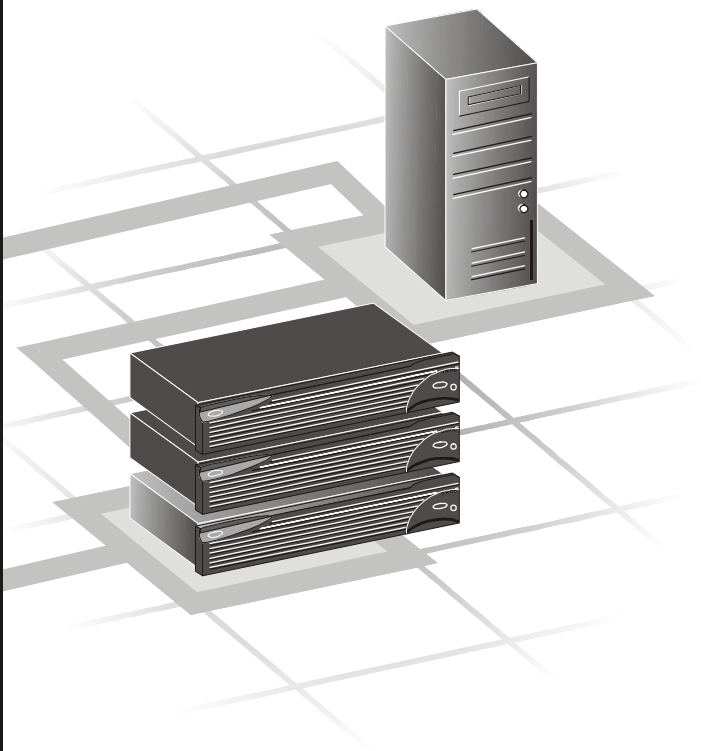
adaptec

INSTALLATION AND USER GUIDE

DURASTOR 412R/6320SS/7320SS



Regulatory Compliance Statements

Federal Communications Commission Radio Frequency Interference Statement

WARNING: Changes or modifications to this unit not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

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

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

European Union Compliance Statement

This Information Technology Equipment has been tested and found to comply with EMC Directive 89/336/EEC, as amended by 92/31/EEC and 93/68/EEC, in accordance with:

- EN55022 (1998) Emissions
- EN55024 (1998) Immunity:
  - EN61000-4-2 (1998) Electrostatic discharge: ±4 kV contact, ±8 kV air
  - EN61000-4-3 (1998) Radiated immunity
  - EN61000-4-4 (1995) Electrical fast transients/burst: ±1 kV AC, ±0.5 kV I/O
  - EN61000-4-5 (1995) Surges ±1 kV differential mode, ±2 kV common mode
  - EN61000-4-6 (1996) Conducted immunity: 3 V
  - EN61000-4-11 (1994) Supply dips and variation: 30% and 100%

In addition, all equipment requiring U.L. listing has been found to comply with EMC Directive 73/23/EEC as amended by 93/68/EEC in accordance with EN60950 with amendments A1, A2, A3, A4, A11.

Australian/New Zealand Compliance Statement

This device has been tested and found to comply with the limits for a Class A digital device, pursuant to the Australian/New Zealand standard AS/NZS 3548 set out by the Spectrum Management Agency.

Canadian Compliance Statement

This Class A digital apparatus meets all requirements of the Canadian Interference-Causing Equipment Regulations.

Cet appareil numérique de la classe A respecte toutes les exigences du Règlement sur le matériel brouilleur du Canada.

Japanese Compliance (Voluntary Control Council Initiative)

This is a class A product. In a domestic environment, this product may cause radio interference, in which case the user may be required to take corrective action.

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4 Monitoring DuraStor

5 Understanding and Maintaining Components

6 Troubleshooting

C Advanced Configurations and Cabling

1

Introduction

In This Chapter

About This Guide

This *Installation and User's Guide* describes how to install, use, and maintain these Adaptec DuraStor products:

- DuraStor 412R drive enclosure
- DuraStor 6320SS SCSI-to-SCSI external RAID storage subsystem
- DuraStor 7320SS Fibre Channel-to-SCSI external RAID storage subsystem

This *Guide* does not describe the two storage management software tools provided as part of the complete DuraStor package. Detailed operation instructions for these tools are provided in separate user's guides. See Chapter 3, *Accessing Your Storage Management Tools*.

This *Guide* assumes that you are familiar with basic computer hardware and network administration terminology and tasks, and that, if you are using your DuraStor product as part of an external storage subsystem, you have a working knowledge of Redundant Array of Independent Disks (RAID) technology.

Overview

DuraStor 412R

Figure 1-1 shows the components of the DuraStor 412R drive enclosure.

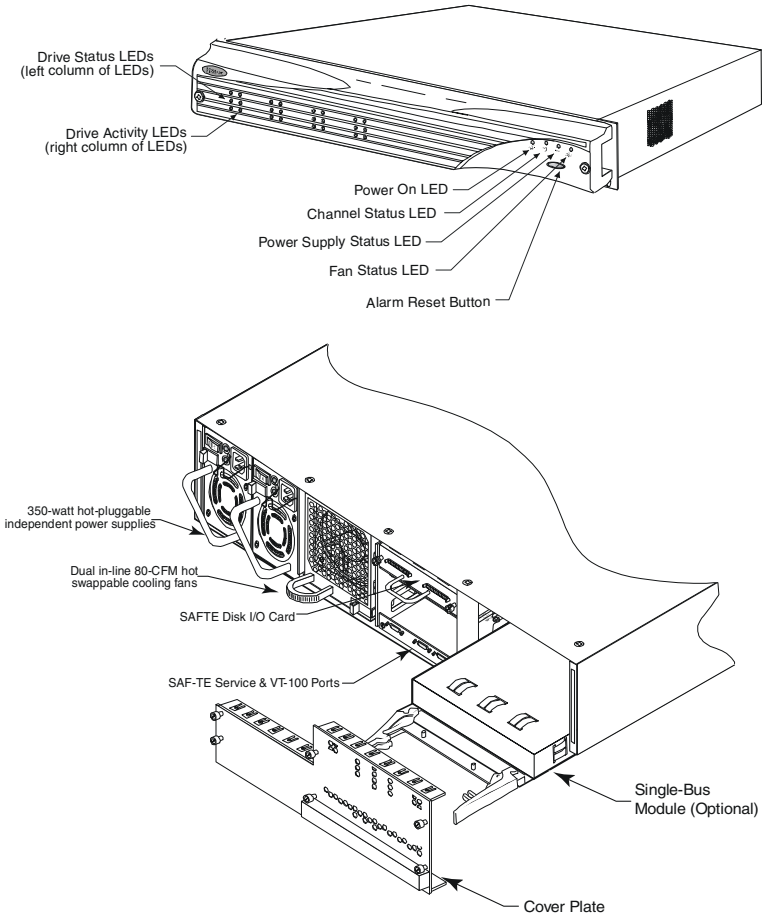


Figure 1-1 DuraStor 412R Drive Enclosure

DuraStor 6320SS

Figure 1-2 shows the components of the DuraStor 6320SS Storage Subsystem.

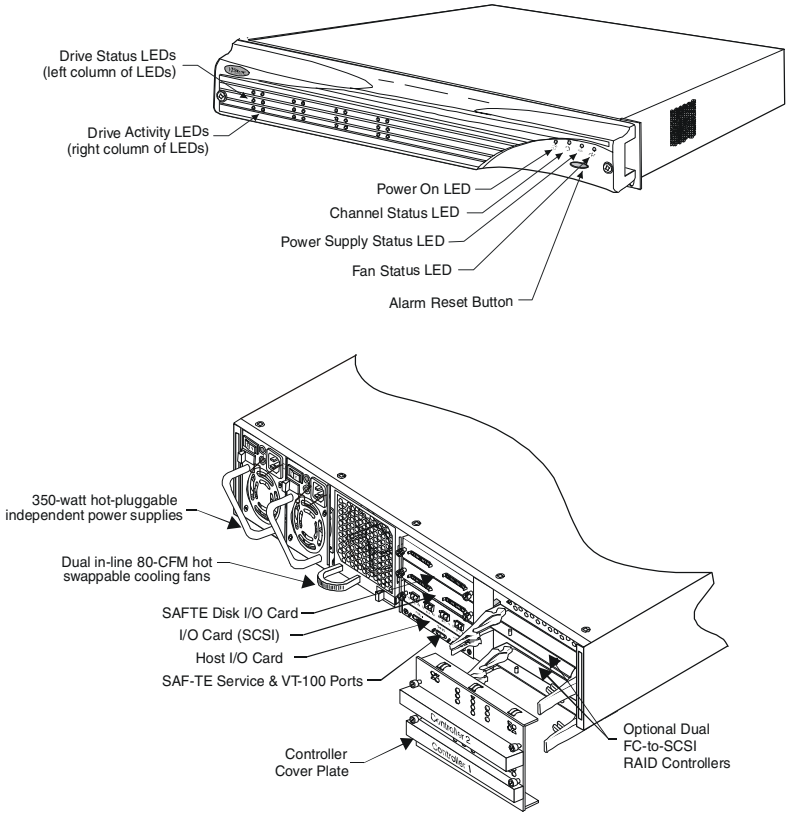


Figure 1-2 DuraStor 6320SS Storage Subsystem

DuraStor 7320SS

Figure 1-3 shows the components of the DuraStor 7320SS Storage Subsystem.

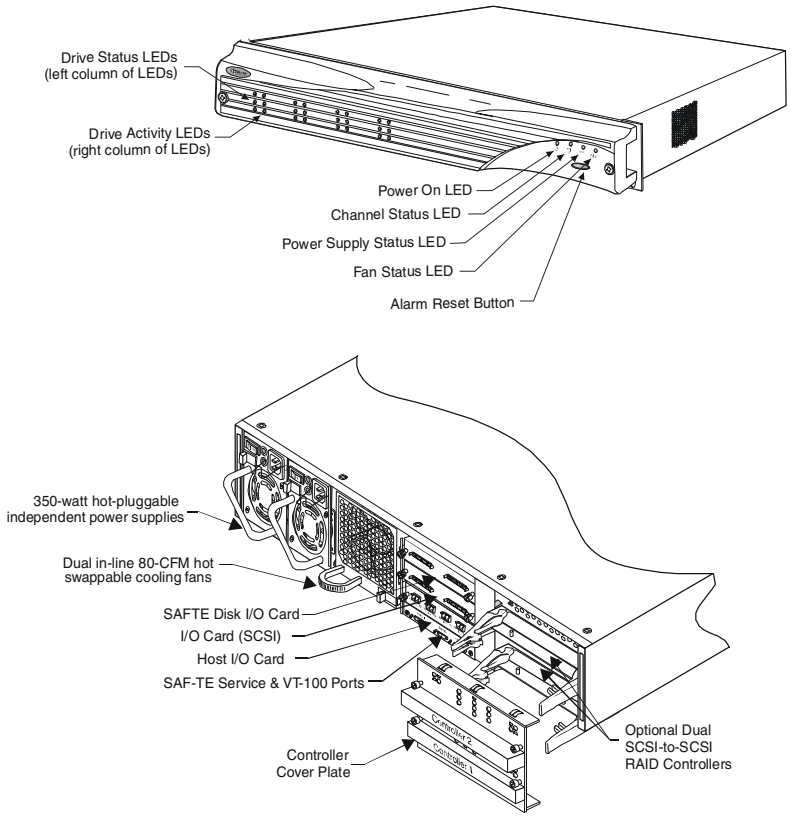


Figure 1-3 DuraStor 7320SS Storage Subsystem

About the Storage Management Software Tools

If you are building an external RAID storage subsystem, you can create and manage it using either of the two software tools included with your storage subsystem:

- Adaptec Storage Manager™ Pro
- Adaptec Disk Array Administrator

Adaptec Storage Manager Pro

We recommend using the Storage Manager Pro software application. It is included on the DuraStor CD as part of the DuraStor Storage Subsystem and runs on Windows NT,® Windows® 2000 and Sun Solaris 8. Use it to create and reconfigure arrays, manage spares, monitor the status of your storage devices, and more.

Storage Manager Pro allows you to perform all these functions for all DuraStor storage subsystems on your network that are running Storage Manager Pro and gives you the power to manage all your storage devices from a single location.

See *Installing Storage Manager Pro* on page 3-1 for details.

Adaptec Disk Array Administrator

If you are using an operating system other than Windows NT, Windows 2000, or Sun Solaris 8, you need to use Disk Array Administrator to manage your storage subsystem.

Disk Array Administrator is firmware built into the DuraStor 6200S/7200S RAID controller BIOS, and can be accessed using the RS-232 serial port connection on the rear panel of the DuraStor RAID appliance. See *Accessing Disk Array Administrator* on page 3-4 for detailed instructions.

You can find the *Adaptec Disk Array Administrator User's Guide* on the DuraStor CD.

2

Setting Up Your Storage Subsystem

In this Chapter

This chapter explains how to set up the DuraStor 6320SS and 7320SS storage subsystems. Unless otherwise noted, the installation instructions apply to both storage subsystems.

For a smooth and trouble-free installation, thoroughly review this chapter and perform the procedures in the order in which they are presented.

Installation Overview

The installation procedures are divided into three main tasks:

1 Installing your storage subsystem into a rack cabinet (page 2-2).

2 Configuring your storage subsystem (page 2-8), which involves setting SAF-TE Disk I/O card switches and completing subsystem-to-subsystem cabling.

3 Cabling the primary storage subsystem(s) to the host system(s), which involves choosing an operating mode. Basic topologies are presented in this chapter; advanced topologies are discussed in Appendix C, *Advanced Configurations and Cabling*.

Note: DuraStor is flexible and multiple configurations are possible. Read Appendix A, *Theory of Controller Operation* for an overview of the options available.

Installing DuraStor in a Rack

Before you set up or configure your storage subsystem, complete the rack installation. (If you are not installing your DuraStor into a rack, skip to *Powering On and Powering Off* on page 2-7.)

The storage subsystem can be installed into any standard 19-inch rack.

Installation tips: It will be helpful to have someone assist you. Also, make sure that the mounting hardware is easily accessible before you begin the installation.

1 Remove the enclosure from its shipping carton and inspect it for obvious damage. Place it on a flat surface.

2 Unlock the front bezel by turning the screws one-quarter turn to the left. See Figure 2-1.

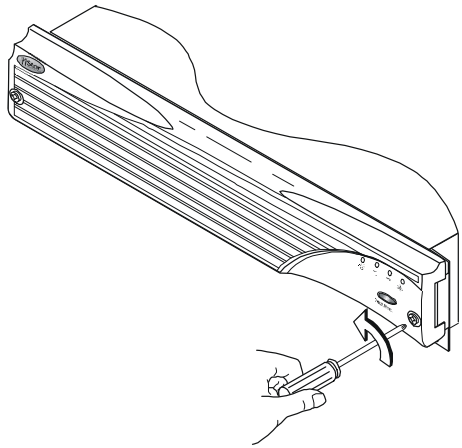


Figure 2-1 Unlocking the Front Bezel

3 Using both hands, pull the front bezel from the storage subsystem. See Figure 2-2.

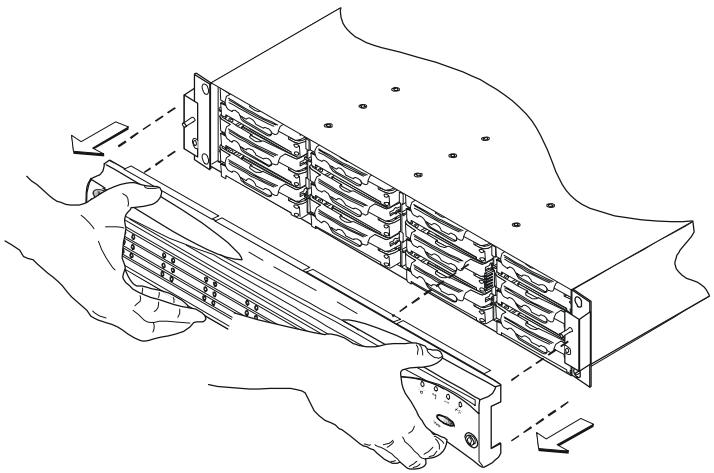


Figure 2-2 Removing the Front Bezel

4 Select a location within your rack.

If you are installing more than one storage subsystem, consider the location of the first one in relation to the others to ensure that there will be adequate airflow and that the cables can be easily reached.

5 Remove the power supplies. See *Replacing a PSU* on page 5-14 for detailed instructions.

6 Remove any disk drives. See *Replacing a Disk Drive* on page 5-10.

7 Place the storage subsystem in the desired position in the rack.

8 Secure the left and right front chassis ears to the rack's front vertical members using the supplied screws and nuts. See Figure 2-3. Ensure that they are even horizontally.

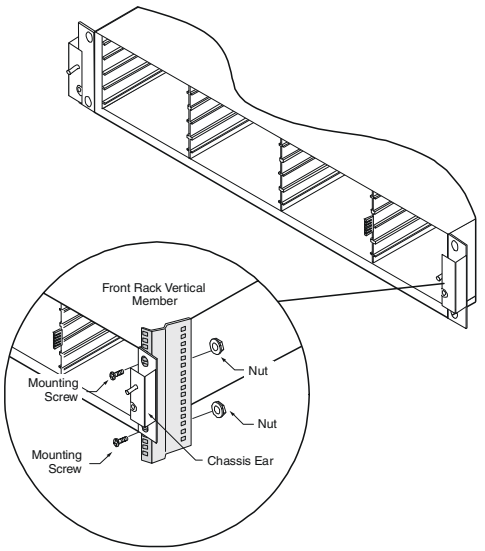


Figure 2-3 Attaching the Chassis Ears

9 Slide one of the rack's mounting rails into the slot on the left side of the RAID appliance's back panel. See Figure 2-4.

Push the rail in until it fits the depth of the rack. The rail should mate with mounting slots on the rack's rear vertical member and make the appliance level and tight-fitting.

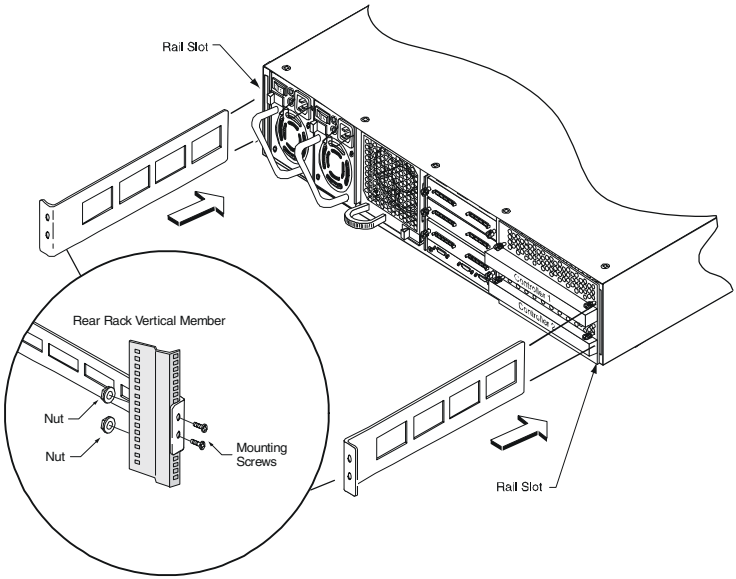


Figure 2-4 Attaching the Rails

10 Secure the left side rail to the rack's rear vertical member using the screws and nuts.

11 Repeat steps 9 and 10 for the other side rail.

Note: Be sure that the RAID appliance is level. Check that you used mounting slots of the same height on both sides of the rack.

12 Reinstall the power supplies. See *Replacing a PSU* on page 5-14 for detailed instructions.

13 Install the disk drives. See *Disk Drives* on page 5-10 for detailed instructions on attaching drive carriers to disk drives and installing disk drives into the storage subsystem.

14 Replace the front bezel. Ensure that it mounts to the two posts and that the bezel lip fits under the chassis top.

15 Lock the front bezel by turning the screws one-quarter turn to the right.

Connecting the Power Cords

Once DuraStor is in place, the power cords can be attached and secured.

1 On the back of the storage subsystem, lift a security bale and plug in a power cord.

2 Place the bale over the cord. See Figure 2-5. This protects the power cord from accidental disconnection.

3 Plug the other end of the power cord into a grounded outlet or UPS power strip.

4 Repeat this process for the other power cord.

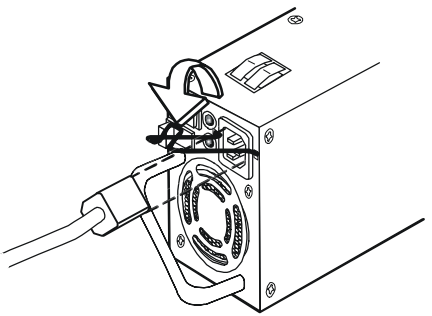


Figure 2-5 Attaching the Power Cord Bales

Powering On and Powering Off

Note: Before turning on the power, ensure that none of the data cables or power cables are obstructing the airflow to the cooling fan modules.

Turning the Power On

1. Locate the PSUs' ON/OFF switches on the back of the storage subsystem.
2. Turn ON each PSU.

   The storage subsystem performs a self-test during start-up.
3. Power ON the host computer(s).

Turning the Power Off

1. If you are shutting down the entire system, power OFF the host computer(s).
2. Gracefully shut down the controller(s). Refer to the *Storage Manager Pro User's Guide* or the *Disk Array Administrator User's Guide* for detailed instructions.
3. Turn OFF each PSU.
4. Repeat Steps 2 and 3 for each connected storage subsystem.

Configuring DuraStor

Note: This section provides configuration information for basic 12-disk drive systems. For more advanced configuration information, see Appendix C, *Advanced Configurations and Cabling*.

Configure your storage subsystem by setting the switches and jumpers and connecting the data cables. Follow the instructions provided for your storage subsystem:

- For the DuraStor 412R, see the next section, *Basic Configuration – DuraStor 412R*.
- For the DuraStor 6320SS, see *Basic Configuration – DuraStor 6320SS* on page 2-12.
- For the DuraStor 7320SS, see *Basic Configuration – DuraStor 7320SS* on page 2-13.

Basic Configuration – DuraStor 412R

The DuraStor 412R can be set up as a single-bus or dual-bus JBOD (Just a Bunch Of Disks) configuration using a single enclosure, which provides a storage solution with up to 12 disk drives.

To set up the storage subsystem as a single-bus, you need to install the single-bus module, which is available as a separate item from Adaptec. Visit www.adaptec.com for ordering information.

In single-bus mode, channel 1 on the SAF-TE disk I/O card assesses every disk drive (drives 1 through 12). In this mode, a single-bus module (see page 5-8) must be installed in the controller 1 slot. This module joins channel 1 and channel 2 together to create a single, continuous SCSI bus. Figure 2-6 shows the disk drive connectivity of the single-bus mode.

Note: In these logical view diagrams, auto sense allows the physical connection to disable termination.

Note: In these logical view diagrams, the numbers 1 to 12 represent disk drive slots and are used to indicate which drives are connected to which channel. They should not be confused with the disk drive SCSI IDs. Those IDs are pre-determined by the SCSI disk I/O card switch settings.

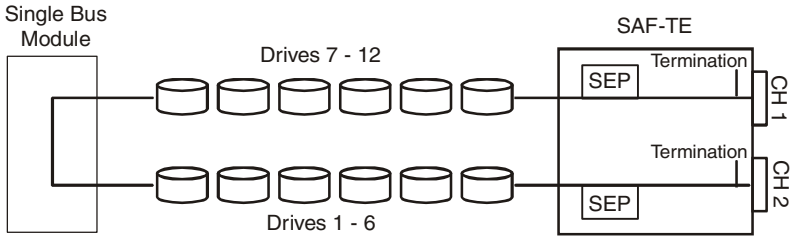


Figure 2-6 Logical Diagram – Drive Connectivity, Single-Bus Mode

In dual-bus mode, the channel 1 connector on the SAF-TE disk I/O card provides access to drives 7 through 12 and the channel 2 connector provides access to drives 1 through 6. Figure 2-7 shows the drive connectivity of the Dual-Bus Mode.

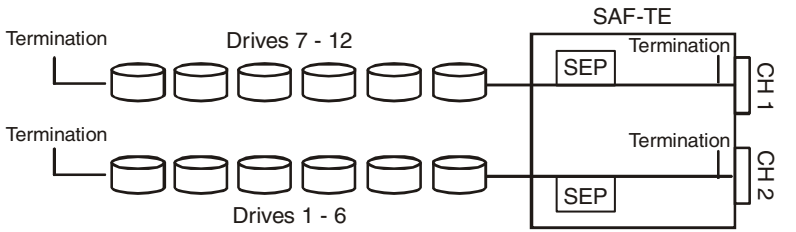


Figure 2-7 Logical Diagram – Drive Connectivity, Dual-Bus Mode

To set up a basic 12-disk drive configuration:

1 Power OFF the storage subsystem. See *Turning the Power Off* on page 2-7.

2 Remove the SAF-TE disk I/O card installed in the enclosure. See *Replacing an I/O Card* on page 5-21 for detailed instructions.

3 Locate the switches on the card and set them as shown in figures 2-8 through 2-10.

Some configurations have multiple switch setting options available. Choose the setting that is appropriate for your system.

There is one switch setting for single-bus mode and two possible settings for dual-bus mode. Refer to the switch setting appropriate for your configuration and set the switches accordingly.

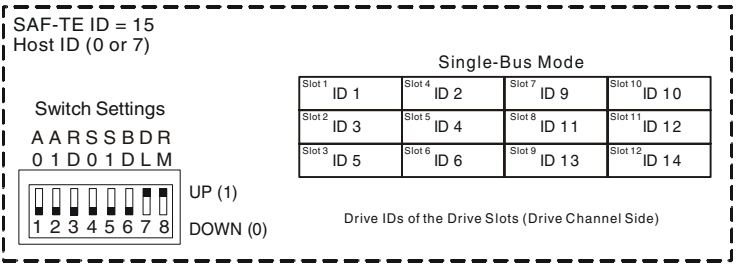


Figure 2-8 Single-Bus JBOD Switch Setting (DuraStor 412R)

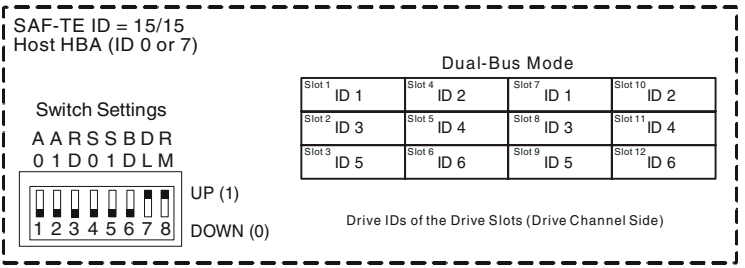


Figure 2-9 Dual-Bus JBOD Switch Setting – Option 1 (DuraStor 412R)

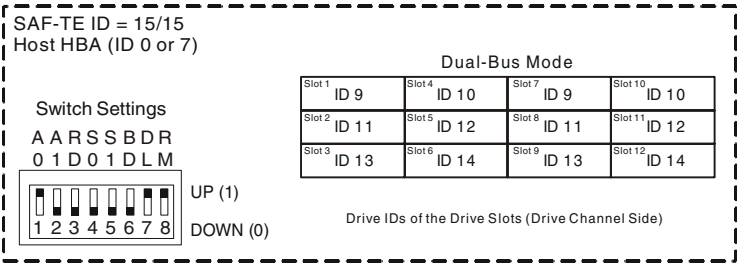


Figure 2-10 Dual-Bus JBOD Switch Setting – Option 2 (DuraStor 412R)

4 Reinstall the SAF-TE disk I/O card. (See *Replacing an I/O Card on page 5-21* for detailed instructions.)

5 (*Single-Bus Mode installations only*) Install the single-bus module in the Controller 1 slot. (See *Installing the Single Bus Module and Cover Plate* on page 5-9 for detailed instructions.)

6 Connect the SCSI data cable from the host system HBA to the SAF-TE Disk I/O card Channel connector as shown in Figure 2-11 and Figure 2-12.

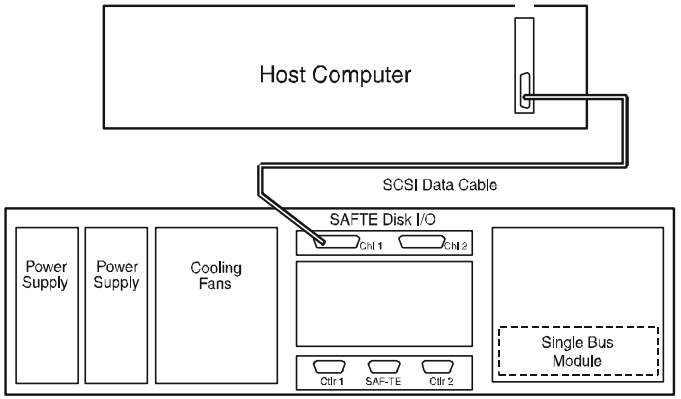


Figure 2-11 Host Cabling Diagram – JBOD, Single-Bus Mode (DuraStor 412R)

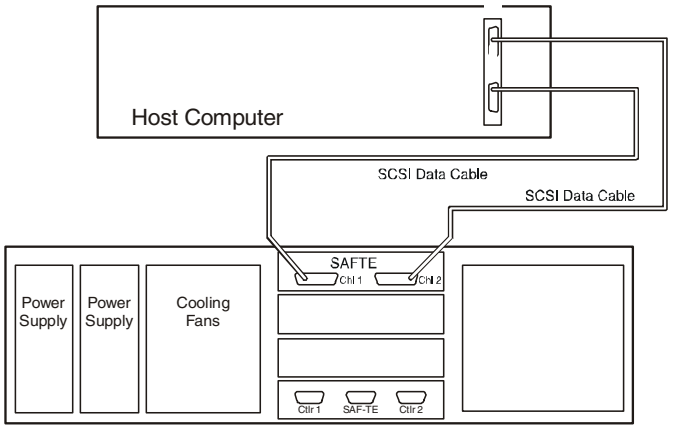


Figure 2-12 Host Cabling Diagram – JBOD Dual-Bus Mode (DuraStor 412R)

The configuration is complete. Refer to the *Storage Manager Pro User's Guide* or the *Disk Array Administrator User's Guide* for instructions on how to set up and configure disk arrays.

Basic Configuration – DuraStor 6320SS

The DuraStor 6320SS can be set up to provide a storage solution with up to 12 disk drives. This configuration uses the primary RAID enclosure only. If you need to use more disk drives, you can add up to two additional 412R drive enclosures to the DuraStor 6320SS storage subsystem.

To set up a basic 12-disk drive configuration

1 Power OFF the storage subsystem. See *Turning the Power Off* on page 2-7.

2 Remove the SAF-TE disk I/O card installed in the storage subsystem. (See *Replacing an I/O Card* on page 5-21 for instructions.)

3 Locate the switches on the card and set them as shown in either Figure 2-13 or Figure 2-14.

The switch settings assign specific SCSI IDs to the drive slots, reserving IDs 6 and 7 for the RAID controller(s), and IDs 8 or 15 for the SAF-TE processors.

There are two possible switch settings for this configuration. You may choose either setting to fit your needs.

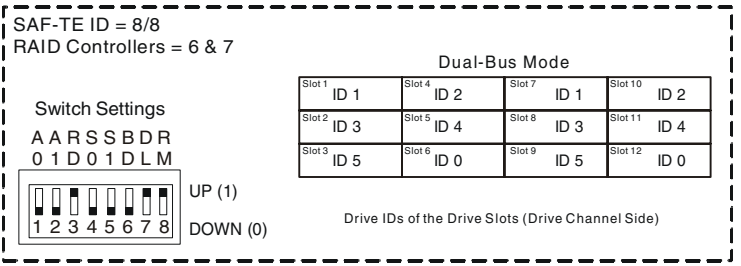


Figure 2-13 Dual-Bus Switch Setting – Option 1 (DuraStor 6320SS)

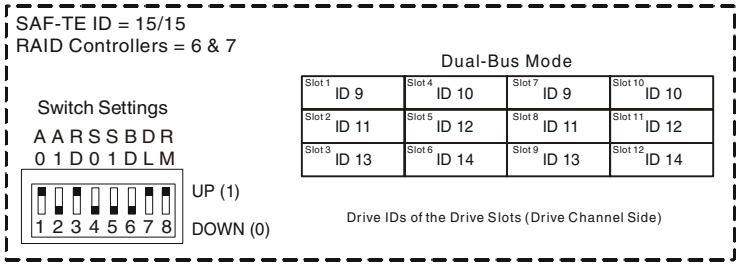


Figure 2-14 Dual-Bus Switch Setting – Option 2 (DuraStor 6320SS)

4 Reinstall the SAF-TE disk I/O card. See *Replacing an I/O Card* on page 5-21 for detailed instructions.

The configuration is complete. Refer to the *Storage Manager Pro User's Guide* or the *Disk Array Administrator User's Guide* for instructions on how to set up and configure disk arrays.

Basic Configuration – DuraStor 7320SS

The DuraStor 7320SS can be set up to provide a storage solution with up to 12 disk drives. This configuration uses the primary RAID enclosure only. If you need to use more disk drives, you can add up to three additional 412R drive enclosures to the DuraStor 7320SS storage subsystem.

To set up a basic 12-disk drive configuration:

1 Power OFF the storage subsystem. See *Turning the Power Off* on page 2-7.

2 Remove the SAF-TE disk I/O card installed in the storage subsystem. (See *Replacing an I/O Card* on page 5-21 for instructions.)

3 Locate the switches on the card and set them as shown in either Figure 2-15 or Figure 2-16.

The switch settings assign specific SCSI IDs to the drive slots, reserving IDs 6 and 7 for the RAID controller(s), and IDs 8 or 15 for the SAF-TE processors.

There are two possible switch settings for this configuration. You may choose either setting to fit your needs.

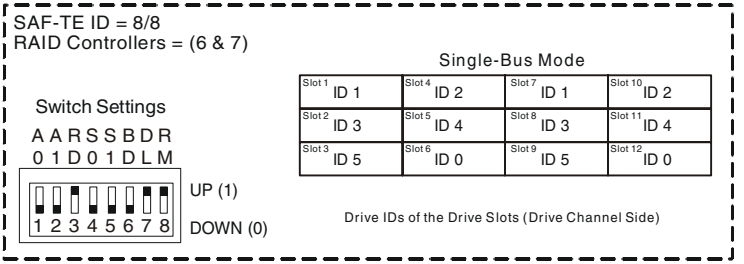


Figure 2-15 Dual-Bus Switch Setting – Option 1 (DuraStor 7320SS)

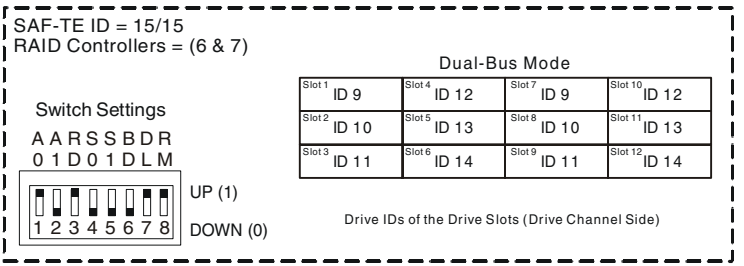


Figure 2-16 Dual-Bus Switch Setting – Option 2 (DuraStor 7320SS)

4 Reinstall the SAF-TE disk I/O card. See *Replacing an I/O Card* on page 5-21 for detailed instructions.

The configuration is complete. Refer to the *Storage Manager Pro User's Guide* or the *Disk Array Administrator User's Guide* for instructions on how to set up and configure disk arrays.

Cabling Your Storage System to the Host

The last step of the DuraStor installation is cabling your system according to the chosen operating mode. See Appendix A, *Theory of Controller Operation* for descriptions of each operating mode.

Follow the instructions provided for your storage subsystem:

- For the DuraStor 6320SS, see the next section (*Basic Connections – DuraStor 6320SS*).
- For the DuraStor 7320SS, see *Basic Connections – DuraStor 7320SS* on page 2-21.

Basic Connections – DuraStor 6320SS

Note: This section provides cabling information for basic topologies. For more advanced topology information, see Appendix C, *Advanced Configurations and Cabling*. See Appendix A, *Theory of Controller Operation* for descriptions of each operating mode.

1. Install your host bus adapter(s) into the host system(s). Refer to your HBA user's guide for specific details.
2. Enable multiple LUN support. Make sure that your host operating system is properly configured to support this feature. Refer to your host operating system's documentation for instructions.
3. Connect the SCSI data cables. Refer to the topology described for your installation on the following pages, and cable your system based on the diagrams shown.
   a. Connect the required SCSI data cable(s) to the host system's SCSI host bus adapter port connector(s).
   b. Connect the other end of the SCSI data cable(s) to the storage enclosure Host Channel ports on the host I/O card(s) as indicated.

4 Power ON your storage subsystem. See *Turning the Power On* on page 2-7 for instructions.

5 Once everything is powered ON, you may need to set the operating mode.

By default, the RAID controller's operating mode is set to active-active single-port. Use Storage Manager Pro or Disk Array Administrator to change the operating mode. Your choices are:

- Stand-alone single-port. See page 2-16.
- Stand-alone dual-port. See page 2-22.
- Active-active single-port. See page 2-19.
- Active-passive dual-port. See page 2-20.

6 Use Storage Manager Pro or Disk Array Administrator to configure the disk arrays as desired.

Stand-Alone Single-Port: Host Cabling

Choose this topology when your application requires a low-cost entry-level, fault-tolerant disk storage solution. This solution provides a single controller configuration that supports a single or dual host(s), and up to three disk channels.

