

SGI® InfiniteStorage TP9500 and TP9700  
RAID User's Guide

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## CONTRIBUTORS

Written by Marisa Daniels, Chris Perleberg, Sylvia Walker, Debbie Hill, and Danta Chandra

Updated by Mark Schwenden

Illustrated by Dan Haines and Chrystie Danzer

Production by Karen Jacobson

Engineering contributions by Marty Castilla, Bill Lusche, Bill Mckevitt, Robert Novak, Henry Ortiz and Sammy Wilborn

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## About This Guide

This guide provides an overview of the SGI InfiniteStorage TP9500, TP9500S, and TP9700 RAID systems. It covers routine operation and replacement procedures and provides troubleshooting and reference information for all customer-replaceable components. References to the TP9500 may apply equally to the TP9500S unless otherwise specified.

The TP9700 uses the same disk arrays, rack enclosures and a similar sized controller enclosure to the TP9500 products. However, the battery, 6998 controller, and fan/power supply are different from the TP9500 cannisters. These items are not interchangeable between the two products. The TP9700 RAID does not use the 10-drive enclosure.

The SGI TP9500 and TP9700 are highly scalable RAID storage systems designed for continuous availability. Some of the features of these systems include hot-swappable components and redundant power and cooling systems.

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

Use this guide to learn about the following:

- The parts of your system: the rack, controller enclosures, and drive enclosures.
- Operating your system.
- Replacing failed components in the controller enclosures and drive enclosures.

Note that users who expect to reconfigure, upgrade, or replace system components should have a good working knowledge of RAID concepts, Fibre Channel technology, and SAN hardware operations.

## Important Information



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**Danger:** Never look into the end of a fiber optic cable to confirm that light is being emitted (or for any other reason). Most fiber optic laser wavelengths (1300 nm and 1550nm) are invisible to the eye and cause permanent eye damage. Shorter wavelength lasers (for example, 780 nm) are visible and can cause significant eye damage. Use only an optical power meter to verify light output.

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**Danger:** Never look into the end of a fiber optic cable on a powered device with any type of magnifying device, such as a microscope, eye loupe, or magnifying glass. Such activity causes a permanent burn on the retina of the eye. Optical signal cannot be determined by looking into the fiber end.

---

## Chapter Descriptions

This guide contains the following chapters:

- Chapter 1, “Introduction to the SGI TP9500 and TP9700,” introduces, gives a functional overview, and describes the features of the system.
- Chapter 2, “TP9500 Controller Enclosures,” gives a detailed overview of the controller enclosure and its components.
- Chapter 3, “Operation of TP9500 and TP9500S Controller Enclosures,” describes the functions and basic operation of the controller enclosure, including power up and troubleshooting with the indicator lights.
- Chapter 4, “Replacement of TP9500 and TP9500S Controller Enclosure Components,” gives detailed procedures for replacing failed controller enclosure components in a TP9500 RAID system.
- Chapter 5, “TP9700 Controller Enclosures,” describes the attributes of the TP9700 controller module and its internal components; the five sub-modules sometimes referred to as “canisters.” This includes the:
  - Controller canister (two)
  - Power supply/fan canister (two)
  - Interconnect/battery canister (one)

- Chapter 6, “Operation of TP9700 Controller Enclosures,” describes the use, operation, and troubleshooting of the 6998 controller enclosure (module). The procedures include: turning on power, turning off power, responding to an unplanned power outage, and responding to the audible alarm.
- Chapter 7, “Troubleshooting of TP9700 Controller Enclosure Components,” provides troubleshooting and recovery procedures for the 6998 controller enclosure (also called the controller module). This chapter also presents tables that explain the meanings of the indicator lights on the canister components.
- Chapter 8, “Replacement of TP9700 Controller Enclosure Components,” describes the replacement of each component in the controller enclosure (module) and explains the procedures for replacing a controller canister, power supply/fan canister, interconnect/battery canister, and SFP transceiver.
- Chapter 9, “Drive Enclosures,” gives a detailed overview of the drive enclosures and their components.
- Chapter 10, “Operation of Drive Enclosures,” describes the functions and basic operation of the drive enclosures, including power up and troubleshooting with the indicator lights.
- Chapter 11, “Replacement of Drive Enclosure Components,” gives detailed procedures for replacing failed drive enclosure components.
- Chapter 12, “TP9500 and TP9700 Cabling,” describes cabling between 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 system.

## Related Publications

This guide is part of a document set that fully supports the installation, operation, and service of the TP9500 or TP9700. See the following documents for more information about your system.

If a document number ends in “X,” use the latest available version of that document.

- *SGI TP9500 RAID Installation and Upgrade Guide (108-0375-00X)*  
This guide gives complete instructions on how to unpack, install, and configure the SGI TP9500 and its components. It also contains upgrade information.
- *SGI InfiniteStorage TPSSM Software Concepts Guide (007-4749-00X)*  
This guide explains the terminology and features of the TPSSM storage management software.
- *SGI InfiniteStorage TPSSM Administration Guide (007-4748-00X)*  
This guide gives complete instructions on how to install the TPSSM software for host and/or client operation.
- *SGI Storage Area Network Installation Instructions (108-0252-00X)*  
This guide is included with the Fibre Channel switch and provides information on Storage Area Network installation and topologies.

You can obtain SGI documentation, release notes, or man pages in the following ways:

- See the SGI Technical Publications Library at <http://docs.sgi.com>. Various formats are available. This library contains the most recent and most comprehensive set of online books, release notes, man pages, and other information.
- If it is installed on your SGI system, you can use InfoSearch, an online tool that provides a more limited set of online books, release notes, and man pages. With an IRIX system, select **Help** from the Toolchest, and then select **InfoSearch**. Or you can type `infosearch` on a command line.
- You can also view release notes by typing either `grelnotes` or `relnotes` on a command line.
- You can also view man pages by typing `man <title>` on a command line.

IRIX based SGI systems include a set of IRIX man pages, formatted in the standard UNIX “man page” style. These are found online on the internal system disk (or CD-ROM) and are displayed using the `man` command. For example, to display the man page for the `Add_disk` command, type the following on a command line:



**man Add\_disk**

Important system configuration files and commands are documented on man pages. References in the documentation to these pages include the name of the command and the section number in which the command is found. For example, “Add\_disk(1)” refers to the Add\_disk command and indicates that it is found in section 1 of the IRIX reference.

For additional information about displaying reference pages using the man command, see man(1).

In addition, the apropos command locates man pages based on keywords. For example, to display a list of man pages that describe disks, type the following on a command line:

**apropos disk**

For information about setting up and using apropos, see apropos(1) and makewhatis(1M).

## Conventions

The following conventions are used throughout this document:

<b>Convention</b>	<b>Meaning</b>
Command	This fixed-space font denotes literal items such as commands, files, routines, path names, signals, messages, and programming language structures.
<i>variable</i>	The italic typeface denotes variable entries and words or concepts being defined. Italic typeface also is used for book titles.
<b>user input</b>	This fixed-space font denotes literal items that the user enters in interactive sessions. Output is shown in nonbold, fixed-space font.
[ ]	Brackets enclose optional portions of a command or directive line.
...	Ellipses indicate that a preceding element can be repeated.
man page(x)	Man page section identifiers appear in parentheses after man page names.

**GUI element** This font denotes the names of graphical user interface (GUI) elements such as windows, screens, dialog boxes, menus, toolbars, icons, buttons, boxes, fields, and lists.

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SGI values your comments and will respond to them promptly.



# Introduction to the SGI TP9500 and TP9700

This chapter gives a brief overview of the features of the system and its primary components in the following sections:

- “System Features” on page 1
- “Rack Features” on page 3
- “Controller Enclosure Features” on page 3
- “Drive Enclosure Features” on page 4

## System Features

The SGI TP9500 and TP9700 RAID storage systems have the following features:

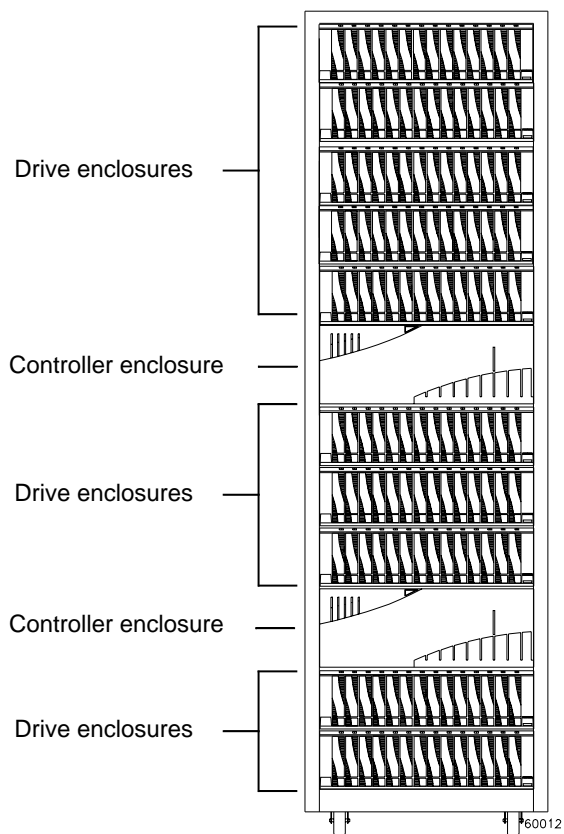
- Outstanding performance, utilizing multi-channel end-to-end Fibre Channel technology.
- Continuous availability, with constant monitoring and optional redundancy of all active components.
- Dynamic scalability, making it easy to grow all subsystem resources without disruption.
- Superior connectivity allowing simultaneous connections to multiple servers directly or by way of storage area networks (SANs). 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 your performance requirements.
- Supports a large number of drives.

- RAID 0, 1, 3, 5 support for LUNs containing n+1 drives (n ≤ 29).
- Battery backup for cache data.

---

**Note:** JBOD is not supported.

---



**Figure 1-1** Rack with Controller Enclosures and Drive Enclosures

## Rack Features

The rack has the following features:

- 72-in. high x 22-in. wide x 36-in. deep.
- 38 rack units (1 rack unit = 1.75 in.).
- Removable rear panel.
- Dual power distribution units (PDUs).
- Convenient access to power and data cables through openings in the top and bottom of the rack.

## Controller Enclosure Features

The controller enclosure has the following features:

- Height equal to four rack units (1 rack unit = 1.75 in.)
- Dual Active RAID controller levels
- Supports RAID 0, 1, 1+ 0, 3, 5
- Supports small form-factor pluggable (SFP) host and drive connections.
- Up to 1-GB ECC-protected cache memory per controller.
- Battery backup for cache data.
- Redundant, hot-swappable power supplies.
- Redundant, hot-swappable cooling fans.
- One to four front-end minihubs per controller enclosure.
- One to four back-end minihubs per controller enclosure.
- Two host connections per front-end minihub (direct attachment only).
- TP9500 has four host ports per RAID controller (via two front-end minihubs).
- TP9700 has four host ports and four drive channels per controller.
- Supports point-to-point, switch, and arbitrated loop topologies.
- Four Fibre Channel drive interfaces with two sets of redundant loops.

- Two Ethernet interfaces per controller enclosure for controller management.
- Audible alarm (controlled with an enable/disable switch).
- Fault and status LEDs.

For more information about the TP9500 controller enclosure, see Chapter 2, “TP9500 Controller Enclosures”. For additional information on the TP9700 controller enclosure, see Chapter 5, “TP9700 Controller Enclosures”.

## Drive Enclosure Features

There are two drive enclosures available:

- A 10-drive enclosure (not available with TP9700)
- A 14-drive enclosure

They share the following features:

- Fault and activity indicators
- Redundant hot-pluggable power supplies
- Redundant hot pluggable environmental service modules (ESMs)
- Redundant cooling fans
- SFP drive enclosure interfaces

For more information about the features of the drive enclosures, see Chapter 9, “Drive Enclosures”.



## TP9500 Controller Enclosures

The TP9500 controller enclosure (also called a module) is a high-performance unit that provides dual redundant controller boards and Fibre Channel interfaces to both the host and drive channels. For information on the TP9700 controllers and enclosure, see Chapter 5, “TP9700 Controller Enclosures”.

This chapter describes the TP9500 controller enclosure and its components in the following sections:

- “Overview” on page 5
- “Controller Canister” on page 8
- “Battery Canister” on page 11
- “TP9500 Controller Fan Canister” on page 12
- “TP9500 Fan/Communications Canister” on page 15
- “TP9500 Power Supply Canister” on page 18
- “TP9500 Minihub Canister” on page 19
- “TP9500 SFP Transceiver” on page 24

### Overview

The controller enclosure, which is designed to provide maximum host- and drive-side redundancy, supports up to eight direct host connections. Figure 2-1 shows front and rear views of the controller enclosure.

---

**Important:** Several references are made in this chapter to the storage management software (TPSSM). For complete information on the operation and use of this software, see the documents titled *SGI InfiniteStorage TPSSM Software Concepts Guide* (007-4749-00X) and *SGI InfiniteStorage TPSSM Administration Guide* (007-4748-00X).

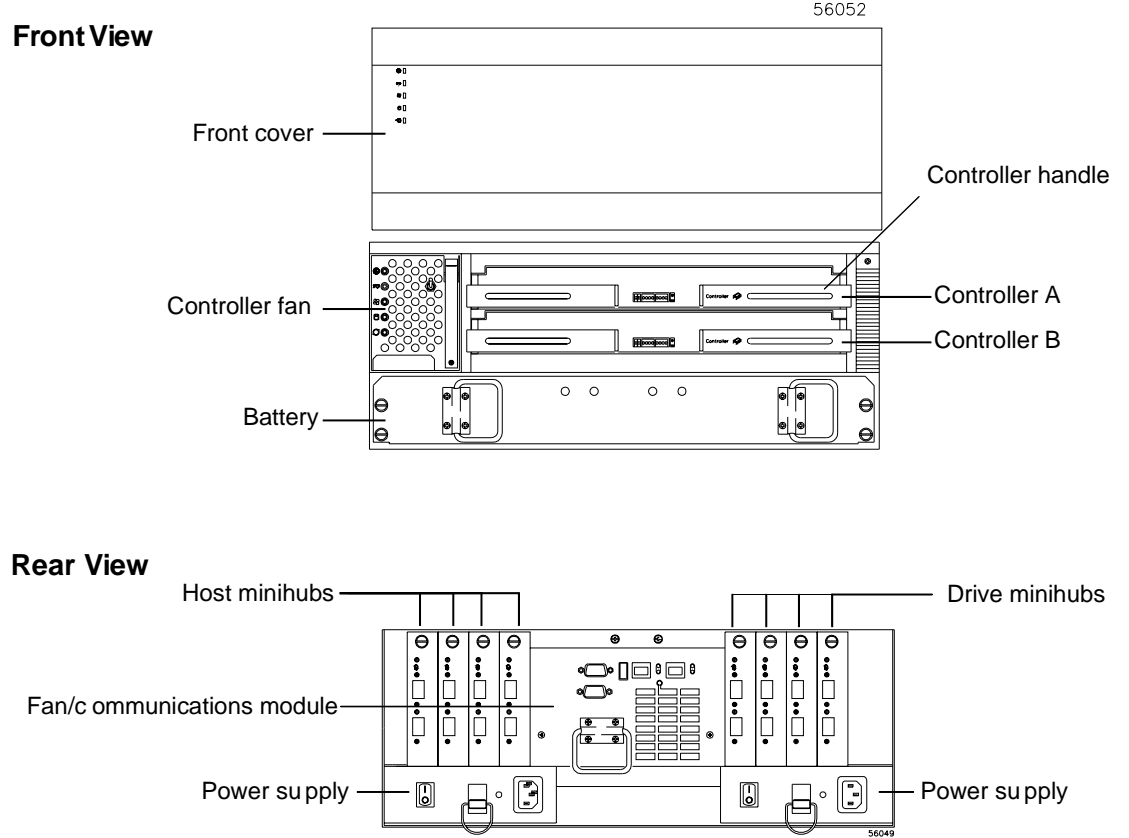
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The front of the TP9500 controller enclosure contains the following components:

- **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 of which contains one controller.

The rear of the TP9500 controller enclosure contains the following components:

- **Host and drive interface minihubs:** Up to eight removable 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.

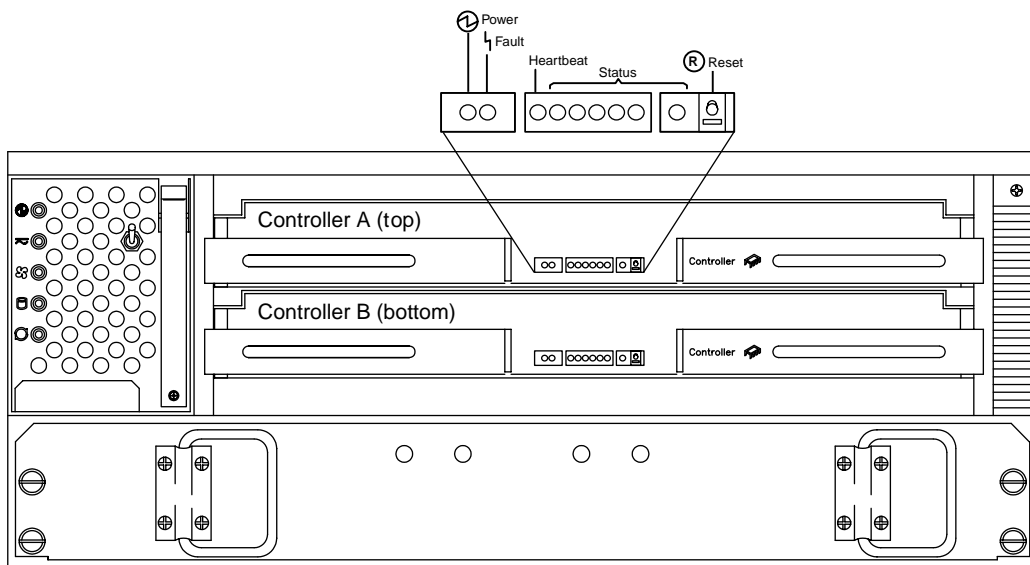


**Figure 2-1** Front and Rear Views of the TP950 Controller Enclosure

**Note:** The controller handles in SGI TP950 systems are gold-colored.

## Controller Canister

Each controller comes in a removable, portable unit, called a controller canister (see Figure 2-2). The controller canister slides 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. The controller slots identify the physical location of the controller in the chassis: controller slot A (top) or controller slot B (bottom). Each controller canister has nine LED indicators: one power LED, one fault LED, one heartbeat LED, and six status indicator LEDs. For more information about the LED indicators, refer to “Checking the Controller Enclosure Indicator Lights” on page 33.



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**Figure 2-2** 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 (TPSSM).

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 (TPSSM) for indications of other component failures.

If a controller canister fails, the controller fault indicator on the affected controller canister will illuminate. For more information about indicators, see “Checking the Controller Enclosure Indicator Lights” on page 33.

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 (TPSSM) 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.

---

The TP9500 uses 5884 controllers, while 6998 controllers are used in the TP9700 storage system module. The two types of controllers cannot be mixed in the same module (enclosure). For technical specifications covering 6998 controllers, see Table 5-1 on page 71.

Table 2-1 provides technical specifications for the 5884 controllers.

**Table 2-1** 5884 Controller Specifications

<b>Specification</b>	<b>5884 Controller</b>
Processor Speed	850 MHz
Processor Memory Capacity	128-MB SDRAM
Flash Memory Capacity	16 MB
NVSRAM Capacity	128 KB
Processor Bus Speed	32 bit, 66 MHz
Buffer Memory Capacity	1 GB RDRAM
Channel Interface	2-Gb dual
Primary PCI Bus Speed	64bit, 66 MHz

---

**Note:** 6998 controllers are not used with serial ATA class products at time of publication.

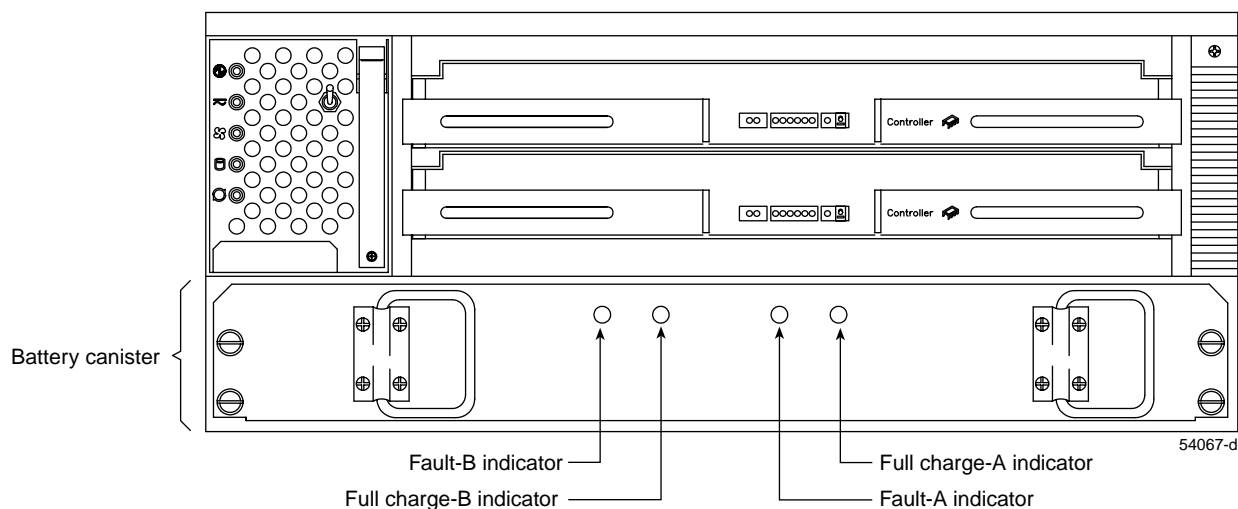
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You can quickly identify 5884 controllers because they have gold-tone handles and are inserted from the front of the module (enclosure) rather than the rear.

See Chapter 5, “TP9700 Controller Enclosures” for a full description of the TP9700 controller features.

## Battery Canister

The battery canister houses rechargeable batteries and a battery charger board. The battery canister plugs into the front of the controller enclosure (see Figure 2-3). 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 can store data in cache for up to seven 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 2-3** 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.

**Note:** 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 41). Check this label to

determine when to replace the canister. See the storage management software (TPSSM) 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, you must use the TPSSM storage management software to ensure that there is no data in cache memory and that all caching is stopped before you remove a battery canister. Data in cache memory 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 illuminate. For more information about indicators, see “Checking the Controller Enclosure Indicator Lights” on page 33.

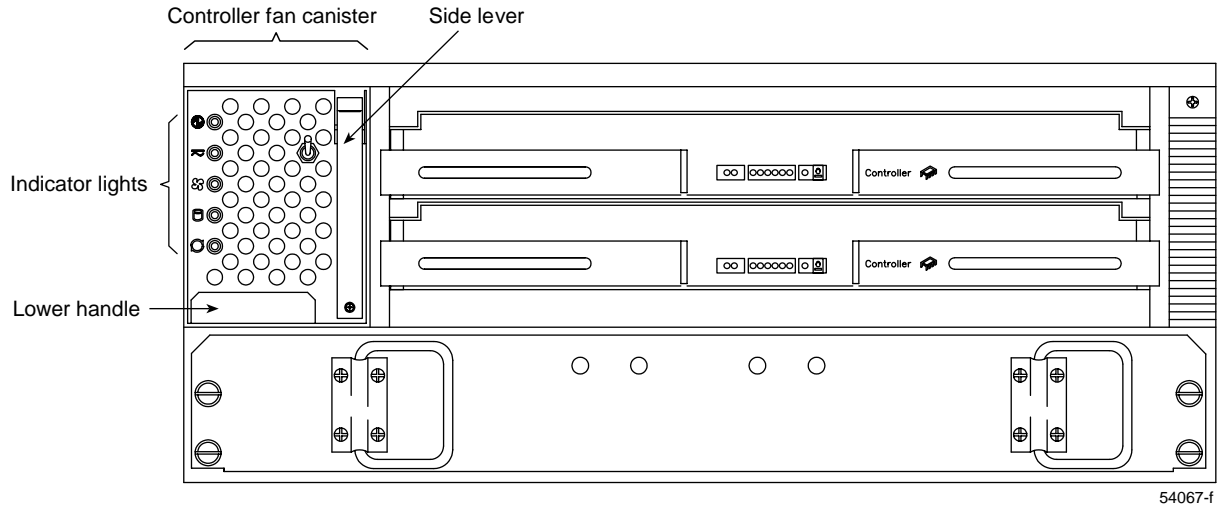
If you replace the battery canister and continue to experience battery problems (such as a loss of battery power to the controllers or batteries not charging properly), the controller enclosure may have defective components or connections. Check the storage management software (TPSSM) for indications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

## TP9500 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 (see Figure 2-4). The fan has a lever and a handle for easy removal. Five indicators provide overall system status information (see Figure 4-8 on page 57). 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.

Note that the TP9700 module uses a fan/power supply canister.

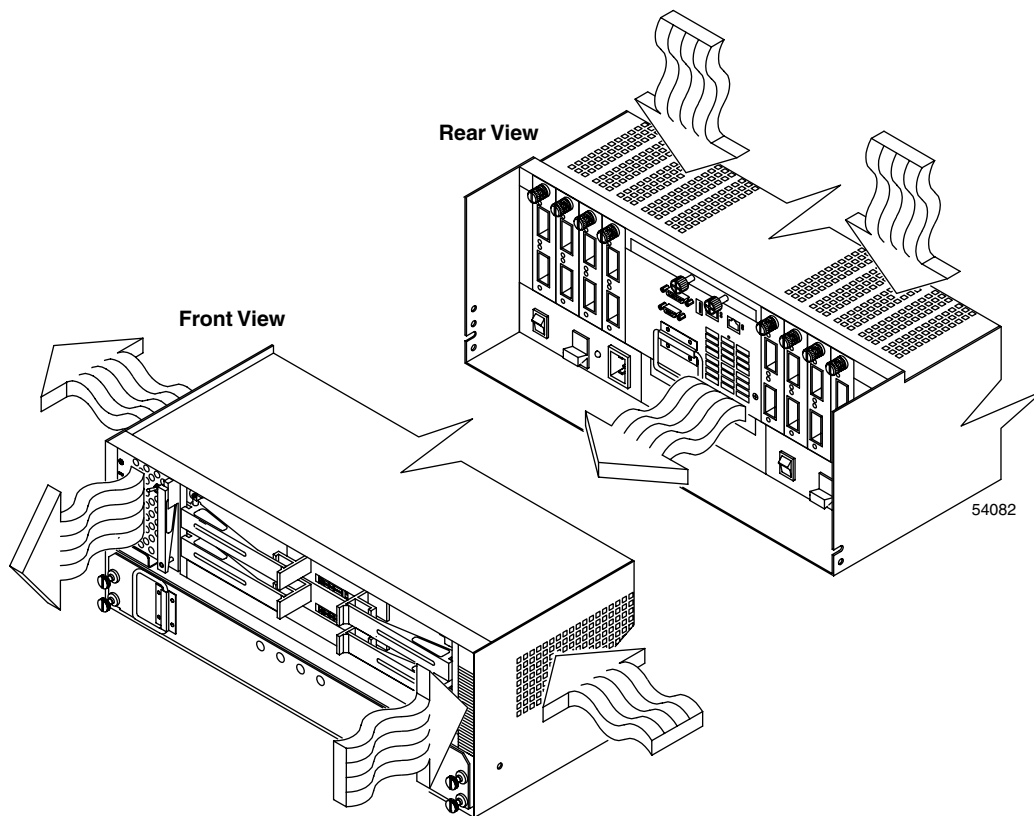




54067-f

**Figure 2-4** TP9500 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, ensure 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 (see Figure 2-5). These vents serve as air intake and exhaust passages. Always keep vents clean and free of obstructions.



**Figure 2-5** Air Flow in the TP9500 Controller Enclosure

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

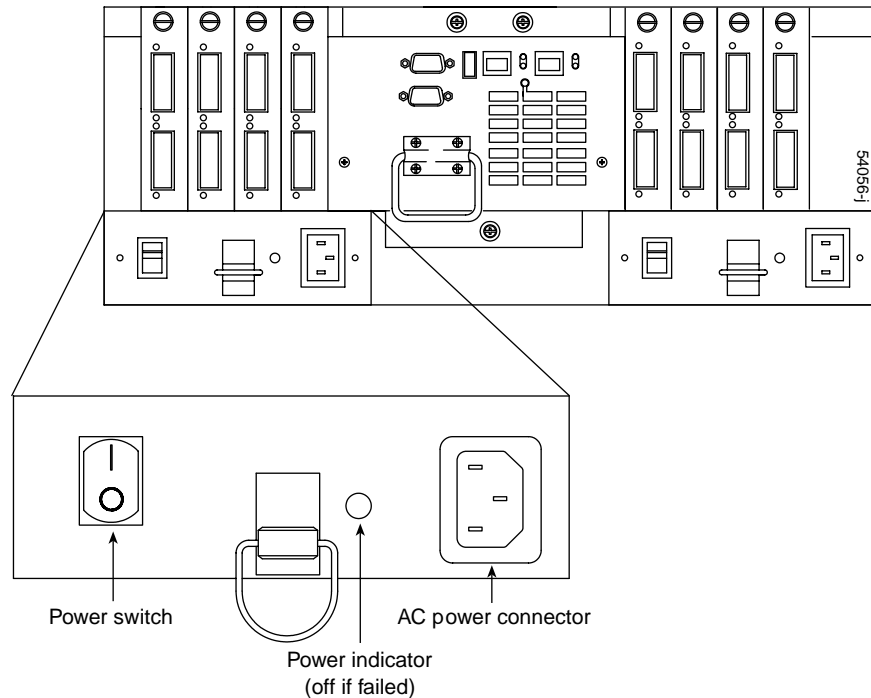
when you remove the failed canister and ends when you re-seat the new one. This does not include the time it takes you to perform the entire procedure (for example, checking indicators).

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 33.

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 (TPSSM) for indications of other component failures.

## **TP9500 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 (see Figure 2-6). 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 2-6** TP9500 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.

---

**Note:** If both fans fail in the fan/communications canister, the system will overheat.

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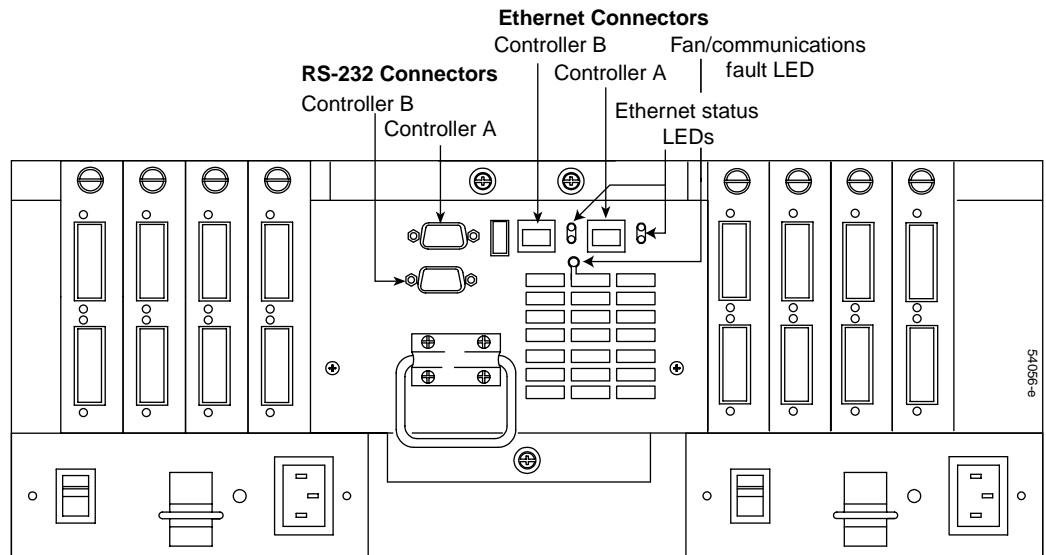
It is unlikely that both fans in the fan/communications canister would fail simultaneously. Such a failure would cause one or both power supplies to overheat. In these circumstances, the amber power supply fault indicator on the front cover turns on and the overheated power supply automatically shuts down (its green power supply indicator turns off). Once the ambient air temperature cools below 70 °C (158 °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 33.

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 (TPSSM) for indications of other component failures.

## TP9500 Diagnostic Interface Connectors

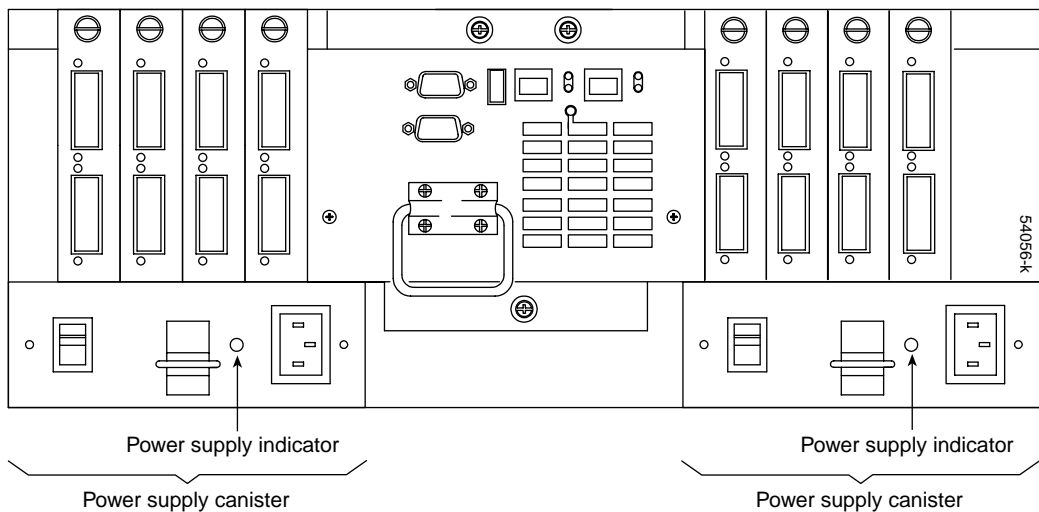
The fan/communications canister has two Ethernet (RJ-45) connectors, one for controller A and one for controller B (see Figure 2-7). The Ethernet connectors are used to manage the storage arrays directly from a remote management station. The canister also has two serial (RS-232) connectors, one for controller A and one for controller B. These connectors are used to diagnose problems, using storage management software (TPSSM) or other diagnostic tools. (The RS-232 connector is primarily intended for use by SGI field personnel.)



**Figure 2-7** Diagnostic Interface Connectors on the TP9500 Controller Enclosure (Rear)

## TP9500 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 2-8). 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 2-8** TP9500 Power Supplies and Indicators

Each of the power supply canisters has a built-in sensor that detects the following conditions:

- Over-voltage
- Over-current
- Overheated power supply

If any of these conditions occurs, one or both power supplies will shut down. All power remains off until one of the following occurs:

- You cycle the power switches (turn the power switches off and then turn them back on). See “Troubleshooting an Overtemp Condition and Power Supply Shutdown” on page 28 for more information on recovering from an overtemp condition.
- The power supplies automatically resume operation when the ambient air temperature cools to below 70 °C (158 °F). When the power supplies automatically resume operation, the controller also 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 (TPSSM) 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 33.

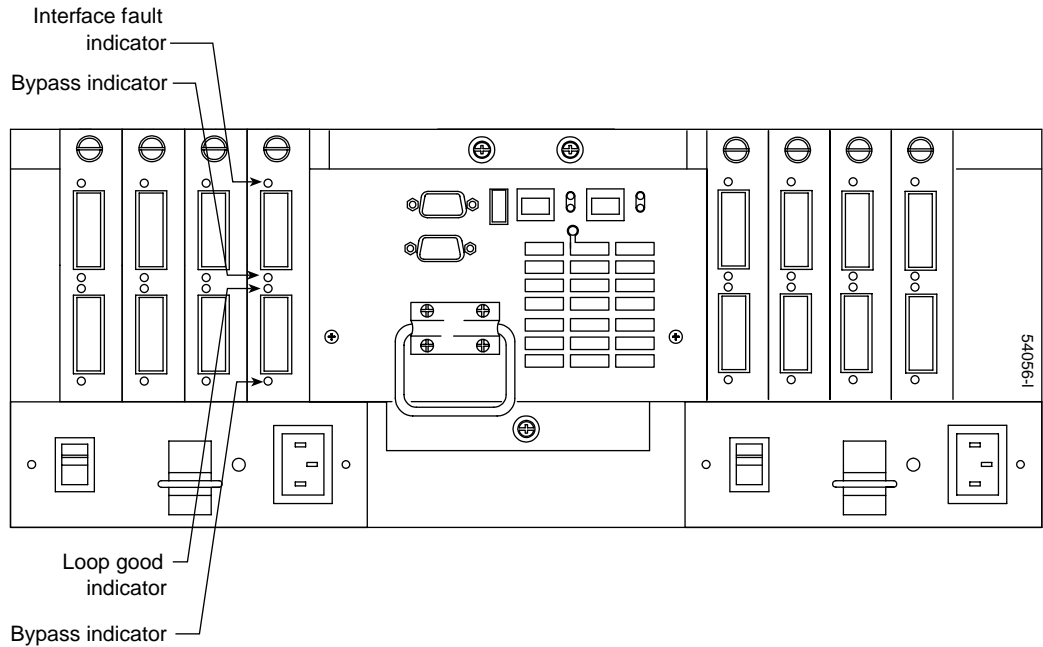
If you replace the power supply canister and continue to experience problems, the controller enclosure may have defective components or connections. Check the storage management software (TPSSM) for indications of other component failures.

## TP9500 Minihub Canister

A minihub canister is an interface card located at the rear of the controller enclosure (see Figure 2-9). It is a single, removable unit that provides the Fibre 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. These connections each require a small adapter called an SFP (small

form-factor pluggable) transceivers. The SFP transceiver interfaces the fiber optic cable to the minihub.

The minihubs are interchangeable and can be installed on either the host-side or the drive-side. Note that there are no minihubs on the TP9700 module.



**Figure 2-9** TP9500 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 33.

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**Note:** Replacing an SFP can induce failover. Check the system management software for messages about movement of device paths.

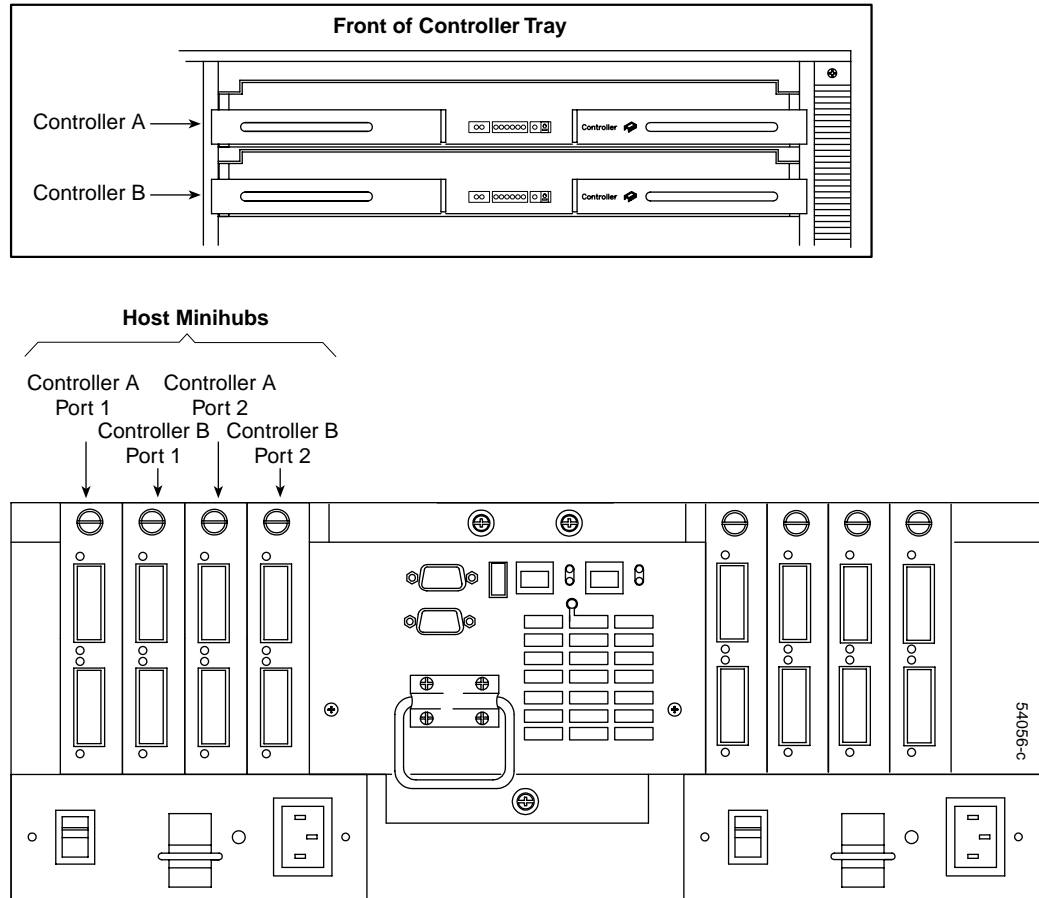
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If you replace the minihub canister and continue to experience problems, the controller enclosure may have defective components or connections. Check the storage management software (TPSSM) for indications of other component failures.

## **TP9500 Host Interface Connectors**

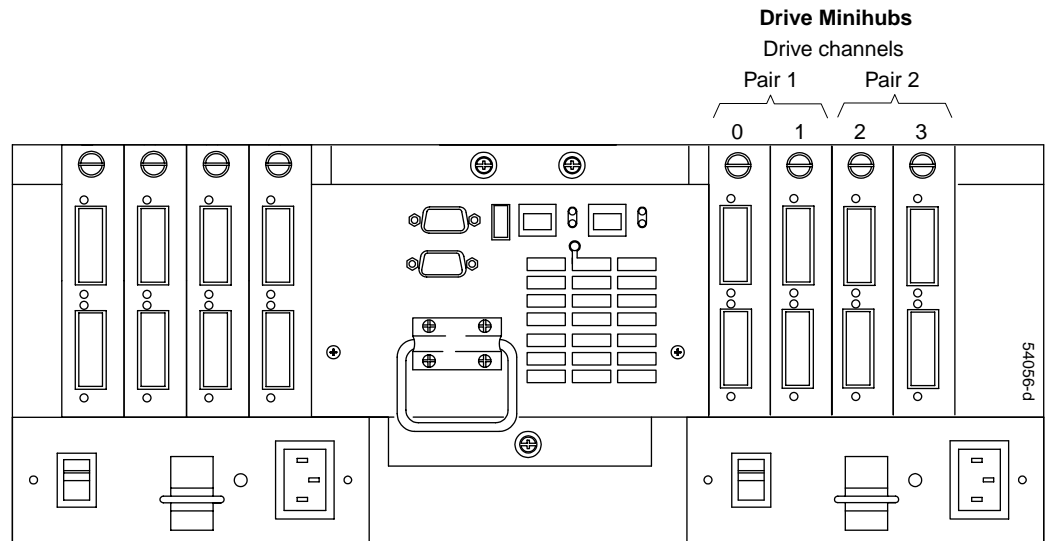
There are up to four host minihubs, two per controller (see Figure 2-10). Minihubs 1 and 3 correspond to the top controller (controller A) and minihubs 2 and 4 correspond to the bottom controller (controller B). Each minihub provides host loop capability and self-diagnostic features. To ensure redundancy, you must connect each host to each controller board.



**Figure 2-10** TP9500 Host Interface Connectors on the Controller Enclosure

## TP9500 Drive Interface Connectors

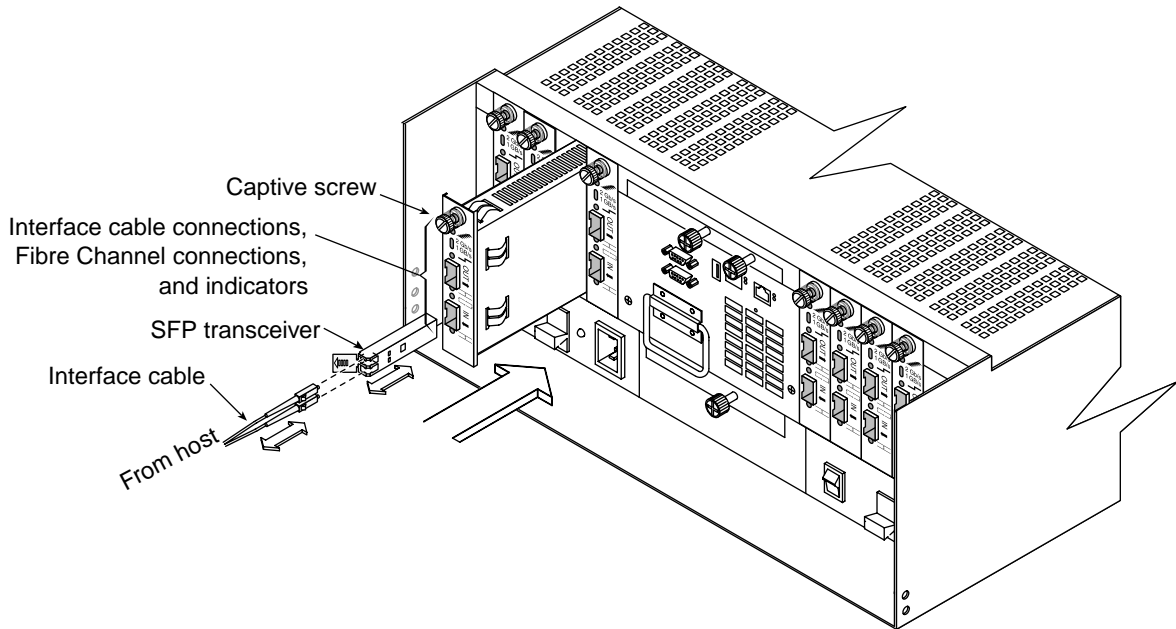
Each drive minihub canister represents a single drive channel (see Figure 2-11). The drive channels are set up in pairs to support two data paths to each drive (redundant drive loop configurations). Each pair supports up to 11 drive enclosures.



**Figure 2-11** TP9500 Drive Minihub Connectors on the Controller Enclosure (Rear)

## TP9500 SFP Transceiver

An SFP (small form-factor pluggable) transceiver is a module that fits into the SFP minihub located at the rear of the controller enclosure (see Figure 2-12). 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 2-12** TP9500 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 (TPSSM) for indications of other component failures.

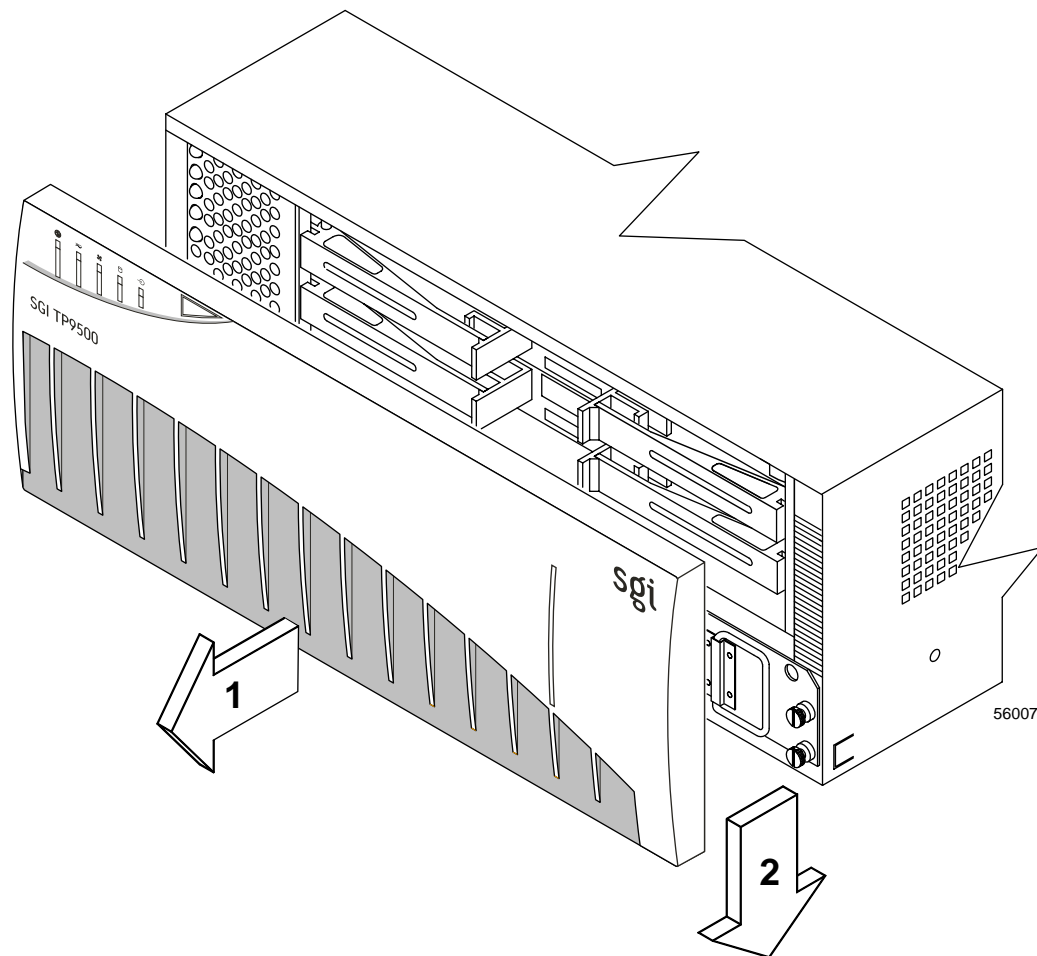
## Operation of TP9500 and TP9500S Controller Enclosures

This chapter describes the operation of the controller enclosures in the following sections:

- “Accessing the Controller” on page 25
- “Turning the Power On” on page 26
- “Troubleshooting an Overtemp Condition and Power Supply Shutdown” on page 28
- “Turning the Power Off” on page 31
- “Monitoring Status with Software” on page 32
- “Checking the Controller Enclosure Indicator Lights” on page 33
- “Checking the Battery Service Date” on page 40
- “Moving the Controller Enclosure” on page 41

### Accessing the Controller

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



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

## Turning the Power On

Follow these instructions to turn on the controller enclosure power. If you are restoring power to the controller enclosure after an emergency shutdown or power outage, proceed to “Troubleshooting an Overtemp Condition and Power Supply Shutdown” on page 28.

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**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.

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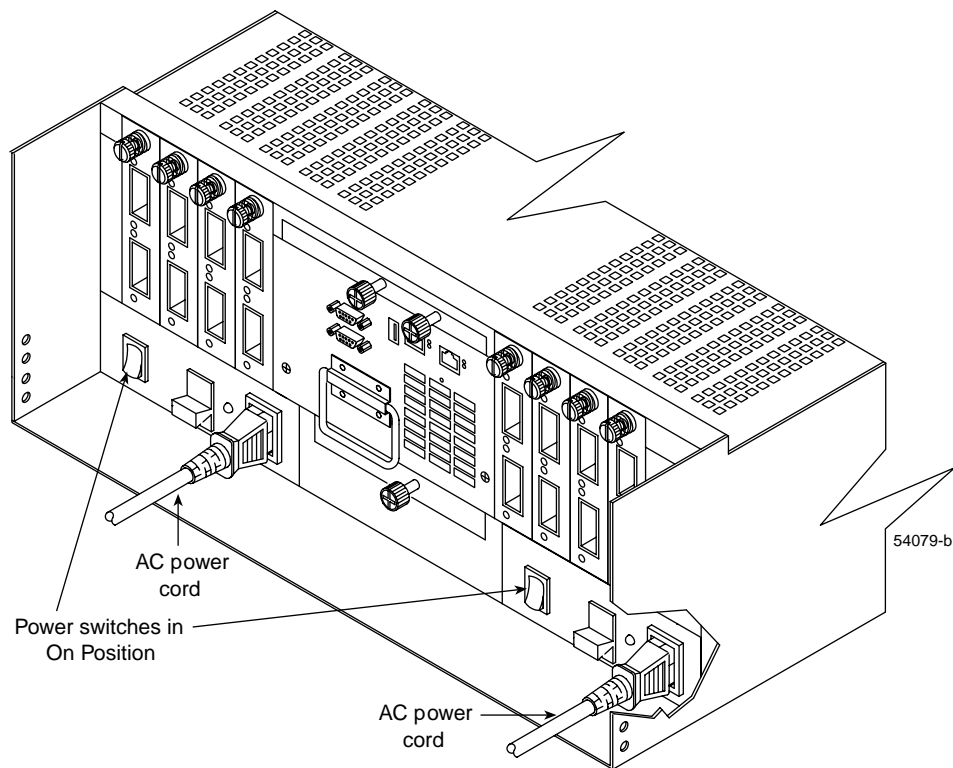
1. Remove the rear access panel on the rack.



**Danger:** Electrical shock can occur. 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.

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2. Turn on both power switches on the rear of the controller enclosure (see 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 33.



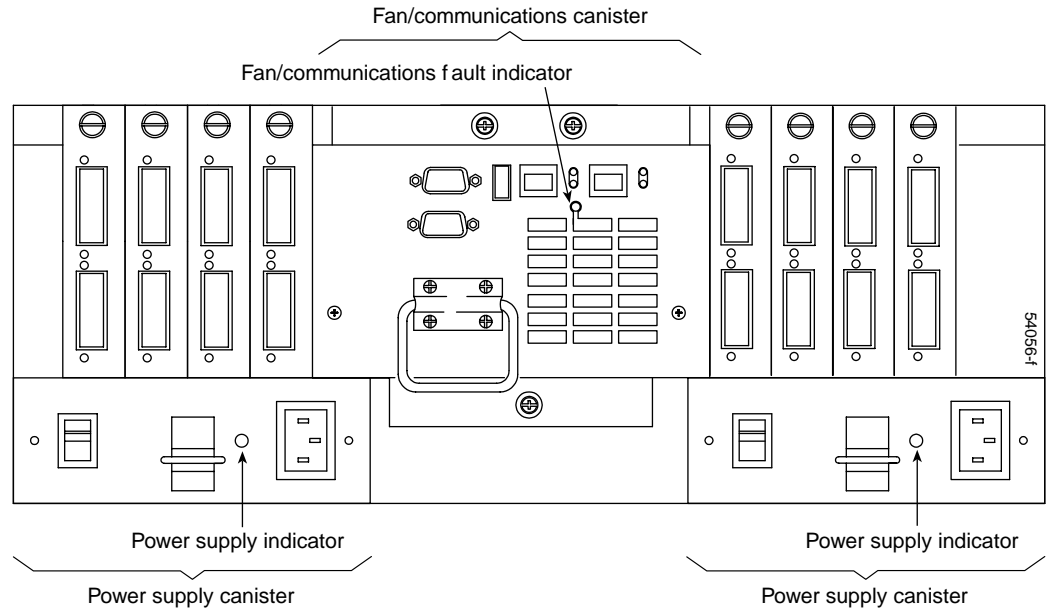
**Figure 3-2** Turning the Power On

Wait until the controller enclosure completes its power on activity before checking for faults. 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.

## Troubleshooting an 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 (see Figure 3-3). If both power supplies shut down, the controller enclosure is inoperable.

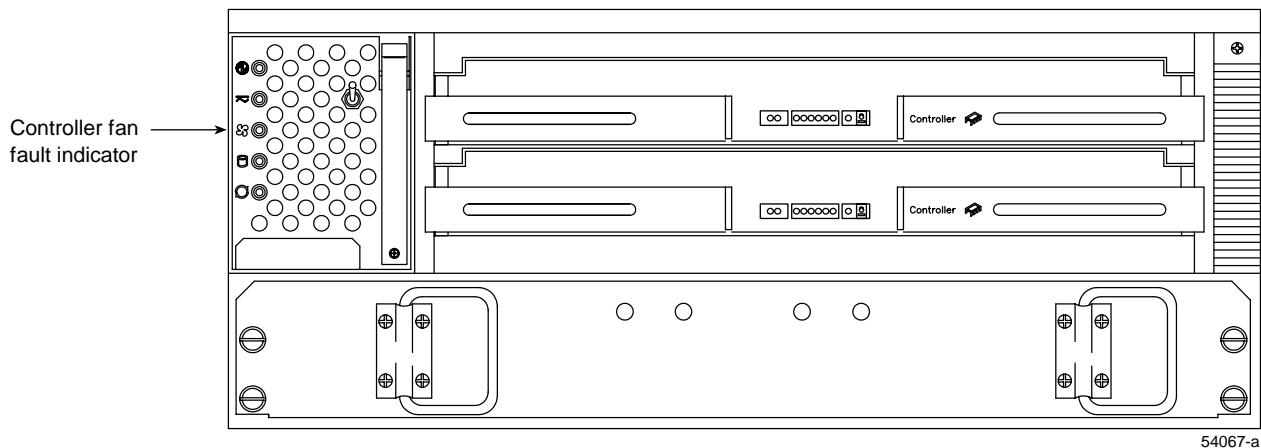




**Figure 3-3** Fan/Communications and Power Supply Indicators (Rear)

The storage management software (TPSSM) 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 (see Figure 3-4) comes on if the temperature reaches 45 °C (113 °F). If both power supplies shut down, the fault indicator cannot illuminate.



54067-a

**Figure 3-4** Controller Fan Fault Indicator (Front)

### Turning the Power On after an Overtemp Shutdown

To regain normal system operation after a power supply shutdown, follow these steps:

1. If your controller enclosure shuts down unexpectedly, use the storage management software (TPSSM) to determine if the controller enclosure has overheated. If an overtemp shutdown is indicated, proceed to the next step.
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:** Electrical shock can occur. 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 (see Figure 3-2). You must turn on both switches to take advantage of the redundant power supplies. Then proceed to “Checking the Controller Enclosure Indicator Lights” on page 33.

## Turning the Power On after an Emergency Shutdown

To regain normal system operation after a power failure or emergency shutdown, follow these steps:

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.



---

**Danger:** Electrical shock can occur. 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.

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**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 on the drive enclosures, see the drive enclosure documentation.

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2. Turn on the power (see Figure 3-2 on page 28).
  - a. If only the rack power is off, check the circuit breaker in the rack.
  - 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 (see Figure 3-2). You must turn on both switches to take advantage of the redundant power supplies. Then, proceed to “Checking the Controller Enclosure Indicator Lights” on page 33.

## Turning the Power Off

Follow these instructions 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.



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**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, see the storage management software (TPSSM) or see “Checking the Controller Enclosure Indicator Lights” on page 33.

