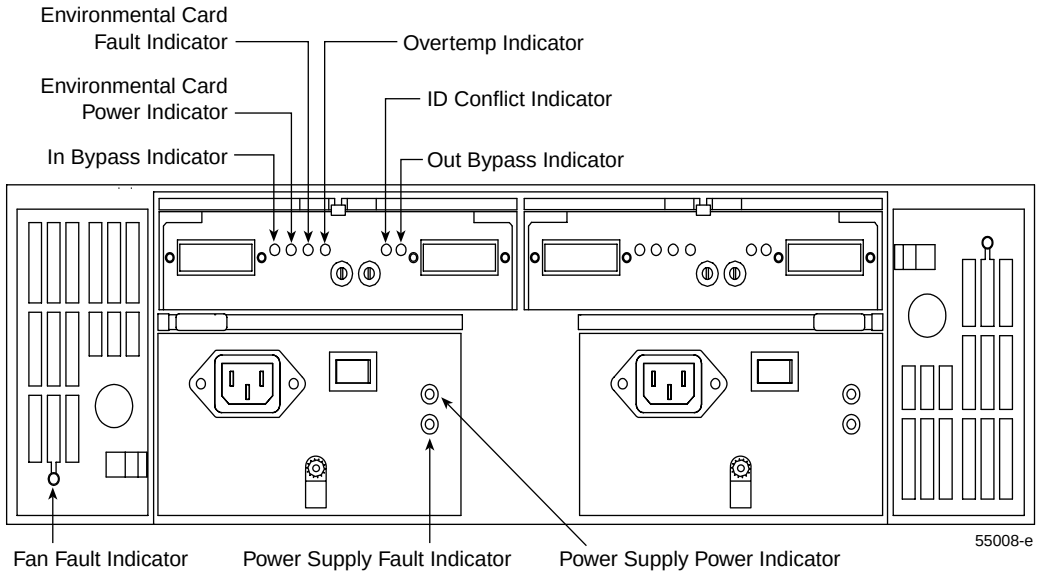

Figure 6-5 Indicator Lights (Rear)

Note: The normal operating state of all indicators on the rear panel is green (blinking if the drives are processing data). If an amber indicator is on, or a green indicator is off, use the storage management software (TPSSM7) to determine the nature of the fault and the recovery procedure.

Exception: If the drive Fault indicators are blinking, it means that the storage management software (TPSSM7) is locating a drive enclosure component. It does not indicate a failure.

Table 6-2 Indicator Lights (Rear)

Component	Indicator Light	Color	Normal Operation	Problem Indicator	Condition Indicated[a]
Environmental Status Module	Environmental Card Fault Indicator	Amber	Off	On, steady	Environmental card canister failure
	Environmental Card Power Indicator	Green	On, steady	Off	No power to drive enclosure; no power to storage array; overtemp condition; power supply failure
	In, Out Bypass Indicators	Amber	Off On, steady[b]	On, steady[c]	GBIC failure; cable failure; controller enclosure mini-hub failure
	Overtemp Indicator[d]	Amber	Off	On, steady	Overtemp condition; fan failure
	ID Conflict Indicator	Amber	Off	On, steady	Enclosure number is set incorrectly; enclosure number is in use by another subsystem on the loop
Fan Canister	Fan Fault Indicator	Amber	Off	On, steady	Fan canister failure; overtemp condition
Power Supply Canister	Power Supply Fault Indicator	Amber	Off	On, steady	Power supply failure; overtemp condition
	Power Supply Power Indicator	Green	On, steady	Off	Power supply off; power supply disconnected; power supply is seated incorrectly; no power to drive enclosure; no power to storage array

a. Always use the storage management software (TPSSM7) to precisely identify a failure.

b. If nothing is connected to the corresponding connector, this fault light is on. If a cable is connected and it is functioning properly, this light is off.

c. This indicates a problem only if a GBIC is plugged into the corresponding connector (see footnote a). Also, more than one Bypass indicator will be on if the connection fails. Usually, if a GBIC fails, its Bypass indicator will come on, as will the Bypass indicator of the GBIC to which it is connected.

d. The Overtemp indicator comes on if the internal drive enclosure temperature reaches 40° C (104° F). See Chapter 6, "Overtemp Condition" for more information on the overtemp condition.

Moving the Drive Enclosure

Before moving the drive enclosure to a new location or before removing the enclosure from its rack, it is highly recommended that you first remove all drive sleds from the enclosure. Doing so will help safeguard the equipment and help ensure a smoother transition to the new environment. Before removing the drive sleds, label each one so that they will be replaced in the correct order.

If you do not have sufficient assistance or equipment to safely move the equipment to its new location, refer to Chapter 7, "Drive Enclosure Component Replacement Procedures" for instructions on depopulating the drive enclosure.

Note: If you are removing the drive enclosure so that you can connect it to another controller enclosure, you must delete all volumes and hot spares from the drives before removing the unit.

Also, if you are moving the drive enclosure a significant distance (to another building, city, etc.), it is recommended that you pack it in its original shipping container.

Removing the Drive Enclosure

Use the following procedure to remove and reinstall the drive enclosure.

1. Remove the front bezel from the drive enclosure (Figure 6-6).

   The front bezel is held on by four snaps. Use a screwdriver to lever each end of the bezel off the rack, then remove the bezel.

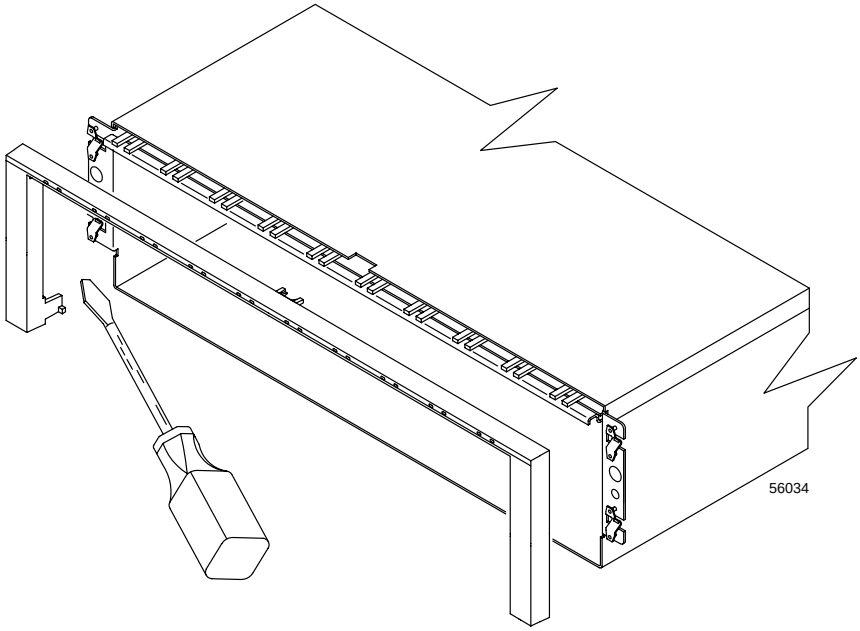

Figure 6-6 Removing the Front Bezel from the Drive Enclosure

2. It is highly recommended that you remove the canisters to make the enclosure lighter and easier to remove. For information, see Chapter 7, “Drive Enclosure Component Replacement Procedures”.
3. Remove the front and rear mounting screws (Figure 6-7). There are two mounting screws at the rear, one for each support rail, and two mounting screws in the front, one in each flange.

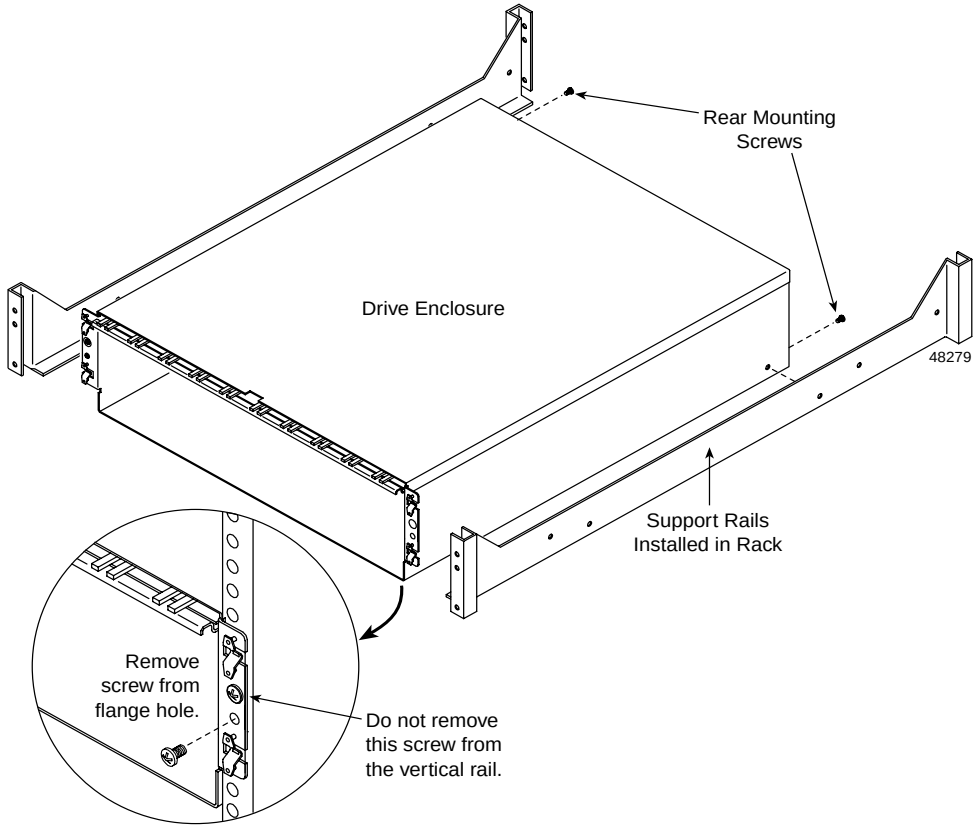

Figure 6-7 Removing the Empty Drive Enclosure

4. Slide the drive enclosure out of the front of the rack.
5. Repeat steps 1 through 4 for any other drive enclosures to be moved.

Reinstalling the Drive Enclosure

Use this procedure to reinstall the drive enclosure into a rack.

1. Install the support rails in the rack. Refer to the procedure in the *SGI TP9400 RAID Installation and Upgrade Guide* (108-0292-001).
2. From the front of the rack, slide the drive enclosure into the rack along the support rails (Figure 6-7).
3. Fasten the rear and front mounting screws (Figure 6-7).
4. Slide the top of the front bezel over the indicator lights and snap into place (Figure 6-6).
5. Wearing antistatic protection, reinstall the components into the drive enclosure. For more information, refer to Chapter 7, “Drive Enclosure Component Replacement Procedures”.

Drive Enclosure Component Replacement Procedures

This chapter describes the replacement of each component in the drive enclosure, in the event of a component failure.

Replacing a Failed Drive Sled

Use the following procedure when instructed by the storage management software (TPSSM7) to replace a failed drive sled.

Before starting this procedure, read "Drive Sled" on page 77.

Caution: Electrostatic discharge can damage sensitive components. Use a grounded wrist strap or other antistatic precautions before handling drive enclosure components.

1. Check the storage management software (TPSSM7) for instructions on drive failure recovery procedures. Follow any steps given in the software procedure before continuing with this procedure.

Caution: Removing the wrong drive can cause data loss. Make sure you remove only the failed drive sled. The drive Fault indicator should be on (amber) above the failed drive sled.

Removing a drive sled while its green Activity indicator is blinking can cause data loss and may cause the host controller to mark the drive as failed. If you remove an active drive accidentally, wait at least 30 seconds and then reinstall it. Refer to the storage management software (TPSSM7) for further recovery instructions.

2. Locate the failed drive sled (its fault light should be on).

3. Wearing antistatic protection, lift (open) the lever of the failed drive sled.
4. Pull out the drive sled (Figure 7-1).

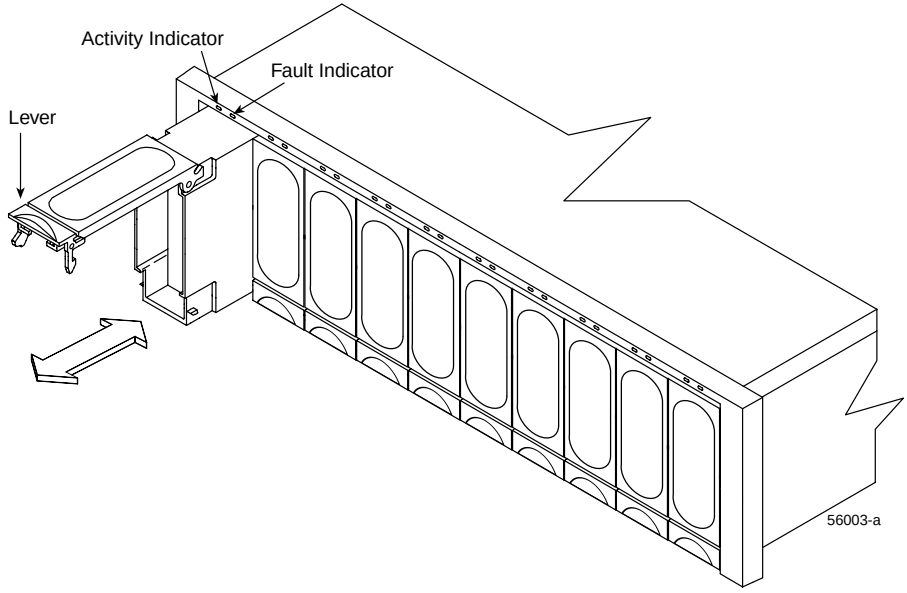

Figure 7-1 Removing and Installing a Drive Sled

5. Wait at least 30 seconds after removing the failed drive sled.
6. Unpack the new drive sled. Save all packing materials in case you need to return the canister.
7. Review all documentation shipped with the new drive sled for updated replacement procedures and other information. If necessary, modify the remaining steps to meet the system requirements. Kits often contain the most current servicing information. If the kit instructions conflict with those in this procedure, use the kit instructions.
8. Wearing antistatic protection, slide the new drive sled fully into the slot.

Caution: Partial insertion of a drive may cause the controller to mark other drives on the same bus as failed. Install a drive in one complete motion. Make sure that you insert it all the way into the slot and lock it into place.

9. Lower (close) the lever. Wait for the new drive to spin up.
10. Check the drive Activity and Fault indicators above the new drive sled.

    The Activity indicator should be on (either blinking or steady) and the Fault indicator should be off.

    Note: The Fault indicator may flash intermittently while the drive spins up. The Activity indicator will blink if data is currently being written to the new drive sled.

    - If the Activity indicator is off, the drive sled may not be installed correctly. Remove the drive sled, wait 30 seconds, and then reinstall it.
    - If the Fault indicator stays on, or the Activity indicator stays off, the new drive may be bad. Refer to the storage management software (TPSSM7) for problem determination.
11. Refer to applicable software procedures (the storage management software (TPSSM7) or other system software) for instructions on bringing the drive sled back online.

    Important: Depending on your storage array configuration, the storage array may automatically reconstruct data to the new drive sled. If the array uses hot spares, it may have to complete reconstruction on the hot spare before it copies the data to the replaced drive. This increases the time required to complete this procedure. Use the storage management software (TPSSM7) to determine the current status of the new drive and the progress of any reconstruction or copyback.

Replacing a Failed Fan Canister

Use the following procedure when instructed by the storage management software (TPSSM7) to replace a failed fan canister.

Before starting this procedure, read "Fan Canister" on page 78.

Caution: Electrostatic discharge can damage sensitive components. Use a grounded wrist strap or other antistatic precautions before handling drive enclosure components.

1. Check the storage management software (TPSSM7) for instructions on fan canister failure recovery procedures. Follow the steps given in the software procedure before continuing with this procedure.
2. Unpack the new fan canister.

   Set the new fan canister on a dry, level surface near the drive enclosure. Save all packing materials in case you need to return the canister.
3. Review all documentation shipped with the new fan canister for updated replacement procedures and other information. If necessary, modify the remaining steps to meet the system requirements. Kits often contain the most current servicing information. If the kit instructions conflict with those in this procedure, use the kit instructions.
4. If the storage management software (TPSSM7) instructs you to do so, turn off the power to the drive enclosure. Otherwise, leave the power on.

Caution: To prevent the drive enclosure from overheating while in use, complete the fan canister replacement procedure within 15 minutes from the time you remove the failed fan canister to the time you install the new fan canister. Both fan canisters must be installed in the drive enclosure to provide sufficient air circulation within the enclosure.

5. Locate the failed fan canister (its Fault light should be on).
6. Wearing antistatic protection, slide the latch to unlock the canister (Figure 7-2). The latch is at the bottom of the left-side fan canister, and at the top of the right-side fan canister.

