



RA7000 and ESA10000 Storage Subsystems

User's Guide

EK-SMCP-UG. A01

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Revision Record

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

Revision Level	Date	Summary of Changes
EK-SMCP-UG. A01	July 1997	Initial release

About This Guide

This section identifies the users of this guide and describes the contents and structure. In addition, it includes a list of conventions used in this guide and related documentation.

RA7000 and ESA10000 Storage Subsystems User's Guide

This guide provides a product description, set up, configuration, and maintenance information for the RAID Array 7000 (RA7000) and the Enterprise Storage Array 10000 (ESA10000) Storage Subsystems.

Visit Our Web Site for the Latest Information

Check our web for the latest drivers , technical tips, and documentation. We can be found in the technical area of our web page, <http://www.storage.digital.com/>

Intended Audience

This guide is intended for users who are responsible for installing, configuring, and repairing the RA7000 and ESA10000 Storage Subsystems.

Document Structure

This guide contains the following chapters:

Chapter 1: Product Description

Product Description provides a product overview of the RA7000 and ESA10000 Storage Subsystems. It also describes their components, features, and operating functions.

Chapter 2: Unpacking and Installation

Unpacking and Installation describes how to unpack and install the subsystem.

Chapter 3: Configuring the Storage cabinet

Configuring the Storage Cabinet describes how to connect the EMU communications bus and setting monitoring controls.

Chapter 4: Error Analysis and Fault Isolation

Error Analysis and Fault Isolation describes the errors, faults, and significant events that may occur during the enclosure's initialization and operation.

Chapter 5: Replacing Components

Replacing Components describes the procedures to remove and install the Field Replaceable Units (FRUs) in the subsystem.

Conventions

This guide uses the following conventions:

Style	Meaning
boldface type	For emphasis and user input.
<i>italic type</i>	For emphasis, manual titles, utilities, menus, screens, and filenames
<code>plain monospace type</code>	Screen text.

Related Documentation

For additional information on the RAID controller, refer to the following StorageWorks documents:

Document Title	Document Part Number
CLI Reference Manual	EK-CLI70-RM
Configuration Manual	EK-HSZ70-CG
Service Manual	EK-HSZ70-SV

1

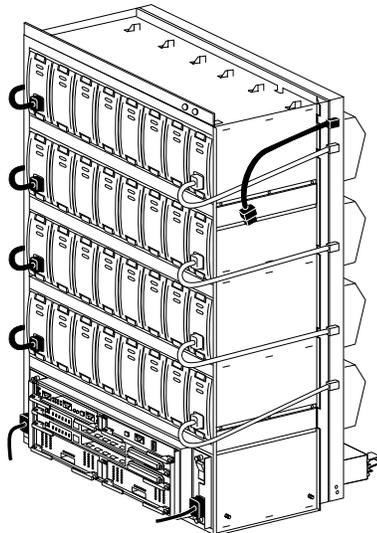
Product Description

This chapter describes the RA7000 and ESA10000 Storage Subsystems including the Ultra Small Computer System Interface (SCSI-3) connections (ports) for StorageWorks building block (SBB) shelves.

1.1 Subsystem Overview

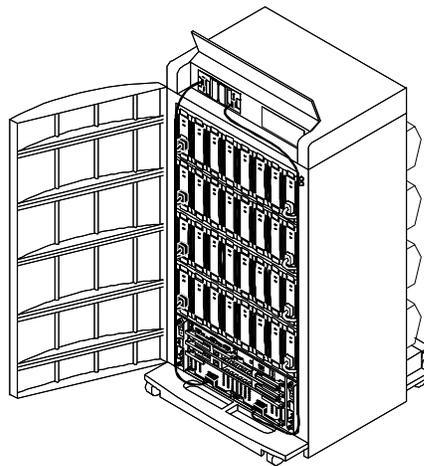
The RA7000 and ESA10000 Storage Subsystems are members of DIGITAL's StorageWorks family of modular enclosures. They share a common major component, the BA370 Rack Mountable Enclosure (Figure 1-1), that includes an Environmental Monitor Unit (EMU) and a Power Verification and Addressing (PVA) module. StorageWorks storage devices, power supplies, controller(s), cache module(s), External Cache Battery (ECB), and power entry controllers may also be included. Figures 1-2, 1-3A, and 1-3B show three possible BA370 configurations.

Figure 1-1 BA370 Rack Mountable Enclosure



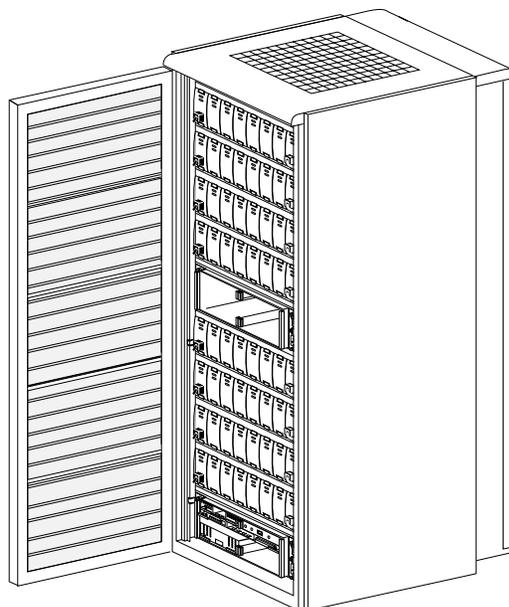
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Figure 1-2 RAID 7000 Enclosure



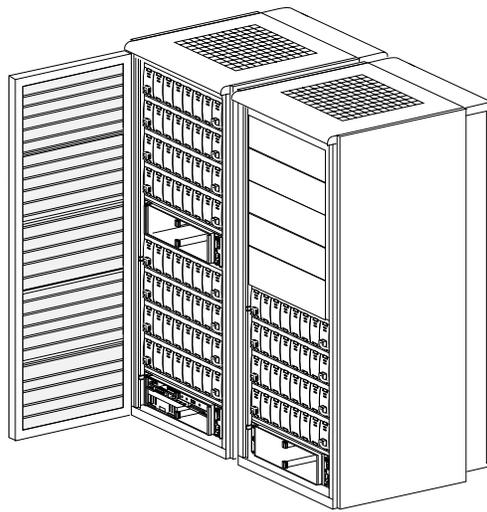
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Figure 1-3A ESA10000 Storage Cabinet (Shown with two BA370 Rack Mountable Enclosures in a single cabinet)



CXO5828A

Figure 1–3B ESA10000 Storage Cabinet (Shown with three BA370 Rack Mountable Enclosures in two cabinets)



CXO5845A

The major features of the BA370 rack mountable enclosure are as follows:

- StorageWorks compatible
- Holds up to twenty-four 3½-inch disk drive SBBs per BA370
- Redundant power distribution to eliminate single points of failure
- Contains six, single-ended, Ultra Wide SBB backplane SCSI buses
- No internal SCSI bus cables
- A StorageWorks HSZ70 RAID array controller that is compatible with the approved host computer SCSI bus adapters
- Redundant ac power entry controllers
- All major components, except the single ended I/O modules and PVA module, can be replaced using the hot-swap method described in Chapter 5.
- Fault monitoring and reporting capability for incorrect voltages, shelf blower failure, power supply failure, and excessive operating temperature.
- The BA370 may be used as a master or an expansion unit

NOTE

The master unit contains the controller(s) and cache module(s). Expansion units contain additional storage devices on the same SCSI buses.

- The 24-SBB RAID Array 7000 storage subsystem and the ESA10000 storage subsystem are Class A FCC certified.

1.2 Major Components

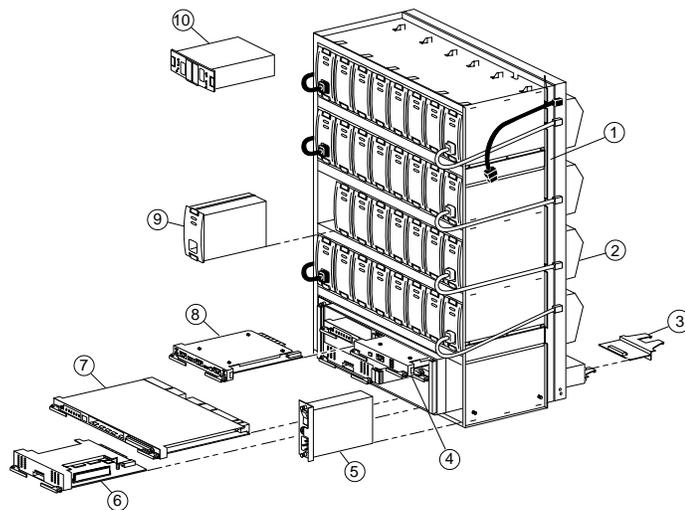
A fully configured redundant subsystem (Figure 1-4) consists of the following major components:

- 1) A BA370 Rack mountable enclosure (1)
- 2) Dual-Speed Blowers (8)
- 3) Single-Ended I/O Modules (6)
- 4) Power Verification and Addressing (PVA) Module (1)
- 5) AC Input Power Controllers (2)
- 6) Cache Modules (2)
- 7) HSZ70 SCSI RAID Array Controllers (2)
- 8) Environmental Monitor Unit (EMU) (1)
- 9) SBB Power Supplies (8)
- 10) External Cache Batteries (2)

also:

- 11) Power Distribution Unit (2) *Not shown, mounted in ESA10000 cabinet only*

Figure 1-4 Configured BA370 Rack Mountable Unit Major Components

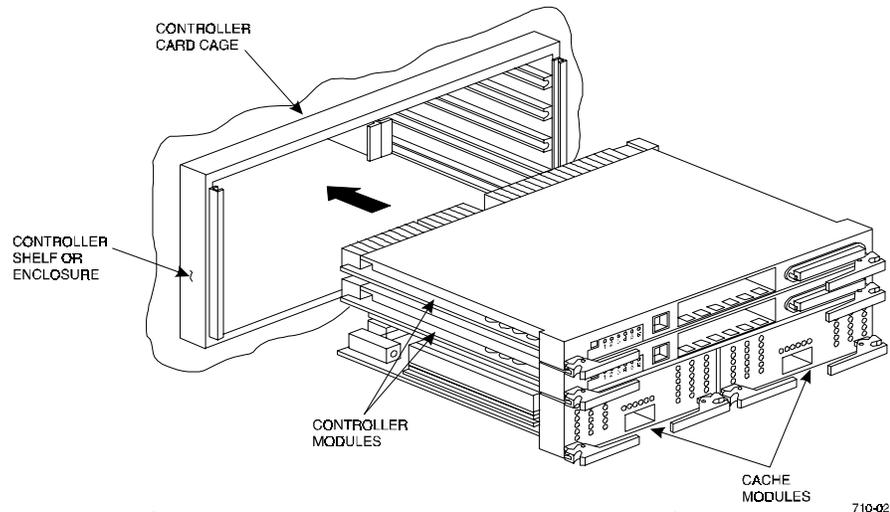


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1.2.1 HSZ70 RAID Array Controllers

The controller connects a host system to the subsystem and appears as another SCSI device connected to one of its I/O buses. The controller then processes the I/O requests to the storage devices of the subsystem. The HSZ70 RAID array controller(s) mount in the lower front of the cabinet (see Figure 1-5). Installing two HSZ70 controllers with cache modules provides complete controller redundancy as described in the *HSZ70 Service Manual*.

Figure 1-5 HSZ70 Controller and Cache Modules



NOTE

Controllers and Cache modules removed from controller card cage for clarity. Modules are not a single unit.

The controller documentation describes procedures for:

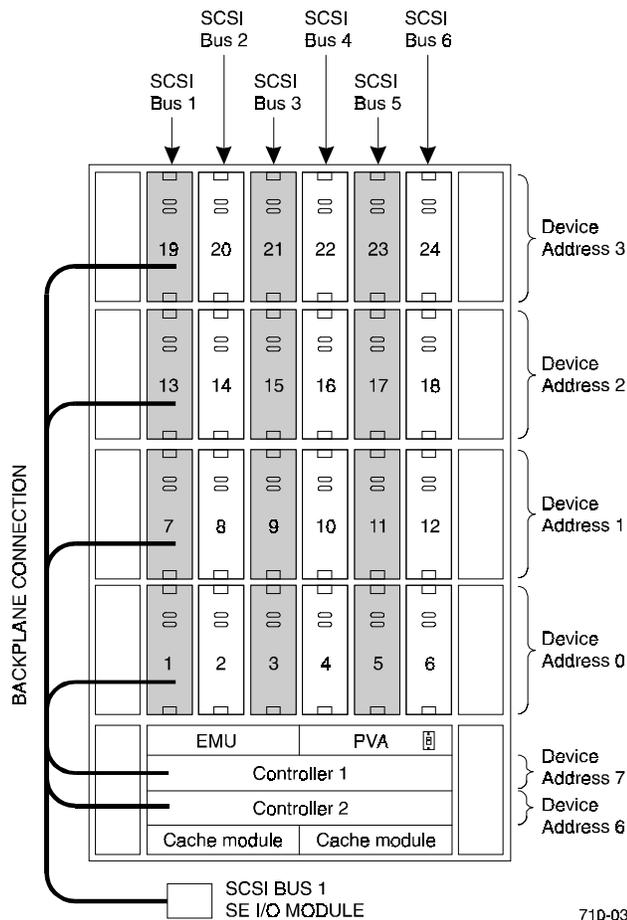
- Configuring the controller
- Setting initial controller parameters using a maintenance terminal
- Determining the proper method for replacing SBBs (hot-swap)

The controller software revision level determines the devices supported by the controller.

1.2.2 SCSI Buses

There are six Ultra Wide SCSI buses associated with the controller. The ports and device addresses for the master unit are shown in Figure 1-6.

Figure 1-6 SCSI Buses



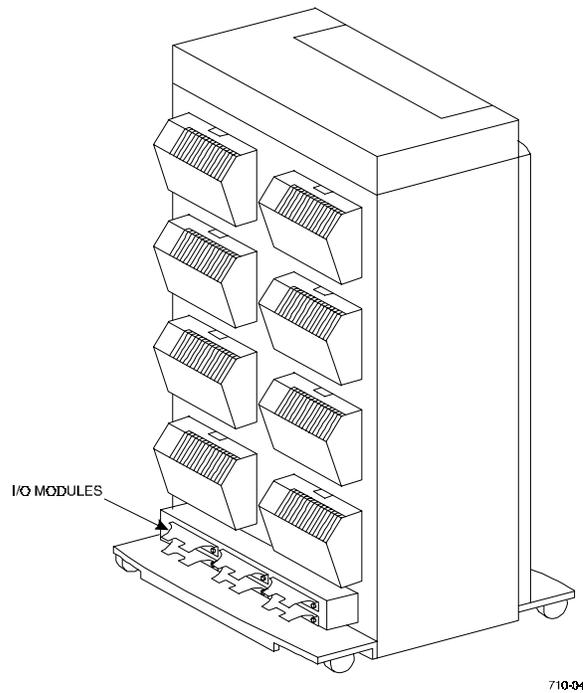
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The subsystem enclosure supports single-ended, Ultra Wide storage devices. The configuration rules for the SCSI buses are as follows:

- 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
- You may only install controller-compatible Ultra Wide storage SBBs
- Device addresses 4 and 5 are only used when the SBB 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

1.2.3 Single-Ended I/O Module (SE I/O)

Figure 1-7 Single-Ended I/O Module Location

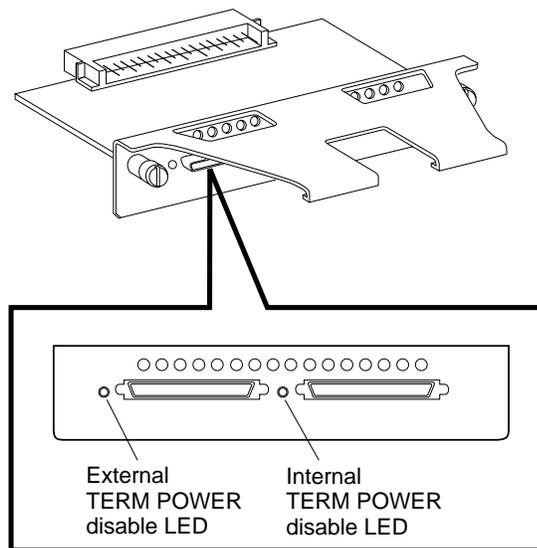


Each SCSI enclosure, whether it is a master or an expansion enclosure, has six I/O modules mounted at the bottom rear of the enclosure as shown in Figure 1-7. In all enclosures these modules are the interconnection point between the controller in the master enclosure and the devices in the expansion enclosures. In an UltraSCSI RAID subsystem, the I/O modules, the internal SCSI buses, and the controller ports all have the same number. For example, controller port 2, SCSI bus 2, and I/O module 2 are different elements of the same bus. The major features of the single-ended I/O module are described in the following sections.

1.2.3.1 Expanding the UltraSCSI Bus

Each I/O module has an UltraSCSI single-ended bus expansion integrated circuit. This device isolates the internal and external SCSI bus and extends the length of the SCSI bus.

Figure 1-8 Single-Ended I/O Module



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The two VHDCI female connectors are the connection points for expanding the SCSI buses between enclosures (see Figure 1-8). These connectors are wired in parallel and act as a tri-link connector. In an expansion configuration, DIGITAL recommends that maximum cable length not exceed 1.5 m (4.6 ft.) between enclosures. DIGITAL supplies a cable kit, DS-BNK37-IE, containing the necessary cables to connect an expansion unit.

1.2.3.2 Controlling the Internal SCSI Bus

The I/O module controls the internal SCSI bus in the following manner:

- Isolates the internal SCSI bus from the external SCSI bus.
- Provides single-ended SCSI bus termination.
- Disconnects the internal SCSI bus from the external SCSI bus when the EMU so directs.
- Distributes TERMPOWER (+5 V dc) to the internal SCSI bus.
- Turns ON the green internal TERMPOWER LED (see Figure 1-8) when the internal TERMPOWER is present.
- Turns OFF the green internal TERMPOWER LED (see Figure 1-8) when there is an internal TERMPOWER overcurrent condition.

1.2.3.3 Controlling the External SCSI Bus

The I/O module controls the external SCSI bus in the following manner:

- Provides single-ended SCSI bus termination.
- Distributes TERMPOWER (+5 V dc) to the external SCSI bus.
- Turns ON the green external TERMPOWER LED (see Figure 1-8) when the external TERMPOWER is present.
- Turns OFF the green external TERMPOWER LED(see Figure 1-8) when there is an external TERMPOWER overcurrent condition.
- Automatically disables the external bus termination when a cable is connected to the right hand VHDCI connector.

1.2.3.4 Controlling the Fault Bus

The I/O module controls the fault bus operation in the following manner:

- Provides a fault bus driver for improved signal transmission.
- Distributes the FAULT_CLK and FAULT_DATA signals from the master enclosure to the expansion enclosures.
- Distributes the SHELF_OK and SWAP_L signals from the expansion enclosures to the master enclosure.

1.2.3.5 “Warm Swapping” I/O Modules and Cables

You can replace either the I/O module or a cable when the associated SCSI bus is quiesced (no data transfers occurring) – a warm swap. This enables you to correct problems affecting only one bus without disrupting data transfers on the other five buses.

The maximum bus length, including external cables (distance from the I/O module terminator to the last terminator on the bus) is a function of the bus speed and the number of devices. If the external bus is configured point to point (from SE I/O module-to-SE I/O module with no devices installed in between), the cables may be extended to 20 meters due to the isolation and re-timing circuitry of the SE I/O module.

1.3 Error Detection and Reporting

The subsystem error detection and reporting function has two major elements – the fault bus and the EMU (environmental monitor unit). For a detailed discussion of error detection, fault reporting, and correction, refer to Chapter 4, Error Analysis and Fault Isolation.

1.3.1 Fault Bus

The subsystem fault bus monitors subsystem operation and reports fault conditions to the HSZ70 RAID array controller and the EMU. The controller and EMU then report the error condition to the user. The fault bus monitors the following conditions:

- Blower failure (SHELF_OK)
- Power supply failure (SHELF_OK)
- Storage device removal (SWAP_L)
- Storage device installation (SWAP_L)
- SBB failure (FAULT_CLK, FAULT_DATA)

The fault bus consists of three subsystem backplane signals routed to the controller port connectors as follows:

- *Shelf Status Signal* – The SHELF_OK status signal indicates the state of subsystem power (ac and dc) and blower operation
- *SBB Swap Signal* – The SWAP_L signal is asserted whenever an SBB is removed from or inserted in the subsystem
- *SBB Fault Signals* – The SBB amber LED displays either the storage address or indicates a device fault. This device fault LED is controlled by the fault clock (FAULT_CLK) and the fault data (FAULT_DATA) control signals.

1.3.2 Environmental Monitor Unit (EMU)

The primary function of the EMU (see Figure 1-9) is to monitor, process, report, and display enclosure and controller environmental status information for the power supplies, temperature, blowers, configuration, SCSI addressing, I/O modules, communications, and the EMU microcode type. The EMU and controller can exchange and process this information.

