Compaq StorageWorks

HSZ70 Solutions Software V7.7 for Novell NetWare - PCI

Installation Guide

AA-R8JUE-TE

First Edition (June 2000)
Compaq Computer Corporation

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About This Guide

This guide is designed to be used as step-by-step instructions for installation and as a reference for operation, troubleshooting, and future upgrades. The following information is provided in this guide:

- How to unpack and assemble the RA7000 Subsystem.
- How to create your first volume.
- How to complete your configuration setup.

Text Conventions

This document uses the following conventions to distinguish elements of text:

Keys	Keys appear in boldface. A plus sign (+) between two keys indicates that they should be pressed simultaneously.
USER INPUT	User input appears in a different typeface and in uppercase.
FILENAMES	File names appear in italics.
Menu Options, Command Names, Dialog Box Names	These elements appear in initial capital letters and bolded.
COMMANDS, DIRECTORY NAMES, and DRIVE NAMES	These elements appear in italics.

Type	When you are instructed to *type* information, type the information **without** pressing the **Enter** key.
Enter	When you are instructed to *enter* information, type the information and then press the **Enter** key.

Table 1
Nomenclature Convention

RAID Advisory Board Description	RAID HSZ70 Solutions Usage
RAID 0	STRIPEset
RAID 1	MIRRORset
RAID 0+1	STRIPED MIRRORset
RAID 5/3	RAIDset

Symbols in Text

These symbols may be found in the text of this guide. They have the following meanings.

WARNING: Text set off in this manner indicates that failure to follow directions in the warning could result in bodily harm or loss of life.

CAUTION: Text set off in this manner indicates that failure to follow directions could result in damage to equipment or loss of information.

IMPORTANT: Text set off in this manner presents clarifying information or specific instructions.

NOTE: Text set off in this manner presents commentary, sidelights, or interesting points of information.

Symbols on Equipment

These icons may be located on equipment in areas where hazardous conditions may exist.

Any surface or area of the equipment marked with these symbols indicates the presence of electrical shock hazards. Enclosed area contains no operator serviceable parts.

WARNING: To reduce the risk of injury from electrical shock hazards, do not open this enclosure.

Any RJ-45 receptacle marked with these symbols indicates a Network Interface Connection.

WARNING: To reduce the risk of electrical shock, fire, or damage to the equipment, do not plug telephone or telecommunications connectors into this receptacle.

Any surface or area of the equipment marked with these symbols indicates the presence of a hot surface or hot component. If this surface is contacted, the potential for injury exists.

WARNING: To reduce the risk of injury from a hot component, allow the surface to cool before touching.

Power Supplies or Systems marked with these symbols indicate the equipment is supplied by multiple sources of power.

WARNING: To reduce the risk of injury from electrical shock, remove all power cords to completely disconnect power from the system.

Cabinet Stability

WARNING: To reduce the risk of personal injury or damage to the equipment, be sure that:

- The leveling jacks are extended to the floor.
- The full weight of the cabinet rests on the leveling jacks.
- The stabilizing feet are attached to the cabinet if it is a single cabinet installation.
- The cabinets are coupled together in multiple cabinet installations.
- Only one component is extended at a time. A cabinet may become unstable if more than one component is extended for any reason.

Getting Help

If you have a problem and have exhausted the information in this guide, you can get further information and other help in the following locations.

Compaq Technical Support

You are entitled to free hardware technical telephone support for your product for as long you own the product. A technical support specialist will help you diagnose the problem or guide you to the next step in the warranty process.

In North America, call the Compaq Technical Phone Support Center at 1-800-OK-COMPAQ. This service is available 24 hours a day, 7 days a week. For continuous quality improvement, calls may be recorded or monitored.

Outside North America, call the nearest Compaq Technical Support Phone Center. Telephone numbers for world wide Technical Support Centers are listed on the Compaq website. Access the Compaq website by logging on to the Internet at http://www.compaq.com

Be sure to have the following information available before you call Compaq:

- Technical support registration number (if applicable)
- Product serial number (s)
- Product model name(s) and numbers(s)
- Applicable error messages

- Add-on boards or hardware
- Third-party hardware or software
- Operating system type and revision level

Compaq Website

The Compaq website has information on this product as well as the latest drivers and Flash ROM images. You can access the Compaq website by logging on to the Internet at http://www.compaq.com /products/StorageWorks

Compaq Authorized Reseller

For the name of your nearest Compaq Authorized Reseller:

- In the United States, call 1-800-345-1518.
- In Canada, call 1-800-263-5868.
- Elsewhere, see the Compaq website for locations and telephone numbers.

Revision Record

This Revision Record provides a concise publication history of this manual. It lists the manual version levels, release dates, and a summary of changes.

The following revision history lists all revisions of this publication and their effective dates. The publication part number is included in the Revision Level column, with the last entry denoting the latest revision. This publication supports the StorageWorks RA7000 Subsystem.

Revision Level	Date	Summary of Changes
AA–R8JUA–TE	October, 1997	Initial release.
AA–R8JUB-TE	April, 1998	This release adds Chapter 4 (*Installing the Command Console Client*) and Chapter 5 (*Using the Command Console to Configure a STORAGEset*) to the guide.
AA–R8JUC-TE	November, 1998	This release adds support for HSOF 7.1 firmware
AA-R8JUD-TE	April 1999	This release supports HSOF V7.3 firmware.

Chapter 1

Unpacking and Setting Up Your RA7000 Subsystem

This chapter describes the site preparation and unpacking procedures for the RA7000 Subsystem. It also describes how to install disk StorageWorks Building Blocks (SBBs).

Unpacking and setting up your RA7000 Subsystem components requires the following major steps:

- Host adapter requirements
- Preparing a site
- Unpacking
- Installing disk SBBs in the RA7000 Storage Cabinet

Host Adapter Installation Requirements

Verify that you have a supported host adapter installed in your Novell NetWare Server system. See Table 1-1 for supported host adapter.

Table 1-1
Supported Host Adapter

Platform	Host Adapter
Netware 4.2 and 5.1, PCI Intel	SWXA3-BD

Install the host adapter in an available PCI slot according to the instructions provided with the host adapter or the Intel-Based System.

CAUTION: Do not attach the host to controller cable connector between the host adapter and the subsystem until you get to the procedure in this document the directs you to make the connection.

Site preparation

Before installing the RA7000 Subsystem, make sure that adequate space is available in front of the cabinet for opening the front door (19 inches clearance) and around the cabinet for adequate airflow. See Figure 1-1 for specific space requirements.

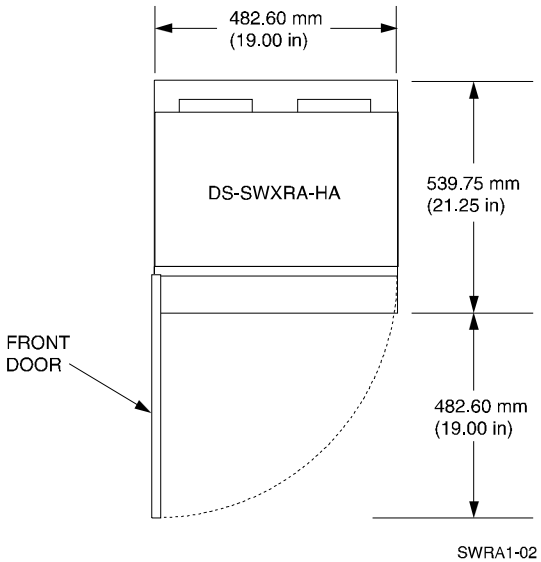

Figure 1-1. Minimum installation clearance measurements

Unpacking

The RA7000 Subsystem is packed in a corrugated carton attached to a wooden shipping pallet, as shown in Figure 1-2 A. Unpack the unit as follows:

NOTE: Before unpacking the equipment, inspect the shipping carton for signs of external damage. Report any damage to the local carrier and to your sales representative.

1. Remove the shipping straps (Figure 1-2 A).
2. Remove the top cover (Figure 1-2 B).
3. Remove the ramp from the top of the shipping carton (Figure 1-2 B) and set it aside for subsequent use in moving the cabinet off the pallet.
4. Remove the two foam cushions from the top of the cabinet container (Figure 1-2 B).
5. Remove the sealed cardboard box packed beside the subsystem unit. It contains cable and documentation.
6. Remove the cardboard carton surrounding the cabinet (Figure 1-2 B).
7. Remove the plastic barrier bag (Figure 1-2 C).
8. Once the cabinet is exposed (Figure 1-2 D), examine the equipment for any apparent damage. Report problems immediately to your sales representative.

Removing the RA7000 Subsystem Storage Cabinet from the Pallet

Use the following procedure to remove the RA7000 Subsystem Storage Cabinet from the Shipping pallet:

WARNING: Serious personnel injury can result if correct safety precautions are not taken during the removal procedure.

We recommend that three people perform the task of unloading the RA7000 Subsystem Storage Cabinet from its shipping pallet. Failure to use sufficient personnel can result in personnel injury and equipment damage.

CAUTION: Do not drop the cabinet from a height of more than two inches, as serious structural damage to the cabinet can result

1. Attach the ramp to the shipping pallet by fitting the lip of the ramp into the groove on the pallet, as shown in Figure 1-3.
2. Lift the lock lever on each front caster to its *up* position so you can move the cabinet.

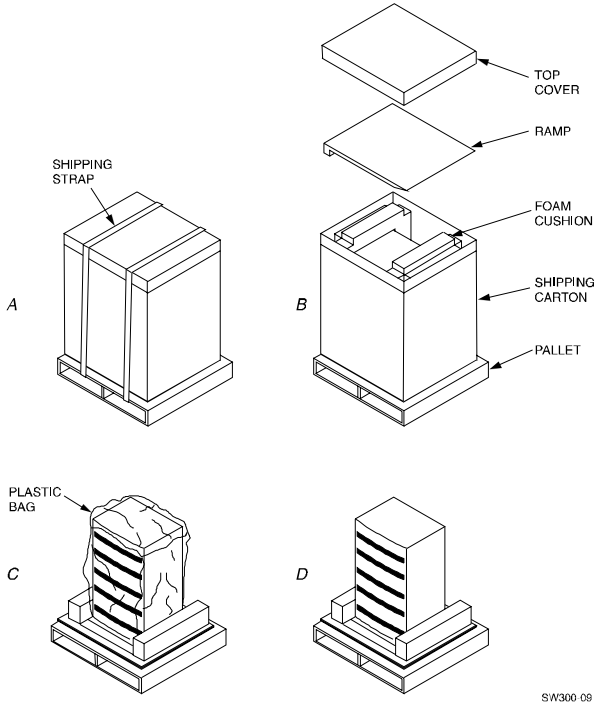

Figure 1-2. Unpacking the RA7000 subsystem storage cabinet

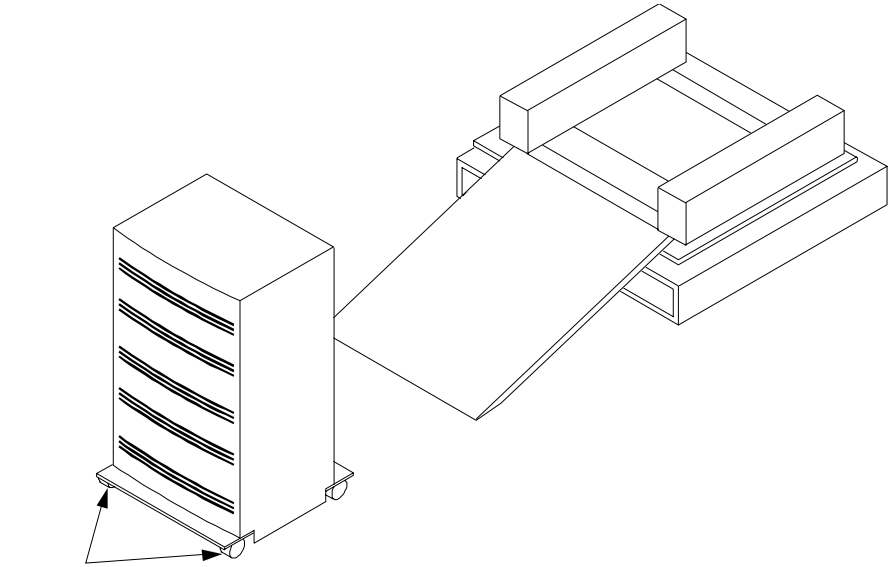

Figure 1-3. Installation of ramp on shipping pallet

3. Grasping the sheet metal base assembly, carefully lift the rear of the cabinet over the "hump" in the center of the pallet and then roll the cabinet off the pallet and down the ramp to the floor. If any further lifting of the cabinet is required, grasp the sheet metal base assembly on the side and lift it carefully.

4. Retain the shipping container and all packing materials.

Placing the RA7000 Subsystem Storage Cabinet

Use the following procedure to move the cabinet to its designated site:

WARNING: To prevent damage to the RA7000 Subsystem Storage Cabinet and injury to personnel, make sure to provide a clear path for the casters.

1. Roll the cabinet to the desired location.
2. If required, engage the lock on each front caster to prevent the cabinet from moving.
3. Figure 1-4 displays a fully configured subsystem with a 24 SBB BA370 Rack-Mountable Enclosure in a Storage Cabinet with the following major components:

- Up to two HSZ70 controllers
- Environmental Monitor Unit (EMU) (1)
- AC Power controllers (2)
- SBB Power Supplies (8)
- SSB Disk Drives (24)
- SBB External Cache Batteries (1)
- Dual-Speed Blowers (8)
- I/O Modules (6)
- Power Verification and Addressing (PVA) Module (1)
- Up to two Cache Modules

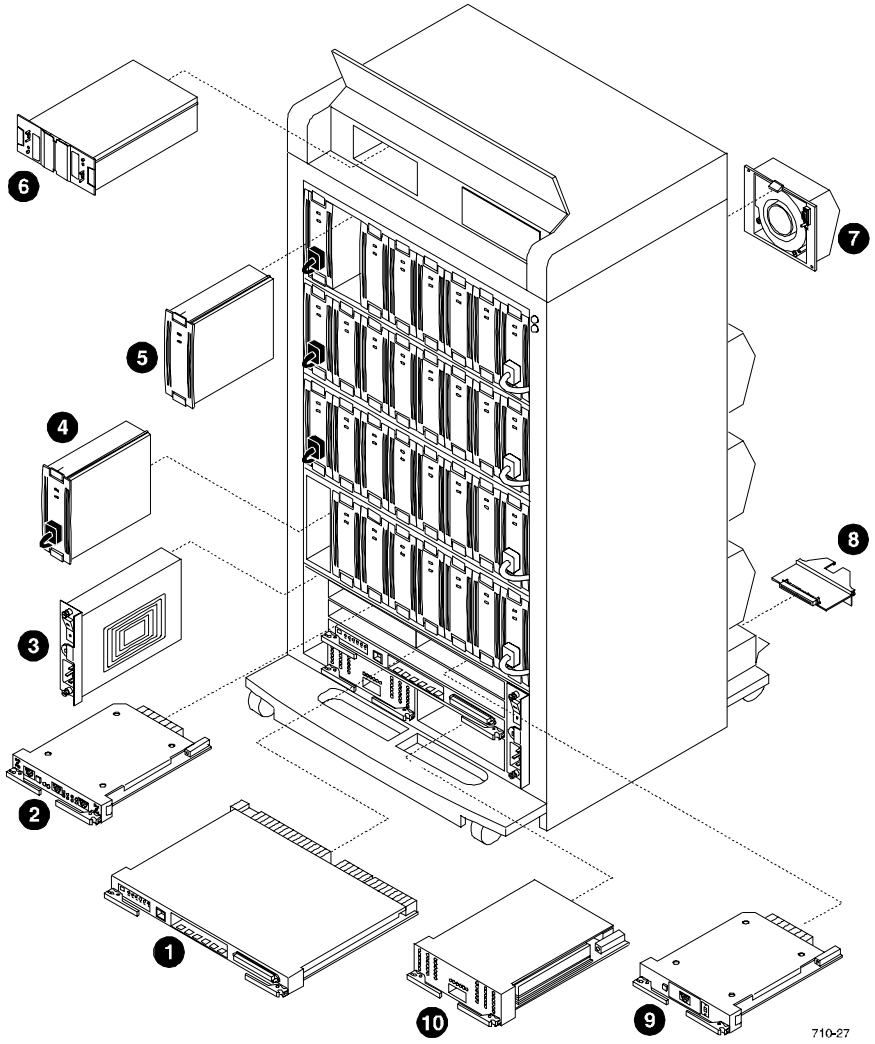

Figure 1-4. RA7000 subsystem major components (typical)

Installing Disk SBBs in the RA7000 Subsystem Storage Cabinet

You can install disk SBBs in the RA7000 Subsystem Storage Cabinet at this time. (Disk SBBs should be installed prior to other installation steps.) The subsystem cabinet supports wide (16-bit) storage devices. We recommend that you install SBBs in the cabinet from left to right, bottom to top (as viewed facing the front of the cabinet). To install an SBB, hold it in both hands, insert it into the guide slots, and firmly push it into the shelf until the mounting tabs snap in place. Installing the SBBs in this sequence distributes the SBBs among the SCSI buses of the Storage Cabinet.

Additional configuration rules for the SCSI buses include:

- All devices and buses in the same column are on the same SCSI bus
- All devices in the same row (device shelf) have the same device address
- You may install controller-compatible 16-bit storage SBBs
- Device addresses are determined by the backplane connector into which the device is inserted, unless the SBB has a device address switch

Figure 1-5 shows the six wide (16-bit) SCSI buses and the device addresses. Refer to Chapter 3, *Configuring the Storage Cabinet*, in the *RA7000 and ESA10000 Storage Subsystems User Guide* (EK–SMCPP–UG), for additional information.

Installing the Program Card

1. Turn on the subsystem power.
2. Insert the program card while pressing and holding the controller Reset button. The Controller will initialize and perform all internal self tests.
3. When the Reset LED flashes at a rate of once every second, the initialization process is complete.
4. Snap the ESD cover into place over the program card. Push inward to lock the cover in place.

If your subsystem has no controllers, or only one controller and you would like to install a second dual-redundant controller, go to Appendix A, *Installing Upgrades on Your RA7000 Subsystem*, to continue the installation by installing the controllers. Otherwise, go to Chapter 2, *Installing the Host Adapter — Intel-Based System.*

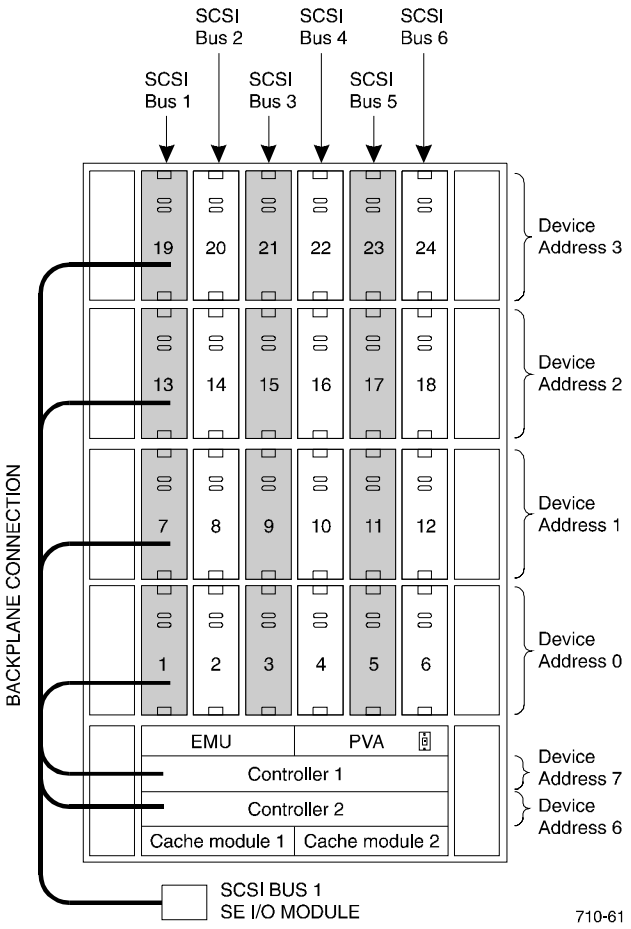

Figure 1-5. SCSI buses

Chapter 2

Installing the Host Adapter - in an Intel-Based System

When preparing your array for first time use, you need to connect your Intel-Based system to the RAID subsystem through a host adapter board. This chapter, along with your system and the associated StorageWorks RA7000 Storage Subsystem manuals, provides instructions for preparing, installing, and connecting the host adapter.

Host Adapter Description

The host adapter qualified for use with your StorageWorks RA7000 Storage Subsystem for NetWare is the SWXA3–BD Ultra-Wide Differential Host Adapter, shown in Figure 2-1. See Table 2-1 for the exact specifications of the qualified host adapter.

Table 2-1
StorageWorks RA7000 NetWare Qualified Adapter Specifications

PCI Adapter	BIOS Revision	NW V4.11 Driver
SWXA3-BD	1.25	AIC7870.dsk

The adapter connects your host computer to the StorageWorks RA7000 Storage Subsystem through a BN38E–0B Technology Adapter cable and a connecting SCSI cable.

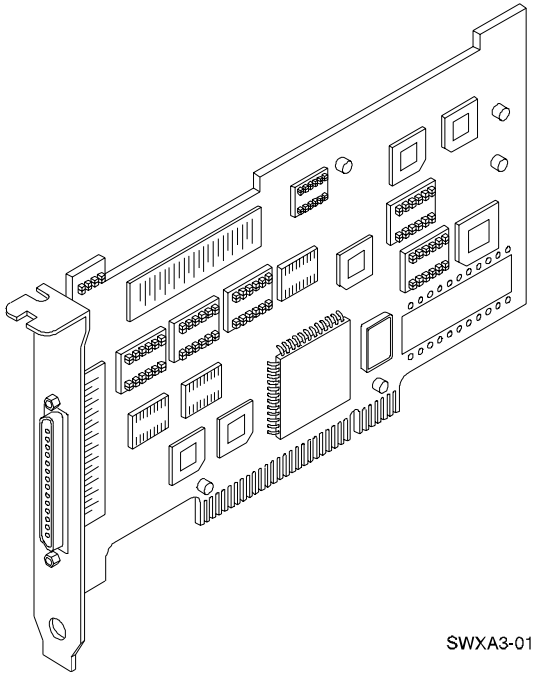

Figure 2-1. SWXA3-BD differential host adapter

Before You Install the Host SCSI Adapter

You need the following items before you begin:

- The host adapter (SWXA3–BD)
- Your computer system hardware manual for reference information
- Host adapter Installation Guide
- Appropriate tools to access your computer
- Technology Adapter Cable (BN38E–0B) — HD68 to VHDCI
- The SCSI cable (BN37A–05), with VHDCI connectors on each end
- HSZ70 Solution Software CD-ROM for NetWare located in the platform kit (contains the *AIC7870.dsk* Driver)

Before installing the adapter in your host system, take precautions to protect the board from electrostatic discharge.

CAUTION: To protect the board from static discharge, always use proper ESD procedures. In addition, do not remove the board from its anti-static protective cover until you are ready to install the adapter.

The major steps for installing the SCSI Host Adapter include:

- Performing the physical installation
- Connecting the SWXA3–BD to the RA7000 subsystem
- Configuring your host adapter (Chapter 3)
- Installing the SWXA3–BD device driver (Chapter 3)

Performing the Physical Installation of the Host Adapter

To physically install the host adapter:

1. Shut down the operating system running on your host computer.
2. When the operating system has shut down, turn off the power to the host computer and all attached peripherals. Then, disconnect power cables from the host computer.

WARNING: Failure to remove power from the host computer and peripherals can introduce a personal hazard, or can result in damage to the host computer with loss of stored data.

3. Open the computer to gain access to the motherboard. Refer to your computer system manual for assistance in completing this procedure.
4. Locate an available PCI expansion slot, and remove the blank filler panel corresponding to that expansion slot at the rear of the system. Retain the screw that held it in place. You need the screw to secure the SWXA3–BD adapter as specified in Step 5 of this procedure.
5. Install the SWXA3–BD Host Adapter Board in a PCI slot in your system, as shown in Figure 2-2. Ensure that the board end plate metal tab aligns in the system chassis opening properly, otherwise the adapter will not seat correctly. Secure the board to the system chassis with the screw you removed from the blank filler panel.

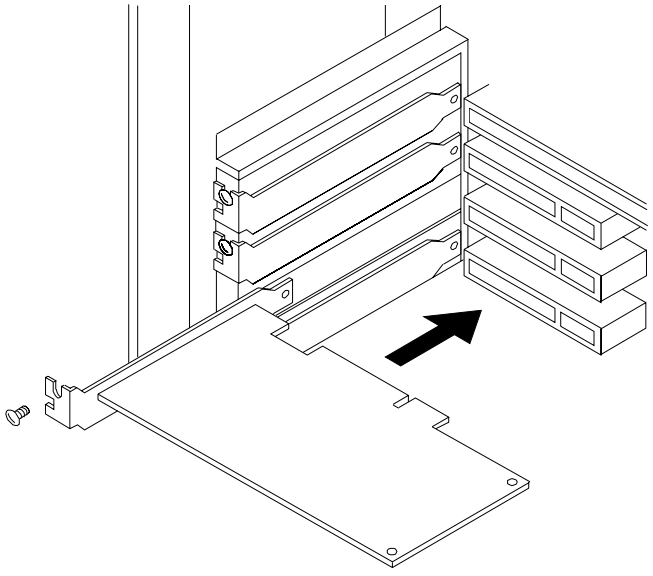

Figure 2-2. Installing the SWXA3-BD host adapter

6. Replace the computer cover. Refer to your host computer manual.

This completes the physical installation of the SWXA3–BD adapter. Later in this installation process, you will power on your system, configure the adapter, install the device driver for the SWXA3–BD Host Adapter.

Connecting the SWXA3-BD to the RA7000 Subsystem

Connect the SWXA3–BD Host Adapter to the RAID Controller in the RA7000 subsystem as follows:

1. Connect the large, thumbscrew-equipped connector on the BN38E–0B Technology Adapter Cable to the SWXA3–BD Host Adapter connector as shown in Figure 2-3.