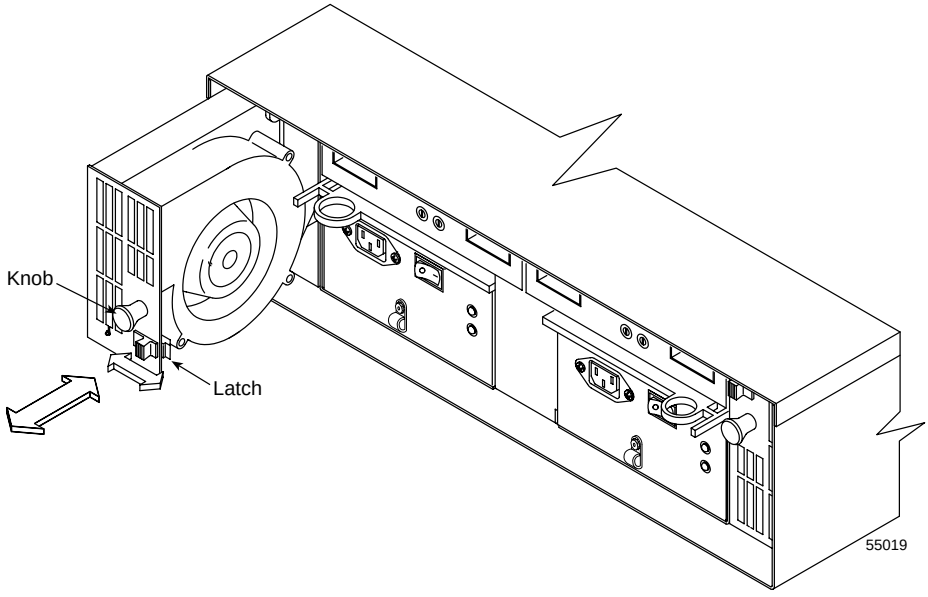

Figure 7-2 Removing and Installing a Fan Canister

7. Pull the knob to remove the canister.
8. Determine the correct orientation for the new fan canister. If replacing the canister on the left, orient the unit so the latch is at the bottom. If replacing the right-side canister, orient the unit so the latch is at the top.
9. Slide the new canister into the slot.
10. Push firmly until the latch snaps into place.
11. If you turned the power off, turn it back on.
12. Check the Fault indicators shown in Figure 7-3.

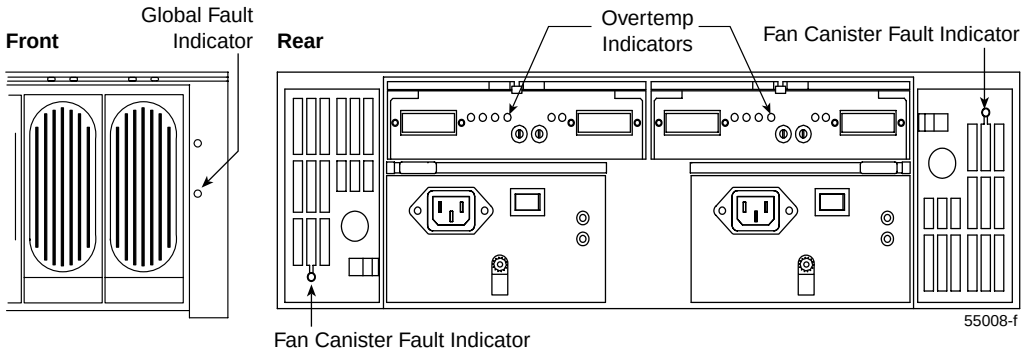

Figure 7-3 Fault Lights for Fan Canister Replacement

- If the fan Fault indicator is on or the fans are not spinning, the canister may be installed incorrectly. Remove the fan canister and reinstall it.
- If any of the other Fault indicators shown in Figure 7-3 are on, refer to the storage management software (TPSSM7) for problem determination.

Replacing a Failed Power Supply Canister

Use the following procedure when instructed by the storage management software (TPSSM7) to replace a failed power supply canister.

Before starting this procedure, read "Power Supply Canister" on page 80.

Caution: Electrostatic discharge can damage sensitive components. Use a grounded wrist strap or other antistatic precautions before handling drive enclosure components.

1. Check the storage management software (TPSSM7) for instructions on power supply failure recovery procedures. Follow the steps given in the software procedure before continuing with this procedure.
2. Unpack the new power supply canister.

   Set the new power supply canister on a dry, level surface near the drive enclosure. Save all packing materials in case you need to return the canister.

3. Review all documentation shipped with the new power supply canister for updated replacement procedures and other information. If necessary, modify the remaining steps to meet the system requirements. Kits often contain the most current servicing information. If the kit instructions conflict with those in this procedure, use the kit instructions.
4. Read the yellow "Caution" label on the rear of the drive enclosure between the power supply canisters (Figure 7-4).

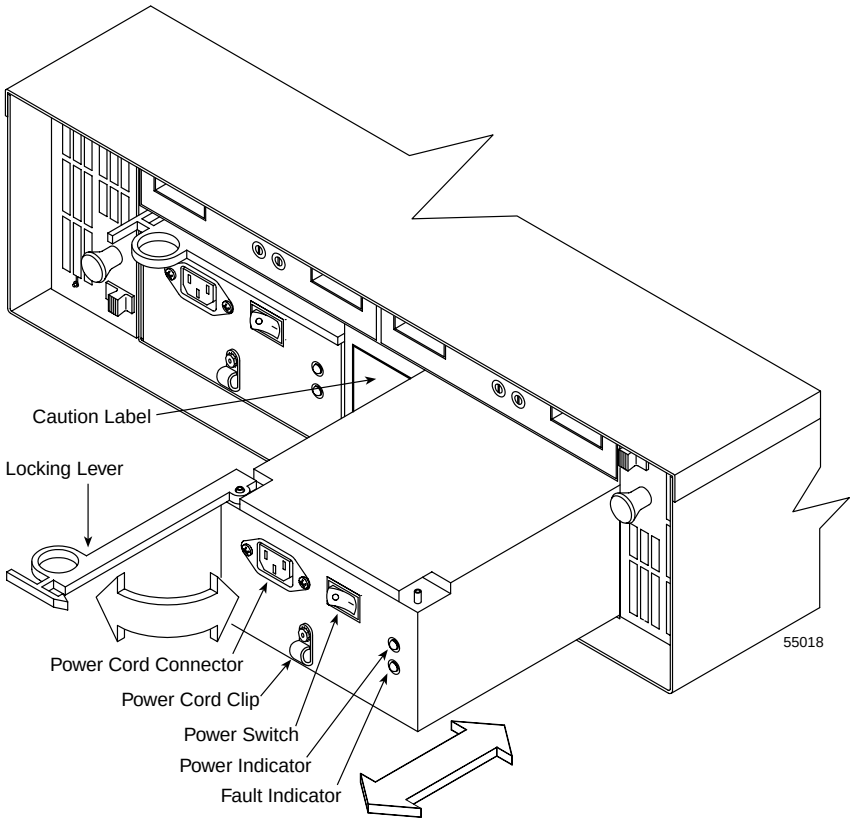

Figure 7-4 Removing and Installing a Power Supply Canister

Warning: Risk of shock. Make sure the power supply is turned off and unplugged before you remove or install it.

5. Locate the failed power supply (its Fault light should be on).
6. Turn off the power and unplug the power cord from the failed canister.
7. Remove the power cord from the power cord clip.
8. Wearing antistatic protection, grasp the pull-ring on the locking lever and squeeze it to unlatch the lever (Figure 7-4).
9. Pull open the lever and remove the failed canister.
10. Check the lever to make sure the orientation is the same as the canister it is replacing. If not, move the lever to the pivot post on the other side (Figure 7-5).

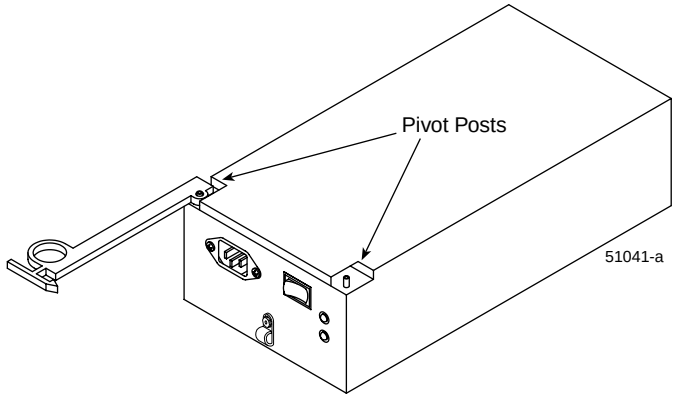

Figure 7-5 Power Supply Canister Lever

Warning: Risk of shock. Make sure the power supply is turned off and unplugged before you remove or install it.

11. Make sure that the power switch on the new power supply canister is turned off.
12. Wearing antistatic protection, slide the new power supply canister into the slot.
13. Close the lever and lock it into place.
14. Secure the power cord in the power cord clip.
15. Plug in the power cord and turn on the power switch.
16. Check that the Power indicator on the new canister is on and the Fault indicator is off (Figure 7-4).

- If the Power indicator is off, the canister may not be installed correctly. Remove it and reinstall it.
- If the Fault indicator is on, or the Power indicator stays off, refer to the storage management software (TPSSM7) for problem determination.

Replacing a Failed GBIC

When instructed by the storage management software (TPSSM7), replace a failed GBIC (Gigabit Interface Connector).

Before starting this procedure, read "GBIC Module" on page 83.

Caution: Electrostatic discharge can damage sensitive components. Use a grounded wrist strap or other antistatic precautions before handling drive enclosure components.

1. Check the storage management software (TPSSM7) for instructions on GBIC failure recovery procedures. Follow the steps given in the software procedure before continuing with this procedure.
2. Unpack the new GBIC.

   Set the new GBIC on a dry, level surface near the drive enclosure. Save all packing materials in case you need to return the GBIC.
3. Review all documentation shipped with the new GBIC for updated replacement procedures and other information. If necessary, modify the remaining steps to meet the system requirements. Kits often contain the most current servicing information. If the kit instructions conflict with those in this procedure, use the kit instructions.
4. Locate the failed GBIC.

   Important: When a GBIC fails, its Bypass indicator glows amber, and so does the Bypass indicator of the GBIC to which it is connected (including the fault light on the controller enclosure). Make sure you remove the correct GBIC. Use the fault lights and the storage management software (TPSSM7) to locate the failed GBIC.
5. Wearing antistatic protection, remove the Fibre Channel cables from the failed GBIC (Figure 7-6).

Caution: Bending or damaging Fibre Channel cables can result in degraded performance or data loss. Fibre Channel cables are fragile. Do not pinch the cables with tie wraps, step on them, or bend at them sharp angles.

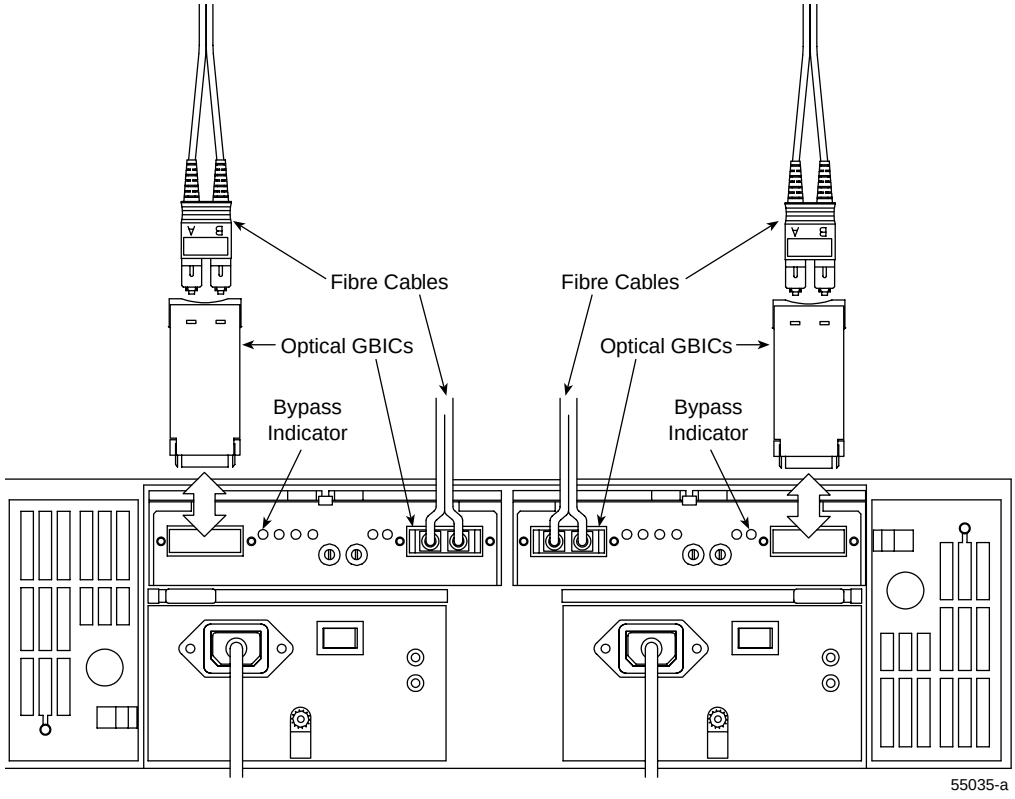

Figure 7-6 Removing and Installing a GBIC

6. Remove the failed GBIC from the environmental status module.
7. Insert the new GBIC into the environmental status module.
8. Connect the Fibre Channel cables to the new GBIC.
9. Check the Bypass indicator next to the failed GBIC (Figure 7-6).

- If the Bypass indicator is on, the GBIC may not have been inserted correctly. Remove the GBIC and reinsert it.
- If the Bypass indicator stays on, or a Fault indicator on the environmental status module comes on, refer to the storage management software (TPSSM7) for problem determination.

Replacing a Failed Environmental Status Module

Use the following procedure when instructed by the storage management software (TPSSM7) to replace a failed environmental status module.

Before starting this procedure, read "Environmental Status Module" on page 81.

Caution: Electrostatic discharge can damage sensitive components. Use a grounded wrist strap or other antistatic precautions before handling drive enclosure components.

1. Check the storage management software (TPSSM7) for instructions on environmental card failure recovery procedures. Follow the steps given in the software procedure before continuing with this procedure.
2. Unpack the new environmental status module.

   Set the new canister on a dry, level surface near the drive enclosure. Save all packing materials in case you need to return the canister.
3. Review all documentation shipped with the new environmental status module for updated replacement procedures and other information. If necessary, modify the remaining steps to meet the system requirements. Kits often contain the most current servicing information. If the kit instructions conflict with those in this procedure, use the kit instructions.
4. Locate the failed environmental status module (its Fault indicator should be on).
5. Remove the Fibre Channel cables from the GBICs in the failed canister, then remove the GBICs (Figure 7-7). Label each cable to ensure that all cables are properly reconnected to the new canister.

Caution: Bending or damaging Fibre Channel cables can result in degraded performance or data loss. Fibre Channel cables are fragile. Do not pinch the cables with tie wraps, step on them, or bend at them at sharp angles.

6. Set the Enclosure ID Numbers on the new canister exactly as they are set on the failed environmental status module (Figure 7-7).

Caution: Failure to set the IDs properly on the new canister can result in data loss on one or all drive enclosures.

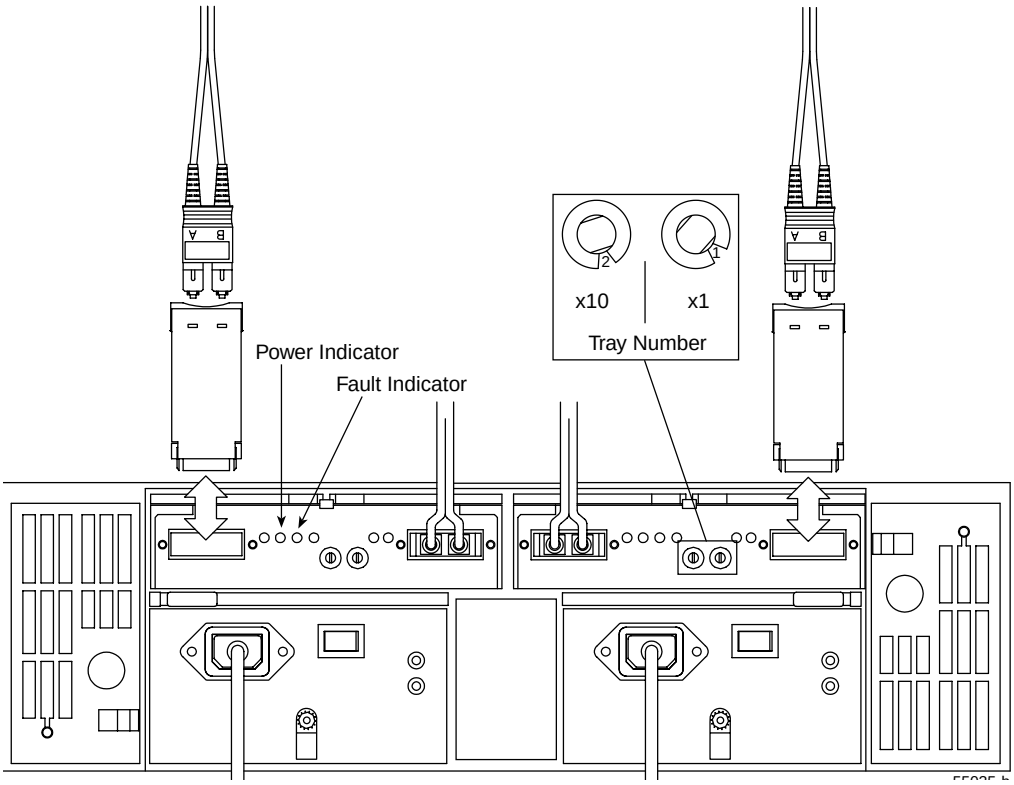

Figure 7-7 Removing GBICs from the Environmental Status Module

7. Wearing antistatic protection, push down on the latch centered above the environmental status module (Figure 7-8).

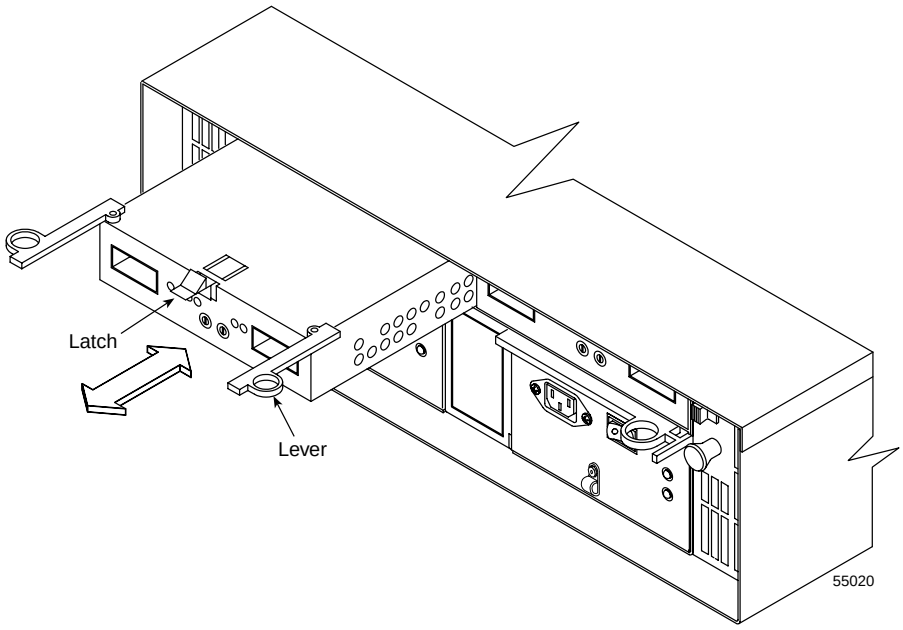

Figure 7-8 Removing and Installing an Environmental Status Module

8. The levers will pop out of the locked position.
9. Grasp the pull-rings and pull on the levers to remove the failed canister.
10. Wearing antistatic protection, slide the new environmental card canister all the way into the empty slot.
11. Close both levers until the latch locks into place.
12. Attach the GBICs and Fibre Channel interface cables to their original locations.
13. Check the Power and Fault indicators on the new canister (Figure 7-7).
    - If the Power indicator is off, the canister may not have been inserted correctly. Remove the canister and reinsert it.
    - If the Fault indicator is on, the Power indicator stays off, or any other Fault indicator is on, refer to the storage management software (TPSSM7) for problem determination.
14. Refer to the storage management software (TPSSM7) for instructions on bringing the environmental status module online.