CAUTION

Proper operation of an UltraSCSI subsystem requires an operational EMU and PVA in each BA370 rack mountable enclosure. You must also establish communications links between the EMUs to ensure proper subsystem operation and error reporting.

The primary EMU function is monitoring and reporting UltraSCSI enclosure environmental status. In conjunction with the PVA and the controller, the EMU identifies controller faults and alerts the user of existing or impending failures using one or more of the following error reporting systems:

- EMU LEDs
- The EMU audible alarm
- Error messages on the host interface
- Enclosure system OK LED
- Enclosure system fault LED

In some instances, such as blower failures or high ambient or internal enclosure temperatures, the EMU automatically initiates corrective actions (for example, operating the blowers at high speed).

When there is the possibility of component damage due to overheating, the EMU can initiate an automatic controlled power shut down.

1.3.2.1 Controller Status

The master EMU also monitors the state of both controllers. Should the EMU detect a controller fault it can:

- Sound the audible alarm
- Cause the EMU system fault status LED to flash
- Display a controller fault code on the blower LEDs when you momentarily press the Alarm Control switch

When an error is detected on the EMU controller communications path, it causes a controller fault.

1.3.2.2 I/O Module Status

The EMU also ensures that all six I/O modules are present, are properly installed, and that each has TERMPOWER. If any of these conditions are not met, the EMU reports an error condition. The EMU also reports each I/O module type to the controller. Should the controller determine that the I/O module configuration is incorrect, it displays this information on the console.

An integrated circuit on each I/O module functions as an UltraSCSI bus extender. The EMU and the controller can enable or disable individual I/O module circuits, thereby controlling individual external SCSI buses.

1.3.2.3 Enclosure Configuration Information

The EMU maintains the following configuration information:

- Enclosure number
- EMU microcode version
- EMU message protocol version
- PVA SCSI ID setting
- Temperature sensor set points
- The number of installed power supplies by location
- The number of installed SBBs by location
- The number of installed blowers by location

1.3.2.4 EMU Front Panel

The EMU front panel contains all of the user interface controls, connectors, and displays (see Figure 1-9 and Table 1-2).

Figure 1–9 Environmental Monitor Unit (EMU)

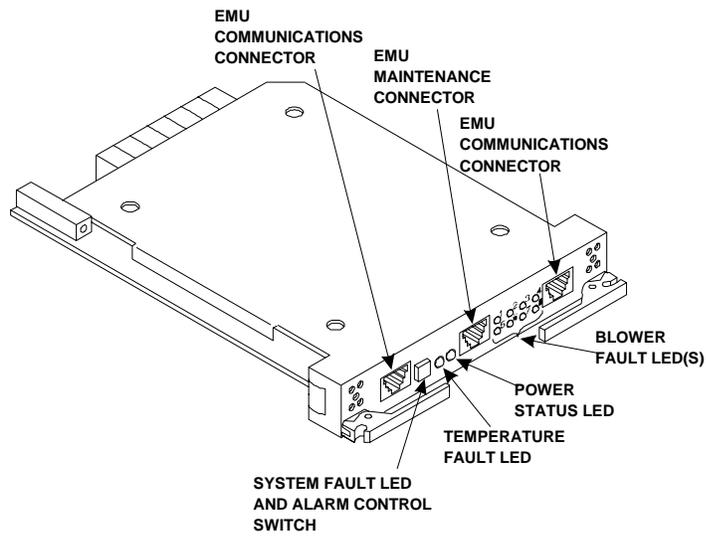


Table 1–2 EMU Front Panel Component Descriptions

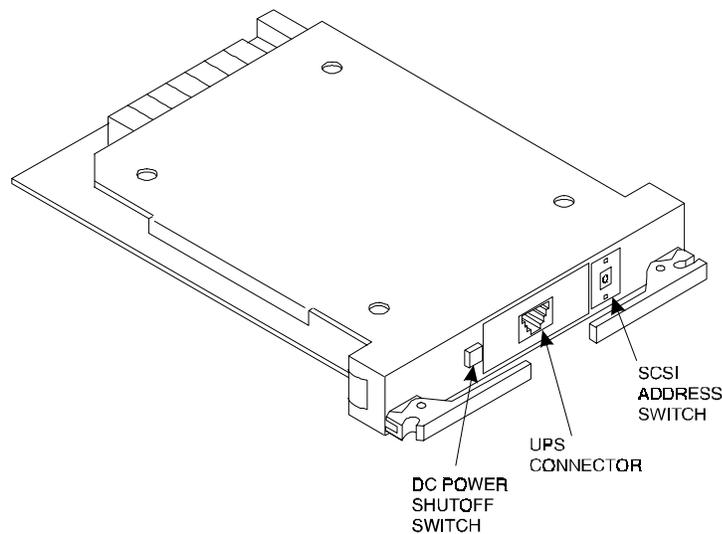
Component	Function
EMU Com. Connector (LEFT)	Provides inter-EMU communications to another EMU.
System Fault LED (amber) and Alarm Control Switch	The System Fault LED in the Alarm Control Switch is ON whenever there is an error condition. This LED is FLASHING whenever the EMU has one or more fault codes to display. When there is a fault code, momentarily pressing this switch turns OFF the audible alarm and starts the fault code LED display. Pressing the Alarm Control switch for at least 5 seconds clears all the active fault codes. After a controlled power shut down, momentarily pressing this switch will restore power to the enclosure.
Temperature Fault LED (amber)	Whenever either the ambient temperature or the enclosure backplane temperature exceeds the user-defined temperature set point, this LED is ON until the condition is corrected.
Power Status LED (green)	This LED is ON whenever there are: At least four operational +5 V dc power supplies At least four operational +12 V dc power supplies TERMPower is present on all six I/O modules This LED is OFF whenever there are: Fewer than four operational +5 V dc power supplies Fewer than four operational +12 V dc power supplies One or more I/O modules are missing TERMPower
EMU Maintenance Connector	You can connect a maintenance terminal or PC to this connector to display EMU: Error messages Information messages A PC can also load EMU microcode through this connector.
Blower Fault LEDs (amber)	One or more of these eight blower fault LEDs are ON whenever one or more blowers are: Not operating Not operating at the correct speed. Removed There is a fault code display
EMU Com. Connector (RIGHT)	Provides inter-EMU communications to another EMU.

1.3.3 Power Verification and Addressing (PVA) Module

Proper operation of the subsystem, whether it be a master or an expansion enclosure, requires both a PVA module and an EMU module. The PVA (Figure 1-10) and its associated EMU ensures that all major UltraSCSI components are functioning properly. When an error condition occurs, these modules notify the user that a problem exists. The controller identifies the specific problem. The PVA and EMU LED displays identify possible causes of the problem.

The PVA mounts in the lower right section of the enclosure, directly above the controller. The PVA and EMU have the same physical dimensions, use the same type connectors, and are mounted next to each other – the EMU on the left and the PVA on the right (see Figure 1-6). They are not interchangeable.

Figure 1-10 Power Verification and Addressing (PVA) Module



As shown in Figure 1-10, the major user-accessible components of the PVA include the following:

- The dc power shutoff switch includes a green power status LED
- The UPS connector (RJ-45) for future expansion
- The enclosure SCSI address switch that establishes the enclosure address and thereby the SCSI bus Ids for each storage device

The PVA has two status indicators:

- The green power status LED in the power Shut down switch. This LED is ON whenever there at least four operational power supplies. When an error condition occurs, the LED is OFF and the PVA reports the error to the EMU. The EMU also monitors the power supplies for this condition
- An audible alarm that beeps at a slow rate when the PVA detects removal of or improper installation of the EMU. This ensures you are aware the EMU must be replaced within 8 minutes to prevent a system shut down

The primary functions of the PVA include the following:

- 1) Ensures that there is a minimum of four operational power supplies in the enclosure. If the PVA senses less than four power supplies, it notifies the EMU.
- 2) Allows the user to select the DIGITAL-supported device SCSI bus addresses for the master and each expansion enclosure.
- 3) Monitors the EMU status and:
 - Notifies the user of removal of the EMU
 - Notifies the user when there is no master EMU
 - Notifies the user when there are multiple master EMUs
 - Provides the user a switch to disconnect dc power from the enclosure power buses
 - Monitors the optional UPS for proper operation and reporting the UPS status

1.3.3.1 Monitoring Power Supply Operation

For accurate, reliable transfer of data without data corruption or loss, the enclosure requires a minimum of four operational power supplies to furnish both +5 and +12 Vdc for operation of the following:

- Storage Devices (SBBs)
- Controllers and cache memories
- EMU
- PVA

Therefore, both the EMU and PVA monitor all of the power supplies (a maximum of eight) to ensure that at least four are operational. An error condition is indicated by one of the following conditions:

- The +5 Vdc voltage drops to +4.7 Vdc
- The +12 Vdc voltage drops to 11.4 Vdc

Another voltage essential for proper operation is the +5 Vdc termination power (TERMPOWER) required for the SCSI bus on each of the six I/O modules. If this voltage drops to +4.5 Vdc, an error condition exists.

As long as there are four operational supplies and TERMPOWER is correct, the EMU and PVA generate the POK (power OK) signal. As long as POK is present the controller can continue to transfer data providing there are no other error conditions.

The loss of the POK signal for any reason causes the controller to reset and halt all data transfers. All six buses remain quiesced (no data transfers occurring) until the controller determines that power is correct. The controller does this by checking the status of the POK signal. Until the POK reports that there are at least four operational power supplies and that TERMPOWER is correct, the controller, the cache memories, and all the devices remain passive. The EMU and the PVA continue to monitor the system and report the error condition.

1.3.3.2 Master Enclosure Controlled Power Shutdown

The EMU can shut down the dc power in the master enclosure or the subsystem when one of the following conditions occur:

- The EMU determines an extreme over-temperature condition that requires removing power from the subsystem
- The user presses and holds down the PVA dc power switch until the EMU initiates a controlled power shut down

NOTE

This is only true if both controllers have been shut_down

When you initiate a controlled power shut down from the master enclosure PVA the sequence of events is as follows:

- 1) The EMU changes its status to indicate that the dc power switch was pressed
- 2) The master EMU notifies the controller of the change in status.
- 3) When the controller is ready, it sends a controlled power shutdown command to the master EMU.
- 4) A controlled power shut down is completed on all the subsystem cabinets.

NOTE

If the master EMU is not communicating with the controller or the controller does not support a controlled shut down, the master EMU commands all enclosures to perform an immediate power shut down.

1.3.3.3 Expansion Enclosure Initiated Power Shutdown

NOTE

This procedure will only work when the controller(s) have been shut_down.

When you press the PVA dc power switch on the enclosure and the expansion EMU *can* communicate with the master EMU, one of the following power shutdown operations occurs:

NOTE

When the expansion EMU *cannot* communicate with the master EMU, pressing the dc power switch causes an immediate controlled power shutdown of only the expansion enclosure.

1. The slave EMU changes its status to indicate that the dc power switch was pressed.
2. The master EMU notes the change in status.
3. The master EMU notifies the controller of the change in status.
4. When the controller is ready, it sends a controlled power shut down command to the master EMU.
5. A controlled power shut down is completed on all the subsystem cabinets.

NOTE

If the master EMU is not communicating with the controller or the controller does not support a controlled shut down, the master EMU commands all enclosures to perform an immediate power shut down.

1.3.3.4 PVA UPS (Uninterruptible Power Supply) Options

DIGITAL does not supply any options for this product. When you install an optional UPS power source, you can use the PVA to monitor its status. Connect the UPS to the UPS Connector on the front of the PVA using a 9-pin RS-232-to-8-pin RJ-45 adapter cable. The PVA monitors the following UPS signals and reports the status to the EMU:

- UPS installed
- UPS has only two minutes of battery power left
- UPS has lost ac input

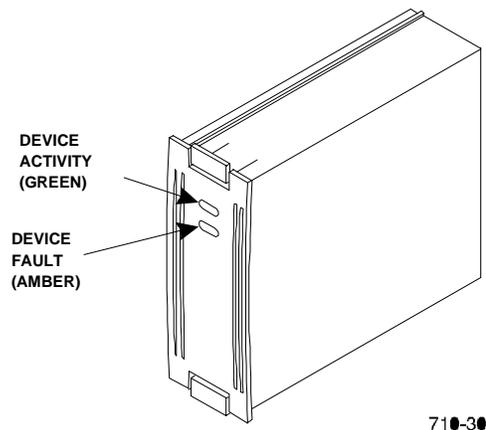
1.4 Storage Device SBBs

The subsystem can accommodate up to twenty four 3½-inch storage device SBBs (Figure 1-11). Each occupies one slot (six SBBs per shelf). The SCSI device addresses of the SBBs can be assigned in the following ways:

- By the backplane connector
- With the SCSI device address switch mounted on the rear of the SBB

The HSZ70 RAID array controller software product descriptions and release notes list the subsystem compatible SBBs.

Figure 1-11 Disk Drive SBB



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1.5 Power Configuration

There are two primary storage subsystem power configurations:

- *Standard* – 4 + 1 power configuration includes one ac power controller and five power supply SBBs on power bus **A**
- *Redundant* – 4 + 4 power configuration includes one ac power controller and four power supply SBBs on power bus **A** and four power supply SBBs on power bus **B**

When there are less than four operational power supplies, the subsystem will cease operating to preserve and protect the data. Table 1-2 lists the storage subsystem power components and configurations.

CAUTION

A minimum of four operational SBB power supplies are required for operation of the subsystem. The fifth SBB power supply provides redundancy.

Table 1–2 Storage Subsystem Major Power Components

Component	Order No.	Power Configurations	
		Standard	Redundant
ac Power Entry Controller	DS-BA35X-HE	1	2
Shelf Power Supply SBB	DS-BA35X-HH	5	8

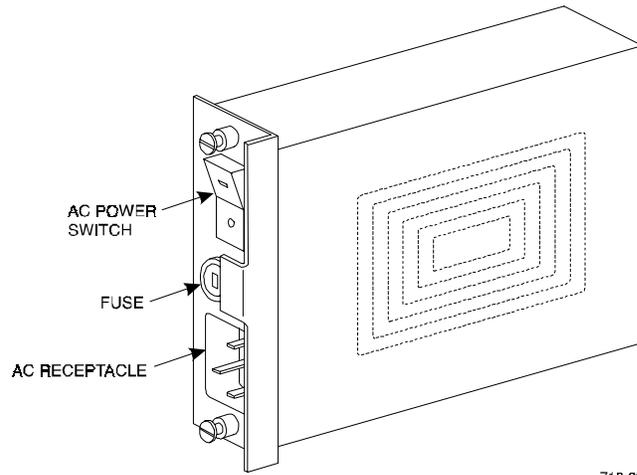
1.5.1 AC Power Entry Controllers

The ac input power is routed from the wall outlet to one of the power entry controllers (Figure 1-12) that may have either of the following input voltages:

- 100 – 120 V ac, 60 Hz, single-phase, 12A
- 220 – 240 V ac, 50 Hz, single-phase, 6A

Each power entry controller has a system ON/OFF switch and distributes ac power to all power supply SBBs on either power bus A or power bus B.

Figure 1-12 AC Power Entry Controller



710-08

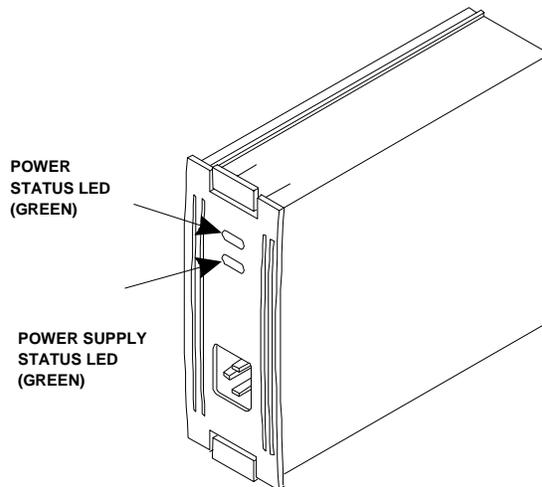
1.6 Power Supply SBBs

CAUTION

The subsystem requires power supply SBBs rated for at least 180 W such as the DS-BA35X-HH. You cannot use lower rated supplies, such as the 131 W (DS-BA35X-HA), the 145 W (DS-BA35X-HD), or the 150 W (DS-BA35X-HF).

The 180 W shelf power supply SBB (Figure 1-13) converts the ac voltage from the power controller to +5 V dc and +12 V dc for distribution throughout the storage subsystem. The maximum capacity of the storage subsystem is eight power supplies.

Figure 1–13 Typical Shelf Power Supply SBB



The 4 + 1 standard configuration provides five power supplies connected to power bus A (the black power cords). As long as any four of these supplies are operational, the subsystem is operational. The failure of a second supply places the subsystem controller in a reset state. This precludes further data processing and prevents the corruption or loss of the stored data.

With the 4 + 4 full redundant power option, the subsystem can survive multiple power supply faults. To fully realize the benefits of the 4 + 4 configuration, connect the power controllers to different ac distribution circuits on the same site distribution panel.

The four subsystem power supply SBBs on the left end of the shelf are connected to power controller A. The four on the right end of the shelf are connected to power controller B.

1.7 Standard (4 + 1) Power Configuration

NOTE

The black power cord at the upper right corner of the subsystem is used only for the standard (4 + 1) configuration. It is not used for the redundant (4 + 4) configuration.

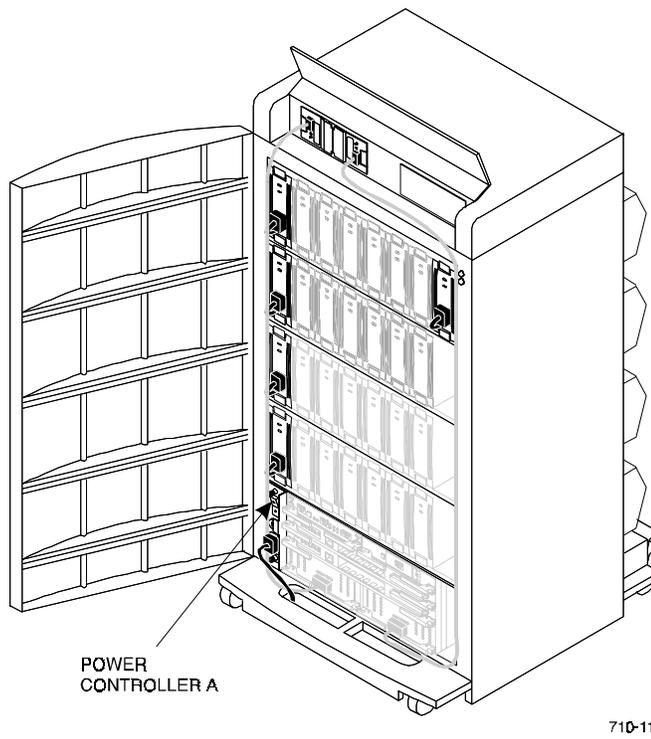
This standard power configuration (Figure 1-14) is the minimum configuration DIGITAL recommends. If a power supply SBB fails you might be able to replace it before a second fails. The standard power configuration has the following components:

- 5 – power supply SBBs
- 1 – power entry controller

Any one of the following errors will cause the subsystem to cease operation:

- Failure of two power supply SBBs
- Failure of the power entry controller
- Failure of the ac power source
- Failure of the PDU (ESA10000 only)

Figure 1-14 Standard Power Configuration (4 + 1)



1.8 Redundant (4 + 4) Power Configuration

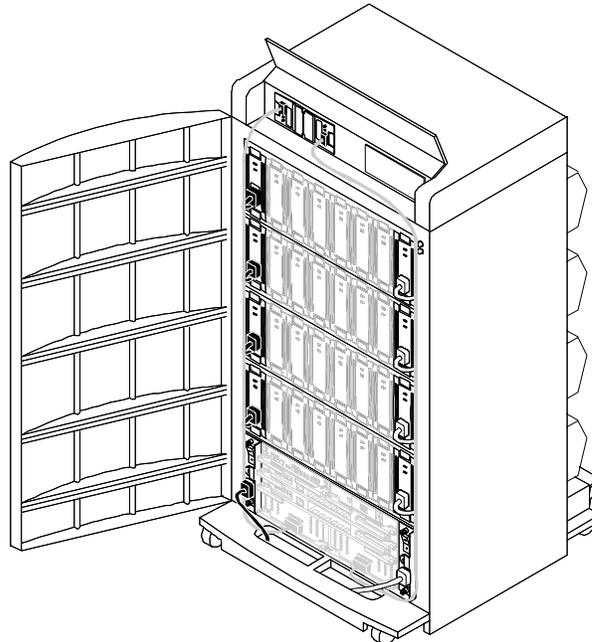
A full redundant power configuration requires two separate power sources, two ac power controllers, and eight shelf power supplies (Figure 1-15). DIGITAL recommends this configuration to provide complete power system redundancy thereby ensuring complete data protection. Any one of the following error conditions will cause the subsystem to cease operation:

- Failure of five power supply SBBs
- Failure of both power entry controllers
- Failure of the ac power source
- Failure of both PDUs (ESA10000 only)

The primary ac source provides power to controller A, which distributes the ac power through the four black power cords to the four power supply SBBs on the left end of each shelf.