---

1. Remove the rear access panel on the rack.
2. Prepare the controller enclosure for shutdown, as follows:
  - a. Stop all I/O activity to the controller enclosure and attached drive enclosures. Logically disconnect the controller and drive enclosures from the hosts. Ensure 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).

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**Note:** If a parity check is in progress, it may take hours or days for the drive indicators to stop blinking. Check the system management software to see if a parity check is in progress.

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- b. Ensure 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 33).
3. Turn off the power switches on the rear of the controller enclosure (see Figure 3-2).
4. Turn off the main circuit breakers in the rack.

## Monitoring Status with Software

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

The storage management software (TPSSM) provides the best way to diagnose and repair controller enclosure failures. This software can help you do the following:

- 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 (TPSSM) 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 (TPSSM) will explain these procedures.



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**Caution:** If the software recovery procedures are not followed, data loss can result.

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**Note:** For more information on the storage management software (TPSSM), see the *SGI TPSSM Administration Guide* (007-4306-00x), the *SGI TPSSM Software Concepts Guide* (007-4305-00x), and the *SGI Storage Area Network Installation Instructions* (108-0252-00x).

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## 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 30 minutes for the battery canister to complete its self test and up to 12 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 3-6).

To check the indicator lights, follow these steps:

1. To view all of the indicators, remove the front cover of the controller enclosure (see Figure 3-1 on page 26) and remove the rear access panel on the rack.

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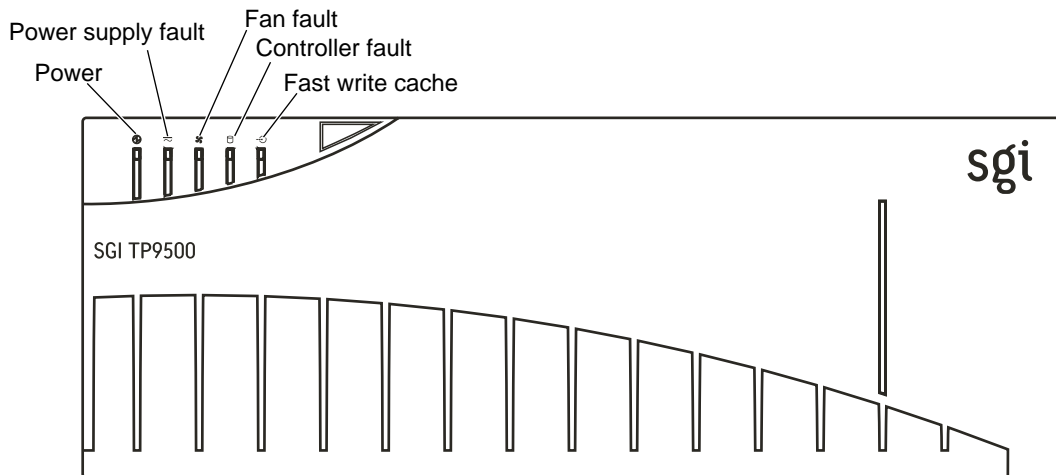
**Note:** The controller enclosure indicators display the status of the controller enclosure and its components. Green indicator lights mean normal operating status; amber indicators mean a possible failure. If you see an amber indicator, use the storage management software (TPSSM) to diagnose and repair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

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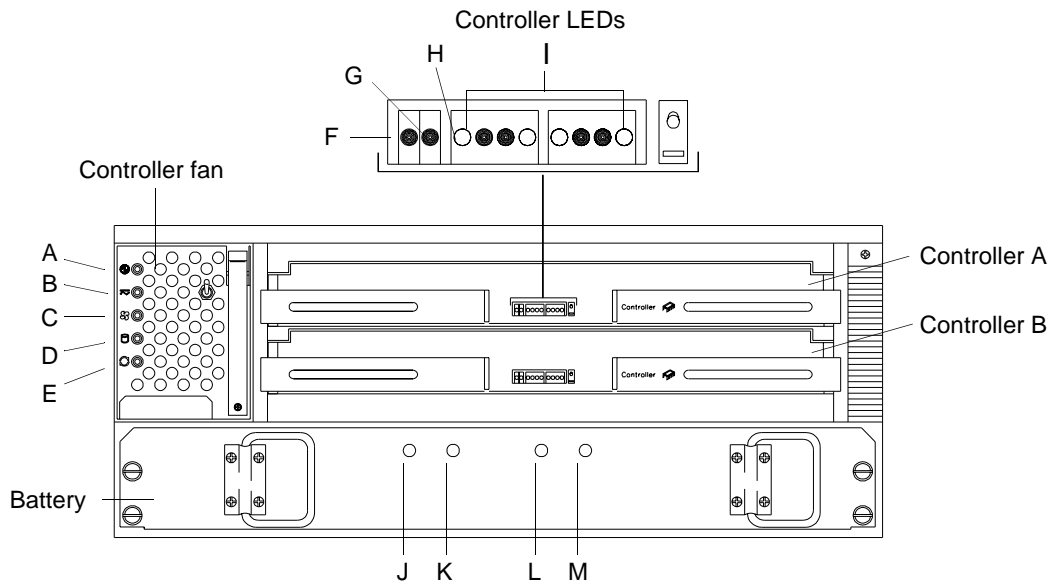
2. Check the indicators on the front of the controller enclosure (see “Front Indicator Lights” on page 34).
3. Check the indicators on the rear of the controller enclosure (see “Rear Indicator Lights” on page 38).
4. If all indicators show a “normal status,” replace the front cover (see Figure 3-1 on page 26). If the indicator lights show a fault, run the storage management software (TPSSM) to diagnose and repair the problem.

## Front Indicator Lights

Figure 3-5 and Figure 3-6 show the indicator lights on the front of the controller enclosure.



**Figure 3-5** Front Indicator Lights on the Controller Enclosure (Cover in Place)



**Figure 3-6** Front Indicator Lights on the Controller Enclosure (Cover Removed)

**Note:** You can use the audible alarm to warn you of faults (see Figure 3-6). The alarm is turned on (in upward position) when shipped. To disable the alarm, flip the switch to the downward position.

Table 3-1 describes the indicators on the front of the controller enclosure.

**Table 3-1** Front Indicator Lights on the Controller Enclosure

Component	Label	Indicator Light	Color	Normal Operation	Problem Indicator	Condition Indicated <sup>a</sup>
Controller fan canister	A	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.
	B	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.
	C	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.
	D	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.
	E	Fast write cache indicator	Green	Steady or Blinking	Software dependent <sup>b</sup>	Indicator light's normal operation is Off if: - Cache is not enabled - Battery is not ready
Battery canister	J	Fault-A or Fault-B indicator	Amber	Off	On	Left or right battery bank failed; battery is either discharged or defective.



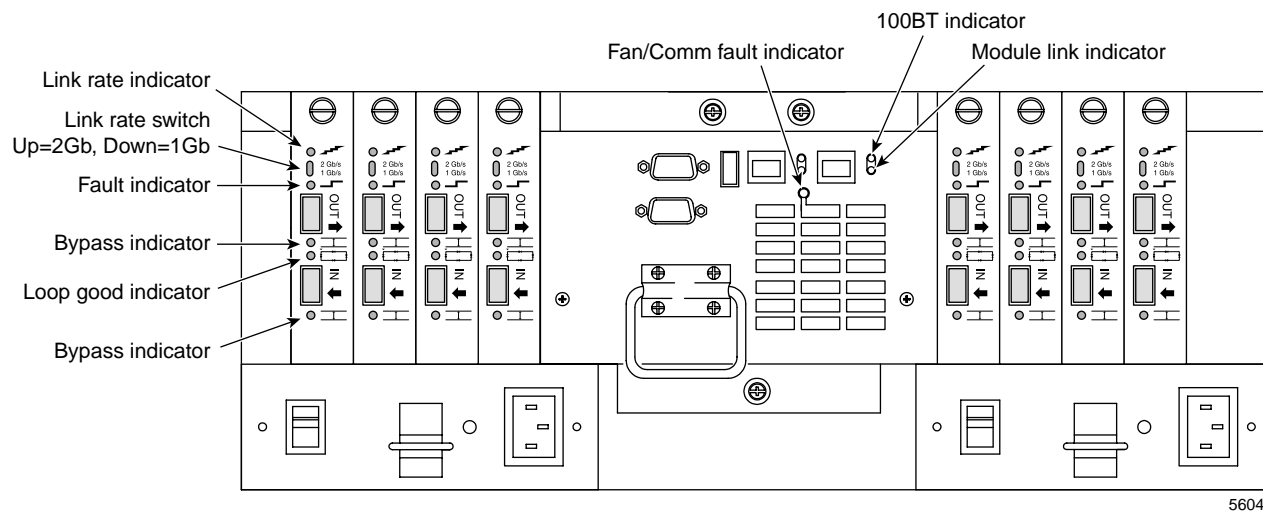
**Table 3-1** Front Indicator Lights on the Controller Enclosure **(continued)**

Component	Label	Indicator Light	Color	Normal Operation	Problem Indicator	Condition Indicated <sup>a</sup>
	K	Full charge-A or Full charge-B indicator	Green	On <sup>c</sup>	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.
Controller canister	F	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.
	G	Controller fault indicator	Amber	Off	On	Controller failure; fault condition on this controller.
	H	Heartbeat indicator	Green	Blinking	Not blinking <sup>d</sup>	No controller activity. (This will always blink during normal operation, even when idle.)
	I	Control status indicator	Green	Active= off Passive= 5 on, 2 off	On Steady	Controller failure; fault condition on this controller.

- a. Always use the storage management software (TPSSM) to precisely identify the failure.
- b. Fast write cache indicator blinks only during a fast write operation.
- c. If either Full charge-A or -B indicator blinks, the battery is in the process of charging. This process may take up to 30 minutes.
- d. There are eight status indicators, the heartbeat and seven others, that flash in various patterns, depending on the controller status.

## Rear Indicator Lights

Figure 3-7 shows the indicator lights on the rear of the controller enclosure.



**Figure 3-7** Rear Indicator Lights on the Controller Enclosure

Table 3-2 describes the indicator lights on the rear of the controller enclosure.

**Table 3-2** Rear Indicator Lights on the Controller Enclosure

Component	Indicator Light	Color	Normal Operation	Problem Indicator	Condition Indicated <sup>a</sup>
Minihub canisters (host side)	Link Rate Indicator	Green	N/A	N/A	On: Data transfer rate is 2 GB/s Off: Data transfer rate is 1GB/s
	Fault Indicator	Amber	Off	On	Lit from power-on through diagnostics and then turned off. If not lit during power-on, 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

**Table 3-2** Rear Indicator Lights on the Controller Enclosure (**continued**)

Component	Indicator Light	Color	Normal Operation	Problem Indicator	Condition Indicated <sup>a</sup>
	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. <b>Note:</b> 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. <b>Note:</b> This light can disabled in the NVSRAM settings.
Minihub canisters (drive side)	Link rate indicator	Green	N/A	N/A	On: Data transfer rate is 2 GB/s Off: Data transfer rate is 1 GB/s
	Link rate switch	N/A	N/A	N/A	Switch in UP position: data transfer rate is 2 GB/s Switch in DOWN position: data transfer rate 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.

**Table 3-2** Rear Indicator Lights on the Controller Enclosure **(continued)**

Component	Indicator Light	Color	Normal Operation	Problem Indicator	Condition Indicated <sup>a</sup>
	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 (TPSSM) to precisely identify the failure.

## Checking the Battery Service Date

To check the battery service date, follow these steps:

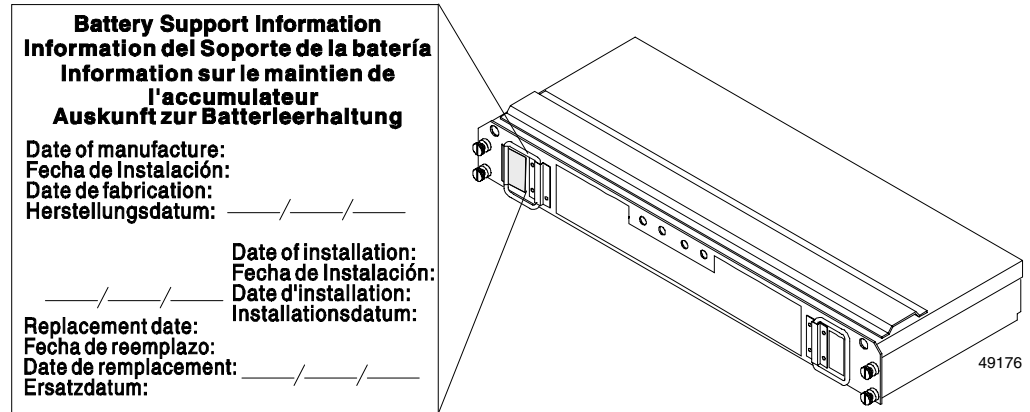
1. Remove the front cover from the controller enclosure (see Figure 3-1).
2. Check the “Battery Support Information” label (see Figure 3-8).

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 51. Otherwise, proceed 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 (see Figure 3-1 on page 26).

## 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, see Chapter 4, "Replacement of TP9500 and TP9500S Controller Enclosure Components" for instructions on depopulating the controller enclosure.

---

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

---

## Removing the Controller Enclosure

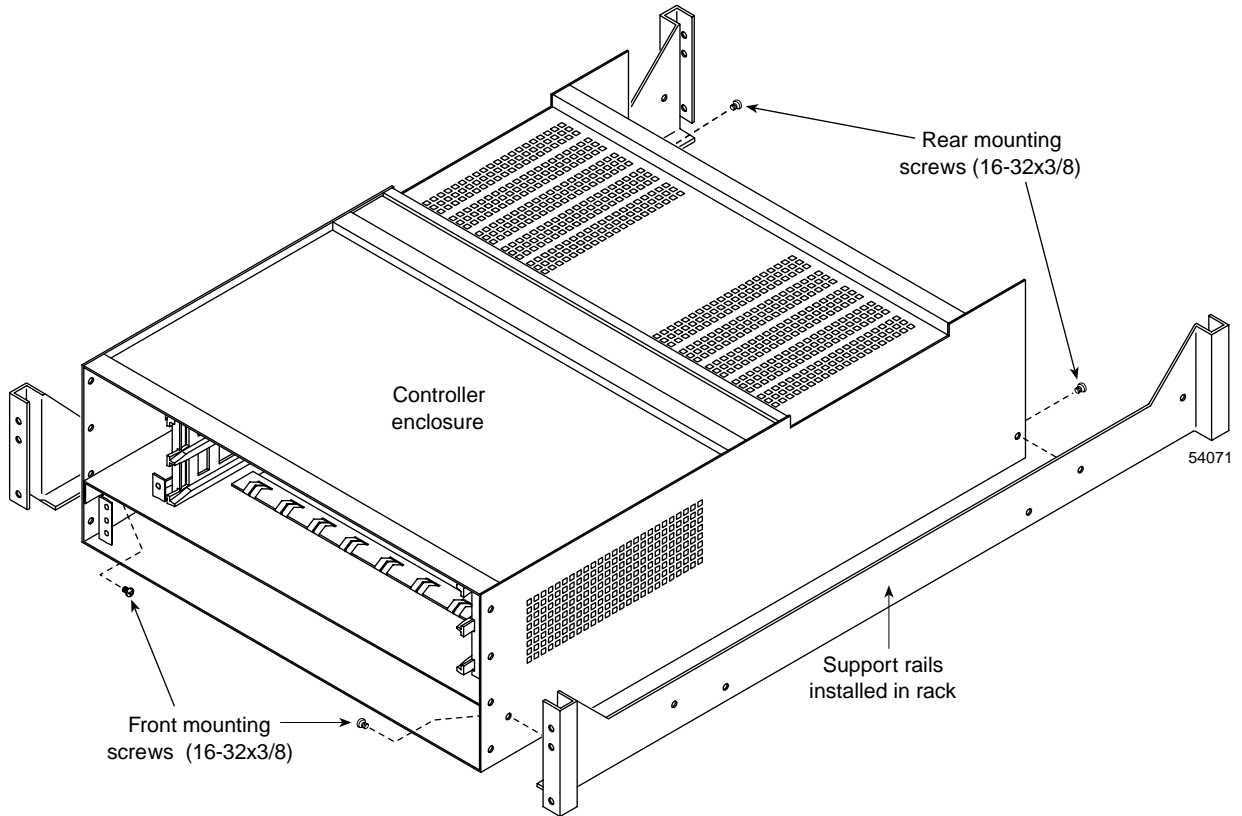
To remove and reinstall the controller enclosure, follow these steps:

---

**Note:** Always label any components that you remove from the enclosure so that you can reinstall them correctly.

---

1. Remove the front cover (see Figure 3-1 on page 26).
2. It is highly recommended that you remove the canisters to make the enclosure lighter and easier to remove. For instructions, see Chapter 4, "Replacement of TP9500 and TP9500S Controller Enclosure Components".
3. Remove mounting screws on the front and rear of the enclosure (see 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

To reinstall the controller enclosure into a rack, follow these steps:

1. Install the support rails in the rack. See the procedure in the *SGI TP9500 RAID Installation and Upgrade Guide (108-0375-00x)*.
2. From the rear of the rack, slide the controller enclosure into the rack along the support rails (see Figure 3-9).
3. Fasten the rear and front mounting screws (see Figure 3-9).
4. Replace the front cover (see Figure 3-1).
5. Wearing antistatic protection, reinstall the components into the controller enclosure. See Chapter 4, "Replacement of TP9500 and TP9500S Controller Enclosure Components".



## Replacement of TP9500 and TP9500S Controller Enclosure Components

This chapter describes the replacement of each component in the controller enclosure in the following sections:

- “Replacing a Failed Controller Canister” on page 45
- “Returning a Failed or New Canister to Normal Operating Mode” on page 49
- “Replacing a Failed Battery Canister” on page 51
- “Replacing a Failed Controller Fan Canister” on page 55
- “Replacing a Failed Fan/Communications Canister” on page 57
- “Replacing a Failed Power Supply Canister” on page 60
- “Replacing an SFP Transceiver” on page 62
- “Replacing a Failed Minihub Canister” on page 64

### Replacing a Failed Controller Canister

When instructed by the storage management software (TPSSM) to replace a controller canister, read the section titled “Controller Canister” on page 8. Then, follow these steps to replace the 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 49.

---



---

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

---

1. Unpack and examine the new controller.



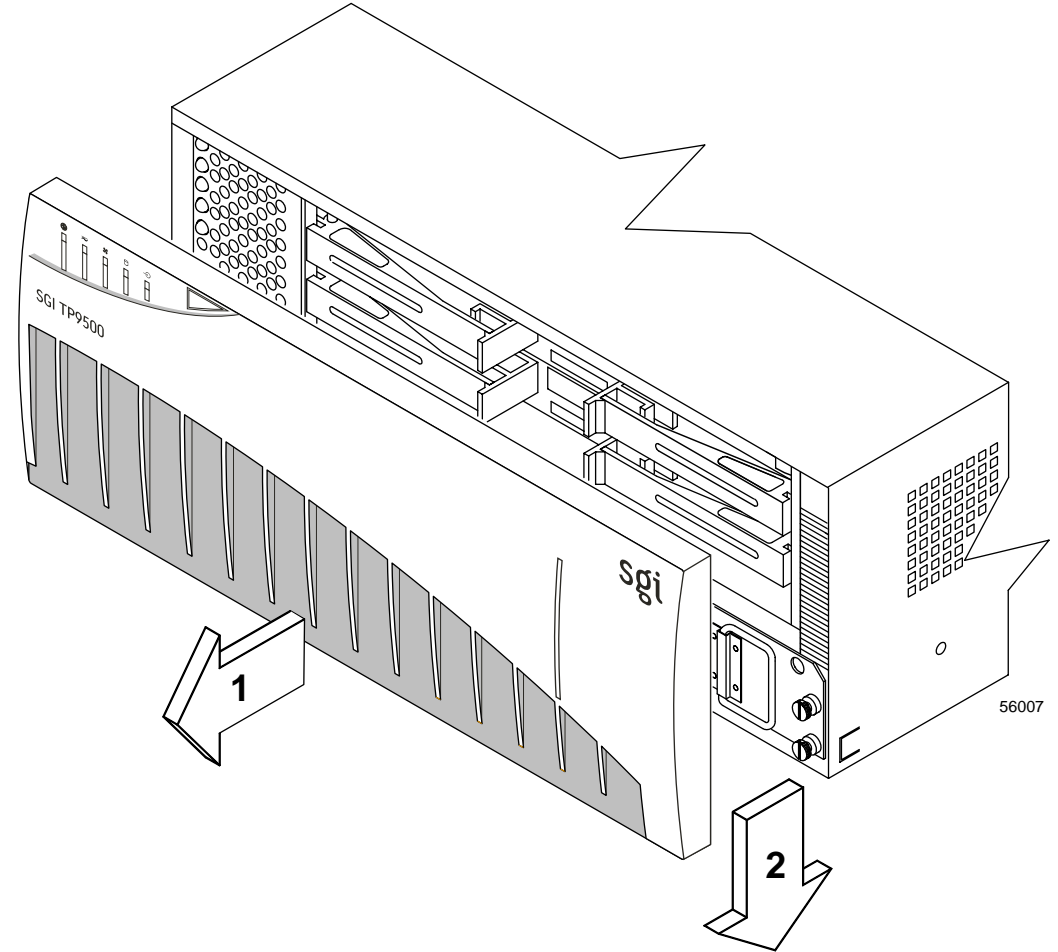
---

**Caution:** To avoid potential data loss, make sure that the new controller is the same type (memory size, and so on) as the one you are replacing. If you accidentally install a controller of a different type, the storage management software (TPSSM) 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 (TPSSM).
  - 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 (see Figure 4-1).

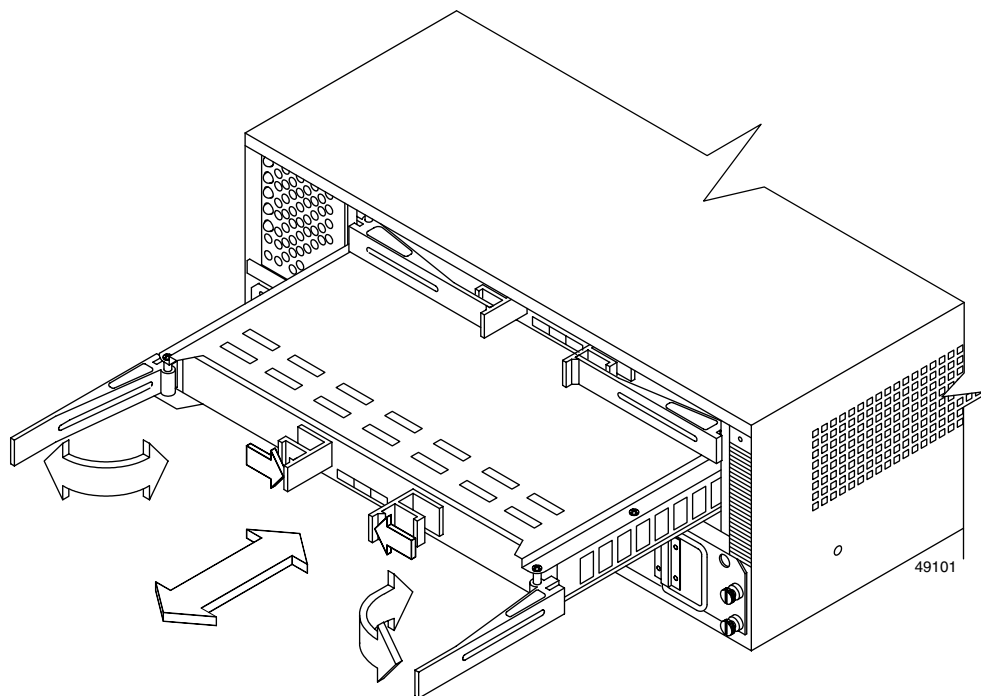


**Figure 4-1** Removing the Front Cover of the Controller Enclosure



**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 (TPSSM).

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 (see Figure 4-2).



**Figure 4-2** Removing and Installing a Controller Canister

5. Install the new controller.

When you replace a failed controller, the storage management software (TPSSM) 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 (see Figure 3-6 on page 35). If so, proceed 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, proceed to step b.
  - b. Use the storage management software (TPSSM) 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, proceed to step 7. If not, proceed 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, proceed to step 7. If not, proceed to step d.
  - d. If the previous steps do not correct the problem, contact your customer support representative (see “Product Support” on page xxvi).
7. Replace the front cover on the controller enclosure (see Figure 4-1 on page 47).

## Returning a Failed or New Canister to Normal Operating Mode

To return a failed or new canister to normal operating mode, follow these steps:

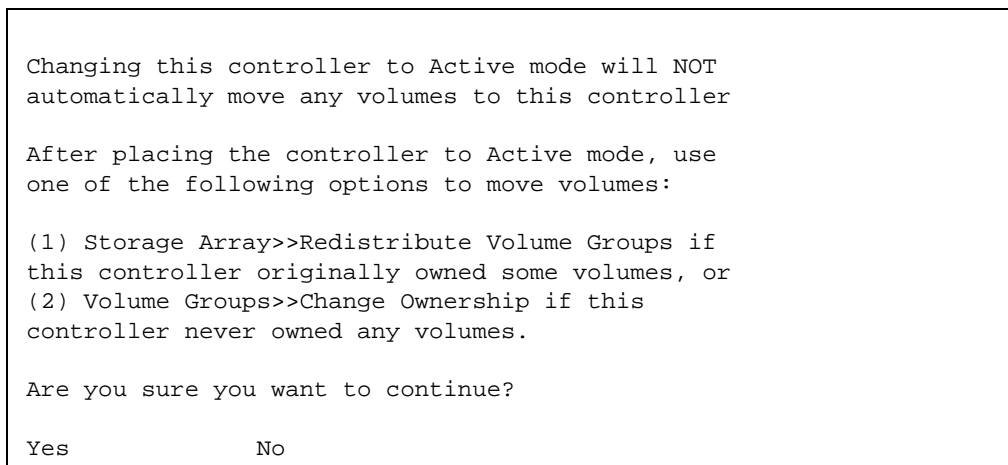
---

**Important:** After replacing a controller, you must return the system to its normal operating mode according to the steps outlined below. Follow these instructions after replacing a failed storage controller canister in a dual-active system.

---

1. Bring up the **TPSSM Storage Manager** window.
2. Left-click the name of the replaced storage controller.
3. Right-click the name of 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 in Figure 4-3 is displayed.



**Figure 4-3**      Active Mode Dialog Box

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

If you see an Error 23 message, click **OK** and repeat steps 2 through 7.

---

**Important:** If you are installing a new controller, or if the above procedure fails to fail over the LUNS, perform the following procedure.

---

1. As “root,” issue the following commands:
  - a. `scsiha -p <ctrls>` (for 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 command activity is 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 **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 in Figure 4-3 is displayed.
6. Read the information in the dialog box, make the appropriate choices, and then wait for 30 to 60 seconds.

---

**Note:** SGI volume manager XLV or XVM is required for the automatic movement of volumes/LUNs between controllers.

---

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 following example command:

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

---

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

---

---

**Note:** Failover can take a long time, depending on the conditions in your system.

---

## Replacing a Failed Battery Canister

When instructed by the storage management software (TPSSM) to replace a battery canister, read the section titled “Battery Canister” on page 11, and then follow these steps:



---

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

---

1. Use the storage management software (TPSSM) 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.

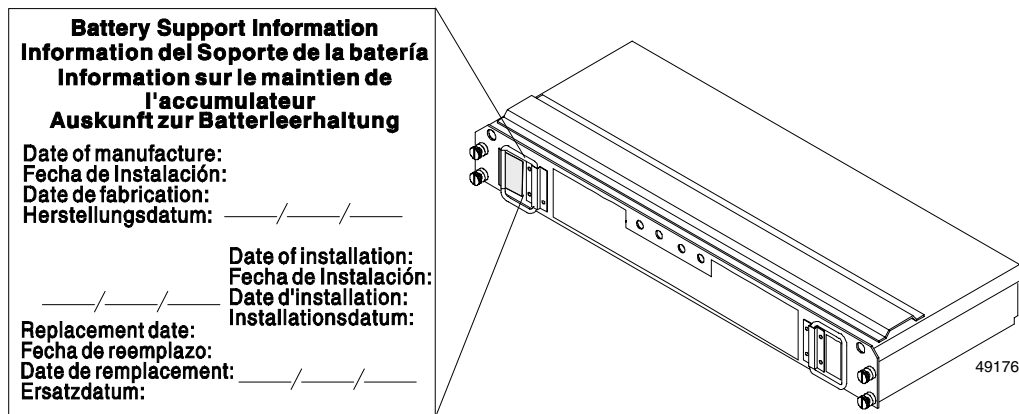


---

**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 (see 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 (see Figure 4-1).



---

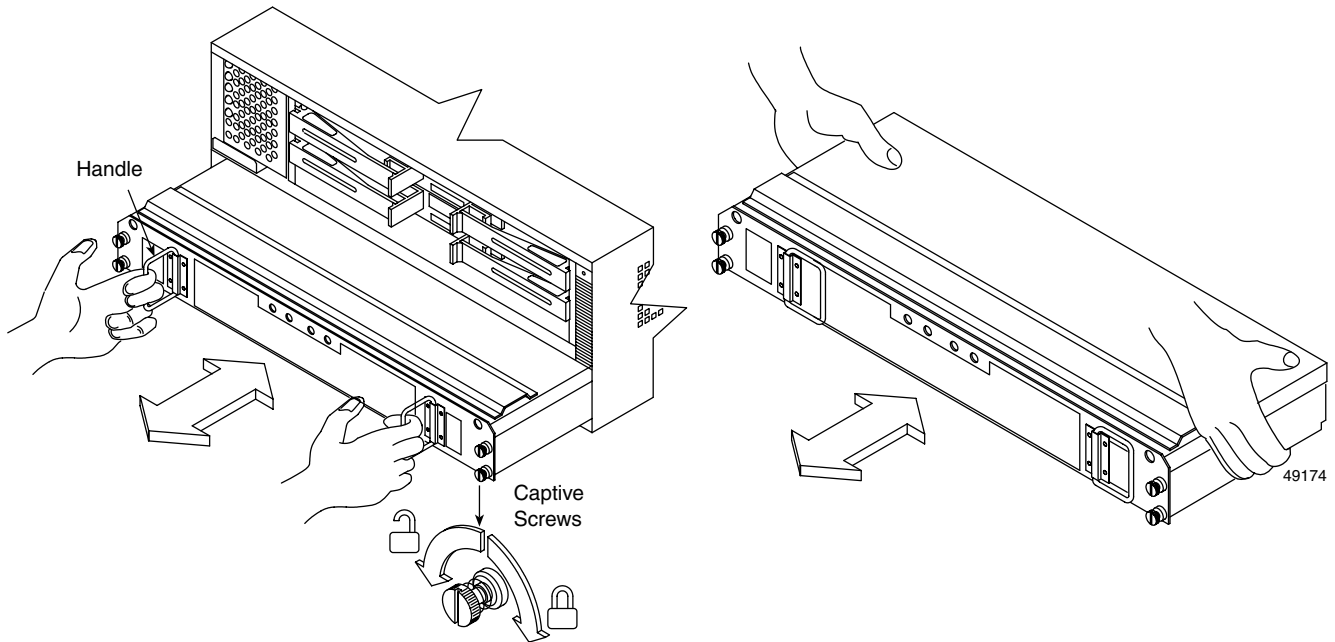
**Caution:** Be careful when removing the battery canister. It weighs approximately 24 lbs.

---

4. Remove the battery canister (see Figure 4-5).

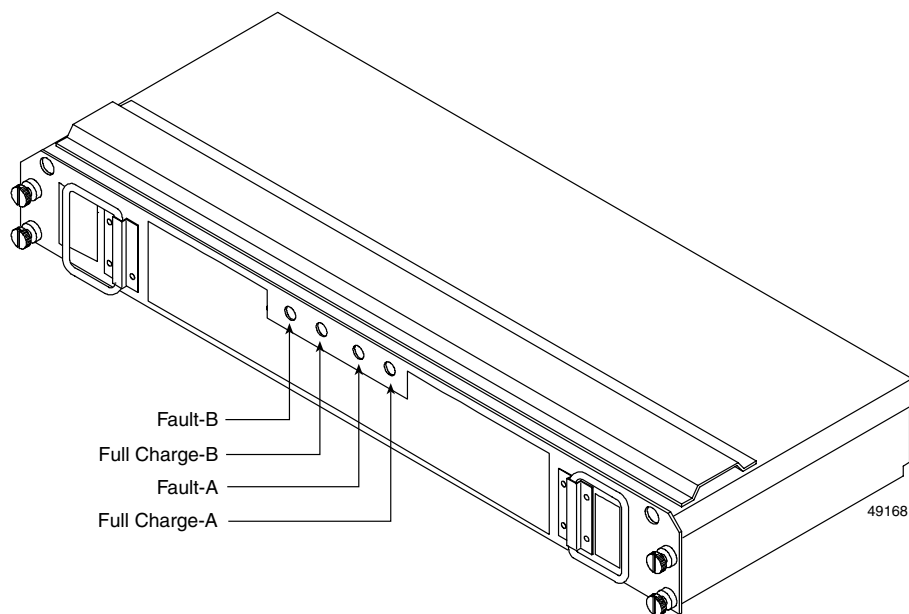


Turn the captive screws counterclockwise, using a flat-blade screwdriver to loosen the screws, if necessary. Use the handles to pull out the battery canister a few inches. Grasp the sides of the battery with both hands and remove the canister.



**Figure 4-5** Removing and Installing a Battery Canister

5. Install the new battery canister by sliding it into the slot and tighten all captive screws.
6. Replace the front cover by reversing the sequence in Figure 4-1.
7. Let the system run for an appropriate amount of time to properly charge the batteries. It may take up to 30 minutes for the battery canister to complete its self test and up to 12 hours to fully charge.
8. Check the battery canister indicators (see 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. You must reset the battery installation date with the storage management software (TPSSM). 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

When instructed by the storage management software (TPSSM) to replace a controller fan canister, read the section titled “TP9500 Controller Fan Canister” on page 12, and then follow these steps:



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

---

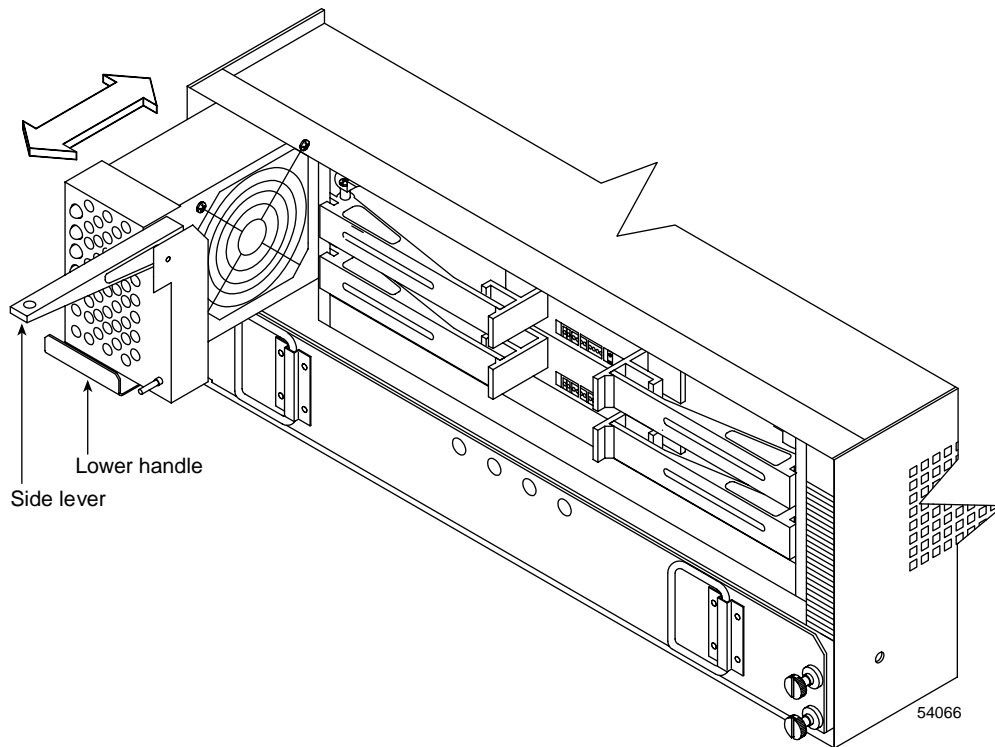
1. Unpack the new controller fan canister.
2. Remove the front cover (see Figure 4-1).



**Warning:** 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 (see Figure 4-7). Pull up on the side lever, and then pull out on the lower handle to remove the fan canister.



**Figure 4-7** Removing and Installing a Controller Fan Canister

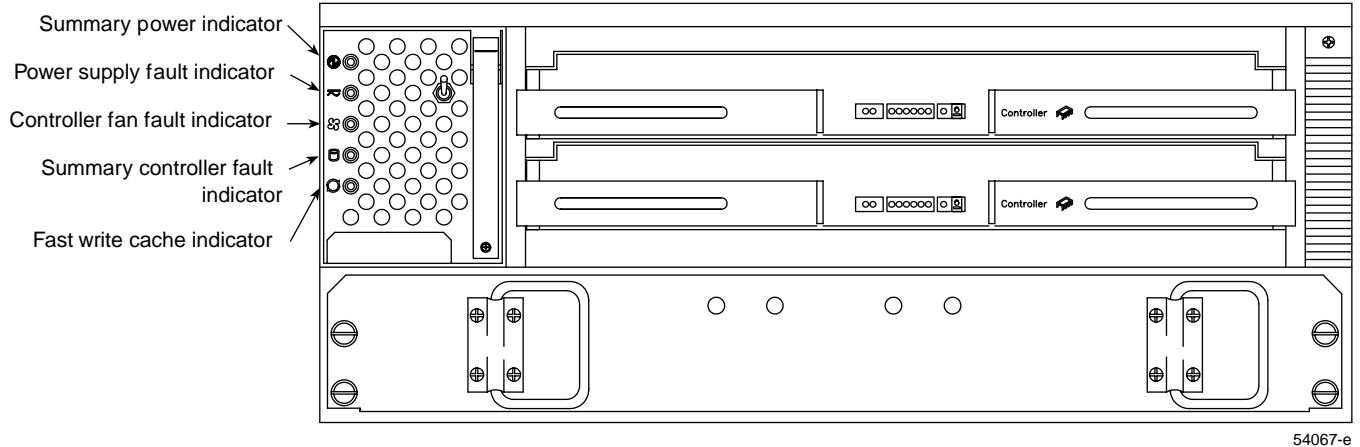
4. Install the new controller fan canister (see Figure 4-7). Slide the new canister all the way into the slot, and then push the side lever down to secure the canister in place.

---

**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 (see Figure 4-8). The green summary power indicator should be on and the amber controller fan fault indicator should be off. Troubleshoot the indicators as follows:
  - 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.



54067-e

**Figure 4-8** Controller Fan Indicators

- 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 (TPSSM) to diagnose and repair the problem.
6. Replace the front cover by reversing the sequence in Figure 4-1.

## Replacing a Failed Fan/Communications Canister

When instructed by the storage management software (TPSSM) to replace a fan/communications canister, read the section titled “TP9500 Fan/Communications Canister” on page 15, and then follow these steps:



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

1. Unpack the new fan/communications canister.

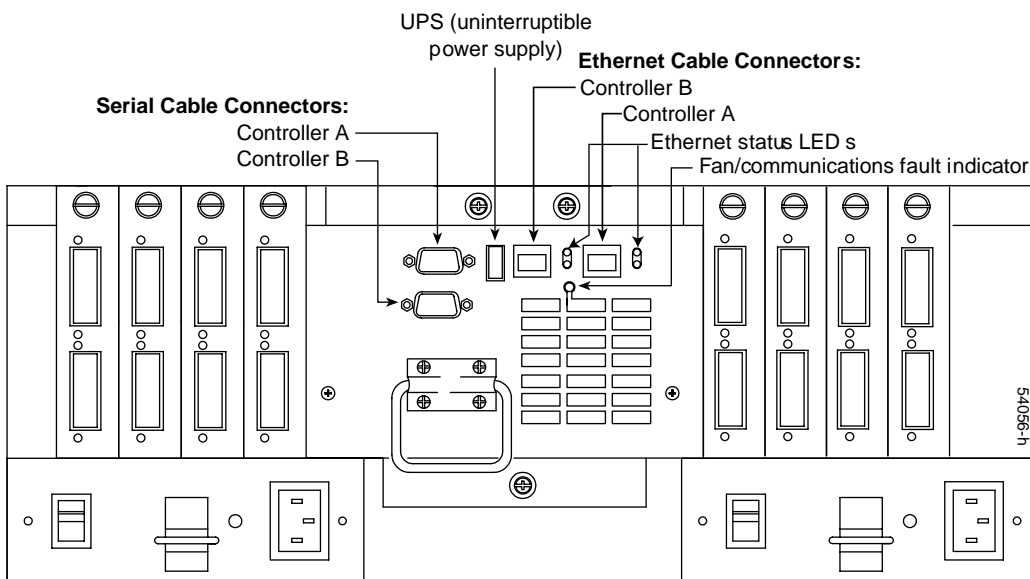


**Caution:** Bending or damaging Fibre Channel cables can result in degraded performance or data loss. Fibre Channel cables are fragile and can break easily. Handle the cables carefully. Do not pinch them with tie wraps, step on them, or bend them at sharp angles.

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 (see Figure 4-9).

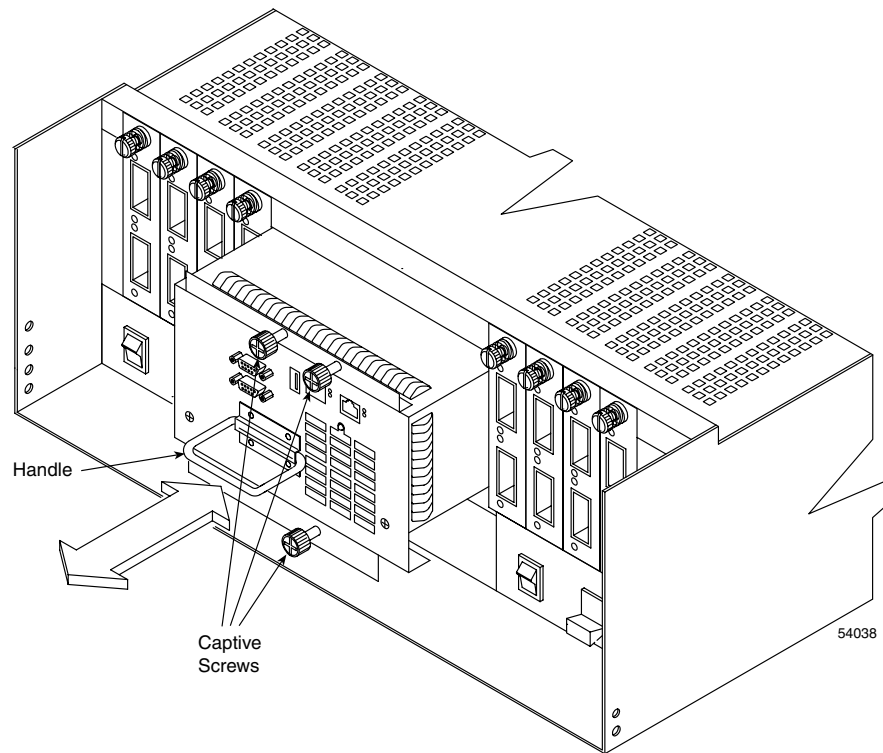


**Figure 4-9** Fan/Communications Interface Cables and Fault Indicator



**Warning:** You must be aware of the time limit to prevent damage to the controller enclosure circuitry. 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 (see 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 58). The amber fault indicator should be off. Troubleshoot the indicator as follows:
  - 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

When instructed by the storage management software (TPSSM) to replace a power supply canister, read the section titled “TP9500 Power Supply Canister” on page 18, and then follow these steps:



**Warning:** 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.



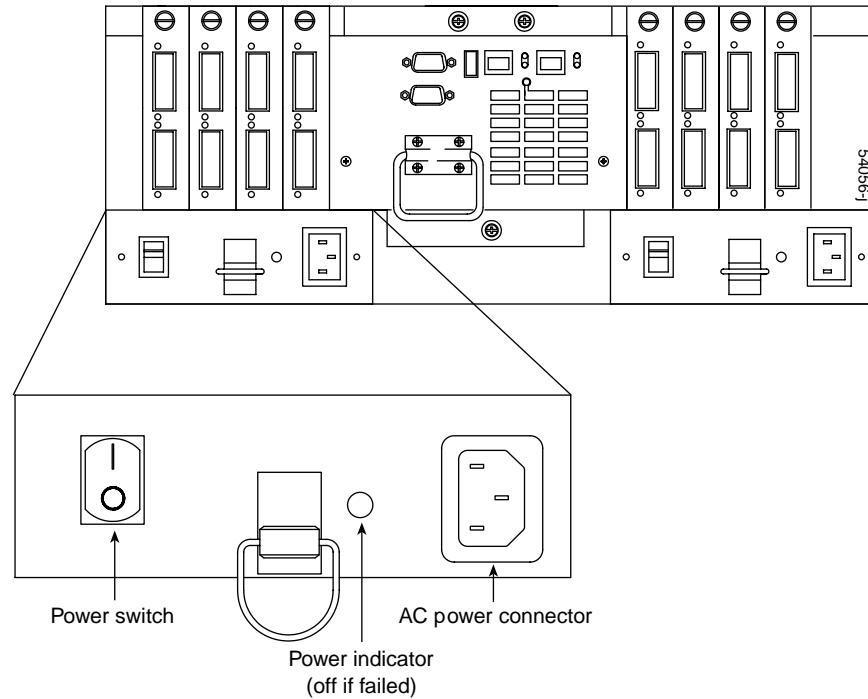
**Caution:** Bending or damaging Fibre Channel cables can result in degraded performance or data loss. Fibre Channel cables are fragile and can break easily. Handle the cables carefully. Do not pinch them with tie wraps, step on them, or bend them at sharp angles.

---

2. Check the power indicator on the power supply at the rear of the controller enclosure (see 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 (see Figure 4-11).

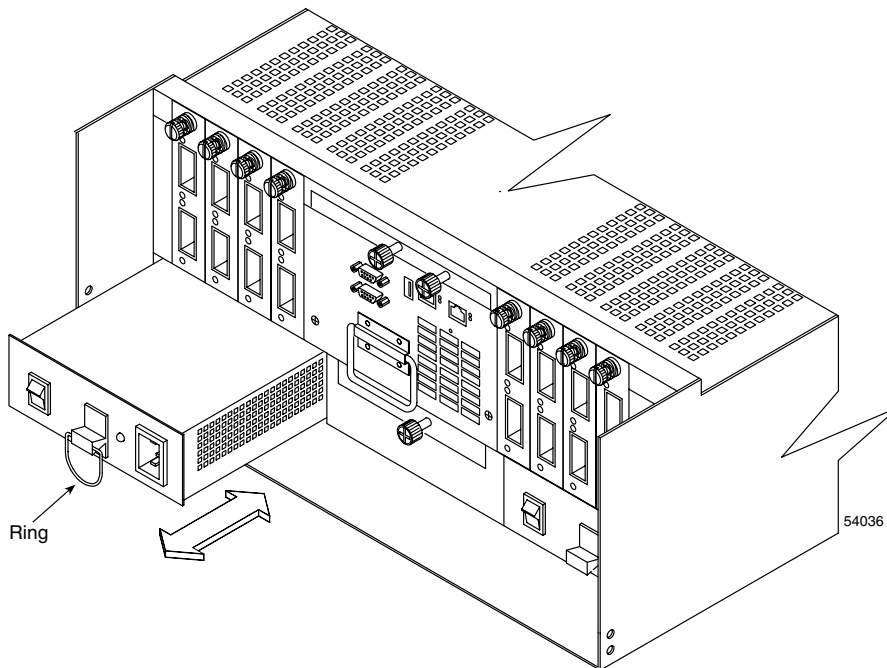


**Figure 4-11** Power Supply Switch, Connector, and Indicator



**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 (see Figure 4-12). Pull up on the ring to release the canister, and then slide it out of the enclosure.



**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 (see 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 (see Figure 4-11).
9. Check the new power supply and other controller enclosure indicators for faults.

## Replacing an SFP Transceiver

When instructed by the storage management software (TPSSM) to replace a SFP transceiver, read the section titled “TP9500 SFP Transceiver” on page 24, and then follow these steps:



---

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

---

---

**Note:** Replacing an SFP transceiver can induce failover. Check the system management software (TPSSM) for messages about movement of device paths.

---

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.

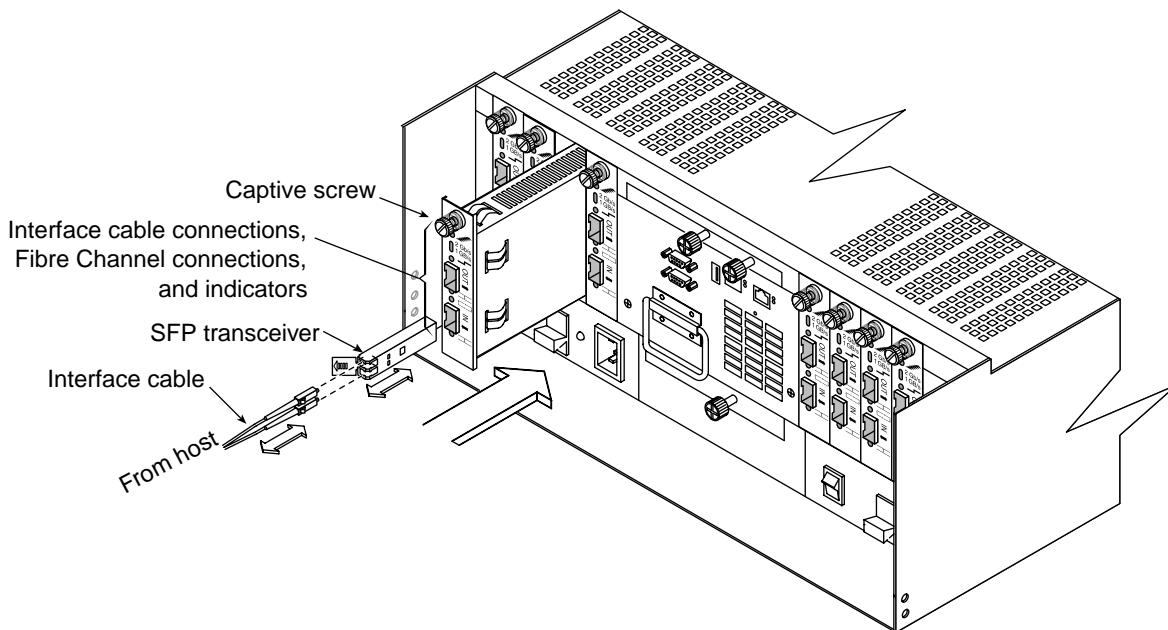


---

**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 (see Figure 4-13).



**Figure 4-13** Removing and Installing an SFP Transceiver

4. Remove the failed SFP transceiver from its minihub slot (see Figure 4-13).
5. Insert the new SFP transceiver into its minihub slot.
6. Reconnect the interface cables.

At the system console, re-enable the interface.

## Replacing a Failed Minihub Canister

Follow these instructions when instructed by the storage management software (TPSSM) to replace a minihub canister. To replace either a host-side or a drive-side minihub canister, read the section titled "TP9500 Minihub Canister" on page 19, and then follow these instructions:



---

**Warning:** 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.

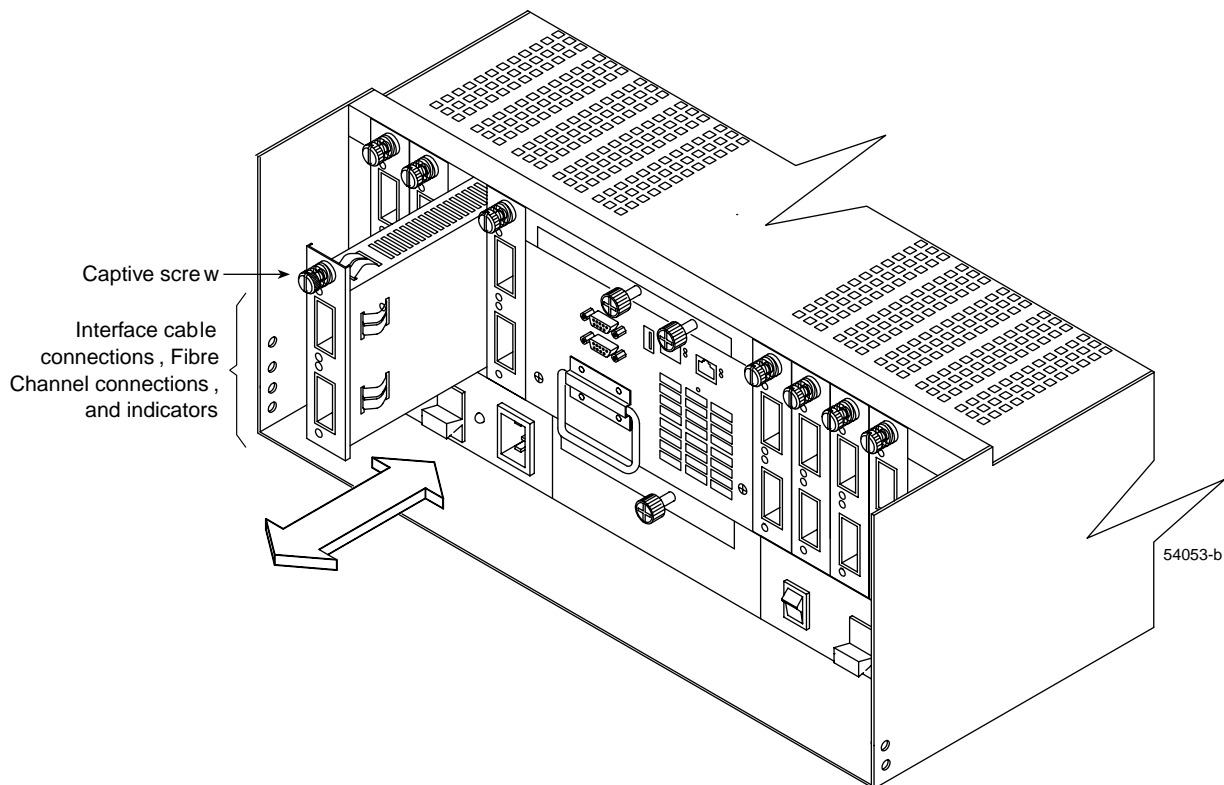


---

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

---

4. Remove the interface cables from the Fibre Channel connections on the failed minihub (see Figure 4-13).
5. Remove each SFP transceiver from the minihub slot (see Figure 4-13).
6. Unfasten the captive screw on the minihub and remove it from the chassis (see Figure 4-14).



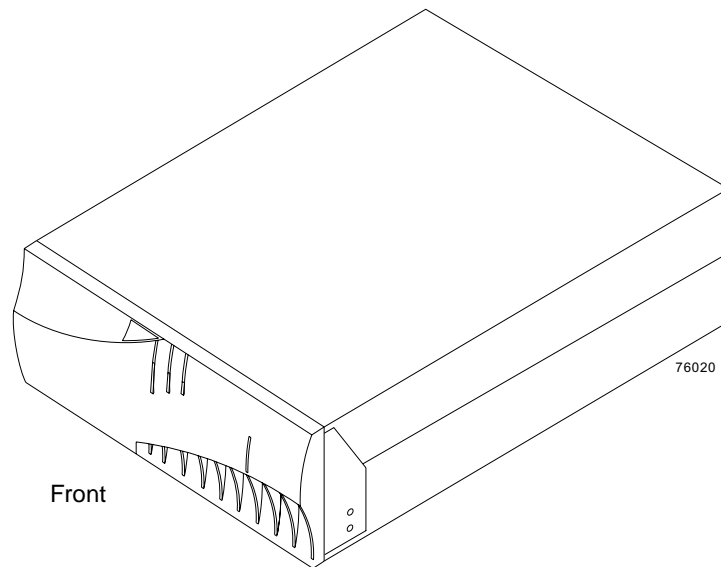
**Figure 4-14** Removing and Installing a MiniHub

7. Install the new minihub into the slot and tighten the captive screw.
8. Install the SFP transceiver(s) 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, see “Rear Indicator Lights” in Chapter 3. If a problem is indicated, use the storage management software (TPSSM) to check the controller enclosure status.

## TP9700 Controller Enclosures

The TP9700's controller enclosure (module) is a high-performance unit that directs and manages the I/O activity between a host and the volumes in a storage array. The 6998 controller module has 4 host channels and can support up to 512 host ports. The enclosure has 4 dual-ported drive channels and can support up to 224 Fibre Channel drives with a maximum of 2048 addressable volumes. The 6998 controller module has 2.4 GHz control processors with 2 GB of cache RAM and port speeds of up to 4 Gb/s. Figure 5-1 shows the 6998 controller module with front cover in place.

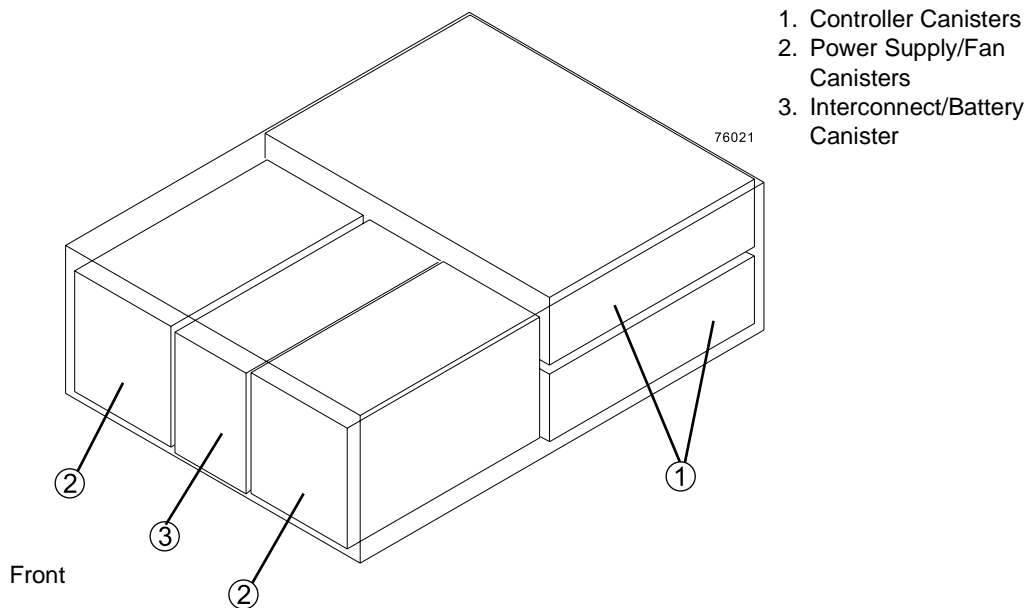


**Figure 5-1** 6998 Controller Module

The 6998 controller module is comprised of five sub-modules referred to as “canisters” which serve individual support functions for the unit. The canisters, and the quantity of each canister in the module, are:

- Controller canister (two)
- Power supply/fan canister (two)
- Interconnect/battery canister (one)

The power supply/fan canisters and interconnect/battery canister are located behind the front cover. The controller canisters are located in the rear of the command module. All canisters are secured in the command module by quick release latches, enabling each canister to be removed by disengaging the latch and sliding the canister from the command module chassis. Figure 5-1 shows the positions of the canisters in the 6998 controller module.