Connect the SCSI data cables as shown in Figure 2-17 and Figure 2-18.

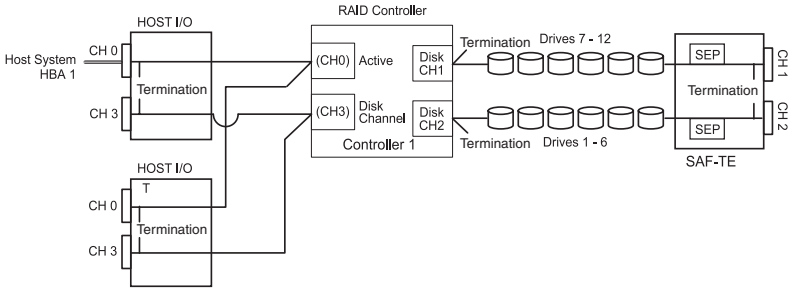


Figure 2-17 Logical Diagram – Stand-Alone Single-Port

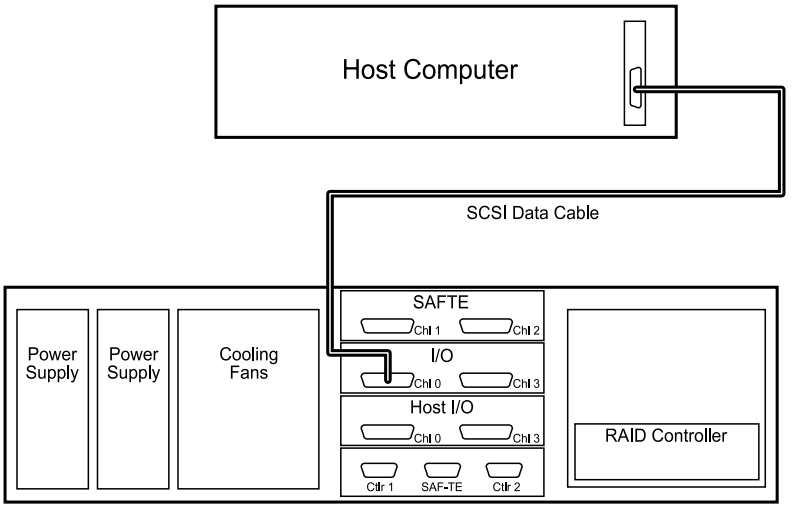


Figure 2-18 Host Cabling Diagram – Single Host, Single HBA

Stand-Alone Dual-Port: Host Cabling

Choose this topology when your application requires a low-cost high-performance, fault-tolerant disk storage solution with multiple paths to storage. This solution provides a single controller configuration that supports multiple or dual ported access to one or more host system computers.

Connect the SCSI data cables as shown in Figure 2-19 and Figure 2-20.

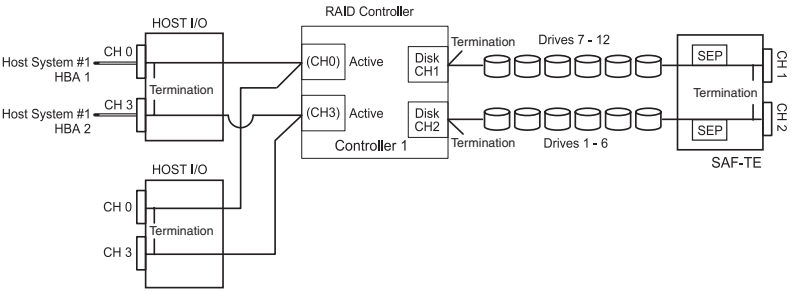


Figure 2-19 Logical Diagram – Stand-Alone Dual-Port

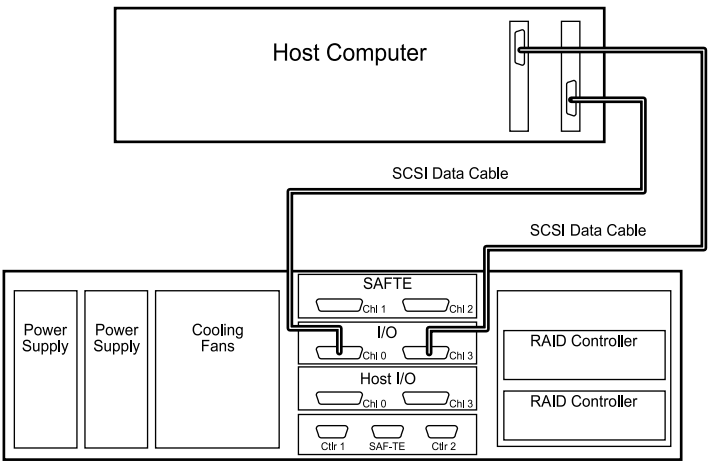


Figure 2-20 Host Cabling Diagram – Single Host, Dual HBAs

Active-Active Single-Port: Host Cabling

Choose this topology when your application requires a high-performance, robust, full system-level fault-tolerant disk storage solution and transparent controller failover/failback. This dual controller configuration supports a host with a single-port HBA and is ideal when the host driver software does not support LUNs that appear twice.

Note: This configuration requires you to have two 6200S RAID controllers installed in the storage subsystem.

Connect the SCSI data cables as shown in Figure 2-21 and Figure 2-22.

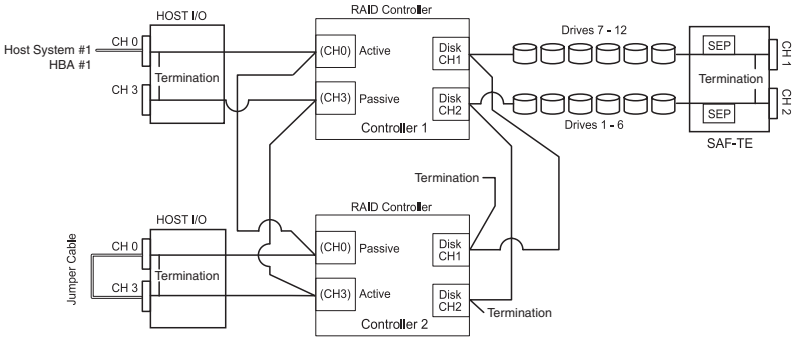


Figure 2-21 Logical Diagram – Active-Active Single-Port

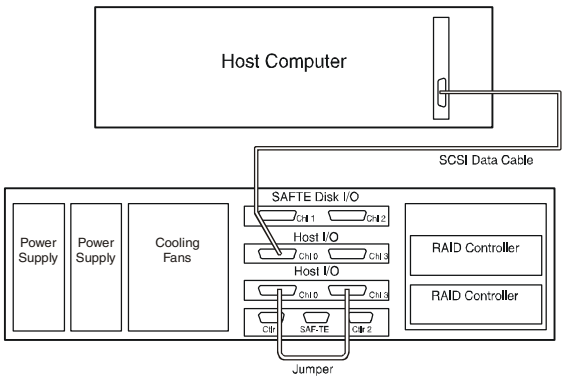


Figure 2-22 Host Cabling Diagram – Single Host, Single HBA

Active-Passive Dual-Port: Host Cabling

Choose this topology when your application requires a high-performance, robust, full system-level fault-tolerant disk storage solution. This dual controller configuration supports multiple hosts and failover and failback operations. All LUNs are available to all hosts.

Note: This configuration requires you to have two 6200S RAID controllers installed in the storage subsystem.

Connect the SCSI data cables as shown in Figure 2-23 and Figure 2-20.

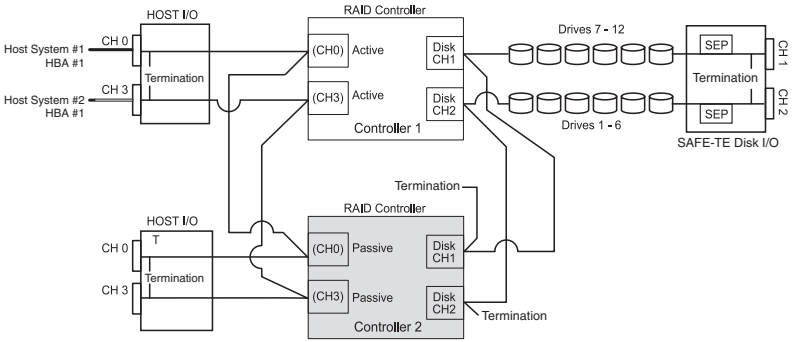


Figure 2-23 Logical Diagram – Active-Passive Dual-Port

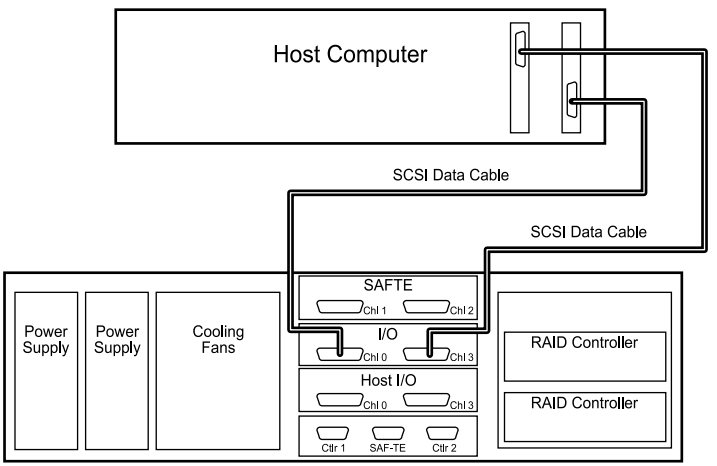


Figure 2-24 Host Cabling Diagram – Single Host, Dual HBAs

Basic Connections – DuraStor 7320SS

Note: This section provides cabling information for basic topologies. For more advanced topology information, see Appendix C, *Advanced Configurations and Cabling*. See Appendix A, *Theory of Controller Operation* for descriptions of each operating mode.

1. Install your host bus adapter(s) into the host system(s). Refer to your HBA user's guide for specific details.
2. Enable multiple LUN support. Make sure that your host operating system is properly configured to support this feature. Refer to your host operating system's documentation for instructions.
3. Connect the fibre channel data cables. Refer to the topology described for your installation on the following pages, and cable your system based on the diagrams shown.
   a. Connect the required fibre channel data cable(s) to the host system's fibre channel host bus adapter port connector(s).
   b. Connect the other end of those fibre channel data cable(s) to the storage enclosure host channel ports on the host I/O card(s) as indicated.
4. Power on your storage subsystem. See *Turning the Power On* on page 2-7 for instructions.
5. Once everything is powered on, you may need to set the operating mode.

   By default, the RAID controller's operating mode is set to active-active dual-port. Use Storage Manager Pro or Disk Array Administrator to change the operating mode. Your choices are:
   - Stand-alone dual-port. See page 2-22.
   - Active-active single-port. See page 2-23.
   - Active-active dual-port. See page 2-24.
   - Active-passive dual-port. See page 2-20.
6. Use Storage Manager Pro or Disk Array Administrator to configure the disk arrays as desired.

Basic Stand-Alone Dual-Port Topology – DuraStor 7320SS Only

Choose a stand-alone dual-port topology when your application requires a low-cost, entry-level, fault-tolerant disk storage solution. This solution provides a single controller configuration that supports dual-ported access with the internal hubs disabled. It is ideal in a host direct-attached application or SAN environments when connected to an external switch or hub. See Appendix B, *SAN Solution Strategies (DuraStor 7320SS only)*.

Note: Other stand-alone dual port topologies are described in Appendix C, *Advanced Configurations and Cabling*.

Connect the fibre channel data cables as shown in Figure 2-25 and Figure 2-26.

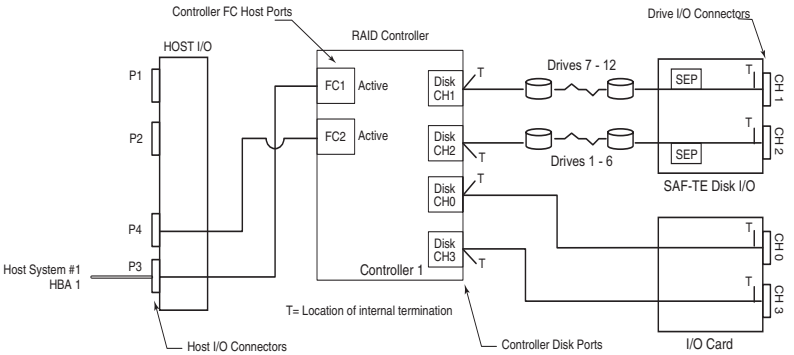


Figure 2-25 Logical Diagram – Single Host, Single HBA, Hubs Disabled

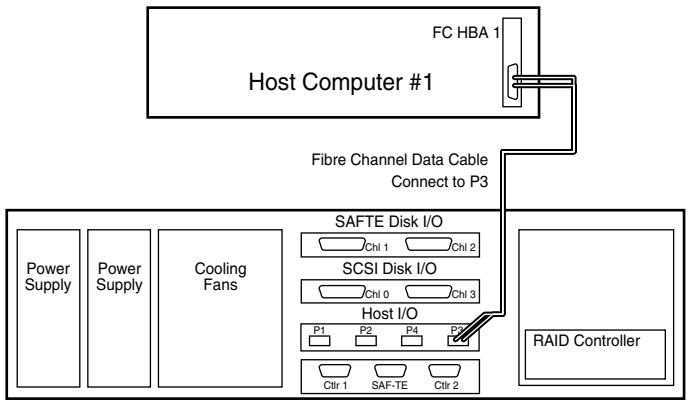


Figure 2-26 Host Cabling Diagram – Single Host, Single HBA, Hubs Disabled

Basic Active-Active Single-Port Topology

Choose this topology when your application requires a high-performance, robust, full system-level fault-tolerant disk storage solution with transparent controller failover/failback. This dual controller configuration supports a host with a single-port HBA and is ideal when the host driver software does not support LUNs that appear twice.

Note: This configuration is shown with hubs enabled.

Connect the fibre channel data cables as shown in Figure 2-27 and Figure 2-28.

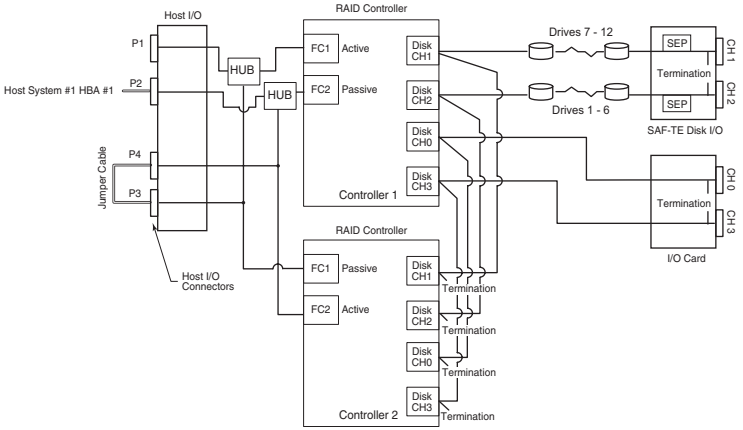


Figure 2-27 Logical Diagram – Single Host, Single HBA, Hubs Enabled

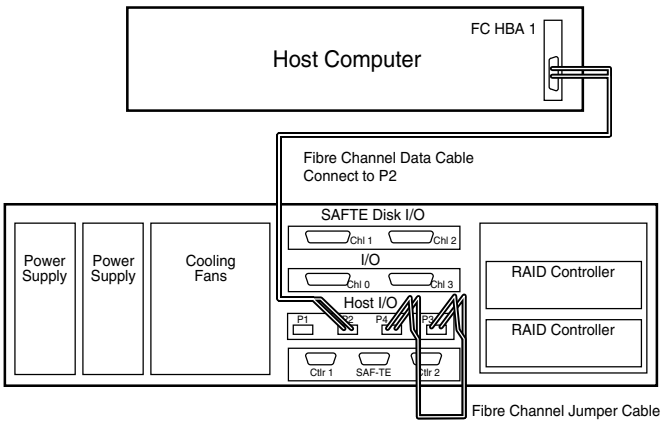


Figure 2-28 Host Cabling Diagram – Single Host, Single HBA, Hubs Enabled

Basic Active-Active Dual-Port Topology

Choose this topology when your application requires a high-performance, robust, full system-level fault-tolerant disk storage solution. This dual controller configuration supports multiple hosts and failover and failback operations. All LUNs are available to all hosts.

Connect the fibre channel data cables as shown in Figure 2-29 and Figure 2-30.

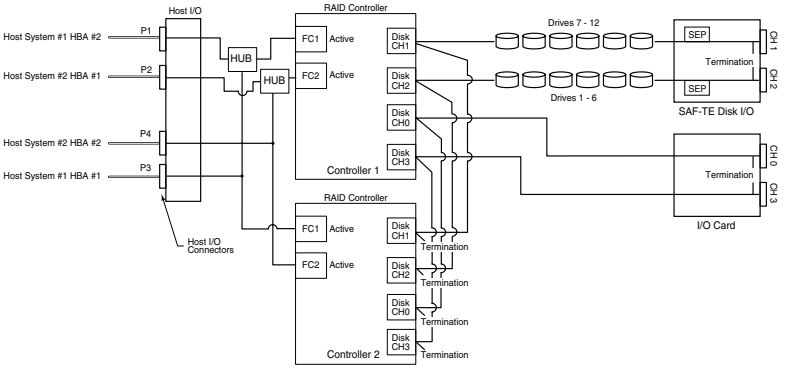


Figure 2-29 Logical Diagram – Dual Host, Dual HBAs, Hubs Enabled

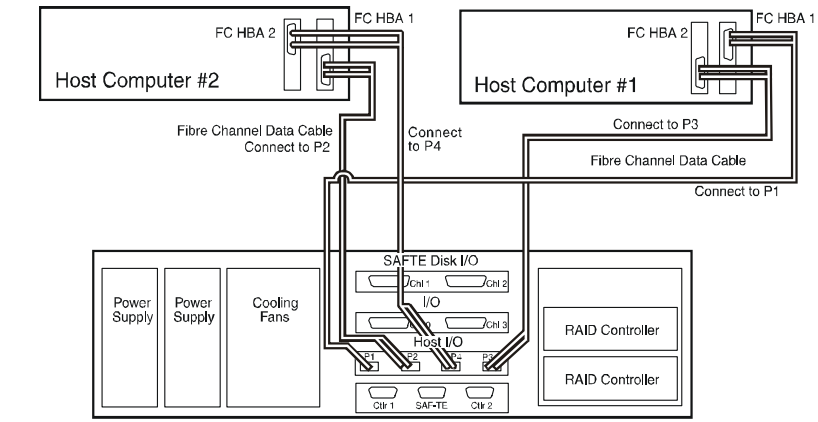


Figure 2-30 Host Cabling Diagram – Dual Host, Dual HBAs, Hubs Enabled

Basic Active-Passive Dual-Port Topology

Choose this topology when your application requires a high-availability, high-access, fault-tolerant disk storage solution. This dual controller configuration supports multiple hosts and failover and failback operations. All LUNs are available to all hosts. The dual host configuration is ideal for shared storage clustering.

Connect the fibre channel data cables as shown in Figure 2-31 and Figure 2-32.

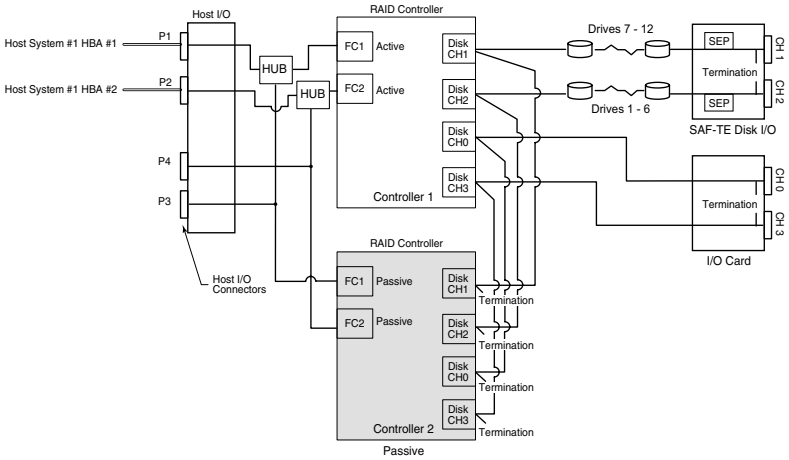


Figure 2-31 Logical Diagram – Single Host, Dual HBAs, Hubs Enabled

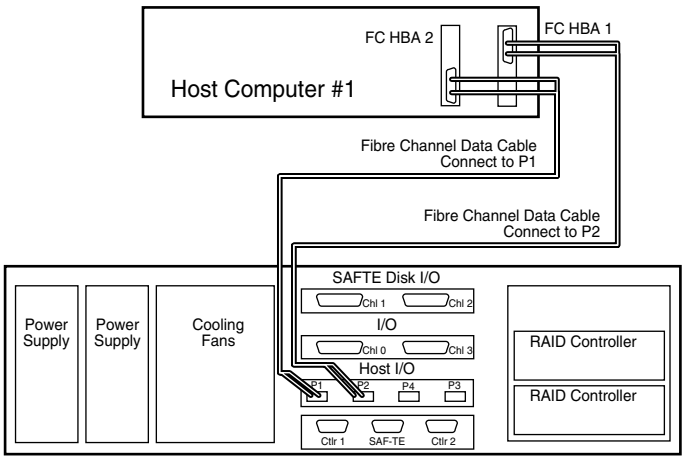


Figure 2-32 Host Cabling Diagram – Single Host, Dual HBAs, Hubs Enabled

Upgrading DuraStor

You may need to change your storage subsystem from one drive configuration to another or add another RAID controller to expand your storage subsystem capabilities and capacity.

The DuraStor RAID controllers features *drive roaming*. Drive roaming allows RAID controllers to keep track of which disk drive belongs to which logical array if the enclosure is changed or the disk drive is moved.

To change to a new drive configuration, follow the set up instructions for that configuration as provided in *Configuring DuraStor* on page 2-8 or Appendix C. To change operating modes, follow the cabling instructions provided in *Cabling Your Storage System to the Host* on page 2-15.

Note: Changing operating mode topologies may alter your configuration choices. Ensure that you select a configuration that is supported by the operating mode topology. Refer to *Operating Modes Overview* on page A-2 for more information.

Note: During an upgrade, you are not required to move disk drives around in the enclosure(s). The Drive Roaming feature will locate those drives when the entire system is powered back up.

3

Accessing Your Storage Management Tools

In this Chapter

Your DuraStor 6320SS or 7320SS includes two different storage management software tools to help you create and manage your external RAID storage subsystems, Storage Manager™ Pro and Disk Array Administrator.

This chapter explains how to install and access these two storage management tools.

Installing Storage Manager Pro

Storage Manager Pro runs on Microsoft Windows 2000, Windows NT 4.0, and Sun Solaris 8 for Sparc (64-bit mode).

Storage Manager Pro's remote management capabilities are only available on your system if it contains a network card configured to use the TCP/IP protocol. For Windows NT, the TCP/IP stack must be installed.

Note: If you already have Storage Manager Pro installed on your computer, you must uninstall it before reinstalling it. You must also delete the old StorageManagerPro directory. To uninstall Storage Manager Pro, refer to the *Adaptec Storage Manager Pro User's Guide*.

When you install Storage Manager Pro for Windows, you automatically install Java Runtime Environment (JRE) 1.1.8, which is required to run Storage Manager Pro. This does not conflict with any other version of the JRE or Java Development Kit (JDK) you have installed.

Installing Storage Manager Pro On Windows

Note: *Do not* install Storage Manager Pro on a network drive, because Storage Manager Pro runs as a Windows NT/2000 service and services do not have network access rights.

To install Storage Manager Pro on Windows:

1. If you are using a Windows 2000 or Windows NT system, verify that you have administrator privileges.
2. If your Windows system is configured to automatically start CD software, insert the *DuraStor CD* into your drive. When the installation menu appears, click **Install Adaptec Storage Manager Pro**.

   If your system does not start the CD automatically, browse the CD and click **autorun.exe**. Click **Install Adaptec Storage Manager Pro** to begin the installation.
3. From the drop-down list box, select the language you want. This selects only the language for the installation information. It does not affect the language used in Storage Manager Pro.
4. Click **OK**. The Storage Manager Pro Introduction window appears.
5. Follow the on-screen instructions to complete the installation.

6 When the installation is complete, click **Done**.

The Set Administrator Password window appears.

7 Type a new password, re-enter it to verify it, then click **OK**. *Do not* click **OK** without changing the password.

Caution: You *must* supply the password immediately. If you do not supply the password, you will be unable to log in after the next reboot, and will have to uninstall and reinstall Storage Manager Pro.

The installation is complete.

You can now perform all of the functions described in the *Adaptec Storage Manager Pro User's Guide*.

Warning: Adaptec strongly recommends that you regularly and consistently back up your data so that it may be recovered in the event of a failure that's not protected by a fault-tolerant array.

Installing Storage Manager Pro On Solaris

To install Storage Manager Pro on Solaris:

1 Log in as root.

2 Type:

```
./setup.bin
```

3 Start Storage Manager pro. Change the directory to /opt StorageManagerPro or the directory where you installed Storage Manager Pro and Type:

```
./ASMPro
```

4 Continue with Step 3 on page 3-2.

The installer creates symbolic links in /user/local/bin/ for the Storage Manager Pro executables. See the Storage Manager Pro User's Guide for information about starting and using the program.

Accessing Disk Array Administrator

Disk Array Administrator is firmware built into the DuraStor 6200S/7200S external RAID controller.

To access Disk Array Administrator, you need

- A computer with terminal emulator software, such as HyperTerminal.
- A null modem cable. (You *cannot* use a straight-through serial cable.)

Using the cable, connect the computer to an RS-232 serial port on the back of your DuraStor RAID appliance. Connect to CTRL 1 port for Controller 1 or CTRL 2 port for Controller 2.

Note: If you are using HyperTerminal as your terminal emulator software with Windows 2000, make sure that you have Windows 2000 Service Pack 2 or later installed. Windows 2000 Service Pack 2 fixes the problem of the up and down arrow (↑ or ↓) keys not functioning in HyperTerminal's VT100 emulation. See www.microsoft.com for information.

Configure the RS-232 serial port in your terminal emulator software using the settings in Table 3-1.

Table 3-1 RS-232 Serial Port Settings

Setting	Value
Terminal Emulation	VT-100 or ANSI (for color support)
Font	Terminal
Translations	None
Columns	80

Set the communications parameters for the terminal program as shown in Table 3-2.

Table 3-2 Communications Parameter Settings

Setting	Value
Baud Rate	115,200
Data Bits	8
Stop Bits	1
Parity	None
Flow Control	None
Connector	COM1 (typically)

To access Disk Array Administrator:

1 From the computer connected to the controller, start your terminal emulator software.

Be sure that your terminal emulator software is set to use the correct COM port on your computer. Refer to the *Adaptec Disk Array Administrator User's Guide* for details on how the DuraStor 6200S/7200S RAID controller can auto-detect the baud rate.

2 Press **CTRL-R**.

The initial Disk Array Administrator screen appears.

3 Press **Enter**.

The System Menu screen appears.

You can now perform all of the functions described in the *Adaptec Disk Array Administrator User's Guide*.

Caution: Adaptec recommends that you regularly and consistently back up your data so that it may be recovered in the event of a failure that's not protected by a fault-tolerant array.

4

Monitoring DuraStor

In this Chapter

Two features of DuraStor help you monitor your external RAID storage subsystem:

- Your storage management tool (Storage Manager Pro or Disk Array Administrator) generates events to inform you of errors, failovers, changes to your array configuration, and other functions. These events appear on your system monitor.
- LEDs and alarms on the hardware components provide visual or audible cues about the status of the disk drives, cooling fans, power supply units, and other physical parts of the system.

This chapter contains details about the onboard monitoring systems and information about managing the storage subsystem's SAF-TE firmware.

For complete instructions on using your storage management tool to monitor your system, refer to the user's guide for the storage management software tool you are using.

Using Front Bezel LEDs

This section explains the notifications about the enclosure components provided by the front bezel LEDs and the One-Touch Annunciation monitoring system. See Figure 4-1 on page 4-3 for the location of the LEDs on the front bezel.

There are four Status LEDs. Table 4-1 explains how to interpret the different colors and conditions they indicate.

Table 4-1 Front Bezel Status LEDs

LED	Color and Condition	Status Indicated
Power On	Green (solid)	The power is ON.
Channel Status	Green (solid)	Array is fault-tolerant.
	Amber (solid)	Array is in rebuild mode or the array has a failed disk drive.
	Amber (flashing)	Controller failure.
Power Supply Status	Green (solid)	Both power supplies are functioning normally.
	Amber (solid)	One or more of the power supplies failed or is turned OFF.
Fan Status	Green (solid)	Both cooling fans are functioning normally
	Amber (solid)	One or more of the fans failed.

Drive LEDs

The drive LEDs are located in pairs on the left side of the front bezel in between the ventilation ribs. The drive LEDs consist of drive status LEDs (on the left) and drive activity LEDs (on the right). See Figure 4-1.

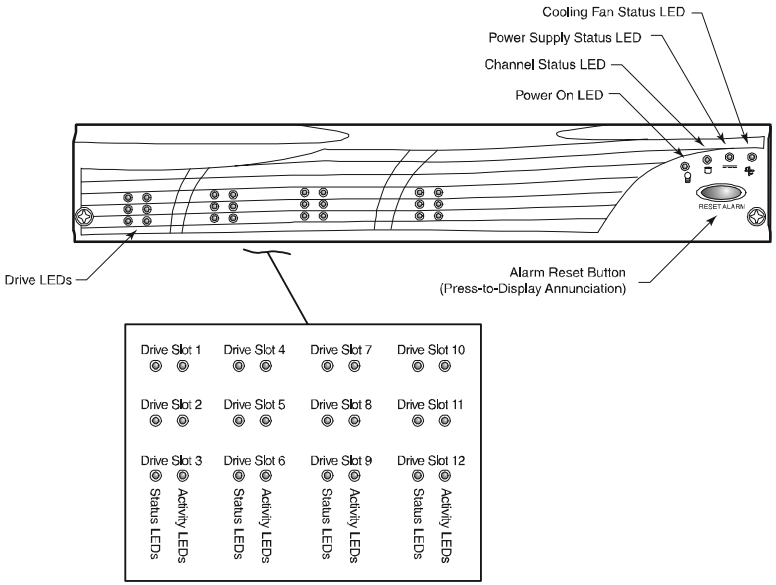


Figure 4-1 Front Bezel LEDs and Components

These drive LEDs assist with identifying which disk drive is experiencing I/O activity, array status, and the presence of a disk.

Table 4-2 explains how to interpret the drive LEDs.

Table 4-2 Drive Status and Activity LEDs

Drive Status LED	Drive Activity LED	Status
Solid green	Solid green	Powering on.
Flashing green	Solid green	Drive ready, not assigned to an array.
Solid green	Solid green	Drive ready, assigned to an array.
Flashing green	Solid green	Hot spare ready, assigned to an array.
Flashing green	Solid amber	Drive error—Fault, not assigned to an array.
Flashing amber	Solid amber	Drive error—Fault, assigned to an array.
Solid amber	Solid amber	Array critical, remaining good drive LEDs.
Solid amber	Solid amber	Hot spare, rebuild mode (all Drive Status LEDs).
Off	N/A	Empty drive slot.
Flashing amber	Solid amber	Drive manually disabled (applies to LVD-LVD only).
Solid green		Array is fault-tolerant.
Solid amber		Array is in rebuild mode.
Solid amber		Array has a failed drive.
Alternating amber and green		Firmware checksum error.

The drive status LEDs are also used for the One-Touch Annunciation monitoring system which can display the status of controllers and SAF-TE card switch settings from the touch of the Alarm Reset button. See *One-Touch Annunciation* on page 4-5 for information.

Disk Drive Carrier Lite Pipes

Also, on each disk drive carrier are LitePipes. (See Figure 4-2.) They are located on the lower right side of each disk drive carrier. The LitePipes present some of the information provided by the front bezel drive LEDs, that is, drive activity information and drive fault (failure) or data rebuilding notifications when the front bezel is removed.

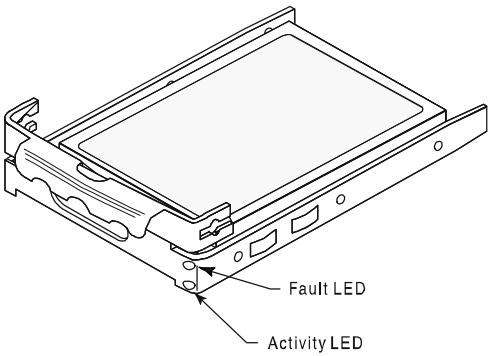


Figure 4-2 Drive Carrier LitePipes

One-Touch Annunciation

The DuraStor One-Touch Annunciation monitoring system is an easily accessible display of the SAF-TE card switch settings, enclosure bus mode, type of host interface, serial communication BAUD rate, and controller status. This information is displayed using the drive status LEDs and the Alarm Reset button. Table 4-3 on page 4-6 describes the meanings of the drive status LEDs as they are used for One-Touch Annunciation.

To use the One-Touch Annunciation, press and hold the **Alarm Reset** button. The drive activity LEDs are turned off and the drive status LEDs illuminate in unique combinations to designate certain enclosure conditions. Table 4-3 describes the drive status LEDs and their meanings when using the One-Touch Annunciation.

Table 4-3 Drive Status LEDs Used for One-Touch Annunciation

Drive Slot	Description	Status LED On	Status LED Off
1	Bus configuration	Dual-bus	Single-bus
2	Hot interface type	SCSI Host	Fibre Host
3	N/A		
4	Switch 1 SCSI IDs	Enabled	Disabled
5	Baud rate, switch 6	19,200 baud	9,600 baud
6	N/A		
7	Switch 2 SCSI IDs	Enabled	Disabled
8	Delay restart, switch 7	Disabled	Enabled
9	Controller 1	Green: good Amber: failed	Not installed
10	Switch 3 RAID addressing	Enabled for RAID	Disabled for JBOD
11	Remote start switch 8	Disabled	Enabled
12	Controller 2	Green: good Amber: failed	Not installed

One-Touch Annunciation Example

Figure 4-3 is an example of the switch settings, and the controller and bus configurations when the One-Touch Annunciation is accessed via the Reset button.

Note: SAF-TE switches 1 (A0) and 2 (A1) work in combinations to create a specific range of SCSI IDs.

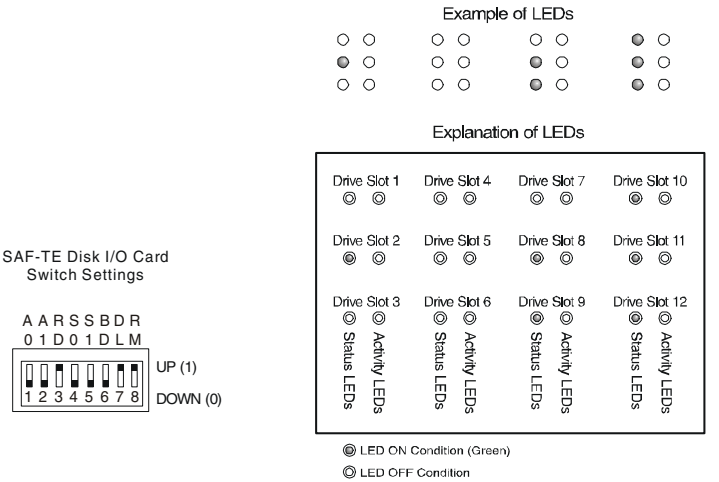


Figure 4-3 Active-Active/Active-Passive Dual-Bus Example

Table 4-4 describes the status LEDs for this example.

Table 4-4 Drive Status LEDs – One-Touch Annunciation Example

Drive Slot	Status LED	Description
1	On	Enclosure is in dual-bus mode.
2	On	SCSI host interface.
3	Off	N/A
4	Off	Switch 1 (A0) is in the DOWN position. This sets the drive SCSI IDs of the slots to IDs 1, 2, 3, 4, 5, 6, 9, 10, 11, 12, 13, 14. It reserves IDs 0 and 7 for the host bus adapter, and SCSI ID 15 for the SAF-TE processor.
5	Off	Switch 6 is in the DOWN position. This sets the BAUD rate for the SAF-TE RS-232 serial port to 9,600.
6	Off	N/A
7	Off	Switch 2 (A1) is in the DOWN position. This sets the drive SCSI IDs of the slots to IDs 1, 2, 3, 4, 5, 6, 9, 10, 11, 12, 13, 14. It reserves IDs 0 and 7 for the host bus adapter, and SCSI ID 15 for the SAF-TE processor.
8	On	Switch 7 is in the UP position. This sets the Delay Start mode to Disabled.
9	On	Controller is present.
10	On	Switch 3 (RD) is in the UP position. This enables RAID addressing and is used when configuring RAID mode (DuraStor 7320SS).
11	On	Switch 8 is in the UP position. This sets the Remote Start mode to Disabled.
12	On	Controller is present.

Enclosure SAF-TE Monitoring

Another feature of DuraStor is the enclosure monitoring capabilities. The firmware-based monitoring program allows users to view storage system component status and information about the firmware. You may access this program by connecting a VT-100 terminal to the SAF-TE Service port.