Upgrading Drives

You can upgrade drives in two ways:

- Add drives to empty slots in the drive enclosure (see "Adding Drives to Empty Slots" on page 114).
- Replace existing drives with larger capacity drives (see "Adding Larger Capacity Drives" on page 115).

Adding Drives to Empty Slots

Use this procedure to install additional drives into empty slots in the drive enclosure. You can install additional drives while the drive enclosure is powered-up and running.

Caution: Electrostatic discharge can damage sensitive components. Use a grounded wrist strap or other antistatic precautions before handling drive enclosure components.

1. Read the pertinent information in the software manuals supplied with your system regarding drive upgrades and installation.
2. Check the storage management software (TPSSM7) and repair all reported problems.
3. Locate the blank drive sleds.
   - Because the blank drive sleds contain no drives, their Activity indicators (on the front bezel above the drive sled) will not be on.
   - Verify these drive positions are blank using the storage management software (TPSSM7).

Caution: Removing the wrong drive can cause data loss. Make sure you remove only the blank drive sleds.

If you remove an active drive accidentally, wait at least 30 seconds and then reinstall it. Refer to the storage management software (TPSSM7) for further recovery instructions.

4. Wearing antistatic protection, lift (open) the lever of the blank drive sled.

5. Pull out the blank drive sled (Figure 7-1 on page 102).
6. Unpack the new drive sled. Save all packing materials in case you need to return the drive sled.
7. Review all documentation shipped with the new drive sleds for updated replacement procedures and other information.
8. Slide the new drive sled fully into the slot.
9. Lower (close) the lever.
10. Check the drive Activity and Fault indicators above the new drive sleds.

    The Activity indicators should be on and the Fault indicators should be off.

    Note: The Fault indicator may flash intermittently while the drive spins up.

    - If the Activity indicator is off, the drive sled may not be installed correctly. Remove the drive sled, wait 30 seconds, and then reinstall it.
    - If the Fault indicator stays on, or the Activity indicator stays off, the new drive may be bad. Refer to the storage management software (TPSSM7) for problem determination.
11. Configure the new drives using the storage management software (TPSSM7).

Adding Larger Capacity Drives

This section provides guidelines for upgrading the disk drives in a storage array. Carefully read your software documentation and this entire section to determine if you should use this procedure, use a modified version of this procedure, or use a different procedure provided by your operating system. Instructions provided with your software should supersede anything given here.

Caution: Electrostatic discharge can damage sensitive components. Use a grounded wrist strap or other antistatic precautions before handling drive enclosure components.

The only method for upgrading disk drives is to replace them all at the same time. This method requires you to back up the drive enclosure and shut down the storage array before replacing the drives. After replacing all the drives, you must reconfigure the drive

enclosure and restore the data from backup media. This is the safest way to exchange drives without losing data. However, this method may take a long time to complete because of the backup, reconfiguration, and restoration processes. In addition, other users will not be able to use the drive enclosure until you finish the procedure. You must use this method on RAID 0 logical units (LUNs).

Use the following procedure to replace all drives at the same time. All the data currently on the drives will be lost when you replace the drives. You must use this method if you are upgrading drives containing RAID 0 volumes.

1. Read the following:
   - The information in the section "Upgrading Drives" on page 114.
   - The information in your software documentation regarding drive upgrades/installation.
   - The documentation shipped 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. Check the storage management software (TPSSM7) and repair all reported problems.
3. Perform a complete backup of the drives you are replacing.

   You need the backup to restore data on the drives later in this procedure.
4. Shut down all I/O activity on the drive enclosure.

   Make sure the drive Activity indicators on the front are not blinking.
5. Turn off both power switches on the rear of the drive enclosure.
6. Remove the drives that you intend to replace. Wearing antistatic protection, lift (open) the lever of the drive sleds. Pull out the drive sleds (see Figure 7-1 on page 102).
7. Unpack a new drive. Save the packing material and documentation in case you need to return the drive.
8. Slide the new drive sled fully into a slot.
9. Lower (close) the lever.
10. Repeat steps 7 through 9 until you have installed all the new drives.

11. Turn on both drive enclosure power switches.
12. Check the drive Activity and Fault indicators above the new drive sleds.

    The Activity indicators should be on and the Fault indicators should be off.

    Note: The Fault indicator may flash intermittently while the drive spins up.

    - If the Activity indicator is off, the drive sled may not be installed correctly. Remove the drive sled, wait 30 seconds, and then reinstall it.
    - If the Fault indicator stays on, or the Activity indicator stays off, the new drive may be bad. Refer to the storage management software (TPSSM7) for problem determination.
13. Configure the drives as necessary.

    Configure the new drives using the storage management software (TPSSM7). See your software documentation for detailed instructions.
14. Restore the data from backup to all the drives.

Adding Additional Drive Enclosures

You can add new drive enclosures to an existing storage array without turning off the array or interrupting data flow. This is done in one of two ways:

- By connecting the new drive enclosure to empty connectors on the controller enclosure (see the following section “Connecting the New Drive Enclosure to a Controller Enclosure”).
- By installing the new drive enclosure into an existing drive loop (see “Connecting the New Drive Enclosure to an Existing Loop” on page 118).

Caution: You can add only new drive enclosures to the storage array. This means that there must be no existing information on the drive enclosure you want to install. If the drive enclosure you want to install currently contains volumes or configured hot spares, you must delete them before adding the drive enclosure to a new configuration.

You need to refer to the installation manual accompanying your controller and drive enclosures to complete this procedure.

Important: The procedures given here apply to the TP9400 controller enclosure containing a TP9400 controller. If you are not using this controller enclosure or this controller, you may not be able to add the new drive enclosures without shutting down the storage array. Check your controller enclosure user guide for more information.

Connecting the New Drive Enclosure to a Controller Enclosure

To install one or more new drive enclosures by connecting the new enclosures directly to the controller enclosure, perform the following procedure.

1. Follow the instructions in your drive enclosure installation manual to set up and mount the new drive enclosures and to connect them to each other.
2. Follow the instructions given in your controller and drive enclosure installation manuals to connect the drive enclosures to the controller enclosure.

Caution: Electrostatic discharge can damage sensitive components. Use a grounded wrist strap or other antistatic precautions before handling drive enclosure components.

After you complete all connections, the controller will locate the new drives.

3. Use the storage management software (TPSSM7) to check the status of the new drives and correct any errors found.
4. Use the storage management software (TPSSM7) to configure the new drives.

Connecting the New Drive Enclosure to an Existing Loop

To install one or more new drive enclosures into an existing loop, perform the following procedure.

1. Follow the instructions in your drive enclosure installation manual to set up and mount the new drive enclosures and to connect them to each other.
2. Re-cable the drive enclosures as shown in Figure 7-9.

Caution: Electrostatic discharge can damage sensitive components. Use a grounded wrist strap or other antistatic precautions before handling drive enclosure components.

a. Disconnect the cable (marked “1” in the illustration) from its current connection and connect it to the In connector on the new drive enclosure. If you are adding more than one drive enclosure, connect this cable to the In connector on the last drive enclosure in the new group.

b. Connect a cable (marked “2” in the illustration) to the In connector you disconnected in the previous step and the Out connector on the new drive enclosure.

c. Connect a second cable (marked “3” in the illustration) to the empty In connector on the current drive enclosure and the Out connector on the new drive enclosure.

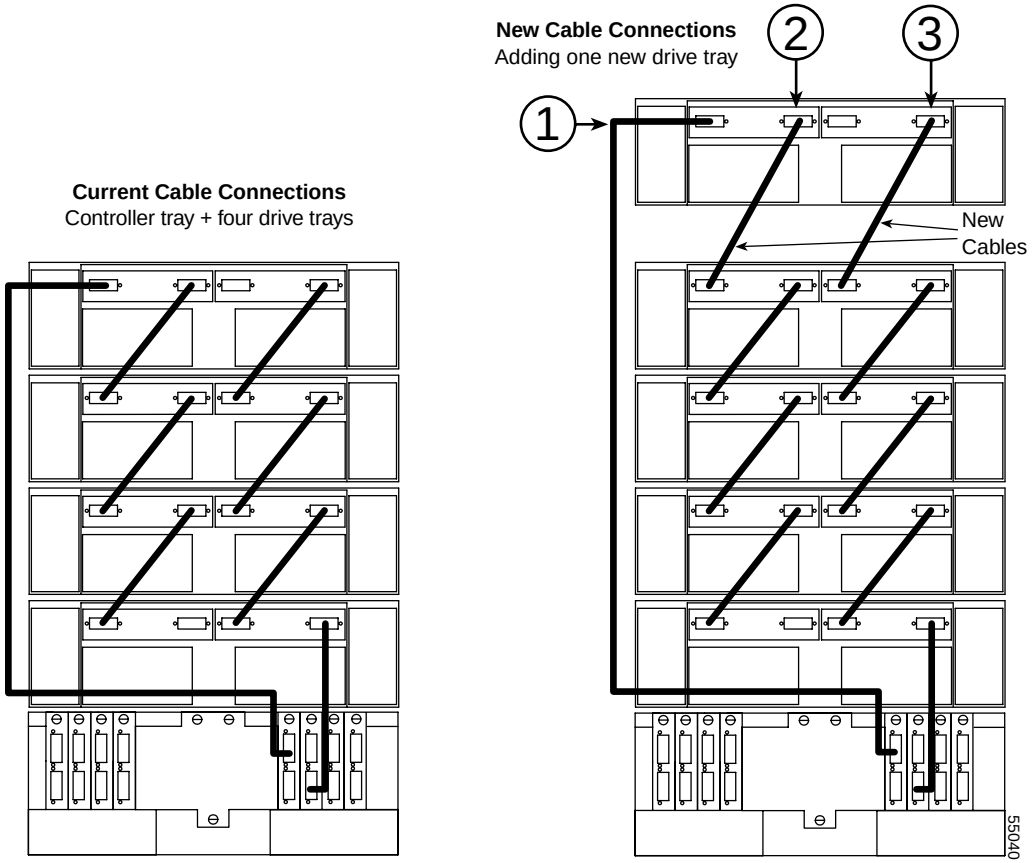

Figure 7-9 Adding A New Drive Enclosure to an Existing Loop

After you complete all connections, the controller will locate the new drives.

Important: Depending on how long it takes you to complete steps a and b in Figure 7-9, the storage management software (TPSSM7) may report a loss of redundancy error on the drive enclosures in the loop. This error will not interfere with data flow, and will disappear after you complete step b.

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3. Use the storage management software (TPSSM7) to check the status of the new drives and correct any errors found.
4. Use the storage management software (TPSSM7) to configure the new drives.

Cabling

This chapter describes the cabling between the controller enclosure and the front-end host, the drive enclosure and the back-end drive side, Ethernet, serial port, and power connections.

Connecting the Drive Loop Cables

The TP9400 is designed to support redundant drive loops. A redundant drive loop consists of one or more drive enclosures connected to the controller enclosure using two sets of data cables. If one data path fails, the controller uses the other data path to maintain access to the drive group.

Use this procedure to cable a group of TP9400 drive enclosures into a redundant drive loop. If the drive loop contains only one drive enclosure, skip this procedure and go to "Connecting Drive Cables to the Controller Enclosure" on page 125.

Caution: Electrostatic discharge can damage sensitive components. Use appropriate antistatic precautions before handling any components.

To complete this procedure, you will need two optic interface cables.

1. Connect the first two drive enclosures to drive Loop A (Figure 8-1).

   Starting with the first drive enclosure, connect an interface cable from the In (sometimes shown as an Up arrow) connector on the left environmental status module to the Out (sometimes shown as a Down arrow) connector on the left environmental status module in the second (next) drive enclosure.

   Note: "In" and "Out" (or Up and Down arrows) do not refer to data flow direction. These are meant to indicate how enclosures are chained.

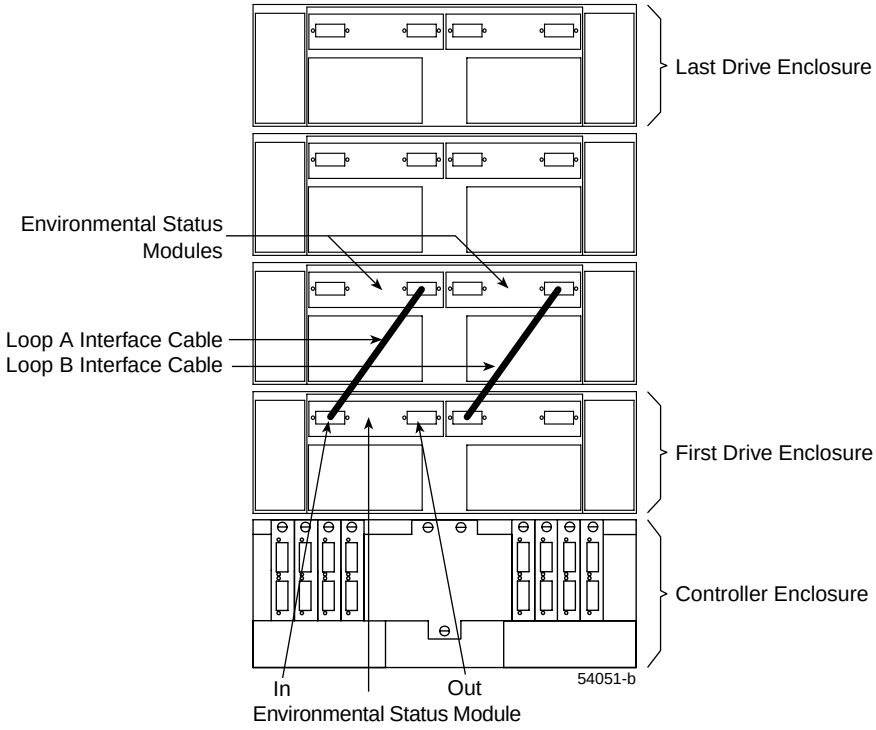

Figure 8-1 Connecting Two Drive Enclosures Into a Redundant Drive Loop

2. Connect the first two drive enclosures to drive Loop B (Figure 8-1).

   Starting with the first drive enclosure, connect an interface cable from the In connector on the right environmental status module to the Out connector on the right environmental status module in the second (next) drive enclosure. If you want to cable more drive enclosures into Loops A and B, continue at step 3, otherwise, skip to step 4.

3. Connect additional drive enclosures to drive Loops A and B (Figure 8-2).

   Starting with the second drive enclosure, cable each additional drive enclosure into Loops A and B in the same manner. Leave the In connectors on the last drive enclosure (the one farthest from the host) and the Out connectors on the first drive enclosure unoccupied. When finished, continue at step 4.