**Figure 5-2** Location of the Canisters in the Command Module

The module provides flexibility in configuring a storage array. A minimal storage array configuration would consist of one controller module and one drive module. The drive module can contain as few as two disk drives. The maximum number of disk drives a two-controller module can support is 224 drives.

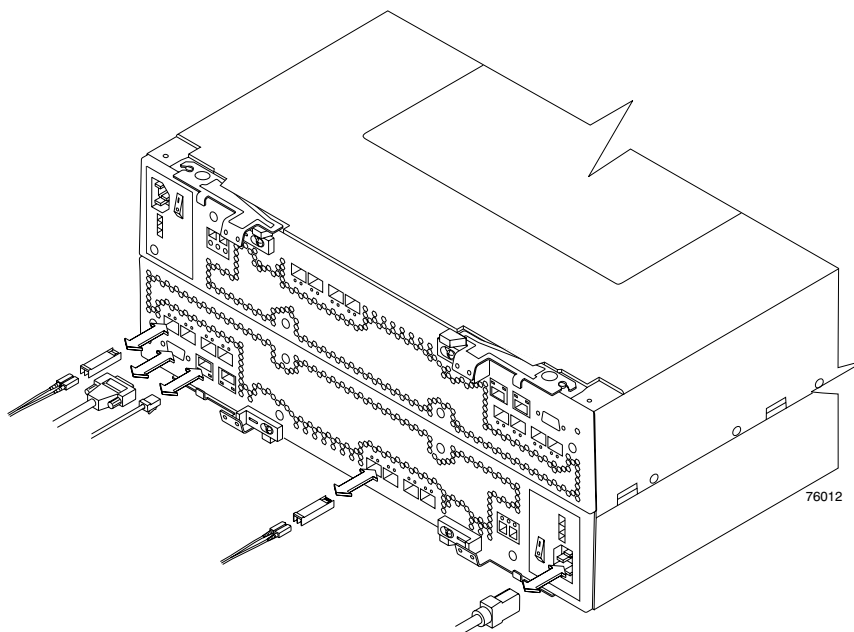


The maximum number of drive enclosures is 16, with each drive module containing 14 disk drives. The 6998 controllers can support the following types of drive modules:

- FC-1 14x
- FC-2 14x

## 6998 Controllers

Each controller module houses two 6998 controllers. Both controllers are identical and interchangeable. The controllers are different from some previous SGI RAID units in that they install from the rear of the module. The upper controller is controller A; the lower controller is controller B. All connections to the hosts and the drives in the storage array are through the controllers. Figure 5-3 shows an example rear view of the controllers.



**Figure 5-3** Controllers A and B in the at the Rear of the TP9700 Module

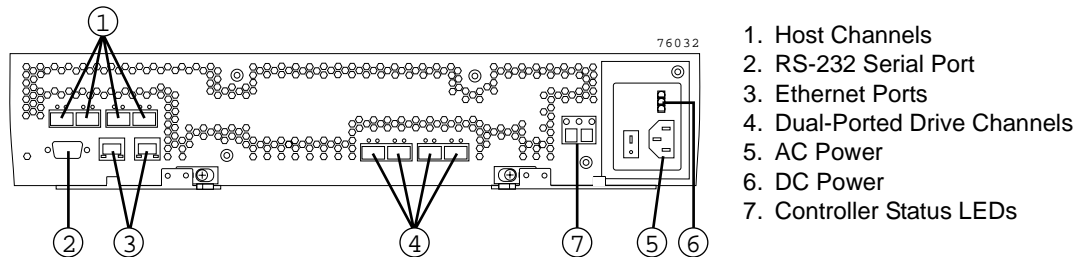
Information about the condition of the controllers is conveyed by two seven-segment status LEDs on the back.

## Controller Cable Connections

Each controller provides the following connections:

- Four host channels
- Two dual-ported drive channels
- Two RJ-45 Ethernets
- One RS-232 serial
- AC or DC power

Figure 5-4 identifies the connectors on the back of each controller canister.



**Figure 5-4** Controller Canister Connectors

Each controller has two drive channels; each drive channel has two ports. The drive channel ports are configured from loop switches.

Each controller has four host Fibre Channel ports. The controllers perform link speed negotiation on each host channel Fibre Channel port (also referred to as auto-negotiation). The controllers interact with the host or switch to determine the fastest compatible speed between the controllers and the host or switch. The fastest compatible speed becomes the operating speed of the link. If the host or switch on the other end of the link are fixed speed or not capable of negotiating, the controllers automatically detect the operating speed of the other host or switch and sets the controller link speed accordingly. Link speed negotiation for a given host channel is limited to link speeds supported by the Small Form-factor Pluggable (SFP) transceiver on that channel.

The controllers will enter into auto-negotiation at these points in time:

- Start-of-Day

- Detection of a link-up event after a previous link-down event

If the auto-negotiation process fails, the controllers will consider the link to be down until negotiation is again attempted at one of these points in time.

For a 4Gb controller, the supported link speeds are 1, 2, and 4Gb.

The Ethernet connections provide for out-of-band management configurations to a host.

The RS-232 serial connection provides a diagnostic port.

## Controller Memory

Each controller has up to 8 GB of memory for processor memory and data cache. The processor memory stores the controller firmware, while the data cache is a buffer used to temporarily store data during data read and write operations. A Fast Cache Write light on the controller turns on when the cache contains unwritten data. The light turns off when the cache does not contain unwritten data.

For specific information about the memory in the controller canisters, refer to the

Table 5-1 lists the technical specifications for the 6998 controllers.

**Table 5-1** 6998 Controller Specifications

Category	Criteria	Specification
Processor	Speed	2.4 GHz
Memory	Processor/cache size	1 GB
Flash Memory	Capacity	32 MB
NVSRAM	Capacity	512 KB
Processor bus	Speed	64b 100MHz
Interface	Host port	4 fiber optic per controller 2 Ethernet per controller (for out-of-band management)
	Drive port	4 fiber optic per controller

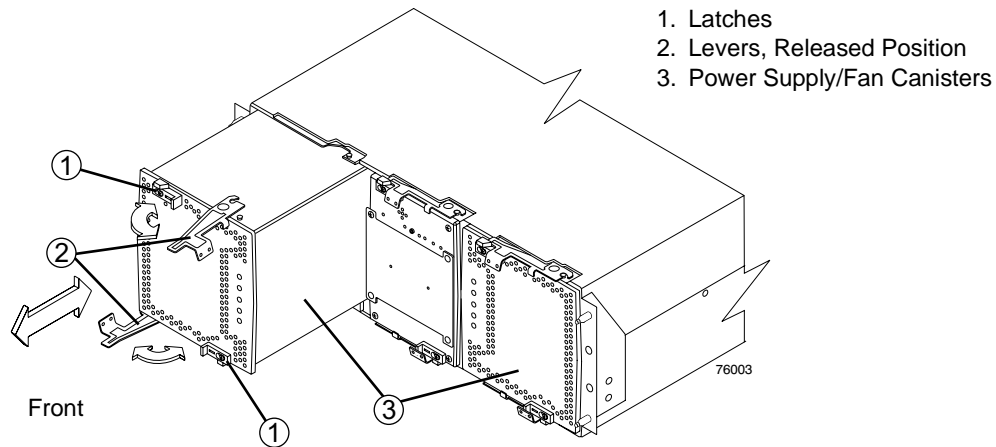
**Table 5-1** 6998 Controller Specifications **(continued)**

Category	Criteria	Specification
Array Support	Drive loops	2 per controller
	Maximum number of drives per loop	112 drives per loop (8 drive modules with 14 drives each)
	Maximum number of drives supported by one 6998 controller module	224 drives (2 drive loops with 112 drive in each loop)
Data Transfer Rates	Fibre Channel host	Up to 4 Gb/sec maximum
	Fibre Channel drives	Up to 4 Gb/sec maximum (depends on drive enclosure speed)
	Primary PCI bus	64-bit 100MHz
	Ethernet	10 Base T 100 Base T

## Power Supply/Fan Canisters

The 6998 controller module has two power supply/fan canisters. Each power supply/fan canister contains a power supply, a fan, and a battery charger. Each power supply provides power to the controllers by converting incoming AC voltage to the appropriate DC voltages. In addition to the AC-to-DC power supply, the command module is available with a DC-to-DC power supply. The DC-to-DC power supply is telephone company/network equipment building standards (TELCO/NEBS) compliant. If one power supply/fan canister is turned off or malfunctions, the remaining power supply/fan canister can maintain electrical power and cooling to the command module.

The power supply/fan canisters install from the front of the command module. Figure 5-5 shows how a power supply/fan canister slides in or out of the controller module. The levers securing the power supply/fan canisters into the command module are shown in the released position.



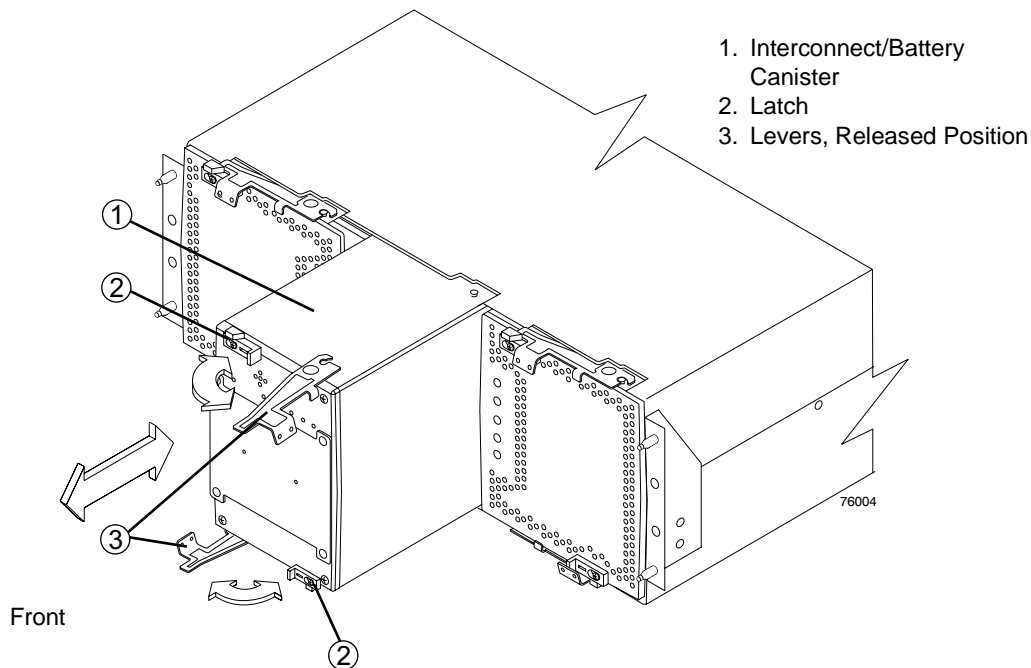
**Figure 5-5** Power Supply/Fan Canister

Information about the condition of the power supplies, fans, and battery charger is conveyed by indicator lights on the front of each of the power supply/fan canisters. The front cover must be removed to see the lights.

## Interconnect/Battery Canister

The interconnect/battery canister is a removable mid-plane that provides cross-coupled signal connection between the controllers. The control output from each controller is connected to the control input in the alternate controller. The interconnect/battery canister contains alternate power, power supply canister signals, inter-controller discrete lines, and redundant drive channels.

Figure 5-6 shows how the interconnect/battery canister slides into the front of the main enclosure. The levers securing the interconnect/battery canisters into the module are shown in the released position.



**Figure 5-6** Interconnect/Battery Canister

The interconnect/battery canister contains one or two battery packs that provide backup power to the controller cache memory. Each battery pack contains sealed, rechargeable lithium ion batteries. The battery pack voltage ranges from 9 to 13 V. For 2 GB cache, one battery pack can maintain memory for seven days. If the command module is connected to an uninterruptable power supply (UPS), a battery pack is not required for backup power to the controller cache memory.

The battery chargers in the power supply canisters perform a battery test when the command module is started and on a regularly scheduled interval thereafter. Data caching starts after the battery completes its startup tests.

The interconnect/battery canister is hot swappable. You can remove the interconnect/battery canister for servicing and then reinsert it while the controllers continue to perform I/O operations without any data loss. Data access is limited to only one controller when the interconnect/battery canister is removed. One controller becomes inactive while the other performs all controller operations.

Removing the interconnect/battery canister after either a controller or a power supply canister has already been removed results in a loss of data access.

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**Caution:** Never remove/replace the interconnect/battery canister unless directed to do so by a Customer Support representative.

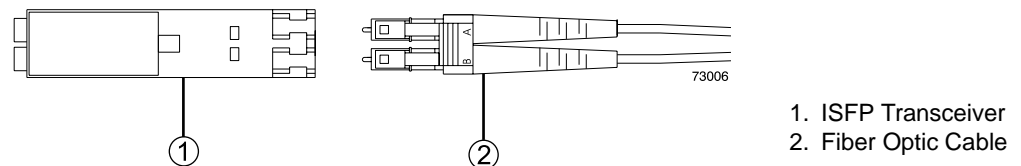
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Information about the condition of the interconnect/battery canister is conveyed by indicator lights on the front of interconnect/battery canister.

## TP9700 SFP Transceivers

The TP9700 controller module supports fiber optic interface cables. These fiber optic cables require a Small Form-factor Pluggable (SFP) transceiver that must be installed in each interface connector on the controller where a fiber optic cable is to be installed.

Figure 5-7 shows an SFP transceiver with fiber optic cable. Note that the SFP transceiver shown may look slightly different from those shipped with your unit. The differences will not affect transceiver performance.



**Figure 5-7** SFP Transceiver and Fiber Optic Cable for TP9700

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**Important:** Several references are made in this manual to the storage management software (TPSSM). For complete information on the operation and use of this software, see the documents titled *SGI InfiniteStorage TPSSM Software Concepts Guide* (007-4749-00X) and *SGI InfiniteStorage TPSSM Administration Guide* (007-4748-00X).

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## Operation of TP9700 Controller Enclosures

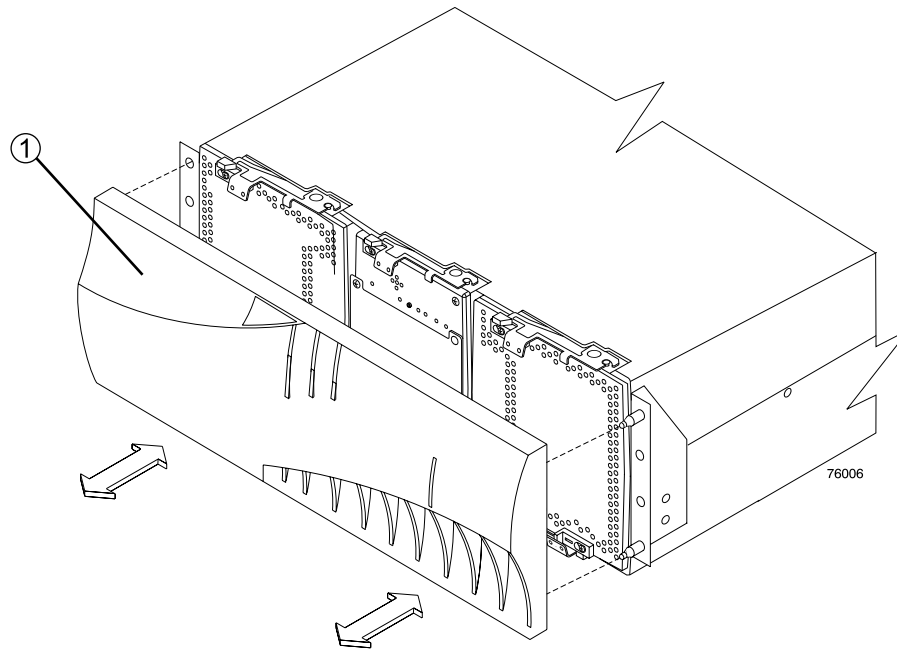
This chapter describes the use, operation, and troubleshooting of the 6998 controller enclosure. The procedures include: turning on power, turning off power, responding to an unplanned power outage, and responding to the audible alarm. The procedures are for controller modules that are already installed and operational. Troubleshooting procedures include failure detection, recovery procedures, and explanations of status indicator LEDs on the enclosure's modules.

### Removing and Replacing the Front Cover

The command module is equipped with a front cover, which you must remove in order to access the power supply/fan canister and interconnect/battery canister, or to view the indicator lights on the front of those canisters.

Figure 6-1 illustrates the following steps used to remove and replace the front cover.

1. Remove the front cover by grasping the sides and pulling the cover toward you.
2. Install the front cover by aligning the pins on the controller module chassis with the spring-steel retainers on the cover, and then press the cover toward the chassis until the pins snap into place.



**Figure 6-1** Removal and Replacement of the TP9700 Module Front Cover

## Turning On Power

Use this procedure to turn on power to a storage array at the initial startup or after a normal shutdown. To restore power after an unplanned shut down, refer to “Restoring Power after an Unplanned Shutdown” on page 85.

---

**Caution: Potential damage to drives and data loss** – Turning off and turning on power without waiting for the disk drives to spin down can damage the drives and may cause data loss. Always let at least 30 seconds elapse from when you turn off the power until you turn on the power again.

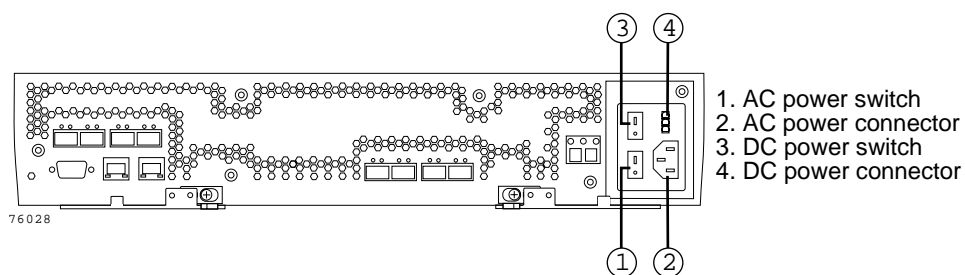
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**Caution:** Turn off both power switches on all modules in the storage array before connecting power cords or turning on the main circuit breakers.

---

1. If the main circuit breakers in the cabinet are off, turn them on.
2. Turn on both power switches on the attached drive modules.
3. You must turn on power to each attached drive module before turning on power to the command module to ensure that the controllers acknowledge each drive module.
4. Turn on the AC power switch on the back of each controller in the command module. Figure 6-2 shows the location of the AC power switch and power connector on the controller.



**Figure 6-2** AC Power Switch and Connector

The command module may take up to 30 seconds to power up. The battery self test may take an additional 10 minutes. The lights will blink intermittently until the command module powers up and completes the battery self test.

---

**Note:** Before attempting any operations, wait for the controller module to completely power up.

---

Determine the status of all modules and components in the storage array by completing the following steps:

1. Check all lights on each component in the drive modules. Ensure that all the lights show normal status.
2. Check all lights on each canister in the command module. Ensure that all the lights show normal status.
3. Open the Array Management Window and display the Physical View for the storage array.
4. The status for each component will be either Optimal or Needs Attention.
5. Review the status of the storage array components shown in the Array Management Window by selecting the appropriate component button for each module.
6. Are the lights indicating normal operation, and is the status Optimal on all the storage array components?
  - **Yes** – End of procedure.
  - **No** – Go to the next steps.

Diagnose and correct any faults by completing the following steps:

1. Run the Recovery Guru by selecting the Recovery Guru toolbar button in the Array Management Window.
2. Complete the recovery procedure.

If the Recovery Guru directs you to replace a failed component, use the individual lights on the modules to locate the failed component. (For procedures to replace a failed component, refer to Chapter 8, “Replacement of TP9700 Controller Enclosure Components”).
3. When the recovery procedure is completed, select Recheck in the Recovery Guru. This will rerun the Recovery Guru to ensure that the problem has been fixed.
4. If the problem has not been fixed, contact your applicable technical support organization.

## Turning Off Power for a Planned Shutdown

Storage Array modules are designed to run continuously, 24 hours a day, and should remain on except during certain upgrade and service procedures.

To turn off power for an unplanned shut down, refer to “Turning Off Power for an Unplanned Shutdown” on page 82.

---

**Caution: Potential damage to drives and data loss** – Turning off and turning on power without waiting for the disk drives to spin down can damage the drives and may cause data loss. Always let at least 30 seconds elapse from when you turn off the power until you turn on the power again.

---

Use the following procedures to turn off power to one or more modules and for a planned shutdown:

1. Stop all I/O activity to the modules.
2. Determine the status of all modules and components in the storage array by completing the following sub-steps.
  - Check all lights on each component in the drive modules. Ensure that all the lights show normal status.
  - Check all lights on each canister in the command module. Ensure that all the lights show normal status. For information about light status, refer to “Troubleshooting the Controller Module” on page 109 and reference the tables in the following sections covering individual canisters.
  - Open the Array Management Window for the storage array and display the Physical View for the storage array.
  - Review the status of the storage array components shown in the Array Management Window by selecting the appropriate component button for each module.

The status for each component will be either Optimal or Needs Attention.

3. Are the lights indicating normal operation, and is the status Optimal on all the storage array components?
  - **Yes** – Go to step 5.
  - **No** – Go to step 4.

4. To diagnose and correct any fault, complete the following steps.
  - Run the Recovery Guru by selecting the Recovery Guru toolbar button in the Array Management Window.
  - Complete the recovery procedure. If the Recovery Guru directs you to replace a failed component, use the individual lights on the modules to locate the failed component.
  - When the recovery procedure is completed, select Recheck in the Recovery Guru. This will rerun the Recovery Guru to ensure that the problem has been fixed.
  - If the problem has not been fixed, contact Customer and Technical Support. Do not turn off power until all problems are corrected.
5. Check the back of the command module, and verify that the Fast Write Cache light is off.

If the Fast Write Cache light is on steady, the cache contains data. Wait for the data to clear from cache memory before turning off the power.
6. Check the lights on the drive modules to verify that all drive Active lights are on steady (not blinking).

If one or more lights are blinking, data is being written to or from the drives. Wait for all Active lights to stop blinking.
7. Turn off the AC power switch on the back of each controller in the command module. (Figure 6-2 on page 79 shows the location of the AC power switch on a controller.)

---

**Note:** Until the power switch on each controller canister is turned off, power still remains turned on for both controllers; therefore, the seven-segment display on each controller stays on until the power switch on each controller canister is turned off.

---

8. Turn off both power switches on the back of each drive module in the storage array to complete the procedure.

## Turning Off Power for an Unplanned Shutdown

Storage array modules are designed to run continuously, 24 hours a day. Certain situations, however, may require that you to shut down all storage array modules

quickly. These situations might include a power failure or an emergency because of a fire, a flood, an extreme weather condition, or some other hazardous circumstance, or a power supply shutdown caused by overheating.

In the event of a power source failure, the 6998 controller module recovers automatically. When normal power is restored after a power source failure, the module performs power-up recovery procedures without operator intervention.

---

**Caution: Potential damage to drives and data loss** – Turning the power off and on without waiting for the disk drives to spin down can damage the drives and cause data loss. Always wait at least 30 seconds from when you turn off the power until you turn it on again. **Potential data corruption** – Turning off power when a fault light is on can cause data corruption. Always check for and correct all faults before turning off the power.

---

Use the following procedures to turn off power to all modules in a storage array during an emergency situation:

1. Stop I/O activity to the storage array.
2. Determine the status of all the modules and their components in the storage array by completing the following sub-steps.
  - Check all lights on each component in the drive module. Ensure that all the lights show normal status.
  - Check all lights on each canister in the command module. Ensure that all the lights show normal status. For information about light status, refer to Chapter 7, “Troubleshooting of TP9700 Controller Enclosure Components”. Check the status table covering the lights for the canister you need information on.
  - Open the Array Management Window for the storage array.
  - Select the appropriate component button for each module in the Physical View of the Array Management Window to view the status of all its components.The status for each component will be either Optimal or Needs Attention.
3. Are the lights indicating normal operation, and is the status Optimal on all the storage array components?
  - **Yes** – Go to step 5.
  - **No** – Go to step 4.

4. Diagnose and correct the fault by completing the following steps.
  - a. Run the Recovery Guru by selecting the Recovery Guru toolbar button in the Array Management Window.
  - b. Complete the recovery procedure.
  - c. If the Recovery Guru directs you to replace a failed component, use the individual lights on the modules to locate the specific failed component.
  - d. When the recovery procedure is completed, select Recheck in the Recovery Guru. This will rerun the Recovery Guru to ensure that the problem has been fixed.
  - e. If the problem has not been fixed, contact Customer and Technical Support.

---

**Note:** Do not turn off power until all problems are corrected.

---

5. Check the back of the 6998 controller module to verify that the Fast Write Cache light is off.

If the Fast Write Cache light is on steadily, the cache contains data. Wait for the data to clear from cache memory before turning off the power.
6. Check the lights on the drive modules to verify that all drive Active lights are on steady (not blinking). If one or more lights are blinking, data is being written to or from the drives. Wait for all Active lights to stop blinking.
7. Turn off the AC power switch on the back of each controller in the command module. (Figure 6-2 on page 79 shows the location of the AC power switch on a controller.)

---

**Note:** Until the power switch on each controller canister is turned off, power still remains turned on for both controllers; therefore, the seven-segment display on each controller stays on until the power switch on each controller canister is turned off.

---

8. Turn off both power switches on the back of each drive module in the storage array to complete the procedure.



## Restoring Power after an Unplanned Shutdown

Use the following procedure to restore power to the module in a storage array after an unplanned shutdown.



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**Warning: Risk of severe electrical shock – Never turn on the power to any equipment if there is evidence of fire, water, or structural damage. Doing so may cause severe electrical shock.**

---

1. Visually check the equipment for damage. Is there evidence of damage to any of the modules, cables, or equipment attached to the modules?
  - **Yes – Do not continue with this procedure.** Contact Customer and Technical Support for assistance. Depending on the current service agreements, you may need to return the equipment to the factory or local service center for repair.
  - **No – Go to step 2.**

---

**Caution: Potential data loss or corruption –** Before resetting circuit breakers in the cabinet, ensure that the command module and drive modules power switches are turned off. Resetting circuit breakers after an emergency situation while the command module and drive module power switches are turned on can cause potential data loss or corruption.

---

2. Verify the main circuit breakers in the cabinet are turned off.
3. Verify that the AC power switch on each 6998 controller module is turned off. (Figure 6-2 on page 79 shows the location of the AC power switch on each controller.)
4. Verify that both power switches on all drive modules in the storage array are turned off.
5. Turn on the main circuit breakers in the cabinet.
6. Turn on both power switches on the back of each drive module.

---

**Important:** You must turn on power to each attached drive module before turning on power to the command module to ensure that the controllers acknowledge each drive module.

---

7. Turn on the AC power switch on the back of each controller in the command module. Figure 6-2 on page 79 shows the location of the AC power switch on the controller.
8. The command module may take up to 30 seconds to power up. The battery self test may take an additional 10 minutes. The lights will blink intermittently until the E6000 command module powers up and completes the battery self test.
9. Determine the status of all modules and their components in the storage array, by completing the following steps.
  - a. Check all lights on each component in the drive modules. Ensure that all the lights show normal status.
  - b. Check all lights on each canister in the 6998 controller module. Ensure that all the lights show normal status. For information about light status, refer to Chapter 7, “Troubleshooting of TP9700 Controller Enclosure Components” and check the table covering any canister that displays a trouble light status.
  - c. Open the Array Management Window and display the Physical View for the storage array.
  - d. Review the status of the storage array components shown in the Array Management Window by selecting the appropriate component button for each module.

The status for each component will be either Optimal or Needs Attention.

10. Are the lights indicating normal operation, and is the status Optimal on all the storage array components?
  - **Yes** – End of procedure.
  - **No** – Go to step 11.
11. Diagnose and correct the fault by completing the following steps.
  - a. Run the Recovery Guru by selecting the Recovery Guru toolbar button in the Array Management Window.
  - b. Complete the recovery procedure.

- c. If the Recovery Guru directs you to replace a failed component, use the individual lights on the modules to locate the specific failed component. For more on troubleshooting the 6998 controller module, refer to Chapter 7, “Troubleshooting of TP9700 Controller Enclosure Components” to find additional troubleshooting information on the individual canisters within the module.
- d. When the recovery procedure is completed, select Recheck in the Recovery Guru. This will rerun the Recovery Guru to ensure that the problem has been fixed.
- e. If the problem has not been fixed, contact Technical Support.

## Responding to the Audible Alarm

The alarm provides an audible warning of potentially serious problems with the command module. Enable the alarm and leave it enabled at all times. The command module is shipped with the alarm enabled. You can enable or disable the Audible Alarm feature using the SANtricity Storage Manager Array Management Window graphical user interface (GUI). Any change you make takes effect immediately.

The GUI indicates alarm status for the command modules as follows:

- Alarm control (enabled/disabled)
- Alarm state (inactive/sounding/muted)
- The GUI provides the following alarm controls for the command modules:
  - Enable/disable alarm (error status is displayed if an attempt is made to enable an alarm that is not present)
  - Mute alarm

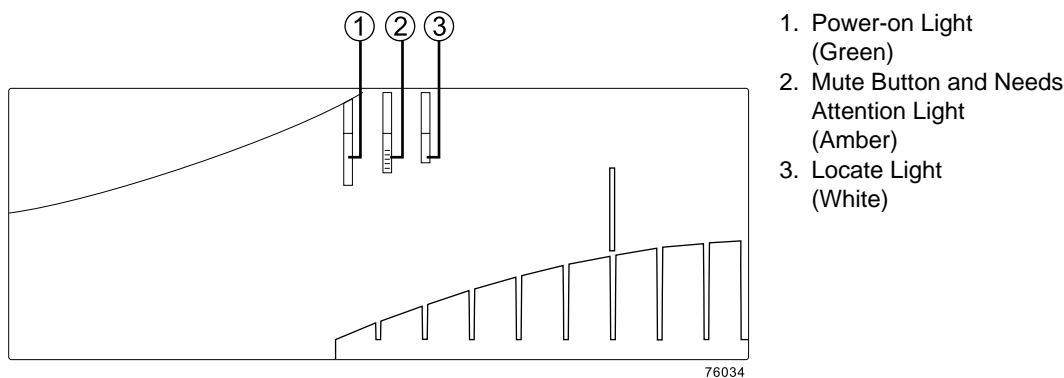
You can configure the alarm duty cycle (the amount of time the alarm sounds) using the User Configurable Option, Audible Alarm Interval Control. The active period when the alarm is sounding, is fixed at one second. The silent period of the cycle is configurable from 1 to 60 seconds. If the interval is set to zero, the alarm will sound continuously when activated.

You cannot change the Audible Alarm Interval Control through the GUI.

The alarm sounds and the Needs Attention light turns on when one of the following conditions occur:

- **Hardware malfunction in a command module** – This includes an overheating condition or a component failures (controllers, power supplies, or fans).
- **Transmission failures** – This includes I/O transmission problems with the SFP transceivers or cables.

The module combines a Mute button and Needs Attention indicator on the front cover. (Figure 6-3 shows the location of the Mute button, as well as the Power-on and Locate lights.) You can mute the alarm using either the Mute button or the storage management software. In either case, the alarm will sound again if a new fault occurs.



**Figure 6-3** Alarm Mute Button on the Controller Module (Enclosure) Front Cover

If the alarm sounds, check the command module for faults. For troubleshooting procedures, refer to “Controller Module Attention Light Procedures” in Chapter 7.

## Troubleshooting the Controller Module

The storage management software enables you to monitor the controller module, diagnose problems, and recover from failures. For best storage array operation, run the storage management software continuously, and frequently check the storage array status.

Use the following procedure to check the status of the controller module. If a problem has occurred, use the storage management software and the lights on the command module to help locate a failed component.

1. If applicable, turn off the alarm by pressing the Mute button on the front cover of the controller module.

---

**Note:** If another fault occurs, the alarm will sound again.

---

2. Use the storage management software to print a storage array profile.
3. Using the Enterprise Management Window, view the status of the storage arrays. Are any storage arrays indicating Needs Attention?
  - **Yes** – Go to step 4.
  - **No** – All components are Optimal. Go to step 8.
4. Open the Array Management Window and display the Physical View for the storage array.
5. View the status of the command module by selecting the command module button and expanding the Overall Component Information.

Using the Overall Component Information view, you can see the status of the following components:

- Interconnect canister and battery packs in the canister
- SFPs
- Support canisters, and fans and power supplies in the canisters
- Temperature sensors
- UPS (optional)

The status for each component will be either Optimal or Needs Attention.

6. Do any components have a Needs Attention status?
  - **Yes** – Go to step 7.
  - **No** – All components are Optimal. Go to step 8.
7. Select the Recovery Guru toolbar button. Perform the procedure in the Recovery Guru to correct the problem. The Recovery Guru may direct you to replace the failed component; if so, go to step 9, otherwise continue with step 8.

8. Check the lights on the command module to determine if a fault has occurred in the command module.

For the definition of the lights, refer to and reference the appropriate table for the canister affected. Are any lights indicating a fault condition?

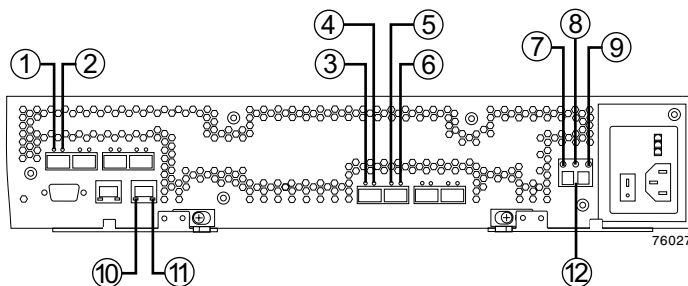
- **Yes** – Go to the next step.
  - **No** – You are finished with this procedure.
9. Replace the failed component, see Chapter 8, “Replacement of TP9700 Controller Enclosure Components” for instructions on replacing the controller canister, power supply/fan canister, interconnect/battery canister, battery pack, and SFP transceivers.

If you are still experiencing a problem with this storage array and are unable to determine the root cause, go to step 10.

10. If the problem has not been fixed contact Customer and Technical Support.

Print a storage array profile and save the storage array support data. The profile and support data will be helpful when troubleshooting storage array problems. (For information about printing a storage array profile and saving the support data, refer to the Array Management Window online help.)

## Controller Canister Lights



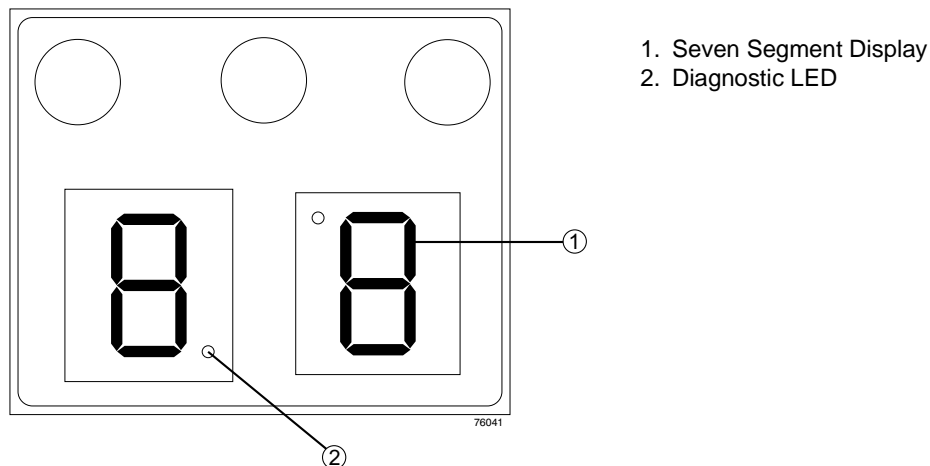
**Figure 6-4** Controller Canister Lights

**Table 6-1** Definition of the Controller Canister Lights

Location in Figure	Light	Color	Normal Status	Problem Status	Procedure
1	Host Channel Speed – L1	Green LED	L1 L2 Definition Off Off No connection/link down On Off 1 Gb		
2	Host Channel Speed – L2	Green LED	Off On 2 Gb On On 4 Gb		
3	Drive Port Bypass (one light per port)	Amber LED	Off	On = Bypass	
4	Drive Channel Speed – L1	Green LED	L1 L2 Definition Off Off No connection/link down Off On 2 Gb		
5	Drive Channel Speed – L2	Green LED	On On 4 Gb		
6	Drive Port Bypass (one light per port)	Amber LED	Off	On = Bypass	
7	Service Action Allowed	Blue LED	Off	On = Safe to remove	Replace a controller canister
8	Needs Attention	Amber LED	Off	On = Controller needs attention	Troubleshooting Chapter
9	Fast Write Cache	Green LED	On = Data in cache Off = No data in cache	Not Applicable	
10	Ethernet Link Speed	Green LED	Off = 10 base T On = 100 base T	Not Applicable	
11	Ethernet Link Activity	Green LED	Off = No link established On = Link established Blinking = Activity	Not Applicable	
12	Numeric Display (Tray ID and Diagnostic Display)	Green/yellow seven segment display	Diagnostic LED = off: Controller ID Diagnostic LED = on: Diagnostic code		

## Numeric Display

The numeric display consists of two seven-segment LEDs that provide information about tray identification and diagnostics. Figure 6-5 shows the numeric display and the diagnostic LED.



**Figure 6-5** Numeric Display

When the command module is operating normally, the numeric display shows the tray identification (tray ID) of the command module. The command module tray ID is automatically set by the controller firmware and automatically adjusts during power-on to avoid conflicts with IDs used for the attached drive modules. You can, however, set the command module tray ID through the SANtricity Storage Manager. The tray ID is an attribute of the command module; both controllers will display the same tray ID. It is possible, however, that one controller will display the tray ID, while the other controller displays a diagnostic code.

If an error has occurred and the controller canister Needs Attention light is on, the numerical display shows diagnostic information. The numeric display indicates the information is diagnostic by illuminating an LED that appears as a decimal point between the display numbers. The diagnostic LED turns off when the numeric display shows the command module tray ID. The numeric display shows diagnostic codes after each power cycle or reset. After diagnostics are complete, the current command module tray ID is displayed.

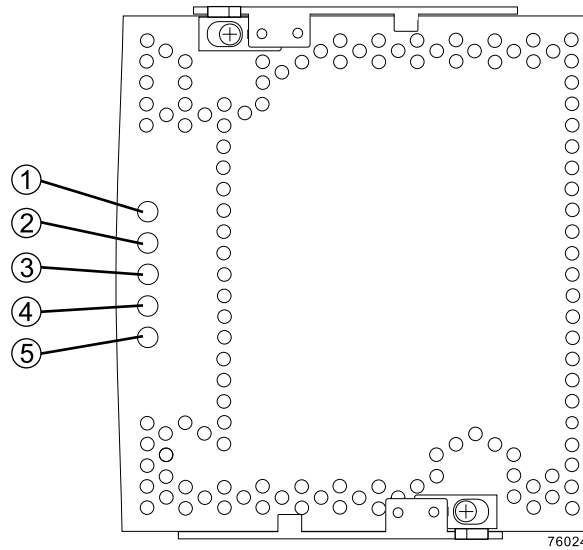


Diagnostic codes in the form of Lx, where x is a hexadecimal digit, indicate controller state information. In general, these codes are displayed only when the controller is in a non-operational state. The controller might be non-operational due to a configuration problem (such as mismatched controller types), or it might be non-operational due to hardware faults. If the controller is non-operational due to system configuration, the controller Needs Attention light will be off. If the controller is non-operational due to a hardware fault, the controller Needs Attention light will be on. The definitions for Lx diagnostic codes are listed in tables in the section beginning with “Controller Canister Lights” in Chapter 7.

**Table 6-2** Numeric Display Diagnostic Codes

<b>Value</b>	<b>Controller State</b>	<b>Description</b>	<b>Storage Manager View</b>
L0	Suspend	Mismatched controller types	Needs Attention condition for board type mismatch
L1	Suspend	Missing interconnect/battery canister	Needs Attention condition for missing interconnect/battery canister
L2	Suspend	Persistent memory errors	Needs Attention condition for offline controller
L3	Suspend	Persistent hardware errors	Needs Attention condition for offline controller
L4	Suspend	Persistent data protection errors	Needs Attention condition for offline controller
88	Reset	Controller is held in reset by alternate controller	

## Power Supply/Fan Canister Lights



**Figure 6-6** Power Supply/Fan Canister Lights

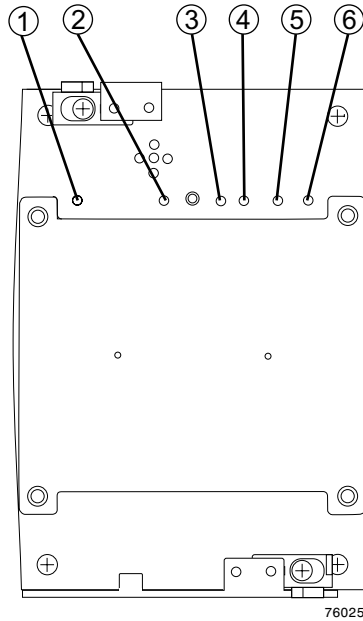
**Table 6-3** Definition of the Power Supply/Fan Canister Lights

Location in Figure	Light	Color	Normal Status	Problem Status	Procedure
1	Power	Green LED	On = Power supply/fan canister is providing power	Off = Power supply/fan canister is not providing power	
2	Battery Charging	Green LED	On = Battery charged and ready Blinking = Battery charging	Off = Battery faulted or discharged	
3	Battery Charging	Green LED	On = Battery charged and ready Blinking = Battery charging	Off = Battery faulted or discharged	

**Table 6-3** Definition of the Power Supply/Fan Canister Lights **(continued)**

Location in Figure	Light	Color	Normal Status	Problem Status	Procedure
4	Needs Attention	Amber LED	Off	On = Power supply/fan canister needs attention	Troubleshooting chapter
5	Service Action Allowed	Blue LED	Off	On = Safe to remove May also indicate an open circuit breaker.	Resetting a circuit breaker in Chapter 8. Replacing a power supply/fan canister in Chapter 8.

**Interconnect/Battery Canister Lights**



**Figure 6-7** Interconnect/Battery Canister Lights

**Table 6-4** Definition of the Interconnect/Battery Canister Lights

Location in Figure	Light	Color	Normal Status	Problem Status	Procedure
1	Battery Needs Attention	Amber LED	Off	On = Battery missing or failed	Replace battery canister Chapter 8
2	Power	Green LED	On = Command Module is powered on	Off = Command Module is powered off	
3	Needs Attention	Amber LED	Off	On = A component in the command module has developed a fault. Inspect the Needs Attention lights on the other canisters to isolate the fault.	Troubleshooting Chapter 7
4	Locate	White LED	Off	On = Command module locate	
5	Service Action Allowed	Blue LED	Off	On = Safe to remove	Replace interconnection /battery canister
6	Battery Needs Attention	Amber LED	Off	On = Battery missing or failed	Battery replace

The Power, Needs Attention, and Locate lights are general indicators for the entire command module, not specifically for the interconnect/battery canister. The Needs Attention light will turn on if a fault condition is detected in any component in the command module. The Power, Needs Attention, and Locate lights shine through the front cover.

**Important:** If you see a Needs Attention light, refer to the storage management software to determine the problem with the command module. Also, inspect the Needs Attention lights on the other canisters in the command module to help isolate the fault to a specific canister.

## Recovering from an Overheated Power Supply

The command module has two power supply/fan canisters. Each power supply/fan canister contains a power supply, a cooling fan, a battery charger, and a built-in temperature sensor designed to prevent the power supplies from overheating. Under normal operating conditions, with an ambient air temperature range of 5° C to 40° C, (40° F to 104° F), the cooling fans maintain a proper operating temperature inside the module.

Several factors can cause the power supplies to overheat. These factors include:

- Unusually high room temperature
- Fan failure
- Defective circuitry in the power supply
- Blocked air vent
- Failure in other devices installed in the cabinet

If the internal temperature rises above 70° C (158° F), one or both power supplies automatically shut down. If *one* power supply shuts down, the storage management software displays a Needs Attention status in the Array Management Window, the alarm sounds, and the Needs Attention light on the front cover of the command module turns on.

If a common environmental stress causes *both* power supplies to shut down, the command module shuts down, and the storage management software displays a Not Responding status in the Array Management Window.

If event monitoring is enabled and event notification is configured, the software also issues critical event notifications.

- **Nominal temperature exceeded** – The command module temperature exceeds the normal operating range.
- **Maximum temperature exceeded** – The command module temperature exceeds 70° C (158° F).

Use the following procedure to resume normal operation after a power supply shutdown.

---

**Caution: Risk of damage from overheating** – Power supplies automatically shut down when air temperature inside the cabinet reaches 70° C (158° F) or above. If the power supplies have shut down, immediately remove all cabinet panels to help cool the cabinet air temperature and prevent damage to the command module.

---

1. If applicable, turn off the alarm by pressing the Mute button on the front cover of the controller module.
2. Use the storage management software to print a storage array profile.
3. Did you use the procedure “Troubleshooting the Controller Module” in Chapter 7 to identify an overheating problem?
  - **Yes** – Go to step 4.
  - **No** – Perform the appropriate procedures under “Troubleshooting the Controller Module” on page 109 to verify that the power supplies have shutdown because of an overheating problem.
4. Try alleviating the overheating problem by:
  - Removing all panels from the cabinet
  - Cooling the area using external fans
  - Shutting down the power to the command modules or drive modules
5. Stop all I/O activity to the command module and to all attached drive modules.
6. Wait until the ambient air temperature around the command module cools.

The command module is capable of power-up recovery without operator intervention after the temperature inside the power supply/fan canister cools to below 70° C (158° F). After the air has cooled, the power supplies should turn on automatically. If the power supplies restart automatically, the controllers reset and return to normal operation.

7. Did the power supplies restart automatically?
  - **Yes** – Go to step 9.
  - **No** – Got to step 8.
8. Turn off the power switch on each controller in the command module. Wait 10 seconds, and then turn on the command module power. If the power supplies go into operation, go to step 9. If not, call Customer and Technical Support.
9. Check the status lights on the front and back of the command module.

For information about controller module and canister lights, refer to Chapter 7, “Troubleshooting of TP9700 Controller Enclosure Components”.

10. Are the lights on the controller module indicating normal status?
  - Yes – Go to next step.
  - No – Got to step 12 and diagnose the fault.
11. Use the storage management software to check the status of all modules in the storage array. Is the status Optimal for each module?
  - **Yes** – End of procedure. Resume normal operation.
  - **No** – Go to step 12.
12. Diagnose and correct the fault by completing the following steps.
  - a. Select the Recovery Guru toolbar button in the Array Management Window to run the Recovery Guru.
  - b. Complete the recovery procedure.
  - c. If the Recovery Guru directs you to replace a failed component, use the individual lights on the modules to locate the specific failed component.
  - d. When the procedure is completed, select Recheck in the Recovery Guru. This will rerun the Recovery Guru to ensure that the problem has been fixed.
  - e. If the problem has not been fixed contact Customer and Technical Support.

Print a storage array profile and save the storage array support data. The profile and support data will be helpful when troubleshooting storage array problems. (For information about printing a storage array profile and saving the support data, refer to the Array Management Window online help.)

## Resetting the Controller Circuit Breakers

Each command module controller has two circuit breakers that provide over current protection to the power supply in a power supply/fan canister. One circuit breaker provides protection for AC input, the second circuit breaker provides protection for DC input. The circuit breakers are mounted inside the controller canister, in line with the internal power cable.

The internal power cable runs from the AC connector and DC connector on a controller canister to the power supply in a power supply/fan canister. Power to the left power supply/fan canister (as viewed from the front of the command module) is routed through the top controller canister; power to the right power supply/fan canister is routed through the bottom controller canister.

If a circuit breaker has tripped, the condition might appear as if a power supply/fan canister has failed. The power supply is no longer providing power to the command module. An tripped circuit breaker is indicated when all of the following conditions are present:

- Alarm is sounding
- Needs Attention light on the command module front cover is turned on
- The controller canister Needs Attention lights are not turned on
- The power supply/fan canister Needs Attention lights are not turned on
- The Service Action Allowed light is turned on for the power supply/fan canister connected to the controller canister with the open circuit breaker
- The Array Manager Window shows the failed controller canister as present, but not responding

Use the following procedure to ensure that a circuit breaker has opened, and then to reset the circuit breaker.

## Tools and Equipment

- Antistatic protection
- Non-conducting stylus

## Procedure

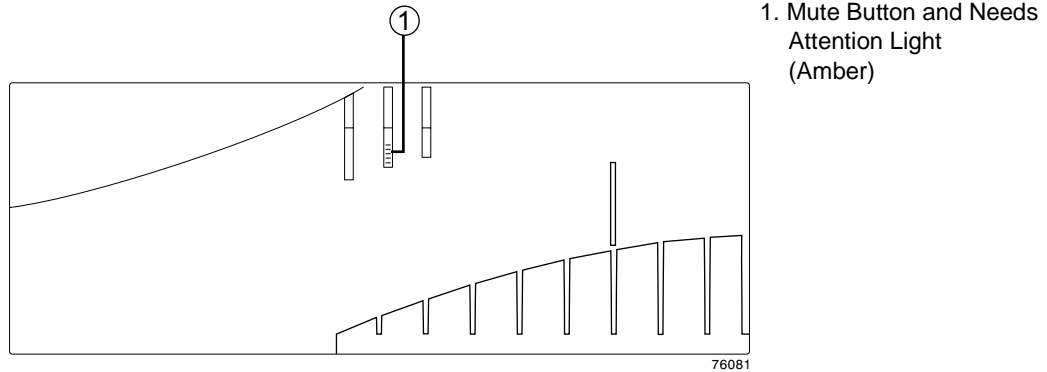
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**Caution: Electrostatic discharge can damage sensitive component.** – Touching the command module or its components without using a proper ground might damage the equipment. To avoid damage, use proper antistatic protection while handling any components.

---

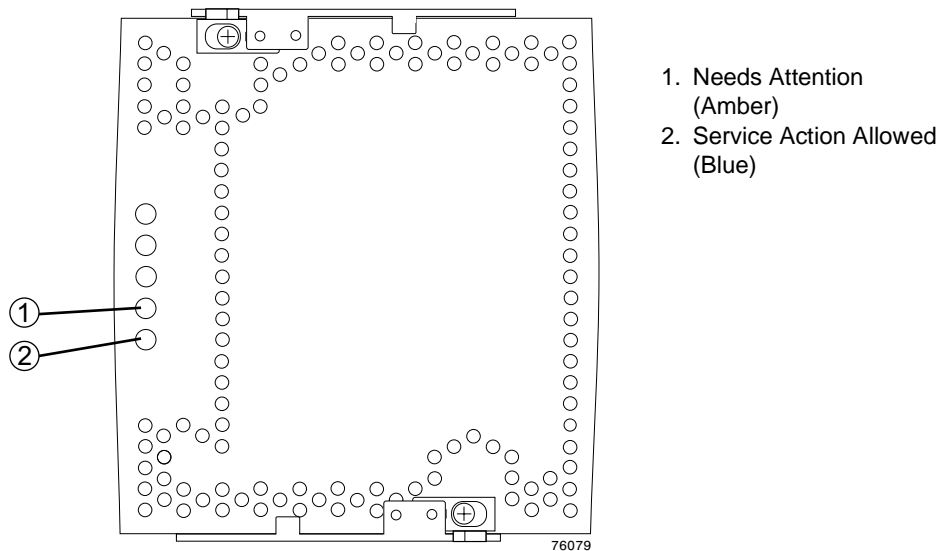


1. If the alarm is sounding, turn off the alarm by pressing the Mute button on the front cover of the command module.



**Figure 6-8** Mute Button and Needs Attention Light on the Command Module Front Cover

2. Check to ensure that the external power cables are completely plugged into the controller canisters and into the power source.
3. Put on antistatic protection.
4. Remove the front cover by grasping the sides and pulling the cover toward you.
5. Check the Needs Attention light on each power supply/fan canister. (Figure 6-9 shows the location of the Needs Attention light.)

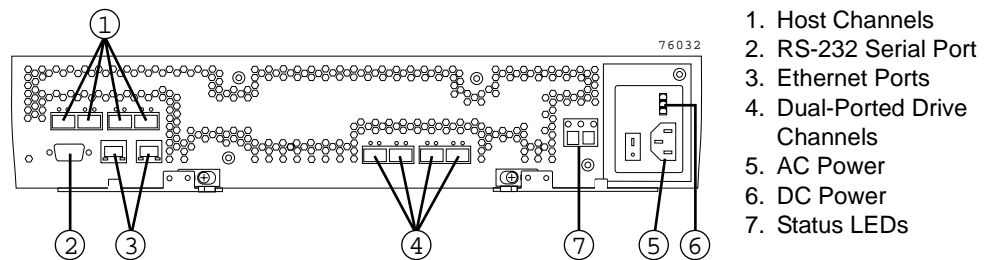


**Figure 6-9** Power Supply/Fan Canister Needs Attention Light

- a. Is a power supply/fan canister Needs Attention light on?
  - **Yes** – A power supply/fan canister has failed. To replace the failed power supply/fan canister, refer to Chapter 8.
  - **No** – Go to sub-step (b).
- b. Is a power supply/fan canister Service Action Allowed light on?
  - **Yes** – If the Service Action Allowed light on the left power supply/fan canister is turned on, then the circuit breakers in the upper controller canister have tripped. If the Service Action Allowed light on the right power supply/fan canister is turned on, then the circuit breakers in the lower controller canister have tripped. (Left and right are determined by facing the front of the command module.) Go on to step 6.
  - **No** – Contact Customer and Technical Support.

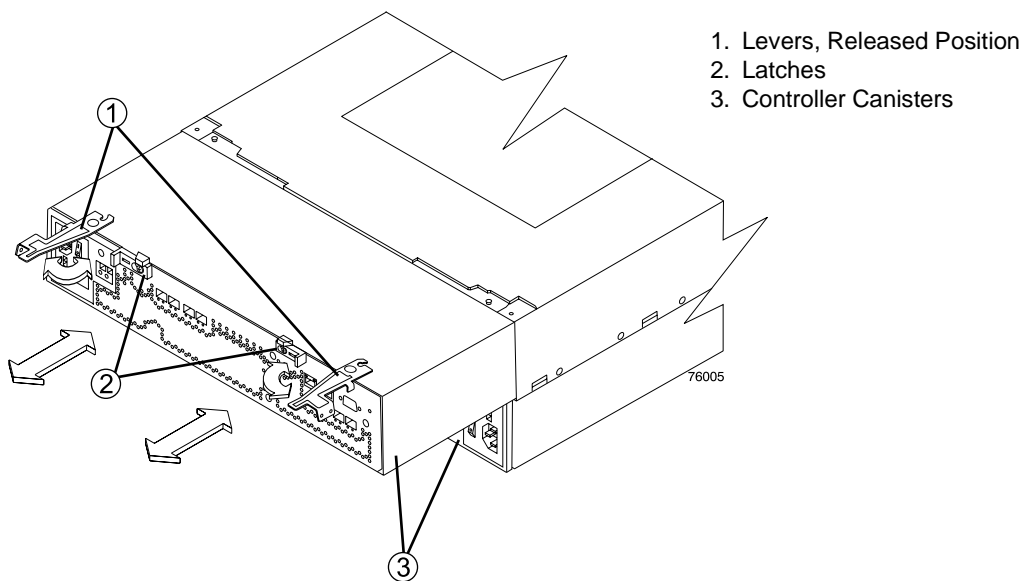
**Caution: Potential damage to fiber optic cables** – Fiber optic cables are fragile. Bending, twisting, folding, or pinching fiber optic cables can cause damage to the cables, degraded performance, or data loss. To prevent damage, do not twist, fold, pinch, or step on the cables. Do not bend the cables in less than a two-inch radius.

**Note:** You do not need to remove the interface cables from the controller canisters to reset the circuit breakers; however, removing the cables can make this procedure easier. If you choose to remove the interface cables ensure that you label each cable so that you can reconnect them correctly to the controller canister. Figure 6-10 identifies all of the connectors on the back of the controller canister.

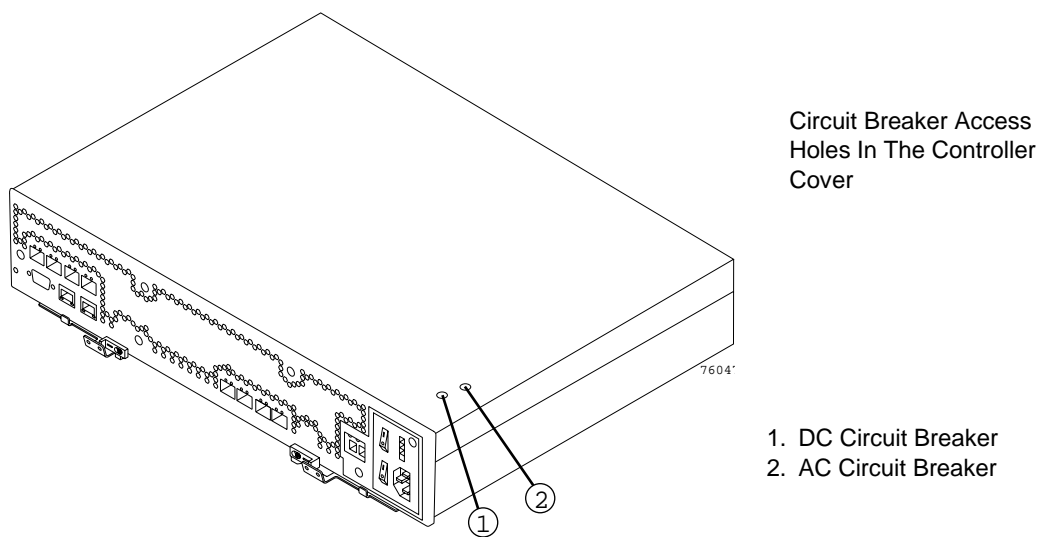


**Figure 6-10** Controller Canister Connectors

6. Use the storage management software to take the controller offline. After the controller is offline, the Service Action Allowed light turns on and you can safely remove the controller.
7. Slide the controller canister with the open circuit breaker from the command module. You do not need to completely remove the controller canister, only slide it out far enough to reveal the holes over the circuit breakers.
  - a. Using your index fingers, simultaneously push the latches to release the levers, and rotate the levers to disengage them from the locking pins.
  - b. Use the levers to slide the controller canister from the command module chassis. (Figure 6-11 shows the controller canister sliding from the command module chassis.)