To access the monitoring program:

1 Connect one end of the null-modem RS-232 cable to the SAF-TE Service port located on the rear panel of the enclosure.

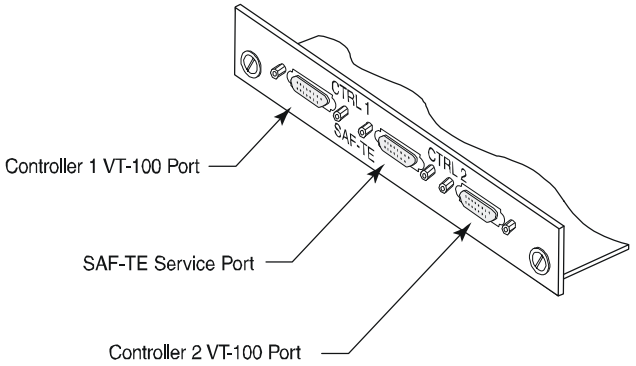


Figure 4-4 Connecting the RS-232 Cable

The cable is a female-to-female DB-9 null-modem cable.

2 Connect the other end of the cable to either a host system's serial communication port or a VT-100 type terminal.

3 On a host system, run a terminal emulation program or start the terminal.

4 Verify the communication parameters are as follows:

- 9600 Baud (optional 19,200)

  Baud rate set by Switch 6 – up for 19,200 and down for 9,600 (verify the setting by pressing the Alarm Reset button and noting the condition of the drive status LED for drive slot 5.
- 8 Data bits
- 1 Stop bit
- None (parity)
- Flow Control Off

5 At the prompt, press **Ctrl+E**. The Enclosure Terminal Utility menu appears.

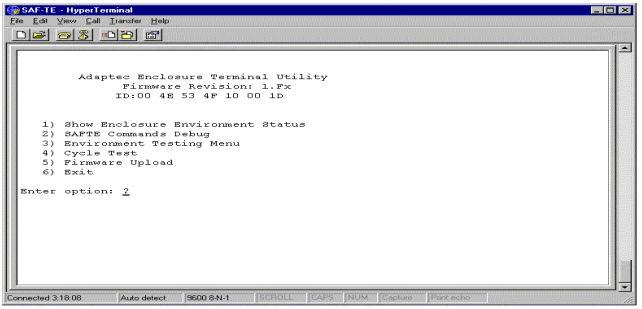


Figure 4-5 Enclosure Terminal Utility Screen

6 To monitor the enclosure components, select option 1, **Show Enclosure Environment Status,** by pressing the **1** key.

The screen provides a status of the internal components such as disk drives in a specific slot, temperature of the thermal sensors, cooling fan status, power supply status, and statistics on enclosure up time.

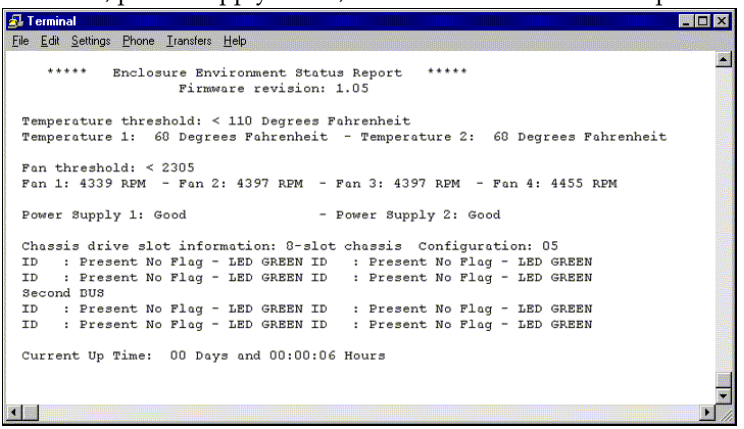


Figure 4-6 Enclosure Environment Status Screen

Note: System degradation occurs if the display is left in the Show Enclosure Environment Status mode. After you have viewed the information, press the <**Esc**> key to remain idle in the main Enclosure Terminal Utility screen.

7 Press **Esc** to return to the Main menu.

Note: Options 2 through 4 are factory and technical support features. Do not access these features unless instructed to do so by a support technician.

Uploading SAF-TE Controller Card Firmware

The following information describes the procedures to upload new firmware to the SAF-TE controller card. The firmware can be uploaded in a live environment. There is no need to turn the system OFF to perform this function.

1 Connect one end of the null-modem RS-232 cable to the SAF-TE Service port located on the rear panel of the enclosure. Refer to Figure 4-4 on page 4-9. The cable is a female-to-female DB-9 null-modem cable.

2 Connect the other end of the cable to either a host system's serial communication port or a VT-100 type terminal.

3 On a host system, run a terminal emulation program or start the terminal.

4 Verify the communication parameters are as follows:

- 9600 Baud (optional 19,200)

  Baud rate set by Switch 6 – up for 19,200 and down for 9,600. Verify the setting by pressing the Alarm Reset button and noting the condition of the drive status LED for drive slot 5.

- 8 data bits
- 1 stop bit
- None (parity)
- Flow control off

5 At the prompt, press **Ctrl+E**. The Enclosure Terminal Utility screen appears, as shown in Figure 4-5 on page 4-10.

6 Press **5** to select **Firmware Upload**.

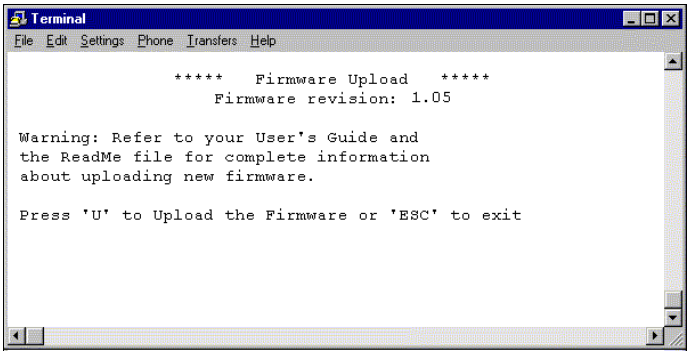


Figure 4-7 Firmware Upload Screen

7 Press the **u** key (lower case) to start the upload. Using the mouse, click on the pull-down menu *Transfers* and select **Send**.

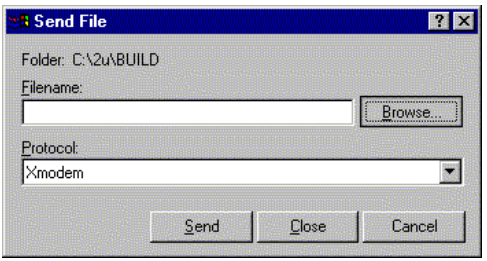


Figure 4-8 Send File Dialog Box

8 Click **Browse** to locate the new Firmware file, then click **Send**. The firmware file will have an S3R extension.

Note: Ensure that the protocol Xmodem is selected.

From the Xmodem File Send dialog box, you can monitor the progress of the upload. You can safely stop the transfer without affecting your existing firmware any time during the transfer until it has been completed. The upload does not overwrite the firmware during the upload process. It writes the new code into

unused EEPROM space until completed, then copies the new firmware code to the EEPROM active region.

If you elect to stop an upload progress, make sure that the stop (abort) command was completed by typing `<Control-X>` at the prompt.

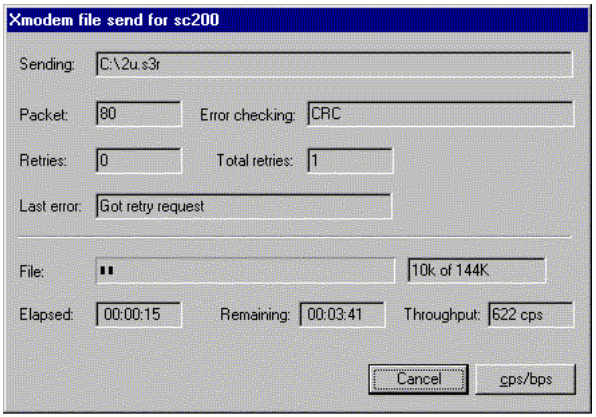


Figure 4-9 Xmodem File Send Dialog Box

9 After the upload is complete, the Upload Program then updates the second SAF-TE processor. A progress status screen appears.

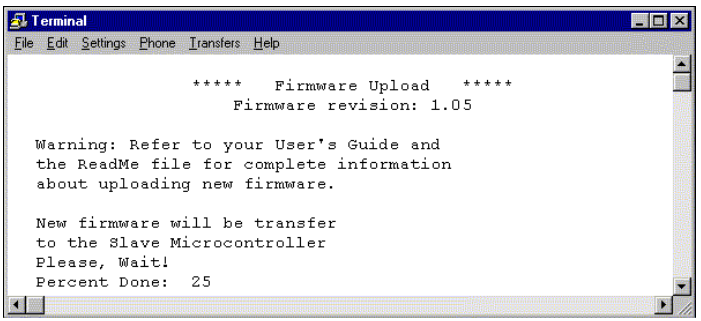


Figure 4-10 Transfer to Second Controller Processor Screen

At 100 percent, the following screen appears.

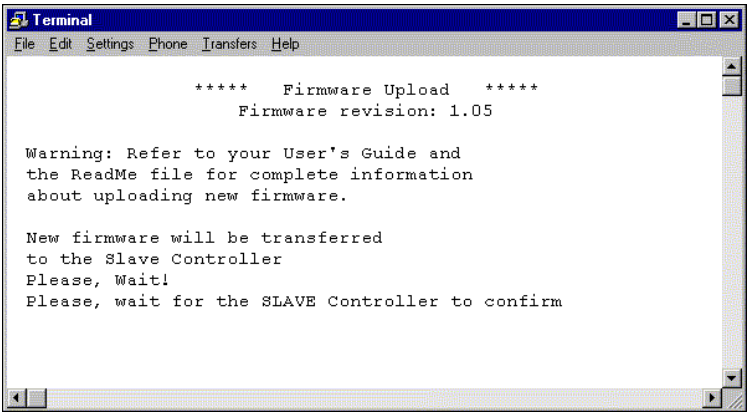


Figure 4-11 Update Confirmation Screen

After the confirmation is complete, the following screen appears.

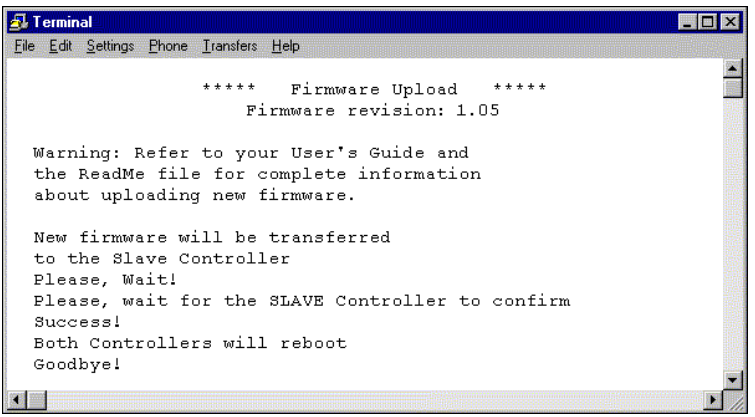


Figure 4-12 Update Status Screen

10 Verify that the new firmware has successfully loaded. Press **Ctrl+E**.

11 Press **Esc** to return to the Main menu.

5

Understanding and Maintaining Components

In this Chapter

In this chapter, you will find detailed descriptions of the major DuraStor components and basic instructions for the care and maintenance of those components.

Front Bezel

The front bezel (Figure 5-1) houses the status LEDs, drive LEDs, and alarm reset button. When the front bezel is removed, you can access the disk drives. The front bezel can be installed or removed without interruption to current system activities.

Embedded within the front bezel is the electronic package that provides the communication with the microprocessor. The microprocessor communicates with the RAID controllers, SAF-TE Environmental Processors (SEPs), and the disk drives in the storage subsystem. It passes that information to the front bezel channel mode and drive status LEDs, and the Disk Array Administrator firmware-based software.

Power is applied to the front bezel through an edge connector, where a control circuit monitors the bezel for proper connection. When the bezel is properly installed and power is applied to the storage subsystem, the bezel is immediately energized.

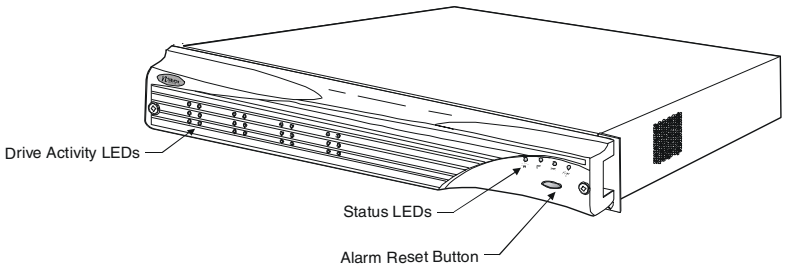


Figure 5-1 Removable Front Bezel

For instructions on removing and replacing the front bezel, see page 2-3.

RAID Controllers (6320SS and 7320SS only)

The 6320SS and 7320SS storage subsystems house one or two RAID controllers. The subsystems provide configurations for single stand-alone and dual active-active/active-passive controller solutions.

In the stand-alone mode, the controller operates autonomously. In the active-active/active-passive mode, the two controllers operate as a pair. If one controller fails in the active-active/active-passive mode, the other can take over the failed controller's work.

The Adaptec Disk Array Administrator storage management tool is embedded in the controller firmware. See Chapter 3, *Accessing Your Storage Management Tools* and the *Adaptec Disk Array Administrator User's Guide* on your *DuraStor CD* for more information.

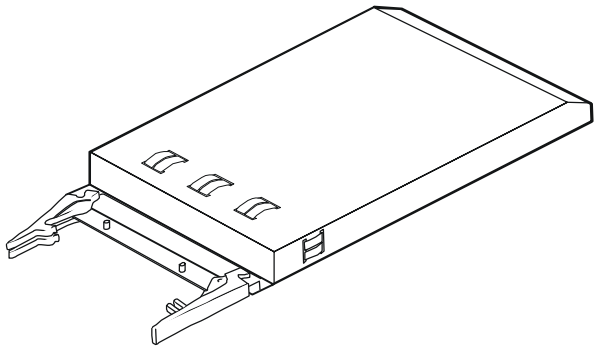


Figure 5-2 RAID Controller and Canister

The DuraStor 6320SS includes a single Ultra160-to-Ultra160 SCSI RAID controller as standard equipment. The controller has two Ultra160 host channels that connect to four host I/O ports on the subsystem and two Ultra160 SCSI disk channels connecting to two disk I/O ports. This controller is referred to in this *Guide* and in the storage management software as the DuraStor 6200S.

The DuraStor 7320SS includes a Fibre Channel-to-Ultra160 SCSI RAID controller a standard equipment. The controller has four 2 Gigabit FC host ports and four Ultra160 SCSI disk channels. This controller is referred to in this Guide and in the storage management software as the DuraStor 7200S.

Replacing a RAID Controller

Note: The RAID controller is hot-swappable.

1 Identify and locate the failed controller. See Chapter 6, *Troubleshooting*.

Controller 1 is the lower controller and Controller 2 is the upper controller, as shown in Figure 5-3.

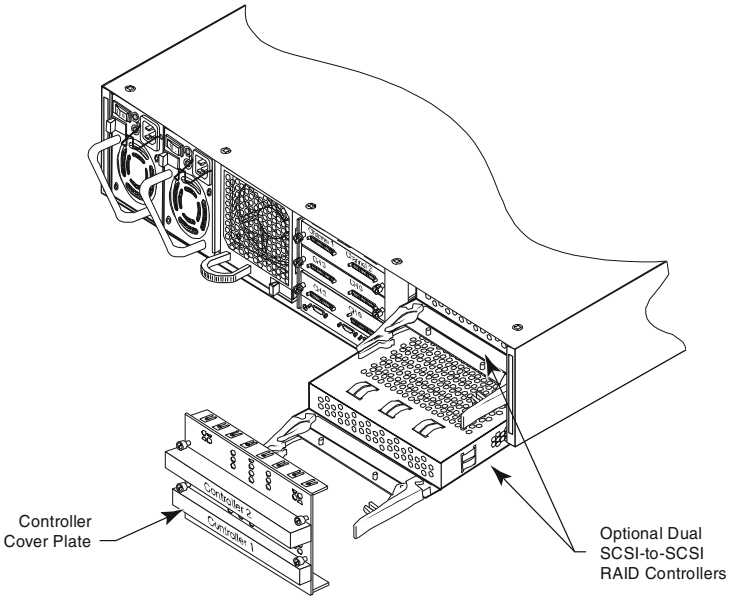


Figure 5-3 Location of RAID Controllers

2 Remove the controller cover plate. Loosen the four thumb screws and pull the plate from the storage subsystem.

3 Pull out on the two latches that secure the controller.

4 Using the latches as handles, carefully pull the controller from the storage subsystem.

5 Install the replacement controller into the storage subsystem. Secure the controller by pressing the latches until they lock into place.

6 Using one of the storage management tools (see page 1-5),verify that the replacement RAID controller has the correct firmware.

Note: Active-active and active-passive dual-controllers require the same version of firmware on both controllers.

7 *(Active-Active Mode only.)* Using one of the storage management tools (see page 1-5), relinquish the partner controller.

Replacing a "Killed" Controller

If one controller detects that the other has a problem, it will kill it, and output an appropriate event. If it is determined that the controller has a permanent failure, then it must be replaced.

Whether in active-active or active-passive mode, simply replace the defective controller and ensure that the firmware on it is at the same level as the surviving controller. If required, upload the correct firmware. Also, ensure that the new controller is set to the same operating mode.

The new controller completes its boot cycle and goes online automatically.

Upgrading the Memory Module

1 Use your screwdriver to loosen and remove the screws that secure the top of the canister to the bottom. There are four screws on each side of the canister and two on the bottom—10 screws in total.

2 Pull the top of the canister away from the bottom, and set it aside.

3 Align the memory module as shown in Figure 5-4 and gently set it in the memory module slot of the DuraStor RAID controller. The memory module is keyed to the slot to ensure proper installation.

4 Push gently but firmly until the memory module snaps into place.

The release latched closes automatically.

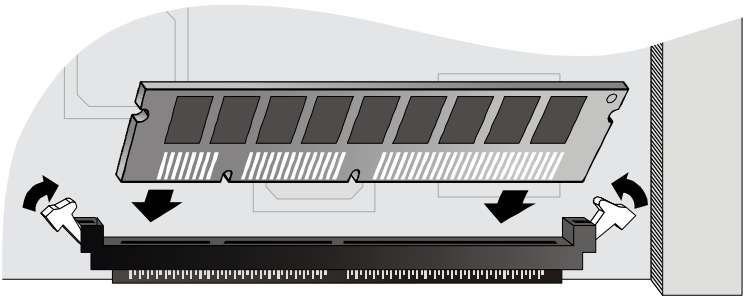


Figure 5-4 Installing the Memory Module

5 Close the canister and replace the screws.

Replacing the Battery

1. Use your screwdriver to loosen and remove the screws that secure the top of the canister to the bottom. There are four screws on each side of the canister and two on the bottom—10 screws in total.
2. Pull the top of the canister away from the bottom, and set it aside.
3. Align the battery as shown in Figure 5-5 and place it in the canister between the battery posts.

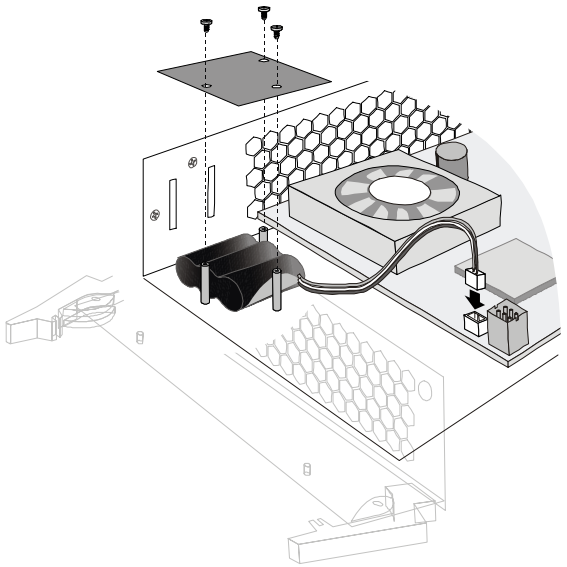


Figure 5-5 Installing the Battery

4. Plug the battery cable into the white, three-pronged connector on the DuraStor RAID controller. See Figure 5-5.
5. Place the battery cover over the battery, lining up the three screw holes with the three battery posts.
6. Use three washer and screw sets to attach the battery cover to the canister. *Do not* over tighten the screws.
7. Close the canister and replace the screws.

Configuring a Single-Bus Module

The DuraStor 412R drive enclosure can be configured to provide a continuous single SCSI bus when you need to address all of the disk drives on one SCSI bus.

To set up the storage subsystem as a single-bus, you need to install the single-bus module, which is available as a separate item from Adaptec. Visit www.adaptec.com for ordering information.

To configure the DuraStor 412R for a single SCSI bus:

1 Remove the controller cover plate.

2 Install the single-bus RAID controller and canister module (Figure 5-6) into the Controller 1 slot (Figure 5-7).

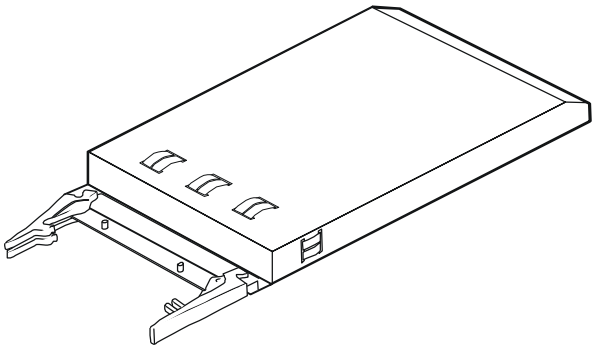


Figure 5-6 Single Bus Module

3 Reinstall the controller cover plate.

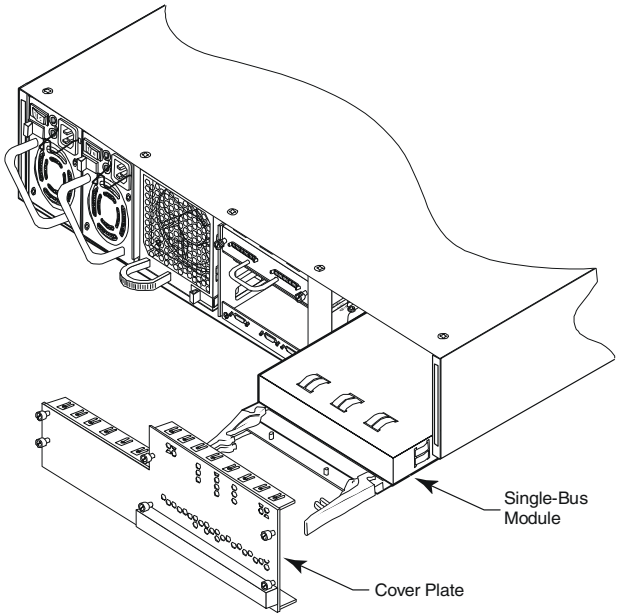


Figure 5-7 Installing the Single Bus Module and Cover Plate

Disk Drives

All models use one-inch-high, 3.5-inch SCSI disk drives. For information on DuraStor-compatible disk drives, go to the Adaptec Web site at www.adaptec.com/go/durastor.

Attaching a Disk Drive to a Drive Carrier

1 Place the disk drive component-side down on a flat surface, with the SCSI connector facing away from you.

2 Slide the drive carrier over the disk drive so that the handle of the drive carrier curves down and is facing you. See Figure 5-8.

3 Attach the drive carrier to the disk drive using six screws, three on each side of the drive carrier.

Replacing a Disk Drive

Warning: Drives and printed circuit board components are sensitive to electrostatic discharge. To prevent damage, establish a ground for yourself by using the wrist grounding strap, or by touching the metal chassis prior to handling or installing the disk drives or printed circuit board components.

Note: There is no need to power OFF the storage subsystem or the host computer system. The disk drives are hot-swappable. Be careful of the "P-factor" effect when removing a disk drive, which is the twisting of the drive in your hand as a result of the spinning disk. Allow the drive to completely spin down before removing it. Do this by pulling the drive slightly from its locked position and allowing it to spin down, then remove the drive.

To replace a disk drive:

1 Remove the front bezel. See page 2-3 for instructions.

2 Identify the failed disk drive using the drive status LED. Refer to *Drive LEDs* on page 4-3.

3 Grasp the drive carrier handle and pull the disk drive from the storage subsystem, as shown in Figure 5-8.

The tension clips on the drive carrier ensure that the fit is tight. Gentle but firm force may be required to remove the disk drive.

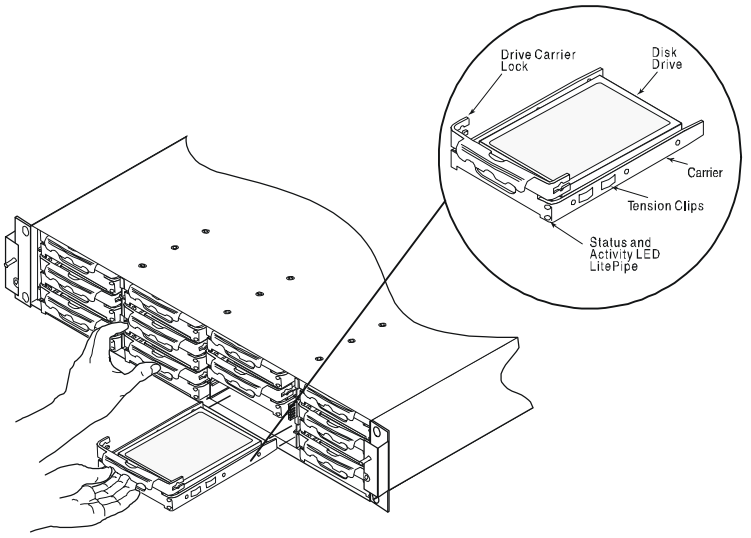


Figure 5-8 Removing a Disk Drive

4 Remove the replacement disk drive from its shipping container and remove the anti-static protection packaging. Inspect the drive for obvious damage.

5 Attach the disk drive to a drive carrier. See *Attaching a Disk Drive to a Drive Carrier* on page 5-10 for instructions.

6 Align the drive carrier rail with the grooves in the drive bay. See Figure 5-9.

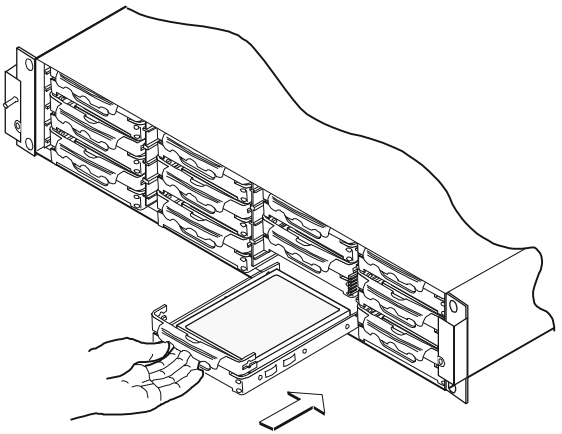


Figure 5-9 Inserting a Disk Drive

7 Push the drive carrier into its bay until it seats completely.

The tension clips on the drive carrier ensure that the fit is tight. Gentle but firm force may be required to completely seat the drive carrier.

8 Reinstall and secure the front bezel. See page 2-2 for instructions.

Power Supply Units

The DuraStor power system consists of two 350-watt hot-swappable power supply units (PSUs), each with independent AC power and cooling fans. This system provides the storage subsystem with N+1 redundant power. Each PSU has auto-switching circuitry for use with either 110V or 220V AC systems. A PSU is shown in Figure 5-10.

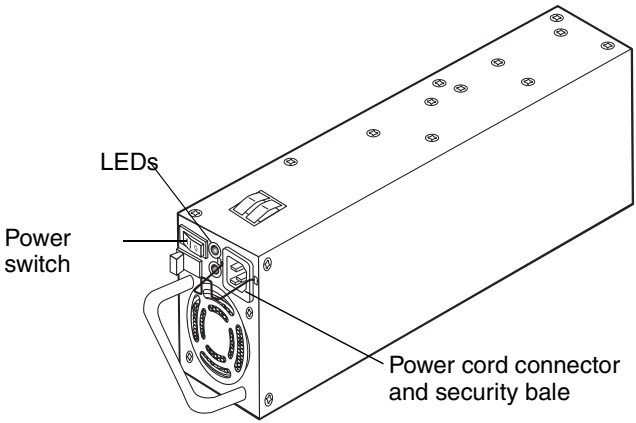


Figure 5-10 Power Supply Unit (PSU)

Each PSU has a power switch and a Power On LED, a power cord connector (with a security bale that fits over the power cord to prevent accidental disconnections), and an independent AC power cord. (The power switches are identified with a 1 for ON and a 0 for OFF.

When you turn on a PSU, its own Power-on LED and the Power Supply LED on the front bezel light up, and the storage subsystem performs a power-on self-test (POST).

If a PSU fails, the Power Supply LED changes from solid green to solid amber and the audible alarm sounds. On the failed PSU, the green Power On LED goes out and the amber Fault LED lights up.

If only one power supply is operational, the front bezel Power LED is amber.

Replacing a PSU

Note: PSUs are hot-swappable.

To replace a PSU:

1 Identify the failed PSU and turn it OFF.

2 Remove the power cord from the PSU.

3 Using your thumb and fore finger, squeeze the power supply release latch while pulling the power supply from the storage subsystem, as shown in Figure 5-11.

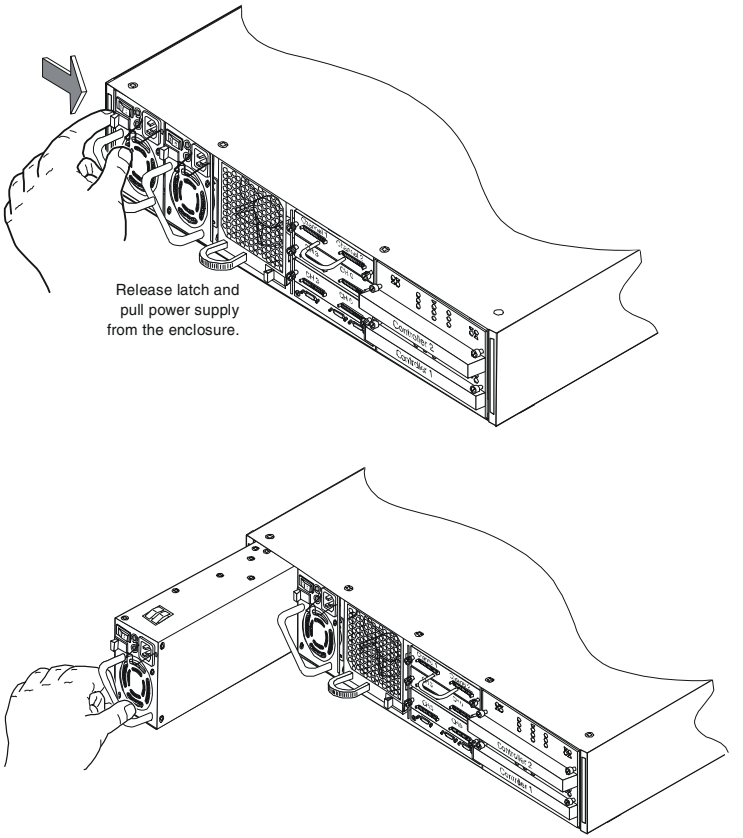


Figure 5-11 Removing a PSU

4 Remove the replacement PSU from the shipping container. Inspect the PSU for obvious damage.

5 Slide the new PSU into the open bay until it seats completely and the retaining latch resets.

6 Reconnect the power cord and replace the security bale.

7 Turn ON the PSU.

The PSU's Power On LED lights up, its Fault LED goes out, and the Power Supply LED on the front bezel changes to solid green to indicate normal PSU status.

Cooling Fan Module

The cooling system consists of two high-performance (80-CFM) cooling fans enclosed in a single fan module (see Figure 5-12). The fan module fits into the open bay at the rear of the storage subsystem and is hot-swappable.

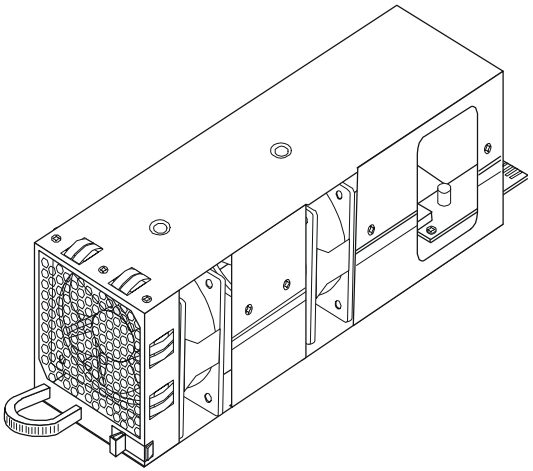


Figure 5-12 Cooling Fan Module

If the storage subsystem temperature exceeds the established threshold of 60° C (140° F), the fan status LED on the front bezel begins to flash amber. (The SAF-TE processor monitors the temperature and reports when this condition occurs.)

If a fan inside the module fails, the fan status LED remains lit and an alarm sounds. *Failed fans must be replaced immediately.*

Warning: Do not operate the storage subsystem for extended periods of time (greater than 5 minutes) with the cooling fan module removed. No cooling is available while the fans are removed.

Replacing the Cooling Fan Module

Note: The cooling fan module is hot-swappable.

To replace the cooling fan module:

1. Grasp the module handle with your left hand.
2. Use your thumb to squeeze the release latch, then pull the module from the storage subsystem, as shown in Figure 5-13.

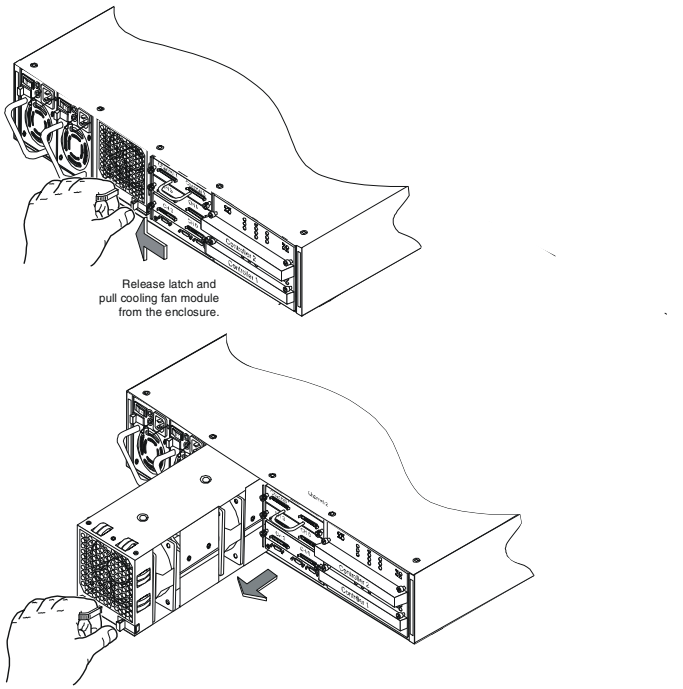


Figure 5-13 Removing the Cooling Fan Module

3 Remove the replacement cooling fan module from the shipping container. Inspect the module for obvious damage.

4 Slide the new cooling fan module into the open bay until it seats completely and the retaining latch resets.

The fan status LED on the front bezel changes to solid green to indicate normal fan status.

SAF-TE Disk I/O Card

Warning: The SAF-TE disk I/O card is *not hot-swappable*. You must power down the storage subsystem to remove or replace this card. See *Turning the Power Off* on page 2-7.

The SAF-TE disk I/O card (Figure 5-14) provides environmental and system status monitoring, and connectivity to the disk drive channels for daisy-chain requirements. It also contains the SAF-TE switches that are used for setting SCSI IDs, VT-100 communication protocols, and drive spin-up options.

Note: Specific switch settings are discussed in Chapter 2, *Setting Up Your Storage Subsystem*.

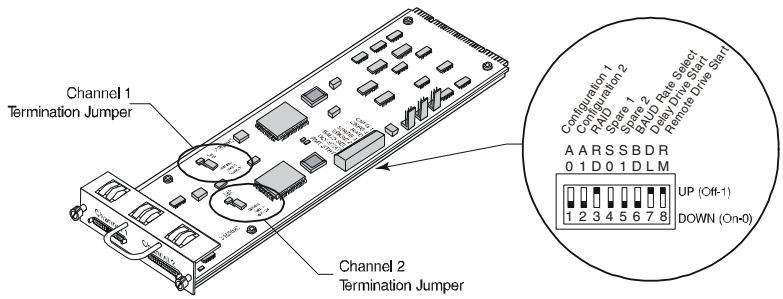


Figure 5-14 SAF-TE Disk I/O Card

The SAF-TE disk I/O card houses two SAF-TE environmental processors (SEPs) compliant with SAF-TE specification protocol version 1.0. The SEPs monitor the disk drives, PSUs, cooling fans, and storage subsystem temperature and continually report conditions to the host system.

At power-on, the SEPs read the SCSI switch settings and configure the system for the appropriate addresses. The SEPs execute firmware from the onboard flash memory and perform a POST. The firmware is flash upgradeable using the SAF-TE RS-232 service port located below the I/O card slots at the rear of the storage subsystem. The firmware also contains the necessary functions for storage subsystem management.