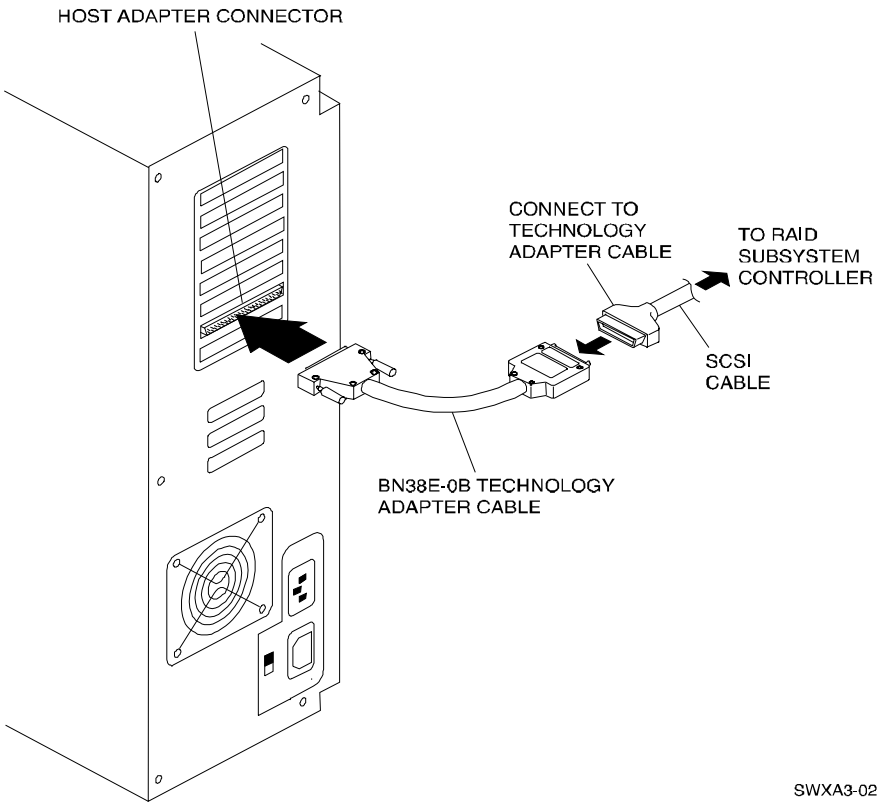

Figure 2-3. Connecting BN38E-0B technology adapter cable to host adapter and SCSI cable

2. Connect the small connector on the BN38E–0B Technology Adapter Cable to either of the BN37A–05 SCSI cable connectors.
3. If necessary, unlock the RAID array subsystem enclosure.
4. Turn off AC power to the subsystem enclosure.
5. Plug a trilink connector into the controller as shown in Figure 2–4 and tighten the thumbscrews.
6. Route the connector of the SCSI bus cable from the host under the subsystem enclosure and up through the front access hole closest to the connector on the trilink connector. Connect the SCSI bus connector to either of the SCSI bus connectors on the trilink connector as shown in Figure 2–4.
7. Install a terminator on the remaining SCSI bus connector of the trilink as shown in Figure 2-4.

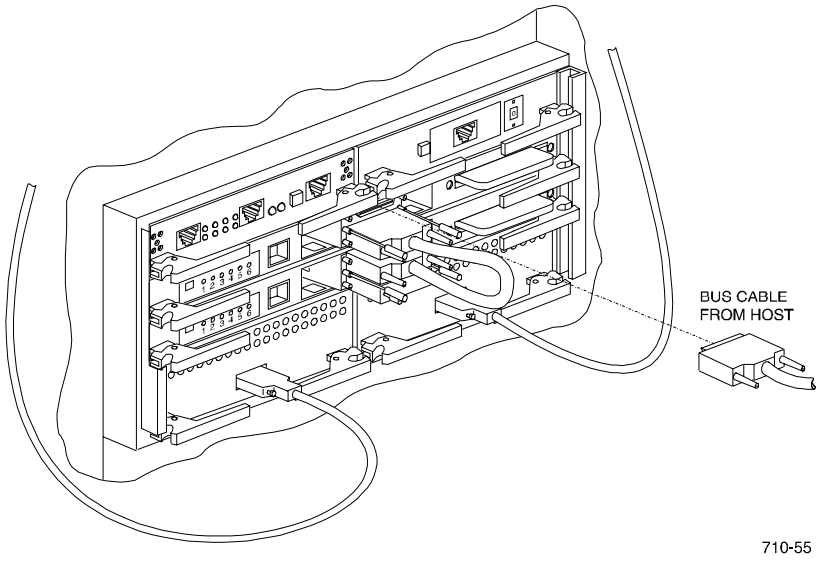

Figure 2-4. SCSI cable connection o trilink on controller

Chapter **3**

Preparing Your Novell NetWare Host for Use with the HSZ70

This chapter contains instructions for configuring your host adapter and installing the SWXA3–BD/Ultra PCI Miniport Device Driver in your host system.

Configuring Your Host Adapter

1. Boot your computer, and when you see the prompt to access the 2944 BIOS setup, press Ctrl+A. Watch closely, the prompt appears quickly at the bottom of the screen during the boot routine.
2. Select **`Configuration/View Host Adapter Settings`** and press **Enter**.
3. Press **F6** to set the adapter to its default settings.
4. Select **`SCSI Device Configuration`** and press **Enter**.
5. Choose **`Yes`** for **`Send Start Unit Command`** for all Target IDs.
6. Verify that **`Initiate Wide Negotiation`** settings are set to **`Yes`**.
7. Press **Esc** to return to the *Configuration Menu Screen*.
8. Select **`ADVANCED CONFIRMATION OPTIONS`** and press **Enter**.
9. Set **`Support for Ultra SCSI Speed`** to **`Enabled`**.
10. Save the configuration and exit the BIOS setup.

NOTE: Your platform kit includes the required adapter-specific software. Use only the adapters and drivers supplied with the platform kit since these are tested and certified to function with the HSZ70 RAID Controller.

The NetWare SCSI Disk driver for a PCI SCSI-2 adapter is the Adaptec SCSI disk driver AIC7870.DSK. This driver is located on the HSZ70 Solution Software V7.3 CD-ROM for NetWare CD-ROM that is supplied with the platform kit.

To install and load AIC7870.DSK:

1. If the server is running NetWare, power down the NetWare.
2. Insert the HSZ70 Solution Software V7.3 CD-ROM in the CD-ROM drive on the server.
3. Make the directory for the drive containing the CD-ROM the current directory.
4. At the MS-DOS prompt, type:

   ```
   CD \NETWARE\V4_XX
   ```

5. Copy Adaptec 2944 drivers for NetWare into the directory containing SERVER.EXE.

If SERVER.EXE is in the C:\SERVER.4X directory, at the MS-DOS prompt type:

```
COPY *.* C:\SERVER.4X
```

NOTE: See Appendix C for additional information about the STARTUP.NCF file.

6. To the STARTUP.NCF file, add a line similar to the following for loading:

   ```
   load aic7870.dsk lun_enable=ff multlun_targets=ff io_timeout=30 io_retries=10
   ```

The **`io-timeout`** and **`io_retries`** are only required for dual HSZ controller support.

Creating a Boot Partition (Optional)

1. Before creating a boot partition, make sure that the disks you intend to use to create the partition do not contain any unwanted partition data. If you are creating the boot partition from used disks, it is recommended that you use the DOS fdisk utility to delete all partitions.
2. Create the desired type of storageset for the boot partition. The boot partition must be assigned as SCSI Target ID 0, LUN 0.
3. Load NetWare on the newly created partition.

   NOTE: Before creating a mirrorset (RAID 0) or a Stripe Mirrorset (RAID 0 + 1), make sure that the cache backup batteries are fully charged. If not, these RAID levels will not be available.

4. Before you can gain access to the RAID 7000 with NetWare, the HSZ host mode functionality must be set to B (see Chapter 7).

Chapter 4

Installing the Command Console Client

This Chapter covers how to install, launch, and use Command Console Client.

Installing Command Console Client

Command Console Client installs from a CD-ROM disk using a standard Windows installation routine on a Windows 95 or Windows NT platform. The program is self-extracting and stores Command Console Client into the directory `C:\Program Files\SWCC` by default. During setup, you have the option to change the disk or directory location.

> **NOTE:** If you are upgrading to a new version of Command Console Client, run Add/Remove Programs in Control Panel to remove previous version before installing the new version.

To install the Command Console software components:

1. Place the software CD labeled *HSZ70 Solution Software for NetWare* in the CD-ROM Drive.
2. Run File Manager or Windows Explorer and open the CD-ROM drive.
3. Navigate to the folder: *\Swcc\Client\Ccmgr*
4. Double-click Setup. This will install the Command Console Manager.
5. Navigate to the folder: *\Swcc\Client\Hsz*
6. Double-click Setup. This will install the HSZ Storage Window component.

Command Console Client installs the Program Group *Command Console V2.1* and places three icons within the group (Figure 4-1). Client also inserts three selections on the Start menu (Figure 4-2).

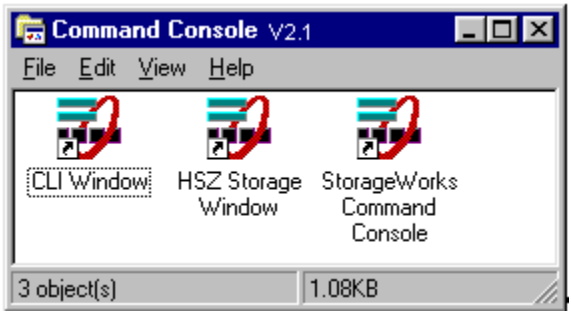

Figure 4-1. Command console program group

Figure 4-2. Command Console Client's start menu

The three choices Client provides you with are:

- **CLI Window:** Displays the CLI Window. The CLI window lets you monitor and configure storage subsystems using text commands. All connection choices are provided: serial line, SCSI bus and network (TCP/IP).
- **HSZ Storage Window:** Displays the Storage Window. This choice lets you monitor and configure storage subsystems using Client's graphical user interface. All connection choices are provided: serial line, SCSI bus and network (TCP/IP).

- **StorageWorks Command Console:** Displays the Navigation Window. The Navigation Window is a network navigation tool used to manage and monitor storage subsystems over a TCP/IP network. This choice lets you monitor and configure one or many storage subsystems over a network using Client's graphical tools.

  NOTE: NetWare only works with a direct connection to a storage subsystem. Therefore, the network navigation tool choice is not applicable. It is not, however, disabled and it will run. You will not be able to make a connection with it. Use either CLI or HSZ choices.

Uninstalling StorageWorks Command Console

Before you install a new version of Client, remove the old version:

1. From the **Start Programs** menu select **Settings**, then **Control Panel**.
2. Double-click on the **Add/Remove Programs** icon.
3. Select Command Console applets from the list by clicking on them, then click the **Add/Remove** button.

Selection should no longer appear in display window.

Starting Command Console Client

Command Console Client provides you with three applet choices: *HSZ Storage Window*, *CLI Window*, and *StorageWorks Command Console*. Choosing *HSZ Storage Window* applet allows you to connect to only one storage subsystem at a time. The *CLI Window* applet allows you to communicate with a storage unit using the Command Line Interface. ***StorageWorks Command Console* does not work with NetWare. Do not use it.** To start one of the applets, double-click on the applet's icon in the *Command Console V2.1* program group or, from the **Start** menu, select the applet's name.

If you select the *HSZ Storage Window* applet, Client displays the *Connection Selection* dialog box (Figure 4-3). This selection lets you connect locally to your storage subsystem over a serial line. SCSI bus or TCP/IP network connections do not apply to NetWare.

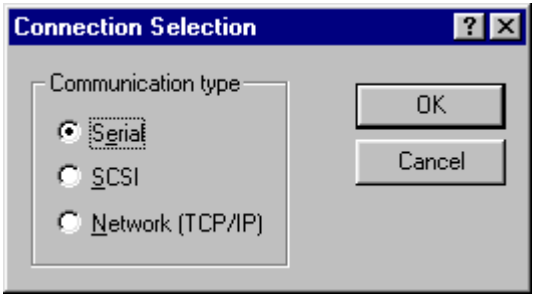

Figure 4-3. Connection Selection for a single storage subsystem

Choosing a Connection Method

Client offers three ways to connect to your storage subsystem: over the controller's serial port, the SCSI bus (Windows NT Only) or over a TCP/IP network (does not apply to NetWare). The serial port and SCSI bus connections are local connections and allow you to connect to only one storage subsystem at a time.

Establishing a Serial Connection

The simplest connection to a storage subsystem is a direct, cable connection from the Client's host system to one of the storage subsystem's serial ports. To establish a serial connection, connect a serial cable from one of the PC's COM ports to the storage subsystem's serial configuration port and proceed as follows:

1. Select the **HSZ Storage Window** applet.
2. When the Connection Selection dialog box displays, click the **Serial radio button**, then click **OK** to display the Connect Serial dialog box (Figure 4-4).
3. On the Serial Connection dialog box, from the drop-down menu, select the **PC COM** port your controller is connected to, a subsystem physical and grid view, and a baud rate. Next click **Connect** to display the Storage Window. When the Storage Window displays, you are connected to your storage subsystem.
4. The default baud rate for the storage subsystem is 9600. Make sure you set up your terminal emulation for 9600 the first time you use it.

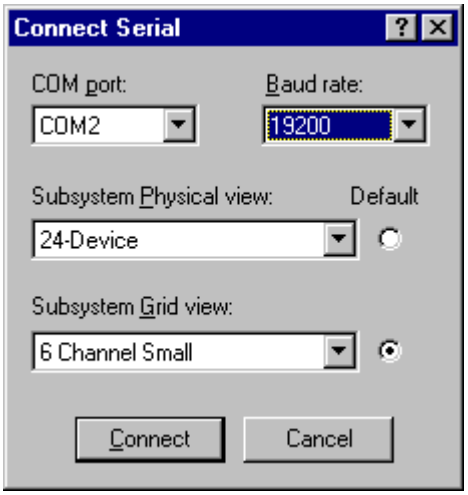

Figure 4-4. Connect Serial dialog box

Chapter 5

Using the Command Console to Configure a STORAGEset

This chapter describes how to create an initial configuration for your RAID Controller using the Command Console Client Graphical User Interface. The configuration steps include:

- Adding systems
- Adding physical devices
- Creating and initializing a RAIDset
- Identifying the storageset as volumes to the host
- Saving the configuration.

What is Command Console?

The Command Console (CC) Client is a Graphical User Interface (GUI) for StorageWorks Controllers. **Command Console Client** is the GUI program designed for use on systems running the Microsoft Windows NT or Windows 95 Operating Systems. It provides a user-friendly method of configuring, operating, monitoring, and troubleshooting your storage subsystem.

NOTE: Command Console Agent is a companion program that enables the CC Client to communicate with your storage subsystems over a network. NetWare does not use this feature of the Command Console package.

The CC Client connects to your storage subsystem via a serial connection. It sends CLI commands to your subsystem's Controllers as you perform subsystem configuration, operation, monitoring, and troubleshooting tasks using its graphical interface. It displays subsystem status by interpreting CLI information returned by the subsystem.

Use the procedures in this chapter to:

- Set up Command Console and establish communication with your storage subsystems.
- Configure your storage devices to create host-accessible volumes by:
  - Configure the Client by adding systems
  - Adding physical devices
  - Creating virtual disks

Starting Command Console

To start Command Console in the configuration and console mode, double-click the *Command Console* icon in the *Command Console* program group or the *StorageWorks Command Console* entry in the Start Programs menu.

NOTE: NetWare servers can only connect using the direct-connect method. This method is described in the Command Console 2.0 User's Guide. Check the DIGITAL StorageWorks web page for updates on network connecting support for NetWare.

Opening a CLI Window

If you are familiar with CLI syntax, you can enter commands into the command line area directly underneath the CLI Window Menu Bar. Error messages and system responses are displayed in the message area directly beneath the command line area.

Creating a Virtual Disk

Before you can create a virtual disk, you must open a Storage Window, set the Controller parameters, and make your physical devices known to your Controller. Devices are represented as icons in the Device Window, a pane in the Storage Window. (You can display a list of device icons and their meanings by selecting *Legend* on the View menu).

Add Physical Devices to Your Configuration

You must make the physical devices known to the Controller before you can create virtual disks from them. To add physical devices to the configuration:

1. In the **Storage** menu, select **Device**, then **Add**.
2. Enter your password if required.

3. When Client prompts you to insert the physical devices (Figure 5-1), insert them in the storage subsystem; then click the **OK** button. Client adds your devices to your configuration and refreshes the Storage Window.

Figure 5-1. Insert devices prompt

Once you have added the physical devices to the storage configuration, you can use them to create a number of different types of logical storage units called virtual disks. You can create:

- Single-device virtual disks JBODs (Just a Bunch of Disks)
- Striped virtual disks (RAID 0)
- Mirrored virtual disks (RAID 1)
- Striped mirrored virtual disks (RAID 1+ 0)
- Striped parity virtual disks (RAID 3/5)

Create a Virtual Disk

1. In the **Storage** menu, select **Add Virtual Disk**. Virtual Disk Wizard's Step 1 appears. There are five steps in total.
2. Click the button of the RAID level you want to create, then click **Next**.

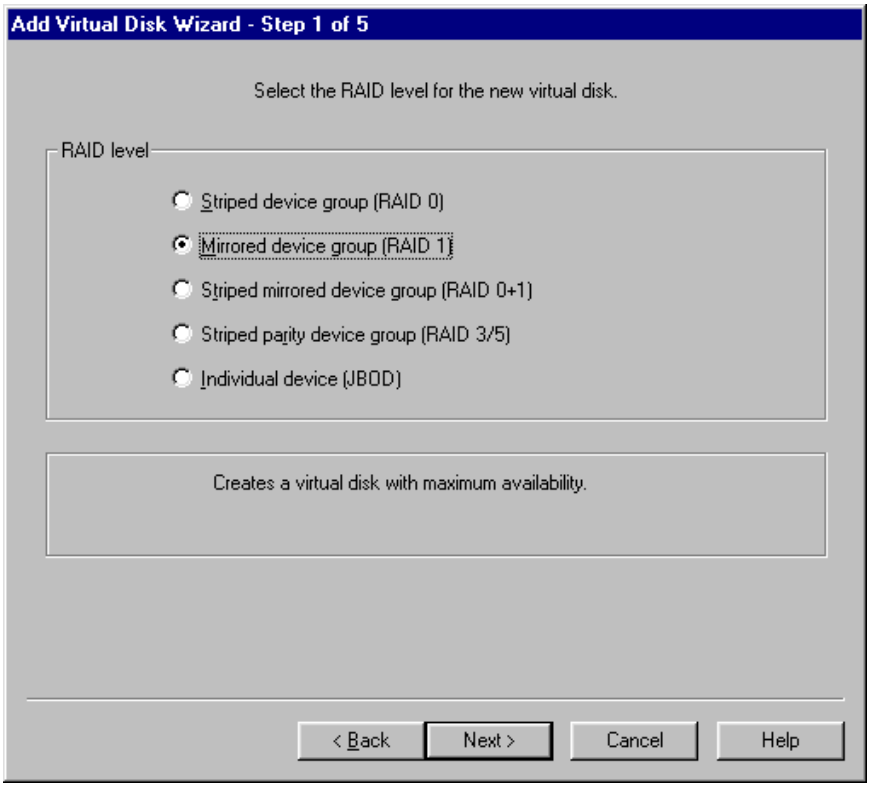

Figure 5-2. Add Virtual Disk wizard step 1

3. Select the devices you want to include in the virtual disk from a list of available storage devices. You select devices by double-clicking them in the *Available Storage* window in the dialog box. As you click them, they move to the *Selected Devices* window in the dialog box. They are also shown as selected in the Device Window pane of the Storage Window.

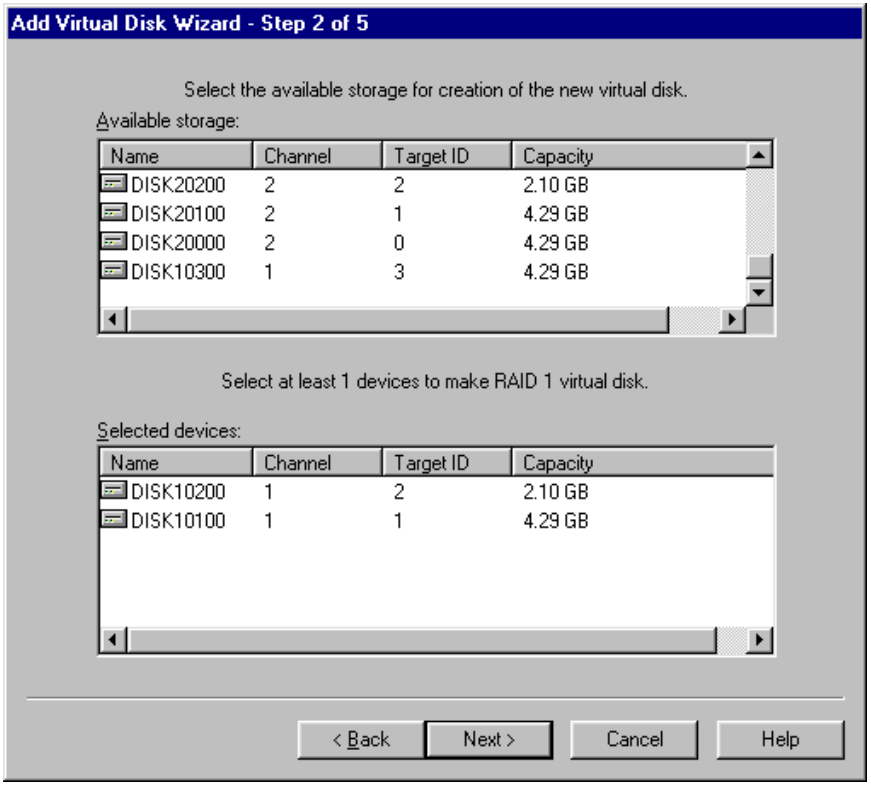

Figure 5-3. Add Virtual Disk wizard step 2

4. Select the capacity of the virtual disk, then click **Next**. The wizard offers you the option of using only a portion of the capacity of the devices you have selected for your new virtual disk. It displays the total, available capacity of the devices you have selected in the capacity box. Enter the size of the virtual disk you want to create in the box.

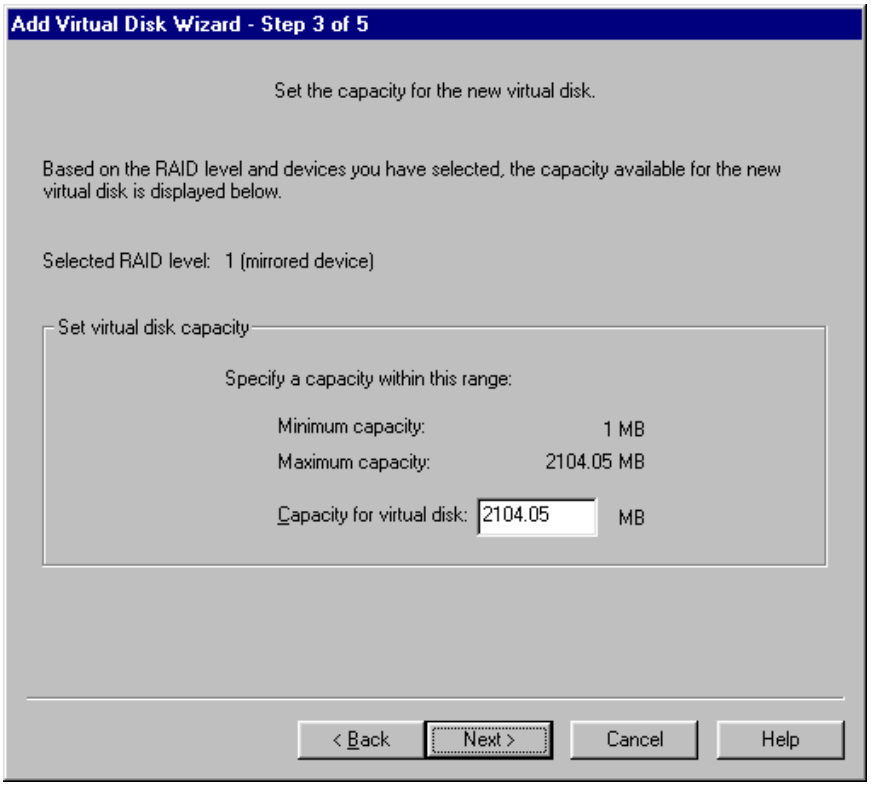

Figure 5-4. Add Virtual Disk wizard step 3

5. Specify the target ID and Logical Unit Number (LUN), operating parameters, and options of your new virtual disk, then click *Next*.

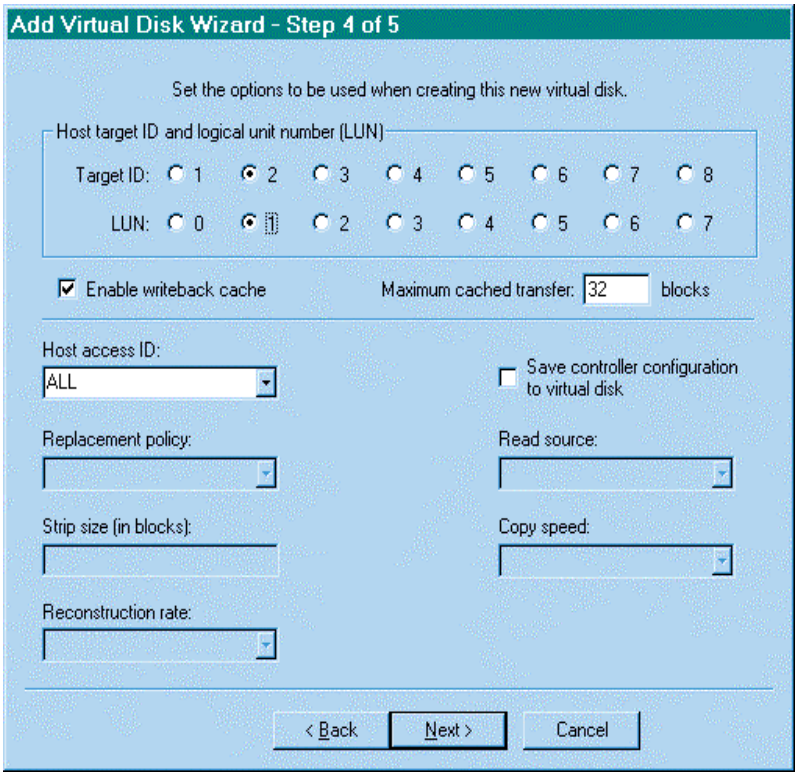

Figure 5-5. Add Virtual Disk wizard step 4

6. The final Virtual Disk Wizard window, Step 5, recaps the choices you have made in steps 1 through 4. If you are satisfied with your choices, click **Finish**. Otherwise, use the **Back** button to go return to the previous step and make the necessary changes.