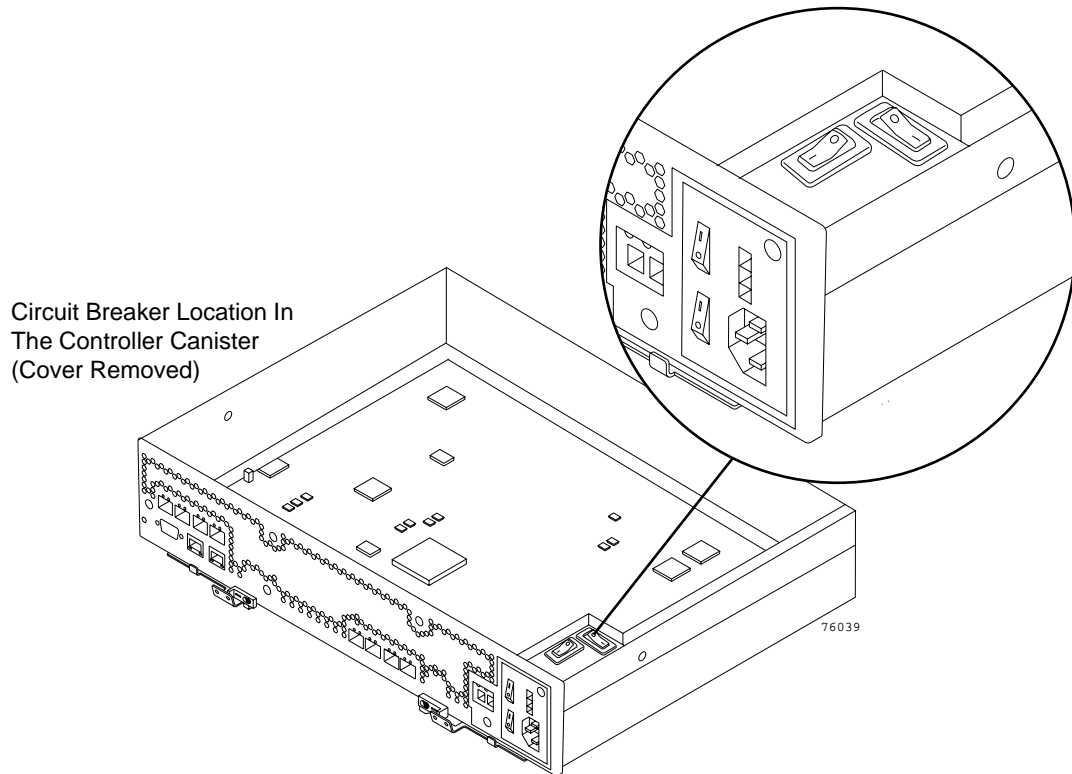


**Figure 6-11** Removing a Controller Canister from the Command Module



**Figure 6-12** Circuit Breaker Access Holes Locations

8. Insert a non-conducting stylus through the appropriate hole in the cover of the controller canister. One hole is over the AC circuit breaker a second hole is over the DC circuit breaker. Figure 6-12 shows the location of the circuit breaker access holes in the controller canister cover and Figure 6-13 shows the location of the circuit breakers in the controller canister.
9. Reset the circuit breaker that tripped by pressing down on the rocker switch.



**Figure 6-13** Controller Circuit Breakers

10. Slide the controller canister into the command module chassis, and push it firmly until the levers snaps into place.
11. If you removed the interface cables, reconnect all host interface cables and drive interface cables, including the SFP transceivers.

12. Wait approximately 60 seconds for the storage management software to recognize the controller canister.
13. Complete any remaining Recovery Guru procedures for controller canister replacement, if needed.
14. Based on the Host Channel Speed, Drive Channel Speed, and Needs Attention light status, proceed to one of the following steps:
  - **All channel speed lights are on *and* the Needs Attention light is off** – Go to step 16.
  - **All channel speed lights are off *or* the Needs Attention light is on** – **Verify the controller has been installed correctly.** Reinstall the controller canister. Go to step 15.

---

**Note:** If a host channel or drive channel does not have a cable connected, the channel speed LEDs will not be illuminated.

---

15. Did this correct the problem?
  - **Yes** – Go to step 16.
  - **No** – If the problem has not been fixed, contact Customer and Technical Support.
16. Remove the antistatic protection.
17. Install the front cover by aligning the pins on the command module chassis with the spring-steel retainers on the cover, and then pressing the cover toward the chassis until the pins snap into place.
18. Using the Enterprise Management Window, view the status of the storage arrays. Are any storage arrays indicating Needs Attention?
  - **Yes** – Go to step 19.
  - **No** – All components are Optimal. You are finished with this procedure.
19. Use the Array Management Window to check the status of all modules in the storage array.

20. Do any storage array modules have a Needs Attention status?

- **Yes** – Select the Recovery Guru toolbar button in the Array Management Window and complete the recovery procedure. If the problem persists, contact Customer and Technical Support.
- **No** – contact Customer and Technical Support.

Print a storage array profile and save the storage array support data. The profile and support data will be helpful when troubleshooting storage array problems. (For information about printing a storage array profile and saving the support data, refer to the Array Management Window online help.)





## Troubleshooting of TP9700 Controller Enclosure Components

This chapter provides troubleshooting and recovery procedures for the 6998 controller enclosure (also called the controller module). This chapter also presents tables that explain the meanings of the indicator lights on the canister components in the module.

### Troubleshooting the Controller Module

The storage management software enables you to monitor the controller module canister functionality, diagnose problems, and recover from failures. For best storage array operation, run the storage management software continuously, and frequently check the storage array status.

Use the following procedures to check the status of the command module. If a problem has occurred, use the storage management software and the lights on the command module to help locate a failed component.

1. If applicable, turn off the alarm by pressing the Mute button on the front cover of the command module.

---

**Note:** If another fault occurs, the alarm will sound again.

---

2. Use the storage management software to print a storage array profile.
3. Using the Enterprise Management Window, view the status of the storage arrays. Are any storage arrays indicating Needs Attention?
  - **Yes** – Go to step 4.
  - **No** – All components are Optimal. Go to step 5.
4. Open the Array Management Window and display the Physical View for the storage array.

5. View the status of the module by selecting the command module button and expanding the Overall Component Information.

Using the Overall Component Information view, you can see the status of the following components:

- Interconnect canister and battery packs in the canister
- SFPs
- Support canisters, and fans and power supplies in the canisters

## Temperature sensors

The status for each component in the module will be either Optimal or Needs Attention. Use the following information to identify any component needing service:

1. Do any components have a Needs Attention status?
  - **Yes** – Go to step 2.
  - **No** – All components are Optimal. Go to step 3 to check for any additional problems.
2. Select the Recovery Guru toolbar button. Perform the procedure in the Recovery Guru to correct the problem. The Recovery Guru may direct you to replace the failed component; if so, go to step 5, otherwise continue to the next step.
3. Check the lights on the command module to determine if a fault has occurred in the command module.

For the definition of the lights, refer to Table 7-1 on page 111, Are any lights indicating a fault condition?

- **Yes** – Go to the next step.
- **No** – You are finished with this procedure.

If you are still experiencing a problem with this storage array, go to the next step.

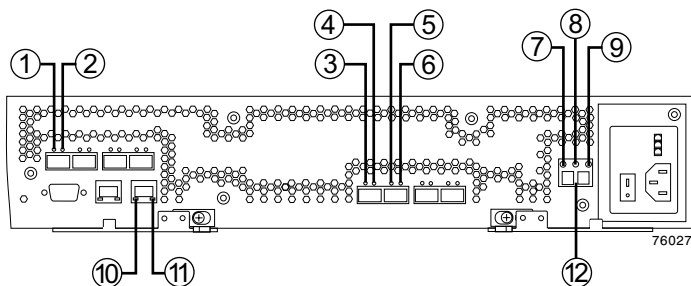
4. Replace the failed component.

For instruction on replacing the controller canister, power supply / fan canister, interconnect / battery canister, battery pack, and SFP transceivers, refer to

5. If the problem has not been fixed, contact your technical support organization.

Print a storage array profile and save the storage array support data. The profile and support data will be helpful when troubleshooting storage array problems. (For information about printing a storage array profile and saving the support data, refer to the Array Management Window online help.)

## Controller Canister Lights



**Figure 7-1** Controller Canister Lights

**Table 7-1** Definition of Controller Canister Lights

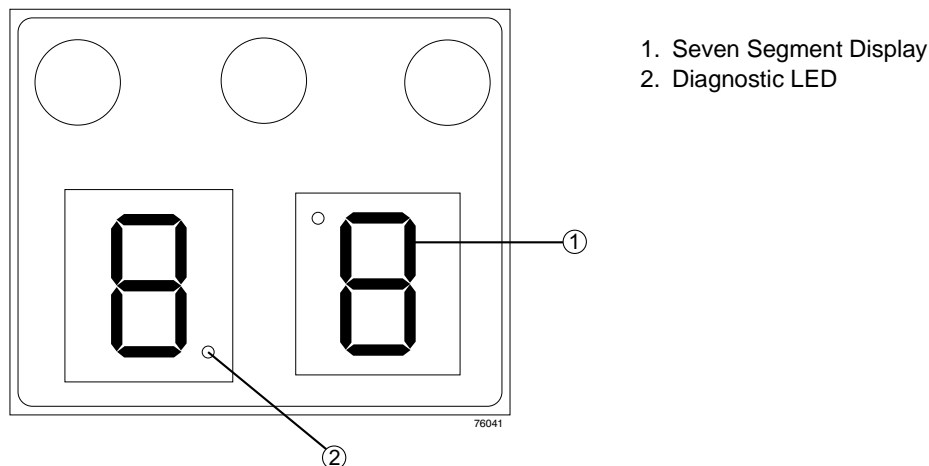
Location in Figure 7-1	Light	Color	Normal Status	Problem Status	Procedure
1	Host Channel Speed – L1	Green LED	L1 L2 Definition Off Off No connection/link down On Off 1 Gb		
2	Host Channel Speed – L2	Green LED	Off On 2 Gb On On 4 Gb		
3	Drive Port Bypass (one light per port)	Amber LED	Off	On = Bypass	
4	Drive Channel Speed – L1	Green LED	L1 L2 Definition Off Off No connection/link down Off On 2 Gb		
5	Drive Channel Speed – L2	Green LED	On On 4 Gb		

**Table 7-1** Definition of Controller Canister Lights (**continued**)

Location in Figure 7-1	Light	Color	Normal Status	Problem Status	Procedure
6	Drive Port Bypass (one light per port)	Amber LED	Off	On = Bypass	
7	Service Action Allowed	Blue LED	Off	On = Safe to remove	Replace controller canister
8	Needs Attention	Amber LED	Off	On = Controller needs attention	“Controller Module Attention Light Procedures” on page 122
9	Fast Write Cache	Green LED	On = Data in cache Off = No data in cache	Not Applicable	
10	Ethernet Link Speed	Green LED	Off = 10 base T On = 100 base T	Not Applicable	
11	Ethernet Link Activity	Green LED	Off = No link established On = Link established Blinking = Activity	Not Applicable	
12	Numeric Display (Tray ID and Diagnostic Display)	Green/yellow sevensegment display	Diagnostic LED = off: Controller ID Diagnostic LED = on: Diagnostic code display		

## Numeric Display

The numeric display consists of two seven-segment LEDs that provide information about tray identification and diagnostics. Figure 7-2 shows the numeric display and the diagnostic LED.



1. Seven Segment Display
2. Diagnostic LED

**Figure 7-2** Numeric Display

When the command module is operating normally, the numeric display shows the tray identification (tray ID) of the command module. The command module tray ID is automatically set by the controller firmware and automatically adjusts during power-on to avoid conflicts with IDs used for the attached drive modules. You can, however, set the command module tray ID through the SANtricity Storage Manager. The tray ID is an attribute of the command module; both controllers will display the same tray ID. It is possible, however, that one controller will display the tray ID, while the other controller displays a diagnostic code.

If an error has occurred and the controller canister Needs Attention light is on, the numerical display shows diagnostic information. The numeric display indicates the information is diagnostic by illuminating an LED that appears as a decimal point between the display numbers. The diagnostic LED turns off when the numeric display shows the command module tray ID. The numeric display shows diagnostic codes after each power cycle or reset. After diagnostics are complete, the current command module tray ID is displayed.

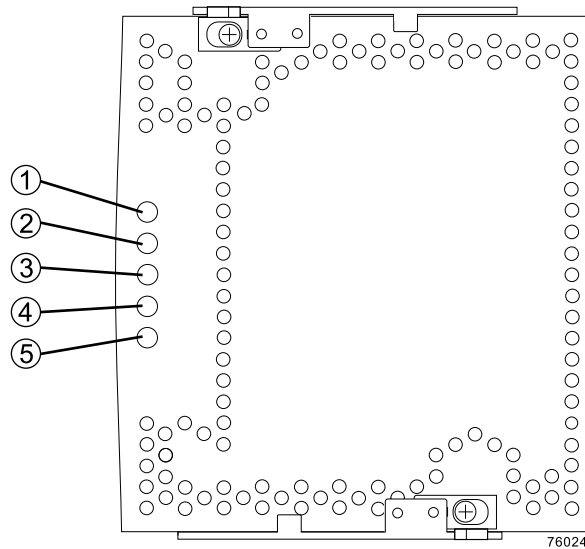
Diagnostic codes in the form of Lx, where x is a hexadecimal digit, indicate controller state information. In general, these codes are displayed only when the controller is in a non-operational state. The controller might be non-operational due to a configuration problem (such as mismatched controller types), or it might be non-operational due to hardware faults. If the controller is non-operational due to system configuration, the

controller Needs Attention light will be off. If the controller is non-operational due to a hardware fault, the controller Needs Attention light will be on. The definitions for Lx diagnostic codes are listed in Table 7-2.

**Table 7-2** Numeric Display Diagnostic Codes

<b>Value</b>	<b>Controller State</b>	<b>Description</b>	<b>SANtricity Storage Manager View</b>
L0	Suspend	Mismatched controller types	Needs Attention condition for board type mismatch
L1	Suspend	Missing interconnect/battery canister	Needs Attention condition for missing interconnect/battery canister
L2	Suspend	Persistent memory errors	Needs Attention condition for offline controller
L3	Suspend	Persistent hardware errors	Needs Attention condition for offline controller
L4	Suspend	Persistent data protection errors	Needs Attention condition for offline controller
88	Reset	Controller is held in reset by alternate controller	

## Power Supply/Fan Canister Lights



**Figure 7-3** Power Supply/Fan Canister Lights

**Table 7-3** Definition of the Power Supply/Fan Canister Lights

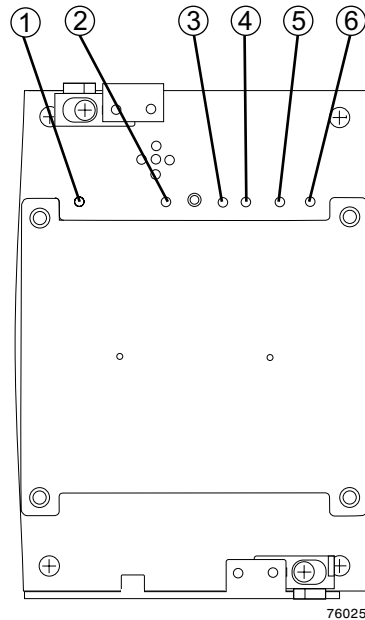
Location in Figure 7-3	Light	Color	Normal Status	Problem Status	Procedure
1	Power	Green LED	On = Power supply/fan canister is providing power	Off = Power supply/fan canister is not providing power	
2	Battery Charging	Green LED	On = Battery charged and ready Blinking = Battery charging	Off = Battery faulted or discharged	

**Table 7-3** Definition of the Power Supply/Fan Canister Lights (**continued**)

<b>Location in Figure 7-3</b>	<b>Light</b>	<b>Color</b>	<b>Normal Status</b>	<b>Problem Status</b>	<b>Procedure</b>
3	Battery Charging	Green LED	On = Battery charged and ready Blinking = Battery charging	Off = Battery faulted or discharged	
4	Needs Attention	Amber LED	Off	On = Power supply/fan canister needs attention	"Power Supply/Fan Canister Lights" on page 115
5	Service Action Allowed	Blue LED	Off	On = Safe to remove. May also indicate an open circuit breaker.	"Resetting the Controller Circuit Breakers" on page 121, Chapter 8, "Replacement of TP9700 Controller Enclosure Components"



## Interconnect/Battery Canister Lights



**Figure 7-4** Interconnect/Battery Canister Lights

**Table 7-4** Definition of the Interconnect/Battery Canister Lights

Location in Figure 7-4	Light	Color	Normal Status	Problem Status	Procedure
1	Battery Needs Attention	Amber LED	Off	On = Battery missing or failed	Replace battery, see: "Replacing a Backup Battery Pack" in Chapter 8
2	Power	Green LED	On = Command Module is powered on	Off = Command Module is powered off	

**Table 7-4** Definition of the Interconnect/Battery Canister Lights (**continued**)

Location in Figure 7-4	Light	Color	Normal Status	Problem Status	Procedure
3	Needs Attention	Amber LED	Off	On = A component in the command module has developed a fault. Inspect the Needs Attention lights on the other canisters to isolate the fault.	“Troubleshooting the Controller Module” on page 109
4	Locate	White LED	Off	On = Command module locate	
5	Service Action Allowed	Blue LED	Off	On = Safe to remove	
6	Battery Needs Attention	Amber LED	Off	On = Battery missing or failed	Replace battery, see: Chapter 8

The Power, Needs Attention, and Locate lights are general indicators for the entire command module, not specifically for the interconnect/battery canister. The Needs Attention light will turn on if a fault condition is detected in any component in the controller module (enclosure). The Power, Needs Attention, and Locate lights shine through the front cover.

**Note:** If you see a Needs Attention light, refer to the storage management software to determine the problem with the command module. Also, inspect the Needs Attention lights on the other canisters in the command module to help isolate the fault to a specific canister.

## Recovering from an Overheated Power Supply

The command module has two power supply/fan canisters. Each power supply/fan canister contains a power supply, a cooling fan, a battery charger, and a built-in temperature sensor designed to prevent the power supplies from overheating. Under normal operating conditions, with an ambient air temperature range of 5° C to 40° C, (40° F to 104° F), the cooling fans maintain a proper operating temperature inside the module.

Several factors can cause the power supplies to overheat. These factors include:

- Unusually high room temperature
- Fan failure
- Defective circuitry in the power supply
- Blocked air vent
- Failure in other devices installed in the cabinet

If the internal temperature rises above 70° C (158° F), one or both power supplies automatically shut down. If *one* power supply shuts down, the storage management software displays a Needs Attention status in the Array Management Window, the alarm sounds, and the Needs Attention light on the front cover of the command module turns on.

If a common environmental stress causes *both* power supplies to shut down, the command module shuts down, and the storage management software displays a Not Responding status in the Array Management Window.

If event monitoring is enabled and event notification is configured, the software also issues critical event notifications.

- **Nominal temperature exceeded** – The command module temperature exceeds the normal operating range.
- **Maximum temperature exceeded** – The command module temperature exceeds 70° C (158° F).

Use the following procedures to resume normal operation after a power supply shutdown.

---

**Caution: Risk of damage from overheating** – Power supplies automatically shut down when air temperature inside the cabinet reaches 70° C (158° F) or above. If the power supplies have shut down, immediately remove all cabinet panels to help cool the cabinet air temperature and prevent damage to the command module.

---

1. If applicable, turn off the alarm by pressing the Mute button on the front cover of the command module.
2. Use the storage management software to print a storage array profile.

3. Did you use the procedure “Troubleshooting the Controller Module” on page 109 to identify an overheating problem?
  - **Yes** – Go to step 4.
  - **No** – Perform the procedure “Troubleshooting the Controller Module” on page 109 to verify that the power supplies have shutdown because of an overheating problem.
4. Try alleviating the overheating problem by:
  - Removing all panels from the cabinet
  - Cooling the area using external fans
  - Shutting down the power to the command modules or drive modules
5. Stop all I/O activity to the command module and to all attached drive modules.
6. Wait until the ambient air temperature around the command module cools.

---

**Note:** The command module is capable of power-up recovery without operator intervention after the temperature inside the power supply/fan canister cools to below 70° C (158° F). After the air has cooled, the power supplies should turn on automatically. If the power supplies restart automatically, the controllers reset and return to normal operation.

---

7. Did the power supplies restart automatically?
8. Yes – Go on to step 10.
  - No – Got to step 9.
9. Turn off the power switch on each controller in the command module. Wait 10 seconds, and then turn on the command module power. If the power supplies go into operation, go to the next step. If not, call Customer and Technical Support.
10. Check the status lights on the front and back of the command module.

For information about command module lights, refer to Table 7-1 on page 111, Table 7-2 on page 114, Table 7-3 on page 115 and Table 7-4 on page 117. Are the lights on the command module indicating normal status?

- Yes – Go to next step.
- No – Got to step 12.

11. Use the storage management software to check the status of all modules in the storage array. Is the status Optimal for each module?
  - **Yes** – End of procedure. Resume normal operation.
  - **No** – Go to next step.
12. Diagnose and correct the fault by completing the following steps.
  - Select the Recovery Guru toolbar button in the Array Management Window to run the Recovery Guru.
  - Complete the recovery procedure.

If the Recovery Guru directs you to replace a failed component, use the individual lights on the modules to locate the specific failed component.

- When the procedure is completed, select Recheck in the Recovery Guru. This will rerun the Recovery Guru to ensure that the problem has been fixed.
- If the problem has not been fixed contact Customer and Technical Support.

Print a storage array profile and save the storage array support data. The profile and support data will be helpful when troubleshooting storage array problems. (For information about printing a storage array profile and saving the support data, refer to the Array Management Window online help.)

## Resetting the Controller Circuit Breakers

Each command module controller has two circuit breakers that provide over current protection to the power supply in a power supply/fan canister. One circuit breaker provides protection for AC input, the second circuit breaker provides protection for DC input. The circuit breakers are mounted inside the controller canister, in line with the internal power cable.

The internal power cable runs from the AC connector and DC connector on a controller canister to the power supply in a power supply/fan canister. Power to the left power supply/fan canister (as viewed from the front of the command module) is routed through the top controller canister; power to the right power supply/fan canister is routed through the bottom controller canister.

If a circuit breaker has tripped, the condition might appear as if a power supply/fan canister has failed. The power supply is no longer providing power to the command

module. An tripped circuit breaker is indicated when all of the following conditions are present:

- Alarm is sounding
- Needs Attention light on the command module front cover is turned on
- The controller canister Needs Attention lights are not turned on
- The power supply/fan canister Needs Attention lights are not turned on
- The Service Action Allowed light is turned on for the power supply/fan canister connected to the controller canister with the open circuit breaker
- The Array Manager Window shows the failed controller canister as present, but not responding

Use the following procedure to ensure that a circuit breaker has opened, and then to reset the circuit breaker.

## Tools and Equipment

- Antistatic protection
- Non-conducting stylus

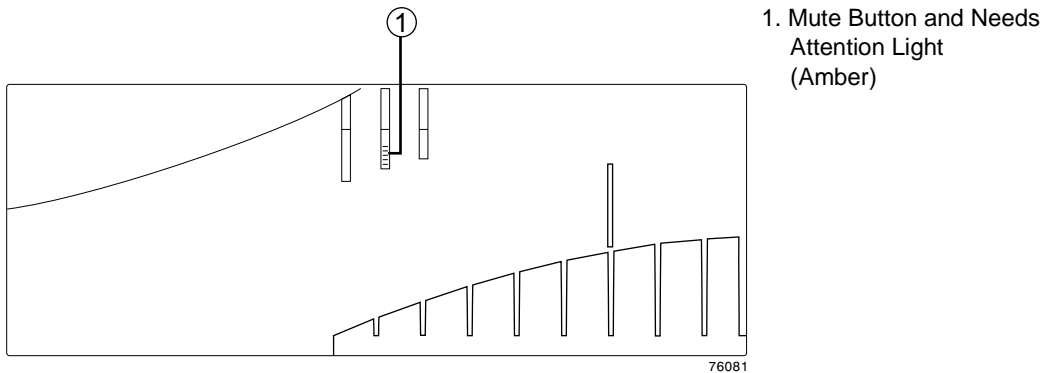
## Controller Module Attention Light Procedures

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**Caution: Electrostatic discharge can damage sensitive component.** – Touching the command module or its components without using a proper ground might damage the equipment. To avoid damage, use proper antistatic protection while handling any components.

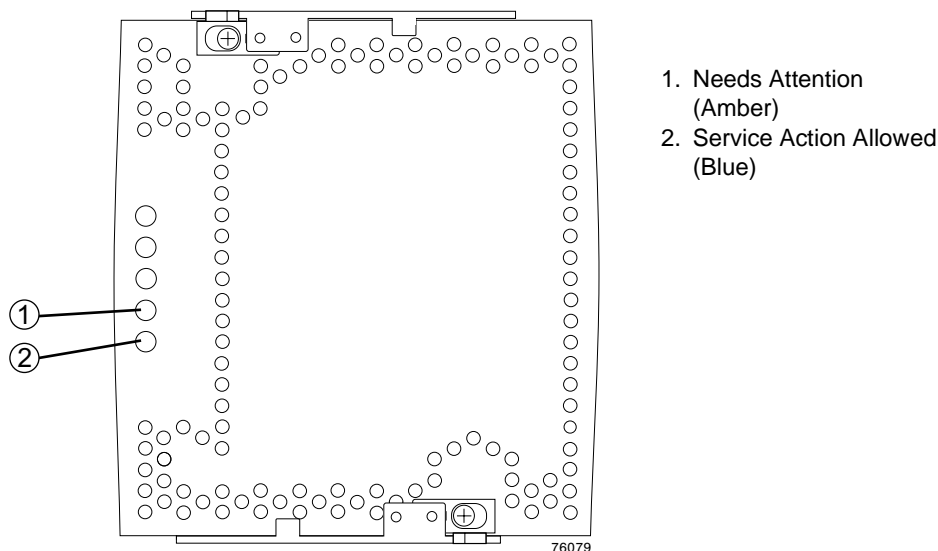
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1. If the alarm is sounding, turn off the alarm by pressing the Mute button on the front cover of the command module.



**Figure 7-5** Mute Button and Needs Attention Light on the Command Module Front Cover

2. Check to ensure that the external power cables are completely plugged into the controller canisters and into the power source.
3. Put on antistatic protection.
4. Remove the front cover by grasping the sides and pulling the cover toward you.
5. Check the Needs Attention light on each power supply/fan canister. (Figure 7-5 shows the location of the Needs Attention light.)



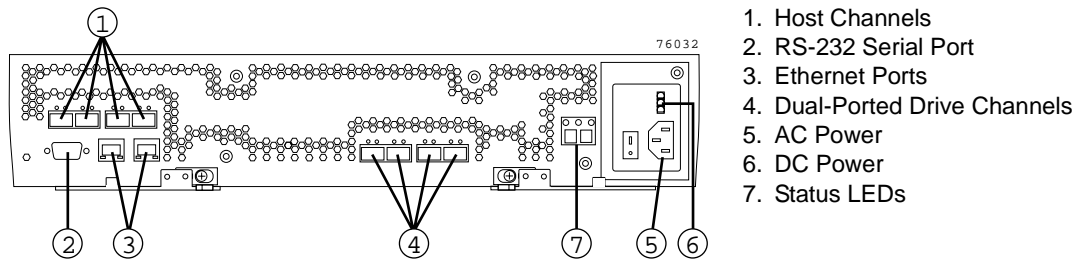
**Figure 7-6** Power Supply/Fan Canister Needs Attention Light

- a. Is a power supply/fan canister Needs Attention light on?
  - **Yes** – A power supply/fan canister has failed. To replace the failed power supply/fan canister, refer to Chapter 8, “Replacement of TP9700 Controller Enclosure Components”.
  - **No** – Go to sub-step b.
- b. Is a power supply/fan canister Service Action Allowed light on?
  - **Yes** – If the Service Action Allowed light on the left power supply/fan canister is turned on, then the circuit breakers in the upper controller canister have tripped. If the Service Action Allowed light on the right power supply/fan canister is turned on, then the circuit breakers in the lower controller canister have tripped. (Left and right are determined by facing the front of the command module.) Go on to step 6.
  - **No** – Contact Customer and Technical Support.



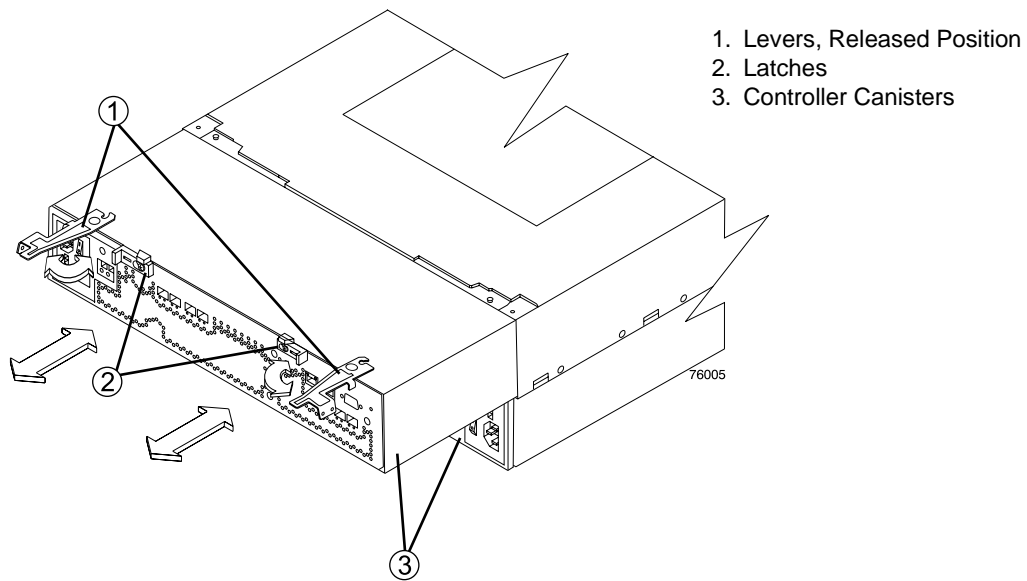
**Caution: Potential damage to fiber optic cables** – Fiber optic cables are fragile. Bending, twisting, folding, or pinching fiber optic cables can cause damage to the cables, degraded performance, or data loss. To prevent damage, do not twist, fold, pinch, or step on the cables. Do not bend the cables in less than a two-inch radius.

**Note:** You do not need to remove the interface cables from the controller canisters to reset the circuit breakers; however, removing the cables can make this procedure easier. If you choose to remove the interface cables ensure that you label each cable so that you can reconnect them correctly to the controller canister. Figure 7-7 identifies all of the connectors on the back of the controller canister.



**Figure 7-7** TP9700 Controller Canister Connectors

6. Use the storage management software to take the controller offline. After the controller is offline, the Service Action Allowed light turns on and you can safely remove the controller.
7. Slide the controller canister with the open circuit breaker from the command module. You do not need to completely remove the controller canister, only slide it out far enough to reveal the holes over the circuit breakers.
  - a. Using your index fingers, simultaneously push the latches to release the levers, and rotate the levers to disengage them from the locking pins.
  - a. Use the levers to slide the controller canister from the command module chassis. (Figure 7-8 shows the controller canister sliding from the command module chassis.)



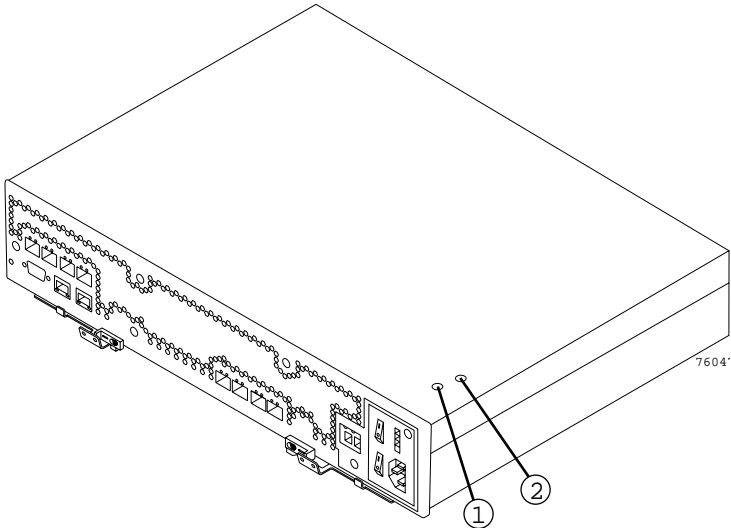
**Figure 7-8** Removing a Controller Canister from the Module

Insert a non-conducting stylus through the appropriate hole in the cover of the controller canister. One hole is over the AC circuit breaker a second hole is over the DC circuit breaker. Figure 7-9 shows the location of the circuit breaker access holes in the controller canister cover.

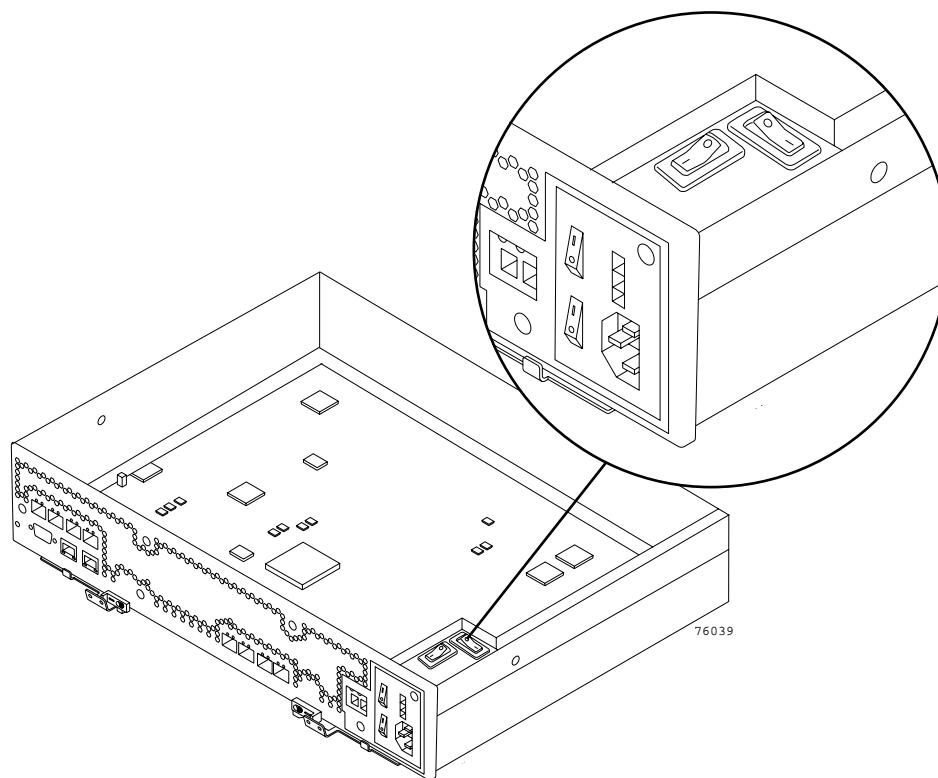
Figure 7-10 on page 128 shows the location of the circuit breakers in the controller canister.

Hole 1 is the DC circuit breaker.

Hole 2 is the AC circuit breaker.



**Figure 7-9** Circuit Breaker Access Holes in the 6998 Controller



**Figure 7-10** Controller Circuit Breakers

8. Reset the circuit breaker that tripped by pressing down on the rocker switch.
9. Slide the controller canister into the command module chassis, and push it firmly until the levers snaps into place.
10. If you removed the interface cables, reconnect all host interface cables and drive interface cables, including the SFP transceivers.
11. Wait approximately 60 seconds for the storage management software to recognize the controller canister.
12. Complete any remaining Recovery Guru procedures for controller canister replacement, if needed.
13. Based on the Host Channel Speed, Drive Channel Speed, and Needs Attention light status, proceed to one of the following steps:

- **All channel speed lights are on *and* the Needs Attention light is off** – Go to step 16.
- **All channel speed lights are off *or* the Needs Attention light is on** – **Verify the controller has been installed correctly.** Reinstall the controller canister. Go to step 14.

---

**Note:** If a host channel or drive channel does not have a cable connected, the channel speed LEDs will not be illuminated.

---

14. Did this correct the problem?
  - **Yes** – Go to step 15.
  - **No** – If the problem has not been fixed, contact Customer and Technical Support.
15. Remove the antistatic protection.
16. Install the front cover by aligning the pins on the command module chassis with the spring-steel retainers on the cover, and then pressing the cover toward the chassis until the pins snap into place.
17. Using the Enterprise Management Window, view the status of the storage arrays. Are any storage arrays indicating Needs Attention?
  - **Yes** – Go to step 18.
  - **No** – All components are Optimal. You are finished with this procedure.
18. Use the Array Management Window to check the status of all modules in the storage array.
19. Do any storage array modules have a Needs Attention status?
  - **Yes** – Select the Recovery Guru toolbar button in the Array Management Window and complete the recovery procedure. If the problem persists, contact Customer and Technical Support.
  - **No** – contact Customer and Technical Support.

Print a storage array profile and save the storage array support data. The profile and support data will be helpful when troubleshooting storage array problems. (For information about printing a storage array profile and saving the support data, refer to the Array Management Window online help.)



## Replacement of TP9700 Controller Enclosure Components

This chapter describes the replacement of each component in the controller enclosure (module) and explains the procedures for replacing a controller canister, power supply/fan canister, interconnect/battery canister, and SFP transceiver. Before using the procedures in this chapter, perform the appropriate troubleshooting steps described in Chapter 7, “Troubleshooting of TP9700 Controller Enclosure Components” and in the Recovery Guru.

### Replacement Parts

The following list has the components that you can replace on site. To order parts, contact your local service center or Customer and Technical Support.

- Controller canister
- Power supply/fan canisters (containing power supplies, fans, and battery chargers)
- Interconnect/battery canister (containing the mid-lane and batteries for the cache backup)
- SFP transceivers
- Interface cables
- Ethernet cables

---

**Important:** Never remove the interconnect/battery canister unless directed to do so by a Customer and Technical Support representative.

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## Hot Swap

*Hot swap* refers to the ability to remove and replace a component “canister” while the controller module (enclosure) is under power and processing data. The 6998 controller module has three major components you can replace on site: the controller canister, power supply/fan canister, and interconnect/battery canister. In a fully-configured module, the controller canisters and power supply/fan canisters are redundant. If any one of these redundant canisters fails, the canister can be replaced without powering off the enclosure, and without interrupting data processing. While you can replace the interconnect/battery canister while the module is under power and processing data, never replace it unless instructed to by a Customer and Technical Support representative.

You can perform all replacement procedures in this chapter as hot swap procedures.

## Service Action Allowed Status Light

Each controller, power supply/fan, and interconnect/battery canister has a Service Action Allowed status light. This light is a blue LED. The purpose of the Service Action Allowed status light is to help ensure that a canister is not removed before it is safe to do so.

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**Caution: Potential loss of data** – Never remove a controller, power supply/fan, or interconnect/battery canister unless the Service Action Allowed status light is turned on.

---

If a controller or power supply/fan canister fails and needs to be replaced, the amber Needs Attention status light on that canister turns on to indicate that service action is required. If there are no data availability dependencies or other conditions that dictate the canister should not be removed, the blue Service Action Allowed status light turns on. The Service Action Allowed status light automatically turns on or off as conditions change. In most cases, the Service Action Allowed status light will turn on steadily when the Needs Attention status light is turned on for the canister.

If the interconnect/battery canister needs to be replaced, the Service Action Allowed status light does not automatically turn on. Before the interconnect/battery canister Service Action Allowed status light can turn on, you must place controller B into Service mode. The reason for this is to route all control and I/O activity through one controller



to help ensure that data availability is maintained while the interconnect/battery canister is removed.

The ability to remove a canister depends on the data availability dependencies of the command module. The Service Action Allowed status light will not turn on if removing a canister will jeopardize data on the drive modules or current I/O activity. An example of limiting when you can remove a canister is when one controller has a Needs Attention status light turned on; you cannot remove the other controller (the Service Action Allowed status light will not turn on), because doing so would jeopardize the data either on the drive modules or transitioning through the controllers. A less obvious example is when the power supply for the controller in slot A has failed, and the controller in slot B has failed. Removing the controller in slot B before replacing the failed power supply/fan canister will cause controller A to lose power, resulting in a loss of data availability. This occurs because power distribution from each power supply/fan canister is through the controller physically connected to that power supply/fan canister.

Table 8-1 shows when the Service Action Allowed status light will not turn on (the light is suppressed) for each canister. An “X” in a table cell indicates the Service Action Allowed status light will not turn on. For example, if the power supply in the power supply/fan – slot A canister has failed, then the Service Action Allowed status light will not turn on for controller B, interconnect/battery, and power supply/fan - slot B canisters.

**Table 8-1** Availability Dependencies

Failure Description	Service Action Allowed Suppressed				
	Controller A	Controller B	Interconnect/ Battery Canister	Power Supply/ Fan Canister – Slot A	Power Supply/ Fan Canister – Slot B
Controller A Failed or Locked Down		X	X		
Controller B Failed or Locked Down	X				

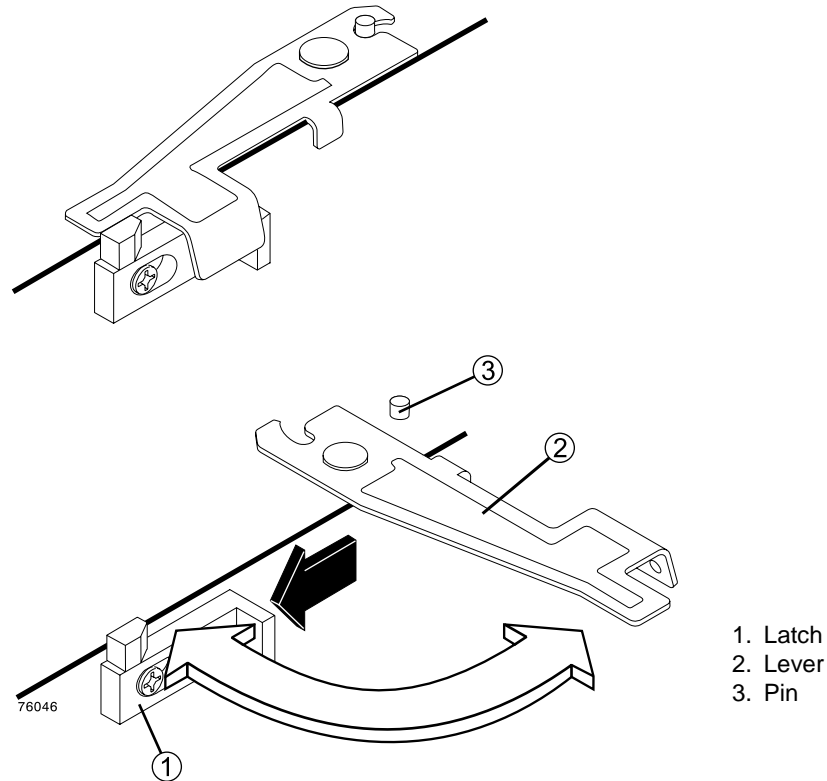
**Table 8-1** Availability Dependencies (continued)

Failure Description	Service Action Allowed Suppressed				
	Controller A	Controller B	Interconnect/ Battery Canister	Power Supply/ Fan Canister – Slot A	Power Supply/ Fan Canister – Slot B
Controller A Drive Path Unavailable		X	X		
Controller B Drive Path Unavailable	X		X		
Power Supply/Fan – Slot A Canister Power Supply Failure		X	X		X
Power Supply/Fan – Slot A Canister Fan Failure					
Power Supply/Fan – Slot B Canister Power Supply Failure	X		X	X	
Power Supply/Fan – Slot B Canister Fan Failure					
Interconnect/Battery Canister Removed	X			X	
Controller A Removed		X	X		X
Controller B Removed	X			X	
Power Supply/Fan Canister A Removed		X	X		X
Power Supply/Fan Canister B Removed	X		X	X	
Battery Pack Failed					
Battery Pack Removed					

## Releasing a Canister Lever

Each canister is secured into the command module chassis by two cam lock levers mounted to the canister. The lever engages with a pin on the command module chassis to pull the canister securely into the chassis. The levers are locked in place by spring-loaded latches. The control canisters have the levers on the same side. The power supply/fan canisters and the interconnect/battery canister have the one lever mounted to the top of the canister and one lever mounted to the bottom of the canister. Figure 8-1

shows a canister lever and the latch that secures the lever. The top view shows the lever in the closed and latched position. The bottom view shows the lever in the released position.



**Figure 8-1** Canister Lever and Latch

The lever and latch are designed to be released with one hand. Using your index finger, simultaneously push the latch to one side until the tab on the latch is past the end of the lever, then rotate the lever, releasing it from the pin. Ensure that the lever is completely free of the pin. Use the both levers to pull the canister from the command module chassis.

When re-installing a canister, ensure that the lever engages the pin so the canister is completely pulled into the command module chassis. This ensures all electrical connections make full contact.

## Replacing a Controller

Use the following procedure to replace a controller in a TP9700 controller module.

---

**Important:** To provide full functionality, the two controller canisters should have the same memory capacity. Although two controller canisters of different memories can be paired in a command module, the mismatch will cause some functions to be disabled (for example, the cache mirroring function). Fail over is disabled during the controller replacement procedure.

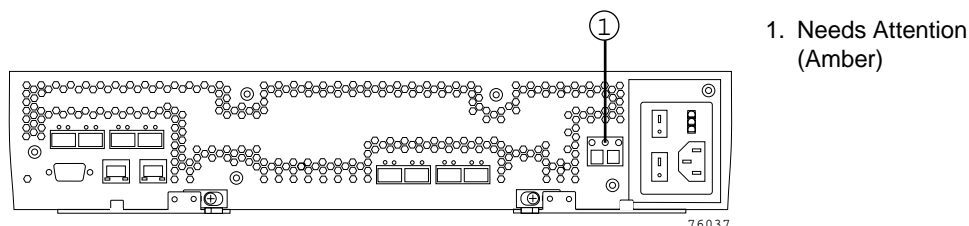
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### Tools and Equipment

- Antistatic protection
- Replacement controller

### Procedure

1. If the alarm is sounding, turn off the alarm by pressing the Mute button on the front cover of the command module.
2. Did you perform the “Troubleshooting the Controller Module” in Chapter 7 procedure and did the procedure direct you to replace a failed controller?
  - **Yes** – Go on to step 3.
  - **No** – To identify the failed component, perform the “Troubleshooting the Controller Module” in Chapter 7 procedures. Perform the maintenance indicated in the procedure.
3. Locate the failed controller by checking the Needs Attention status lights on the controllers in the command module. (Figure 8-2 shows the location of the Needs Attention light on the back of a controller.)



**Figure 8-2** Controller Canister Needs Attention Light

4. Use the storage management software to:
  - a. Print a storage array profile.
  - b. Move volume ownership to the other controller.
  - c. Move the failed controller to an Offline state.

---

**Caution: Potential loss of data** – Never remove a controller unless the Service Action Allowed status light is turned on.

---

5. Is the Service Action Allowed status light turned on. (Figure 8-2 shows the location of the Service Action Allowed status light on the back of a controller.)
  - **Yes** – Go to step 6.
  - **No** – Another component requires attention before you can remove the controller. Run the Recovery Guru to determine, what other components might require attention. If the Recovery Guru does not indicate any other component problems, contact Customer and Technical Support.

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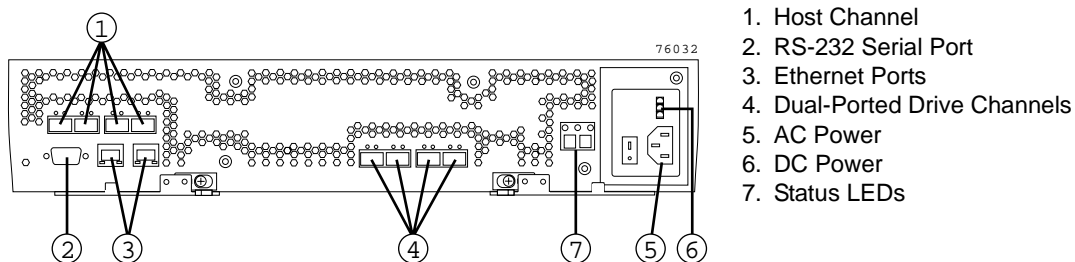
**Caution: Electrostatic discharge can damage sensitive components** – Touching the command module or its components without using a proper ground might damage the equipment. To avoid damage, use proper antistatic protection while handling any components.

---

6. Put on antistatic protection.
7. Unpack the new controller.  
Save all packing materials in the event you need to return the new controller.

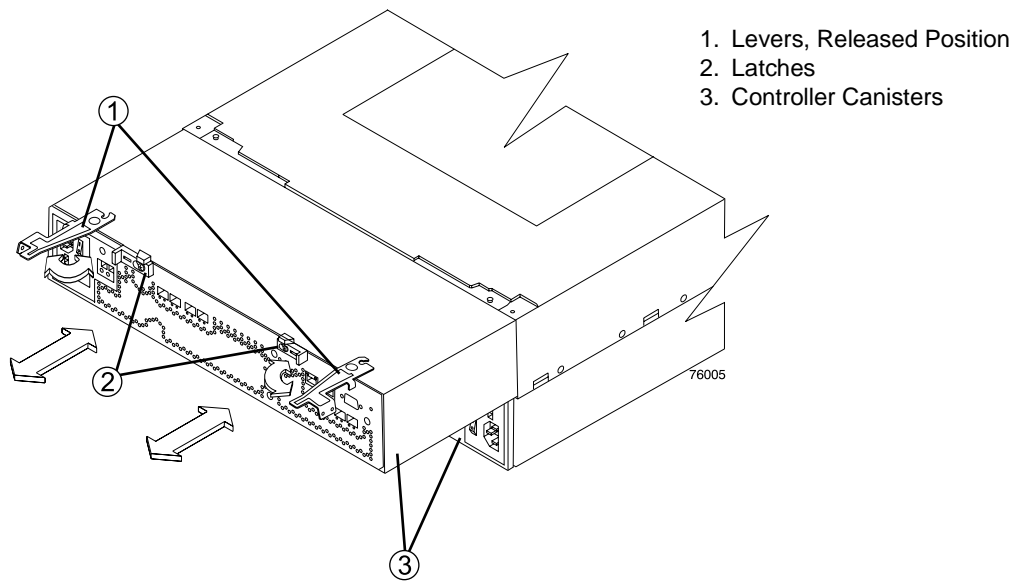
**Caution: Potential damage to fiber optic cables** – Fiber optic cables are fragile. Bending, twisting, folding, or pinching fiber optic cables can cause damage to the cables, degraded performance, or data loss. To prevent damage, do not twist, fold, pinch, or step on the cables. Do not bend the cables in less than a two-inch radius.

8. Disconnect all attached interface cables from the failed controller including the SFP transceivers. Ensure that you label each cable so that you can reconnect them correctly to the new controller. Figure 8-3 shows the location of the connectors on the back of a controller canister.



**Figure 8-3** Connectors on the Back of Each Controller

9. Remove the failed controller. Figure 8-4 on page 139 shows the controller sliding from the command module chassis.



**Figure 8-4** Removing a Controller from the Enclosure

10. Install the new controller.
  - a. Carefully position the controller in the module chassis. Ensure that the controller will slide correctly into the module chassis.
  - b. Slide the controller into the module chassis, and push it firmly until the latches snap into place.
11. Reconnect all host interface cables and drive interface cables, including the SFP transceivers.
12. Wait approximately 60 seconds for the storage management software to recognize the new controller.
13. Complete any remaining Recovery Guru procedures for controller replacement, if needed.
14. Based on the Host Channel Speed, Drive Channel Speed, and Needs Attention light status, proceed to one of the following steps:
  - **All channel speed lights are on and the Needs Attention light is off** – Go to step 16.

- **All channel speed lights are off *or* the Needs Attention light is on – Verify the controller has been installed correctly.** Reinstall the controller canister. Go to step 15.

---

**Note:** If a host channel or drive channel does not have a cable connected, the channel speed LEDs will not be illuminated.

---

15. Did this correct the problem?
  - **Yes** – Go to step 16.
  - **No** – If the problem has not been fixed, contact Customer and Technical Support.
16. Remove the antistatic protection.
17. Use the Array Management Window to check the status of all modules in the storage array.
18. Do any storage array modules have a fault (Needs Attention) status?
  - **Yes** – Select the Recovery Guru toolbar button in the Array Management Window and complete the recovery procedure. If the problem persists, contact Customer and Technical Support.
  - **No** – Go to the next step.
19. Use the storage management software to print a new storage array profile.

## Replacing a Power Supply/Fan Canister

Use the following procedure to replace a power supply/fan canister. Each power supply/fan canister contains a power supply, cooling fan, battery charger, and temperature sensor. If any of these components fail, the power supply/fan canister must be replaced. The power supply, fan, battery charger, and temperature sensor are not replaceable components.

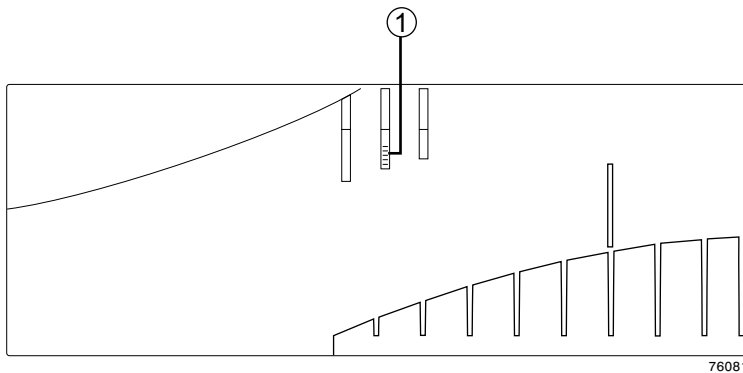
### Tools and Equipment

- Antistatic protection
- Replacement support canister



## Procedure

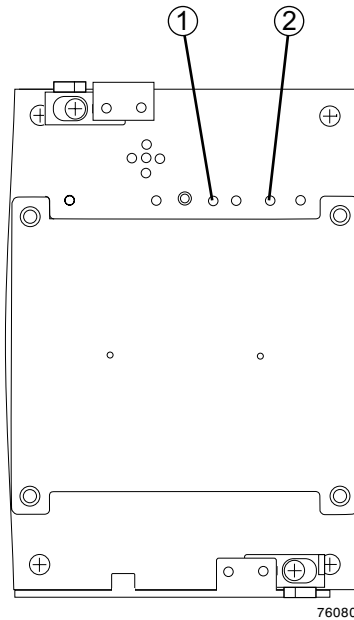
1. If the alarm is sounding, turn off the alarm by pressing the Mute button on the front cover of the command module.
2. Did you perform the “Troubleshooting the Controller Module” in Chapter 7 procedures and did the procedure direct you to replace a failed power supply/fan canister?
  - **Yes** – Go on to step 3.
  - **No** – To identify the failed component, go through the “Troubleshooting the Controller Module” in Chapter 7 procedures, then perform the maintenance indicated by the procedure.
3. Use the storage management software to print a storage array profile.
4. Locate the module that contains the failed power supply/fan canister by checking the Needs Attention light on the front cover of the module. (Figure 8-5 shows the location of the Needs Attention light on the front cover.)



1. Mute Button and Needs Attention Light (Amber)

**Figure 8-5** Needs Attention Light on the Module Front Cover

5. Remove the front cover by grasping the sides and pulling the cover toward you.
6. Locate the failed power supply/fan canister by checking for the power supply/fan canister Needs Attention light that is turned on. (Figure 8-6 shows the lights on the power supply/fan canister.)



1. Needs Attention  
(Amber)
2. Service Action Allowed  
(Blue)

**Figure 8-6** Power Supply/Fan Canister Lights

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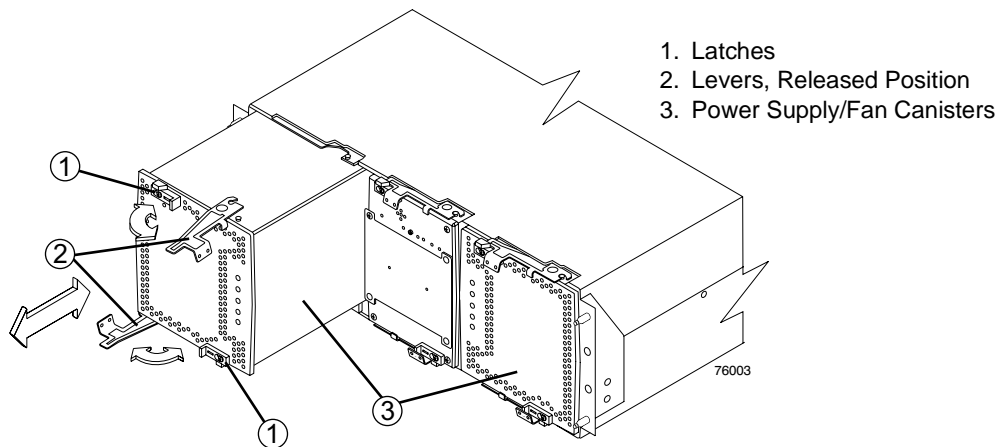
**Caution: Potential loss of data** – Never remove a power supply/fan canister unless the Service Action Allowed status light is turned on.

---

7. Is the Service Action Allowed status light turned on. (Figure 8-6 shows the location of the Service Action Allowed status light on the power supply/fan canister.)
  - **Yes** – Go to step 8.
  - **No** – Another component requires attention before you can remove the power supply/fan canister. Run the Recovery Guru to determine, what other components might require attention. If the Recovery Guru does not indicate any other component problems, contact Customer and Technical Support.

**Caution: Electrostatic discharge can damage sensitive components** – Touching the command module or its components without using a proper ground may damage the equipment. To avoid damage, use proper antistatic protection while handling any components.