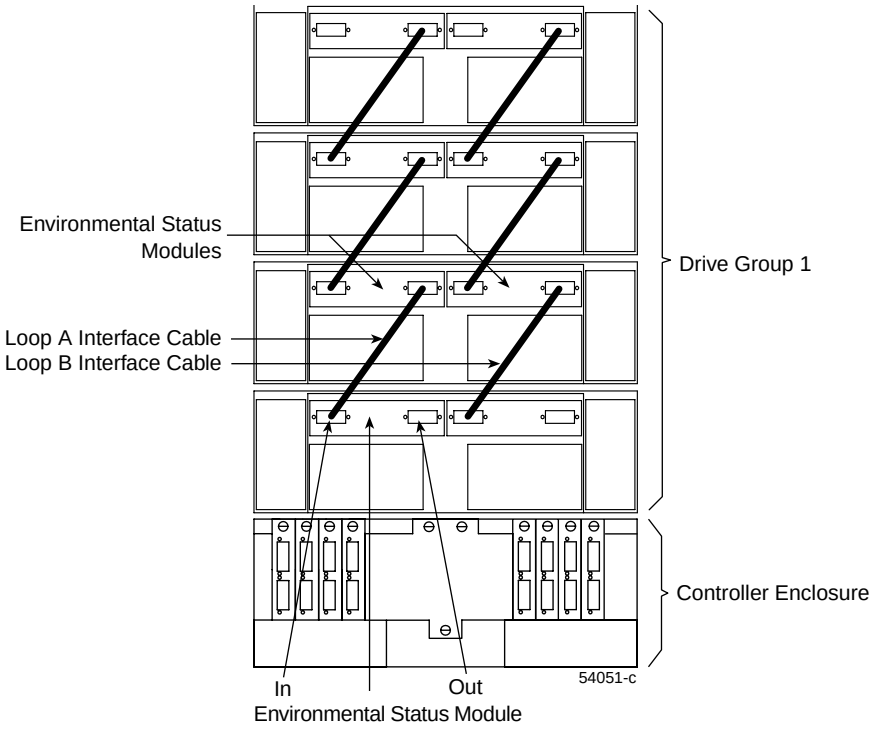

Figure 8-2 Connecting Additional Drive Enclosures to Drive Loops A and B

4. Repeat step 1 through step 3 to cable a second drive group in the same manner (Loop C and Loop D on Drive Group 2) (Figure 8-3).

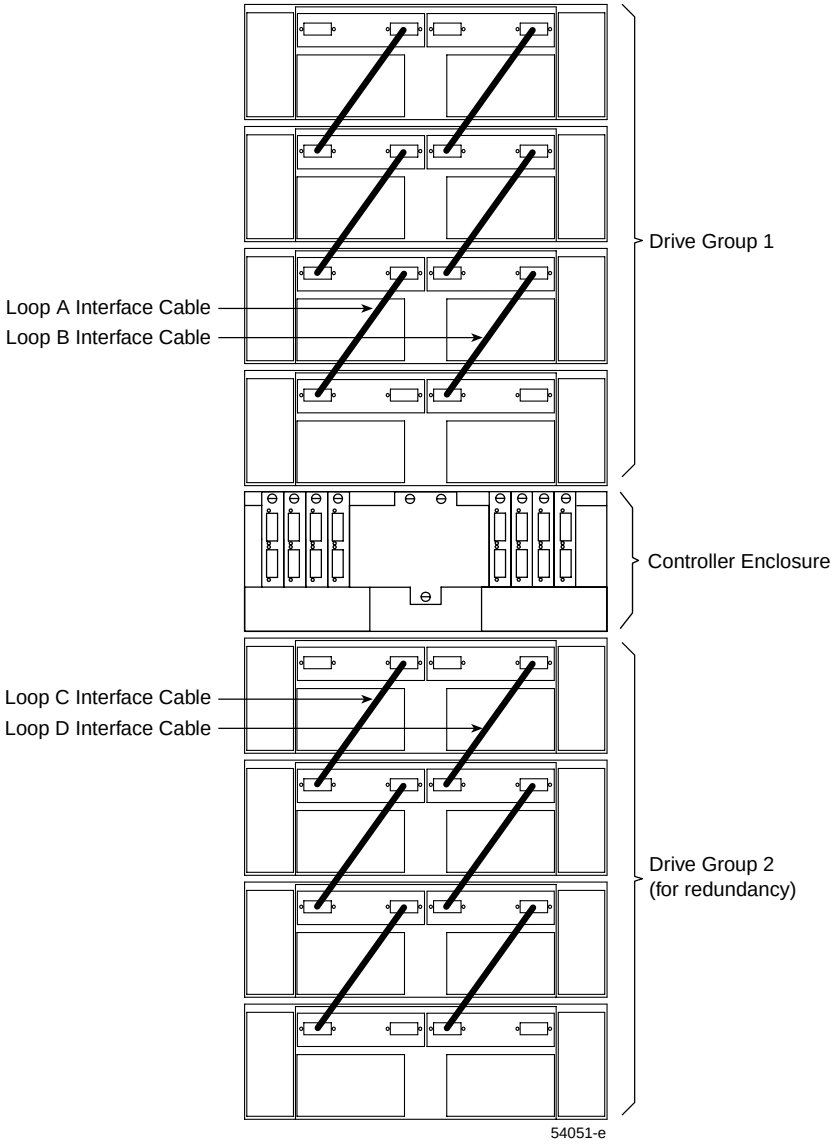

Figure 8-3 Connecting a Second Redundant Drive Loop

Connecting Drive Cables to the Controller Enclosure

Use the following procedure to connect a redundant drive loop to the TP9400 controller enclosure. You will need two fiber optic cables per drive loop.

Caution: Electrostatic discharge can damage sensitive components. Use appropriate antistatic precautions before handling any components.

1. Connect drive Loop A to the controller enclosure (Figure 8-4).

   Starting with the last drive enclosure, cable the In connector on the left environmental card to the upper connector on drive minihub card 4 on the controller enclosure. Leave the In lower connector on card 4 unoccupied.

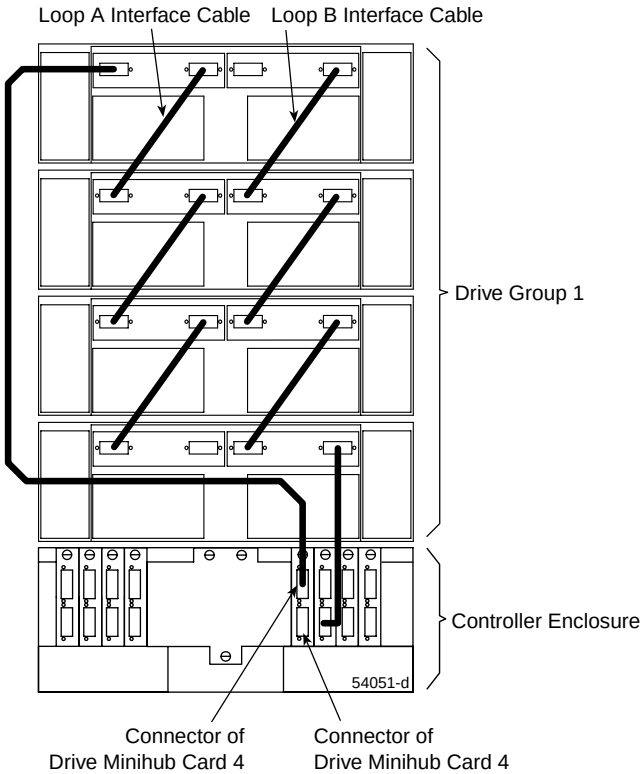

Figure 8-4 Cabling Redundant Drive Loops to the Controller

2. Connect drive Loop B to the controller enclosure (Figure 8-4).

   Starting with the first drive enclosure, cable the Out connector on the right environmental card to the In (lower) connector on drive minihub card 3. Leave the Out connector on the left environmental card and the upper connector on card 3 unoccupied.

3. To connect a second drive group as a redundant drive loop to the same controller enclosure, continue at Step 4. Otherwise go to "Connecting the TP9400 to the Hosts" on page 128.

4. Connect drive Loop C to the controller enclosure (Figure 8-5).

   Starting with the first drive enclosure, cable the In connector on the left environmental card to the Out (upper) connector on drive minihub card 2. Leave the In (lower) connector on card 2 unoccupied.

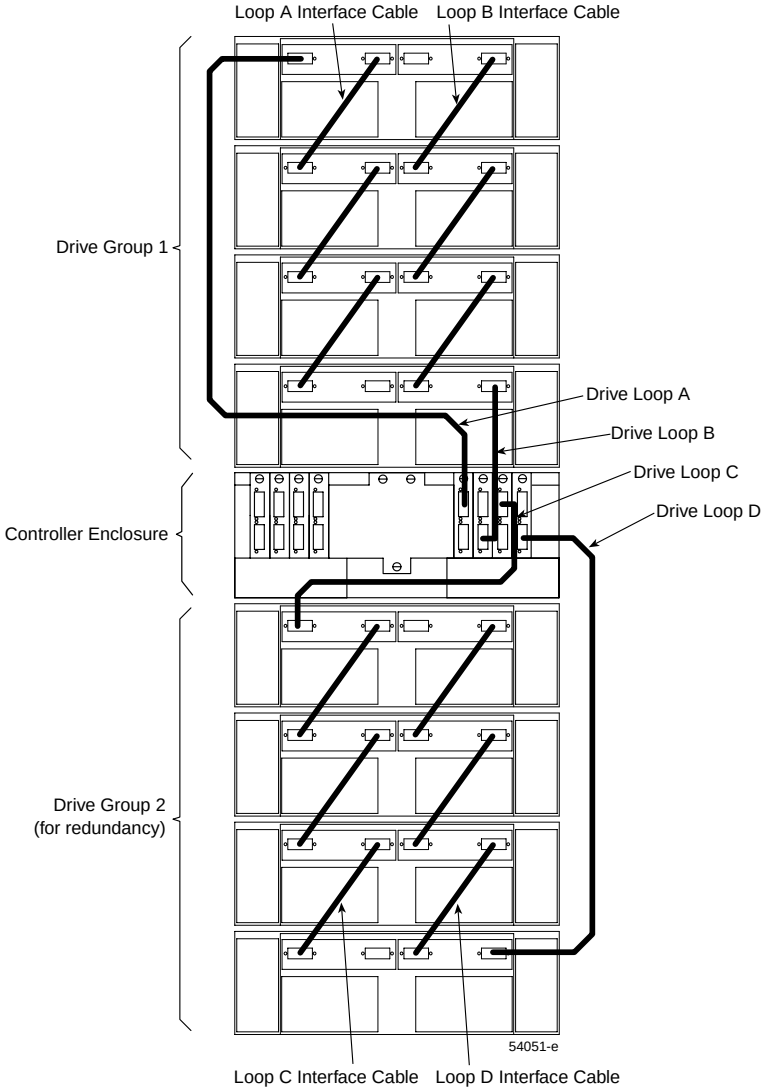

Figure 8-5 Two Drive Groups, Each With Redundant Drive Loops

5. Connect drive Loop D to the controller enclosure (Figure 8-5).

Starting with the last drive enclosure, cable the Out connector on the right environmental card to the In (lower) connector on drive minihub card 1. Leave the Out (upper) connector on card 1 unoccupied.

Connecting the TP9400 to the Hosts

The TP9400 can be connected to the host computer (or multiple host computers) in many ways. The following figures show typical examples of how you can connect the TP9400 either by direct connect or fabric connect. All examples assume dual controller High Availability (HA) configurations.

Caution: Electrostatic discharge can damage sensitive components. Use appropriate antistatic precautions before handling any components.

Examples of Direct Host Connection Cabling

Figure 8-6 shows the simplest dual-controller, direct connection. The Host Bus Adapter (HBA) 1 is connected to Controller A, and the HBA 2 is connected to Controller B.

Note: If the host's operating system does not support fail-over, the host can only to be connected to one controller. Refer to Figure 8-8.

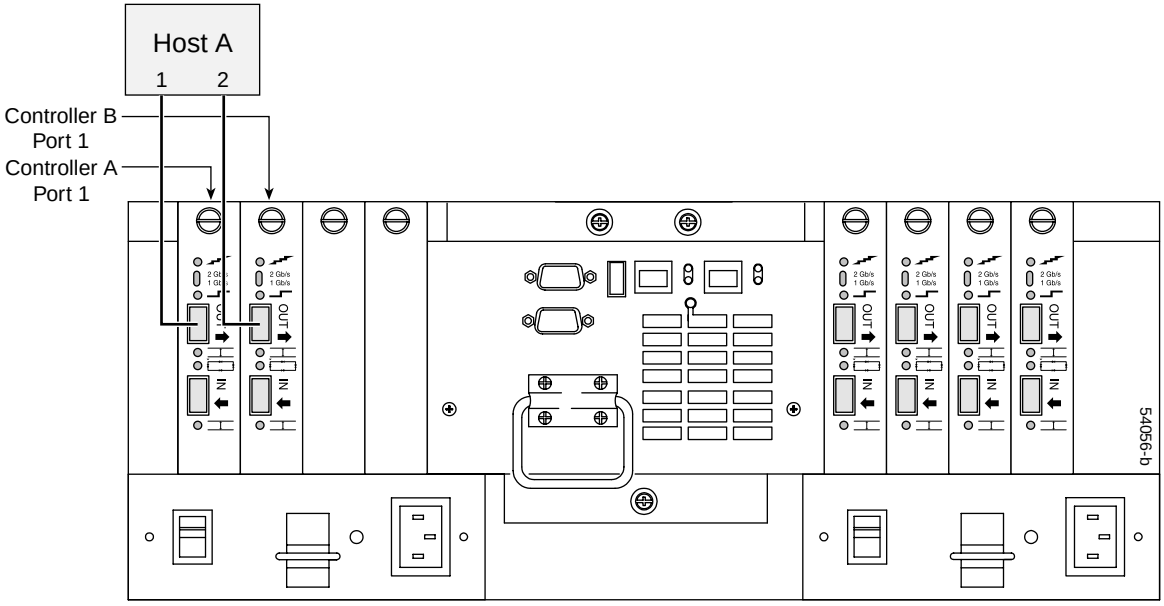

Figure 8-6 Direct Host Connect — 1 Host - 2 HBA

Figure 8-7 shows a high bandwidth configuration. Each of the four HBAs is connected to each host (front end) minihub.

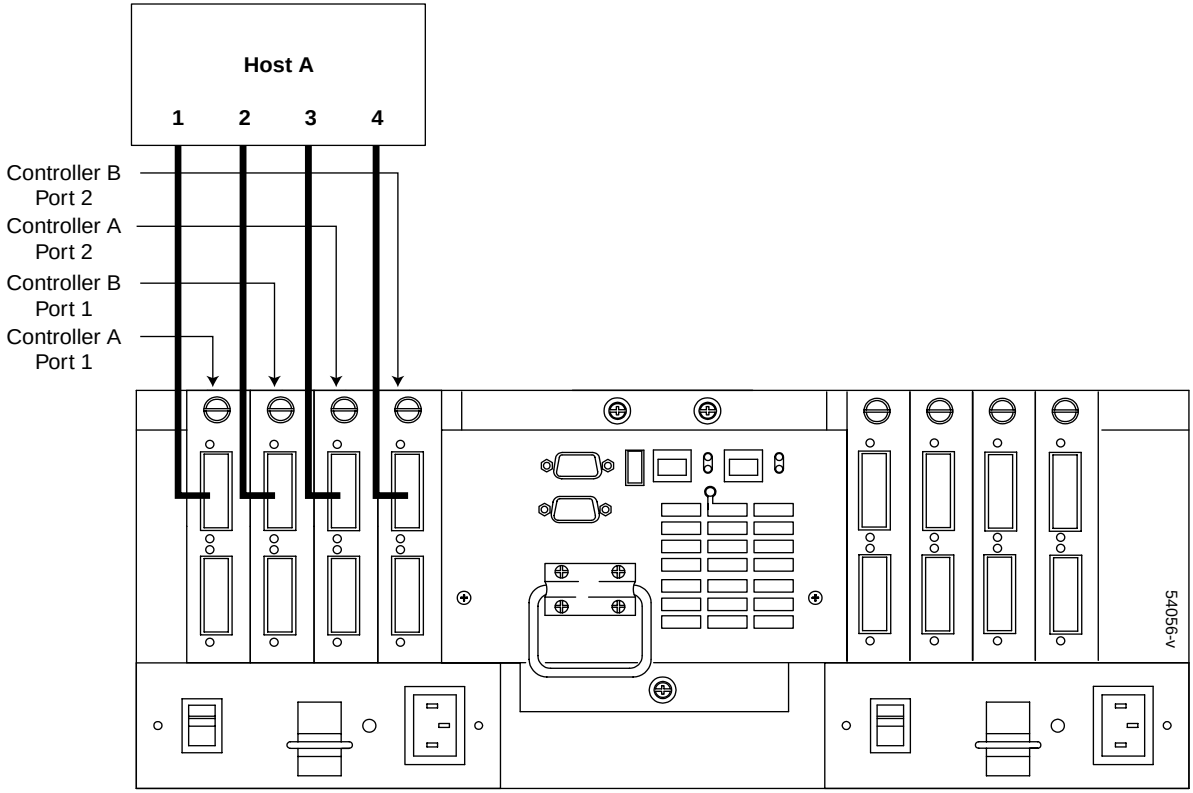

Figure 8-7 Direct Host Connect — 1 Host - 4 HBA

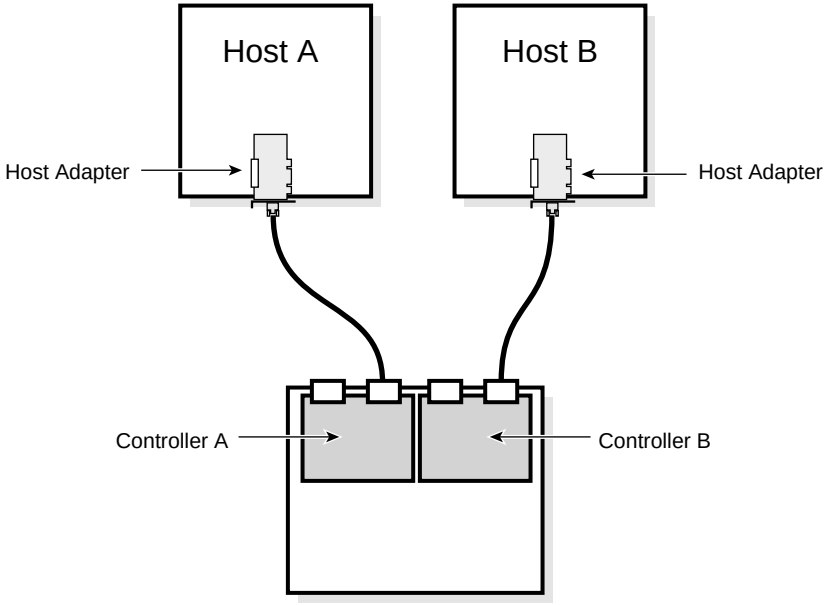

Figure 8-8 Direct Host Connect for Non fail-over Configuration

Figure 8-9 shows two hosts directly connected. These hosts share controller bandwidth.