The second, or redundant, ac source provides power to controller B. The four power supply SBBs on the right end of each shelf are connected to power bus B with the four gray power cords.

Figure 1–15 Redundant Power Configuration (4 + 4)



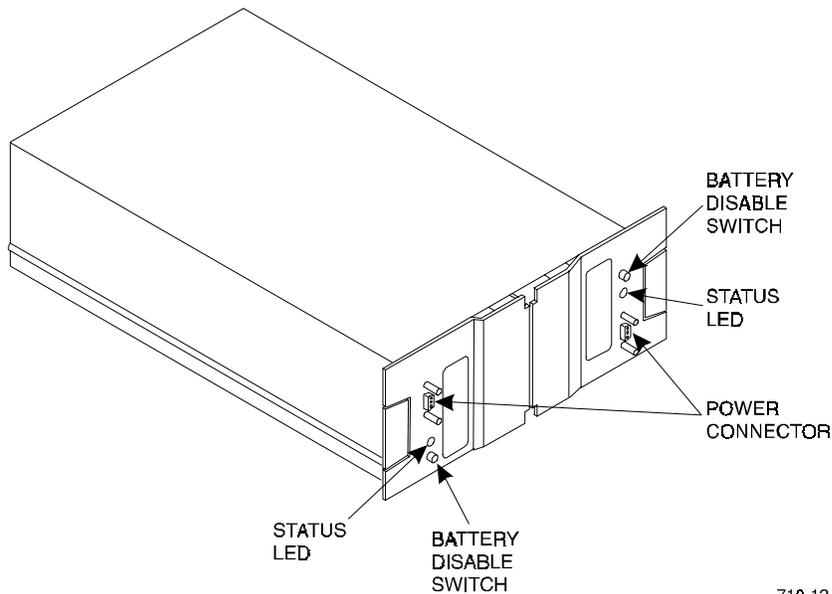
710-10

1.9 ECB SBBs

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. Two ECBs mounted in each SBB module provide support for two cache modules. Each has a power connector, status LED, and battery disable switch (see Figure 1-15).

To check the ECB status, look at the ECB status LED (one for each cache module) for the appropriate indication (see Figure 1-16 and Table 1-3).

Figure 1-16 External Cache Battery (ECB) SBB



710-12

Table 1-3 ECB Status Indications

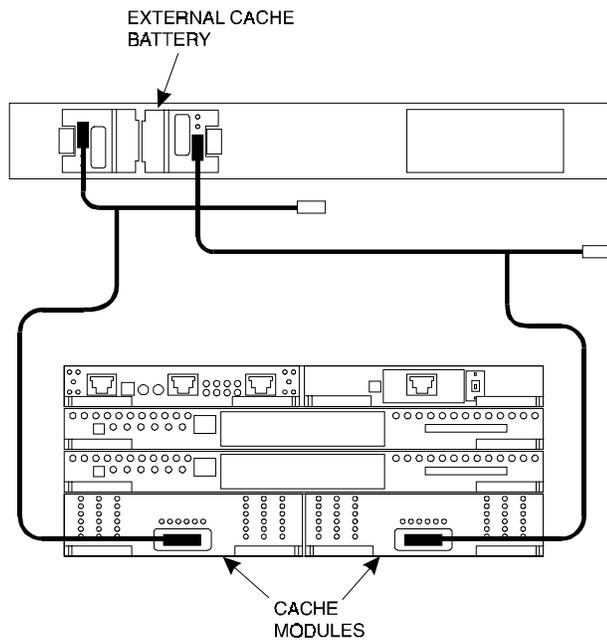
LED Status	Battery Status		
	System power is on and the ECB is fully charged.		
	System power is on and the ECB is charging.		
	System power is off and the ECB is supplying power to the cache.		
	System power is off and the ECB is not supplying power to the cache.		
LEGEND			
 = Off	 = On	 = Blink fast	 = Blink slow

The ECB SBB is mounted at the top of the SW370 cabinet. A Y-cable connects the ECB to the array controller cache module. The cache is mounted under the controller and is identified by the single plug in the middle of the module (Figure 1-17). Cache module to ECB cables are factory installed.

CAUTION

The ECB cable is configured in a “Y” for convenient routing within the cabinet. The cable is only to be used to connect ONE battery to ONE cache module. Do not connect both ends of the ECB “Y” cable at the same time during normal operation. See chapter 5 of this manual for ECB replacement.

Figure 1-17 Cache-to ECB-Connection



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1.10 Subsystem Cooling

As shown in Figure 1-18, the subsystem is equipped with eight dual-speed blowers. These blowers pull air in from the front of the cabinet, through the SBBs, controllers and EMUs, and exhaust it out the rear. Backplane connectors provide +12 V dc to operate the blowers and route the blower status signals to the shelf backplane and the EMU.

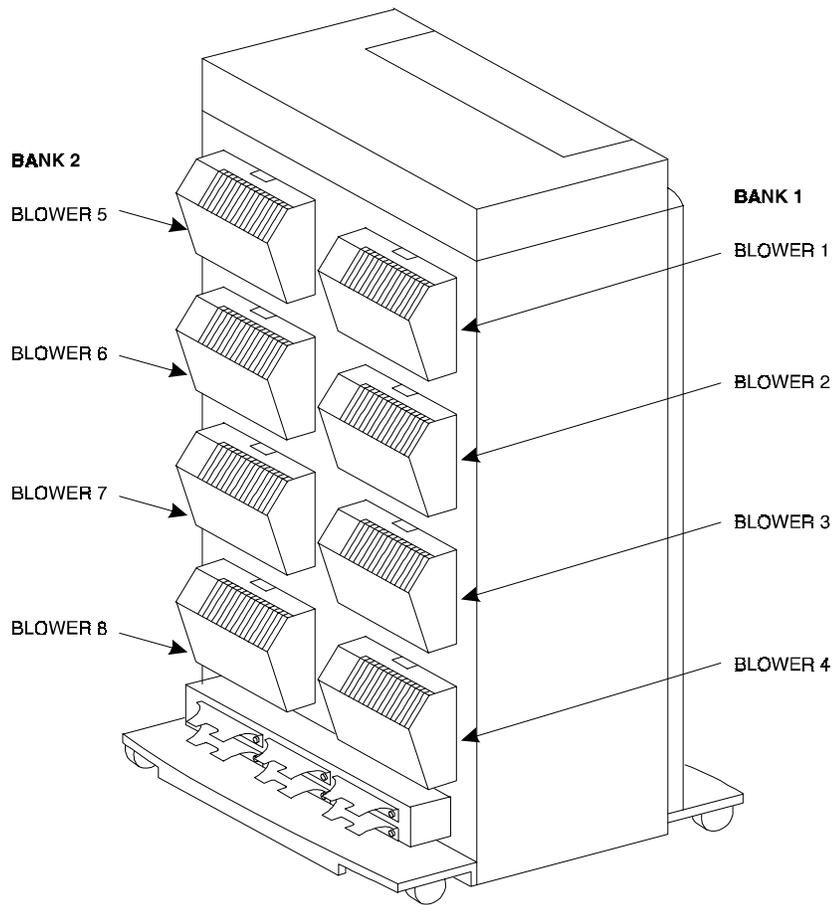
The EMU may be set to automatically increase fan speed or set to a constant fanspeed of high. Refer to the *CLI Reference Manual* for the `set_emu` commands.

If set for automatic, the EMU switches all operational blowers from low-speed to high-speed when one or more of the following conditions occur:

- When a blower is removed
- When a blower malfunctions
- When a blower is not rotating at the right speed
- When the EMU detects an over-temperature condition

When the fault condition is corrected, the EMU returns the blowers to low speed.

Figure 1-18 Dual Speed Blower Locations



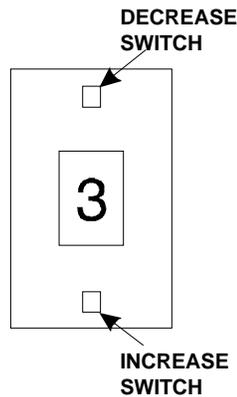
710-14

1.11 Setting the PVA SCSI Address

The SCSI bus address switch on the front of the PVA module (see Figure 1-19) controls the SCSI address (device ID) of each storage device in the enclosure. The following configuration rules (restrictions) apply in establishing the PVA SCSI bus address:

1. The master PVA address is always 0.
2. There is only one master PVA in any subsystem installation.
3. In an expansion subsystem, no two enclosures can have the same address.
4. DIGITAL does not support any PVA address that assigns SCSI bus device addresses 6 or 7 to any storage device.
5. DIGITAL does not support any combination of PVA addresses that assign the same SCSI bus device address to more than one device on any SCSI bus.

Figure 1-19 PVA SCSI Address Switch



To decrease the configuration number:

Press the upper switch to step the address down one address at a time (decrement) until the preferred configuration number is displayed.

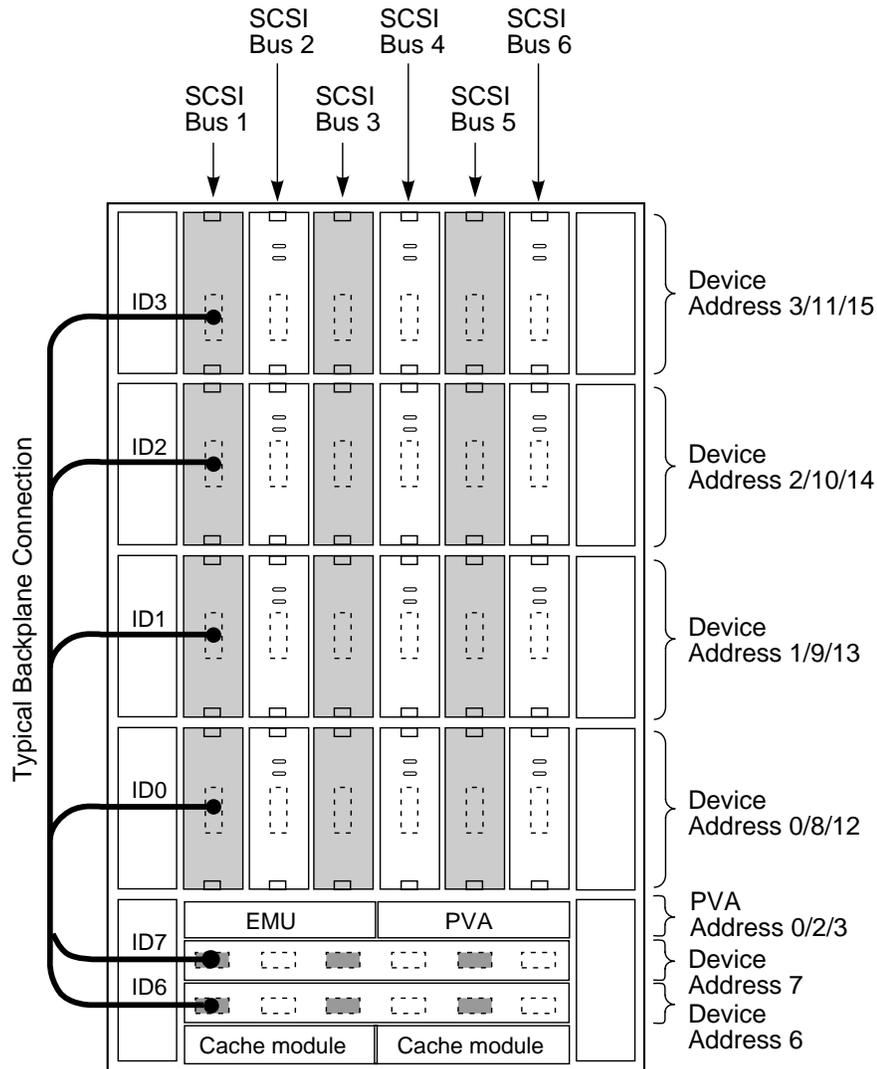
To increase the configuration number:

Press the lower switch to step the address up one address at a time (increment) until the preferred configuration number is displayed.

1.11.1 DIGITAL Supported Master PVA Address

DIGITAL supports PVA address “0” only for the master enclosure. Figure 1-20 defines the SBB device IDs for a master enclosure, one expansion, and two expansion units. The device addresses are denoted to the right of Figure 1-20.

Figure 1–20 Enclosure SCSI Bus Addresses for all SBB Device IDs



CXO5889A

1.11.2 DIGITAL Supported Expansion PVA Addresses

DIGITAL only supports PVA addresses 2 and 3 for expansion enclosures. Figure 1-20 defines the SBB device IDs for these two settings of the PVA SCSI bus address switch, respectively. The use of these addresses in combination depends on the number of enclosures and possible addressing conflicts.

CAUTION

DIGITAL does not support any PVA address combination not listed in Table 1-4.

Table 1-4 Expansion Enclosure Address Combinations

Enclosure	PVA Address Switch Setting for Two BA370 Rack Mountable units	PVA Address Switch Setting for Three BA370 Rack Mountable units
Master	0	0
First Expansion Unit	2	2
Second Expansion Unit	N/A	3

1.11.3 Non-Supported PVA SCSI Bus Addresses

DIGITAL *does not* support the following PVA SCSI bus addresses:

- Address 1
This PVA address assigns controller SCSI bus device addresses 6 and 7 to storage devices.
- Address 4
This PVA address assigns addresses already assigned to the master enclosure.
- Address 5
This PVA address assigns controller SCSI bus device addresses 6 and 7 to storage devices.
- Address 7
This PVA address assigns addresses already assigned to the master enclosure.

2

Unpacking and Installation for the RA7000 and ESA10000 Storage Subsystems

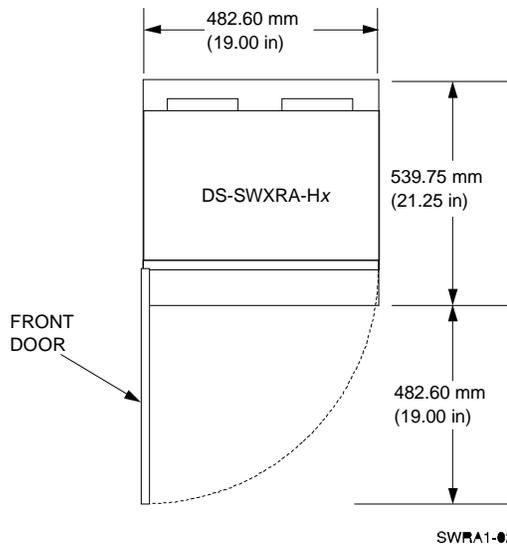
This chapter describes the site preparation, unpacking, and installation procedures for the RA7000 and ESA10000 Storage Subsystems.

2.1 Installing the RA7000

2.1.1 RA7000 Site Preparation

The RA7000 storage cabinet is designed for installation in a Federal Communications Commission (FCC) Class A environment. Before installing the storage cabinet, 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 2-1 for specific space requirements.

Figure 2-1 RA7000 Minimum Installation Clearance Measurements



2.1.2 Unpacking the RA7000 Subsystem Enclosure

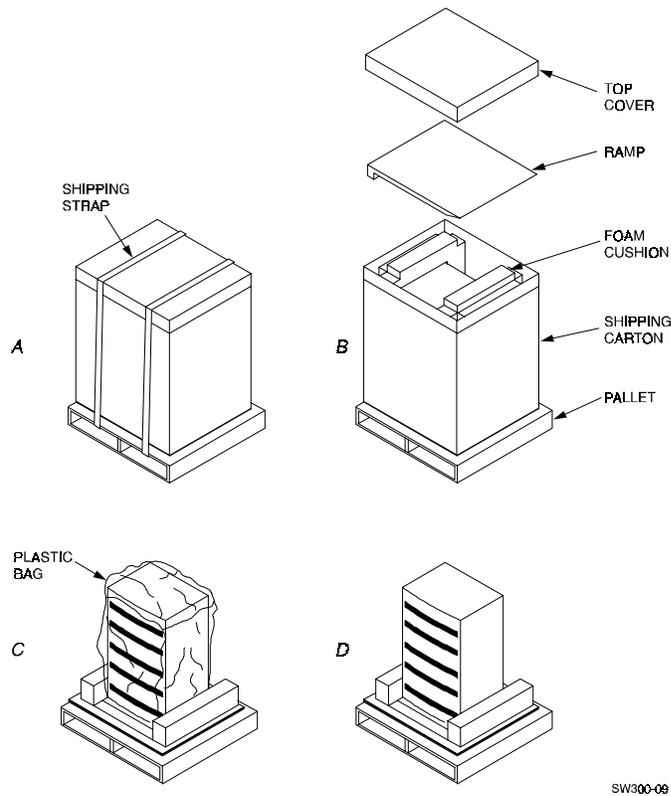
The storage cabinet is packed in a corrugated carton attached to a wooden shipping pallet, as shown in Figure 2-2A. Unpack the cabinet as follows:

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 2-2A).
2. Remove the top cover (Figure 2-2B).
3. Remove the ramp from the top of the shipping carton (Figure 2-2B) 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 2-2B).
5. Remove the cardboard carton surrounding the expansion cabinet (Figure 2-2B).
6. Remove the plastic barrier bag (Figure 2-2C).
7. Once the cabinet is exposed (Figure 2-2D), examine the equipment for any apparent damage. Report any problems immediately to your sales representative.

Figure 2-2 Unpacking the RA7000 Storage Enclosure



2.1.3 Removing the RA7000 from the Pallet

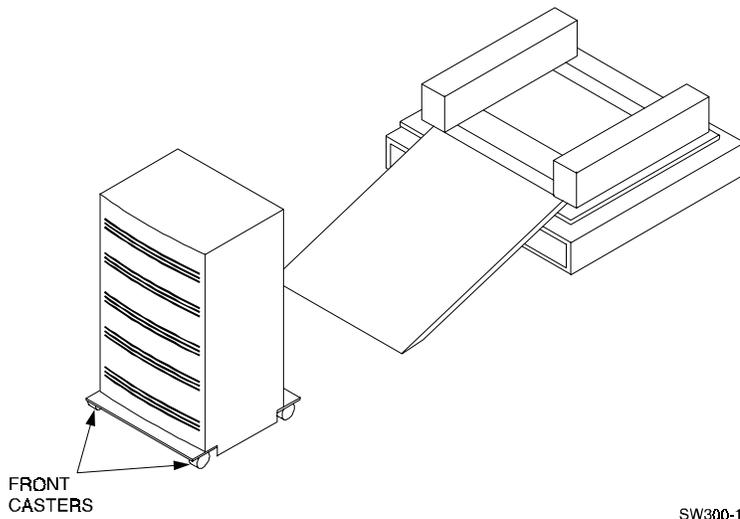
Use the following procedure to remove the storage cabinet from the shipping pallet:

WARNING

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

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 2-3.

Figure 2-3 Installation of Ramp on Shipping Pallet



SW300-10

2. Lift the lock lever on each front caster to its up position so that the storage cabinet can be moved.

WARNING

We recommend that three people be assigned to the task of unloading the cabinet from its shipping pallet. Failure to use sufficient personnel may result in personnel injury and equipment damage.

CAUTION

Do not drop the storage cabinet from a height of more than two inches as serious structural damage can result.

3. Grasping the sheet metal base assembly, carefully lift the rear of the storage 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.

2.1.4 Placing the RA7000 Storage Enclosure

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

WARNING

To prevent damage to the cabinet and injury to personnel, make sure to provide a clear path for the casters.

1. Roll the expansion cabinet to the desired location.
2. If required, engage the lock on each front caster to prevent the cabinet from moving.

2.1.5 Connecting the Enclosure to the Host

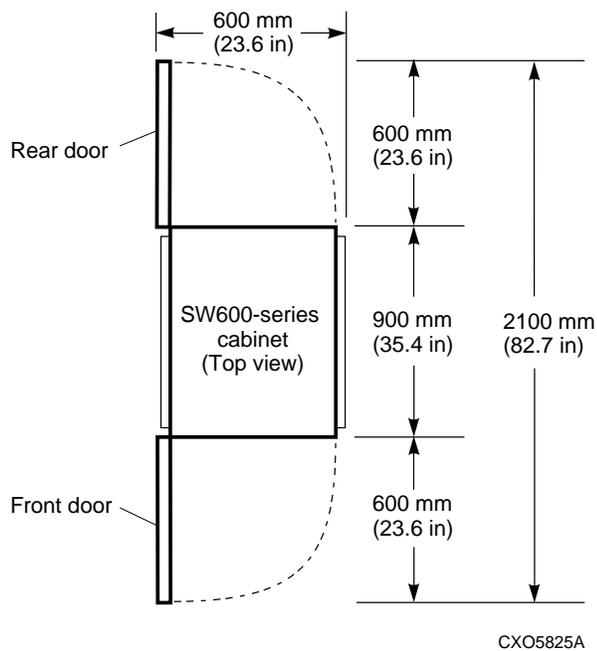
Refer to the *Getting Started Installation Guide* for specific instructions describing how to connect the RAID Array 7000 subsystem to the host.