8. Put on antistatic protection.
9. Unpack the new power supply / fan canister.
10. Save all packing materials in the event you need to return the new power supply / fan canister.
11. Remove the failed power supply / fan canister. (Figure 8-7 shows a power supply / fan canister sliding from the command module chassis.)



**Figure 8-7** Removing a Power Supply/Fan Canister from the Command Module

12. Install the new power supply / fan canister.
  - a. Carefully position the power supply / fan canister in the command module chassis.

Note that the power supply / fan canister has a relief formed along one long edge of the canister. The canister relief fits onto a rail cast into the command module chassis. Ensure that the canister relief fits onto the rail before attempting to slide the controller into the command module chassis.

- b. Slide the power supply/fan canister into the into the command module chassis, and push it firmly until the latches snaps into place.
13. Wait approximately 60 seconds for the storage management software to recognize the new power supply/fan canister.
14. Complete any remaining Recovery Guru procedures for power supply/fan canister replacement, if needed.
15. Did this correct the problem?
  - **Yes** – Go to step 16.
  - **No** – Contact Customer and Technical Support.
16. Remove the antistatic protection.
17. Install the front cover by aligning the pins on the command module chassis with the spring-steel retainers on the cover, and then press the cover toward the chassis until the pins snap into place.
18. Use the Array Management Window to check the status of modules in the storage array.
19. Do any storage array modules have a fault (Needs Attention) status?
  - **Yes** – Select the Recovery Guru toolbar button in the Array Management Window and complete the recovery procedure. If the problem persists, contact Customer and Technical Support.
  - **No** – Go to step 20.
20. Use the storage management software to print a new storage array profile.

## Replacing the Interconnect/Battery Canister

Use the following procedure to replace the interconnect/battery canister.

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**Important:** Never remove the interconnect/battery canister unless directed to do so by a Customer and Technical Support representative.

---

## Tools and Equipment

- Antistatic protection
- Replacement interconnect/battery canister

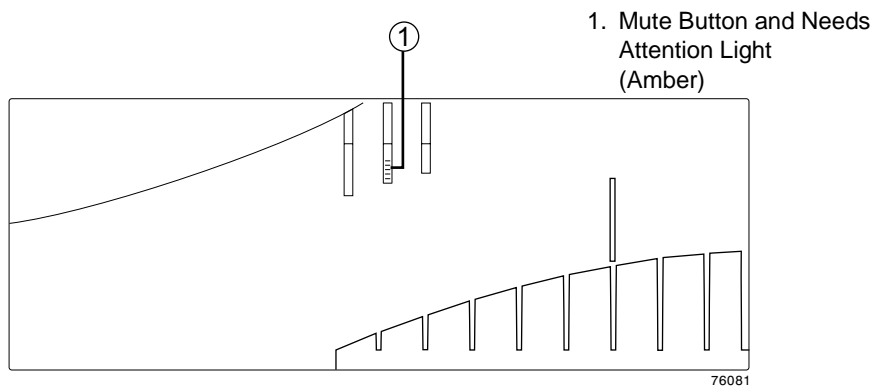
## Procedure

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**Caution: Electrostatic discharge can damage sensitive component.** – Touching the command module or its components without using a proper ground may damage the equipment. To avoid damage, use proper antistatic protection while handling any components.

---

1. If the alarm is sounding, turn off the alarm by pressing the Mute button on the front cover of the command module.
2. Did you perform the “Troubleshooting the Controller Module” in Chapter 7 procedures and did the procedure direct you to replace a failed interconnect/battery canister?
  - **Yes** – Go to step 3.
  - **No** – To identify the failed component, perform the “Troubleshooting the Controller Module” in Chapter 7 procedures and then perform the maintenance indicated.
3. Use the storage management software to print a storage array profile.
4. Locate the failed interconnect/battery canister by checking the Needs Attention light on the front cover of the command module. (Figure 8-8 on page 146 shows the location of the Needs Attention light on the front cover.)



**Figure 8-8** Needs Attention Light on the Enclosure's Front Cover

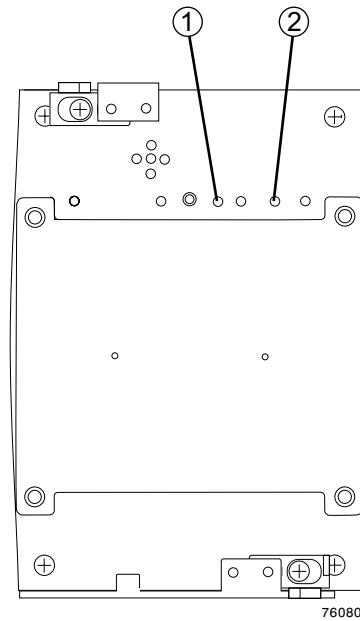
5. Remove the front cover by grasping the sides and pulling the cover toward you.

---

**Caution: Potential loss of data** – Never remove a power supply/fan canister unless the Service Action Allowed status light is turned on, see Figure 8-9.

---

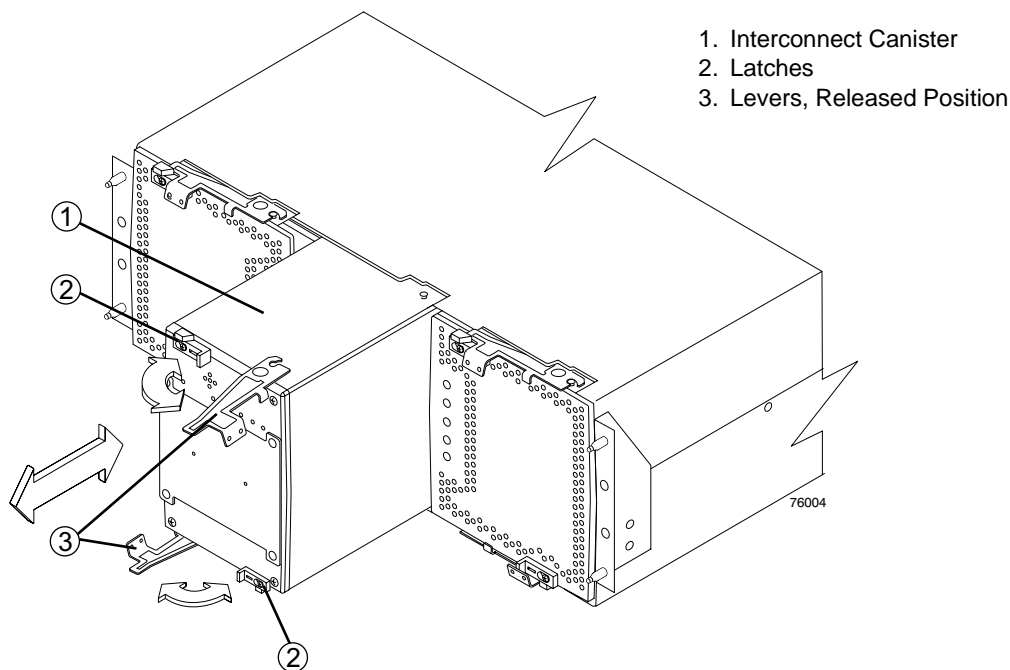
6. Is the Service Action Allowed status light turned on. (Figure 8-9 shows the location of the Service Action Allowed status light on the interconnect/battery canister.)
  - **Yes** – Go to step 7.
  - **No** – Another component requires attention before you can remove the interconnect/battery canister. Run the Recovery Guru to determine, what other components might require attention. If the Recovery Guru does not indicate any other component problems, contact Customer and Technical Support.



1. Needs Attention Light (Amber)
2. Service Action Allowed (Blue)

**Figure 8-9** Interconnect/Battery Canister Needs Attention and Service Action Allowed Lights

7. Put on antistatic protection.
8. Unpack the interconnect/battery canister.  
Save all packing materials in the event you need to return the new interconnect/battery canister.
9. Remove the failed interconnect/battery canister. (Figure 8-10 on page 148 shows the interconnect/battery canister sliding from the command module chassis.)



**Figure 8-10** Removing an Interconnect/Battery Canister from the Enclosure

10. Install the new interconnect/battery canister.
  - a. Carefully position the interconnect/battery canister in the command module chassis.

The interconnect/battery canister has a pin on the connector end of the canister. The pin fits onto a relief cast into the command module chassis. (You can see the relief by peering into the slot for the interconnect canister.) Ensure that the interconnect canister pin is aligned with the relief in the command module chassis before attempting to slide the interconnect canister into the command module chassis.
  - b. Slide the interconnect/battery canister into the slot, and push it firmly until the latches snap into place.
11. Wait approximately 60 seconds for the storage management software to recognize the new interconnect canister.



12. Complete any remaining Recovery Guru procedures for interconnect/battery canister replacement, if needed.
13. Did this correct the problem?
  - **Yes** – Go to step 14.
  - **No** – If the problem has not been fixed, contact Customer and Technical Support.
14. Remove the antistatic protection.
15. Install the front cover by aligning the pins on the command module chassis with the spring-steel retainers on the cover, then press the cover toward the chassis until the pins snap into place.
16. Use the Array Management Window to check the status of all modules in the storage array.
17. Do any storage array modules have a fault (Needs Attention) status?
  - **Yes** – Select the Recovery Guru toolbar button in the Array Management Window and complete the recovery procedure. If the problem persists, contact Customer and Technical Support.
  - **No** – Go to step 18.
18. Use the storage management software to print a new storage array profile.

## Replacing a Backup Battery Pack

Use the following procedure to replace a backup battery pack in the interconnect/battery canister.

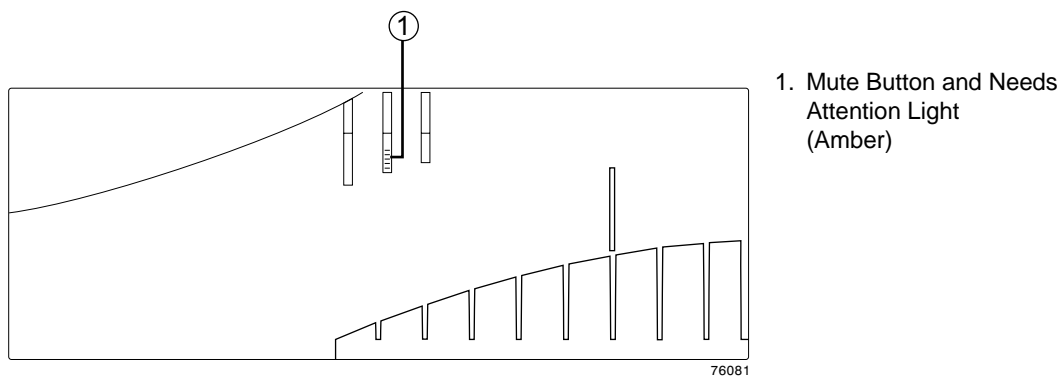
### Tools and Equipment

- Antistatic protection

## Replacement battery pack Procedure

**Caution: Electrostatic discharge damage to sensitive components** – To prevent electrostatic discharge damage to the module, use proper antistatic protection when handling the module components.

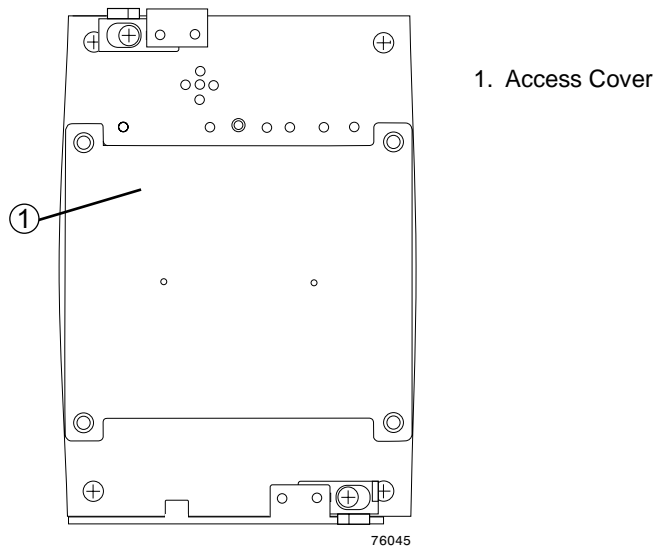
1. If the alarm is sounding, turn off the alarm by pressing the Mute button on the front cover of the command module.
2. Did you perform the “Troubleshooting the Controller Module” in Chapter 7 procedures and did the procedure direct you to replace a failed backup battery pack?
  - **Yes** – Go to step 3.
  - **No** – To identify the failed component, perform the procedures in “Troubleshooting the Controller Module” in Chapter 7.
3. Use the storage management software to print a storage array profile.
4. Locate the command module that contains the interconnect/battery canister with the failed battery by checking the Needs Attention light on the front cover of the command modules in the storage array. (Figure 8-11 shows the location of the Needs Attention light on the front cover.)



**Figure 8-11** Needs Attention Light on the Enclosure Front Cover

5. Remove the front cover by grasping the sides and pulling the cover toward you.

6. Put on antistatic protection.
7. Unpack the new battery pack.  
Save all packing materials in the event you need to return the new battery pack.
8. Remove the battery access cover from the front of the interconnect/battery canister by removing the thumb screws that secure the cover to the canister. Figure 8-12 shows the access cover and mounting screws on the interconnect/battery canister.



**Figure 8-12** Battery Access Cover on the Interconnect/Battery Canister

9. Remove the battery pack by sliding it out of the interconnect/battery canister.
10. The battery pack is mounted to a sheet metal bracket. The sheet metal bracket has a flange formed on the end of the bracket closest to the access in the interconnect/battery canister. Grasp the flange to slide the battery pack from the interconnect/battery canister.
11. Install the replacement battery pack.
  - a. Carefully position the battery pack to ensure that the battery pack will slide correctly into the interconnect/battery canister.
  - b. Slide the battery pack into the interconnect/battery canister. Push the battery pack firmly into the interconnect/battery canister to ensure that the battery

pack completely engages with the connectors in the interconnect/battery canister.

12. Reinstall the battery access cover onto the front of the interconnect/battery canister.
13. Remove the antistatic protection.
14. Install the front cover by aligning the pins on the command module chassis with the spring-steel retainers on the cover, then press the cover toward the chassis until the pins snap into place.
15. Use the Array Management Window to check the status of all modules in the storage array.
16. Do any storage array modules still have a fault (Needs Attention) status?
  - **Yes** – Select the Recovery Guru toolbar button in the Array Management Window and complete the recovery procedure. If the problem persists, contact Customer and Technical Support.
  - **No** – Go on to step 17.
17. Use the storage management software to print a new storage array profile.

---

**Warning:** Potentially hazardous material – The battery pack contains sealed lithium ion batteries that may be considered hazardous material. Use proper facilities to recycle the used battery. You must handle the battery pack in accordance to all applicable local and federal regulations.

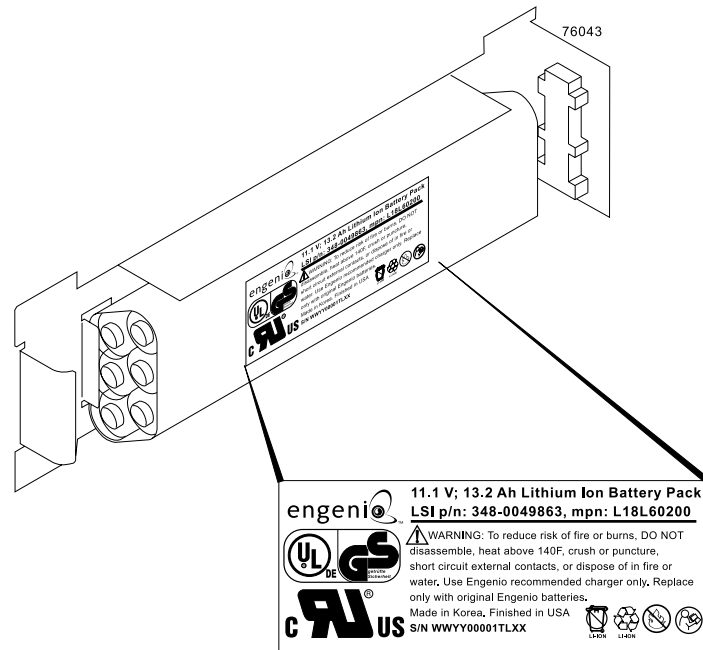
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**Warning:** Potentially hazardous material – If the used battery pack is physically damaged and is leaking, DO NOT ship it to a recycling center. Doing so exposes you and others to potentially hazardous material. You must dispose of damaged batteries according to local regulations, which may include procedures for handling batteries as a hazardous waste.

---

18. Dispose of the used battery pack according to local and federal regulations, which may include hazardous material handling procedures. Figure 8-13 shows the warning label on the battery.



**Figure 8-13** Battery Warning Label

19. After 24 hours, check the Needs Attention, and Battery lights to ensure that the battery is working properly.

If the battery is indicating a fault, use the storage management software to check the command module status and obtain the recovery procedure.

## Replacing an SFP Transceiver

Use the following procedure to replace an SFP transceiver in a controller canister.

The SFP transceiver shown in this procedure may look different from those you are using, but the difference will not affect transceiver performance.

## Tools and Equipment

- Antistatic protection
- Replacement SFP transceiver

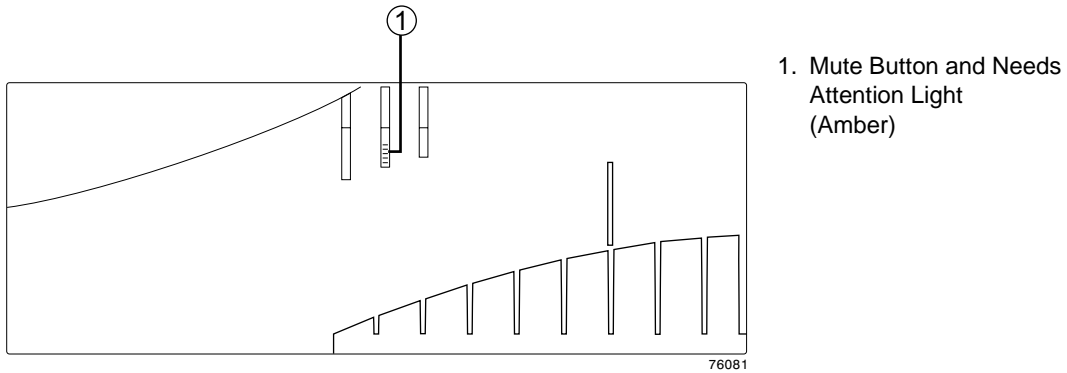
## Procedure

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**Caution: Electrostatic discharge damage to sensitive components** – To prevent electrostatic discharge damage to the command module, use proper antistatic protection when handling the module components.

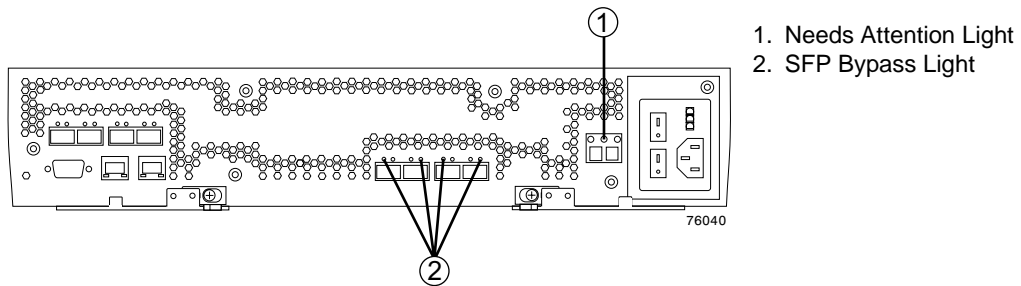
---

1. If the alarm is sounding, turn off the alarm by pressing the Mute button on the front cover of the command module.
2. Did you perform the “Troubleshooting the Controller Module” in Chapter 7 procedures and did the procedure direct you to replace a failed SFP transceiver?
  - **Yes** – Go to step 3.
  - **No** – To identify the failed component, perform the procedures in “Troubleshooting the Controller Module” on page 109. Perform the maintenance indicated by the procedure.
3. Use the storage management software to print a new storage array profile.
4. Locate the command module that has the failed SFP transceiver by checking the Needs Attention light on the front cover of the command module. (Figure 8-14 shows the location of the Needs Attention light on the front cover.)



**Figure 8-14** Needs Attention Light on the Enclosure Front Cover

5. Locate the failed SFP transceiver by checking the SFP Bypass light and Needs Attention light on the controller canisters. If a fault is detected, the lights will be on. Figure 8-15 shows the location of the controller canister SFP Bypass light and Needs Attention light on the controller canister.



**Figure 8-15** SFP Transceiver Bypass Lights

6. Put on antistatic protection.
7. Unpack the new SFP transceiver. Verify that it is the same type of transceiver you are replacing.

Save all packing materials in the event you might need to return the new SFP transceiver.

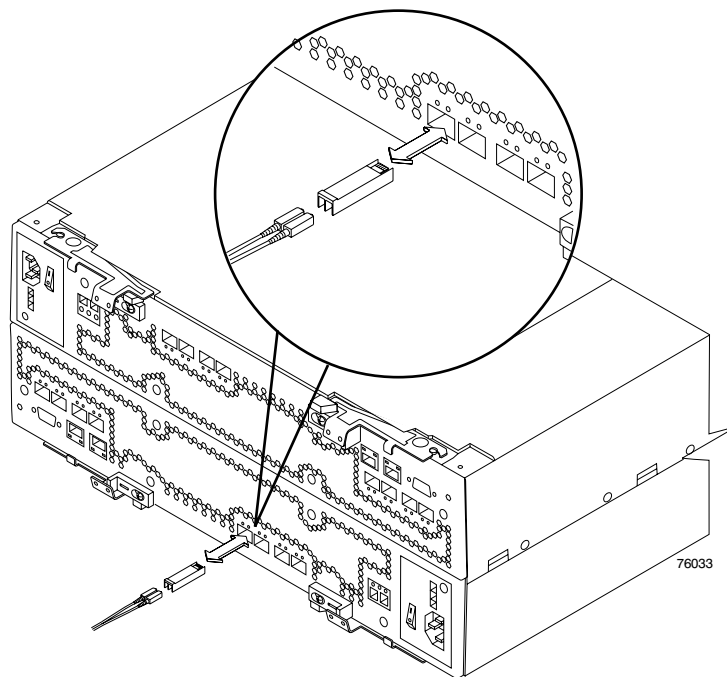
**Caution: Potential damage to fiber optic cables** – Fiber optic cables are fragile. Bending, twisting, folding, or pinching fiber optic cables can cause damage to the cables, degraded performance, or data loss. To prevent damage, do not twist, fold, pinch, or step on the cables. Do not bend the cables in less than a two-inch radius.

---

**Caution: Potential data loss** – Removing an SFP transceiver that has not failed can cause data loss. To prevent data loss, remove only the SFP that has a Bypass light on or a failed status in the storage management software.

---

8. Disconnect the interface cable from the SFP transceiver. (Figure 8-16 shows the SFP transceiver, interface cable, and the rear of a controller canister.)



**Figure 8-16** Replacing an SFP Transceiver

9. Remove the failed SFP transceiver from the controller canister.
10. Install the new SFP transceiver into the controller canister.



11. Reconnect the interface cable.
12. Check the Bypass and Needs Attention lights for the new SFP transceiver.  
Based on the status of the Bypass and Needs Attention lights, choose one of the following steps.
  - **Bypass light or Needs Attention light is illuminated** –The SFP transceiver and cables may be installed incorrectly, or the cable may not be securely connected. Reinstall the SFP transceiver and cable, check the cable connection, and then go to step 13.
  - **Bypass light and Needs Attention light are off** – Go to step 14.
13. Is the problem corrected?
  - Yes – Go to step 14.
  - **No** – Contact Customer and Technical Support.
14. Remove the antistatic protection.
15. Use the Array Management Window to check the status of all modules in the storage array.
16. Do any storage array modules have a Needs Attention (Needs Attention) status?
  - **Yes** – Select the Recovery Guru toolbar button in the Array Management Window and complete the recovery procedure. If the problem persists, contact Customer and Technical Support.
  - **No** – Go to step 17.
17. Use the storage management software to print a new storage array profile.



## Drive Enclosures

The drive enclosures are compact units that provides high-capacity disk storage for Fibre Channel environments. Drive enclosures contain the following components:

- Fibre Channel disk drives
- Redundant power supplies
- Redundant fans
- Redundant environmental status modules
- Fibre Channel interface

This chapter contains information about the drive enclosures in the following sections:

- “Enclosure Types” on page 159
- “Interface Connectors and Switches” on page 164
- “Drive Enclosure Components” on page 167

### Enclosure Types

This section describes the two types of drive enclosures: 10-drive enclosures and 14-drive enclosures. They share many of the same components and differ only in physical dimensions and capacity. Note that the 10-drive enclosure is *not* used with or supported by the TP9700 controller modules.

#### 10-Drive Enclosure for TP9500

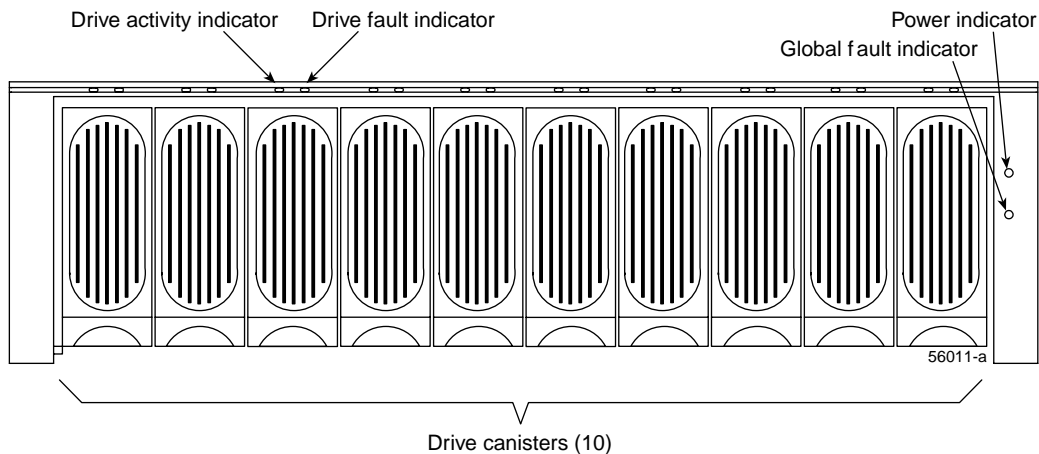
The 10-drive enclosure has the following features:

- Height equal to three rack units (1 rack unit = 1.75 in.)
- Holds up to 10 hot-pluggable dual-ported Fibre Channel drives (FC-AL)

- Supports 1-in. and 1.6-in. drive form factors
- Fault and activity indicators
- Redundant hot-pluggable power supplies
- Redundant hot pluggable environmental service modules (ESMs)
- Redundant cooling fans
- SFP drive enclosure interfaces

Figure 9-1 shows the components found on the front of the 10-drive enclosure:

- **Drive modules:** Ten removable modules containing disk drives. For more information on the drive modules, see “Drive Module” on page 167.
- **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.

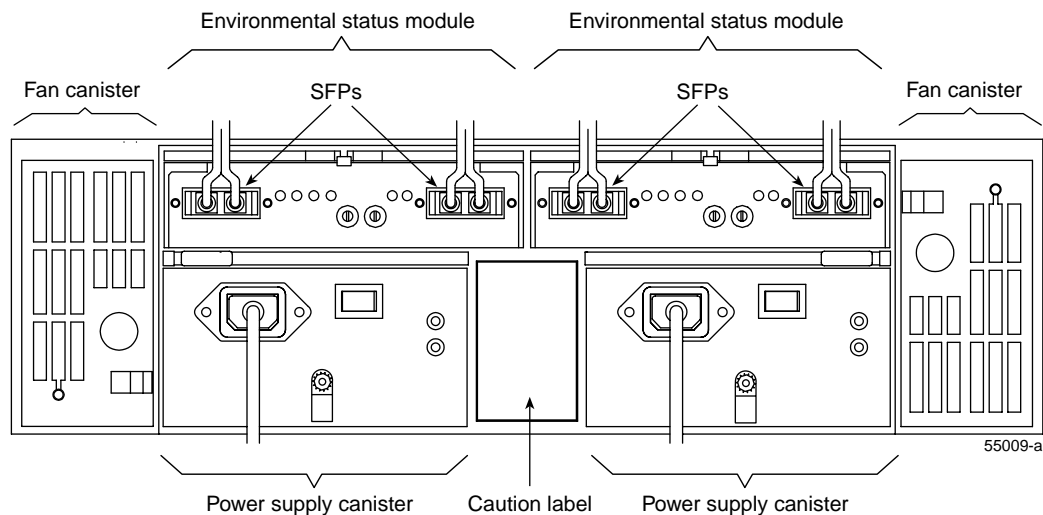


**Figure 9-1** Front View of the 10-Drive Enclosure

**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 (TPSSM) to diagnose and repair the problem. For more information on the indicators, see “Checking the Indicator Lights” on page 181.

Figure 9-2 shows the components found on the rear of the 10-drive enclosure:

- **Fan canisters:** Two removable canisters containing the cooling fans. For more information on the fan canisters, see “Fan Canister” on page 169.
- **Power supply canisters:** Two removable canisters containing the power supplies. For more information on the power supply canisters, see “Power Supply Canister” on page 170.
- **Environmental status modules:** Two removable canisters containing the interface board, called an ESM (environmental services monitor) board. Each canister has two slots for SFP transceivers. For more information on environmental status modules, see “Environmental Status Module” on page 172.
- **Indicators:** Each canister has indicators showing component status. See “Checking the Indicator Lights” on page 181 for details.



**Figure 9-2** Rear View of the 10-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 (TPSSM) to diagnose and repair the problem. For more information on the indicators, see “Checking the Indicator Lights” on page 181.

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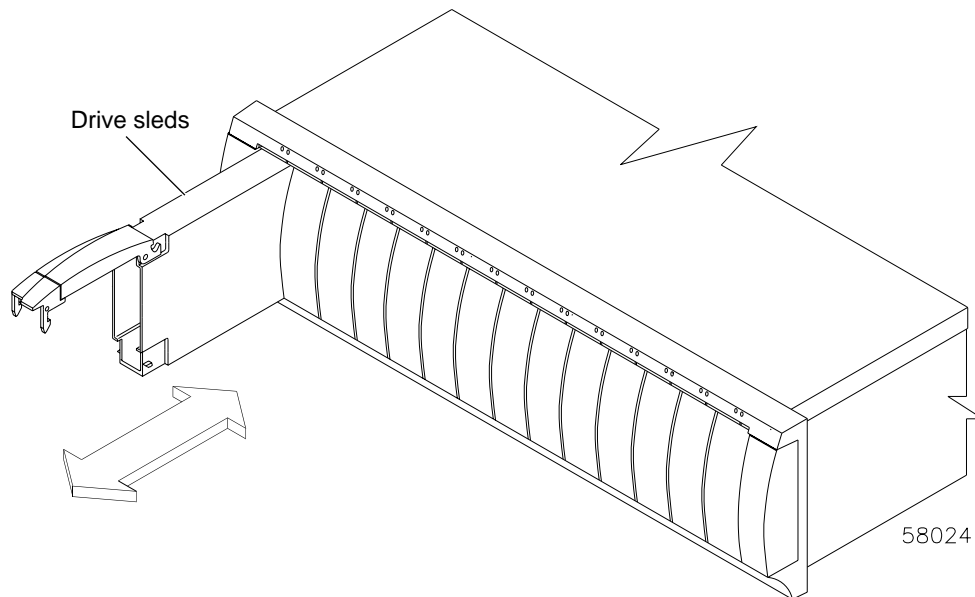
## 14-Drive Enclosure

The 14-drive enclosure has the following features:

- Height equal to three rack units (1 rack unit = 1.75 in.)
- Holds up to 14 hot-pluggable dual-ported Fibre Channel drives (FC-AL)
- Supports 1-in. drive form factor only
- Fault and activity indicators
- Redundant hot-pluggable power supplies
- Redundant hot-pluggable environmental service modules (ESMs)
- Redundant cooling fans
- SFP drive enclosure interfaces

Figure 9-1 shows the components on the front of the 14-drive enclosure as follows:

- **Drive modules:** Ten removable modules containing disk drives. For more information on the drive modules, see “Drive Module” on page 167.
- **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 9-3** 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 (TPSSM) to diagnose and repair the problem. For more information on the indicators, see “Checking the Indicator Lights” on page 181.

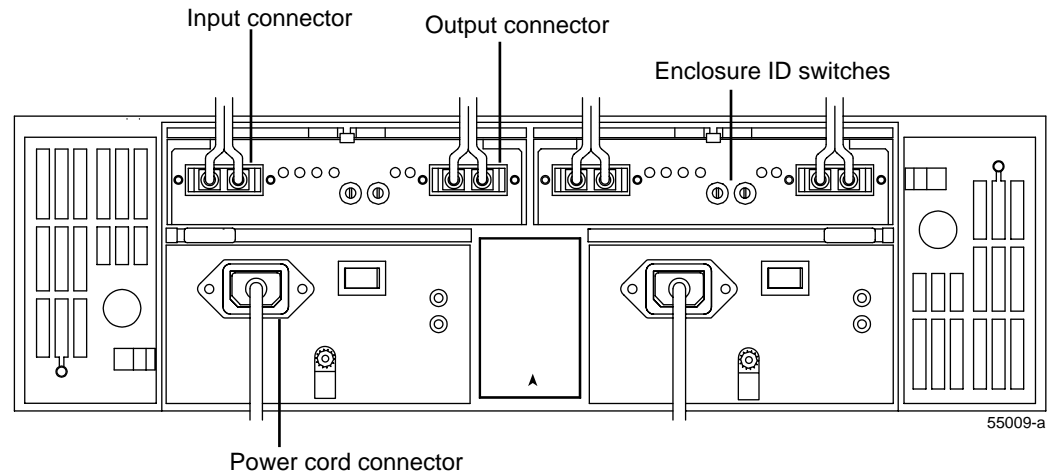
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Figure 9-2 shows the components on the rear of the 10-drive enclosure:

- **Fan canisters:** Two removable canisters containing the cooling fans. For more information on the fan canisters, see “Fan Canister” on page 169.
- **Power supply canisters:** Two removable canisters containing the power supplies. For more information on the power supply canisters, see “Power Supply Canister” on page 170.
- **Environmental status modules:** Two removable canisters containing the interface board, called an ESM (environmental services monitor) board. Each canister has two slots for SFP transceivers. For more information on environmental status modules, see “Environmental Status Module” on page 172.







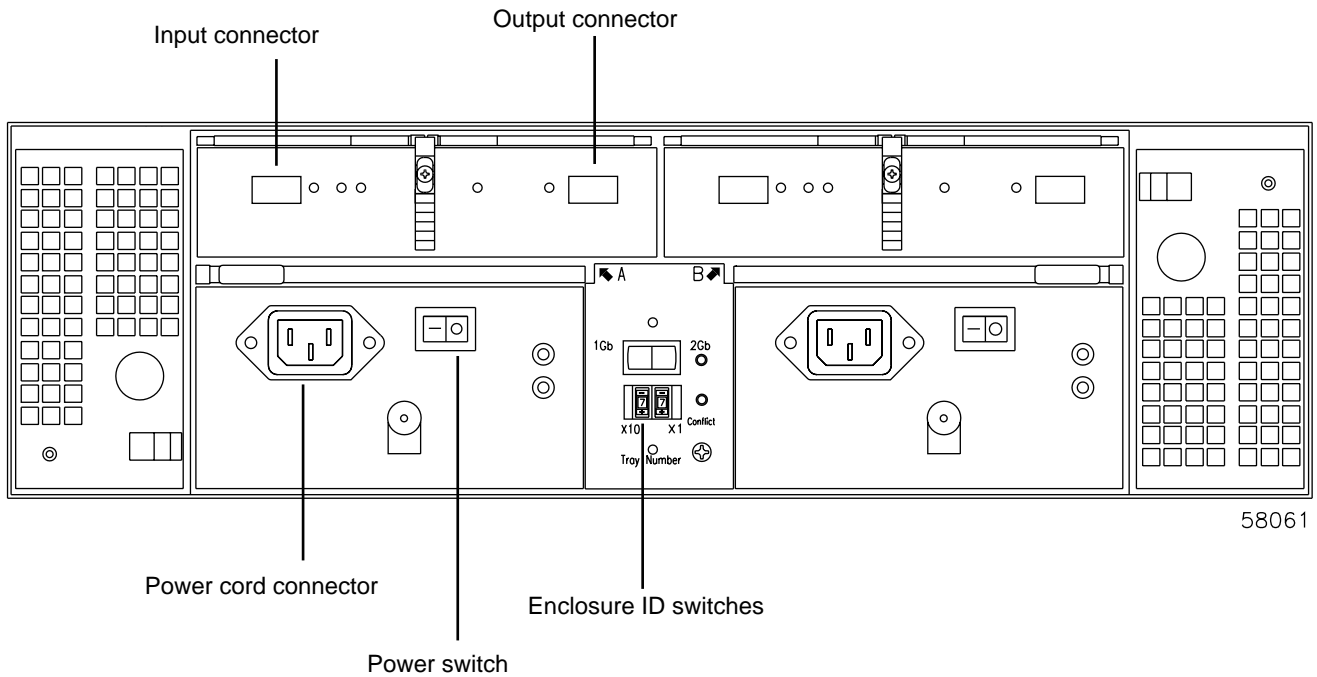
**Figure 9-5** Connectors and Switches on the 10-drive Enclosure (Rear)

**Table 9-1** Connectors and Switches on the 10-drive Enclosure (Rear)

Item	Description
Input and output connectors	The connectors are slots that contain an optical SFP. Each canister has two slots, one In and one Out. The SFPs convert the Fibre Channel signals to electrical signals. All drives are accessible from either environmental status module.
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 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.

## Connectors and Switches on the 14-drive Enclosure

Figure 9-6 shows the connectors and switches on the rear of the 14-drive enclosure. Table 9-2 describes these items.



**Figure 9-6** Connectors and Switches on the 14-drive Enclosure

**Table 9-2** Connectors and Switches on the 14-drive Enclosure (Rear)

Item	Description
Input and output connectors	The connectors are slots that contain an optical SFP. Each canister has two slots, one In and one Out. The SFPs 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 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

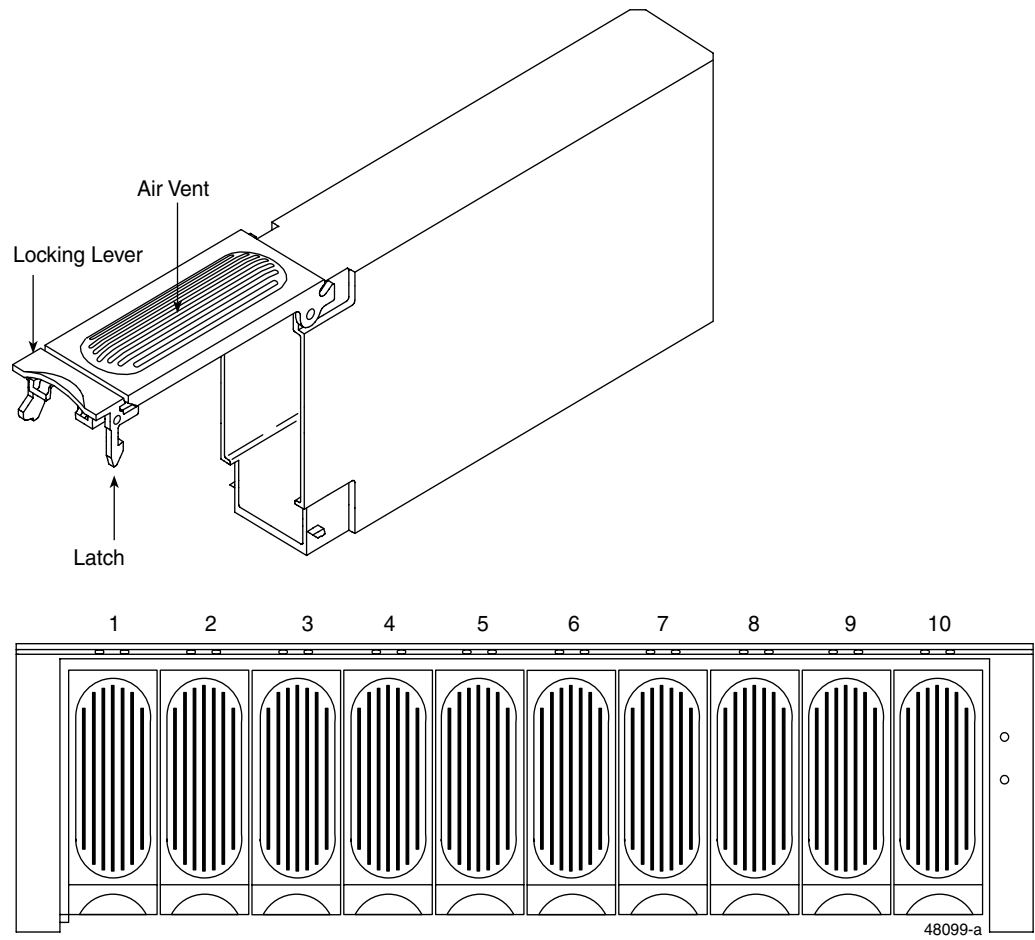
The drive enclosure contains several owner-removable and owner-replaceable components called “canisters.” The following sections describe each of these components as follows:

- “Drive Module” on page 167
- “Fan Canister” on page 169
- “Power Supply Canister” on page 170
- “Environmental Status Module” on page 172
- “SFP Transceivers” on page 173

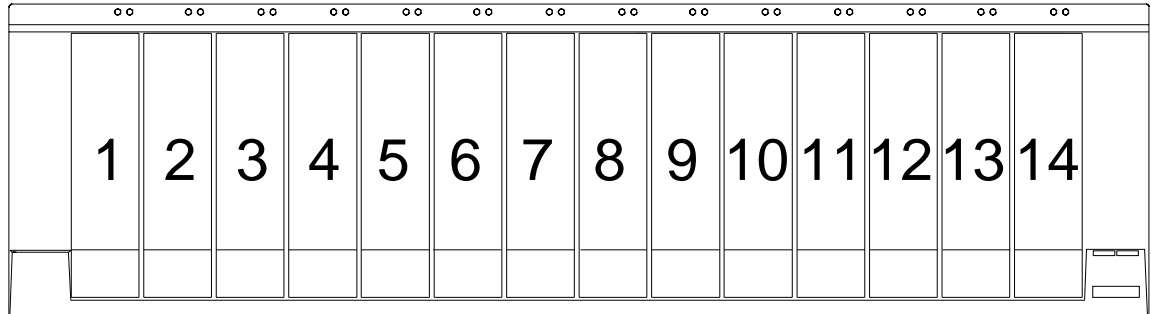
### Drive Module

All disk drives are housed in portable drive modules (see Figure 9-7) that plug directly into one of the 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 from left to right, as shown in Figure 9-7 and Figure 9-8.



**Figure 9-7** Drive Module Numbering on the 10-Drive Enclosure



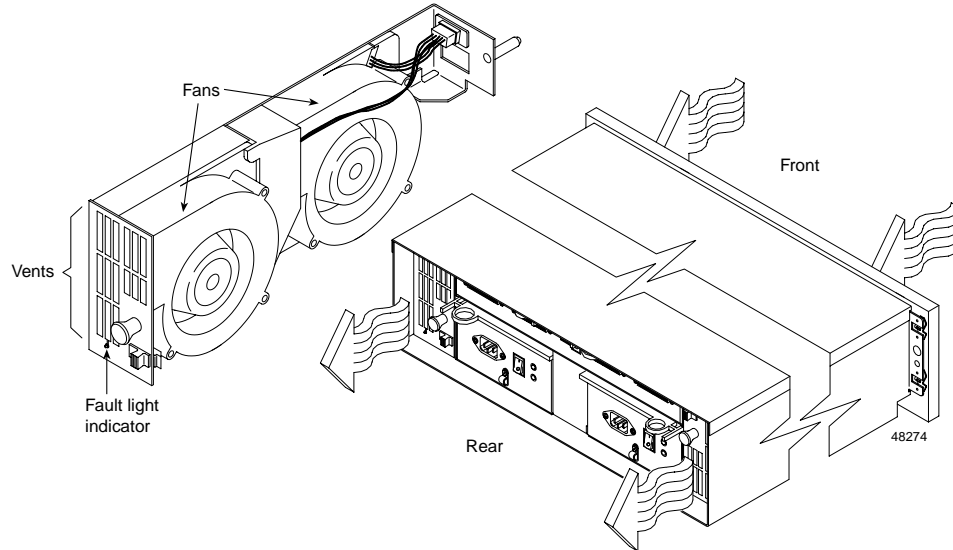
58012

**Figure 9-8** Drive Module Numbering on the 14-Drive Enclosure

## 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 (see Figure 9-9). 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 (see Figure 9-9) that serve as air intake and exhaust passages. Always keep vents clean and free of obstructions.



**Figure 9-9** Fan Canister and Drive Enclosure Air Flow

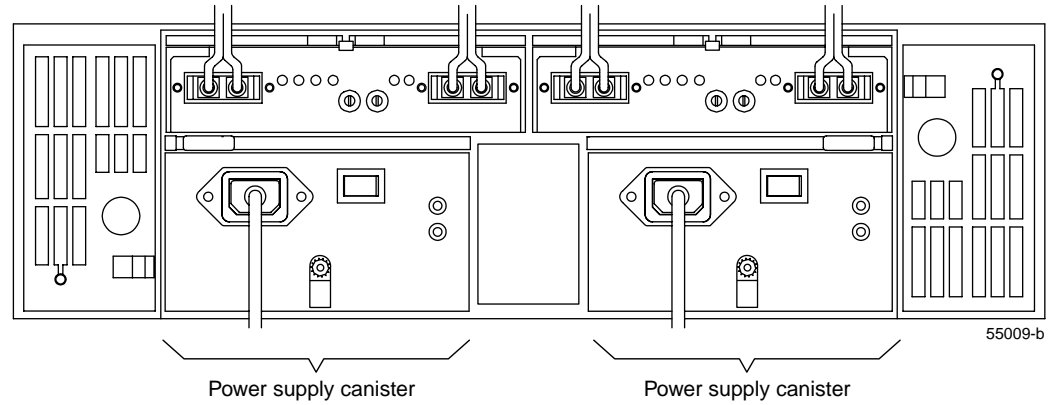


**Warning:** To avoid damage to the internal components and circuitry, do not run the drive enclosure without adequate ventilation and cooling. In the unlikely event that more than one fan fails at the same time, shut down the drive enclosure immediately.

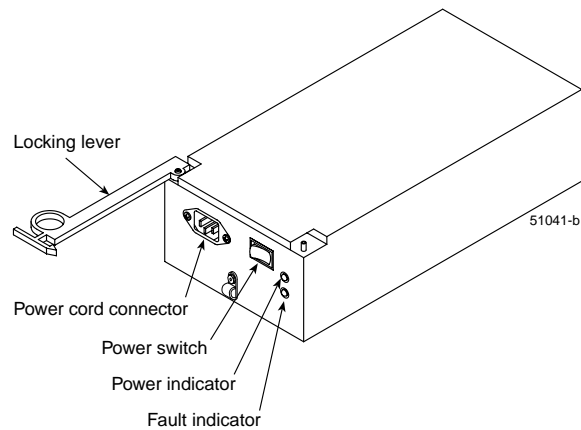
If both fan canisters fail or cannot maintain the internal temperature below 70 °C (158 °F), the drive enclosure will automatically shut down. If this occurs, you must cool the drive enclosure and restart it. See “Troubleshooting an Overtemp Condition” on page 177 for more information.

## Power Supply Canister

The drive enclosure’s power system consists of two power supply canisters (see Figure 9-10). 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 (see Figure 9-11).



**Figure 9-10** Power Supply Canisters in a Drive Enclosure



**Figure 9-11** Power Supply Canister

Each of the power supply canisters has a built-in sensor that detects the following conditions:

- Over-voltage
- Over-current
- Overheated power supply

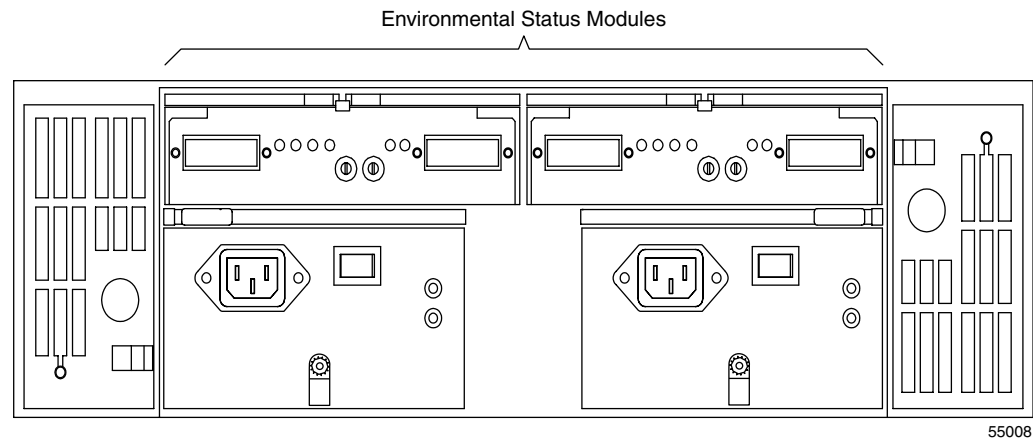
If any of these conditions occurs, one or both power supplies will shut down. All power remains off until you cycle the power switches. (To do so, turn the power switches off,

wait at least 30 seconds, and then turn the power switches on). See “Troubleshooting an Overtemp Condition” on page 177 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.

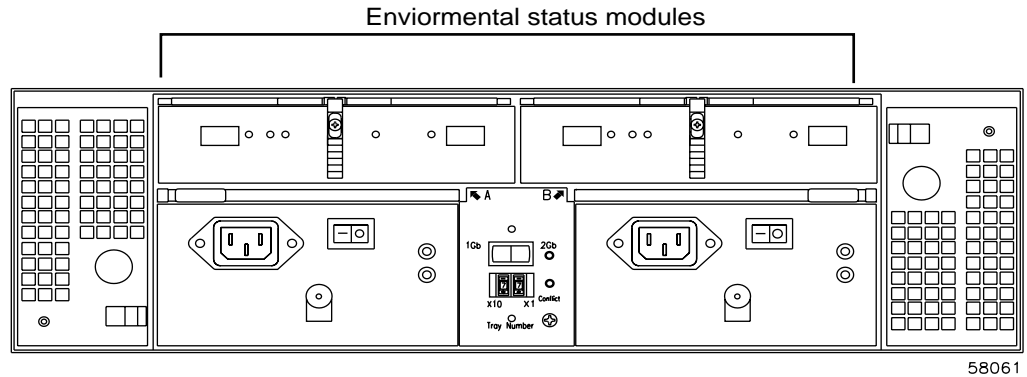
## Environmental Status Module

Each environmental status module contains an ESM (environmental services monitor) board and two slots for SFPs. 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 enclosures, as shown in Figure 9-12 and Figure 9-13.



**Figure 9-12** Environmental Status Modules in the 10-drive Enclosure



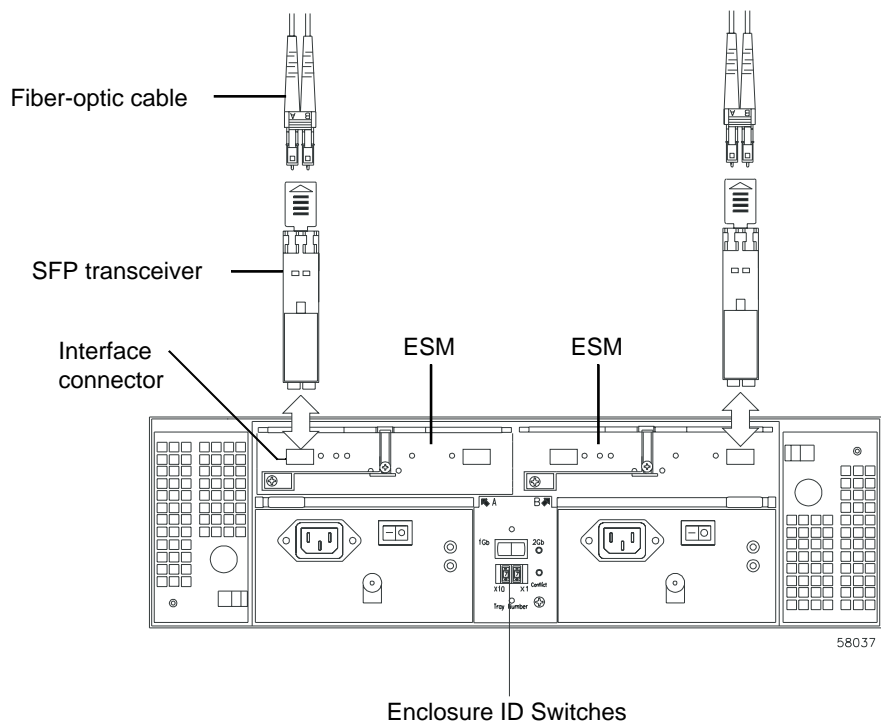


**Figure 9-13** Environmental Status Modules in the 14-drive Enclosure

See “Checking the Indicator Lights” on page 181 for descriptions of the environmental status module indicators.

## SFP Transceivers

An SFP (small form-factor pluggable) transceiver fits into the environmental status module located at the rear of the drive enclosure (see Figure 9-14). Each environmental status module has up to two optical SFP transceivers which are replaceable. You can hot-swap a failed SFP transceiver, replacing it while the drive enclosure is in operation.



**Figure 9-14** Fibre Channel Cables and SFPs

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

## Operation of Drive Enclosures

This chapter describes the operation of the drive enclosure in the following sections:

- “Turning the Power On” on page 175
- “Turning the Power On after an Unexpected Shutdown” on page 176
- “Turning the Power Off” on page 179
- “Monitoring Status with Software” on page 180
- “Checking the Indicator Lights” on page 181
- “Moving the Drive Enclosure” on page 188

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**Note:** All of the procedures in this chapter apply to both the 10-drive and 14-drive enclosures.

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### Turning the Power On

If the drive enclosure was turned off due to an unexpected shutdown or a power failure, follow the instructions in “Turning the Power On after an Unexpected Shutdown” on page 176.



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**Danger:** Severe electrical shock can occur. 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.

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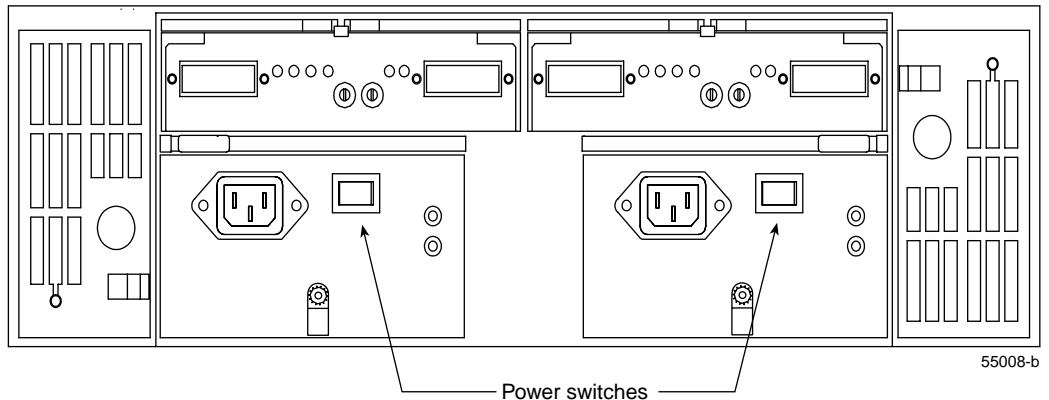
To turn on the drive enclosure after a normal shutdown (as described in “Turning the Power Off” on page 179), turn on both power switches on the rear of the drive enclosure

(see Figure 10-1) 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 10-1** 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 (TPSSM) 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 “Troubleshooting an 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 (in “Turning the Power Off” on page 179) due to an emergency situation.

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



**Warning:** 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 (TPSSM) to determine if the drive enclosure has overheated.

- If an overtemp condition is indicated, follow the steps in “Turning the Power On After an Overtemp Shutdown” on page 178 to restart the drive enclosure.
- If the drive enclosure has shut down because of a power failure or an emergency shutdown, follow the steps in “Turning the Power On after an Emergency Shutdown” on page 178 to restart the drive enclosure.

## Troubleshooting an 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 (TPSSM) 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 comes on if the temperature reaches 40 °C (104 °F). If both power supplies shut down, the overtemp indicator cannot

come on. See Figure 10-4 and Figure 10-5 for the locations of the overtemp indicators on the 10- and 14-drive enclosures.

## Turning the Power On After an Overtemp Shutdown

To restart the drive enclosure after a unexpected shutdown due to an overtemp condition, follow these steps:

1. Turn off both power switches (see Figure 10-1).
2. Do whatever is necessary to cool the drive enclosure (replace the fans, use external fans to cool the room, and so on).



---

**Danger:** Severe electrical shock can occur. 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 on.
5. Use the storage management software (TPSSM) and the drive fault indicators (see “Checking the Indicator Lights” on page 181) to check the overall status of the drive enclosure and its components. Repair any faults found.

## Turning the Power On after an Emergency Shutdown

To restart the drive enclosure after a power failure or emergency shutdown, follow these steps:

1. After the emergency situation is over or power is restored to the site, turn off all power switches (see Figure 10-1).



---

**Danger:** Severe electrical shock can occur. 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 (see Figure 10-1).
4. Use the storage management software (TPSSM) and the drive fault indicators (see “Checking the Indicator Lights” on page 181) 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. To turn the power off, follow these steps:

1. Use the storage management software (TPSSM) 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 (TPSSM) 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 (see Figure 10-2 and Figure 10-3).

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



**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. The brick will continue to operate if both switches are not turned off and both cords are not disconnected.

---

4. Turn off both power switches on the rear of the drive enclosure or the main circuit breaker, whichever is applicable (see Figure 10-1).

**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 in “Turning the Power On” on page 175.

## Monitoring Status with Software

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

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

- 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 (TPSSM) 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 (TPSSM) 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 (TPSSM) provides these procedures.



---

**Caution:** If the software recovery procedures are not followed, data loss can result.

---

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**Note:** For more information on the storage management software (TPSSM), see the *SGI TPSSM Administration Guide* (007-4306-00x), the *SGI TPSSM Software Concepts Guide* (007-4305-00x), and the *SGI Storage Area Network Installation Instructions* (108-0252-00x).

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## Checking the 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 10-2 and Figure 10-4, an amber light indicates a drive enclosure component failure. If you see an amber indicator, run the storage management software (TPSSM) to diagnose and repair the problem.