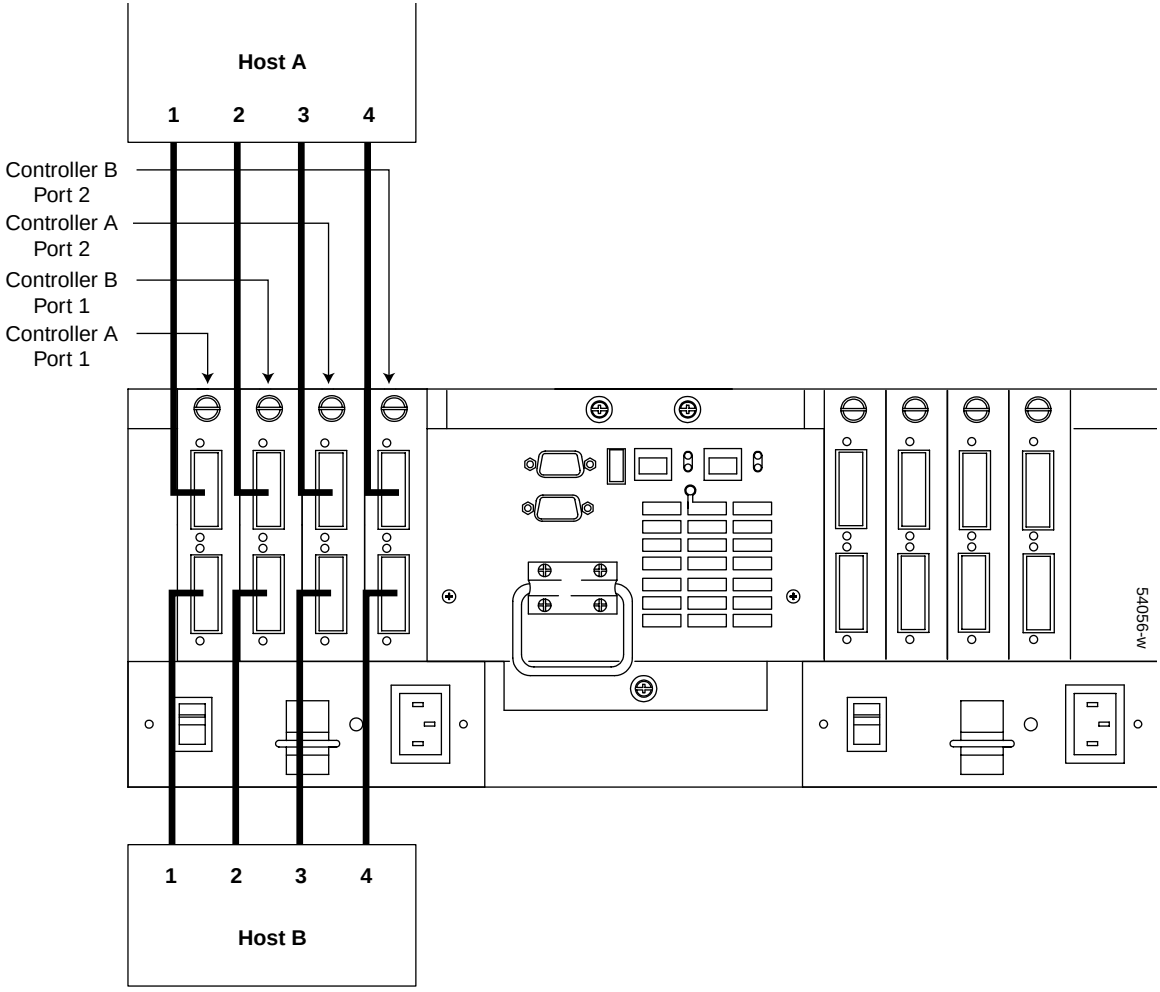

Figure 8-9 Direct Host Connect — 2 Host - 4 HBA/Host

Examples of Fabric/Switch Host Connection Cabling

The following are example configurations. For more information, see the "SGI Storage Area Network Installation Instructions" (108-0252-00X) shipped with the Fibre Channel Switch.

Note: When you install a 2 GB interface controller in a switched configuration, you MUST remove the SFP transceiver from the lower fibre channel connector on each front end (host) minihub that is connected to the switch.

Figure 8-10 shows a simple switch configuration.

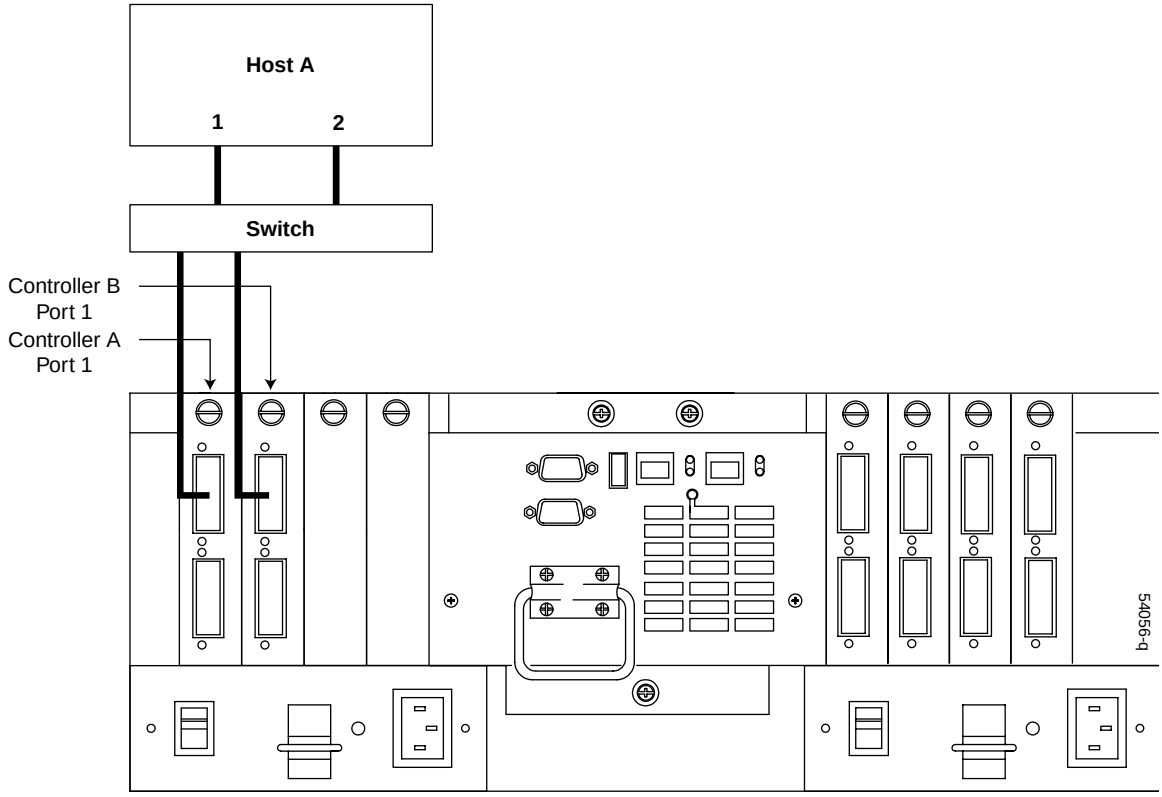

Figure 8-10 Switch Connect — 1 Host - 2 HBA

Figure 8-11 shows a dual hosted switch configuration.

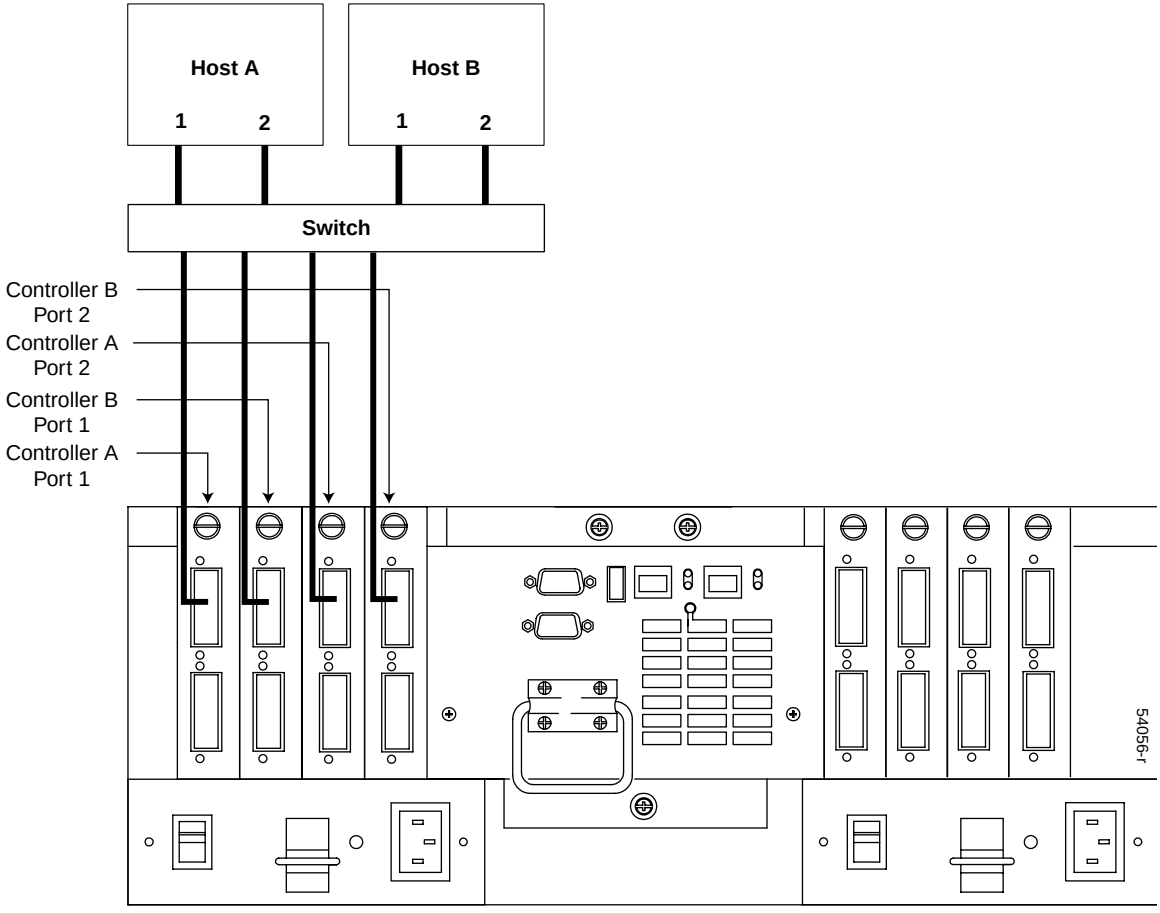

Figure 8-11 Switch Connect — 2 Host - 2 HBA/Host

Figure 8-12 shows a High Availability (HA) switch configuration.

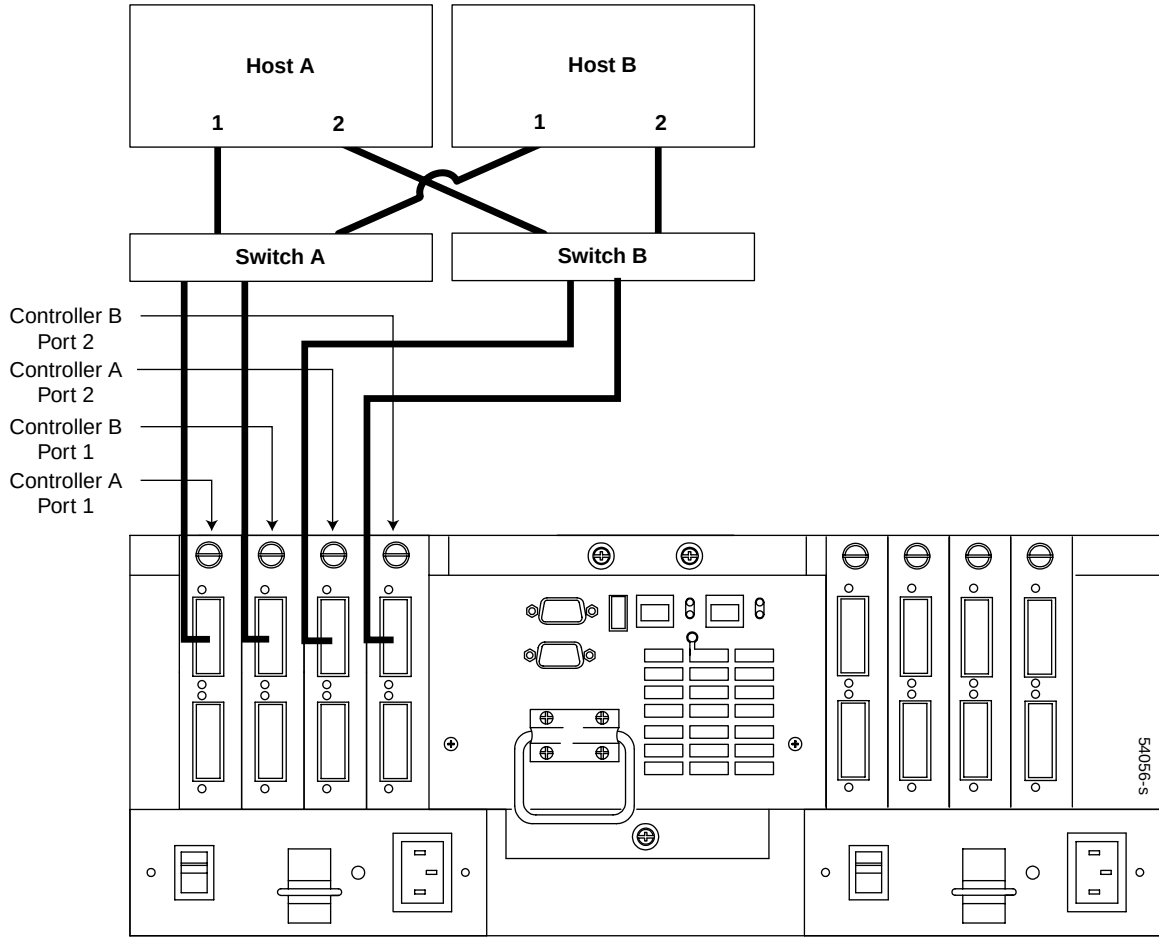

Figure 8-12 Multi-Switch Connect — 2 Host

In-Band and Out-of-Band Array Management

There are two methods of managing the TP9400. In-band management requires only the Fibre Channel host interface be present and functional. Out-of-band management requires Ethernet or serial connections be cabled to each controller.

Note: Refer to *SGI TP9400 RAID IRIX Administration Guide* (007-4306-001) and the *SGI TP9400 RAID Software Concepts Guide* (007-4305-001) for software installation and more information on storage management options.

Use this procedure to connect Ethernet or serial (RS-232) interface cables to the TP9400 controller enclosure for direct management of the storage array. Optionally, you can use the Ethernet or serial connectors for diagnostic procedures.

Caution: Electrostatic discharge can damage sensitive components. Use appropriate antistatic precautions before handling any components.

1. Connect the Ethernet interface cables (Figure 8-13).

   Connect a pair of Ethernet cables from the storage management station to the Ethernet connectors for controller A (top) and controller B (bottom) on the rear of the controller enclosure.

2. Optionally, connect the serial interface cables (Figure 8-13).

   Connect a serial (RS-232) interface cable from the storage management station to the serial connectors for controller A and controller B on the rear of the controller enclosure.

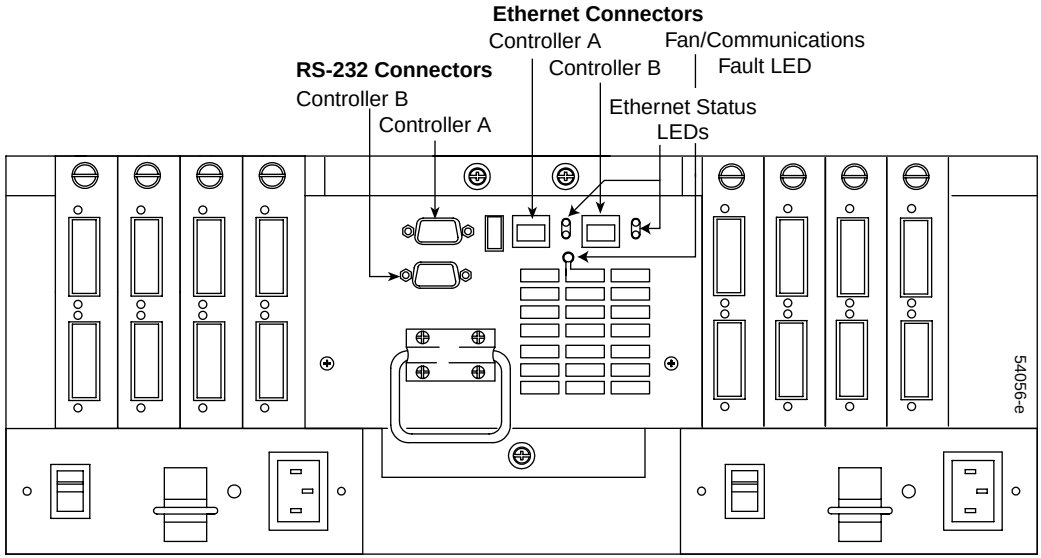

Figure 8-13 Connecting Ethernet and Serial Interface Cables

Powering Up the TP9400

Use this procedure to connect the controller and the drive enclosures to the AC power source, and power up the system.