2.2 Installing the ESA10000

2.2.1 Site Preparation

Before installing the ESA10000, ensure that adequate space is available in front of the enclosure for opening the front door and around the enclosure for adequate airflow. See Figure 2-4 for specific space requirements.

Figure 2-4 Minimum Installation Clearance Measurements



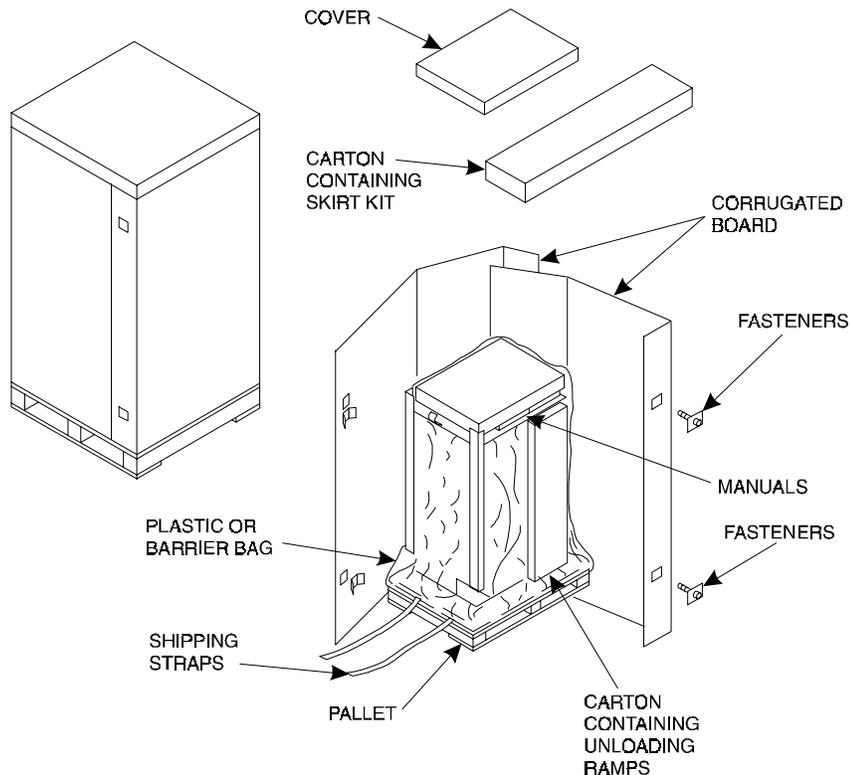
2.2.2 Unpacking the ESA10000 Subsystem

The ESA10000 comes wrapped in shrink wrap and attached to a wooden shipping pallet. European shipments are also packaged with an outer corrugated cardboard piece, which must be removed first. On the outside of both types of packages, there resides an international de-skidding label, showing how to de-skid the cabinet. Under the first layer of shrink wrap is the international unpacking labels, showing how to unpack the ESA10000 and further instructions on how to de-skid the ESA10000 cabinet. Unpack the unit as instructed by the international unpacking label. See Figure 2-5.

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.

Figure 2-5 Shipping Container Contents



After using the international unpacking label information to unpack your ESA10000, follow the de-skidding instructions on the international unpacking label and the information on the international de-skidding label to push the ESA10000 off the shipping pallet, keeping in mind the following warnings and cautions.

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 ESA10000 SW600 cabinet from its shipping pallet. Failure to use sufficient personnel can result in personnel injury and equipment damage.

The following procedure, along with the international unpacking label and Figure 2-5, will help you to remove the ESA10000 from the shipping pallet:

1. Remove the cover, the fasteners, and the corrugated board from the pallet.
2. Remove the cartons containing the ramp set and skirt kit and set them aside.
3. Cut the shipping straps. Some cabinets are packaged in a plastic or barrier bag. If the cabinet arrives in a plastic bag, leave the bag in place until the cabinet has adjusted to the local temperature and humidity.
4. Once the cabinet is unpacked, examine the front and rear doors, right and left side panels, top panel, and undercarriage for any apparent damage. Report such problems immediately.
5. Retain the shipping container and all packing materials.

2.2.3 Removing the ESA10000 from the Pallet

Use the following procedure to remove the cabinet from the shipping pallet:

1. Remove any packing material remaining on the pallet.
2. Remove the two unloading ramps from the carton and inspect them.

WARNING

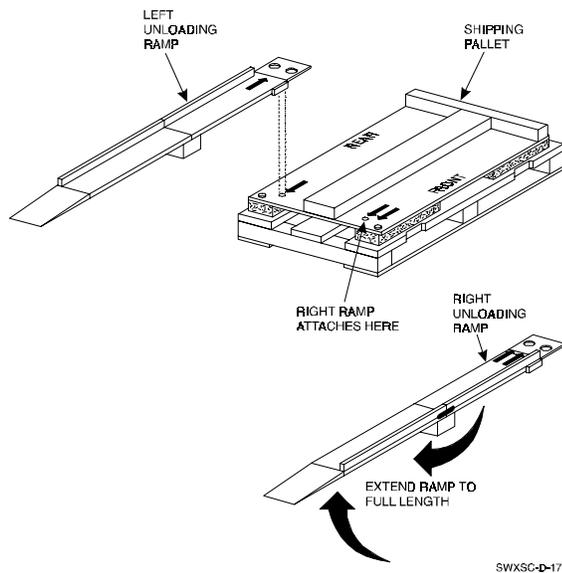
Serious personal injury may result if correct safety precautions are not observed during the unpacking procedure. All personnel should wear safety glasses. The ramps, ramp side rails, and metal hardware should be inspected for the following defects:

- Cracks more than 25 percent of the ramp depth, either across or lengthwise on the ramp.
- Knots or knotholes going through the thickness of the ramp and greater than 50 percent of the ramp width.
- Loose, missing, or broken ramp side rails.
- Loose, missing, or bent metal hardware.

If any of these defects exist, do not use the ramp. Investigate alternate means of removing the cabinet or order a new ramp. (The part number for the ramp set is 99-08897-05.)

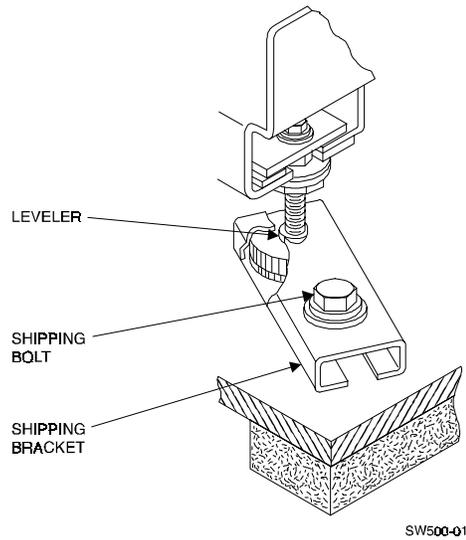
3. Attach the ramps by fitting the metal prongs into the holes on the pallet, as shown in Figure 2-6. Make sure that the arrows on the ramps match up with the arrows on the pallet.

Figure 2-6 Shipping Pallet Ramp Installation



4. Extend the ramps to their full length.
5. See Figure 2-7 for the location of the shipping bolts. Remove the bolts.
6. Remove the shipping brackets, shown in Figure 2-7, from the cabinet levelers and set them aside.

Figure 2-7 Shipping Bolts and Brackets



WARNING

The levelers must be raised fully for the cabinet to roll easily down the unloading ramps. Failure to do so may result in personnel injury as a result of the cabinet tipping off the pallet or ramp.

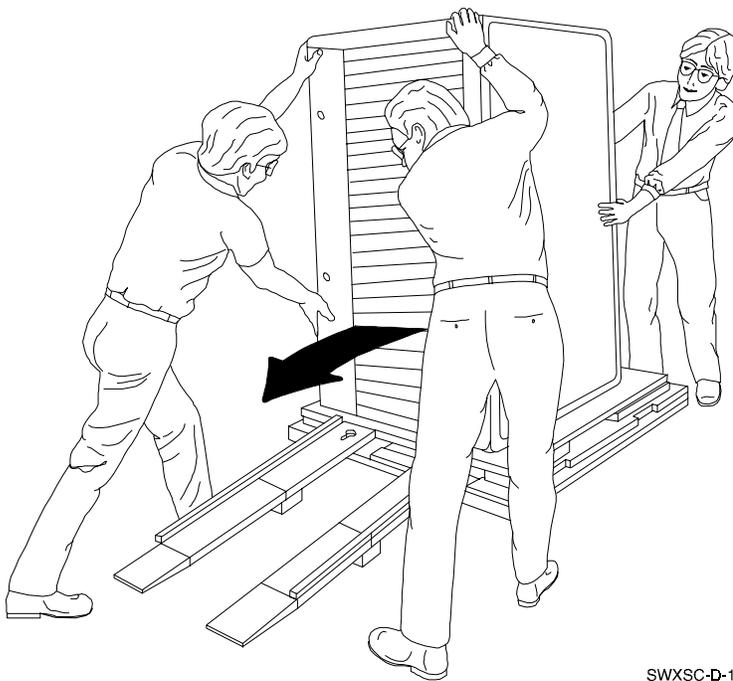
7. Loosen the leveler locking nuts and screw the four cabinet levelers all the way up into the cabinet.

WARNING

Three people are required to unload the cabinet from the shipping cabinet. Failure to use sufficient personnel may result in injury and equipment damage.

8. Carefully roll the cabinet off the pallet and down the ramps to the floor as shown in Figure 2-8.

Figure 2-8 Removing the Cabinet from the Pallet



SWXSC-D-18

2.2.4 Moving the ESA10000 to It's Designated Site

WARNING

Using extreme caution when rolling the cabinet across the floor. Failure to raise all leveler feet and to provide a clear path for the cabinet's casters may result in the cabinet tipping over and injury to personnel.

Once the cabinet rack space is configured as desired, the cabinet may be rolled to its final installation position. Secure loose cabinet cables up and out of the way when rolling the cabinet.

2.2.5 Joining Adjacent ESA10000s

NOTE

Skip to Section 2.2.7 "Leveling the Cabinet" if you do not have to join adjacent ESA10000 cabinets.

A cabinet joiner kit comes secured within the ESA10000 packaging. Use the joiner kit to join two ESA10000 cabinets. In the joiner kit are instructions to position the cabinets, to remove the side panels, to install the necessary joiner kit hardware, to use the supplied Allen wrench, and how to complete the procedure by installing trim pieces onto the cabinets. The following text will also help you to start and complete the joining procedure, as you are referring to the instructions contained in the joiner kit.

When joining two ESA10000's, the recommended configuration is to have the cabinet that resides on the left (viewed from the front) to have two BA370's installed with no controllers and for the cabinet that resides on the right to have one BA370 in the bottom position with controllers installed in that BA370.

You must first remove one of the side panels from each cabinet before the joiner kit can be installed. Refer to the joiner kit instructions and follow this procedure.

1. Open the back door of the cabinet to gain access to the screw attaching the side panel to the cabinet.
2. Use a standard 5/16" nut driver or wrench to remove the single screw holding the side panel to the rear vertical rail. The SW600 has only one screw attaching the side panel to the cabinet. That screw is on the bottom, rear vertical rail of the cabinet and is accessible from the inside of the cabinet. You will install a shoulder bolt into that hole later as well as into the corresponding hole in the front of the cabinet. Cabinet upper and lower brackets on which the side panel rests hold the side panel in place.
3. From the outside of the cabinet, lift the side panel up and off. This may require two people.
4. Store the side panel. Repeat Steps 1 through 4 for the other side panel.
5. Continue the joining process.
6. Position the two cabinets you are about to join next to each other, allowing ample room to walk around both cabinets
7. As you face the front of the cabinets, position the cabinet containing controllers to the right. Position the cabinet with no controllers to the left.
8. The correct side panels should already be removed.
9. From the outside of the left cabinet, screw a large head shoulder bolt into the top hole below the rectangular cutout in the lower part of the cabinets vertical rail (the hole from which you previously removed the screw that held the side panel onto the cabinet). Screw a second large head shoulder bolt into the front vertical rail hole that corresponds to the rear side panel screw hole.
10. Using two screws provided, attach the top trim piece to the right cabinet.
11. Stand facing the side of the left cabinet (the side with the panel removed). Install keps over holes 9 and 12 from the top of the vertical cabinet rails, front and rear. Install keps over holes 9 and 12 from the bottom of the vertical cabinet rails, front and rear.

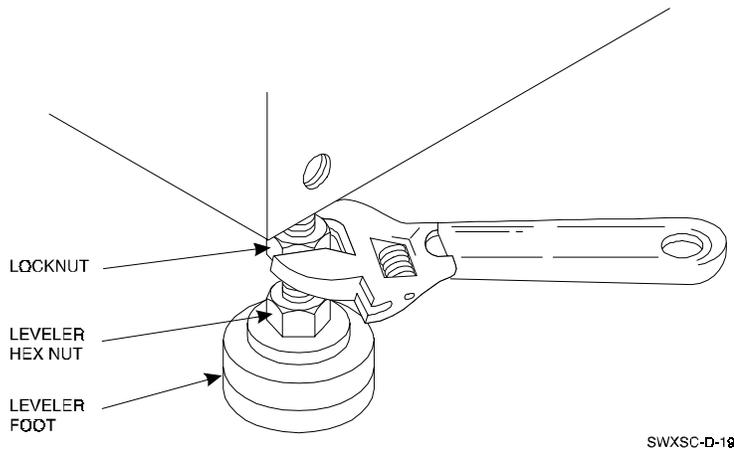
12. Still facing the side with the panel removed, install a latch on the left front top vertical cabinet rail through the kep nuts with the 10/32” screws provided. Install a receiver on the right front top of the vertical cabinet rail through the kep nuts with the 10/32” screws provided.. As you are standing facing the side of the cabinet with the side panel removed, latches and receivers should be oriented with the black colored part of the assemblies facing outwards. Repeat this step at the bottom of the cabinet, again with the latch to the left and the receiver to the right as you are facing the cabinet side with the side panel removed. Note that the latch has the movable part while the receiver does not.
13. Turn and face the side of the other cabinet with the sidepanel removed. Repeat the procedure in Step 7 for the second cabinet.
14. Roll the two cabinets close together, aligning the joiner latches to the joiner receivers.
15. Insert the large Allen wrench (provided) into one of the tool receptacle holes on a bottom latch and turn clockwise to latch. Turn until the receiver and latch “clicks” into place. Continue turning the Allen wrench until it can not be turned further. Repeat for the other bottom joiner latch. Repeat for the top joiner latches.
16. Slide the notch at the bottom of the front trim bracket over the large head bolt that you attached to the lower front side of the left cabinet. Rotate the upper part of the front trim bracket so that it slides in beneath the top trim piece, which was installed in Step 5, and lock into place with a screw through the top trim piece.
17. Slide the notch at the bottom of the rear trim bracket over the large head bolt that you attached to the lower rear side of the left cabinet. Rotate the upper part of the rear trim bracket so that it slides in beneath the top trim piece, installed in Step 5, and lock into place with a screw through the top trim piece.

2.2.6 Leveling the Cabinet

Level the cabinet in its final position as follows:

1. Loosen the locknuts on all four leveler feet as shown in Figure 2-9.
2. Turn each leveler hex nut clockwise until the leveler foot contacts the floor.
3. Adjust all four feet until the cabinet is level and the load is removed from all casters. Verify that the casters spin freely.
4. Tighten the locknuts on all four leveler feet.

Figure 2-9 Leveler Foot Adjustment



2.3 Installing Additional Components

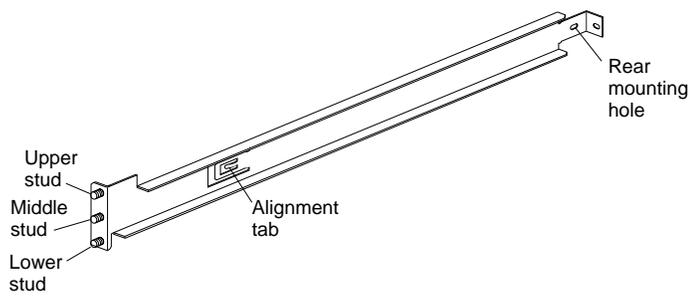
The following sections describe the procedures for installing additional components into the ESA10000 data center cabinet.

2.3.1 Installing the BA370 Rack-Mountable Enclosure

You may wish to install an additional BA370 rack-mountable enclosure into your ESA10000 to expand the storage capacity. The BA370 is shipped with a rack mounting kit containing **mounting rails**, which you install onto the vertical mounting rails of the SW600 cabinet, and **mounting brackets**, which you attach to the sides of the BA370.

You must first install the BA370 mounting rails into the SW600 cabinet. Ensure proper orientation of the rails by referring to Figure 2-10 while visually inspecting the rails and reading the following text. It is very important that the rails be installed into the SW600 cabinet properly oriented or the BA370 will not install. The front of the 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 protruding studs through designated holes in the SW600 cabinet front vertical rails. The rear of the rail has a U-shaped flange and two screw holes, one in the U-shaped flange and one in the rail itself. The rear of the mounting rail is installed towards the rear of the cabinet. The bottom of the rail has a flange running the entire length of the rail. The top of the rail has a flange that runs most of the length of the rail from the rear of the rail to approximately two inches from the front of the rail. Use Table 2-1 and Table 2-2 as a guide for installing the mounting rails into the proper holes of the vertical mounting rails of the SW600 cabinet and refer to Figure 2-10 and 2-11.

Figure 2-10 Mounting Rail Orientation



CXO5932A

Table 2-1 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

If using Table 2-1, count the holes from the **top** of the SW600 cabinet.

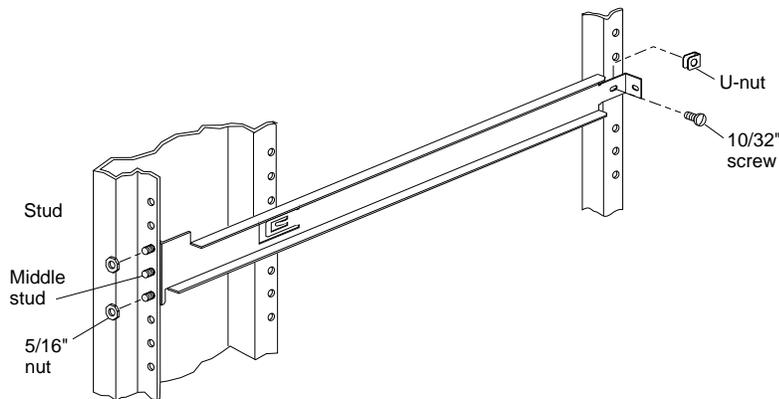
Table 2-2 Installing Rails for the Lower BA370

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

If using Table 2-2, count the holes from the **bottom** of the cabinet.

1. Position the mounting rails in the hole positions indicated by Tables 2-1 or 2-2. The upper and lower studs on the front of the mounting rail align with the indicated holes in the front of the SW600 cabinet. The alignment tab slides into a hole on the inner front vertical rail of the SW600 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 2 5/16" nuts on the top and bottom studs of each rail and tighten. Refer to Figure 2-11. **DO NOT** attach a 5/16" 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 SW600 cabinet and over the obvious holes that correspond to the rear mounting holes of the SW600 cabinet's vertical rails, as shown in Figure 2-11. Attach the rear of the mounting rails to the SW600 cabinet by inserting a 10/32" X 5/8" screw through the holes in the mounting rails, through the rear vertical rails of the SW600 and through the U-nuts. Because the front of the mounting rail is already attached to the SW600 cabinet, the rear hole on the mounting rail should automatically align with the proper hole on the rear vertical rail of the SW600 cabinet. If you have doubts on proper rear hole alignment, count the number of holes on the front of the SW600 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.

Figure 2-11 Rail Installation into Cabinet



3. At this time, install the ECB into the right position (viewed from the rear) of the ECB shelf, as shown in Figure 2-11. Install two ECB Y-cables, as shown in Figure 2-12 and tie-wrap them to the SW600 cabinet's inner vertical rails. These cables will be connected to the ECB during a later step in this procedure.