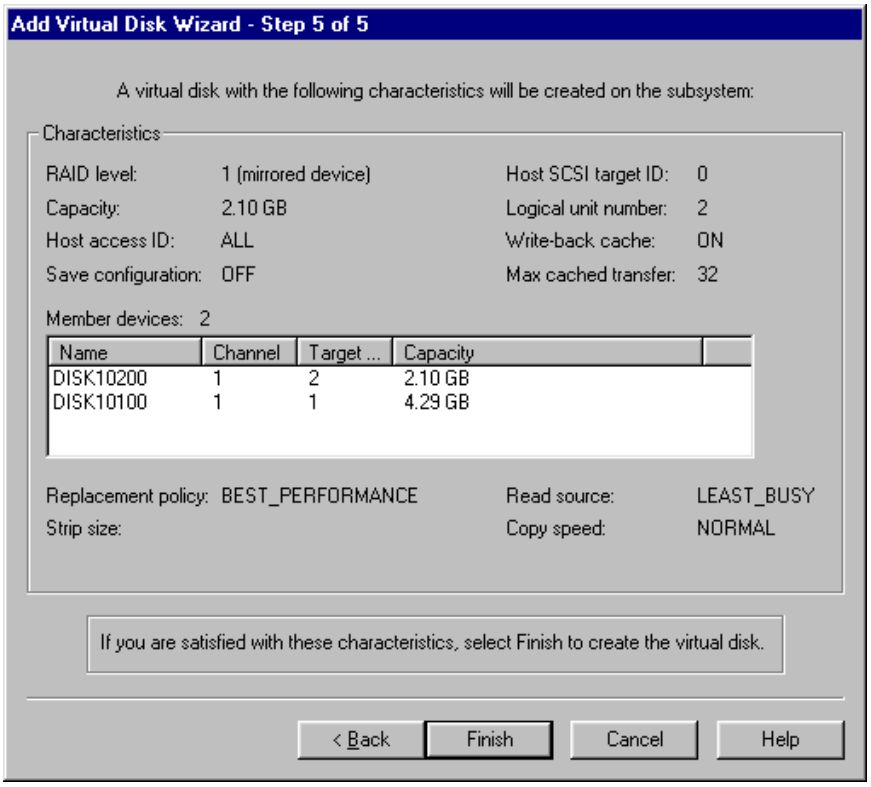

Figure 5-6. Add Virtual Disk wizard step 5

Delete a Virtual Disk

To delete a virtual disk:

1. Select its **icon** by clicking on it in the Virtual Disk Window.
2. Choose **Storage** from the Menu Bar; then **Virtual Disk**, then **Delete**.

Saving the Configuration

1. From the **Storage** menu, click **Controller Configuration**, then **Save**.
2. The Save dialog box appears, enter the desired location and file name. Your configuration is saved.
3. See Chapter 7 to complete the configuraton of the RAID 7000 for NetWare.

Chapter **6**

Creating Your Storage Configuration with the CLI

This chapter contains instructions for creating an initial configuration for your HSZ70 Controller using the Command Line Interpreter (CLI). It briefly describes the CLI and how to access it. The configuration steps include: adding devices; creating and initializing RAIDsets, stripesets, mirrorsets, and stripe mirrorsets; identifying a storageset as a unit to the host; and verifying and recording the final configuration.

Once you complete the physical setup of the RAID Array, configure the devices in your subsystem into storagesets.

To configure the devices in your subsystem into storagesets, you need to:

- Add disks to the controller
- Plan your configuration
- Create storagesets
- Save the configuration
- Record the configuration

NOTE:

This change extends the controller's addressable storage capacity, allowing it to address up to 72 drives. See Figure 6-4 for new mapping of Busses (Ports) and Targets.

Configuration Guidelines

Use the following guidelines to configure the HSZ70 controller and your host system to optimize system performance.

Controller Configuration Guidelines

1. Evenly distribute the devices across separate busses (ports). This permits parallel activities on the controller's available busses (ports) to the attached devices.
2. Mix higher and lower performance devices on the same port. For example, use 7200 rpm and 5400 rpm drives on the same port.
3. Evenly set preferred targets across both controllers in a dual-redundant configuration.
4. Evenly distribute logical units across separate targets; that is, use different SCSI IDs, if possible. The subsystem supports a maximum of eight SCSI IDs.
5. Avoid configuring multiple mirrorsets with the first member being on the same port. Configure multiple mirrorsets as similar to the following example:

   add mirrorset mirr_1 disk10000 disk20000
   add mirrorset mirr_2 disk20100 disk10100

The default mirrorset read selection algorithm will choose the first member of the mirrorset if the mirrorset does not already have a read queue.

Host System Configuration Guidelines

You get optimal host system performance when you have a minimum of six processes running concurrently. This takes advantage of the command tag queuing and multi-controller ports of your subsystem.

Accessing the CLI

The Command Line Interpreter (CLI) is a command line user interface to the HSZ70 controller. It provides a series of commands for you to create a configuration for the subsystem through the controller's firmware.

See the *CLI Reference Manual* for detailed descriptions of all CLI commands.

This chapter describes only the CLI commands required to create an initial configuration on the controller.

You must make a serial connection to the HSZ70 controller to access the CLI.

See "*Command Line Interpreter*" in the *HSZ70 RAID Array Controller CLI Reference Manual* for detailed descriptions of all CLI commands.

Connecting the Cable

To connect a maintenance terminal or PC to a HSZ70 controller:

1. Locate the connecting cable that came with the RA7000 Subsystem. It has an RJ12 connector (similar to standard telephone plug) on one end and a 9-pin serial connector on the other end.
2. Plug the serial connector into the 9-pin serial port/com port 1 of the PC. If a 9-pin serial port is not available on a PC, use the 9-pin to 25-pin adapter (P/N: 12-45238-01) supplied with your subsystem.
3. Plug the RJ12 connector from the PC or maintenance terminal into the maintenance port on the HSZ70 controller (see Figure 6-1).
4. Note which serial port you use; you will need that information if using a communications program.

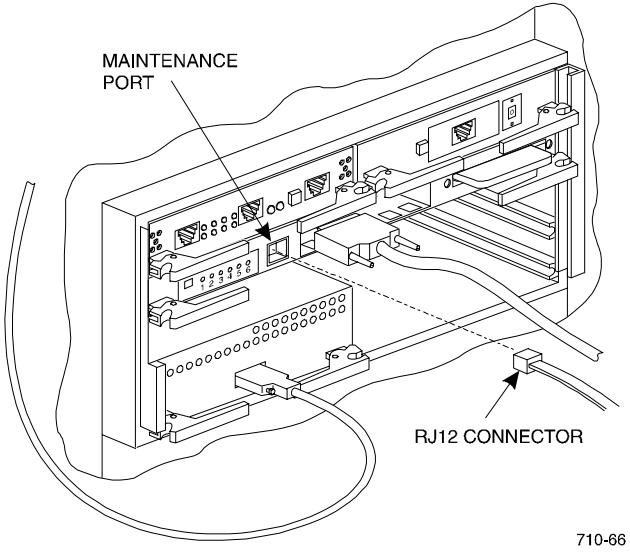

Figure 6-1. Making a serial connection to the HSZ70 controller

Installing a Ferrite Bead over the Connecting Cable

Install a ferrite bead cable in order to prevent possible radio frequency interference.

> **NOTE:** The hinge on the ferrite bead housing is semi-rigid and will break if flexed multiple times. Follow the directions carefully to minimize the risk of breakage. It is not recommended that the bead be removed after installation although it is removable if the latch is pried open.

Install the ferrite bead on the cable so that it is within one inch of the front of the controller as shown in Figure 6-2.

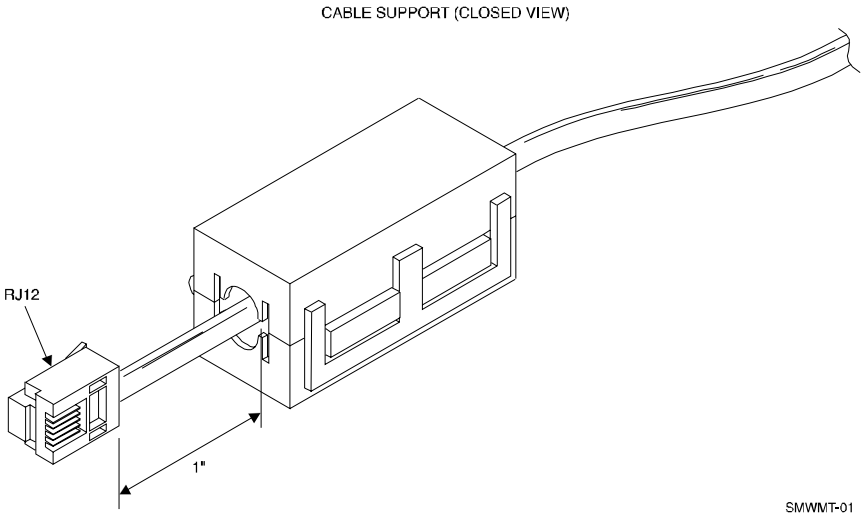

Figure 6-2. Ferrite bead with cable installed

To install the ferrite bead:

1. Locate the maintenance port on the HSZ70 controller.
2. Place a mark on the end of the cable that connects to the maintenance port of the HSZ70 controller one inch from the RJ12 connector.
3. Locate the cable guides on the bead housing (see Figure 6–3). Lay the communication cable in the groove.

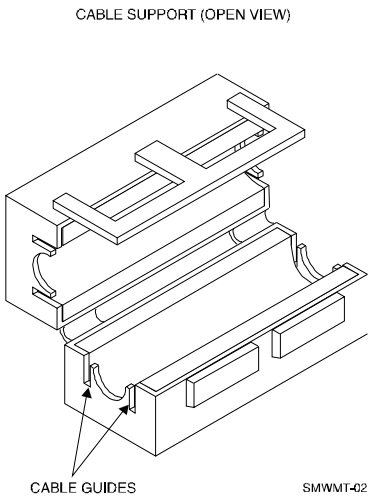

Figure 6-3. Ferrite bead (open)

4. Ensure that the end of the bead closest to the RJ12 connector is lined up with the 1” mark. Slowly close the bead housing so that the cable fits within the cable guides (top and bottom, see Figure 6-2).
5. Press the halves together until they snap into place. Make sure that the bead is locked on the cable.

Establishing Connection with a Maintenance Terminal

To establish a connection between a maintenance terminal (VTX terminal) and the controller:

1. After connecting the maintenance terminal cable to the controller, press the Enter key. The CLI prompt appears in the window similar to the following:

   HSZ70 >

2. To view the status of the controller, type:

   hsz70 > show this_controller full

   or

   show other controller full

The controller displays information similar to the following example:

```
Controller:
   HSZ70 ZG73101263 Firmware V73Z-0, Hardware H01
   Not configured for dual-redundancy
   Device Port SCSI address 7
   Time: NOT SET
Host port:
   SCSI target(s) (0, 1, 2, 3, 4, 5, 8, 9)
   Preferred target(s) (0, 1, 2, 3, 4, 5, 8, 9)
   TRANSFER_RATE_REQUESTED = 20MHZ
   Host Functionality Mode = B
   Command Console LUN is disabled
Cache:
   128 megabyte write cache, version 4
   Cache is GOOD
   Battery is Good
   No unflushed data in cache
   CACHE_FLUSH_TIMER = DEFAULT (10 seconds)
   NOCACHE_UPS
Mirrored Cache:
   Not enabled
Extended Information:
   Terminal speed 9600 baud, eight bit, no parity, 1 stop bit
   Operation control: 00000004  Security state code: 7022
   Configuration backup disabled
HSZ70>
```

Establishing Connection with a PC

To establish a connection between your PC and controller, you must use a communications program. Follow these steps to make the connection:

1. Start a communications program on your PC (Hyperterminal).

   \Start\Programs\Accessories\Hyperterminal

2. Set the communications program to use the serial port that is connected to the controller.

3. Set the communications parameters to:

   - 8 bits
   - 9600 baud
   - 1 stop bit
   - No parity

4. From your communications program, issue a connect command to establish a connection with the controller, and then press the Enter key. You should see the CLI prompt, which looks similar to:

   HSZ70 >

5. To view the status of the controller, type:

   HSZ70 > SHOW THIS_CONTROLLER FULL

```
The controller displays information similar to the
following example:
Controller:
        HSZ70 ZG73101263 Firmware V73Z-0, Hardware H01
        Not configured for dual-redundancy
        Device Port SCSI address 7
        Time: NOT SET
Host port:
        SCSI target(s) (0, 1, 2, 3, 4, 5, 8, 9)
        Preferred target(s) (0, 1, 2, 3, 4, 5, 8, 9)
        TRANSFER_RATE_REQUESTED = 20MHZ
        Host Functionality Mode = B
        Command Console LUN is disabled
Cache:
        128 megabyte write cache, version 4
        Cache is GOOD
        Battery is Good
        No unflushed data in cache
        CACHE_FLUSH_TIMER = DEFAULT (10 seconds)
        NOCACHE_UPS
Mirrored Cache:
        Not enabled
Extended Information:
        Terminal speed 9600 baud, eight bit, no parity, 1 stop bit
        Operation control: 00000004  Security state code: 7022
        Configuration backup disabled

HSZ70>
```

Adding Disks to the Configuration

The CONFIG utility locates and adds disks to the controller. Run the CONFIG utility whenever you add new disks to the controller. (See Chapter 1 regarding installing/adding disks in the StorageWorks enclosure.) Enter the following command to start the configuration utility. The disk numbers will correspond to the disk locations for your subsystem.

HSZ70 > RUN CONFIG

The controller responds with a display similar to that shown below:

Config Local Program Invoked

Config is building its tables and determining what devices exist on the subsystem. Please be patient.

ADD DISK10000 1 0 0
ADD DISK10100 1 1 0
ADD DISK10200 1 2 0
ADD DISK20000 2 0 0
ADD DISK20100 2 1 0
ADD DISK20200 2 2 0
ADD DISK30000 3 0 0
ADD DISK30100 3 1 0
ADD DISK30200 3 2 0
ADD DISK40000 4 0 0
ADD DISK40100 4 1 0
ADD DISK40200 4 2 0
ADD DISK40300 4 3 0
ADD DISK50000 5 0 0
ADD DISK50100 5 1 0
ADD DISK50200 5 2 0
ADD DISK50300 5 3 0
ADD DISK60000 6 0 0
ADD DISK60100 6 1 0
ADD DISK60200 6 2 0
ADD DISK60300 6 3 0
CONFIG –NORMAL TERMINATION

In this example, the controller has located 21 new disks. The 5-digit number associated with each disk corresponds to Port Number, Target Number and Controller Logical Unit Number. The Controller Logical Unit Number will always be 0. DISK40000, in this example, corresponds to the disk located on Port 4, on controller Target 0, and Controller Logical Unit 0. DISK50100 corresponds to the disk located on Port 5, controller Target 1, and Controller Logical Unit 0. The following diagram shows the mapping of Busses (Ports) and Targets for the Office Expansion RAID Enclosure:

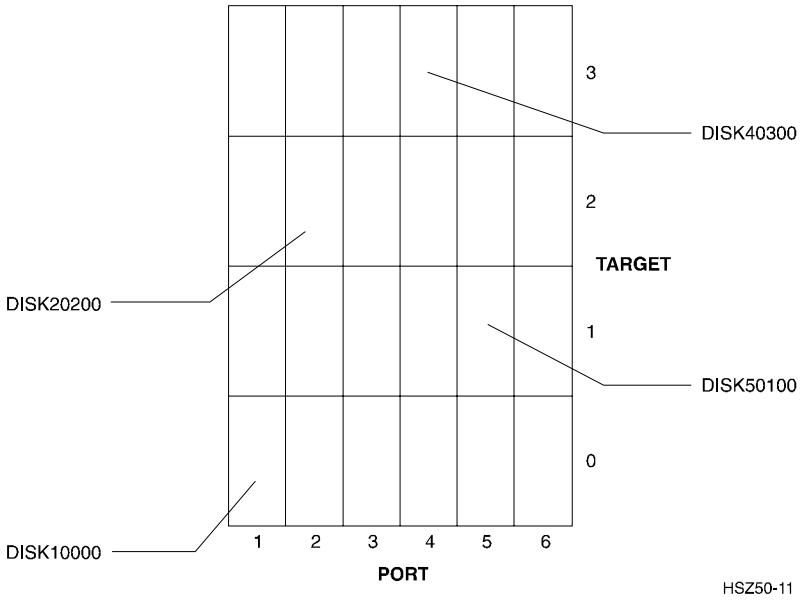

Figure 6-4. Mapping of busses (ports) and targets

Creating a RAIDset

RAIDsets stripe user data over multiple drives and calculate parity information for data redundancy. Create RAIDsets to use redundant stripesets in your array. RAIDsets must have at least three members and can have as many as fourteen. This example creates two three member RAIDsets using the ADD RAIDSET command.

HSZ70 > ADD RAIDSET DVGRPR0 DISK10000 DISK20000 DISK30000

HSZ70 > ADD RAIDSET DVGRPR1 DISK40000 DISK50000 DISK60000

In this example, "DVGRPR0" and "DVGRPR1" are the names of the RAIDsets, and they are followed by a list of disks to be included in each RAIDset. The names of the RAID sets are user selectable. Performance of your RAIDsets will be optimized if each RAIDset includes disks from different busses (ports) as shown in the example.

Initializing a RAIDset

Before putting a RAIDset(s) into service as a logical unit, you must initialize it. The INITIALIZE command copies controller metadata onto a small amount of disk space available on the RAIDset and makes this space inaccessible to the host.

When you initialize a RAIDset, you can specify a chunksize. A chunksize is the number of blocks of data that is transferred at one time. By using the default chunksize, the controller will optimize the chunksize by selecting a number equal to the number of blocks in one track of disk data. Compaq recommends using the default chunksize.

HSZ70 > INITIALIZE DVGRPR0 CHUNKSIZE=DEFAULT

HSZ70 > INITIALIZE DVGRPR1 CHUNKSIZE=DEFAULT

Adding a RAIDset as a Logical Unit

To make a RAIDset available to the host computer, you must identify it as a host logical unit. The unit number is a one or three digit number preceded by "D." The unit number identifies the controller's target number and the RAIDset as the Logical Unit (LUN) connected to the target. Units identified with controller target number 0 have a single digit number which corresponds to LUN number. For example, D5 would be target 0, LUN 5. Units identified with controller targets 1 through 6 use a 3 digit number. The first digit corresponds to the controller target number, the second digit is always 0 and the third digit corresponds to the LUN number. For example, D205 would be target 2, LUN 5. You must now identify the RAIDsets as Host Logical Units by using the ADD UNIT command.

HSZ70 > ADD UNIT D1 DVGRPR0

HSZ70 > ADD UNIT D2 DVGRPR1

This example uses the controller target of 0 and LUN 1 and 2 as the digits in D1 and D2, since the two RAIDsets are the first and second units identified on the controller.

Creating a Stripeset

Use stripesets to stripe data across multiple disks. Striping data across multiple disks increases I/O performance compared with the performance of a single disk. Stripsets must have at least two members and can have as many as fourteen. This example creates a three member stripeset using the ADD STRIPESET command.

HSZ70 > ADD STRIPESET DVGRPS0 DISK10100 DISK20100 DISK30100

In this example, "DVGRPS0" is the name of the stripeset, and it is followed by a list of the disks to be included in the stripeset. The names of the stripesets are user selectable. Performance of your stripesets will be optimized if each stripeset includes disks from different busses (ports) as shown in Figure 6-4.

Initializing a Stripeset

Before putting a stripeset into service as a logical unit, you must initialize it. The INITIALIZE command copies controller metadata onto a small amount of disk space available on the stripeset and makes this space inaccessible to the host.

When you initialize a stripeset, you can specify a chunksize. A chunksize is the number of blocks of data that is transferred at one time. By using the default chunksize, the controller will optimize the chunksize by selecting a number equal to the number of blocks in one track of disk data. Compaq recommends using the default chunksize.

HSZ70 > INITIALIZE DVGRPS0 CHUNKSIZE=DEFAULT

Adding a Stripeset as a Logical Unit

To make a stripeset available to the host computer, you must identify it as a host logical unit. The unit number is a one or three digit number preceded by "D." The unit number identifies the controller's target number and the stripeset as the Logical Unit (LUN) connected to the target. Units identified with controller target number 0 have a single digit number which corresponds to LUN number. For example, D5 would be target 0, LUN 5. Units identified with controller targets 1 through use a 3 digit number. The first digit corresponds to the controller target number, the second digit is always 0 and the third digit to the LUN number.

For example, D205 would be target 2, LUN 5. You must now identify the stripesets as Host Logical Units by using the ADD UNIT command.

HSZ70 > ADD UNIT D3 DVGRPS0

This example uses the controller target of 0 and LUN 3 as the digit in D3, since the stripeset is the third unit identified on the controller.

Setting Writeback Cache

The final step in creating the stripeset is to enable the writeback cache. A single CLI command enables that feature for the entire stripeset:

HSZ70 > SET D3 WRITEBACK_CACHE

Where D3 represents the host logical unit of the stripeset described above.

Creating a Mirrorset

Create mirrorsets to increase data availability and achieve data redundancy by maintaining at least two drives that have exactly the same data. Mirrorsets must have at least two members, and can have as many as six. This example creates a two member mirrorset using the ADD MIRRORSET command.

HSZ70 > ADD MIRRORSET DVGRPM0 DISK10200 DISK20200

In this example, DVGRPMO is the name of the mirrorset, and it is followed by a list of the disks to be included in the mirrorset. The names of the mirrorsets are user selectable. Performance of your mirror sets will be optimized if each mirrorset includes disks from different busses (ports) as shown in the example.

Initializing a Mirrorset

Before putting a mirrorset into service as a logical unit, you must initialize it. The INITIALIZE command copies controller metadata onto a small amount of disk space available on the mirrorset and makes this space inaccessible to the host.

When you initialize a mirrorset you can specify a chunksize. A chunksize is the number of blocks of data that is transferred at one time. By using the default chunksize, the controller will optimize the chunksize by selecting a number equal to the number of blocks in one track of disk data. Compaq recommends using the default chunksize.

HSZ70 > INITIALIZE DVGRPM0

Adding a Mirrorset as a Logical Unit

To make a mirrorset available to the host computer, you must identify it as a host logical unit. The unit number is a one or three digit number preceded by "D." The unit number identifies the controller's target number and the mirrorset as the Logical Unit (LUN) connected to the target. Units identified with controller target number 0 have a single digit number which corresponds to LUN number. For example, D5 would be target 0, LUN 5. Units identified with controller targets 1 through 6 use a 3 digit number. The first digit corresponds to the controller target number, the second digit is always 0, and the third digit corresponds to the LUN number. For example, D400 would be target 4, LUN 0. You must now identify the stripesets as Host Logical Units by using the ADD UNIT command.

HSZ70 > ADD UNIT D400 DVGRPM0

This example uses the controller target of 4 and LUN 0.

> **NOTE:** For some operating systems, Logical Units must be sequential. They must begin with D0 and be followed by D1, D2, D3, ... and so on.

Setting Writeback Cache

The final step in creating the mirrorset is to enable the writeback cache. A single CLI command enables that feature for the entire mirrorset:

HSZ70 > SET D400 WRITEBACK_CACHE

Where D400 represents the host logical unit of the mirrorset described above.

Creating a Stripe Mirrorset

Create a stripe mirrorset to achieve high I/O performance and maximum data availability. Stripe mirrorsets must have at least two mirrorset members, and can have as many as 14. To create stripe mirrorsets, you first create mirrorsets and then you create stripesets with those mirrorsets.

Creating Mirrorsets

These examples create 2, two member mirrorsets for the stripe mirrorset.

HSZ70 > ADD MIRRORSET MIRR_0 DISK30200 DISK40200

HSZ70 > ADD MIRRORSET MIRR_1 DISK50200 DISK60200

In these examples, MIRR_0 and MIRR_1 are the names of the mirrorsets. Each is followed by the list of disks to be included in it.

Striping the Mirrorsets

Stripe mirrorsets must have at least two members, and can have as many as 14. This example uses the ADD STRIPESET command to create a two member stripeset with the mirrorsets that you just created.

HSZ70 > ADD STRIPESET DVGRPSM0 MIRR_0 MIRR_1

In this example, DVGRPSM0 is the name of the stripe mirrorset, and it is followed by a list of mirrorsets to include in it. The name of the stripeset is user selectable. Performance of your stripe mirrorset will be optimized if each mirrorset includes disks from different busses (ports).

Initializing the Stripe Mirrorset

Before putting a stripe mirrorset(s) into service as a logical unit, you must initialize it. The INITIALIZE command copies controller metadata onto a small amount of disk space available on the stripe mirrorset and makes this space inaccessible to the host.

When you initialize a stripe mirrorset you can specify a chunksize. A chunksize is the number of blocks of data that is transferred at one time. By using the default chunksize, the controller will optimize the chunksize by selecting a number equal to the number of blocks in one track of disk data. Compaq recommends using the default chunksize.

HSZ70 > INITIALIZE DVGRPSM0 CHUNKSIZE=DEFAULT

Adding a Stripe Mirrorset as a Logical Unit

To make a stripe mirrorset available to the host computer, you must identify it as a host logical unit. The unit number is a one or three digit number preceded by "D." The unit number identifies the controller's target number and the mirrorset as the Logical Unit (LUN) connected to the target. Units identified with controller target number 0 have a single digit number which corresponds to LUN number. For example, D5 would be target 5, LUN 0. Units identified with controller targets 1 through 6 use a three digit number. The first digit corresponds to the controller target number, the second digit is always 0 and the third digit corresponds to the LUN number. For example, D500 would be target 5, LUN 0. You must now identify the stripesets as Host Logical Units by using the ADD UNIT command.

HSZ70 > ADD UNIT D500 DVGRPSM0

Setting Writeback Cache

The final step in creating the stripe mirrorset is to enable the writeback cache. A single CLI command enables that feature for the entire stripe mirrorset:

HSZ70 > SET D500 WRITEBACK_CACHE

where D500 represents the host logical units of the stripe mirrorset described above.