To check the 10-drive enclosure indicators and operating status, follow the guidelines in Table 10-1 on page 183 (front indicators) and Table 10-3 on page 186 (rear indicators). If any indicators show anything other than a “normal” status, run the storage management software (TPSSM) to diagnose and repair the problem.

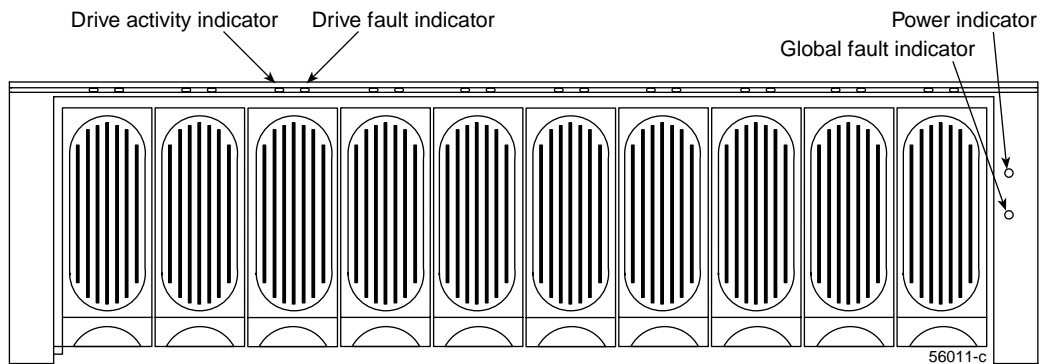
To check the 14-drive enclosure indicators and operating status, follow the guidelines in Table 10-2 on page 184 (front indicators) and Table 10-4 on page 187 (rear indicators). If any indicators show anything other than a “normal” status, run the storage management software (TPSSM) to diagnose and repair the problem.

## Front Indicator Lights

This section describes the front indicator lights for the 10-drive enclosure and the 14-drive enclosure.

### Front Indicator Lights on the 10-drive Enclosure

Figure 10-2 shows the front indicators for the 10-drive enclosure.



**Figure 10-2** Front Indicator Lights on the 10-Drive Enclosure

**Note:** The normal operating state of all indicators on the front panel is green. If an amber indicator is on, or a green indicator is off, use the storage management software (TPSSM) 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 (TPSSM) is locating a drive enclosure component. It does not indicate a failure.

Table 10-1 describes the front indicator lights on the 10-drive enclosure.

**Table 10-1** Front Indicator Lights on the 10-drive Enclosure

Indicator Light	Color	Normal Operation	Problem Indicator	Condition Indicated <sup>a</sup>
Drive activity indicator	Green	On, steady On, blinking <sup>b</sup>	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 <sup>c</sup>	On, steady	Drive failure; drive failed by user.
Power indicator	Green	On	Off	No power to drive enclosure; no power to storage array; power supply failure; overtemp condition.
Global fault indicator <sup>d</sup>	Amber	Off	On	Drive enclosure component failure.

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

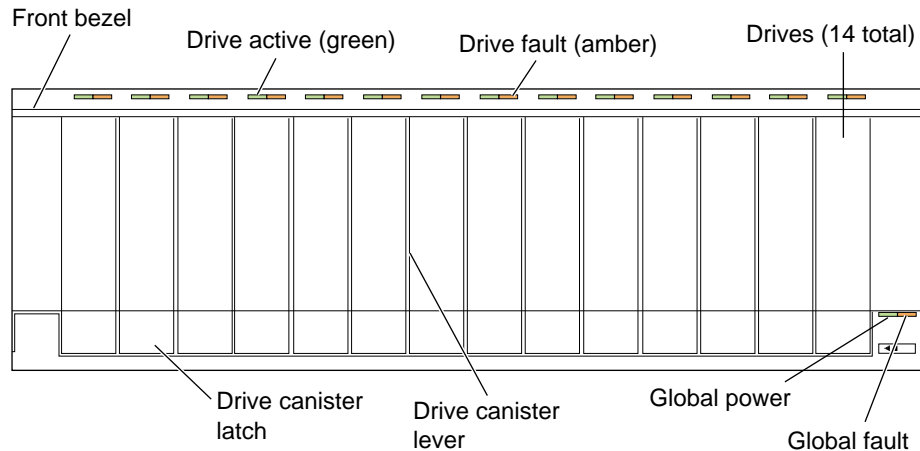
b. The drive activity indicator blinks if data is being processed on the drives; otherwise, the indicator is on, steady.

c. The drive fault indicator blinks when the storage management software (TPSSM) 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 “Monitoring Status with Software” on page 88 for more information.

### Front Indicator Lights on the 14-drive Enclosure

Figure 10-3 shows the front indicators on the 14-drive enclosure.



**Figure 10-3** Front Indicator Lights on the 14-Drive Enclosure

Table 10-2 describes the front indicators on the 14-drive enclosure.

**Table 10-2** Front Indicator Lights on the 14-drive Enclosure

Indicator Light	Color	Normal Operation	Problem Indicator	Condition Indicated <sup>a</sup>
Drive activity indicator	Green	On, steady On, blinking <sup>b</sup>	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 <sup>c</sup>	On, steady	Drive failure; drive failed by user.
Power indicator	Green	On	Off	No power to drive enclosure; no power to storage array; power supply failure; overtemp condition.
Global fault indicator <sup>d</sup>	Amber	Off	On	Failure of drive enclosure component.

a. Always use the storage management software (TPSSM) 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 (TPSSM) is locating a drive, volume, or storage array. Otherwise, it is off.

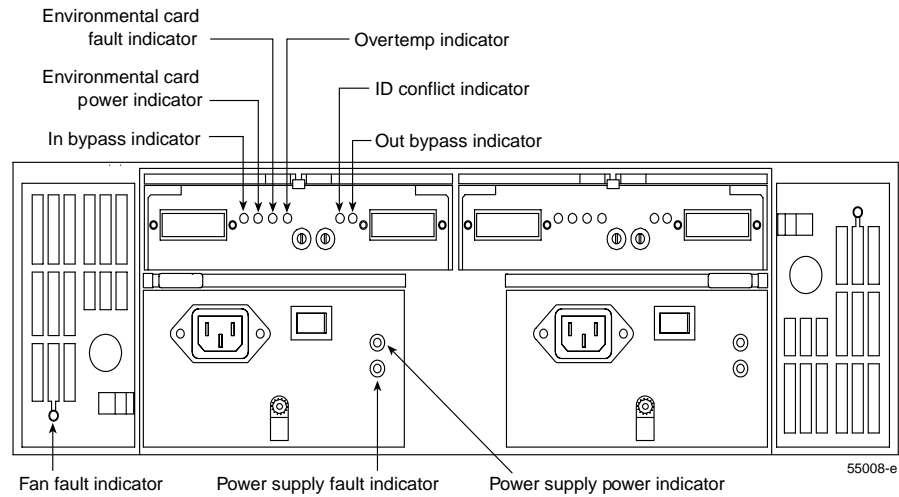
d. Not all drive enclosure component failures will turn this light on. See “Monitoring Status with Software” on page 88 for more information.

## Rear Indicator Lights

This section describes the rear indicator lights for the 10-drive and the 14-drive enclosures.

### Rear Indicator Lights on the 10-drive Enclosure

Figure 10-4 shows the rear indicators on the 10-drive enclosure.



**Figure 10-4** Rear Indicator Lights on the 10-Drive Enclosure

Table 10-3 describes the rear indicators on the 10-drive enclosure.

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

**Table 10-3** Rear Indicator Lights on the 10-drive Enclosure

Component	Indicator Light	Color	Normal Operation	Problem Indicator	Condition Indicated <sup>a</sup>
Environmental status module	Environmental card fault indicator	Amber	Off	On, steady	Failure of environmental card canister.
	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 <sup>b</sup>	On, steady <sup>c</sup>	SFP failure; cable failure; controller enclosure minihub failure.
	Overtemp indicator <sup>d</sup>	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 (TPSSM) to precisely identify a failure.

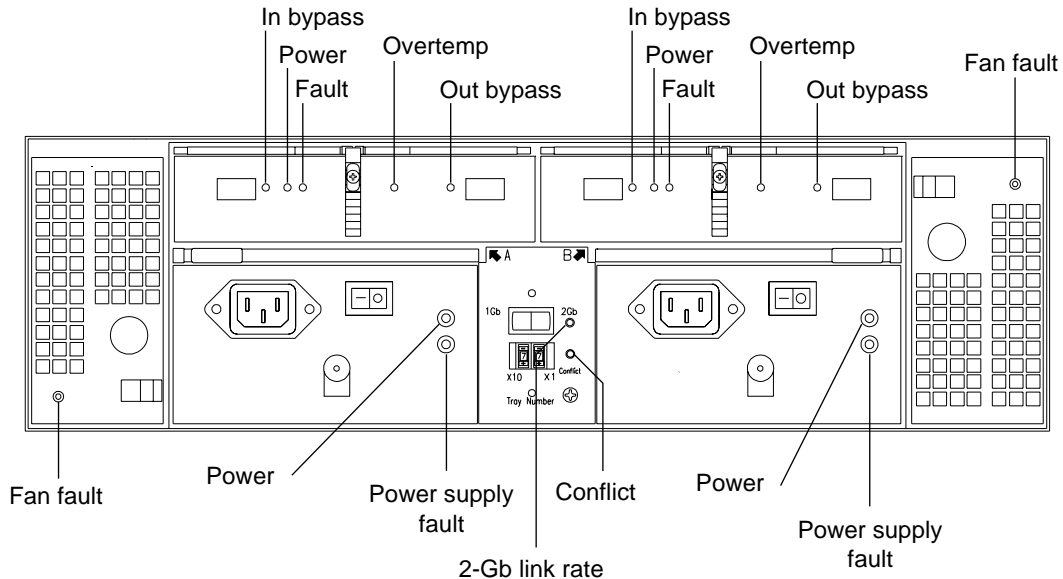
b. If nothing is connected to the corresponding connector, this fault light is on. If a cable is connected and it is functioning properly, this light is off.

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

d. The overtemp indicator comes on if the internal drive enclosure temperature reaches 40 °C (104 °F). See “Troubleshooting an Overtemp Condition” on page 85 for more information.

### Rear Indicator Lights on the 14-drive Enclosure

Figure 10-5 shows the rear indicators on the 14-drive enclosure.



**Figure 10-5** Rear Indicator Lights on the 14-Drive Enclosure

Table 10-4 describes the rear indicators on the 14-drive enclosure.

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

**Table 10-4** Rear Indicator Lights on the 14-drive Enclosure

Component	Indicator Light	Color	Normal Operation	Problem Indicator	Condition Indicated <sup>a</sup>
Environmental status module	Environmental card fault indicator	Amber	Off	On, steady	Failure of environmental card canister.
	Environmental card power indicator	Green	On, steady	Off	No power to drive enclosure; no power to storage array; overtemp condition; power supply failure.
	In and out bypass indicators	Amber	Off On, steady <sup>b</sup>	On, steady <sup>c</sup>	SFP failure; cable failure; controller enclosure minihub failure.
	Overtemp indicator <sup>d</sup>	Amber	Off	On, steady	Overtemp condition; fan failure.

**Table 10-4** Rear Indicator Lights on the 14-drive Enclosure **(continued)**

Component	Indicator Light	Color	Normal Operation	Problem Indicator	Condition Indicated <sup>a</sup>
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.
Enclosure ID Switches	ID conflict indicator	Amber	Off	On, steady	Enclosure number is set incorrectly; enclosure number is in use by another subsystem on the loop.
	Link rate indicator	Green	On or off	None	When lit, data transfer rate is set to 2 Gb. When off, data transfer rate is 1 Gb.

- a. Always use the storage management software (TPSSM) 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 SFP is plugged into the corresponding connector (see footnote a). Also, more than one Bypass indicator will be on if the connection fails. Usually, if an SFP fails, its bypass indicator will come on, as will the bypass indicator of the SFP to which it is connected.
- d. The overtemp indicator comes on if the internal drive enclosure temperature reaches 40 °C (104 °F). See “Troubleshooting an Overtemp Condition on page 85 for more information.

## 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, see Chapter 11, “Replacement of Drive Enclosure Components” 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. 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.

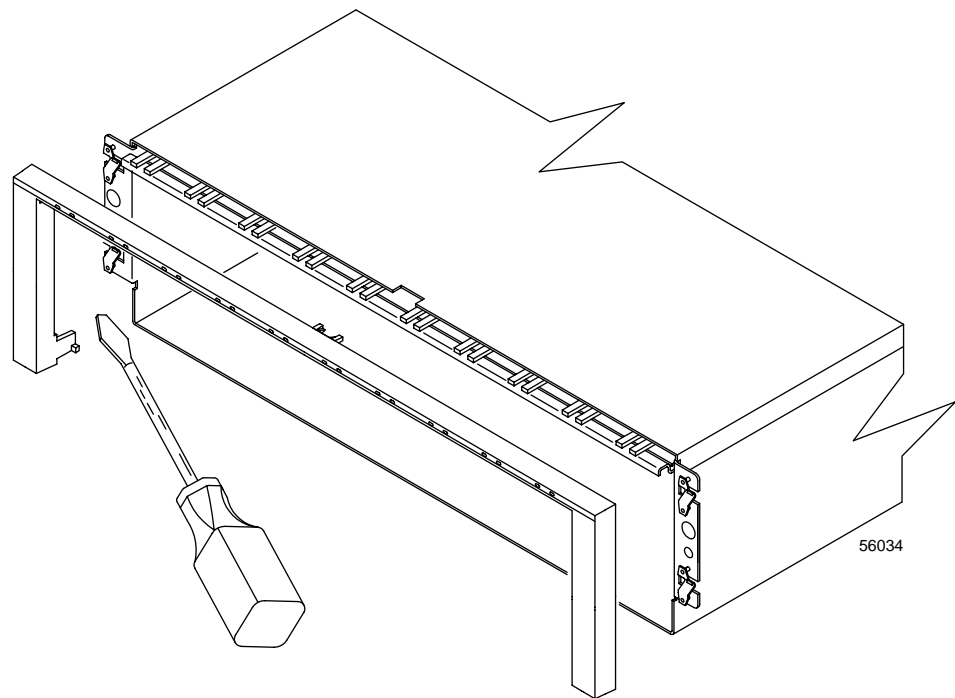
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## Removing the Drive Enclosure

To remove and reinstall the drive enclosure, follow these steps:

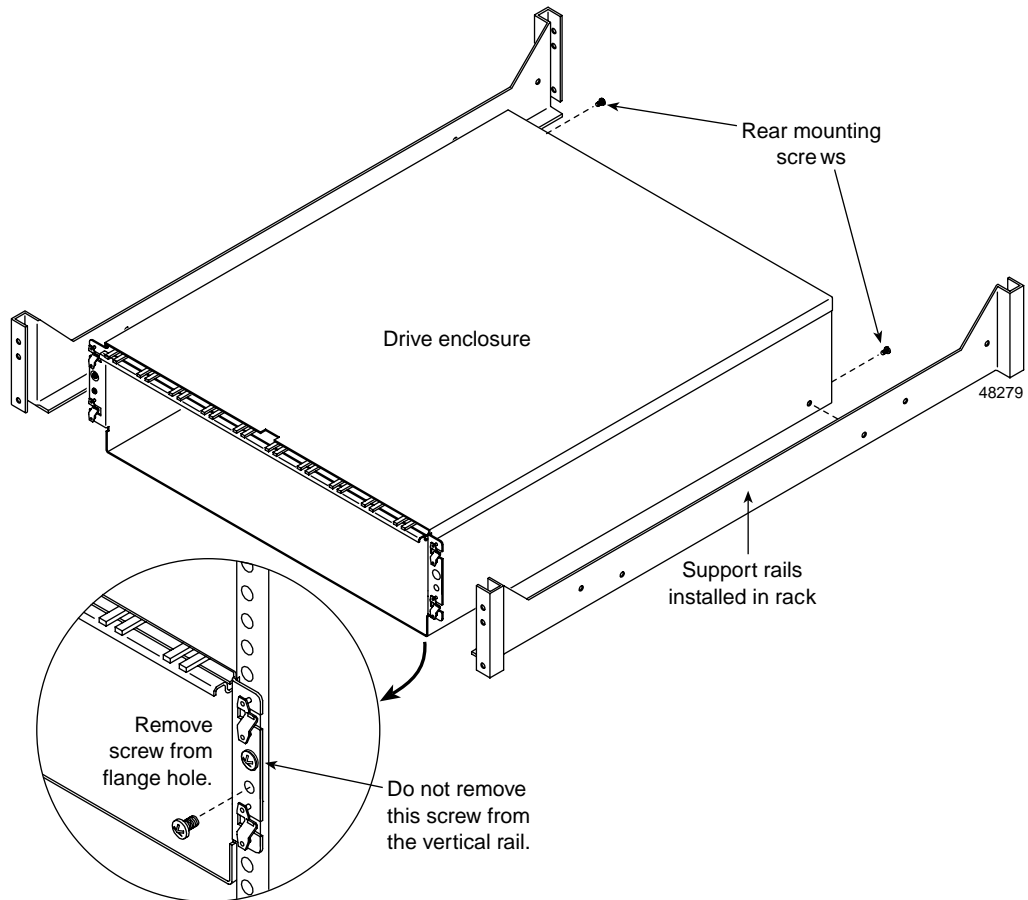
1. Remove the front bezel from the drive enclosure (see Figure 10-6).

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 10-6** 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 11, "Replacement of Drive Enclosure Components".
3. Remove the front and rear mounting screws (see Figure 10-7). 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 10-7** 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

To reinstall the drive enclosure into a rack, follow these steps:

1. Install the support rails in the rack. See the procedure in the *SGI TP9500 RAID Installation and Upgrade Guide* (108-0375-00x).
2. From the front of the rack, slide the drive enclosure into the rack along the support rails (see Figure 10-7).
3. Fasten the rear and front mounting screws (see Figure 10-7).
4. Slide the top of the front bezel over the indicator lights and snap into place (see Figure 10-6).
5. Wearing antistatic protection, reinstall the components into the drive enclosure. For more information, see Chapter 11, "Replacement of Drive Enclosure Components".



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## Replacement of Drive Enclosure Components

This chapter describes the replacement of each component in the drive enclosure in the following sections:

- “Replacing a Failed Drive Module” on page 193
- “Replacing a Failed Fan Canister” on page 196
- “Replacing a Failed Power Supply Canister” on page 198
- “Replacing a Failed SFP Transceiver” on page 201
- “Replacing a Failed Environmental Status Module” on page 203
- “Upgrading Drives” on page 206
- “Adding Drive Enclosures” on page 209

### Replacing a Failed Drive Module

When the storage management software (TPSSM) instructs you to replace a failed drive module, read the section titled “Drive Module” on page 167, and then follow these steps:



**Warning:** 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 (TPSSM) for instructions on drive failure recovery procedures. Follow any steps given by the software before proceeding.



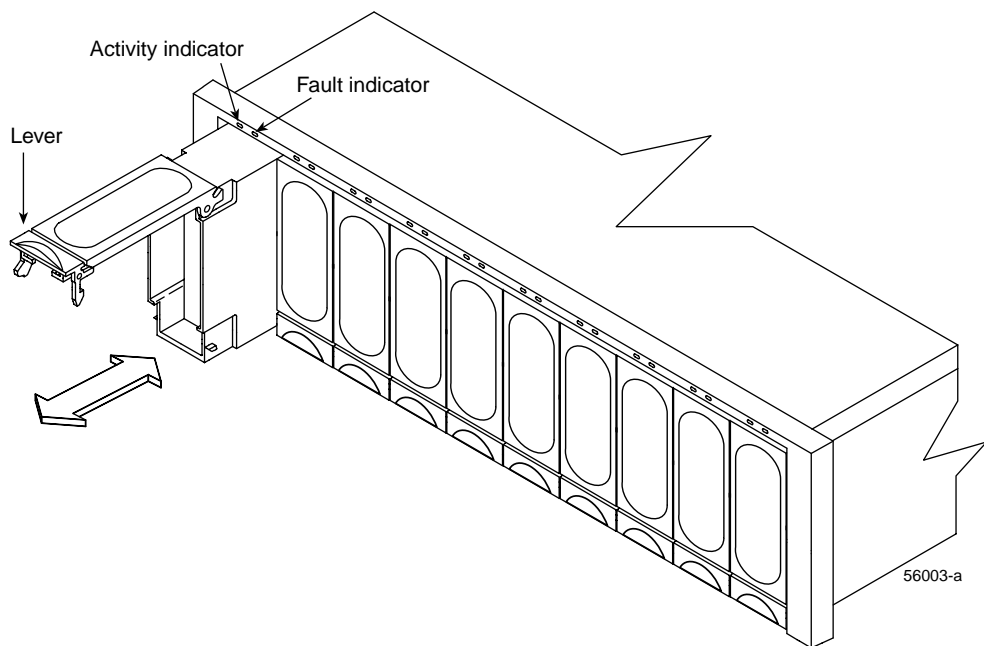
**Caution:** Removing the wrong drive can cause data loss. Ensure that you remove only the failed drive. The drive fault indicator will be illuminated amber above the failed drive module.

Removing a drive module 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. See the storage management software (TPSSM) for further recovery instructions.

---

2. Locate the failed drive module (its fault light should be on).
3. Wearing antistatic protection, lift (open) the lever of the failed drive module.
4. Pull out the drive module (see Figure 11-1).



**Figure 11-1** Removing and Installing a Drive Module

5. Wait at least 30 seconds for the drive to spin down. Then remove the failed drive module from the enclosure.
6. Unpack the new drive module. Save all packing materials in case you need to return the module.

7. Review all documentation shipped with the new drive 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.
8. Wearing antistatic protection, slide the new drive module 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 module.  
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 module.

---

- If the activity indicator is off, the drive module could be installed incorrectly. Remove the drive module, 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. Check the storage management software (TPSSM) to determine the problem.
11. Refer to applicable software procedures (the storage management software (TPSSM) or other system software) for instructions on bringing the drive module back online.

---

**Important:** Depending on your storage array configuration, the storage array may automatically reconstruct data to the new drive module. 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 (TPSSM) to determine the current status of the new drive and the progress of any reconstruction or copyback.

---

## Replacing a Failed Fan Canister

When the storage management software (TPSSM) instructs you to replace a failed fan canister, read the section titled “Fan Canister” on page 169, then follow these steps:



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**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 (TPSSM) for instructions on fan canister failure recovery procedures. Follow any steps given by the software before proceeding.
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 (TPSSM) instructs you to do so, turn off the power to the drive enclosure. Otherwise, leave the power on.



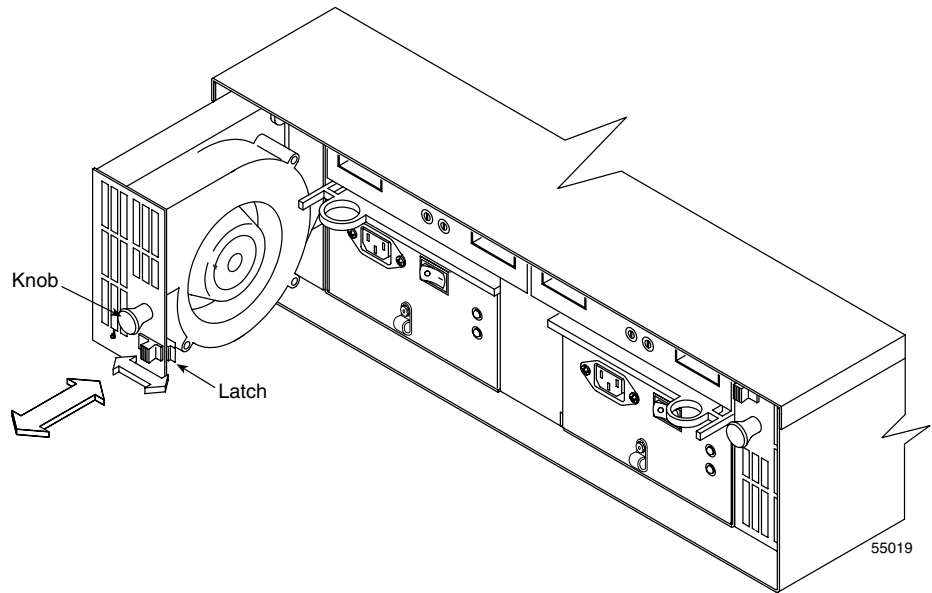
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**Caution:** To prevent the drive enclosure from overheating while in use, complete the fan canister replacement procedure within 15 minutes from the time you remove the failed fan canister to the time you install the new fan canister. Both fan canisters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

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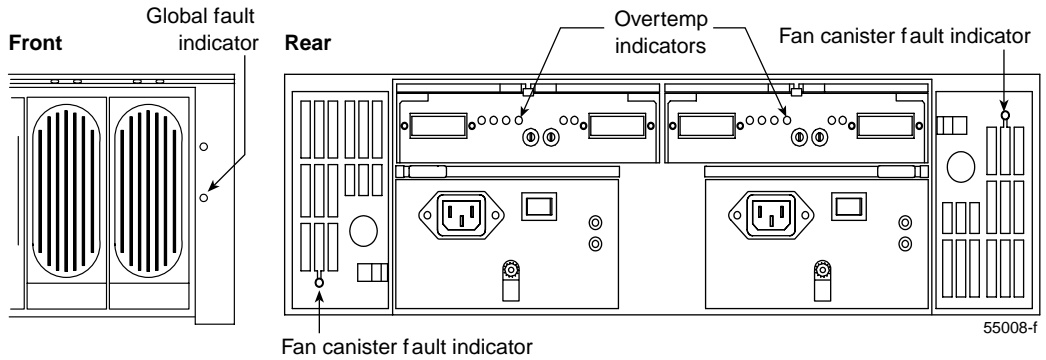
5. Locate the failed fan canister (its fault light should be on).
6. Wearing antistatic protection, slide the latch to unlock the canister (see Figure 11-2). The latch is at the bottom of the left-side fan canister, and at the top of the right-side fan canister.





**Figure 11-2** 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 11-3.



**Figure 11-3** Fault Lights for Fan Canister Replacement

- If the fan fault indicator is on or the fans are not spinning, the canister might be installed incorrectly. Remove the fan canister and reinstall it.
- If any of the other fault indicators shown in Figure 11-3 are on, check the storage management software (TPSSM) to determine the problem.

## Replacing a Failed Power Supply Canister

When instructed by the storage management software (TPSSM) to replace a failed power supply canister, rear the section titled “Power Supply Canister” on page 170, and then follow these steps:



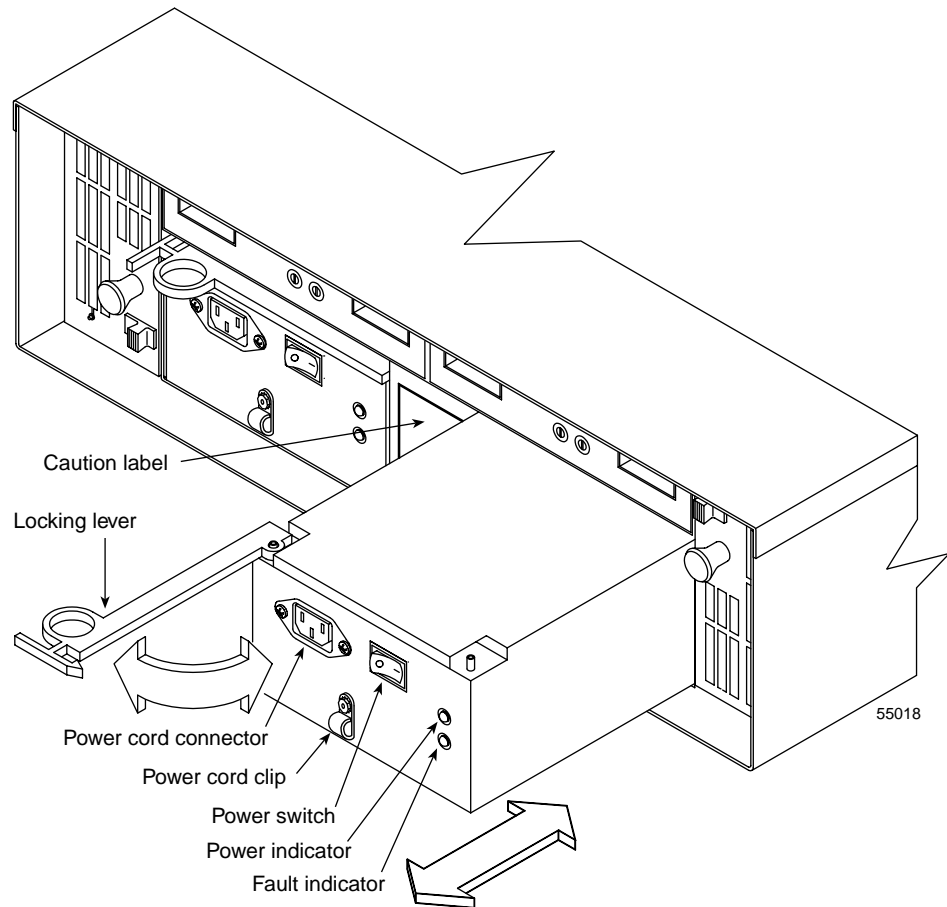
---

**Warning:** 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 (TPSSM) for instructions on power supply failure recovery procedures. Follow any steps given by the software procedure before you proceed.
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 (see Figure 11-4).



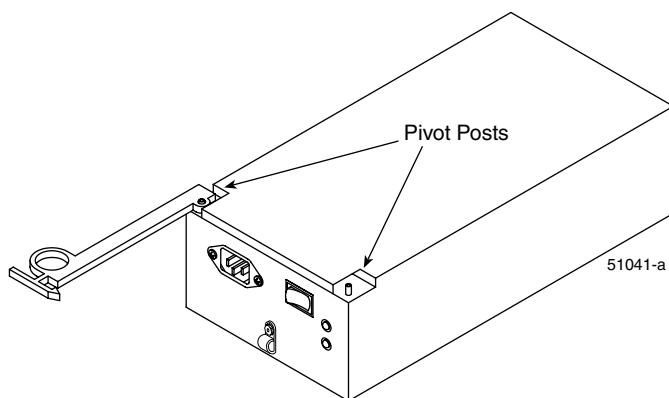
**Figure 11-4** Removing and Installing a Power Supply Canister



**Danger: Shock can occur. 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 the tab against the ring to unlatch the lever (see Figure 11-4).
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 (see Figure 11-5).



**Figure 11-5** Lever on Power Supply Canister



**Danger: Shock can occur. 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 (see Figure 11-4).
  - If the power indicator is off, the canister might be installed incorrectly. Remove it and reinstall it.
  - If the fault indicator is on, or the power indicator stays off, check the storage management software (TPSSM) to determine the problem.

## Replacing a Failed SFP Transceiver

To replace a failed SFP Transceiver, read the section titled “SFP Transceivers” on page 173, and then follow these steps:



---

**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 (TPSSM) for instructions on SFP failure recovery procedures. Follow any steps given by the software before you proceed.
2. Unpack the new SFP transceiver. Set it on a dry, level surface near the drive enclosure. Save all packing materials in case you need to return the SFP transceiver.
3. Review all documentation shipped with the new SFP transceiver 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 SFP transceiver.

---

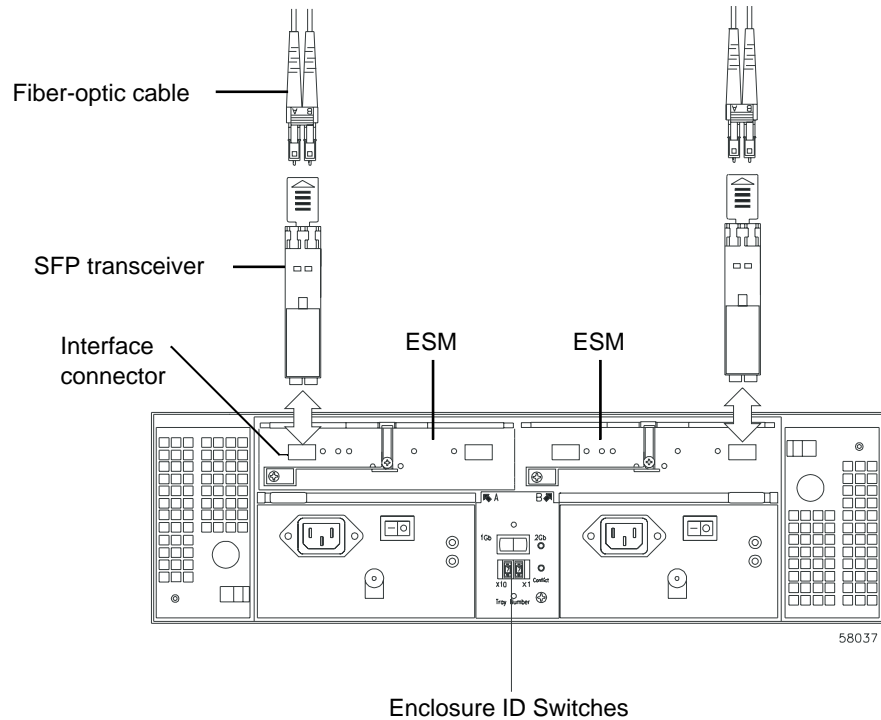
**Important:** When an SFP transceiver fails, its bypass indicator glows amber, and so does the Bypass indicator of the module to which it is connected (including the fault light on the controller enclosure). Make sure you remove the correct SFP transceiver. Use the fault lights and the storage management software (TPSSM) to locate the failed SFP transceiver.

---

5. Wearing antistatic protection, remove the Fibre Channel cables from the failed SFP transceiver (see Figure 11-6).



**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 11-6** Removing and Installing an SFP Transceiver

6. Remove the failed SFP transceiver from the environmental status module.
7. Insert the new SFP transceiver into the environmental status module.
8. Connect the Fibre Channel cables to the new SFP transceiver.
9. Check the bypass indicator next to the failed SFP transceiver (see Figure 11-6).
  - If the bypass indicator is on, the SFP transceiver might be installed incorrectly. Remove the SFP transceiver and reinsert it.

- If the bypass indicator stays on, or a fault indicator on the environmental status module comes on, check the storage management software (TPSSM) to determine the problem.

## Replacing a Failed Environmental Status Module

When the storage management software (TPSSM) instructs you to replace a failed environmental status module, read the section titled “Environmental Status Module” on page 172, and then follow these steps:



**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 (TPSSM) for instructions on environmental card failure recovery procedures. Follow any steps given by the software before you proceed.
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. Disconnect the Fibre Channel cables from the SFP transceivers in the failed canister; then remove the SFP transceivers (see Figure 11-7). 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.

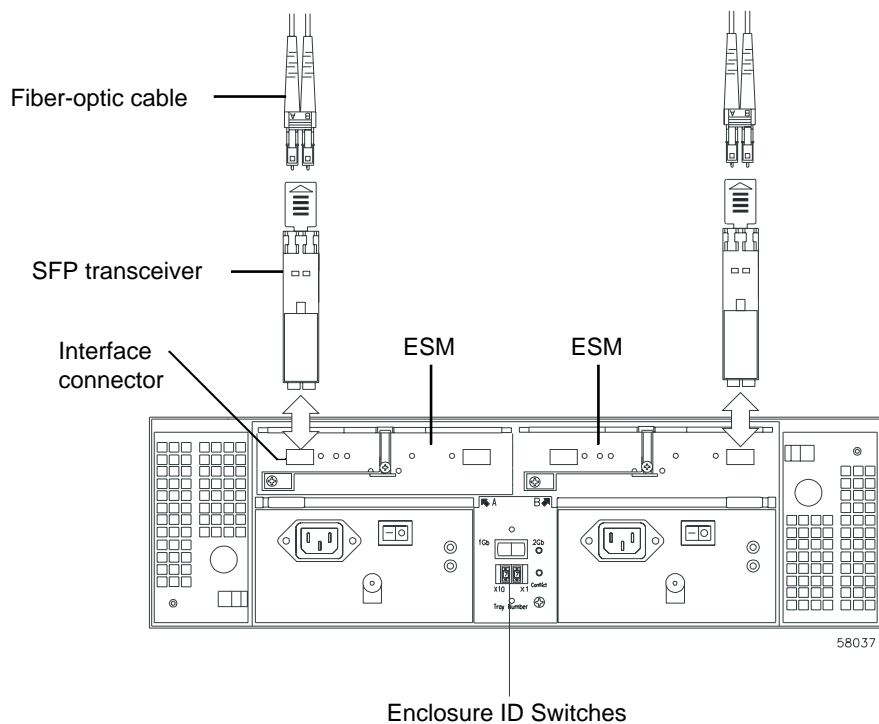
---

6. Set the enclosure ID numbers on the new canister exactly as they are set on the failed environmental status module (see Figure 11-7).

**Note:** Figure 11-7 shows a 14-drive enclosure. The enclosure ID switches on a 10-drive enclosure are located on the rear of each ESM.



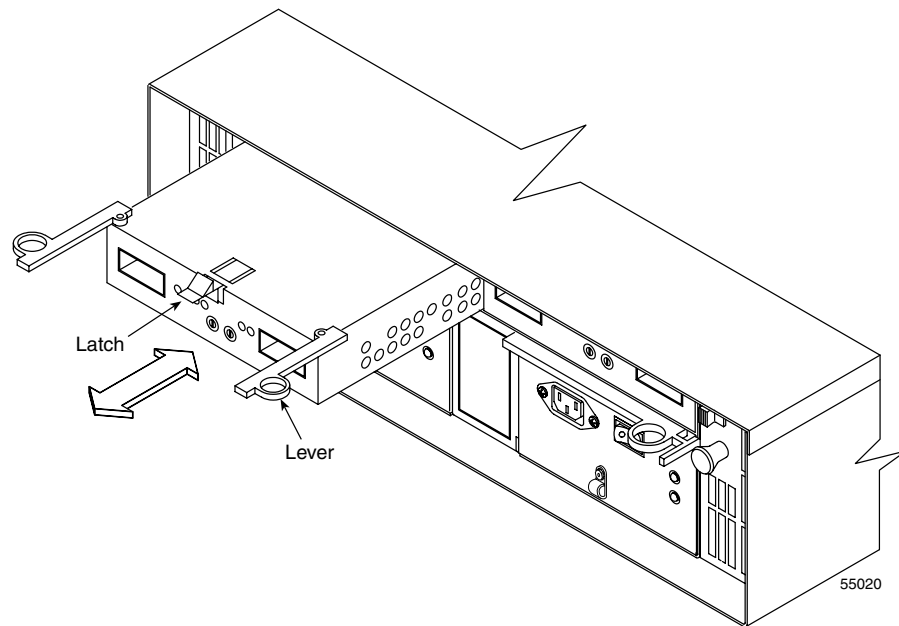
**Caution:** Failure to set the IDs properly on the new canister can result in data loss on one or all drive enclosures.



**Figure 11-7** Removing SFPs from the Environmental Status Module

7. Wearing antistatic protection, push down on the latch centered above the environmental status module (see Figure 11-8).





**Figure 11-8** 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. Confirm that the environmental status module performs a power on sequence and comes online after it is plugged into the midplane.
13. Install the SFP transceivers and Fibre Channel interface cables in their original locations.
14. Check the power and fault indicators on the new canister (see Figure 11-7).
  - 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, check the (TPSSM) software to determine the problem.

## Upgrading Drives

You can upgrade drives in two ways:

- Add drives to empty slots in the drive enclosure (see “Adding a Drive to an Empty Slot” on page 206).
- Replace existing drives with drives of larger capacity (see “Adding Drives of Larger Capacity” on page 207).

### Adding a Drive to an Empty Slot

Follow these instructions to install an additional drive into empty slot in the drive enclosure. You can install additional drives while the drive enclosure is powered on and running.



**Warning:** 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 (TPSSM) and repair all reported problems.
  3. Locate the blank drive module you will replace with a drive as follows:
    - Because a blank drive module contain no drive, its Activity indicator (on the front bezel above the drive module) will not be on.
    - Verify the drive position is blank using the storage management software (TPSSM).
- 



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

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

---

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

5. Pull out the blank drive module (see Figure 11-1 on page 194).
6. Unpack the new drive module. Save all packing materials in case you need to return the module.
7. Review all documentation shipped with the new drive module for updated replacement procedures and other information.
8. Slide the new drive module fully into the slot.
9. Lower (close) the lever.
10. Check the drive activity and fault indicators above the new drive module.  
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 module may not be installed correctly. Remove the drive module, 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. Check the storage management software (TPSSM) to determine the problem.
11. Configure the new drive using the storage management software (TPSSM).

If you need to install more than one drive module, repeat these steps.

## Adding Drives of Larger Capacity

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 the instructions in the section.



---

**Warning:** 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).

Follow these instructions 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 section titled “Upgrading Drives” on page 206.
- The information in your software documentation.
- 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 (TPSSM) 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 modules. Pull out the drive modules (see Figure 11-1 on page 194).
7. Unpack a new drive. Save the packing material and documentation in case you need to return the drive.
8. Slide the new drive module 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 power switches on the drive enclosure.
12. Check the drive activity and fault indicators above the new drive modules.  
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 module may not be installed correctly. Remove the drive module, 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. Check the storage management software (TPSSM) to determine the problem.
13. Configure the drives as necessary.  
Configure the new drives using the storage management software (TPSSM). See your software documentation for detailed instructions.
  14. Restore the data from backup to all the drives.

## Adding Drive Enclosures

You can add new drive enclosures to an existing storage array without turning off the array or interrupting data flow. You do so in one of the following 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 210).



---

**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.

## 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, follow these steps:

1. Follow the instructions in *SGI TP9500 RAID Installation and Upgrade Guide* to set up and mount the new drive enclosures and to connect them to each other.
2. Follow the instructions in the *SGI TP9500 RAID Installation and Upgrade Guide* to connect the drive enclosures to the controller enclosure.



---

**Warning:** 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 (TPSSM) to check the status of the new drives and correct any errors found.
4. Use the storage management software (TPSSM) 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, follow these steps:

1. Follow the instructions in the *SGI TP9500 RAID Installation and Upgrade Guide* to set up and mount the new drive enclosures and to connect them to each other.
2. Re-cable the drive enclosures follows (see Figure 11-9):



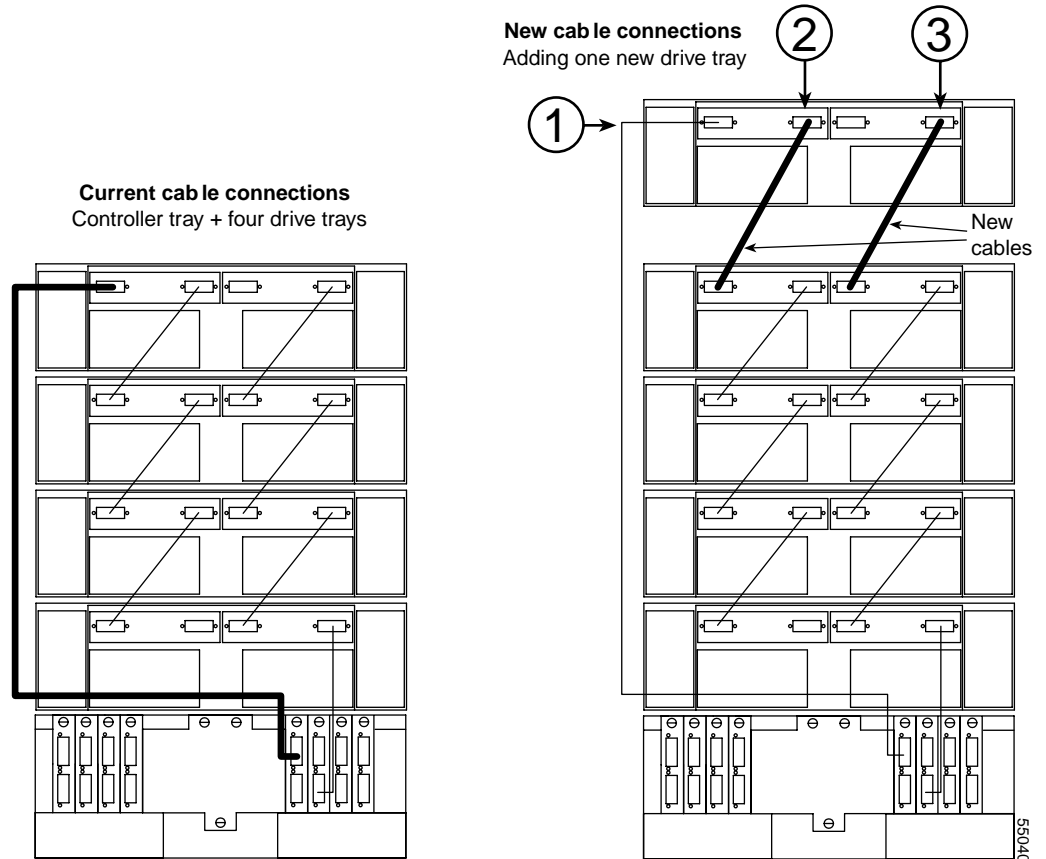
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**Warning:** Electrostatic discharge can damage sensitive components. Use a grounded wrist strap or other antistatic precautions before handling drive enclosure components.

---

- a. Disconnect the cable (marked “1” in Figure 11-9) 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 Figure 11-9) to the In connector that you disconnected in the previous step and the Out connector on the new drive enclosure.
- c. Connect a second cable (marked "3" in Figure 11-9) to the empty In connector on the current drive enclosure and the Out connector on the new drive enclosure.



**Figure 11-9** Adding a New Drive Enclosure to an Existing Loop

- d. 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 11-9, the storage management software (TPSSM) 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.

---

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



## TP9500 and TP9700 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 in the following sections.

The sections covering the TP9500 include:

- “Connecting the TP9500 Drive Loop Cables” on page 214
- “Command Module Host Ports” on page 214
- “Out-of-Band Management” on page 218
- “Preparing a Command Module for Host Cabling” on page 219
- “Cabling a Direct Topology with Failover Capability” on page 221
- “Cabling a Direct Topology without Failover Capability” on page 223
- “Cabling a Single Host Bus Fabric Topology” on page 225
- “Cabling a Dual Host Bus Fabric Topology” on page 227
- “Cabling a Mixed Topology” on page 229
- “Cabling for Out-of-Band Management” on page 232
- “TP9500 Drive Module Cabling” on page 233
- “Powering On the System” on page 243

The sections covering the TP9700 include:

- “Connecting the TP9700 Drive Loop Cables” on page 248
- “Host Cabling Topologies” on page 215
- “Direct Topology” on page 216
- “Fabric Topology” on page 217
- “Controller Module Drive Channel Ports” on page 233

- “Controller Module Drive Channel Ports” on page 233
- “Preparing the Controller Module and Drive Modules for Cabling” on page 235
- “Cabling One Command Module to One Drive Module” on page 237
- “Cabling One Controller Module to Multiple Drive Modules” on page 239

## Connecting the TP9500 Drive Loop Cables

This section provides procedures for cabling a command module to one or more hosts. The modules described in this chapter are physically similar, and the figures in this section are applicable to all of the covered modules.

---

**Caution: Risk of loss of access to data** – If you are using the HP-UX operating system, do not use Qlogic and HP-UX host bus adapters (HBAs) in the same storage area network (SAN). Doing so can cause errors in identification of targets and initiators. To ensure proper performance, use only one manufacturer’s HBAs in a SAN.

---

---

**Caution: Risk of loss of access to data** – If you are using the Solaris operating system, do not use JNI and LSI Logic HBAs in the same SAN. Doing so can cause errors in identification of targets and initiators. To ensure proper performance, use only one manufacturer’s HBAs in a SAN.

---

---

**Caution: Risk of loss of access to data** – If you are using an operating system that does not support host failover with alternate path software, you can connect a maximum of two hosts to a command module by connecting one host to each controller. Do not connect a dual-HBA host to both controllers.

---

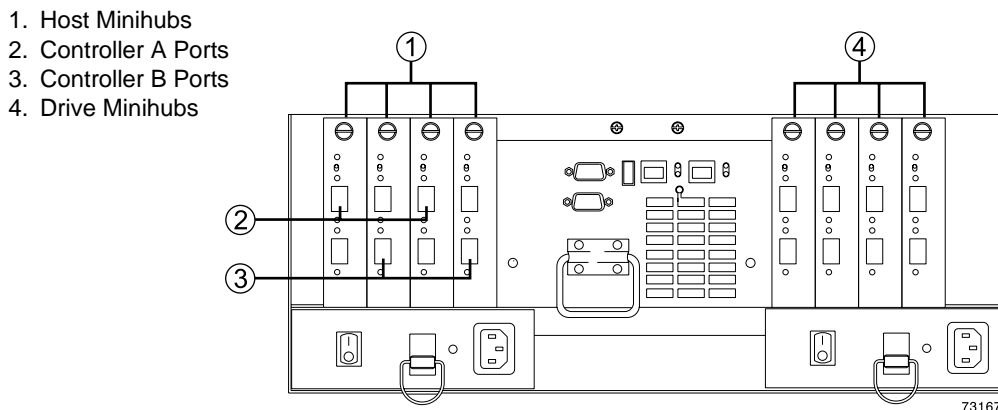
## Command Module Host Ports

The command modules described in this chapter have four host minihubs, one pair per controller. The host minihubs are located on the back, left side of the command module.

To achieve redundancy, connect each host to both a Controller A host minihub and a Controller B host minihub.

The host minihubs in slots 1 and 3 connect to Controller A. The host minihubs in slots 2 and 4 connect to Controller B. Figure 12-1 shows the relationship between Controllers A and B and the host minihub slot positions. Using a direct connection, you can connect a host to each of the eight ports on the four minihubs.

**Important:** The minihubs on the right side are for connecting drive modules. Do not use the minihubs on the right for connecting hosts.



**Figure 12-1** Command Module – Host Ports

## Host Cabling Topologies

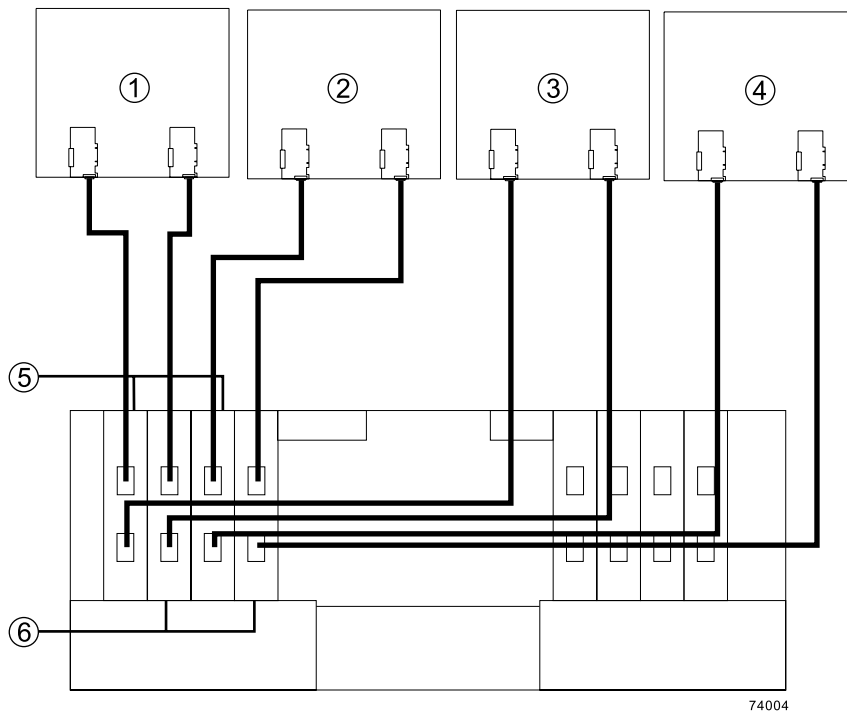
A controller module supports both direct and fabric topologies for host I/O cabling. This section describes each type of topology.

The term “failover” describes the automatic transfer of I/O requests from a primary controller to another controller.

Failover occurs when a component failure or other error occurs either in the primary controller or in the data path to the primary controller.

## Direct Topology

In a direct topology, one or more hosts are directly connected to the host minihubs on the controller module without the use of a switch. A direct topology might not support failover. Fiber-optic cable must be used in a direct topology. Figure 12-2 shows a direct connection to four hosts with failover capability.



- |           |  |
|-----------|--|
| 1. Host 1 | 5. Host Minihubs 1 and 3<br>(Controller A) |
| 2. Host 2 | 6. Host Minihubs 2 and 4<br>(Controller B) |
| 3. Host 3 |  |
| 4. Host 4 |  |

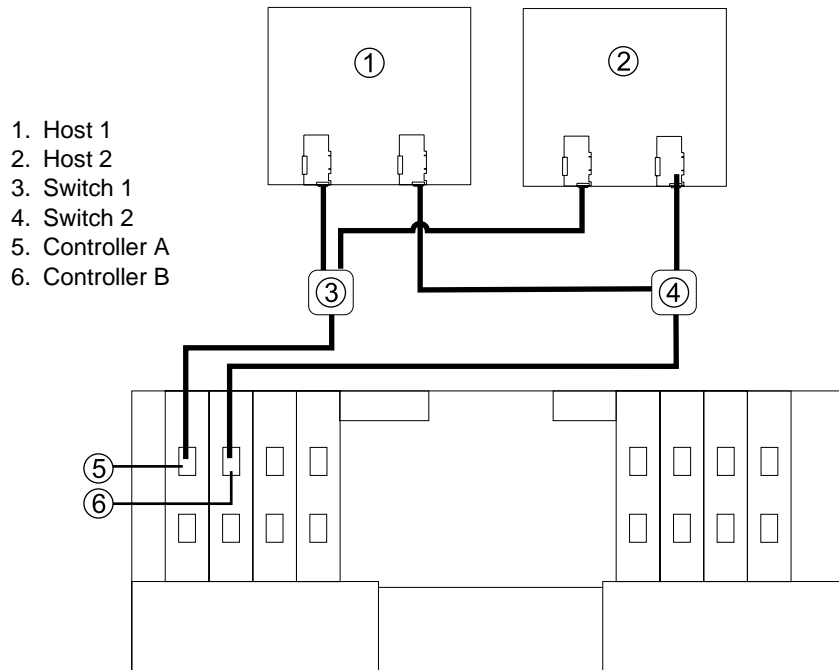
**Figure 12-2** Controller Module – Direct Topology

## Fabric Topology

A fabric topology uses one or more switches to connect fiber-optic cables from the host to the command module.

A fabric topology typically supports failover but might also be used for non-failover scenarios. Depending on your host operating system, you might have a choice of failover methods for a storage array. For operating system-specific failover options, refer to the post-installation tasks in the *SANtricity*® Storage Manager installation guide for your operating system.

Figure 12-3 shows a fabric topology using two hosts and two switches.



74010

**Figure 12-3** Controller Module – Fabric Topology

## Out-of-Band Management

A command module is equipped with two Ethernet ports. An Ethernet connection enables out-of-band management of the storage array.

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**Important:** Ethernet cabling is for out-of-band management only. Ethernet connections do not support data transfer between hosts and drives in a storage array.

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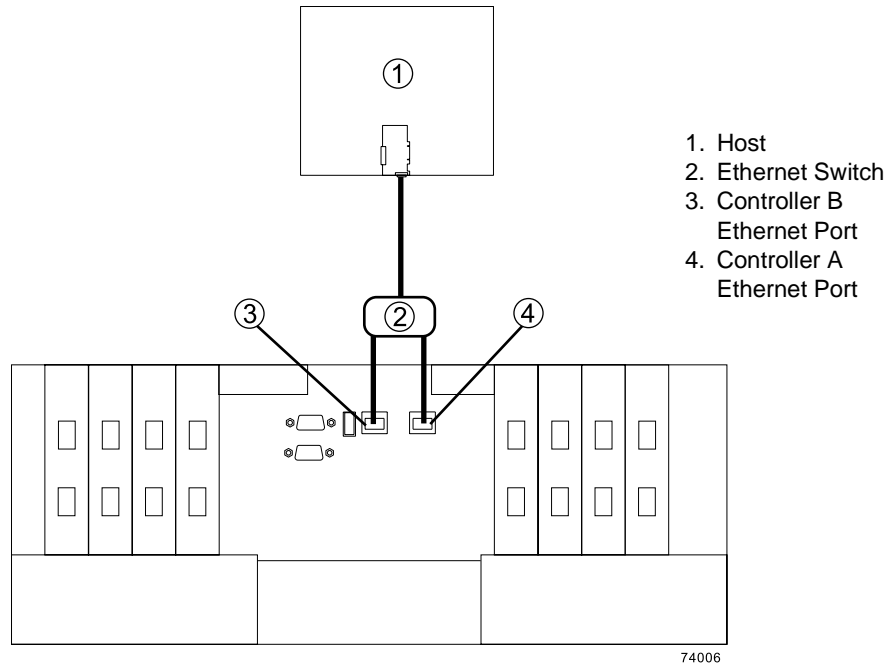
When out-of-band management is used, SANtricity Storage Manager Client is installed and operates on a remote workstation. The remote workstation is connected to the command module through an Ethernet port located on the command module.

You can cable a storage management station either directly to the Ethernet or to an Ethernet switch. If a switch is used, the switch is then connected by Ethernet cables to the command module. Figure 12-4 shows an Ethernet topology using a switch. Each direct Ethernet connection requires a crossover cable.

---

**Important:** To connect a host directly to a command module, a crossover cable is required.

---



**Figure 12-4** Command Module – Out-of-Band Management

## Preparing a Command Module for Host Cabling

A host minihub on a command module supports only fiber-optic cables. Small Form-factor Pluggable (SFP) transceivers must be installed in each host minihub port to which you will connect a fiber-optic cable. The SFP transceiver shown in Figure 12-5 might look slightly different than the ones shipped with your command module. The difference does not affect performance.

Figure 12-5 on page 221 and Figure 12-6 on page 221 show how to use an SFP to connect a fiber-optic cable to a minihub. Complete the following steps to prepare the command module for connection to the host.



---

**Warning: Risk of exposure to laser radiation – Do not attempt to disassemble or remove any part of an SFP transceiver. Removal of parts or disassembly could result in exposure to hazardous laser radiation.**

---

---

**Caution: Risk of component failure – Do not connect LSI Logic® and QLogic™ HBAs to a single minihub. Connecting these two different manufacturers' HBAs to a single minihub can result in an HBA failure.**

---

---

**Caution: Electrostatic discharge damage to components – To prevent electrostatic discharge damage to the command module, use proper antistatic protection when handling command module components.**

---

---

**Caution: Potential data loss or degraded performance – Do not twist, fold, pinch, or step on fiber-optic cables. Do not bend the cables tighter than a 2-inch radius. Doing so can cause data loss, degrade performance, or damage the cables.**

---

1. Complete all preparatory and installation procedures described in the installation guide for your command module and in the installation guide for any attached drive module.
2. If your command module or array module will be attached to a drive module, complete all preparatory and installation procedures in the installation guide for the drive module.