Figure 2-12 ECB Position

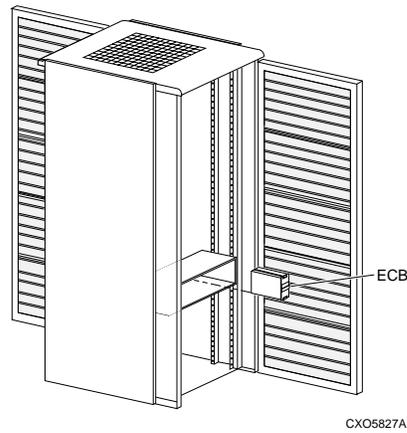
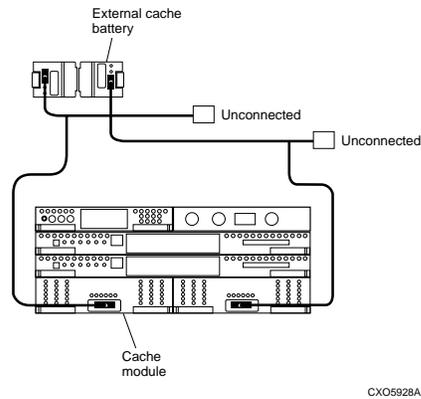


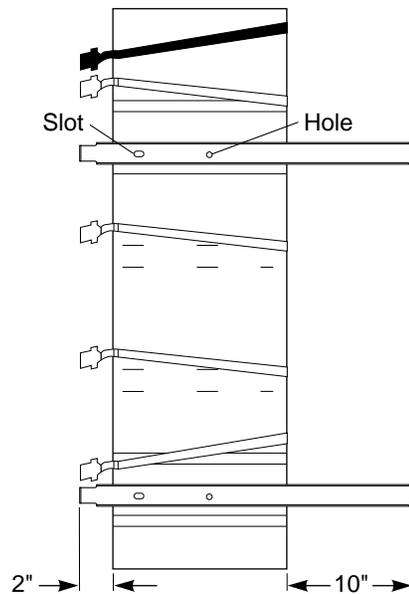
Figure 2-13 Installing ECB Y-Cables



Now you must attach the **mounting brackets** to the BA370 rack mountable enclosure.

1. Attach the mounting brackets to the sides of the BA370 using the two 8/32" X 1/4" screws provided as shown in Figure 2-14. Notice that the mounting bracket's screw holes are 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 and tighten. Install the second screw into the screw slot and tighten. Note that once attached, the bracket extends further towards the rear of the BA370 than it does towards the front of the BA370.

Figure 2-14 Attaching Mounting Brackets to the BA370



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

WARNING

Installing the BA370 into an ESA10000 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 residing in the lower position already. 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 HSOE 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 SW600 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 SW600 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 one person on each side of the BA370, grasp the BA370 by the mounting bracket with one hand and by the front top bank of the BA370, with the other hand. Lift the BA370 up, matching the mounting brackets with the mounting rails, and slide the BA370 into the SW600 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 SW600 vertical rails, into the LED cable harness on the top of the BA370.
7. Ensure 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" nut over the middle stud on the front of each mounting rail. In the rear of the cabinet, use a 10/32" screw through the screw holes of the mounting rails and brackets. Refer to Figure 2-11. This effectively locks the BA370 securely into the SW600 cabinet.
9. Ensure the ac power distribution unit (PDU) circuit breaker is off and the ac input power controller switch on the ac input power controllers is off.
10. Re-install all power supply and disk drive SBBs into the BA370.
11. For 4+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. Refer to Figure 1-14 in *Chapter 1* of this manual. For 4+4 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. Refer to Figure 1-15 in *Chapter 1* of this manual.
12. Ensure 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 input power controller(s) on the front of the BA370.

13. For BA370's with 4+4 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 SW600 cabinet. Attach ECB cables to the ECB and to the cache modules. The top BA370 ECB is located on the left-hand side of the ECB shelf. The bottom BA370 ECB is located on the right-hand side of the ECB shelf.
14. Plug the PDU ac power cable(s) into the ac power source.

2.4 Cabling a Master Enclosure to an Expansion Enclosure(s)

NOTE

One DS-BNK37-1E cable kit is required for each expansion unit.

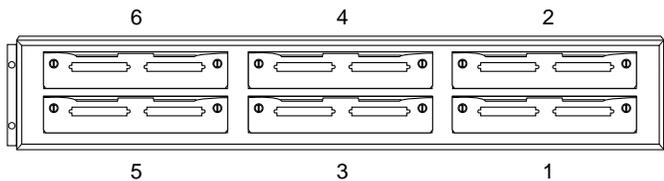
2.4.1 Cabling Sequence

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

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

2.4.2 Attaching the SE I/O Cables

Figure 2-15 SE I/O Port Identification



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There is a separate cable for each port of the controller and all cables are identical. Refer to Figure 2-15 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 unit connects to port 1 of the expansion unit(s), port 2 of the master unit connects to port 2 of the expansion unit(s), and so forth. Start with the bottom row (ports 1, 3, 5) first then the top row (ports 2, 4, and 6).

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

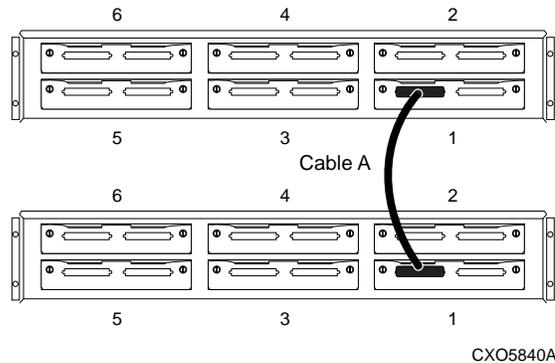
Do not omit the tightening of the jackscrews. There is not enough contact pressure to hold the cables in place between enclosures.

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

2.4.2.1 Cabling for One Expansion Unit

For a single expansion unit, cable from the **terminated** side of the I/O module on the master unit to the **terminated** side of the expansion unit. The terminated side is identified by the resistor symbol, it is also the LEFT-hand connector of the SE I/O module. See Figure 2-16.

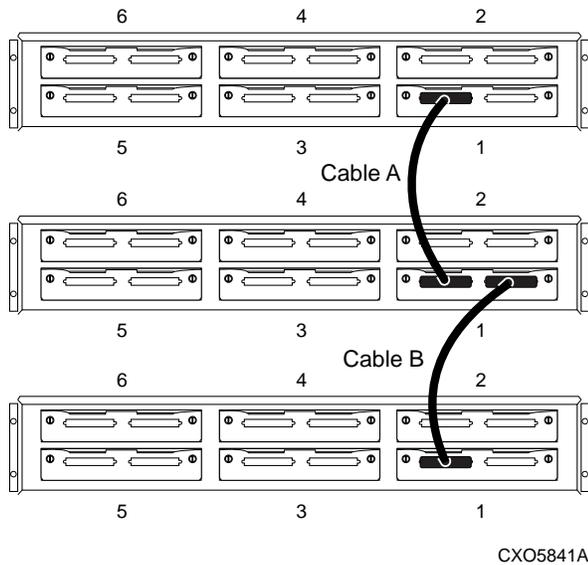
Figure 2-16 SE I/O Port Wiring (One Expansion Unit)



2.4.2.2 Cabling for Two Expansion Units

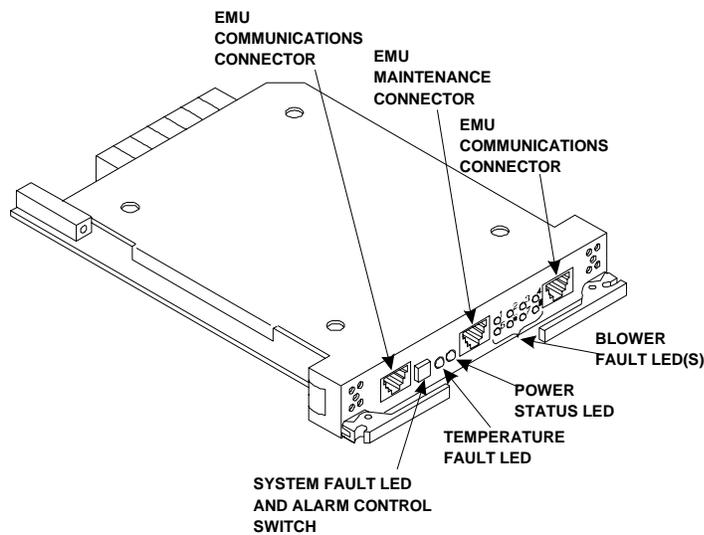
For two expansion units, cable from the **terminated** side of the I/O module on the master unit to the **terminated** side of the I/O module on the first expansion unit. Then connect from the **unterminated** side of that I/O module on first expansion unit to the **terminated** side of the I/O module on the second expansion unit. 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 2-17.

Figure 2-17 SE I/O Connections for Two Expansion Units



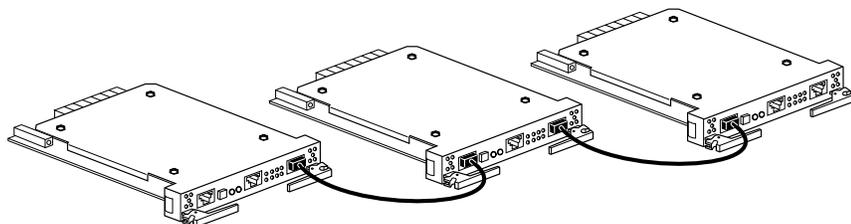
2.4.3 Attaching the EMU Communications Cable

Figure 2-18 EMU Front Panel



Connect the EMU Communications cable from one EMU communications port (See Figure 2-18) of the master RA7000 to the communications port of the first expansion unit. If there is a second expansion unit, connect an EMU communications cable from one EMU communications port of the first expansion unit to a communications port of the second expansion unit. See Figure 2-19.

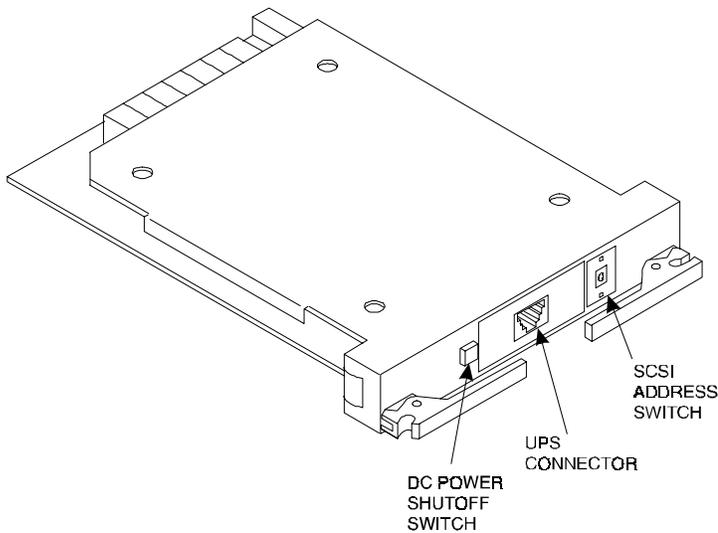
Figure 2-19 Multiple EMUs Connected Together



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2.4.4 Setting the PVA Addresses

Figure 2–20 PVA Module Front Panel



710-47

DIGITAL supports enclosure addresses 2 and 3, only for expansion enclosures. Figure 2-21 defines the 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.

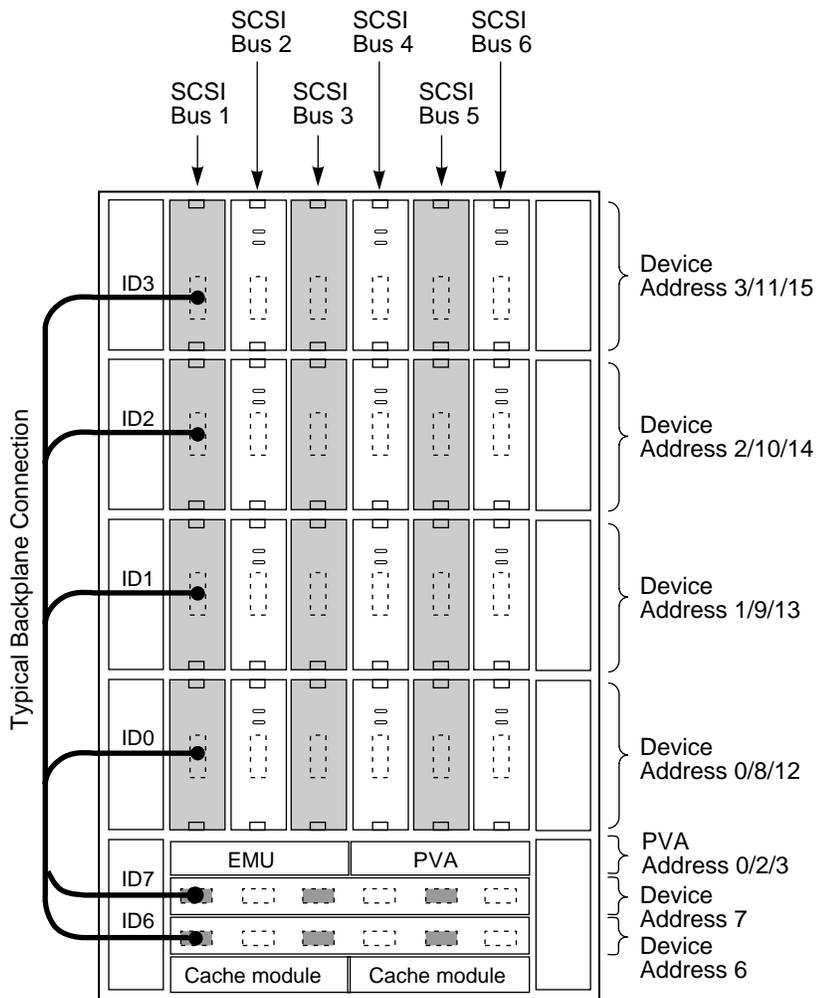
CAUTION

DIGITAL does not support any enclosure address combination not listed in Table 2-3.

Table 2–3 Expansion Enclosure Address Combinations

Enclosure	PVA Address Switch Setting for Two BA370 Rack Mountable Units	PVA Address Switch Setting for Three BA370 Rack Mountable Units
Master	0	0
First Expansion Enclosure	2	2
Second Expansion Enclosure	N/A	3

Figure 2–21 Expansion Enclosure SCSI Bus Addresses



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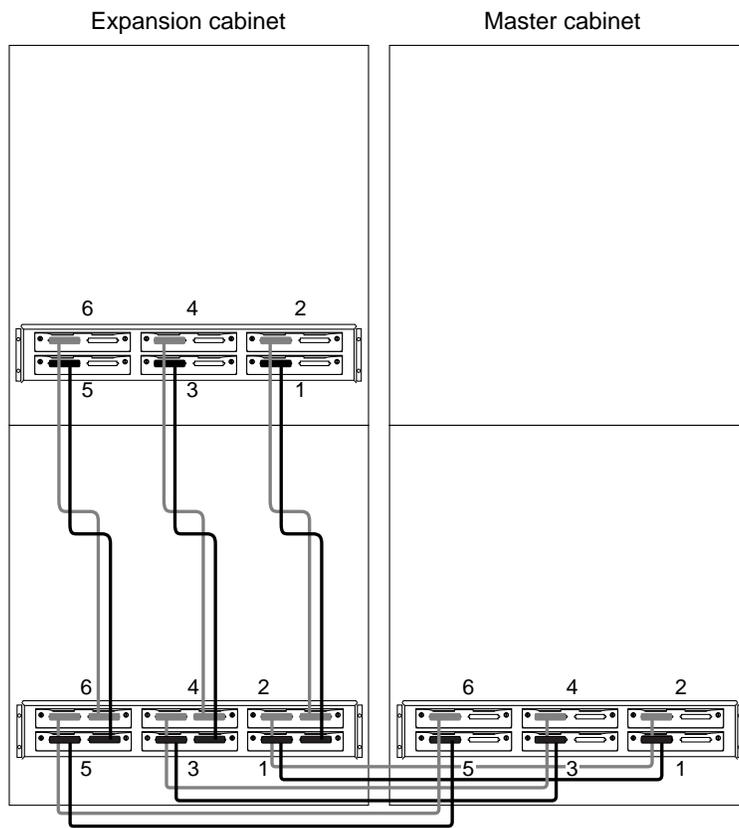
2.5 Connecting SCSI Bus Cables to the ESA10000

The internal SCSI bus cabling of two BA370's within an ESA10000 cabinet as well as the SCSI bus cabling between a master and expansion cabinet is shown in Figure 2-22. 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 BA370's.

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 BA370's that reside in the same cabinet. Again refer to Figure 2-22 for help in routing SCSI bus cables.

The maximum bus length, including external cables (distance from the I/O module terminator to the last terminator on the bus) is a function of the bus speed and the number of devices. If the external cable is figured from SE I/O module to SE I/O module with no devices installed in the middle, the cables may be extended to 20 meters due to the isolation and re-timing circuitry of the SE I/O module.

Figure 2-22 SCSI Bus Cabling for the ESA10000



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2.6 Installing SBBs

This section describes the procedures for installing Storage Building Blocks (SBBs) into a BA370 rack mountable enclosure. The SBBs consist of disk drives, power supplies, and the external cache battery.

2.6.1 Installing SBB Disk Drives

Initial and additional disk SBBs may be installed into the BA370 rack-mountable enclosure. The recommended procedure for installing disk SBBs is to install them into the enclosure bottom to top and from left to right as viewed from the front of the enclosure.

Use the following guidelines when installing Disk SBBs into the BA370(s):

1. Install the 9GB Disk SBBs into each BA370
2. Fill the BA370 from bottom shelf to top shelf
3. Fill each shelf in a left to right order
4. Repeat this process for the 4GB Disk SBBs
5. Repeat this process for the 2GB Disk SBBs

Before beginning the Disk SBB installation process, group the Disk SBBs according to capacity. If there is more than one BA370 enclosure involved, divide each of the groups by total number of BA370 rack mountable enclosures. Now distribute the disks (by capacity) amongst the BA370s. The goal is to spread the disks across the BA370s to ensure that a raidset is not all on one BA370. It is not necessary to favor the master BA370 [the one with the HSZ70 controller(s)] over the expansion enclosure(s).

Example:

DISK TYPE	TOTAL NUMBER OF DISKS BY TYPE	NUMBER OF DISKS IN MASTER	NUMBER OF DISKS IN EXPANSION
RZ1DB, 9GB, WIDE Ultra	9	4	5
RZ1CB, 4GB, WIDE Ultra	5	3	2
RZ1BB, 2GB, WIDE Ultra	3	1	2

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:

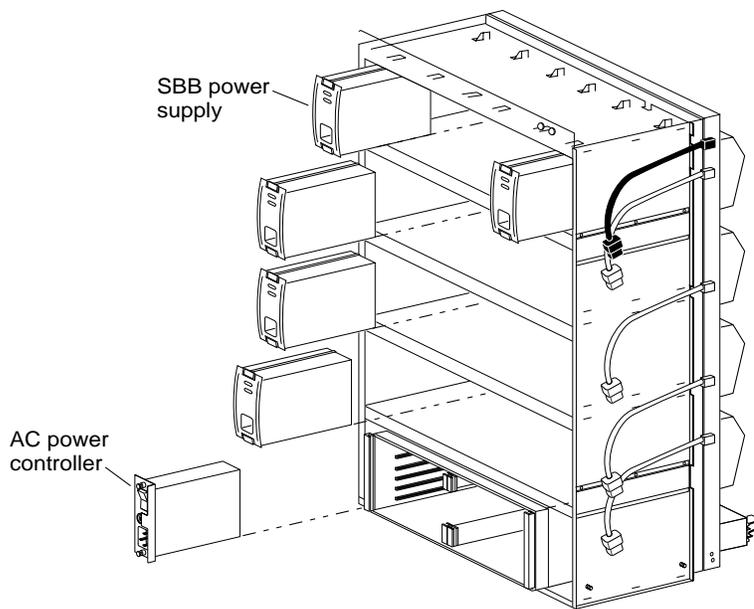
1. All devices and ports in the same column are on the same SCSI bus or port.
2. All devices in the same row (device shelf) have the same device address.
3. Devices installed must be listed in the HSOF Ultra 70 Solutions Software SPD.
4. Device address 4 and 5 are used only when the disk drive SBB has a device address switch.
5. Device addresses are determined by the backplane connector into which the device is inserted unless the SBB has a device address switch.
6. For the addressing of SBB disk drives on the SCSI bus, device addresses for each SBB in each extender 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 extender cabinet is set to PVA address 2 and device addresses in that extender cabinet have addresses 8 through 11. The PVA in the second extender cabinet is set to PVA address 3 and device addresses for that extender are from 12 through 15. Figure 2-21 helps to illustrate the addressing scheme.

Figure 2-21 shows the six Ultra Wide SCSI buses and their associated ports and device addresses.

2.6.2 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. Refer to Figure 2-23 during the installation.

Figure 2-23 Installing Power Supply SBB (4+1 Shown)



CXO5930A

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 power cord to the SBB power supply.
3. Turn on the AC input power controller.
4. Observe the power supply SBB LEDs. Both LEDs should be lit, indicating proper power supply operation on the associated bus.
5. 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 input power controller has failed, or the SBB power supply just installed has failed.