Adding Individual Disks as Logical Units

To use an individual disk in a RA7000/ESA10000 subsystem, you must initialize it and then add it as a logical unit.

Initializing Individual Disks

Before putting an individual disk into service as a logical unit, you must initialize it. The INITIALIZE command copies controller metadata onto a small amount of disk space available on the disk and makes this space inaccessible to the host.

When you initialize a disk, you can specify a chunksize. A chunksize is the number of blocks of data that is transferred at one time. By using the default chunksize, the controller will optimize the chunksize by selecting a number equal to the number of blocks in one track of disk data. Compaq recommends using the default chunksize.

HSZ70 > INITIALIZE DISK40100 CHUNKSIZE=DEFAULT

HSZ70 > INITIALIZE DISK50100 CHUNKSIZE=DEFAULT

Adding as Logical Units

If you require individual Disks to be available to the host as Logical Units, you must identify the Disks as Host Logical Units by using the ADD UNIT command.

HSZ70 > ADD UNIT D4 DISK40100

HSZ70 > ADD UNIT D5 DISK50100

In this example, disks DISK40100 and DISK50100 were identified to the host as units D4 (Target 0, LUN 4) and D5 (Target 0, LUN 5) respectively.

Adding Devices to the Spareset

It is advisable to add devices to the spareset to create a pool of devices for the controller to use as replacements for devices in a RAIDset, mirrorset or stripe mirrorset that fail. If no spareset exists, these redundant types of storagesets will run "reduced," and you should replace the disabled disk as soon as possible. To create the Spareset, identify the drive(s) using the ADD SPARESET command.

HSZ70 > ADD SPARESET DISK60100

In this example, DISK60100 was identified to the controller as a Spareset.

Saving Copies of the Configuration

Use the following INITIALIZE command to save a copy of the entire controller configuration on a device or storageset in the subsystem. Save a copy of the controller configuration on a device or storageset so that in the event of a controller failure, you will not need to create a new controller configuration.

The controller automatically updates the saved copy of the configuration whenever the configuration changes.

We recommend keeping a copy of the configuration on at least two devices or storagesets.

To save a copy of the configuration on disk, use the INITIALIZE command as follows:

HSZ70 > INITIALIZE DISK10000 SAVE_CONFIGURATION

The controller places a copy of the configuration onto the specified device or storageset and automatically updates this saved copy whenever the configuration changes. To ensure availability of a copy of the configuration, save the configuration on at least two devices.

Recording Your Configuration

You have now completed all the steps required to create an initial configuration for your controller. In the following steps, you should verify and record your configuration for future reference. Additional worksheets are provided in this chapter for recording future new or modified configurations.

First, verify the Logical Units you have configured:

HSZ70 > SHOW UNITS

The controller responds with a display similar to that shown below:

```
LUN   Uses
D1    DVGRPR0
D2    DVGRPR1
D3    DVGRPS0
D4    DISK40100
D5    DISK50100
D400  DVGRPM0
D500  DVGRPSM0
```

Record the information in the following table:

Date_____	
LUN	**Uses**

Next, verify the storagesets you have configured:

HSZ70 > show storagesets

The controller responds with a display similar to that shown below:

Name	StorageSet	Uses	Used by
DVGRPS0	stripeset	DISK10100	D3
		DISK20100	
		DISK30100	
DVGRPSM0	stripeset	MIRR_0	D500
		MIRR_1	
DVGRPM0	mirrorset	DISK10200	D400
		DISK20200	
MIRR_0	mirrorset	DISK30200	DVGRPSM0
		DISK40200	
MIRR_1	mirrorset	DISK50200	DVGRPSM0
		DISK60200	
DVGRPR0	raidset	DISK10000	D1
		DISK20000	
		DISK30000	
DVGRPR1	raidset	DISK40000	D2
		DISK50000	
		DISK60000	
SPARESET	spareset	DISK60100	
FAILEDSET	failedset		

Individual devices are not displayed in this report. To display individual devices, enter the following:

```
HSZ70 > SHOW DEVICES
```

Record the above information in the following table. In the event of a controller failure, the information that is recorded here will assist you in reconstruction of the storageset on your RA7000/ESA10000 subsystem.

Date_____

Name	StorageSet	Uses	Used by

Chapter 7

Completing Your Storage Configuration Under Novell NetWare

This chapter contains instructions for completing your configuration.

Completing Your Configuration under Novell NetWare

In order for NetWare to recognize new StorageWorks RA7000 Storage Subsystem devices or changes to existing configurations, you must reboot your system to restart NetWare.

Disable Virtual LUN

By default, the virtual LUN (Command Console LUN target 0, lun 1) is enabled. Disable the virtual LUN at this time. Do so by entering the following command using the CLI:

```
hsz70 > set this_controller nocommand_console_lun
```

Host Mode

NetWare requires host functionality mode B. Use the Command Console or the following command to set this mode:

hsz70 > set this_controller host_function=B

or

set other_controller host_function=B

To create a NetWare 4.11 partition for each disk:

1. From the NetWare server console, type **Load Install**
2. From the Installation menu, follow this menu path:

```
Disk options -> Modify disk partitions and Hot Fix
```

3. From the list of disks on the Available Disk Drives menu, select the disk to partition.
4. From the `Disk Partition Options` menu, select the **`Create NetWare disk partition`** **option**.
5. Either **accept** or **decrease** the NetWare partition size.
6. Either **accept** or **change** the size of the data area or the Hot Fix redirection area.
7. Press the **Esc** and select **Yes** at the prompt to create the partition.
8. From the `Installation Options` menu, select **`Volume Options`**.
9. Enter a volume name.
10. Press the **Esc** and select **Yes** at the prompt to create the volume.
11. Press **F10** to save the volume(s) you created, and answer **Yes** to mount them.

Chapter 8

Installing Upgrades to Your RA7000 Subsystem

This appendix describes the procedures for installing upgrades on your RA7000 Subsystem. It describes the procedures for adding cabinets, installing additional cache memory, installing and connecting single or dual-redundant controllers, and setting controller parameters and configuring dual-redundant controller failover.

Installing Upgrades on Your RA7000 Subsystem

Your RA7000 Subsystem can be upgraded to include the following:

- Installing a Single Controller
- Installing a Second, Dual-Redundant Controller
- Connecting Controllers
- Installing Additional Cache Memory
- Preparing the Controllers and Cache Modules for Use
- Connecting Storage Cabinets
- Connecting to External Storage with Single-Ended I/O Modules

Installing Controllers and Cache Modules

Each controller has an associated cache module. You must install each controller and its cache module into corresponding slots of the storage enclosure.

Installing controllers requires the following steps:

- Determining the corresponding controller and cache module slots
- Installing the controller and cache module

Table 8-1 lists the tools required to install a controller.

Table 8-1
Tools Required to Install a Controller

Required Tools	Purpose
ESD wrist strap	To protect all equipment against electrostatic discharge
Flat-head screwdriver	To loosen/tighten and to disconnect /connect cables

Locating the Appropriate Controller and Cache Module Slots

Use Table 8-1 and Table 8-2 to determine the correct controller and cache module slots.

Table 8-2
Controller Slots and Corresponding SCSI IDs

Controller and Cache Module	SCSI ID	Slot
First Controller	SCSI ID 7	Top Controller Slot
Cache Module	N/A	Left Cache Module Slot
Second Controller	SCSI ID 6	Bottom Controller Slot
Cache Module	N/A	Right Cache Module Slot

NOTE: If you purchased only one controller, you must install it in the top controller slot (SCSI ID 7) and its cache module in the left cache module slot.

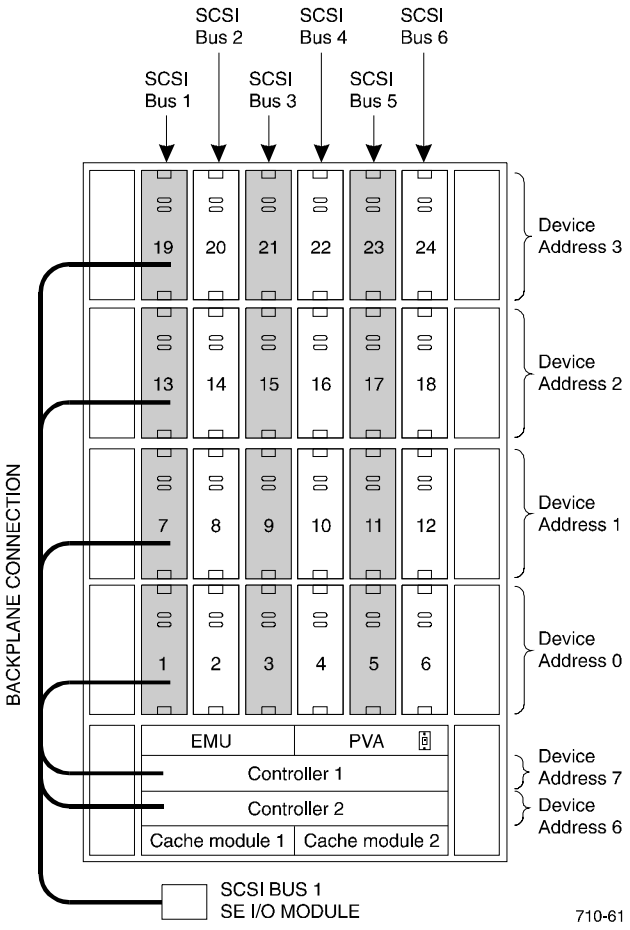

Figure 8-1. Device address locations

Installing First Controller and Cache Module

Install any additional cache memory you purchased for your cache module prior to installing the second controller and cache module. See the section *Installing Additional Cache Memory,* in this Appendix, to install cache memory.

To install the first controller:

1. Obtain and place an ESD wrist strap around your wrist. Ensure that the strap fits snugly around your wrist.
2. Attach or clip the other end of the ESD wrist strap to the cabinet grounding stud or a convenient cabinet grounding point (non-painted surface).
3. If this is the first controller, slide it, without inserting the program card, into the top controller slot in the storage enclosure, as shown in Table 8-2. Press the handles to firmly seat the controller in the slot.

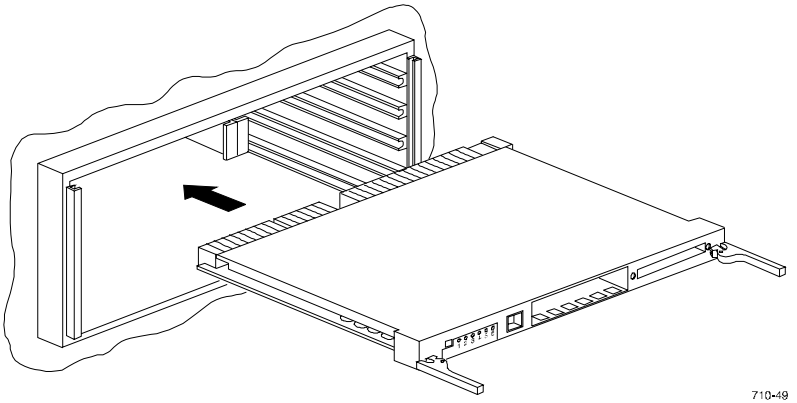

Figure 8-2. Installing first controller Into the top controller slot

4. Slide the cache module associated with the first controller into the left cache module slot, as shown in Figure 8-3. Press the handles to firmly seat the cache module in the slot.

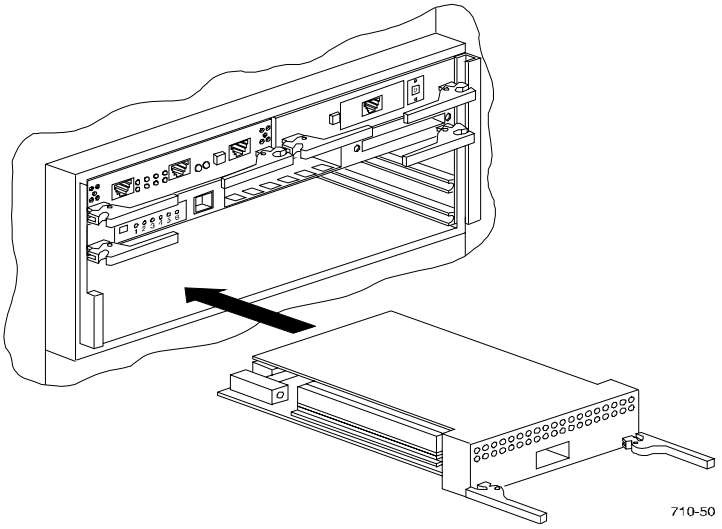

Figure 8-3. Installing the cache module associated with the first controller

5. Insert the external cache battery (ECB) into the empty slot at the top of the enclosure (RA7000), or in the battery carrier on the back of the unit (ESA10000).

6. Connect the cable between the cache module and the ECB as shown in Figure 8-4.

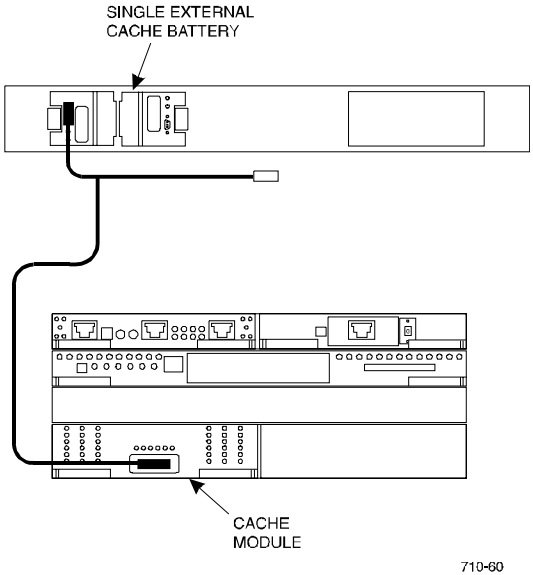

Figure 8-4. Connecting first cache module to an ECB

7. Turn on the Subsystem power.
8. Insert the program card while pressing and holding the controller Reset button. The Controller will initialize and perform all internal self tests.
9. When the Reset LED flashes at a rate of once every second, the initialization process is complete.

10. Snap the ESD cover into place over the program card as shown in Figure 8-5. Push inward to lock the cover in place.

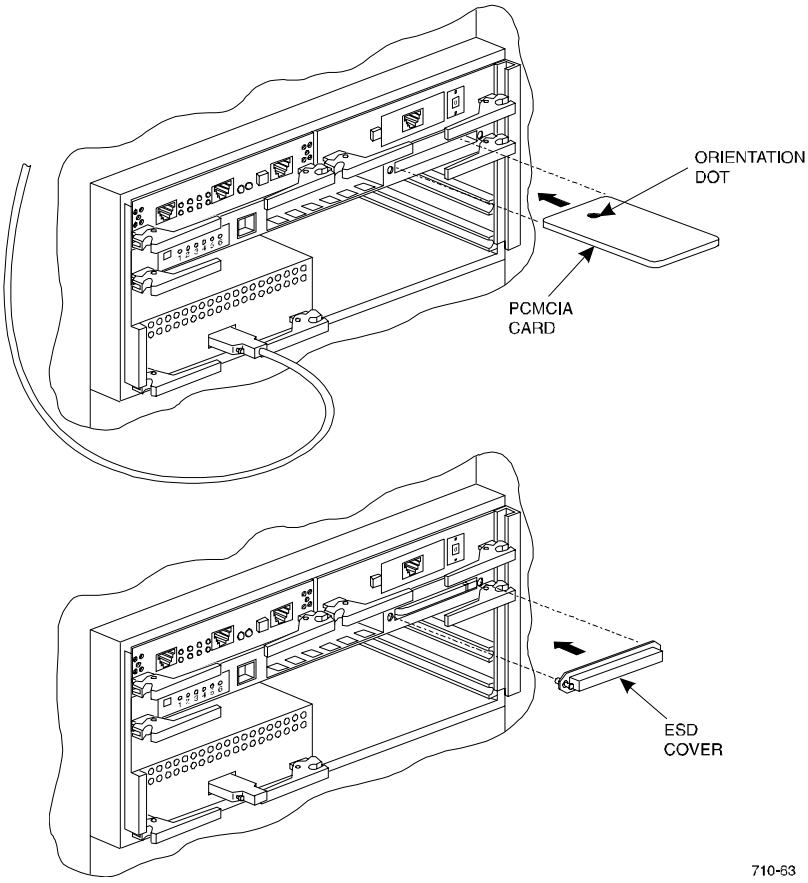

Figure 8-5. Inserting the Internal Program Card

If you purchased only one controller, go on to the section for "Preparing Controllers and Cache Modules" in this appendix. If you purchased a second controller, continue with the procedure that follows.

Preparing and Installing the Second Controller and Cache Module

The following is a procedure for installing a second controller.

Preparing to Install a Second Controller

Before installing the second controller:

- Make a serial connection to the installed controller
- Shutdown the installed controller

Serial Connection

To make a serial connection to the installed see the section, "Accessing the CLI," in Chapter 6. Once you have made the serial connection, return to this section.

Shutting Down the Installed Controller

Shut down the installed controller then the storage enclosure.

To shut down the installed controller:

1. Connect a maintenance terminal to the existing controller and access the CLI. (See Chapter 6, "Accessing the CLI.")
2. Press **Enter** to get to a CLI prompt.
3. At the `HSZ70 >` prompt, type:

HSZ70 > SHOW THIS_CONTROLLER

The controller displays information similar to the following example:

```
Controller:

       HSZ70 ZG64900264 Firmware V73Z-0, Hardware DX12
       Not configured for dual-redundancy
       Device Port SCSI address 7
       Time: NOT SET

Host port:

       SCSI target(s) (0)
       Preferred target(s)
       TRANSFER_RATE_REQUESTED = 20MHZ
       Host Functionality Mode = A
       Command Console LUN is target 0, lun 0

Cache:

       128 megabyte write cache, version 4
       Cache is GOOD
       Battery is Good
       No unflushed data in cache
       CACHE_FLUSH_TIMER = DEFAULT (10 seconds)
       NOCACHE_UPS

Mirrored Cache:

       Not enabled
```

NOTE: Notice the first line of information displayed beneath `Cache:` indicates memory size, type and version of cache, if cache exists.

4. Shutdown the existing controller by typing:

HSZ70 > SHUTDOWN THIS_CONTROLLER

When you enter the SHUTDOWN command, do not specify any optional qualifiers. The default qualifiers do not allow the controller to shut down until data is completely and successfully stored on the appropriate storage devices.

5. To determine when the controller has shut down, observe the front panel of the controller. When the controller's reset button and first three LEDs are on continuously, the controller has shutdown.

6. Turn off the power to the subsystem by using the ON/OFF on the AC Power Controller module(s) in the bottom of the enclosure (see Figure 8-6). If your enclosure contains two AC Power Controllers (one in both lower corners), you must turn off power on both Power Controllers.

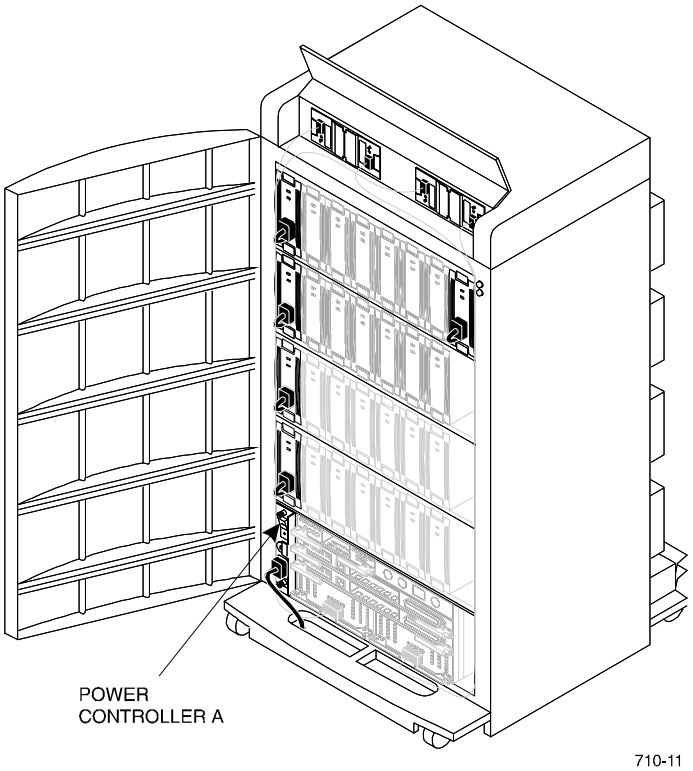

Figure 8-6. Power controller

Installing a Second Controller and Cache Module

Install any additional cache memory you purchased for your second cache module prior to installing the second controller and cache module. See the section, "Installing Additional Cache Memory", to install cache memory.

Use the following guidelines to install the second controller and its associated cache module. The second controller will be installed in the remaining bottom slot as shown in Figure 8-1Figure 8-7 and the cache module will be installed as shown in Figure 8-8.

To install the second controller:

1. Obtain and place an ESD wrist strap around your wrist. Ensure that the strap fits snugly around your wrist.
2. Attach or clip the other end of the ESD wrist strap to the cabinet grounding stud or a convenient cabinet grounding point (non-painted surface).
3. Slide the second controller, without inserting the program card, into the lower of the two controller slots in the storage enclosure, as shown in Figure 8-7.
4. Press the handles to seat the controller in the slot firmly.

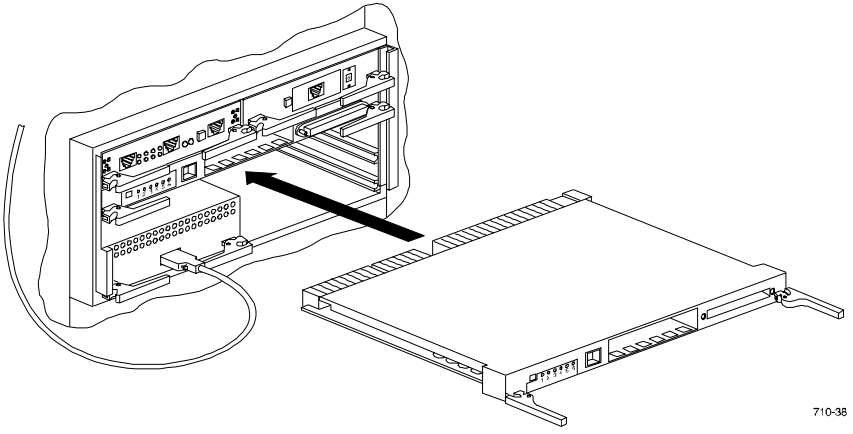

Figure 8-7. Installing the second controller into the bottom controller slot

5. Slide the second cache module into the right cache module slot, as shown in Figure 8-8. Press the handles to firmly seat the cache module in the slot.

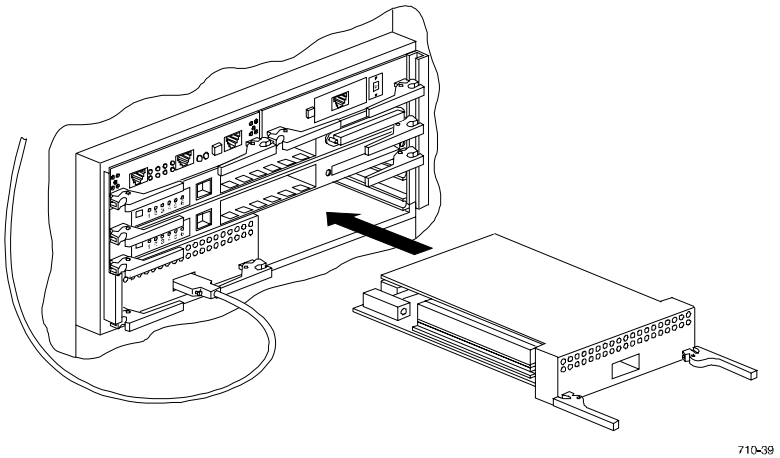

Figure 8-8. Installing the second cache module into the right cache

6. Connect the second cache module to the connector on the ECB in the top of the cabinet (see Figure 8-9). Up to two cache modules can be connected to the ECB using the two ECB connectors.

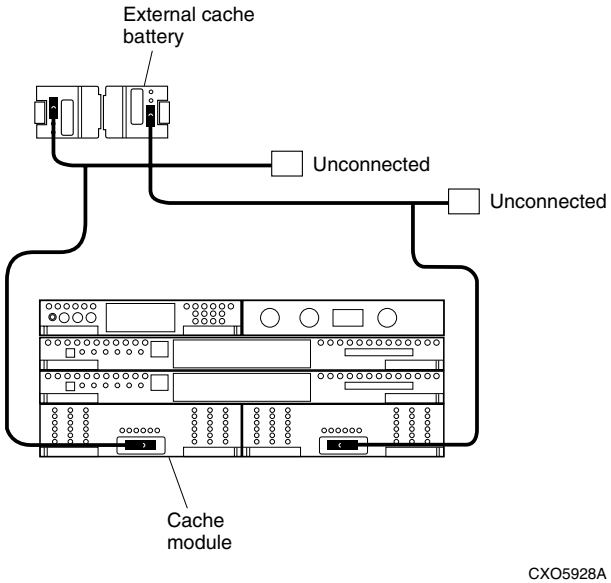

Figure 8-9. Second cache module to ECB cabling

7. Turn on the subsystem power.
8. Insert the program card while pressing and holding the controller Reset button. The Controller will initialize and perform all internal self tests.
9. When the Reset LED flashes at a rate of once every second, the initialization process is complete.