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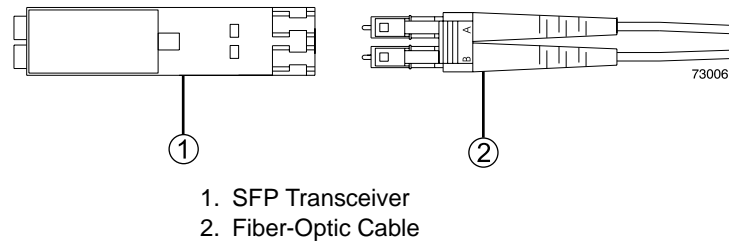
**Caution: Potential loss of access to data – Install SFP transceivers only in the host minihub ports that are used in your cabling topology. Installing an SFP transceiver in an unused minihub port can result in temporary loss of access to data.**

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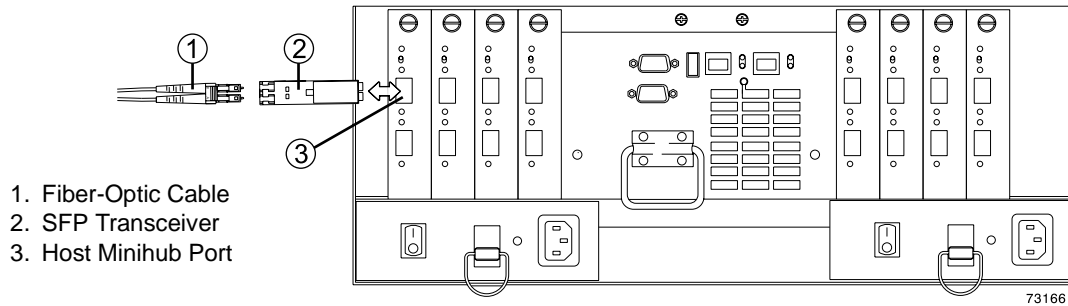
3. Insert an SFP transceiver into each host channel port used in your topology, and ensure that each SFP transceiver is fully seated. Figure 12-6 on page 221 shows inserting an SFP transceiver.
4. Based on your planned topology, choose one of the following procedures:
  - a. “Cabling a Direct Topology with Failover Capability” on page 221.



- b. “Cabling a Direct Topology without Failover Capability” on page 223.
- c. “Cabling a Single Host Bus Fabric Topology” on page 225.
- d. “Cabling a Dual Host Bus Fabric Topology” on page 227.
- e. “Cabling a Mixed Topology” on page 229.
- f. “Cabling for Out-of-Band Management” on page 232.



**Figure 12-5** SFP Transceiver with Fiber-Optic Cable



**Figure 12-6** Command Module – Installing the SFP Transceiver

## Cabling a Direct Topology with Failover Capability

Use the following procedure to connect fiber-optic cables from the hosts to both Controller A and Controller B. Figure 12-7 shows an example of this cabling scenario.

---

**Caution: Electrostatic discharge damage to components** – To prevent electrostatic discharge damage to the array module or command module, use proper antistatic protection when handling array module or command module components.

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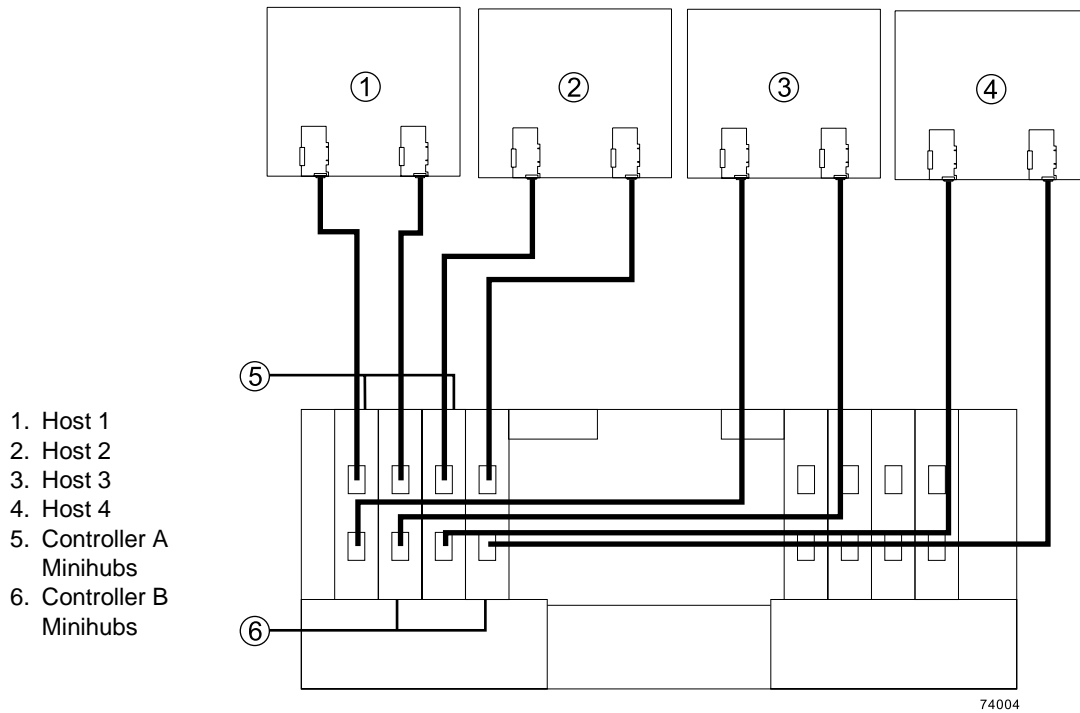
1. Verify that an SFP transceiver is installed and firmly seated in each host channel port in your planned topology. For procedures on installing SFP transceivers, see “Preparing a Command Module for Host Cabling” on page 219.
2. Ensure that each host has two available HBAs. A host might have two adapters on one card, or two cards with one adapter each.

---

**Caution: Potential data loss or degraded performance** – Do not twist, fold, pinch, or step on fiber-optic cables. Do not bend the cables tighter than a 2-inch radius. Doing so can cause data loss, degrade performance, or damage the cables.

---

3. Connect interface cables from the Host 1 HBAs to host minihubs 1 and 2.
4. Connect interface cables from the Host 2 HBAs to host minihubs 3 and 4.
5. Connect interface cables from the Host 3 HBAs to host minihubs 1 and 2.
6. Connect interface cables from the Host 4 HBAs to host minihubs 3 and 4.



**Figure 12-7** Controller Module – Direct Host Connections with Failover

7. Do you intend to use out-of-band storage array management?
  - **Yes** – Go to “Cabling for Out-of-Band Management” on page 232.
  - **No** – Continue on to step 8.
8. To connect drive modules to this command module, go to “TP9500 Drive Module Cabling” on page 233.

## Cabling a Direct Topology without Failover Capability

Use the following procedure to connect fiber-optic cables from multiple hosts to a command module. Figure 12-8 shows an example of this cabling scenario. Note that this cabling scenario does not support failover.

---

**Caution: Electrostatic discharge damage to components** – To prevent electrostatic discharge damage to the array module or command module, use proper antistatic protection when handling array module or command module components.

---

1. Verify that an SFP transceiver is installed and firmly seated in each host minihub port used for your planned topology. For procedures on installing SFP transceivers, see “Preparing a Command Module for Host Cabling” on page 219.

---

**Caution: Potential data loss or degraded performance** – Do not twist, fold, pinch, or step on fiber-optic cables. Do not bend the cables tighter than a 2-inch radius. Doing so can cause data loss, degrade performance, or damage the cables.

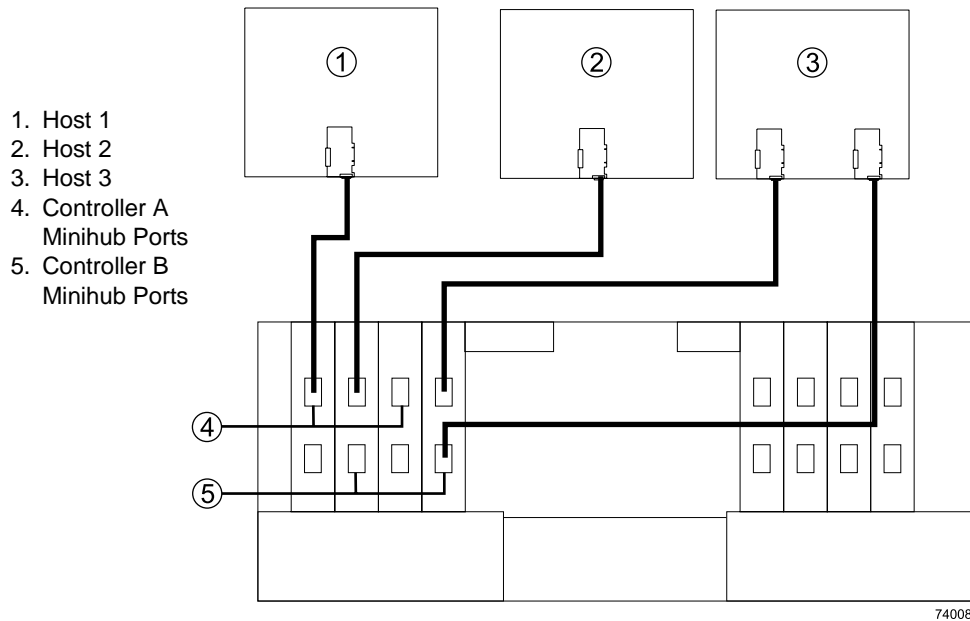
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**Important:** In topologies where the operating system does not support failover, or a failover driver is not installed, cable only one single-HBA host to each controller of a dual-controller command module.

---

2. Based on the number and locations of HBAs in your hosts, perform one of the following steps:
  - a. **Hosts with a single HBA** – Connect an interface cable from the HBA on each host to either port on an available host channel. Figure 12-8 on page 225 shows this method for Host 1 and Host 2.
  - b. **Hosts with two HBAs** – Connect an interface cable from two host HBAs to both ports on an available host channel. Figure 12-8 on page 225 shows this method for Host 3.



**Figure 12-8** Command Module – Direct Host Connections without Failover Capability

3. Do you intend to use Ethernet connections for direct management of the storage array?
  - **Yes** – Go to “Cabling for Out-of-Band Management” on page 232.
  - **No** – If you need to connect drive modules to this command module, go to “TP9500 Drive Module Cabling” on page 233. Otherwise, to complete the installation process, return to the point in the installation guide for your command module where you were referred to this cabling guide.

## Cabling a Single Host Bus Fabric Topology

Use the following procedure to create a single host bus fabric topology with one or two hosts. Figure 12-9 shows an example topology.

---

**Caution: Potential data loss or degraded performance** – Do not twist, fold, pinch, or step on fiber-optic cables. Do not bend the cables tighter than a 2-inch radius. Doing so can cause data loss, degrade performance, or damage the cables.

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---

**Important:** To ensure that only a single path is visible to the host, connect one host bus adapter to only one controller per storage array.

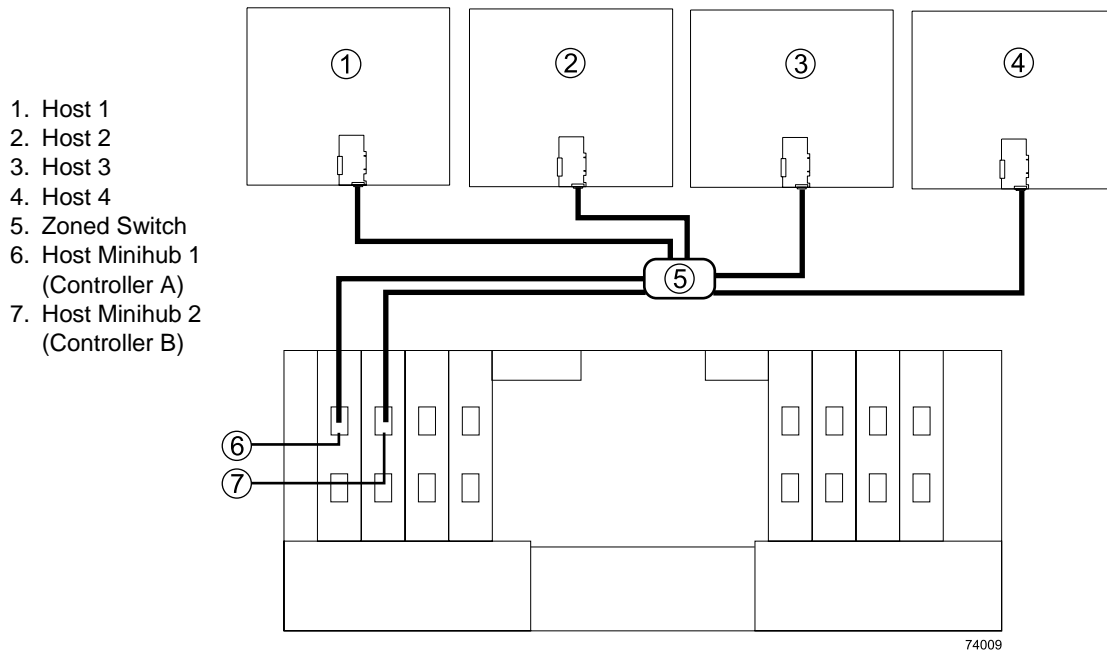
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---

**Important:** For fabric topologies that use only one switch, a zoned switch is required to achieve redundant paths between each host and the command module. In these topologies, it might not be the case that all volumes are visible to all hosts.

---

1. Verify that an SFP transceiver is installed and firmly seated in each host minihub port in your planned topology. For procedures on installing SFP transceivers, see “Preparing a Command Module for Host Cabling” on page 219.
2. Verify that each host has one available HBA.
3. Connect an interface cable from one HBA on each host to the switch.
4. Connect interface cables from the switch to the command module minihub Host Channel 1 and Host Channel 2 ports.



**Figure 12-9** Command Module – Single Host Bus Fabric Topology

5. Do you intend to use out-of-band storage array management?
  - **Yes** – Go to “Cabling for Out-of-Band Management” on page 232.
  - **No** – Continue with step 6.
6. To connect drive modules to this command module, go to “TP9500 Drive Module Cabling” on page 233.

## Cabling a Dual Host Bus Fabric Topology

Use the following procedure to create a dual host bus fabric topology. Figure 12-10 on page 229 shows an example of this topology.

---

**Important:** To ensure that only a single path is visible to the host, connect one HBA to only one controller per storage array.

---

---

**Important:** For fabric topologies that use only one switch, a zoned switch is required to achieve redundant paths between each host and the command module. In these topologies, it might not be the case that all volumes are visible to all hosts.

---

1. Verify that an SFP transceiver is installed and firmly seated in each host minihub port in your planned topology. For procedures on installing SFP transceivers, see “Preparing a Command Module for Host Cabling” on page 219.
2. Verify that each host has two available HBAs.

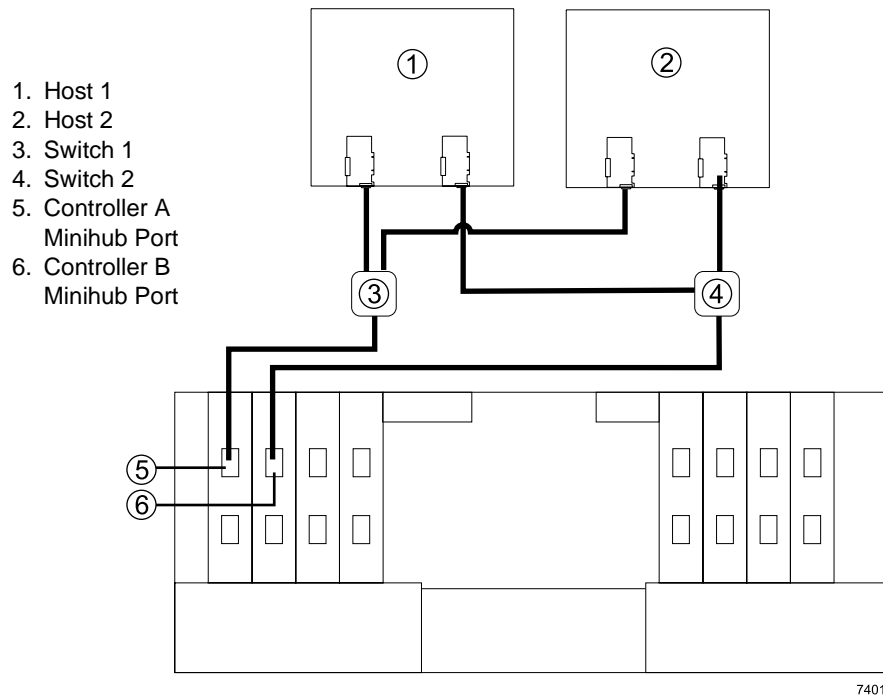
---

**Caution: Potential data loss or degraded performance** – Do not twist, fold, pinch, or step on fiber-optic cables. Do not bend the cables tighter than a 2-inch radius. Doing so can cause data loss, degrade performance, or damage the cables.

---

3. Cable the fabric topology. Figure 12-10 on page 229 shows an example topology.
  - a. Connect an interface cable from a Host 1 HBA to Switch 1.
  - b. Connect an interface cable from the second Host 1 HBA to Switch 2.
  - c. Repeat substeps (a) and (b) for Host 2 and for any additional hosts in your topology. When you have finished, continue with substep (d).
  - d. Connect an interface cable from Switch 1 to a Controller A host port on the command module.
  - e. Connect an interface cable from Switch 2 to a Controller B host port on the command module.





**Figure 12-10** Command Module – Dual Host Bus Fabric Topology

4. Do you intend to use out-of-band storage array management?
  - **Yes** – Go to “Cabling for Out-of-Band Management” on page 232.
  - **No** – Continue with step 5.
5. To connect drive modules to this command module, go to “TP9500 Drive Module Cabling” on page 233.

## Cabling a Mixed Topology

Use the following procedure to create a mixed topology (a fabric and a direct connection within the same topology). Figure 12-11 shows an example topology.

---

**Important:** To ensure that only a single path is visible to the host, connect one HBA to only one controller per storage array.

---

---

**Important:** For fabric topologies that use only one switch, a zoned switch is required to achieve redundant paths between each host and the command module. In these topologies, it might not be the case that all volumes are visible to all hosts.

---

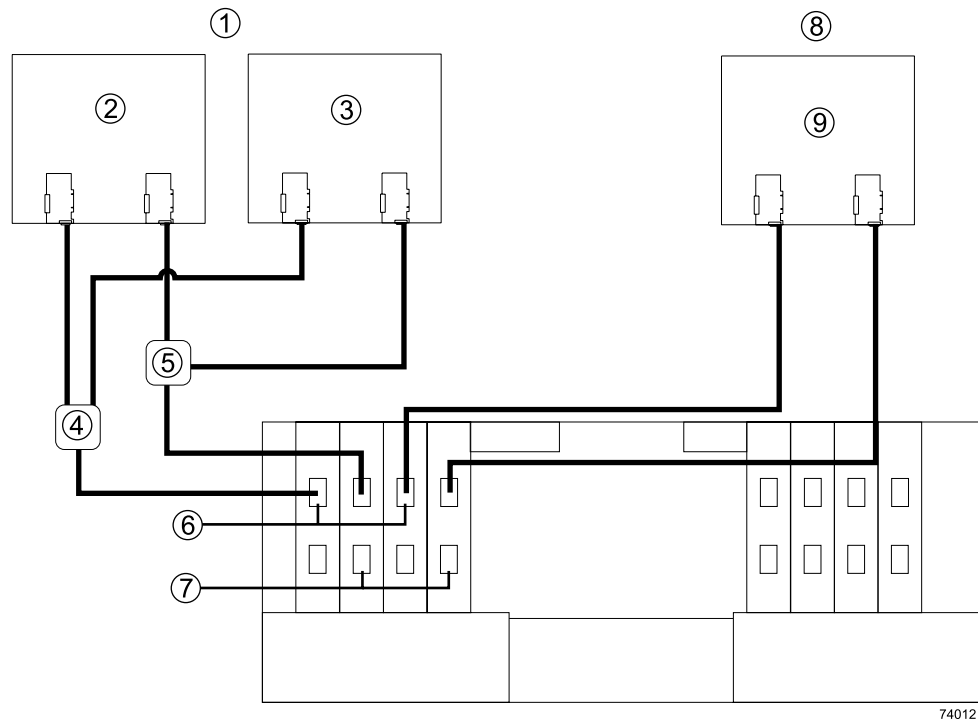
1. Verify that an SFP transceiver is installed and firmly seated in each host minihub port in your planned topology. For procedures on installing SFP transceivers, see “Preparing a Command Module for Host Cabling” on page 219.
2. Verify that the hosts that will have failover capability each have two available HBAs.

---

**Caution: Potential data loss or degraded performance** – Do not twist, fold, pinch, or step on fiber-optic cables. Do not bend the cables tighter than a 2-inch radius. Doing so can cause data loss, degrade performance, or damage the cables.

---

3. Cable the fabric topology. Figure 12-11 on page 231 shows an example topology.
  - a. Connect an interface cable from a Host 1 HBA to Switch 1.
  - b. Connect an interface cable from the second Host 1 HBA to Switch 2.
  - c. Repeat substeps (a) and (b) for Host 2 and for any additional hosts in your topology. When you have finished, continue with substep (d).
  - d. Connect an interface cable from Switch 1 to a Controller A host port on the command module.
  - e. Connect an interface cable from Switch 2 to a Controller B host port on the command module.



- |                    |                               |
|--------------------|-------------------------------|
| 1. Fabric Topology | 6. Controller A Minihub Ports |
| 2. Host 1          | 7. Controller B Minihub Ports |
| 3. Host 2          | 8. Direct Topology            |
| 4. Switch 1        | 9. Host 3                     |
| 5. Switch 2        |                               |

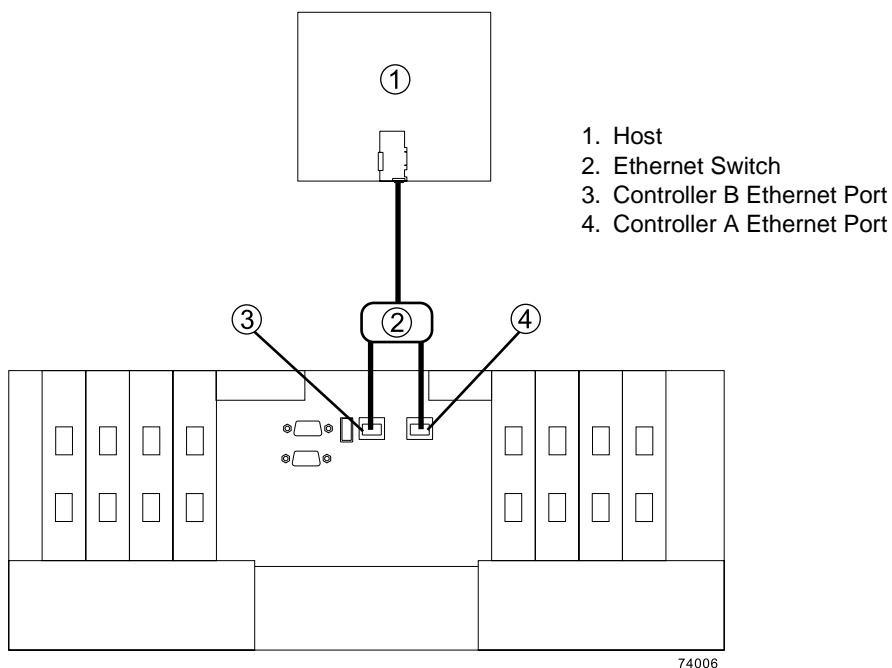
**Figure 12-11** Command Module – Mixed Topology

4. Cable the direct connection topology. Connect interface cables from the host HBAs to an available host channel. Host 3 in Figure 12-11 shows an example of this topology.
5. Do you intend to use out-of-band storage array management?
  - **Yes** – Go to “Cabling for Out-of-Band Management” on page 232.
  - **No** – Continue with step 6.
6. To connect drive modules to this command module, go to “TP9500 Drive Module Cabling” on page 233.

## Cabling for Out-of-Band Management

Use the following procedure to cable the command module for out-of-band management. Figure 12-12 shows an example topology. For more information on management methods, refer to the *Storage System Planning Checklist*.

1. Connect an Ethernet cable from the host to the Ethernet switch.
2. Connect interface cables from the Ethernet switch to the Ethernet ports on Controllers A and B on the back of the command module.



**Figure 12-12** Controller Module – Out-of-Band Management Topology

## TP9500 Drive Module Cabling

This section provides procedures for cabling the command module to one or more drive modules. Table 12-1 shows which drive modules are compatible with which command modules.

**Table 12-1** Controller to Drive Module Compatibility

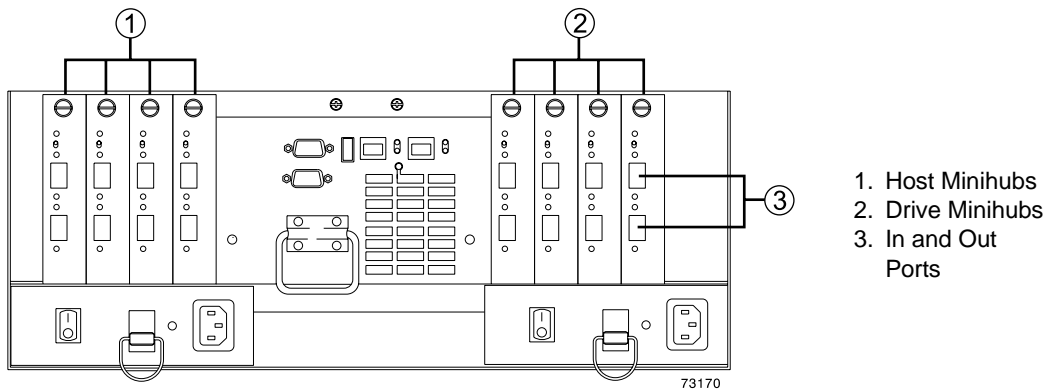
Controller Module	Compatible Drive Modules
5884 controller (TP9500)	FC-2 14x drive module SATA-2 14x drive module

The cable connections between the command module and the drive modules create two or more drive loops. These drive loops connect multiple drives in an arbitrated loop. Drive connections support either fiber-optic or copper cables. If you use fiber-optic cables, you must install SFP transceivers in the drive minihub ports and the drive module ports to attach those cables.

**Caution: Potential configuration data loss** – Do not connect more drive modules than are supported for your command module. Attaching additional drive modules can cause your storage array to lose configuration data and become inaccessible.

### Controller Module Drive Channel Ports

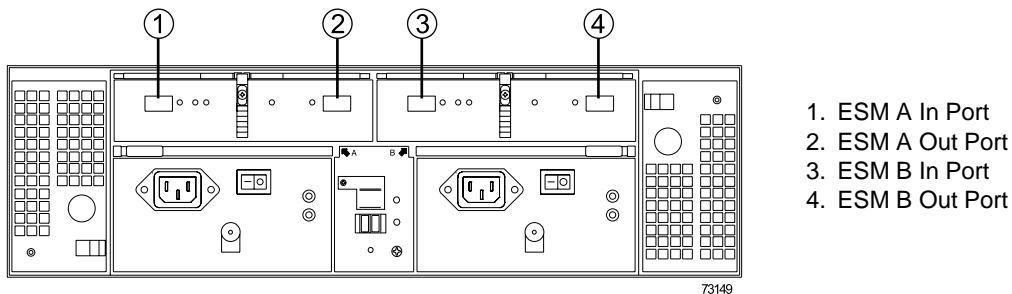
Each controller module has four drive minihubs, one per drive channel. Figure 12-13 shows the location of the minihubs. Drive channel numbering goes from 4 through 1, left to right. Each minihub has an Out port and an In port. You may use these ports to connect the command module to the drive modules with interface cables.



**Figure 12-13** Controller Module – Drive Channel Ports

### TP9500 Drive Module Channel Ports

Each drive module has four ports, two per environmental services module (ESM). Each ESM has an In port and an Out port, identified either by an up-arrow or a down-arrow. You may use these ports to connect the drive module to the command module with interface cables. Figure 12-14 shows the drive channel ports.



**Figure 12-14** Drive Channel Ports

## Preparing the Controller Module and Drive Modules for Cabling

Use the following procedure to prepare the modules for cabling.

---

**Caution: Electrostatic discharge damage to components** – To prevent electrostatic discharge damage to the command module, use proper antistatic protection when handling command module components.

---

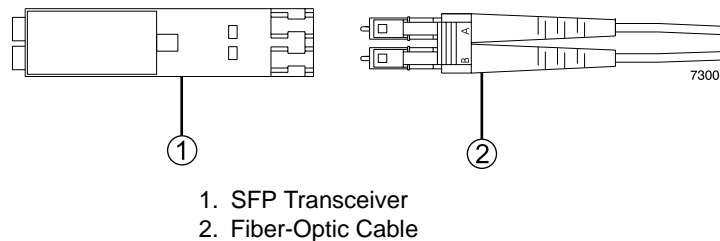


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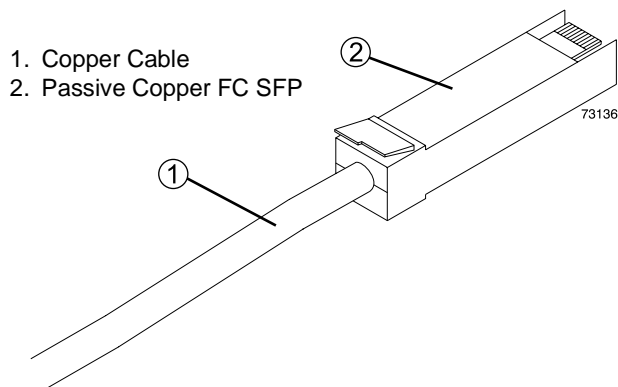
**Important:** Ensure that each drive module has a unique tray ID. Refer to the installation guide for each type of module for information on setting the tray ID.

---

1. Figure 12-15 and Figure 12-16 show the two types of drive interface cables. Compare your cables with those in the figures, and then choose one of the following options, based on your interface cable type. The SFP transceiver shown in Figure 12-15 might look slightly different than the ones shipped with your command module. The difference does not affect performance.
  - a. **Fiber-optic cable** – An SFP transceiver is required for each connection. Go to step 2.
  - b. **Copper cable** – An SFP transceiver is not required for connection. Go to step 4.



**Figure 12-15** SFP Transceiver with Fiber-Optic Cable

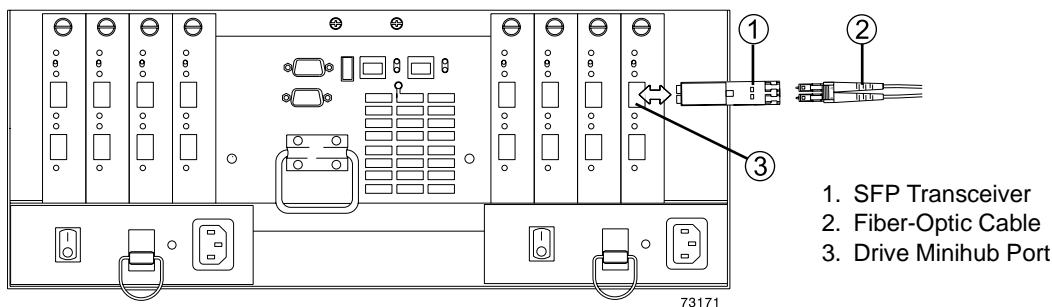


**Figure 12-16** Copper Cable with Passive Copper FC SFP



**Warning:** Risk of exposure to laser radiation – To prevent exposure to hazardous laser radiation, do not disassemble or remove any part of an SFP transceiver.

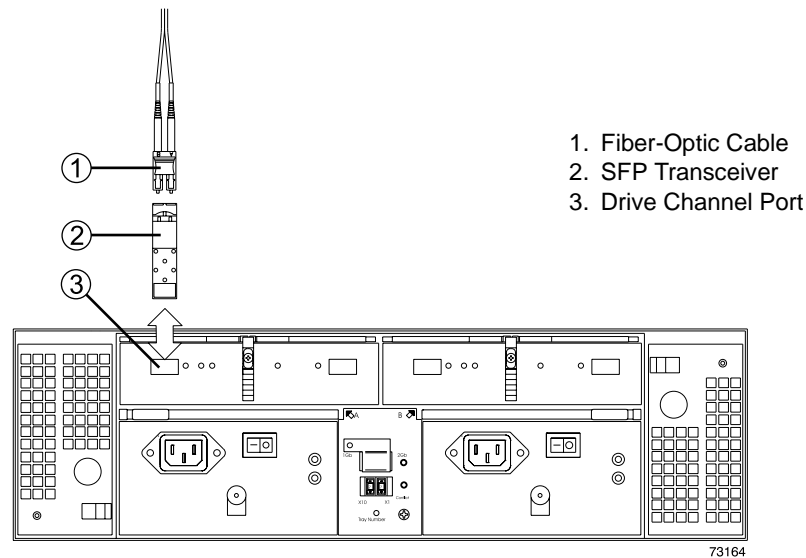
2. If you are using fiber-optic cables, insert an SFP transceiver into the drive ports on the command module. Figure 12-17 shows inserting an SFP transceiver.



**Figure 12-17** Controller Module – Installing an SFP Transceiver

3. Insert an SFP transceiver into the ESM ports of each drive module to be used in your cabling topology. Figure 12-18 shows inserting an SFP transceiver.





**Figure 12-18** Drive Module – Installing an SFP Transceiver

4. Choose one of the following procedures, based on the number of drive modules to be included in this storage array:
  - a. “Cabling One Command Module to One Drive Module” on page 237.
  - b. “Cabling One Controller Module to Multiple Drive Modules” on page 239.

## Cabling One Command Module to One Drive Module

Use the following procedure for a new installation to cable one controller to one drive module.

---

**Note:** The drive module can be located above or below the controller module in the cabinet, and the interface cables can be connected to either the upper or lower drive minihub ports on the controller module.

---

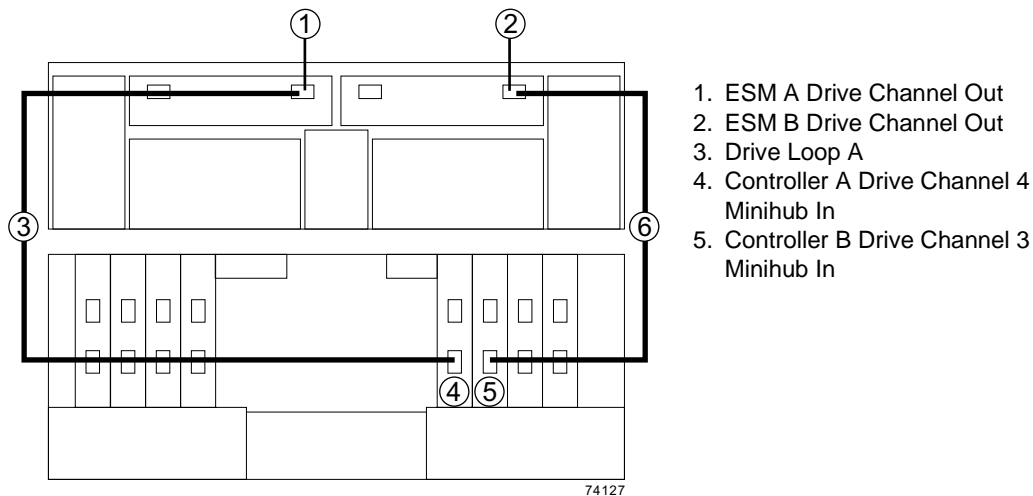
1. If you are using fiber-optic cables, verify that an SFP transceiver is installed and firmly seated in each controller module and drive module port to be used in your planned topology.

---

**Caution: Potential data loss or degraded performance** – Do not twist, fold, pinch, or step on fiber-optic cables. Do not bend the cables tighter than a 2-inch radius. Doing so can cause data loss, degrade performance, or damage the cables.

---

2. **Configure Drive Loop A.** Attach an interface cable from the controller module – Drive Channel 4 port to the drive module – ESM A Out port. Figure 12-19 shows an example of this connection.
3. **Configure Drive Loop B.** Attach an interface cable from command module – Drive Channel 3 port to the drive module – ESM B Out port.



**Figure 12-19** One Controller Module and One Drive Module

4. Secure the interface cables, and ensure that the cables do not block the vents on the controller module or expansion drive module.
5. To complete the installation process, return to the point in the installation guide for your controller module where you were referred to this cabling information.

## Cabling One Controller Module to Multiple Drive Modules

Use the following procedure for a new installation or to expand an existing storage array. You may locate a drive module either above or below the controller module in the cabinet. You may connect the command module interface cables to either the upper or lower drive minihub ports on the command module. Comments are based on Figure 12-20 on page 240.

---

**Important:** To ensure uninterrupted operation of the storage array when adding drive modules, at least one loop to the drive modules must be complete and functional at any given time.

---

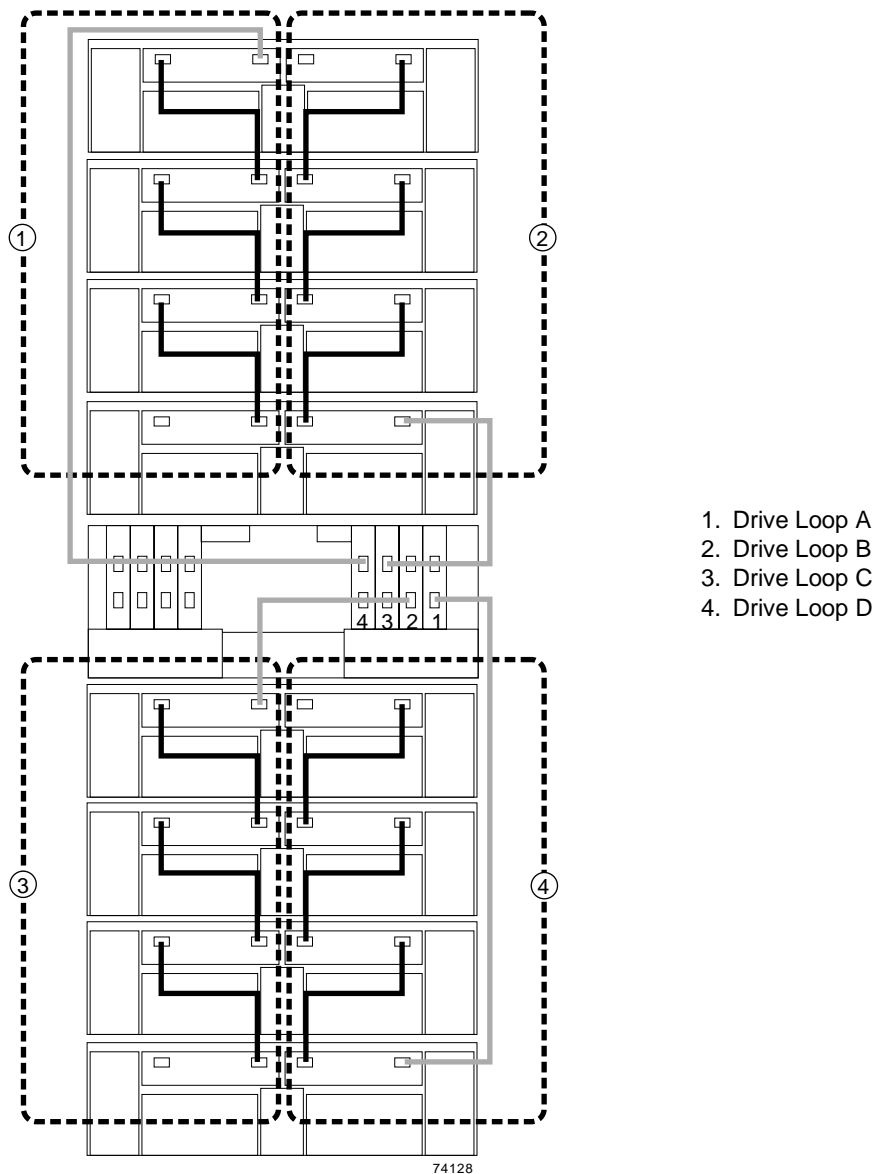
1. If you are using fiber-optic cables, verify that an SFP transceiver is installed and firmly seated in each command module and drive module port in your planned topology.

---

**Caution: Potential data loss or degraded performance** – Do not twist, fold, pinch, or step on fiber-optic cables. Do not bend the cables tighter than a 2-inch radius. Doing so can cause data loss, degrade performance, or damage the cables.

---

2. Based on your topology, choose one of the following options:
  - a. **Cable new or expand existing Drive Loops A and B** – Go to step 3.
  - b. **Cable new or expand existing Drive Loops C and D** – Go to step 8.
3. Based on your topology, choose one of the following options:
  - a. **Cable new or expand existing Drive Loops A and B** – Go to step 4.
  - b. **Add new drive module to Drive Loops A and B** – Disconnect the Drive Loop A cable from the existing ESM A Out port, and connect it to the new ESM A Out port. Leave the other end of the cable connected to the controller module – Drive Channel 4 port. When finished, go to step 6.
4. Begin Drive Loop A. Attach an interface cable from the controller module – Drive Channel 4 port to the ESM A Out port.
5. Begin Drive Loop B. Attach an interface cable from the controller module – Drive Channel 3 port to the first drive module – ESM B Out port. See Figure 12-20.



**Figure 12-20** One Controller Module and Multiple Drive Modules

6. Continue Drive Loop A.
  - a. Attach an interface cable from ESM A In port to the preceding drive module – ESM A Out port.
  - b. Attach an interface cable from the same preceding drive module – ESM A In port to the next drive module – ESM A Out port.
  - c. Repeat the cabling pattern described in substep (b) to configure the remaining drives into Drive Loop A. When finished, go to step 7.
7. Continue Drive Loop B.
  - a. Attach an interface cable from the first drive module – ESM B In port to the next drive module – ESM B Out port.
  - b. Attach an interface cable from the same drive module – ESM B In port to the next drive module – ESM B Out port.
  - c. Repeat the cabling pattern described in substep (b) to configure the remaining drives into Drive Loop B. When finished, go to step 8.
8. Are you configuring Drive Loops C and D?
  - **Yes** – Based on your topology, choose one of the following options:
    - Cable new Drive Loops C and D. Go to step 9.
    - Add new drive module to Drive Loops C and D – Disconnect the Drive Loop D cable from the existing drive module, and connect it to ESM B Out port. Leave the other end of the Drive Loop D cable connected to the controller module – Drive Channel 1 port. When finished, go to step 11.
  - **No** – Go to step 13.
9. Begin Drive Loop C. Attach an interface cable from the controller module – Drive Channel 2 port to the first drive module – ESM A Out port.
10. Begin Drive Loop D. Attach an interface cable from the controller module – Drive Channel 1 port to the ESM B Out port.
11. Continue Drive Loop C.
  - a. Attach an interface cable from the first drive module – ESM A In port to the next drive module – ESM A Out port.
  - b. Attach an interface cable from the ESM A In port on the same preceding drive module to the next drive module – ESM A Out port.

- c. Repeat the cabling pattern described in substep (b) to configure the remaining drives into Drive Loop C. When finished, go to step 12.
12. Continue Drive Loop D.
  - a. Attach an interface cable from the ESM B In port to the preceding drive module – ESM B Out port.
  - b. Attach an interface cable from the same preceding drive module – ESM B In port to the next drive module – ESM B Out port.
  - c. Repeat the cabling pattern described in substep (b) to configure the remaining drives into Drive Loop D. When finished, go to step 13.
13. Secure the interface cables, and ensure that the cables do not block the vents on the command module or expansion drive module.
14. To complete the installation process, return to the point in the installation guide for your command module where you were referred to this cabling guide.

---

**Note:** For more information on the storage management software (TPSSM), see the *SGI InfiniteStorage TPSSM Administration Guide* (007-4306-00x), the *SGI InfiniteStorage TPSSM Software Concepts Guide* (007-4305-00x), and the *SGI Storage Area Network Installation Instructions* (108-0252-00x).

---

To connect Ethernet or serial (RS-232) interface cables to the controller enclosure for direct management of the storage array, follow these steps. Optionally, you can use the Ethernet or serial connectors for diagnostic procedures.



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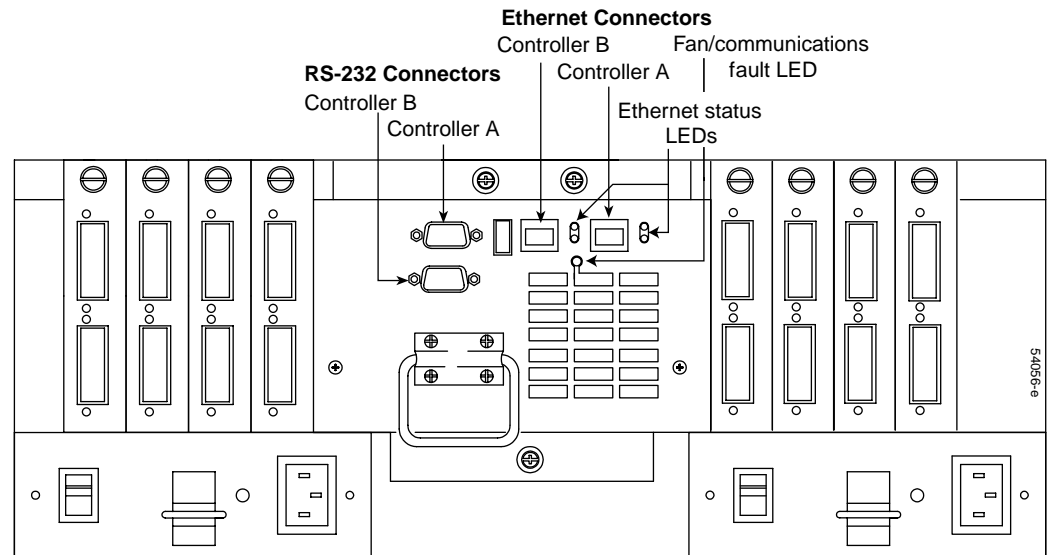
**Warning:** Electrostatic discharge can damage sensitive components. Use appropriate antistatic precautions before handling any components.

---

1. Connect the Ethernet interface cables (see Figure 12-21).

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 (see Figure 12-21).

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 12-21** Connecting Ethernet and Serial Interface Cables

## Powering On the System

To connect the controller and the drive enclosures to the AC power source and power on the system, follow these steps:

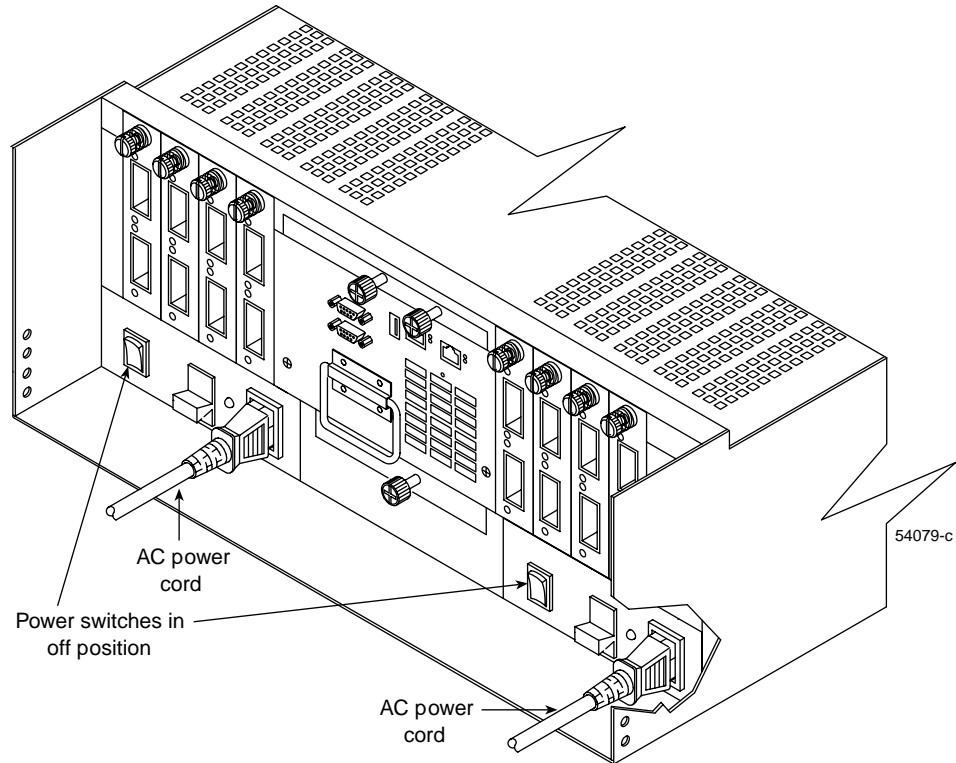
**Note:** To speed drive spin-up, it is recommended that you start the drive enclosures before or at the same time as the controller enclosure. This procedure powers up all components in the system by turning on the power distribution units.



**Warning:** 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 (see Figure 12-22).



**Figure 12-22** Connecting the Power Cords to the Controller Enclosure

4. Plug the controller enclosure power cords into the power distribution units. Plug the left power cords into the left PDU and plug the right power cords into the right PDU.

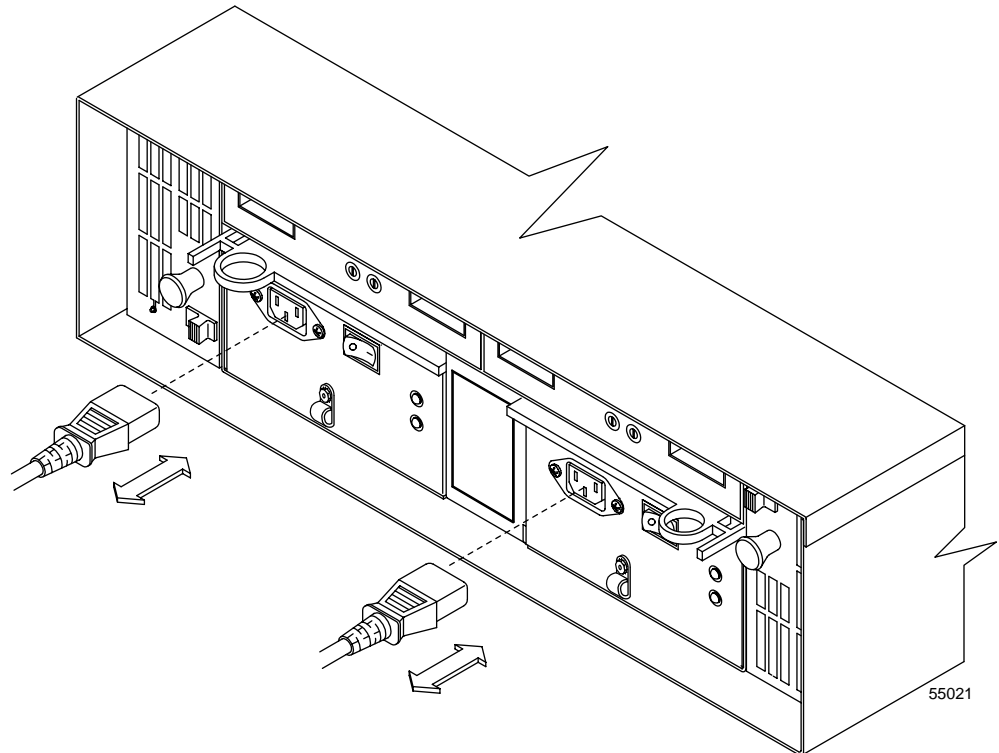
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**Note:** For details on power requirements, see Appendix A, “Specifications and Requirements”.

---

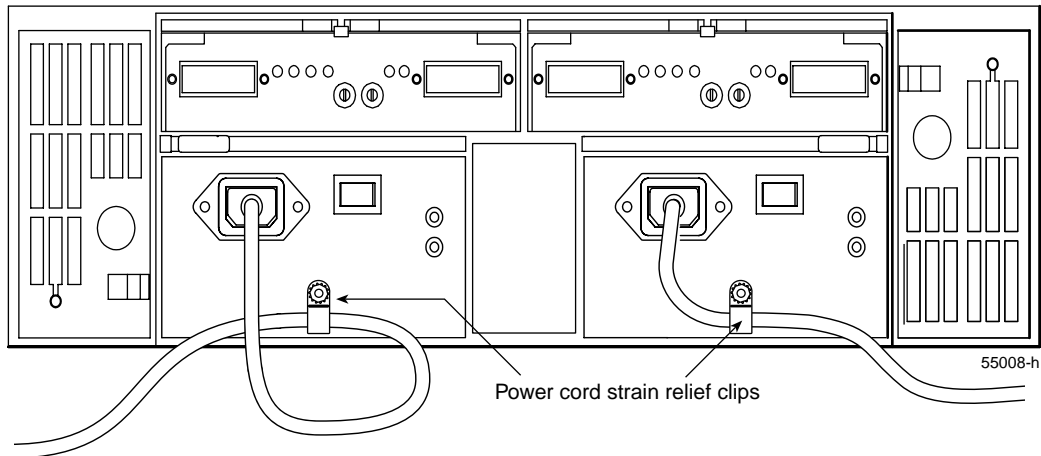
5. Plug the drive enclosure power cords into each power supply in the drive enclosures (see Figure 12-23).





**Figure 12-23** Connecting the Power Cords to the Drive Enclosure

6. To keep the power cords from being accidentally pulled from the power connections, secure the cords in the strain relief power cord clips. Figure 12-24 shows how the cords should be secured.



**Figure 12-24** Securing the Power Cords in the Cord Clips

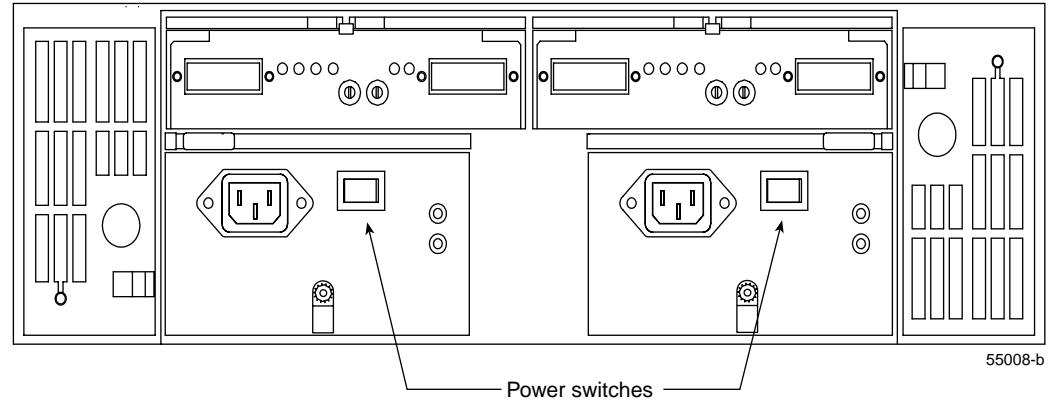
7. Plug all drive enclosure power cords into the power distribution units. Plug the left power cords into the left PDU and plug the right power cords into the right PDU.

---

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

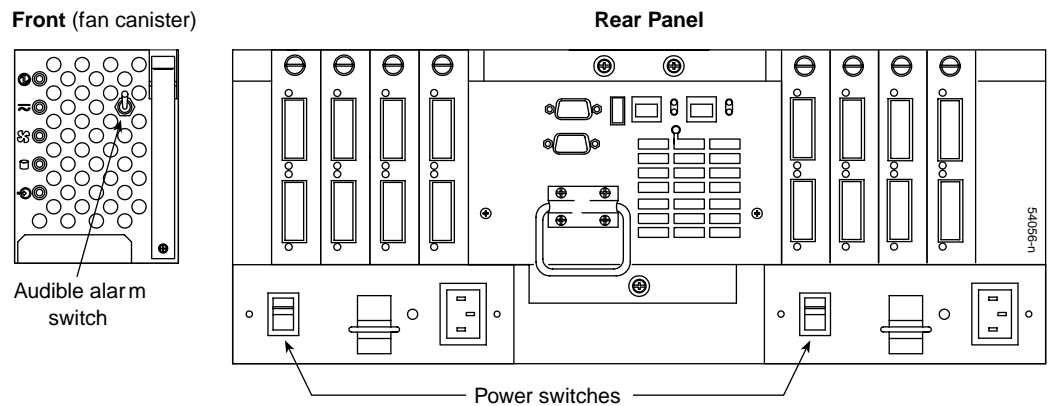
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8. To assure power redundancy, plug each power distribution unit into a separate AC power source.
9. Turn on both power switches on the rear of each drive enclosure (see Figure 12-25).



**Figure 12-25** Power Switches on the Drive Enclosure

10. Turn on both power switches on the rear of each controller enclosure (see Figure 12-26).



**Figure 12-26** Power Switches and Alarm Switch on the Controller Enclosure

11. Arm the optional alarm switch by setting it to the up position (see Figure 12-26).
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, see “Checking the Controller Enclosure Indicator Lights” on page 33 and “Checking the Indicator Lights” on page 181.

## Connecting the TP9700 Drive Loop Cables

The following information provides cabling guidelines for the TP9700 controller module using the 6998 controller. Direct topologies, fabric topologies, and mixed topologies are addressed. You are not limited to using only these topologies; the examples are included to provide basic concepts to help you define a maximal host-cabling topology. A table listing the maximum supported number of hosts is included.

### Maximum Number of Host Connections

Table 12-2 lists the maximum number of hosts that can be connected to a single controller module or array module.

**Table 12-2** Maximum Number of Host Connections

<b>Model</b>	<b>Maximum No. of Host Ports</b>
TP9700 (6998 controller module)	512

## TP9700 Direct Topologies

The following host to command module or array module topologies do not use switches.

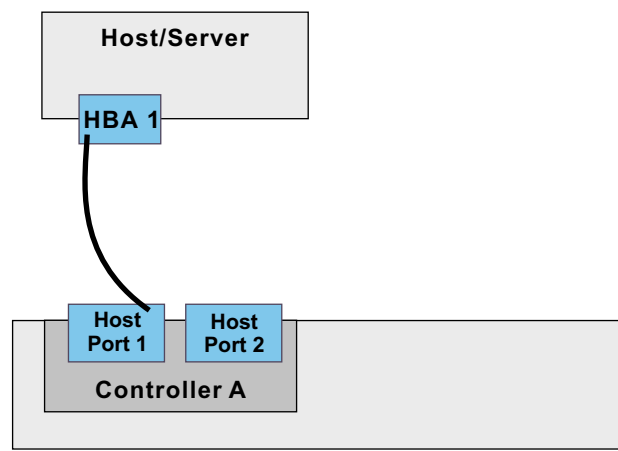
### One Single-HBA Host to a Single-Controller Command Module or Array Module

Figure 12-27 shows an example of a direct topology with one host and a single-controller command module or array module.