2.6.3 Installing the AC Input Power Controller

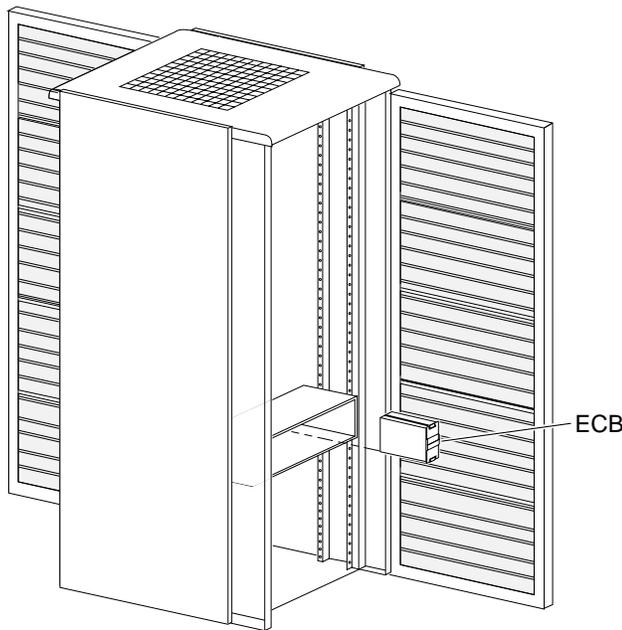
There are no external indications of a power controller failure on the ac power controller itself. Both status LEDs on the power supply being off indicate a possible power controller failure. Use the following procedure to install a new AC power controller. Refer to Figure 2-23.

1. Press **O** on the AC input power controller ON/OFF switch.
2. Insert the AC input power controller into the ESA10000 enclosure .
3. Tighten the two retaining screws at the top and bottom of the power controller.
4. Connect the AC power cord to the power controller.
5. Press **I** on the AC power controller ON/OFF switch.
6. Observe the power supply status LEDs for proper operation.

2.6.4 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. Refer to Figure 2-24.

Figure 2-24 Installing the External Cache Batteries



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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.

3

Configuring the Storage Cabinet

This chapter describes configuration rules and restrictions for configuring the Environmental Monitor Unit. When specific rules and restrictions are not provided, references are given to the proper StorageWorks documentation.

3.1 Configuring the Storage Cabinet

Configuring the storage cabinet is primarily configuring the EMU. Configuring the EMU requires connecting the EMU communications bus and then using the CLI SET_EMU command to establish the following:

- Enclosure backplane temperature sensor set points on all enclosures
 - SENSOR_1 or SENSOR_1_SETPOINT = DEFAULT
 - SENSOR_2 or SENSOR_2_SETPOINT = DEFAULT
- EMU module internal temperature sensor set point SENSOR_3 or SENSOR_3_SETPOINT = DEFAULT
- The blower speed controls of either FANSPEED = HIGH or FANSPEED = AUTOMATIC

DIGITAL recommends setting the FANSPEED to AUTOMATIC, unless (1) the ambient temperature is in excess of 38°C (100°F), (2) there is no air conditioning, or both conditions exist. Should these conditions exist, DIGITAL recommends setting the FAN SPEED to HIGH.

NOTE

For instructions on using these commands, refer to the *CLI Reference Manual*.

3.1.1 Connecting the EMU Communications Bus

In an expansion configuration you must establish communications between the master EMU and each of the expansion EMUs. This is accomplished by connecting a communications port on each EMU to a communications port on another EMU. By establishing an EMU communications bus chain you ensure that the master EMU can monitor and control all the enclosures in the UltraSCSI subsystem.

DIGITAL recommends that you use a BN25G cable no longer than 4 m (13.1 ft.) to connect the EMUs.

3.1.2 Setting the Temperature Sensors

There three temperature sensors in each UltraSCSI enclosure – two on the rear of the backplane in the top middle and one mounted on the EMU module. You have the option of setting the temperature at which an individual sensor reports an over-temperature condition. You enter the desired temperature in degrees Celsius (°C) within the range of 0°C (32°F) through 49°C (120°F). See Table 3–3 for the relationship between °C and °F (Fahrenheit).

The EMU sensor monitors the input, or ambient, air temperature while the two enclosure sensors monitor the exhaust air temperature. The exhaust air temperature can be higher than the ambient air temperature.

For each of the three sensors you have the option of selecting `SENSOR_n_SETPOINT = DEFAULT` which establishes a set point of 35°C (95°F). DIGITAL recommends that you use this setting for all three sensors.

Should the ambient temperature regularly be higher than 35°C (95°F), DIGITAL recommends you select a temperature setting that ensures the continued operation without endangering the components. Setting the temperature sensors to the highest expected ambient temperature should ensure optimum operation.

CAUTION

To ensure proper operation, enter all temperatures in °C. You cannot enter temperatures as fractions, decimals, or in °F.

Table 3–1 EMU Set Point Temperatures

°C	°F	°C	°F	°C	°F	°C	°F	°C	°F
0	32	10	50	20	68	30	86	40	104
1	34	11	52	21	70	31	88	41	106
2	36	12	54	22	72	32	90	42	108
3	37	13	55	23	73	33	91	43	109
4	39	14	57	24	75	34	93	44	111
5	41	15	59	25	77	35	95	45	113
6	43	16	61	26	79	36	97	46	115
7	45	17	63	27	81	37	99	47	117
8	46	18	64	28	82	38	100	48	118
9	48	19	66	29	84	39	102	49	120

In an expansion configuration (two or more enclosures operating with the same controller) you only set the master EMU temperatures. The temperature set points for the other UltraSCSI enclosures, the “slaves”, automatically change to match the setting for the master EMU.

3.1.3 Setting the Blower Speed Control

The UltraSCSI enclosure blowers normally operate at low speed and provide sufficient air flow to cool the enclosure components and ensure proper operation. You can use the CLI FANSPEED command to change the operating speed of the blowers.

- When you set FANSPEED = HIGH all blowers in all enclosures operate at high speed
- When you enter FANSPEED = AUTOMATIC the local EMU controls the blower speed in each enclosure.

DIGITAL recommends using the FANSPEED = AUTOMATIC command to enable the EMU in each enclosure to implement corrective action whenever any one of the following error conditions occurs:

- A blower fails
- You remove a blower
- A blower is rotating too slowly to provide sufficient air flow
- The ambient air temperature (EMU intake) exceeds the user defined temperature.
- Either backplane (exhaust) temperature exceeds the user-defined temperature

When the EMU detects any of these error conditions, it will automatically switch all the operational blowers to high speed, thereby increasing the air flow through the enclosure to reduce the possibility of component failure. Simultaneously, the EMU can initiate the following actions:

- Enable the audible alarm on the EMU
- Turn on the amber System Fault LED whenever the temperature exceeds one or more set points
- Turn on the amber Temperature Fault LED
- Notify the controller of the error condition
- Start the EMU 8-minute timer when (1) all blowers in a bank are defective, or (2) a blower is removed.

NOTE

Removing a blower significantly changes the air flow pattern within the enclosure. This can cause an over-temperature condition in a very short time. Therefore, this condition starts the 8-minute timer.

When you momentarily depress the Alarm Control switch the EMU audible alarm will turn off and the fault status LEDs remain on, At this time, the blower LEDs will display the system fault codes (see EMU System Fault Code Displays).

3.1.4 Alarm Control Switch

Whenever a power, environment, or blower error or fault condition occurs, the EMU turns on the local audible alarm. At the same time, the alarm sounds and an amber LED in the switch turns on. The alarm remains on until one of the following conditions occurs:

- Correction of the error condition
- The user momentarily presses the Alarm Control switch

When you momentarily press the switch you turn off the audible alarm for all current error conditions in the local subsystem. The alarm remains off until one of the following conditions occurs:

- One hour elapses
- A different fault occurs
- An existing fault clears and re-occurs

When you press and hold the switch for at least 5 seconds you clear all the fault codes.

NOTE

The Alarm Control switch does not affect either the error condition or the error code. Only correcting the error condition will clear the error code.

During a controlled power shut down, the Alarm Control switch functions as an enclosure power switch. When a controlled power shut down is in affect, you must press the Alarm Control switch to restore dc power to the enclosure.

4

Error Analysis and Fault Isolation

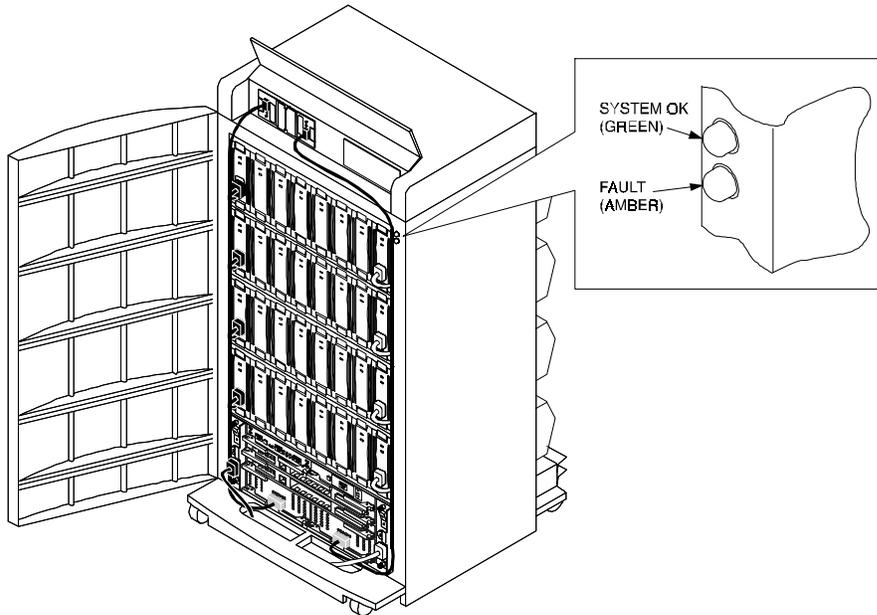
This chapter describes the errors, faults, and significant events that can occur during the storage subsystem initialization and normal operation. The chapter provides a description of the events and how to respond. The error and event descriptions isolate failures to the field replaceable unit (FRU). Refer to Chapter 5 for a list of FRUs.

4.1 Storage Subsystem Error Reporting

There are multiple light emitting diodes (LEDs) that display error conditions. The two most easily observed are the subsystem front panel (Figure 4–1). You must then use the EMU front panel ((Table 4–1), the power supply LEDs, the storage SBB LEDs, and the controller LEDs to isolate the error condition to a component.

The front panel LEDs are simple *go–no go* indicators. The green LED is the System OK LED; the amber LED is the Fault LED. When the Fault LED is ON you must check all the other status LEDs to determine the cause of the error.

**Figure 4-1 Storage Subsystem Status LEDs
(RA7000 Shown)**

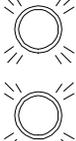


710-19

NOTE

The ESA10000 cabinet has Subsystem LEDs mounted in the cabinet door and in a small panel above each BA370 Rack Mountable Enclosure. The cabinet door LEDs permit the operator to determine the Subsystem status without opening the cabinet door.

Table 4–1 Subsystem Status LEDs

When the LED display is . . .	The subsystem status is . . .
 <p>710-34A</p>	<p>Operating normally; there are no error conditions.</p>
 <p>710-34B</p>	<p>There is a failed subsystem component. Recommended Corrective Actions: Check the EMU control panel LEDs to determine which component has failed. 2. Check the host to determine and replace the failed component.</p>
 <p>710-34C</p>	<p>The subsystem does not have power applied or is in a RESET state. Recommended Corrective Actions: Check the EMU control panel LEDs to determine which component has failed. Check that there are at least four operational SBB power supplies. Check the system terminal for error messages.</p>
<p>ON =  OFF = </p> <p>710-34D</p>	

4.2 EMU Error and Fault Status Reporting

The EMU processes subsystem status reports, and when there is an error condition, notifies the user of the problem using the EMU audible alarm and the status LEDs (system, temperature, power, blower) located on the EMU front panel (see Figure 4-2).

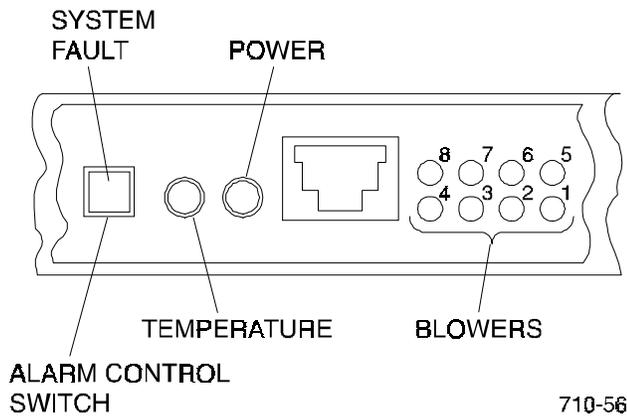
Whenever the audible alarm sounds, the user should check the EMU status LEDs to determine the problem.

CAUTION

Should the audible alarm sound, but the status LEDs not indicate an error condition, it is possible that the error condition no longer exists. However, you should always check the controller error log to verify the error condition no longer exists.

The EMU reports the system status, to include error conditions, to the controller which records this information in the error log and displays it on the controller console.

Figure 4-2 EMU Front Panel Layout



4.3 EMU Subsystem Status LEDs

Table 4–2 Shows the possible EMU status LED displays. LEDs that blink or flash at a one second or greater interval are considered ON.

Table 4–2 EMU Subsystem Status LEDs

Symbol	Condition
 710-59A	ON or blinking slowly (interval of 1 second or more).
 710-59B	OFF.
 710-59C	Flashing (blinking)

The EMU LEDs (see Table 4–3) display the status of the enclosure (System Fault), the temperature status (overtemperature), error conditions (enclosure fault), and the status of the individual blowers and banks of blowers. When the enclosure is functioning properly, only the Power LED is ON. Table 4–3 describes:

- The EMU LED display
- The enclosure status associated with each display
- The probable cause of the error condition
- The actions recommended to correct the problem

NOTE

Not all possible combinations of LED displays are shown. For example, there eight different displays for the failure of an individual blower. Therefore, only a representative display of each error condition type is shown.

Table 4–3 EMU LED Displays

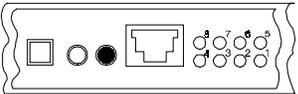
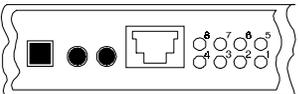
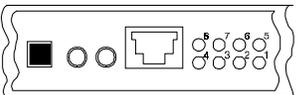
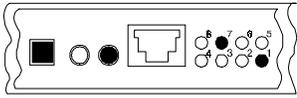
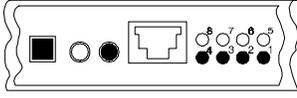
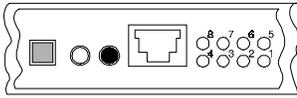
Display	Subsystem Status
 <p style="text-align: right;">710-56A</p>	<p>The subsystem is fully operational.</p> <p>Comment The dc power supplies and the blowers are operating properly. The ambient and exhaust air temperatures are within the user specified limits.</p>
 <p style="text-align: right;">710-56B</p>	<p>Over-temperature condition. Overheating can cause system failure.</p> <p>Probable Cause The ambient temperature in one or more enclosure is above the user-specified limit. Temperature set point may be set too low for environment.</p> <p>Corrective Action Complete first corrective action. If it does not correct the problem, complete the second. Determine and correct the cause of this condition as quickly as possible to prevent the over-condition from causing a subsystem reset or failure. Change temperature set point.</p>
 <p style="text-align: right;">710-56C</p>	<p>Non-operational</p> <p>Probable Cause One of the following error conditions exists: Either + 5 V dc or 12 V dc out of range. TERMPower less than + 4.5 V dc on one or more I/O modules.</p> <p>Corrective Action Complete first corrective action. If it does not correct the problem, complete the second. Observe the power supply status LEDs to determine the defective power supply and replace it. Examine I/O modules to find the one with either the external or internal TERMPower LED ON and replace it.</p>

Table 4–3 EMU LED Displays (continued)

Display	Subsystem Status
 <p style="text-align: right;">710-56D</p>	<p>Blower fault. Operational blowers are running at high speed.</p> <p>Corrective Action Replace defective blowers.</p> <p>Comment (Refer to Figure 1–18) In this example, blowers 1 and 7 are not operating and must be replaced.</p>
 <p style="text-align: right;">710-56E</p>	<p>Blower fault. Operational blowers are running at high speed.</p> <p>Probable Cause One of the following error conditions exist: A blower is removed. All blowers in one bank are not operating. Multiple blowers are installed incorrectly.</p> <p>Corrective Action Complete first corrective action. If it does not correct the problem, complete the second. Replace the missing blower. Remove and install blowers correctly within 8 minutes. Replace defective blowers.</p> <p>Comment (Refer to Figure 1–18) In this example, the following condition exists in Bank 1: A blower is removed. Or Two or more blowers are not operating Failure to replace the missing blower within 8 minutes can result in an automatic controlled power shut down.</p>
 <p style="text-align: right;">710-56F</p>	<p>Configuration error.</p> <p>Probable Cause One or more of the following conditions exists: Configuration error Slave EMU cannot communicate with master EMU External SHELF_OK signal indicates error</p> <p>Corrective Action See “EMU System Fault Code Displays” and complete corrective actions for the specific error code.</p>

4.3.1 EMU System Fault Code Displays

The system fault, temperature, power, and blower LEDs cannot display all the possible system faults. Therefore, a Flashing system fault LED indicates that the blower LEDs are displaying a two-digit, hexadecimal fault code. The upper LEDs (8 – 5) display the first digit; the lower LEDs (4 – 1) display the digit.

The EMU can display configuration fault codes on the blower LEDs (see Table 4–4) only when the system fault LED is flashing. To view fault codes on the blower LEDs you must momentarily depress the Alarm Control switch.

Once you momentarily press the Alarm Control switch the EMU initiates the following actions:

1. Displays the first reported hexadecimal fault code on the blower LEDs three times in succession.
 - The LEDs display the first reported fault code the first time for one second and then go off.
 - The LEDs display the first reported fault code the second time for one second and then go off.
 - The LEDs display the first reported fault code the third time for one second and then go off.
2. The LEDs now display the next reported fault code three times.
3. Display of all fault codes occur in sequence. Then the cycle starts over.
4. Releasing the Alarm Control switch stops the fault code display.

NOTE

When multiple corrective actions are listed, complete the first procedure and see if the problem is corrected. If the problem still exists, complete the second procedure.