The SAF-TE disk I/O card has two 68-pin VHD/CI SCSI connectors that provide the connectivity from the primary storage subsystem to the disk drives in the daisy-chained DuraStor storage subsystems. The connectors are labeled *Channel 1* and *Channel 2*. The following bus modes are possible:

- In JBOD dual-bus mode, the Channel 1 connector provides SCSI bus access to the disk drives in slots 7 through 12, and the Channel 2 connector provides access to the drives in slots 1 through 6. Termination is automatic and provided internally on the drive mid-plane circuit board.
- In JBOD single-bus mode, the Channel 1 connector provides SCSI bus access to all the disk drive slots, 1 through 12, and the Channel 2 connector provides the automatic SCSI bus termination.
- In a daisy-chain configuration, you will be required to make changes to the jumper settings in the last enclosure's SAF-TE disk I/O card in that daisy-chain.

In each of the supported configurations, all DuraStor 412R enclosures appear at the end of the daisy chains. Therefore, all daisy-chained DuraStor 412R enclosures must have jumpers installed on JP7 and JP8.

Note: Only the channel for each connection requires a jumper. However, for best convenience in light of the fact that the SAF-TE Disk I/O card is not hot swappable, set both jumpers at the same time.

These jumpers allow the automatic termination to function properly. For each channel used, install a jumper on JP8 for Channel 1 and JP7 for Channel 2. By default, the jumper is left hanging on one pin, or *unjumpered*.

When the RAID controllers are installed, the SCSI connectors on the SAF-TE disk I/O card provide the daisy-chain connection to additional DuraStor 412R drive enclosures providing further storage expandability.

Note: No external terminators are required.

For instructions on removing and replacing the SAF-TE I/O card, see *Replacing an I/O Card* on page 5-21.

SCSI I/O Card

Warning: The SCSI I/O card is *not hot-swappable*. You must power down the storage subsystem to remove or replace this card. See *Turning the Power Off* on page 2-7.

The SCSI I/O card (Figure 5-15) provides the Channel 0 and Channel 3 SCSI drive ports, two of the four drive ports available for additional drive expansion connectivity to the storage subsystems.

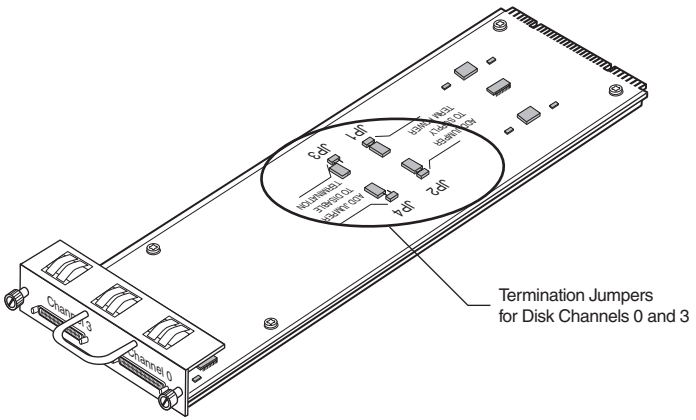


Figure 5-15 SCSI I/O Card

The SCSI I/O cards are configured with automatic termination and do not require any external terminators. Termination power and jumpers are available on the card; however, their settings do not

require any changes. The default is to have jumpers installed on JP1 and JP2 with JP3 and JP4 unjumpered.

For instructions on removing and replacing the SAF-TE I/O card, see *Replacing an I/O Card* on page 5-21.

Fibre Channel Host I/O Card (7320SS *only*)

Warning: The Fibre Channel host I/O card is *not hot-swappable*. You must power down the storage subsystem to remove or replace this card. See *Turning the Power Off* on page 2-7.

The Fibre Channel (FC) host I/O card (Figure 5-16) provides the connectivity from the host computer(s) to the RAID controller FC host ports. The connectors are labeled *P1*, *P2*, *P4*, and *P3*.

Cabling diagrams are provided in Chapter 2 for each supported topology. To ensure proper failover and failback operations and LUN presentation, following the cabling diagram for your selected topology.

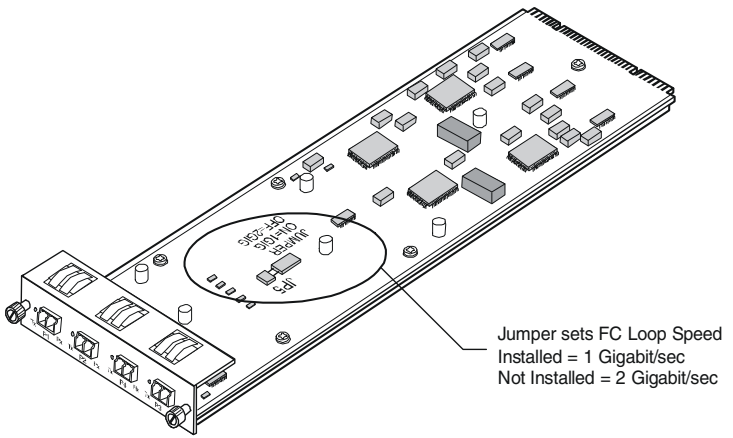


Figure 5-16 Fibre Channel Host I/O Card

The fibre channel host I/O card has a jumper on the card that allows the user to set the FC Loop speed. When JP5 has a jumper installed, the loop speed is 1 Gigabits/sec; when unjumpered, the loop speed is 2 Gigabits/sec.

Replacing an I/O Card

Warning: The I/O cards are *not hot-swappable*. You must power down the storage subsystem to remove or replace any I/O card. See *Turning the Power Off* on page 2-7.

1. Power off DuraStor. See *Turning the Power Off* on page 2-7.
2. Identify the faulty I/O card.
3. Disconnect the cables attached to the faulty I/O card.
4. Loosen the two thumb screws that secure the card.
5. Grasp the thumb screws and gently pull the I/O card from the storage subsystem. (You can use the handle on the SAF-TE disk I/O card instead of the screws.)
6. *(SAF-TE Disk I/O only)* Note the position of the jumpers and the switch settings on the faulty card.
7. Remove the new replacement card from the shipping container. Inspect the card for obvious damage.
8. *(SAF-TE Disk I/O only)* Set the jumpers and switches to match those on the faulty card being replaced.

9 Align the I/O card with the rail guides of the open bay and push gently but firmly until the card seats completely. The SAF-TE disk I/O card is shown as an example in Figure 5-17.

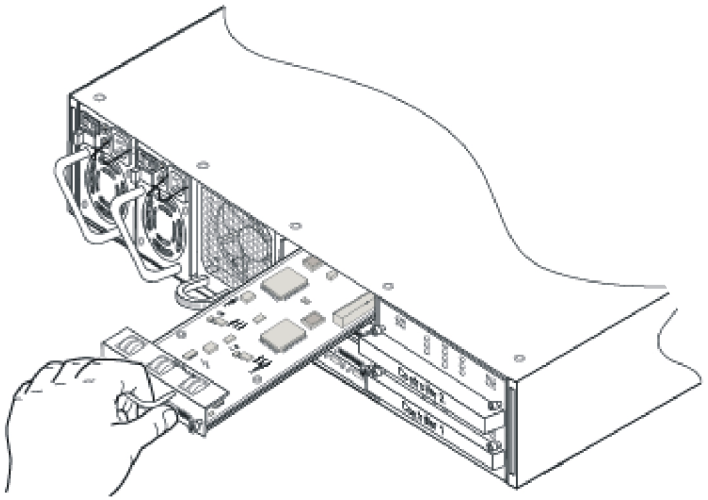


Figure 5-17 Reinstalling the SAF-TE Disk I/O Card

10 Tighten the thumb screws. *Do not* overtighten.

11 Reconnect the data cables to the replacement card.

12 Power-on the storage subsystem. See *Turning the Power On* on page 2-7.

Optical SFP Transceiver (7320SS *only*)

The Fibre Channel host I/O card uses a hot-swappable Small Form-Factor Pluggable (SFP) transceiver (Figure 5-18). The SFP optical transceiver provides operations up to 2.5 Gigabits/sec. The transceiver includes a lost signal detect circuit that provides TTL logic high output when an unusable input signal is detected.

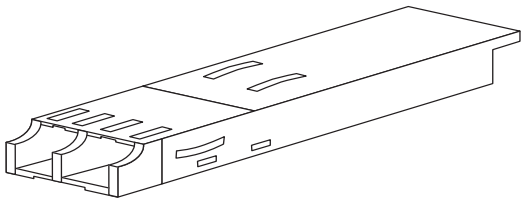


Figure 5-18 Optical Transceiver

The SFP transceiver is Class 1 Laser safety compliant and conforms to Class 1 eye safety standards.

Caution: Do not look into the laser light beam for any extended period of time.

Dust covers are provided to protect the optical transceivers' optics. Adaptec highly recommends using the dust covers provided when a connector is not in place. Figure 5-19 shows how the dust covers fit into the transceiver.

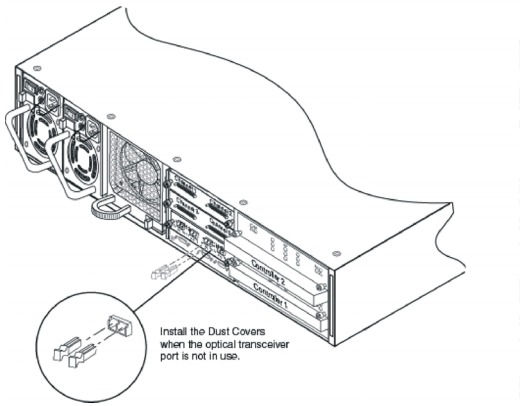


Figure 5-19 Installing and Removing SFP Dust Covers

RS-232 Ports

Located below the I/O card slots are the SAF-TE service and VT-100 RAID controller RS-232 serial ports. See Figure 5-20 for the location of these ports on the rear panel.

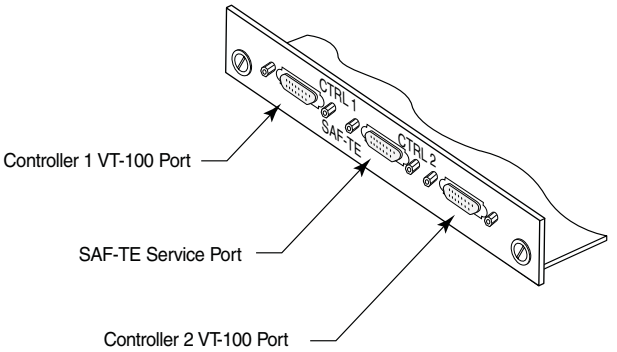


Figure 5-20 RS-232 Service and Controller Ports

The SAF-TE service port provides an RS-232 serial interface to the SAF-TE disk I/O card allowing firmware uploads, and maintenance/service monitoring of the SEPs. This port is labeled SAF-TE.

The two RAID controller ports, which are labeled CTRL 1 and CTRL 2, provide an RS-232 serial interface to each RAID controller. These connectors provide access to the Disk Array Administration software onboard the controllers and allow for firmware updates. The ports are standard DB9 connectors that provide a connection via a null-modem serial cable for VT-100 terminal and host serial portion communication via emulation software.

Replacing the Storage Subsystem

If you need to completely replace the DuraStor 6320SS or 7320SS, follow these instructions carefully to remove and replace the storage subsystem safely.

Warning: Printed circuit board components are sensitive to electrostatic discharge. To prevent damage, establish a ground for yourself by using a wrist grounding strap, or by touching the metal chassis prior to handling or installing a printed circuit board component.

Removing the Old Storage Subsystem

1. Remove your replacement storage subsystem from the shipping container and inspect the shipment.
2. Power OFF the host computer and DuraStor. See *Turning the Power Off* on page 2-7.

   Note: Note the location of the data cables, disk drives, and I/O cards, and the switch settings on SAF-TE disk I/O card, prior to disconnecting or removing these items. Tag the cables and disk drives appropriately to make reinstallation easier.

3. Disconnect the cables and power cords from the faulty storage storage subsystem.
4. Remove the front bezel. See Figure 2-2 on page 2-3 for detailed instructions.
5. Remove the disk drives. See *Replacing a Disk Drive* on page 5-10.
6. Remove each power supply. See *Replacing a PSU* on page 5-14.
7. Remove the cooling fan module. See *Replacing the Cooling Fan Module* on page 5-16.
8. If applicable, remove each RAID controller, noting its position. Tag the controllers to make reinstallation easier. See *Replacing a RAID Controller* on page 5-4.

9 Remove the I/O cards. See *Replacing an I/O Card* on page 5-21.) Remove the defective storage subsystem from the rack cabinet. Reverse the installation procedures in *Installing DuraStor in a Rack* on page 2-2.

Installing the New Storage Subsystem

1 Install the replacement storage subsystem in the rack cabinet. See *Installing DuraStor in a Rack* on page 2-2.

2 Reinstall the I/O cards. Refer to the notes you made of the jumper and switch settings to ensure they remain in the same positions.

3 Reinstall the power supplies. See *Replacing a PSU* on page 5-14.

4 Reinstall the cooling fan module. See *Replacing the Cooling Fan Module* on page 5-16.

5 Install the disk drives. See *Replacing a Disk Drive* on page 5-10 for installation instructions.

6 If applicable, reinstall the RAID controllers in the same positions as in the old storage subsystem. Refer to the notes you made of the proper installation locations. (See *Replacing a RAID Controller* on page 5-4 for installation instructions.)

Warning: The connector is sensitive to alignment. Carefully seat each controller's connector and secure the controller by closing the latches.

7 Reconnect the data cables and power cords. Refer to the notes you made of the proper connection locations.

8 Replace the front bezel. See Step 14 on page 2-6

9 Power ON DuraStor. Then, power ON the host computer. See *Turning the Power On* on page 2-7.

10 Verify that all systems are operating normally.

11 Use Storage Manager Pro or Disk Array Administrator to verify that the replacement RAID controller has the correct firmware.

Note: Active-active and active-passive dual controllers require the same version firmware on both controllers and the same amount of memory.

6

Troubleshooting

In this Chapter

This chapter provides typical solutions for problems you may encounter while using DuraStor.

General Enclosure Problems

Symptom	Cause	Solution
Fails to power ON.	■ Power cords are not connected properly. ■ Power not available at the outlet. ■ Power switch not in the proper position. ■ Faulty power cord. ■ Faulty power supply.	■ Verify that the power cord is properly connected to the power module. ■ If the enclosure is plugged into a three-hole grounded outlet, verify that power to the outlet has not been interrupted. This can be accomplished by testing the outlet with a known working appliance, such as a lamp. ■ Be sure that the power switch is in the ON position, labeled with an I. ■ Replace the power cord. ■ Identify the failed PSU, see *Replacing a PSU* on page 5-14. ■ If the enclosure is not responding, contact your service provider.

Common SCSI Bus Problems

SCSI Bus problems can usually be attributed to cabling issues or a faulty SAF-TE disk I/O card. Refer to the chart below and review troubleshooting and fault isolation procedures to assist you in identifying the suspect component.

Symptom	Probable Cause	Solution
Host SCSI BIOS scan hangs.	Termination or SCSI ID conflict.	Check the Host ID and proper system configuration.
Not all disk drives connected to the HBA channels are displayed during boot.	Termination or SCSI ID conflict.	■ Check that the SCSI connectors are properly connected. ■ Check SCSI ID assignments. ■ If the enclosure is the daisy-chained enclosure, check the I/O card jumper settings in the last enclosure on the chain.

Symptom	Probable Cause	Solution
SCSI Bus hangs, SCSI Bus excessively retries, and/or drives drop offline.	■ Faulty connectivity. ■ Faulty SAF-TE disk I/O card (JBOD or daisy- chained enclosure) or host I/O card.	■ Re-check the cable connections to the SAF-TE disk I/O card and/or host disk I/O card. ■ If you have daisy-chained storage subsystems connected on the SCSI bus, you need to perform some fault isolation. ■ If all the disk drives on one bus are offline, start with the daisy-chain storage subsystem. Disconnect the data cable. If the remaining disk drives return to a normal state, it indicates that the isolated storage subsystem has the faulty component. ■ If this does not return the remaining drives to a normal state, it is a good indication that the problem is in the first storage subsystem and/or its SAF-TE disk I/O card. ■ You may use the SAF-TE disk I/O card from the other storage subsystem or a new, known good card. Substitute this card for the suspect card and it should return the storage subsystem bus to a normal condition.

Symptom	Probable Cause	Solution
SCSI Bus hangs, (continued).		■ **NOTE:** A return to a normal condition is indicated by the disk drives coming back online. ■ After the faulty card is replaced, begin re-connecting the data cables on the SAF-TE disk I/O card, noting the SCSI bus and drives remain in a normal state. ■ Re-check the cables to the SAF-TE disk I/O card, host I/O card, and the host adapter.
	■ Faulty SAF-TE disk I/O card (JBOD or Daisy-chained enclosure) or host I/O card (continued).	■ Replace the SAF-TE disk I/O card or host I/O card. ■ If the problem still exists in a RAID configuration, with the primary enclosure isolated to the host system, follow the procedures above to test the connectivity and operation of the host I/O card. There are two host I/O cards installed in RAID configurations. You can move the cable to the second card, same channel connector to fault isolate the host I/O card.

Terminal Emulator and COM Port Problems

Symptom	Probable Cause	Solution
Screen displays unintelligible strings of characters.	Baud rate mismatch between the terminal emulator and the controller. The default baud rate is 115,200.	Follow these steps if you set your terminal emulator to the default rate and still get garbage characters: 1 If you are able, shut down the controller. If you are unable to shut down the controller, continue with step 2. 2 Turn OFF the power to the enclosure containing the controller. 3 Press the spacebar of your terminal emulator. 4 Turn ON the power while continuing to press the spacebar. This allows the controller to auto-detect the baud rate setting. 5 When the Flash Utility appears, select option 5 to continue to boot the controller. **Note:** Some terminal emulators do not immediately change to the new baud rate settings, and you have to exit and restart the emulator to use the new settings.

Symptom	Probable Cause	Solution
Nothing is displayed on the terminal emulator screen.	Faulty RS-232 cable connection or swapped transmit/ receive lines.	If the cable is properly connected on both ends, try a *null modem* adapter that will reverse the RS-232 transmit and receive signals. The need for a null modem adapter depends on both your enclosure and the RS-232 cable you are using.
Screen is updated, but will not respond to keystrokes.	Improper setting.	Disable hardware flow control on the terminal or terminal emulator. The controller supports XON/ XOFF flow control and works properly in most cases with no flow control.

Host SCSI Channel Problems

Symptom	Solution
The host SCSI BIOS scan displays "Device name not available."	The controller is properly installed, but no arrays have been created. Use Disk Array Administrator to create an array and reboot the host system.
The host SCSI BIOS scan hangs.	Check that termination is set correctly in the Configuration Menu and the drive enclosure. Check that the device ID set in the software does not conflict with any other devices on the host SCSI channel. If you have a long SCSI cable, try a different or shorter cable.
Only one array is displayed during host SCSI BIOS scan.	Check to ensure that LUN support is enabled. Most SCSI host adapters ship with LUN support disabled by default. Check the LUN assignment for each array. If LUN 0 is not assigned to an array, or some other LUN numbers are skipped, change the LUN assignments for each array until you have LUN numbers starting at 0 with no LUNs skipped. You must reboot the host system to recognize the new LUN assignment.
All arrays are displayed during host SCSI BIOS scan, but only one array is seen by the operating system.	SCSI drivers for some operating systems require a parameter switch to enable LUN support. Check the driver documentation for your host SCSI channel. You may also need to compact the LUN mapping.

Device SCSI Channel Problems

Symptom	Solution
Not all disk drives connected to the controller device channels are displayed during boot, or the controller hangs during display of connected drives.	■ See Chapter 2, *Setting Up Your Storage Subsystem* to be sure that the enclosure is properly configured for use with a RAID controller. ■ Check termination and ID assignment. If you have enabled Ultra/Ultra2 SCSI on any device channels, try disabling it.

Problems During Bootup

The following sections describe problems you might encounter during Power On Self-Test (POST) or during bootup sequence of the enclosure and explains how to resolve those problems. POST shows problems related to the processor, logic, and memory.

Symptom	Solution
Controller failed the onboard memory test.	When this failure occurs, it means the internal CPU memory failed. Replace the controller to correct the problem.
System hangs at Loading Bridge during BFLU Loader Menu.	Re-flash the firmware to ensure you are using the latest version. Refer to the *Disk Array Administrator User's Guide*. If you cannot update the firmware or if the updated firmware does not correct the problem, replace the controller. Dual RAID controllers require the same version of firmware on both controllers.
One of the POST diagnostic tests failed.	Contact service provider.

Symptom	Solution
The system hangs at CT_srv starting.	Follow these steps: 1 Verify that there are no SCSI address conflicts. 2 Check the enclosures to make sure everything is properly connected. 3 If the enclosures and the disk drive work properly, replace the controller.
The system hangs during a drive scan.	Follow these steps: 1 Check the enclosures to make sure everything is properly connected. 2 Remove and replace the disk drive that failed the scan. 3 If the enclosures and the disk drive work properly, replace the controller.
An active-active controller pair hangs during boot up drive scan (typically after displaying CT_Init on the RS-232 display).	■ Verify that all fibre channel/ SCSI channels are connected, cabled, and terminated properly. ■ Verify that the controllers are set to their default configuration (active-active single-port mode).
An active-active controller pair hangs the host system during normal operation or after failing over.	Verify that all fibre channel/SCSI channels are connected, cabled, and terminated properly.
An active-active controller pair always fails over after booting up.	■ Verify that the controller that is failed/killed is set to its default configuration (active-active mode). ■ Verify the same SDRAM DIMM sizes are in both controllers. active-active controllers require the same SDRAM DIMM size.

Controller Problems

Symptom	Solution
The controller's STATUS LED is ON, but there is no RS-232 display.	■ Check that the RS-232 cable is the correct type (null modem). ■ Check that the terminal emulation utility on the computer system is properly configured.
The controller reports a SDRAM memory error.	Check that the SDRAM DIMM is fully seated in the connector and the latches are fully engaged into the DIMM notches.
The controller reports a Battery error.	Verify that the correct NiMH battery pack is installed.

Common Problems and Interpreting the LEDs

Symptom	Probable Cause	Solution
Power supply status LED is illuminated.	■ Power supply has failed. ■ Power supply turned OFF. ■ Power supply missing. ■ Loss of AC power to the power supply.	■ Replace the suspect faulty power supply. ■ Ensure that all the power supply switches are in the ON position. ■ Replace the missing power supply and turn it ON. ■ Verify that proper AC power is available to the power supplies. If the enclosure is plugged into a three-hole grounded outlet, verify that power to the outlet has not been interrupted. This can be accomplished by testing the outlet with a known working appliance, such as a lamp.
Fan status LED is illuminated.	Failed cooling fan.	Replace cooling fan module.
Drive status LED is not illuminated and a disk drive is present in the slot.	■ Fault on the SAF-TE disk I/O card. ■ Faulty disk drive. ■ Faulty SAF-TE disk I/O card. ■ Faulty host I/O card.	■ Replace a faulty SAF-TE disk I/O card. ■ Replace the faulty disk drive. ■ Replace the faulty SAF-TE disk I/O card. ■ Replace the faulty host I/O card.

Warning and Error Events

There are a number of conditions that trigger warning or error events, activate the alarm, and may affect the state of the STATUS and FAULT LEDs. The alarm sounds mainly when the software displays a warning or error event.

The alarm will silence when you press the Alarm Reset button. The events in these categories are listed below.

Warnings

Warning events let you know that something related to the controller or an array has a problem. You should correct the problem as soon as possible. The table below defines each warning event and recommends the action you should take.

Event	Definition	Recommended Action
BATT FAIL INFO	A warning condition in the battery pack and/or charging interface has been detected.	Replace the controller. See *Replacing a RAID Controller* on page 5-4.
REPLACE BATTERY	The battery is approaching its 3-year life span.	Replace the controller. See *Replacing a RAID Controller* on page 5-4.
ARRAY CRITICAL	One or more disk drives were downed and the array is online, but is no longer fault tolerant.	Add a spare to the array or the spare pool. Refer to the *Storage Manager Pro User's Guide*. Then, replace the bad drive. See *Replacing a Disk Drive* on page 5-10.
DRIVE DOWN	An error occurred with the disk drive and it was downed, removing it from the active array.	Add a spare to the array or the spare pool. Refer to the *Storage Manager Pro User's Guide*. Then, replace the bad drive. See *Replacing a Disk Drive* on page 5-10.

Event	Definition	Recommended Action
SPARE UNUSABLE	The disk drive still contains metadata that must be cleared.	Clear the metadata from the spare drive. Refer to the *Storage Manager Pro User's Guide*.
SMART EVENT	A disk drive informational exceptions page control (IEPC) predictive failure message was received. No actions by the controller are taken on the drive for these events.	Run diagnostics available from your operating system on the affected disk drive. Replace the drive, if necessary. See *Replacing a Disk Drive* on page 5-10.
ARRAY OFFLINE	More than one disk drive in a RAID 0 or volume set went down, bringing the array to an offline state. This array is no longer accessible by the host.	Replace the bad drive (see *Replacing a Disk Drive* on page 5-10) and restore the data from backup.
VOLT/TEMP WARN	The analog-to-digital converter monitored a temperature and/or voltage in the warning range.	■ Check that the controller's fan is running. ■ Check that the ambient temperature is not too warm. See Appendix E, *Technical Specifications*.
UNWRITABLE CACHE	The SDRAM cache has battery backed-up data, and the arrays assigned to this data are not present.	■ Determine which disk drives are missing and reinstall them, or ■ Select Yes when asked if you want to discard this data.
SDRAM CORR ECC	A correctable single-bit SDRAM ECC error occurred.	If this error occurs frequently, replace the memory.

Errors

Error events let you know that something related the enclosure, controller, or disk drives has failed and requires immediate attention. The table below defines each error event and recommends the action you should take.

Event	Definition	Recommended Action
VOLT/TEMP FAIL	The analog-to-digital convertor monitored a temperature and/or voltage in the failure range.	■ Check that the enclosure fans are running. ■ Check that the ambient temperature is not too warm. See Appendix E, *Technical Specifications*.
ENCLOSURE FAIL	Enclosure specific general purpose I/O triggered a failure condition.	Check the status of the enclosure.
BATTERY FAILED	A failure in the battery pack and/or charging interface has been detected.	Replace the controller. See *Replacing a RAID Controller* on page 5-4.
DISK CHAN FAILED	An error has occurred in communicating on the disk channel.	Check the cables on the channel.
SDRAM UNCORR ECC	A noncorrectable multiple-bit SDRAM ECC error occurred.	Reseat the memory. If the problem continues, replace the memory.

Disk Errors

If a disk detects an error, it reports the error and records it in the event log. The following is an example of a disk-detected error.

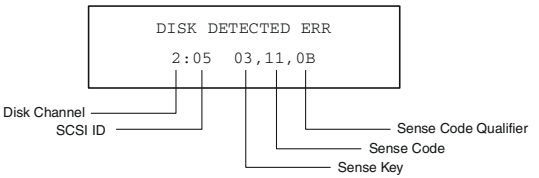


Figure 6-1 Disk Detected Error Example

Using the information in the Sense Key and ASC tables, you can see that this is a medium error, unrecovered read error – recommended reassignment.

Table 6-1 Sense Key Descriptions

Sense Key	Description	Sense Key	Description
0h	No sense	9h	Vendor-specific
1h	Recovered error	Ah	Copy aborted
2h	Not ready	Bh	Aborted command
3h	Medium error	Bh	Aborted command
4h	Hardware error	Ch	Obsolete
5h	Illegal request	Dh	Volumes overflow
6h	Unit attention	Eh	Miscompare
7h	Data protect	Fh	Reserved
8h	Blank check		

Table 6-2 ASC and ASCQ Descriptions

ASC	ASCQ	Description
0C	02	Write error, auto-reallocation failed.
0C	03	Write error, recommend reassignment.
11	00	Unrecovered read error.
11	01	Read retries exhausted.
11	02	Error too long to correct.
11	03	Multiple read errors.
11	04	Unrecovered read error, auto-reallocation failed.
11	0B	Unrecovered read error, recommend reassignment.
11	0C	Unrecovered rear error, recommend rewrite data.
47	00	SCSI parity error.
48	00	Initiator-detected error message received.

Disk Channel Errors

Disk channel errors are similar to disk-detected errors, except they are detected by the controller, instead of the disk drive. Some disk channel errors are displayed as text strings, others are displayed as hexadecimal values.

Figure 6-2 shows a disk channel error displaying the hexadecimal codes. Most disk channel errors are informational because the controller issues retries to correct any problem. Errors that cannot be corrected with retries will result in another critical event describing the affected disk array (if any).

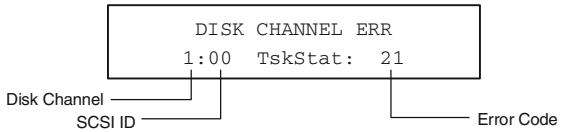


Figure 6-2 Disk Channel Error Example

Table 6-3 Disk Channel Error Codes

Error Code	Description
04	Data overrun or underrun occurred while getting sense data.
05	Request for sense data failed.
20	Selection time-out occurred (displayed as Sel Timeout).
21	Controller detected an unrecoverable protocol error on the part of the target.
22	Unexpected bus-free condition occurred (displayed as Unex Bsfree).
23	Parity error on data was received from a target displayed as Parity Err).
24	Data overrun or underrun has been detected (displayed as Data OvUnRn).
30	Target reported busy status (displayed as Device Busy).
31	Target reported queue full status (displayed as Queue Full).
32	Target has been reserved by another initiator.
40	Controller aborted an I/O request to this target because it timed out (displayed as I/O Timeout).

Table 6-3 Disk Channel Error Codes (Continued)

Error Code	Description
41	I/O request was aborted because of a channel reset.
42	I/O request was aborted because of controller's decision to reset the channel.
43	I/O request was aborted because of third-party channel reset (displayed as Abort 3PRST).
44	Controller decided to abort I/O request for reasons other than bus or target reset.
45	I/O request was aborted because of target reset requested by controller.
46	Target did not get response properly to abort sequence.
4B	I/O aborted due to operating mode change (such as LVD to SE or SE to LVD) (displayed as Abort MdChg).
50	Disk channel hardware failure (displayed as DskChn Fail). This may be the result of bad termination or cabling.

A

Theory of Controller Operation

In this Appendix

This chapter provides a functional overview and understanding of the supported topologies and operating modes for the DuraStor 6320SS and 7320SS storage subsystems. With this information, you will be able to make the best choice based on the supported topologies, to set up your storage solution.

The DuraStor 6200S and 7200S RAID controllers can be set up to operate in one of three different modes:

- Stand-alone
- Active-active
- Active-passive

These provide a configuration that includes different host connections, disk channel connections, internal hub configurations, single or dual RAID controllers, and whether the controllers are operating in single or dual port modes.

Operating Modes Overview

The operating modes let you configure the RAID controllers to support a variety of host environments.

- **Stand-alone single-port**—Use this mode when you have a single RAID controller and require single-HBA host access. There will be several cabling schemes to choose from when you setup this operating mode.
- **Stand-alone dual-port**—Use this mode when you have a single RAID controller and require dual-HBA host access, or two independent host access. There will be several cabling schemes to choose from when you setup this operating mode.
- **Active-active single-port**—Use this mode when you have two RAID controllers and require both controllers to be active and processing host I/O operations. This operating mode uses one channel on each of the RAID controllers and supports single or dual host system connections. There are several cabling schemes when setting up the single host system or dual host systems.
- **Active-active dual-port**—(*DuraStor 7320SS only.*) Use this mode when you have two RAID controllers and require both controllers to be active and processing host I/O operations. This operating mode uses both FC host ports of each RAID controller and supports single or dual host system connections. There are several cabling schemes when setting up the single host system or dual host systems.
- **Active-passive dual-port**—Use this mode when you have two RAID controllers and require only one RAID controller to be active. The other controller is in a passive mode as a "hot" standby. This operating mode supports single or dual host system with several cabling schemes. It does not provide the performance compared to either of the active-active modes.

The naming conventions are broken down into two parts: the first part refers to the number of controllers and their state, and the second part refers to the state of the controller's host ports (not to be confused with the physical I/O ports).

Stand-alone designates a single controller system, and active-active or active-passive designates a dual controller system.

The single-port or dual-port component of the name convention refers to the number of enabled host ports on the active controller. Note that there are two host ports on each controller (internally).

Table A-1 and Table A-2 summarize the operating modes for the DuraStor 6320SS and 7320SS, respectively.

Table A-1 Summary of Operating Modes – DuraStor 6320SS

Operating Mode	Number of Controllers	Number of Active Host Ports per Controller	Number of Disk Channels
Stand-Alone Single-Port	1	1	3
Stand-Alone Dual-Port	1	2	2
Active-Active Single-Port	2	1	2
Active-Passive Dual-Port	2	2 (active controllers only)	2

Table A-2 Summary of Operating Modes – DuraStor 7320SS

Operating Mode	Number of Controllers	Number of Active Host Ports per Controller	Number of Disk Channels
Stand-Alone Dual-Port	1	2	4
Active-Active Single-Port	2	1	4
Active-Active Dual-Port	2	2	4
Active-Passive Dual-Port	2	2 (active controllers only)	4

(DuraStor 7320SS Only) Another consideration when selecting one of these topologies is whether you will enable or disable the internal hubs. Each DuraStor storage subsystem has built-in internal hubs. These internal hubs, when enabled, essentially replace the need for external hub hardware. They provide for up to

four (4) host connections. You can enable or disable this feature using Disk Array Administrator.

For a detailed discussion of each operating mode, see the section that applies to your DuraStor storage subsystem:

For the DuraStor 6320SS, see the next section.

For the DuraStor 7320SS, see page A-14.

Operating Modes – DuraStor 6320SS

Stand-Alone Mode

In stand-alone mode, the RAID controller operates autonomously. The controller has two SCSI host I/O connector ports. They are labeled in the diagrams as "CH 0" and "CH 3." In single-port mode, the "CH 3" connector becomes a drive channel providing one additional drive channel for expansion.

Advantages:

- Low cost entry-level RAID storage solution that is field upgradeable.
- Allows the use of dual host ports to maximize bandwidth and host IOPs. (For example: this configuration is ideal for sequential access patterns, where disks can supply more than 160 MB/sec of data to a host.)
- Host system has multiple paths to each array (with host driver).
- All arrays appear on both host ports at the same LUN positions in Dual Port mode. (If both ports are connected to the same host, the host will see a given array twice unless it does special processing to detect duplicate paths to array. A host device driver may provide this functionality.)
- Hosts can detect redundant paths to an array by matching array serial numbers from SCSI inquiry data.

Disadvantages:

- The controller is a single point of failure.
- Third-party software is required for upstream path fail-over.

Figures A-1 through A-5 show the logical function of this operating mode.