---

**Note:** The TP9700 has four host ports per controller. In the following illustrated examples however, we are using/showing only two host ports.

---



**Figure 12-27** Direct Topology – One Host and a Single-Controller Module or Array Module

Table 12-3 defines which of the components in this topology are non-redundant and present the risk of a single point of failure.

**Table 12-3** Redundant and Non-Redundant Components in a Single-HBA Host to a Single Controller Command Module or Array Module

Component	Redundant	Non-Redundant
Host/server		Y
HBA		Y
Host-to-controller cable		Y
Controller		Y

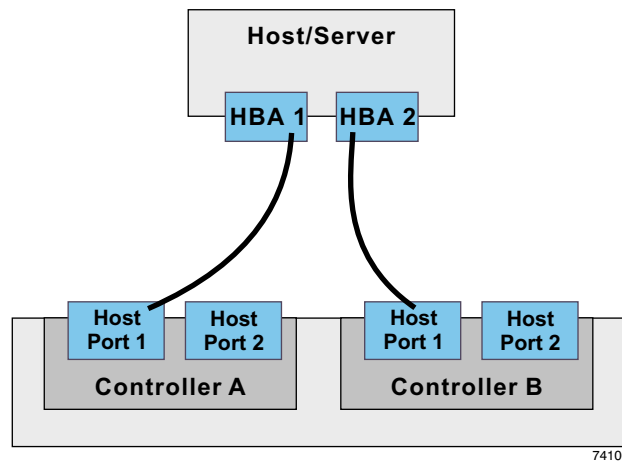
### One Dual-HBA Host to a Dual-Controller Command Module or Array Module

Figure 12-28 shows an example of a direct topology with one host and a dual-controller module or array module. Table 12-4 defines which of the components in this topology are non-redundant and present the risk of a single point of failure.

---

**Caution: Risk of loss of access to data** – Alternate path software or an alternate path (failover) driver must be installed on the host to support failover in the event of an HBA or host channel failure.

---



**Figure 12-28** Direct Topology – One Host and a Dual-Controller Module or Array Module

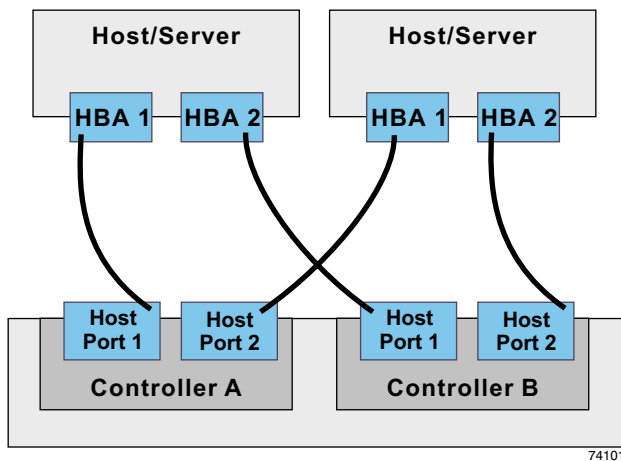
**Table 12-4** Redundant and Non-Redundant Components in a Dual-HBA Host to a Single Controller Command Module or Array Module

Component	Redundant	Non-Redundant
Host/server		Y
HBA	Y	
Host-to-controller cable	Y	
Controller	Y	

## Two Dual-HBA Hosts to a Dual-Controller Module or Array Module

Figure 12-29 shows an example of a direct topology with two hosts and a dual-controller command module or array module. Table 12-5 defines which of the components in this topology are non-redundant and present the risk of a single point of failure.

**Caution: Risk of loss of access to data** – Alternate path software or an alternate path (failover) driver must be installed on the host to support failover in the event of an HBA or host channel failure.



**Figure 12-29** Direct Topology – Two Hosts and a Dual Controller Module or Array Module

**Table 12-5** Redundant and Non-Redundant Components in Two Dual-HBA Hosts to a Dual-Controller Command Module or Array Module

Component	Redundant	Non-Redundant
Host/server	Y	
HBA	Y	
Host-to-controller cable	Y	
Controller	Y	

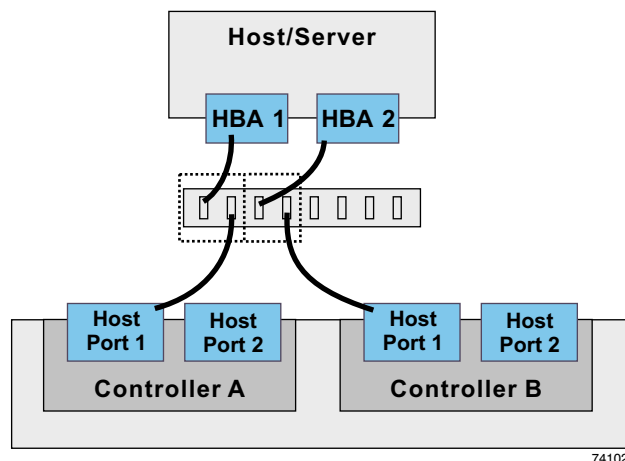
## TP9700 Fabric Topologies

The following host to command module or array module topologies include one or more switches. Note that the TP9700 has four host ports per controller. In the following illustrated examples however, we are using only two host ports.



## One Dual-HBA Host to a Dual-Controller Module or Array Module

Figure 12-30 shows an example of a fabric topology with one host, a dual-controller module or array module, and a zoned switch. Table 12-6 defines which of the components in this topology are non-redundant and present the risk of a single point of failure.



**Figure 12-30** Fabric Topology – One Host and a Dual-Controller Module or Array Module with a Switch

**Caution: Risk of loss of access to data** – Alternate path software or an alternate path (failover) driver must be installed on the host to support failover in the event of an HBA or host channel failure.

**Table 12-6** Redundant and Non-Redundant Components in a Dual-HBA Host to a Dual-Controller Command Module or Array Module with a Switch

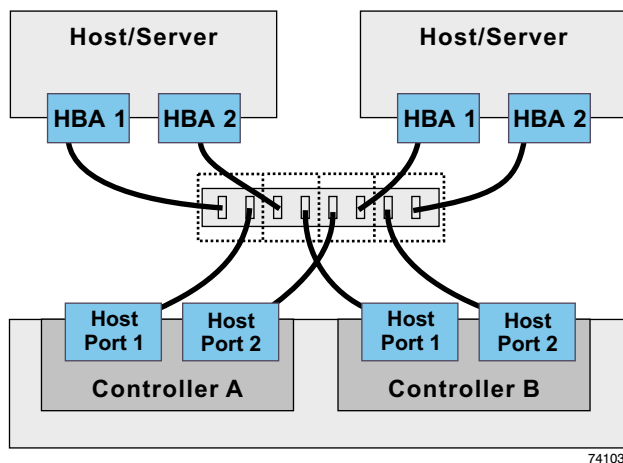
Component	Redundant	Non-Redundant
Host/server		Y
HBA	Y	
Host-to-controller cable	Y	

**Table 12-6** Redundant and Non-Redundant Components in a Dual-HBA Host to a Dual-Controller Command Module or Array Module with a Switch

Component	Redundant	Non-Redundant
Switch		Y
Controller	Y	

### Two Dual-HBA Hosts to a Dual-Controller Module or Array Module

Figure 12-31 shows an example of a fabric topology with two hosts, a dual-controller command module or array module, and a zoned switch. Table 12-7 defines which of the components in this topology are non-redundant and present the risk of a single point of failure.



**Figure 12-31** Fabric Topology – Two Hosts and a Dual-Controller Module or Array Module with a Zoned Switch

**Table 12-7** Redundant and Non-Redundant Components in Two Dual-HBA Host to a Dual-Controller Command Module or Array Module with a Zoned Switch

Component	Redundant	Non-Redundant
Host/server	Y	
HBA	Y	
Host-to-controller cable	Y	
Switch		Y
Controller	Y	

---

**Caution: Risk of loss of access to data** – Alternate path software or an alternate path (failover) driver must be installed on the host to support failover in the event of an HBA or host channel failure.

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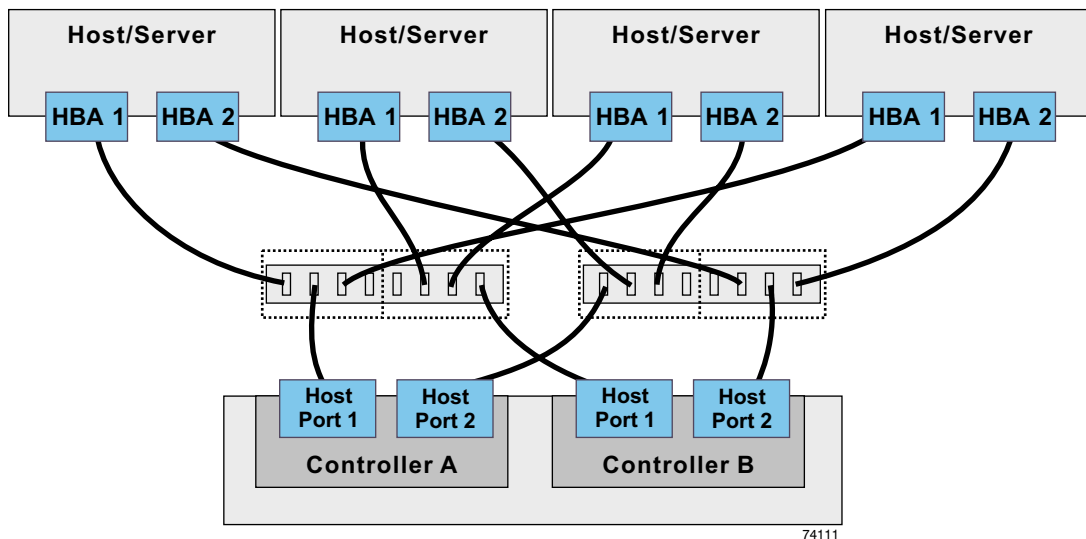
## Four Dual-HBA Hosts to a Dual-Controller Module or Array Module

Figure 12-32 shows an example of a fabric topology with four hosts, a dual-controller command module or array module, and two zoned switches. Table 12-8 defines which of the components in this topology are non-redundant and present the risk of a single point of failure.

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**Caution: Risk of loss of access to data** – Alternate path software or an alternate path (failover) driver must be installed on the host to support failover in the event of an HBA or host channel failure.

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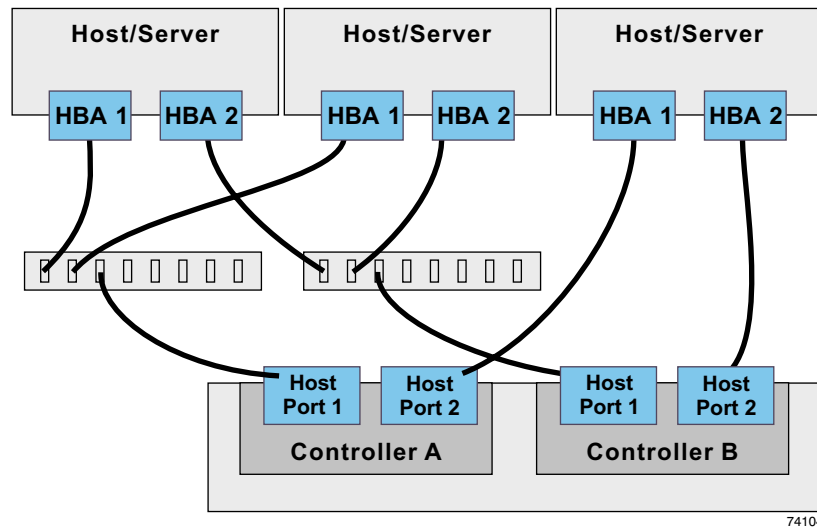
**Figure 12-32** Fabric Topology – Four Hosts and a Dual-Controller Module or Array Module with Two Zoned Switches

**Table 12-8** Redundant and Non-Redundant Components in Four Dual-HBA Hosts to a Dual-Controller Command Module or Array Module with Two Zoned Switches

Component	Redundant	Non-Redundant
Host/server	Y	
HBA	Y	
Host-to-controller cable	Y	
Switch	Y	
Controller	Y	

## Mixed Topologies

Figure 12-33 shows an example of a mixed topology, that is, a topology that combines both fabric and direct topologies. The example shows three hosts, a dual-controller command module or array module, and two switches. Table 12-9 defines which of the components in this topology are non-redundant and present the risk of a single point of failure.



**Figure 12-33** Mixed Topology – Three Hosts and a Dual-Controller Module or Array Module

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**Caution:** Risk of loss of access to data – Alternate path software or an alternate path (failover) driver must be installed on the host to support failover in the event of an HBA or host channel failure.

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**Table 12-9** Redundant and Non-Redundant Components in Three Dual-HBA Hosts to a Dual-controller Module or Array Module with Two Switches

Component	Redundant	Non-Redundant
Host/server	Y	
HBA	Y	
Host-to-controller cable	Y	
Switch	Y	
Controller	Y	

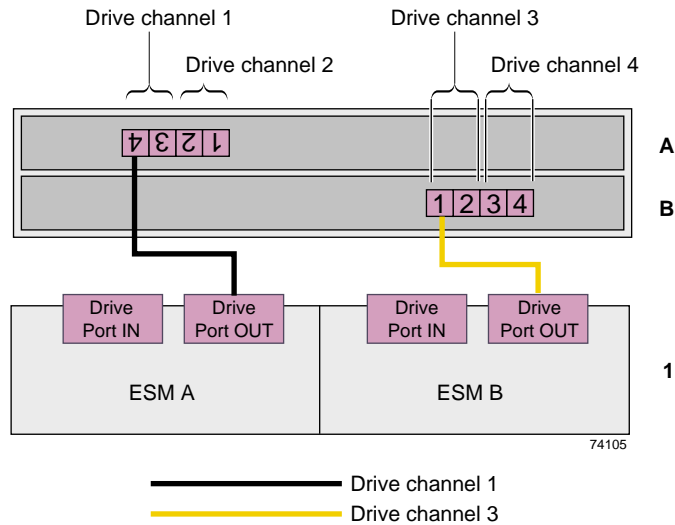
## 6998 Controller Module Drive Cabling Topologies

This section provides four cabling examples for the 6998 controller module. Each example provides redundant paths to the drives. If one of these examples is suitable for your hardware and application, complete the cabling connections as described by the tables. If you have hardware other than what is shown in these examples to include in your topology, use these examples as a starting point for creating your specific topology.

If you are using fiber-optic cables, install SFP transceivers into the ports that will receive the cables before installing the cables.

### One 6998 Controller Module and One Drive Module

If you are cabling one 6998 controller module to one drive module, use the cabling topology described in Figure 12-34 and Table 12-10.



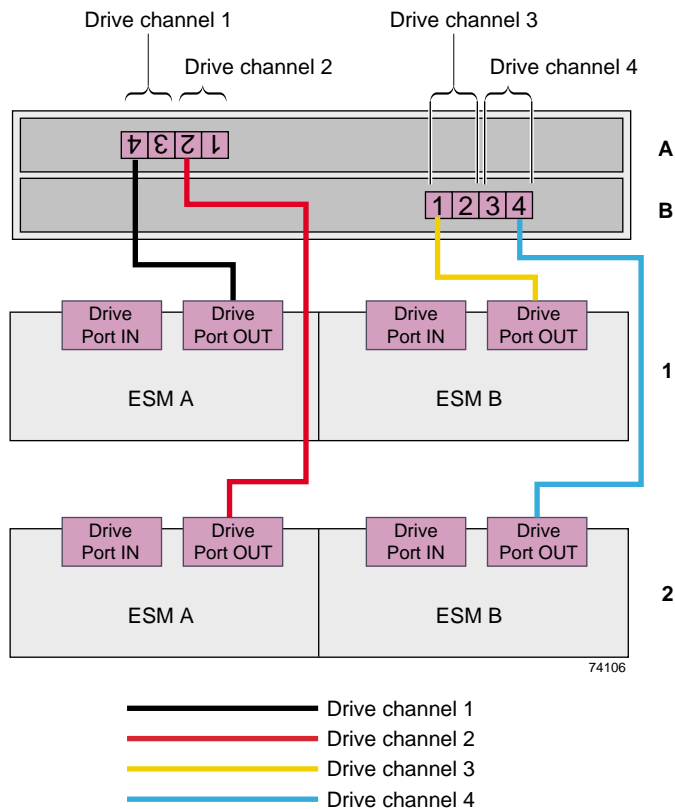
**Figure 12-34** One 6998 Controller Module and One Drive Module

**Table 12-10** One 6998 Controller Module and One Drive Module

Drive Channel	Connection Point		Connection Point	
	Module/Component	Port Number/Location	Module/Component	Port Number/Location
1	Controller A	4	Drive Module 1	Left ESM Drive Port Out
3	Controller B	1	Drive Module 1	Right ESM Drive Port Out

## One 6998 Controller Module and Two Drive Modules

If you are cabling a 6998 controller module to two drive modules, use the cabling topology described in Figure 12-35 and Table 12-11.



**Figure 12-35** Two 6998 Controllers With Two Drive Module Connections Each

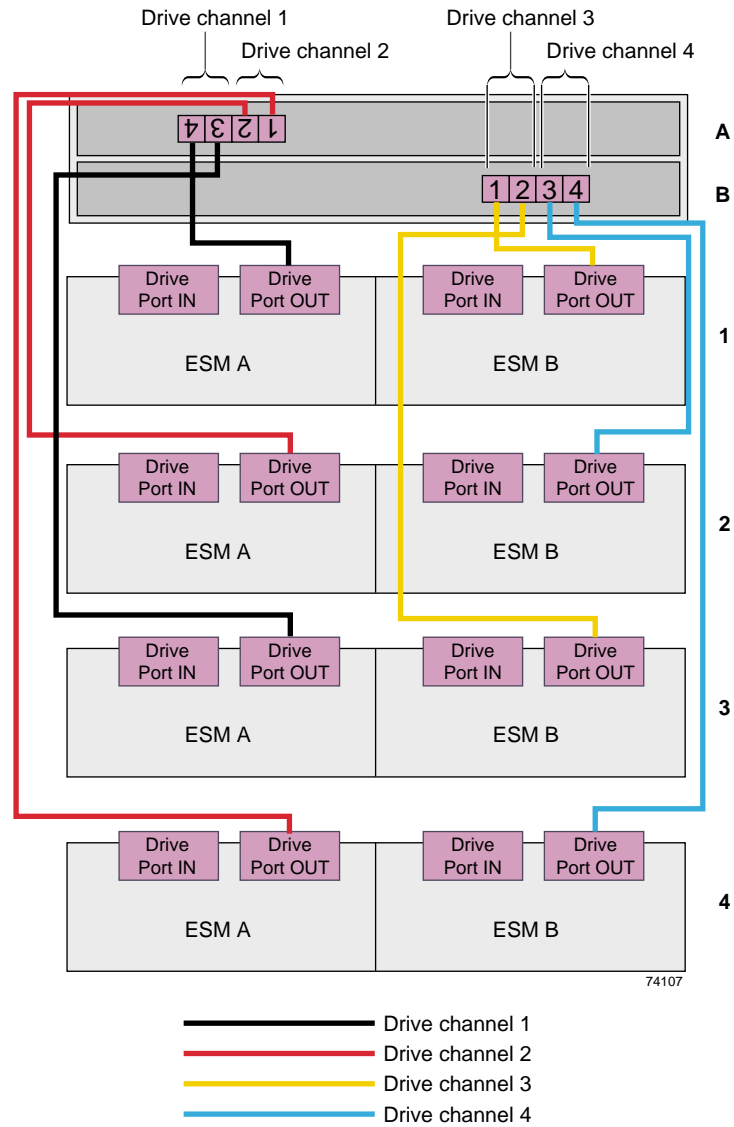
**Table 12-11** Two 6998 Controller Modules and Two Drive Modules

Drive Channel	Connection Point		Connection Point	
	Module/Component	Port Number/Location	Module/Component	Port Number/Location
1	Controller A	4	Drive Module 1	Left ESM Out
3	Controller B	1	Drive Module 1	Right ESM Out
2	Controller A	2	Drive Module 2	Left ESM Out
4	Controller B	3	Drive Module 2	Right ESM Out



## One 6998 Controller Module and Four Drive Modules

If you are cabling two 6998 controllers to four drive modules, use Figure 12-36.



**Figure 12-36** Two 6998 Controllers and Four Drive Modules

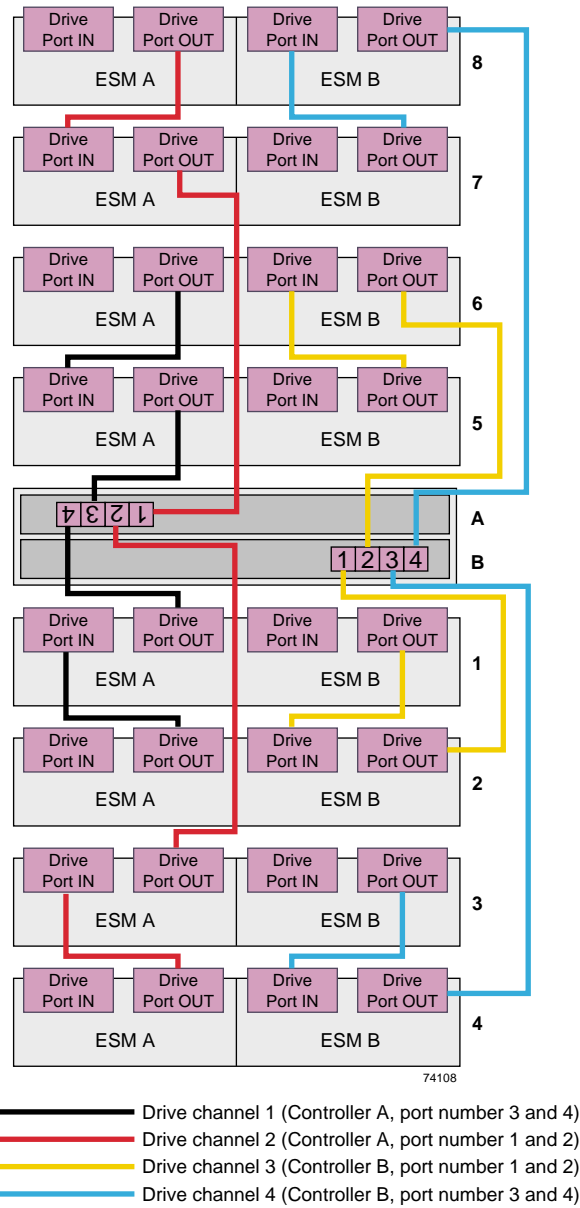
The cabling topology for connecting two controllers (one enclosure) to four drive modules is also described in Table 12-12.

**Table 12-12** Two Controllers and Four Drive Modules

Drive Channel	Connection Point		Connection Point	
	Module/Component	Port Number/Location	Module/Component	Port Number/Location
1	Controller A	4	Drive Module 1	Left ESM Out
3	Controller B	1	Drive Module 1	Right ESM Out
2	Controller A	2	Drive Module 2	Left ESM Out
4	Controller B	3	Drive Module 2	Right ESM Out
1	Controller A	3	Drive Module 3	Left ESM Out
3	Controller B	2	Drive Module 3	Right ESM Out
2	Controller A	1	Drive Module 4	Left ESM Out
4	Controller B	4	Drive Module 4	Right ESM Out

### One 6998 Command Module and Eight Drive Modules

If you are cabling eight 6998 controller modules to a drive module, use the cabling topology described in Table 12-13 and Figure 12-37.



**Figure 12-37** 6998 Controller Module and Eight Drive Modules

**Table 12-13** Eight 6998 Controller Modules and One Drive Module

Drive Channel	Connection Point		Connection Point	
	Module/Component	Port Number/Location	Module/Component	Port Number/Location
1	Controller A	4	Drive Module 1	Left ESM Out
	Drive Module 1	Left ESM In	Drive Module 2	Left ESM Out
	Controller B	1	Drive Module 2	Right ESM Out
	Drive Module 2	Right ESM In	Drive Module 1	Right ESM Out
2	Controller A	3	Drive Module 5	Left ESM Out
	Drive Module 5	Left ESM In	Drive Module 6	Left ESM Out
	Controller B	2	Drive Module 6	Right ESM Out
	Drive Module 6	Right ESM In	Drive Module 5	Right ESM Out
3	Controller A	2	Drive Module 3	Left ESM Out
	Drive Module 3	Left ESM In	Drive Module 4	Left ESM Out
	Controller B	3	Drive Module 4	Right ESM Out
	Drive Module 3	Right ESM In	Drive Module 4	Right ESM Out
4	Controller A	1	Drive Module 7	Left ESM Out
	Drive Module 7	Left ESM In	Drive Module 8	Left ESM ut
	Controller B	4	Drive Module 8	Right ESM Out
	Drive Module 8	Right ESM In	Drive Module 7	Right ESM Out

## Ethernet Cabling Information

This section provides examples of how to connect your storage array to an Ethernet network for out-of-band storage array management. If you plan to use in-band storage array management, Ethernet cabling is unnecessary.

---

**Caution: Risk of interruption of access to data** – If out-of-band management is used, connect the command module or array module Ethernet ports to a private network segment behind a firewall. If the Ethernet connection is not protected by a firewall, it is possible for data to become unavailable for a prolonged period of time and data may be at risk of being accessed from outside your network.

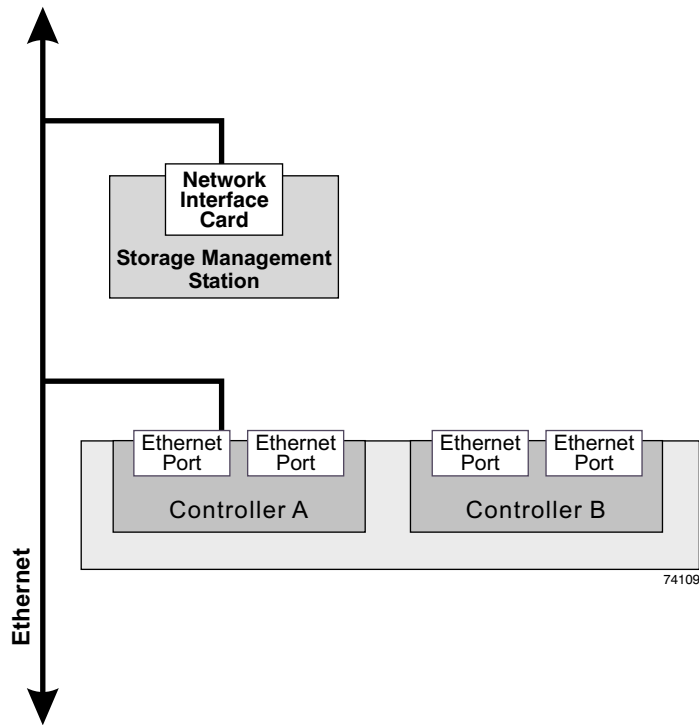
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Figure 12-38 shows a single connection from the command module or array module to the Ethernet. In this topology, a network interface card (NIC) must be installed in the storage management station where the client software resides

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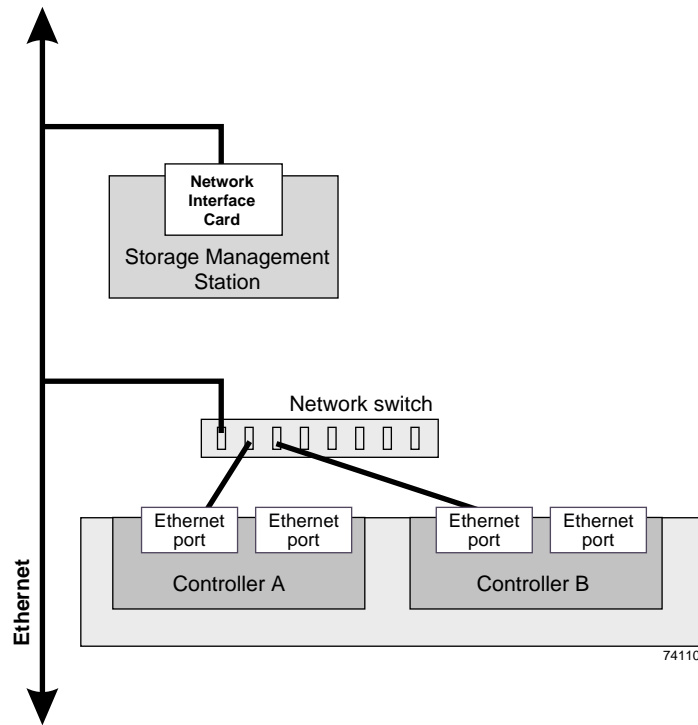
**Important:** If the command module or array module is connected directly to the storage management station NIC, and an Ethernet cross-over cable must be used to cable the storage management station to the Ethernet port. An Ethernet cross-over cable is a special cable that reverses the pin contacts between the two ends of the cable.

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**Figure 12-38** Direct Non-Redundant Out-of-Band Ethernet Topology

Figure 12-39 shows two connections from the command module or array module to two ports on an Ethernet switch. In this topology, a network interface card must be installed in the storage management station where the client software resides, and an Ethernet switch and Ethernet cables must be used for all cabling.



**Figure 12-39** Redundant Out-of-Band Ethernet Topology

If you have a total of four available Ethernet ports on your module or array module (two per controller), reserve one port on each controller for Customer Technical Support access to the storage array.





## Specifications and Requirements

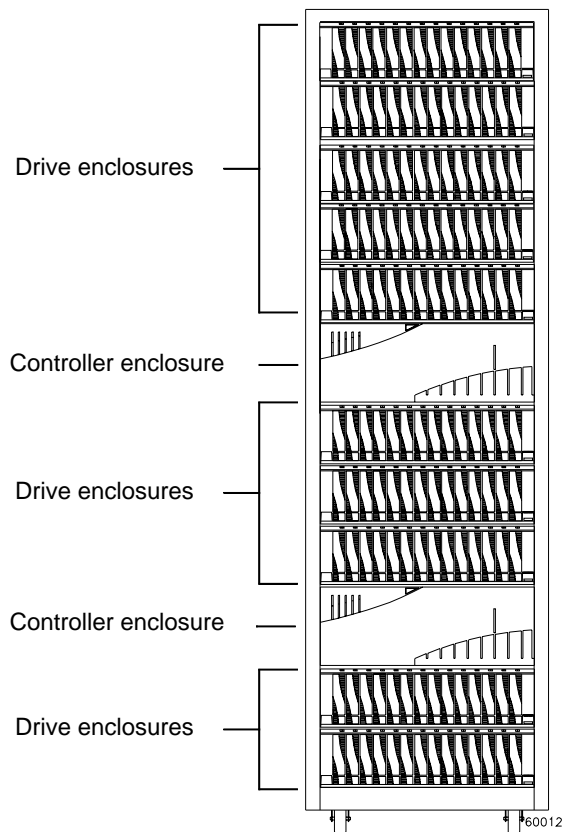
This appendix describes the technical specifications and requirements of the system rack and components in the following sections:

- “Rack Specifications” on page 269
- “Controller Enclosure Specifications” on page 279
- “Drive Enclosure Specifications” on page 284

### Rack Specifications

The system is housed in 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.

Figure A-1 shows a fully populated rack that contains ten 14-drive enclosures and two controller enclosures mounted in a 72-inch high rack.



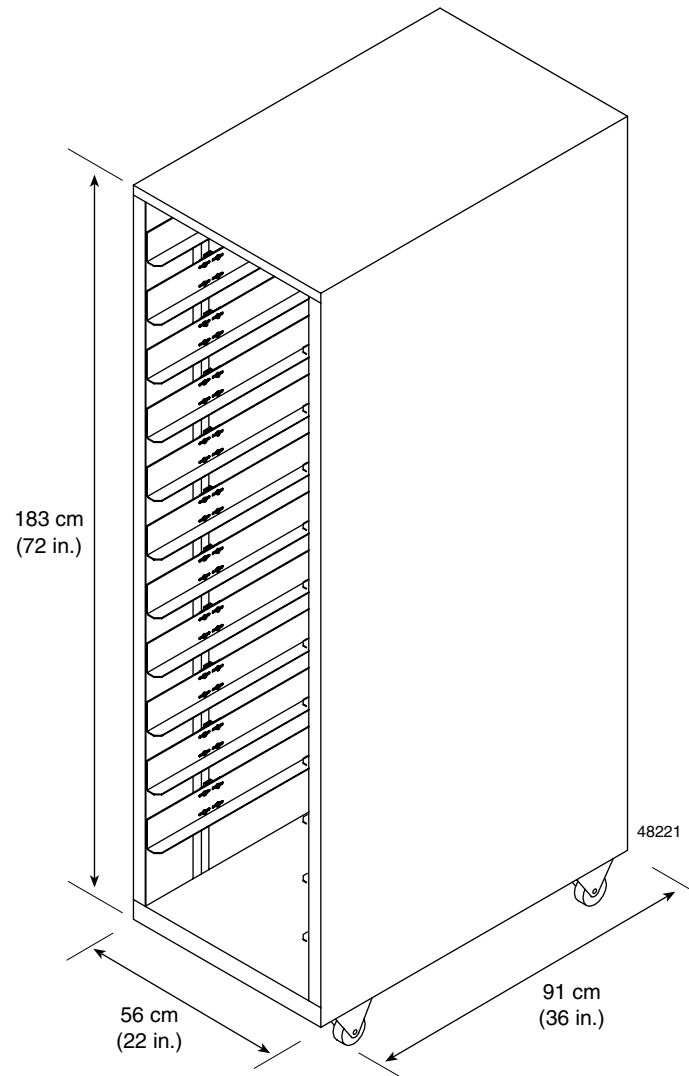
**Figure A-1** Rack Controller Enclosures and Drive Enclosures

For more information on installation and cabling schemes, see the following documents:

- *SGI InfiniteStorage TPSSM Software Concepts Guide (007-4749-00X)*  
This guide explains the terminology and features of the TPSSM storage management software.
- *SGI InfiniteStorage TPSSM Administration Guide (007-4748-00X)*  
This guide gives complete instructions on how to install the TPSSM software for host and/or client operation.
- *SGI TP9500 RAID Installation and Upgrade Guide (108-0375-00X)*

## Dimensions

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



**Figure A-2** Dimensions of the System Rack

## Weight

The total weight of the system 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.

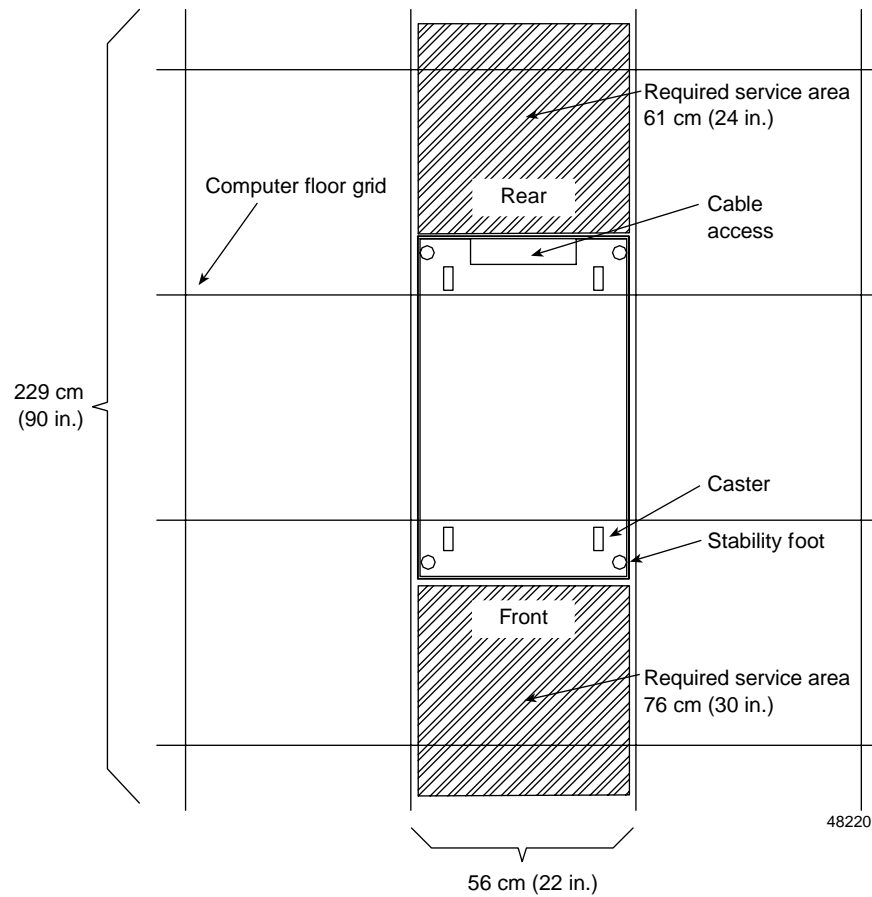
**Table A-1** Rack, Crate, and Enclosure Weights

<b>Rack (Empty)</b>	<b>Crate (Empty)</b>	<b>Controller Enclosure (Maximum)</b>	<b>Drive Enclosures (Maximum)</b>	<b>Drive Enclosures (Maximum)</b>
121.0 kg (270.0 lb)	97.0 kg (215.0 lb)	44.0 kg (97.0 lb)	<b>10-Drive Enclosure</b>	<b>10-Drive Enclosure</b>
			36-GB drives	37.2 kg (82.0 lb)
			73-GB drives	40.4 kg (89.0 lb)
			180-GB drives	42.8 kg (94.0 lb)
			<b>14-Drive Enclosure</b>	<b>14-Drive Enclosure</b>
			36-GB drives	40.4 kg (89.0 lb)
			73-GB drives	42.1 kg (93.0 lb)

## Area Requirements

The floor area at the installation site must provide the following:

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



**Figure A-3** System Area Requirements

**Table A-2** System 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 14-drive enclosures with 36-GB drives	44.0 kg (97.0 lb) 40.4 kg (89.0 lb)	368.0 kg (807 lb)
Configuration B	2 controller enclosures and 10 14-drive enclosures with 36-GB drives	44.0 kg (76.0 lb) 40.4 kg (89.0 lb)	619.0 kb (1347 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 system 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 SGI TP9500 and SGI TP9700 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 A

**Table A-4** AC Power Requirements for Typical Configurations

Current	Configuration A <sup>a</sup>	Configuration B <sup>b</sup>	Configuration C <sup>c</sup>
Operating current	7.35 A	14.7 A	13.16 A
Surge current	10.95 A	21.9 A	22.20 A

a. Configuration A contains 1 controller enclosure and 5 drive enclosures.

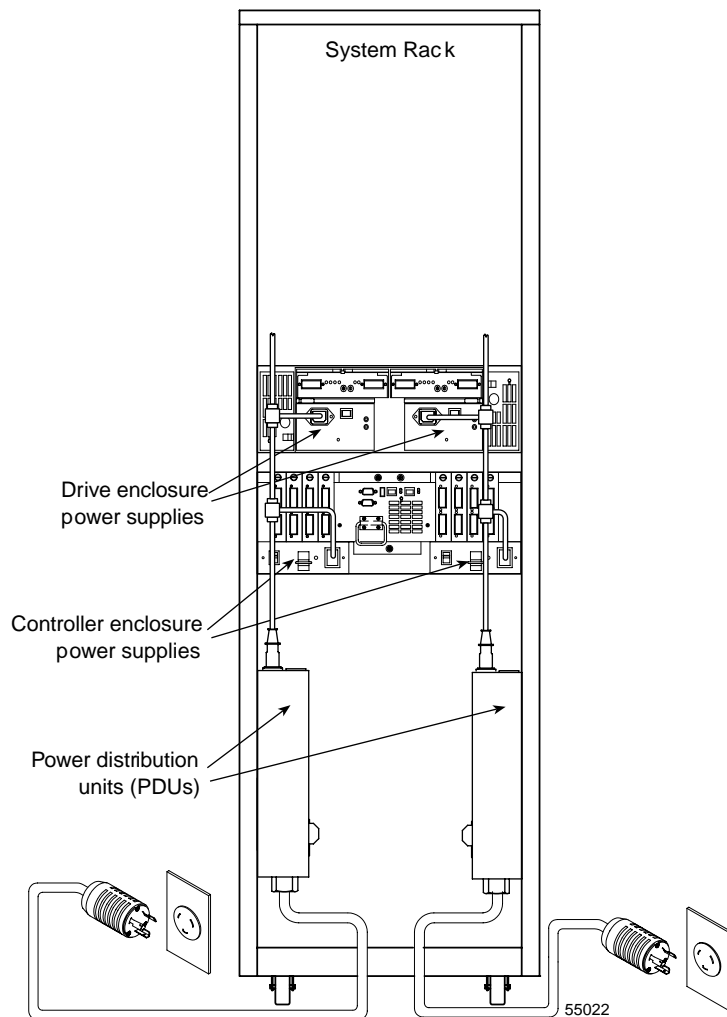
b. Configuration B contains 2 controller enclosure and 10 drive enclosures.

c. Configuration C contains 3 controller enclosure and 8 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 (see 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:

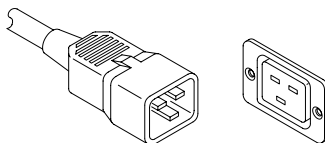
- **Component power cord:** Connects from each component to the PDU.
- **Domestic power cord:** Connects from the PDU to an independent 20 A circuit breaker.
- **International power cord:** Connects from the PDU to an independent 20 A circuit breaker.

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.

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### Component

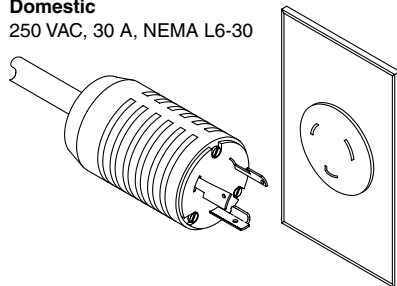
250 VAC, 16 A, IEC 320-C19



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### Domestic

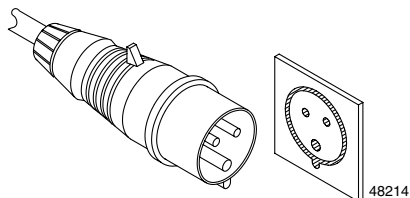
250 VAC, 30 A, NEMA L6-30



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### International

230 VAC, 32 A, IEC 309



**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 SGI TP9500 and SGI TP9700.



**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 95 °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 <sup>a</sup>	
	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
	Configuration B <sup>b</sup>	
	36-GB drives	2.87 kVA 2885 W 9855 Btu/hr
	73-GB drives	3.37 kVA 3395 W 11595 Btu/hr

a. 1 controller enclosure, 5 drive enclosures.

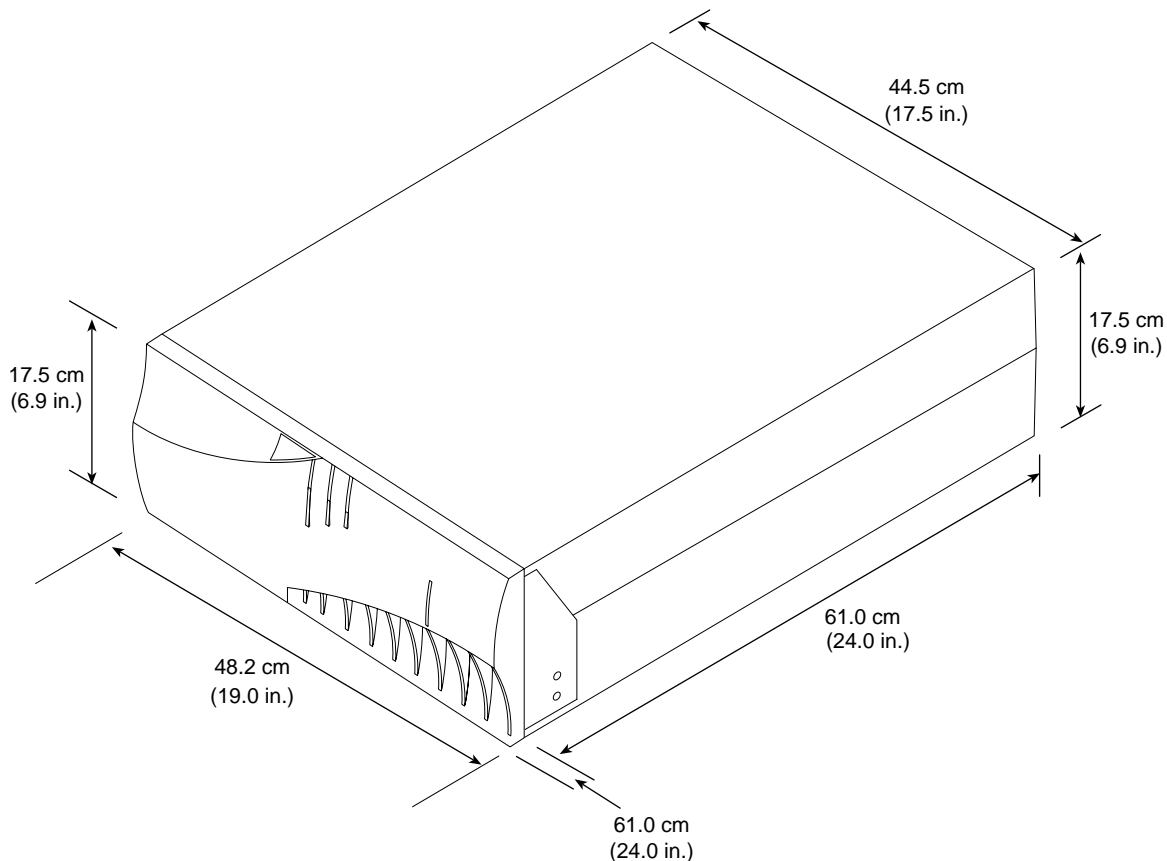
b. 2 controller enclosures, 10 drive enclosures.

## Controller Enclosure Specifications

This section lists 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** Dimensions of the Controller Enclosure

## 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 <sup>a</sup>	Empty Weight <sup>b</sup>	Maximum Shipping Weight <sup>c</sup>	Empty Shipping Weight <sup>d</sup>
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)
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, and so on).

- **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** Site Wiring Voltages for Controller Enclosures (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** Altitude Requirements for Controller Enclosures

Condition	Range	Requirement below Sea Level	Requirement above Sea Level
Altitude <sup>a</sup>	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** Environmental Requirements for Controller Enclosures

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	1 °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

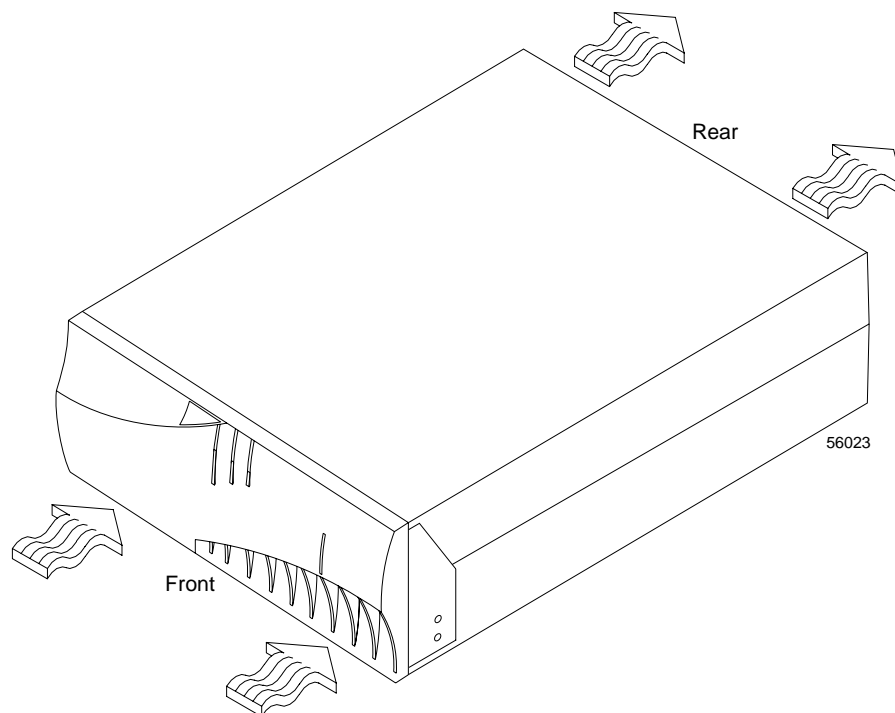
## Air Flow

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

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

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**Figure A-7** Air Flow Through the Controller Enclosure

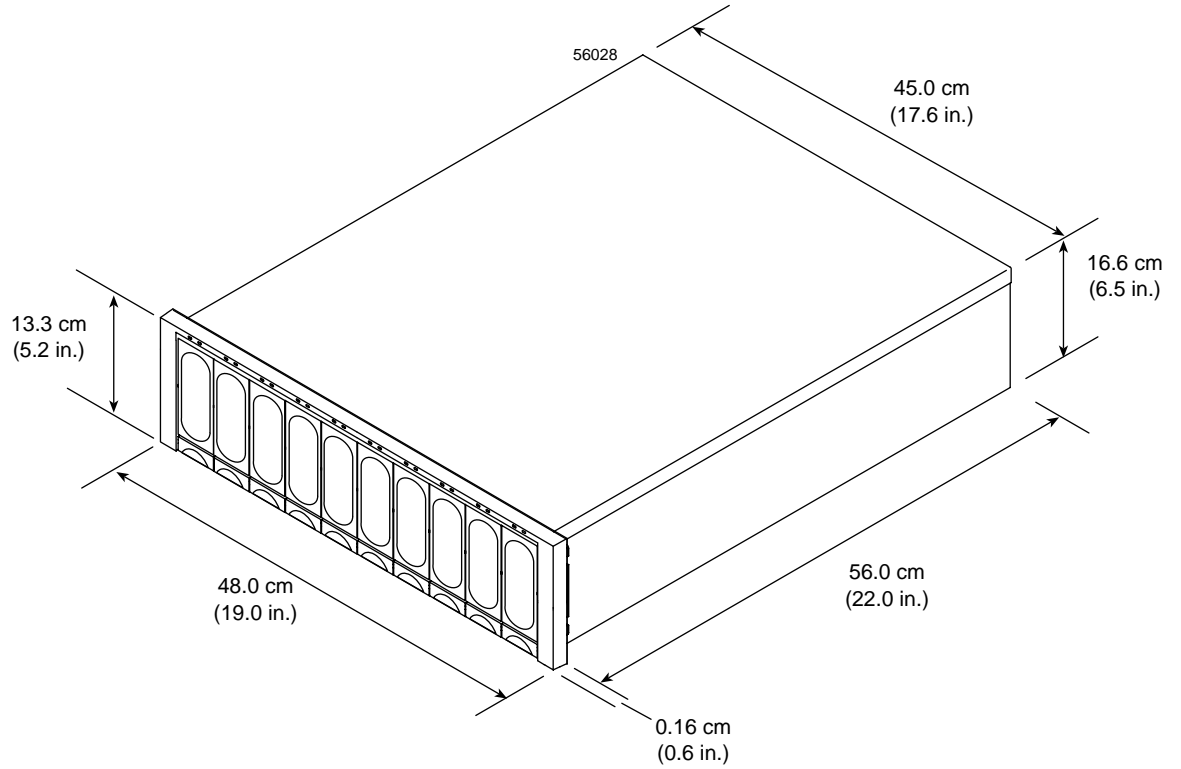
## Drive Enclosure Specifications

This section lists the dimensions and weights, as well as the wiring, power, environmental, and airflow requirements for the 10- and 14-drive enclosures.

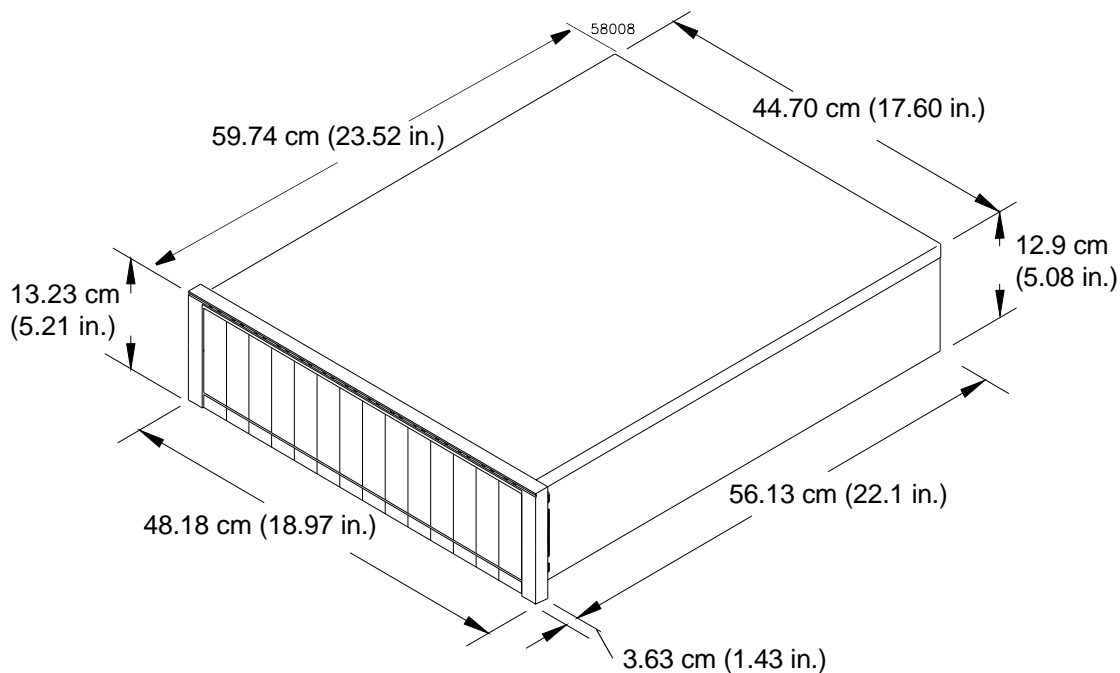
### Dimensions

Make sure the installation site provides a minimum of two feet of space around the rack to install and service the drive enclosures and to allow adequate ventilation during operation. Figure A-8 shows the dimensions of the 10-drive enclosure; Figure A-9 shows the dimensions of the 14-drive enclosure.





**Figure A-8** Dimensions of the 10-Drive Enclosure



**Figure A-9** Dimensions of the 14-Drive Enclosure

## 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 and Table A-14 list the unit and shipping weights for individual canisters and the weights of minimum, maximum, and empty drive enclosure configurations in both the 10- and 14-drive enclosures.

**Table A-13** 10-Drive Enclosure Weights

Unit	Minimum <sup>a</sup>	Maximum <sup>b</sup>	Empty <sup>c</sup>	Shipping <sup>d</sup>
10-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)
10-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)
10-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.

**Table A-14** 14-Drive Enclosure Weights

Unit	Minimum <sup>a</sup>	Maximum <sup>b</sup>	Empty <sup>c</sup>	Shipping <sup>d</sup>
14-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)
14-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)

**Table A-14** 14-Drive Enclosure Weights (**continued**)

<b>Unit</b>	<b>Minimum<sup>a</sup></b>	<b>Maximum<sup>b</sup></b>	<b>Empty<sup>c</sup></b>	<b>Shipping<sup>d</sup></b>
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 (see Table A-15). 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 A 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.



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

**Table A-15** Site Wiring Voltages for Drive Enclosures  
(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-16 and Table A-17 lists the environmental requirements for the drive enclosure.

**Table A-16** Drive Enclosure Altitude Requirements

Condition	Range	Requirement below Sea Level	Requirement above Sea Level
Altitude <sup>a</sup>	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-17** Environmental Requirements for Drive Enclosures

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
Relative humidity (no Condensation)	Operating	20% to 80%
	Storage	10% to 90%
	Transit	5% to 95%
	Max. dew point	26 °C (79 °F)
	Max. humidity Gradient	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

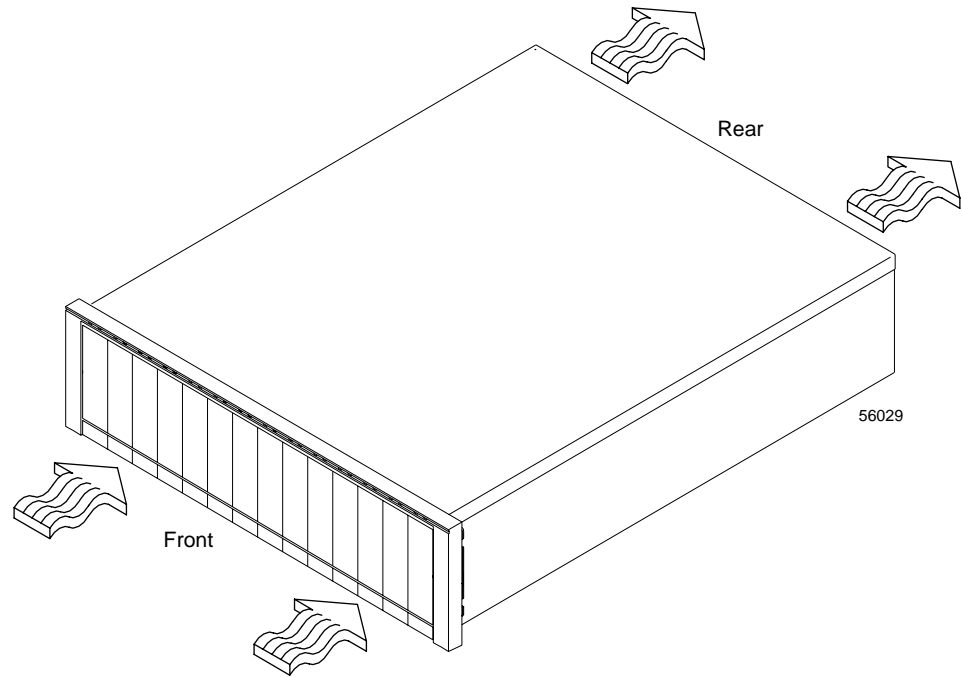
## Air Flow

Figure A-10 shows the air flow in the drive enclosure. 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-10** Air Flow in the Drive Enclosure

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**Note:** The enclosure shown in Figure A-10 is a 14-drive enclosure. The air flow in 10-drive enclosures is similar.

---





## 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, Inc. 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



---

**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.

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## 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'émet pas de perturbations radioélectriques dépassant les normes applicables aux appareils numériques de Classe A prescrites dans le Règlement sur les interférences 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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