Table 4-4 EMU Fault Code LED Displays

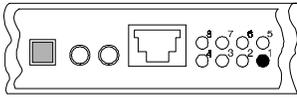
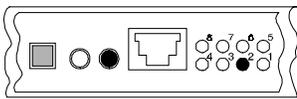
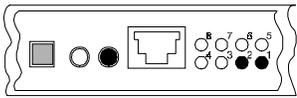
Display	Error
 <p style="text-align: right;">710-57A</p>	<p>Error Code 01 One of the following error conditions exists: Boot ROM signature fail. Boot ROM checksum failure. Corrective Action Replace EMU.</p>
 <p style="text-align: right;">710-57B</p>	<p>Error Code 02 Both microcode images are bad. Corrective Action Complete first corrective action. If it does not correct the problem, complete the second. Load microcode image to EMU from maintenance terminal. Replace EMU.</p>
 <p style="text-align: right;">710-57C</p>	<p>Error Code 03 Either a PVA SCSI ID switch setting is invalid (4, 5, 6, or 7) or there no master enclosure (SCSI ID 0). Corrective Action Complete first corrective action. If it does not correct the problem, complete the second. Ensure PVA SCSI ID settings are set as follows: – Master Enclosure = 0 – First Expansion Enclosure = 2 – Second Expansion Enclosure = 3 Replace each PVA in sequence until the fault condition clears.</p>

Table 4–4 EMU Fault Code LED Displays (continued)

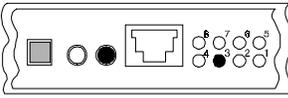
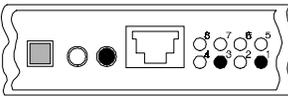
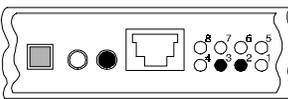
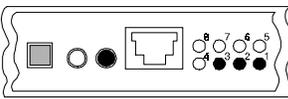
Display	Error
 <p style="text-align: right;">710-57D</p>	<p>Error Code 04 Master EMU cannot communicate with expansion EMU. Corrective Action Complete first corrective action. If it does not correct the problem, complete the second. Ensure EMU cables are properly connected. Remove all EMU cables and install one at a time. Replace defective cable. Replace EMU.</p>
 <p style="text-align: right;">710-57E</p>	<p>Error Code 05 Master EMU cannot communicate with controller. Corrective Action Complete first corrective action. If it does not correct the problem, complete the second. Replace EMU. Replace controller.</p>
 <p style="text-align: right;">710-57F</p>	<p>Error Code 06 One or more temperature sensors indicating an “invalid” temperature – one that is greater than 49°C (120°F). Corrective Action Complete first corrective action. If it does not correct the problem, complete the second. Replace EMU. Replace temperature sensor (field-service task).</p>
 <p style="text-align: right;">710-57G</p>	<p>Error Code 07 Invalid configuration. Corrective Action Controller-specific action.</p>

Table 4–4 EMU Fault Code LED Displays (continued)

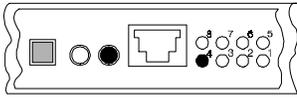
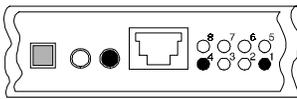
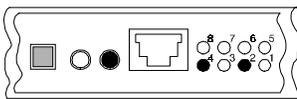
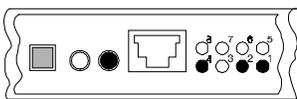
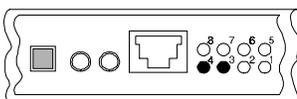
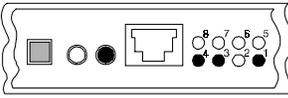
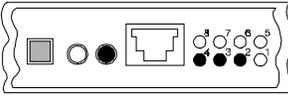
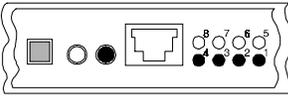
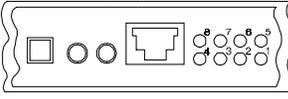
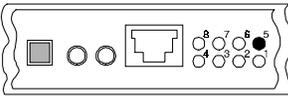
Display	Error
 <p style="text-align: right;">710-57H</p>	<p>Error Code 08 Two PVA SCSI ID switch settings are the same. Corrective Action Complete first corrective action. If it does not correct the problem, complete the second. Ensure PVA SCSI ID settings are set as follows: – Master Enclosure = 0 – First Expansion Enclosure = 2 – Second Expansion Enclosure = 3 Replace each PVA in sequence until the fault condition clears.</p>
 <p style="text-align: right;">710-57I</p>	<p>Error Code 09 EMU installed in PVS slot. Corrective Action Install EMU in left slot.</p>
 <p style="text-align: right;">710-57J</p>	<p>Error Code 0A No PVA installed. Corrective Action Install PVA.</p>
 <p style="text-align: right;">710-57K</p>	<p>Error Code 0B Controller fault. Corrective Action Requires a controller-specific action.</p>
 <p style="text-align: right;">710-57L</p>	<p>Error Code 0C One or more defective power supplies. Corrective Action Complete first corrective action. If it does not correct the problem, complete the second. Observe all power supply status LEDs. Replace any power supply with the lower LED OFF.</p>

Table 4–4 EMU Fault Code LED Displays (continued)

Display	Error
 <p style="text-align: right;">710-57M</p>	<p>Error Code 0D Controller installed in expansion enclosure. Master enclosure SCSI ID address incorrect. Corrective Action Complete first corrective action. If it does not correct the problem, complete the second. Install controller in master enclosure. Change PVA SCSI ID to 0.</p>
 <p style="text-align: right;">710-57N</p>	<p>Error Code 0E EMU memory test failed. Correction Action Replace EMU.</p>
 <p style="text-align: right;">710-57O</p> <p>Controlled Power Shut Down Display</p>  <p style="text-align: right;">710-57P</p>	<p>Error Code 0F Fewer than four operational power supplies. Comment The EMU initiates a controlled power shut down when this condition occurs. Corrective Action See Chapter ? "Power Distribution" for detailed corrective actions for this problem.</p>
 <p style="text-align: right;">710-57Q</p>	<p>Error Code 10 EMU diagnostic program loaded. Comment The audible alarm is ON continuously and you cannot clear it by pressing the alarm control switch. Corrective Action Complete first corrective action. If it does not correct the problem, complete the second. Load new microcode. Replace EMU with one with the correct microcode.</p>

4.3.2 Controlled Power Shut Down

Implementation of the controlled power shut down ensures that UltraSCSI subsystem components are properly protected when significant error conditions exist. The shut down can be initiated either automatically by the EMU or by the user.

A controlled power shut down accomplishes the following:

- Disconnects all the power supply output voltages from the enclosure power buses. This includes the internal TERMPOWER on the I/O modules. The power supplies remain operational as long as the ac input voltage is present.

NOTE

The availability of the external TERMPOWER is determined by the state of the device providing TERMPOWER.

- Supplies a “trickle” voltage to the EMU to maintain the controlled power shut down state.
- Enables the Alarm Control switch power-on function

During a controlled power shut down, the Alarm Control switch functions as an enclosure power switch. When a controlled power shut down is in effect, you must press the Alarm Control switch to restore dc power to the enclosure.

4.3.3 Automatic Shut Down

The EMU in any enclosure can initiate a controlled power shut down to protect the components from an over-temperature condition. The conditions that cause the EMU to initiate this action include one or more of the following:

- Any two temperature sensors register a temperature of 50°C (122°F)
- Removing one or more blowers for more than 8 minutes
- No blowers have been operational for more than 8 minutes
- Fewer than four operational power supplies

The automatic shut down affects only the enclosure in which the EMU is located. However, in an expansion configuration other actions may be implemented by the master EMU or the controller.

After correcting the problem that required the controlled power shut down, you can restore power by:

1. Momentarily pressing the Alarm Control switch on each expansion unit EMU.
2. Momentarily pressing the Alarm Control switch on the master EMU.

4.3.4 User-Initiated Master Enclosure Shut Down

When you initiate a controlled power shut down on the master enclosure PVA by pressing and holding the dc power switch for at least 5 seconds, the sequence of events is as follows:

NOTE

If the master EMU is not communicating with the controller or the controller does not support a controlled power shut down, the master EMU commands all enclosures to perform an immediate power shut down.

1. The EMU changes its status to indicate that the dc power switch was pressed.
2. The master EMU notifies the controller of the change in status.
3. When the controller is ready, it sends a controlled power shut down command to the master EMU.
4. A controlled power shut down is completed on all subsystem cabinets.

After correcting the problem that required the controlled power shut down you can restore power by:

1. Momentarily pressing the Alarm Control switch on each expansion unit EMU.
2. Momentarily pressing the Alarm Control switch on the master EMU.

4.3.5 User-Initiated Expansion Enclosure Shut Down

When you press and hold the PVA dc power switch for at least 5 seconds on the expansion enclosure and the expansion EMU can communicate with the master EMU, one of the following power shut down operations occur:

NOTE

When the expansion unit *cannot* communicate with the master EMU, pressing the dc power switch causes an immediate controlled power shut down of just the expansion enclosure.

1. The slave EMU changes its status to indicate that the dc power switch was pressed.
2. The master EMU notes the change in status.

NOTE

When the master EMU is not communicating with the controller or the controller does not support a controlled power shut down, the master EMU commands all enclosures to perform an immediate power shut down.

3. The master EMU notifies the controller of the change in status.
4. When the controller is ready, it sends a controlled power shut down command to the master EMU.
5. A controlled power shut down is completed on all subsystem cabinets.

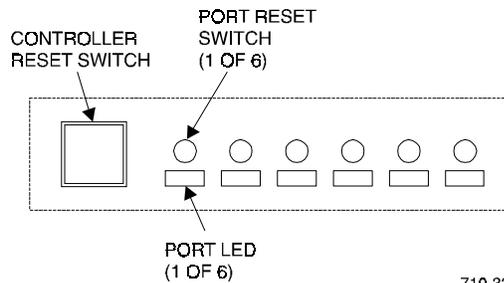
After correcting the problem that required the controlled power shut down you can restore power by momentarily pressing the Alarm Control switch on each EMU.

4.4 Controller Error Conditions

The HSZ70 RAID controller Operator Control Panel (OCP) contains the following switches and indicators (see Figure 4-3):

- Controller reset switch with an embedded green status LED
- Six amber SCSI bus status LEDs

Figure 4-3 Typical Controller OCP Display



The green controller LED indicates the status of the controller. This LED flashes constantly once the controller initialization process is complete and the software is functioning. Pressing this switch resets the controller.

The amber port LEDs are OFF when the bus is functioning properly. A port LED that is ON or FLASHING indicates that a device on the bus is not functioning properly.

4.5 Storage Device Fault Notification

The storage device SBBs two front panel LEDs display the status of the drives using one of three possible states (ON, OFF, or FLASHING). The green Device Activity LED is ON or FLASHING when the SBB is active (processing data). The amber Device Fault LED is either ON or FLASHING to indicate an error condition or configuration problem. Table 4-5 lists the SBB LED display combinations and the corresponding drive status.

CAUTION

Removing a storage SBB when the Device Activity LED is ON or FLASHING can cause the loss or corruption of data.

Figure 4-4 Storage SBB LEDs

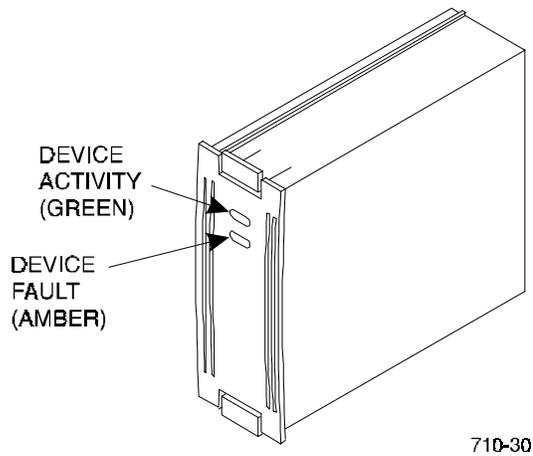


Table 4-5 Storage SBB Status LED Displays

When the LED display is . . .	The drive status is . . .
 <p>710-35A</p>	When the green Device Activity LED is ON or FLASHING, and the amber Device Fault LED is OFF, the SBB is operating normally (no fault condition).
 <p>710-35B</p>	When the green Device Activity LED is OFF, and the amber Device Fault LED is OFF, the device is inactive and the SBB is operating normally (no fault condition).
 <p>710-35C</p>	<p>Fault Status:</p> <p>When the green Device Activity LED is ON and the amber Device Fault LED is ON, the device is probably not responding to control signals.</p> <p>Corrective Action:</p> <p>Replace the SBB.</p>
 <p>710-35C</p>	<p>Fault Status:</p> <p>When the green Device Activity LED is ON and the amber Device Fault LED is FLASHING, the SBB is active and is spinning down.</p> <p>Corrective Action:</p> <p>Replace the SBB.</p>

4.6 Power Supply Fault Notification

Each power supply SBB has two green LEDs that display the status of the power supply. Table 4–6 describes the state of these LEDs, the status being reported, and the recommended corrective action.

Figure 4–5 Power Supply SBB Status LEDs

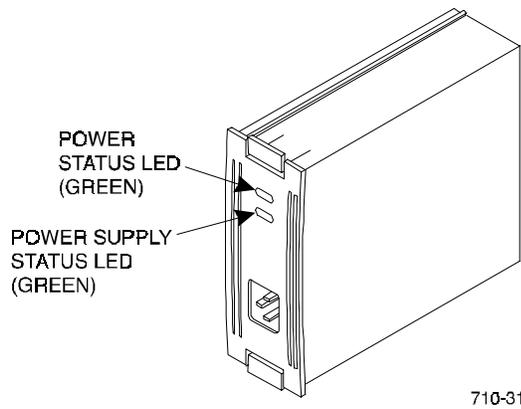


Table 4–6 Power Supply SBB Status LED Displays

When the LED display is . . .	The power supply SBB status is . . .
 <p>710-35C</p>	<p>All the power supply SBBs on the associated power bus (A or B) are functioning properly.</p>
 <p>710-35D</p>	<p>At least one power supply SBB on the associated power bus has malfunctioned.</p> <p>This power supply SBB is functioning properly.</p> <p>Corrective Action: Identify and replace the defective power supply SBB.</p>
 <p>710-35B</p>	<p>Either there is no ac power, the ac power controller has failed, or this power supply SBB has failed.</p> <p>Corrective Action:</p> <ol style="list-style-type: none"> 1. Check the ac power source. 2. Check the associated ac power entry controller for proper operation. Replace if necessary. 3. This power supply has failed and must be replaced.

4.7 I/O Module Error Reporting

The EMU monitors the status of all the I/O modules for the following error conditions:

- The installation of incompatible I/O modules
- A TERMPower problem

4.7.1 Incompatible I/O Modules

Only when all I/O modules are the same type can an UltraSCSI RAID subsystem function properly. The DIGITAL UltraSCSI controller only supports single-ended, UltraSCSI buses. Therefore, you can only use single-ended I/O modules. Installing any other module type creates an error condition that the EMU reports to the controller.

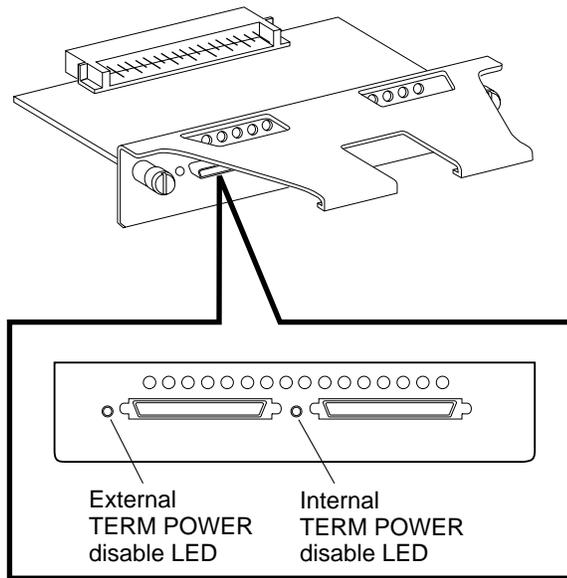
4.7.2 No I/O Module Installed

Failure to install, or installing an I/O module incorrectly, automatically disables the SCSI bus within the enclosure. Without an I/O module, there is no TERMPower available to the internal SCSI bus and the bus cannot function.

4.7.3 TERMPower Errors

The I/O module displays the TERMPower status for both the internal and the external bus (see Figure 4–6). The nominal TERMPower voltage for both buses is +5 V dc.

Figure 4-6 I/O Module LEDs



CXO5947A

- The green internal and external TERMPower LEDs are ON during normal operation.
- Whenever there is a TERMPower over-current condition, the associated LED is OFF.

When there is an internal TERMPower over-current condition, you must replace the I/O module. When there is an external TERMPower over-current condition, you must first replace the associated cable. If this does not correct the problem, replace the I/O module.

5

Replacing Components

This chapter describes the procedures to remove and install the field replaceable units (FRUs) in the RAID Array 7000 Departmental Storage Cabinet. The FRUs are listed and shown in the last section of the chapter.

5.1 Replacing a Controller or Cache Module

5.1.1 Tools Required

You need the following tools to remove or replace the controller module:

- ESD (ElectroStatic Discharge) strap
- Small blade screwdriver for trilink and external cache battery cable fasteners

5.1.2 Precautions

In general, you should follow routine ESD protection procedures when handling controller modules and cache modules and when working around the cabinet and shelf that houses the modules.

Follow these guidelines to further minimize ESD problems:

- Use ESD wrist straps, antistatic bags, and grounded ESD mats when handling controllers and cache modules
- Obtain and wear an ESD wrist strap on your wrist. Make sure the strap fits snugly.
- Attach the lead on the ESD strap to a convenient cabinet grounding point.
- After removing a module from the shelf, place the module into an approved antistatic bag or onto a grounded antistatic mat.
- Remain grounded while installing a replacement module.

CAUTION

Follow program card guidelines or damage to the program card and controller software can result.

5.2 Preparing Your Host System

Before starting the upgrade process you will need to prepare your system. This includes performing a complete system backup and shutting down the system.

5.2.1 Backup the System

As a precaution before starting this procedure you should backup the entire system, especially data stored on the RAID Array.

5.2.2 Shut Down the System

Unmount from the host system any units that are accessed through the RAID Array that is about to be repaired. Follow the proper procedures to shutdown the host system.

5.3 Controller Module Removal

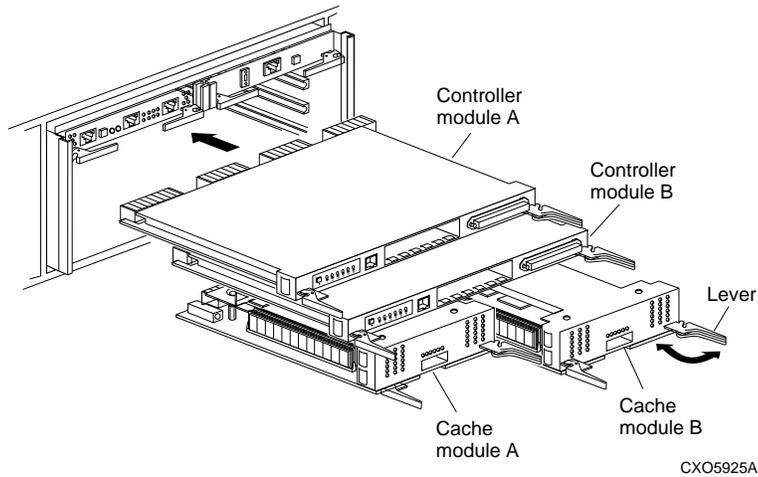
Use the following procedure to remove the controller module. Repeat the procedure for dual-redundant controller configurations.

1. Access the controller modules in the cabinet.
2. Unsnap and remove the ESD shield covering the program card by pulling out on the two retainer buttons.
3. Remove the program card by pushing the eject button on the controller panel. Pull the card out and save it.

CAUTION

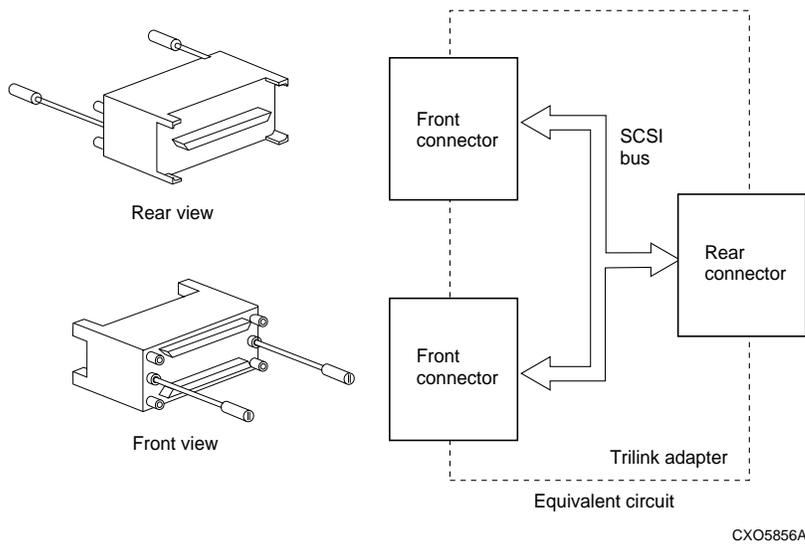
Never remove a controller while it is still servicing devices. Doing so may destroy data.

Figure 5-1 HSZ70 Controllers and Cache Modules



4. With a small blade screwdriver, loosen the captive screws on the trilink connector and remove the trilink from the front of the controller. Do not remove cables or terminators from the trilink or you will interrupt the host SCSI bus. You will have to work around any SCSI cable or terminator connections when removing the trilink.

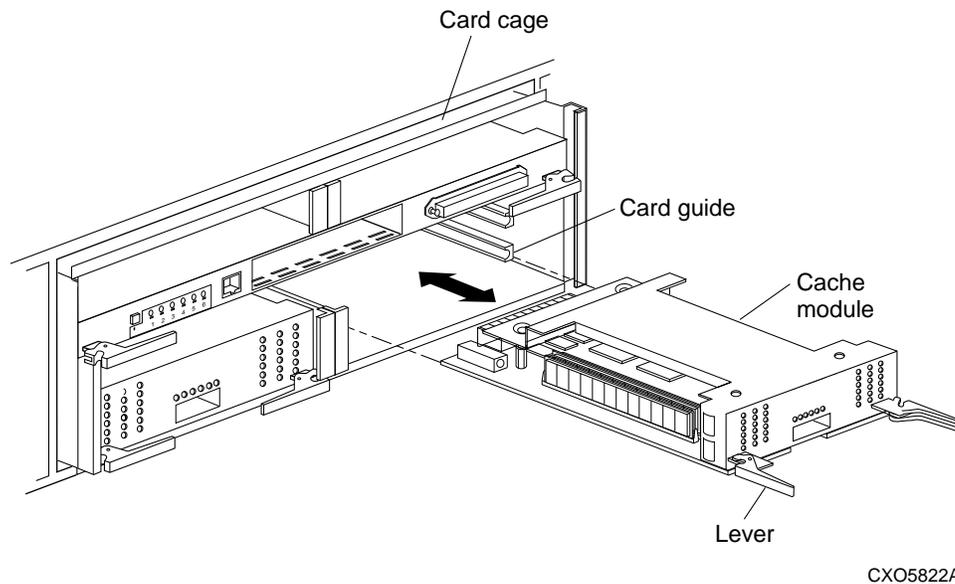
Figure 5-2 Trilink Connector



5. Remove the maintenance terminal cable (if attached).
6. Pull the lever on each side of the module to release it from the card cage.
7. Slide the module out of the shelf (noting which rails the module was seated in) and place on an approved ESD work surface or mat.
8. To install the controller module, slide the module into the shelf.
9. Use a gentle up-and-down rocking motion to help seat the module into the backplane. Press firmly on the module until it is seated. Finally, press firmly once more to make sure the module is seated.