10. Snap the ESD cover into place over the program card as shown in Figure 8-10. Push inward to lock the cover in place.

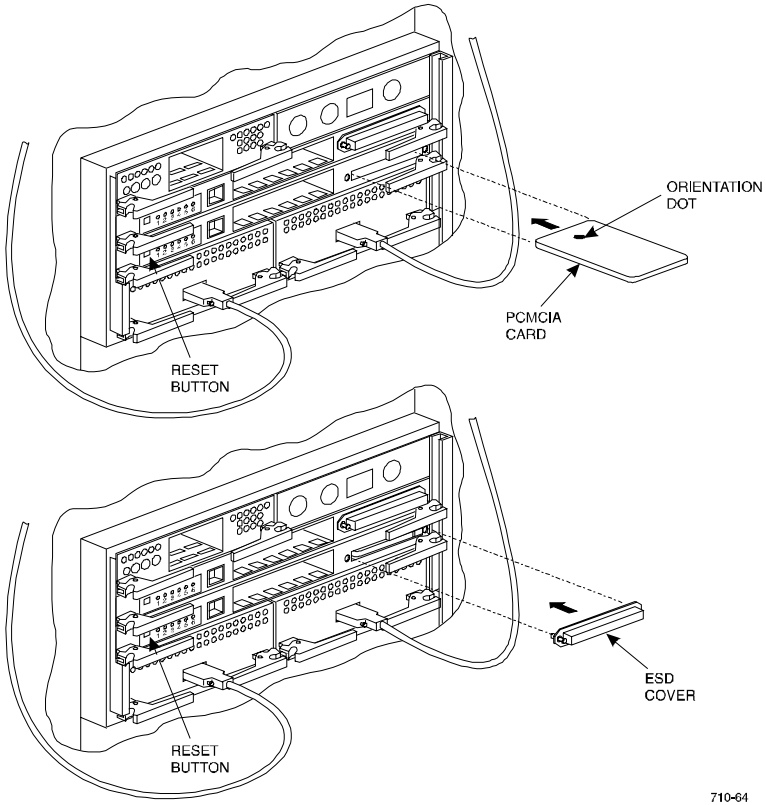

Figure 8-10. Inserting the internal program card

Installing Additional Cache Memory

Cache modules come with 64MB cache memory already installed. You can increase the cache memory to 128MB by installing two, 32MB SIMM boards onto the cache module.

> **NOTE:** Supported cache memory is either 64MB or 128MB. Do not configure your cache for 96MB; otherwise, improper system operation may occur.

To mirror cache in a dual-redundant controller subsystem, each cache module must have the same amount of memory: either 64 or 128MB.

To expand the memory of a cache module already installed in a subsystem enclosure, you must first remove the cache module.

> **NOTE:** The external cache battery (ECB) SBB provides power to the RAID array controller cache module if system power fails. The cache module in turn provides power to the ECB during normal operation.

To install memory on a cache module:

1. Obtain and place an ESD wrist strap around your wrist. Make sure that the strap fits snugly around your wrist.
2. Attach or clip the other end of the ESD wrist strap to the cabinet grounding stud or a convenient cabinet grounding point (non-painted surface).
3. The existing SIMMs (SIMM0 and SIMM2) are installed in the cache module as shown in Figure 8-11. The corresponding SIMM slots can be identified by referring to the lower ends of the slots, which are labeled SIMM0 through SIMM3.

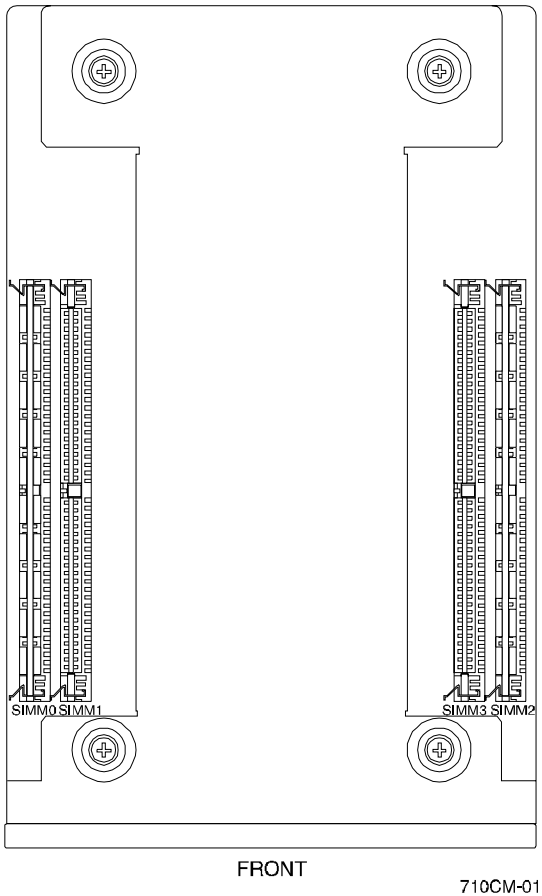

Figure 8-11. Exfisting SIMMs Installed in Slots 0 and 2

Install the additional SIMMs in SIMMs slots 1 and 3 as shown in Figure 8-12.

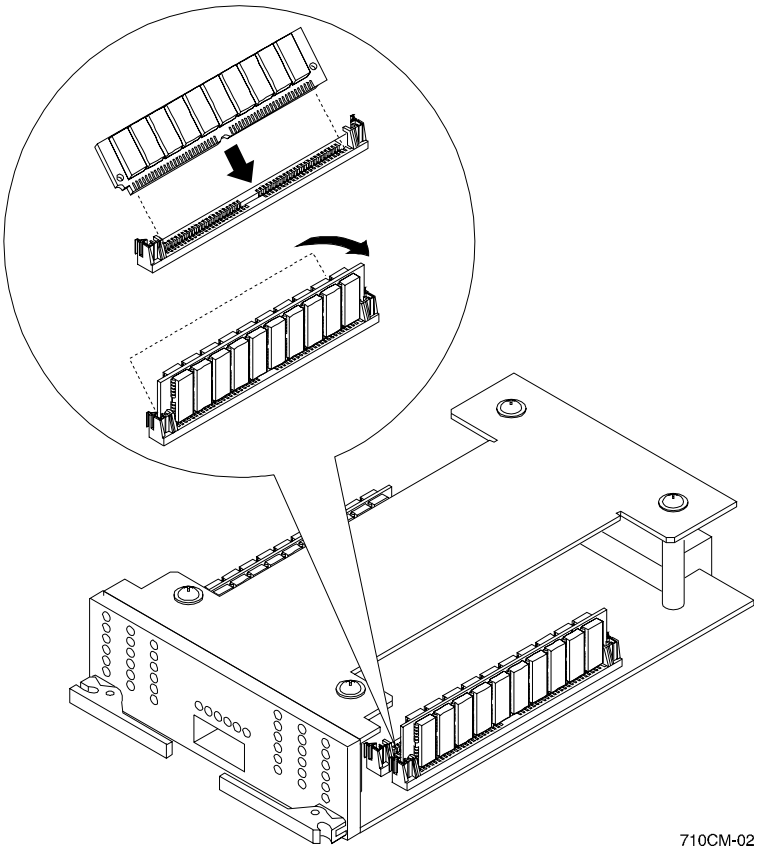

Figure 8-12. How to install SIMMs into a cache module

1. Install the notched end of the SIMM in slot 3 towards the front of the cache module.
2. Install the notched end of the SIMM in slot 1 towards the back of the cache module.

The cache module now appears similar to Figure 8-13.

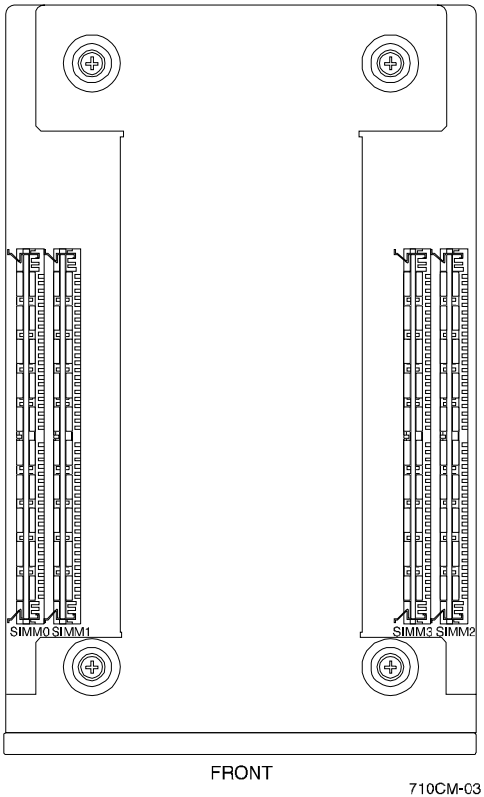

Figure 8-13. 128MB Cache Memory installed in a cache module

If you want to mirror cache, you need equal amounts of memory in each of the cache modules. Repeat this procedure to install additional memory in the other cache module.

Preparing Controllers and Cache Modules for Use

To prepare controllers and cache modules for operation, follow these major steps:

- Make a serial connection. See Chapter 2, "Accessing the CLI," in this guide.
- Set single controller parameters (See Table 8-3)

or

Configure failover and set parameters for dual-redundant controllers (See Section, *Configuring Failover and Setting Parameters for Dual-Redundant Controllers*)

Table 8-3
Controller Parameters

Parameter	Options	Default
CACHE_FLUSH_TIMER Sets the amount of time, in seconds, between flushes of the entire contents of the write-back cache to disk.	1–65535 seconds	10 seconds (Ensures cash flushed and written to storage devices on regular basis.)
HOST_FUNCTION Sets the controller to provide some responses, and operational and error behaviors consistent with the specified host operating system type.	A = Most Hosts B = IBM/RS 6000 and Novell NetWare Hosts C = Reserved D = Windows NT Server	A

continued

Table 8-3
Controller Parameters *continued*

Parameter	Options	Default
ID Sets the SCSI ID of the controller on the host SCSI bus. Set a unique SCSI ID for the controller.	0–7	None
PROMPT Allows you to specify a prompt for the controller's system command line interface.	1–16 ASCII printable characters (in double quotes).	'HSZ70 > "
TERMINAL_PARITY Sets the terminal parity to odd, even or none. No terminal parity causes the controller to not check for or transmit any parity on the terminal lines.	ODD EVEN NOTERMINAL_PARITY	NOTERMINAL_PARITY
TERMINAL_SPEED Sets the terminal speed to the specified baud rate.	4800 9600 19200	9600
TIME Sets the current date and time.	dd-mmm-yyyy:hh:mm:ss = day-month-year:hour: minute:second	None
TRANSFER_RATE_REQUESTED Sets the maximum data transfer rate between the controller and host.	DEFAULT 20 MHZ 10 MHZ 5 MHZ	20 MHZ

Configuring a Single Controller

Configuring a single controller RA7000 Subsystem involves specifying SCSI target IDs for the controller, and if desired, changing the default settings of other controller parameters. For additional information, refer to:

- DIGITAL™ StorageWorks HSZ70 Array Controller HSOF Version 7.0 Configuration Manual (EK–HSZ70–CG)
- DIGITAL™ StorageWorks HSZ70 Array Controller HSOF Version 7.0 CLI Reference Manual (EK–HSZ70–RM)

To configure a single controller:

1. Choose SCSI target IDs to establish addresses through which the host can address the controller. You can specify up to eight SCSI target IDs. Valid SCSI target IDs include 0-15. To set the SCSI target IDs, type:

HSZ70 > SET THIS_CONTROLLER ID = (*N,N,N,N,N,N,N,N*)

where (*N,N,N,N,N,N,N,N*) represents the SCSI target IDs selected between 0-15.

The controller displays information similar to the following example:

```
warning 4000: A restart of this controller is required before all the
parameters modified will take effect
%CER--HSZ70>>--13-JAN-1996 04:39:25 (time not set)—Restart of this
controller-required
Restart of the controller required
HSZ70 >
```

Although the CLI indicates that a restart of the controller must occur for the changes to take effect, do not restart the controller until after you make all of your changes to the controller configuration.

2. In addition to setting the SCSI target IDs for the controller, you can change other controller parameters described in Table A-3 from default to other setting options. To change any of the controller parameters listed in Table A-3, use command syntax similar to that shown in Step 1.

HSZ70 > SET THIS_CONTROLLER ID = (*N,N,N,N,N,N,N,N*)

replacing the ID = (*N,N,N,N,N,N,N,N,*) with another parameter and valid setting, for example:

HSZ70 > SET THIS_CONTROLLER PROMPT = 'RA7000> "

NOTE: You must set each parameter using a separate command.

3. Restart the controller to initialize with the new settings, type:

   HSZ70 > RESTART THIS_CONTROLLER

4. When the CLI prompt reappears, type the following to verify the configuration:

   HSZ70 > SHOW THIS_CONTROLLER FULL

Configuring Failover and Setting Parameters for Dual Redundant Controllers

Dual controllers allow you to maintain data availability in the event of a controller failure, when configured for failover. Failover mode allows both controllers to access the storage devices, providing higher output than a single controller. If one of the two controllers fails, the devices and cache (if any) become available to and accessible through the other controller.

Failover mode also provides you with the option to mirror cache. Mirrored write-back cache provides additional assurance of data availability. With mirrored write-back cache, data in cache memory is redundant and therefore not lost in the event of a cache failure. The controller uses half the available memory in each cache for transferring data from the host to the storage devices and half the available memory for redundancy of the other cache module. Therefore, if your cache modules have 64MB memory per module, with mirrored-cache, each uses 32MB for data transfer, and 32MB for redundancy of the contents of the other cache module.

To mirror cache, you simply enter an additional command while configuring the controllers. However, you can only mirror cache if both cache modules have equal amounts of either 64MB or 128MB of memory. For more information about mirroring cache, see *DIGITAL StorageWorks HSZ70 Array Controller HSOF Version 7.0 Configuration Manual (EK-HSZ70-CG).*

To configure failover:

1. Establish a serial connection with the first controller in the first slot as specified the section , "Accessing the CLI," in this guide.

   NOTE: In the steps that follow, the controller to which you made a serial connection is referred to as this_controller.

2. Put this controller into failover mode, type:

   HSZ70 > SET FAILOVER COPY = THIS_CONTROLLER

The other_controller inherits this_controller's configuration, then restarts. Wait for the other_controller to return to normal operation before continuing.

3. Enable mirrored cache mode, if desired. Type:

   HSZ70 > SET THIS_CONTROLLER MIRRORED_CACHE

Both controllers automatically restart, and this can take up to five minutes.

4. The next couple of steps guide you through setting the SCSI target IDs for each of the controllers and balancing the I/O load between the controllers by specifying preferred IDs. Additional reference information is contained in the *DIGITAL StorageWorks HSZ70 Array Controller HSOF Version 7.0 Configuration Manual (EK–HSZ70–CG).*

Choose SCSI target IDs to establish addresses through which the host can access the controllers. You can specify up to eight SCSI target IDs. Valid SCSI target IDs include 0-15. Set the same SCSI target IDs for each of the controllers. To set SCSI target IDs for each of the controllers, type the following commands:

HSZ70 > SET THIS_CONTROLLER ID = (*N,N,N,N,N,N,N,N*)

where (*N,N,N,N,N,N,N,N*) represents up to eight SCSI target IDs between 0-15.

A message appears indicating that you need to restart the controllers for the changes to take effect. However, wait until you complete all of the procedures in this section before restarting the controllers.

5. You can set preferred IDs to utilize both controllers during normal operation or set nopreferred IDs to effectively make the other_controller a hot standby which the subsystem uses only in the event that this_controller fails.

Set preferred IDs to specify which of the two controllers respond to which SCSI target IDs on the SCSI bus. This balances the I/O load and improves the throughput for the dual-redundant pair. In the event that one of the controllers fails, the other controller automatically responds to the SCSI target IDs preferred to the failed controller.

To prefer SCSI target IDs for each controller, type:

HSZ70 > SET THIS_CONTROLLER PREFERRED_ID = (*N,N,N,N*)

where (*N,N,N,N*) specifies which target(s) will be handled by this_controller. The other controller will automatically be preferred the remaining IDs.

Set noprefered IDs to make this_controller process all I/O operations and the other_controller a hot standby, which does not respond to any SCSI targets on the host SCSI bus. The other_controller takes over processing I/O operations in the event that this_controller fails.

To declare that the other_controller has no preferred SCSI target IDs, type:

HSZ70 > SET OTHER_CONTROLLER NOPREFERRED_ID

6. In addition to setting the SCSI target IDs for the controller, you can change other controller parameters described in Table A-3 from defaults to other setting options. To change any of the controller parameters listed in Table A-3, use command syntax similar to:

   HSZ70 > SET THIS_CONTROLLER ID = (*N,N,N,N,N,N,N,N*)

Replace the parameter (ID) and its setting (= (*N,N,N,N,N,N,N,N*)) with another parameter and valid setting, for example:

HSZ70 > SET THIS_CONTROLLER PROMPT = "RA7000> "

NOTE: You must set each parameter using a separate command.

7. After you set all of the controller parameters, restart the controllers to initialize with the new settings, type:

   HSZ70 > RESTART OTHER_CONTROLLER

   HSZ70 > RESTART THIS_CONTROLLER

8. When the CLI prompt reappears, type the following to verify the configuration:

   HSZ70 > SHOW THIS_CONTROLLER FULL

The controller displays information similar to the following example:

```
Controller:

        HSZ70 ZG64900264 Firmware V73Z-0, Hardware DX12
        Configured for dual-redundancy with ZG64900218
        in dual redundant configuration
        Device Port SCSI address 7
        Time: NOT SET

Host port:

        SCSI target(s) (0, 1, 2, 3)
        Preferred target(s) (2, 3)
        TRANSFER_RATE_REQUESTED = 20MHZ
        Host Functionality Mode = A
        Command Console LUN is target 0, lun 0

Cache:

        64 megabyte write cache, version 4
        Cache is GOOD
        Battery is Good
        No unflushed data in cache
        CACHE_FLUSH_TIMER = DEFAULT (10 seconds)
        NOCACHE_UPS

Mirrored Cache:

        64 megabyte write cache, version 4
        Cache is GOOD
        Battery is GOOD
        No unflushed data in cache

Extended Information:

        Terminal speed 9600 baud, eight bit, no parity, 1 stop bit
        Operation control: 00000004  Security state code: 26622
        Configuration backup disabled
```

HSZ70 > SHOW OTHER_CONTROLLER FULL

The controller displays information similar to the following example:

```
Controller:

        HSZ70 ZG64900218 Firmware V73Z-0, Hardware DX12
        Configured for dual-redundancy with ZG64900264
        in dual redundant configuration
        Device Port SCSI address 6
        Time: NOT SET

Host port:

        SCSI target(s) (0, 1, 2, 3)
        Preferred target(s) (0, 1)
        TRANSFER_RATE_REQUESTED = 20MHZ
        Host Functionality Mode = A

        Command Console LUN is target 0, lun 0

Cache:

        64 megabyte write cache, version 4
        Cache is GOOD
        Battery is Good
        No unflushed data in cache
        CACHE_FLUSH_TIMER = DEFAULT (10 seconds)
        NOCACHE_UPS

Mirrored Cache:

        64 megabyte write cache, version 4
        Cache is GOOD
        Battery is GOOD
        No unflushed data in cache

Extended Information:

        Terminal speed 9600 baud, eight bit, no parity, 1 stop bit
        Operation control: 00000004  Security state code: 53223
        Configuration backup disabled
```

Connecting RA7000 Expansion Cabinets

NOTE: One DS–BNK37–1E cable kit is required for each expansion cabinet.

Cabling Sequence

When adding an expansion BA370 cabinet, the following sequence is suggested.

1. Connect all six SE I/O cables between cabinets.
2. After the SE I/O cables are attached, connect the Environmental Monitor Unit (EMU) communication cable.
3. The last step is to set the PVA address.

Attaching the SE I/O Cables

There is a separate cable for each port of the controller and all cables are identical. See Figure 8-14 and attach the cables to one port at a time. SE I/O cables are connected port-to-port maintaining the same port number at each end. Port 1 of the master cabinet connects to port 1 of the expansion cabinet(s), port 2 of the master cabinet connects to port 2 of the expansion cabinet(s), and so forth. Start with the bottom row (ports 1, 3, 5) first. Then attach cables to ports 2, 4, and 6.

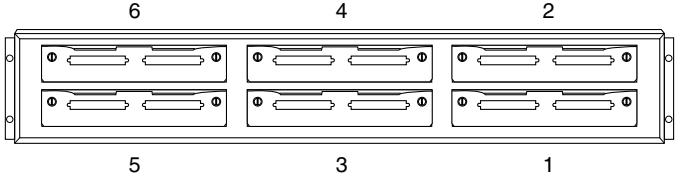

Figure 8-14. SE I/O port identification

Place the cable clip on each cable prior to attaching the cable to the I/O module. Orient the connector on the cable to match the I/O module connector and plug the cable connector into the I/O module connector.

Secure the cable by tightening the cable connector jackscrews.

> **NOTE:** Do not omit the tightening of the jackscrews. There is not enough contact pressure to hold the cables in place between enclosures.

Slide the cable clip along the cable and press it into the hole of the I/O module bracket.

Cabling for One Expansion Cabinet

For a single expansion cabinet, cable from the **terminated** side of the I/O module on the master cabinet to the **terminated** side of the expansion cabinet. The terminated side is identified by the resistor symbol, it is also the left-hand connector of the SE I/O module. See Figure 8-15.

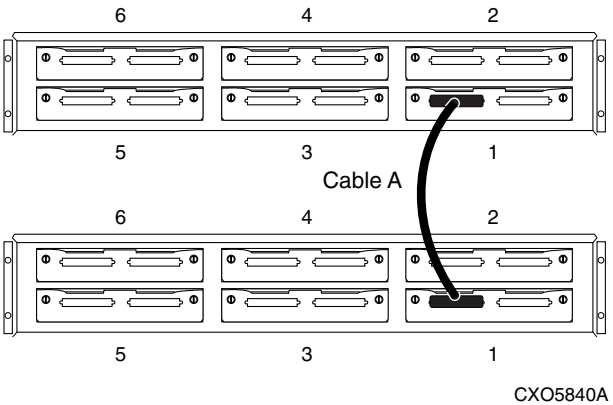

Figure 8-15. SE I/O port wiring (one expansion cabinet)

Cabling for Two Expansion Cabinets

For two expansion cabinets, cable from the **terminated** side of the I/O module on the master cabinet to the **terminated** side of the I/O module on the first expansion cabinet. Then connect from the **unterminated** side of that I/O module on first expansion cabinet to the **terminated** side of the I/O module on the second expansion cabinet. The unterminated side is identified by the resistor symbol enclosed in a circle with a diagonal bar across the symbol. It is also the right-hand connector of the SE I/O module. See Figure 8-16.

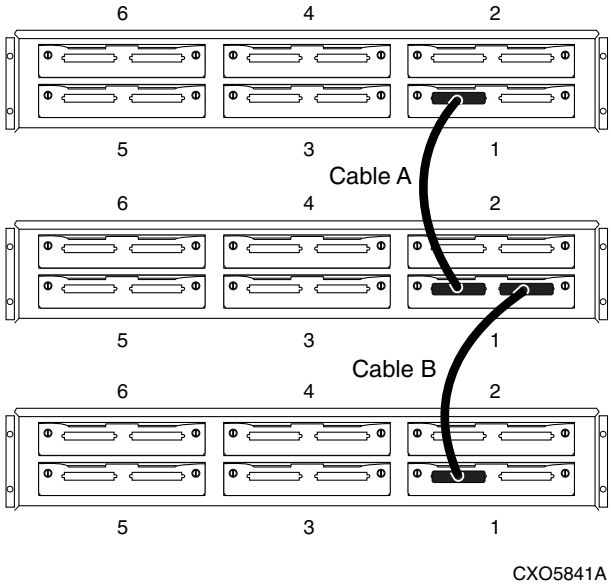

Figure 8-16. SE I/O connections for two expansion cabinets

Attaching the EMU Communications Cable

Connect the EMU Communications cable from one EMU communications port (See Figure 8-17) of the master RA7000 to the communications port of the first expansion cabinet. If there is a second expansion cabinet, connect an EMU communications cable from one EMU communications port of the first expansion cabinet to a communications port of the second expansion cabinet. See Figure 8-17.

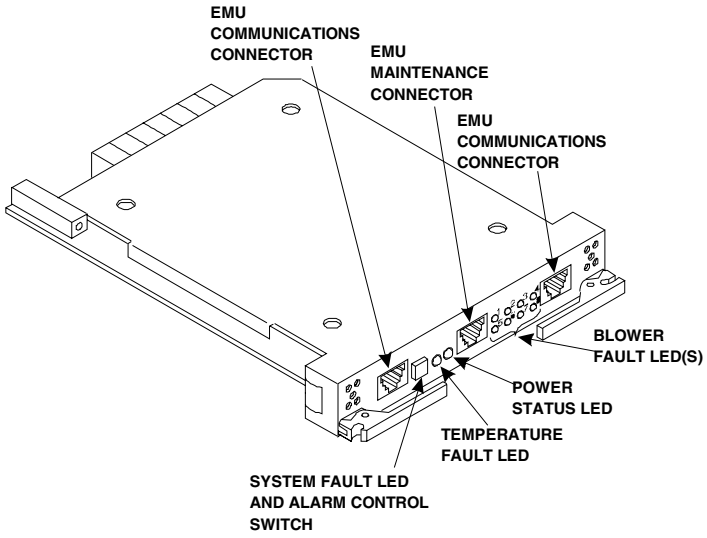

Figure 8-17. EMU front panel

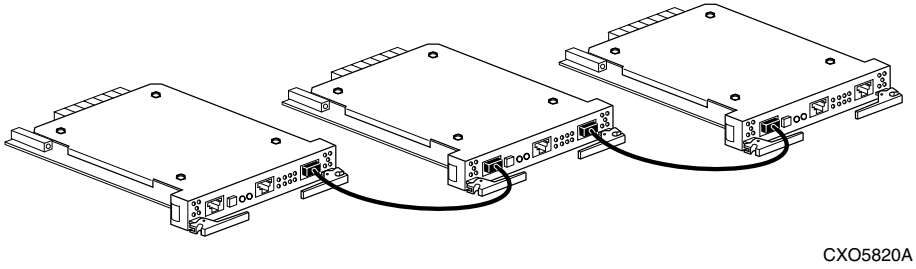

Figure 8-18. Multiple EMUs connected together

Setting the PVA Addresses

Compaq supports enclosure addresses 2 and 3, only for expansion enclosures. Figure 8-19 shows the SCSI bus address switch location on the Power Verification and Addressing (PVA) module and Figure 8-20 defines the StorageWorks Building Block (SBB) device IDs for these two settings of the PVA SCSI bus address switch. The use of these addresses in combination depends on the number of enclosures and possible addressing conflicts.

CAUTION: Compaq does not support any enclosure address combination not listed in Table 8-4.