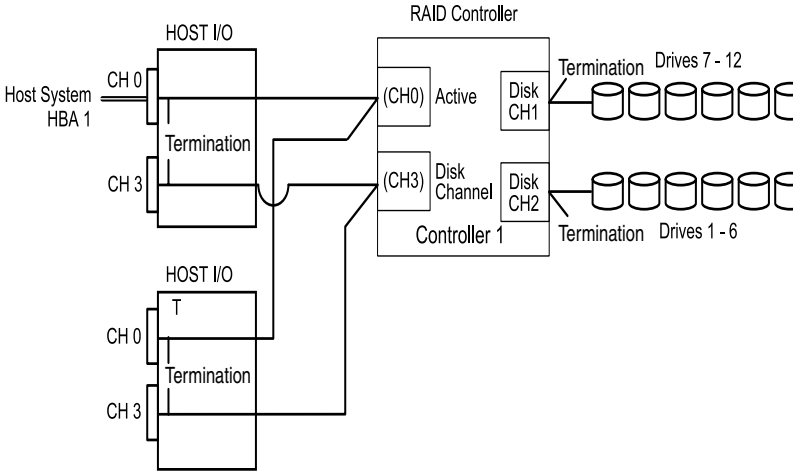


Figure A-1 Stand-Alone, Single-Port, Single Host

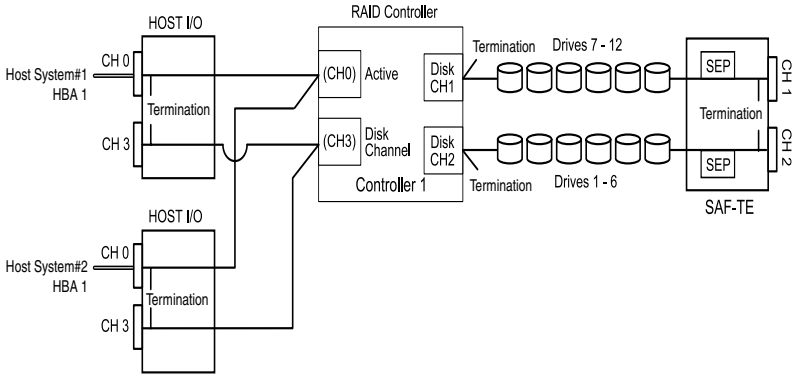


Figure A-2 Stand-Alone, Single-Port, Two Hosts

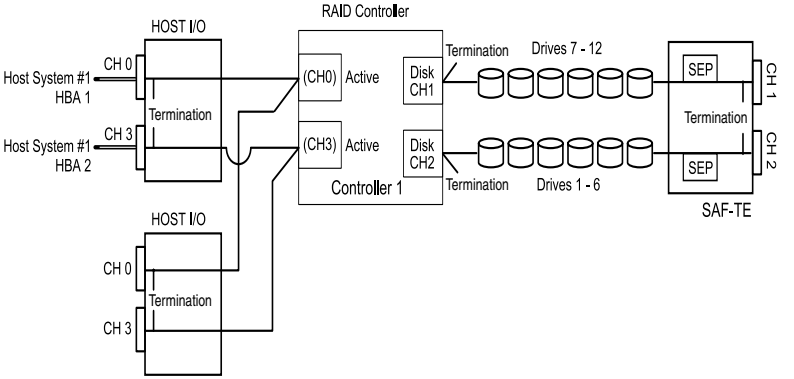


Figure A-3 Stand-Alone, Dual-Port, Single Host

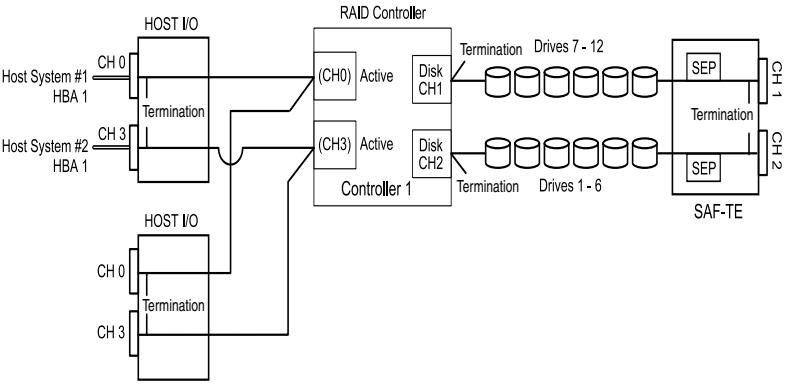


Figure A-4 Stand-Alone, Dual-Port, Two Hosts

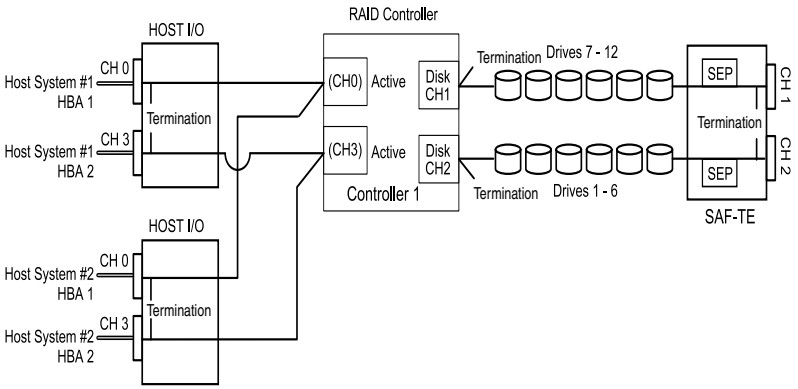


Figure A-5 Stand-Alone Dual-Port with Dual Host (Quad Cabling)

Active-Active Mode

In the active-active mode, the two RAID controllers cooperate to provide redundancy. If one controller fails, the remaining controller will take over the failed controller's functionality. Each controller has two SCSI host ports, they are labeled in the diagrams as "CH 0" and "CH 3."

In the active-active single-port mode, one host port is normally active, and the other is normally passive. In a failed over condition, the passive port of the surviving controller becomes active and assumes the identity of the failed controller. This failover process occurs without user intervention. Table A-3 lists the presentation of LUNs in active-active single-port mode.

Table A-3 Presentation of LUNs in Active-Active Single-Port Mode

Controller Status	Controller 1 Channel 0	Controller 1 Channel 3	Controller 2 Channel 0	Controller 2 Channel 3
Both controllers online	Controller 1 LUNs	Passive	Controller 2 LUNs	Passive
Controller 1 Fails	Inactive	Inactive	Controller 2 LUNs	Controller 1 LUNs
Controller 2 Fails	Controller 1 LUNs	Controller 2 LUNs	Inactive	Inactive

Arrays can only be accessed by the controller that currently owns them. One controller will have no visibility to the others' arrays. If one controller fails, the surviving controller will take ownership of all arrays. Pool spares and unassigned disks are visible to both controllers.

The two controllers communicate via the back-end disk buses. Although many different message types are sent between the two controllers, the majority of the data is write cache data. In the default write-back caching mode, any data that the host writes to one controller is copied to the other controller before a good status is returned to the host. By mirroring the data, if a controller fails, the surviving controller will have a copy of all data that has not been written to the disk.

Warning: The controllers communicate with each other using SCSI Initiator IDs 6 and 7 on each of the disk channels. You should not change these ID settings.

Each controller sends heartbeat messages to its partner controller. If a controller does not receive a heartbeat message within a set time period, it will kill the other controller assuming that it has malfunctioned.

After killing the other controller, it will take ownership of the arrays and will activate its passive host port to assume the defunct controller's identity.

Figure A-6 and Figure A-7 illustrate the logical function of the controllers when both are active and then again when one controller has failed.

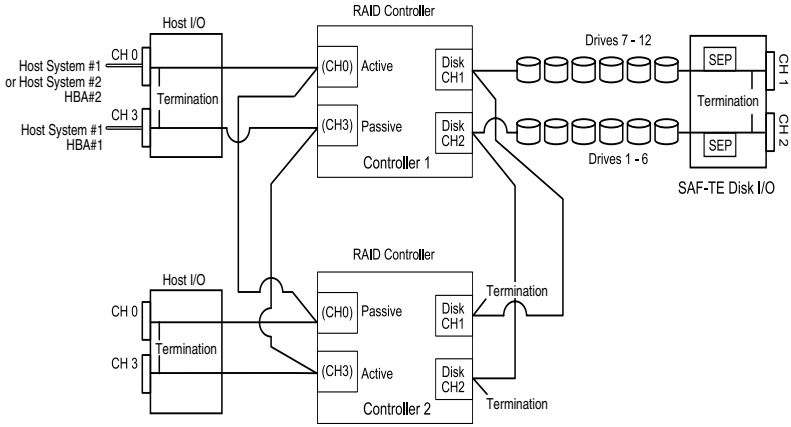


Figure A-6 Active-Active, Single-Port Mode, Both Controllers Active

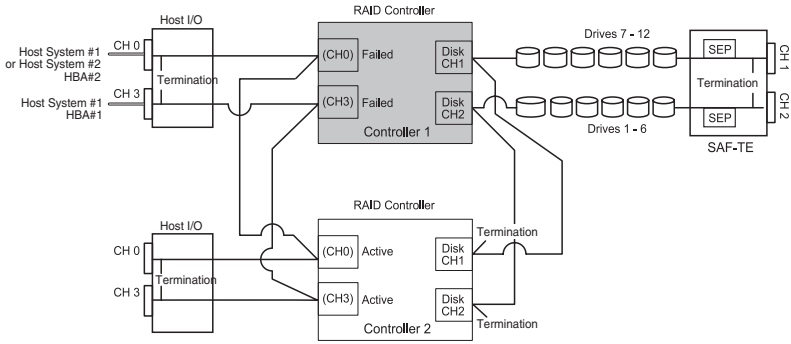


Figure A-7 Active-Active, Single-Port Mode, Controller 1 Failed

In the failed-over condition, the active controller will present its native identity on one host port, and the failed-over controller's identity on its other host port.

After the controller has failed-over, the user can replace the failed controller with a new controller, and the arrays will fail-back to the new controller without intervention. If you want to retry the failed controller, it's necessary to release the killed status that the

survivor asserts. This is accomplished using Storage Manager Pro or the Disk Array Administrator.

If you replace a failed controller with a new controller, the new controller will attempt to retrieve its configuration (see *Understanding Mirrored Operations* on page A-24) from the surviving controller. This means that the replacement controller will boot up with the same configuration as the controller it replaced.

If the surviving controller for some reason does not contain a valid mirrored configuration, then the user must manually configure the replacement controller. The correct host target ID must be set, and the active-active operating mode must be enabled.

The active-active controller system makes some assumptions about the host operating system's SCSI processing. Specifically, the host must retry incomplete commands after a specific time period. This retry is necessary because a host may issue a command to a controller, the controller fails over, and the new controller does not have a copy of the command.

Advantages:

- LUN isolation with the single-port, single host system.
- Access to all LUNs with the quad cabling configuration.
- Provides transparent fail-over and fail-back.

Disadvantages:

- Host HBA or the Host SCSI bus are single points of failure.
- In a single host configuration, the host system is also a single point of failure.
- No upstream fail-over with a single host dual HBA configuration. Upstream fail-over requires dual host with quad cabling and third-party file share/file lock software.
- Protected LUN sharing between two host systems is not supported without the use of third-party file share/file lock software.

Active-Passive Mode

In active-passive mode, there is one active and one passive RAID controller. The primary (active) controller operates with both of its host ports enabled and presents all LUNs on both ports to maximize bandwidth. The secondary (passive) controller keeps both of its host ports passive, and does not service any LUNs. Both controllers monitor each other's heartbeats and the passive controller receives write data and parity logs from the active controller.

If the active controller fails, normal fail-over occurs to the passive controller, which becomes active by enabling both of its host ports and takes ownership of all arrays.

Table A-4 Presentation of LUNs in Active-Passive Mode

Controller Status	Controller 1 Host Port 0 (FC1)	Controller 1 Host Port 1 (FC2)	Controller 2 Host Port 0 (FC1)	Controller 2 Host Port 1 (FC2)
Both controllers online	Controller 1 LUNs	Inactive	Inactive	Controller 2 LUNs
Controller 1 failed	Inactive	Inactive	Controller 1 LUNs	Controller 2 LUNs
Controller 2 failed	Controller 1 LUNs	Controller 2 LUNs	Inactive	Inactive

Controller 1 is the default active controller. Controller 2 is always passive unless controller 1 fails. The default active controller is not selectable.

Because the active controller does not have to mirror the passive controllers data, more write-back cache memory can be made available to the active controller. This means that half the cache memory can be dedicated to writes and half to reads. This is the same allocation used in stand-alone mode.

Each controller sends heartbeat messages via the SCSI buses to its partner controller. If a controller does not receive a heartbeat message within a set time period, it will kill the other controller assuming that it has malfunctioned. After killing the other controller, it will take ownership of the arrays and will activate its passive host port to assume the defunct controller's identity.

Warning: The controllers communicate with each other using SCSI Initiator IDs 6 and 7 on each of the disk channels. You should not change these ID settings.

Advantages:

- Transparent fail-over and fail-back.
- Single point of failure is the host system. (There are no single points of failure when dual host systems are configured with clustering software.)
- Upstream fail-over.

Disadvantages:

- Lower performance than the active-active mode.
- Upstream fail-over requires third-party software.
- Careful administration is necessary because all the arrays are reported twice to the host operating system, which must use third-party file share/file lock software to prevent data overwrites.

Figure A-8 and Figure A-9 illustrate the active-passive mode logical functions when the controllers are functioning in a normal condition and then in a failed condition.

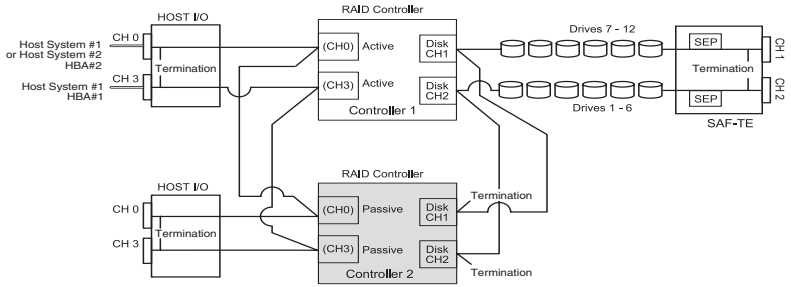


Figure A-8 Active-Passive, Dual-Port, Controller 1 Active

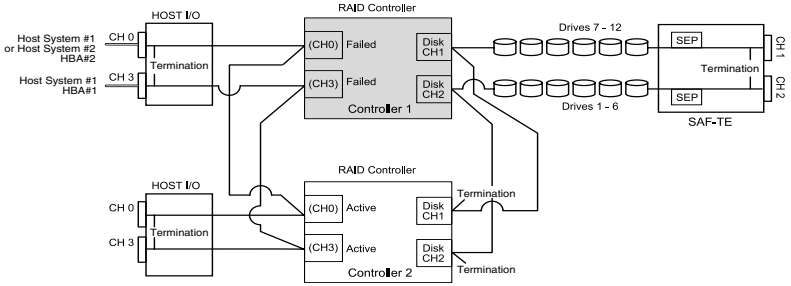


Figure A-9 Active-Passive, Dual-Port, Controller 1 Failed

Operating Modes – DuraStor 7320SS

Stand-Alone Mode

In stand-alone mode, the RAID controller operates autonomously. The controller has two fibre channel (FC) host ports, they are labeled in the diagrams as FC1 and FC2. This operating mode uses both FC host ports.

Advantages:

- Low cost entry-level RAID storage solution that is field upgradeable.
- Allows the use of dual host ports to maximize bandwidth and host IOPs. (For example: this configuration is ideal for sequential access patterns, where disks can supply more than 160 MB/sec of data to a host.)
- The host system has multiple paths to each array (with the host driver).
- All arrays appear on both host ports at the same LUN positions in Dual Port mode. (If both ports are connected to the same host, the host will see a given array twice unless it does special processing to detect duplicate paths to array. A host device driver may provide this functionality.)
- Hosts can detect redundant paths to an array by matching array serial numbers from SCSI inquiry data.

Disadvantages:

- The controller is a single point of failure.
- Third-party software is required for upstream path fail-over.

Figure A-10 and Figure A-11 depict the logical function of this operating mode.

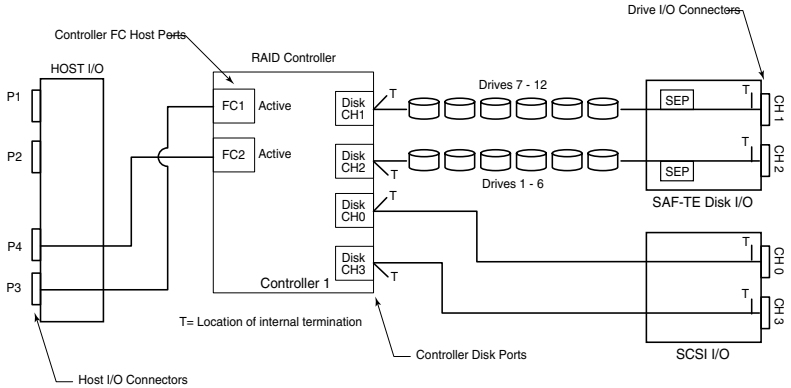


Figure A-10 Stand-Alone, Dual-Port, Hubs Disabled

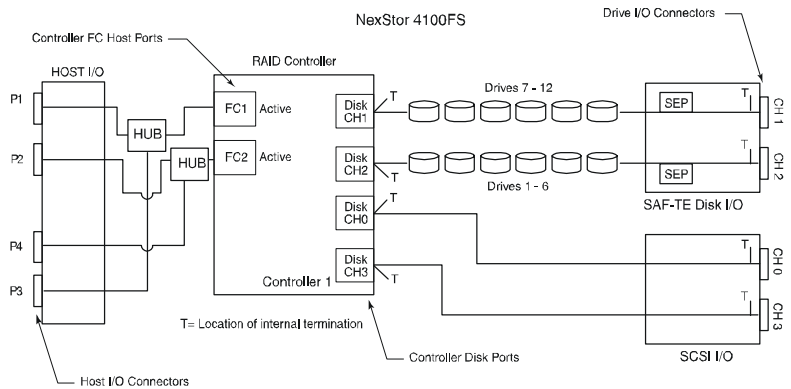


Figure A-11 Stand-Alone, Dual-Port, Hubs Enabled

Active-Active Mode

In the active-active mode, the two RAID controllers cooperate to provide redundancy. If one controller fails, the remaining controller will take over the failed controller's functionality. Each controller has two fibre channel host ports, they are labeled in the diagrams as FC1 and FC2.

In the active-active single-port mode, one FC host port is normally active, and the other is normally passive. In a failed over condition, the passive port of the surviving controller becomes active and assumes the identity of the failed controller. This failover process occurs without user intervention. Table A-5 lists the presentation of LUNs in active-active single-port mode.

In the active-active dual port mode, both FC host ports are active and each controller normally presents the LUNs it owns on both of its FC host ports. This provides the host with dual-ported access. However, when a controller fails, the surviving controller presents its LUNs on one of its FC host ports and the LUNs of the failed controller on its other FC host port. Table A-6 lists the presentation of LUNs in active-active dual port mode.

Table A-5 Presentation of LUNs in Active-Active Single-Port Mode

Controller Status	Controller 1 FC 1 Host Port	Controller 1 FC 2 Host Port	Controller 2 FC 1 Host Port	Controller 2 FC 2 Host Port
Both controllers online	Controller 1 LUNs	Passive	Controller 2 LUNs	Passive
Controller 1 fails	Inactive	Inactive	Controller 2 LUNs	Controller 1 LUNs
Controller 2 fails	Controller 1 LUNs	Controller 2 LUNs	Inactive	Inactive

Table A-6 Presentation of LUNs in Active-Active Dual-Port Mode

Controller Status	Controller 1 FC 1 Host Port	Controller 1 FC 2 Host Port	Controller 2 FC 1 Host Port	Controller 2 FC 2 Host Port
Both controllers online	Controller 1 LUNs	Controller 1 LUNs	Controller 2 LUNs	Controller 2 LUNs
Controller 1 fails	Inactive	Inactive	Controller 2 LUNs	Controller 1 LUNs
Controller 2 fails	Controller 1 LUNs	Controller 2 LUNs	Inactive	Inactive

In either mode, arrays can only be accessed by the controller that currently owns them. One controller will have no visibility to the others' arrays. If one controller fails, the surviving controller will take ownership of all arrays. Pool spares and unassigned disks are visible to both controllers.

The two controllers communicate via the back-end disk buses. Although many different message types are sent between the two controllers, the majority of the data is write cache data. In the default write-back caching mode, any data that the host writes to one controller is copied to the other controller before a good status is returned to the host. By mirroring the data, if a controller fails, the surviving controller will have a copy of all data that has not been written to the disk.

Note: The controllers communicate with each other using SCSI initiator IDs 6 and 7 on each of the disk channels. You should not change these IDs.

Each controller will send heartbeat messages to its partner controller. If a controller does not receive a heartbeat message within a set time period, it will kill the other controller assuming that it has malfunctioned. After killing the other controller, it will take ownership of the arrays and will activate its passive host port to assume the defunct controller's identity.

Figure A-12 to Figure A-15 illustrate the logical function of the controllers when both are active and then again when one controller has failed.

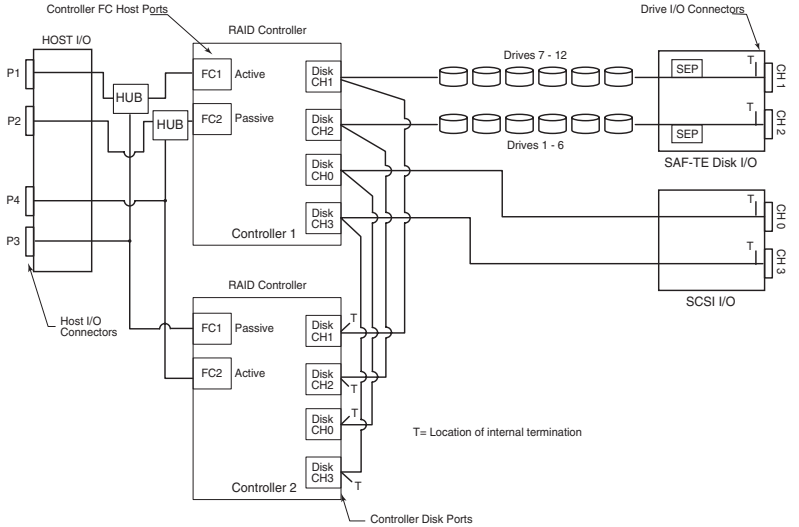


Figure A-12 Active-Active Single-Port Mode with Hubs Enabled and Both Controllers Active

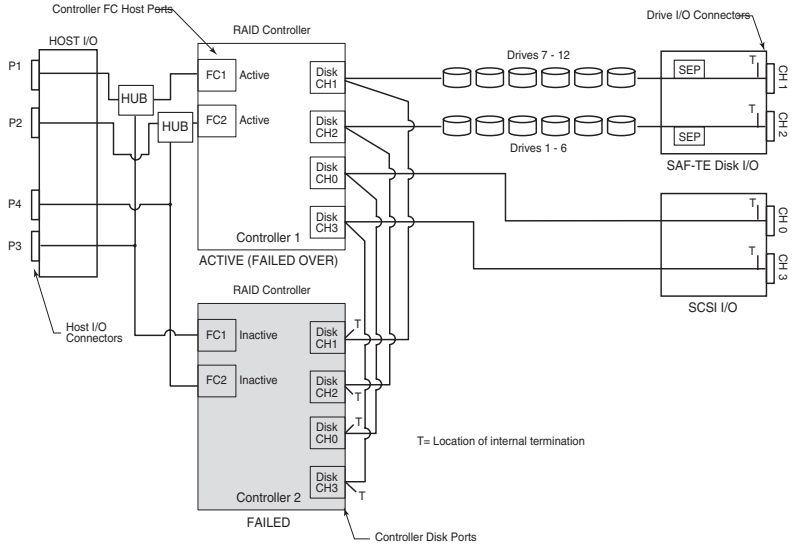


Figure A-13 Active-Active Single-Port Mode with Hubs Enabled and Controller 2 Failed

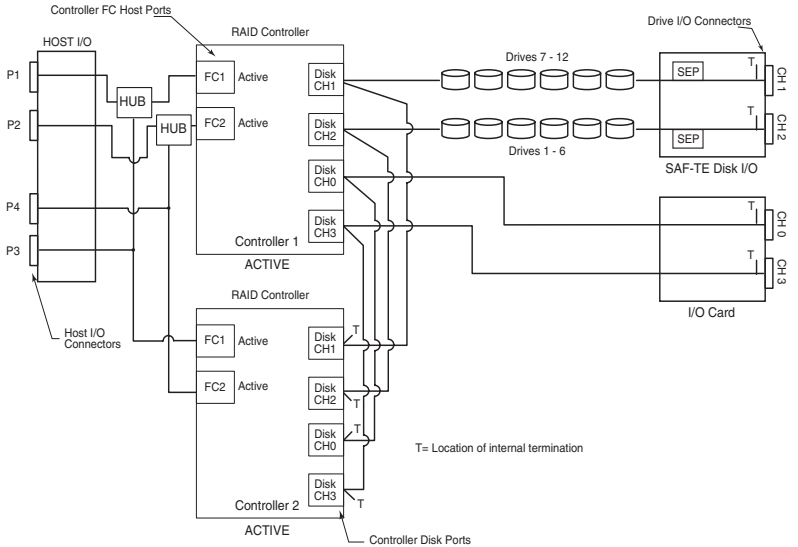


Figure A-14 Active-Active Dual-Port Mode with Hubs Enabled and Both Controllers Active

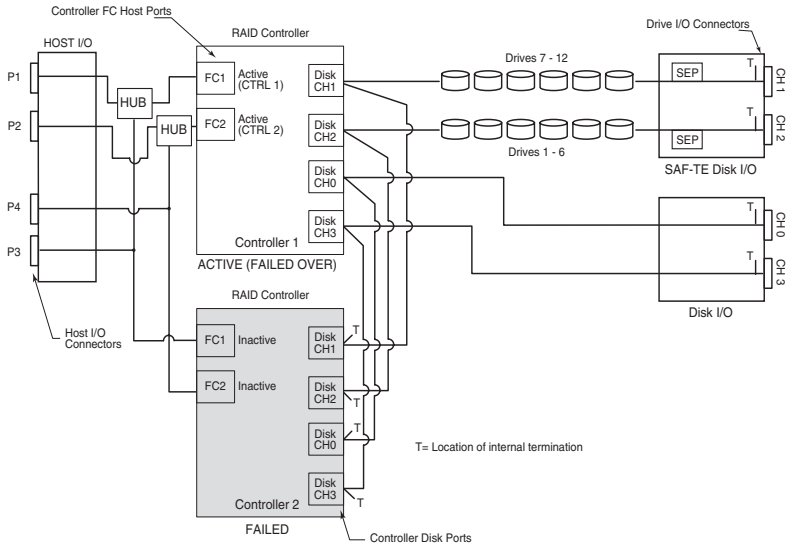


Figure A-15 Active-Active Dual-Port with Hubs Enabled and Controller 2 Failed

In the failed-over condition, the active controller will present its native identity on one FC host port, and the failed-over controller's identity on the other port. This is slightly different when using a dual port configuration, where each array is presented on both FC host ports.

After the controller has failed-over, the user can replace the failed controller with a new controller, and the arrays will fail-back to the new controller without intervention. If you want to retry the failed controller, it's necessary to release the kill line that the survivor asserts. This is accomplished using Storage Manager Pro or the Disk Array Administrator (Other Controller Menu, Unkill Other option).

If you replace a failed controller with a new controller, the new controller will attempt to retrieve its configuration (see *Understanding Mirrored Operations* on page A-24) from the surviving controller. This means that the replacement controller will boot up with the same configuration as the controller it replaced.

If the surviving controller for some reason does not contain a valid mirrored configuration, you must manually configure the replacement controller. The correct host target ID must be set, and the active-active operating mode must be enabled.

The Active-Active controller system makes some assumptions about the host operating system's SCSI processing. The host must retry incomplete commands after a specific time period. This retry is necessary because a host may issue a command to a controller, the controller fails over, and the new controller does not have a copy of the command.

Advantages

- LUN isolation with the single-port, single host system.
- Dedicated LUNs with a single-port, dual host system.
- Access to all LUNs with a dual port-dual host quad cabling configuration.
- Provides transparent fail-over and fail-back.
- No single point of failure with the active-active dual-port configuration, must have third-party clustering and file share/file lock software installed.

Disadvantages

- Host HBA or the Fibre loop are single points of failure.
- In single host configuration, the host system is also a single point of failure.
- No upstream fail-over with a single host that has dual HBAs or dual host systems.
- Protected LUN sharing between two host systems is not supported without the use of third-party file share/file lock software.

Active-Passive Mode

In the active-passive mode, there is one active and one passive RAID controller. The primary (active) controller operates with both of its FC host ports enabled and presents all LUNs on both ports to maximize bandwidth. The secondary (passive) controller keeps both of its FC host ports passive, and does not service any LUNs. Both controllers monitor each other's heartbeats and the passive controller receives write data and parity logs from the active controller.

If the active controller fails, normal fail-over occurs to the passive controller, which becomes active by enabling both of its FC host ports and takes ownership of all arrays.

Controller 1 is the default active controller. Controller 2 is always passive unless Controller 1 fails. The default active controller is not selectable.

Because the active controller does not have to mirror the passive controllers data, more write-back cache memory can be made available to the active controller. This means that half the cache memory can be dedicated to writes and half to reads. This is the same allocation used in stand-alone mode.

Each controller sends heartbeat messages via the SCSI buses to its partner controller. If a controller does not receive a heartbeat message within a set time period, it will kill the other controller assuming that it has malfunctioned. After killing the other controller, it will take ownership of the arrays and will activate its passive host port to assume the defunct controller's identity.

Note: The controllers communicate with each other using SCSI initiator IDs 6 and 7 on each of the disk channels. You should not change these IDs.

Advantages

- Transparent fail-over and fail-back.
- Single point of failure is the host system. (There are no single points of failure when dual host systems are configured with clustering software.)
- Upstream fail-over.

Disadvantages

- Lower performance than the active-active mode.
- Upstream fail-over requires third-party software.
- Careful administration is necessary, since all the arrays are reported twice to the host operating system which must use third-party file share/file lock software to prevent data overwrites.

Figure A-16 and Figure A-17 illustrate the active-passive mode logical functions when the controllers are operating in a normal condition and then in a failed condition.

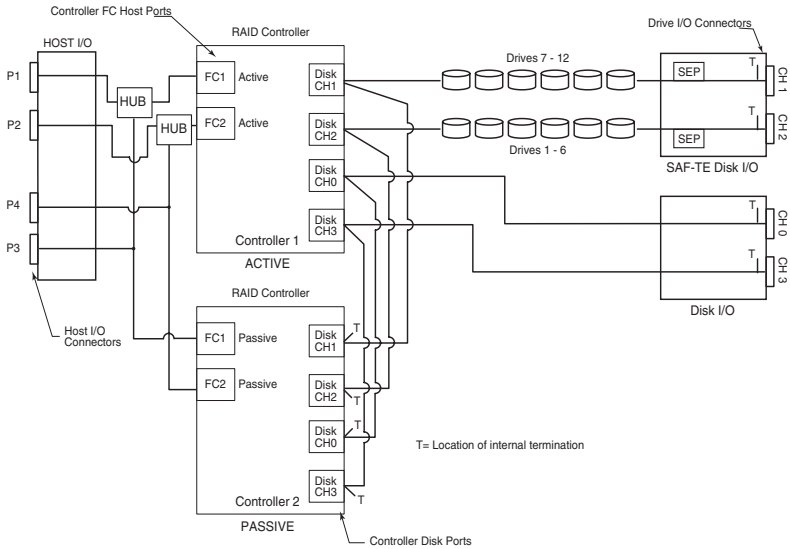


Figure A-16 Active-Passive Dual-Port, Hubs Enabled, Controller 1 Active

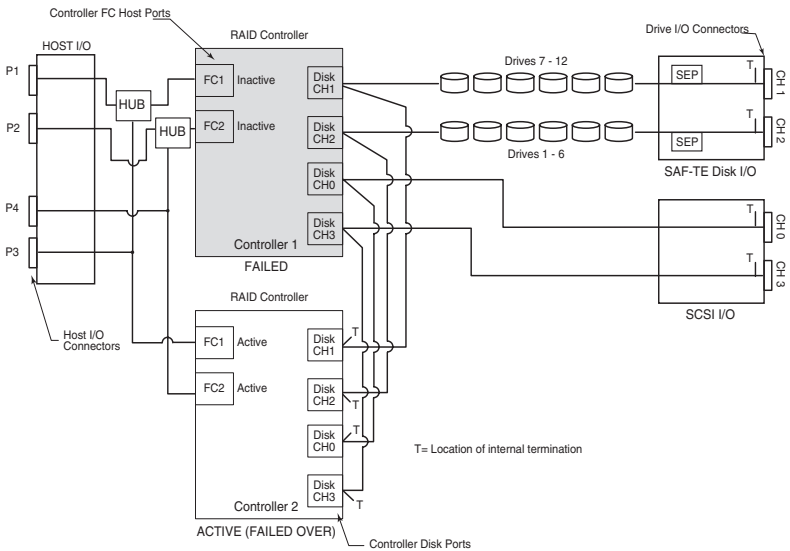


Figure A-17 Active-Passive Dual-Port, Hubs Enabled, Controller 1 Failed

Understanding Mirrored Operations

The mirroring feature causes configuration changes to be mirrored to the opposite controller in an active-active configuration. The mirrored configuration is stored in the other controller's firmware (Flash). If a controller fails and is replaced, then on boot up, it attempts to retrieve this configuration data from the opposite controller. The intent is that the user will not need to reconfigure a new controller when it is replaced.

Note: Dual RAID controller operations require that both controllers must have the same version firmware installed.

If a replacement controller uses its mirrored configuration, you will see it print a message during boot (saying it's using the mirrored configuration), and then it will reboot (rebooting is necessary for the mirrored configuration to take effect).

Here's how the mirrored configuration works in different scenarios:

- Stand-alone mode—The feature is not active.
- Active-active mode where both controllers are operating normally – Each controller uses its own local configuration.
- Active-active mode where one controller boots and the other controller does not boot due to some problem – The controller that boots uses its local configuration.
- Active-active mode where one controller is up when a new replacement controller boots – the new controller attempts to get its mirrored configuration from the other controller. If it is not available, it will try to use its local configuration. If that is not available, then it will use the default settings.

Note: When Clear Configuration is selected in the Flash Utility menu, both the local Flash configuration and the other controller's mirrored configuration image are cleared. Also, there is an option (J) in the Flash Utility menu that can be used to tell a booting controller to temporarily ignore the mirrored configuration. This can be used, if for whatever reason, the mirrored configuration should not be used by a booting controller. This is primarily a safeguard, because a retrieved mirrored configuration is checked extensively before it is used.

Clustering

Minimizing Downtime for Maximum Data Availability

So-called open systems, such as Windows NT servers, just don't provide the level of availability that IS managers are familiar with on mainframes. A partial solution to this problem is server clustering.

Clusters consist of two or more loosely coupled systems with a shared-disk subsystem and software that handles failover in the case of a node (host) failure. In most cases, hardware/software failover is performed automatically and is transparent to users, although users will experience performance degradation as processing is shifted to another cluster node. In some cases this failover can occur in a matter of seconds.

High availability of data and applications is by far the most compelling reason to go with clustering technology. For example, the accepted rule is that stand-alone UNIX systems can provide 99.5 percent uptime. Adding a RAID subsystem can increase the uptime to 99.9 percent. The goal of clustering is 99.99 percent availability.

Beyond clustering, fault-tolerant systems can provide 99.9999 percent uptime. At the high end, continuous-processing systems offer virtually 100 percent uptime.

Although the increase from 99.5 percent to 99.99 percent availability may seem insignificantly small, it adds up in terms of minutes per year of downtime. For example, assuming a 7x24 operation, 99.5 percent uptime translates into 2,628 minutes, or

more than 43 hours of downtime per year. In contrast, 99.99 percent uptime translates into less than one hour (52 minutes) of downtime per year.

Availability figures relate primarily to unplanned downtime. But the advantages of clusters in terms of planned or scheduled downtime are even more significant. If you figure two to sixteen hours per month for a server in a large shop.

Planned downtime requires shutting down stand-alone systems entirely. Result: 100 percent loss of processing for the duration of the downtime. But, with cluster, you can shut down one node and off-load the processing to other nodes in the cluster with no interruption of processing.

High availability is not the only benefit of clustering. In some cases, users may see advantages in the areas of performance, scalability, and manageability. In reality, you can expect a 1.6x (80 percent efficiency) to 1.8x (90 percent efficiency) performance increase as you go from one node to two nodes. Going from one node to a four node cluster generally yields a 2.5x or 3x performance boost. However, the cluster performance is application dependent. For example, READ operations may yield a 1.8x performance increase going from one to two nodes, but in a WRITE intensive application, you may only see a 1.4-1.6x improvement.

Although clusters seem to be relatively simple, they involve complex technology that can be implemented in a variety of ways. The number of nodes supported and type of interconnection used, and a number of other features differentiate cluster implementations. One area of implementation is the manner in which distributed lock manager is implemented. Some perform this at the user level and others in the kernel, with the latter enhancing performance.

In addition to the differing features you should consider if the cluster:

- has the ability to hot load new nodes without bringing down the whole cluster?
- provides automatic or manual failover?
- loads balance?
- uses a journalized file system?
- provides a fast cluster failover?

- allows for the nodes to be geographically located?

How Available are Clusters?

Table A-7 outlines the maximum availability per downtime in the different architectures:

Table A-7 Maximum Availability Per Downtime

Architecture	Maximum Availability	Downtime per Failure	Downtime per Year (in minutes)
Continuous Processing	100.00%	None	0
Fault-Tolerant	99.9999%	Cycles	0.5 – 5
Clusters	99.9 – 99.999%	Seconds to minutes	5 – 500
High Availability	99.9%	Minutes	500 – 10,000 (disk mirroring)
Stand Alone System	99.5%	Hours	2,600 – 10, 000 (without disk mirroring)

Application of Availability

The DuraStor storage subsystem implementation of availability within its supported topologies are shown in Table A-8.

Table A-8 Implementation in Topologies

Architecture	Corresponding Topology
Continuous Processing	Not Available
Fault-Tolerant	Active-Passive Dual-Port
Cluster	Active-Active Dual-Port
High Availability	Active-Active Single-Port
Stand Alone System	Stand-Alone Dual-Port

B

SAN Solution Strategies *(DuraStor 7320SS only)*

In this Appendix

This chapter describes connecting the DuraStor 7320SS Storage Subsystems to provide an active-active/active-passive solution to a Storage Area Network (SAN).

Active-Active Dual-Port Mode for SAN

At the heart of this strategy is the active-active dual-port operating mode. In this mode, four fibre channel (FC) ports are simultaneously active when both controllers are online. In the event of a controller failure, two FC ports remain available to service all host I/O. Table B-1 illustrates how LUNs are presented by each controller in this mode.

Table B-1 LUN Presentation by Controller

	Controller 1 Host Port 0 (FC1)	Controller 1 Host Port 1 (FC2)	Controller 2 Host Port 0 (FC1)	Controller 2 Host Port 1 (FC2)
Both Controllers Online	Controller 1 LUNs	Controller 1 LUNs	Controller 2 LUNs	Controller 2 LUNs
Controller 1 Failed	Inactive	Inactive	Controller 2 LUNs	Controller 1 LUNs
Controller 2 Failed	Controller 1 LUNs	Controller 2 LUNs	Inactive	Inactive

Note that when a controller fails, the surviving controller continues to present its LUNs to its Host Port 0, and changes to present the failed controller's LUNs to its Host Port 1. The fibre channel node and port world wide names corresponding to the failed controller's Host Port 0 (FC1) are also associated with its LUNs on the surviving controller's Host Port 1 (FC2).

Hubs Enabled

In Figures B-1 and B-2, the controllers are configured in an active-active dual-port mode with the internal hubs enabled. Two hosts are connected via two independent loops using the enclosure's built-in hub bypass circuits. These circuits provide two internal hubs, eliminating the need for the use of external FC hardware, other than the cables.