5.4 Cache Module Removal

Figure 5–3 Cache Module Replacement



1. Pull the lever on each side of the module to release it from the card cage.
2. Slide the module out of the shelf (noting which rails the module was seated in) and place on an approved ESD work surface or mat.

WARNING

Do not allow the write-back cache to contact any conductive surface, or injury and/or equipment damage may result.

Use the following procedure to install the write-back cache module:

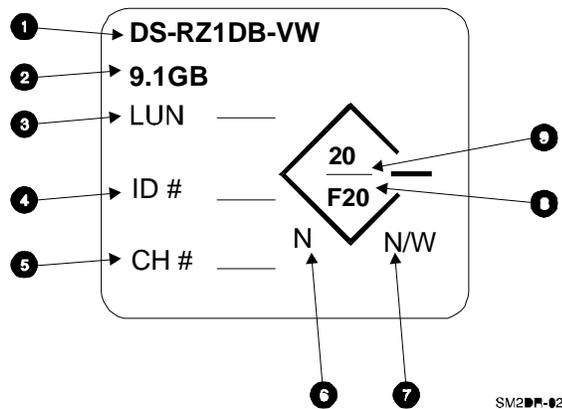
1. Slide the write-back cache module into the appropriate slot in the shelf and be sure the levers are pulled straight out.
2. Use a gentle up-and-down rocking motion to help seat the module into the backplane. Press firmly on the module until it is seated. Finally, press the levers firmly once more to make sure the module is seated.

5.5 Replacing an SBB Storage Device

Swapping a storage device is the process of replacing one drive with an identical unit. This replacement is normally required only when a device fails. Usually the controller determines that a drive requires replacement when it cannot address the device, receives no response from the device, or detects excessive device errors.

You may decide to replace a device based on controller OCP codes. The bezel mounted SBB identification label (see Figure 5-3) defines the device model, the SCSI bus width, the compatible SBB shelf widths, the SCSI bus speed, and the device transfer rate.

Figure 5-4 SBB Identification Label



The components of the device identification label are defined as follows:

- 1) The device model number.
- 2) The total amount of data the device stores (capacity)
- 3) The user-assigned SCSI logical unit number (LUN)
- 4) The user-assigned SCSI identification number (target ID)
- 5) The user-assigned controller channel number that is the controller port or SCSI bus
- 6) The SCSI bus device width where, N is an 8-bit device
- 7) The StorageWorks shelf type (wide or narrow) in which you can install the device where, N/W means the device is compatible with any SBB shelf
- 8) The bus speed expressed in megabits (Mbits) per second where, F is a Fast device
- 9) The rate at which the device can transfer data in megabytes (MB) per second

5.5.1 Replacement Method

The method used to replace a device must preserve the integrity of the data and either the controller or the operator must determine that the swap is necessary.

Replacing an SBB involves quickly removing and replacing a storage device SBB using the hot-swap method. During this method of device replacement the complete system remains on-line and active during device removal or insertion. The device being removed or inserted is the only device in the system that cannot perform operations during this process.

CAUTION

The hot-swap method supports removing and replacing a single storage SBB. You must repeat the complete procedure for each SBB you are replacing.

5.5.2 Before You Replace a Storage SBB

Whenever you replace a storage SBB you must consider the following factors:

- Installing a different model device requires you to reconfigure the subsystem
- You do not need electrostatic discharge (ESD) protection (such as an ESD wrist strap) to replace an SBB. However, you can cause ESD damage by touching the SBB connector. Always use both hands to remove or install an SBB

5.5.3 SBB Replacement

The procedures for replacing a storage SBB accomplish the following:

- Preserve data integrity
- Ensures that the controller performs in a predictable manner
- Reduce the amount of time a port and the associated devices are not available
- Removing or inserting a storage SBB generates the C_SWAP low signal. Table 5-1 describes the expected controller responses

Table 5–1 RAID Controller Response to an SBB Replacement

Action	Expected Controller Response
Removing a storage device when data is not being transferred.	No controller response expected.
Removing a storage device during a data transfer operation.	Reduced operation.
Installing a storage device.	The controller reconstructs the disk data.

The following procedure is only an example. Complete the following procedure to replace an SBB:

1. From the maintenance console, enable the Auto Spare CLI switch.

NOTE

If the Auto Spare CLI switch is not enabled prior to replacing the SBB, the new SBB will not load the proper data.

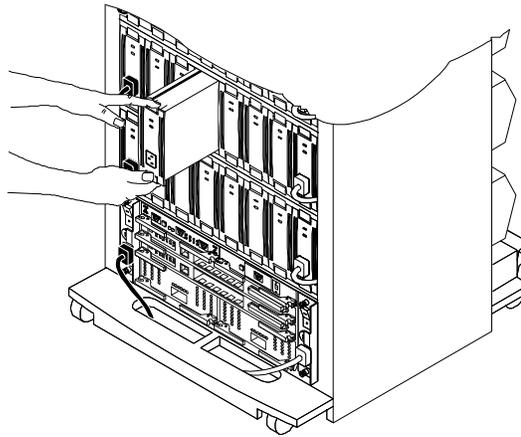
CAUTION

Always use two hands when removing or installing an SBB.

2. Remove the SBB by pressing the two mounting tabs together to release it from the shelf, and pull it out using both hands (see Figure 5-2).
3. Insert the replacement SBB into the guide slots and firmly push it into the shelf until the mounting tabs snap into place. The controller automatically configures the replacement SBB.
4. Disable the Auto Spare CLI switch from the maintenance console.

For additional information on storage device replacement, see the *StorageWorks Solutions SBB User's Guide*.

Figure 5-5 SBB Replacement



710-22

5.6 Replacing Storage Subsystem Blowers

You can install a dual-speed blower only one way and have it operate properly. The blower connector and the guide allow you to insert the unit without the possibility of a connector mismatch.

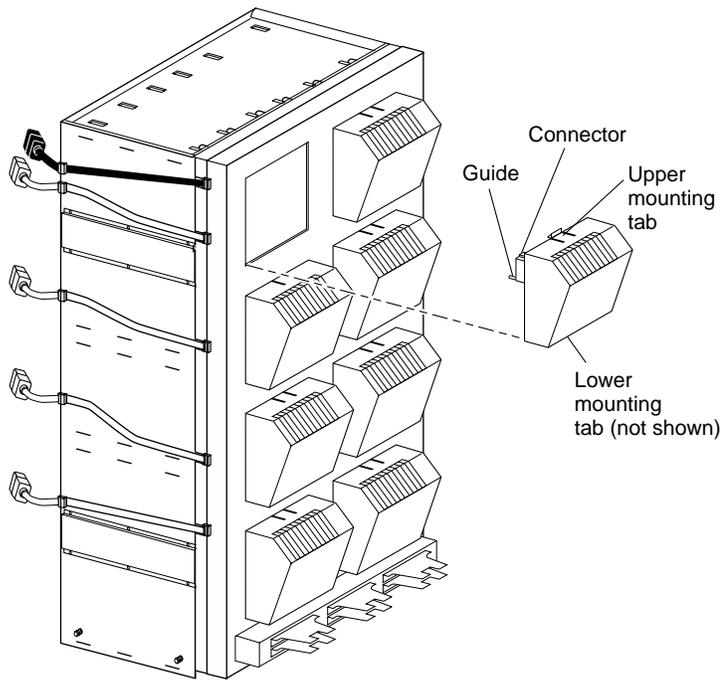
CAUTION

Operating a subsystem with a blower removed significantly changes the air flow pattern and reduces the air flow through the shelf and is associated devices. To prevent an over-temperature condition, never remove a blower unless you can replace it within one minute.

To remove a blower, refer to Figure 5-3 and complete the following procedure:

1. Press down the upper blower mounting tab to release the blower.
2. Rotate the blower cover down until the tab just clears the enclosure rear panel.
3. Pull the blower straight out and clear of the enclosure.

Figure 5-6 Blower Replacement



CX05753A

Perform the following procedure to install a blower (see Figure 5-3).

1. Orient the replacement blower so the connector and guide pin align with the blower opening on the rear panel.
2. Push the blower straight in making sure the upper and lower mounting tabs snap into place.

5.7 Replacing a Power Supply SBB

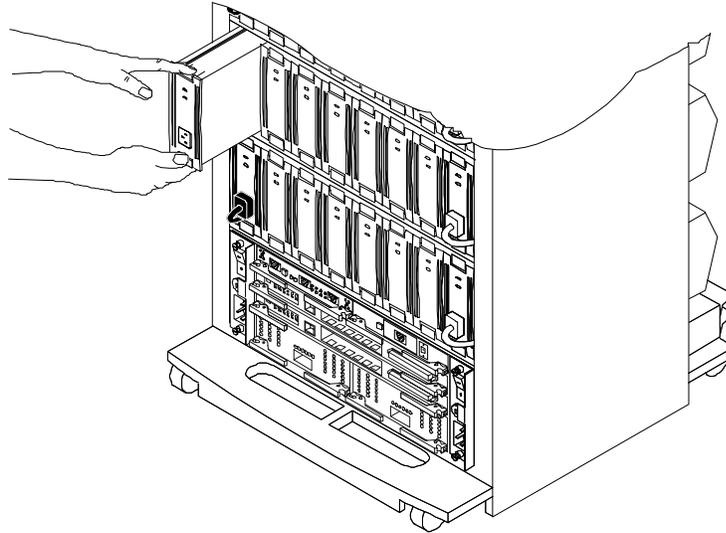
Power supply SBBs normally are replaced with power applied to the shelf. Use the following procedure to replace a power supply SBB (see Figure 5-4).

CAUTION

To prevent ESD damage to an SBB, do not touch the SBB connector. Also, always use two hands to remove or install an SBB.

1. Disconnect the power cord from the front of the power supply SBB.
2. Press the two mounting tabs together to release the SBB from the shelf.
3. Use both hands and pull the power supply SBB out of the shelf.

Figure 5-7 Power Supply SBB Replacement



710-24

Perform the following procedure to install a power supply SBB:

1. Insert the replacement power supply SBB into the guide slots and push it in until it is fully seated and the mounting tabs engage the shelf.
2. Connect the power cord to the power supply SBB.
3. After input power is applied, observe the power supply SBB LEDs to make sure the power supply is functioning properly (both status LEDs on).

5.8 Replacing a Power Entry Controller

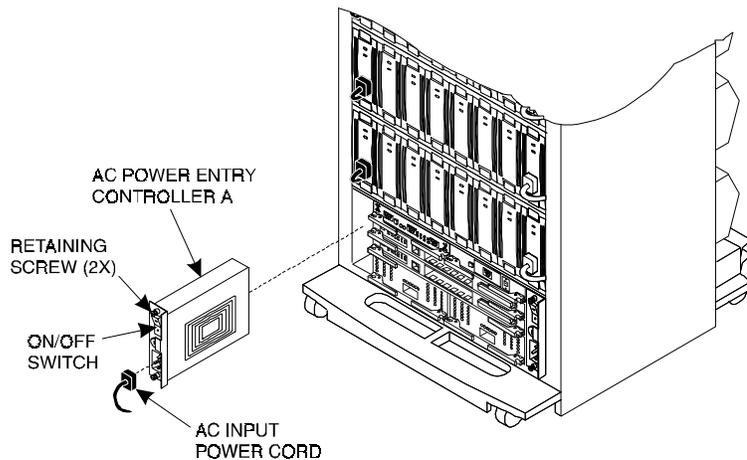
CAUTION

Removing and installing a power entry controller should only be performed by qualified service personnel.

Perform the following procedure to remove a power-entry controller (see Figure 5-5):

1. Press 0 on the ON/OFF switch to turn the power controller to OFF.
2. Disconnect the ac input power cord.
3. Loosen the two retaining screws.
4. Pull the power controller from the subsystem.

Figure 5-8 Power Entry Controller Replacement



Perform the following procedure to install a power-entry controller (see Figure 5-5):

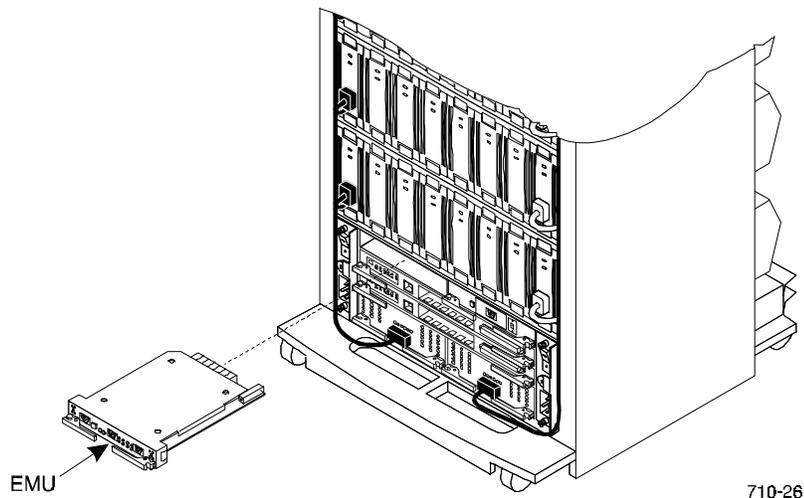
1. Press 0 on the ON/OFF switch to turn the power controller to OFF.
2. Insert the replacement power controller into the subsystem.
3. Tighten the retaining screws.
4. Connect the ac input power cord.
5. Press 1 on the ON/OFF switch to turn the power controller to ON.
6. All power supply status LEDs should be on.

5.9 Replacing an EMU

Perform the following procedure to remove or install an EMU without turning off the subsystem (see Figure 5-6).

1. Rotate the left-hand and right-hand levers outward from the unit.
2. Pull the EMU straight out to disconnect it from the backplane and clear of the subsystem.

Figure 5-9 EMU Module Replacement



Perform the following procedure to install an EMU (see Figure 5-6).

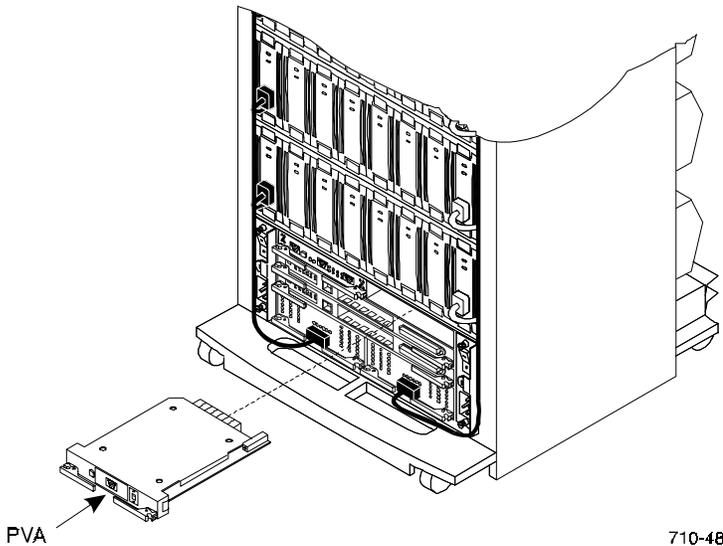
1. Insert the replacement EMU into the guide slots and push it in against the backplane connector. Be sure the two levers are straight out from the unit to allow engagement with the brackets.
2. Rotate the levers in toward the unit to fully seat the EMU.

5.10 Replacing a PVA

Perform the following procedure to remove or install a PVA module without turning off the subsystem (see Figure 5-7).

1. Rotate the left-hand and right-hand levers outward from the unit.
2. Pull the PVA straight out to disconnect it from the backplane and clear of the subsystem.

Figure 5-10 PVA Module Replacement



Perform the following procedure to install an PVA (see Figure 5-7).

1. Insert the replacement PVA into the guide slots and push it in against the backplane connector. Be sure the two levers are straight out from the unit to allow engagement with the brackets.
2. Rotate the levers in toward the unit to fully seat the PVA.

5.11 FRU Parts List

The Field Replaceable Units in the storage cabinet is shown in the exploded view of Figure 5-8. Refer to Figure 5-8 to identify the FRU, and then to Table 5-2 to obtain the description of the FRU and its corresponding part number.

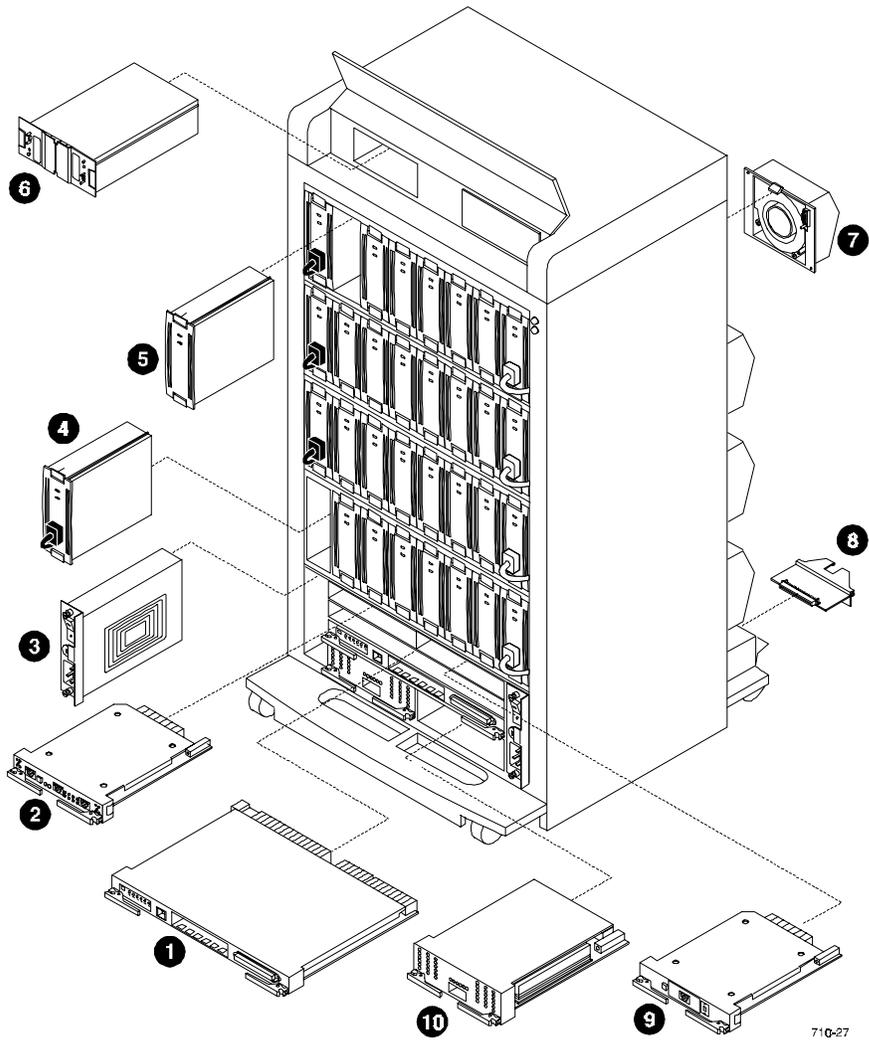
Table 5–2 Subsystem Field Replaceable Units

Item	Description	Part Number
1	RAID Array Controller	78-32832-07
2	Environmental Monitor Unit (EMU)	DS-BA35X-EB
3	AC Power Entry Controller	DS-BA35X-HE
4	Power Supply SBB	DS-BA35X-HH
5	External Cache Backup (ECB) Single Double	DS-HS35X-BC DS-HS35X-BB
6	Dual-Speed Blower	DS-BA35X-MK
7	Single-Ended I/O Module	DS-BA35X-MN
8	Power Verification and Addressing (PVA)	DS-BA35X-EC
9	Cache Module	70-32835-01
10	One or more Cache SIMMs *	DS-HSSIM-AB
11	Power Distribution Unit (PDU)** 60 Hz 50 Hz	DS-SW6XP-AA DS-SW6XP-AB

* 32 MB, 64 MB, or 128 MB may be mounted in 32 MB SIMM socket in the controllers

*** The Power Distribution Unit (PDU) is used in the ESA10000 only.

Figure 5-11 Storage Cabinet Field Replaceable Parts (RA7000 Shown)



Item number 11, the PDU, is not shown.

Reader's Comments

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