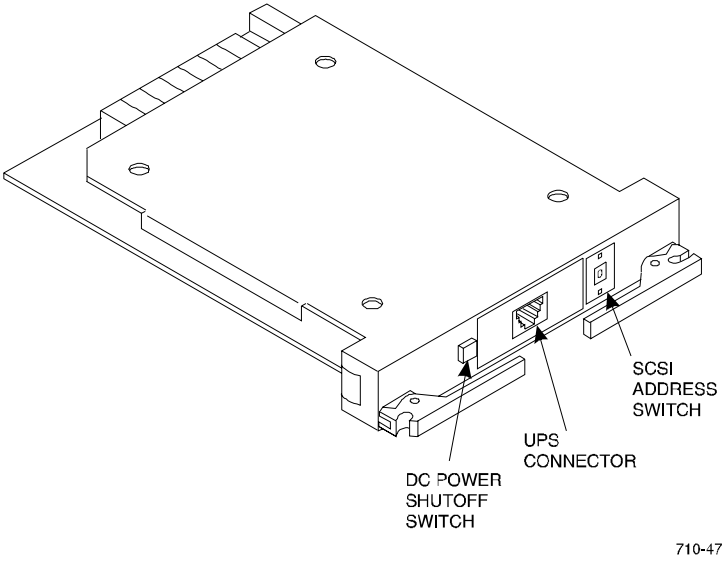

Figure 8-19. PVA module front panel

Table 8-4
Expansion Enclosure Address Combinations

Enclosure	PVA SCSI Buss Address Switch Setting for Two Enclosure Subsystem	PVA SCSI Buss Address Switch Setting for Three Enclosure Subsystem
Master	0	0
First Expansion Enclosure	2	2
Second Expansion Enclosure	N/A	3

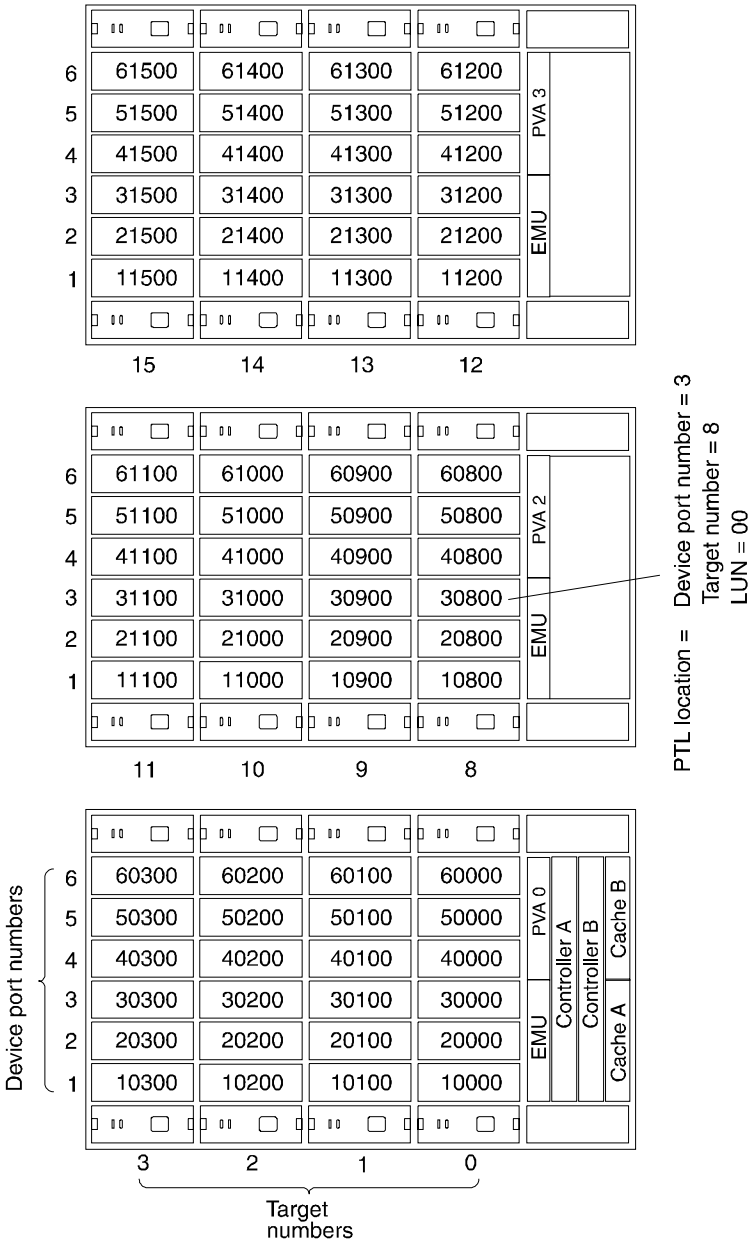

Figure 8-20. Expansion enclosure SCSI bus addresses

Connecting SCSI Bus Cables to the ESA10000

The internal SCSI bus cabling of two BA370s within an ESA10000 cabinet as well as the SCSI bus cabling between a master and expansion cabinet is shown in Figure 8-21. The cabling scheme is to route the upper BA370's I/O module number 1's left port to the lower BA370's I/O module number 1's right port. Route the upper BA370's I/O module number 2's left port to the lower BA370's I/O module number 2's right port. Follow this cabling scheme for cabling SCSI bus cables in an ESA10000 that contains two BA370s.

To expand the SCSI bus from a master cabinet to an expansion cabinet, route the lower BA370's SCSI bus cables from I/O module number 1's left port to the expansion cabinet's I/O module number 1's left port. Notice for expansion that the cables run from the left port of the master cabinet to the left port of the expansion port, just the opposite as for SCSI bus cabling between two BA370s that reside in the same cabinet. See Figure 8-21 for help in routing SCSI bus cables.

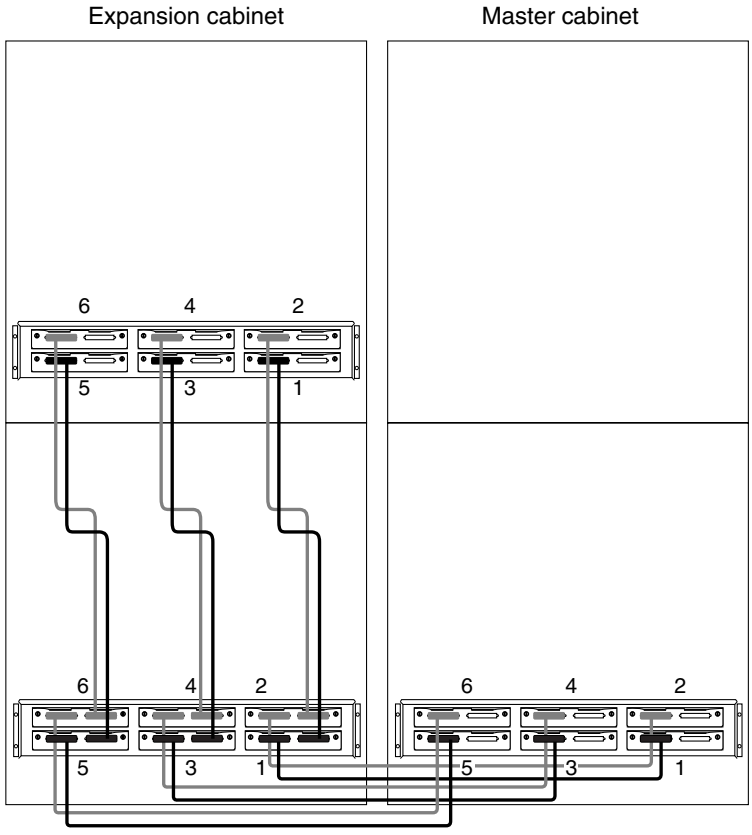

Figure 8-21. SCSI bus cabling for the ESA10000

Installing Additional BA370 Rack-Mountable Enclosure

Install an additional BA370 rack-mountable enclosure into your ESA10000 data center cabinet to expand storage capacity. Kits you will need to complete an installation of a BA370 into an ESA10000 data center cabinet are the following:

DS-BA370-AA -- The BA370 rack-mountable enclosure that includes not only the enclosure, but also five 180 watt power supplies, eight fans, a rack mounting kit, an EMU, and a PVA.

DS-HSZ70-AH -- The controller kit that includes not only the I/O controller module assembly, but also two cache module assemblies, SIMM modules to upgrade the cache modules if necessary, all necessary labels and cables along with a ferrite bead kit for the controller to host cable, necessary hardware, and the ECB cable installation kit.

DS-HS35X-BD -- The ECB itself.

DS-SW6XP-AA/AB -- A second 60 Hz or 50 Hz power distribution unit.

DS-BA35X-HH -- To configure a fully redundant system, **three** more 180 watt power supplies must be added to the BA370.

The BA370 is shipped with a rack mounting kit containing **mounting rails**, which you install onto the data center cabinet's vertical rails, and **mounting brackets**, which you attach to the sides of the BA370 rack-mountable enclosure.

You must first install the **mounting rails** onto the data center cabinet's vertical rails. Ensure proper orientation of the rails by referring to Figure 8-22 and Figure 8-23, while visually inspecting the rails and reading the following text. It is very important that you properly install the mounting rails onto the data center cabinet's vertical rails or you will not be able to install the BA370. The front of the mounting rail has three protruding studs, with an alignment tab approximately five inches behind the studs. The front of the mounting rail is installed towards the front of the cabinet with the alignment tabs facing the cabinet side panels and with the three studs protruding through designated holes in the cabinet front vertical rails. The rear of the mounting rail has a U-shaped flange and two screw holes, one in the U-shaped flange and one in the mounting rail itself. The rear of the mounting rail is installed towards the rear of the cabinet. The bottom of the mounting rail has a flange running the entire length of the rail. The top of the mounting rail has a flange that runs most of the length of the mounting rail from the rear of the mounting rail to approximately two inches from the front of the mounting rail.

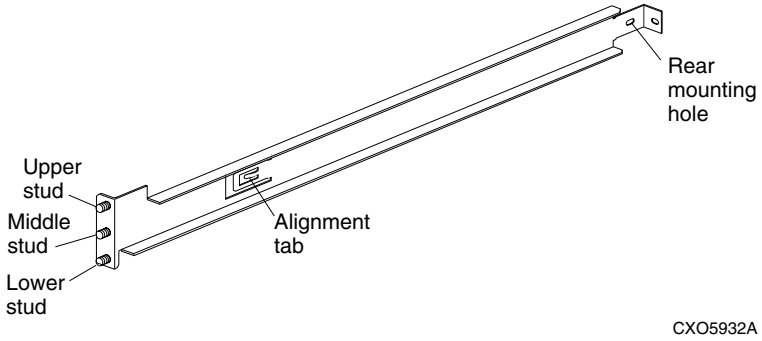

Figure 8-22. Mounting rail orientation

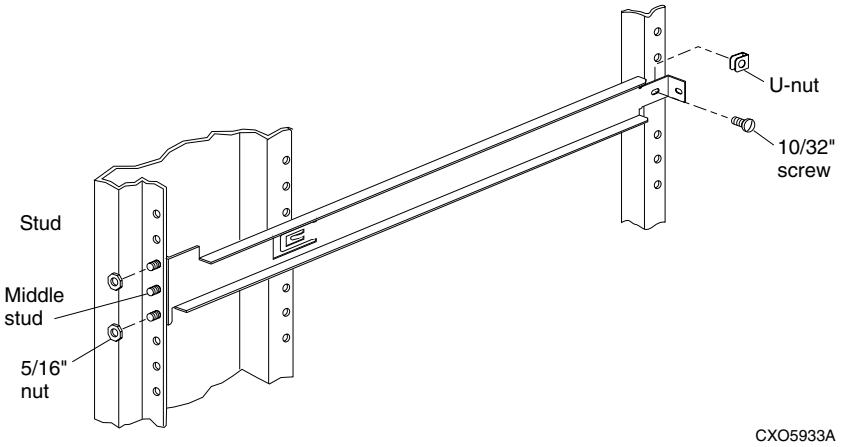

Figure 8-23. Mounting rail installation on cabinet vertical rail

Use Table 8-5 and Table 8-6 as a guide for installing the mounting rails into the proper holes of the vertical rails of the data center cabinet. If using Table 8-5, count the holes from the **top** of the data center cabinet. If using Table 8-6, count the holes from the **bottom** of the data center cabinet.

Table 8-5
Installing Rails for the Upper BA370

Rail	Top Hole	Bottom Hole
Upper BA370, upper left rail	4	6
Upper BA370, lower left rail	26	28
Upper BA370, upper right rail	7	9
Upper BA370, lower right rail	24	26

Table 8-6
Installing Rails for the Lower BA370

Rail	Top Hole	Bottom Hole
Lower BA370, upper left rail	28	26
Lower BA370, lower left rail	6	4
Lower BA370, upper right rail	25	23
Lower BA370, lower right rail	8	6

1. Position the mounting rails in the hole positions indicated by Table 8-5 or Table 8-6. The upper and lower studs on the front of the mounting rails align with the indicated holes on the data center cabinet's front vertical rails. The alignment tab slides into a hole on the inner front vertical rail of the cabinet that corresponds to the middle stud of the mounting rail. Attach the front of the mounting rail to the front of the cabinet using two 5/16 inch nuts on the top and bottom studs of each mounting rail and tighten. See Figure 8-23. **DO NOT** attach a 5/16 inch nut to the middle stud of the mounting rail. This is reserved for locking the BA370 into the cabinet.

2. Slide four U-Nuts onto the rear vertical rails of the data center cabinet and over the obvious holes that correspond to the rear mounting holes of the cabinet's vertical rails, as shown in Figure 8-23. Attach the rear of the mounting rails to the cabinet by inserting a 10/32 inch x 5/8 inch screw through the holes in the mounting rails, through the rear vertical rails of the cabinet and through the U-nuts. Because the front of the mounting rail was attached to the cabinet in Step 1, the rear hole on the mounting rail should automatically align with the proper hole on the rear vertical rail of the cabinet. If you have doubts on proper rear hole alignment, count the number of holes on the front of the cabinet up to the middle stud of the mounting rail. The rear screw attachment hole should correspond to the middle stud hole on the front of the mounting rail as well as to the alignment tab hole.

3. At this time, install the ECB into the proper position of the ECB shelf. ECBs (Part Number DS-HS35X-BD) for the ESA10000 can be ordered, and must be available prior to starting an installation of a BA370 rack-mountable enclosure. Figure 8-24 shows an ECB being installed into the right position of the ECB shelf (viewed from the back). An ECB installed in this position is for the cache modules that are installed in the upper BA370 rack-mountable enclosure. An ECB installed in the left position of the ECB shelf is for the cache modules installed in the lower BA370 rack-mountable enclosure. On the service label, enter the date of installation, serial number, and revision level on the label. Place the service label on the shelf below the ECB.

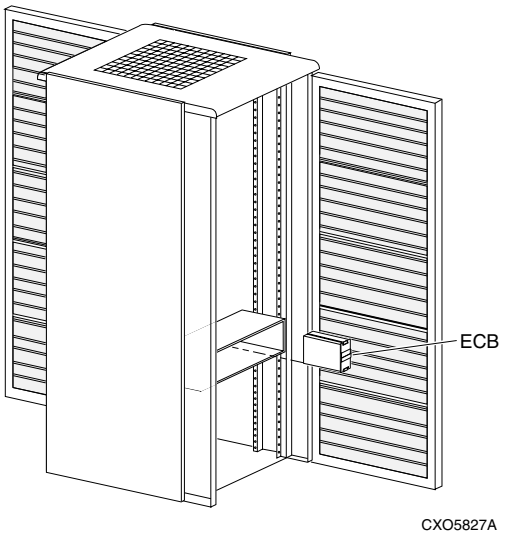

Figure 8-24. Location of ECB shelf and ECB

4. You must now install the ECB Y-cables. For the installation of ECB Y-cables, see Figure 8-25. For purposes of this discussion, the top ECB Y-cables are referred to as P2 and S2; P2 for the left ECB Y-cable position (upper cache A) and S2 for the right ECB Y-cable position (upper cache B), viewed from the front of the cabinet. The bottom ECB Y-cables are referred to as P1 and S1; P1 for the left ECB Y-cable position (lower cache A) and S1 for the right ECB Y-cable position, (lower cache B) viewed from the front of the cabinet. See Figure 8-25.

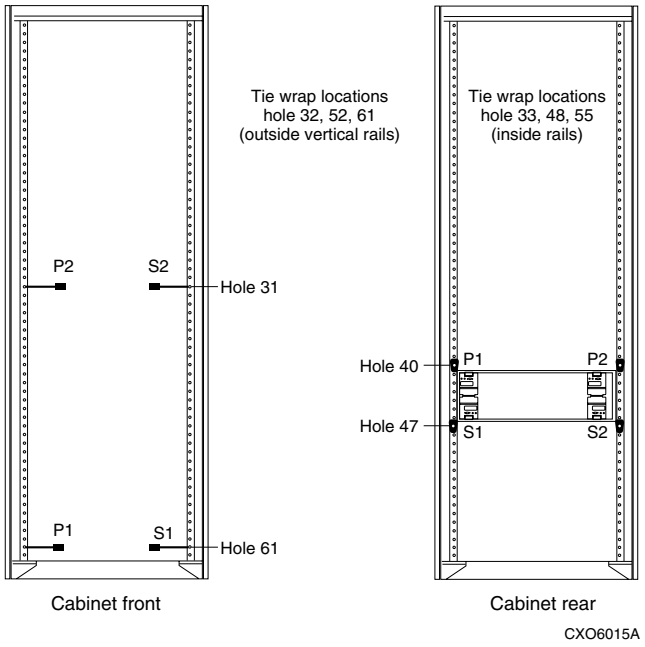

Figure 8-25. Tie-Wrap locations for front and rear view of cabinet

This step, and steps 6 through 13 of this procedure are for installing a BA370 into the top position of the cabinet.

To install a BA370 in the **bottom** position, go to Step 14 of this procedure.

For a BA370 that is to be installed in the **top** position of the data center cabinet, install the tie-wrap assemblies, 90-11456-01, contained in the ECB cable installation kit (part of the DS-HSZ70-AH controller kit) at hole numbers 33, 48, and 55 on both inner rear vertical rails of the cabinet. See Figure 8-25.

1. At the front of the cabinet, tie-wrap the ECB Y-cables referred as P2 and S2 to holes 31 of the cabinet's front outside vertical rails, both left and right side. See Figure 8-25. Leave approximately 7 inches of cable extended for each cable in the front of the cabinet so that the cable can be attached to the cache module later.
2. Route P2 through the cabinet to hole 33 on the right (viewed from the rear) inner vertical rail of the cabinet and secure with the previously installed tie-wrap. See Figure 8-26.

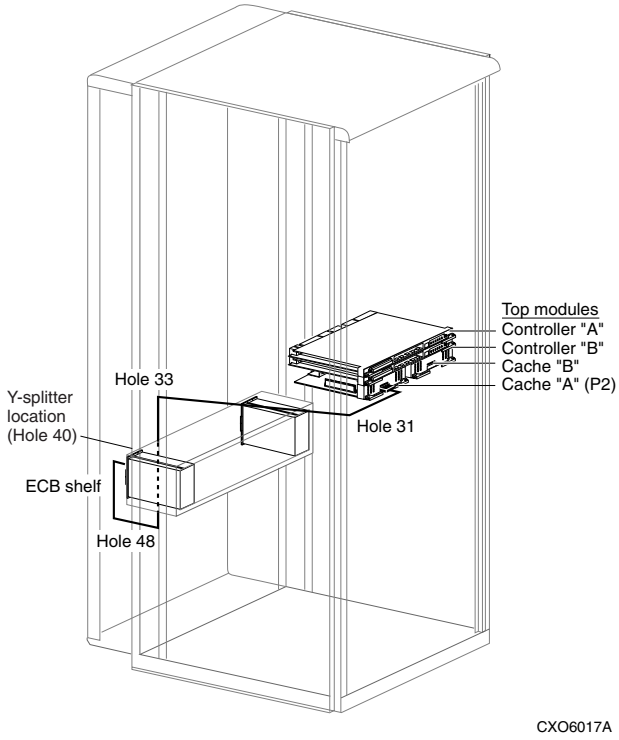

Figure 8-26. ECB Y-cable routing for P2 (Cache A)

3. Route P2 down the inner vertical rail to hole 48 and secure. Do not pull the tie-wrap tight, as other cables will be secured at this same hole location.

4. Route P2 towards the outer rear vertical rail on the same side and secure the Y-splitter at hole 40 of the right (viewed from the rear) rear outer vertical rail directly above the ECB shelf. Position the Y-splitter with its screw recess facing you. Secure the Y-splitter with one screw (90-06025-01), one washer, (90-00000-01) and one nut, (90-09243-00) using a 5 inch/pound torque driver. The short end of P2 plugs into the top ECB of the dual ECB assembly. Route the long end of P2 down the outer vertical rail and secure at hole 52. More than one cable will be secured at this hole, so do not pull the tie-wrap tight until all cables have been installed. See Figure 8-27.

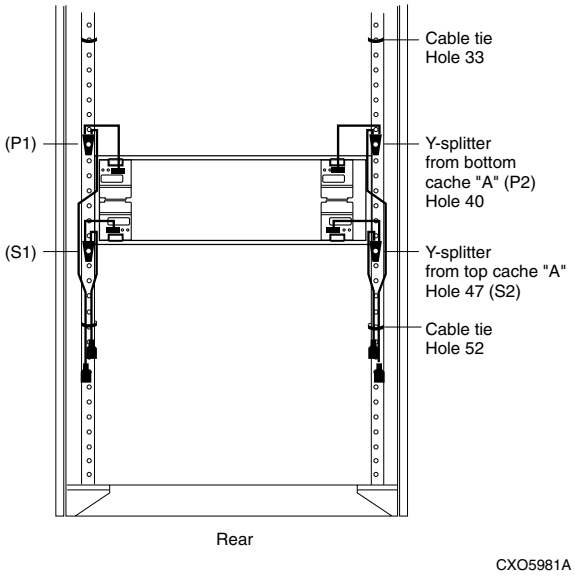

Figure 8-27. Rear view of cabinet showing ECB Y-Cable routing

5. Route S2 through the cabinet towards the rear to hole 33 of the left (viewed from the rear) inner vertical rail and secure with the previously installed tie-wrap. See Figure 8-28.

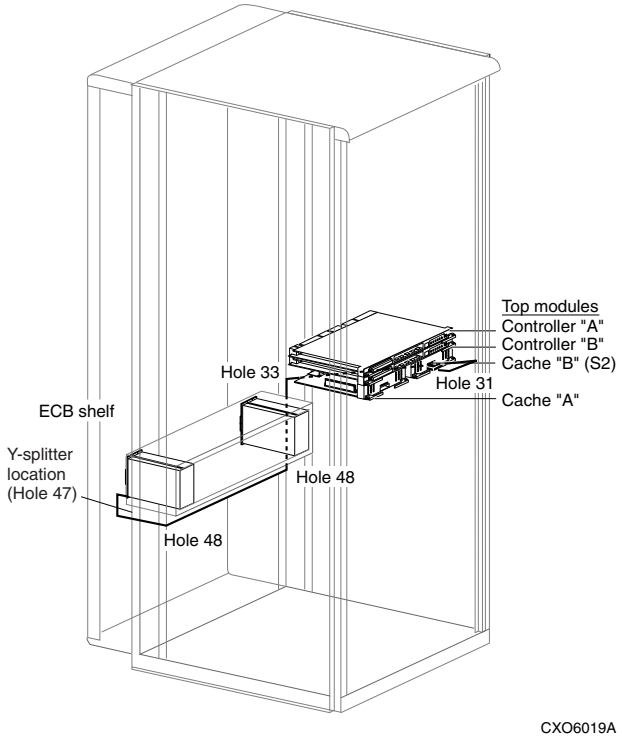

Figure 8-28. ECB Y-Cable routing for S2 (Cache B)

6. Route S2 down the inner vertical rail to hole 48 and secure. More than one cable will be secured at this location, so do not pull the tie-wrap tight until all cables have been installed.

7. Route S2 **under** the ECB shelf to the opposite inner vertical rail to hole 48 of the right (viewed from the rear) inner vertical rail and secure. More than one cable will be installed at this location , so do not pull the tie-wrap tight until all cables have been installed.

8. Route S2 towards the outer vertical cabinet rail and secure the Y-splitter at hole 47 of the right outer vertical rail. The short end of the cable plugs into the bottom ECB of the dual ECB assembly. The long end of the cable is secured to hole 52. More than one cable will be secured at this location, so do not pull the tie-wrap tight until all cables have been installed. See Figure 8-28.

9. For a BA370 that is to be installed in the **bottom** position of the data center cabinet, install the tie-wrap assemblies, 90-11456-01, contained in the ECB cable installation kit (part of the DS-HSZ70-AH controller kit) at hole numbers 33, 48, and 55 of both of the cabinet's rear inner vertical rails. See Figure 8-25.

10. At the front of the cabinet, secure P1 to hole 61 of the left front vertical rail as shown in Figure 8-25 and secure S1 to hole 61 of the right front vertical rail as shown in Figure 8-25. Leave approximately seven inches of cable extended for each cable in the front of the cabinet so that the cable can be attached to the cache module later.

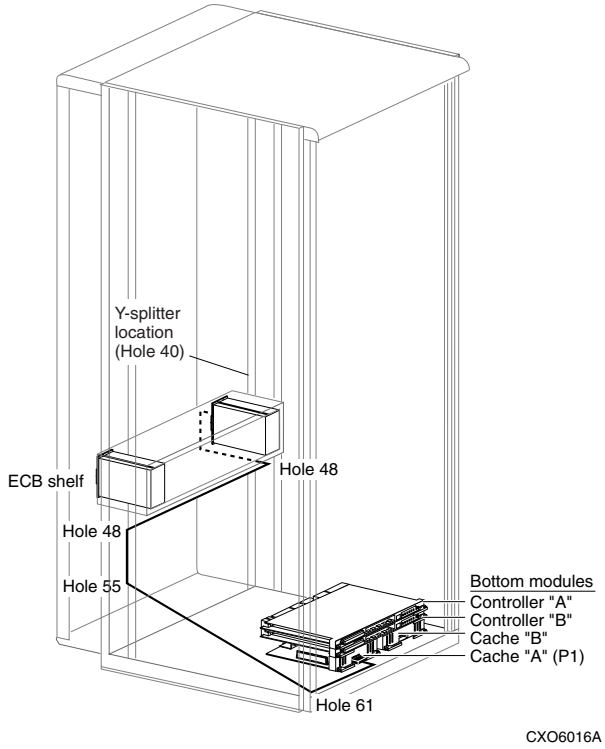

Figure 8-29. ECB Y-Cable routing for P1 (Cache A)

11. Route P1 through the cabinet to hole 55 on the right (viewed from the rear) inner vertical rail of the cabinet and secure with the previously installed tie-wrap. See Figure 8-29.