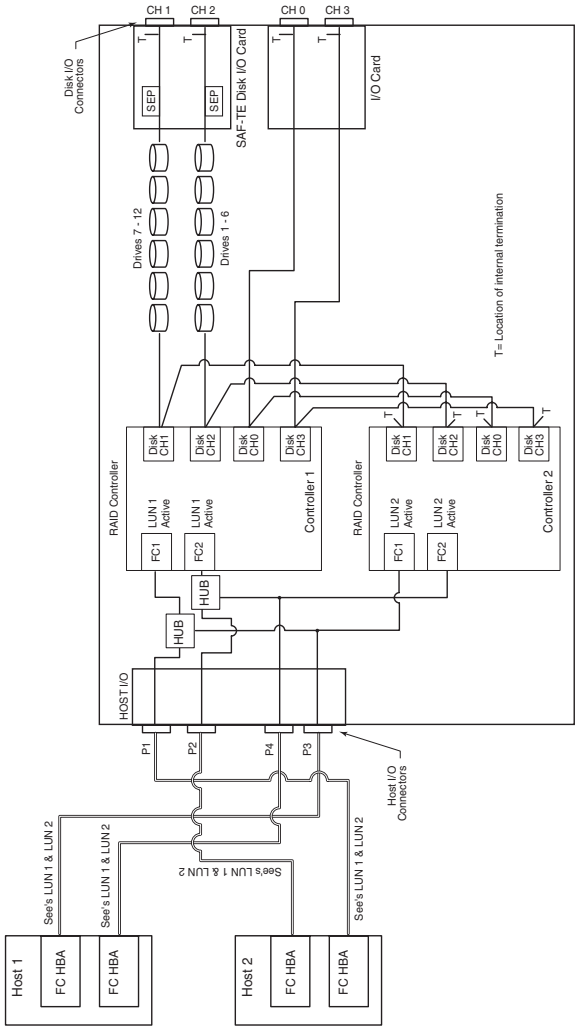


Figure B-1 Two Hosts and Two Independent Loops

Figure B-2 illustrates the conditions when Controller 2 fails. Note that both hosts can still see Controller 1's LUNs (LUN 1) and Controller 2's LUNS (LUN 2). However, each host HBA can only see one LUN, instead of both.

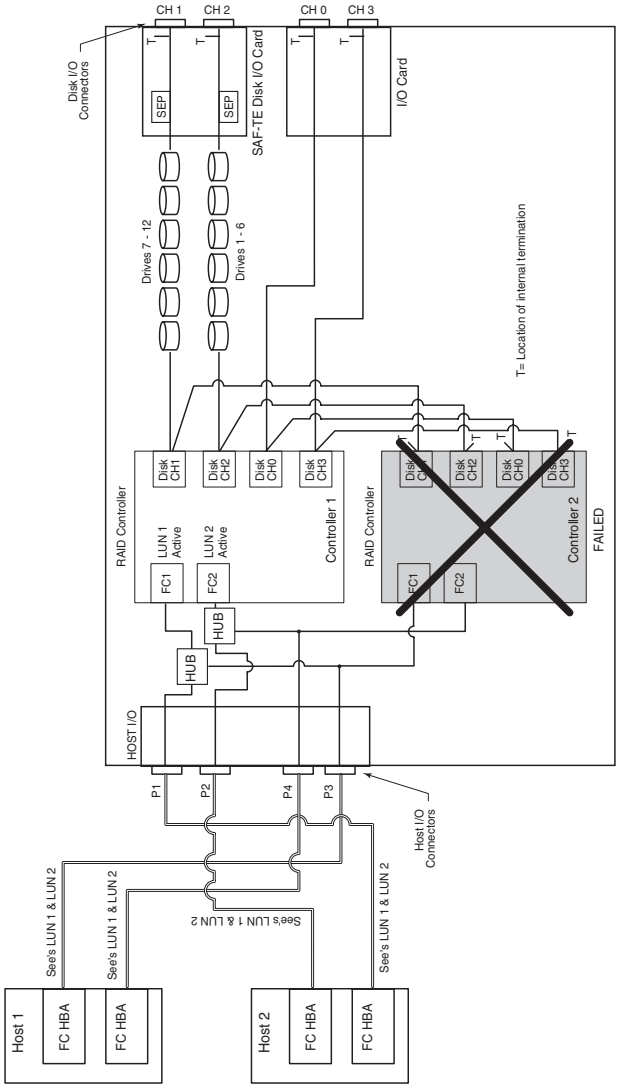


Figure B-2 Controller 2 Failed

Hubs Disabled

Figures B-3 and B-4 show two controllers configured in an active-active dual-port mode with the internal hubs disabled. Two hosts are connected via two independent switches. Using external switches supports higher bandwidth, since the host ports are not required to share bandwidth on a loop.

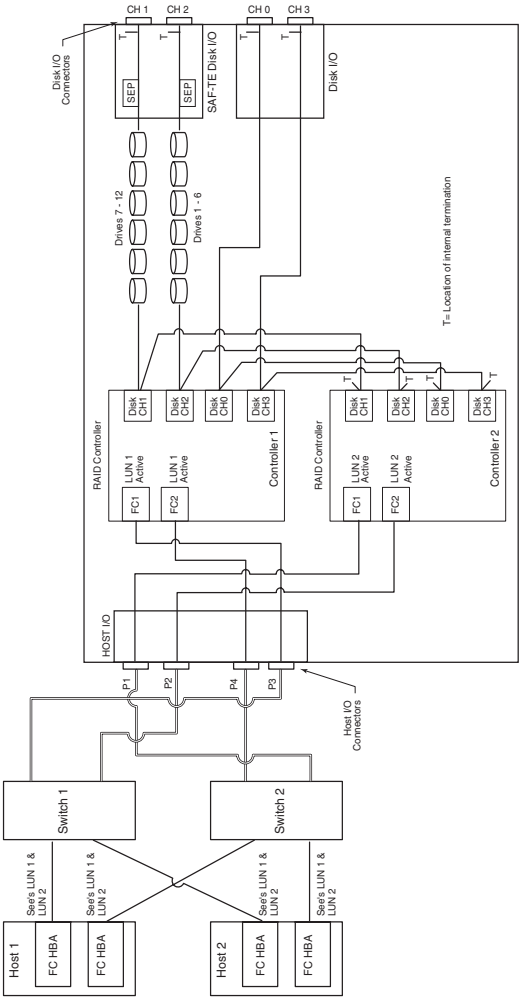


Figure B-3 Two Hosts and Two Switches

In Figure B-4, two hosts are connected via two independent switches. Note that both hosts can still see Controller 1's LUNs (LUN 1) and Controller 2's LUNs (LUN 2). However, each host HBA can only see one LUN, instead of both.

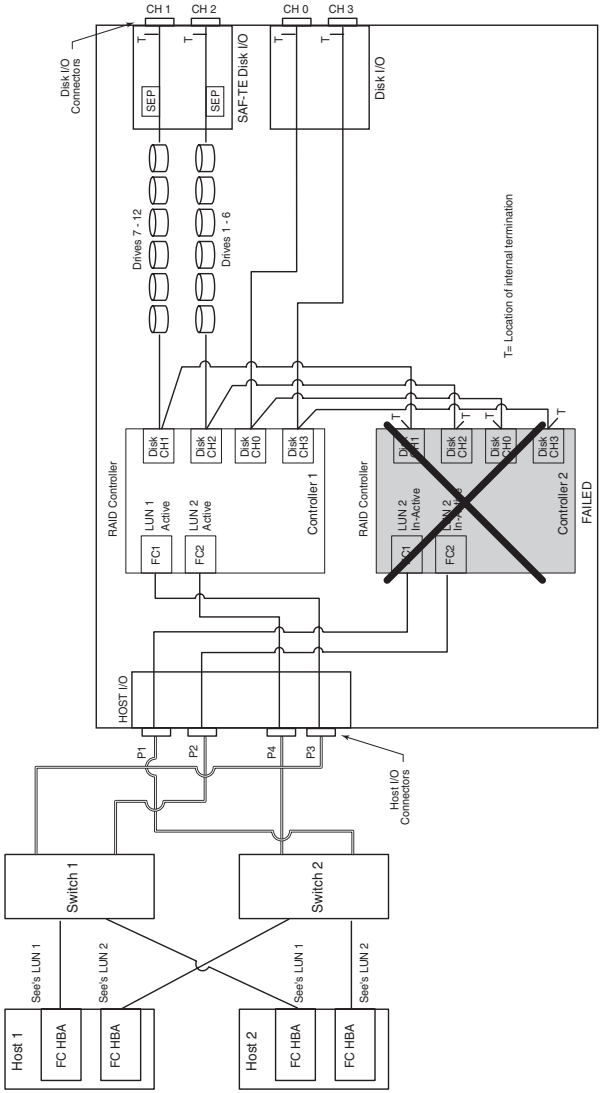


Figure B-4 Controller 2 Failed

Active-Active Single-Port Mode for SAN

In some scenarios, where the host has a single FC port and the SAN is not truly fault-tolerant, it may be desirable to configure the controllers in active-active single-port mode.

Hubs Disabled (Single-Port Hosts and One Switch)

Figure B-5 shows two single ported hosts connected to the two controllers via a single switch.

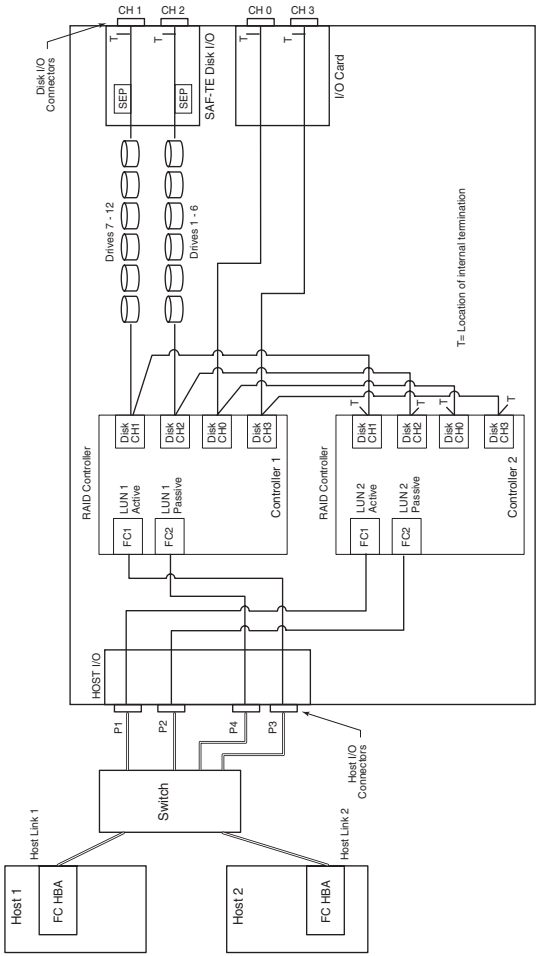


Figure B-5 Two Hosts, Two Controllers, One Switch

In this case, there would be an advantage to configuring the controllers in active-active dual-port mode, because of increased connectivity. However, the host driver software would need to handle the fact that each LUN would appear twice in the SAN fabric, and that one image of the LUNs would disappear if one controller failed.

Depending on the host software being used, it may be more desirable to run in active-active single-port mode, since a controller failover would be transparent to the hosts (as far as the number of LUN images and the port WWNs attached to the LUNs). The advantages of using a switch is that the two hosts each have a direct path to a controller port and don't have to compete for access on the same loop.

Hubs Disabled (Single External Hub)

Figure B-6 shows the hosts in a single loop configuration using an external hub. When a controller failover occurs, this configuration operates much the same as the previous one which uses a switch. The advantage is that a hub is less expensive. In active-active dual-port mode, you must manage the multiple images of the same LUN.

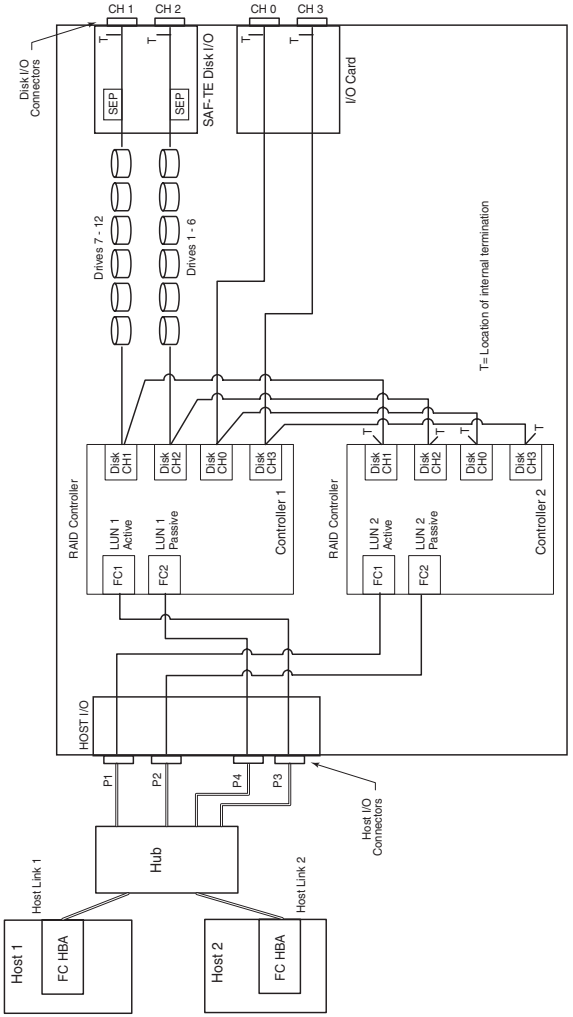


Figure B-6 Single-Loop Configuration

Hubs Enabled

Figure B-7 shows hosts in a single loop configuration with the internal hubs enabled. The internal hubs eliminate the need for an external hub. It allows one or two hosts to be connected to the active-active storage enclosure without the cost of external hardware other than cables.

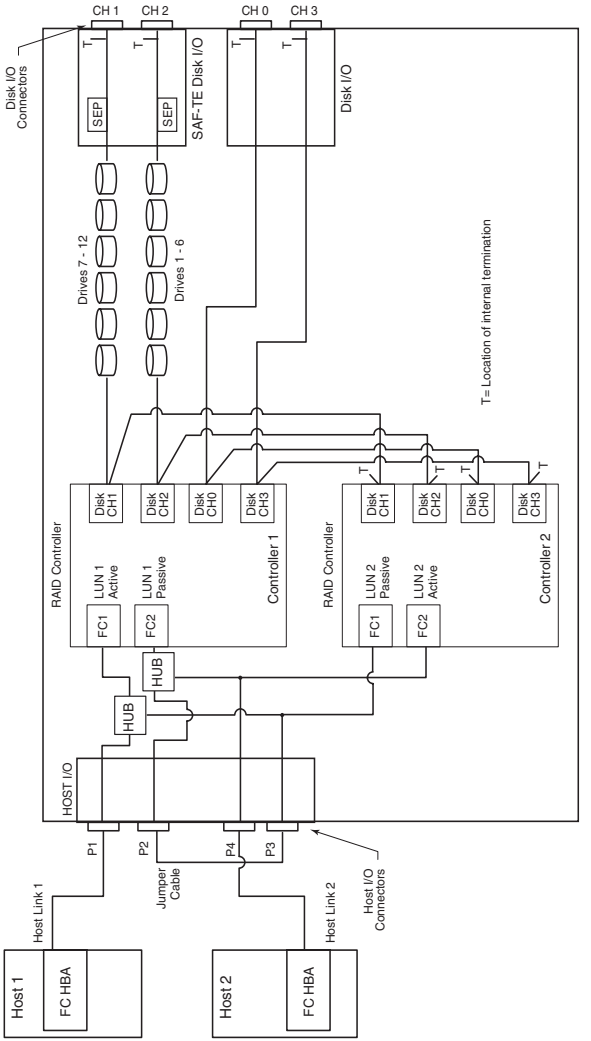


Figure B-7 Single Loop Configuration, Hubs Enabled

SAN Configuration Not Supported

In the active-active dual-port configuration with two independent hubs or the internal hubs, two single-ported hosts is *not* supported. The issue with this configuration is that if a controller fails, each host loses access to one of the LUNs.

For example, if Controller 1 fails, Host 1 can no longer access LUN 2, because Port 2 on Controller 2 has changed from presenting its own LUNs to presenting Controller 1's LUNs. A need for this SAN configuration can arise if multiple single-ported hosts need access to LUNs from both controllers, and two hubs are desired to improve performance by decreasing loop access contention.

Note that this SAN is only partially fault-tolerant because the hubs and controllers have redundant hardware, but the hosts do not. The problem with this configuration can be overcome by using a single switch at the cost of replacing the two hubs with a switch. If loop access contention is not an issue, then the single hub configuration works as well.

True LUN Sharing

When considering the presentation of LUNs for active-active controllers, a good question might be, "Why not just present all LUNs on all ports?" The answer is that LUN sharing greatly increases complexity and sacrifices performance. In order to do LUN sharing between two controllers, the following must happen:

1. Some common data sharing method must be developed so that access to resources shared by both controllers can be administered. Because of this arbitration for resources, the performance of both controllers suffers as compared to two controllers that must only control their own resources.
2. Read cache on one controller must be invalidated if the data is modified by a write to the other controller.
3. Writes to disk must be controlled to ensure that simultaneous updates to the same region do not occur by both controllers.
4. RAID utility functionality (parity verification and expansion, for example) must be controlled to ensure that collisions between utilities and data accesses on the two controllers don't occur.

The active-active strategy chosen allows a host to access two separate fibre channel ports (one from each controller) which are connected together via a switch or hub, in order to support access to LUNs owned by different controllers. This is simpler and provides higher performance than so-called "true LUN sharing" schemes.

C

Advanced Configurations and Cabling

In this Appendix

Advanced Configurations – DuraStor 412R

JBOD – 24-Drive Configuration

The DuraStor 412R can be set up as a Single-Bus JBOD (Just a Bunch of Drives) configuration with two enclosures that provide up to a 24-drive (12 per channel) storage solution. In this configuration you can have a single host system with a single HBA that has dual independent ports or a single host system with two single-port HBAs.

In this configurative, both enclosures are in single-bus mode. Channel 1 on the SAF-TE disk I/O card will assess all of the disk drives 1 through 12. A single-bus module must be installed in the

Controller 1 slot. This single-bus module connects Channel 1 and Channel 2 together to create a single continuous SCSI bus.

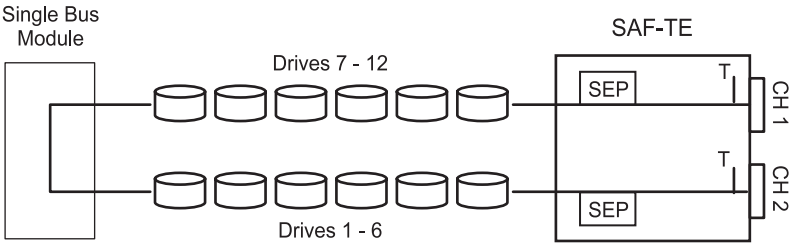


Figure C-1 Logical View of Connectivity – Single-Bus Mode

Note: In Figure C-1, the drive slots are used to indicate which drives are connected to which channel. They should not be confused with the disk drive SCSI IDs. Those IDs are pre-determined by the SCSI disk I/O switch settings.

1 Remove the SAF-TE Disk I/O card installed in both enclosures. See *Replacing an I/O Card* on page 5-21 for detailed instructions.

2 Locate the switches on each card and set them as shown in Figure C-2.

There is one switch setting for both enclosures.

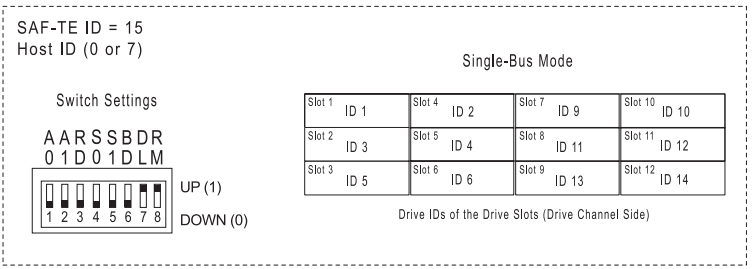


Figure C-2 Single-Bus JBOD Switch Setting

3 Reinstall the SAF-TE disk I/O card in each enclosure. (See *Replacing an I/O Card* on page 5-21 for detailed instructions.

4 Install the single-bus module in the Controller 1 slot in both enclosures. See *Installing the Single Bus Module and Cover Plate* on page 5-9 for detailed instructions.

5 Connect a SCSI data cable from the host system HBA(s) to the SAF-TE disk I/O card Channel 1 connectors on each enclosure, as shown in Figure C-3.

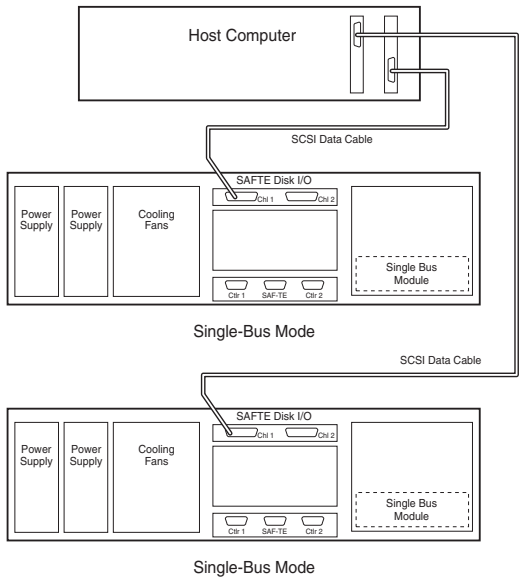


Figure C-3 Cabling Diagram JBOD Dual Enclosures

The configuration is complete. See *Turning the Power On* on page 2-7.

Advanced Configurations – DuraStor 6320SS

RAID – 12-Drive Configuration

The DuraStor 6320SS can be setup to provide up to a 12 disk drive storage solution using the primary RAID enclosure only.

1 Remove the SAF-TE disk I/O card installed in both enclosures. See *Replacing an I/O Card* on page 5-21 for instructions.

2 Locate the switches on each card and set them as shown in either Figure C-4 or Figure C-5.

There are two possible switch settings for this configuration.

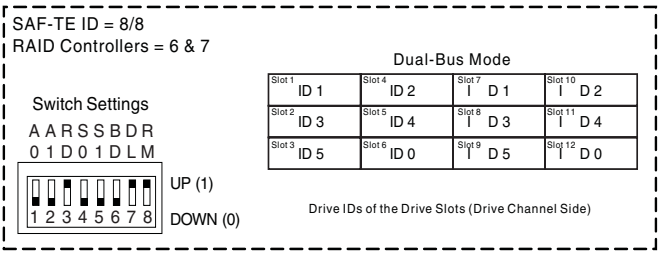


Figure C-4 Switch Setting – Option 1

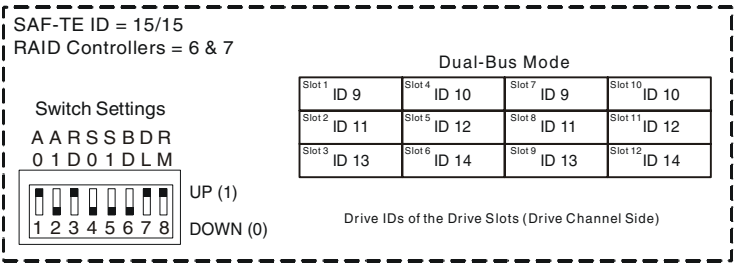


Figure C-5 Switch Setting – Option 2

The switch settings assign specific SCSI IDs to the drive slots as indicated, and reserve IDs 6 and 7 for the RAID controllers, and IDs 8 or 15 for the SAF-TE processors.

3 Reinstall the SAF-TE disk I/O card in each enclosure. See *Replacing an I/O Card* on page 5-21 for instructions.

4 Connect a SCSI data cable from the host system(s) HBA(s) to the host I/O card as indicated in *Basic Connections – DuraStor 6320SS* on page 2-15 or *Advanced Cabling – DuraStor 6320SS* on page C-21.

The configuration is complete. Refer to the *Storage Manager Pro User's Guide* or the *Disk Array Administrator User's Guide* for instructions on how to set up and configure disk arrays.

RAID – 24-Drive Configuration

The DuraStor 6320SS can be setup to provide up to a 24 disk drive storage solution (12 per channel).

1 Remove the SAF-TE disk I/O card installed in both enclosures. See *Replacing an I/O Card* on page 5-21 for instructions.

2 Locate the switches on each card and set them as shown in Figure C-6.

The switch settings assign specific SCSI IDs to the drive slots as indicated, and reserve IDs 6 and 7 for the RAID controller), and IDs 8 or 15 for the SAF-TE processors.

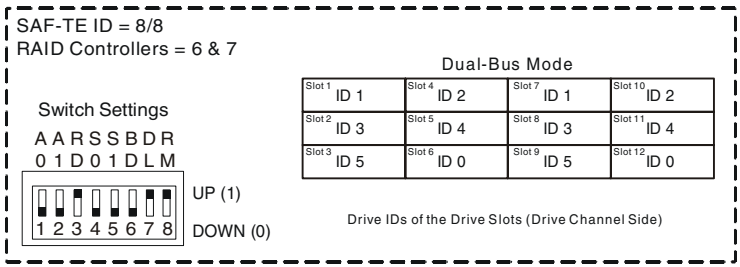


Figure C-6 Switch Setting – Primary RAID Enclosure (DuraStor 6320SS)

3 Reinstall the SAF-TE disk I/O card in each enclosure. See *Replacing an I/O Card* on page 5-21 for instructions.

4 Remove the SAF-TE disk I/O card installed in the daisy-chain enclosure. See *Replacing an I/O Card* on page 5-21 for instructions.

The daisy-chain enclosure will be configured to dual-bus mode. This provides the drive channel expansion from the primary enclosures' disk I/O channels. Set the switches as shown in Figure C-7.

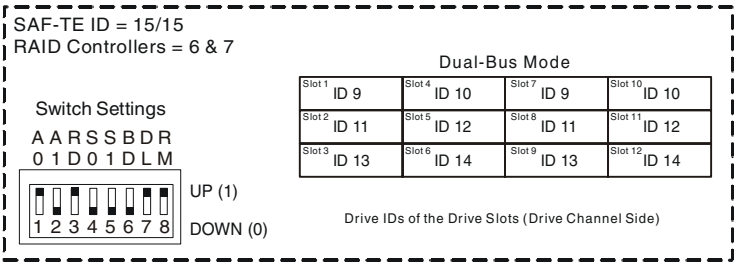


Figure C-7 Switch Setting – Dual-Bus Daisy-Chain Enclosure

5 *(Daisy-chain enclosure only)* Change the jumper settings on the SAF-TE disk I/O card JP7 and JP8 as described.

Locate jumpers JP7 and JP8. See Figure 5-14 on page 5-17 for help locating the jumpers. Add a jumper (installed on both pins) to JP8 for Channel 1 and JP7 for Channel 2.

This ensures that the automatic termination feature functions properly.

6 Reinstall the SAF-TE disk I/O card into the daisy-chain enclosure. See *Replacing an I/O Card* on page 5-21 for instructions.

7 Connect the SCSI data cables from the DuraStor 6320SS to the daisy-chain enclosures' SAF-TE disk I/O card as shown in Figure C-8.

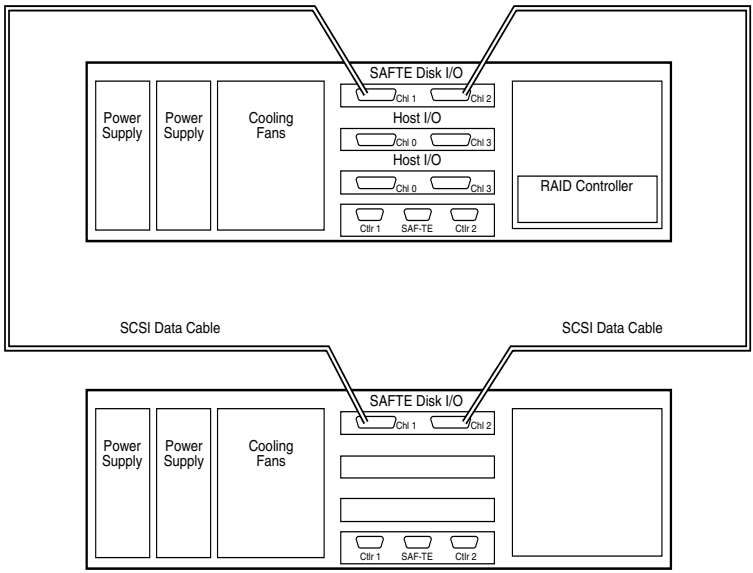


Figure C-8 Enclosure Cabling Diagram

8 Connect a SCSI data cable(s) from the host system(s) HBA(s) to the host I/O card as indicated in *Basic Connections – DuraStor 6320SS* on page 2-15 or *Advanced Cabling – DuraStor 6320SS* on page C-21.

The configuration is complete. Refer to the *Storage Manager Pro User's Guide* or the *Disk Array Administrator User's Guide* for instructions on how to set up and configure disk arrays.

RAID – 36-Drive Configuration

Only the DuraStor 6320SS in the stand-alone single-port mode can be setup in this configuration. It provides up to a 36 disk drive storage solution (12 per channel). This is due to one of the host I/O ports (CH 3) is used as a drive channel to provide the additional connectivity for the second DuraStor 412R drive enclosure.

1 Remove the SAF-TE disk I/O card installed in both enclosures. See *Replacing an I/O Card* on page 5-21 for instructions.

2 Locate the switches on each card and set them as shown in Figure C-6.

The switch settings assign specific SCSI IDs to the drive slots as indicated, and reserve IDs 6 and 7 for the RAID controllers, and IDs 8 or 15 for the SAF-TE processors.

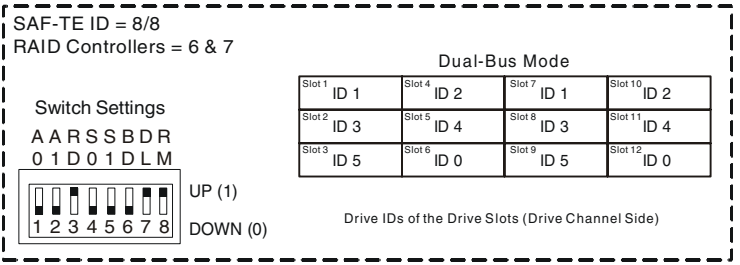


Figure C-9 Switch Setting – Primary RAID Enclosure

3 Reinstall the SAF-TE disk I/O card in each enclosure. See *Replacing an I/O Card* on page 5-21 for instructions.

4 Remove the SAF-TE disk I/O card installed in the daisy-chain enclosure. See *Replacing an I/O Card* on page 5-21 for instructions.

The first daisy-chain enclosure will be configured to dual-bus mode. This provides the drive channel expansion from the

primary enclosures' disk I/O channels. Set the switches as shown in Figure C-7.

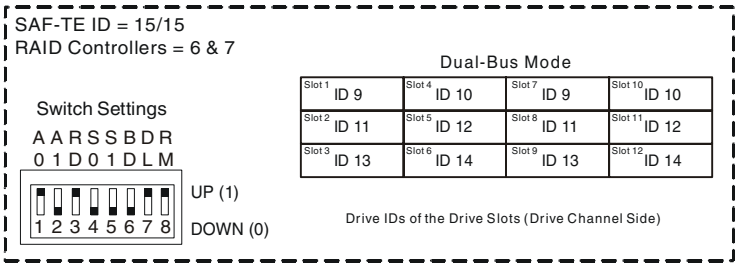


Figure C-10 Switch Setting – Dual-Bus Daisy-Chain Enclosure

5 Configure the jumper settings on this first daisy-chain enclosure SAF-TE disk I/O card.

Locate and add (installed on both pins) the jumpers at JP7 and JP8. See Figure 5-14 on page 5-17 for help locating the jumpers. The default position of the jumpers are offset (installed on one pin only).

This ensures that the automatic termination feature functions properly.

6 Reinstall the SAF-TE disk I/O card in each enclosure. See *Replacing an I/O Card* on page 5-21 for instructions.

7 Remove the SAF-TE disk I/O card installed in the second daisy-chain enclosure. See *Replacing an I/O Card* on page 5-21 for instructions.

8 Locate the switches on the card and set them as shown in Figure C-11.

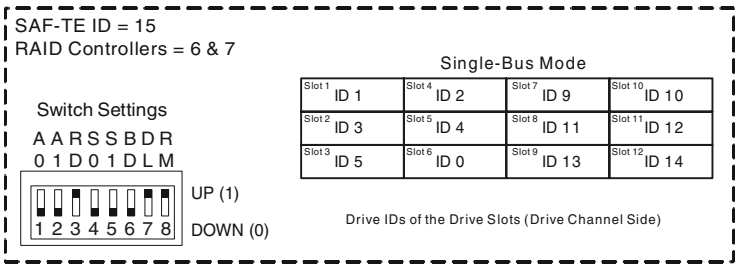


Figure C-11 Switch Setting – Single-Bus Daisy-Chain Enclosure

9 Configure the jumper settings on this second daisy-chain enclosure SAF-TE disk I/O card.

Locate and add (installed on both pins) the two jumpers at JP7 and JP8. The default position of the jumpers are offset.

10 Reinstall the SAF-TE disk I/O card in each enclosure. See *Replacing an I/O Card* on page 5-21 for instructions.

11 Connect the SCSI data cables as shown in Figure C-8.

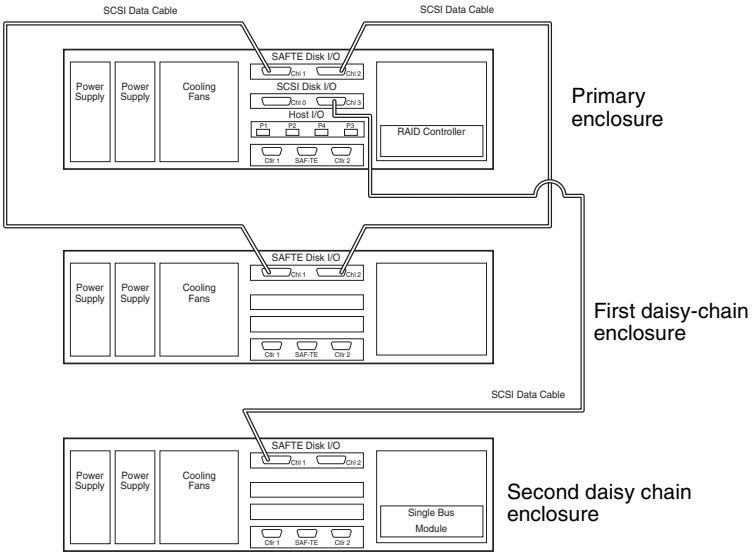


Figure C-12 Enclosure Cabling Diagram

12 Connect a SCSI data cable from the host system(s) HBA(s) to the host I/O card as indicated in *Basic Connections – DuraStor 6320SS* on page 2-15 or *Advanced Cabling – DuraStor 6320SS* on page C-21.

The configuration is complete. Refer to the *Storage Manager Pro User's Guide* or the *Disk Array Administrator User's Guide* for instructions on how to set up and configure disk arrays.

Advanced Configurations – DuraStor 7320SS

RAID – 24-Drive Configuration

The DuraStor 7320SS can be setup to provide up to a 24 disk drive storage solution. In this configuration you will attach a DuraStor 412R to the primary RAID enclosure which will extend the drive channels (12 drives per channel).

1 Remove the SAF-TE disk I/O card installed in both enclosures. See *Replacing an I/O Card* on page 5-21 for instructions.

Locate the switches on each card and set them as shown in Figure C-13.

The switch settings assign specific SCSI IDs to the drive slots as indicated, and reserve IDs 6 and 7 for the RAID Controller(s) and IDs 8 or 15 for the SAF-TE processors.

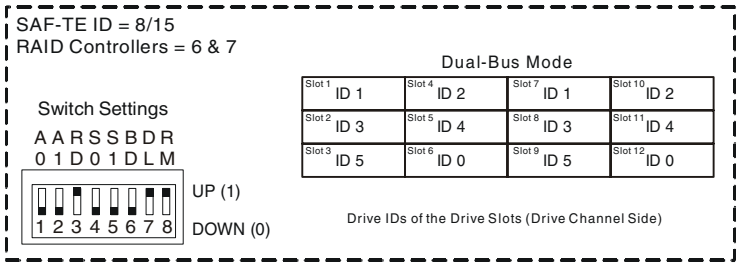


Figure C-13 Switch Setting – Primary RAID Enclosure

2 Reinstall the SAF-TE disk I/O card in each enclosure. See *Replacing an I/O Card* on page 5-21 for instructions.

3 Remove the SAF-TE disk I/O card installed in the daisy-chain enclosure. See *Replacing an I/O Card* on page 5-21 for instructions.

The daisy-chain enclosure will be configured to dual-bus mode. This provides the drive channel expansion from the primary enclosures' disk I/O channels. Set the switches as shown in Figure C-14.