Note: To speed drive spin-up, it is recommended that you start the drive enclosures before or at the same time as the controller enclosure. This procedure powers up all components in the system by turning on the Power Distribution Units.

Caution: Electrostatic discharge can damage sensitive components. Use appropriate antistatic precautions before handling any components.

1. Make sure the switches on the Power Distribution Units (rear of the rack inside the access panel) are in the off position.
2. Make sure both power switches on the controller and drive enclosures are off.
3. Plug the controller enclosure power cords into the controller enclosure power supplies (Figure 8-14).

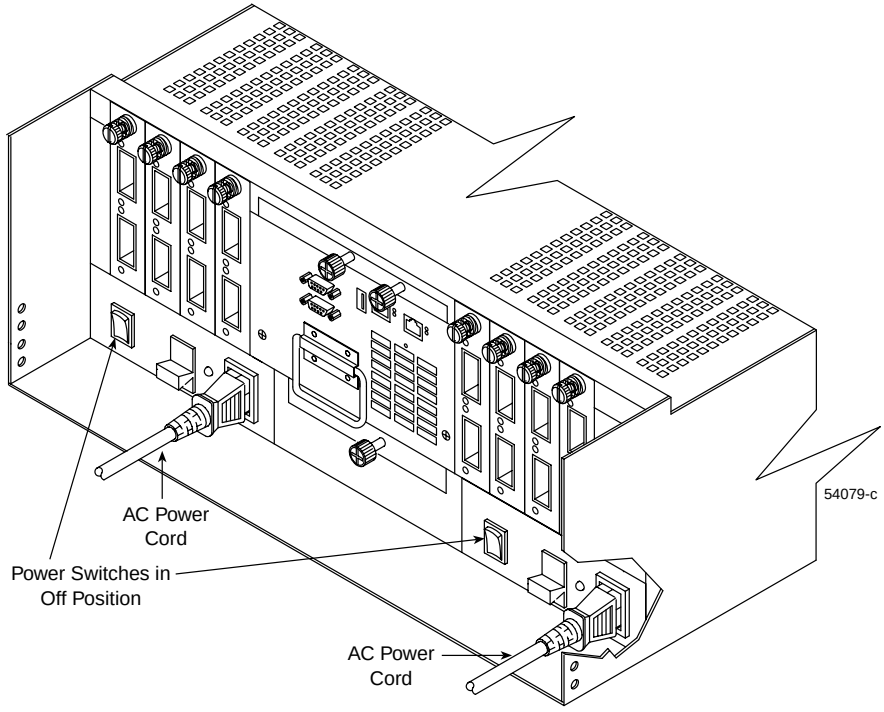

Figure 8-14 Connecting the Controller Enclosure Power Cords

4. Plug the controller enclosure power cords into the Power Distribution Units. Plug the left power cords into the left PDU and the right power cords into the right PDU.

Note: For details on power requirements, refer to Appendix A, “Specifications and Requirements”.

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5. Plug the drive enclosure power cords into each power supply in the drive enclosures (Figure 8-15).

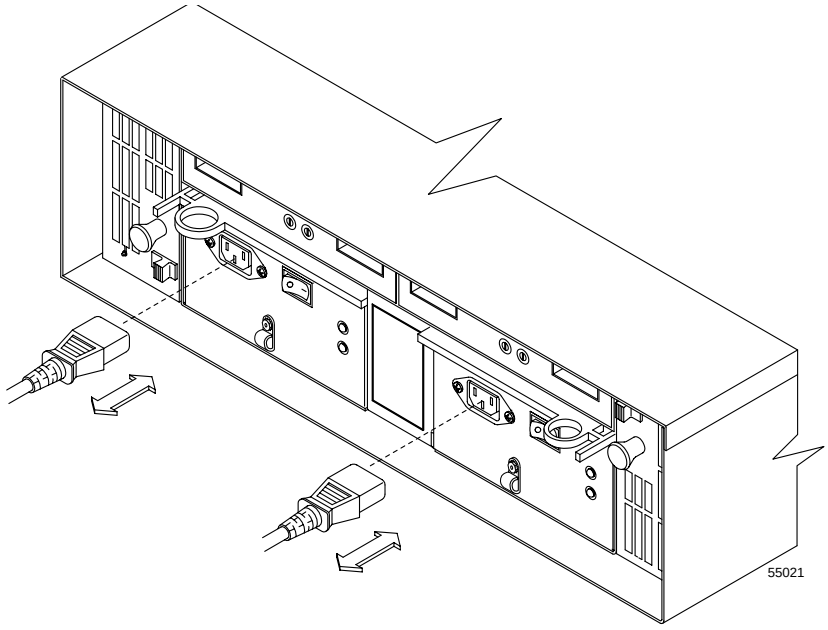

Figure 8-15 Connecting the Drive Enclosure Power Cords

6. To keep the power cords from being accidently pulled from the power connections, secure the cords in the strain relief power cord clips. Figure 8-16 shows how the cords should be secured.

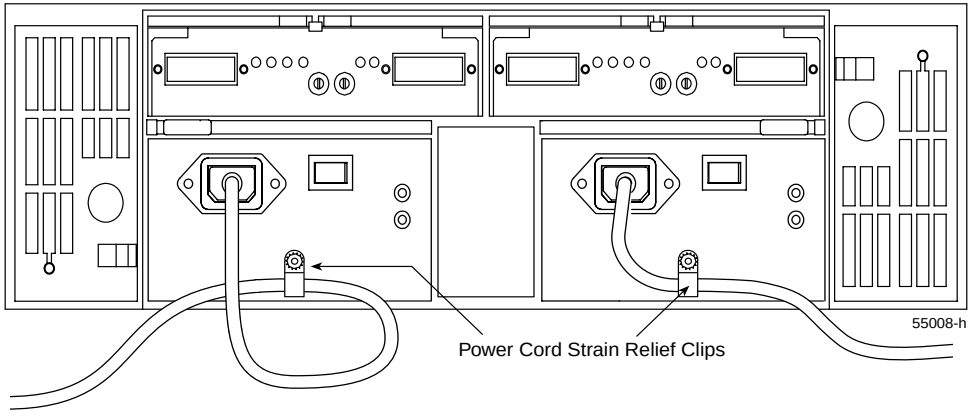

Figure 8-16 Securing the Power Cords in the Cord Clips

7. Plug all drive enclosure power cords into the Power Distribution Units. Plug the left power cords into the left PDU and the right power cords into the right PDU.

   Note: For details on power requirements, refer to Appendix A, "Specifications and Requirements".

8. To assure power redundancy, plug each Power Distribution Unit into a separate AC power source.
9. Turn on both power switches on the rear of each drive enclosure (Figure 8-17).

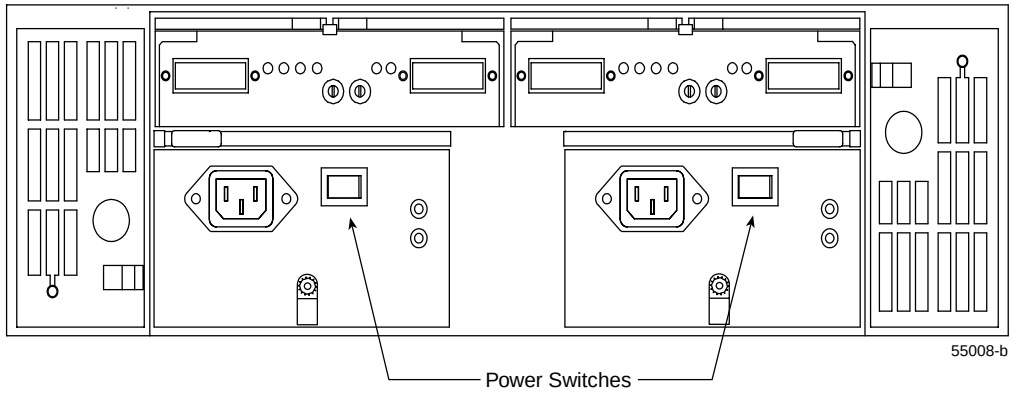

Figure 8-17 The Drive Enclosure Power Switches

10. Turn on both power switches on the rear of each controller enclosure (Figure 8-18).

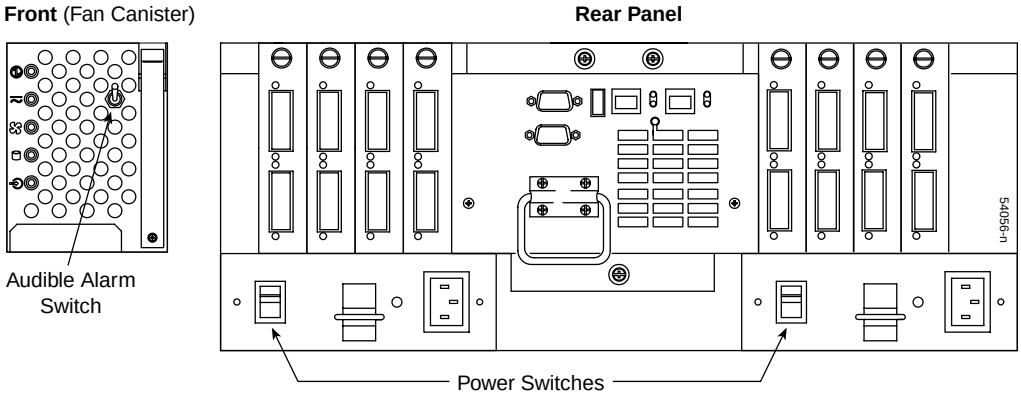

Figure 8-18 The Controller Enclosure Power Switches and Alarm Switch

11. Arm the optional alarm switch by setting it to the up position (Figure 8-18).
12. When all controller and drive enclosure power switches are in the on position, flip the breaker switches of both PDUs to the on position.
13. Check the indicator lights on the front and rear of each component. If any lights indicate a fault, refer to “Checking the Controller Enclosure Indicator Lights” on page 36 and “Checking the Drive Enclosure Indicator Lights” on page 92.

Specifications and Requirements

This appendix describes the technical specifications, area and power requirements of the TP9400 rack and components.

Rack Specifications

The TP9400 is a 22-inch wide rack that contains two AC distribution boxes. Standard EIA rails provide mounting holes for installing 19-inch wide devices. There are roller casters and stability feet on the bottom of the rack for moving and leveling during installation and relocation.

Depending upon performance, capacity, and availability requirements, you can customize the TP9400 to meet your data storage needs.

For example, the key building blocks for the TP9400 include controller enclosures and drive enclosures. The controller enclosure is a rackmount unit containing two array controllers, a battery backup system, two fans, and redundant power supplies. The drive enclosure is also a rackmount unit and contains up to ten drives, redundant fans and power supplies, and either an array controller or Environmental Status Module (ESM) board.

Figure A-1 shows a typical configuration that includes five drive enclosures and one controller enclosure mounted in a 72-inch high rack. The rack is shipped with only the bottom half filled to provide stability when shipping and moving the rack to the installation site. The top half is filled with blank panels.

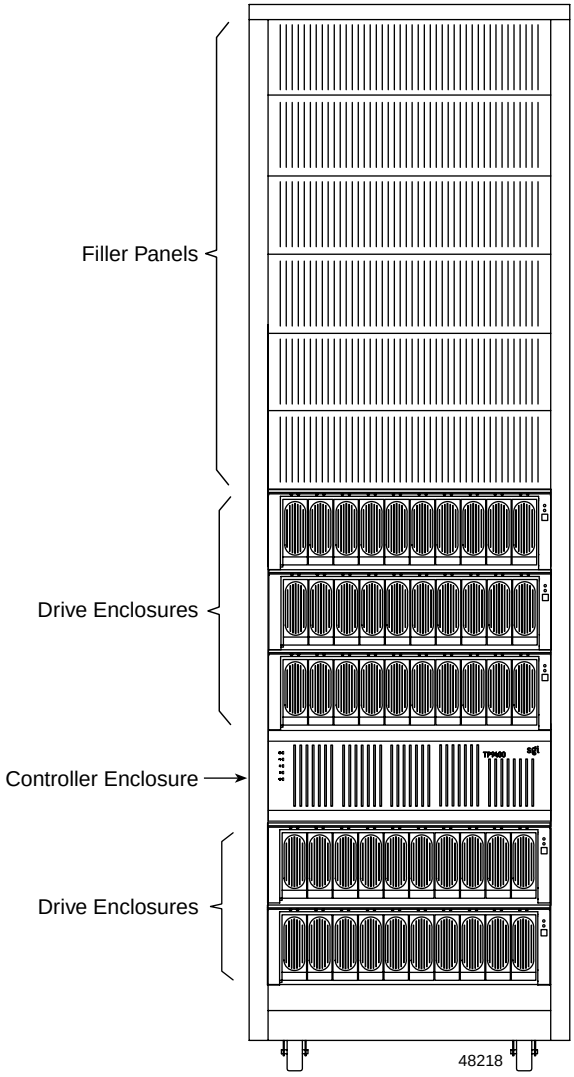

Figure A-1 TP9400 with Controller Enclosures and Drive Enclosures

For more information on the controller enclosures and drive enclosures, their installation, and cabling schemes, refer to the *SGI TP9400 RAID Installation and Upgrade Guide* (108-0292-001).

Dimensions

Figure A-2 shows the TP9400 rack and its dimensions.

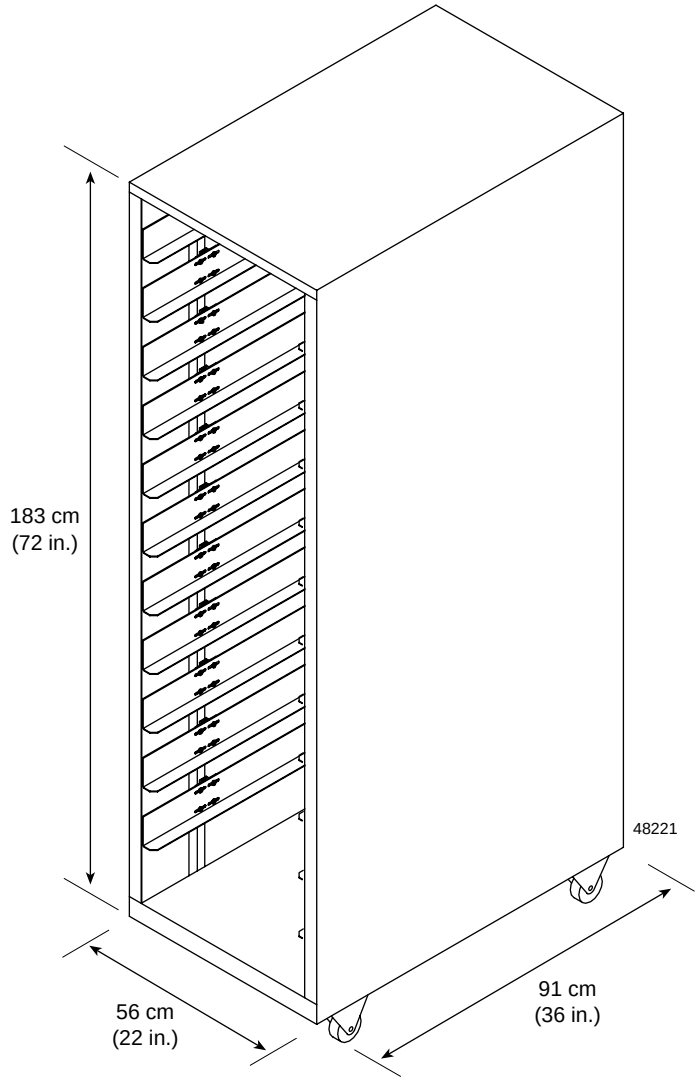

Figure A-2 TP9400 Rack Dimensions

Weight

The total weight of the TP9400 rack depends on the type and quantity of enclosures installed. Table A-1 lists the overall weight of the rack, plus the maximum weights for the controller enclosures and drive enclosures. You can use these weights to estimate the total weight of your system, based on the number of devices installed in the rack.

Remember, the racks are shipped with only the bottom half filled with enclosures. If you order enough enclosures to fill the rack, they will be packed separately.

Table A-1 Rack, Crate, and Enclosure Weights

Rack (Empty)	Crate (Empty)	Controller Enclosure (Maximum)	Drive Enclosure (Maximum) Drive (Size)	Drive Enclosure (Maximum) Weight
121.0 kg (270.0 lb)	97.0 kg (215.0 lb)	44.0 kg (97.0 lb)	18 GB 36 GB 73 GB 180 GB	38.6 kg (85.0 lb) 37.2 kg (82.0 lb) 40.4 kg (89.0 lb) 42.8 kg (94.0 lb)

Area Requirements

The floor area at the installation site must provide:

- Enough stability to support the weight of the TP9400 and installed devices (see Table A-2).
- Sufficient space to install and service the rack and components (Figure A-3).