12. Route P1 up the inner vertical rail to hole 48 of the outer vertical rail and secure. More than one cable will be secured at this location, so do not tighten the tie-wrap until all cables have been installed.

13. Route P1 under the ECB shelf to the opposite side of the cabinet and secure to hole 48 of the left (viewed from the rear) inner vertical rail. More than one cable will be secured at this location so do not tighten the tie-wrap until all cables have been installed.
14. Route P1 to the left rear outer vertical rail and secure the Y-splitter at hole 40 above the ECB shelf. The short end of the cable plugs into the top ECB of the dual ECB assembly. The long end of the cable is routed down the outer vertical rail to hole 52 and secured. See Figure A-27. More than one cable will be secured at this location so do not tighten the tie-wrap until all cables have been installed.
15. Route S1 through the cabinet towards the rear. Secure S1 at hole 55 on the left inner vertical rail. See Figure 8-30.

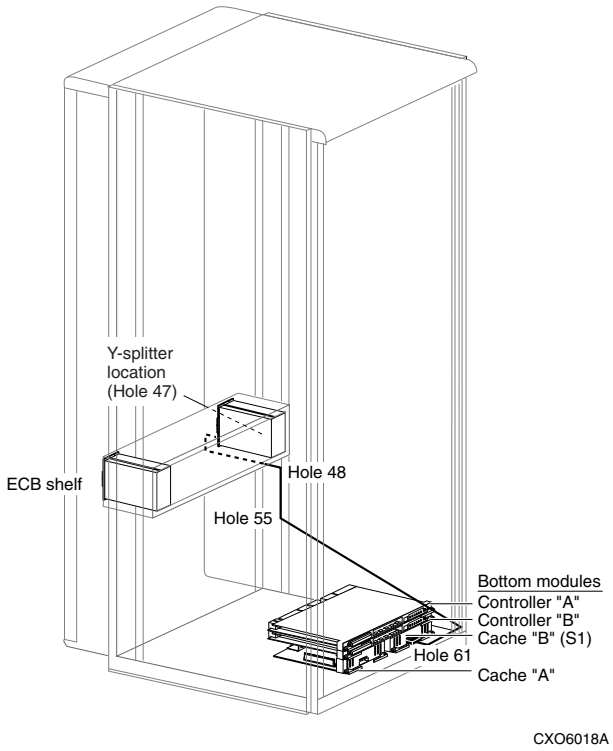

Figure 8-30. ECB Y-Cable routing for S1 (Cache B)

16. Route S1 up the inner vertical rail to hole 48 and secure. More than one cable will be secured at this location, so do not pull the tie-wrap tight until all cables have been installed.

17. Route S1 towards the outer vertical rail and secure the Y-splitter at hole 47 of the left outer vertical rail. The short end of S1 plugs into the bottom ECB of the dual ECB assembly. The long end of S1 is secured to hole 52 with other cables. See Figure 8-27. The ECB cable installation is now complete. Remember to tighten all tie-wraps that have multiple cables secured with them. ECB Y-cabling at the rear of the cabinet should appear as in Figure 8-27. Now you must attach the **mounting brackets** to the BA370 rack-mountable enclosure.

18. Attach the **mounting brackets** to the sides of the BA370 using the two 8/32 inch x 1/4 inch screws provided, as shown in Figure 8-31. Notice that the mounting bracket's screw holes are actually one slot and one hole. Position the bracket so that the slot is towards the front of the BA370. Install the screw into the screw hole first and tighten. Install the screw into the screw slot second and tighten. Note that once attached, the bracket extends further on the rear of the BA370 than it does on the front of the BA370.

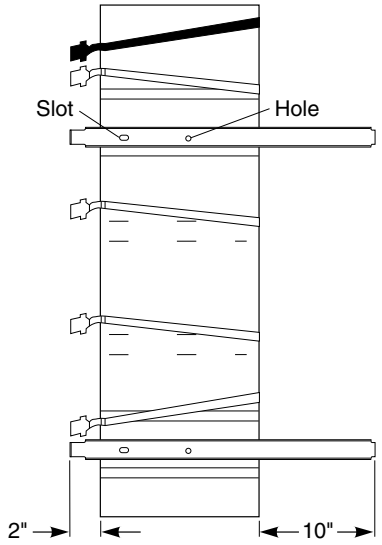

Figure 8-31. Attaching mounting brackets to the BA370

Now you are ready to install the BA370 rack-mountable enclosure into the ESA10000 data center cabinet. Use the following procedure.

WARNING:

- Installing the BA370 into an ESA 100000 requires two people. Never attempt to lift the BA370 by yourself. Doing so may cause injury, damage the equipment, or both.
- Never install a BA370 into the upper position of an ESA10000 unless there is a BA370 already residing in the lower position. Doing so may cause injury, damage the equipment, or both.
- Never attempt to install the BA370 with SBBs installed. You must first remove all power supply and disk drive SBBs from the BA370 before completing this installation.
- Serious personnel injury can result if correct safety precautions are not taken when installing the BA370 rack-mountable enclosure

1. If power is applied to the cabinet, power down the HSZ70 controllers by following the procedure contained in the *DIGITAL StorageWorks HSZ70 Array Controller HSOF Version 7.0 Service Manual*. Remove AC power to the BA370 by moving the switch on the AC power controllers to 0. Remove AC power to the Power Distribution Unit (PDU) by moving the breaker switch to 0. Disconnect the power distribution unit from the AC power source.
2. When you install an additional BA370 into the cabinet, you must also install and tie-wrap the external cache battery (ECB) cable that connects the HSZ70 controller to the ECB. Your ESA10000 comes precabled for AC power. For the bottom BA370, tie-wrap each ECB cable to the bottom hole on both front vertical siderails of the cabinet in the general vicinity of the AC power cables that come pre-installed and tie-wrapped. For the top BA370, tie-wrap each ECB cable in the general vicinity of the AC power cords tie-wrapped to the vertical rails. Leave the ECB cable extended in the front approximately 10 inches. This ensures that the ECB cables can be plugged into the cache modules. Tie-wrapping ensures that the ECB cables are not damaged when you install a BA370.
3. Tuck the ECB cables and AC power cords behind the front vertical rail of the BA370. Remember, you left the ECB cables extended by 10 inches. Failure to tuck the cables behind the cabinet rails may cause damage to the cables when you install the BA370 into the cabinet.
4. Position the BA370 on the floor in front of the cabinet. Remove **ALL** power supply and disk drive SBBs from the BA370 **BEFORE** attempting to lift the BA370

5. With a person on each side, grasp the BA370 by the mounting bracket with one hand and by the front top bank of the BA370, (where you previously removed the SBB disk drives) with the other hand. Lift the BA370 up, matching the mounting brackets with the mounting rails, and slide the BA370 into the cabinet **half way** or **until the fans enter the cabinet**.
6. Plug the four-wire front door LED cable harness, which is tie-wrapped along with the AC input power cables to the cabinet vertical rails, into the LED cable harness on the top of the BA370.
7. Make sure that all cables, LED, ECB and AC power, are out of the way and cannot be damaged when the BA370 is slid entirely into the cabinet. Slide the BA370 into the cabinet until it stops.
8. Lock the BA370 into place by attaching a 5/16 inch nut over the middle stud on the front of each mounting rail. In the rear of the cabinet, use a 10/32 inch screw through the screw holes of the mounting rails and brackets. See Figure A-23. This effectively locks the BA370 securely into the cabinet.
9. Ensure the AC power distribution unit (PDU) circuit breaker is off and the AC power controller switch on the AC power controllers is off.
10. Re-install all power supply and disk drive SBBs into the BA370.

For n+1 power redundancy, plug black power supply cables into all left-hand power supply SBBs and one black power cable into the right, top most power supply SBB. See Figure 8-32. For dual power redundancy, plug all black power cords into all left-hand power supply SBBs and plug all white power cords into all right-hand power supply SBBs. See Figure 8-33.

11. Make sure the HSZ70 controllers, EMU, and PVA are seated in the BA370 in their proper locations. Also plug the AC power cord(s) into the AC power controller(s) on the front of the BA370.
12. For BA370s with n+1 power configurations, go to the rear of the cabinet and plug the black AC power cord from the BA370's AC power controller into the bottom PDU that already has a black power cord plugged into it. For dual-redundancy units, plug the gray AC power cord from the BA370's AC power controller into the top PDU in the rear of the cabinet. Attach ECB cables to the ECB and to the cache modules The top BA370 ECB is located on the left side of the ECB shelf. The bottom BA370 ECB is located on the right side of the ECB shelf.
13. Plug the PDU AC power cable(s) into the AC power source.

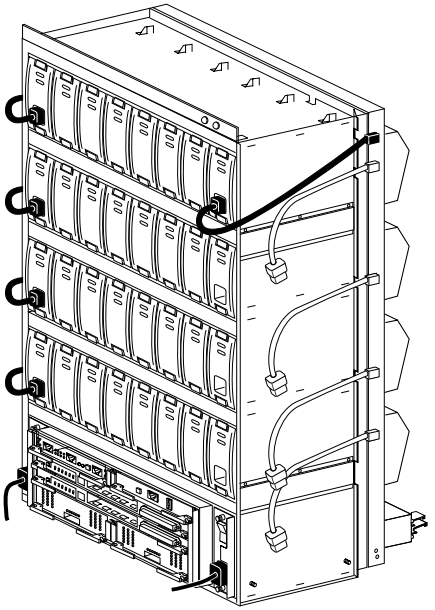

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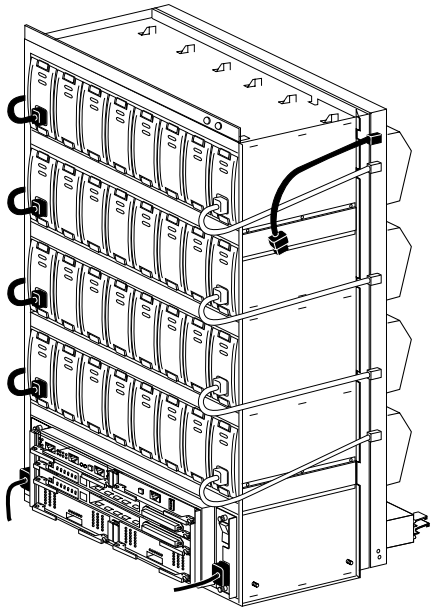
Figure 8-32. N+1 power cabling



CXO5797A

Figure 8-33. Fully redundant power cabling

Joining ESA10000 Data Center Cabinets

The ESA10000 packaging contains a cabinet joiner kit (2T-H9C10-JC). See Table 8-7.

Table 8-7
Joiner Kit Contents

Description	Quantity
Top trim piece	1
Front trim piece	1
Rear trim bracket	1
Joiner pawl assembly	4
Joiner receptacle assembly	4
M5 x 12 mm machine screw	18
M5 x 16 mm machine screw	2
M5 keybutton screw	2
M5 U-clips	16
24 inch Allen wrench	1

NOTE: Pawl assemblies have a hole through the assembly, and a movable piece. Receptacle assemblies do not have a hole through the assembly, and they do not have a movable piece.

Use the following procedure to join two ESA10000 data center cabinets.

1. Roll the cabinets to the desired location. Viewed from the front, configure the left (expansion) cabinet with two BA370s, with no controllers, and configure the right (master) cabinet with one BA370 in the bottom position with controllers installed.
2. Open the expansion cabinet's back door, to access the 5/16 inch hex head screw located on the bottom, rear vertical rail. See Figure 8-34.
3. Remove the right side panel, using a standard 5/16 inch open-end wrench to remove the screw. Later, this hole position and the corresponding front hole position, will be used to install M5 keybutton screws.

4. From the outside of the expansion cabinet, lift the side panel up and off the upper and lower brackets upon which the side panel rests. This may require two people. Store the side panel.

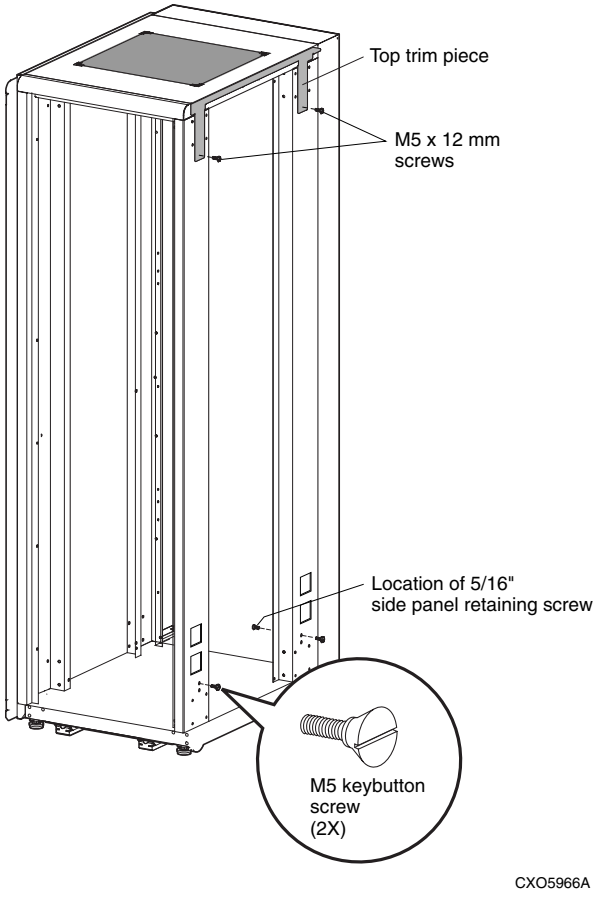


Figure 8-34. Expansion cabinet with top trim piece installed and M5 keybutton screws

5. Remove the left side panel from the master cabinet (Repeat Steps 2 and 3 for the master cabinet's side panel).

6. From the outside of the expansion cabinet, screw a large M5 keybutton screw into the top hole below the rectangular cutout in the bottom part of the cabinet's rear vertical rail (the hole from which you previously removed the 5/16 inch screw that held the side panel onto the cabinet). See Figure 8-34. Screw a second large M5 keybutton screw into the front vertical rail hole that corresponds to the rear side panel screw hole. Tightened these screws to their shoulders. See Figure 8-34.

7. Attach the top trim piece to the expansion cabinet, using two M5 x 12 mm machine screws. See Figure 8-34.
8. Install eight M5 U-clips over the holes of the expansion cabinet's vertical rails. See Figure 8-35. M5 U-clips are installed over holes 9 and 12 (counting from the top down on the cabinet's vertical rails, front and rear), and over holes 9 and 12 (counting from the bottom up on the cabinet's vertical rails, front and rear). Ensure that the threaded portion of the M5 U-clips face toward the inside of the cabinet.
9. Install eight M5 U-clips over the corresponding holes on the master cabinet's vertical rails.

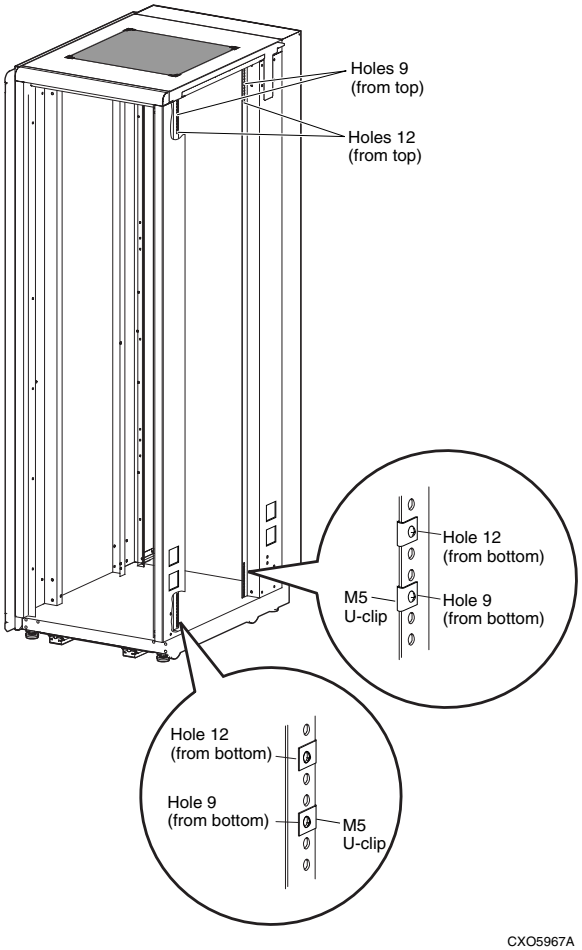


Figure 8-35. Location of M5 U-clips

10. Install joiner **pawl** assemblies onto the M5 U-clips on the expansion cabinet's **front** vertical rails, top and bottom, using two M5 x 12 mm screws per assembly. See Figure 8-36. Install joiner **receptacle** assemblies onto the M5 U-clips on the expansion cabinet's **rear** vertical rails, top and bottom, using two M5 x 12 mm screws per assembly. See Figure 8-36. Viewing the side of the expansion cabinet with the side panel removed, pawls and receptacles should be oriented with the black colored part of the assemblies facing **outwards**.

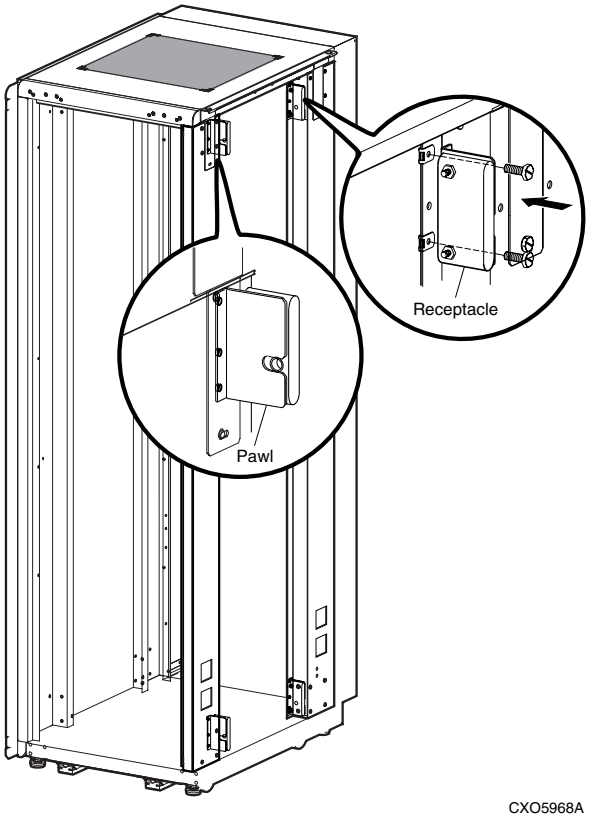


Figure 8-36. Location of pawl and receptacle assemblies on expansion cabinet

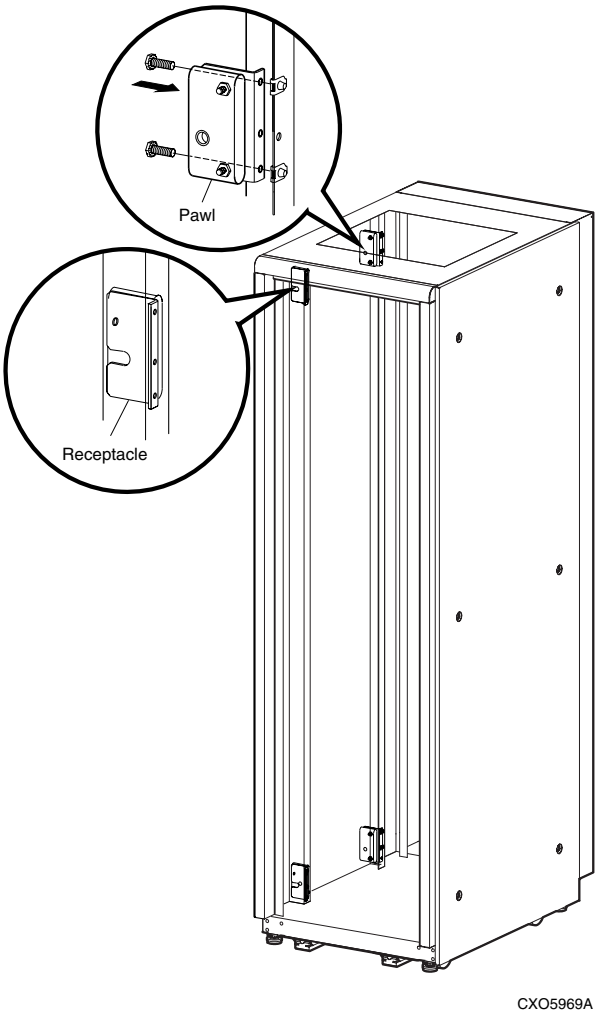


Figure 8-37. Location of pawl and receptacle assemblies on master cabinet

11. Install joiner **receptacle** assemblies onto the M5 U-clips on the master cabinet's **front** vertical rails, top and bottom, using two M5 x 12 mm screws per assembly. See Figure 8-37. Install joiner **pawl** assemblies onto the M5 U-clips on the master cabinet's **rear** vertical rails, top and bottom, using two M5 x 12 mm screws per assembly. See Figure 8-37. Viewing the side of the master cabinet with the side panel removed, pawls and receptacles should be oriented with the black colored part of the assemblies facing **outwards**.

12. Roll the cabinets together, aligning the joiner pawl assemblies to the joiner receptacle assemblies. See Figure A-38.

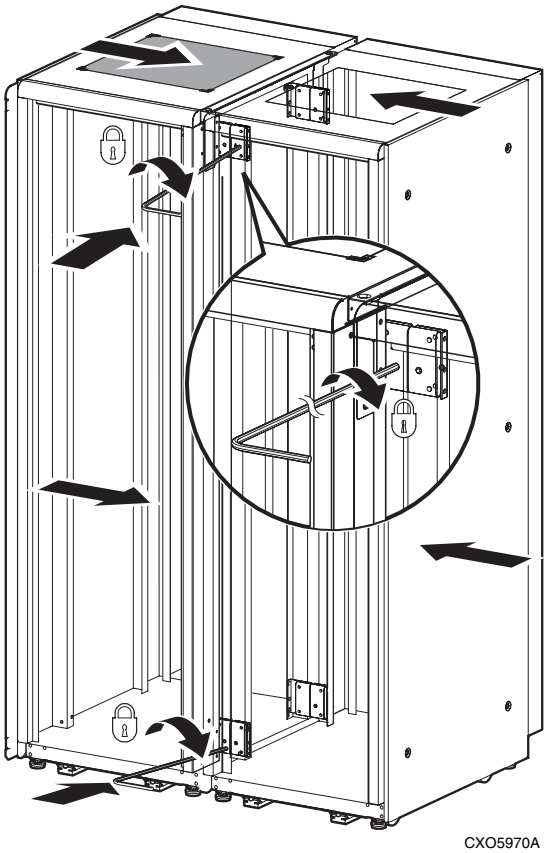


Figure 8-38. Joining ESA10000 data center cabinets

13. Insert the 24 inch Allen wrench into one of the holes on a bottom pawl assembly and turn clockwise to latch. Turn until the pawl and receptacle "clicks" into place. Continue turning the Allen wrench until it can be turned no further. Repeat for the other bottom joiner pawl. Repeat for the top two joiner pawls. See Figure 8-38.

14. Referring to Figure 8-39, slide the notch at the bottom of the front trim bracket over the M5 keybutton screw, installed in Step 4, to the lower front right side of the expansion cabinet. Rotate the upper part of the front trim bracket up so that it slides in beneath the top trim piece, installed in Step 5, and lock into place with a M5 x 16 mm screw through the top trim piece.

    NOTE: On the front trim bracket, the notch shown in Figure 8-39 is on the expansion side of the front trim bracket, allowing it to match up with the M5 keybutton screw on the expansion cabinet. Front and rear trim brackets are **not** interchangable.

15. Install the rear trim bracket as you did the front trim bracket by sliding the notch at the bottom of the rear trim bracket over the M5 keybutton screw, installed in Step 4, to the lower rear side of the expansion cabinet. Rotate the upper part of the rear trim bracket up so that it slides in beneath the top trim piece, installed in Step 5, and lock into place with a M5 x 16 mm screw through the top trim piece.

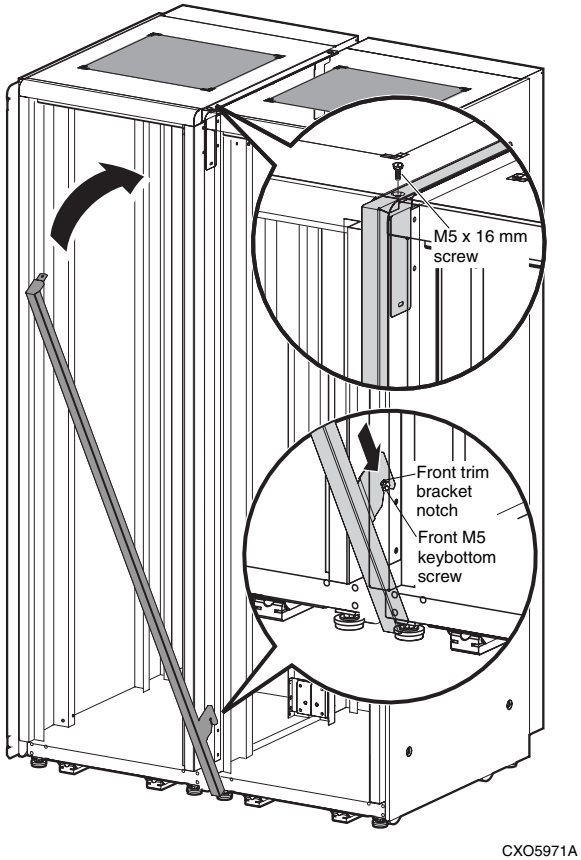


Figure 8-39. Installing front trim bracket

Leveling the Cabinet

Level the cabinet in its final position as follows:

1. Loosen the locknuts on each leveler foot as shown in Figure 8-40.
2. Turn each leveler hex nut clockwise until the leveler foot contacts the floor.
3. Adjust each leveler foot until the cabinet is level and the load is removed from all casters. Verify that the casters spin freely.
4. Tighten the locknuts on each leveler foot.