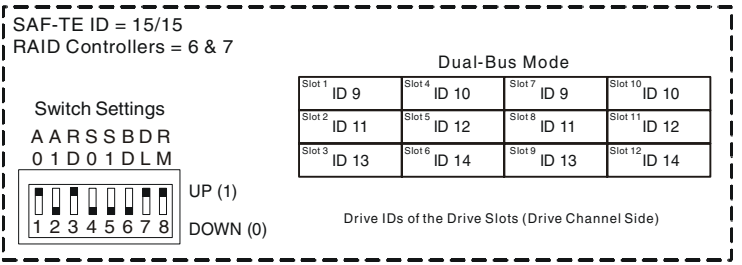


Figure C-14 Switch Setting – Dual-Bus Daisy-Chain Enclosure

4 *(Daisy-chain enclosure only)* Change the jumper settings on the SAF-TE Disk I/O card JP7 and JP8 as described.

Locate jumpers JP7 and JP8. See Figure 5-14 on page 5-17 for help locating the jumpers. Add a jumper (installed on both pins) to JP8 for Channel 1 and JP7 for Channel 2.

This ensures that the automatic termination feature functions properly.

5 Reinstall the SAF-TE disk I/O card into the daisy-chain enclosure. See *Replacing an I/O Card* on page 5-21 for instructions.

6 Connect the SCSI data cables from the DuraStor 7320SS disk I/O card to the daisy-chain enclosures' SAF-TE disk I/O card as shown in Figure C-15.

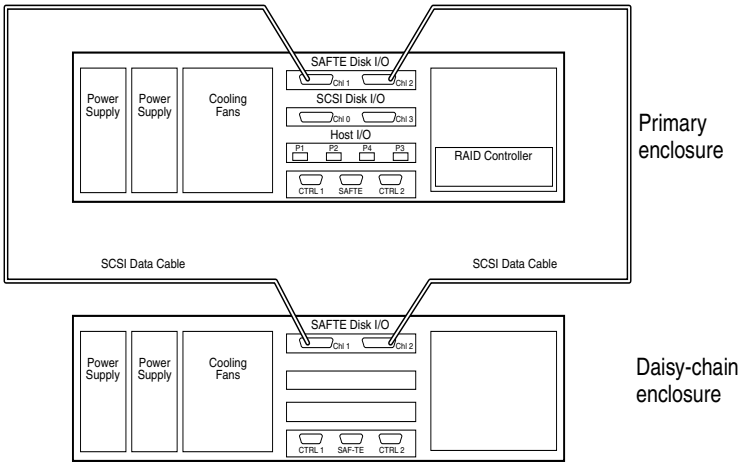


Figure C-15 Enclosure Cabling Diagram

7 Connect a fibre channel data cable(s) from the host system(s) HBA(s) to the host I/O card as indicated in *Basic Configuration – DuraStor 7320SS* on page 2-13 or *Advanced Cabling – DuraStor 7320SS* on page C-29.

The configuration is complete. Refer to the *Storage Manager Pro User's Guide* or the *Disk Array Administrator User's Guide* for instructions on how to set up and configure disk arrays.

RAID – 36-Drive Configuration

The DuraStor 7320SS can be setup to provide up to a 36 disk drive storage solution. In this configuration you will attach two DuraStor 412R drive enclosures to the primary RAID enclosure which will extend the drive channels (12 drives per channel).

1 Remove the SAF-TE disk I/O card installed in both enclosures. See *Replacing an I/O Card* on page 5-21 for instructions.

2 Locate the switches on each card and set them as shown in Figure C-16.

The switch settings assign specific SCSI IDs to the drive slots, as shown in Figure C-13 on page C-11, and reserve IDs 6 and 7 for the RAID Controller(s), and IDs 8 or 15 for the SAF-TE processors.

3 Reinstall the SAF-TE disk I/O card in each enclosure. See *Replacing an I/O Card* on page 5-21 for instructions.

4 Remove the SAF-TE disk I/O card installed in the first daisy-chain enclosure. See *Replacing an I/O Card* on page 5-21 for instructions.

The first daisy-chain enclosure is configured to dual-bus mode. It provides the drive channel expansion from the primary enclosures' disk I/O channels. Set the switches as shown in Figure C-16.

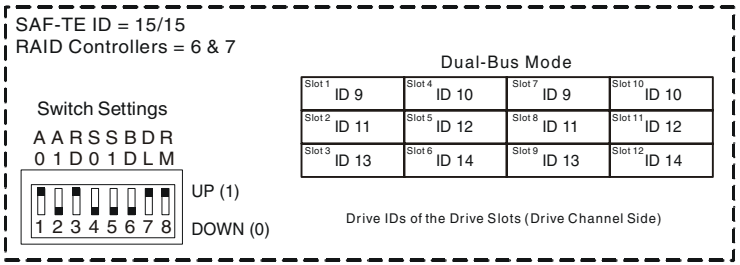


Figure C-16 Switch Setting – Dual-Bus Daisy-Chain Enclosure

5 (*First Daisy-chain Enclosure*) Change the jumper settings on the SAF-TE disk I/O card JP7 and JP8 as described.

Locate and add the two jumpers (JP7 and JP8). See Figure 5-14 on page 5-17 for help locating the jumpers. Add a jumper (installed on both pins) to JP8 for Channel 1 and JP7 for Channel 2.

This ensures that the automatic termination feature functions properly.

6 Reinstall the SAF-TE disk I/O card into the daisy-chain enclosure. See *Replacing an I/O Card* on page 5-21 for instructions.

7 Remove the SAF-TE disk I/O card installed in the second daisy-chain enclosure. See *Replacing an I/O Card* on page 5-21 for instructions.

The second daisy-chain enclosure is configured to single-bus mode. It provides the drive channel expansion from the primary enclosures' I/O card Channel 0. Set the switches as shown in Figure C-17.

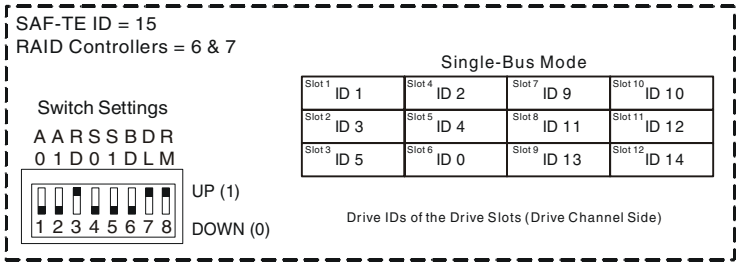


Figure C-17 Switch Setting – Single-Bus Daisy-Chain Enclosure

8 *(Second Daisy-chain Enclosure)* Change the jumper settings on the SAF-TE disk I/O card JP7 and JP8 as described.

Locate and add the two jumpers (JP7 and JP8). See Figure 5-14 on page 5-17 for help locating the jumpers. Add a jumper (installed on both pins) to JP8 for Channel 1 and JP7 for Channel 2.

This will ensure that the automatic termination feature functions properly.

9 Reinstall the SAF-TE disk I/O card into the second daisy-chain enclosure. See *Replacing an I/O Card* on page 5-21 for instructions.

10 *(Second Daisy-chain Enclosure)* Install the Single-Bus Module in the Controller 1 slot. See *Installing the Single Bus Module and Cover Plate* on page 5-9 for instructions.

11 Connect the SCSI data cables from the DuraStor 7320SS to the two daisy-chain enclosures as shown in Figure C-15 on page C-13.

Note: When connecting the single-bus DuraStor 7320SS enclosure to the primary RAID enclosure, you connect to the Channel 0 connector on the I/O card installed in the primary RAID enclosure.

12 Connect a Fibre Channel data cable(s) from the host system(s) HBA(s) to the Host I/O card as indicated in *Basic Connections – DuraStor 6320SS* on page 2-15 or *Advanced Cabling – DuraStor 7320SS* on page C-29.

The configuration is complete. Refer to the *Storage Manager Pro User's Guide* or the *Disk Array Administrator User's Guide* for instructions on how to set up and configure disk arrays.

RAID – 48-Drive Configuration

The DuraStor 7320SS can be setup to provide up to a 48 disk drive storage solution. In this configuration you will attach three DuraStor 412R drive enclosures to the primary RAID enclosure which will extend the drive channels (12 drives per channel).

1 Remove the SAF-TE Disk I/O card installed in both enclosures. See *Replacing an I/O Card* on page 5-21 for detailed instructions.

2 Locate the switches on each card and set them as shown in Figure C-18.

The switch settings will assign specific SCSI IDs to the drive slots as indicated, and reserve IDs 6 and 7 for the RAID Controller(s), and IDs 8 or 15 for the SAF-TE processors.

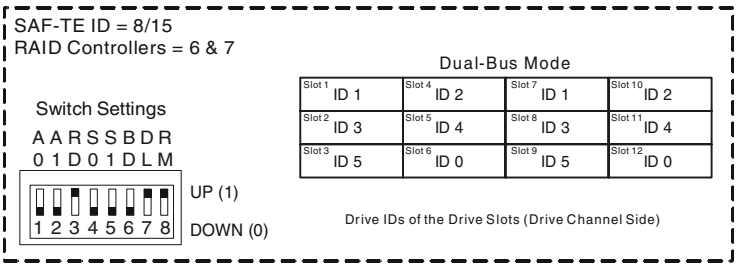


Figure C-18 Switch Setting – Primary RAID Enclosure

3 Reinstall the SAF-TE Disk I/O card in each enclosure. See *Replacing an I/O Card* on page 5-21 for detailed instructions.

4 Remove the SAF-TE Disk I/O card installed in the first daisy-chain enclosure. See *Replacing an I/O Card* on page 5-21 for detailed instructions.

The first daisy-chain enclosure will be configured to dual-bus mode. It provides the drive channel expansion from the primary enclosures' Disk I/O channels. Set the switches as shown in Figure C-19.

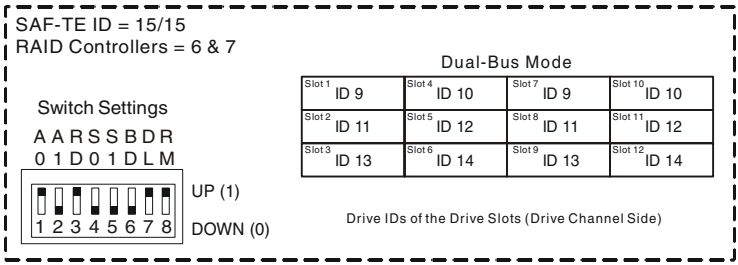


Figure C-19 Switch Setting – Dual-Bus Daisy-Chain Enclosure

5 *(First Daisy-chain Enclosure)* Change the jumper settings on the SAF-TE Disk I/O card JP7 and JP8 as described.

Locate and add the two jumpers (JP7 and JP8). See Figure 5-14 on page 5-17 for help locating the jumpers. Add a jumper (installed on both pins) to JP8 for Channel 1 and JP7 for Channel 2. This will ensure that the automatic termination feature functions properly.

6 Reinstall the SAF-TE Disk I/O card into the first daisy-chain enclosure. See *Replacing an I/O Card* on page 5-21 for detailed instructions.

7 Remove the SAF-TE Disk I/O card installed in the second daisy-chain enclosure. See *Replacing an I/O Card* on page 5-21 for detailed instructions.

The second and third daisy-chain enclosures will be configured to single-bus mode through their switch settings. Therefore, the

switch setting is the same for both of these daisy-chained enclosures. Set the switches as shown in Figure C-20.

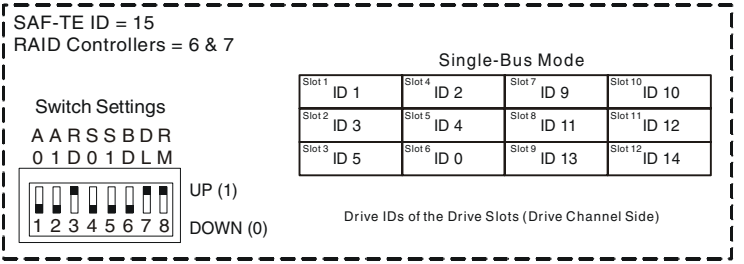


Figure C-20 Switch Setting – Single-Bus Daisy-Chain Enclosure

8 *(Second & third daisy-chain enclosure)* Change the jumper settings on the SAF-TE Disk I/O card JP7 and JP8 as described.

Locate and add the two jumpers (JP7 and JP8). See Figure 5-14 on page 5-17 for help locating the jumpers. Add a jumper (installed on both pins) to JP8 for Channel 1 and JP7 for Channel 2. This will ensure that the automatic termination feature functions properly.

9 Reinstall the SAF-TE Disk I/O cards in each enclosure. See *Replacing an I/O Card* on page 5-21 for detailed instructions.

10 *(Second & third daisy-chain enclosure)* Install the Single-Bus Module in the Controller 1 slot in both of these enclosures. For details, see *Installing the Single Bus Module and Cover Plate* on page 5-9.

11 Connect the SCSI data cables as shown in Figure C-21.

Note: When connecting the single-bus DuraStor 412R drive enclosure to the primary RAID enclosure, you will connect it to the Channel 0 and Channel 1 connectors on the I/O card installed in the primary RAID enclosure.

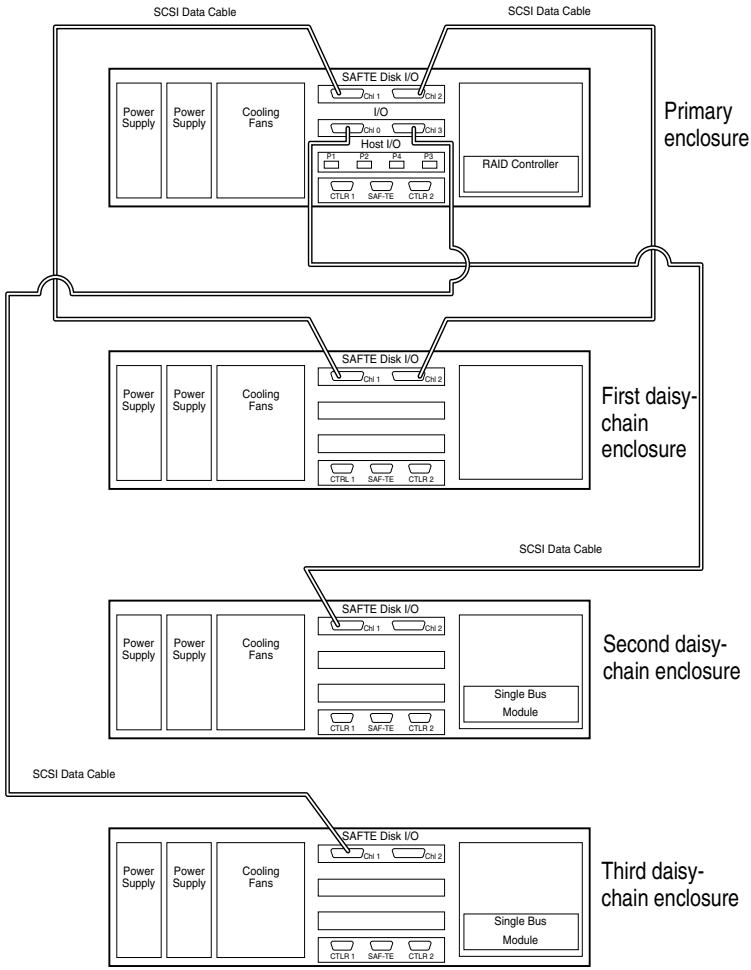


Figure C-21 Enclosure Cabling Diagram

12 Connect a Fibre Channel data cable(s) from the host system(s) HBA(s) to the Host I/O card as indicated in *Basic Configuration – DuraStor 7320SS* on page 2-13 or *Advanced Cabling – DuraStor 7320SS* on page C-29.

The configuration is complete. Refer to the *Storage Manager Pro User's Guide* or the *Disk Array Administrator User's Guide* for instructions on how to set up and configure disk arrays.

Advanced Cabling – DuraStor 6320SS

Stand-Alone Single-Port (Dual Hosts, Single HBAs)

Connect the SCSI data cables as described Figure C-22 and Figure C-23.

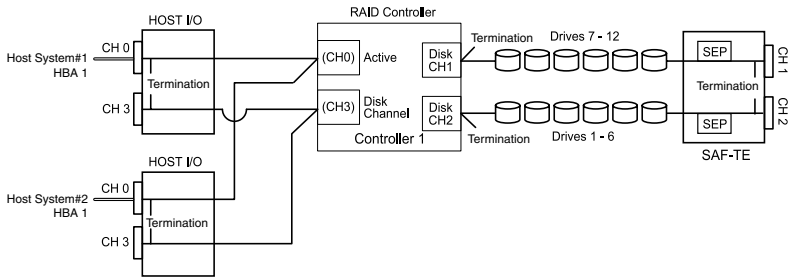


Figure C-22 Logical Diagram – Stand-Alone, Single-Port

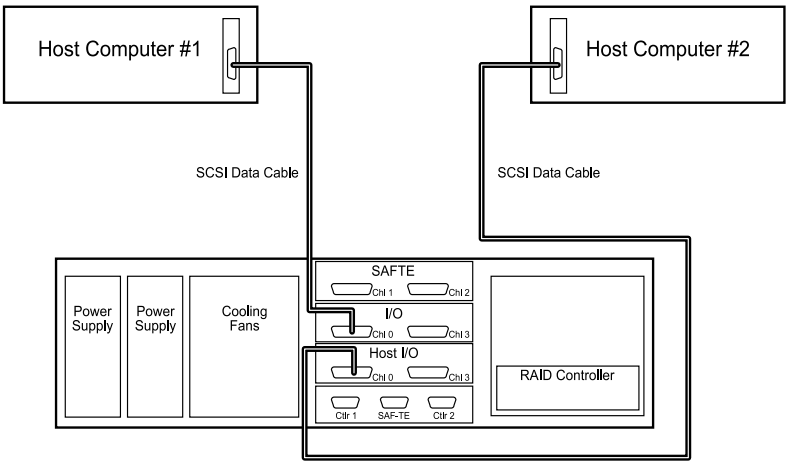


Figure C-23 Host Cabling Diagram – Dual Host, Single HBAs

Stand-Alone Dual Port (Dual Hosts, Single HBAs)

Connect the SCSI data cables as described in Figure C-24 and Figure C-23.

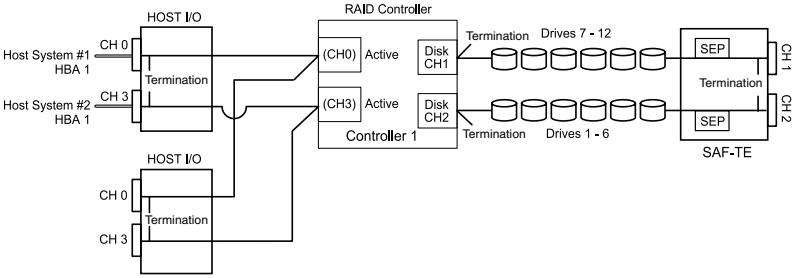


Figure C-24 Logical Diagram – Stand-Alone, Dual-Port

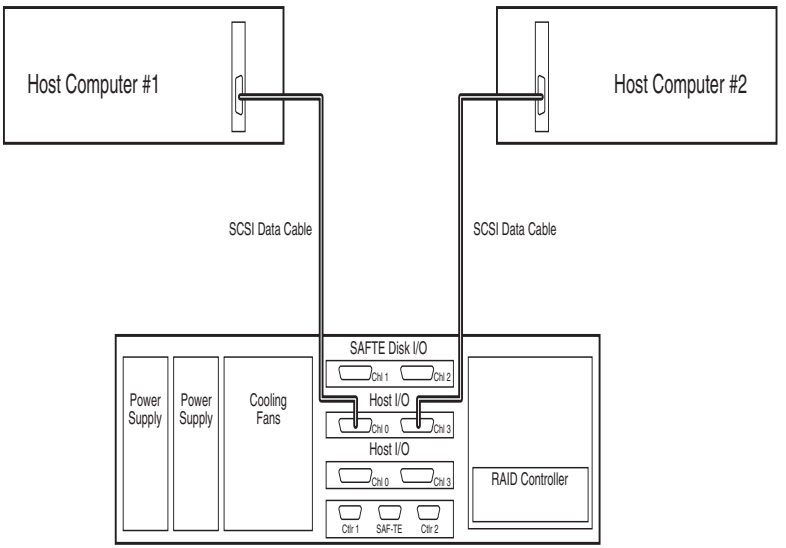


Figure C-25 Host Cabling Diagram – Dual Host, Single HBAs

Stand-Alone Dual Port – Quad Cabling (Two HBAs, Shared SCSI Bus)

Connect the SCSI data cables as shown in Figure C-24 and Figure C-27.

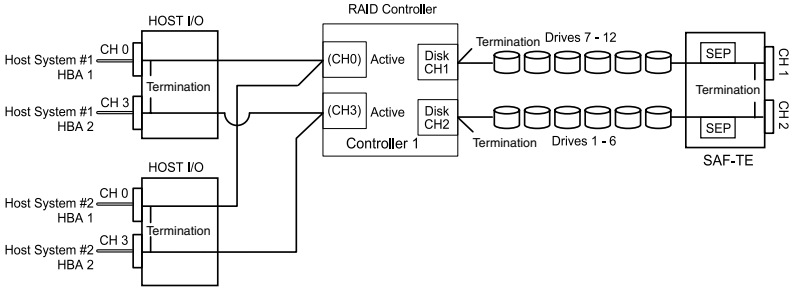


Figure C-26 Stand-Alone Dual-Port Logical Diagram

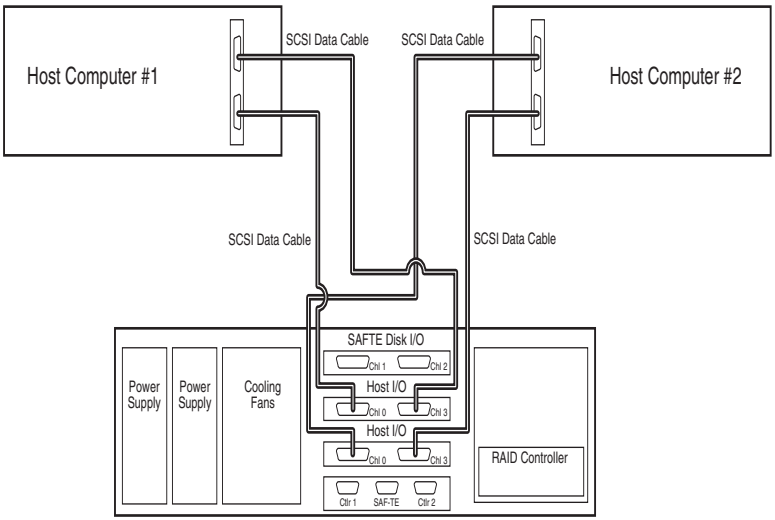


Figure C-27 Host Cabling Diagram – Dual Host, Quad Cabling, Two HBAs

Active-Active Single-Port (Single Host, Two HBAs)

Connect the SCSI data cables as shown in Figure C-28 and Figure C-29.

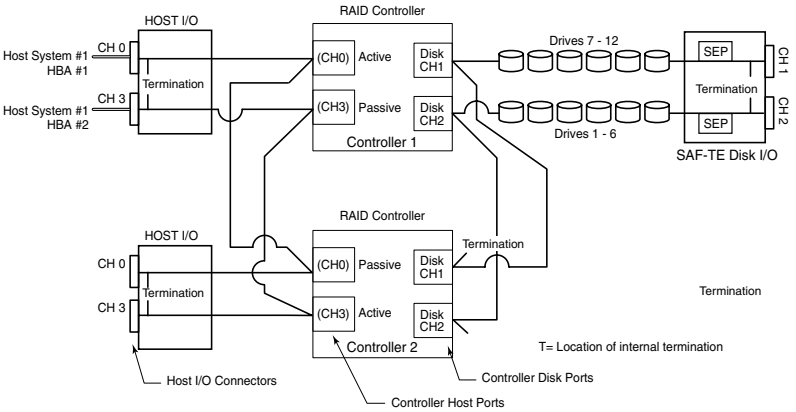


Figure C-28 Logical Diagram – Active-Active Single-Port

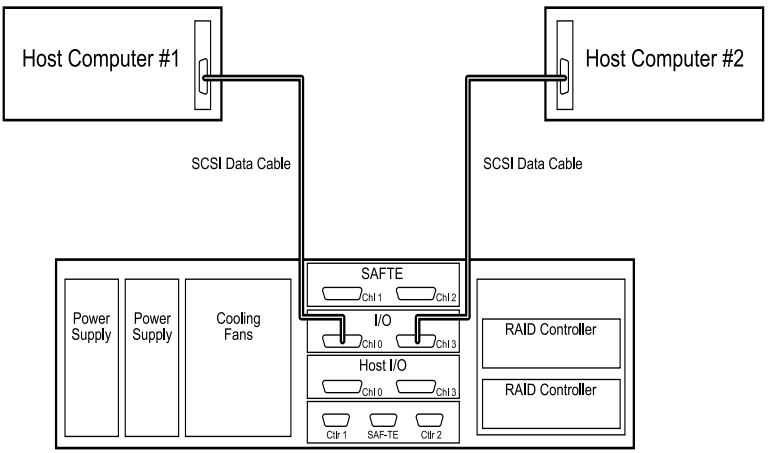


Figure C-29 Host Cabling Diagram – Single Host, Two HBAs

Active-Active Single-Port (Dual Host, Single HBAs)

Connect the SCSI data cables as shown in Figure C-28 and Figure C-23.

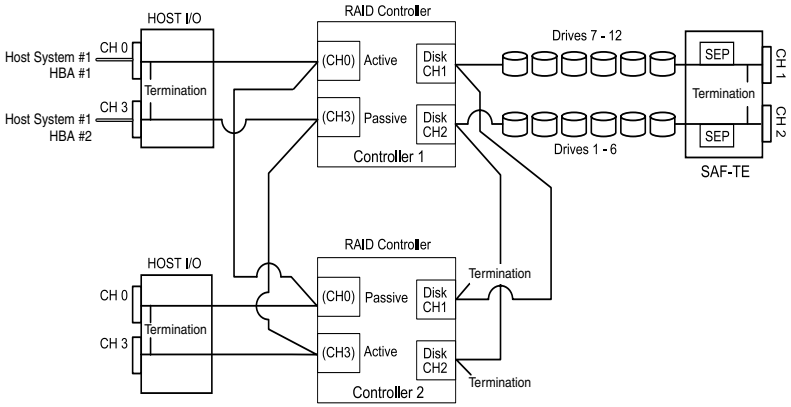


Figure C-30 Logical Diagram – Active-Active Single-Port

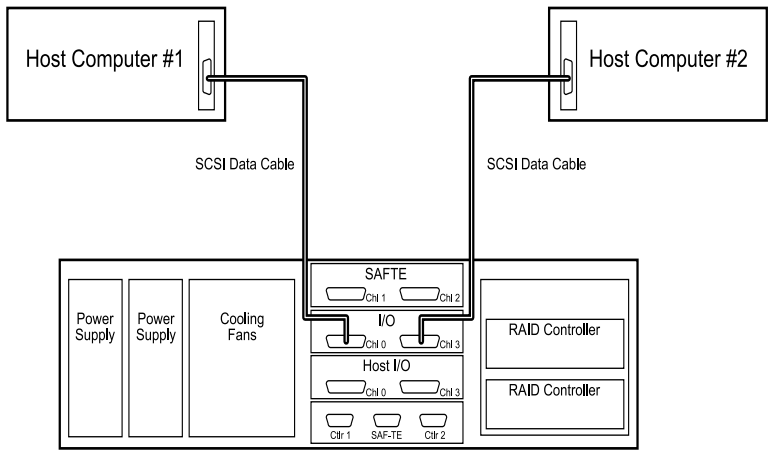


Figure C-31 Host Cabling Diagram – Dual Host, Single HBAs

Active-Active Single-Port – Quad Cabling (Dual Host, Dual HBAs) #1

This setup will provide an isolated SCSI bus. Connect the SCSI data cables as shown in Figure C-32 and Figure C-33.

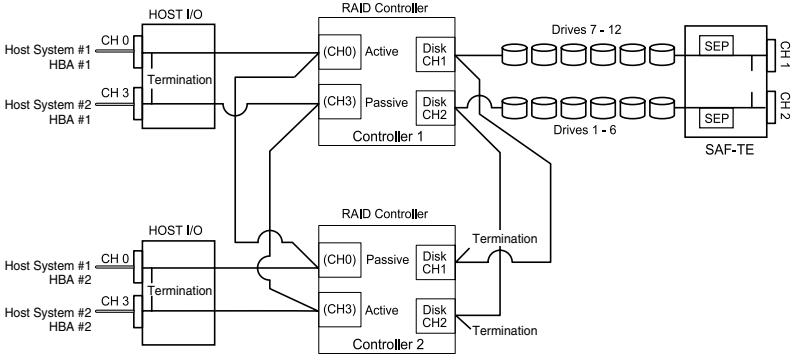


Figure C-32 Logical Diagram – Active-Active Single-Port

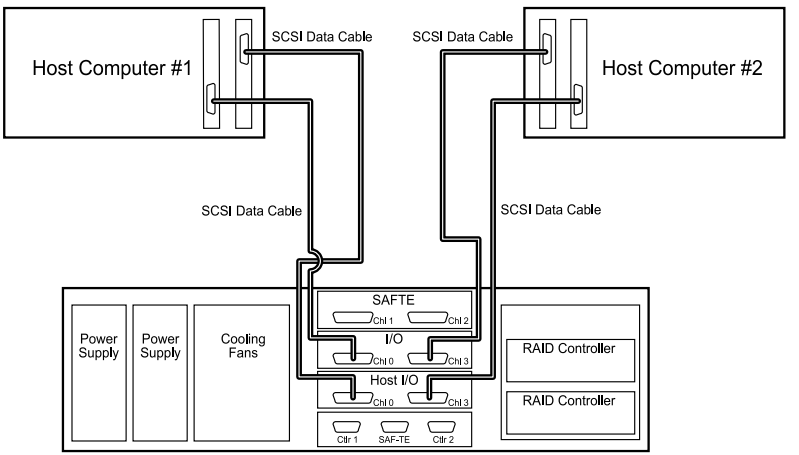


Figure C-33 Host Cabling Diagram – Dual Host, Dual HBAs

Active-Active Single-Port – Quad Cabling (Dual-Host, Dual-HBAs) #2

This setup is ideal for clustering configurations. Connect the SCSI data cables as shown in Figure C-34 and Figure C-33.

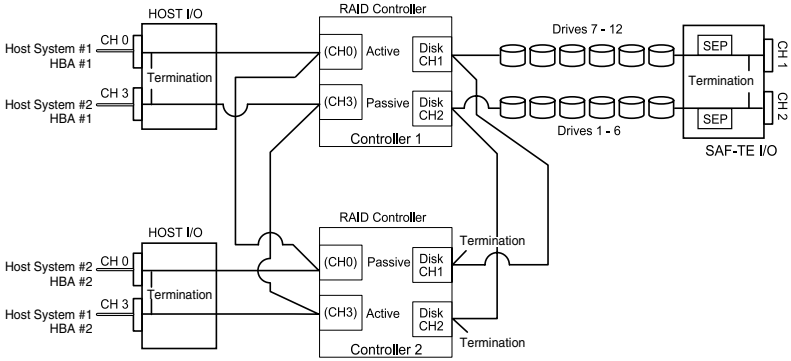


Figure C-34 Logical Diagram – Active-Active Single-Port

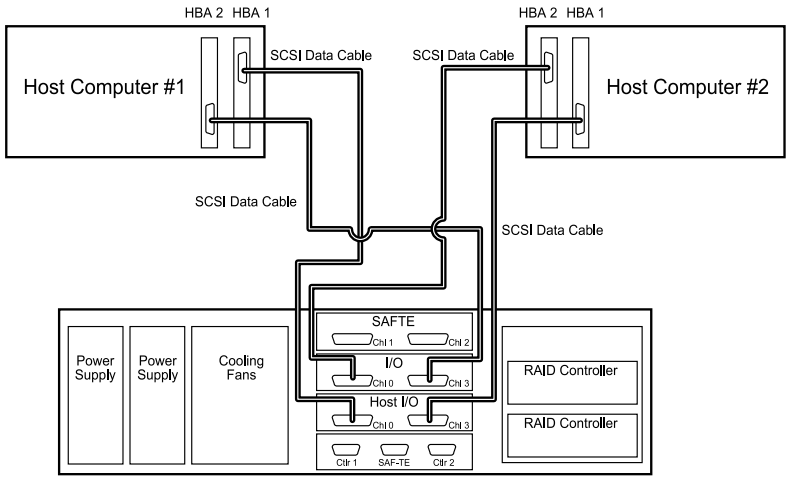


Figure C-35 Host Cabling Diagram – Dual Host, Dual HBAs

Active-Passive Dual-Port (Dual Hosts, Single HBAs)

Connect the SCSI data cables as shown in Figure C-36 and Figure C-23.

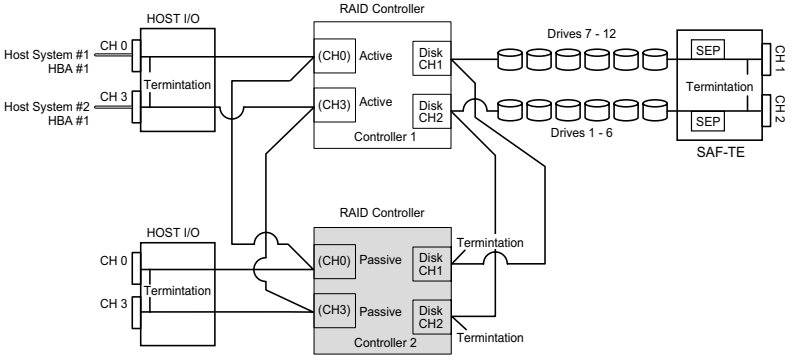


Figure C-36 Logical Diagram – Active-Passive Dual-Port

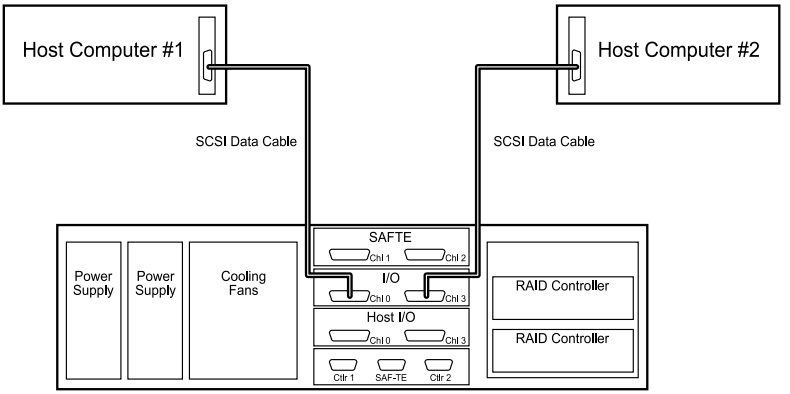


Figure C-37 Host Cabling Diagram – Dual Host, Single HBAs

Advanced Cabling – DuraStor 7320SS

Stand-Alone Dual-Port (Single Host, Two HBAs, Hubs Disabled)

Connect the Fibre Channel data cables as shown in Figure C-38 and Figure C-39.

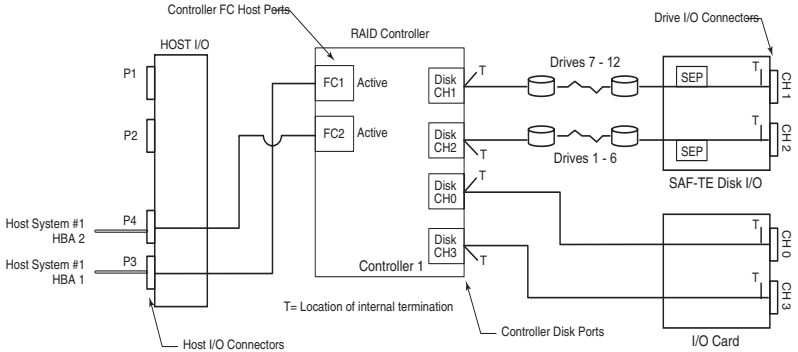


Figure C-38 Logical Diagram – Single Host, Two HBAs, Hubs Disabled

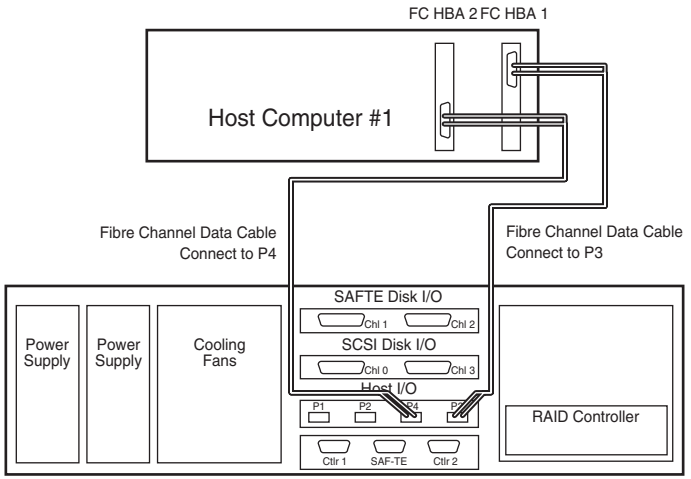


Figure C-39 Host Cabling Diagram – Single Host, Two HBAs, Hubs Disabled

Stand-Alone Dual-Port (Single Host, Two HBAs, Hubs Enabled)

Connect the Fibre Channel data cables as shown in Figure C-40 and Figure C-41.