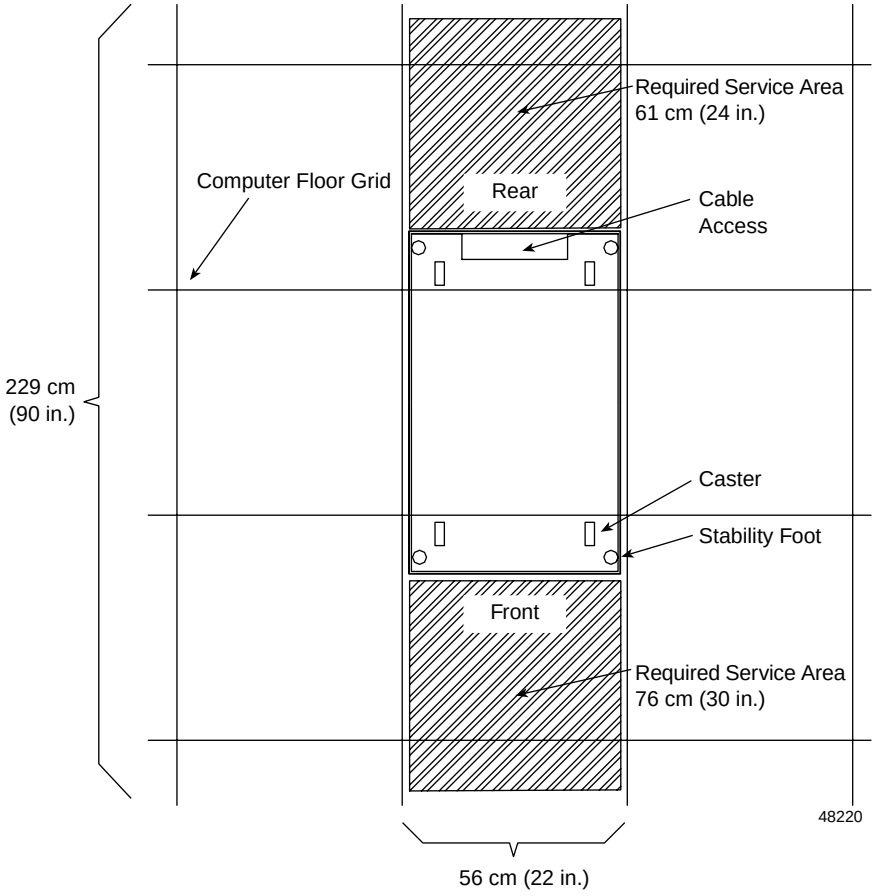

Figure A-3 TP9400 Area Requirements

Table A-2 TP9400 Weights with Typical Configurations

Configuration	Number of Enclosures Per Configuration	Weight of Each Enclosure	Total Weight (Including Rack)
Configuration A	1 controller enclosure and 5 (36 GB) drive enclosures	34.5 kg (76.0 lb) 38.3 kg (84.4 lb)	368.0 kg (811 lb)
Configuration B	2 controller enclosures and 10 (36 GB) drive enclosures	34.5 kg (76.0 lb) 38.3 kg (84.4 lb)	619.0 kb (1365 lb)

Wiring and Power

The rack's AC distribution boxes use common industrial wiring. Consider the following site wiring and power source requirements:

- **AC power source —** The AC power source must provide the correct voltage, current, and frequency specified on the manufacturer's name plate.
- **Earth ground —** You must have an earth grounding conductor to the rack's power receptacles.
- **Circuit overloading —** Make sure the power circuits and associated circuit breakers provide sufficient power and overload protection. To prevent possible damage to the AC distribution boxes and other components in the rack, isolate its power source from large switching loads (such as air conditioning motors, elevator motors, and factory loads).
- **Enclosure power distribution —** There are two accessory outlets inside the rack for enclosure power distribution. All units attached to these outlets must be auto-ranging between 180-257 VAC, 50-60 Hz.
- **Power Interruptions —** The TP9400 and its enclosures will withstand the following applied voltage interruptions (with or without an integrated UPS):
  - **Input transient:** 50% of nominal voltage
  - **Duration**: one half cycle
  - **Maximum frequency:** once every ten seconds
- **Power Failures —** After total power failure, the TP9400 and its enclosures will automatically perform a power-up recovery without operator intervention, once power is restored.

Power Requirements

Table A-3 and Table A-4 lists the power requirements for the rack.

Table A-3 AC Power Requirements (Domestic and International)

Unit of Measure	Requirement
AC Distribution, 250 VAC, 16 A	Approved IEC 320-C19 connector
Domestic, 250 VAC, 30 A	NEMA L6-30P locking plug, 6-30R receptacle (2)
International, 230 VAC, 32 A	IEC 309 locking plug; IEC 309 receptacle (2)
Voltage Range	180 to 257 VAC
Frequency	49 to 50.5 Hz or 59 to 60.6 Hz
Current Specified at Volt/Freq	220/50/60
Circuit Breaker	20 Amp

Table A-4 AC Power Requirements for Typical Configurations

Configuration	Enclosure Operating Current	Enclosure Surge Current
Configuration A[a]		
18 GB drives	6.125 A	6.675 A
36 GB drives	6.125 A	6.675 A
73 GB drives	7.275 A	7.925 A
181 GB drives	6.2 A	7.0 A
Configuration B[b]		
18 GB drives	12.25 A	13.35 A
36 GB drives	12.25 A	13.35 A
73 GB drives	14.55 A	15.85 A
181 GB drives	12.4 A	14.0 A

a. 1 controller enclosure and 5 drive enclosures.

b. 2 controller enclosures and 10 drive enclosures.

Power Distribution Units

The rack has two PDUs (Power Distribution Units). Each PDU has its own power cord. Because of limited space inside the rack, it may be easier to connect and route power cords before installing the support rails, controller or drive enclosures.

To ensure redundancy, connect the PDUs in the rack to independent power sources. Connect one power cord from each controller and drive enclosure to each PDU in the rack (Figure A-4).

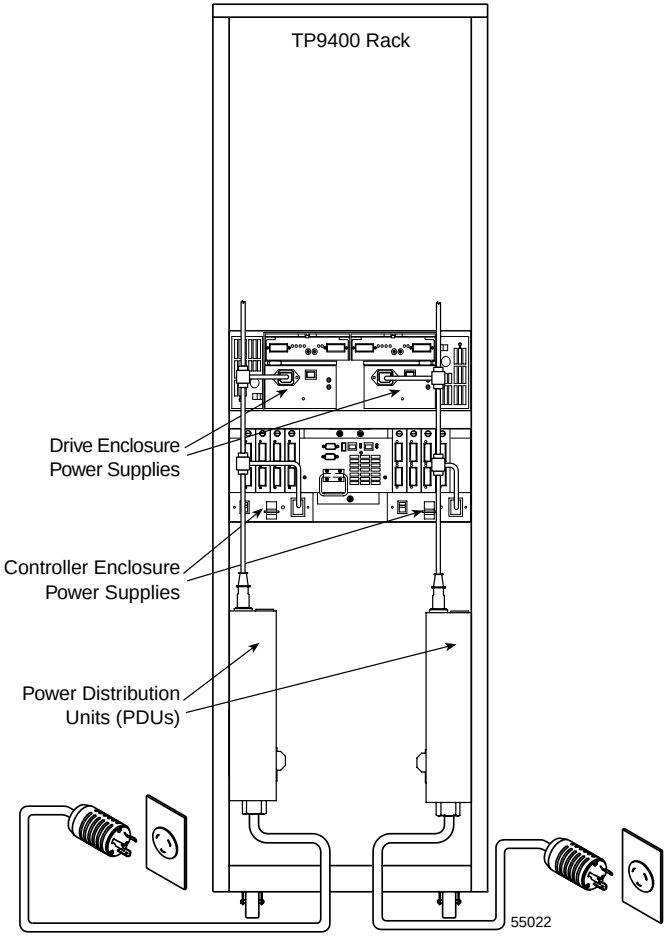

Figure A-4 Power Connections to Controller and Drive Enclosures

Power Cords and Receptacles

The rack is shipped with three types of power cords:

- **Component power cord** — Connects from each component to the PDU.
- **Domestic power cord** — Connects from the PDU to an independent 20 A circuit breaker.
- **International power cord** — Connects from the PDU to an independent 20 A circuit breaker.

The Power Distribution Unit has two outlets for connecting the power cords from devices installed in the rack. Figure A-5 shows the connectors and receptacles for these cords.

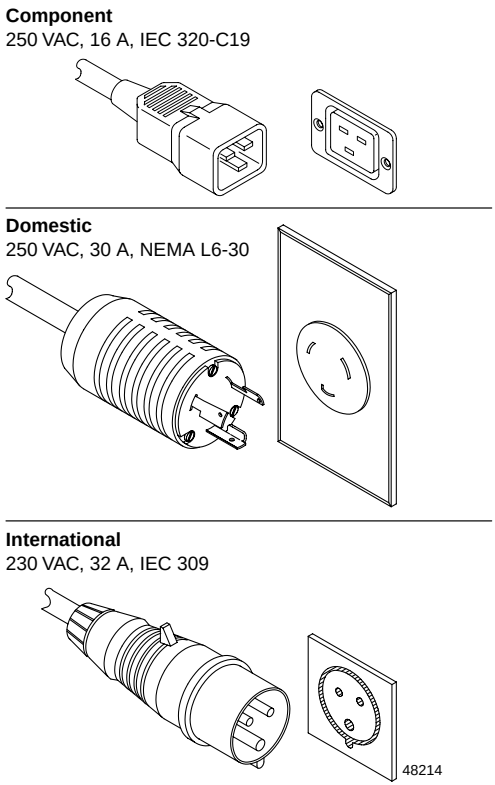

Figure A-5 AC Power Connectors and Receptacles

Environmental

Table A-5, Table A-6, and Table A-7 list the environmental requirements for the TP9400.

Caution: If you receive the rack and enclosures in cold weather (below 32˚ F (0˚ C)), leave them crated for at least 24 hours to prevent condensation. This 24-hour stabilization period can be modified either up or down, depending on the outside temperature at arrival.

Table A-5 Environmental Requirements

Environment	Unit of Measure	Requirement
Air Flow	N/A	Air flow is from front to rear
Temperature	Operating Range Storage Range Transit Range	10˚ C to 35˚ C (50˚ F to 104˚ F) -10˚ C to 50˚ C (14˚ F to 122˚ F) -40˚ C to 60˚ C (-40˚ F to 140˚ F)
Temperature Change (Maximum Allowed)	Operating Storage Transit	10˚ C per hour (21˚ F per hour) 15˚ C per hour (31˚ F per hour) 20˚ C per hour (42˚ F per hour)
Relative Humidity (No Condensation)	Operating Range Storage Range Transit Range Max. Dew Point Max. Humidity Gradient	20% to 80% 10% to 90% 5% to 95% 28˚ C (82˚ F) 10% per hour
Noise Level	Steady Non-Steady Normal Operation	6.8 bels (maximum) 6.8 bels (maximum) 65 dBA

Table A-6 Altitude Requirements

Environment	Unit of Measure	Requirement Below Sea Level	Requirement Above Sea Level
Altitude	Operating Range Storage Range Transit Range	30.5 m (100 ft.) 30.5 m (100 ft.) 30.5 m (100 ft.)	3,000 m (9,840 ft.) 3,000 m (9,840 ft.) 12,000 m (40,000 ft.)

Table A-7 Heat Dissipation Requirements

Environment	Unit of Measure	Requirement
Heat Dissipation	Configuration A[a]	
	18 GB drives	1.43 kVA 1442.5 W 4929.5 Btu/hr
	36 GB drives	1.43 kVA 1442.5 W 4929.5 Btu/hr
	73 GB drives	1.69 kVA 1697.5 W 5797.5 Btu/hr
	180 GB drives	1.45 kVA 1439 W 4912 Btu/hr
	Configuration B[b]	
	18 GB drives	2.87 kVA 2885 W 9855 Btu/hr
	36 GB drives	2.87 kVA 2885 W 9855 Btu/hr
	73 GB drives	3.37 kVA 3395 W 11595 Btu/hr
	180 GB drives	2.90 kVA 2878 W 9824 Btu/hr

a. 1 controller enclosure, 5 drive enclosures.

b. 2 controller enclosures, 10 drive enclosures.

Controller Enclosure Specifications

Below are the dimensions and weights, as well as the wiring, power, environmental, and airflow requirements for the controller enclosures.

Dimensions

Make sure that the installation site provides a minimum of two feet of space around each side of the rack to install and service the controller enclosure, and to allow adequate ventilation during operation. Figure A-6 shows the dimensions for the controller enclosure and the front cover.

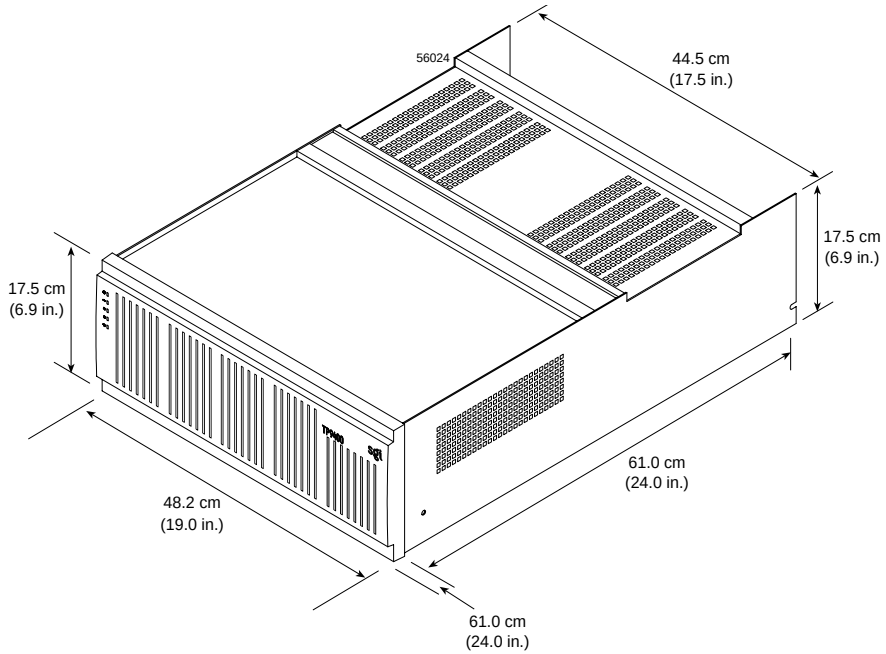

Figure A-6 Controller Enclosure Dimensions

Weights

Ensure that the floor space at the installation site has sufficient stability to support the maximum weight of the controller enclosure and associated equipment. The controller enclosure's total weight depends on the number of canisters in the enclosure. Table A-8 and Table A-9 lists the unit and shipping weight of the controller enclosure and the weight of the individual canisters.

Table A-8 Controller Enclosure Weights

Maximum Weight[a]	Empty Weight[b]	Maximum Shipping Weight[c]	Empty Shipping Weight[d]
44.0 kg (97.0 lb)	18.1 kg (39.8 lb)	54.9 kg (121.0 lb)	29.0 kg (63.8 lb)

a. Includes a controller enclosure containing all applicable canisters.

b. Includes a controller enclosure with all canisters removed.

c. Includes the shipping carton and a fully configured controller enclosure.

d. Includes the shipping carton and a controller enclosure containing no canisters.

Table A-9 Controller Canister Weights

Canister	Weight	Shipping Weight
Controller	3.0 kg (6.6 lb)	5.0 kg (11.0 lb)
Battery	9.7 kg (21.4 lb)	11.8 kg (26.0 lb)
Controller Fan	0.9 kg (1.9 lb)	2.3 kg (5.0 lb)
Fan/Communications	1.84 kg (4.1 lb)	2.5 kg (5.4 lb)
Power Supply	1.5 kg (3.3 lb)	2.9 kg (6.5 lb)
GBIC Minihub	0.6 kg (1.3 lb)	0.7 kg (1.6 lb)
SFP Minihub	0.6 kg (1.3 lb)	0.7 kg (1.6 lb)

Wiring and Power

The controller enclosure is a 120/220 VAC, 50/60 Hz unit that meets standard voltage requirements for both domestic (USA) and international operation. It uses standard industrial wiring with a line-to-neutral power connection (Table A-10). Review the following specifications when preparing the controller enclosure installation site:

- **Earth ground —** The unit must be properly grounded, including an earth ground conductor on the AC power source.
- **Circuit overloading** — Make sure the power circuits and associated circuit breakers in the rack and building provide sufficient power and overload protection. To prevent possible damage to the unit, isolate its power source from large switching loads (for example, air conditioning motors, elevator motors, factory equipment, etc.).
- **Power interruptions —** The unit will withstand the following voltage interruptions:
  - **Input transient:** 50% of nominal voltage
  - **Duration:** one half-cycle
  - **Minimum frequency:** once every 10 seconds
- **Power failures —** Once power is restored after a complete power failure, the unit automatically performs a power-up recovery sequence without operator intervention.

- **Power supply voltage range —** The wide-ranging, redundant 175 W power supplies operate on 90–264 VAC at 50 or 60 Hz. The power supplies meet domestic and international requirements and can operate at any voltage within the specified range.

Table A-10 Controller Enclosure Site Wiring Voltages (Single-Phase Line-to-Neutral)

50 Hz	Nominal	100	127	220	230	240
	Minimum	90	114	198	207	216
	Maximum	107	136	235	246	264
60 Hz	Nominal	100	120			
	Minimum	90	104			
	Maximum	107	127			

Environmental

Table A-11 and Table A-12 lists the environmental requirements for the controller enclosure.