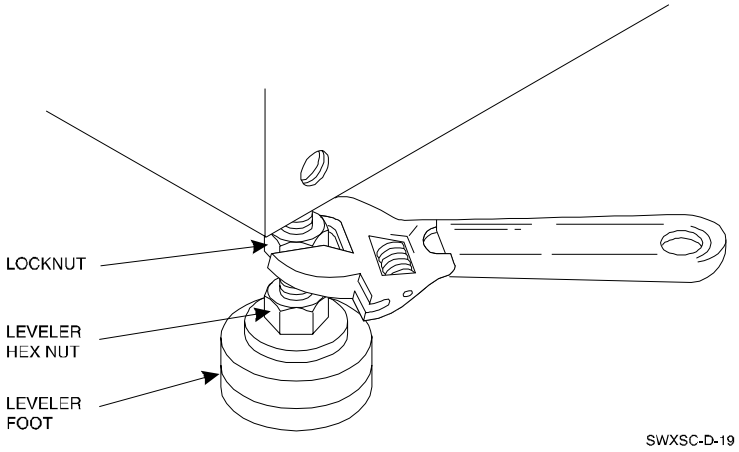


Figure 8-40. Leveler foot adjustment

Connecting HSZ70 to External Storage with Single-Ended I/O Modules

The single-ended I/O modules, located on the rear of the ESA10000, are the interconnection point between the controller and external storage (Figure 8-41). The I/O module has the following characteristics:

- Jumper controlled internal termination for each bus.
- Jumper controlled, current-limited terminator power for each bus.
- Two VHDC1 connectors (no external connectors on the termination I/O module).
- HSZ70 or compatible controllers.
- Fully supports 16-bit devices on either SCSI-2 (FAST 10) or UltraSCSI (FAST 20) buses.

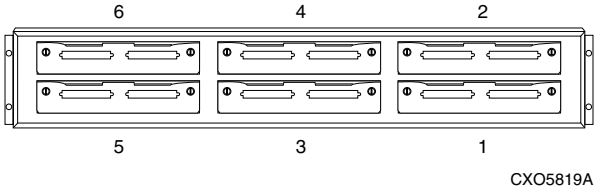
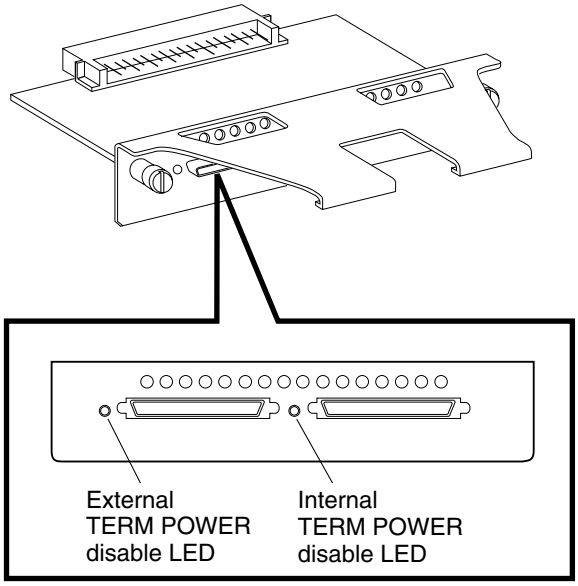


Figure 8-41. I/O Module orientation

Single-Ended I/O Module

The single-ended I/O module is the interconnection point between the controller and an external 16-bit, single-ended storage enclosure. It is installed when one or more BA370s are configured. The single-ended I/O module (Figure 8-42) has the following features:

- Provides isolation and signal re-timing between the external single-ended SCSI bus and the internal SCSI bus
- Provides the ability of Smart EMU to disable the SCSI connection between the internal SCSI bus and the external SCSI bus
- Provides automatic external SCSI disable if connected between the internal SCSI bus and the external SCSI bus
- Provides a jumper to automatically disable the external SCSI bus if no EMU is installed in the cabinet
- Provides automatic re-direction for the Fault Bus if the controller is not installed in the cabinet
- Has two external fault LEDs: one in the center of the bulkhead, and one on the left side of the bulkhead
- Provides disable to the internal and external SCSI TERMPOWER
- Provides TERMPOWER to the internal and external SCSI bus
- Provides external single-ended SCSI bus termination
- Provides disable to internal SCSI bus termination
- Has two external SCSI connectors (VHDC1)
- Provides module type to a Smart EMU
- Can be hot-swapped
- Provides re-drivers for the Fault Bus



CXO5947A

Figure 8-42. Single-Ended I/O module

Connecting SCSI Bus Cables to the ESA10000

The internal SCSI bus cabling of two BA370s within an ESA10000 cabinet as well as the SCSI bus cabling between a master and expansion cabinet is shown in Figure 8-43. The cabling scheme is to route the upper BA370's I/O module number 1's left port to the lower BA370's I/O module number 1's right port. Route the upper BA370's I/O module number 2's left port to the lower BA370's I/O module number 2's right port. Follow this cabling scheme for cabling SCSI bus cables in an ESA10000 that contains two BA370s.

To expand the SCSI bus from a master cabinet to an expansion cabinet, route the lower BA370's SCSI bus cables from the master cabinet's I/O module number 1's left port to the expansion cabinet's I/O module number 1's left port. Notice for expansion that the cables run from the left port of the master cabinet to the left port of the expansion port, just the opposite as for SCSI bus cabling between two BA370s that reside in the same cabinet. See Figure 8-43 for help in routing SCSI bus cables.

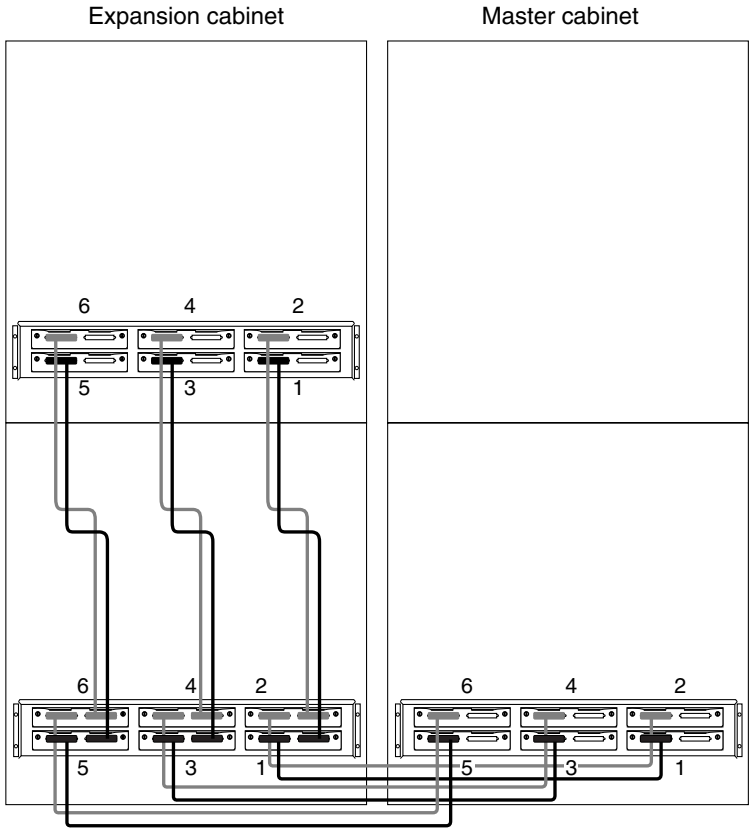


Figure 8-43. SCSI bus cabling for the ESA10000s

Installing SBBs

This section describes the procedures for installing Storage Building Blocks (SBBs) into an ESA10000. The SBBs consist of disk drives, power supplies, and the external cache battery.

Installing and Verifying SBB Disk Drives

Additional SBB disk drives may be installed into the BA370 rack-mountable enclosure that resides in your ESA10000. You may install controller compatible 16-bit (-VW suffix) SBB disk drives. Figure A-44 shows how additional SBB disk drives would be installed, in accordance with the guidelines given here.

The recommended guidelines for installing SBB disk drives is as follows:

- Divide the SBB disk drives (by capacity) between the number of subsystems in the order. That is, each subsystem should receive equal quantities of 9GB, 4GB, and 2GB disks, respectively.
- The BA370 that contains the HSZ controllers is populated first, the expander cabinet with PVA address set to two (2) is populated next, followed by the expander cabinet with PVA address set to three (3), last.
- BA370s are populated with the largest capacity disks first, in a bottom to top, left to right manner. This gives the 9GB disks a higher priority because SCSI IDs 0-7 are still the highest priority on USCSI. Since those addresses exist on the main cabinet, installing all the 9GB disk SBBs first (using this procedure) will give them the highest priority. This procedure also ensures that the disks are evenly distributed (by capacity) across the SCSI ports of the controller.
- BA370s are populated from bottom to top (as viewed from the front of the enclosure); that is, the lowest BA370 shelf is fully populated first, etc. SBB disk drives are installed in each shelf starting on the left and filling to the right.
- Install 9GB drives first, followed by 4GB drives. Install 2GB drives last.
- Shelves should be fully populated before SBB disk drives are inserted into the shelves above.

Installing the SBB disk drives in above sequence distributes the SBB disk drives evenly among the SCSI ports of the ESA10000.

To install an SBB disk drive, hold it in both hands, insert the disk drive into the designated guide slots and firmly push the disk drive into the shelf until the mounting tabs snap into place.

Additional rules for configuring SCSI buses include:

- All devices and ports in the same column are on the same SCSI bus or port.
- All devices in the same row (device shelf) have the same device address.
- Device address 4 and 5 are used only when the SBB disk drive has a device address switch.
- Device addresses are determined by the backplane connector into which the device is inserted, unless the SBB has a device address switch.

For the addressing of SBB disk drives on the SCSI bus, device addresses for each SBB in each expander cabinet are determined by the PVA address. The main cabinet's PVA address is set to PVA address 0 and device addresses in that cabinet have addresses 0 through 3. The PVA address in the first expander cabinet is set to PVA address 2 and device addresses in that expander cabinet have addresses 8 through 11. The PVA in the second expander cabinet is set to PVA address 3 and device addresses for that expander cabinet are from 12 through 15. Figure 8-44 helps to illustrate the addressing scheme.

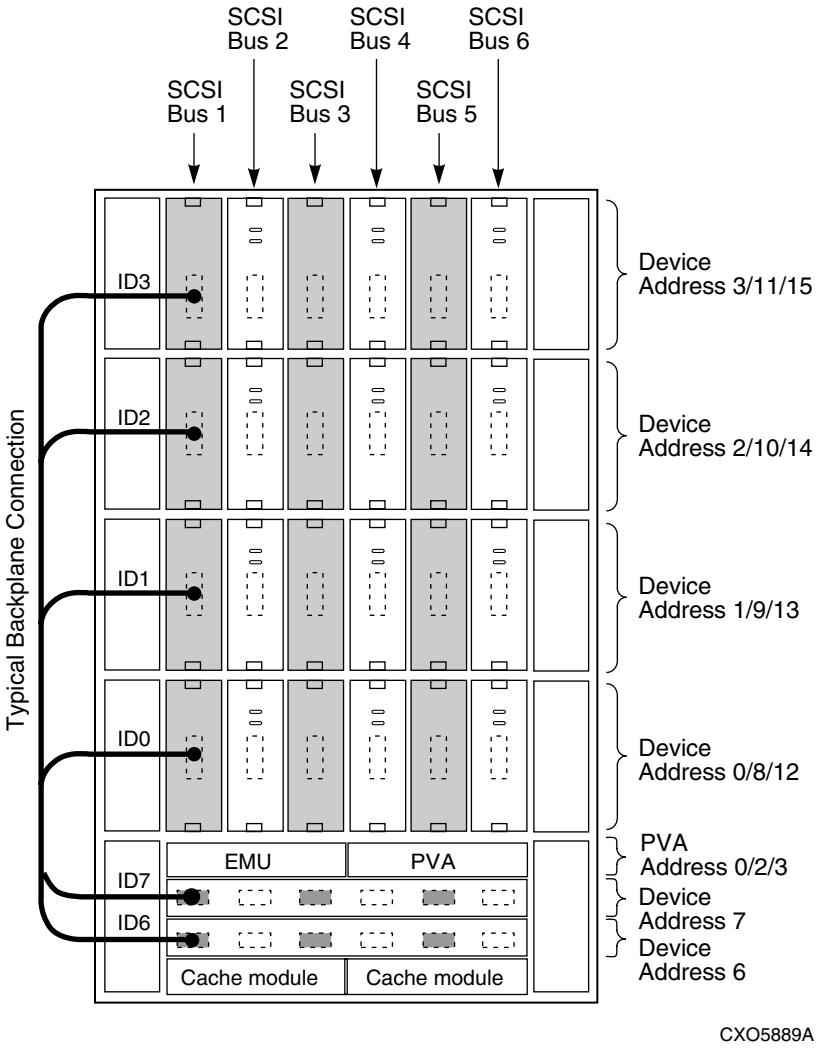


Figure 8-44. Addressing scheme

Figure 8-44 shows the six 16-bit SCSI buses and their associated ports and device addresses. Refer to the Chapter 3, "Configuration Rules and Restrictions," of the *SWXSC-AA Office Expansion RAID Enclosure User Guide (EK-SMCPD-UG)*, for additional information on installing SBB disk drives.

Installing SBB Power Supplies

Each SBB power supply has two green status LEDs. The upper LED indicates AC power status and the lower LED indicates power supply status. The procedure for installing power supplies is basically the same for installing any SBB. See Figure 8-45 during the installation.

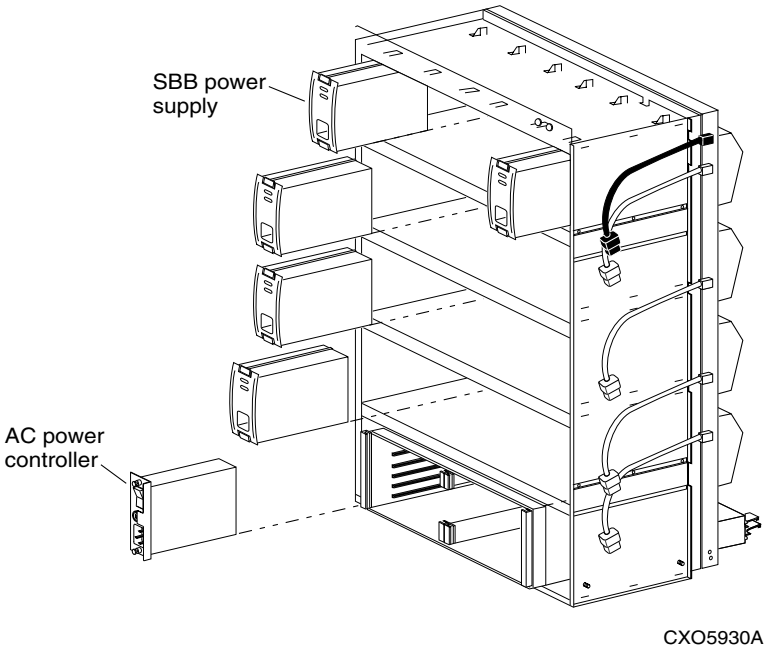


Figure 8-45. Installing power supply SBB (n+1 Shown)

1. Insert the SBB power supply into the guide slots and push in until the power supply is fully seated and the mounting tabs are engaged into the shelf.
2. Connect the AC power cord to the SBB power supply.
3. Turn on the AC power controller.

4. Observe the power supply SBB LEDs. Both LEDs should be lit, indicating proper power supply operation on the associated bus. If the upper LED is not lit after installation, this indicates that the power supply is not functioning properly and needs to be replaced. If both status LEDs are not lit after the installation, either there is a lack of AC power, the AC power controller has failed, or the SBB power supply just installed has failed.

Installing the AC Power Controller

There are no external indications of an AC power controller failure on the AC power controller itself. Both status LEDs on the power supply being off indicate a possible AC power controller failure. Use the following procedure to install a new AC power controller. See Figure 8-46.

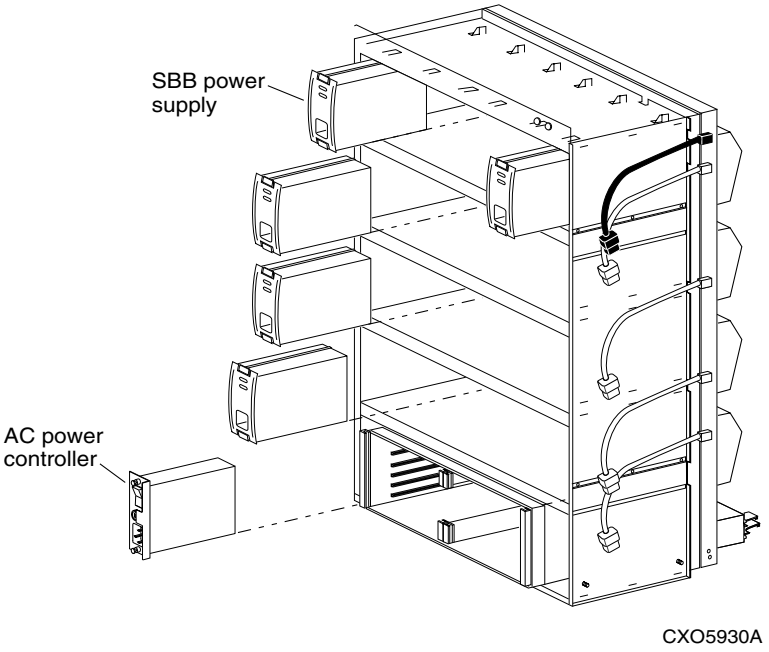


Figure 8-46. Installing an AC power controller

1. Press **0** on the AC power controller ON/OFF switch.
2. Insert the AC power controller into the ESA10000 enclosure.
3. Tighten the two retaining screws at the top and bottom of the AC power controller.

4. Connect the AC power cord to the power controller.
5. Press **1** on the AC power controller ON/OFF switch.
6. Observe the power supply status LEDs for proper operation.

Installing the External Cache Battery (ECB)

Install the external cache batteries (ECBs) into the ESA10000 into the ECB shelf mounted in the rear of the cabinet. See Figure 8-47.

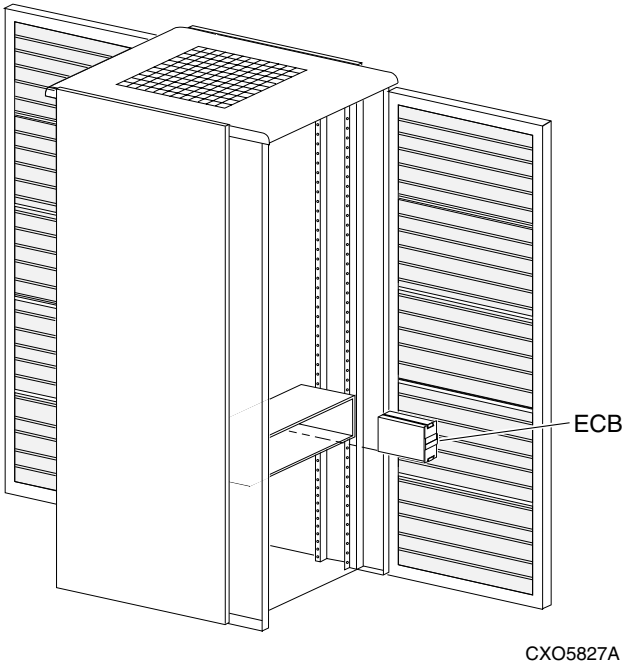


Figure 8-47. Installing the external cache battery

The following procedure details external cache battery installation:

1. Insert the external cache battery into the guide slots of the rear mounted shelf.
2. Push in the external cache battery until it seats firmly into the shelf and the mounting tabs engage the shelf.
3. Connect the ECB cable between the cache module and the ECB.

Appendix A

Planning Your Storage Configuration

This appendix describes the RAID configuration options and RAID concepts which you need to know to create your storage configuration.

Planning Your Configuration

RAID stands for Redundant Array of Independent Disks. It is a way of configuring multiple physical disk drives to achieve high data availability and/or larger virtual disk devices. RAID is implemented as a set of multiple storage devices (disks, tapes, and solid-state disks), called an array, and a specialized array controller, that manages the distribution of data across the array.

A RAID array, whether it contains two, five, or seven physical drives, can be configured to look like one or more large virtual disk drives. Use a RAID array virtual drive just as you would a physical drive. You can partition it if you want, and you do not need to make any application changes to realize the benefits of RAID. A RAID array provides higher levels of data availability and performance than a single physical disk drive of similar capacity.

Data for a given file is divided into chunks that is then be written across multiple drives. A *chunk* is a group of contiguous data blocks that are stored on a single physical disk drive. By using more than one physical drive, the data is transferred in chunks to multiple physical devices simultaneously, achieving transfer rates greater than each physical disk. Depending on the RAID level used, arrays also provide redundancy to protect the data availability. Arrays provide redundancy in two main ways: by mirroring and by generating parity.

The storage configuration options available depend upon your storage needs and the number of disks that you purchased for your RAID array. Table A-1 describes the storage options available and the minimum number of physical disks required to implement each.

You can use a variety of storageset type containers within a single subsystem, providing you have the disk device resources to support them.

Table A-1
Configuration Options

Storage Method	Storageset	Number of Devices	Offers
RAID 3/5 A redundant-stripeset combining the optimized data transfers of RAID 3 with the striping of parity of RAID 5.	RAIDset	3 - 14	Good throughput and read bandwidth for a high request rate of small to medium transfers. High Data Availability.
RAID 0	Stripeset	2 - 14	Good performance for both read and write requests. Provides load balancing with each request requiring a single data operation. Data availability equivalent to that of an individual disk device.
RAID 1	Mirrorset	2 - 6 devices per mirrorset, up to 20 mirrorsets per RAID array	Good performance for read requests. High Data Availability
RAID 0 + 1	Striped mirrorsets	2 - 20 mirrorsets	Performance for read requests surpassing that of an unstriped mirrorset since it can achieve load balancing. High Data Availability.
Individual Devices (JBOD)	Disk Drive	1	Provides the storage capacity and access speed of the disk used. If device fails, data is lost.

Once you select the type of storagesets that you want to use in your subsystem, you must create them using an appropriate configuration manager.

Appendix ***B***

Adaptec Driver Information

This appendix describes the Adaptec Driver options and that you need to know to properly configure the Adaptec Driver for NetWare.

Adaptec Driver

To take full advantage of the features of the RAID Array 7000, the Adaptec driver AIC7870.DSK must be loaded with the following switches:

```
Load aic7870.dsk lun_enable=ff multlun_targets=ff
io_timeout=30 io_retries=10
```

The dual controller failover capability must have the io-timeout and the io_retries values set. This value depends on the number and size of storagesets configured. If you are using a single controller RAID Array 7000, you do not need these two switches.These values will vary according to the amount and size of Newware volumes you have. The range for io_timeouts is 15 to 200 and the range for io_retries is 0 - 100.

The io_timeout variable is a counter that is used to detect and retry/abort I/O requests that have either come back with an error or haven't come back at all (i.e. lost or not completed for some reason). Approximately every two seconds, the driver calls a timer routine that decrements the io_timeout counter of all I/O requests. When it reaches 0, the I/O request is either retried or aborted (depending on the io_retries variable). Therefore, io_timeout * 2 is approximately the number of seconds the driver waits before retrying or aborting a given I/O command. Its primary purpose is to prevent the system from hanging while waiting for lost I/O requests.

The io_retries is a counter for how many times to retry a command before aborting it. Every time the io_timeout counter reaches 0, io_retries is decremented and the I/O request is retried. When io_retires reaches 0, the driver reports an error to the OS (i.e. the request is aborted).

NOTE: If the request is retried, its io_timeout counter is reset to the user-specified value Thus, if a timeout of 30 seconds IS specifiec along with retry count of 10, there may be potentially a wait of 5 minutes before the request's status is reporting back to the OS.

Mapping Netware Partitions with Device IDs

The lun_enable and multlun_targets switches must be set for Netware to see multiple luns configured on the RAID Array 7000. If you do not use multiple luns you do not need to enable these two switches.

lun_enable=	LUN scan enable mask on all targets	Hexadecimal 0 - FF	1 (Scan LUN 0 only)
multlun_targets=	Bitmask that enables LUNS on selected targets	Hexadecimal 0 - FFFF	FFFF (LUNs on all targets)

Bit Mask Options

Use this example to aid in calculating bit mask options hex values. Each SCSI device ID 0-7 (or 0-15 for wide host adapters) is enabled by a 1 in its corresponding bit position. In this example, lun_enable=05 enables scanning for LUNs 0 and 2 on all targets.

Table B-1
Example Bit Mask Options

	Bit Position			
SCSI ID 0, 2	15 14 13 12 0 0 0 0	11 10 09 08 0 0 0 0	07 06 05 04 0 0 0 0	03 02 01 00 0 1 0 1
Converted binary to hex:	0	0	0	5

= 05h

The RAID Array 7000 is capable of using up to 8 SCSI ID's (0-5, 8, and 9. ID's 6 and 7 are reserved). Each SCSI IS can have up to 8 LUNS.

If you use the SHOW THIS command from the CLI you will see the SCSI ID's enabled for your controller.

HSZ> SHO THIS

Controller:

HSZ70 ZG64900263 Firmware V73Z-0, Hardware H01
Configured for dual-redundancy with ZG64900241 In dual-redundant configuration
Device Port SCSI address 7
Time: NOT SET

Host port:

SCSI target(s) (0, 1, 2, 3, 4, 5)
Preferred target(s) (0, 1, 2)
TRANSFER_RATE_REQUESTED = 20MHZ
Host Functionality Mode = B
Allocation class 0
Command Console LUN is disabled

HSZ> sho device

Name	Type	Port	Targ	Lun	Used by
DISK50200	disk	5	2	0	
DISK50300	disk	5	3	0	
DISK60000	disk	6	0	0	
DISK60100	disk	6	1	0	D506
DISK60200	disk	6	2	0	D507

HSZ>

When you create your Netware partitions, the Disk Options will show the devices as:

```
51.     Device  #       43      DEC     HSZ70   (5D020105).
52.     Device  #       44      DEC     HSZ70   (5D020205).
53.     Device  #       45      DEC     HSZ70   (5D020305).
54.     Device  #       46      DEC     HSZ70   (5D020405).
55.     Device  #       47      DEC     HSZ70   (5D020505).
56.     Device  #       48      DEC     HSZ70   (5D020605).
57.     Device  #       49      DEC     HSZ70   (5D020705).
```

Device #49 DEC HSZ70 (5D020705) breaks down as:

5D (adapter device ID)
02 (adapter number)
07 (logical unit number)
05 SCSI ID

This is the same device as seen from the CLI:

```
DISK60200    disk              6   2   0      D507
```

In this case D5 is the SCSI ID and the 07 in the LUN.

This is a valid storageset and you can create a Netware partition on it.