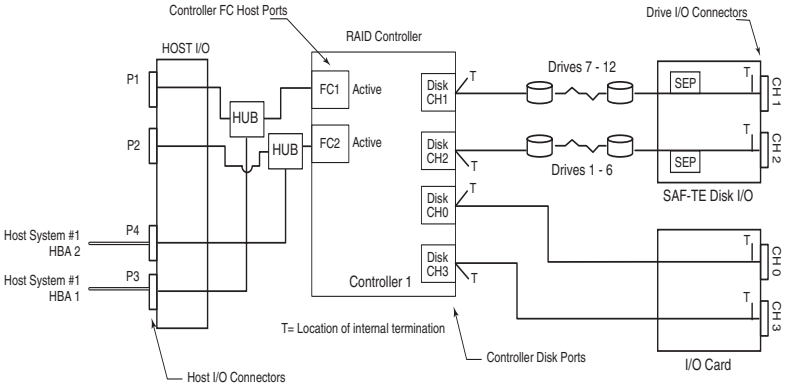


Figure C-40 Logical Diagram – SIngle Host, Two HBAs, Hubs Enabled

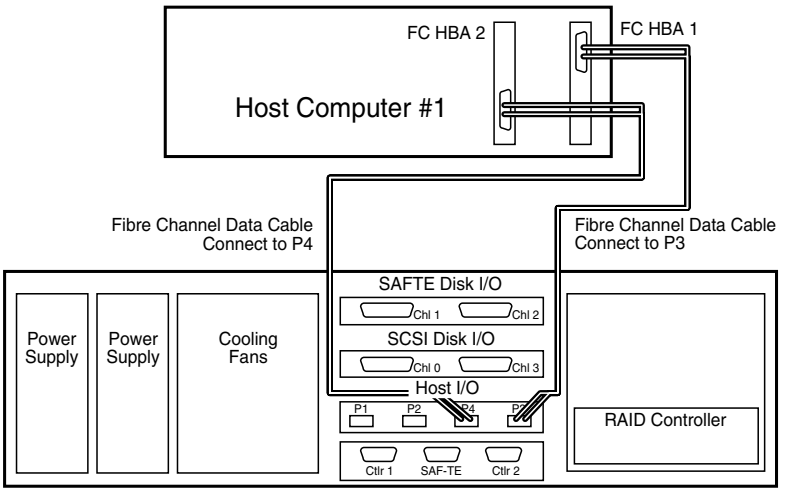


Figure C-41 Host Cabling Diagram – SIngle Host, Two HBAs, Hubs Enabled

Stand-Alone Dual-Port (Multiple Hosts, Single HBAs, Hubs Enabled)

Connect the Fibre Channel data cables as shown in Figure C-42 and Figure C-43.

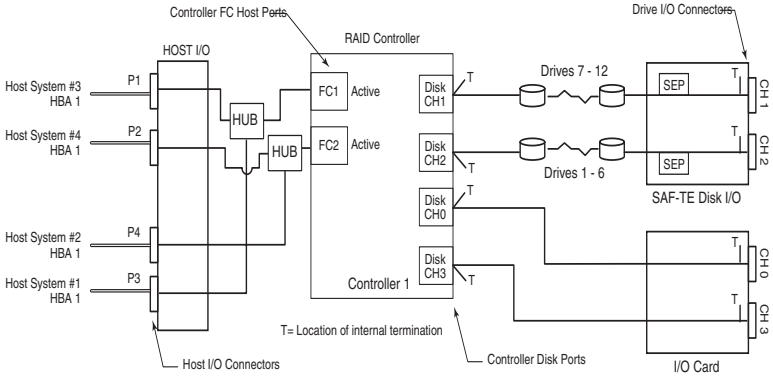


Figure C-42 Logical Diagram – Multiple Host with Single HBAs, Hubs Enabled

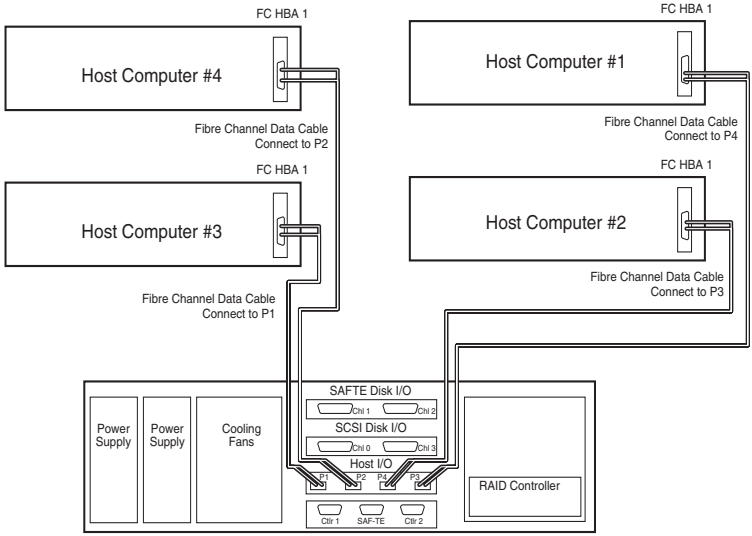


Figure C-43 Host Cabling Diagram – Multiple Host, Single HBAs, Hubs Enabled

Active-Active Single-Port (Single Host, Dual HBAs, Hubs Enabled)

Connect the Fibre Channel data cables as shown in Figure C-44 and Figure C-45.

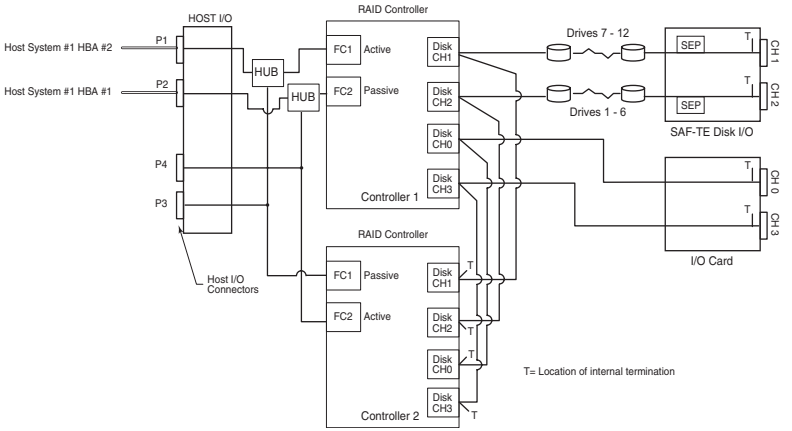


Figure C-44 Logical Diagram – Single Host with Dual HBAs, Hubs Enabled

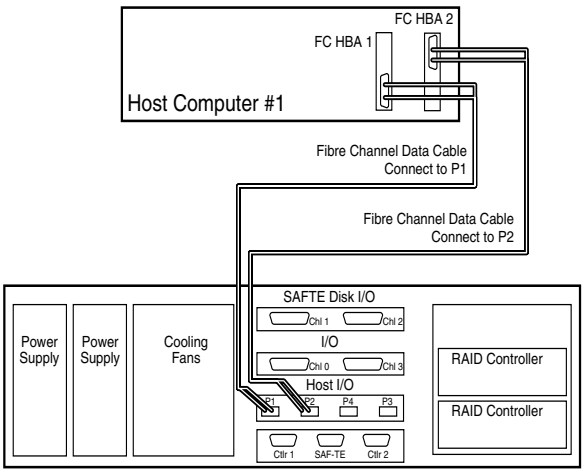


Figure C-45 Host Cabling Diagram – Single Host with Dual HBAs, Hubs Enabled

Active-Active Single-Port (Dual Host, Single HBAs, Hubs Enabled)

Connect the Fibre Channel data cables as shown in Figure C-50 and Figure C-51.

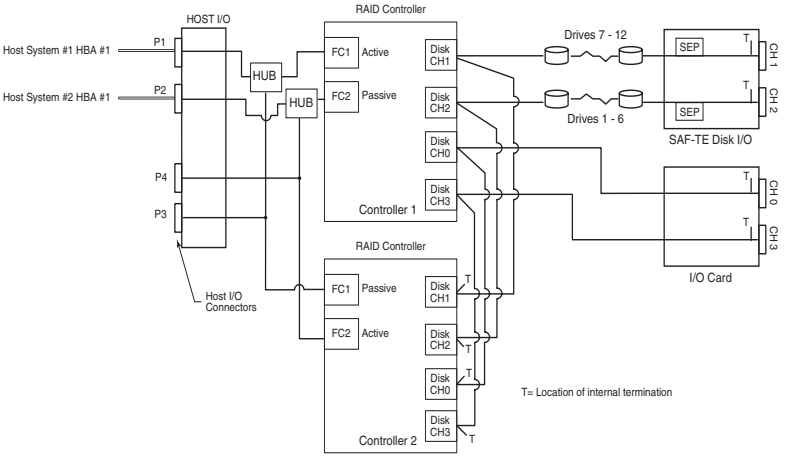


Figure C-46 Logical Diagram – Dual Host with Single HBAs, Hubs Enabled

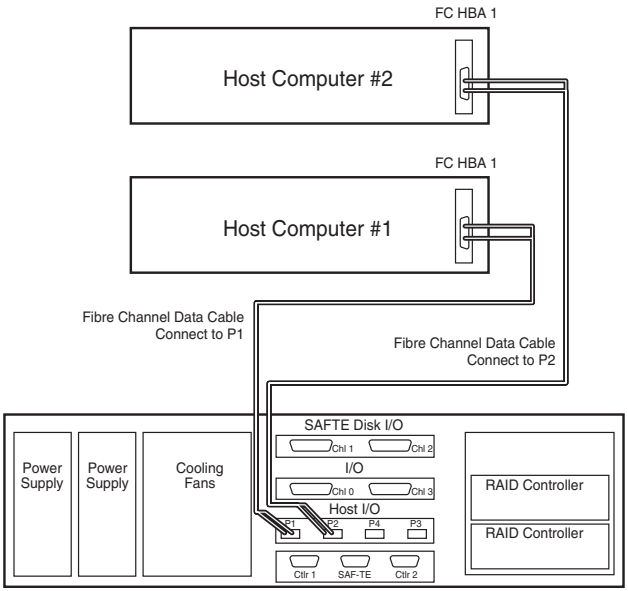


Figure C-47 Host Cabling Diagram – Dual Host with Single HBAs, Hubs Enabled

Active-Active Single-Port (Dual Host, Dual HBAs – Quad Cabling, Hubs Enabled)

Connect the Fibre Channel data cables as shown in Figure C-48 and Figure C-49.

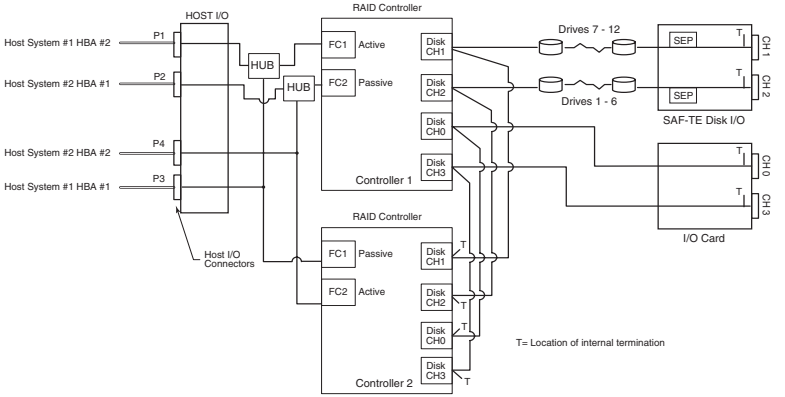


Figure C-48 Logical Diagram – Dual-Host with Dual HBAs, Quad Cabling, Hubs Enabled

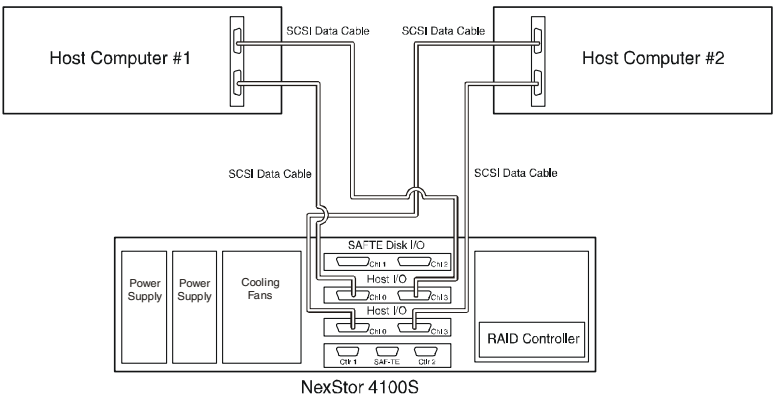


Figure C-49 Host Cabling Diagram – Dual-Host with Dual HBAs, Quad Cabling, Hubs Enabled

Active-Passive Dual-Port (Dual Host, Single HBAs, Hubs Enabled)

Connect the Fibre Channel data cables as shown in Figure C-50 and Figure C-51.

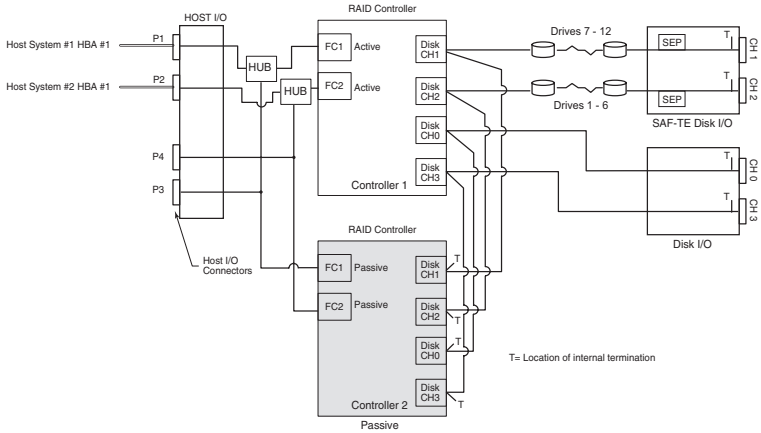


Figure C-50 Logical Diagram – Dual-Host with Single HBAs, Hubs Enabled

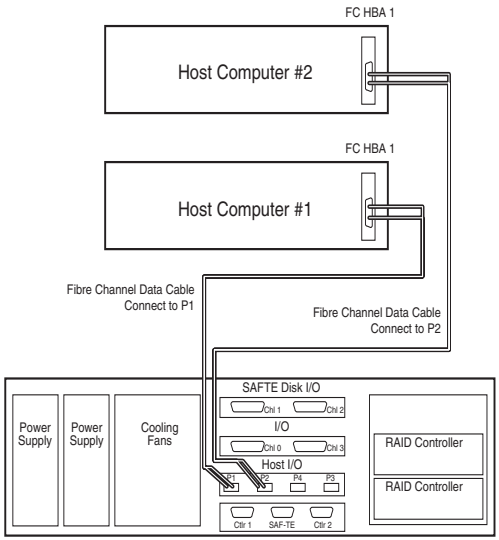


Figure C-51 Host Cabling Diagram – Dual-Host with Single HBAs, Hubs Enabled

D

Port Information

In this Appendix

This appendix contains detailed information about the very-high-density SCSI connectors on the SAF-TE disk I/O card and host I/O cards.

VHDCI SCSI Connectors

On each SAF-TE Disk I/O and host I/O card are two VHDCI SCSI connectors, similar to the one shown in Figure D-1. These connectors provide the input/output interface from the storage enclosure bus to the host system. Table D-1 provides signal names and pin numbers for both connectors.

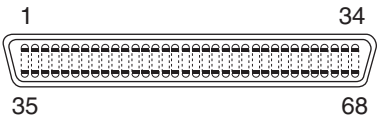


Figure D-1 VHD/CI Connector

Table D-1 VHD/CI Connector Pin Assignment

Connector P1		Connector P2	
Signal Name	**Pin Number**	**Signal Name**	**Pin Number**
+DB(12)	1	+DB(12)	1
+DB(13)	2	+DB(13)	2
+DB(14)	3	+DB(14)	3
+DB(15)	4	+ DB(15)	4
+DB(P1)	5	+DB(P1)	5
+DB(0)	6	+DB(0)	6
+DB(1)	7	+DB(1)	7
+DB(2)	8	+DB(2)	8
+DB(3)	9	+DB(3)	9
+DB(4)	10	+DB(4)	10
+DB(5)	11	+DB(5)	11
+DB(6)	12	+DB(6)	12
+DB(7)	13	+DB(7)	13
+DB(P0)	14	+DB(P0)	14
GROUND	15	GROUND	15
DIFFSENS	16	DIFFSENS	16
TERMPWR	17	TERMPWR	17
TERMPWR	18	TERMPWR	18

Table D-1 VHD/CI Connector Pin Assignment

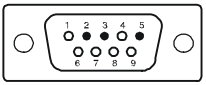
Connector P1		Connector P2	
Signal Name	**Pin Number**	**Signal Name**	**Pin Number**
RESERVED	19	RESERVED	19
GROUND	20	GROUND	20
+ATN	21	+ATN	21
GROUND	22	GROUND	22
+BSY	23	+BSY	23
+ACK	24	+ACK	24
+RST	25	+RST	25
+MSG	26	+MSG	26
+SEL	27	+SEL	27
+C/D	28	+C/D	28
+REQ	29	+REQ	29
+I/O	30	+I/O	30
+DB(8)	31	+DB(8)	31
+DB(9)	32	+DB(9)	32
+DB(10)	33	+DB(10)	33
+DB(11)	34	+DB(11)	34
-DB(12)	35	-DB(12)	35
-DB(13)	36	-DB(13)	36
-DB(14)	37	-DB(14)	37
-DB(15)	38	-DB(15)	38
-DB(P1)	39	-DB(P1)	39
-DB(0)	40	-DB(0)	40
-DB(1)	41	-DB(1)	41
-DB(2)	42	-DB(2)	42
-DB(3)	43	-DB(3)	43
-DB(4)	44	-DB(4)	44
-DB(5)	45	-DB(5)	45
-DB(6)	46	-DB(6)	46
-DB(7)	47	-DB(7)	47
-DB(P0)	48	-DB(P0)	48

Table D-1 VHD/CI Connector Pin Assignment

Connector P1		Connector P2	
Signal Name	**Pin Number**	**Signal Name**	**Pin Number**
GROUND	49	GROUND	49
GROUND	50	GROUND	50
TERMPWR	51	TERMPWR	51
TERMPWR	52	TERMPWR	52
RESERVED	53	RESERVED	53
GROUND	54	GROUND	54
-ATN	55	-ATN	55
GROUND	56	GROUND	56
-BSY	57	-BSY	57
-ACK	58	-ACK	58
-RST	59	-RST	59
-MSG	60	-MSG	60
-SEL	61	-SEL	61
-C/D	62	-C/D	62
-REQ	63	-REQ	63
-I/O	64	-I/O	64
-DB(8)	65	-DB(8)	65
-DB(9)	66	-DB(9)	66
-DB(10)	67	-DB(10)	67
-DB(11)	68	-DB(11)	68

RS-232 Service Ports

The RS-232 service ports are located on the back of the storage subsystem. The service port labeled SAF-TE provides a serial interface to the SAF-TE disk I/O card for firmware uploads, maintenance, and service monitoring of the SEPs. Figure D-2 shows the pin signals for this port.

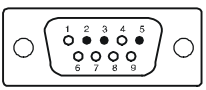


Pin Number	Signal Name
1	NC
2	Rx
3	Tx
4	NC
5	Gnd
6	NC
7	NC
8	NC
9	NC

Figure D-2 SAF-TE Disk I/O Card RS-232 Pin Signals

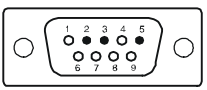
The RS-232 service ports for the RAID controllers are labeled CTRL 1 and CTRL 2. They provide a serial interface to each RAID controller for firmware uploads. You also access the Disk Array Administrator software through VT-100 emulation. Figure D-3 shows the pin signals for these ports.

CTRL 1



Pin Number	Signal Name
1	NC
2	Rx
3	Tx
4	NC
5	Gnd
6	NC
7	NC
8	NC
9	NC

CTRL 2



Pin Number	Signal Name
1	NC
2	Rx
3	Tx
4	NC
5	Gnd
6	NC
7	NC
8	NC
9	NC

Figure D-3 RAID Controller RS-232 Port Pin Signals

Null-Modem Cable

The null-modem cable is DB-9 (female) to DB-9 (female). Figure D-4 shows the pin signals.

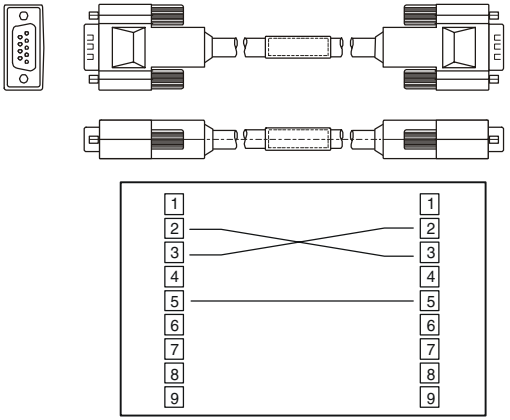


Figure D-4 DB-9 to DB-9 Type Null-Modem Cable Pin Signals

E

Technical Specifications

In this Appendix

DuraStor 412R Drive Enclosure

Operating Environment	
Operating	+40°F to +95°F (+5°C to +35°C)
Non-Operating	–4°F to +158°F (-20°C to +70°C)
Relative Humidity	
Operating/Non-Operating	5% – 95% (non-condensing)
Power Requirements	100 – 240 VAC (auto-sensing) 3.0 Amperes (maximum) 50-60 Hz 2 x 350 Watts
Dimensions (HxWxD)	3.47" x 17.65" x 20.25"
Weight (w/2 power supplies)	38.55 lbs without drives 58.00 lbs with 12 drives
Altitude	-200 to 10,000 feet
Number of Drives Supported	12 per enclosure
Total Capacity	876 gigabytes (73 GB drives)
Host Interface	Ultra320/160 SCSI
Drive Interface	SCA-80 Ultra320/160 SCSI
I/O Interface	RS-232 (Power Supply, Temperature, and Fan monitoring)
Electromagnetic Emissions Requirements (EMI)	FCC, Part 15, Class A CISPR 22 EN55022-A VCCI, BSMI
Safety Requirements	ANSI/UL60950 CSA #950
CE Compliance (EMC)	89/336/EEC EMC Directive
Shock	
Operating	1.0 G, 2 – 50 ms
Non-Operating	20.0 G, 2 – 20ms
Vibration	
Operating	5 – 500 Hz, 0.25 G (pk to pk)
Non-Operating	5 – 500 Hz, 1.0 G (pk to pk)

DuraStor 6320SS Storage Subsystem

Operating Environment	
Operating	+40°F to +95°F (+5°C to +35°C)
Non-Operating	–4°F to +158°F (-20°C to +70°C)
Relative Humidity	
Operating/Non-Operating	5% – 95% (non-condensing)
Power Requirements	100 – 240 VAC (auto-sensing) 3.0 Amperes (maximum) 50-60 Hz 2 x 350 Watts
Dimensions (HxWxD)	3.47" x 17.65" x 20.25"
Weight (w/2 power supplies)	38.55 lbs without drives 58.00 lbs with twelve drives
Altitude	-200 to 10,000 feet
Number of Drives Supported	12 per enclosure
Total Capacity	876 gigabytes (73 GB drives)
Host Interface	Ultra160 SCSI
Drive Interface	SCA-80 Ultra320/160 SCSI
I/O Interface	RS-232 (Power Supply, Temperature, and Fan monitoring)
Electromagnetic Emissions Requirements (EMI)	FCC, Part 15, Class A CISPR 22 EN55022-A VCCI, BSMI
Safety Requirements	ANSI/UL60950 CSA #950
CE Compliance (EMC)	89/336/EEC EMC Directive
Shock	
Operating	1.0 G, 2 – 50 ms
Non-Operating	20.0 G, 2 – 20ms
Vibration	
Operating	5 – 500 Hz, 0.25 G (pk to pk)
Non-Operating	5 – 500 Hz, 1.0 G (pk to pk)

DuraStor 6200S External RAID Controller

Onboard CPU	Mobile Pentium II 333 MHz, 256-KB on-chip L2 cache
Host/device data rate	160-MB/sec Ultra160 SCSI
Host interface channels	Two 160-MB/sec Ultra160 SCSI Channel (1x3 or 2x2), the default is two channels
Device interface channels	Two or three 160-MB/sec Ultra160 SCSI device channels; the default is two channels
SCSI protocol	Narrow (8-bit) or Wide (16-bit): Fast (20MB/sec), Ultra (40MB/sec), Ultra2 (80MB/sec), Ultra160 (160MB/sec)
Advanced RAID features	Active-active, host-independent failover/failback in the 2x2 configuration Write-back data cache memory bus, 800 MB/sec bandwidth On-line capacity expansion Up to 24 independent logical arrays per subsystem Spare pooling and dedicated spares; array verification Controller/drive hot swap supported Array status monitoring; adjustable stripe width; automatic sector remapping User-settable priority for array Reconstruct, Verify, Create, and Expand operations Arrays configurable as RAID levels 0, 1, 3, 4, 5, 10, 50, JBOD
Advanced hardware features	64 MB to 512 MB, PC-133 compatible SDRAM DIMM, ECC protected 16 MB ECC protected onboard SDRAM processor memory 2 MB onboard Flash memory for upgradable firmware Integrated Nickel Metal Hydride (NiMH) cache battery backup interface

Advanced SCSI features	Full backward SCSI compatibility 70 simultaneous commands and Command Queuing supported Reserve/Release (multihost ready, up to 15 initiators with single controller) Ultra160 SCSI for data transfer up to 160 MB/sec Ultra160 SCSI connection for up to 15 devices per channel (14 in active-active mode) Domain validation and CRC data protection with Ultra160
Configuration and management	Disk Array Administrator or RS-232 serial interface to ANSI terminal or terminal emulator Performance statistics monitoring; event logging, rebuild, and verify utilities SAF-TE and SMART environmental monitoring support AdminiStor support
Board form factor	4.25 in x 9.0 in PCB outline (10.80 cm x 22.86 cm) 1.1 in (2.79 cm) total height with unbuffered DIMM, 1.2 in (3.05cm) with registered DIMM
Backplane connector	376 I/O pin AMP Z-Pack HM series
Power requirements	+5.0Vdc, 6.0A typical, 8.0A max, ±5% input tolerance +12.0Vdc, 0.2A max (normal operation), 0.6A max (battery charging), ±10% input tolerance
Battery backup	3-cell NiMH Battery Pack, with integrated thermistor and overcurrent fuse.
Temperature	
Normal	+5°C to +45°C
Degraded	0°C to +5°C and +45°C to +50°C
Non-Operating	–40°C to +100°C
Humidity	
Operating	10% to 85% noncondensing
Non-Operating	5% to 90% noncondensing
Air flow	10.0 cubic-ft/min. (CFM)

DuraStor 7320SS Storage Subsystem

Operating Environment	
Operating	+40°F to +95°F (+5°C to +35°C)
Non-Operating	–4°F to +158°F (-20°C to +70°C)
Relative Humidity	
Operating/Non-Operating	5% – 95% (non-condensing)
Power Requirements	100 – 240 VAC (auto-sensing) 3.0 Amperes (maximum) 50-60 Hz 2 x 350 Watts
Dimensions (HxWxD)	3.47" x 17.65" x 20.25"
Weight (w/2 power supplies)	38.55 lbs without drives 58.00 lbs with twelve drives
Altitude	-200 to 10,000 feet
Number of Drives Supported	12 per enclosure
Total Capacity	876 gigabytes (73 GB drives)
Host Interface	FC-AL (Fibre Channel Arbitrated Loop
Drive Interface	SCA-80 Ultra320/160 SCSI
I/O Interface	RS-232 (Power Supply, Temperature, and Fan monitoring)
Electromagnetic Emissions Requirements (EMI)	FCC, Part 15, Class A CISPR 22 EN55022-A VCCI, BSMI, C-TICK
Safety Requirements	ANSI/UL60950 CSA #950
CE Compliance (EMC)	89/336/EEC EMC Directive
Shock	
Operating	1.0 G, 2 – 50 ms
Non-Operating	20.0 G, 2 – 20ms
Vibration	
Operating	5 – 500 Hz, 0.25 G (pk to pk)
Non-Operating	5 – 500 Hz, 1.0 G (pk to pk)

DuraStor 7200S External RAID Controller

Onboard CPU	Mobile Pentium II 333 MHz, 256-KB on-chip L2 cache
Host/device data rate	100-MB/sec per Fibre Channel connections (200 MB/sec Full Duplex).
Host interface channels	Two 100 MB/sec Fibre Channel ports.
FC protocol	FC-AL, point-to-point, and switched fabric support
Device interface channels	Four 160-MB/sec Ultra160 SCSI device channels
SCSI protocol	Narrow (8-bit) or Wide (16-bit): Fast (20MB/sec), Ultra (40MB/sec), Ultra2 (80MB/sec), Ultra160 (160MB/sec)
Advanced RAID features	Active-active, host-independent failover/failback in the 2x4 configuration Write-back data cache memory bus, 800 MB/sec bandwidth On-line capacity expansion Up to 24 independent logical arrays per subsystem Spare pooling and dedicated spares; array verification Controller/drive hot swap supported Array status monitoring; adjustable stripe width; automatic sector remapping User-settable priority for array Reconstruct, Verify, Create, and Expand operations Arrays configurable as RAID levels 0, 1, 3, 4, 5, 10, 50, JBOD
Advanced hardware features	64 MB to 512 MB, PC-133 compatible SDRAM DIMM, ECC protected 16 MB ECC protected onboard SDRAM processor memory 2 MB onboard Flash memory for upgradable firmware Integrated Nickel Metal Hydride (NiMH) cache battery backup interface

Advanced FC features	Dual port embedded multitasking RISC protocol engines 2 gigabit/sec Fibre Channel arbitrated loop and switched fabric support Full duplex send and receive payload buffers capable of 1 gigabit/sec speed Supports 64-bit PCI data path to deliver bandwidth up to 266 MB/sec per channel Class 3 connection with FCP (SCSI) protocols (class 1 and 2 capable) Greater than 500 concurrent active exchanges with rapid command context change
Advanced SCSI features	Full backward SCSI compatibility 70 simultaneous commands and Command Queuing supported Reserve/Release (multihost ready, up to 15 initiators with single controller) Ultra160 SCSI for data transfer up to 160 MB/sec Ultra160 SCSI connection for up to 15 devices per channel (14 in Active-Active mode) Domain validation and CRC data protection with Ultra160
Configuration and management	Fibre Channel or RS-232 serial interface to ANSI terminal or terminal emulator Menu-based text interface over LCD Operator Panel Performance statistics monitoring; event logging, rebuild, and verify utilities SAF-TE and SMART environmental monitoring support AdminiStor support
Board form factor	4.25 in x 9.0 in PCB outline (10.80 cm x 22.86 cm) 2.7 in x 4.7 in daughter board PCB board outline (6.86 cm x 11.94 cm) 1.1 in (2.79 cm) total height with unbuffered DIMM, 1.2 in (3.05cm) with registered DIMM
Backplane connector	376 I/O pin AMP Z-Pack HM series

Power requirements	+5.0Vdc, 6.0A typical, 8.0A max, ±5% input tolerance +12.0Vdc, 0.2A max (normal operation), 0.6A max (battery charging), ±10% input tolerance
Battery backup	3-cell NiMH Battery Pack, with integrated thermistor and overcurrent fuse.
Temperature	
Normal	+5°C to +45°C
Degraded	0°C to +5°C and +45°C to +50°C
Non-Operating	–40°C to +100°C
Humidity	
Operating	10% to 85% noncondensing
Non-Operating	5% to 90% noncondensing
Air flow	10.0 cubic-ft/min. (CFM)

Glossary

A

active-active
Active-active mode is when two controllers in an external subsystem cooperate to provide redundancy. If one controller fails, the remaining controller will take over the failed controller's functionality. To accomplish this, each controller has two host SCSI ports, one of which is normally active, the other normally passive. In a failed-over configuration, the passive port becomes active and assumes the identity of the failed controller. In active-active mode, arrays can be accessed only by the controller that currently owns them. One controller will have no visibility of the other controller's arrays. Disk drives in the spare pool and unassigned disk drives are visible to both controllers.

array
Two or more physical drives grouped together to appear as a single device (logical drive) to the user. Also known as a container.

B

bus
See channel.

C

channel
Any path used for the transfer of data and the control of information between storage devices and a storage controller. Each controller's channels are identified by a number. They are numbered in enter short product name starting with number 0. Also known as a bus. *See also* LUN (logical unit number).

controller
A hardware device that performs I/O functions. Controllers also perform other functions such as read and write caching and RAID management. Also known as an adapter, embedded storage controller, or subsystem.

D

disk array
See array.

disk drive
A physical disk drive on a SCSI bus. Drives are addressed by their disk ID, which includes the channel (bus) number, SCSI ID, and LUN. *See also* channel; LUN (logical unit number).

E

enclosure
A physical housing for drives, which can be connected internally or externally to a computer. An enclosure usually contains one or more power supplies, fans, and temperature sensors. The term enclosure also applies to a SAF-TE-compliant backplane.*See also* SAF-TE (SCSI Accessed Fault-Tolerant Enclosure).

F

failback
In active-active mode, failback is the act of returning ownership of controller resources from a surviving controller to a previously failed (but now active) controller. The resources include disk arrays, cache data, and host ID information.

failover
In active-active mode, failover is the act of temporarily transferring ownership of controller resources from a failed controller to a surviving controller. The resources include disk arrays, cache data, and host ID information.

fibre channel
A high-performance connection standard designed for bidirectional, serial data communication. FC provides long-distance connectivity and high bandwidth for efficiently moving large data files.

H

HBA (host bus adapter)
An HBA is the critical link between a host server or workstation and a subsystem, integrating computing platforms, OSs, and I/O protocols to ensure proper interoperability and functionality. The bus adapter provides direct storage connectivity from the system to data within the subsystem and enables stable, high-speed transmission of information and files. HBAs manage the controller-specific aspects of handling a storage driver interface device implemented as a target driver, which supports mass storage peripheral devices such as disks and tapes. A storage driver interface is used to implement SCSI and other storage device drivers. An HBA connects the storage subsystem to the host computer and uses either fiber or copper media.

hot-swapping
Removing a component from a system and installing a new component while the power is on, the system is running, and without pausing I/O.

K

kill
In active-active mode, one controller can kill the other controller by resetting it and taking it offline.

L

LUN (logical unit number)
The number assigned to a subdevice (logical unit) of a SCSI device. Each SCSI device can contain up to eight subdevices numbered 0 through 7; however, most SCSI devices contain only one subdevice (LUN 0).

LVD (low voltage differential)
LVD is a method of powering SCSI cables that will be formalized in the SCSI-3 specifications. LVD uses less power than the current differential drive (HVD), is less expensive, and allows for higher speeds such as those of Ultra2 SCSI. LVD requires 3.3 volts (versus 5 volts for HVD).

O

ownership
In an active-active configuration, each controller has ownership of arrays and dedicated spares. If one controller fails, the other controller assumes temporary ownership of its arrays and dedicated spares.

P

PSU
Stands for Power Supply Unit.

S

SAF-TE (SCSI Accessed Fault-Tolerant Enclosure)
The SAF-TE specification is an open specification designed to provide a comprehensive standardized method to monitor and report status information on the condition of disk drives, power supplies, cooling systems, and other components used in high-availability LAN servers and subsystems. *See also* enclosure.

SAN (Storage Area Network)
A high-speed, special-purpose network that interconnects different data storage devices with data servers, on behalf of a larger network of users.

SCSI (Small Computer System Interface)
SCSI is an industry standard for connecting peripheral devices and their controllers to an initiator. Storage devices are daisy-chained together and connected to an HBA. The HBA provides a shared bus that attached peripherals use to pass data to and from the host system. Examples of devices attached to the HBA include disk drives, CD-ROM drives, optical disk drives, and tape drives. In

theory, any SCSI device can be plugged into any SCSI controller. *See also* HBA (host bus adapter).

SCSI adapter
A SCSI adapter is a 16-bit fast/wide or 8-bit narrow, single-ended or differential physical connection between a router and SCSI devices. Each SCSI adapter supports up to 16 (fast/wide) or 8 (narrow) SCSI devices, including itself.

SCSI bus
A SCSI bus provides a means of transferring data between SCSI devices. A SCSI bus is either an 8- or 16-bit bus that supports up to 8 or 16 devices, including itself. The bus can consist of any mix of initiators and targets, with the requirement that at least one initiator and one target must be present.

SCSI device
A SCSI device is a single unit on a SCSI bus that originates or services SCSI commands. A SCSI device is identified by a unique SCSI address. SCSI devices can act as initiators or targets.

SCSI port
A SCSI port is an opening at the back of a router that provides connection between the SCSI adapter and SCSI bus.

slot
A receptacle in an enclosure for inserting and removing a SCSI device.

spin-up
Disk drives operate at a specific speed, for instance 10,000 rotations per minute. When power is applied to a disk drive, it *spins up* (starts spinning and spins at increasing speeds) to reach this final operating speed.

stand-alone
Stand-alone mode is when only one controller is used in an external subsystem.

U

unkill
In active-active mode, when a surviving controller removes the reset from the other controller, it unkills it. The other controller will reboot and attempt to come online.

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Adaptec, Inc.
691 South Milpitas Boulevard
Milpitas, CA 95035 USA

Part Number: 513282-06, Ver. AA, RF 07/02