Table A-11 Controller Enclosure Altitude Requirements

Condition	Range	Requirement Below Sea Level	Requirement Above Sea Level
Altitude[a]	Operating	30.5 m (100 ft.)	3,048 m (10,000 ft.)
	Storage	30.5 m (100 ft.)	3,048 m (10,000 ft.)
	Transit	30.5 m (100 ft.)	12,000 m (40,000 ft.)

a. If planning to operate the controller enclosure at altitudes between 1,000 m (3,280 ft.) and 3,000 m (9,850 ft.), lower the environmental temperature 1.7° C (3.3° F) for every 1,000 m (3,280 ft.) above sea level.

Table A-12 Controller Enclosure Environmental Requirements

Condition	Range	Requirement
Temperature	Operating	10° C to 40° C (32° F to 109° F)
	Storage	-10° C to 65° C (14° F to 149° F)
	Transit	-40° C to 65° C (-40° F to 149° F)
Maximum Temperature Change Allowed	Operating	10° C (18° F) per hour
	Storage	15° C (27° F) per hour
	Transit	20° C (36° F) per hour
Relative Humidity (No Condensation)	Operating	20% to 80%
	Storage	10% to 93%
	Transit	5% to 95%
	Maximum Dew Point	26° C (79° F)
	Maximum Humidity Gradient	10% per hour
Heat Dissipation	557.5 Btu/hr (.1925 kVA or 192.5 W)	
Sound	Power	6.5 bels
	Pressure	65 dBA

Air Flow

Figure A-7 shows the controller enclosure air flow. Make sure your installation site will allow the controller enclosure adequate ventilation during operation.

Important: Allow a minimum of two feet of clearance in front of and behind the controller enclosure for proper ventilation and servicing.

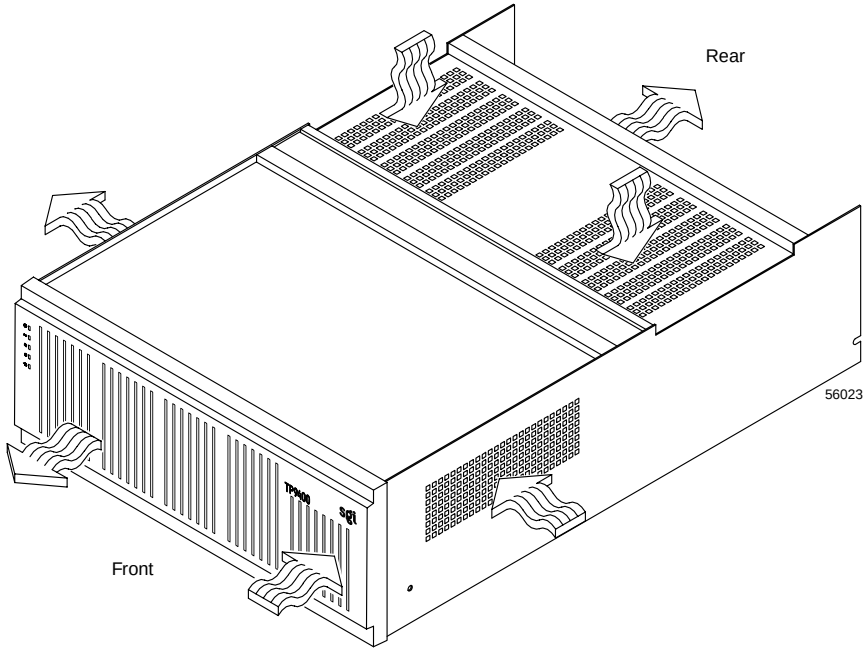

Figure A-7 Controller Enclosure Air Flow

Drive Enclosure Specifications

Below are the dimensions and weights, as well as the wiring, power, environmental, and airflow requirements for the drive enclosures.

Dimensions

Make sure the installation site provides a minimum of two feet of space around the rack to install and service the drive enclosure, and to allow adequate ventilation during operation. Figure A-8 shows the dimensions of the drive enclosure, front cover, and front bezel.

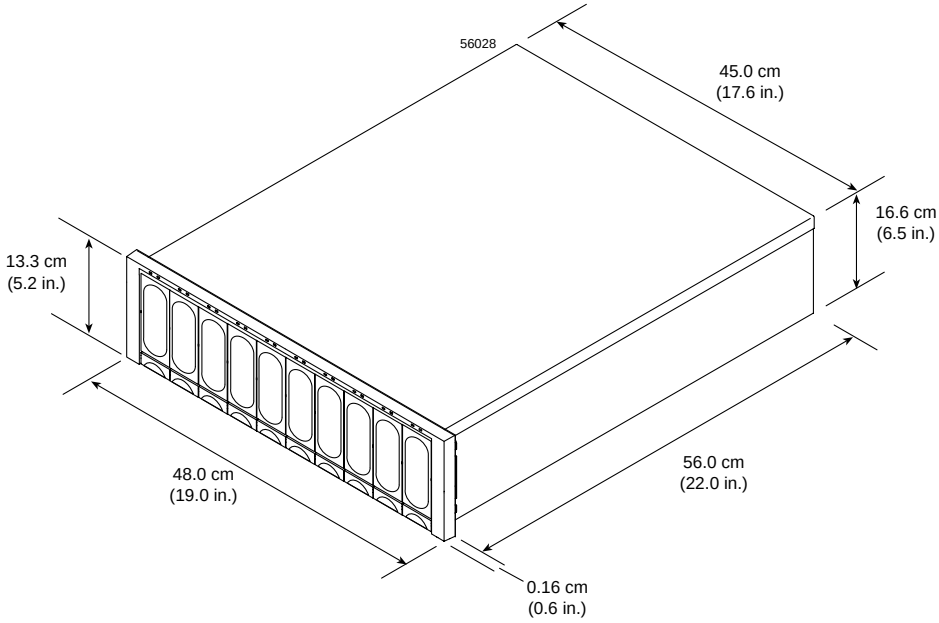

Figure A-8 Drive Enclosure Dimensions

Weights

Ensure that the site's floor can support the total weight of all drive enclosures and associated equipment. The drive enclosure's total weight depends on the number of canisters in the enclosure. Table A-13 lists the unit and shipping weights for individual canisters and the weights of minimum, maximum, and empty drive enclosure configurations.

Table A-13 Drive Enclosure Weights

Unit	Minimum[a]	Maximum[b]	Empty[c]	Shipping[d]
Drive Enclosure (18 GB)	30.4 kg (67.0 lb)	38.6 kg (85.0 lb)	12.7 kg (28.0 lb)	51.3 kg (113.0 lb)
Drive Enclosure (36 GB)	29.9 kg (66.0 lb)	37.2 kg (82.0 lb)	12.7 kg (28.0 lb)	50.4 kg (111.0 lb)
Drive Enclosure (73 GB)	31.3 kg (69.0 lb)	40.4 kg (89.0 lb)	12.7 kg (28.0 lb)	53.1 kg (117.0 lb)
Drive Enclosure (181 GB)	36.18 kg (80.0 lb)	42.8 kg (94.0 lb)	12.7 kg (28.0 lb)	55.4 kg (122.0 lb)
Empty Drive Canister	1.4 kg (3.0 lb)			
Environmental Card Canister	1.8 kg (4.0 lb)			
Power Supply Canister	2.5 kg (5.4 lb)			
Fan Canister	1.0 kg (2.2 lb)			

a. Contains four drive canisters, two environmental card canisters, two fan canisters, and two power supply canisters.

b. Contains 10 drive canisters, two environmental card canisters, two fan canisters, and two power supply canisters.

c. Drive enclosure weight with all canisters removed.

d. Includes shipping carton and fully configured drive enclosure.

Wiring and Power

The drive enclosure is a 120/220 VAC, 50/60 Hz unit that meets standard voltage requirements for domestic and international operation. It uses standard industrial wiring

with a line-to-neutral power connection (Table A-14). When installing a drive enclosure, review the following specifications:

- **Earth ground —** The drive enclosure requires an earth ground conductor on the AC power source.
- **AC power source —** The AC power source must provide the correct voltage, current, and frequency specified by the manufacturer. If the drive enclosure will be plugged into an internal AC distribution unit, make sure the internal unit can handle the drive enclosure power requirements.
- **Redundant AC Power, nominal 100 volt —** To meet power requirements and maintain power redundancy, connect the drive enclosure to 90 – 136 volt, 15 amp. circuits as follows,
  - **Up to three drive enclosures —** Use two, 90–136 volt, 15 amp. circuits. On each drive enclosure, connect one power supply to one circuit and the other power supply to the second circuit.
  - **Four or more drive enclosures** — Use four 90–136 volt, 15 amp. circuits. Connect half of the drive enclosures to two circuits and the remaining drive enclosures to the other two circuits. Make sure each drive enclosure connects to two different circuits (one per power supply).
- **Redundant AC Power, nominal 240 volt —** Use two 200–264 volt, 15 amp. circuits. Connect one power supply from each drive enclosure to one circuit and the other power supplies to the second circuit.
- **Power supply voltage ranges** — The auto-ranging power supplies automatically match the voltage range (120 VAC or 220 VAC) to the AC power source. You can switch the power supplies to alternate voltages (120 VAC to 220 VAC power sources) an unlimited number of times.

Caution: Wait at least 10 seconds between each voltage change before powering up the drive enclosure to prevent damaging the power supplies.

Table A-14 Drive Enclosure Site Wiring Voltages (Single-Phase Line-to-Neutral)

50 Hz	Nominal	100	127	220	230	240
	Minimum	90	114	198	207	216
	Maximum	107	136	235	246	264
60 Hz	Nominal	100	120			
	Minimum	90	104			
	Maximum	107	127			

Environmental

Table A-15 and Table A-16 lists the environmental requirements for the drive enclosure.

Table A-15 Drive Enclosure Altitude Requirements

Condition	Range	Requirement Below Sea Level	Requirement Above Sea Level
Altitude[a]	Operating	30.5 m (100 ft.)	3,000 m (9,840 ft.)
	Storage	30.5 m (100 ft.)	3,000 m (9,840 ft.)
	Transit	30.5 m (100 ft.)	12,000 m (40,000 ft.)

a. If operating the drive enclosure at altitudes between 1,000 m and 3,000 m (3,280 ft. and 9,850 ft.), lower the temperature by 1.7° C (3.3° F) for every 1,000 m (3,280 ft.) above sea level.

Table A-16 Drive Enclosure Environmental Requirements

Condition	Range	Requirement
Temperature	Operating	10° C to 40° C (50° F to 104° F)
	Storage	-10° C to 50° C (14° F to 122° F)
	Transit	-40° C to 60° C (-40° F to 140° F)
Maximum Temperature Change Allowed	Operating	10° C (18° F) per hour
	Storage	15° C (27° F) per hour
	Transit	20° C (36° F) per hour

Table A-16 (continued) Drive Enclosure Environmental Requirements

Condition	Range	Requirement
Relative Humidity (No Condensation)	Operating Storage Transit Max. Dew Point Max. Humidity Gradient	20% to 80% 10% to 90% 5% to 95% 26° C (79° F) 10% per hour
Average Heat Dissipation	Low-Profile Drive	854.0 Btu/hr (0.248 kVA or 250.0 W)
	Half-Height Drive	1028.0 Btu/hr (0.298 kVA or 301.0 W)
Sound	Idle	Power: 6.5 bels Pressure: 65 dBA
	Operating	Power: 6.8 bels Pressure: 68 dBA

Air Flow

Figure A-9 shows the drive enclosure air flow. Make sure your installation site will allow the drive enclosure adequate ventilation during operation.

Important: Allow a minimum of two feet of clearance in front of and behind the drive enclosure for proper ventilation and servicing.

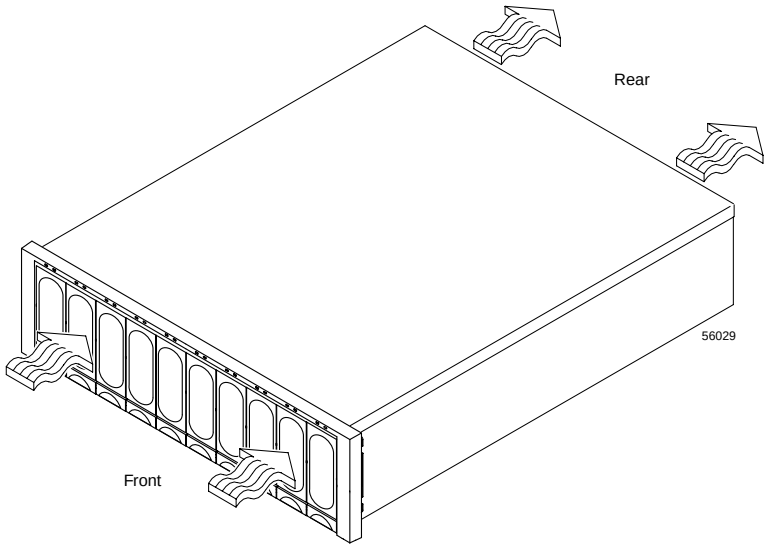

Figure A-9 Drive Enclosure Air Flow

SGI Field Engineering Compliance Statements

Electromagnetic Emissions

The equipment described in this guide complies with the Class A limits of Part 15 of the FCC Rules. Operation is subject to the following two conditions:

1. This device may not cause harmful interference.
2. This device must accept any interference received, including interference that may cause undesired operation.

This equipment does not exceed the Class A limits of Canada's Department of Communications Radio Interference Regulations for radio noise emissions.

This device complies with Class A electromagnetic emissions limits of C.I.S.P.R. Publication 22, Limits and Methods of Measurement of Radio Interference Characteristics of Information Technology Equipment, Germany's BZT Class A limits for Information Technology Equipment, and with Japan's VCCI Class A limits.

Caution: Do not modify this product in any way that is not expressly approved by Silicon Graphics. If you do, you may lose your FCC or other government agency authority to operate this device.

Radio and Television Interference

The equipment described in this guide generates and uses radio frequency energy. If it is not installed and used in accordance with the instructions in this guide, it can cause radio and television interference.

This equipment has been tested and complies with the limits for a Class A computing device in accordance with the specifications in Part 15 of FCC rules. These specifications

are designed to provide reasonable protection against such interference in an industrial or office installation. However, there is no guarantee that the interference will not occur in a particular installation. This system is not certified for home use.

You can determine whether your system is causing interference by turning it off. If the interference stops, it was probably caused by the workstation or one of the peripherals. To tell if the interference is caused by one of the peripherals, try disconnecting one peripheral at a time to see if the interference stops. If it does, that peripheral is the cause of the interference.

If your workstation does cause interference to radio or television reception, try to correct the interference by using one or more of the following suggestions:

- Turn the television or radio antenna until the interference stops.
- Move the workstation to one side or the other of the radio or television.
- Move the system farther away from the radio or television.
- Plug the system into an outlet that is on a different circuit from the radio or television. (Make certain the workstation and the radio or television are on circuits controlled by different circuit breakers or fuses.)

Product Safety

This product has been tested and is listed, certified, or approved to the following product safety standards:

- UL 1950
- CAN/CSA C22.2, No. 950-M89
- IEC 950
- EN 60 950
- Standard for Safety of Information Technology Equipment, including Electrical Business Equipment, Class 1, SELV

Electrostatic Discharge

SGI designs and tests its products to be immune to effects of electrostatic discharge (ESD). ESD is a source of electromagnetic interference and can cause problems ranging from data errors and lockups to permanent component damage.

It is important that while you are operating this equipment you keep all the covers and doors, including the plastics, in place. The shielded cables that came with the system and its peripherals should be installed correctly, with all thumbscrews fastened securely.

An ESD wrist strap is included with some products, such as memory and graphics upgrades. The wrist strap is used when installing these upgrades to prevent the flow of static electricity, and it should protect your system from ESD damage.

Shielded Cables

The equipment described in this guide is FCC-compliant under test conditions that include the use of shielded cables between it and its peripherals. This equipment and any peripherals you purchase from SGI have shielded cables. Shielded cables reduce the possibility of interference with radio, television, and other devices. If you use any cables that are not from SGI, make sure they are shielded. Telephone cables do not need to be shielded.

In Germany, a shielded cable must be used on the Ethernet 10BaseT port.

The monitor cable supplied with your system uses additional filtering molded into the cable jacket to reduce radio frequency interference. Always use the cable supplied with your system. If your monitor cable becomes damaged, a replacement cable should be obtained from SGI. (From the “POWER Onyx Rackmount Owner’s Guide.”)

FCC Warning

This equipment complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

1. This device may not cause harmful interference, and
2. This device must accept any interference received, including interference that may cause undesired operation.

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

If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna
- Increase the separation between the equipment and the receiver
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected
- Consult the dealer of an experienced radio/TV technician for help

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Caution: The user is cautioned that changes or modifications to the equipment not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

EMI Collar

For increased radiated emissions margin, you may install an EMI collar to your optical Fibre channel card. Contact your SGI service representative and ask for SGI part number 0403370-001.

VDE 0871/6.78

The equipment described in this guide has been tested to and is in compliance with the Level A limits per VDE 0871.

European Union Statement

This device complies with the European Directives listed on the "Declaration of Conformity" which is included with each product. The CE mark insignia displayed on the device is an indication of conformity to the aforementioned European requirements.

International Special Committee on Radio Interference (CISPR)

The equipment described in this guide has been tested to and is in compliance with the Class A limits per CISPR publication 22.

Canadian Department of Communications Statement

This digital apparatus does not exceed the Class A limits for radio noise emissions from digital apparatus as set out in the Radio Interference Regulations of the Canadian Department of Communications.

Attention

Cet appareil numérique n'emet pas de perturbations radioélectriques dépassant les normes applicables aux appareils numériques de Classe A préscrites dans le Règlement sur les interferences radioélectriques établi par le Ministère des Communications du Canada.

Japanese Class A Compliance Statement

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

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